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Utilisation des télécommunications/technologies de l'information et de la communication pour la réduction et la gestion des risques de catastrophe

Rapport final sur la Question 5/2 de l'UIT-D

Utilisation des télécommunications/technologies de l'information et de la communication pour la réduction et la gestion des risques de catastrophe

Périodes d'études 2018-2021

Utilisation des télécommunications/technologies de l'information et de la communication pour la réduction et la gestion des risques de catastrophe: Rapport final sur la Question 5/2 de l'UIT-D pour la période d'études 2018-2021

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Les commissions d'études du Secteur du développement des télécommunications de l'UIT (UIT-D) offrent un cadre neutre permettant à des experts issus du secteur public, du secteur privé, d'organisations de télécommunication et d'établissements universitaires du monde entier de se réunir, afin d'élaborer des outils pratiques et des ressources pour examiner les questions touchant au développement. À cette fin, les deux commissions d'études de l'UIT-D sont chargées d'élaborer des rapports, des lignes directrices et des recommandations sur la base des contributions soumises par les membres. La Conférence mondiale de développement des télécommunications (CMDT) décide de mettre à l'étude des Questions tous les quatre ans. Les membres de l'UIT, réunis à la CMDT-17 tenue à Buenos Aires en octobre 2017, ont décidé que pendant la période 2018-2021, la Commission d'études 2 serait chargée de l'étude de sept Questions, qui s'inscrivent dans le cadre général des "services et applications reposant sur les technologies de l'information et de la communication pour promouvoir le développement durable".

Le présent rapport a été élaboré au titre de la Question 5/2, intitulée **"Utilisation des télécommunications/technologies de l'information et de la communication pour la réduction et la gestion des risques de catastrophe"**, sous la supervision et la coordination générales de l'équipe de direction de la Commission d'études 2 de l'UIT-D, dirigée par M. Ahmad Reza Sharafat (République islamique d'Iran), Président, secondé par les Vice-Présidents suivants: M. Nasser Al Marzouqi (Émirats arabes unis) (qui a démissionné en 2018); M. Abdelaziz Alzarooni (Émirats arabes unis); M. Filipe Miguel Antunes Batista (Portugal) (qui a démissionné en 2019); Mme Nora Abdalla Hassan Basher (Soudan); Mme Maria Bolshakova (Fédération de Russie); Mme Celina Delgado Castellón (Nicaragua); M. Yakov Gass (Fédération de Russie) (qui a démissionné en 2020); M. Ananda Raj Khanal (République du Népal); M. Roland Yaw Kudozia (Ghana); M. Tolibjon Oltinovich Mirzakulov (Ouzbékistan); Mme Alina Modan (Roumanie); M. Henry Chukwudumeme Nkemadu (Nigéria); Mme Ke Wang (Chine); et M. Dominique Würges (France).

Ce rapport a été rédigé sous la direction des Corapporteurs pour la Question 5/2, à savoir M. Sanjeev Banzal (Inde); M. Joseph Burton (États-Unis) (qui a démissionné en 2020); et Mme Kelly O'Keefe (États-Unis), en collaboration avec les Vice-Rapporteurs suivants: M. Parag Agrawal (Inde), M. Hideo Imanaka (Japon); M. Joses Jean-Baptiste (Haïti); et M. Abdulkarim Ayopo Oloyede (Nigéria).

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Table des matières

Liste des tableaux et figures

Tableau

Figures

Résumé analytique

La Commission d'études 2 du Secteur du développement des télécommunications de l'UIT (UIT-D) a l'honneur de présenter son Rapport final sur la Question 5/2 (Utilisation des télécommunications/TIC pour la réduction et la gestion des risques de catastrophe). Ce rapport s'appuie sur les contributions soumises par les États Membres et les Membres de Secteur et sur les discussions interactives qui ont été menées durant la période d'études 2018-2021. Il donne un aperçu des télécommunications/technologies de l'information et de la communication (TIC) utilisées aux fins de la réduction et de la gestion des risques de catastrophe et décrit différentes études de cas sur les technologies et les politiques présentées par des administrations et des organisations concernant l'utilisation des TIC pendant toutes les phases d'une catastrophe.

Qu'elles aient une origine naturelle ou qu'elles soient causées par l'homme, les catastrophes peuvent avoir des conséquences dramatiques pour les sociétés, en perturbant le bon fonctionnement de la vie sociale et économique. Les autorités et les populations doivent réagir immédiatement pour aider les personnes touchées et rétablir un niveau de bien-être et des conditions de vie acceptables. L'association de dangers, d'une vulnérabilité et de l'incapacité à atténuer les conséquences que pourrait avoir la concrétisation d'un risque peut se révéler catastrophique. Dans la mesure où il est impossible de prévoir bon nombre de catastrophes, la préparation aux catastrophes et la gestion des risques de catastrophe jouent un rôle crucial pour sauver des vies et protéger les biens. Il est aussi important de se pencher sur la gestion des risques (par exemple, atténuation et anticipation des dégâts, alerte avancée/prévision) avant qu'une catastrophe ne survienne. Une planification et une préparation efficaces peuvent permettre de sauver des vies et contribuent effectivement à le faire.

Les télécommunications et les TIC jouent un rôle clé dans la prévention et la gestion des catastrophes et dans l'atténuation de leurs effets. Une gestion efficace des catastrophes nécessite l'échange rapide et efficace d'informations entre différentes parties prenantes, et les TIC constituent des outils essentiels à cet égard. Elles apportent un soutien dans toutes les phases des catastrophes, notamment celles de la prévision et de l'alerte avancée. En effet, il a été observé que diverses techniques de réduction des risques efficaces étaient mises en œuvre à travers le monde, contribuant dans une large mesure à limiter les pertes humaines et matérielles lorsqu'une catastrophe se produit.

Durant la période d'études 2018-2021, les discussions menées au titre de la Question 5/2 ont porté sur l'utilisation des télécommunications/TIC pour la réduction et la gestion des risques de catastrophe. Des politiques efficaces peuvent jouer un rôle essentiel dans la conception et la mise en œuvre globales de plans nationaux pour les télécommunications d'urgence. En conséquence, l'environnement politique et réglementaire devrait être conçu de manière à permettre une préparation et des interventions efficaces et à faciliter ces activités. Des politiques devraient être mise en place en vue du déploiement de systèmes de communications d'urgence pour l'alerte avancée, la continuité des communications et l'efficacité des interventions. Elles devraient être conçues en gardant à l'esprit l'accessibilité des communications et devaient donc être inclusives et porter sur toutes les couches de la société. Grâce à leur développement rapide, les nouvelles technologies, en particulier l'Internet des objets (IoT), les communications de machine à machine (M2M) et l'intelligence artificielle (IA), ont contribué à appuyer les activités durant toutes les phases des catastrophes et continueront de le faire dans le futur. Il est ainsi

important de se tenir au courant des dernières avancées dans le domaine des technologies de communication en cas de catastrophe, qui sont l'objet de l'un des chapitres du présent rapport.

Les systèmes d'alerte avancée jouent un rôle essentiel pour informer les populations des catastrophes imminentes et devraient donc être déployés dans les zones exposées aux catastrophes. La transmission et la diffusion efficaces des informations jouent un rôle important avant, pendant et après une catastrophe. Lors d'un atelier sur les systèmes d'alerte avancée organisé durant la période d'études, de nombreuses contributions utiles ont été soumises sur ce sujet. Un chapitre du présent rapport lui est donc consacré.

La préparation aux catastrophes suppose de réaliser des exercices et des simulations, qu'il s'agisse d'exercices théoriques ou d'entraînements à grande échelle. Les lacunes mises en évidence par ces exercices et simulations exigent des analyses et des mesures correctives, de façon que, lorsqu'une catastrophe se produit, chacun agisse de manière cohérente et coordonnée selon le plan prévu. Il est important d'exploiter les bonnes pratiques adoptées par d'autres pays, en particulier ceux qui sont exposés aux catastrophes et qui ont tiré des enseignements de leurs expériences. Le présent rapport contient des études de cas de différents pays, qui décrivent les enseignements tirés. À la suite d'un atelier consacré aux exercices et aux simulations effectués durant la période d'études, les avis des spécialistes ont été réunis au sein d'un ensemble de lignes directrices à l'intention des petits États insulaires et des pays sans littoral. Elles sont reproduites dans le présent rapport.

Il est indispensable de disposer d'un environnement politique propice si l'on veut gérer une catastrophe. Les politiques devraient être formulées de telle sorte qu'elles garantissent une certaine souplesse lors du déploiement d'équipements de communication d'urgence et favorisent une utilisation efficace des télécommunications et des TIC au service de la préparation et des interventions en cas de catastrophe. Il est important de déterminer quels sont les composants d'un environnement politique propice qui améliore la planification préalable des télécommunications d'urgence, la résilience des réseaux, la réduction des risques de catastrophe et la gestion des catastrophes.

Le monde est actuellement confronté à un défi sans précédent en raison de la pandémie de COVID-19, qui a fait des millions de morts et a grevé l'économie mondiale à hauteur de plusieurs milliers de milliards de dollars. Aucun pays n'a été épargné. Un webinaire sur un environnement politique propice pour la gestion des catastrophes, notamment la lutte contre les pandémies, a permis d'étudier les solutions réalisables et efficace pour faire face à la pandémie et à offert à de nombreux pays la possibilité de partager leurs données d'expérience en ce qui concerne l'amélioration et le renforcement de l'infrastructure TIC lorsque les populations se tournent vers le télétravail et que les pays mettent en place des mesures de confinement, ce qui entraîne une augmentation considérable du trafic sur l'Internet. Les contributions reçues au titre de la Question 5/2 rendent également compte des mesures prises par les pays pour faire face à la pandémie de COVID-19. Les informations pertinentes sont présentées dans le Chapitre 2 du présent rapport.

Pour résumer, le rapport comporte sept chapitres, comme suit:

- Le **Chapitre 1** (Introduction), définit la portée du rapport et donne un aperçu rapide du rôle des télécommunications/TIC dans le processus général de gestion des catastrophes.
- Le **Chapitre 2** (Environnement politique et réglementaire), donne des informations détaillées sur les politiques propices et l'environnement réglementaire, notamment sur les politiques relatives au déploiement des systèmes de communication d'urgence et

d'alerte avancée afin de promouvoir la continuité des communications et de permettre des interventions plus efficaces.

- Le **Chapitre 3** (Technologies de communication d'urgence) porte sur les technologies de communication d'urgence.
- Le **Chapitre 4** (Systèmes d'alerte avancée et systèmes d'avertissement) porte sur les systèmes d'alerte avancée et d'avertissement et sur l'utilisation des TIC dans la planification de ces systèmes. Il traite également du déploiement des systèmes d'alerte avancée pour la réduction des risques de catastrophe, des systèmes de radiodiffusion d'alertes en cas d'urgence, de systèmes d'information et de secours en cas de catastrophe et de technologies assurant la résilience des réseaux.
- Le **Chapitre 5** (Entraînements et exercices) contient un résumé des lignes directrices pour la préparation et la réalisation d'exercices et d'entraînements liés aux communications d'urgence.
- Le **Chapitre 6** (Études de cas de pays et d'entreprises) présente plusieurs études de cas de pays et d'entreprises fondées sur les contributions des Membres de l'UIT-D.
- Le **Chapitre 7** (Bonnes pratiques, lignes directrices et conclusions) porte sur les bonnes pratiques et les enseignements tirés mis en évidence, ainsi que sur les lignes directrices proposées pendant la période d'études.

Abréviations et acronymes

2G/3G/4G/5G	réseaux mobiles de deuxième/troisième/quatrième/cinquième génération
BDT	Bureau de développement des télécommunications de l'UIT
BGAN	réseau global large bande (*broadband global area network*)
CAP	protocole d'alerte commun (*common alerting protocol*)
COVID-19	maladie à coronavirus 2019
ETC	groupe des télécommunications d'urgence des Nations Unies
FEMA	Agence fédérale de gestion des situations d'urgence des États-Unis (*federal emergency management agency*)
GIS	système d'information géographique (*geographic information system*)
GSMA	Association GSM
IA	intelligence artificielle
IoT	Internet des objets
IPAWS	système intégré d'alerte et d'avertissement du public (*integrated public alert & warning system*)
IPAWS-OPEN	plate-forme ouverte pour les réseaux d'urgence du système intégré d'alerte et d'avertissement du public (*integrated public alert & warning system open platform for emergency networks*)
M2M	machine à machine (*machine-to-machine*)
MDRU	unité de ressources TIC mobile et déployable (*movable and deployable ICT resource unit*)
MHEWS	systèmes d'alerte avancée multirisques (*multi-hazard early-warning system*)
ML	apprentissage automatique (*machine learning*)
NETP	plan national pour les télécommunications d'urgence (*national emergency telecommunication plan*)
NOAA	Administration nationale de l'atmosphère et des océans (*national oceanic and atmospheric administration* (États-Unis))
ODD	objectifs de développement durable
OMS	Organisation mondiale de la santé
OMM	Organisation météorologique mondiale

(suite)

ONG	organisation non gouvernementale
OSCAR	outil d'analyse et d'examen de la capacité des systèmes d'observation de l'OMM (*WMO observing systems capability analysis and review tool*)
PAM	Programme alimentaire mondial
PEID	petits États insulaires en développement
PMA	pays les moins avancés
PPDR	protection publique et secours en cas de catastrophe (*public protection and disaster relief*)
SNS	services de réseaux sociaux (*social networking services*)
TIC	Technologies de l'information et de la communication
UAV	aéronef sans pilote (*unmanned aerial vehicle*)
UIT	Union internationale des télécommunications
UIT-D	Secteur du développement des télécommunications de l'UIT
UIT-R	Secteur des radiocommunications de l'UIT
UIT-T	Secteur de la normalisation des télécommunications de l'UIT
UNISDR	stratégie internationale des Nations Unies pour la prévention des catastrophes
UNITAR	Institut des Nations Unies pour la formation et la recherche
UNOSAT	Programme opérationnel des Nations Unies pour les applications satellitaires de l'UNITAR
UN-SPIDER	Programme des Nations Unies pour l'exploitation de l'information d'origine spatiale aux fins de la gestion des catastrophes et des interventions d'urgence
VoLTE	téléphonie utilisant la technologie LTE (évolution à long terme) (*voice over long term evolution*)
VSAT	microstation (*very small aperture terminal*)

Chapitre 1 – Introduction

1.1 Considérations générales

Plusieurs Résolutions de la Conférence de plénipotentiaires de l'UIT, de la Conférence mondiale de développement des télécommunications (CMDT) et de la Conférence mondiale des radiocommunications (CMR), ainsi que des rapports du Secteur du développement des télécommunications de l'UIT (UIT-D), du Secteur de la normalisation des télécommunications de l'UIT (UIT-T) et du Secteur des radiocommunications de l'UIT (UIT-R) ont mis en évidence le rôle des télécommunications/technologies de l'information et de la communication (TIC) dans la préparation en prévision des catastrophes, l'alerte avancée, les opérations de secours, l'atténuation des effets des catastrophes, les interventions et le rétablissement. En outre, les grandes orientations du Sommet mondial sur la société de l'information (SMSI), les Objectifs de développement durable fixés par les Nations Unies (ODD) ainsi que plusieurs résolutions de la Stratégie internationale des Nations Unies pour la prévention des catastrophes (UNISDR) et le Cadre d'action de Sendai pour la réduction des risques de catastrophe 2015-2030 font état de la nécessité de réduire les risques liés aux catastrophes et de construire une infrastructure durable et résiliente. Les TIC jouent aussi un rôle dans l'assistance humanitaire, la protection du public et les opérations de secours en cas de catastrophe.

Dans ses efforts visant à promouvoir les activités nationales et régionales de préparation en vue des catastrophes naturelles et des catastrophes causées par l'homme, l'UIT n'a cessé de préconiser l'utilisation des télécommunications/TIC aux fins de la planification en prévision des catastrophes, de l'atténuation des effets des catastrophes, des interventions et des activités de rétablissement en cas de catastrophe. Dans ce contexte, l'UIT a encouragé la collaboration et l'échange de données d'expérience aux niveaux régional et mondial. Pendant la période d'études précédente (2014-2017), les responsables de l'étude de la Question 5/2 de l'UIT-D ont examiné divers aspects liés à la planification et à la gestion des communications en cas de catastrophe et aux interventions dans ce domaine. Durant la période d'études 2018-2021, l'accent a été mis sur l'utilisation des télécommunications/TIC dans la réduction et la gestion des risques de catastrophe.

1.2 Objet du présent rapport

Le présent rapport vise à poursuivre l'examen de l'application des télécommunications/TIC aux fins de la prévision, la détection, la surveillance, l'alerte avancée, les interventions et les secours en cas de catastrophe, l'examen des bonnes pratiques ou des lignes directrices relatives à la mise en œuvre, ainsi qu'à la mise en place d'un environnement réglementaire favorable au déploiement et à la mise en œuvre rapides. Le présent rapport contient des données d'expérience et des études de cas au niveau national concernant la planification en prévision des catastrophes, l'atténuation des effets des catastrophes et les secours en cas de catastrophe, ainsi que l'élaboration de plans nationaux sur les communications en cas de catastrophe. Il vise à examiner les thèmes communs et les bonnes pratiques. Le présent rapport porte sur quatre domaines généraux:

- Environnement politique et réglementaire propice

- Technologies de communication d'urgence
- Systèmes d'alerte avancée et systèmes d'avertissement
- Entraînements et exercices.

Les études de cas et les bonnes pratiques pertinentes sont citées à titre de référence dans les chapitres correspondants.

1.3 Les télécommunications/TIC au service de la gestion des catastrophes et des opérations de secours en cas de catastrophe

Comme chacun sait, les télécommunications/TIC jouent un rôle essentiel dans la gestion des catastrophes et la réduction des risques de catastrophe. Afin de protéger les populations et les biens matériels pendant et après une catastrophe, il est indispensable de concevoir un plan national pour les télécommunications d'urgence, de mettre en place des systèmes d'alerte avancée et de surveillance au moyen des TIC et de garantir la disponibilité des équipements de télécommunication d'urgence. Les télécommunications/TIC ont un rôle à jouer dans toutes les phases des catastrophes, qu'il s'agisse de la détection, de la réduction des risques, de l'alerte avancée, de la surveillance et des opérations de secours ou des efforts de rétablissement après une catastrophe. L'accès aux informations et une communication efficace constituent des aspects essentiels pour limiter les effets des catastrophes. Différentes technologies de l'information et de la communication et différents réseaux (y compris les réseaux à satellite, les réseaux radioélectriques et les réseaux mobiles, l'Internet, les logiciels GIS (systèmes d'informations géographiques), les systèmes d'observation de la Terre par satellite, l'Internet des objets, l'analyse en temps réel au moyen de mégadonnées et l'informatique évoluée, les technologies de communication mobile et les réseaux sociaux) peuvent contribuer à améliorer les capacités de gestion des catastrophes et à atténuer la vulnérabilité des populations. La communauté locale, les pouvoirs publics, le secteur privé, les organismes de gestion des catastrophes, les organisations météorologiques, la société civile, les organismes humanitaires et les organisations internationales contribuent à coordonner les activités de gestion des catastrophes, à conclure des partenariats et à promouvoir la planification et la préparation avec toutes les parties prenantes essentielles.

1.4 L'utilisation des télécommunications/TIC dans toutes les phases des catastrophes

Les télécommunications/TIC sont des outils essentiels dans toutes les phases des catastrophes, et toute gestion efficace des catastrophes s'appuie sur divers moyens de télécommunication/TIC. À titre d'exemples à cet égard, on peut citer la télédétection par satellite, les systèmes de radar, de télémesure et de météorologie et les technologies de détection M2M par satellite, qui permettent l'alerte avancée; les technologies de radiodiffusion et les technologies mobiles (radiodiffusion sonore et télévisuelle, radioamateurs, satellites, téléphonie mobile et Internet), qui permettent de diffuser les alertes; et les stations de base provisoires, les systèmes d'urgence portatifs, etc., qui contribuent à évaluer les dégâts, à transmettre les instructions aux équipes de recherche, d'intervention, de secours et de rétablissement, et à restaurer l'infrastructure de communication et les autres infrastructures, notamment grâce à l'utilisation de dispositifs tels que les téléphones satellitaires. Une gestion globale des catastrophes au moyen des TIC exige donc une infrastructure de télécommunication qui soit robuste et fiable et qui puisse garantir des communications efficaces avant, pendant et après une catastrophe, afin de limiter les pertes humaines et matérielles.

De plus, il est essentiel de tirer des enseignements après chaque catastrophe, afin de se préparer au mieux à la prochaine. Les télécommunications/TIC sont ainsi utilisées pour collecter des données à la suite de catastrophes de grande ampleur, notamment afin d'analyser leur propre utilisation et leur efficacité. Les enseignements tirés contribuent aussi à faire évoluer la technologie et à améliorer les plans et les procédures de gestion des catastrophes.

1.5 Environnement politique et réglementaire propice

L'instauration d'un environnement politique et réglementaire propice est une composante importante de la gestion des communications en cas de catastrophe. Un tel environnement comporte deux aspects: un cadre réglementaire et politique général applicable aux télécommunications pour le déploiement et l'utilisation des TIC en général, et des cadres et politiques spécifiques en cas de catastrophe. Les considérations relatives aux politiques publiques sont notamment la réduction des obstacles réglementaires entravant le déploiement des TIC, la promotion du développement d'une infrastructure TIC solide et résiliente, la rationalisation des procédures d'octroi de licences et la gestion du spectre. Les cadres et politiques applicables aux communications en cas de catastrophe contribuent à préciser les activités et les responsabilités lorsqu'une catastrophe se produit et à assurer la continuité du fonctionnement des TIC durant la phase de rétablissement. Les cadres de gestion des catastrophes peuvent comprendre des mesures de nature politique et réglementaire propres aux TIC, par exemple des procédures accélérées d'octroi de licences à appliquer en cas de catastrophe, la suppression des possibles barrières douanières limitant l'entrée des équipements de communication d'urgence ou l'application de la Convention de Tampere sur la mise à disposition de ressources de télécommunication pour l'atténuation des effets des catastrophes et les opérations de secours. Un certain nombre de contributions soumises pendant la période d'études 2018-2021 portaient sur les stratégies et les plans adoptés par les pouvoirs publics et les organisations.

1.6 Technologies de communication d'urgence

Comme indiqué précédemment, les télécommunications/TIC peuvent être utilisées dans toutes les phases de catastrophes: les technologies de détection permettent d'alerter rapidement la population en cas de catastrophes imminentes comme des cyclones et des ouragans. De plus, grâce aux TIC, les informations essentielles peuvent être échangées entre ceux qui subissent les effets des catastrophes, notamment la population, et ceux qui prennent part aux interventions à court et à long terme. Il est aussi essentiel de comprendre quelles technologies de communication et quels types d'informations doivent être partagés. À titre d'exemple, les technologies de communication utilisées pour alerter rapidement les populations sont notamment les téléphones mobiles, les microstations, les téléphones par satellite, les systèmes à réponse vocale interactive, l'Internet (y compris les médias fondés sur le web), la télévision, la radio, la presse, les services d'affichage numérique, les haut-parleurs et les réseaux de connaissances nationaux. Les réseaux sociaux peuvent être utilisés pour collecter des données et partager des informations, permettant ainsi aux autorités chargées des interventions et des opérations de secours de répondre aux demandes d'assistance et de mettre en place des liaisons entre les groupes et au sein des groupes aux fins de l'échange d'informations, de l'analyse de la situation et de la communication de rapports. Bien qu'il existe de nombreux outils TIC pour la gestion des catastrophes, le présent rapport ne traite que de quelques-uns de ces outils. Les spécialistes devraient envisager sérieusement une approche fondée sur des normes pour éviter d'être bloqués dans une ou plusieurs solutions ou technologies de conception spécifiques.

1.7 Mécanismes d'intervention existants

Lorsqu'un État est confronté à une catastrophe et que ses capacités de télécommunication habituelles sont compromises, il peut choisir de déclarer l'état d'urgence, ce qui permet au Groupe des télécommunications d'urgence (ETC) des Nations Unies de déclencher un mécanisme permettant d'identifier et de déployer rapidement et gratuitement des technologies de communication essentielles dans la zone touchée. Les États devraient connaître l'existence de ce mécanisme et savoir qu'il est mis à leur disposition. Ce mécanisme est conçu pour éviter l'adoption d'une approche ad hoc faisant intervenir différentes organisations non gouvernementales (ONG), dans laquelle chacune se rend sur place en apportant des équipements et des solutions faisant doublon, ce qui peut entraîner des gaspillages. En outre, le mécanisme permet à la communauté humanitaire et aux pouvoirs publics de mettre en œuvre des interventions plus prévisibles[1].

1.8 Systèmes d'alerte avancée

Les systèmes d'alerte avancée sont essentiels pour limiter les pertes humaines et les dégâts matériels. Ils permettent de détecter ou de prévoir une catastrophe, mais aussi de fournir rapidement des informations à la population, en utilisant les réseaux de télécommunication/TIC pour suivre la situation et émettre des alertes. Les systèmes d'alerte avancée favorisent l'évaluation des risques sur la base des données d'expérience et des vulnérabilités, contribuent à surveiller et à prévoir les catastrophes et fournissent des messages clairs à ceux qui se trouvent dans les zones exposées aux catastrophes. Ils sont également utiles dans le cadre des activités d'intervention en cas d'urgence, une fois l'alerte lancée.

Le protocole d'alerte commun (CAP) est un protocole numérique pour l'échange d'alertes d'urgence sur plusieurs canaux de communication: la téléphonie mobile, la télévision, la radio, les hauts parleurs/sirènes, les fenêtre contextuelles sur ordinateur, les courriers électroniques, les messages texte, etc. Les messages d'alerte au format CAP sont exploitables par les machines et par les humains. Dans les *Lignes directrices de l'UIT relatives à l'élaboration de plans nationaux pour les télécommunications d'urgence*[2], il est recommandé que des systèmes d'alerte avancée soient mis au point et déployés, en faisant en sorte, dans la mesure du possible, de lier tous les systèmes de prévention des dangers, de manière à tirer parti d'économies d'échelle et à améliorer la durabilité et l'efficacité grâce à un cadre polyvalent prenant en considération divers dangers potentiels ainsi que les besoins des utilisateurs finals. Un inventaire de ces systèmes devrait figurer dans le plan national pour les télécommunications d'urgence. Il devrait être revu et mis à jour de façon régulière.

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[1] Association pour l'Europe, le Moyen-Orient et l'Afrique des opérateurs de satellites (ESOA). Services. Communications d'urgence.

[2] UIT. Rapports thématiques. Lignes directrices de l'UIT relatives à l'élaboration de plans nationaux pour les télécommunications d'urgence. UIT, Genève, 2020.

1.9 Entraînements et exercices

Les exercices et les entraînements jouent un rôle important dans la préparation de la gestion des catastrophes, car ils contribuent à renforcer les capacités et la formation, de façon que, lorsqu'une catastrophe se produit réellement, les parties prenantes réagissent de la manière attendue. L'objectif principal des exercices et entraînements est de recenser les écarts entre les procédures établies et leur mise en œuvre dans la pratique, puis d'y remédier. Ce type de renforcement des capacités a également pour avantage d'améliorer la rapidité, la qualité et l'efficacité des activités de préparation et d'intervention en cas de catastrophe, d'améliorer la responsabilisation et la mesure des résultats et de réduire le risque de catastrophe lorsque cela est possible.

1.10 Bonnes pratiques et lignes directrices

Le but d'une étude collaborative est d'échanger des enseignements collectifs issus des données d'expérience de chacun, puis d'identifier et d'appliquer les bonnes pratiques. Outre les discussions qui ont été menées durant les réunions des Commissions d'études, les quatre ateliers organisés pendant la période d'études et les informations présentées dans les annexes du présent rapport final ont permis d'identifier des lignes directrices à l'intention de tous les pays, en particulier les petits États insulaires en développement et les pays en développement sans littoral, ainsi que des bonnes pratiques dans les domaines de l'alerte avancée, des exercices et entraînements et de l'élaboration des politiques.

1.11 Facteurs humains et collaboration entre les parties prenantes

Les catastrophes ne connaissent pas de frontières. Pour en atténuer les conséquences, un large éventail de parties prenantes – pouvoirs publics aux niveaux national, régional et local, organisations étrangères d'aide et de secours, ONG et organisations de la société civile, entités du secteur privé, bénévoles et groupes de citoyens – doivent jouer un rôle. Ces acteurs doivent agir en étroite collaboration, et, par conséquent, communiquer efficacement, afin d'apporter des solutions efficaces aux problèmes provoqués par une catastrophe. Un autre facteur doit être pris en considération, à savoir les conséquences que peut avoir une catastrophe sur la famille d'un membre de l'équipe d'intervention et la capacité ou non de cette personne à contribuer aux activités d'intervention. Des plans de secours sont impératifs dans ces situations. De plus, toutes les catastrophes se produisent au niveau local, c'est-à-dire que lorsqu'une catastrophe se produit, les premiers secours sont assurés par les voisins, et le premier réflexe de chacun est de se mettre en sécurité. Les TIC ont un rôle à jouer à cet égard, en permettant aux habitants d'agir par leurs propres moyens ou de s'entraider. À cette fin, des cartes des risques devraient être élaborées à l'avance, avec l'aide des habitants et du gouvernement local, indiquant les zones susceptibles d'être touchées par une catastrophe ou la localisation des centres d'évacuation et d'accueil.

Les facteurs humains et la collaboration entre les parties prenantes sont extrêmement importants dans la gestion des situations de catastrophe. Pendant les exercices et les entraînements, cet aspect de la communication et de la coordination est examiné avec attention. Si des lacunes sont décelées, il convient de les corriger et d'en rendre compte, et des procédures opérationnelles normalisées ou des lignes directrices doivent être rédigées sur ce sujet.

En outre, lorsqu'une catastrophe se produit, les femmes sont plus vulnérables que les hommes et plus susceptibles de perdre la vie. La pandémie de COVID-19 a des conséquences socio-économiques dévastatrices pour les femmes et les jeunes filles, car selon les estimations, celles-ci représentent 70% des professionnels de santé, sont surreprésentées dans l'économie informelle et effectuent la plus grande partie des travaux domestiques, autant d'aspects qui aggravent les inégalités déjà existantes. Parallèlement, les femmes sont des parties prenantes essentielles pour ce qui est de développer la résilience en cas de catastrophe. Les points de vue et les données d'expérience des femmes, ainsi que leurs capacités d'organisation, de pression et d'information, peuvent contribuer dans une large mesure à faire progresser la gestion des risques de catastrophe. Pourtant, elles sont confrontées à bien des obstacles qui limitent leur capacité de se protéger elles-mêmes et de participer aux processus décisionnels tout au long du cycle de gestion des risques de catastrophes.

Une publication du Bureau de développement des télécommunications (BDT) de l'UIT et du Groupe ETC intitulée "Les femmes, les TIC et les télécommunications d'urgence: perspectives et contraintes"[3] décrit les facteurs à l'origine de la fracture numérique entre les hommes et les femmes et de la vulnérabilité accrue des femmes et des jeunes filles avant, pendant et après une catastrophe. Elle présente des bonnes pratiques et des exemples d'utilisation des TIC pour renforcer l'égalité hommes-femmes dans la gestion des risques de catastrophe.

1.12 Les TIC au service de la gestion des catastrophes et du développement durable intelligent

Le développement durable intelligent est étroitement lié aux facteurs humains et à la collaboration entre les parties prenantes. Il suppose de relever un certain nombre de défis de taille: élaborer des mécanismes visant à améliorer la coordination entre un large éventail de parties prenantes participant aux opérations d'intervention TIC en cas d'urgence; concevoir des stratégies de financement nécessaires pour conclure des partenariats efficaces et trouver des sources de financement souples et prévisibles; garantir l'efficacité des programmes de formation des bénévoles et le développement des réseaux d'échange des bénévoles; et renforcer les capacités des réseaux régionaux et tirer parti de leur savoir-faire. En outre, des mesures ont été prises, notamment, afin de concevoir des partenariats public privé propres à promouvoir des possibilités de collaboration régionales et mondiales; de créer une plate-forme de plus grande envergure pour la gestion des catastrophes et, partant, de garantir en tout temps des services de télécommunication pour les secours en cas de catastrophe; de mettre en place des solutions préplanifiées afin d'éviter de perdre du temps avec des solutions improvisées sur le terrain; et d'instaurer un cadre réglementaire propre à faciliter les efforts de secours. Les mesures prises dans ces domaines contribueront à la réalisation des ODD. L'UIT a élaboré un rapport relatif à la gestion des catastrophes et au développement durable intelligent[4] sur la base des discussions menées au sein de trois groupes de travail sur le Fonds mondial pour une intervention rapide en cas d'urgence; sur les volontaires pour les télécommunications d'urgence; et sur le guide pratique et les indications réglementaires. Ces groupes ont traité la question de façon exhaustive.

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[3] UIT-D et Groupe ETC. Les femmes, les TIC et les télécommunications d'urgence: perspectives et contraintes. UIT, Genève, 2020.

[4] UIT, Conseil consultatif pour un modèle intelligent de développement durable. Rapport sur le modèle intelligent de développement durable, 2018. Outils pour des interventions TIC d'urgence rapide et pour le développement durable. (UIT, Genève, 2018).

1.13 Considérations liées à l'accessibilité

Les catastrophes sont particulièrement dévastatrices pour les personnes vulnérables, comme les personnes handicapées, les enfants, les personnes âgées, les travailleurs migrants, les chômeurs et les populations déplacées à cause de précédentes catastrophes. La gestion des catastrophes doit être inclusive de manière à répondre aux besoins de ces personnes. Un rapport de l'UIT-D[5] donne des informations détaillées sur le rôle que les TIC peuvent jouer pour aider les populations marginalisées qui rencontrent des difficultés pour accéder aux services mis en œuvre en cas de catastrophe et contient des recommandations précises à l'intention des parties prenantes pour chaque étape de la gestion d'une catastrophe. Les recommandations transversales sont notamment les suivantes:

- Consulter directement les membres des populations vulnérables pour connaître leurs besoins et faciliter leur participation à toutes les étapes du processus de gestion d'une catastrophe.
- Veiller à ce que l'accessibilité et la facilité d'utilisation des TIC soient prises en compte dans tous les projets se rapportant à des processus de gestion des catastrophes fondés sur les TIC ou dans les projets de développement fondés sur les TIC.
- Utiliser différents types de stratégies et de mécanismes pour encourager des TIC accessibles, y compris avec des textes législatifs, des politiques, des réglementations, des conditions d'octroi de licences, des codes de bonne conduite ou des mesures d'incitation de nature financière ou autre.
- Renforcer la capacité des populations vulnérables d'utiliser les TIC lorsqu'une catastrophe se produit grâce à des programmes de sensibilisation, de formation et de renforcement des compétences.
- Utiliser de multiples modes de communication pour fournir des informations avant, pendant et après une catastrophe, notamment les canaux suivants:
  - site web et applications mobiles accessibles, conçus conformément aux Directives d'accessibilité du contenu web en vigueur;
  - diffusion d'annonces sur les radios et télévisions de service public (en appliquant des mesures garantissant l'accessibilité comme l'audiodescription, le sous-titrage et l'interprétation en langue des signes);
  - envoi de messages et de conseils par SMS, MMS ou envoi groupé de courriers électroniques à l'intention des habitants par les autorités publiques, les organismes de secours, etc.;
  - fiches d'information et manuels électroniques accessibles;
  - présentations multimédia (webinaires, diffusions sur le web et vidéos, y compris sur des sites populaires comme YouTube);
  - outils dédiés sur les réseaux sociaux, par exemple des pages Facebook et des comptes Twitter créés par les pouvoirs publics et des organisations de secours en cas de catastrophe.

Grâce aux progrès accomplis dans le domaine de l'intelligence artificielle, la technologie peut être utilisée pour concevoir des agents conversationnels afin de recueillir et de diffuser des renseignements liés aux catastrophes. Ces applications seront utiles pour les groupes vulnérables, notamment les personnes handicapées.

[5] UIT, Centre for Internet and Society, Inde (CIS) et Initiative mondiale pour des technologies de l'information et de la communication inclusives (G3ict). Des TIC accessibles pour les personnes handicapées: organiser la préparation. UIT, 2016

Chapitre 2 – Favoriser un environnement politique et réglementaire propice

La communauté internationale reconnaît le rôle essentiel que jouent les TIC dans toutes les phases des catastrophes et l'importance d'élaborer des plans nationaux pour les télécommunications d'urgence. Il est admis que les efforts visant à réduire les risques de catastrophe doivent être systématiquement intégrés dans les politiques, les plans et les programmes de développement durable. Le déploiement et l'utilisation efficaces des TIC, de même que l'élaboration et la mise en œuvre de plans nationaux pour les télécommunications d'urgence, exigent un environnement politique propice et efficace. Cet impératif est reflété dans le Cadre d'action de Hyōgo 2005-2015: "La réduction des risques, envisagée dans une optique globale prenant en considération tous les aléas, devrait faire partie intégrante des politiques, plans et programmes relatifs au développement durable ainsi qu'aux opérations de secours et aux activités de remise en état et de relèvement après les catastrophes et après les conflits dans les pays sujets aux catastrophes"[6]. Ce cadre d'action souligne que les cadres législatifs jouent un rôle essentiel pour intégrer la réduction des risques de catastrophe aux politiques et aux plans en matière de développement: "Les pays qui se dotent d'un cadre de politique générale ainsi que de cadres législatif et institutionnel pour la réduction des risques de catastrophe et qui sont en mesure de suivre les progrès accomplis grâce à des indicateurs précis et mesurables sont mieux à même de gérer les risques et d'obtenir que, dans toutes les couches de la société, les mesures de réduction des risques de catastrophe fassent l'objet d'un large consensus et que chacun participe à leur application et s'y conforme"[7]. La législation et les règles formelles écrites sont importantes, car elles définissent les responsabilités de ceux qui exercent des fonctions particulières. Les lois et réglementations peuvent permettre de déterminer le cadre pour les mécanismes de coordination, les canaux de communication et les procédures d'exploitation, et d'identifier les décideurs au sein des organismes compétents. En outre, la législation et les règles écrites contribuent à la durabilité du processus de gestion des risques de catastrophe, de façon que les politiques en la matière survivent aux gouvernements successifs et permettent de conserver un budget indépendamment des manœuvres politiques partisanes. Dans de nombreux cas, la législation nationale relative à la réduction des risques de catastrophe contribue à façonner les stratégies nationales pertinentes ainsi que les structures correspondantes au niveau sous-national. De cette manière, il est possible de décentraliser les rôles et les responsabilités vers le niveau d'autorité le plus bas, mais aussi de fournir une structure de coordination globale entre les secteurs et les niveaux de gouvernement[8].

Les cadres et politiques applicables aux communications en cas de catastrophe contribuent à préciser les activités et les responsabilités lorsqu'une catastrophe se produit et à assurer la continuité du fonctionnement des TIC durant la phase de rétablissement. Les cadres de gestion

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6 Stratégie internationale pour la prévention des catastrophes naturelles (ISDR). Cadre d'action de Hyōgo 2005-2015: Pour des nations et des collectivités résilientes face aux catastrophes, extrait du rapport final de la Conférence mondiale sur la prévention des catastrophes (A/CONF.206/6), Partie III.A, paragraphe 13(c)

7 Ibid., Partie III.B.1, paragraphe 16.

8 UIT, op. cit. (note 2).

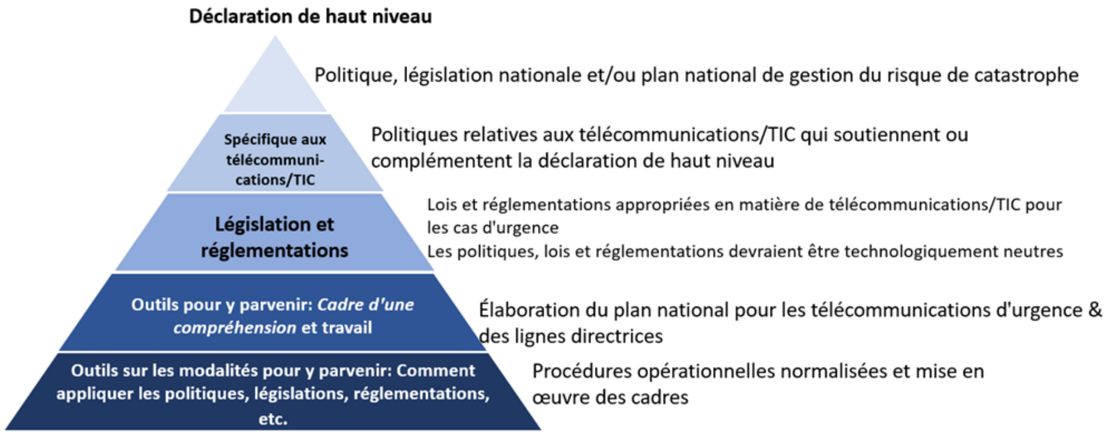
des catastrophes peuvent comprendre des mesures de nature politique et réglementaire propres aux TIC, par exemple des procédures accélérées d'octroi de licences à appliquer en cas de catastrophe, la suppression des possibles barrières douanières limitant l'entrée des équipements de communication d'urgence ou l'application de la Convention de Tampere.

Comme indiqué au **Chapitre 1** (introduction), l'un des objectifs au titre de la Question 5/2 est de mener une discussion au sujet de l'environnement politique et réglementaire propice. Dans ce contexte, un webinaire public a été organisé le 14 juillet 2020. Cet atelier, intitulé "Environnement politique propre à permettre une gestion efficace des catastrophes, y compris de la pandémie de COVID-19" (voir l'**Annexe 4, paragraphe A4.4**) a réuni des spécialistes qui ont examiné les composants d'un environnement politique propre à améliorer la préparation des télécommunications d'urgence, la résilience des réseaux, la réduction du risque de catastrophe et la gestion des catastrophes. Ils ont également examiné les politiques propres à favoriser la souplesse lors du déploiement des équipements de communication d'urgence et à améliorer la préparation et les interventions en cas de catastrophe du point de vue des télécommunications/TIC, ainsi qu'à tirer des enseignements concernant l'élaboration et la mise en œuvre de politiques propices et de plans nationaux relatifs aux télécommunications d'urgence.

2.1 Politiques relatives au déploiement de systèmes de communications d'urgence

Les plans nationaux pour les communications d'urgence visent à définir des stratégies claires permettant d'assurer la disponibilité des communications durant toutes les phases d'une catastrophe, en favorisant la coordination et le dialogue entre tous les niveaux d'administration, les organismes humanitaires, les fournisseurs de services et les communautés exposées à des risques.

Figure 1 – Politique pour le déploiement de systèmes de communications d'urgence: éléments constitutifs



Source: UIT[9].

[9] Ibid.

Les politiques relatives au déploiement de systèmes de communications d'urgence sont issues d'une déclaration politique de haut niveau, de la législation nationale et/ou d'un plan national de gestion des risques de catastrophe (voir la **Figure 1**), qui forment un cadre institutionnel et interinstitutionnel pour l'action des pouvoirs publics et de la société civile face à une menace ou à une catastrophe.

Le plan devrait refléter l'engagement des pouvoirs publics au plus haut niveau, et ceux-ci devraient fournir un appui sur le plan de l'organisation et de la direction, affecter des ressources et s'engager à produire les résultats attendus. Un ensemble spécifique de politiques devraient être mis en place dans le domaine des communications d'urgence afin d'appuyer ou de compléter la législation nationale. Il convient de s'assurer que les politiques soient mises au point en vue de créer, de développer ou d'améliorer les capacités de télécommunications interopérables au niveau national.

Plusieurs pays disposent déjà d'un cadre stratégique de ce type. En Inde, les communications d'urgence revêtent une importance prioritaire. La politique nationale relative aux télécommunications de 2012 souligne l'importance de créer des réseaux de télécommunication robustes et résilients pour répondre aux besoins en matière d'appui proactif en vue d'atténuer les catastrophes d'origine naturelle ou causées par l'homme. Cette politique établit des procédures opérationnelles normalisées en fonction des secteurs afin de promouvoir une atténuation rapide et efficace en situation d'urgence ou de catastrophe et encourage l'utilisation des TIC afin de prévoir et de surveiller les catastrophes, de lancer des alertes et de diffuser des informations. Le Gouvernement de l'Inde a mis en place une politique, un plan et des lignes directrices en cas de catastrophe à travers une série de mesures: la Loi de 2005 relative à la gestion des catastrophes; la politique de gestion des catastrophes de 2009; les Lignes directrices relatives aux communications d'urgence de 2012; et le plan de gestion des catastrophes de 2019. Dans le cadre de la lutte contre la pandémie de COVID-19, des instructions concernant les mesures de confinement/réouverture et des mesures de sûreté et de sécurité ont été mises en place en vertu de la loi relative à la gestion des catastrophes. Le régulateur des télécommunications de l'Inde, à savoir l'Autorité de régulation des télécommunications, a également mené à bien des travaux dans le domaine des télécommunications d'urgence. Elle a formulé des recommandations à l'intention du gouvernement concernant le numéro d'urgence unique (112) pour le routage des appels prioritaires passés par les personnes chargées des interventions et des opérations de secours, ainsi que la nécessité, pour les fournisseurs de services de télécommunication, de permettre à leurs abonnés de naviguer sans surcoût sur d'autres réseaux en cas de catastrophe. Le régulateur a également recommandé la création d'un réseau de protection du public et de secours en cas de catastrophe en Inde.

Haïti ne dispose pas encore d'un système de télécommunications d'urgence intégré, mais a mis en place un Comité sectoriel sur les télécommunications d'urgence (COSTU), chargé de coordonner les interventions dans le secteur conformément au plan national de gestion des risques et des désastres. Le comité a été créé dans le but d'utiliser les télécommunications et les TIC pour renforcer la coordination des activités de prévention, de préparation et d'intervention en cas de catastrophe. Sa création témoigne de la volonté des pouvoirs publics de renforcer les mesures de prévention, de préparation et d'intervention en cas de catastrophe.

Le Programme alimentaire mondial (PAM) et l'UIT ont élaboré une liste de contrôle relative à la préparation dans le domaine des télécommunications d'urgence portant sur les principaux domaines thématiques susceptibles de figurer dans un plan national pour les télécommunications d'urgence et fournissant une approche de notation simple visant à évaluer les progrès accomplis au regard de chaque point de décision ou chaque mesure au fil du temps. Cette liste de contrôle appuie essentiellement la création et l'amélioration de plans nationaux pour les télécommunications d'urgence, l'accent étant mis sur l'évaluation de l'état de préparation du pays en vue de permettre les communications en cas de catastrophe et l'identification des zones cibles qui appellent une attention particulière.

2.2 Politiques favorisant l'alerte rapide, la continuité des communications et des interventions plus efficaces

L'objectif des systèmes d'alerte avancée en cas de catastrophe naturelle est de limiter les effets que ces catastrophes produisent sur les populations exposées. Les risques naturels peuvent devenir catastrophiques lorsque les populations touchées ne sont pas en mesure d'y faire face. Ainsi, l'objectif premier d'un système d'alerte est de donner les moyens aux particuliers et aux communautés de réagir rapidement et de manière appropriée afin de réduire le risque de décès, de blessure ou de dommage matériel, et d'atténuer les effets d'une catastrophe. Une communauté qui ne bénéficie pas de l'alerte rapide sera mal préparée et subira des conséquences plus dramatiques en cas de catastrophe.

La deuxième priorité sur les cinq énoncées dans le Cadre d'action de Hyōgo 2005-2015 est de "*mettre en évidence, évaluer et surveiller les risques de catastrophe et renforcer les systèmes d'alerte rapide*"[10]. Les autorités qui prennent les décisions sur le plan de l'atténuation des catastrophes nécessitent des alertes rapides de plus en plus précises pour pouvoir mettre au point des mesures efficaces. Cela suppose d'allonger le délai des alertes, d'améliorer leur précision, de répondre à la demande croissante vis-à-vis des prévisions probabilistes, d'une meilleure communication et d'une plus grande diffusion des alertes, d'utiliser les nouvelles technologies pour alerter la population, d'orienter les services d'alerte vers les utilisateurs particuliers concernés, et d'envoyer des messages d'alerte clairs, faciles à comprendre et dénués d'ambigüité qui suscitent une réaction appropriée. Il est préférable que les délais d'alerte et les prévisions probabilistes soient plus longs, de manière à éviter les fausses alertes. Les contributions soumises par les États Membres durant la période d'études ont montré que de nombreux pays ont pris des mesures pour mettre en place un système d'alerte avancée robuste et efficace. L'Inde, par exemple, a créé des organismes centraux de première ligne chargés de surveiller les catastrophes dans le pays et de diffuser des alertes avancées, à savoir le Département météorologique de l'Inde, chargé des cyclones, inondations, sécheresses et tremblements de terre; la Commission centrale de l'eau, chargée des inondations; l'Office indien de la géologie, pour les glissements de terrain; le Centre national pour les services d'information océanique, pour les tsunamis; et l'Office pour l'étude des avalanches, chargé des avalanches.

Les organismes d'alerte rapide de l'Inde envoient aussi des informations importantes aux pays voisins et à d'autres organismes similaires dans la région de l'océan Indien et de l'Asie-Pacifique. Grâce aux efforts coordonnés de ces divers organismes et à la diffusion des informations au sein de la communauté au moyen des outils électroniques, de la téléphonie fixe et mobile et de technologies telles que le protocole CAP, l'Inde a été en mesure d'accroître le délai d'alerte en cas de cyclone, par exemple, de façon que les organismes de secours et d'intervention compétents disposent de suffisamment de temps pour secourir les populations et les mener en lieu sûr. Les pertes humaines et animales ainsi que les dommages matériels ont ainsi pu

[10] Cadre d'action de Hyōgo 2005-2015, op. cit., note 6, Partie III.B.2.

être considérablement réduits durant les cyclones, qui touchent chaque année les régions côtières du pays.

Au Burundi, de nombreux organismes sont chargés des interventions en cas de catastrophe. L'Institut géographique du Burundi, une administration publique, a pour but de promouvoir les activités météorologiques nationales pour le bien-être de la population. La Croix-Rouge du Burundi assure les interventions rapides visant à secourir des victimes en cas de catastrophe dues aux changements climatiques. Les administrations locales jouent un rôle prépondérant dans la protection de la population avec l'aide d'autres parties prenantes s'occupant de la lutte contre les catastrophes. Le Burundi a mis en place une plate-forme nationale de gestion des risques chargée de la prévention et de la gestion des risques liés aux catastrophes, de la sensibilisation et de la mise en œuvre de mesures concrètes en cas de catastrophe. Toutes ces entités travaillent en coordination pour réduire les risques de catastrophe et lutter contre les catastrophes.

Le Brésil, le Japon, la Nouvelle-Zélande et les États-Unis sont également dotés de systèmes d'alerte avancée et utilisent différents moyens, par exemple le protocole CAP, tout récemment, pour lancer des alertes.

La prévention en prévision des catastrophes, la résilience face aux catastrophes et les capacités des services d'urgence peuvent être améliorées grâce aux dernières avancées concernant les réseaux de communication par satellite, le réseau de communication mobile public et des réseaux privés utilisés aux fins des communications d'urgence, ainsi qu'à l'intégration des ressources des réseaux spatiaux et des réseaux de Terre utilisés pour les communications d'urgence. D'autres technologies de communication en cas de catastrophe sont présentées au **Chapitre 3** (La Chine, par exemple, utilise des satellites à haut débit dans la bande Ka et des services 4G pour les interventions en cas d'urgence et les opérations de secours en cas de catastrophe (voir l'**Annexe 1, paragraphe A1.2.8**)). Il existe diverses applications, et des solutions peuvent être déployées en tirant parti des communications et de l'imagerie par satellite, afin de détecter et de transmettre des informations relatives aux catastrophes. Les satellites permettent d'assurer des communications en temps réel partout dans le monde.

Dans le cadre de ses travaux, la Commission d'études a organisé une table ronde sur les systèmes d'alerte avancée, y compris la confirmation de sécurité, le 8 mai 2018. Cette session a permis de mettre en évidence un certain nombre de bonnes pratiques relatives aux politiques d'alerte avancée, à la continuité des communications et aux interventions efficaces (on trouvera de plus amples renseignements dans l'**Annexe 4, paragraphe A4.1**), en particulier sur le plan de la souplesse réglementaire et de la souplesse en général, de l'évolution des technologies et des systèmes d'alerte d'urgence, de la nécessité de disposer de politiques propices, de la connectivité, du renforcement des capacités, de l'amélioration continue des procédures d'urgence et des listes de contrôle.

2.3 Interventions stratégiques liées à la pandémie de COVID-19

Le COVID-19 a été qualifié de pandémie par l'Organisation mondiale de la santé (OMS) le 11 mars 2020. La maladie s'est propagée rapidement à travers le monde, faisant des millions de morts et entraînant des pertes économiques de l'ordre de plusieurs milliers de milliards de dollars. Au moyen des TIC, les pays ont apporté des solutions très diverses aux problèmes que tous ont rencontrés, consistant par exemple à prendre des mesures pour répondre à la demande croissante concernant le large bande, à supprimer ou à réduire les taxes/redevances relatives aux télécommunications; à faciliter le rechargement gratuit des forfaits téléphoniques à prépaiement pour les abonnés qui ne sont pas en mesure de recharger leur forfait durant les périodes de confinement, à permettre le traçage des personnes contaminées et de leurs contacts grâce à des applications mobiles; et à concevoir des applications mobiles indiquant les lits disponibles à l'hôpital et dans les infrastructures de santé associées.

Parmi les enseignements tirés de la pandémie et examinés durant le webinaire sur les environnements de politiques générales facilitant la gestion des catastrophes, y compris la pandémie de COVID-19, tous sont convenus que les réseaux de télécommunication et les infrastructures numériques du monde entier doivent être robustes, résilients, adaptables et évolutifs et doivent être mieux préparés pour faire face aux catastrophes de tous types.

Chapitre 3 – Technologies de communication d'urgence

Le présent chapitre met en évidence différentes technologies de communication d'urgence pouvant être mises en œuvre afin d'appuyer la gestion des catastrophes.

3.1 Technologies de communication

L'utilisation des télécommunications/TIC peut être utile aux fins de la prévention des catastrophes, de la préparation en prévision des catastrophes, de l'alerte avancée, des interventions et des opérations de secours en cas de catastrophe. La plupart des TIC sont connectées aux réseaux de télécommunication, c'est pourquoi il est important de s'assurer que l'infrastructure de télécommunication en place soit appropriée. Différents réseaux de télécommunication peuvent être utiles aux fins de la gestion des catastrophes.

- **Les réseaux de télécommunication par satellite**: les communications par satellite présentent l'avantage de ne pas être endommagée durant les catastrophes naturelles. De nombreux services par satellite, incluant des équipements fixes par satellite, des équipements installés sur des véhicules en mouvement tels que des véhicules d'intervention ou des ambulances et des équipements portatifs tels que les téléphones satellitaires et les terminaux de réseau global large bande (BGAN), sont actuellement utilisés pour les communications d'urgence. En outre, les communications par satellite jouent un rôle précieux dans la prévision, l'atténuation, l'alerte avancée et les interventions en cas de catastrophe, et sont souvent parmi les premières technologies à être déployées lorsque les technologies terrestres sont endommagées. Elles peuvent contribuer à regrouper les données et à assurer des communications résilientes aux fins du rétablissement. À cette fin, elles ont été intégrées dans les réseaux de Terre, par exemple dans le réseau des services d'urgence du Royaume-Uni.
- **Véhicules aériens**: de la même manière que pour les systèmes de communication par satellite, les transmissions radioélectriques entre les répéteurs placés sur des véhicules aériens, y compris des aéronefs sans pilote, et les stations de relais ne rencontrent aucun obstacle sur le terrain et sont utiles en cas de catastrophe naturelle.
- **Technologies de réseau ad hoc**: bien que les réseaux ad hoc n'offrent pas de capacités de réseau à grande échelle, leur configuration maillée unique peut être utilisée de façon complémentaire pour les secours d'urgence dans les zones isolées, les abris temporaires et les zones d'évacuation en hauteur.
- **Réseaux mobiles 5G**: les trois principaux scénarios d'application de la 5G (large bande mobile évolué, communications ultra fiables à faible temps de latence et communications massives de type machine) permettent de répondre à la plupart des besoins en matière de communications d'urgence en offrant une grande largeur de bande, un faible temps de latence et une grande fiabilité. Ils permettent d'améliorer les capacités de communication de secours et d'appui globales en cas d'urgence, afin d'atteindre un plus haut niveau de gestion des situations d'urgence. Dans le futur, les réseaux privés et les réseaux publics 5G devraient fonctionner de concert pour fournir des services de communication résilients aux fins de la gestion des catastrophes. L'association des réseaux publics et privés permettra de disposer de réseaux de communication d'urgence garantis en trois dimensions reposant sur l'intégration et l'interopérabilité des systèmes spatiaux et des systèmes de Terre. Il sera ainsi possible d'atteindre les mêmes résultats que les systèmes de communication d'urgence garantis.

3.2 Les technologies émergentes au service des communications d'urgence

3.2.1 Applications mobiles

À mesure que les téléphones intelligents gagnent en popularité, les particuliers utilisent de plus en plus les services fondés sur l'Internet, comme les réseaux sociaux, la recherche d'informations et le commerce électronique, et les applications mobiles fondées sur l'internet s'imposent comme des solutions importantes en situation de catastrophe. L'application Fisher Friend Mobile, par exemple, est une application mobile d'alerte rapide et une solution à guichet unique pour les besoins généraux de la communauté des pêcheurs en termes de communication côtière, fournissant aux pêcheurs un accès immédiat à des services de connaissances et d'informations essentiels quasiment en temps réel sur la météorologie, les zones de pêches, les prévisions océaniques et les renseignements liés au marché. Les pêcheurs reçoivent régulièrement des prévisions météorologiques en mer, des alertes avancées sur les conditions météorologiques dangereuses et des conseils concernant les zones de pêche.

À titre d'exemple, on peut également citer l'outil de cartographie des catastrophes de Facebook. Les personnes utilisant l'application Facebook en autorisant la localisation de leur appareil reçoivent régulièrement des informations sur la longitude et la latitude de leur position. Rassemblées et désidentifiées, ces données sur la localisation géologique peuvent être exploitées après une catastrophe. Les types d'ensembles de données Facebook peuvent concerner les déplacements de personnes et la densité d'une foule, ainsi que les informations collectées par l'outil de vérification de la sécurité de Facebook après une catastrophe.

3.2.2 Utilisation des services de réseaux sociaux

Les réseaux sociaux sont des plates-formes permettant aux utilisateurs de créer, de voir et de commenter des contenus tout en communiquant avec les autres utilisateurs et le public. Les services de réseautage social en ligne et les réseaux sociaux tels que Facebook, Twitter, YouTube et Google+ peuvent être utilisés lors de catastrophes afin d'alerter ceux qui se trouvent en dehors des zones concernées, de recruter des bénévoles ou de faire appel à des dons, de réunir les familles et amis qui ont été déplacés et de fournir des renseignements sur les biens non réclamés et les corps non identifiés, ou sur les centres d'assistance et autres ressources. Ils peuvent être utilisés afin de donner des informations actualisées sur les routes fermées, les pannes de courant, les incendies, les accidents ou d'autres incidents, par exemple. Ils permettent aux particuliers d'être mieux préparés en cas de catastrophe et de comprendre quelles sont les organisations qui peuvent agir. En situation de catastrophe, ils permettent aux utilisateurs de communiquer directement avec leurs familles, les journalistes, les organisations de bénévoles et d'autres habitants, afin de partager rapidement des informations. Après une catastrophe, ils permettent à la communauté de se réunir pour parler de l'évènement, partager des informations, coordonner les efforts de rétablissement, obtenir des renseignements sur l'assistance disponible, etc.

Au lendemain d'une catastrophe majeure qui a eu lieu au Japon, par exemple, les réseaux sociaux ont été largement utilisés durant les opérations de secours et les activités de levée de fonds. Les réseaux sociaux peuvent diffuser des informations sur les installations et les équipements facilitant le rétablissement après une catastrophe de manière beaucoup plus rapide, précise et fiable que les modes de communication classiques.

Durant les inondations qui ont eu lieu en 2015 à Chennai (Inde), la population a largement utilisé les réseaux sociaux pour rester en contact avec le monde extérieur. Les habitants de la ville ont utilisé les réseaux sociaux pour proposer un hébergement aux sinistrés et les protéger des intempéries. Les mots-dièse #ChennaiFloods et #ChennaiRainHelps ont ainsi été employés aussi bien par les victimes que par les bénévoles.

Le Japon a conçu un système de réseau local portatif, baptisé "Système en nuage accessible localement" pour les cas où les catastrophes entraînent une panne des services de télécommunication, en particulier des services fondés sur l'Internet. Le système est constitué d'un point d'accès WiFi, d'un petit serveur informatique, d'une batterie et d'autres périphériques. Ces composants sont assemblés dans une caisse portative qui peut être rapidement acheminée vers les zones touchées par une catastrophe. Le serveur fait office de serveur web et assure des fonctions de communication de base nécessaires en cas de catastrophe.

Le Japon a également mis au point un agent conversationnel baptisé SOCDA (SOCial dynamics observation and victims support Dialogue Agent platform for disaster management (Plate-forme d'agents conversationnels pour l'observation de la dynamique SOCiale et le soutien aux victimes aux fins de la gestion des catastrophes)). Le système utilise l'intelligence artificielle pour recueillir des informations liées aux catastrophes auprès des particuliers via les réseaux sociaux, regroupe les contenus en utilisant des technologies d'analyse et de synthèse des informations relatives aux catastrophes (voir la **Section 3.6** ci-dessous), place ces informations sur une carte et communique les renseignements nécessaires pour évacuer rapidement les populations. Les particuliers et le personnel d'intervention peuvent utiliser le système en l'ajoutant comme ami sur les réseaux sociaux. Ce système devrait être utilisé par les autorités nationales et locales, le personnel d'intervention (y compris les professionnels de santé) et les personnes vivant dans des zones touchées par des catastrophes, aussi bien dans les pays développés que dans les pays en développement.

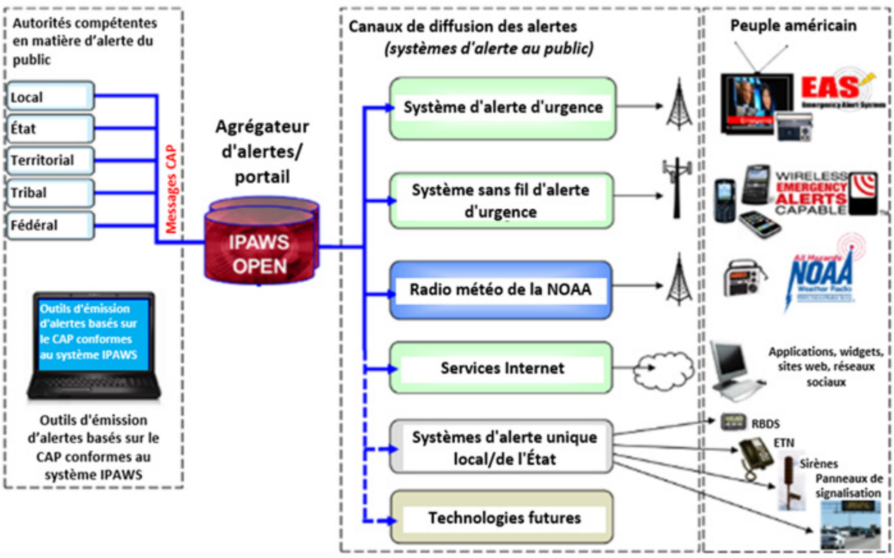
3.2.3 Système intégré d'alerte

Il est essentiel, lorsque l'on met au point un système d'alerte et d'avertissement, de disposer de l'autorité, des politiques et de la gouvernance nécessaires, afin d'établir les priorités en matière de ressources humaines et financières.

Aux États-Unis, le système intégré d'alerte et d'avertissement du public (IPAWS) de l'Agence fédérale de gestion des situations d'urgence (FEMA) est une infrastructure nationale d'alerte et d'avertissement multirisques et multiutilisateurs utilisée par des entités au niveaux fédéral, des États, local, tribal et territorial. Le système IPAWS utilise les normes relatives aux technologies et à l'information pour relier plusieurs infrastructures technologiques de communication du secteur privé, ce qui permet de transmettre un message d'urgence unique de façon simultanée via plusieurs canaux de diffusion à l'intention du public, par exemple la radio, la télévision, les dispositifs mobiles et les systèmes connectés à l'Internet, les sites web et les applications.

L'architecture du système IPAWS (voir la **Figure 2**) est conçue pour prendre en charge l'interopérabilité avec tout système d'alerte et d'avertissement du pays qui utilise les mêmes normes. La plate-forme ouverte pour les réseaux d'urgence du système intégré d'alerte et d'avertissement du public (IPAWS-OPEN) est l'infrastructure qui achemine les messages d'alerte et d'avertissement authentifiés jusqu'au public au moyen de systèmes de radio et de télévision dans le système d'alerte en cas d'urgence, le système sans fil d'alertes en cas d'urgence destinées aux téléphones mobiles, la radio météo de l'Administration nationale de l'atmosphère et des océans ainsi que d'autres systèmes de communication.

Figure 2 – Architecture du système IPAWS



Source: États-Unis[11].

3.2.4 Utilisation d'aéronefs avec et sans pilote

Les aéronefs sans pilote (UAV) sont de plus en plus utilisés par les pouvoirs publics, les consommateurs et les entreprises. Ils offrent un large éventail de solutions pour différents secteurs et sont largement utilisés dans les services d'utilité publique, l'agriculture, les services de livraison exprès, les interventions en situation d'urgence, l'énergie, etc.

Utilisation des aéronefs UAV dans la lutte contre les incendies

Les aéronefs UAV, ou drones aériens, se sont révélés extrêmement utiles dans la lutte contre les incendies. Ils permettent de suivre la progression des incendies, de repérer les départs de feu et d'orienter l'action des sapeurs-pompiers. Des images des incendies et de leur propagation, notamment des images thermiques, peuvent être utilisées pour déterminer la façon de lutter contre ces incendies. En avril 2019, deux aéronefs UAV civils ont été utilisés pour lutter contre l'incendie de la cathédrale Notre-Dame à Paris. Aujourd'hui, le réseau 4G permet de répondre aux besoins de communication de certains scénarios UAV, mais de nombreux problèmes subsistent sur le plan de la largeur de bande, du temps de latence et de la coordination relative aux brouillages. En raison du développement rapide du secteur des aéronefs UAV, de nouveaux besoins sont apparus concernant les liaisons de communication UAV et l'intégration plus étroite avec les techniques de communication mobile cellulaire. Il sera possible de répondre à ces besoins lorsque les technologies 5G se seront généralisées.

[11] Document SG2RGQ/152 + Annexe (États-Unis) de la CE 2 de l'UIT-D.

Communications d'urgence au moyen des stations de base à haute altitude

En cas de catastrophe naturelle, les aéronefs UAV permettent de déployer rapidement des stations de base à haute altitude pour rétablir les fonctions de communication (voix et données).

Les véhicules de communication d'urgence sont généralement utilisés de manière provisoire pour assurer la communication en cas de perturbation de grande ampleur causée par un séisme, une inondation, un glissement de terrain ou une autre catastrophe naturelle. Toutefois, ces véhicules desservent une zone de service relativement limitée et la stabilité des signaux qu'ils émettent est faible. Ils ne permettent même pas, dans certains cas, d'atteindre l'épicentre de la zone touchée par la catastrophe si les routes sont effondrées ou encombrées. Il est donc difficile, coûteux et inefficace de s'en remettre aux moyens traditionnels de mise en place de stations de communication d'urgence et de rétablissement des stations de base, sans compter que ce processus prend du temps. Étant donné que les technologies UAV sont parvenues à un degré d'élaboration avancé et qu'elles sont intégrées aux systèmes de communications d'urgence, les opérateurs disposent d'un moyen innovant, plus rapide et plus pratique pour assurer le rétablissement des communications dans les zones touchées par des catastrophes.

Aéronefs UAV captifs + station de base à haute altitude

Les systèmes d'aéronefs UAV captifs sont alimentés depuis le sol. Les aéronefs UAV sont reliés à une plate-forme de décollage par un câble de retenue et ont une autonomie illimitée. Une fois que la station de base à bord d'un aéronef UAV fonctionne, les dispositifs d'alimentation au sol alimentent le système captif et les unités radio distantes de bord. Ces dispositifs communiquent avec les véhicules de communication d'urgence via les unités en bande de base au sol par l'intermédiaire du câble à fibre optique du système captif, de sorte que les véhicules de communication d'urgence peuvent se connecter au pylône de la station de base située à proximité. À cette fin, ils utilisent des dispositifs hyperfréquences, la fibre optique ou des véhicules de communication par satellite, puis raccordent le signal au réseau central pour assurer la couverture du signal mobile. Ainsi, on peut remédier efficacement au problème des incidences du terrain sur les ondes électromagnétiques et garantir une couverture continue dans une zone donnée.

Les stations de base UAV à haute altitude pour les communications d'urgence peuvent couvrir une zone pouvant atteindre 50 km^2 et fournir simultanément un service de messagerie instantanée à des milliers d'utilisateurs de téléphones mobiles. Capables d'atteindre rapidement une altitude comprise entre 50 et 200 m, les stations de ce type peuvent assurer un service de téléphonie utilisant la technologie LTE (évolution à long terme) (VoLTE) continu 24 h sur 24 ainsi que d'autres services de données dans les zones frappées par une catastrophe. Les aéronefs UAV captifs utilisés avec les stations de base à bord d'aéronefs permettent de rétablir rapidement les communications sur place, de résoudre les problèmes de couverture des signaux dans les situations d'urgence et d'améliorer véritablement la capacité de prise en charge des communications d'urgence des pouvoirs publics et des opérateurs à la suite de catastrophes naturelles.

Aéronefs UAV à voilure fixe + station de base à haute altitude

Lorsqu'ils évoluent vers la zone cible, les aéronefs UAV à voilure fixe de grande dimension transportant des stations de base de communication mobiles et des systèmes de communication par satellite peuvent permettre d'assurer une couverture de signaux mobiles continue et stable pendant une période prolongée (d'au moins 24 heures) dans une zone de plus de 30 km^2, ce qui permet de rétablir rapidement les communications et de réduire les pertes humaines et matérielles dans la zone touchée par la catastrophe.

Les aéronefs UAV à voilure fixe en réseau, équipés d'une caméra orthographique et d'un module photoélectrique, peuvent être utilisés pour obtenir les données du système d'information géographique (GIS), qui sont nécessaires pour la transmission rapide des données et la création d'une carte à trois dimensions de la zone touchée par le tremblement de terre, données qui serviront de base aux décisions sur les secours.

À l'aide de petits systèmes intégrés à usage individuel, les équipes de reconnaissance au sol peuvent communiquer des données cruciales sur les opérations de secours, retransmettre des informations vidéo et des images en temps réel et envoyer rapidement des équipes et des équipements de secours à partir des données GIS, ce qui améliore largement la rapidité et la précision des interventions d'urgence.

Communications d'urgence au moyen d'aéronefs UAV: prochaines étapes

L'élaboration de normes constitue un défi dans le domaine des communications d'urgence assurées au moyen aéronefs UAV. La Chine met actuellement au point des prescriptions techniques pour les communications d'urgence assurées par des stations de base à haute altitude au moyen d'aéronefs UAV captifs. De plus, étant donné que les stations de base classiques fournissent essentiellement une couverture au sol, les aéronefs UAV ont besoin de stations de base spéciales pour assurer une couverture au moyen d'aéronefs. Les aéronefs UAV utilisant la technologie 5G s'appuient aujourd'hui sur les équipements CPE généraux en 5G (équipements des locaux d'abonnés actuellement utilisés pour convertir les signaux 5G en signaux WiFi) pour les communications. À terme, des terminaux spéciaux et des modules de communication 5G seront nécessaires pour améliorer l'intégration.

3.3 Les technologies émergentes au service des interventions et des secours en cas de catastrophe

Les technologies et les outils émergents, tels que l'analyse des données issues de la télédétection et l'outil d'analyse et d'examen de la capacité des systèmes d'observation (OSCAR) de l'Organisation météorologique mondiale (OMM)[12], permettent d'analyser les informations relatives aux catastrophes et contribuent à l'élaboration des mesures d'intervention et de secours appropriées en cas de catastrophe. Plusieurs institutions du système des Nations Unies élaborent et utilisent de tels outils, dont certains sont présentés ci-dessous.

Pour tirer le meilleur parti possible des données de télédétection, un organisme local de gestion des situations d'urgence doit être mis en place pour acheminer les informations pertinentes vers les personnes sur le terrain. Le Programme des Nations Unies pour l'exploitation de l'information d'origine spatiale aux fins de la gestion des catastrophes et des interventions d'urgence (UN-SPIDER) a été créé pour aider les pays à se doter des capacités nécessaires pour gérer les catastrophes. Il se spécialise dans la mise en place d'organismes de secours et la formation de leur personnel, tandis que d'autres organisations sont plus orientées vers les données.

[12] Voir le système OSCAR de l'OMM.

L'outil OSCAR de l'OMM comprend un tableau présentant tous les satellites passés, actuels et futurs utilisés aux fins de la météorologie et de l'observation de la Terre. Il peut être utilisé pour trouver des sources de données supplémentaires.

Il existe une autre source de données télédétectées appelée Programme d'applications satellitaires opérationnelles (UNOSAT) de l'Institut des Nations Unies pour la formation et la recherche (UNITAR). Ce programme a été mis en place pour offrir à la communauté internationale et aux pays en développement un meilleur accès aux images satellite et aux services fondés sur des systèmes GIS.

3.4 Les technologies de télédétection de Terre et par satellite pour la gestion des catastrophes naturelles

La gestion des catastrophes naturelles exige une grande quantité de données spatiales multi temporelles. La télédétection par satellite est un outil idéal pour la gestion des catastrophes, dans la mesure où cette technique fournit des informations sur des zones étendues à intervalles fréquents. Bien que cet outil puisse être utilisé dans toutes les phases de la gestion des catastrophes, on constate que, jusqu'à présent, il a surtout été utilisé aux fins des alertes et de la surveillance. Au cours des dernières décennies, les technologies spatiales/par satellite ont été utilisées aux fins des phases de préparation et d'alerte en cas de cyclone, de sécheresse et d'inondation.

Les services des auxiliaires de la météorologie, de météorologie par satellite et d'exploration de la Terre par satellite jouent un rôle déterminant dans certaines activités, telles que:

- l'identification des zones à risque;
- la prévision météorologique et la prévision des changements climatiques;
- la détection et le suivi des tremblements de terre, des tsunamis, des ouragans, des feux de forêt, des marées noires, etc.;
- la fourniture d'informations d'alerte/d'avertissement sur ces catastrophes;
- l'évaluation des dommages causés par les catastrophes;
- la fourniture d'informations destinées à la planification des opérations de secours;
- le suivi du rétablissement après une catastrophe.

Ces services fournissent des données utiles, voire essentielles, pour maintenir et améliorer l'exactitude des prévisions météorologiques, surveiller et prévoir les changements climatiques et collecter des informations sur les ressources naturelles. Les objectifs et les applications associées des technologies par satellite sont présentés dans le **Tableau 1**.

Tableau 1 – Objectifs et technologies satellitaires associées

Technologies / Objectifs	Imagerie radar à ouverture synthétique	Imagerie radar à ouverture synthétique interférométrique	Imagerie active en hyperfréquence	Altimétrie radar	Diffusiométrie radar	Radar de détection des précipitations	Occultation radio GPS	Imagerie passive en hyperfréquence	Sondeur passif en hyperfréquence	Imagerie géographique en lumière visible et en infrarouge	Imagerie optique	Imagerie optique multispectrale	Imagerie infrarouge
Risques côtiers	x										x		
Sécheresse	x		x	x	x			x		x	x	x	
Tremblements de terre	x	x					x				x		
Phénomènes météorologiques extrêmes					x	x	x	x	x	x	x		
Inondations	x		x		x	x	x	x	x		x		
Glissements de terrain	x	x									x	x	
Pollution des océans	x											x	
Pollution											x	x	
Glaces marines et lacustres	x							x			x		
Volcans	x	x						x			x	x	x
Feux de forêt								x			x	x	x

3.5 Communications par satellite

Depuis des décennies, les communications par satellite ont permis de fournir un appui aux organisations internationales d'intervention et aux populations dans les zones touchées. Il s'agit d'un élément essentiel de la préparation aux catastrophes et des opérations de secours en cas de catastrophe dans le monde entier. Elles permettent d'assurer des communications large bande, souvent en s'affranchissant des conditions sur le terrain. L'écosystème des communications par satellite en cas de catastrophe qui a vu le jour il y a plus de 50 ans est désormais plus abordable et plus efficace.

Les communications satellitaires fonctionnent de manière indépendante par rapport aux infrastructures de télécommunication locales, et de petites batteries ou des systèmes d'alimentation électrique indépendants peuvent permettre d'assurer la continuité lorsque les sources d'alimentation locales sont endommagées lors d'une catastrophe. Les terminaux de communication par satellite sont autosuffisants et ont démontré, dans le cadre de leur déploiement dans diverses situations, qu'ils peuvent être utilisés quelques minutes à peine après leur déploiement sur place.

Les équipements de communication en cas de catastrophe peuvent être compacts, légers et portatifs, ce qui permet aux équipes de secours de communiquer avec leur base de rattachement pour les tâches urgentes, qu'il s'agisse de télécharger des rapports de situation détaillés ou de demander des approvisionnements.

Certaines des principales caractéristiques des communications par satellite qui les rendent particulièrement adaptées à la réduction et à la gestion des risques de catastrophe sont présentées dans le **Tableau 2**.

Tableau 2 – Principales caractéristiques des communications par satellite

Souplesse	– Idéales pour un déploiement rapide – Installation instantanée sur place dès qu'une catastrophe se produit – Possibilité de contrôler et de restreindre l'accès aux services
Portativité	– Terminaux compacts idéaux pour une personne se déplaçant seule entre plusieurs sites
Simplicité d'utilisation	– Une formation simple permet de développer le savoir-faire technique nécessaire pour installer et utiliser la plupart des dispositifs satellitaires
Couverture mondiale	– Connectivité à distance – Couverture étendue
Fiabilité	– Fiabilité pour les données essentielles – Indépendance par rapport à l'infrastructure de Terre
Fourniture d'une connectivité essentielle	– Fourniture d'une liaison de raccordement pour l'infrastructure de Terre – Fourniture d'une connectivité large bande à un coût qui ne dépend pas de la densité du déploiement

3.6 Analyse des mégadonnées au service de la gestion des catastrophes

Le monde est désormais fortement tributaire des technologies de l'information, et l'avènement des mégadonnées rend possible la prise de décisions sur la base de l'analyse des données. L'analyse des mégadonnées permet aux sociétés d'adapter leurs stratégies de gestion des catastrophes afin d'atténuer les conséquences sur le plan humain et de réduire les pertes économiques. L'objectif premier des spécialistes de l'informatique et des décideurs consiste à utiliser les mégadonnées pour en tirer des renseignements sous différents formats et les stocker en vue de leur utilisation aux fins de la gestion des catastrophes.

L'analyse des réseaux sociaux désigne le processus par lequel un immense volume de données, pour la plupart non structurées ou semi-structurées, sont collectées sur les réseaux sociaux et analysées. Le processus s'appuie sur divers algorithmes d'apprentissage automatique, tels que les arbres de décision, les machines à vecteurs de support, les forêts d'arbres décisionnels, la classification naïve bayésienne, la régression logistique ou encore la plate-forme d'intelligence artificielle et d'intervention en cas de catastrophe. Les algorithmes analysent les données, à partir desquelles ils génèrent des résultats, et permettent de visualiser ces résultats avec précision et selon le point de vue souhaité. Les informations générées peuvent être exploitées utilement dans le cadre des opérations de recherche et de sauvetage et pour les activités de triage, de secours et de réhabilitation postérieures à la catastrophe. De nombreux outils d'intelligence artificielle et d'apprentissage automatique se concentrent sur la façon dont les notifications des médias sociaux peuvent signaler un incident et contribuer à informer la population concernée de la situation.

Lorsqu'une catastrophe se produit, un nombre considérable de messages brefs et de tweets sont postés sur les réseaux sociaux; les informations qu'ils contiennent peuvent être utiles, ou sans importance. Ces messages et tweets peuvent être analysés au moyen de techniques d'analyse des mégadonnées. Au Japon, l'Institut national des technologies de l'information et de la communication (NICT) a mis au point deux systèmes d'analyse des données: le système de synthèse des informations relatives aux catastrophes (Disaster information SUMMarizer (D-SUMM)) et le système d'analyse des informations relatives aux catastrophes (DISaster information ANAlyser (DISAANA)). Le système D-SUMM extrait automatiquement des systèmes de réseaux sociaux (SNS) les messages faisant état de catastrophes et organise, résume et présente leur contenu de manière conviviale. Le système DISAANA extrait les messages faisant état de catastrophes tels qu'ils sont rédigés (par exemple, "il y a un tremblement de terre!" ou "il y a encore des répliques!"). En résumant les messages faisant état de catastrophe dans chaque sous-zone, le système D-SUMM permet aux utilisateurs de comprendre rapidement ce qui se passe et à quel endroit. Il est également possible d'effectuer une recherche en indiquant plusieurs critères et en affichant le résultat sur une carte, ou encore de savoir combien de fois un phénomène a été signalé, ce qui permet d'avoir facilement un aperçu de la situation.

3.7 L'intelligence artificielle au service de la gestion des catastrophes

L'intelligence artificielle vise à simuler l'intelligence humaine à l'aide de machines, en particulier des systèmes informatiques. Il s'agit de reproduire les capacités d'apprentissage (l'acquisition d'informations et de règles sous forme d'algorithmes afin d'utiliser ces informations), de raisonnement (l'utilisation des règles pour tirer des conclusions approximatives ou précises) et d'autocorrection. De plus en plus de smartphones disposent d'un matériel optimisé pour l'intelligence artificielle.

L'apprentissage automatique désigne la capacité d'apprentissage d'une machine à l'aide de l'intelligence artificielle. Il se traduit par la création d'algorithmes capables d'évoluer sans intervention humaine ou sans être explicitement programmés pour assimiler un élément spécifique. Pour ce faire, les systèmes informatiques analysent les données structurées qui alimentent leurs algorithmes. Ainsi, le processus d'apprentissage repose sur l'observation, le traitement et l'analyse de données et sur la prise de mesures pertinentes. Les possibilités et les avantages que peuvent offrir l'apprentissage automatique et l'intelligence artificielle sont exploités par la plate-forme d'intelligence artificielle et d'intervention en cas de catastrophe, qui utilise l'apprentissage automatique pour analyser les données sur les catastrophes d'origine naturelle et humaine recueillies à partir des tweets, de façon automatique et en temps réel. Elle est à la disposition de toutes les parties prenantes impliquées dans les opérations d'intervention face aux catastrophes.

L'intelligence artificielle et l'apprentissage automatique ont évolué de telle sorte qu'ils sont désormais extrêmement performants sur le plan des prévisions, de l'identification et de la classification. Les informations en temps réel générées par le partage de données collaboratif ainsi que par l'analyse des données sont utiles aux fins des opérations d'intervention et de secours ainsi que pour atténuer les conséquences néfastes.

3.8 L'Internet des objets au service de la gestion des catastrophes

L'Internet des objets (IoT) est un réseau d'"objets" (c'est-à-dire de dispositifs physiques dotés de capteurs électroniques, de logiciels et d'autres équipements) connectés entre eux sur l'Internet et qui échangent des informations avec d'autres dispositifs et systèmes. Les avancées dans le domaine de l'informatique en nuage, les réseaux hertziens large bande, les détecteurs eux-mêmes et l'analyse les données ont donné naissance à des systèmes IoT en temps réel, puissants et intégrés. Aujourd'hui, les applications IoT sont utilisées dans tous les secteurs, qu'il s'agisse de la santé, de l'éducation, des transports, de l'agriculture, de l'industrie, etc. S'agissant de la gestion des catastrophes, l'IoT peut être utilisé pour surveiller les catastrophes naturelles soudaines, telles que les séismes et les glissements de terrain, afin de diffuser des alertes d'urgence et de transmettre des données aux centres de contrôle et de gestion des situations d'urgence pratiquement en temps réel, ce qui permet d'accroître les capacités en matière de prévention des catastrophes et d'atténuation des effets des catastrophes. Dans le cadre du Projet 3GPP (3rd Generation Partnership Project), on a déjà mis en œuvre un ensemble de technologies IoT à bande étroite fondées sur la technique LTE (à savoir les technologies IoT à bande étroite et les communications évoluées de type machine), qui viennent élargir la gamme des technologies LTE, ce qui permet une utilisation plus large de services IoT plus efficaces sur le plan énergétique. En outre, il est envisagé d'utiliser les communications par satellite et d'autres réseaux non terrestres (NTN NB-IoT).

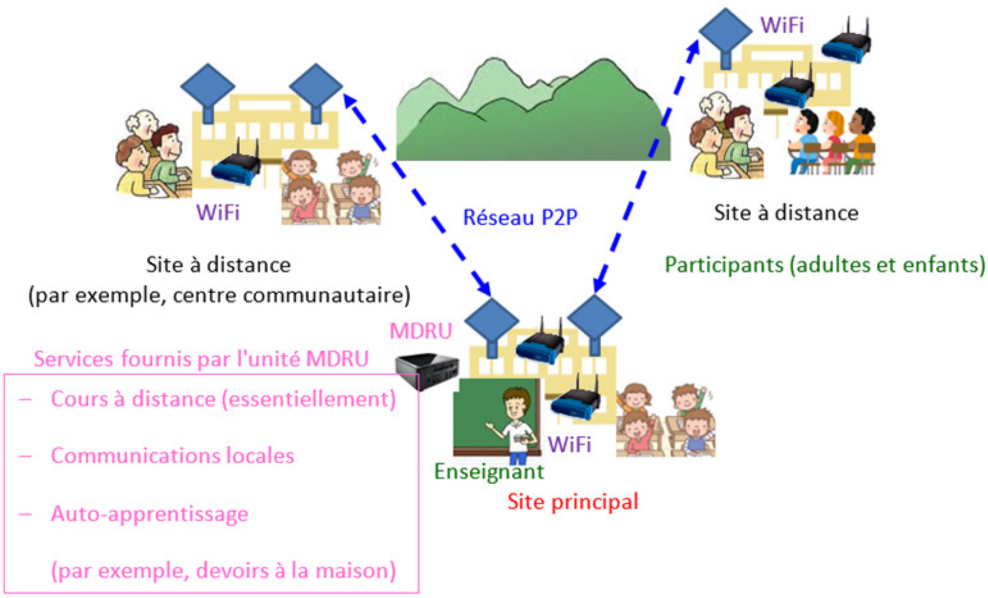
3.9 Gestion des catastrophes dans les villes intelligentes

Outre l'introduction, par le secteur des télécommunications classique, de nouvelles générations de TIC dans les télécommunications d'urgence, un certain nombre de pays du monde ont soutenu avec un grand intérêt l'idée d'appliquer les TIC à la gestion des urgences dans les villes intelligentes qu'ils cherchent à édifier. L'un des aspects clés de la construction des villes intelligentes consistait à utiliser les technologies numériques pour améliorer les télécommunications d'urgence. En disposant de données plus compréhensibles, dynamiques et reçues en temps réel, il est possible de mettre en œuvre des plans d'intervention d'urgence plus rapidement avec un meilleur rapport coût-efficacité. Parmi les systèmes technologiques d'urgence et les activités à mener en cas d'urgence qui peuvent être associés au développement des villes intelligentes figurent les systèmes d'alerte avancée en cas de catastrophe, l'optimisation des interventions d'urgence (traitement des appels en arrière-plan et opérations sur le terrain, notamment le déploiement stratégique de véhicules d'urgence), les applications d'alerte individuelles (permettant de transmettre exemple sa localisation et des données vocales aux services d'intervention d'urgence ou à ses proches), surveillance intelligente de la zone où se déroulent les opérations, etc.

3.10 Utilisation des systèmes de télécommunication d'urgence en temps normal

Des systèmes de télécommunications d'urgence tels que des unités MDRU (unités de ressources TIC mobiles et déployables utilisées en situation d'urgence) devraient être mis en place en nombre suffisant avant qu'une catastrophe ne survienne. D'une manière générale, toutefois, il peut arriver que les systèmes installés à l'avance ne soient pas utilisés pendant une période prolongée, puisqu'il est très difficile d'estimer quand une catastrophe va se produire. Dans ce contexte, les systèmes peuvent tomber en panne le moment venu, en raison de problèmes liés à la capacité de fonctionnement ou à la durée de vie de la batterie. Il est donc judicieux de les utiliser dans des situations courantes, par exemple en tant qu'infrastructure de télécommunication provisoire dans les zones rurales où l'infrastructure est insuffisante. On trouvera dans la **Figure 3** un exemple d'unité MDRU permettant d'établir une connexion entre une école élémentaire et deux villages situés à proximité. Le fait de former les enfants et les agriculteurs à l'utilisation du système signifie qu'ils seront dotés des capacités nécessaires pour l'utiliser en cas de catastrophe.

Figure 3 – Utilisation de l'infrastructure de télécommunication dans une zone rurale en temps normal



Source: Japon[13].

[13] Document SG2RGQ/188(Rév.1) (Japon) de la CE 2 de l'UIT-D.

3.11 Système TIC autonome distribué

En situation de catastrophe, les autorités locales jouent plusieurs rôles importants, par exemple en étant les premiers à intervenir dans une zone touchée par une catastrophe, en apportant les premiers secours à la population et en assurant les services de lutte contre les incendies. Pour exercer ces rôles, elles ont besoin de systèmes TIC publics, qui permettent de se connecter aux serveurs sur place ou aux serveurs en nuage via l'Internet ou des réseaux de télécommunication. Lorsque les télécommunications sont interrompues, les services publics peuvent être perturbés. L'utilisation de systèmes TIC autonomes distribués est une solution pour contribuer à assurer la continuité des services publics lorsque les réseaux de télécommunication sont en panne, à titre de plan pour la continuité des activités. L'Institut NICT (Japon) a mis au point un système TIC autonome distribué, baptisé "Die-Hard Network" (Réseau infaillible), avec un réseau d'enregistrement et de retransmission installé sur des véhicules en vue de lutter contre les catastrophes. Ce réseau est constitué de plusieurs serveurs en périphérie, qui sont situés au niveau du siège des services des autorités locales, comme les mairies; et dans des bureaux répartis, comme les hôpitaux municipaux et les véhicules, ainsi que de réseaux de communication, comme les réseaux WiFi et les réseaux d'enregistrement et de transmission[14].

[14] Document 2/401 (Institut national des technologies de l'information et de la communication (NICT) (Japon)) de la CE 2 de l'UIT-D.

Chapitre 4 – Systèmes d'alerte avancée et systèmes d'avertissement

Les télécommunications/TIC jouent un rôle essentiel avant, pendant et après une catastrophe. Elles apportent un soutien dans toutes les phases des catastrophes, notamment celles de la préparation, de la prévision, de l'alerte avancée, de l'intervention et du rétablissement. Les progrès technologiques permettent d'accroître la résilience et de garantir la redondance, en accélérant le rétablissement de la connectivité après une catastrophe. Toutefois, la gestion efficace des catastrophes dépend de la préparation, y compris de la mise en œuvre de systèmes d'alerte avancée et de l'organisation régulière d'exercices et de simulations. Il est largement reconnu que les systèmes d'alerte avancée constituent un outil essentiel qui permet de sauver des vies en cas d'inondations, de sécheresses, de tempêtes, de feux de brousse et d'autres dangers (tremblements de terre, tsunamis). Les pertes économiques enregistrées en lien avec des phénomènes hydrométéorologiques extrêmes ont été multipliées par près de 50 au cours des cinq dernières décennies, mais les pertes humaines dans le monde ont considérablement diminué, puisqu'elles ont été divisées par 10 environ, ce qui signifie que des millions de vies ont été sauvées au cours de cette période[15].

4.1 Utilisation des TIC dans la planification des systèmes d'alerte avancée et des systèmes d'avertissement

La stratégie adoptée en matière de gestion des catastrophes repose sur le constat que les catastrophes sont inévitables, et que des initiatives appropriées pour en être prévenus le plus tôt possible permettront de sauver des vies et des biens, de réduire les répercussions à grande échelle, d'assurer des secours immédiats et de contribuer à faire en sorte que les effets de catastrophes analogues soient atténués à l'avenir.

Il est important de diffuser des informations avant, pendant et après une catastrophe. Pour que la diffusion d'alertes avancées soit efficace avant une catastrophe, il faut disposer des capacités et des moyens de publier des informations d'alerte en cas de catastrophe. Lorsque cela est nécessaire, l'alerte face à un danger imminent doit parvenir le plus rapidement possible à toutes les personnes de la zone concernée.

L'utilisation de technologies telles que les logiciels GIS (système d'information géographique), les systèmes d'observation de la Terre par satellite, l'IoT, l'analyse en temps réel au moyen de mégadonnées et de l'informatique évoluée, les technologies associées aux communications mobiles, les réseaux sociaux, la robotique et la chaîne de blocs peut contribuer à la gestion des catastrophes et ouvrir des perspectives de développement plus durables, plus résilientes et solidement étayées.

[15] Voir OMM. Programme de réduction des risques de catastrophe. Systèmes d'alerte précoce multidangers (*Multi-hazard Early Warning Systems*, MHEWS).

4.2 Déploiement de systèmes d'alerte avancée pour la réduction des risques liés aux catastrophes

4.2.1 Le protocole d'alerte commun et son utilisation pour les systèmes d'alerte avancée

Le protocole d'alerte commun (CAP) est un format de données fondé sur la norme XML qui permet d'échanger des avertissements publics et des informations d'urgence entre des systèmes d'alerte. Il permet ainsi de diffuser un message d'avertissement de manière cohérente et simultanée par l'intermédiaire de nombreux systèmes d'alerte vers de nombreuses applications. Il permet en outre d'augmenter l'efficacité de l'alerte et de simplifier la tâche visant à activer l'alerte. Il est possible de recevoir des alertes normalisées provenant de nombreuses sources et les alertes sont configurées de sorte que les applications puissent les traiter et y donner suite comme souhaité. Étant donné qu'il permet de normaliser les données d'alerte à l'échelle des menaces, des juridictions et des systèmes d'alerte, le protocole CAP peut aussi servir à détecter des tendances et des structures dans les activités d'alerte. L'Inde a réalisé des études de cas et des essais au cours desquels le protocole CAP a été utilisé dans les systèmes d'alerte avancée pour diffuser des informations en cas de tremblement de terre, de crue soudaine, etc. La Nouvelle-Zélande utilise aussi des fils de nouvelles au format CAP pour obtenir des alertes concernant des tremblements de terre, des conditions météorologiques graves et des situations d'urgence liées à la protection civile.

4.2.2 Systèmes d'alerte avancée en cas de tremblement de terre et de tsunami

En cas de tremblement de terre et de tsunami, les systèmes d'alerte avancée aident à limiter les pertes en vie humaine et les dégâts matériels. Il existe aujourd'hui des technologies capables de détecter des tremblements de terre, qu'ils soient modérés ou violents, suffisamment tôt pour qu'une alerte puisse être envoyée dans les zones situées à l'extérieur de l'épicentre avant que les ondes destructrices n'y parviennent. Le mécanisme d'alerte avancée en cas de tremblement de terre repose sur les données émises par une station unique ou un réseau de stations. On peut améliorer la précision et le délai de lancement de l'alerte en associant les messages envoyés par une seule station et les données issues d'un réseau sismique régional. En cas de tremblement de terre modéré à puissant, les données de la station sur site et celles du réseau régional sont regroupées dans le système de démonstration Shake Alert. À l'avenir, les systèmes d'alerte avancée en cas de tremblement de terre pourraient aussi s'appuyer sur les smartphones et les systèmes embarqués dans les voitures, ainsi que sur les dispositifs intelligents et les objets toujours plus nombreux du quotidien qui comportent des détecteurs et des puces de communication qui leur permettent de se connecter à un réseau mondial.

En Inde, plus de 100 capteurs déployés dans la région de l'Himalaya transmettent des alertes avancées en cas de tremblement de terre à destination des villes du nord du pays et permettent ainsi de détecter des événements, d'identifier leur localisation, d'effectuer une estimation de leur amplitude et de publier des alertes. Dans le sillage du tsunami de 2004, le Gouvernement de l'Inde a pris des mesures pour mettre en place des systèmes d'alerte avancée robustes: le Ministère des sciences de la Terre a élaboré le Système national d'alerte avancée en cas de tsunami, au sein du Centre national des services d'information sur les océans d'Hyderabad (État de l'Andhra Pradesh), tandis que le Département météorologique relevant du Ministère a mis au point des systèmes basés sur les TIC pour émettre des alertes précises et produire des bulletins météorologiques en temps réel à l'intention de tous les organismes importants de gestion des catastrophes.

4.2.3 Systèmes d'alerte avancée en cas de cyclone

Les cyclones, ouragans et typhons sont des tempêtes provoquées par des perturbations atmosphériques, dans lesquelles l'air est en rotation cyclique autour d'un centre de basse pression, appelé "œil". Dans l'hémisphère Nord, la rotation des vents s'effectue dans le sens inverse des aiguilles d'une montre et dans l'hémisphère Sud, dans le sens horaire. Des cyclones d'intensité variable se forment chaque année dans l'océan Indien, durant les mois de juin et de juillet. Grâce aux systèmes d'alerte avancée robustes qu'elle a mis en place, l'Inde a pu faire face de manière efficace aux cyclones Phailin (2013) et Fani (2019), par exemple, qui ont frappé les côtes du pays avec des vents dépassant 200 km/h et ont entraîné de fortes précipitations. Les messages d'alerte transmis via le système d'alerte avancée se sont révélés concis et précis. Ces messages donnaient aussi des informations sur les endroits où l'on s'attendait que des dommages soient causés aux abris et aux infrastructures ainsi que sur la nature de ces dommages. En conséquence, il a été possible de réduire considérablement le nombre de pertes en vie humaine et de bétail.

4.2.4 Systèmes d'alerte avancée en cas de pluies torrentielles

Des événements tels que des averses orageuses et des pluies torrentielles/fortes précipitations mènent à des situations de catastrophe. Le Japon a mis au point le radar météorologique à balayage électronique permettant de détecter des pluies torrentielles et ainsi de prévenir les dégâts qu'elles causent. Ce radar permet de recueillir toutes les 30 secondes des informations sur la structure tridimensionnelle des précipitations (réflectivité du radar et vitesse Doppler), afin de détecter à un stade précoce la formation localisée et rapide de cumulonimbus.

4.2.5 Systèmes d'alerte avancée en cas d'inondations, de glissements de terrain et de coulées de boue

Les systèmes d'alerte avancée peuvent être utilisés lors de catastrophes telles que des inondations, des glissements de terrain et des coulées de boue. Il est possible d'utiliser des technologies mises au point récemment et équipées de capteurs fondés sur l'IoT pour détecter les mouvements des sols et leur teneur en humidité, d'une part, et pour générer des alertes dans les meilleurs délais, d'autre part. Dans la municipalité Shiojiri au Japon, où les niveaux d'humidité des sols sont détectés au moyen de capteurs IoT, des alertes sont envoyées de manière automatique au gestionnaire des risques au niveau de la municipalité lorsque le niveau d'humidité du sol est supérieur à une valeur numérique donnée.

En Zambie, l'UIT et l'Autorité des technologies de l'information et de la communication du pays ont cofinancé un projet relatif à la mise en place de systèmes d'alerte avancée dans deux communautés, sur l'île de Mbeta et dans le village de Kasaya. Ces systèmes permettent de diffuser des alertes sur les inondations et les catastrophes imminentes aux communautés qui vivent à proximité du fleuve Zambèze. Ils seront également utilisés pour la sécurité du public en ce qu'ils facilitent l'échange d'informations entre les communautés locales et les organismes publics.

4.3 Systèmes de radiodiffusion d'alertes en cas d'urgence

Les messages d'alerte peuvent aussi être diffusés via la radiodiffusion sonore et télévisuelle, la télévision par câble et la radiodiffusion directe par satellite. La Chine, la Nouvelle-Zélande, les États-Unis et beaucoup d'autres pays utilisent des systèmes de radiodiffusion d'alertes en cas d'urgence. Aux États-Unis, le système d'alerte en cas d'urgence, par exemple, permet de transmettre des messages d'alerte via la radiodiffusion sonore et télévisuelle, la télévision par câble et la radiodiffusion directe par satellite. Un autre système, à savoir le système sans fil d'alerte en cas d'urgence, permet d'envoyer des messages d'alerte sur des téléphones mobiles dans des zones ciblées (il permet aussi de transmettre des alertes en cas d'enlèvement d'enfants). En Chine, les réseaux 4G sont améliorés en permanence pour veiller à ce que les abonnés aux services mobiles puissent recevoir, en temps voulu, les messages d'alerte en cas d'urgence revêtant une importance vitale. La Chine a mis au point un système de radiodiffusion, le système Tuibida, qui est une infrastructure Internet mobile de services "live to push" (envoyer en direct).

4.4 Technologie des systèmes d'alerte avancée et des systèmes d'avertissement

4.4.1 Systèmes d'alerte précoce multidangers

Le Cadre d'action de Sendai pour la réduction des risques de catastrophe 2015-2030 reconnaît les avantages des systèmes d'alerte avancée multirisques (MHEWS) et les inscrit dans l'un de ses sept objectifs mondiaux (Objectif (g) – "Améliorer nettement, d'ici à 2030, l'accès des populations aux dispositifs d'alerte rapide multirisque et aux informations et évaluations relatives aux risques de catastrophe").

Ce Cadre préconise un changement radical dans la façon dont les informations sur les risques sont recueillies, évaluées et utilisées dans les systèmes d'alerte avancée multirisques, les stratégies de réduction des risques de catastrophe et les politiques publiques. Lors d'une table ronde sur les systèmes d'alerte avancée organisée en mai 2018 dans le cadre de l'étude de la Question 5/2, un expert de l'OMM a décrit les outils de l'OMM qui peuvent être utiles aux activités en matière d'alerte avancée et d'avertissement au niveau national, notamment la liste récapitulative des systèmes d'alerte précoce multidangers (disponible sur le site web de l'OMM) et l'initiative sur les systèmes d'alerte précoce aux risques climatiques. L'OMM a également adopté le protocole d'alerte commun (UIT-T X.1303) et la plate-forme d'alerte appelée "Alert Hub". Le Système mondial d'alerte multidangers a pour objectif de fournir des informations et des conseils faisant autorité aux institutions des Nations Unies et aux organisations humanitaires, pour leurs processus de prise de décisions tant opérationnels qu'à long terme.

4.4.2 Système intégré d'alerte et d'avertissement du public

Le système intégré d'alerte et d'avertissement du public (IPAWS) de l'Agence fédérale de gestion des situations d'urgence (FEMA) des États-Unis s'appuie sur les normes relatives aux technologies et à l'information pour relier plusieurs infrastructures technologiques de communication du secteur privé, afin de leur donner la possibilité de transmettre un message d'urgence unique de façon simultanée via plusieurs canaux de diffusion à l'intention du public (par exemple: la radio, la télévision, les dispositifs mobiles et les systèmes connectés à l'Internet, les sites web et les applications).

La première étape essentielle en vue de la conception de ce système a consisté à utiliser le protocole CAP et d'autres normes techniques. Lorsque les services d'alerte et d'avertissement sont conformes au protocole CAP et qu'ils sont intégrés dans le système IPAWS, il est possible d'utiliser la plate-forme comme intermédiaire pour authentifier les messages provenant d'utilisateurs agréés qui transmettent des informations d'urgence authentiques à des personnes situées dans une région géographique spécifique, rapidement et via plusieurs canaux de diffusion. Ainsi, l'information provenant d'une source unique au sujet d'un incident particulier peut être transmise au public via la radio, la télévision, les téléphones sans fil, l'Internet ainsi que les futures technologies connectées du système IPAWS conformes au protocole CAP. L'approche fondée sur des normes permet d'adapter l'architecture nationale du système d'alerte et d'avertissement aux technologies futures et d'en tirer parti. L'utilisation de plusieurs canaux de diffusion pour les alertes du public augmente sensiblement la probabilité que le message atteigne son public cible. En outre, transmettre un seul message d'alerte du protocole CAP via plusieurs canaux simultanément diminue le temps nécessaire pour envoyer les alertes et la charge de travail des responsables de la gestion des urgences, lesquels devraient dans le cas contraire élaborer et envoyer plusieurs alertes distinctes dans un format propre à chaque canal. L'approche fondée sur des normes du système IPAWS permet d'accélérer la transmission d'informations essentielles et vitales.

4.5 Systèmes d'alerte avancée et de télédétection

Comme il a été dit précédemment, les TIC fournissent un appui durant toutes les phases des catastrophes, notamment la prévision, l'analyse des vulnérabilités et l'évaluation des risques, l'alerte avancée et le rétablissement après une catastrophe. Les informations relatives à l'alerte avancée sont recueillies au moyen de systèmes de télédétection (satellites, radars, systèmes télémétriques et météorologiques, technologies de détection de machine à machine (M2M) par satellite, etc.) et diffusées sur différents médias. Pour ce faire, il est nécessaire de mettre en place un organisme local pour gérer les situations d'urgence et acheminer les informations pertinentes vers les personnes qui en ont besoin sur le terrain. Des informations détaillées sur le rôle des programmes UN-SPIDER et UNOSAT, ainsi que sur le rôle de l'OMM, sont données dans la **Section 3.3**. La Recommandation UIT-R RS.1859 porte sur l'utilisation des systèmes nationaux de télédétection pour la collecte des données en cas de catastrophe.

Au niveau national, le Japon a mis au point le radar météorologique à balayage électronique qui permet de détecter des pluies torrentielles et de prévenir les dégâts qu'elles causent (voir la **Section 4.2.4**).

En Inde, le Centre national de télédétection relevant de l'Organisation indienne de recherche spatiale (ISRO), en coopération avec d'autres organisations telles que l'Office indien de la géologie, le Bureau de normalisation indien et l'Organisation pour l'interdiction des armes chimiques (OPCW), a élaboré des cartes séparant le pays en zones en fonction de la vulnérabilité aux catastrophes, grâce aux données de détection. Ces cartes sont particulièrement utiles dans le cadre des activités de planification, de prévention et d'atténuation des effets en amont des catastrophes. La plate-forme d'information géographique de l'ISRO, Bhuvan, fournit une large gamme de services basés sur des cartes élaborées par l'Office de la géologie.

Les organismes indiens responsables de l'alerte avancée envoient des informations importantes provenant de données de télédétection par satellite aux pays voisins et à plusieurs organismes analogues dans la région de l'océan Indien et la région Asie-Pacifique. Le système d'alerte avancée de l'Inde fait également partie du système mondial de télécommunications qui compose le programme de veille météorologique mondiale de l'OMM (WWW).

De même, les services des auxiliaires de la météorologie, de météorologie par satellite et d'exploration de la Terre par satellite jouent un rôle majeur dans les activités liées à l'alerte avancée et à la télédétection aux États-Unis (voir la description dans la **Section 3.4**).

4.6 Systèmes d'information et de secours en cas de catastrophe

Faire face aux catastrophes naturelles est une gageure tant pour les autorités publiques que pour les entreprises privées. La communication joue un rôle crucial dès lors qu'il est nécessaire de traiter les informations rapidement et avec précision. Les systèmes d'information peuvent servir à établir les procédures qui s'imposent, à définir les responsabilités et à prendre des décisions, ce qui permet d'améliorer l'efficience et l'efficacité de la gestion des catastrophes. Les systèmes d'information fournissent un appui aux autorités publiques et aux entreprises dans leurs efforts visant à rétablir la confiance, à reconstruire leur réputation et à maintenir la capacité de fonctionnement.

En Inde, par exemple, grâce à la mise en place de procédures et de protocoles, à la définition des responsabilités et à l'établissement de structures pour la prise de décisions, il a été possible d'échanger des données précises sur les trajectoires des cyclones Phailin (2013) et Fani (2019), aux niveaux national, local et de l'État, ce qui a contribué à réduire considérablement le nombre de décès dus à ces catastrophes. De plus, l'alerte avancée émise par le Département météorologique indien a été appuyée par des activités de préparation aux catastrophes et d'atténuation des effets des catastrophes déployées par le Gouvernement de l'État. En effet, celui-ci a mis à disposition un abri et des vivres, établi un système de volontariat, conduit régulièrement des simulations et élaboré des procédures opérationnelles normalisées en vue de la gestion des catastrophes aux niveaux de l'État et des villages.

Utilisation des médias sociaux

Les médias sociaux peuvent s'avérer particulièrement utiles lors des opérations de secours en cas de catastrophe, non seulement pour les communications individuelles, mais aussi pour recueillir des informations relatives aux dégâts à l'intention des équipes de premiers secours. Au Japon, par exemple, les médias sociaux ont été constamment utilisés durant les inondations qui ont été causées récemment par de fortes tempêtes et des pluies torrentielles. Le système D-SUMM (Disaster-information and SUMMarizerd) de l'Institut national des technologies de l'information et de la communication (NICT) vise à extraire automatiquement les messages faisant état de catastrophes et à organiser, à synthétiser et à présenter leur contenu de manière conviviale. Ce système permet d'alerter les utilisateurs en récupérant non seulement les informations relatives aux catastrophes, mais aussi toute donnée contradictoire.

En Inde, le Gouvernement de l'État du Kerala a eu recours aux médias sociaux pour faire des appels aux dons en faveur du Fonds de secours placé sous l'égide du Premier ministre (Chief Minister's Distress Relief Fund)[16]. Face à l'ampleur de la catastrophe, le Gouvernement de l'État du Kerala a fait appel à des ingénieurs en logiciel du monde entier, afin de les inviter à s'associer

[16] Scroll.in. As Kerala battles flood, social media helps connect anxious relatives, coordinate relief efforts (Pendant que l'État du Kerala lutte contre les inondations, les médias sociaux contribuent à connecter des proches en proie à l'inquiétude et à coordonner les opérations de secours), 17 août 2018.

à son équipe chargée des technologies de l'information en vue de créer un site web. Ce site web a permis aux volontaires qui participaient aux secours d'indiquer quels étaient les besoins des sinistrés, afin de faciliter la prompte intervention des autorités dans les districts touchés par les inondations. De la même manière, une fraternité d'étudiants en génie mécanique d'une école d'ingénieurs publique au Kerala a créé le groupe Inspire. Les étudiants ont construit plus de 100 batteries portables temporaires avant de les distribuer aux personnes qui étaient dans l'incapacité de contacter leurs familles dans les zones sinistrées et les camps de secours. Ainsi, les téléphones pouvaient récupérer près de 20% de leur batterie en quelques minutes. Ces batteries ont représenté une aide précieuse pour les personnes n'ayant pas accès à l'électricité. Dans un autre cas, lors des inondations à Chennai, les habitants se sont largement appuyés sur les médias sociaux pour rester en contact avec le monde extérieur. Malgré une situation difficile, de très nombreux gestes de solidarité ont ponctué cette tragédie. Les habitants de la ville ont utilisé les médias sociaux pour proposer un hébergement aux sinistrés et les protéger des intempéries. Les hashtags #ChennaiFloods et #ChennaiRainHelps ont ainsi été employés aussi bien par les victimes que par les bénévoles pour trouver/offrir un abri, de la nourriture, un moyen de transport ou même la possibilité de recharger leur téléphone mobile. Ils ont également servi à diffuser les numéros d'assistance téléphonique publique, les coordonnées des organisations non gouvernementales proposant une aide, etc.

Les informations et les données relatives aux catastrophes, l'organisation efficace des opérations de secours et de sauvetage, l'utilisation des médias sociaux et la participation de la société civile aux opérations de secours sont autant d'éléments qui peuvent entraîner une diminution considérable des pertes en vies humaines et animales, et favoriser une reprise économique rapide.

Chapitre 5 – Entraînements et exercices

Les entraînements et les exercices jouent un rôle important dans la préparation en matière de gestion des situations d'urgence, dans la mesure où ils contribuent à renforcer les capacités et à promouvoir la formation, de sorte que lors d'une catastrophe concrète, les personnes touchées puissent réagir comme prévu. Ils ont plusieurs objectifs, notamment ceux présentés ci-dessous.

- *Évaluer le programme de préparation et recenser les lacunes aux niveaux de la planification et des procédures*: il se peut que les programmes de préparation n'aient pas été testés, qu'ils ne soient pas à jour ou qu'ils ne soient pas en mesure de s'adapter à des situations inédites. Les entraînements sur les télécommunications d'urgence peuvent avoir pour conséquence de mettre en lumière les carences dans le programme, de vérifier son adaptabilité aux situations inattendues et d'évaluer si des modifications et des améliorations sont nécessaires.
- *Améliorer les moyens de réaction à des événements concrets*: les entraînements sur les télécommunications d'urgence peuvent contribuer à éprouver la mise en place de nouvelles technologies et les ressources en matière d'information et de communication, à évaluer les fonctionnalités de nouveaux équipements et à renforcer la capacité d'appui des télécommunications d'urgence. Ils peuvent fournir des indications concernant les capacités offertes par les ressources existantes et recenser les déficits de ressources.
- *Améliorer la coordination entre les équipes, les organisations et les entités internes et externes, et accroître le niveau d'appui entre les régions*: les entraînements ont pour vocation de renforcer la capacité de coordination lors des interventions rapides associant plusieurs départements, et d'améliorer la communication et la coordination entre les organisations et le personnel d'intervention en cas d'urgence.
- *Former l'équipe pour les télécommunications d'urgence*: les entraînements sur les situations d'urgence contribuent à améliorer les capacités du chef d'équipe en termes d'analyse, de prise de décisions, d'organisation et de coordination. Ils permettent au personnel travaillant dans le domaine des télécommunications de comprendre les rôles et les responsabilités sur le terrain. Ils peuvent aussi contribuer à renforcer les activités de sensibilisation et la compréhension des dangers et de leurs effets potentiels, à remédier aux situations de panique et à promouvoir la coopération avec les autorités publiques et les départements qui en dépendent, l'objectif étant d'améliorer la capacité globale de la société à réagir en cas d'urgence.

Durant la période d'études, la Commission d'études 2 a élaboré un projet de lignes directrices[17] qui fournissent des orientations adaptables ou modulables à l'intention des gouvernements et des organisations dans les pays en développement, les petits États insulaires en développement (PEID) et les pays les moins avancés (PMA), pour organiser des exercices et des entraînements sur les communications d'urgence au niveau national. Les principaux éléments du projet sont brièvement présentés dans la **Section 5.1** ci-dessous. La réalisation d'entraînements et d'exercices à une fréquence régulière offre des avantages évidents et peut fournir un appui aux organisations s'occupant de la préparation aux catastrophes dans les activités suivantes:

- Tester l'état de préparation pour le maintien et le rétablissement des communications en cas d'urgence.

[17] Document 2/TD/32 (Corapporteurs pour la Question 5/2) de la CE 2 de l'UIT-D.

- Déterminer si les procédures, les politiques générales et les systèmes de communication en cas d'urgence conviennent.
- Apporter des améliorations aux plans nationaux pour les télécommunications d'urgence (NETP) compte tenu des résultats de l'exercice.
- Sensibiliser davantage les parties prenantes aux points forts et aux lacunes potentiels associés à la couverture des télécommunications et à la planification de la continuité des activités.
- Permettre un apprentissage pratique dans un environnement sûr.
- Évaluer la répartition des ressources et du personnel entre les parties prenantes, en prenant note des lacunes et des doubles emplois potentiels.
- Mettre sur pied des équipes et entretenir de bonnes relations de travail.
- Instaurer et mettre à l'essai une coopération intersectorielle.
- Mobiliser et motiver les parties prenantes, afin d'assurer une coordination plus étroite sur les mesures de préparation.
- Faire en sorte que les professionnels des interventions d'urgence disposent des compétences requises en matière de communication.
- Évaluer les communications entre différentes parties prenantes et accroître l'interopérabilité.
- Créer une culture de l'amélioration constante.
- Accroître la résilience des communications.

5.1 Lignes directrices relatives à la préparation et à la réalisation d'exercices et d'entraînements sur les communications en cas de catastrophe

Le projet de lignes directrices de la Commission d'études 2 fournit des orientations détaillées à l'intention des acteurs chargés de la planification ou de la réalisation d'un entraînement ou d'un exercice. Ces lignes directrices peuvent être adaptées à l'échelle ou au type d'entraînement/d'exercice et aux besoins propres au pays ou aux organisations concernés. Les principaux éléments ou les principales étapes en vue de la planification et de la réalisation d'un entraînement/exercice sont brièvement présentés ci-dessous.

- Établir en premier lieu une note de synthèse soulignant les objectifs.
- Faire en sorte que la haute direction soit favorable à la réalisation d'un entraînement.
- Mettre sur pied une équipe pour la planification/facilitation chargée de planifier l'exercice dans les moindres détails.
- Rédiger le scénario.
- Élaborer un plan d'évaluation.
- Mener l'exercice.
- Consigner l'exercice en détail afin de faciliter la suite à donner et les enseignements tirés.
- Dresser un bilan avec les participants afin d'aider à identifier les lacunes en matière de préparation, à consolider ce qui a bien fonctionné, et à mettre en évidence les enseignements tirés, les points forts et les points faibles.
- Organiser une analyse après action pour veiller à ce que les étapes suivantes soient déployées de manière structurée.
- Définir et fixer des objectifs pour les mesures correctives.
- Mettre à jour les plans, les politiques générales, les procédures et les équipements d'intervention, selon les besoins, afin de tenir compte des résultats.
- Suivre les progrès en cours et rester déterminés à appuyer un programme d'amélioration continue, grâce à l'organisation à intervalles réguliers d'entraînements/d'exercices.

5.2 Évaluation et tenue à jour des plans

Les résultats issus des entraînements ou des exercices, tels qu'ils ressortent de l'analyse et des rapports après action, devraient servir à établir le plan d'action applicable aux domaines figurant dans un plan NETP ou dans des stratégies et des procédures connexes qui appellent des améliorations ou des ajustements, et à recenser les points forts. Afin d'obtenir l'appui de la direction en faveur d'un programme régulier et continu d'entraînements et d'exercices, il est crucial de démontrer l'efficacité du programme.

De plus, afin de mettre en place une culture d'amélioration continue, il faudrait s'efforcer de renforcer la dynamique consécutive au rapport après action, en transformant en bonnes pratiques les points à améliorer qui ont été identifiés. En intégrant les principes adoptés pour consigner, suivre et mener à terme les mesures qui ont des effets positifs sur la planification de la préparation, la désignation des propriétaires et la tenue de réunions d'amélioration périodiques, une organisation peut intégrer les améliorations dans la prochaine itération du plan, y compris le prochain exercice. Il faudrait que ce processus se poursuive d'un entraînement ou d'un exercice à l'autre, dans la mesure où cela contribuera à créer une dynamique en faveur d'une méthodologie d'amélioration constante des plans NETP.

Chapitre 6 – Études de cas de pays et d'entreprises

Cette section présente brièvement les études de cas de pays et d'entreprises soumises dans le cadre de l'étude de la Question 5/2 durant la période d'études. On dénombre cinq catégories d'études de cas: environnement politique et réglementaire propice; technologies de communication en cas de catastrophe; systèmes d'alerte avancée et systèmes d'avertissement; entraînements et exercices; et divers. Les études de cas sont exposées en détail dans l'**Annexe 1** du présent rapport. Le **Tableau 3** dresse la liste des études de cas par titre et par pays et indique pour chaque thème les sections correspondantes dans l'**Annexe 1**.

Tableau 3 – Études de cas

Thème	Pays	Entité	Titre de l'étude de cas	Section
Environnement politique et réglementaire propice	Inde		Cadres de politiques générales applicables aux TIC et à la gestion des catastrophes	A1.1.1
	Inde		L'importance des TIC dans la gestion des catastrophes	A1.1.2
	Haïti		Télécommunications d'urgence dans le cadre du Comité sectoriel sur les télécommunications d'urgence	A1.1.3
	Monde	PAM	Liste de contrôle relative à la préparation dans le domaine des télécommunications d'urgence	A1.1.4
	Nouvelle-Zélande		Alerte avancée fondée sur le protocole CAP	A1.1.5
	Burundi		Rôle des TIC dans la gestion des effets des inondations	A1.1.6
	Plusieurs pays		Webinaire public sur les environnements de politiques générales facilitant la gestion des catastrophes, y compris la pandémie de COVID-19	A4.4
Technologies de communication en cas de catastrophe	Chine	China Telecom	Combinaison des ressources des réseaux de télécommunications d'urgence de Terre et spatial	A1.2.1
	Inde		Cadres de politiques générales applicables aux TIC et à la gestion des catastrophes (L'application mobile "Fisher Friend")	A1.1.1
	Chine		Gestion intelligente des télécommunications d'urgence	A1.2.2
	Chine		Services et réseaux de communication d'urgence	A1.2.3

Tableau 3 – Études de cas (suite)

Thème	Pays	Entité	Titre de l'étude de cas	Section
	Inde		Rôle des plates-formes de médias sociaux	A1.2.4
	Chine		Fourniture de services de communication dans des zones touchées par des catastrophes	A41.2.5
	Japon		Système en nuage accessible localement	A1.2.6
	États-Unis	Loon LLC	Solutions de télécommunication pour la planification en prévision des catastrophes et les situations d'urgence reposant sur l'utilisation de ballons	A1.2.7
	Chine		Modèle associant la bande Ka et la 4G dans le cadre des interventions en cas d'urgence et des opérations de secours en cas de catastrophe	A1.2.8
	Europe	ESOA	Connectivité par satellite pour l'alerte avancée (Lutte contre les incendies en forêt, surveillance des digues à stériles)	A1.2.9
	Japon	NICT	Système d'agents conversationnels SOCDA pour la gestion des catastrophes	A1.2.10
	Japon	NICT	Système TIC autonome distribué	A1.2.11
	Monde	Commission d'études 11 de l'UIT-T	Architecture de signalisation du réseau de télécommunications d'urgence à déploiement rapide utilisé en cas de catastrophe naturelle	A3.8
	Monde	Groupe de travail 4A de l'UIT-R	Accès à l'Internet large bande au niveau mondial à l'aide de systèmes du service fixe par satellite	A3.7
	Monde	Commission d'études 11 de l'UIT-T	Réseau de télécommunications d'urgence à déploiement rapide	A3.8
	Monde	Commission d'études 5 de l'UIT-R	Utilisation des systèmes hertziens fixes pour l'atténuation des effets des catastrophes et les opérations de secours	A3.9
	Monde	Groupe de travail 4B de l'UIT-R	Systèmes à satellites	A3.10
	Monde	Groupe de travail 5A de l'UIT-R	Protection du public et secours en cas de catastrophe	A3.11
	Monde	Groupe de travail 5D de l'UIT-R	Protection du public et secours en cas de catastrophe grâce aux IMT	A3.12

Tableau 3 – Études de cas (suite)

Thème	Pays	Entité	Titre de l'étude de cas	Section
	Plusieurs pays		Séance sur les exercices de gestion des catastrophes et les technologies émergentes en la matière	A4.2
Systèmes d'alerte avancée et systèmes d'avertissement	Inde		Système d'alerte avancée en cas de tremblement de terre au nord de l'Inde fondé sur le protocole CAP	A1.3.1
	Inde		Cadres de politiques générales applicables aux TIC et à la gestion des catastrophes	A1.1.1
	Europe	ESOA	Connectivité par satellite pour l'alerte avancée (Alerte avancée en cas d'inondation, et détection des tremblements de terre et des tsunamis)	A1.2.9
	Inde		Mise en œuvre d'un essai du protocole CAP	A1.3.2
	Chine	China Telecom	Les TIC dans la préparation en prévision des catastrophes	A1.3.3
	Brésil		Mise en œuvre des systèmes d'alerte d'urgence	A1.3.4
	Japon	NICT	Alerte avancée et collecte d'informations sur les catastrophes	A1.3.5
	Japon		Technologies d'alerte avancée de pointe	A1.3.6
	Chine		Alertes en cas d'urgence utilisant le service Tuibida	A1.3.7
	États-Unis		État d'avancement des activités relatives à la télédétection	A1.3.8
	Inde		Prévision et suivi précis de la trajectoire des cyclones	A1.3.9
	États-Unis		Systèmes d'alerte et systèmes d'avertissement	A1.3.10
	Monde	Commission d'études 2 de l'UIT-T	Cadre de gestion des catastrophes pour les systèmes de secours en cas de catastrophe	A3.6
	Plusieurs pays		Table ronde sur le thème des systèmes d'alerte avancée	A4.1
Entraînements et exercices	Chine		Entraînements sur les télécommunications d'urgence	A1.4.1
	Algérie		Exercice de simulation de la mise en œuvre du plan ORSEC des télécommunications	A1.4.2

Tableau 3 – Études de cas (suite)

Thème	Pays	Entité	Titre de l'étude de cas	Section
	Chine	China Telecom	Combinaison des ressources des réseaux de télécommunications d'urgence de Terre et spatial	A1.2.1
	Japon	NICT	Système d'agents conversationnels SOCDA pour la gestion des catastrophes	A1.2.10
	Japon	NICT	Système TIC autonome distribué	A1.2.11
	Plusieurs pays		Séance sur les exercices de gestion des catastrophes et les technologies émergentes en la matière	A4.2
	Plusieurs pays		Séance sur l'organisation d'entraînements et d'exercices sur les communications d'urgence au niveau national – Lignes directrices à l'intention des PEID et des PMA	A4.3
Divers	Japon		Statistiques mondiales relatives aux catastrophes	A1.5.1
	Japon		Systèmes de télécommunications d'urgence déployés au préalable	A1.5.2
	République démocratique du Congo		Lutte contre la maladie à virus Ébola	A1.5.3
	États-Unis	Facebook	Cartographie des catastrophes	A1.5.4
	Chine		Rôle des TIC dans la lutte contre la pandémie de COVID-19	A1.5.5
	États-Unis		Lutte contre le COVID-19	A1.5.6
	Monde	Commission d'études 15 de l'UIT-T	Cadre de gestion des catastrophes pour la résilience et le rétablissement des réseaux	A3.1
	Monde	Groupe de travail 7C de l'UIT-R	Systèmes de télédétection	A3.3
	Monde	Commission d'études 2 de l'UIT-T	Termes et définitions pour les systèmes de secours en cas de catastrophe, la résilience et le rétablissement des réseaux	A3.5
	Plusieurs pays		Webinaire public sur les environnements de politiques générales facilitant la gestion des catastrophes, y compris la pandémie de COVID-19	A4.4

Chapitre 7 – Bonne pratiques, lignes directrices et conclusions

Au cours de la période d'études, l'équipe chargée de la Question 5/2 a organisé des ateliers/séances sur quatre thèmes: systèmes d'alerte avancée; entraînements relatifs aux catastrophes et technologies émergentes en matière de gestion des catastrophes; entraînements et exercices sur les communications d'urgence au niveau national à l'intention des PEID et des PMA; et environnements de politiques générales propres à faciliter la gestion des catastrophes, y compris la pandémie de COVID-19.

7.1 Analyse et définition des lignes directrices relatives aux bonnes pratiques et enseignements tirés

Les bonnes pratiques et lignes directrices suivantes sont ressorties des débats, des délibérations, des contributions et des avis d'experts formulés lors des ateliers/séances.

A) Systèmes d'alerte avancée

- **Tenir compte des besoins des pays en développement**: les systèmes d'alerte doivent répondre aux besoins des pays en développement et tenir compte du niveau des technologies utilisées.
- **Garantir une certaine souplesse**: il est essentiel de faire preuve de souplesse dans la conception, l'adaptation et la mise à l'essai des systèmes d'alerte pour les différents risques auxquels les pays en développement sont exposés.
- **Garantir une certaine souplesse réglementaire**: il est essentiel d'élaborer des politiques générales qui ménagent une certaine souplesse réglementaire avant qu'une catastrophe ne se produise. À titre d'exemple, les régulateurs peuvent se voir octroyer une autorisation temporaire spéciale (special temporary authority) qui permet de raccourcir le délai d'approbation pour le déploiement de systèmes de communications d'urgence.
- **Adapter les systèmes d'alerte en cas d'urgence**: les pays doivent examiner les modalités de communication de la population. Ainsi, les supports de radiodiffusion (radio, télévision, etc.) revêtent toujours une importance cruciale pour la diffusion d'informations aux citoyens en cas de catastrophe, mais il faut reconnaître également que la population utilise de plus en plus les dispositifs mobiles pour obtenir des informations.
- **Assurer la connectivité**: l'absence de connectivité n'est pas seulement un problème de de sécurité, mais aussi un problème de développement. En effet, elle peut entraver l'accès des populations aux alertes et aux avis susceptibles de sauver des vies, et entraîner des retards dans les interventions et les activités de rétablissement en cas de catastrophe, ou constituer un obstacle à leur bon déroulement. Il faut que les stratégies de développement des communications prennent en considération les besoins éventuels en matière de communications d'urgence et la résilience des réseaux.
- **Renforcer les capacités**: il existe différentes possibilités pour le BDT de renforcer les capacités des PMA et des PEID, afin qu'ils puissent produire et communiquer des alertes avancées et des informations sur les risques qui soient efficaces et soient fonction des effets des catastrophes, qui prennent en compte les dangers multiples et intègrent le principe de l'égalité des sexes. Il est essentiel de renforcer les capacités pour améliorer l'alerte, la détection et les interventions.

- **Élaborer des politiques générales propices**: la Convention de Tampere est un outil précieux que les pays peuvent mettre à profit pour renforcer leurs capacités en matière de préparation aux catastrophes et d'intervention en cas de catastrophe. Dans bien des cas toutefois, les pays signataires de la Convention n'ont pas mis en place les politiques générales et les procédures propices nécessaires.
- **Améliorer constamment les procédures d'urgence**: les projets pilotes et les entraînements/exercices sur la gestion des catastrophes sont importants pour tester les procédures et procéder aux ajustements nécessaires pour être mieux préparés à certaines situations d'urgence. Une coordination constante entre les parties prenantes est également nécessaire.
- **Être attentifs aux progrès techniques**: l'évolution des technologies joue un rôle important dans le renforcement de l'efficacité et de l'efficience de la diffusion d'alertes avancées multirisques. Par exemple, en plus de détecter des catastrophes naturelles, tels que des tsunamis et des inondations, les technologies fondées sur l'IoT peuvent faciliter la collecte de données qui seront traitées au moyen de technologies d'analyse des mégadonnées pour détecter des catastrophes, réduire les effets des catastrophes ou modéliser les effets potentiels des catastrophes. Les procédures et les technologies doivent être évaluées et mises à jour en permanence pour faire en sorte que les alertes et les avertissements soit pertinents, diffusés en temps opportun et suivis par les communautés qui les reçoivent.
- **Autres domaines à examiner**:
  - la formation avancée sur les systèmes à satellites et d'autres systèmes qui peuvent être utilisés à des fins d'alerte avancée et d'intervention;
  - les messages d'alerte du dernier kilomètre envoyés par les autorités locales aux citoyens, et les capacités des systèmes à satellites;
  - la recherche permanente de connaissances en matière de risques liés aux catastrophes, laquelle peut être approfondie en procédant systématiquement à la collecte de données et à l'évaluation des risques liés aux catastrophes (détection, suivi, analyse et prévision des dangers et des conséquences éventuelles). Il sera ainsi possible de diffuser en temps voulu des alertes précises, pertinentes et exploitables contenant des informations sur les probabilités d'occurrence des catastrophes, les effets des catastrophes et les mesures à prendre.

B) Entraînements relatifs aux catastrophes et technologies émergentes en matière de gestion des catastrophes

- L'imagerie par satellite revêt un rôle important lorsqu'il s'agit d'évaluer l'étendue des zones affectées par une catastrophe et l'ampleur des dégâts subis.
- Il est important de mettre en pratique des exercices, à l'instar de l'exercice Triplex[18], et d'assurer une coordination efficace entre les acteurs sur site et le centre de contrôle.
- Les entraînements et les exercices fondés sur la réalité virtuelle devraient reposer sur des données réelles tirées des catastrophes précédentes, afin de permettre d'élaborer des scénarios de catastrophe plus réalistes et de proposer des formations plus proches de la réalité.
- Les unités de ressources TIC mobiles et déployables (MDRU) peuvent s'avérer utiles pour accélérer le rétablissement des réseaux TIC.

[18] TRIPLEX est un exercice de simulation à échelle réelle, effectué régulièrement par le Partenariat humanitaire international et permettant aux organismes humanitaires de mettre en pratique leurs mécanismes d'intervention dans le cadre d'un scénario de catastrophe naturelle soudaine

- Il faut élaborer des plans en matière de résilience des réseaux, qui tiennent compte également des questions relatives à la capacité et à l'alimentation des réseaux, car même les réseaux en bon état ne sont pas à l'abri d'une saturation lors des catastrophes, les batteries de réseau pourraient être épuisées et les lignes de transmission déconnectées, et l'infrastructure physique pourrait subir des dommages directs.
- Dès lors que les technologies ne sont pas déployées de manière isolée, il est essentiel d'accorder une certaine attention à la planification, à la coordination et aux exercices/entraînements, en vue de réviser en permanence les politiques générales et les procédures. Il faut en outre tester régulièrement les équipements.
- Des exercices devraient être réalisés afin de tester la disponibilité et l'utilisation des équipements en cas de catastrophe, tels que des téléphones satellitaires, afin de veiller à ce qu'un nombre minimal d'intervenants y aient accès et sachent les utiliser.
- Les solutions de basse technologie peuvent s'avérer essentielles. Le personnel d'intervention devrait être paré à l'éventualité que les technologies ne fonctionnent pas et disposer de moyens de communication de secours en cas de déconnexion ou de panne de courant.
- Les activités de planification sont cruciales et les objectifs associés aux exercices doivent être définis au préalable et communiqués aux participants ainsi qu'aux parties prenantes.
- Le scénario d'exercice est important et devrait être adapté en fonction des dangers et des conditions au niveau local. Tous les participants devraient néanmoins être prêts à s'adapter et à procéder à des ajustements, c'est pourquoi il est essentiel de faire preuve de souplesse. Afin de mieux préparer les participants à des scénarios complexes et susceptibles d'évoluer, il convient de prévoir un certain nombre d'événements inattendus (ci-après "injects") afin d'intensifier le scénario et de tester la capacité des participants à réagir à des situations de plus en plus complexes.
- Un seul mot d'ordre: la pratique! Il est essentiel de dispenser des formations, de proposer des séances de remise à niveau et d'organiser des simulations d'intervention en cas de catastrophe sur une base régulière afin de recenser les lacunes et de perfectionner les politiques générales et les procédures.
- Immédiatement après une catastrophe, la demande de services de communication explose puisque les personnes essaient de contacter leurs proches et les équipes de premiers secours s'efforcent de coordonner les interventions sur des réseaux saturés ou endommagés. La demande diminuera au fil du temps et tout au long de la période de reprise.
- Il convient d'axer les entraînements sur des thèmes précis selon les besoins et les applications qui sont prioritaires, par exemple pour les informations médicales.
- Les entraînements et les activités de planification devraient tenir compte des personnes handicapées et des personnes ayant des besoins particuliers. Il convient de prendre des mesures pour veiller à ce que ces personnes aient accès aux informations et que leurs besoins en matière de communication soient satisfaits en utilisant tous les moyens à disposition, y compris la langue des signes et les sous-titres.
- Il est indispensable de déployer des mesures d'évacuation rapide pour assurer la survie des personnes handicapées.
- Les pays devraient encourager l'utilisation du service de radioamateur comme moyen de communication de secours en cas d'interruption de toutes les autres infrastructures de réseau.
- Le compte rendu (ou rapport après action), au cours duquel les facilitateurs et les participants échangent leurs données d'expérience, débattent des difficultés rencontrées et donnent leur avis, est la partie la plus importante de l'exercice. Il s'agit de confirmer les points forts du programme de préparation et de définir un plan d'action dans les domaines qui appellent des améliorations ou des ajustements. Le plan d'action devrait accorder un rang de priorité élevée aux activités de suivi et établir en premier lieu des "solutions à effet rapide" repérées durant l'exercice.

- Un exercice de simulation théorique peut s'avérer particulièrement efficace dans un premier temps pour permettre de recenser les lacunes et de perfectionner les plans et les procédures. Il devrait être suivi d'exercices de simulation fictive, d'exercices fonctionnels et d'exercices à échelle réelle, dans l'ordre indiqué. Le travail en équipe lors des exercices sera payant s'agissant de la coordination lors de situations réelles.
- Il importe d'inclure différents participants lors des entraînements sur les communications, tels que des responsables de la communication, des opérateurs de fréquences d'urgence, ainsi que des acteurs de la sécurité publique et des responsables au niveau régional.
- Les entraînements et les exercices devraient également permettre d'examiner les moyens d'accroître la souplesse réglementaire (par exemple, grâce aux autorisations temporaires spéciales) afin de faciliter l'importation et le déploiement rapides des infrastructures TIC.
- Les pays devraient contacter le BDT pour bénéficier d'une assistance en matière de renforcement des capacités et obtenir des informations concernant la préparation en prévision des catastrophes et les communications d'urgence.
- Il convient de solliciter une assistance extérieure chaque fois que cela est souhaitable.
- Il faut élaborer des procédures opérationnelles normalisées aux niveaux national, de l'État et de la municipalité/communauté et examiner les moyens d'accroître l'interopérabilité entre les entités concernées.

C) Entraînements et exercices sur les communications d'urgence au niveau national à l'intention des PEID et des PMA

Étapes/mesures de planification recommandées

- **Établir en premier lieu une note de synthèse** décrivant l'objectif et les résultats attendus de l'exercice, les ressources nécessaires et les échéances. La note de synthèse présentera les parties prenantes à l'exercice.
- **Mettre sur pied une équipe de planification** chargée de planifier minutieusement le scénario d'exercice, les délais, les participants, les ressources nécessaires, etc.
- **Rédiger le scénario**: l'élaboration d'un scénario est nécessaire pour chaque type d'exercice, qu'il s'agisse d'exercices de simulation théorique ou d'entraînements à échelle réelle. Le scénario est le document qui pose les bases de l'exercice. Il faut veiller à ce que le scénario se rattache aux objectifs définis de l'exercice.
- **Élaborer un plan d'évaluation**, qui sera la composante essentielle faisant de l'exercice une source d'enseignements précieuse.
- **Mener l'exercice**: il convient de vérifier que tous les équipements et toutes les ressources soient en place. L'équipe de facilitation donnera ensuite les consignes aux participants et dirigera l'exercice fondé sur un scénario.
- **Suivre l'exercice**: il faut évaluer comment les participants réagissent face aux principaux événements. Les objectifs ont-ils été atteints? Quels sont les résultats obtenus?
- **Consigner** toutes les décisions et tous les résultats importants.
- **Dresser un bilan** avec les participants.
- **Organiser** l'analyse après action/recueillir les réactions à chaud.
- **Définir et fixer des objectifs pour les mesures correctives** compte tenu des observations tirées de l'exercice.
- **Mettre à jour** les plans, les politiques générales, les procédures et les équipements, selon les besoins.

Planification d'exercices: bonnes pratiques

- **Prévoir un laps de temps important pour la planification**: il convient de prévoir un délai suffisant, lors du cycle de planification de l'exercice, pour informer les participants (si tel est le cas). Par exemple, s'il est prévu que des acteurs du secteur des télécommunications participent à un exercice ou à un entraînement, ceux-ci devront être informés longtemps à l'avance pour pouvoir mobiliser les ressources nécessaires à leur participation.
- **Planifier de manière détaillée la portée du scénario et le rédiger**, puis établir un calendrier et déterminer les ressources dont les équipes internes et externes auront besoin pour atteindre les résultats attendus.
- **Organiser à intervalles réguliers des exercices ou des entraînements** (chaque année, si possible) pour renforcer les résultats.
- **Rédiger un calendrier de l'exercice qui comporte deux échelles de temps**: le temps chronologique réel et le temps de la durée de l'exercice. Par exemple, si un exercice commence à 9 h 00 un lundi en temps réel mais à 3 h 00 un dimanche matin selon le scénario, l'exercice devrait se dérouler par tranches de temps compréhensibles dans les deux échelles de temps (par exemple: heure de début: 3 h 00 = 9 h 00; exercice 1: heure de début + 1 heure = 10 h 00; exercice 2: heure de début + 2 heures = 11 h 00).
- **Allonger le calendrier de l'exercice** pour examiner les mesures qui auraient été prises avant ou après l'événement simulé. Par exemple, un scénario d'ouragan/de cyclone devrait couvrir les activités de préparation, d'atténuation des effets et de rétablissement/d'intervention allant de T moins 5 jours à T plus 3 jours, afin d'inclure les éléments suivants: le positionnement des ressources en amont (carburant et provisions inclus); la mise sur pied d'équipes d'intervention en cas d'urgence prêtes à intervenir; les pannes de réseau; la disponibilité du personnel; et les mesures prises pour lutter contre les inondations, telles que l'utilisation de sacs de sable. Il convient d'ajouter des "injects" dans le calendrier de l'exercice.
- **Tenir compte du calendrier du scénario**: il convient de se demander si le scénario pourrait se dérouler pendant la haute saison touristique ou pendant une période moins chargée de l'année; pendant la saison des fêtes ou à la fin du mois/de l'année. De cette manière, on pourra tester la disponibilité des ressources, en particulier si la simulation a pour objet de garantir l'état de préparation en vue d'une manifestation importante à venir.
- **Inclure un calendrier détaillé** qui rend compte du temps et des ressources dont les équipes internes et externes auront besoin pour atteindre les résultats attendus.
- **Associer les acteurs du secteur**: le scénario devrait être conçu de sorte qu'il soit clair que les opérateurs du secteur peuvent contribuer en indiquant si le scénario est réaliste et entrevoir les avantages qu'ils pourraient retirer de leur participation. Il pourrait s'agir notamment d'instaurer une coordination intersectorielle, de renforcer les liens avec le régulateur et les organismes publics, et de permettre aux opérateurs de tester leurs propres moyens de communications.
- **Concevoir l'exercice en se fondant sur des plans existants (s'ils sont disponibles):** il s'agit de comprendre l'objet et la portée des politiques générales et des plans nationaux applicables à l'entraînement (il est déconseillé de concevoir un essai qui contourne tous les processus réglementaires actuels). Quels sont les objectifs en matière de délai de rétablissement? Quelles sont les cibles en matière de rétablissement (le cas échéant)? Il s'agit ensuite de concevoir une évaluation/un essai pour évaluer la capacité d'atteindre les cibles fixées et mobiliser des ressources tout au long du processus. Les principaux processus d'intervention/opérationnels et les objectifs en matière de délai de rétablissement associés ont-ils été identifiés dans les plans? Si tel n'est pas le cas, il s'agit d'ores et déjà d'une observation que l'exercice permet de mettre en lumière.
- **Aligner la formulation et le vocabulaire**: il faut s'assurer que tous les participants connaissent bien les termes employés. Il peut être nécessaire de publier un glossaire avant la tenue de l'exercice.

- **Faire en sorte que le scénario reste réaliste**: il convient de concevoir un scénario qui présente des avantages pour tous les acteurs, afin d'aider les parties prenantes à mieux jouer leur rôle. Il faut également tenir compte de la portée géographique de l'exercice. Les participants devront-ils être déplacés sur de plus longues distances? Le scénario prévoit-il la participation du public en général (évacuations, mise en place d'installations médicales d'urgence, radiodiffusions cellulaires, etc.)?
- **Proposer des scénarios et des "injects" dynamiques** afin de pousser les organisations et les individus à faire face à des effets en cascade. Étant donné que les catastrophes naturelles ne suivent pas un plan déterminé au préalable, il est indispensable de se préparer à une multitude de scénarios.
- **Susciter l'adhésion des principales parties prenantes**: il convient de dresser une liste des principaux acteurs qui doivent participer et une autre liste d'acteurs dont la participation est facultative. Il vaut mieux définir un rang de priorité pour les participants. Si des parties prenantes qui ne tombent pas sous votre supervision directe ou qui ne font pas partie de votre organisation figurent au nombre des participants, il faut veiller à ce qu'elles aient donné leur accord pour la participation de leur personnel, dans la mesure où cette participation peut prendre beaucoup de temps. Il faut en outre s'assurer que leurs responsables et leur direction sont informés de la participation prévue, éventuellement pendant plusieurs jours.
- **Incidences sur les ressources**: il convient d'être conscient des incidences sur les ressources si les produits nécessitent un travail considérable (collecte de données, par exemple).
- **Savoir quand il faut mettre fin à l'activité**: il faut se tenir prêt à mettre fin à l'exercice si les circonstances rendent son déroulement peu pratique ou si les résultats ne sont pas utiles ou réalistes. Cette expérience servira à améliorer le prochain exercice.
- **Mettre à l'épreuve**: il convient d'envisager de retirer de l'exercice les plates-formes technologiques courantes, au profit de processus manuels avec des communications limitées. Cela aura pour effet d'"éprouver" les processus et de tester la capacité de planification préalable des équipes, la connaissance de leurs plans et leur capacité à se livrer à l'exercice sans directives.
- **Utiliser des processus et des systèmes réels**: il faut éviter de créer des groupes, des adresses électroniques et des voies de communication "uniquement pour l'exercice", qui ne permettront pas de valider réellement l'efficacité des systèmes utilisés dans une situation réelle.

Réalisation d'exercices et d'entraînements

- Faciliter la conduite d'un exercice fondé sur un scénario: le facilitateur devrait distribuer à l'avance aux participants le plan d'urgence de l'organisation, le cas échéant. Le facilitateur peut également contacter à l'avance les responsables de la gestion des urgences aux niveaux local et régional ainsi que les intervenants communautaires, pour obtenir des informations au préalable, par exemple sur les problèmes actuels de gestion des situations d'urgence au niveau local susceptibles d'influer sur la planification de l'organisation[19]. Le facilitateur a pour rôle de créer un cadre propice au dialogue et d'orienter les discussions pour atteindre les objectifs de l'exercice, donner des informations sur les plans d'urgence de l'organisation, favoriser le travail d'équipe et former les participants. À cet égard, il peut notamment:

    - donner aux participants une vue d'ensemble de l'exercice, y compris la portée, le scénario, les objectifs du calendrier, le rôle des participants et les prochaines mesures à prendre;
    - demander aux participants de se présenter;

[19] Voir également Exercising Business Continuity Plans for Natural Disasters: A Quick Guide for MNOs (Mise en application de plans pour la continuité des activités en cas de catastrophe naturelle: Guide rapide à l'intention des opérateurs de réseaux mobiles), GSMA, 2017.

- faire travailler les participants en équipe (ou les répartir en plusieurs équipes);
- présenter le scénario aux participants comme s'il s'agissait d'un incident réel;
- guider l'équipe à l'aide de modules interactifs en fonction des phases des catastrophes (préparation, intervention, rétablissement et atténuation des effets) et discuter des mesures concrètes à prendre à chaque phase;
- encourager une discussion approfondie sur les mesures de préparation, d'atténuation des effets et d'intervention qu'il convient de prendre, afin d'améliorer la capacité de communication lors de catastrophes futures;
- ajouter des "injects" à des moments décisifs;
- organiser une séance de "compte rendu" ou de "réactions à chaud" au cours de laquelle les participants sont amenés à résumer leurs observations et conclusions, en principe pour intégrer des éléments d'information dans les plans d'urgence nationaux et les modifier;
- participer à un processus complet a posteriori.

Réalisation d'exercices: bonnes pratiques

– **Consigner les événements**: désigner un rédacteur qui sera chargé de rendre dûment compte de la chronologie et des décisions importantes.
– **Fournir un calendrier** et commencer par expliquer comment l'exercice se déroulera du début à la fin. Le calendrier doit indiquer la fréquence des appels des participants, le moment où les appels auront lieu et le type d'appels prévus, ainsi que l'heure de fin.
– **Maintenir un programme chargé**, que ce soit en présentiel ou lors d'une conférence téléphonique. Il faut essayer de réduire au maximum les tâches administratives.
– **Les "injects"** devraient être conçus de manière à stimuler les mesures, les activités et les conversations des équipes, des organismes et des individus, qu'ils participent directement ou indirectement à l'exercice. Ils devraient également tenir compte des plans existants. Par exemple, si le scénario prévoit d'examiner les interventions d'urgence à la suite d'un ouragan au niveau d'une installation donnée, le premier "inject" pourrait être un bulletin météorologique diffusé dans les médias sur une dépression tropicale qui se transforme en ouragan. Le suivant serait un rapport de suivi sur la trajectoire de l'ouragan vers la zone touchée.
– **Les "injects" devraient rattacher l'événement simulé aux mesures que les organisateurs veulent que les personnes prennent**. Ils donnent une certaine cohérence à l'exercice et sont fournis par les contrôleurs pour conduire le scénario. Ils interviennent généralement indépendamment des mesures prises par les participants. Par exemple, une simulation d'assistance routière d'urgence pourrait nuire à la capacité d'organiser une évacuation par une route principale. Il s'agit d'un "inject", car le contrôleur de l'exercice informera les joueurs à un moment prédéterminé que cet événement simulé a eu lieu, indépendamment des mesures prises. On peut citer d'autres exemples comme des pannes de générateur, des pénuries de carburant (pas de carburant dans les trois heures qui suivent, par exemple), des fuites de produits chimiques nécessitant un nettoyage par des équipes spécialisées dans le traitement des matières dangereuses, ou des troubles à l'ordre public à proximité d'un hôpital. Lors de la planification d'un "inject", il faut établir un lien entre l'effet simulé de cet "inject" et les mesures voulues par les participants.

- **Concevoir des "injects" qui remettent en question la structure de l'intervention, tester la souplesse des plans d'intervention et privilégier les discussions relatives aux priorités**: on peut citer, à titre d'exemple, les dommages causés aux moyens de communication (par exemple: les antennes-relais dans des zones d'importance primordiale sont détruites ou endommagées, l'Internet est en panne ou les lignes téléphoniques sont coupées, les câbles sous-marins sont endommagés et il n'y a aucun accès à la récupération de données en nuage) et les problèmes liés à l'infrastructure ayant des incidences sur les mesures d'intervention (par exemple: la fermeture des aéroports ou des routes endommagées).
- **Déterminer la date à laquelle les produits doivent être présentés et leur niveau de précision** (produits complets ou partiels).
- **Fixer des règles de base en matière de communication pendant l'exercice**: il convient d'utiliser la mention "Il s'agit seulement d'un exercice" ("This is an exercise only") au début de l'exercice et d'indiquer quand toutes les communications liées à l'exercice ont pris fin.
- **Déterminer les conditions pour l'établissement de rapports pendant l'événement**: qu'est-ce qui fait l'objet d'un suivi et qui se charge de cette tâche? Quelles informations peuvent être communiquées? Quel est l'état des rapports qui sont produits? Qu'est-ce que les opérateurs sont tenus de signaler et comment le feront-ils?
- **Définir des chaînes hiérarchiques**: à qui et à quelle fréquence les rapports sont-ils présentés et que contiennent-ils? Dans quelle mesure ces canaux de communication sont ils dûment compris?

D) Enseignements tirés

- L'accès à une infrastructure TIC robuste, résiliente et sûre dans le monde entier est crucial en situation de pandémie et en cas de catastrophe, quelle qu'elle soit.
- Les TIC facilitent la fourniture de services essentiels dans une situation d'urgence mondiale. Toutefois, si nous voulons que les TIC puissent assurer dûment leurs fonctions, nous devons instaurer un environnement de politique générale propice afin d'appuyer la mise en place de réseaux résilients ainsi que le rétablissement rapide et le déploiement des TIC en cas de catastrophe. À titre d'exemple, des dispositions pourraient être prises en vue de l'octroi d'autorisations temporaires visant à permettre l'utilisation d'une quantité supplémentaire de spectre ou de l'assignation de marges de recharge gratuites pour les appels d'urgence.
- Les réseaux de télécommunication et l'infrastructure numérique du monde entier doivent être mieux préparés à faire face à tous types de catastrophes. Il est nécessaire de déployer une action concertée afin d'aider à faire en sorte que des entraînements soient menés et que des mesures d'intervention rapide soient prêtes à être appliquées, car les catastrophes – y compris les pandémies – peuvent se produire à tout moment et en tout lieu, et sont pour ainsi dire imprévisibles.
- Les éventuelles conséquences négatives des catastrophes peuvent être réduites si des réseaux robustes et résilients, d'une part, et des outils et des pratiques en matière de gestion des catastrophes, d'autre part, sont mis en place suffisamment à l'avance.

7.2 Conclusions

Tout au long de la période d'études, la Commission d'études 2 de l'UIT-D a examiné un large éventail d'activités liées à l'utilisation des télécommunications/TIC lors des situations de catastrophe et d'urgence, tant dans les pays développés que dans les pays en développement (dans le cadre de l'étude de la Question 5/2). Il est encourageant de noter que de plus en plus de pays et d'organisations prennent des mesures pour élaborer des systèmes d'alerte avancée, déployer les toutes dernières technologies et renforcer la résilience des réseaux de télécommunication/TIC face aux risques liés aux catastrophes. Les enseignements tirés et les lignes directrices élaborées durant la période d'études permettront d'améliorer les activités de préparation pour ce qui est de l'alerte avancée, des entraînements et des exercices, et de l'élaboration, en temps voulu, de politiques générales efficaces. Cela étant dit, il est ressorti des discussions que les pays en développement ont besoin d'un appui supplémentaire pour mettre en œuvre des moyens de communication en cas de catastrophe. Il s'agit donc désormais de se concentrer sur l'utilisation des télécommunications/TIC lors des interventions et des activités de rétablissement en cas de catastrophe et sur la mise en œuvre de plans pour les télécommunications en cas de catastrophe. Les pays devraient néanmoins continuer de faire part de données d'expérience et de contributions relatives à l'utilisation des télécommunications/TIC dans tous les domaines de la gestion des catastrophes, en particulier concernant les mesures déployées face à la pandémie de COVID-19. Les pays en développement pourraient aussi consacrer plus de temps à l'échange de données d'expérience, notamment dans le cadre d'ateliers interactifs, en vue de recenser les défis communs, de mettre en avant les pratiques ayant fait leurs preuves, et d'appuyer l'élaboration et la mise en œuvre actuelles de cadres, de technologies et de plans dans le domaine des communications en cas de catastrophe.

Annexes

Annex 1: Detailed use cases

A1.1 Enabling policy and regulatory environment

A1.1.1 Policy frameworks on ICT and disaster management (India)[20]

(1) India's policy framework – Role of ICTs in disaster situations

The National Telecom Policy 2012 emphasizes the importance of disaster management and contains various provisions relating thereto, including with regard to:

- the creation of robust and resilient telecommunication networks to address the need for proactive support to mitigate natural and man-made disasters;
- sectoral standard operating procedures to promote effective and early mitigation during disasters and emergencies;
- the creation of an appropriate regulatory framework for the provision of reliable means of public communication by telecommunication service providers during disasters;
- encouraging use of ICTs to predict, monitor and issue early warnings of disasters, and to spread information;
- facilitating an institutional framework to establish a nationwide unified emergency response mechanism by providing a nationwide single access number for emergency services.

(2) India's standard operating procedures for the use of telecommunication services in disasters

The Department of Telecommunications, which is part of India's Ministry of Communications, prepared standard operating procedures for disaster-response and emergency communications in 2015. A crisis management plan for disaster communications was also released in 2015, and the standard operating procedures were last updated in March 2017. The update covers detailed procedures for communication services during all kinds of disasters, including the following:

- the organization of telecom services at all levels (central, state and district) for implementing and monitoring disaster-management plans;
- the constitution of committees at national, state and district level that meet once every six months to review disaster-management plans and activities;
- robust and preventive measures for telecommunication systems;
- the obligation for telecommunication service providers to make provision for physical infrastructure safety and redundancy in traffic management;
- the obligation for telecommunication service providers to identify the vulnerabilities of their respective telecommunication infrastructure and prepare emergency plans accordingly, including back-up components (e.g. engine alternator, batteries);
- an overload protection mechanism for traffic overload and congestion management;

[20] ITU-D SG2 Document 2/70 from India

- the provision of control room management/activities during and after the disaster;
- periodic training to promote ongoing awareness and drills to check preparedness.

Details are available at the Department of Telecommunications website.

(3) Telecom Regulatory Authority of India initiatives

The recommendations of the Telecom Regulatory Authority of India (TRAI) regarding a single emergency number in India provide a framework for implementation of an integrated emergency communication and response system. The recommendations were accepted by the Government of India and the number "112" was allocated to this service. The Department of Telecommunications subsequently issued the necessary instructions to telecommunication service providers for implementation. In 2013, TRAI also issued recommendations on priority call routing for persons involved in rescue and relief operations, which were also largely accepted. Telecommunication service providers were asked to provide Intra Circle Roaming for their subscribers so that, should mobile services be interrupted because of infrastructure failure during a disaster, subscribers can obtain roaming service for 15 days on the network of another telecommunication service provider whose network is in working condition. TRAI is currently consulting on next-generation PPDR communication networks. Detailed information is available on its website.

(4) Early-warning systems

India has a very robust early-warning system, comprising the following primary nodal agencies:

- the India Meteorological Department (cyclones, floods, drought, earthquakes);
- the Central Water Commission of the Ministry of Water Resources (floods);
- the Indian Space Research Organisation (ISRO) National Remote Sensing Centre, which provides all manner of space navigation services;
- the Geological Survey of India (landslides);
- the Ministry of Earth Sciences, via the Indian Tsunami Early-Warning Centre at the Indian National Centre for Ocean Information Services, Hyderabad (tsunamis);
- the Snow and Avalanche Study Establishment (avalanches).

Indian early-warning agencies send important information derived from satellite-based sensing data to neighbouring countries and to several similar agencies in the Indian Ocean and Asia Pacific region. The Indian early-warning system is also part of the WMO World Weather Watch Global Telecommunication System.

The ISRO National Remote Sensing Centre, together with other organizations such as the Geological Survey of India, the Bureau of Indian Standards and OPCW, has produced maps dividing India into zones on the basis of hazard vulnerability using sensing data. These maps are very useful for pre-disaster planning, prevention and mitigation activities. Bhuvan is the ISRO geoplatform providing an extensive range of services based on Geological Survey maps.

(5) Disaster management: an integrated approach using ICT applications to enable efficacious disaster prediction

In the wake of the 2004 tsunami, the Government of India took steps to build robust early-warning systems: the Ministry of Earth Sciences established the National Tsunami Early-Warning System at the Indian National Centre for Ocean Information Services in Hyderabad, Andhra Pradesh; and the Ministry's Meteorological Department developed ICT-based systems that issue accurate warnings and generate real-time weather reports for all major disaster-management agencies.

The benefits of early warnings and preparedness became apparent when Cyclone Phailin, the strongest storm to hit India in more than a decade, swept across the Bay of Bengal to the eastern coast states of Andhra Pradesh and Odisha on Saturday, 12 October 2013, making landfall with winds over 200 km/h and bringing heavy rainfall. The red message, the highest alert message from the Indian Meteorology Department in New Delhi, was concise, accurate and to the point. It also indicated where and what type of damages were expected to shelter and infrastructure.

The Orissa State Disaster Management Authority team and the National Disaster Management Authority managed the largest-ever evacuation exercise in the state. Nearly 500 000 people were evacuated in time and moved to higher ground and safer cyclone shelters. State, federal and local administration officials, international and national NGOs, and community leaders joined hands in a well-planned large-scale relief operation. Control rooms were set up in ten districts, mobile phone numbers were updated and verified, leaves were cancelled to ensure that all staff members were on stand-by, and food and relief stocks were kept in readiness. The National Disaster Management Authority facilitated local efforts in Odisha, mobilizing rescue teams and sending equipment to possible hot spots. It deployed nearly 2 000 personnel of the National Disaster Response Force in Andhra Pradesh, Odisha and West Bengal. The teams were equipped with satellite phones and wireless sets to maintain smooth communications.

Thanks to the efficient early-warning system and the rapid evacuation measures deployed, a very low death toll was reported: only 21 people died (12 million lived in the storm's path). By contrast, a 1999 cyclone in the same area had a much more devastating impact, killing 10 000 people. Similarly, the 2004 tsunami took the lives of about 10 000 people in coastal states of India.

The early warning issued by the India Meteorological Department was also effective thanks to the state government disaster preparedness and mitigation activities for communities at risk carried out previously: shelters and food had been made available, a volunteer system established, drills regularly conducted and standard operating procedures drawn up for disaster management at state and village level.

(6) The Fisher Friend Mobile Application

The Indian National Centre for Ocean Information Services has collaborated with a very renowned research institution, the M.S. Swaminathan Research Foundation, to develop the Fisher Friend Network, which ensures safety at sea and improves the livelihoods of fishermen. The Fisher Friend Mobile Application is a unique, single-window solution for the holistic shore-to-shore needs of the fishing community, providing vulnerable fishermen immediate access to critical, near real-time knowledge and information services on weather, potential fishing zones, ocean state forecasts and market-related information. Fishermen now receive regular ocean weather forecasts, early warnings about adverse weather conditions and advisories on potential fishing zones. The application is an efficient and effective decision-making tool enabling the fisher community to make informed decisions about their personal safety and the safety of their boats, and to make smart choices about fishing and marketing their catches.

The application was developed on an android platform in partnership with Wireless Reach Qualcomm and Tata Consultancy Services. It is currently available in Tamil, Telugu and English.

Fishermen have been trained to recognize warning signs to ensure their own safety and that of their communities.

A1.1.2 The importance of ICTs in disaster management (India)[21]

(1) Disaster-management governance and law

Major disasters, such as the earthquakes in Uttarkashi (1991), Latur (1993) and Chamoli (1999), the Assam floods (1998) and the Orissa super cyclone (1999), led to serious brainstorming on the state of disaster management in India and on the actions required to improve the situation. A key step in that direction was the establishment by India, which was a party to the 1994 Yokohama Strategy for a Safer World, of the High-Power Committee under the chairmanship of Mr J.C. Pant, former secretary of the Indian Government. The Committee produced a detailed report and a set of fundamental and practical recommendations. The Gujarat Bhuj earthquake in 2001 triggered the proposed Disaster Management Bill, which was enacted after the 2004 Indian Ocean tsunami as the Disaster Management Act 2005. The Act enshrines the paradigm shift to "prevention-mitigation based holistic disaster management". Interestingly, in 2005 India also participated in the Kobe World Conference on Disaster Reduction, which adopted the Hyogo Framework for Action 2005–2015. Although India's pioneering legislation on systemic disaster planning and preparedness, the Emergency Planning, Preparedness and Response Rules 1996, was adopted as part of the Environmental Protection Act 1996, the mechanism for holistic planning for disaster management and a tiered approach involving national, state, district and local authorities was introduced by the Disaster Management Act 2005.

The Disaster Management Act 2005 clearly spells out the institutional structures and corresponding functional responsibilities needed to bring about the paradigm shift, leading to the establishment of the National Disaster Management Authority, the National Institute of Disaster Management (the National Authority's capacity-building arm) and the National Disaster Response Force. Similar responsibilities at state and local level resulted in the establishment of the respective institutions at state and district level. This institutional framework ensures that, in post-disaster situations, the communities concerned have assured sustainable livelihoods and reduced vulnerability to future disasters. India is also a party to all international disaster risk reduction strategies and a signatory of the Sendai Framework for Disaster Risk Reduction 2015–2030, the 2030 Agenda for Sustainable Development and the 2015 Paris Climate Agreement.

The National Disaster Management Authority has drawn up the National Policy on Disaster Management, which defines India's disaster-management vision. The policy aims to promote a culture of prevention, preparedness and resilience at all levels through knowledge, innovation and education. It encourages mitigation measures based on technology, traditional wisdom and environmental sustainability, and promotes mainstreaming of disaster management into the development planning process. The policy envisions the use of science and technology in all aspects of disaster management in India and is available on the website of the National Disaster Management Authority.

[21] ITU-D SG2 Document 2/70 from India

(2) National telecom policy and emergency telecommunication initiatives

India's National Telecom Policy 2012 emphasizes the importance of disaster management and contains various provisions relating thereto, including with regard to:

- the creation of robust and resilient telecommunication networks to address the need for proactive support to mitigate natural and man-made disasters;
- sectoral standard operating procedures to promote effective and early mitigation during disasters and emergencies;
- the creation of an appropriate regulatory framework for the provision of reliable means of public communication by telecommunication service providers during disasters;
- encouraging use of ICTs to predict, monitor and issue early warnings of disasters, and to spread information;
- facilitating an institutional framework to establish a nationwide unified emergency response mechanism by providing a single access number for emergency services valid throughout the country.

Pursuant to the National Telecom Policy 2012, the Department of Telecommunications, which is part of India's Ministry of Communications, prepared standard operating procedures for disaster response and emergency communications in 2015. A crisis management plan for disaster communications was also released in 2015, and the standard operating procedures were last updated in March 2017. The update covers detailed procedures for communication services during all kinds of disasters.

Going further, the Department of Telecommunications has now created an organizational structure at each Telecom Licensed Service Area (which normally corresponds to India's states), a functional role specific to disaster management empowered to implement the standard operating procedures in all Telecom Licensed Service Areas and drive emergency telecommunications at federal and state government level.

The Telecommunication Engineering Centre, the Department of Telecommunications' telecom research and standardization arm, produced a paper on disaster communications in 2008. The paper's recommendations were adopted as the department's standard operating procedures. The Centre has recently released a testing procedure for enhanced Multi-Level Precedence and Pre-Emption priority services for emergency communications.

The Telecom Regulatory Authority of India has already issued recommendations on priority call routing, the single emergency number and next-generation PPDR communication networks.

(3) ICT-based forecasting and warning networks

In line with the ongoing paradigm shift in disaster management, and with the priorities and action points of the Sendai Framework for Disaster Risk Reduction 2015–2030, the 2030 Agenda for Sustainable Development and the 2015 Paris Climate Agreement, disaster risk reduction, climate change adaptation and sustainable development are now interrelated. In India, the emphasis is now on disaster risk reduction through prevention, mitigation and preparedness. India has built up a very strong early-warning system. The country's meteorological service, the India Meteorological Department (IMD), was established in 1875. It is the principal government agency in all matters relating to meteorology, seismology and allied subjects. The IMD offers observation, data collection, monitoring and forecasting services across various sectors: monsoons, hydrology, agriculture, health, aviation, transport, shipping, cyclones, climatology, mountaineering, disaster management, etc. It offers many web-based forecast services. For example, weather forecasts, meteorological information, nowcasts and warnings are provided from IMD headquarters in New Delhi and various IMD offices. The IMD's meteorological telecommunications consist of an integrated network of point-to-point and point-to-multipoint links with meteorological centres in the country and worldwide for receiving data and relaying it selectively. The IMD also has a VSAT-based network. It has a two-tier organization:

- the Meteorological Telecommunication Network, which is part of the WMO World Weather Watch Global Telecommunication System;
- the National Meteorological Telecommunication Network.

The Global Telecommunication System, the main part of the WMO National Meteorological Telecommunication Centre, in Mausam Bhavan, New Delhi, acts as a WMO regional telecommunication hub.

The IMD is mandated:

- to take meteorological observations and to provide current and forecast meteorological information for optimum operation of weather-sensitive activities such as agriculture, irrigation, shipping, aviation and offshore oil exploration;
- to warn against severe weather phenomena such as tropical cyclones, northwesters, dust storms, heavy rains and snow, and cold and heat waves, which cause destruction of life and property;
- to provide the meteorological statistics required for agriculture, water resource management, industries, oil exploration and other nation-building activities;
- to conduct and promote research in meteorology and allied disciplines;
- to detect and locate earthquakes and to evaluate seismicity in different parts of the country for development projects.

Apart from the IMD, other Indian agencies monitor and provide early warnings of disasters:

- the Central Water Commission of the Ministry of Water Resources (floods);
- the ISRO National Remote Sensing Centre, which provides all manner of space navigation services;
- the Geological Survey of India (landslides);
- the Ministry of Earth Sciences, via the Indian Tsunami Early-Warning Centre at the Indian National Centre for Ocean Information Services, Hyderabad (tsunamis);
- the Snow and Avalanche Study Establishment (avalanches).

Indian early-warning agencies send important information derived from satellite-based sensing data to neighbouring countries and to several similar agencies in the Indian Ocean and Asia Pacific region. The Indian early-warning system is also part of the WMO World Weather Watch Global Telecommunication System.

(4) Mapping and hazard zones

The ISRO National Remote Sensing Centre, together with other organizations such as the Geological Survey of India, the Bureau of Indian Standards and OPCW, has produced maps dividing India into zones on the basis of hazard vulnerability. The maps are specific to an area's hazard profile. The maps are very useful for pre-disaster planning, prevention and mitigation, and mainstreaming of disaster risk reduction and development planning activities. They are also used to implement building by-laws.

(5) Bhuvan data discovery and metadata portal

Bhuvan is the ISRO geoplatform providing an extensive range of services based on Geological Survey maps. The portal, which was developed by the ISRO National Remote Sensing Centre, is meant to:

- improve access to and integrated use of spatial data and information;
- support decision-making;
- promote multidisciplinary approaches to sustainable development;
- enhance understanding of the benefits of geographic information.

It is being extensively used for disaster risk reduction. It also helps pinpoint the location of events. For example, forest fires can be quickly located and remedial action taken thanks to this geo-portal. Details of the various disaster services on offer are available here.

A1.1.3 Emergency telecommunications under Haiti's Sectoral Working Group (Haiti)[22]

(1) Disaster management in Haiti

In Haiti, disaster management is entrusted to the Civil Defence Directorate (*Direction de la Protection Civile*, or DPC), which is under the authority of the Ministry of the Interior and Local Government Authorities. The DPC receives support for natural disaster management from many other State bodies and private and international institutions.

In addition to planning and coordinating relief activities, the DPC also manages a UHF telecommunication network to facilitate communication between the different bodies involved in the disaster-management process. For field telecommunications, the DPC relies on the support of the National Telecommunication Council (CONATEL) to mobilize all telecommunication/Internet operators and broadcasters. CONATEL's responsibilities in terms of emergency telecommunications are as follows:

- coordinate with telecommunication operators with a view to ensuring availability of telecommunication networks for relief operations;
- issue alerts via radio and television stations;
- activate and distribute satellite telephones to government officials for the coordination of relief operations;
- coordinate the deployment of telecommunication systems with ITU.

(2) Regulator's emergency telecommunication plan of action

The regulator's emergency telecommunication plan of action involves the following:

- coordination with the DPC, mobile operators, Internet access providers, and radio and television stations for emergency alerts to the public;
- ensuring the resilience of mobile operator, Internet access provider and radio and television station networks;
- coordination of assistance from ITU and other international organizations for emergency telecommunications;
- advocacy for the adoption and implementation of a national plan for emergency telecommunications;

[22] ITU-D Document SG2RGQ/121 from Haiti

- introduction of a mechanism for the efficient and optimal use of telecommunication resources during emergencies.

(3) Role of telecommunication/Internet operators and broadcasters

Telecommunication operators and Internet access providers have the following responsibilities:

- provide telecommunication services in disaster-affected areas;
- issue emergency alerts at the DPC's request;
- offer calls free of charge to persons living in disaster-affected areas.

Radio and television stations are supposed to broadcast alerts to disaster-affected populations.

(4) Support from international organizations

ITU provides appropriate support to Haiti during emergencies. Its interventions take two forms:

- deployment of emergency telecommunication equipment to facilitate communication among relief teams;
- distribution of satellite telephones to government officials for the coordination of relief activities.

Several other international NGOs, either established in Haiti or arriving specifically for emergencies, deploy their telecommunication equipment to support DPC activities.

(5) Projects under way

There are currently two emergency telecommunication projects under way.

Haiti does not yet have an integrated emergency telecommunication system. It has therefore been decided to establish a sectoral committee on emergency telecommunications (*Comité sectoriel sur les télécommunications d'urgence*, or COSTU), charged with coordinating sectoral responses, in accordance with the national disaster and risk management plan. COSTU was set up with a view to using telecommunications and ICTs to enhance the coordination of disaster prevention, preparedness and response.

COSTU reflects an ongoing commitment bringing together the Ministry of Public Works, Transport and Communications, through the participation of CONATEL, and the Ministry of the Interior and Local Government Authorities, through the participation of the DPC. It demonstrates the Government's determination to strengthen disaster prevention, preparedness and response measures through joint planning and to take advantage of the essential role of telecommunications in this regard.

COSTU's terms of reference include the following elements:

- mission and functions
- composition
- operating mechanisms
- task descriptions
- financing arrangements
- expected outcomes
- follow-up and assessment mechanisms.

WFP and the GSMA contributed to work leading to the establishment of the sectoral working group on emergency telecommunications.

The second project concerns the introduction of an early-warning system to issue public alerts in the event of a disaster. The system is designed to operate on mobile telephone operator networks. Arrangements are being made for it to be installed on the networks of the country's two mobile operators. The system, which will be provided by Microimage, receives assistance from the GSMA and is financed by the World Bank.

A1.1.4 Emergency Telecommunications Preparedness Checklist (WFP)[23]

As disasters continue to increase in frequency and scope across the world, and ITU-D Question 5/2 considers the critical role of how communication policy-makers can help enable emergency telecommunications in disaster preparedness, mitigation, response and relief, the WFP-led Emergency Telecommunications Cluster and ITU-D have jointly developed the Emergency Telecommunications Preparedness Checklist. The checklist examines key thematic areas that could be considered for inclusion in an NETP and provides a simple scoring approach to assess the state of progress on each decision point or action over time. It primarily supports the establishment and refinement of NETPs, with a focus on understanding national readiness to enable response communications in a disaster. It also identifies targeted areas that may require attention. For a more detailed listing of potential questions that communications authorities may ask when drafting an NETP, please refer to the Emergency Communications Checklist.[24]

A1.1.5 CAP-based early warning (New Zealand)[25]

(1) Governance

The New Zealand CAP Working Group is chaired by the Ministry of Civil Defence & Emergency Management (MCDEM) and is open to anyone with an interest in promoting the general uptake of CAP, using CAP for registered alerting authority alerts and developing software or supplying hardware to support the dissemination of alerts in New Zealand.

Owing to the CAP's flexible definition of hazard levels and nomenclature, the Working Group maintains a technical standard, Common Alerting Protocol (CAP-NZ) Technical Standard [TS 04/18], to assist with CAP implementation in the New Zealand alerting context. The standard aims to provide clarity for alerting authorities on the formatting and categorization of alerts and how those alerts should then reach the public via various alerting end-points. It encompasses the Working Group's decisions, recommendations and lexicons to ensure consistency within New Zealand's alerting environment. It is reviewed annually.

The MCDEM coordinates associated task groups and working groups, which implement information systems and alerting end-points utilizing CAP concepts such as its schema, its alert gradings of certainty, severity or urgency, its distribution through alerting end-points, and the New Zealand-specific lexicons to provide common understanding of the message contents. It also coordinates the development of best-practice messaging in New Zealand for the various end-point technologies.

23 ITU-D Document SG2RGQ/182+Annexes from the World Food Programme
24 ITU, op. cit. (note 2), Annex A
25 ITU-D SG2 Document SG2RGQ/145 from New Zealand

The Working Group does not have any decision-making capacity; instead it makes recommendations to the Public Alerting Governance Committee, which considers and approves the specification documents produced by the Working Group.

The Public Alerting Governance Committee was established by the Hazard Risk Board, one of the governance boards of the Officials' Committee for Domestic and External Security Coordination[26]. It comprises senior officials responsible for public alerting and representatives of New Zealand mobile operators and the scientific organizations that monitor natural hazards.

(2) New Zealand CAP feeds

New Zealand currently has three public live feeds of alerting information in CAP format; a fourth is under development.

Earthquakes

GNS Science uses the GeoNet system to maintain a CAP feed of Modified Mercalli intensity "moderate" (MM5) or higher earthquakes occurring in the last seven days in the New Zealand region and of a suitable quality for alerting.

Severe weather

The Meteorological Service of New Zealand Limited (MetService) maintains a CAP feed of severe weather warnings and watches for rain, wind, snow and thunderstorms.

Civil defence emergencies

New Zealand has sixteen regional Civil Defence Emergency Management Groups. They have adopted the Red Cross Hazard App as their preferred mobile device application for notifying multiple hazards in their region. The Storm CMS is used to prepare these alert messages and their impact zones, and these are published as a CAP feed.

Emergency Mobile Alert

New Zealand's public alerting technology is cell broadcasting. A CAP feed is currently being developed by system provider One2many BV to publish these alerts and allow their uptake by multiple other channels, such as apps, websites and digital signage. It is expected to go live by the end of 2019.

(3) High-priority alerts

New Zealand's registered alerting authorities have agreed to use the CAP to share and disseminate their alerts and warnings. But the CAP is not just a data protocol, it is also a way of classifying alerts. Its classification criteria were used to define the scenarios acceptable for use by New Zealand's Emergency Mobile Alert (EMA) system. The cornerstone attributes of urgency, certainty and severity enable agencies to grade their alerts and make them comparable.

New Zealand has also adopted the unofficial, but widely accepted, definition of high-priority alerts. These are defined to be at level (a) or (b) within each of the following three CAP criteria:

[26] ODESC is a committee of Chief Executives that manages national security in New Zealand. It is chaired by the Chief Executive of the Department of the Prime Minister and Cabinet.

Certainty

a. Observed: determined to have occurred or to be ongoing
b. Likely: probability of occurrence greater than 50%

Severity

a. Extreme: extraordinary threat to life, health or property
b. Severe: significant threat to life, health or property

Urgency

a. Immediate: responsive action should be taken immediately
b. Expected: responsive action should be taken soon

(4) Interpretations of "certainty", "severity" and "urgency"

When designing the protocol for use of the EMA system, decision-makers responsible for issuing EMA messages requested further guidance on the CAP definitions of certainty, severity and urgency in order for them to be more useful in an operational environment.

Certainty

Likely should consider that a qualitative estimate of probability may vary by up to 30 per cent, and erring on the side of caution may be preferable in some circumstances. The desire to wait for certainty is a trade-off against allowing sufficient time for action.

Severity

Extreme applies to an emergency affecting a town, city or region:

- **life**: widespread deaths are possible; or
- **health**: widespread permanently incapacitating injuries or illness are possible; or
- **property**: widespread destruction (or rendering uninhabitable) of buildings is possible.

Severe applies to an emergency affecting rural dwellers or a small part of a suburb in an urban area:

- **life**: limited deaths (i.e. individuals or small groups) are possible; or
- **health**: limited permanently incapacitating injuries or illness are possible; or
- **property**: limited (i.e. few or very localized) destruction (or rendering uninhabitable) of buildings is possible.

Urgency

Expected: *soon* must include time for action – the minimum amount of time people could reasonably be expected to carry out the instructions in the alert. For example:

- 5 minutes: "Do not take personal belongings other than critical medication and personal documents";
- 30 minutes: "Bring in outdoor objects such as lawn furniture, toys and garden tools, and anchor objects that cannot be brought inside".

(5) Optimal warning and guidance messages

The Working Group considers the social science around public messaging to be a logical extension of its terms of reference.

A consequence of the EMA system was the need for short warning messages of 90 characters or less, in effect the CAP **headline** element. A report[27] was commissioned that provides best practice for writing short warning messages for the public to achieve a desired behavioural response. It was based on an international literature review and some preliminary results from primary New Zealand research. It focused on warnings for regional tsunamis, with additional examples for a volcanic eruption and a flood event.

In order to permit a future relaxation of the 90-character limit, and for other channels featuring short messages, the guidance is useful for up to 930 characters, the technical limit for EMA messages in New Zealand under the most favourable conditions. This upper limit typically also covers social media, short emails and electronic billboards.

Another messaging initiative has been to support the Red Cross "What Now" service. This involves adapting standard multi-hazard key action messages to a New Zealand setting, to ensure consistency, clarity and safety. For each hazard, and for up to six stages of an emergency, several short, clear action messages are promoted as being the key ones for dealing with the hazard.

(6) Trigger levels matrix

New Zealand has been using the concept of a Hazard Intensity Metric (HIM). This is one or more measures that can be calibrated against their potential impacts, including causing death, injury or illness, or property damage.

The Working Group aims to set thresholds for the three critical CAP elements (certainty, severity and urgency) that work across a variety of hazards and their HIM metrics in the setting of the broadcasting and messaging end-points through which they should be distributed. For each hazard, the responsible alerting authority is consulted on the intensities that might trigger different alerting end-point behaviours.[28] For example, an EMA is only issued for high-priority alerts.

(7) New Zealand events and event codes lexicon

Like other nations, and in line with the current OASIS (Organization for the Advancement of Structured Information Standards) CAP initiative to provide a consistent set of event codes, New Zealand is creating a table of event codes that provide more specificity to the nature of the emergency. At this time, the table is restricted to those alerts available on public feeds, primarily weather and earthquakes.

With the EMA system soon to be providing its alerts as a CAP feed, further event descriptions and event codes have to be agreed, to cover situations such as boil water notices, flooding, biotoxins, hazardous substances and criminal activities. New Zealand has looked to previous

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27 Sally Potter. Recommendations for New Zealand agencies in writing effective short warning messages. GNS Science report 2018/2.Lower Hutt, New Zealand, 2018.

28 For weather, wind speed can be measured in km/h, or rainfall in mm/hour. For tsunamis, it could be wave height in metres, and for earthquakes, Modified Mercalli intensity. Intensity levels are less clear for perils such as pandemics.

work by Australia[29] and Canada[30] for guidance, but with this topic being considered at a global level, it is pausing now to ensure that it is aligned with the future direction for these elements. At this time, the **event code** element is not used in New Zealand.

(8) Package names

Although work has not commenced, the Working Group has identified a need to work on the standardization of "package names" describing alerts (e.g. watch, warning, bulletin, outlook). Many of these terms have long been used by the alerting authorities that issue them, and there may even be legislative implications should change be deemed desirable.

Nevertheless, it is the sentiment of the Working Group that the use of these terms should be defined more clearly and align more consistently across the impacts of hazards they describe.

(9) Conclusion

Since 2015, New Zealand's CAP Working Group has been an active committee of approximately 60 member national and local agencies, industry members from the geospatial community, and alerting app and warning system hardware manufacturers. It has provided technical guidance and an opportunity for networking and collaboration, and enjoys official government recognition of the importance of the CAP to the alerting environment.

The Working Group remains committed to supporting the worldwide CAP community and following the initiatives being spearheaded by other nations in order to ensure that the CAP is a truly global, trusted and consistent alerting protocol.

A1.1.6 ICTs in managing the effects of floods (Burundi)[31]

(1) Management of the floods in March 2019 and 2020

In March 2019 and March 2020, successive torrential rains fell in the region of Imbo and the surrounding area. The rivers which flow into Lake Tanganyika via the town of Bujumbura burst their banks, causing material damage, including the destruction of homes, loss of life and the massive displacement of the inhabitants of Cibitoke, Bubanza and the Bujumbura districts of Buterere in 2019 and Gabtumba in March 2020.

During rescue operations, the use of mobile communications saved the lives of people in danger as a result of the floods. The use of short numbers assigned to the Burundi Red Cross and the police enabled the sick to be swiftly evacuated to hospitals in Bujumbura to receive treatment.

To assess the contribution of the telecommunication/ICT sector to disaster management, the Telecommunication Regulation and Control Agency (ARCT) carried out a survey on the use of ICTs in disaster management in Burundi. The data collected revealed that the floods and landslides in Cibitoke, Bujumbura and Bubanza resulted in casualties, displaced persons and the destruction of property and personal possessions. Flooding, strong winds and landslides

[29] For Australia event codes, see: Australian Government. CAP-AU-STD version 3.0: Australian Government Standard for the Common Alerting Protocol (CAP-AU-STD) and in particular Annex 2 to CAP-AP.
[30] For Canada event codes, see: Government of Canada. Public Safety Canada. CAP-CP Event References 1.0.
[31] ITU-D SG2 Document SG2RGQ/222 from Burundi

had also occurred in the last five years elsewhere in the country, and ICTs played a significant role in their management.

Social media were used to involve the general public, facilitate communication between population groups, raise awareness of the situation and concerns in the event of an emergency, and facilitate the response at the local level.

(2) The role of stakeholders

Geographic Institute of Burundi

The Geographic Institute of Burundi is a public agency responsible for promoting national meteorological activities for the well-being of the population. Its mission is to provide high-quality, reliable and affordable meteorological services in line with its partners' expectations. It thus plays a part in protecting property, people and the environment in general, in line with the national objective of prosperous socio-economic development.

Burundi Red Cross

The Burundi Red Cross is a key player in the population's social development. It provides a rapid response in the event of climate change-related disasters. It has been assigned a toll-free short number so that victims of natural disasters and people in need of emergency aid can call its services free of charge.

Territorial administration

Local government plays a leading role in the protection of the population and is obliged to collaborate with stakeholders involved in fighting disasters. It has a duty to carry out awareness-raising campaigns on disaster prevention and management methods, and facilitates activities on the ground in the event of a disaster within the area administered.

National risk management platform

Burundi set up a national platform to focus on disaster management in the country by Decree No. 100/016 of 8 February 2019, on the appointment of the members of the National Platform for Disaster Risk Reduction and Management. This multi-party team is responsible for disaster-related risk prevention and management, raising awareness and taking concrete action in the event of disasters.

The media

The national radio and television service of Burundi (RTNB) is a public media outlet that contributes considerably to public information. It broadcasts weather reports for the purposes of prevention and airs information and awareness-raising campaigns during and after disasters.

Telecommunication operators

Telecommunication operators play a major role, ensuring communication and interconnection in order to relay and transmit information to users. Toll-free numbers are operational and mobile telephony, operating mainly through social media, is increasingly used to transmit information before, during and after disasters.

A1.1.7 Case studies of satellites in disaster risk reduction and management[32]

(1) Case studies of satellites

There are many examples or case studies demonstrating the vital role of satellite communications in disaster risk reduction and management. The following provide a few examples:

- In October 2016, when Hurricane Matthew struck Haiti, nine days before mobile networks were restored, satellite phones helped 2 461 people across 19 communities restore family links. VSAT equipment deployed to departmental emergency operations centres (COUDs) to replace local Internet connection stayed in place for months after the event.[33]
- In 2017, Inmarsat's high-speed solution was used by Télécoms Sans Frontières (TSF) for the first time in the wake of Hurricanes Irma and Maria in the Caribbean.[34]
- In September 2018, Inmarsat satellite connectivity supported the emergency response in three regions of the Philippines battered by Typhoon Mangkhut.[35]
- In September 2018, TSF deployed a team of technicians just hours after Sulawesi Island in Indonesia was hit by a 7.5-magnitude earthquake, triggering a deadly tsunami on 28 September 2018. With medical and food supplies in danger of running out and terrestrial communications down, it was essential to establish satellite connectivity to coordinate emergency response.[36]
- In September 2019, the Bahamas was in the path of Hurricane Dorian, the most powerful storm to hit the region since records began. The Category 5 tropical cyclone destroyed entire communities and left 70 000 people in need of food and shelter. TSF used Inmarsat's satellite connectivity to set up fast, reliable communication links for aid agencies and national governments coordinating relief efforts, as well as offering victims free satellite phone calls.[37]

(2) Policy considerations: the need for reduction of regulatory barriers

Although the previous section simply serves to highlight the role played by satellites in disaster risk reduction and management with practical examples, it is worth mentioning some of the lessons learned from disasters and some of the key policy considerations to be taken into account in order to be able to fully utilize satellite communications for disaster risk reduction and management.

Some of the lessons learned from disasters include the following:

- Disaster preparedness planning is essential.

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32 ITU-D SG2 Document 2/410 from Inmarsat (United Kingdom)
33 Inmarsat. Latest News. TSF on the ground in the wake of hurricane Matthew. 5 October 2016.
34 Inmarsat. Disaster Response. Reliable connectivity when seconds count; Inmarsat. Latest News. TSF deploys to West Indies as hurricane Irma batters islands. 6 September 2017; and Inmarsat. Latest News. Over 1,000 hurricane victims helped by TSF. 26 October 2017.
35 Inmarsat. Latest News. Typhoon relief efforts aided by satcoms. 28 September 2018.
36 Inmarsat. Latest News. TSF deploys to Indonesia in aftermath of devastating tsunami. 1 October 2018.
37 Inmarsat. Latest News. Hurricane Dorian victims offered satellite call lifeline. 12 September 2019.

- The business of disaster response is conducted before a disaster strikes.
- Efficient coordination and network sharing by NGOs and other end users is needed.
- Frameworks for customs clearance are required.
- Well-trained first responders and media are key.
- Prepared users drive satellite usage.
- Social networking and mobility-based applications are revolutionizing disaster response.
- Data requirements on the ground are growing dramatically.
- Responders need a mix of connectivity solutions (satellite, terrestrial, hybrid, fixed, mobile) in their daily toolkit.

Some of the key policy considerations to allow satellite communications to be most effectively used for disaster risk reduction and management include the following:

- Exemption from/temporary waiver of regulations that might restrict the use of telecommunication equipment/radio frequencies during the use of such resources for disaster mitigation and relief.
- Recognition of foreign type approval of telecommunication equipment and/or operating licences.
- Exemption from regulations that might restrict the import/export of telecommunication equipment.
- Facilitating the transit of personnel, equipment, materials and information involved in the use of telecommunication resources for disaster mitigation and relief into, out of and through the disaster area.

A1.2 Disaster communication technologies

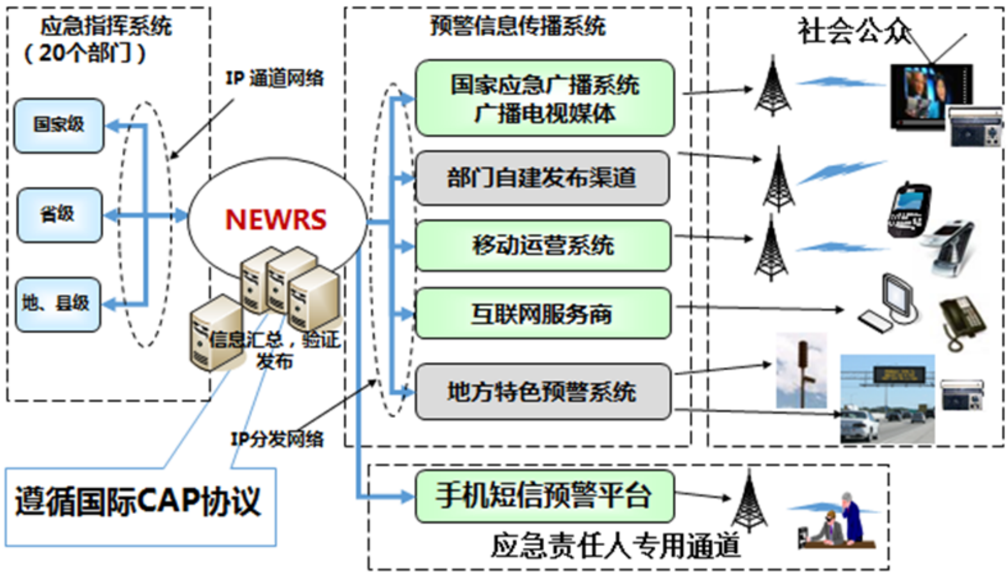
A1.2.1 Integration of space and terrestrial emergency communication network resources (China Telecom, China)[38]

(1) Introduction

Many governments around the world have recognized that cell broadcast technology can be used to deliver emergency alert notifications. China has developed public emergency alert notifications standards based on that technology that support global roaming and are compatible with standards in Europe and the United States. The emergency alert system in China is depicted in **Figure 1A**.

[38] ITU-D SG2 Document 2/158 from China

Figure 1A: Emergency alert system in China



Legend:
应急指挥系统 20个部门: Emergency command system (20 departments)
国家级: National level
省级: Provincial level
地、县级: Prefecture and county level
IP通道网络: IP-based channel network
信息汇总、验证、发布: Information summary, verification and distribution
IP分发网络: IP-based delivery network
遵循国际CAP协议: Compliance with the CAP
预警信息传播系统: Emergency alerting system
国家应急广播系统广播电视媒体: National public alerting system
Broadcast and TV media
部门自建发布渠道: Self-built departmental dissemination channels
移动运营系统: Mobile operation system
互联网服务商: Internet service providers
地方特色预警系统: Local specialty emergency alert system
手机短信预警平台: Mobile phone SMS alerts platform
应急责任人专用通道: Dedicated channel for emergency management chief
社会公众: The general public

4G networks are being continuously improved, and it is particularly important that they be used efficiently, to ensure that mobile subscribers can receive vital emergency alert messages in time. It is strongly recommended that, for the benefit of the general public, efforts be made to develop emergency cell broadcast alerting systems based on 4G networks for use in major natural disasters and other public safety incidents such as earthquakes, typhoons and mudslides, and to ensure that 4G emergency alerting management platforms can interconnect with the existing interfaces of emergency alert management organizations.

To meet disaster mitigation and prevention needs, China Telecom has researched and developed the LTE cell broadcast technology-based multi-channel emergency alerting system. It has used the system to send emergency alert messages by concurrent mode in the shortest possible time, rendering it a vital component of the national emergency communication assurance plan. The system will be widely used in various scenarios and applications, including disaster prevention and emergency alerting.

China Telecom will further optimize its emergency alerting strategies to facilitate the inclusion of next-generation cell broadcasting in network entry standards for telecommunication equipment and will support the use of social media, including mobile Internet, to issue alerts, with a view to increasing emergency alerting capabilities.

(2) Detection and monitoring of natural disasters and other emergencies

In disaster management, IoT can be used to monitor sudden-onset natural hazards such as earthquakes and mudslides, to issue emergency alerts, and to transmit data in near real time to emergency management and command centres, thereby boosting disaster prevention and mitigation capabilities. The 3rd Generation Partnership Project has already launched a set of LTE-based narrowband IoT technologies (i.e. narrowband IOT and enhanced machine-type communication), which have expanded the LTE technology portfolio to support broader application of more energy-efficient IoT services.

To operate, conventional IoT devices rely on terrestrial communication networks, which can be easily damaged or destroyed in a severe natural disaster. Satellite IoT can compensate for that weakness. Extensive coverage, resistance to destruction and flexible network construction have together made satellite IoT irreplaceable for real-time monitoring of large areas impacted by a natural hazard.

China Telecom already has the ability to monitor and report on various natural hazards in real time using 4G IoT. It can provide end-to-end solutions, from data collection in earthquake zones to 4G-network coverage and transmission, and then to back-office processing and analysis. In 2017, in partnership with the China Earthquake Administration, China Telecom uploaded seismic data from an earthquake-affected region to a cloud platform via its IoT Link card. The monitoring data were mainly obtained from measurements of earthquake intensity, which are then used to analyse the earthquake's vibration process and real-time scenarios. Such data supplement those collected by professional seismic stations and provide a basis for decision-making and prediction.

In addition, China Telecom has used its exclusively operated satellite mobile communication system platform to provide satellite IoT applications and services, and expanded coverage of IoT monitoring applications thanks to satellite IoT terminal devices. Monitoring and detection operations focus on river water levels and discharge; sediment concentrations; environmental and atmospheric conditions; cereal pests and diseases; forest fires; seismic data; natural gas production and operations; water leakages; mudslides; avalanches; wind speed and direction; and rain and snowfall.

(3) Emergency communication exercises

It is recommended that more efforts be made to conduct cross-sector and -regional emergency communication exercises by various means, including table-top exercises, full-scale exercises and functional exercises, so as to increase synergy and interconnection, operability and continuity, and to build a specialized emergency communication support team characterized by professionalism, dedication and supportiveness.

China Telecom has conducted a number of special emergency communication exercises covering various disaster recovery scenarios. The exercises feature a national specialized emergency communication support team, include programmes such as "Building a Front-line Command System", "Emergency Relief Communications Support" and "Public Network Communications Support", and demonstrate China Telecom's integrated air/ground ICT applications and cross-sector emergency communication capabilities in times of natural disaster or other emergency. Apart from deploying conventional services related to emergency communications (e.g. Tianyi (Skywings) Walkie-Talkies, satellite phones, 4G individual communications and a variety of emergency vehicles), the exercises also involve new services, such as the new generation of narrowband IoT, big-data and visual dispatch systems, and new equipment, including helicopters, mooring UAV and airborne balloons.

(4) Emergency communication command and control capabilities

An emergency communication command and control system is an integrated emergency command and control platform that integrates such functions as presentation, dispatch, deployment, dial testing and intelligent analysis.

(5) Building airborne emergency communication platforms

Built to meet the needs of three-dimensional wireless coverage, airborne emergency communication platforms consist of mooring UAVs, wireless broadband access systems, 3G/4G trunked emergency communication systems, air safety protection systems, high-definition video live broadcast systems, airborne lighting and call systems, etc.

Airborne emergency communication platforms are used in emergency zones to facilitate disaster recovery and assistance in major public safety incidents and other important events. They serve to set up wireless broadband access and 4G mobile communication and trunked communication service networks, provide users in the field with mobile and data communication services, and transmit dynamic information to back-end command and control centres. China Telecom has already developed its airborne emergency communication platform specifications and can provide the relevant solutions and services, the application scenarios of which include the following:

- Emergency communications in isolated areas without access to communications: In areas devastated by natural hazards such as earthquakes, typhoons, floods or fires and in which emergency operations are ongoing, satellite communication access systems, ad hoc mesh networks and portable 2G/4G mobile communication access systems are set up and speedily activated, in order to provide government, corporate customers and the general public with emergency mobile communication and natural disaster surveillance services.
- Emergency communications at hotspots: At communication hotspots such as cultural, sports or business events at which emergency operations are ongoing, satellite communication access systems or optical transmission access systems, ad hoc mesh networks and portable 2G/4G mobile communication access systems are set up and speedily activated to provide the media, government, business customers and the general public with emergency mobile communications and data communication services.
- Emergency communications for emergency command and control: At cultural, sports or business events and at major public safety incidents at which emergency operations are ongoing, satellite communication access systems, ad hoc mesh networks and portable 800 MHz digital trunked communication access systems are set up and speedily activated to provide police forces and public safety agencies with critical digital trunked communication services.

A1.2.2 Intelligent emergency telecommunication management (China)[39]

(1) Upgrading emergency telecommunication command and control systems utilizing Internet+ cloud computing and big data

In many parts of China, attempts have been made to apply the Internet+ to the development of emergency telecommunication command and control systems. For instance, the Shanghai communication industry has used the Internet+ to reinforce its development of the command and control system covering emergency communication vehicles, emergency support supplies and response teams. In combination with digital maps, emergency-related data such as emergency support mission statistics, emergency telecommunication vehicle utilization rates, emergency service statistics, emergency response teams and emergency support equipment have been included in the command and control system. The system enables closed-loop management of satellite resource applications and allocation and approval of material reserves. It can be easily and speedily operated via mobile apps, significantly increasing emergency response efficiency.

(2) Using big data to analyse people flows and network traffic in hotspots

Through the integrated use of Internet and big-data processing technologies, valuable information can be drawn from massive, scattered, unstructured and constantly changing data relevant to the emergency, so that the associated macro environment can be analysed and understood, and the incident's development profile can be obtained in a timely and efficient manner to support scientific decision-making.

In public safety incidents, emergency alerts can be issued using data analytics and the Internet. Big data can be used to analyse the network access and transportation modes of mobile subscribers during major conferences and exhibitions, on holidays and during festivals, in order to predict and identify areas with high-moving crowd densities or large people flows during peak hours. Data on large crowds and flow trends are used as reference information by organizers, who can then notify people in areas at high risk of a safety-related incident via mobile Internet and avoid human stampedes and crushes.

In Shanghai, where mobile Internet is flourishing, people-flow monitoring, mobile Internet perception in key areas and an analytical platform were built based on big-data analytics of 2G/3G/4G cell service statistics. The relevant analytical results are displayed in such a way as to make it easy for emergency command centres to allocate resources, dispatch personnel and troubleshoot. In abnormal field situations, the platform can identify problems before mobile subscribers perceive them, enhancing safety in mass gatherings. Similar systems developed to analyse mobile service data targeting in key areas and hotspots provide information on the total number of people (mobile subscribers), popular apps, people flow, etc.

(3) Using Internet communication tools to support emergency responses

In recent years, Internet instant messaging tools such as Wechat and QQ have also been widely used in China. They are highly efficient, fast and convenient to use for assigning emergency tasks, reporting and delivering information, etc.

In the aftermath of a major disaster in Japan, social media such as Twitter and Facebook were widely used for rescue operations and to attract donors. According to a survey conducted

[39] ITU-D SG2 Document 2/159 from China

after the disaster, social media had an outstanding impact on the transmission of information, spreading news of disaster recovery facilities and materials much more quickly, accurately and reliably than traditional channels of communication. Widely distributed cell broadcasts and dedicated message recordings played a significant role in providing locally generated information, including on the location of emergency food and water supplies, delivery time and location of disaster recovery supplies, and psychological counseling services.

Another example is Facebook Disaster Maps. People using the Facebook app with the location service enabled receive regular information on the longitude and latitude of their position. When gathered and de-identified, such geological location data can be a source of post-disaster information. Facebook data-set types include movements of people, crowd density and Facebook Safety Check information collected after the disaster.

(4) Increased smart-city capabilities facilitate the development of intelligent emergency telecommunications

Apart from introducing new generations of ICTs to emergency telecommunications via the conventional telecommunication industry, countries around the world have shown great enthusiasm about the application of ICTs in the emergency management sector. In a 2018 report,[40] consulting firm McKinsey and Company noted that one key aspect of building smart cities is using digital technologies to improve emergency telecommunications. With more comprehensive, real-time and dynamic data, emergency response services are able to monitor emergency incidents closely and understand the changing models of needs. They are therefore able to implement emergency response plans more speedily and more cost-effectively. Emergency technological systems and emergency efforts that can be linked to the development of smart cities include at least the following: disaster early-warning systems; emergency response optimization (i.e. back-office call processing and field operations such as the strategic deployment of emergency vehicles); personal alert applications (transmitting emergency alerts such as location and voice data to emergency response services or loved ones) and smart monitoring of the operation zone. According to McKinsey and Company's analysis of research data on a large number of cities around the world,[41] cities can cut emergency response times by 20 to 35 per cent on average by deploying new types of smart applications (e.g. smart systems to optimize call centres and field operations; traffic signal pre-emption to clear lanes for emergency vehicles). More mature cities with an already low response time of eight minutes can shave almost two more minutes off by doing smart-city upgrades and retrofits. Less-developed cities starting with an average response time of 50 minutes might be able to trim that by at least 17 minutes by introducing new types of smart applications.

(5) Accelerated integration and development of next-generation ICTs and emergency telecommunications

The future will see an accelerated integration of next-generation ICTs such as big data and AI into emergency telecommunication systems. With the expedited restructuring and rapid iterations of core technological systems, including new generations of hardware, software and services, future emergency telecommunication technological applications will experience

40 McKinsey Global Institute. Smart Cities: Digital Solutions for a More Livable Future. McKinsey and Company, June 2018.

41 The sample comprised 50 cities around the world that had already developed or announced ambitious smart-city development plans and were selected for their overall representativeness in terms of geographical coverage, differences in income levels, population density and infrastructure quality.

an increasingly manifest trend of integration and innovation. Thanks to the accelerated convergence of emergency telecommunication networks and edge computing technologies that promote and support self-perception, self-decision-making, self-optimization and self-execution, the blockchain technology that supports multiple party and reliable data storage and exchange capabilities, and virtual/enhanced reality technologies that support three-dimensional intuitive display, new types of emergency telecommunications featuring such newly emerged key elements as emergency status perception, data processing and immersive telepresence will expedite the realization of smart command and control, network control and maintenance, smart dispatch of work order tasks and smart reserves, and will help deliver opportunities for a new industrial ecosystem.

In the new development stage, with new features including physical integration of information, ubiquitous intelligence and computing, resilient platform components, data-centered operations, emergency telecommunications will enter a completely new track of smart development, embracing a historic turning point marked by capability upgrades in all dimensions. An integral part of emergency management, emergency telecommunications provide important tools for disaster mitigation and prevention. In the past, people tended to be concerned about the response times and capabilities of emergency telecommunications in the aftermath of a disaster. To a great extent, however, emergency telecommunication services should focus more on emergency preparedness. Turning disadvantages into strengths, building highly efficient emergency alert systems, delivering emergency alert messages to the public in a timely and effective manner, enhancing disaster prevention and mitigation capabilities, and improving emergency response capabilities at all levels of emergency management agencies – these are the future trends in emergency telecommunications.

A1.2.3 Emergency communication services and networks (China)[42]

(1) Overview

China suffers frequent natural disasters and therefore has a highly developed form of natural disaster prevention and response. On the other hand, state-level super-large-scale activities, sports events and so on make the task of emergency communication increasingly onerous. Whether for natural disasters or public incidents, emergency communication support has become increasingly important and urgent, raising the bar for the development of emergency communication services and networks.

(2) Current networks for emergency management in China

At present, the existing emergency communication network includes public communication networks, private networks, satellite networks, and so on.

1) Public communication networks: The existing public fixed telephone and mobile networks play an important role in emergency communication support, but find it difficult to meet all needs in emergency situations. For example, it is difficult to ensure call priority for voice communications amid the sharp increase in the number of calls during an emergency, resulting in network congestion. In the special circumstances of emergencies, it is difficult for public networks to guarantee that the need for efficient cluster scheduling capabilities will be met.

[42] ITU-D SG2 Document SG2RGQ/183 from China

2) Private networks: Emergency communication has strict and special requirements. During a critical emergency response, when the public network cannot meet emergency communication requirements, emergency communication capability must be boosted through the private wireless communication network.

The international community has reached a consensus that government emergency response command and dispatch communications should essentially rely on dedicated wireless systems. Currently, private wireless network technologies include:

- analogue narrowband technology: analogue voice technology, providing only voice services;
- digital narrowband technology: digital speech coding and channel coding can provide voice services and narrowband data services, but not real-time video or integrated data query services;
- B-TrunC technology: LTE-based wireless broadband trunking technology can provide broadband data services such as voice services, real-time video and positioning;
- in the long run, digital narrowband networks and wireless broadband B-TrunC networks will coexist and interconnect.

3) Satellite communication networks: Communication via radio waves from satellites to relay stations has the advantage that it is not damaged during natural disasters. Satellite systems such as Tiantong and BeiDou are currently used in emergency communications.

4) Ad hoc network technology: Although ad hoc networks do not have large-scale networking capabilities, they have unique mesh capabilities that can be used as a supplementary technology for emergency rescues in wilderness areas, temporary basements and high-rise egress routes.

In addition, although China's telecommunication network has matured, its coverage is still relatively limited. Many areas prone to natural disasters and emergencies, such as oceans, mountains and deserts, have not yet achieved ground network coverage. Therefore, other communication modes, such as satellite and private communication networks, also play a very important role in emergency communication and support.

(3) Analysis of key service requirements for future emergency communications

Future emergency communication services have the following key service requirements:

1) *key voice*: The business that the emergency communications must guarantee;
2) *real-time video*: Real-time video from cameras or through UAV transmission can show the scene in real time;
3) *multimedia messaging*: Transmission of drawings, maps, etc., of the scene, fire, etc.;
4) *remote database access*: To query emergency materials information, vehicle information, personnel information, plans and so on, remotely;
5) *indoor and outdoor positioning and flow tracking*: Realizing real-time situational awareness of personnel, vehicles and materials;
6) *interconnection*: Interconnection with broadband trunking, narrowband trunking and other networks.

In order to meet the above requirements, emergency communication networks must have broadband, security/isolation, an ad hoc network, priority guarantees, fast trunking communication capabilities, high reliability, portability, and unified dispatch and command characteristics.

(4) Research on the development of new emergency communication technologies

In the future, emergency communication systems will be comprehensive information systems integrating network technologies such as private networks, public mobile networks and satellite networks, able to unify dispatch and command, and to coordinate various departments to play an effective emergency role. Development support is moving in that direction, as described below.

- In order to meet the growing demand for mobile broadband for emergency personnel, advantage should be taken of mature LTE technology in public networks and user scale efficiency to reduce costs, encourage standard research and development of key LTE technology supporting tasks and promote support for LTE-based technology.

    1) Emergency communications can be delayed by damage to public infrastructure on the ground. In order to solve that problem, and to meet the need for large-capacity critical mission communication support in the incident area, regional emergency communication systems based on low-altitude platforms positioned near the ground are being studied and developed.
    2) In order to provide priority services for key tasks in the public network after the IP architecture network has been fully developed, standards and solutions are being studied and developed for emergency priority services in next-generation networks.
    3) Emergency communication scenarios are being studied to take advantage of 5G broadband, low latency and high reliability.

The 5G standard is constantly improving. There are still many key technologies that need to be urgently improved with a view to ensuring reliable access to emergency communications at any time, anywhere: multimedia multicast broadcasting service, enhanced security capability, end-to-end network visualization, integrated emergency command and dispatch capability, and base station non-core network working mode in emergencies.

5G plays a very important role in promoting the development of emergency communication towards broadband and intelligence. The three main 5G application scenarios – enhanced mobile broadband, ultra-reliable and low-latency communications, and massive machine-type communications – meet most emergency communication business needs for large bandwidth, low latency and high reliability. They have the potential to enhance emergency communication rescue and comprehensive emergency support capabilities, with a view to achieving a new level of emergency management.

Research is currently being carried out on the potential demand for 5G, the relevant business model and the technical support required for its use in emergency response. Various characteristic 5G+ emergency applications have been deeply excavated and incubated, including 5G+ monitoring and early warning, 5G+ safety production, 5G+ fire prevention and 5G+ emergency dispatch. In addition, some operators have 5G-equipped emergency communication vehicles.

It is anticipated that private networks and 5G public networks will work together in the future to provide guaranteed communication services for emergency management. Combinations of public and private networks will result in three-dimensional guaranteed emergency communication networks featuring space-Earth integration and interoperability, and will adapt and match emergency guaranteed communication systems.

A1.2.4 The role of social media platforms (India)[43]

(1) Artificial intelligence for disaster response

The huge volumes of real-time information generated through crowdsourced data sharing can be used, with the help of AI-based data analytics, to predict important outcomes required for response and relief. AI is the simulation of human intelligence processes by machines, especially computer systems. The processes include learning (the acquisition of information and rules imbibed in the form of algorithms for using the information), reasoning (using rules to reach approximate or definite conclusions) and self-correction. Several new and recent smartphones also have hardware optimized for AI. Machine learning is defined as the ability of machines to learn automatically by using AI. It involves the creation of algorithms that can modify themselves without human intervention or without being explicitly programmed to produce learning output. This is achieved by analysing structured data fed to a machine's algorithms. The learning process thus involves observing, processing and analysing data, and acting accordingly.

The potential opportunities and benefits of machine learning and AI have been leveraged by the Artificial Intelligence for Disaster Response platform, which uses machine learning to analyse data on natural and man-made disasters collected from tweets in real time and automatically. It is accessible to all those involved in disaster response.

(2) Social media platforms and disaster management

Social media analysis is the process by which huge volumes of data, for the most part semi-structured or non-structured, are collected from social media sites and analysed. The process uses various machine-learning algorithms, such as decision trees, support vector machines, random forests, Naive Bayes classifiers, logistic regression and the Artificial Intelligence for Disaster Response platform. These algorithms analyse the data, generate outcomes therefrom and help visualize the outcomes precisely and as desired. The resulting information can be used for search-and-rescue operations and for post-disaster triage, relief and rehabilitation. Many AI and machine-learning tools focus on how social media updates provide incident indications and contribute to situational awareness.

(3) Utilization of social media platforms for managing disasters in India

Case 1: Kerala floods

The southern Indian state of Kerala was hit by the worst floods in a century on 16 August 2018, the result of unusually high rainfall during the monsoon season. All 14 of the state's districts were placed on red alert. Around one million people were evacuated, mainly from Chengannur, Pandanad Edanad, Aranmula, Kozhencherry, Ayiroor, Ranni, Pandalam, Kuttanad, Malappuram, Aluva, Chalakudy, Thrissur, Thiruvalla, Eraviperoor, Vallamkulam, North Paravur, Chellanam and Palakkad. The National Disaster Relief Force was deployed alongside the Indian Army and Navy to conduct intensive search-and-rescue operations. During the floods, thousands of people took to social media platforms via mobile phones to coordinate search, rescue and food distribution

[43] ITU-D SG2 Document 2/269 from India

efforts, and to reach out to people who needed help.[44]The National Disaster Management Authority and the state government, for their part, used a CAP-based warning system to send alerts to mobile users. Social media were extensively used to provide information about those stranded in different parts of Kerala who needed access to relief.

As part of its coordinating efforts, the state government took to social media to share information about donations to the Chief Minister's Distress Relief Fund.[45] As the scope of the disaster became clear, it reached out to software engineers from around the world, asking them to join the state government-run Information Technology Cell to create a website. The website allowed volunteers who were helping with disaster relief in Kerala's many flood-affected districts to share the needs of stranded people so that the authorities could provide a timely response. The volunteers comforted the victims in emergency operation centres. People joined social media groups with hundreds of members who were coordinating rescue and relief efforts. They were able to reach people marooned at home and faced with medical emergencies. A team of volunteers called the Kerala Designers Collaborative compiled vital information in the form of infographics on anything from post-flood car maintenance (check for lizards and venomous snakes, and remove moisture content from the lights) to burying animal bodies to prevent the spread of disease. The infographics were very useful and were translated into five Indian languages.[46]

Similarly, a fraternity of mechanical engineering students at a government-run engineering college at Barton Hill in Kerala created a group called Inspire. The group built over 100 temporary power banks and distributed them among those unable to contact their families in flood-affected areas and relief camps. A power bank could boost a mobile phone's charge by 20 per cent in minutes – a critical feature for people without access to electricity. The authorities agreed to distribute the power banks, wrapping them in bubble wrap and airdropping them into areas where people were marooned. As the waters receded, ordinary citizens tweeted about where to go for free medical care and other services.[47] Charity organizations used their websites to collect donations for relief kits.

Case 2: Use of social media during the Chennai flood

Between October and December 2015, the southern Indian state of Tamil Nadu received 90 per cent more rainfall than during a normal monsoon season, because of El Niño. The state capital, Chennai, received more rainfall than at any other time in this century. The flood caused severe damages, made even worse by poor urban planning and drainage systems. An estimated 500 or more people were killed and 1.8 million displaced, with huge economic losses ranging in the thousands of millions of rupees. The Indian Army and Navy were deployed in the city for search-and-rescue operations, Chennai airport was closed and several other transport facilities in the city came to a standstill. During this testing time, people used social media extensively to connect to the outside world.[48]The calamity brought out thousands of helping hands. Chennai residents took to social media to offer their homes to strangers seeking shelter from the rain

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44 Nikita Mandhani. How Indians are using social media to help flood-hit Kerala. BBC.com. BBC News Delhi, 20 August 2018.

45 Scroll.in. As Kerala battles flood, social media helps connect anxious relatives, coordinate relief efforts. 17 August 2018.

46 Kamala Thiagarajan. How Social Media Came to the Rescue after Kerala's Floods. npr.org, 22 August 2018.

47 Ibid.

48 Scroll.in. #ChennaiRainsHelp: How a flooded city is using Twitter to lend a hand to strangers. 2 December 2015.

and floods. #ChennaiFloods and #ChennaiRainHelps were used by victims and volunteers alike to find/offer shelter, food, transport and even mobile phone recharges, share government helpline numbers, provide information on NGOs offering help, etc.

Case 3: Fighting drought with the help of the Internet of Things

A Hyderabad-based start-up has offered technology-based solutions in crucial sectors such as agriculture, water management, education and smart-city planning.[49] It has built a water resources information and management system for India's southern states. Its website enables the public to view information on rainfall, ground water, reservoirs – major, medium and minor – soil moisture, rivers and streams, irrigation canals and environmental factors like temperature, humidity, sunshine and wind speed. The technological solutions offered are powered by IoT devices such as automatic weather stations, ground water sensors, and reservoir and canal level sensors, backed up by satellite-based imagery and manual data. As a result, all data relevant to water are available on one platform and presented in real time for all the water-related assets of a large state, county, district or block. Information on water stress mitigation is also available. The AI-based system is being trained to learn and produce effective results. The application uses the same data to produce village water budgets on the basis of village water supply and demand. The water budgets make villagers aware of their water sources, impending water crises and water stress mitigation possibilities, helping to fight droughts.

Case 4: Using AI to enhance crop yield

The International Crop Research Institute for the Semi-Arid Tropics, a non-profit, non-political agricultural research organization for development in Asia and sub-Saharan Africa, has developed a sowing app that uses AI, cloud machine learning, satellite imagery and advanced analytics to help smallholder farmers increase their incomes through higher crop yields and greater price control.[50] The app helps farmers gauge the right time to sow their crops, using an AI-based study of climate data collected over 30 years in the Devanakonda area of Andhra Pradesh. The Moisture Adequacy Index (MAI) is the standardized measure used to assess whether rainfall and soil moisture will be adequate to meet the water requirement of crops. The real-time MAI is calculated from the daily rainfall recorded and reported by the Andhra Pradesh State Development Planning Society. The future MAI is calculated from weather forecasting models. Sowing advisories are issued accordingly; they indicate an optimal sowing date, the need for soil test-based fertilizer and farmyard manure, seed treatment, optimum sowing depth, etc. This AI-based sowing advisory leads to 30 per cent higher yields and helps farmers exercise better price control.

A1.2.5 Delivering communication services to disaster zones (China)[51]

(1) Integrating UAV and wireless communication technology

In recent decades, wireless communication migrated rapidly from voice-dominated 2G to data-dominated 3G and 4G. It is now entering the 5G era, which is characterized by the Internet of Everything. In the past, wireless signals mainly covered people and objects on the ground,

49 See The Economic Times website
50 Microsoft. Microsoft Stories India. Digital Agriculture: Farmers in India are using AI to increase crop yields. Microsoft News Center, India, 7 November 2017.
51 ITU-D SG2 Document 2/277 from China

without aerial coverage specifically designed for UAVs. Low-altitude digitization is therefore a treasure to be explored. UAVs have been partially networked in 4G networks.

Mobile networks continue to offer people greater choices in terms of means of communication and daily life; they also enable the digital transformation of all industries, improving operational efficiency and service quality. The brand-new 5G network architecture represents another leap in network performance, providing over 10 Gbit/s of bandwidth, millisecond latency and ultra-high density connection. ITU proposes three 5G scenarios: enhanced Mobile Broadband, ultra-reliable and low-latency communications, and massive machine-type communications. Compared with 4G networks, 5G networks are better able to meet the communication needs of most UAV application scenarios. Networked UAV will drive the application upgrade of multiple scenarios.

The integration of 5G cellular mobile technology and UAVs makes what was once inconceivable possible. To satisfy future needs for more automated and intelligent UAV applications, such as autonomous flight and flight in formation, greater demands will be made of mobile communication network capabilities.

(2) Demand analysis of UAV emergency scenarios

1) In the event of a natural disaster, UAVs can quickly put high-altitude base stations in place to restore communication functions (voice and data).

Traditionally, emergency communication vehicles are used temporarily to ensure communications when earthquakes, floods, mudslides and other natural disasters cause large-scale disruptions. However, such vehicles provide relatively limited service coverage and have weak signal stability, owing to limitations in technology, hardware and other factors; it may even be impossible to transport them to the central disaster area if roads collapse or are congested. This traditional way of setting up emergency communication stations and restoring base stations is therefore inefficient, costly, difficult and time-consuming. The maturity of UAV technology and its integration into emergency communication systems make it a new, faster and more convenient way for operators to restore communications in disaster areas.

2) During major sports events when traffic increases sharply, UAVs help ensure uninterrupted communication, build networks and provide aerial video footage.

(3) UAV emergency communication mode

1) Tethered UAV + high-altitude base station

Tethered UAV systems are powered from the ground and raised to a UAV take-off platform by a tethering cable capable of uninterrupted flight. Once the UAV aerial base station is working, ground power-generating devices supply power to the tethered system and the onboard remote radio units. The onboard units communicate with the emergency communication vehicles via ground baseband unit devices using the fibre-optic line of the tethered system, and the emergency communication vehicles can connect to the nearby base station tower via microwave devices, optical fibre or satellite communication vehicles, and then relay the signal to the core network to achieve mobile signal coverage. The impact of terrain on the electromagnetic wave is thus effectively dealt with and continuous coverage guaranteed in a certain area.

UAV emergency high-altitude base stations can cover up to about 50 square kilometres and provide instant messaging service to thousands of mobile phone users simultaneously. Capable of climbing quickly to between 50 and 200 metres, they can provide 24-hour uninterrupted VoLTE and other data services to disaster areas.

In a natural disaster, tethered UAVs used in combination with aerial base stations can quickly restore onsite communications, address the problem of signal coverage in emergency situations and effectively improve the emergency communication support capability of the government and operators in response to natural disasters.

Tethered UAVs, which can stay in the air for long periods and carry large payloads, can be used in conjunction with high-altitude searchlights and loudspeakers to provide high-altitude illumination over large areas to support rescue operations at night. Loudspeakers facilitate command and coordination of people onsite, message broadcasting and other similar tasks, and improve the level of hardware support onsite. Using a mount-and-drop mechanism, UAVs can carry rescue items into areas too difficult and dangerous to access at short notice and with a heavy load.

The mobile phones of people trapped in an area covered by a UAV base station will be automatically connected to the onboard base station, which will send the user's international mobile subscriber identity number and current geographic information in graphical form to the search-and-rescue teams in real time.

This all-new emergency communication method aims to solve the problems of slow device deployment, high cost and poor environmental adaptability. It features quick response capabilities, is easy to operate, provides flexible coverage, can be airborne for long periods and is readily scalable.

2) Fixed-wing UAV + high-altitude base station

Large fixed-wing UAVs carrying mobile communication base stations and satellite communication systems, when flown to a target area, can provide stable continuous mobile signal coverage over a long period (not less than 24 hours) in an area of more than 30 square kilometres, thus restoring communications in no time and reducing loss of life and property in the disaster area.

A networked fixed-wing UAV equipped with an orthographic camera and a photoelectric pod can be used to obtain the GIS data needed for rapid data transmission and efficient generation of a three-dimensional map of an earthquake area, providing a basis for rescue decisions.

During single-soldier system drills, ground advance teams can report key rescue information, send back real-time video and images, and quickly dispatch rescue personnel and equipment based on the GIS data, effectively improving the timeliness and accuracy of emergency rescue operations.

(4) UAV emergency communication: next steps

Standard-setting is one of the challenges facing UAV emergency communications. China is developing technical requirements for the emergency communications of high-altitude base stations with tethered UAVs. In addition, since ordinary base stations provide mainly ground coverage, UAVs need special base stations for aerial coverage. 5G UAVs currently rely on the general 5G Customer Premises Equipment used to convert 5G signals to Wi-Fi signals for communication; in the future, dedicated terminals and 5G communication modules will be needed to improve integration.

Meanwhile, China has issued successive series of regulations on UAV production, sales and flight. Regulations concerning the transaction process include the Regulations on the Management of Real-name Registration of Civil Unmanned Aircraft and the Interim Regulations on the Management of Unmanned Aircraft Flight (Draft for Comments). The difficulties related to flight plan applications, the complicated procedures involved and other issues are expected to be resolved following the establishment of a comprehensive UAV regulatory platform. In terms of corporate operations, the Management Measures for the Operational Flight Activities of Civilian Unmanned Aircraft (Interim) have greatly simplified the entry requirements for unmanned aircraft operating licenses, retaining only basic licensing requirements such as corporate legal persons, real-name registered unmanned aircraft, certified training capabilities (for enterprises in the training category) and ground third-party liability insurance.

A1.2.6 Locally Accessible Cloud System (Japan)[52]

(1) Background

Every year, the global community faces numerous disasters, including earthquakes, typhoons and floods. Such disasters often damage social infrastructure like telecommunication networks, electric power distribution networks and transportation systems, severely disrupting the lives of people.

When disasters occur, telecommunication networks may be damaged. Base stations for mobile communication services, access network cables, communication equipment and even communication buildings can be damaged in large-scale disasters. The damages cause outages of telecommunication services including not only fixed/mobile telephone services, but also Internet services and any other services delivered over the Internet. To address this issue, movable and deployable ICT resource units have been proposed and standardized. Their chief objective is to restore fixed/mobile telephone services. With the growing use of smartphones, people have come to rely heavily on Internet-based services for social networking, information searches and e-commerce. Restoring Internet-based services is becoming a key aspect in disaster situations.

The Japanese Government endorsed research and development projects on disaster-management technologies after the Great East Japan Earthquake in 2011. In one of the projects, the Cabinet Office's Strategic Innovation Programme conducted several disaster-management exercises involving movable and deployable ICT resource units (MDRUs); it aims to implement the results throughout society. MDRUs can provide telephone and file-exchange services using Wi-Fi and IP-PBX when telecommunication infrastructure is damaged. Similar to the MDRU, one of the Programme's solutions is the Locally Accessible Cloud System (LACS), which instantly provides Internet-based service in local disaster areas.

A LACS feasibility study carried out in the Philippines in December 2019 examined the use of LACS for e-education and e-health in island areas.

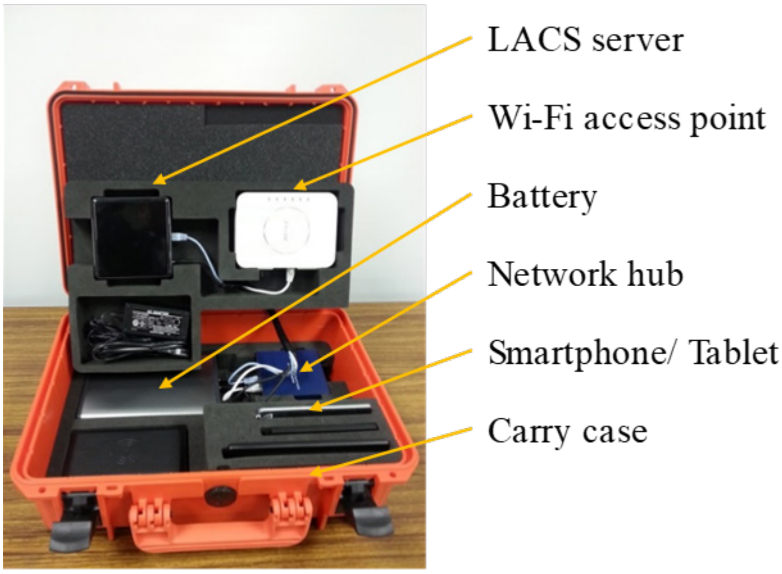
(2) Introducing the Locally Accessible Cloud System

The LACS comprises a Wi-Fi access point, a small PC server, a battery and other peripheral devices assembled in a portable carrying case (see **Figure 2A**) for easy transport to disaster-affected areas. The server acts as a web server and offers the basic communication functions

[52] ITU-D SG2 Document 2/309 from Japan

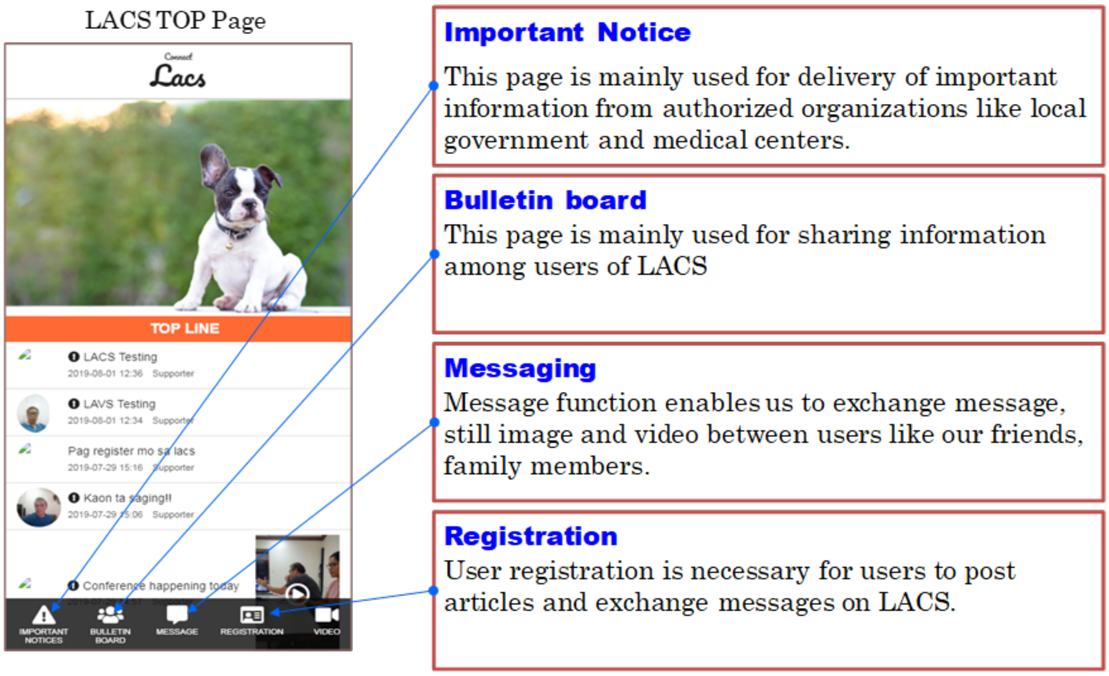
required in disaster situations. The LACS offers basic communication functions, including information broadcasting, information sharing and bi-directional communication between users, although service delivery is restricted to small areas, namely, the area around the LACS. The LACS handles demands for local communications, which is generally where most demand is. Users access the service using a Wi-Fi-enabled network device like a smartphone to deliver and collect information and to communicate locally with people like family members, friends and neighbours. They can send and receive large-size content in the form of text, voice, videos and still images. The LACS is able to collaborate with other systems (e.g. Internet disaster-management systems) once its access to the Internet has been restored.

Figure 2A: LACS pilot product



Users can access the top page of the LACS server over the web browser, as shown in **Figure 3A**. By clicking on the icons at the bottom of the top page, they can access the functions the system offers. The pilot product offers three basic functions: the "Important notices" function delivers important information from authorized organizations like local governments and hospitals; the "Bulletin board" function enables users to share information; and the "Messaging" function enables them to exchange messages, still images and videos. "Registration" is a management function for user registration. Users who upload information via the important notice and/or bulletin board function or who use the messaging function are required to register so that they can be identified in the system.

Figure 3A: LACS basic functions



(3) Case study in the Philippines

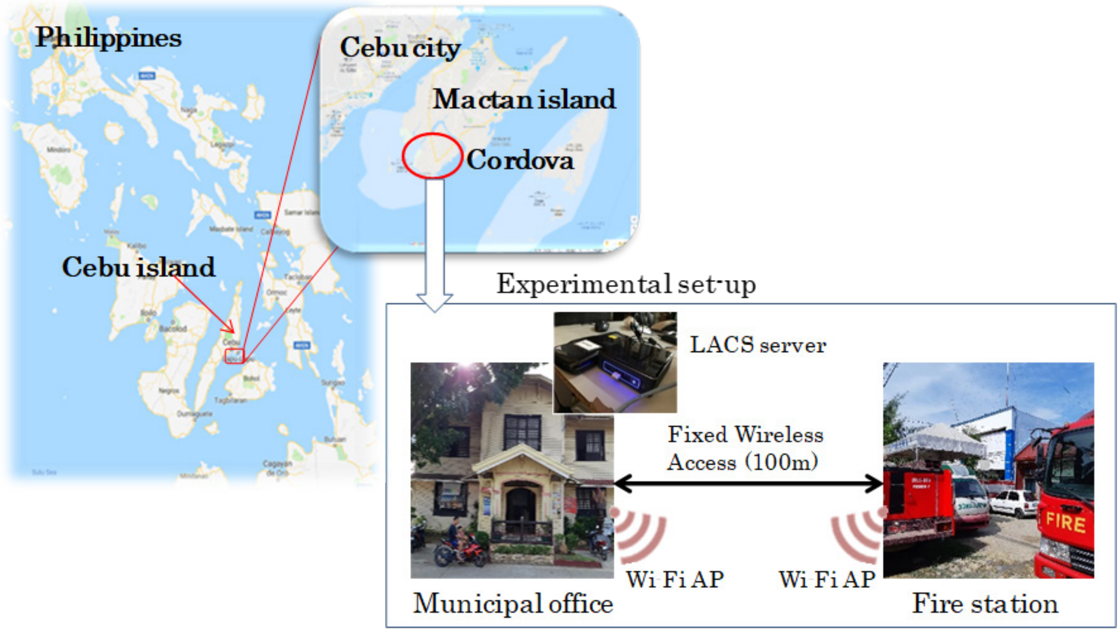
The LACS is not only an answer to communication difficulties in disaster situations; it can also be used in ordinary, non-disaster situations. Its anticipated users are disaster relief workers (including government, police and hospital staff), people in disaster areas and residents in developing countries. The LACS is expected to play an important role in developing countries with insufficient networking infrastructure.

In order to confirm the feasibility of the LACS concept, an experiment was conducted in the Philippines with the cooperation of Cordova municipality in Cebu, in the central Philippines. **Figure 4A** shows the location and setup. A LACS server and Wi-Fi access point equipment were installed in the Cordova municipal office to form a locally accessible cloud environment. The local area was extended to the fire station, located 100 metres from the municipal office, using point-to-point fixed wireless access equipment and a Wi-Fi access point installed in the fire station.

The experiment was conducted for both the residents of Barangay Poblacion, a part of Cordova municipality, and students of Cordova Public College. In the first experiment, to test LACS e-education possibilities, students used the LACS file-sharing function to download an educational video to their smartphones, then watched the video on their smartphones and uploaded their comments to the LACS bulletin board for their teacher. In the second experiment, a disaster simulation, residents of Barangay Poblacion were asked to use the LACS bulletin board to take pictures of supposed disaster areas and upload them to the LACS server, so that officials in municipal offices could confirm the status of disaster areas. To demonstrate the system's e-health possibilities, selected residents consulted medical professionals using the LACS video communication function.

The experiment's 32 participants were asked to evaluate the LACS. All the participants said that the LACS was useful during disasters and in ordinary times; 99 per cent found the LACS easy to use.

Figure 4A: Experimental set-up in Cordova, Cebu

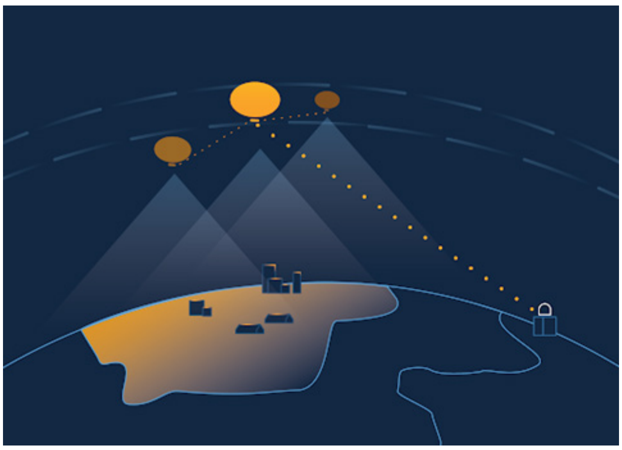


A1.2.7 Balloon-enabled preparedness and emergency telecommunication solutions (Loon LLC, United States)[53]

(1) Overview

Loon is a network of high-altitude balloons designed to deliver stratospheric Internet connectivity to unserved and underserved communities around the world (see **Figure 5A**). The network aims to connect people everywhere by inventing and integrating new and emerging technologies and concepts.

Figure 5A: Illustration of stratospheric Internet delivery



[53] ITU-D SG2 Document 2/327 from Loon LLC (United States)

Each balloon carries a payload with an LTE base station connecting users to the network of the local mobile operator. With the advantage of height, one balloon can transmit service over an area 20 to 30 times greater than a traditional ground-based system. Unlike cell-on-wheels or satellite technologies, each balloon can connect directly to LTE/4G smartphones, including in remote and hard-to-serve areas (islands, mountains, jungles). The network (including mesh links between balloons) operates above the ground and is therefore weather resilient, with independent solar power for each balloon and minimal ground logistics. It can be deployed quickly if infrastructure and network integration are prepared ahead of a crisis and the vehicles are properly positioned.

The most effective communication system is one that can expediently provide basic Internet connectivity to the public and emergency response providers after natural disasters, and offer disaster preparedness service to mobile network operators to quickly reconnect people on the ground. Therefore, preparedness and related training activities are the most effective ways to be ready for disasters, whether natural or man-made.

It is imperative to work in close partnership with local aviation and telecommunication authorities, and to partner with local mobile network operators, to ensure integration with existing network equipment before disaster strikes. On regulatory matters, Loon LLC works with local partners to obtain all necessary approvals for spectrum use, aviation overflights and other operating requirements. With the local carrier partner, it pre-installs ground equipment in the country or region, prepositions fleet resources, and performs network integration and testing with the telecom partner.

(2) Disaster preparedness service description

Loon LLC has extensive experience of preparedness planning and recovery communication operations, and has developed a robust set of tools for non-disaster communications. In collaboration with local mobile network operators, regulators and other stakeholders, it offers a three-phase service: initial set-up and integration; ongoing "stand-by" operations; and emergency service activation.

Phase 1: Set-up

In the initial integration phase, Loon LLC works to:

- coordinate regional ground station certification with regulators;
- complete an assessment of installation, operation and maintenance considering geographic diversity;
- secure reliable, high-speed IP connectivity from ground station locations to the Loon-evolved packet core (EPC), in collaboration with local cable operators;
- integrate the balloon-based network and Loon EPC components with a local mobile operator, IP exchange provider, or Telecom Roaming Sponsor;
- to secure authorization for Loon-compatible LTE spectrum bands (e.g. Band 28) and for millimetre wave (mmWave) spectrum for backhaul and balloon-to-balloon links (E band, 71-76 GHz and 81-86 GHz);
- conduct end-to-end ground-to-balloon-to-LTE user testing;
- secure overflight approvals from local aviation authorities to operate the balloons over each country.

Phase 2: Stand-by

After integration, Loon LLC prepares the fleet and network for expedient emergency response by performing the following activities:

- monitor weather patterns, providing guidance for locations where telecom networks may be impacted by weather;
- pre-position a balloon fleet to expediently navigate to impacted areas, with expected time-to-destination 24/7 air traffic and radio coordination.

Phase 3: Service activation

In the event of an emergency, Loon LLC:

- makes reasonable best efforts to provide a balloon-based LTE radio access network for local operator subscribers at designated locations and times (this may be affected by the severity of the disaster, other location factors, weather and coordination with the local carrier partner);
- customizes each coverage area's network availability capacity by monitoring demand levels and areas of determined need;
- coordinates with carrier partners to provide network outage reporting as required or needed to regulatory agencies.

(3) Regulatory requirements to enable the stratospheric Internet

Meeting regulatory mandates is critical for successful deployment of stratospheric Internet for preparedness and emergency communications.

Equipment homologation: The ground station equipment is certified to national regulatory requirements before use. This includes equipment type approval, electromagnetic compatibility, safety and demonstrating that the equipment has met national radio spectrum requirements.

Streamlined import process: Ground stations, which are compact systems measuring 1.3 m across by 1.6 m high, connect the mmWave backhaul service to the LTE service. Typically, two ground stations are deployed to cover a service area, with options for both roof and tower mounting. The number of ground stations depends on the geography, the local carrier partner's network and the area needing to be covered.

Spectrum authorizations, for both mmWave and LTE: Two spectrum bands are used to enable Loon technology. The first is mmWave spectrum in the E band (71-76 GHz/81-86 GHz), which is used between the balloons and with the ground station, to provide backhaul service. The second is the local operator partner's LTE spectrum, to provide connectivity between the balloons and the user equipment.

Authorization to use the E band for backhaul is critical for providing the stratospheric Internet. The E band is a 71-76 GHz uplink paired with an 81-86 GHz downlink. A channel bandwidth of 750 MHz is used to ensure sufficient system capacity. Two frequency pairs are used per site, with centre frequencies of 71 500 MHz / 81 500 MHz and 74 000 MHz / 84 000 MHz. The backhaul service is integrated into the local carrier partner's network.

To transmit the LTE spectrum, the local carrier partner identifies spectrum bands between 700 and 900 MHz. Loon LLC ensures that its technology meets any national licensing requirements.

It works with local agencies and does testing with the local carrier to ensure that there are no interference issues that could disrupt other services within the country.

Cross-border coordination: The technology can geofence areas to mitigate interference. The Loon carrier partner has also done previous work and achieved regulatory approvals to operate in an area under its licensing terms.

Other non-telecommunication regulatory considerations

- Overflight authorizations: The balloons require overflight authorization from the civil aviation authority of every country that they may fly over.
- Business registration: Loon LLC is not a direct customer-facing entity; the local mobile operator still represents the service and handles all billing and related customer-facing operations.

(4) Recommendations/lessons learned

The following recommendations should be considered to allow innovative solutions like stratospheric Internet to occur.

Consider an overall spectrum strategy, including mmWave and 5G applications

- Members States are encouraged to consider spectrum licensing in the larger context of technological developments and what applications they would like to enable. Loon LLC uses E-band spectrum for backhaul services because it has wide channels that enable long range, narrowly targeted communications between directional antennas. Member States have different ways of licensing E band, from licence exempt to self-coordinated and flexible licensing. In the United States, there is a "flexible licensing" scheme for the E band that allows for innovative uses of mmWave spectrum but nonetheless requires that users seek licensing from the Federal Communications Commission. That entails coordination across the Government and registering individual links in a third-party database. This transparency also allows for efficient and innovative use of the spectrum to spur competition in the industry.
- In countries like the United States, having a database of spectrum licence holders has enhanced understanding of the market potential and ways to use spectrum more efficiently. Member States should also consider ways to assess their spectrum assets and make spectrum holdings and usage transparent, to enable future thinking about how to use spectrum more efficiently, particularly as new technologies are developed and deployed.
- A complementary strategy to enable innovation is to consider how experimental licences would allow for proof-of-concept ideas to move to commercialization. In many cases, companies apply for an experimental licence to test technologies over the airwaves, but after the licence expires, there is no clear regulatory path for transitioning to a commercial licence.

Streamline homologation procedures and timeframes

- Support innovative technologies by developing streamlined national or regional processes to certify equipment that can be used to supply preparedness or emergency communication services. These requirements should be made publicly available, for example, on the regulator's website.
- In most cases, it might be possible to utilize the supplier's declaration of conformity to show that equipment meets a country's technical specifications. If a country does not allow such declarations, countries and regions should consider developing a common set of

homologation requirements for emergency communication equipment, to facilitate speed and availability.

Streamline equipment import processes

Countries can support innovative technologies by making it easier for local providers to partner with companies like Loon to deliver services. While a country may have emergency procedures to allow the import of equipment to provide communications in times of disaster, the focus on preparedness means that equipment procedures should be predictable and timely.

Encourage cross-border coordination for innovative services

Serious consideration must be given to the ability to protect communication services from interference. Countries can encourage all carriers to coordinate in a timely and effective manner to effectively operate systems that serve communities in time of need. This may include network management opportunities like using facilities across borders, as long as this is compliant with related telecommunication regulations.

Partner with civil aviation authorities to approve overflight authorizations

In most countries, overflight authorization is approved by the national civil aviation authority. To ensure that aerial connectivity solutions are available during and after emergencies, telecommunication regulators should work collaboratively with civil aviation authorities in support of the necessary overflight authorizations.

A1.2.8 Ka + 4G model in emergency response and disaster relief (China)[54]

(1) Overview

In order to meet the requirements for the activation of 4G base stations at emergency disaster sites, satellite communication is usually used as the means of relay and backhaul for emergency base stations. However, because of transmission capacity and cost factors, traditional satellite communication can only provide satellite relay capability up to about 2 Mbit/s, and can therefore meet the application requirements of basic voice and low-speed data services only below 2Mbit/s; it is difficult to meet the requirements for relay and backhaul of 4G base stations.

The new-generation Ka high-throughput satellites (HTS) have technical features such as multi-spot beams, frequency reuse and high beam gains. Compared with a traditional communication satellite, Ka HTS have advantages in terms of capacity and unit bandwidth cost, which can help address the bottleneck created when traditional satellites are used for 4G base station backhaul.

Chinasat-16 is the first geostationary HTS in China. It has 26 spot beams and provides Ka frequency band HTS communication services, with a total system capacity of 20 Gbit/s. It provides the end users with an access speed of up to 150 Mbit/s in downlink and 12 Mbit/s in uplink, delivering satellite broadband Internet in the true sense.

China Telecom is actively conducting studies on the application of Ka HTS in the field of emergency communication to explore how to implement the Ka + 4G application model and improve the application capability of emergency satellite broadband services. It has also applied

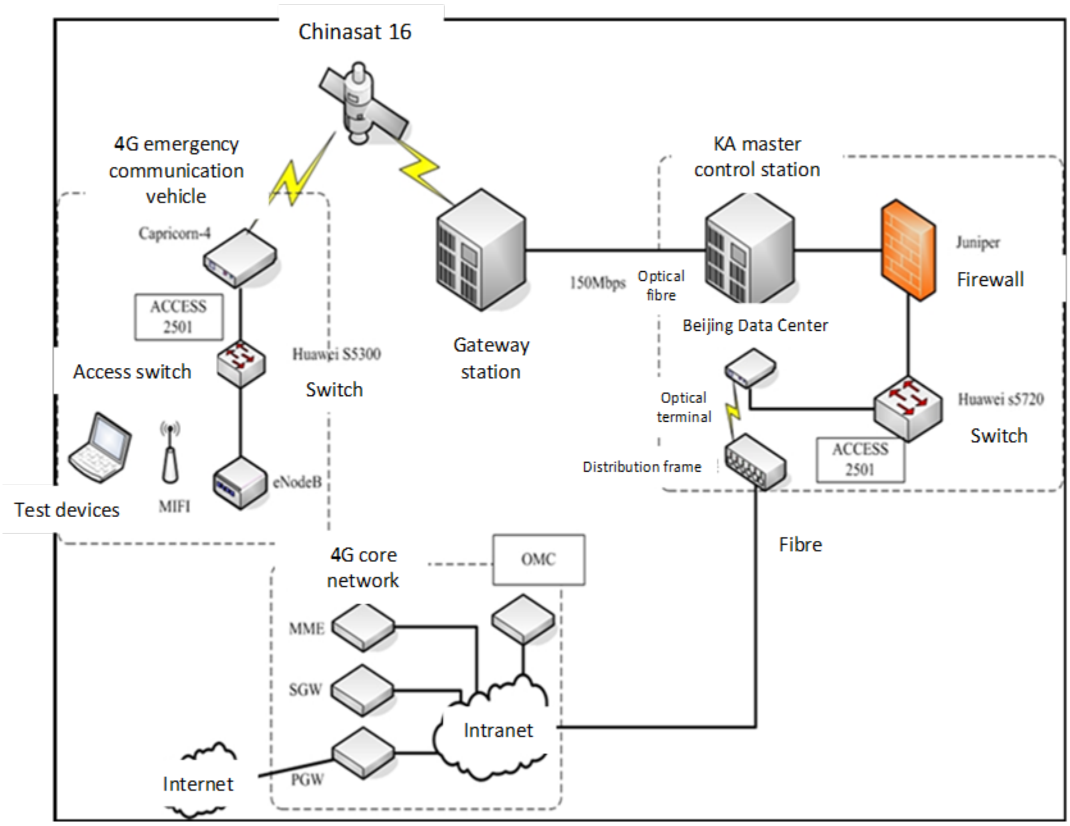
[54] ITU-D SG2 Document SG2RGQ/228 from China

relevant study results to actual emergency communication guarantee tasks and achieved excellent results. Depending on the characteristics and business requirements of different emergency scenarios, there are two different satellite backhaul models for 4G emergency base stations.

Two-layer private line model

The two-layer private line model connects the Ka HTS network to the bearer network on the ground; from there, the satellite network is connected to the mobile core network (see **Figure 6A**). As it extends the wide-area wireless coverage of the existing 4G network, this model can meet the access requirements of most base stations in the public network. It has the advantages of stable transmission quality and strong 4G service capability, and is therefore widely used in various emergency communication guarantee scenarios.

Figure 6A: Topology of a two-layer private line model



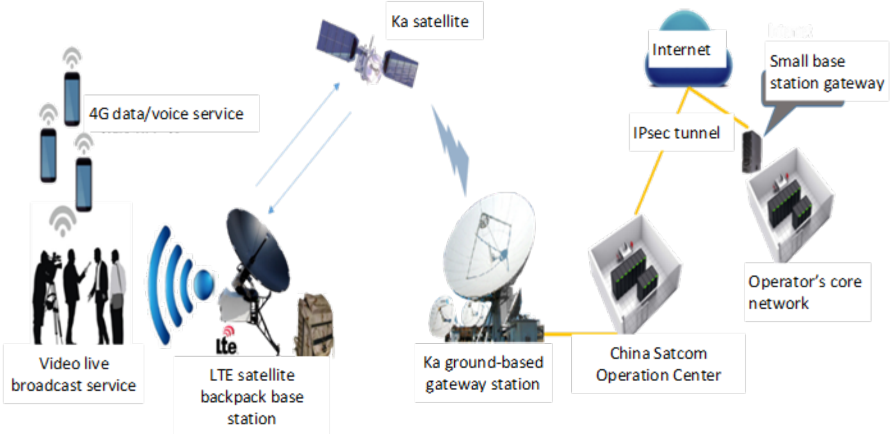
In order to be simultaneously activated in different regions within the same network architecture, different types of service need to be segregated and isolated. Two-layer services mainly rely on virtual local area network tagging and related IP addresses for service segregation and isolation.

Three-layer Internet model

The three-layer Internet model, which is based on the public Internet through a secure encrypted IPsec tunnel and a dedicated service gateway, connects the satellite communication to the bearer network on the ground; from there, satellite communication is connected to the mobile core network (See **Figure 7A**).

This model is mainly suitable for access by small base stations. It can quickly activate emergency base stations through public interconnection when there is a lack of private line transmission on the ground. It can provide various emergency broadband value-added services through innovative technologies such as multi-access edge computing and software-defined networking.

Figure 7A: Topology of a three-layer Internet model

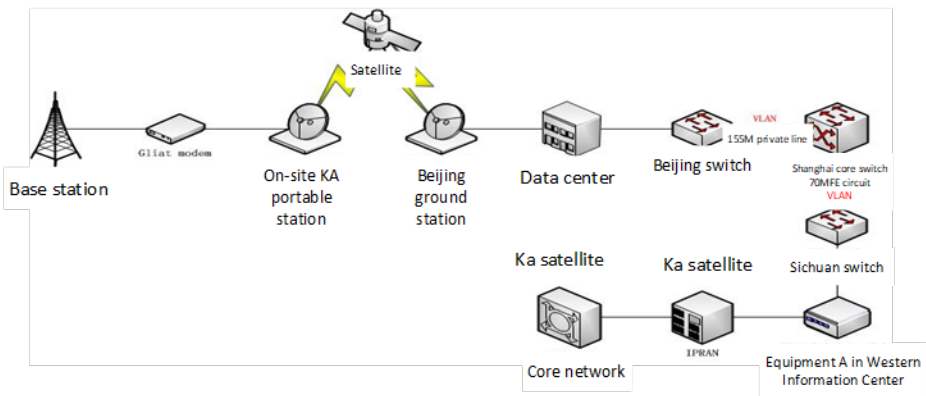


(2) Application promotion

Having completed its study of the innovative application of Ka HTS for emergency communication, China Telecom has gained a comprehensive and systematic understanding of the functional characteristics and business capabilities of HTS, and obtained a huge amount of first-hand test data, laying the technical foundation for the applications of Ka HTS in actual situations of emergency response and disaster relief. The technology has also been tested in an actual situation.

On 20 August 2019, torrential rainfall and heavy mudslides occurred in Wenchuan, Aba, and communications in many towns and villages in Wenchuan County were interrupted. At the disaster relief site, the mobile communication bureau of China Telecom in Sichuan activated the 4G backpack base station through the Ka portable station based on the two-layer private line model to guarantee 4G services for the staff in the emergency response command and control office. The overall system topology is shown in **Figure 8A**.

Figure 8A: Topology for the application of Ka + 4G when mudslides struck Wenchuan, Aba, on 20 August 2019



The onsite service testing data are shown in **Figure 9A**.

Figure 9A: Screenshot of service testing data of the 4G backpack base station

- Download rate: 57.2 Mbit/s (the Ka satellite station downlink speed limit is 60 Mbit/s)
- Upload rate: 4.28 Mbit/s (the Ka satellite station uplink speed limit is 10 Mbit/s)
- Latency: 700 ms
- Jitter: 11 ms
- Coverage distance: 200-300 metres
- Test environment: moderate to heavy rain, thick clouds, and a Ka satellite receive level of about 11 dB.

A1.2.9 Satellite connectivity for early warning (ESOA)[55]

Early warning is as much about satellite communications as it is about satellite imagery. Imagery is necessary but so is communication. Satellite communications play an important role because they enable real-time data for real-time action. Specifically, they provide solutions for areas where it is often difficult to send people and in response to large threats and risks, and they enable data delivery for an unlimited number of users, often using small, low-power, portable terminals.

Below are some examples that show how satellite plays an important role for early-warning systems and monitoring of earthquakes; tsunamis; floods; wildfires; and mining.

Fighting wildfires

The destructiveness of a fire can be devastating. Emergency workers may not have the manpower to manage a growing fire or must evacuate for safety reasons before a fire is out. The solution includes a mobile trailer containing hoses and sprinklers carried on a mobile platform that can be remote-controlled from a laptop or mobile phone relying on satellite/cellular terminals depending on the location and network coverage.[56]

Tailings dam monitoring

The mining industry increasingly stores often toxic or radioactive by-products in so-called 'tailings dams'. A failure of the dam can have disastrous consequences for the environment and so constant monitoring is essential. The solution collects data from sensors distributed along

[55] ITU-D SG2 Document SG2RGQ/237 from the EMEA Satellite Operators Association (ESOA)
[56] W.A.S.P. Manufacturing Ltd. https://waspwildfire.com/

the dam which are then transferred across a satellite network to a single cloud dashboard. This enables mining companies and other stakeholders to gain a comprehensive view of the status of their dams with detailed metrics such as pond elevation, piezometric pressures, inclinometer readings and weather conditions displayed in one place, no matter where the mine is located, minimizing environmental risks and achieving high levels of safety.[57]

Early flood warning

Water levels are on the rise in many places for various reasons, and require constant monitoring. The solution consists of several water-level monitoring sites with stream gauges connected to a satellite messaging terminal frequently powered by solar panels. Changes in water levels are transmitted via satellite to a central monitoring site. Since many of the monitoring stations are in mountains, canyons and other remote areas, satellite messaging terminals provide a cost-effective means to install a communication link where other services providing real-time data and guaranteeing data delivery are not available.[58]

Earthquake and tsunami detection

The increasing disasters in the world include earthquakes and tsunamis, and several solutions that rely on satellite communications are implemented in some parts of the world. These range from sensors along coastlines measuring minute changes in tides or currents, to broadband stations deployed across a territory measuring seismic movements, or deep-ocean tsunami detectors. The solutions rely on satellite to transmit real-time data for international coordination and early warning – often through WMO's Global Telecom System.[59,60,61].

Safety systems are often seen as a cost and only considered once a disaster has happened. Solutions to increase our preparedness for climate change and other disasters are available today.

A1.2.10 "SOCDA" chatbot system for disaster management (NICT, Japan)

(1) Background

Every year, the global community faces numerous disasters, including earthquakes, typhoons and floods. Such disasters often damage social infrastructure like telecommunication networks, electric power distribution networks and transportation systems, severely disrupting the lives of people.

SNS are known to be useful not only for individual communications but also for collecting information on damages for first responders. They have been used in recent floods caused by severe storms and heavy rains in Japan. However, it is also well known that SNS can cause confusion, because the information they are used to spread is not always true; it may be misleading or even fake. The NICT has been developing an SNS disaster information analysis system called DISAANA, which compiles useful disaster-related information from huge volumes

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57 Inmarsat. Solutions and Services. Tailings insight: Award-winning tailings dam monitoring solutions, enabling smarter and faster decision-making, safer operations and enhanced regulatory compliance.
58 Skywave.com. Application Profile: satellite for Early Flood Warning.
59 Australian Government. Bureau of Meteorology. Deep Ocean Tsunami Detection Buoys.
60 Inmarsat. Solutions and Services. BGAN 2M.
61 Inmarsat. Solutions and Services. Connectivity you can rely on.

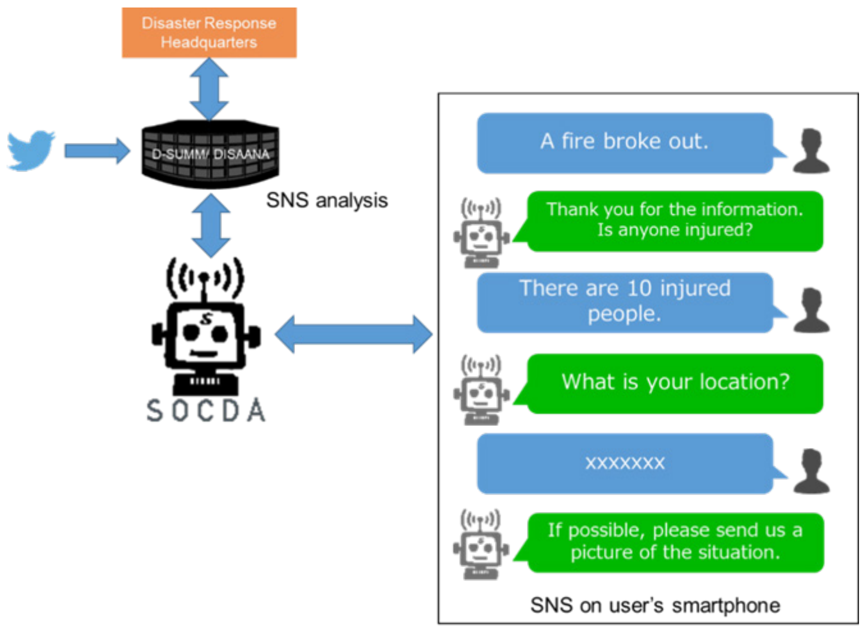
of SNS data, and a disaster information summarizing system called D-SUMM. An overview of the systems was provided in an NICT contribution in 2018. DISAANA and D-SUMM retrieves both disaster-related and contradictory information. When disaster strikes, information can help save lives. The type of information sought by the victims varies widely, depending on their situations, so it needs to be collected from as many sources as possible. However, postings on SNS are currently voluntary, and this means that much important disaster-related information is not reported. SNS chatbots are a useful means of collecting disaster-related information effectively. When operated on smartphones/tablets, chatbots can reach many victims and facilitate two-way communication. They can survey and deliver disaster-related information proactively.

(2) Overview

As part of the Cabinet Office's Strategic Innovation Programme, a chatbot called SOCDA (SOCial dynamics observation and victims support Dialogue Agent platform for disaster management) has been jointly developed by the NICT and other organizations. Since the Programme aims to implement research results throughout society, feasibility studies employing SOCDA have been conducted involving several local governments in Japan. Expected users of SOCDA are the national government, local governments, first responders (including medical staff) and ordinary citizens in disaster-affected areas in both developed and developing countries. They have been involved in several emergency drills and exercises simulating a natural and/or pandemic situation.

SOCDA uses AI to collect disaster-related information via SNS. It aggregates the contents by applying DISAANA and D-SUMM technologies, plots them on a map and distributes the information needed for people's timely evacuation. Citizens and first responders can use SOCDA simply by "friending" it on SNS. **Figure 10A** shows an example of interactive information collection using SOCDA, which answers users automatically and collects information on their situation and damages.

Figure 10A: Interactive information collection by SOCDA



SOCDA has three main functions.

1) Disaster-related information-sharing function: When a disaster occurs, users can submit a wide variety of information via SNS after friending SOCDA's account.
2) Inquiry function: A huge inquiry operation can be automated thanks to FAQ written beforehand.
3) Evacuation support function: Appropriate evacuation support information is provided for individual users in the light of their attributes and location.

(3) Case study: safety confirmation training for people requiring evacuation support

In January 2020, the Council on Artificial Intelligence for Disaster Resilience conducted a demonstration of a new safety confirmation model, using the SNS app "LINE" to confirm that around 300 people in Itami, Hyogo prefecture, were safe. The demonstration aimed to confirm that SOCDA could be used by elderly and other people who needed evacuation support. This was the first safety confirmation project employing SNS for people requiring evacuation support, including elderly persons. The demonstration was based on the assumption that Itami had been hit by a heavy earthquake at 10 a.m. After the demonstration started, SOCDA sent safety confirmation messages to all participants, who answered questions such as "Please tell me where you are now" and "Is the health of the person requiring nursing care okay?" By 4 p.m., replies had been received from nine people in need of evacuation assistance and 32 people had heard from relatives.

The demonstration also aimed to collect disaster-related information, including reports on the disaster situation sent by city officials. The information was aggregated by SOCDA and used at the city disaster-response headquarters.

(4) Case study: training in disaster information sharing (heavy rainfall)

In June 2020, the Council on Artificial Intelligence for Disaster Resilience conducted a demonstration in Kurashiki, Okayama prefecture, where many people had been affected by heavy rainfall in June 2018. People had observed how difficult it was to know what was happening at the time of evacuation, so the purpose of the demonstration was to share information throughout the region.

The training involved local residents using an SNS account on a smartphone/tablet on which SOCDA had been installed. Information on rising water levels in the Takahashi and Oda rivers that could trigger floods was posted on SNS, mapped by SOCDA and sent throughout the region. The 398 participants, including local residents, posted about 270 reports. It was concluded that SOCDA is able to collect information over a wide area across multiple local governments.

(5) Case study: evacuation assistance during the COVID-19 pandemic

In a pandemic situation such as COVID-19, appropriate arrangements must be made to avoid the "Three Cs": closed spaces with poor ventilation; crowded places; and close contacts (e.g. close-range conversations at evacuation shelters). To make such arrangements, local governments need to have a full understanding of evacuation shelters, especially those where people gather voluntarily, or they will face serious difficulties.

The SOCDA AI chatbot system, which is in the research and development phase, will first provide information on such voluntary evacuation shelters and then distribute provisional information on COVID 19. SOCDA serves to visualize and analyse such situations in order to help protect people from the pandemic even in disaster evacuation shelters. Should the pandemic situation worsen, well-separated evacuation is required to avoid the "Three Cs". SOCDA can help both infected and non-infected victims by providing several types of useful information in a timely manner.

A1.2.11 Autonomous distributed ICT system (Japan)[62]

(1) Autonomous distributed ICT systems

In order to address the issues and needs facing local governments in the event of disasters, the use of an autonomous distributed ICT system should be considered as much as possible as a business system in the local governments. Such a system offers major benefits in an environment with limited telecommunications. It allows on-site workers to continue their business and share information between various remote departments and organizations, even when the telecommunication network is down. In addition, voice communication can be achieved by voice data exchanged via distributed servers.

(2) Development of the "Die-Hard Network"

NICT Japan has developed the Die-Hard Network as an autonomous distributed ICT system with a store-carry-forward network supported by vehicles for disaster countermeasures. Parts of the study were supported by the Cross-ministerial Strategic Innovation Promotion (SIP) programme of the Council for Science, Technology and Innovation (CSTI) of Japan's Cabinet Office , entitled "Enhancement of national resilience against natural disasters" (Funding agency: National Research Institute for Earth Science and Disaster Resilience - NIED).

The Die-Hard Network consists of various communication systems and several edge servers, as shown in **Figure 11A**. In the event of telecommunication network outage in some areas, the system can transfer rescue and/or governmental information between distributed offices and headquarters through available networks, for example a low-power wide-area (LPWA) or satellite network, or a vehicle with an edge server as a part of store-carry-forward network. The vehicle-borne edge servers go around headquarters and distributed offices in telecommunication outage areas, and send and receive data to edge servers using device-to-device (D2D) communication technology and fast initial link setup (FILS) when the vehicle approaches a distributed area. Features of the Die-Hard Network are summarized below:

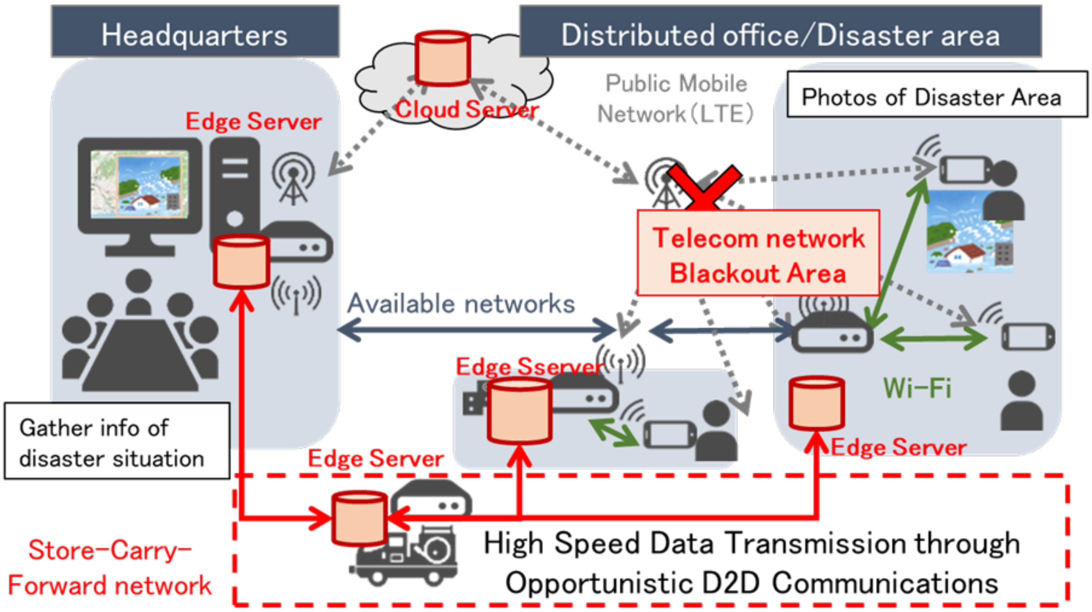
- *Links between distributed on-premises systems*: An autonomous distributed architecture does not have a node that centrally manages and controls the system; each node provides application services as on-premises. When a connection is detected, it is possible to automatically share information between remote locations by synchronously sharing data between the nodes.
- *Utilization of heterogeneous communication systems*: In the event that the fixed-line telecommunication network is down, various kinds of available transmission technologies should be exploited to connect the network. For example, cellphone network, Wi-Fi, LPWA, convenience radio and satellite should be used in an appropriate manner.
- *Proactive use of mobile resources*: By not assuming constant connection, D2D communication technology can be used just when a vehicle with the device installed approaches, and information can be stored and transported by actively utilizing the

[62] Document 2/401 from the National Institute of Information and Communications Technology (NICT) (Japan)

vehicle. This type of communication network is called "store-carry-forward network" or "delay/disruption-tolerant network".

- *Authentication and access control in distributed environments*: Even in the event of a disaster, officers of local governments have to process secure information such as personal data. Therefore, it is necessary to restrict the connection of each node to the distributed systems and access to data and information stored and managed, so that it is allowed only via the authenticated user and terminal.

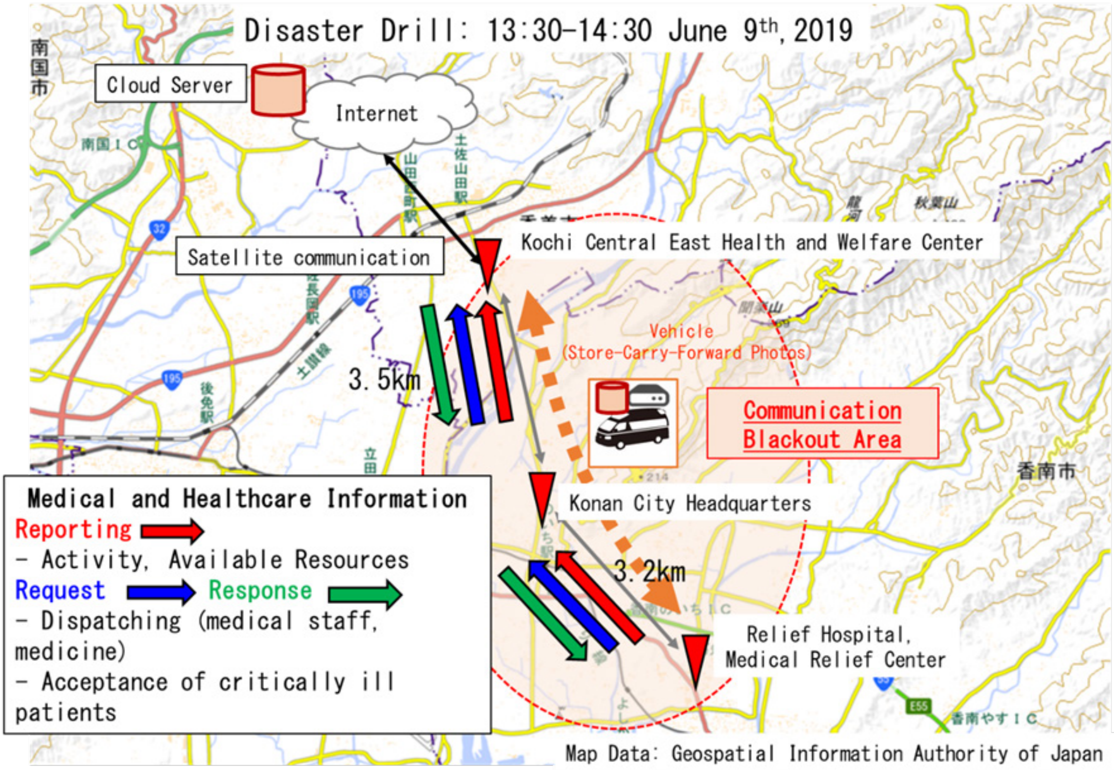
Figure 11A: Concept of Die-Hard Network



(3) Case study in Kochi prefecture in Japan

The Kochi Prefecture Comprehensive Disaster Prevention Drill was held on 9 June 2019. The nodes of the Die-Hard Network system were set up in the Kochi Central East Welfare Health Centre, the Konan City Headquarters, and the Relief Hospital and Medical Relief Centre (Akaoka Health Centre in Konan City). In this disaster medical training exercise, people were trained in information transmission using the system, such as the transmission of activity status reports from medical care centres, requests for dispatch of medical personnel and requests and consent for the acceptance of critically ill patients. An overview of the drill is shown in **Figure 12A**.

Figure 12A: Overview of disaster drills using Die-Hard Network



Assuming a Nankai Trough earthquake scenario in which public telecommunication networks were totally unavailable, the disaster drill was carried out using conventional means of information exchange, such as fax-based communication, involving filling out a paper form used in the prefecture and faxing it from the Medical Relief Centre to the City Headquarters, and from there to the Kochi Central East Welfare Health Centre. In parallel with this fax-based communication drill, a similar drill was carried out using the Die-Hard Network system.

With the latter system, when the report and the request were input at the Medical Relief Centre, the input text information was shared automatically and synchronously with the City Headquarters and the Prefecture Health and Welfare Centre by means of digital convenience radios.[63] At each site, the status information was automatically shared after approval processing. The drill was carried out according to the disaster drill scenario, with the system being used by city and prefecture employees.

Transmission of information that could not be accommodated in the format of the prefecture form, such as the condition of severe patients housed in medical relief centres and photos of triage tags, was also demonstrated by automatically synchronizing information through Wi-Fi via communication nodes mounted on moving vehicles. It was confirmed that the high-resolution photo data registered in the medical relief centre system were automatically synchronized to the vehicle through Wi-Fi. These data were automatically transferred from the system in medical relief centre to the server on the vehicle when the vehicle arrived at the centre's parking lot. As a result, it was confirmed that information sharing could be performed automatically by the Die-Hard Network, even in the case of large-capacity data that are difficult to transmit with the digital convenience radio during a public telecommunication blackout.

63 https://www.soumu.go.jp/main_content/000361388.pdf [in Japanese]

A1.3 Early-warning and alert systems

A1.3.1 CAP-based earthquake early-warning system in northern India (India)[64]

(1) Disaster-management framework in India

Due to its unique geo-climatic and socio-economic conditions, India is vulnerable in varying degrees to disasters such as floods, droughts, cyclones, tsunamis, earthquakes, landslides and forest fires. Of the country's 35 states and union territories, 27 are disaster prone. In addition, 58.6 per cent of the landmass is prone to earthquakes of moderate to very high intensity; 12 per cent is prone to floods and river erosion; of 7 516 km of coastline, 5 700 km are prone to cyclones and tsunamis; 68 per cent of arable land is vulnerable to drought; and hilly areas are at risk from landslides and avalanches. Fires, industrial accidents and other man-made disasters involving chemical, biological and radioactive materials are additional hazards that have underscored the need to strengthen mitigation, preparedness and response measures.

National Policy on Disaster Management

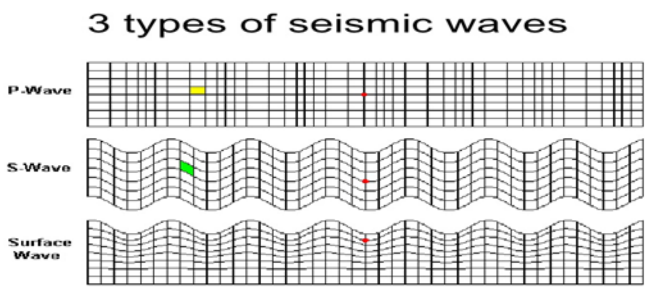
Pursuant to the Disaster Management Act, 2005, the National Policy on Disaster Management envisages a safe and disaster-resilient India that develops a holistic, proactive, multi-disaster-oriented and technology-driven strategy through a culture of prevention, mitigation, preparedness and response.

Earthquake Early-Warning system

Earthquakes produce vibrations – seismic waves – that travel in all directions and release huge amounts of energy. There are three types of wave (see **Figure 13A**):

- P waves compress and expand the ground like an accordion, travel through solids and liquids, and are fast moving and longitudinal;
- S waves vibrate from side-to-side as well as up and down, travel through solids only, and are slow moving and transversal;
- Surface waves move up and down like ocean waves; they are the slowest-travelling waves, with movement greatest at the Earth's surface and weakest beneath the surface.

Figure 13A: Types of seismic wave



During an earthquake, seismic waves radiate out from the epicentre. It is these waves that make the Earth shake and cause damage to structures. The technology exists to detect moderate to large earthquakes so quickly that a warning can be sent to locations outside the area where

64 ITU-D SG2 Document 2/36 from India

the earthquake begins before these destructive waves arrive. Data from a single station or from a network of stations form the basis of earthquake early warning. In a "single station" warning system, data are not sent to a central processing site. The single station alert is more prone to false alarms. The accuracy of early warnings can be enhanced by using a combination of alerts from single stations and a regional seismic network. The CISN Shake Alert demonstration system, for example, combines onsite and regional alerts for moderate to serious earthquakes. The future of earthquake early-warning systems may be in smartphones and vehicles, "smart" appliances and the increasing number of everyday objects embedded with sensors and communication chips that connect them to a global network.

Single-station approach: A single sensor located at the site to be protected detects the arrival of the P wave and sends out a warning before the arrival of the S wave. This method is simple, but is less accurate; it gives rise to false alerts and provides less warning time.

Network approach: Many seismic sensors distributed over a wide area where earthquakes are likely to occur are networked. A central site receives the data from these sensors, analyses ground motion signals, detects earthquakes and issues suitable warnings. The system maintains a higher level of readiness all the time and is more accurate in predicting quakes. Earthquake early warnings are most effective when the earthquake begins on a fault far from the current location and the rupture propagates towards that location. Earthquake early-warning messages are sent quickly to all members of the public with the help of every available ICT and IoT technology. The public is periodically sent messages and tutorials on how to understand and respond to alerts.

Earthquake early-warning alerts warn people to take protective action and trigger automatic responses in places like factories, dams and transit systems. They operate in means of transport, utilities, offices, industrial sites, medical facilities, restaurants, schools, cars and trucks, and during emergencies.

CAP-based earthquake early-warning system

ITU-T X.1303 Common alerting protocol establishes a common standard-oriented platform instead of a separate public warning system for each particular type of emergency and for each particular communication medium. The CAP is an XML-based data format for exchanging public warnings and emergencies between alerting technologies. It allows a warning message to be consistently disseminated simultaneously over many warning systems to many applications. It increases warning effectiveness and simplifies warning tasks. Standardized alerts can be received from many sources and configured for applications to process and respond as desired. By normalizing alert data across threats, jurisdictions and warning systems, the CAP can also be used to detect trends and patterns in warning activities or hostile acts. From a procedural perspective, the CAP reinforces a research-based template for effective warning message content and structure.

The CAP data structure is backward-compatible with existing alert formats, including Specific Area Message Encoding (the protocol used to encode the Emergency Alert System and NOAA Weather Radio, Wireless Emergency Alerts, etc.), while adding capabilities such as the following:

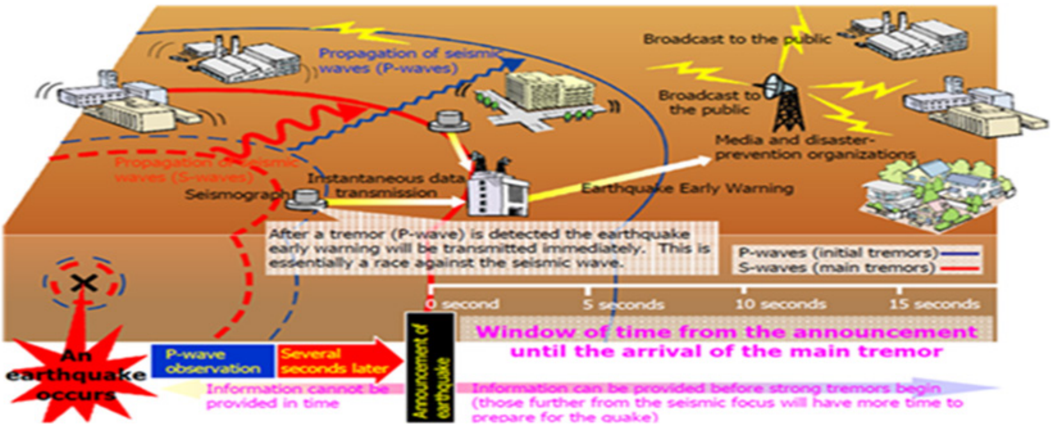
- flexible geographic targeting by using latitude/longitude "boxes" and other geospatial representations in three dimensions;
- multilingual and multi-audience messaging;

- phased and delayed effective times and expirations;
- enhanced message update and cancellation features;
- template support for framing complete and effective warning messages;
- digital encryption and signature capability; and,
- facility for digital images, audio and video.

Central and state government agencies can all receive information in the same format for the same type of application and then sound different alarms based on the information received. The CAP also detects trends and patterns in warning activity, such as might indicate an undetected hazard or hostile act. International organizations such as UNDP, ITU and WMO are urging nations to implement the CAP as an essential communications formatting step for emergency early warnings.

The main components of earthquake early-warning systems are velocity of electromagnetic waves >>> velocity of seismic waves (seismograph), propagation of seismic waves (S waves), propagation of seismic waves (P waves), instantaneous data transmission, e-warning-broadcast to the public (see **Figure 14A**).

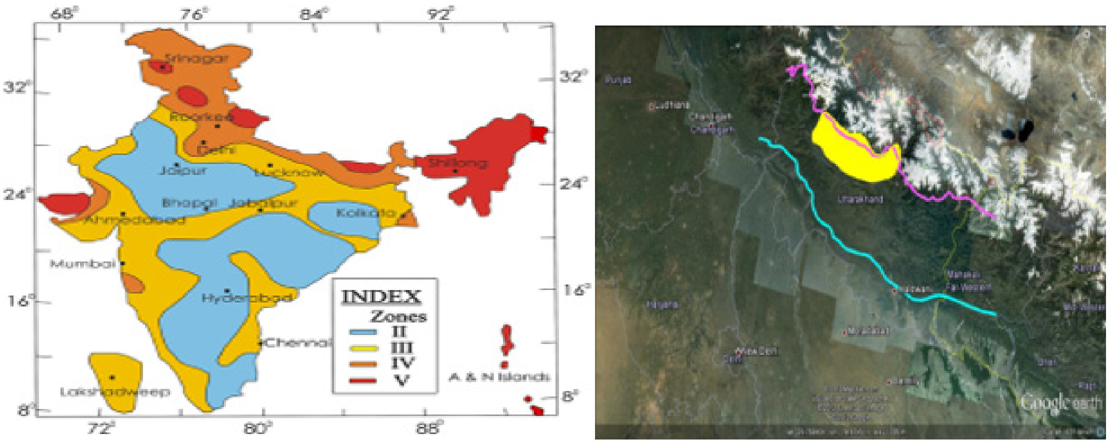
Figure 14A: Earthquake early-warning systems



Earthquake early warning in northern India

Major earthquakes originating in the central Himalayas, a prominent "seismic gap", frequently rock Indian cities (including New Delhi) and industrial hubs with high population densities located 100 to 300 km from the epicentre, with a lead time of 25 to 80 seconds. This makes an earthquake early-warning system very useful. More than 100 sensors (see **Figure 15A**) have been deployed in the Himalayas to detect and locate seismic events potentially affecting the cities of northern India, estimate their magnitude and issue alert notifications.

Figure 15A: Earthquake early warning in northern India



Components of the CAP-based earthquake early-warning system

- Information sharing by alerting agencies such as the Indian Metrological Department, the Geological Survey of India, the Central Water Commission, the Ministry of Home Affairs and the Indian National Centre for Ocean Information: Information in the same format can be received by all central and state government agencies, which can sound different alarms based on the information received.
- Alert-forwarding media agencies (see **Figure 16A**) include telecom operators, All India and other radio stations, Doordarshan and other television broadcasting agencies, the National Highway Authority of India for road displays, the Internet and other related organizations. People need to receive alerts of earthquakes, cyclones and heavy rainfall in advance.

Figure 16A: Common alerting media agencies

- The earthquake early-warning system has a management platform (see **Figure 17A** and **Figure 18A**) for collecting CAP-compliant input messages in XML/JSON format sent via web portals/mobile apps/SMS in standard message format by alerting agencies; processing SMS/e-mail notifications sent to the first-level alert-generating authority (i.e. the National Disaster Management Authority); storing (BTS data are stored); transmission; and control (for state/regional warning-issuing authorities). It also has a feedback evaluation system.

Figure 17A: Earthquake early-warning management platform

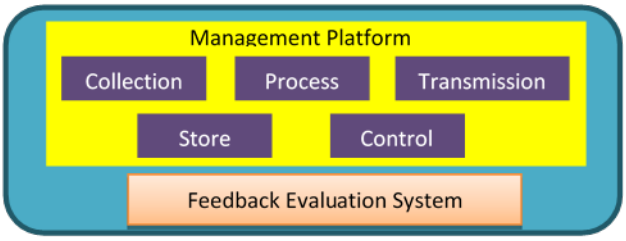
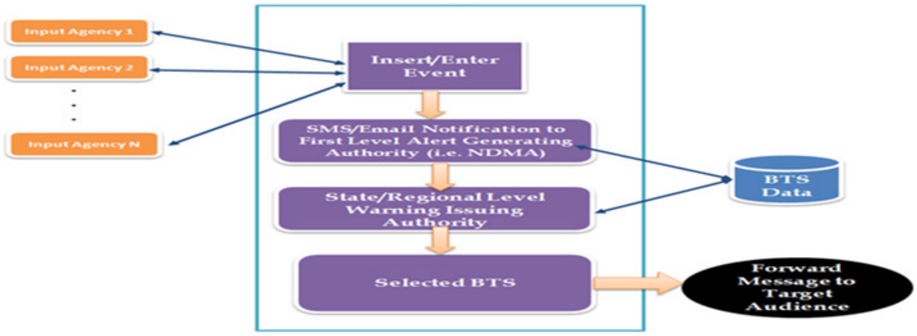
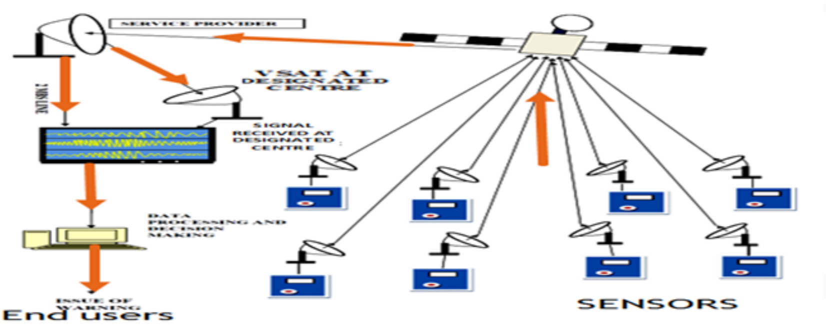


Figure 18A: Management platform



In terms of information flow (see **Figure 19A**), the Static Disaster Management Software Platform framework has been incorporated into the national network and plans are to integrate it with the National Disaster Management Authority. Disaster areas are identified using geofencing. Manual alarms are pushed using a two-tier approach to nationwide telecom networks able to send SMS automatically to marked areas.

Figure 19A: Common alerting system – Flow of information*



* The arrows indicate the direction of sensor signals received at the designated centre, data processing and issue of warnings to end users.

A1.3.2 Implementing a CAP trial (India)[65]

(1) CAP and its use in early-warning systems

ITU-T X.1303 Common alerting protocol establishes a common standard-oriented platform instead of a separate public warning system for each particular type of emergency and for each particular communication medium.

Trials of CAP use in early-warning systems are constantly being carried out in India. ITU-T X.1303 provides a detailed description of CAP features, as summarized below:

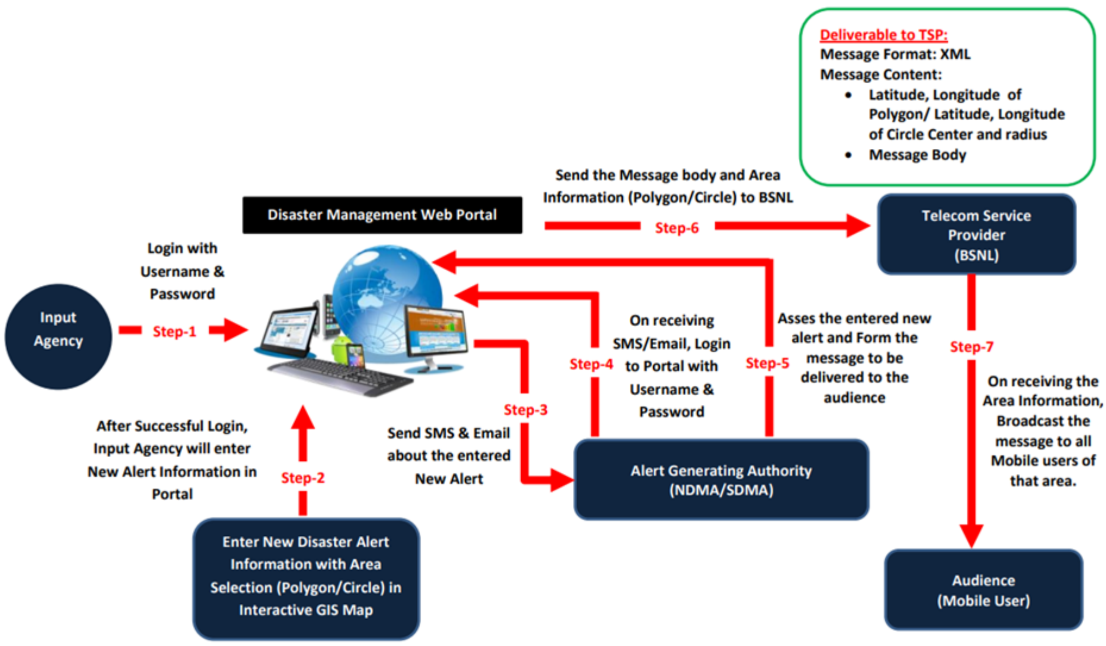
- the CAP allows a warning message to be consistently disseminated simultaneously over many warning systems;
- standardized alerts can be received from many sources and configured for applications to process and respond as desired;
- flexible geographic targeting using latitude/longitude boxes, polygons or circles and other geospatial representations in three dimensions;
- facility for digital images, audios and videos.

International organizations such as UNDP, ITU and WMO are urging nations to implement the CAP as an essential communications formatting step for emergency early warnings.

(2) Recent trial run of CAP implementation carried out in India

Figure 20A depicts the workflow of a CAP trial carried out in different Indian states.

Figure 20A: CAP trial workflow



The CAP trials are run through the portal developed by the Centre for Development of Telematics (C-DoT), a government-owned telecommunication research and development centre.

[65] ITU-D SG2 Document SG2RGQ/77 from India

Access to the portal has been given to alerting agencies, the National Disaster Management Authority, the state disaster management authorities of different states in India, State Governments and the Department of Telecommunications. The portal is presently connected to telecommunication service providers through the Internet or multiprotocol label switching virtual private networks, so that alerts can be passed on to telecom service users. Customers are identified through the call detail records (last six hours) or network visitor location register and the warning SMS are sent to them. The SMS are also sent by cell broadcast from the base stations lying in the polygons identified.

The CAP trial runs are summarized in **Table 1A**.

Table 1A: CAP trial runs

Date	Area selected	Number of recipients
7 June 2018	Small area of Marina Beach Chennai	5 181
8 June 2018	Nungembakkam, Chennai	2 768
8 June 2018	Idduki, Kerala	883
13 June 2018	Vijaywada, Andhra Pradesh	4 125
13 June 2018	Begumpet Airport, Hyderabad	3 796
14 June 2018	Dehradun, Uttarakhand	1 386
18 June 2018	Civil Secretariat Srinagar and Amarnath Yatra Route	1 001
20 June 2018	Secretariat, Dispur, Assam	2 295
29 June 2018	Bhopal, Madhya Pradesh	4 474
3 July 2018	Guwahati, Assam	7 252
25 July 2018	Dharamshala, Nahan, Reckon Peo, Chota Shimla, Himachal Pradesh	56 772

The telecom service providers involved in the trial runs were BSNL, Airtel and Reliance Jio.

The agencies involved in the trial runs were the National Disaster Management Authority; the state disaster management authorities of Tamil Nadu, Kerala, Andhra Pradesh, Uttarakhand, Jammu and Kashmir, Assam, Madhya Pradesh and Himachal Pradesh; the India Meteorological Department; State Governments; the Department of Telecommunications; and C-DoT.

During Amarnath Yatra, a total of 200 399 SMS were sent in respect of six different events between 28 June 2018 and 25 July 2018 to customers of BSNL and Reliance Jio through the C-DoT CAP early-warning platform. The SMS contained information about weather conditions so that pilgrims and government authorities could take timely precautionary action. They were also delivered to all Airtel customers using cell broadcast.

(3) Conclusion: experience gained and way forward

The trial run was initially conducted in experimental conditions and later in real conditions. The following observations were made:

- during the actual run of the CAP early-warning system, authorities, agencies and pilgrims responded well, suggesting that the system should be regularly deployed in the future;
- it took considerably longer to send SMS from mobile networks using 2G/3G (20 to 60 minutes) than from 4G networks (3 to 5 minutes);
- efforts are being made to optimize the response times, especially in 2G (which predominates in rural areas) (3G is gradually being replaced by 4G);
- smartphones club message parts if the message size exceeds the prescribed limit; normal phones do not have this facility, and efforts are being made to overcome the issue;
- the trial runs used messages in English only; efforts are being made to introduce vernacular languages for better and effective outreach.

A1.3.3 ICT disaster preparedness (China Telecom, China)[66]

(1) Disaster preparedness

There are many aspects to disaster preparedness.

- Publishing early-warning information: The ability and means to publish disaster warning information must be organized before a disaster occurs. Warnings of imminent danger should reach every customer in the designated area within 10 minutes.
- Making suggestions on the LTE SMS cell broadcasting network, terminal support and deployment, researching the specifications and requirements already in place and deployed on both the network and terminal sides of LTE SMS medium and small cell broadcasting, and putting forward relevant requirements in network planning and construction; sending early-warning information to users through various just-in-time mobile Internet means of communication (such as WeChat) (operator networks interconnected with just-in-time mobile Internet communication systems send early-warning information promptly).
- Carrying out multiple optical cable route deployments, formulating plans to transform the optical fibre cable lines on single routes or vulnerable routes in the light of the damages sustained in recent years. Employing optical fibre cable fast recovery technology such as erbium-doped fibre amplifiers in emergency communication repairs.
- Satellite transmission: scenarios and recommendations regarding the use of Ka high throughput satellites, Ku and C band satellites, various middle and low orbit satellites in emergency communications; using Ka high throughput broadband satellites to provide 4G services to mobile emergency communication vehicles, islands and remote base stations, and engaging in research on the use of Ku and C band satellites for high-definition video transmission and low orbit satellites for satellite IoT.
- Miniaturization and portability of VSAT devices, and scenarios and suggestions for their application in emergency communications: keeping track of the development of miniaturized and portable VSAT devices in various frequency bands and making it possible for a single person to carry the devices on foot to the disaster areas to open up services.
- The application scenarios and recommendations regarding short wave transmission in emergency communications: studying the application of short wave in emergency communications on account of its long transmission distance and strong damage-resistant characteristics.

[66] ITU-D SG2 Document 2/56(Rev.1) from the China Telecommunications Corporation (China Telecom) (China)

- Deployment and testing of 4G/5G in emergency communication vehicles: researching the deployment of 4G equipment and the application of some 5G technologies in emergency communication vehicles. The application of spherical antennas and various new types of antenna in emergency communications has resulted in a multifold increase in capacity or directional transmission distance. Research has also been conducted on emergency communication vehicle-supported IoT applications, namely deploying narrowband-IOT equipment in emergency communication vehicles to support IoT applications.
- Studying the use of various satellite telephones and the application of satellite telephone positioning, data and SMS in emergency communications: The positioning information return, data service and SMS functions of satellite telephony are used to position and rescue people and vehicles in distress beyond mobile signal coverage.
- Researching UAV-borne base stations and the results of application scenario study, testing and field operation of tethered UAVs, wingspan UAVs, airships, helicopter-borne LTE base stations and other equipment in emergency communications: research on providing 4G services with the LTE base stations on board tethered UAVs used wireless ad hoc network devices (mesh) carried by tethered UAVs to examine how to apply the transmission relay to provide fixed and vehicle-borne base station services that are able to recover damaged transmissions and promptly access current networks to deliver 4G services during a disaster. The LTE base station satellite transmission or microwave equipment on board stratospheric airships is able to connect with current networks to offer 4G services to remote areas.
- Researching the use of mesh technology to rapidly re-establish network connections damaged by the disaster and the joint employment of mesh and UAV to commence 4G services: Wireless ad hoc network (mesh) devices serve to quickly open up the last 10 kilometres.
- Studying the specifications of the emergency command and dispatch system based on Internet+ emergency communication, with the system applied in vehicle positioning, disaster warning, resource scheduling, command and dispatch, task management and so on: The emergency vehicle location and tracking function, by providing information on real-time vehicle location, monitoring and control, vehicle status, etc., mobilizes vehicles and personnel in the vicinity to participate in disaster relief efforts as required. The system is able to display specific information on wind, rain, haze and other weather disasters, and on typhoons and earthquakes, collected from professional Internet websites at high frequencies, on the GIS map at different levels, facilitating the deployment of advance personnel with targeted early-warning information to the areas concerned. The emergency task command has put in place flat, streamlined and close-looped process monitoring to keep track of task execution. With the implementation of vehicle/personnel location and tracking, and the adoption of command and dispatch visualization, the system takes overall responsibility for managing emergency personnel, vehicles, equipment/supplies, spare parts, circuits, satellite bandwidth, and so on, thus achieving intensive emergency resource management and optimization of resource allocation, dynamic tracking of resource distribution, a fully controlled and visualized resource allocation process and whole-process management of equipment and other resources.
- Conducting research on sending the disaster scene video back to the command centre or accessing the video via Internet: By way of satellite, 4G and other means, the video of the disaster site is returned to the command centre or accessed through online terminals, personal computers, mobile phones, and so on. Examination and analysis of the quality of video service transmitted by satellite has resulted in indications of the time delay and jitter of image transmission.
- The storage and allocation of emergency supplies such as generators: keeping in reserve all kinds of fuel generator, such as 5 kW light generators, 10-12 kW generators, 30-50 kW generator vehicles, and 100-500 kW large generator vehicles for different application scenarios.
- Drills organized on the basis of real emergency situations: Based on real and simulated emergency scenarios, drills have been conducted of rapid relief team assembly and

dispatch at short notice. The teams provided all kinds of emergency services in designated areas, building a well-trained and skillful corps of relief personnel.

- Training: Establishing training requirements for emergency response personnel and developing graded training content and materials.
- Studying the emergency plan preparation; formulating emergency plans in response to various disaster scenarios, defining the types and focus of the plans and conducting drills accordingly; testing the contingency plans for the command system, circuit scheduling, line repairs, emergency power supply, service launch on board emergency communication vehicles, etc., in the wake of disasters such as earthquakes, typhoons, floods and mudslides in totally cut-off areas.

(2) Disaster mitigation

Disaster mitigation also has a number of different aspects.

- Mitigation of floods: Moving low-lying machine rooms to higher ground, elevating generators and other equipment, adopting protective measures for outdoor equipment before rainstorms.
- Typhoons: Delivering generators and other emergency materials and equipment in advance to disaster areas.
- Building a robust disaster fighting network based on the disaster damage data collected over the years.

(3) Response

Disaster response also comprises a number of different aspects.

- The process of making use of the mobile phone positioning function to rescue trapped people; selectively calling and positioning mobile users in disaster areas; sending the relevant information to the rescue team to facilitate relief efforts.
- Conducting big-data analyses through mobile network-related network management and based on customer information (i.e. of damage location, number of victims and/or damage/impact/repairs), and informing the relevant government agencies of the results for use in disaster relief command.
- Following the emergency plan to rapidly restore communication services in disaster-stricken areas.

A1.3.4 Implementation of emergency alerts (Brazil)[67]

(1) Model implemented

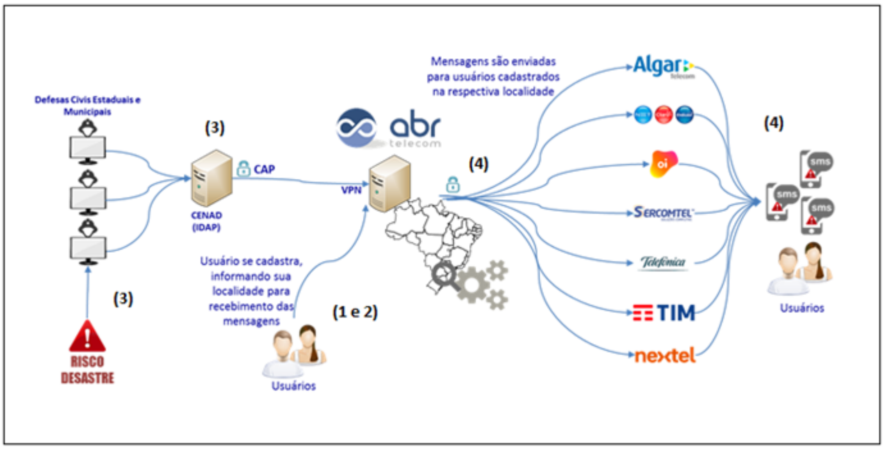
The working group of the main stakeholders in the process (regulatory agency, telecommunication operators and civil defence organizations, represented by national and some state bodies) decided to prioritize the delivery of alerts to mobile phone users, who are more numerous than pay-TV costumers.

The regulations do not limit the technological possibilities that can be used in emergency situations, and the working group judged that the technology with the greatest reach, considering the terminals used by the Brazilian population, would be SMS, which could be implemented more quickly and at lower costs, without prejudice to future developments in other technologies such as cell broadcasting.

[67] ITU-D SG2 Document SG2RGQ/33 from Brazil

The first step taken by the working group was to establish the process (see **Figure 21A**).

Figure 21A: Establishment of the process to send SMS alerts



Legend:
Defensas civis estaduais e municipais: State and municipal civil defence
Risco desastre: Disaster risk
Usuário se cadastra, informando sua localidade para recebimento das mensagens: Users register, indicating their location for receiving messages
Usuários: Users
Mensagems são enviados para usuários cadastrados na respective localidade: Messages are sent to registered users in the location concerned
(1 e 2): (1 and 2)

The procedure consists in identifying an imminent disaster, mapping the area at risk and determining the content of the message to be sent. Then civil defence organizations access a web portal to record the event and request delivery of the message. The system platform receives the request and identifies operators in the region at risk and consumers enabled to receive the messages, which are then triggered by a concentrator agent (ABR) contracted by the operators for that purpose (broker).

The process has four main steps:

1) the campaign: inform the population that the alert service will be available in a given region, and make available to the interested parties the option of joining the service;
2) registration and emergency database: build a database of the cell phone numbers of the people interested in receiving civil defence alerts, using the postal code(s) of the places indicated during the registration process;
3) Civil defence alert: determine the region at risk, the submission period and the text of the alert message to be forwarded;
4) Alert message: the IDAP system (public alert interface) and the web portal automatically send registered alerts to the concentrator agent, which uses the database to convert the georeferenced polygon into a list of terminals for the alert message (based on the postal codes in that polygon) and each user's mobile operator.

Before the process could be implemented nationally, it was important to test the platform and the communication protocols between the various civil defence agents and telecommunication operators. Functional tests were thus conducted in 20 municipalities of Santa Catarina state starting on 7 February 2017 and in five municipalities of Paraná state starting on 13 June 2017. On 16 October 2017, the service began to be expanded first to all municipalities of those two states, then to other states, according to the schedule indicated in **Table 2A**.

Table 2A: Schedule for deployment of the emergency alert model

Start data	State/federative unit
16 Oct. 2017	Santa Catarina and Paraná (other municipalities)
16 Nov. 2017	São Paolo
18 Dec. 2017	Rio Grande do Sul, Rio de Janeiro and Espírito Santo
15 Jan. 2018	Minas Gerais, Matto Grosso do Sul and Goiás
19 Feb. 2018	Distrito Federal, Matto Grosso and Tocantins
19 March 2018	Bahia, Sergipe, Alagoas, Pernambuco, Paraíba, Rio Grande do Norte, Ceará, Piauí, Maranhão, Pará, Amapá, Acre, Amazonas, Rondônia and Roraima

One of the aspects of great importance for successful implementation was how the population was informed, with the regulatory agency taking active steps to distribute the schedule and forms of operation through national and local media. Whenever the service was about to expand to a particular federative unit, the agency repeated its communication with the local media for the entire population.

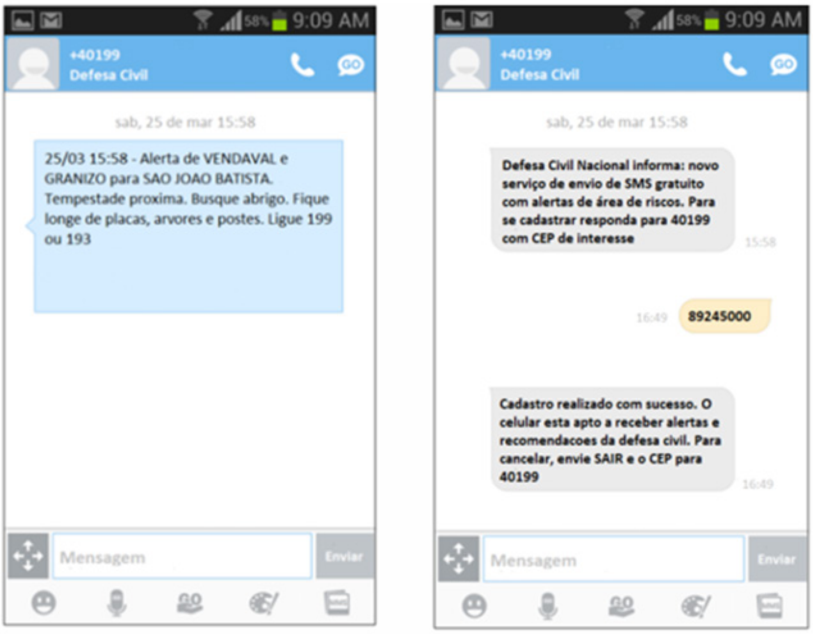
The service is free, so messages can be sent and received even if the user's phone has no credit or Internet access – suffice it for interested people to register to receive emergency alerts.

One of the project's limits is that users have to first register. This can be done in one of two ways:

1. When the service is provided in a municipality, the users of that municipality will receive a text message (SMS) from the number 40199 inviting them to register. In this case, the user simply responds to the message with the postal code(s) of their regions of interest. There is no limit to the number of individual postal codes per user.
2. Users who do not receive the text message (SMS) informing them about the start of the registration phase can, at any time, send a text message (SMS) to the number 40199 with the postal codes of interest.

In both cases, the user will receive a reply via text message (SMS) indicating if the registration was successful. The process is illustrated in **Figure 22A**.

Figure 22A: Registration and sending of alerts to citizens



(2) Civil defence organizations

In Brazil, disaster monitoring and preparation activities are headed by the Ministry of National Integration, whose National Centre for Risk and Disaster Management (CENAD) receives and consolidates information from various federal government agencies responsible for forecasting weather and temperature; assessing geological conditions in hazardous areas; monitoring the movement of tectonic plates; monitoring river basins; controlling forest and other fires; and transporting and storing hazardous products.

The agencies concerned include the National Centre for Natural Disaster Monitoring and Alerting, the Brazilian Geological Survey, the Brazilian Institute for the Environment and Renewable Natural Resources, the National Agency of Water, the Brazilian Intelligence Agency, the Centre for Weather Forecasting and Climate Studies, the National Institute of Meteorology, the Centre for Amazonia, the Armed Forces and other organizations of the Federal Executive Branch.

The data are evaluated and processed at the CENAD and forwarded to the civil protection and defence organizations of at-risk states and municipalities.

Law No. 12,608/2012, on the National System for the Protection of Civil Defence, establishes the roles of the union, states and municipalities in terms of national protection and civil defence policy. The result is a trustworthy ecosystem of public institutions and a set of voluntary initiatives integrating the common goal of preventing and mitigating the effects of natural disasters.

In disaster situations, the response is usually coordinated by the local civil defence agency; all those involved must act jointly, hence the need for local bodies to be well structured.

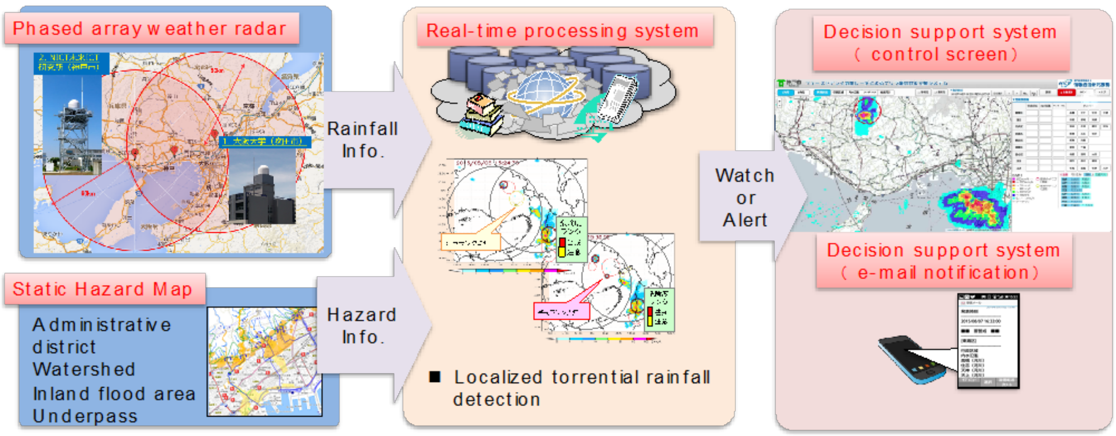
Further studies should include contributions or suggestions from Question 5/2 participants about the types of early-warning system used by developing countries and how to provide services to citizens and visitors (international and regional), so that they receive early-warning messages.

A1.3.5 Early warning and the collection of disaster information (NICT, Japan)[68]

(1) Torrential rainfall short-term early warnings using phased array weather radar

An increase in localized torrential rainfall events has recently been observed in urban areas in Japan. To prevent the damages caused by this kind of event, the NICT has developed phased array weather radar (PAWR). PAWR can observe three-dimensional rainfall information (radar reflectivity and Doppler velocity) every 30 seconds. It can therefore detect locally and rapidly developing cumulonimbus at an early stage. The NICT has also developed a system to monitor localized torrential rainfall using the early detection algorithm of baby rain cells. The cells are first extracted using three-dimensional radar reflectivity. The target area is covered by two PAWR, so it is less susceptible to rain attenuation. Secondly, the vertical vorticity in the baby cell is calculated using the Doppler velocity. Finally, a cell with a vertical vorticity above a threshold value is determined to develop into heavy rainfall on the ground. For the decision-support system, a dynamic hazard map (see **Figure 23A**) with location-dependent degree-of-risk information is produced by integrating the early detection of baby rain cells into the localized torrential rainfall and local static hazard map. The dynamic hazard map is displayed on the control screen and the warning information distributed by e-mail to a limited number of authorized staff. Real-time demonstrations were conducted in Kobe between August and October 2016. The entire system is operated using SNS data stripped of private information purchased by the NICT from third parties.

Figure 23A: Example of a dynamic hazard map produced using the PAWR

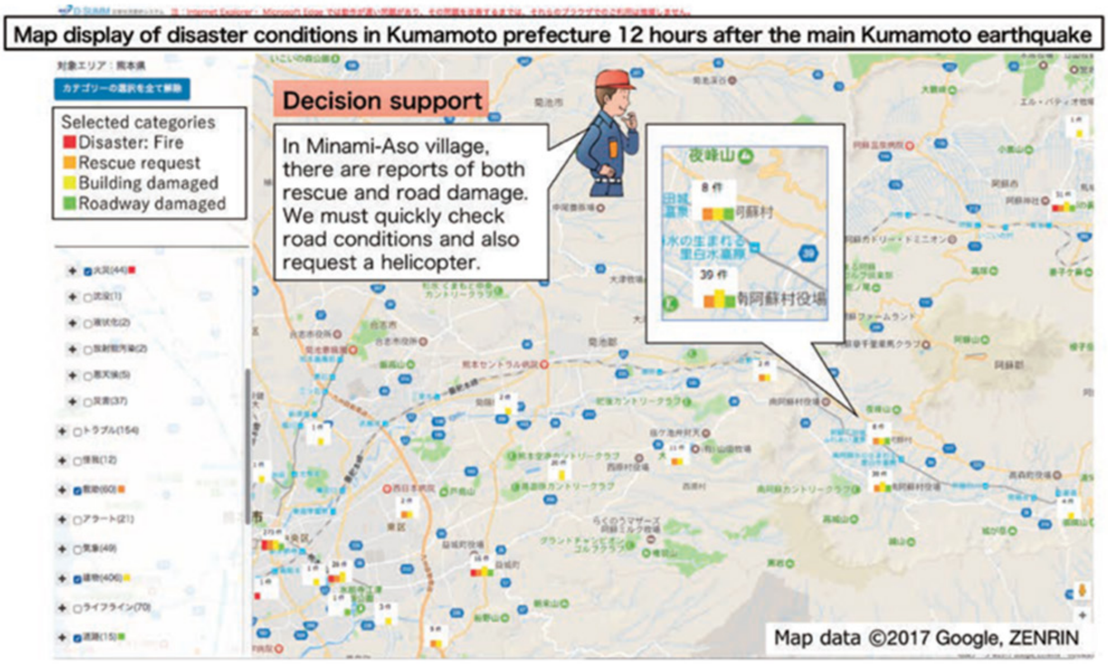


(2) Disaster data analytics systems

The NICT has developed two data analytics systems: the Disaster information SUMMarizer (D-SUMM) and the DISaster information ANAlyser (DISAANA) (for information on what the systems do, see **Section 3.6** of this report). The systems are used to obtain an overview of disaster conditions, as shown on the map in **Figure 24A**.

[68] ITU-D SG2 Document SG2RGQ/60 from the National Institute of Information and Communications Technology (NICT) (Japan)

Figure 24A: Example of an evacuation map generated by D-SUMM



A1.3.6 Advanced early-warning technologies (Japan)[69]

(1) Background

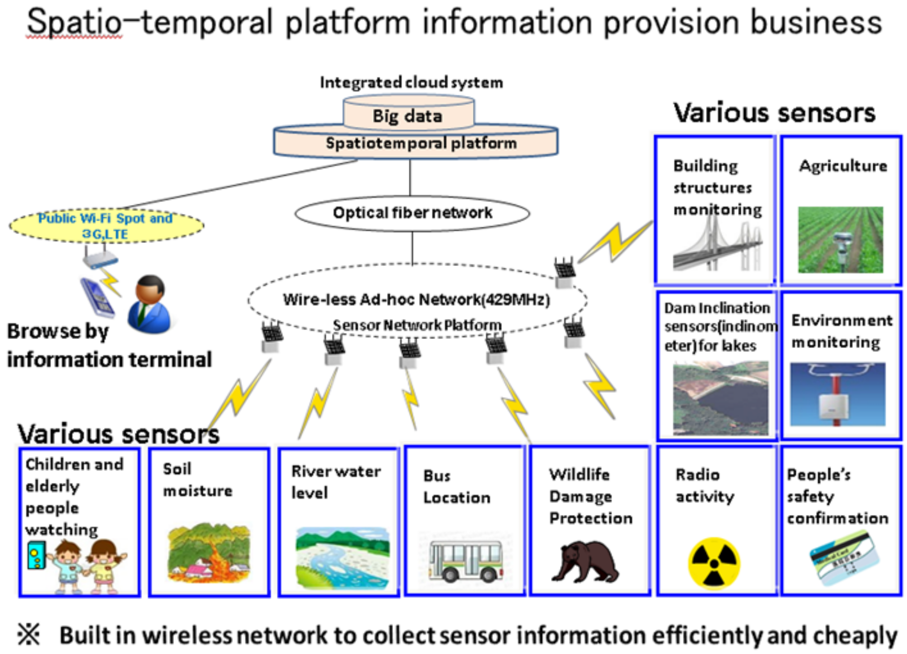
In 2000, Shiojiri municipality started to build an autonomous optical fibre network of 90 km (later extended to 130 km) and 75 public facilities in the city are now connected by gigabit ether network. The network is interconnected with upper-layer service providers. The municipality then established an information and incubation plaza for the IT-literate population. It built a low-power wireless area network with an ad hoc network configuration at 429 MHz. The 640 wireless repeater stations distributed are powered by solar panels and self-sustaining, thanks to their low cost and efficiently interconnected IoT sensors.

Japan is one of the first countries to experience a fall in population numbers and a declining birth rate – a serious and accelerating social phenomenon. In the coming 50 years, the population's age composition will change again, a source of further social concern. The effect on the country's rural municipalities is remarkable. The aim of building a smart society using ICT is to improve the lives of rural community dwellers and thus help suppress migration from rural to urban areas or even promote migration in the opposite direction. The IoT sensor network is partially government subsidized; Shiojiri has promoted the development of ICT-related devices and application software by small and medium-sized enterprises and the region's academic institutions (university, college and technical high school), establishing an incubation plaza where they can collaborate on ICT development. It recently invested in building a network of IoT sensors (see **Figure 25A**) that reaches every corner of the region and automatically collects environmental data that are then exchanged among the organizations concerned for the benefit of community dwellers. In order to meet individual household and ICT network power demands, Shiojiri invested in a biomass power plant to supply low-cost, eco-friendly and carbon neutral power to the region's 67 000 residents. The investment will contribute to

[69] ITU-D SG2 Document SG2RGQ/28+Annex from Japan

regional socio-economic development in the forestry and related industries, and create job opportunities. It is expected to drive a marked improvement in the quality of life of the region's residents in the coming years.

Figure 25A: Shiojiri's environmental information data-collection platform and IoT sensor network



a) Watching children and elderly people

The network of sensors watches and locates children going to and from school and elderly people walking outside in remote communities, detecting the signal emitted by the active tag with embedded button battery that they carry.

b) Soil moisture

Sensors detect soil moisture content at 20-cm increments to predict landslides or mudslides. They send out alerts when the moisture level exceeds the threshold or safety announcements when the level goes down.

c) River water level

Sensors measure the water level of lakes and rivers. They send out alerts when the water level exceeds the threshold, so that the community can evacuate to a shelter before being hit by floods or debris.

d) Bus location

Sensors inform users of the location of buses on routes through the city every 30 seconds. In remote areas of Shiojiri, buses run every one or two hours, so this service is for the convenience of residents in remote areas.

e) Wildlife damage protection

Sensors are used to protect villagers or farmers in rural and remote areas in the suburbs of Shiojiri from wildlife such as boar and monkeys. They detect wildlife movements with a view to reducing the damages the animals cause.

f) Radioactivity

The network of sensors protects people from radioactive pollution by detecting the level of aerial radioactivity in the city.

g) Safety confirmation

Sensors locate residents when they evacuate to community shelters and compile the number of people in each shelter, confirming their safety to family and relatives.

h) Structure monitoring

Sensors monitor the age deterioration of public structures, in particular bridges, detecting abnormalities in their characteristics with a view to taking measures to suppress further deterioration.

i) Agricultural sensors

Sensors track the long-term behaviour of farmers, and agricultural and environmental data such as temperature, humidity and solar radiation, which may be useful for predicting massive insect infestations. They store expert agricultural know-how in digitized format, so that it be easily passed on to new farmers.

j) Dam inclination sensors (inclinometer) for lakes

Sensors record the micro inclinations of dam lakes over the long term; the digitized difference may indicate a dangerous change resulting in the dam bursting.

k) Environment monitoring

The environmental data such as temperature, humidity, wind direction, wind speed, solar radiation and rainfall obtained from the sensors can be digitized and stored in the cloud, for use in combination with other data.

(2) Platform for analysis of unique data collected from various IoT sensors

The unique data collected can be analysed in combination with other data obtained at other times and locations to obtain valuable information of importance for regional economic development.

(3) Case studies

a) Data such as temperature, humidity and solar radiation can be used to predict insect infestations or to reduce the amount of agricultural chemicals needed. Indeed, it may be possible to reduce pesticide use by at least one-fifth, thus lowering costs and easing environmental destruction.

b) The conventional method of gauging the risk of mud- or landslides was to draw on expert knowledge of rainfall amounts and duration. Now that soil moisture levels are detected by IoT sensors, alerts can be sent automatically to the Shiojiri municipality risk manager when the level exceeds a certain digital value. The alerts can be switched on/off automatically and accurately.

c) In the past, it was difficult to predict serious frost damage to crops. Thanks to the IoT sensor network, however, frost warnings can now be issued according to temperature and moisture levels at the sites.

A1.3.7 Emergency alerts using the Tuibida service (China)[70]

(1) Background

Because they provide the widest coverage and most effective means of reaching subscribers, mobile intelligent terminals are the most important channels for delivering emergency alert messages. As major methods of reaching target groups via terminal devices, SMS and push notifications still pose problems. While they may be highly reliable in terms of real-time messaging, SMS can only transmit text messages containing a limited number of characters and no audiovisual content; they also feature deep service entrance, and emergency alerts sent by SMS are very likely to be buried in large amounts of junk text messages. While push notifications can initiate the relevant application, pushing value-added information such as excavation maps or weather trends to subscribers, the sending of emergency alerts is affected to some extent by issues such as low reachability and a low rate of real-time delivery.

Developed jointly by the China Academy of Information and Communications Technology with China Unicom, China Mobile and China Telecom, the Tuibida service delivers the push experience via highly reliable signalling pathways provided by telecom operators. Tuibida is based on the signalling network and features capabilities, such as Quick Apps (click-to-run services, including Google's instantApp/PWA), installed on the terminal device. If the app has not been installed on the terminal device, the service offers the click-to-run function instead, ensuring that subscribers can obtain the relevant service by pushing the Tuibida notification on the terminal device.

(2) Tuibida helps deliver emergency alerts

By integrating Tuibida into the distribution of emergency alerts, longstanding problems in the delivery of emergency alerts, such as monotonous text messaging, a lack of interaction and follow-up service, and insufficient use of the capabilities of the subscriber's terminal device, can be fixed. Use of Tuibida can accelerate the transition from distributing simple text messages to emergency alert services based on mutual interaction.

Message reliability ensured by signalling and pathways

The Tuibida service employs highly reliable signalling pathways to push messages. In contrast to conventional push notifications, Tuibida has some obvious advantages. Close cooperation with telecom operators can ensure instantaneous information delivery. By classifying information so as to give emergency alerts high priority, and by connecting to the relevant signalling pathways of telecom operators, critical/red alerts can be distributed in timely fashion.

From message delivery to reaching the target audience

Currently, emergency alerts are distributed mainly via SMS text messages. One weakness of SMS is that they can only deliver text messages, whereas emergency-related services often have

[70] ITU-D SG2 Document 2/157(Rev.1) from China

more valuable information to deliver to the subscriber, e.g. an excavation map in the case of an earthquake, the scope of a tsunami or the path of a typhoon.

Tuibida has a 100 per cent delivery guarantee and, thanks to better integration with instant apps, can trigger the clink-to-run function when an app is not installed on the subscriber's device. Subscribers will thus not only be informed of upcoming disasters or emerging events as they happen, they will also be provided with a variety of useful information in real time. This can have a big impact in terms of maintaining social order and strengthening public confidence in the area when a disaster or emergency happens.

From one-way broadcast to two-way interactions

At present, the distribution of emergency alerts is mainly based on one-way broadcasts. In an enduring disaster, however, two-way interaction is of huge importance, as it will not only provide substantial support for more accurate delivery of emergency alerts in follow-up efforts, it will also help subscribers help themselves. For example, conventional SMS cannot provide feedback on location information. In contrast, since the Tuibida service can invoke the QuickApp, it can obtain the subscriber's location information during an emergency and provide support for rescue efforts by fully utilizing the capabilities of the subscriber's terminal device. Such two-way interactions are of great value and significance with respect to disaster assistance and emergency relief operations.

A1.3.8 The status of remote-sensing activities (United States)[71]

(1) Early warning and prevention

Early warning and prevention include:

- disaster prediction, including the acquisition and processing of data concerning the probability of future disaster occurrence, location and duration; and
- disaster detection, including the detailed analysis of the topical likelihood and severity of a disaster event.

Meteorological aids, meteorological-satellite and Earth exploration-satellite services play a major role in activities such as:

- identifying areas at risk;
- forecasting weather and predicting climate change;
- detecting and tracking earthquakes, tsunamis, hurricanes, forest fires, oil leaks, etc.;
- providing alerts/warning information of such disasters;
- assessing the damage caused by such disasters;
- providing information for planning relief operations; and
- monitoring recovery from a disaster.

These services provide useful if not essential data for maintaining and improving the accuracy of weather forecasts, monitoring and predicting climate change, and furnishing information on natural resources. The frequencies used by these services and their associated applications are summarized in Table 1 of Recommendation ITU-R RS.1859.

[71] ITU-D SG2 Document SG2RGQ/150 from the United States

On-the-ground, at-the-spot (in situ), at-the-time measurements or observations are usually more precise and more accurate than similar observations made from space. These kinds of observations are known as "ground truth" and are used to calibrate space-borne instrumentation. However, when in situ instrumentation or the supporting infrastructure needed to use such instrumentation is not in place or has been disabled by the disaster, or the ground measurements are not accurate enough, space-borne observations can provide useful information for alleviating the effects of disasters. Space-borne observations are particularly useful in vast areas with low population densities, and when the technical infrastructure is vulnerable or not well developed.

(2) ITU-R activities

Recommendation ITU-R RS.1859 has been revised to add examples of how space-borne sensors can help identify areas at risk by using synthetic aperture radar (SAR)-generated digital elevation models to locate low areas subject to flooding, or by using SAR-generated bathymetry to identify ocean bottom structure that might worsen an incoming tsunami or storm surge. It also demonstrates how satellite-based remote sensors have proven useful in providing an overall assessment of drought conditions or have identified nearby, previously unrecognized areas having much better-than-average crops. Such information enabled quick yet inexpensive relief to be provided, since transportation time and costs were minimized (i.e. using nearby trucks instead of distant airplanes). After a major earthquake, the sooner an accurate damage estimate is made, the sooner the appropriate rescue assets can be mobilized. Interferometric SAR (InSAR) observations pinpoint the location of earthquake epicentres far more accurately than remote seismographs, thus enabling more precise damage estimates on which to base relief efforts. Recent launches of fleets of SAR-equipped satellites (COSMO-SkyMed (ASI), TDX and TSX (DLR), the Sentinel–1 series (ESA), and the upcoming RADARSAT constellation (CSA)) have made these assessments more readily available than in the past. Precipitation radars flown on NASA's Global Precipitation Mission provide 3-dimensional images of the rainfall from severe storms. The mission includes passive instruments which provide complimentary storm information extending beyond the swath of the radar.

Table 3A indicates for which type of disaster a particular technology may provide useful data.

(3) Obtaining remote-sensing data

To gain the maximum benefit from remote-sensing data, a local emergency management agency is needed to direct the appropriate information to people in the field who need it. UN-SPIDER is focused on helping nations develop the capacity to manage disasters. While UN-SPIDER helps organize relief organizations and train their personnel, other organizations are more data-oriented.

The WMO Observing Systems Capability Analysis and Review Tool includes a table showing all known past, current and future satellites for meteorological and Earth observation purposes. The table can be used to identify additional sources of data.

Another source of analysed remote-sensing data is UNOSAT, a United Nations programme created to provide the international community and developing nations with enhanced access to satellite imagery and GIS services.

Table 3A: Satellite-based technologies for managing natural disasters

Objective / Technologies	SAR Imagery	In SAR Imagery	Active microwave imagery	Radar altimetry	Radar scatterometry	Precipitation radar	GPS radio occultation	Passive microwave imagery	Passive microwave sounder	Geographic visual and infrared imagery	Optical imagery	Multispectral optical imagery	Infrared imagery
Coastal hazards	X										X		
Drought	X		X	X	X			X		X	X	X	
Earthquakes	X	X					X				X		
Extreme weather					X	X	X	X	X	X	X		
Floods	X		X		X	X	X	X	X		X		
Landslides	X	X									X	X	
Ocean pollution	X											X	
Pollution											X	X	
Sea/lake ice	X							X			X		
Volcanoes	X	X						X			X	X	X
Wildland fires								X			X	X	X

A1.3.9 Monitor and accurately predict the path of cyclones (India)[72]

(1) Background

India has adopted a "Zero Casualty" policy to the management of disasters like cyclones, and its federal and state governments are now better prepared in terms of early-warning systems, evacuation plans, rescue and rehabilitation. Disaster drills help prepare for disasters, but the real test comes only when disaster actually strikes, in all its fervour and intensity. Recently, in May 2019, an extremely severe cyclone, Fani, struck Odisha state, on India's eastern coast. It was almost as severe as the "super cyclone" that hit the same state in 1999, killing more than 10 000 people. In the last two decades, India has prepared well to deal with disasters, including cyclones. As a result, Fani caused only 64 fatalities, despite its intensity. The United Nations Office for Disaster Risk Reduction praised the accuracy of the India Meteorological Department's early warnings, which helped the authorities in Odisha evacuate people and minimize the number of deaths.

(2) Cyclones/hurricanes/typhoons

Cyclones, hurricanes and typhoons are types of storms caused by atmospheric disturbances, wherein the air rotates cyclically around a low-pressure centre called the "eye". In the northern hemisphere, winds rotate counter-clockwise, and in the southern hemisphere, clockwise. Cyclones of variable intensity are born almost every year in the seas off India, during the months of June and July. Fani occurred in May, which is rare.

[72] ITU-D SG2 Document SG2RGQ/147 from India

Cyclonic disturbances are classified depending on the wind speed around the centre. Satellite imagery of clouds and other meteorological features is used to estimate the intensity and wind speed of these intense systems. Satellite cloud configurations, expressed as "T" numbers, have a unique relationship with the wind field of a cyclonic disturbance. **Table 4A** below shows the categories of cyclones. The strong winds, heavy rains and large storm surges associated with tropical cyclones are the factors that eventually lead to loss of life and property.

Table 4A: Categories of cyclonic disturbances

Categorisation of Cyclonic Disturbances

S. No.	Intensity	Strength of wind Satellite	'T' No.	condition of Sea	Wave Height (m)
1	Depression (L)	31- 49 kmph (17-27 knots)	1.5	Moderate to Rough	1.25-2.5 2.5-4.0
2	Deep Depression (DD)	50 – 61 kmph (28-33 knots)	2.0	Very Rough	4.0-6.0
3	Cyclonic Storm (CS)	62 – 87 kmph (34-47 knots)	2.5-3.0	High	6.0-9.0
4	Severe Cyclonic Storm (SCS)	88-117 kmph (48-63 knots)	3.5	Very High	9.0-14.0
5	Very Severe Cyclonic Storm (VSCS)	118-166 kmph (64-89 knots)	4.0-4.5	Phenomenal Over	14.0
6	Extremely Severe Cyclonic Storm (ESCS)	167-221 kmph (9--119 knots)	5.0-6.0	Phenomenal Over	14.0
7	Super Cyclonic Storm (SuCS)	222 kmph and more (120 knots and more)	6.5 and more	Phenomenal Over	14.0

Source: http://www.rsmcnewdelhi.imd.gov.in

(3) Early-warning models adopted by the Indian Meteorological Department

The India Meteorological Department translates observational data into numerical weather prediction models. The information is collated and analysed with that of other countries. The Department refers to 10 different numerical models every day. These models ingest the current observations and are applied in different physical principles and mathematical equations. With the help of high-powered computing systems, experts solve and analyse these equations to obtain actual observations. They then issue a prediction for different days. Forecasters go through all the models developed every day to find out whether any low-pressure system is developing anywhere offshore. Based on the observations, scientists discuss the models and arrive at a consensus and then decide to issue warnings and predictions. Warnings have the following components: warning generation; warning product presentation; warning dissemination; coordination with emergency response units; post-event review; pre-season exercise; and public education and outreach.

(4) Four-stage warnings for states

Warnings are issued to states in a cyclone's path in four stages.

The first-stage warning, the **Pre-Cyclone Watch**, is issued 72 hours in advance. It warns that a cyclonic disturbance is developing in the Indian Ocean/seas.

The second-stage warning, the **Cyclone Alert**, is issued at least 48 hours in advance of the expected commencement of adverse weather over the coastal area. It contains information on the location and intensity of the storm, its likely direction and intensity, coastal districts likely to experience adverse weather and advice to fishermen, general public, the media and disaster-management agencies. It is issued by the Area Cyclone Warning Centres (ACWCs), Cyclone Warning Centres (CWCs) and Cyclone Warning Divisions (CWDs) concerned.

The third-stage warning, the **Cyclone Warning**, is issued at least 24 hours in advance of the expected commencement of adverse weather over the coastal area. The point of landfall is forecast at this stage. Third-stage warnings are issued by the ACWCs, CWCs and CWDs at three-hour intervals, giving the cyclone's latest position and intensity, the likely point and time of landfall, associated heavy rainfall, strong wind and storm surge, along with information on potential impact and advice to the general public, the media, fishermen and disaster managers.

The fourth-stage warning, the **Post-landfall Outlook**, is issued by the centres at least 12 hours in advance of the expected time of landfall. It gives the cyclone's likely direction after landfall and indicates the adverse weather likely to be experienced in the interior.

Different colour codes are used to denote the stages of cyclone warning bulletins. Cyclone alerts are **yellow**, cyclone warnings are **orange** and post-landfall outlooks are **red**.

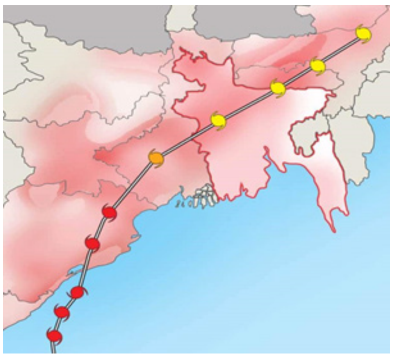
(5) ICTs used to issue early warnings in India

The following ICTs are used to send early-warning information: mobile phones, VSATs, satellite phones (Inmarsat), interactive voice response systems, LAN and virtual private networks, radio, TV, web media, loudspeakers and the national knowledge network.

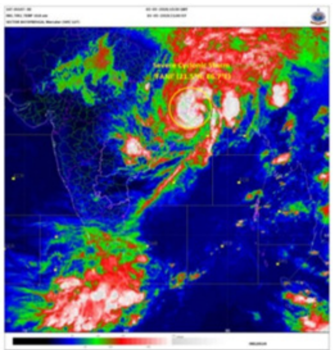
(6) Cyclone Fani

Cyclone Fani, a rare summer cyclone in the Bay of Bengal, hit eastern India on 3 May 2019. It was one of the strongest cyclones to reach India in the last 20 years. Fani was an Extremely Severe Cyclonic category storm. It crossed the temple town of Puri in Odisha state (see **Figure 26A**) at a speed of 175 to 185 km/h, gusting to 205 km/h, resulting in widespread loss of property. The fact that loss of human lives and livestock was significantly reduced can be credited to a number of things: the effective early-warning system; the availability of adequate infrastructure; the timely evacuation of millions of people; better coordination between federal and state governments; the deployment of national disaster relief forces; India's Zero Casualty approach; and the Meteorological Department's improved model for predicting cyclone paths and landfall accurately and with minimum errors.

Figure 26A: Cyclone Fani



(a) Path of Cyclone Fani



(b) Winds along the path

(7) Steps taken to reduce loss of lives during Cyclone Fani

As mentioned above, the Government's Zero Casualty approach to natural disasters and the improved accuracy of the India Meteorological Department's early-warning system helped reduce the number of deaths during Cyclone Fani.

A record 1.2 million people (equal to the population of Mauritius) were evacuated in less than 48 hours, and almost 7 000 kitchens, providing food for 9 000 shelters, were made functional overnight. This mammoth exercise involved more than 45 000 volunteers. Thanks to this timely action, Fani resulted in about 60 fatalities.

(8) Comparison with other cyclones/hurricanes

The statistics are striking when compared to the impact of big weather events around the world. When Hurricane Maria hit Puerto Rico in 2017 with wind speeds of 175 miles per hour, it caused a death toll of 2 975. The same year, Hurricane Harvey struck Texas with winds of 130 mph, causing devastating flooding. Texas reported USD 125 billion in damages and at least 68 direct storm-related deaths. Cyclone Idai hit Mozambique in March 2019; after it ripped through Madagascar, Malawi and Zimbabwe, more than 1 000 people were feared dead.

Thus, Odisha's ability to put such an effective disaster-management plan in place and save thousands of lives is a template that the world can learn from.

(9) Key takeaways from the Fani response

Build relief infrastructure and establish a clear command-and-control structure

Until 1999, when it was hit by a super cyclone, Odisha did not have a well-laid-out plan for disaster management. Two months after the cyclone hit, the Odisha state Disaster Management Authority was set up and plans put in place. Around 900 cyclone shelters were built in vulnerable pockets of the state, with systems in place for the evacuation of hundreds of thousands of people.

There is a clear command-and-control structure for disaster relief and there are clear protocols in place for carrying out relief operations. These were successfully used in the response to Cyclone Phailin in 2013 (a storm five times the size of Hurricane Katrina), Cyclone Hudhud in 2014 and Cyclone Fani in 2019.

Accuracy of early-warning systems

The India Meteorological Department has built an effective service able accurately to predict when a cyclone will form in the Bay of Bengal and when it will make landfall along India's coastline. This early-warning system promotes disaster readiness and minimizes loss of lives. It is then crucial that people follow the protocols in place when the warnings come in.

Clear communication plan

Roughly 6.5 million text messages were sent to locals and farmers in clear language before Cyclone Fani hit, alerting those potentially affected. People were repeatedly advised over all media not to panic and given clear "do and don'ts". This helped in the record evacuation of 1.2 million people to safe buildings.

Effective coordination of groups

Preparations to fight the onslaught of Fani involved a number of government agencies, local community groups and volunteers working together. The government's disaster-response forces were pre-positioned in vulnerable locations and food packets were made ready for air force helicopters to drop to people. Senior state officials and police officers were sent to the districts affected to coordinate the efforts of various agencies.

A1.3.10 Alert and warning systems (United States)[73]

(1) Introduction

Mitigation is the effort to reduce loss of life and property by lessening the impact of disasters.[74] Timely and effective alert and warning systems strengthen mitigation and community resilience by informing citizens of risks they may face and recommended actions to save lives and protect property. Development of better alert and warning capabilities helps to mitigate hazards and lessen the impact of disasters.

Proper authorities, policy and governance are critical foundational elements for the development of an alert and warning system, especially to prioritize personnel and resource justifications. The United States established the IPAWS as a unique, multi-hazard, multi-user alert and warning infrastructure that the US Federal Emergency Management Agency (FEMA) makes available for use by its constituents – federal, state, local, tribal and territorial entities – across the country. The IPAWS uses technology and information standards to join multiple private sector communication technology infrastructures, providing the ability to deliver a single emergency message simultaneously to multiple public dissemination pathways (e.g. radio, TV, mobile devices and Internet-connected systems, websites and applications). Authorized public Alerting Authorities (AAs) draft tailored messages to send alerts and warnings to citizens, residents and visitors in their jurisdiction. Using the IPAWS helps the constituent AAs to communicate information about an emergency situation to the greatest number of people in the shortest amount of time by leveraging local private sector ICTs to disseminate alerts and warnings. Distributing the same message across multiple sources increases the likelihood that people will receive it and will take timely action consistent with the threats or emergency situation.

FEMA's IPAWS Programme Management Office works to sustain and enhance the platform's unique abilities by continuously interfacing with industry to track and ultimately develop or interface new and emerging ICTs and thus expand the number of systems available for distribution of alerts and warnings using the same standards-based format (electronic road signs, sirens, smart kiosks, etc.). This is done by working hand-in-hand with the Federal Communications Commission (FCC), the United States regulatory body, and private industry partners. To date, this alliance has enabled the IPAWS to help over 1 300 AAs send emergency messages to the public using radio, television and cell phones in the United States.

(2) The IPAWS architecture

The IPAWS architecture was and is designed to support interoperability with any alert and warning system in the nation that employs the same standards. IPAWS-OPEN is the infrastructure that routes authenticated alert and warning messages to the public using the radio and television

[73] ITU-D SG2 Document SG2RGQ/152+Annex from the United States
[74] United States Government. FEMA. FEMA's Mitigation Directorate fact sheet.

systems in the Emergency Alert System, Wireless Emergency Alerts to cell phones, NOAA Weather Radios and other communication systems.

The first critical step in initiating this design solution was to use the CAP and other technical standards. When alert and warning services are made CAP-compliant and integrated with the IPAWS, the platform acts as a mediator, authenticating messages from authorized users disseminating authentic emergency information to people in a specific geographic area quickly through multiple dissemination pathways. Information from a single source about a single incident can thus reach the public via radio, television, wireless phones, Internet services and future CAP-compliant IPAWS-connected technologies. The standards-based approach enables a national alert and warning architecture to adapt to and leverage future technologies. Making use of multiple dissemination pathways for public alerts significantly increases the likelihood that the message will reach its target. In addition, disseminating a single CAP alert message simultaneously via multiple pathways reduces the time needed to send alerts and the workload on emergency managers, who would otherwise have to prepare and send multiple separate channel-specific formatted alerts. The IPAWS standards-based approach speeds the delivery of critical, life-saving information.

Use of the open CAP standard enables industry partners (i.e. Internet, carriers, software vendors, broadcast) to develop technology and/or devices that can be used by individuals with disabilities, and others with access and functional needs, to receive alerts and warnings. Thanks to standards-based interoperability, the CAP enables the transport of rich multimedia attachments and hyperlinks in all alert and warning messages. The IPAWS adopted the Emergency Data Exchange Language (EDXL) CAP, which is developed and maintained by the Organization for the Advancement of Structured Information Standards (OASIS). It continues to work with the OASIS Standards Committee to adapt changes to the CAP standard specifications for IPAWS-OPEN. The current system utilizes the CAP v1.2 Standard and the CAP v1.2 IPAWS USA Profile v1.0. The IPAWS does not provide an alert origination tool; instead, it works with more than 25 different alert origination tool vendors to ensure that their products are compliant with the CAP v1.2 Standard and United States profile specification. Constituent AAs can find the tool that best fits local operations. The IPAWS engages and provides training to AAs and tool vendors, and encourages them to adopt the system for their alert and warning needs.

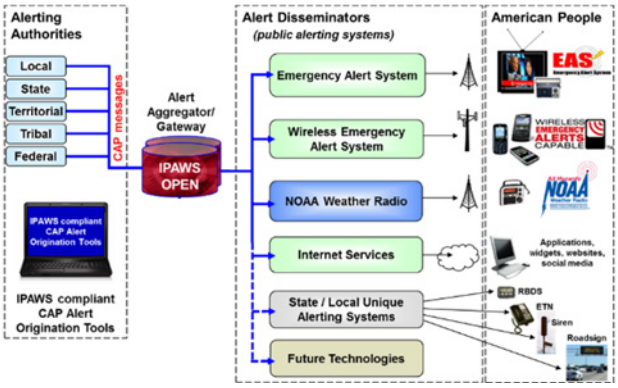
Together with the Alliance for Telecommunications Industry Solutions (ATIS), a United States-based technical and operational standards and solutions development organization for the ICT industry, the IPWAS developed and adopted standards used for wireless emergency alerts in the United States. ATIS addresses common, critical priorities and shares resources, efforts and costs to develop large-scale, interoperable solutions. It is accredited by the American National Standards Institute. The IPAWS actively participates in ATIS meetings with cellular service providers and partners to continuously update wireless emergency alert capabilities.

The IPAWS liaises and collaborates with relevant professional associations, including the National Association of Broadcasters, the NCTA Internet & Television Association (formerly the National Cable & Telecommunications Association), the National Emergency Management Association and the International Association of Emergency Managers. In addition to working with standards institutes and various associations, the IPAWS, in coordination with FEMA headquarters, actively engages with the FCC and Congress to update laws and regulations and thus improve alert and warning capabilities. It worked with committees of the National Research Council and The

National Academies Press to develop published workshop reports on the Public Response to Alerts and Warnings on Mobile Devices[75] and Geotargeted Alerts and Warnings[76].

Thanks to its regular use and development of standards, and participation in associations, the IPWAS participates proactively in operational tests, training, exercises and evaluations of new and emerging technologies. These activities enable progress toward the integration of additional and new technologies into the national alert and warning interoperability backbone, and encourage industry and other private sector innovators to meet the mitigation risk reduction and risk management needs of the emergency management community at large. The IPAWS architecture is shown in **Figure 27A**.

Figure 27A: IPAWS architecture



Source: FEMA

(3) Using IPAWS capabilities

The original requirement for the IPAWS was to provide the President with a means of warning the public of impending disasters and attacks. At present, however, the national IPAWS is used daily by local emergency managers in a very wide variety of situations that threaten public safety and property. Local authorities have used it to issue emergency messages related to chemical spills, child abductions, dam failures, the availability of disaster recovery resources, earthquakes, evacuations, flash floods, gridlocked traffic, hurricanes, large-scale power outages, law enforcement operations, nuclear facility accidents, roadway closures, shelter-in-place orders, snowstorms, tornados, toxic plumes, volcano eruptions, wildfires and water contamination. Details can be obtained from the IPAWS website.

(4) Alerting Authorities

Over 1 300 constituent AAs use CAP-based alert origination tools to create alerts and warnings that are compatible with the national architecture. In the United States, depending on constituent policies, AAs can include, but are not limited to, government agencies at all levels, fire and police departments, military bases, colleges and universities, nuclear power plants and hospitals. All AAs requesting use of the IPAWS platform must independently acquire software compatible with the IPAWS CAP specifications and sign a memorandum of agreement with FEMA. Each memorandum dictates the development of effective local alert and warning practices and

75 Sub-title: "Summary of a Workshop on Current Knowledge and Research Gaps". Computer Science and Tele-communications Board, National Research Council, The National Academies Press, Washington, DC, 2011.

76 Sub-title: "Report of a Workshop on Current Knowledge and Research Gaps". Computer Science and Tele-communications Board, National Research Council, The National Academies Press, Washington, DC, 2013.

procedures, requires completion of FEMA IPAWS training, and stipulates monthly training to demonstrate that the AA can react and send a properly formatted alert and warning in a test environment. All emergencies are local, and each area threatened by a disaster or emergency is unique, which is why AAs have the freedom and autonomy to determine message content and when to send alerts and warnings.

(5) Success stories

– Wildfires: During the Southern California wildfires of 2017, the Governor's Office of Emergency Services warned seven counties to stay alert and listen to authorities during periods of strong winds. Winds did in fact spread fires, at times over more than one acre per second. Wildfires burned over 307 900 acres and forced the evacuation of over 230 000 people, but only one civilian death was recorded, thanks in part to advance notification. In 2018, many wireless and Emergency Alert System alerts were sent during a wildfire that burned in four counties for 54 days. Media reports indicate that many people were evacuated on time as the public seemed very receptive to the alerts.

– Bomb threat: New York City Emergency Management sent a wireless emergency alert in the form of an electronic wanted poster to identify the suspect in connection with bombings in Manhattan and New Jersey in 2016; the suspect was captured within hours. This was the first widespread effort to transform the citizens of a major American city into a vigilant eye for authorities. "This is a tool we will use again in the future… This is a modern approach that really engaged a whole community," said Mayor Bill de Blasio.[77]

– Tornado alert: In 2016, the groom at a wedding reception in Ohio received a tornado alert on his phone. The phones of family members in attendance from New York, New Jersey, South Carolina and even Canada immediately received the same alert. Even when the guests and family members in attendance are from different geographic areas, wireless emergency alerts can reach any cell phone using a specific tower, including those in moving vehicles.[78]

– Child abduction/Amber Alert: On 31 December 2016 in Sharpsville, Pennsylvania, an armed and dangerous adult male abducted his eight-month-old daughter. An off-duty security worker in Reading, Pennsylvania, received an Amber Alert on his phone and noticed a vehicle matching the description provided in the alert. He provided 911 dispatchers with information that allowed police to find the vehicle. The child was found safe less than an hour after the Amber Alert was issued.[79]

A1.4 Drills and exercises

A1.4.1 Emergency telecommunication drills (China)[80]

This case study introduces the purpose, types and requirements of emergency telecommunication drills. It suggests further strengthening emergency telecommunication drills and experience

77 J. David Goodman and David Gilles. Cellphone Alerts Used in New York to Search for Bombing Suspect. The New York Times, 19 September 2016.
78 Samuel Reed. Wedding almost a disaster – literally. Sidney Daily News, 13 September 2016.
79 CBS News. Report: Pa. man who saw Amber Alert helped find infant abducted by murder suspect. 3 January 2017.
80 ITU-D SG2 Document SG2RGQ/61 from China

sharing in the field of telecommunications/ICT for disaster preparedness, mitigation and response.

(1) Purpose of emergency telecommunication drills

Exercises are a great way to:

- Evaluate the preparedness programme and identify planning and procedural deficiencies: Preparedness programmes may be untested, not updated or unable to adapt to new situations. Emergency telecommunication drills can reveal shortcomings in the programme, check its adaptability to unexpected situations and gauge the need for modifications and improvements.
- Improve capabilities to respond to real events: Emergency telecommunication drills can help verify new technology application and information communication resources, assess new equipment capabilities and enhance emergency telecommunication support capability. They can provide indications of the capabilities of existing resources and identify resource gaps.
- Improve coordination between internal and external teams, organizations and entities, and boost the level of cross-regional support: Drills serve to strengthen the coordination ability of multi-department and rapid response operations, and to improve communication and coordination between emergency organizations and personnel.
- Train the emergency telecommunication team: Emergency drills help improve the team leader's ability to analyse, make decisions, organize and coordinate. They help telecommunication personnel understand onsite roles and responsibilities. They can also help heighten awareness and understanding of hazards and their potential impact, reduce panic and promote cooperation with the government and its departments, in order to improve the overall social emergency response capacity.

Figure 28A: Emergency telecommunication drill

(2) Types of emergency telecommunication drill

Different types of drill can be used to evaluate programme plans, procedures and capabilities.

- Emergency telecommunication drills that focus on **organization** include tabletop exercises and actual-combat drills. In tabletop exercises, team members use maps, sand tables, flowcharts, computer simulations, video conferencing and other means to discuss their roles and responses during an emergency situation. Such exercises are usually conducted in rooms. In actual-combat drills, the participants use the emergency equipment and materials available to simulate pre-set emergency scenarios and subsequent development scenarios through actual decision-making, action and operations. Such drills are usually conducted in specific locations.

- Emergency telecommunication drills that focus on **content** include single and comprehensive drills. A single drill involves only one specific emergency response function in the emergency plan or a series of emergency response functions in the onsite plan. It focuses on specific units and functions. Comprehensive drills involve multiple or all emergency response functions in contingency plans. They emphasize testing of various links and functions, especially the emergency mechanism and joint response capability of different departments.
- Emergency telecommunication drills that focus on **purpose and function** include test drills, demonstration drills and research drills. Test drills test emergency plan feasibility, emergency preparation, emergency mechanism coordination and the ability of relevant personnel to take their places. Demonstration drills are a kind of performance drill carried out in strict accordance with the emergency plan to demonstrate emergency ability or instruct observers. Research drills are organized to study and solve the key difficulties of emergency plan activation and to test new schemes, technologies and equipment.
- Emergency communication drills that focus on **notification** include notification and script-free drills. Notification drills follow a script and check the emergency communication support according to the plan of action. In double-blind emergency telecommunication drills or flight inspections without script or notification, the drill time and place are not announced in advance. The emergency telecommunication equipment and personnel are temporarily deployed to the drill site, where the equipment is assembled; both are then dispatched to an actual-combat simulation drill in a certain area.

Different types of drill can be combined: table-top drill, integrated table-top drill, demonstration of single drill, demonstration of integrated drill, and so on.

The general emergency telecommunication drill is a comprehensive drill. The drill scenario might be as follows: a simulated earthquake causes business disruptions; a group organized via a remote emergency rescue and disaster relief drill in neighbouring provinces comprises seven teams; 24 emergency vehicles, 24 sets of equipment and 78 drill personnel are sent in; topics covered in the drill include coverage of the UAV base station, Wi-Fi coverage of Ku and Ka portable stations, a C network base station with satellite circuit, optical fibre fusion, emergency power supply and other business subjects.

Figure 29A: Emergency telecommunication drill

A1.4.2 Exercise to simulate the implementation of the civil security plan for telecommunications (Algeria)[81]

In order to strengthen disaster preparedness for emergency telecommunication resources, the Ministry of Post and Telecommunications of Algeria, in cooperation with the Algerian Space Agency, the General Directorate for Civil Protection and the telecommunication operators organized a partial civil security (ORSEC) simulation exercise for the telecommunication module on 24 October 2020 in the wilaya of Boumerdes located 45 kilometres to the north-east of the nation's capital city.

(1) Legal framework

Operators who hold licenses for setting up and operating public telecommunication networks (fixed and mobile) have certain obligations under their licensing terms. In particular there is an article relating to emergency calls:

- to elaborate, in concert with the officials in charge of disaster relief and the local authorities, plans and preparations for the provision and rapid restoration of a minimum level of emergency telecommunications, and to implement them at their own initiative or upon a request from the competent authorities;
- to reserve equipment that is mobile, transportable and suitable for response work and participate in exercises organized by the responsible public bodies.

(2) Objective of the simulation exercise

The principal objective of this simulation exercise was to test the continuity of operations of telecommunication services, particularly with regard to the command structure and the population, and to permit Civil Protection to evaluate the effectiveness of the emergency measures put in place on the operational level.

Accordingly, it aimed to first, strengthen coordination between the different operators in the telecommunication sector and to ascertain their readiness and effectiveness in a disaster situation; and second, employ the resources of Algeria's ALCOMSAT-1 satellite in cooperation with the Algerian Space Agency (ASAL) and Algérie Télécom Satellite (ATS). ALCOMSAT-1 was launched in December 2017 and is the country's first telecommunication satellite.

(3) Scenario of the simulation exercise

The simulation manoeuvres were based on "an earthquake of magnitude 6.8 on the Richter scale, with the epicentre located 8 km to the north of the town of Boumerdes, leading to loss of life and major damage to urban areas, infrastructure and residences. The zone most heavily affected is that of the communes of Boumerdes and Zemmouri, with total disruption of the telecommunication networks."

For the links and telecommunications module, the scenario had two aspects:

- Operational aspect: telecommunication links were provided by ASAL with the installation of mobile and fixed VSAT stations to enable VoIP, data and videoconference transmission between the various command sites managed by Civil Protection via ALCOMSAT-1, complementing the voice-only VHF relays and terminals;

[81] ITU-D SG2 Document SG2/384 from Algeria

- Civil aspect: (Deployment exercise) involving telecommunication operators for fixed and mobile telephony so as to maintain service continuity in the affected zone and provide telecommunication services to the population.

(4) Human and material resources

This large-scale exercise involved some 100 participants from such telecommunication players as ASAL, ATS, the *Agence Nationale des Fréquences* (ANF), Algérie Télécom (AT), Algérie Télécom Mobile (ATM Mobilis), Wataniya Télécom Algérie (WTA-OOREDOO) and Orascom Télécom Algérie (OTA-Djezzy), as well as Civil Protection members at various levels.

With regard to the telecommunication resources deployed for the simulation exercise, Civil Protection and ASAL, as well as the telecommunication operators, made available some major technical equipment, including:

- Civil Protection: VHF stations, relays and terminals;
- ASAL: six VSAT station, including two mobile (van and 4x4 vehicle), one portable and three fixed;
- AT: two eNodeB trailer-mounted 4G stations with built-in generator sets, one mini eNodeB 4G station, two complete DRSS links, and five 25 kVA generator sets;
- ATM: one trailer-mounted 2G/3G/4G-compatible station with built-in generator set and VSAT antenna;
- OTA: one trailer-mounted 2G/3G-compatible station with an Outdoor generator set;
- WTA: one mobile lorry-mounted 2G/3G-compatible station with built-in generator set;
- ATS: two VSAT stations (for Mobilis, the VSAT station is already integrated), six satellite modems and two 1.8-metre antennas;
- ANF: two spectrum monitoring units.

(5) Conduct of the simulation

The simulation exercise took place on the five following sites:

- **Sites 1 and 2**: two zone command posts (PCZ), located in the affected zones;
- **Site 3**: an operational command post (PCO) for representatives of the executive bodies under the authority of the Civil Protection for coordinating the rescue efforts;
- **Site 4**: a fixed command post (PCF) at the Wilaya headquarters for the officers in charge, under the authority of the wali or a representative;
- **Site 5**: the headquarters for the General Directorate for Civil Protection, simulating the interministerial crisis cell.

Operational portion

At the different sites involved ASAL deployed fixed VSAT stations, a mobile station (van), a VSAT station and a 4x4 vehicle equipped with a VSAT link for transmitting imagery filmed by a camera mounted on a Civil Protection helicopter and providing the different mobile-mode transmission services to remote sites. Voice and videoconference transmission between those sites was tested successfully, as was the reception of aerial images and videos of the affected areas transmitted by the Civil Protection helicopter. Transmission was done via ALCOMSAT-1. In addition, all of the sites were interconnected by the Civil Protection VHF network for the provision of voice transmission.

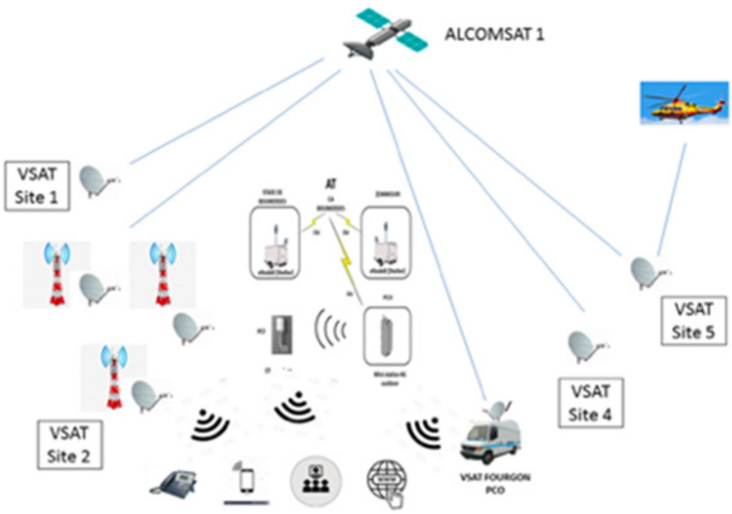
Civil portion

Coverage of the affected areas was provided by the three mobile telephony operators and by the incumbent fixed telephony operator AT.

The topology of the networks deployed on the day of the simulation was organized around the following points:

- AT deployed two trailer-mounted 4G stations, one mini 4G station at the PCO, with the installation of 4G CPE, one Outdoor CPE unit and videoconference equipment at the five sites. Tests for voice, data and video were successful and transmission was provided by the 800 Mbit/s DRSS links;
- the mobile operators deployed three trailer-mounted stations in the affected area to provide voice coverage for the population with a 2 Mbit/s VSAT satellite link by ATS for each operator;
- ANF put up two spectrum analysers to monitor and verify the quality of the signal and frequencies used.

Figure 30A: Emergency telecommunication drill



(6) Conclusion

Thanks to the different tests performed on the day of the simulation, it was possible to obtain information on the resources available from each operator and establish direct contact with the different players. In the same framework, future simulation days organized annually across the entire country should lead to improvements at the organizational and procedural level, while preserving the dynamic interaction and coordination between the players as regards the civil security plan and providing solutions for the different technical and organizational problems that simulation operations invariably bring to light.

The tests also contributed to informing the vision of Algeria's Ministerial Department with regard to the preparation and elaboration of a national emergency telecommunication plan, in accordance with Target 3.5 defined in the strategic plan for the period 2020-2023 in Resolution 71 (Rev. Dubai, 2018) of the Plenipotentiary Conference of the International Telecommunication Union: ***"By 2023, all countries should have a national emergency telecommunication plan as part of their national and local disaster risk reduction strategies"***.

These national plans will make it possible to bring together all of the players so as to examine the disaster-management cycle, define the ICT capabilities needed to deal with emergency and elaborate a governance framework allocating roles and responsibilities.

A1.5 Others

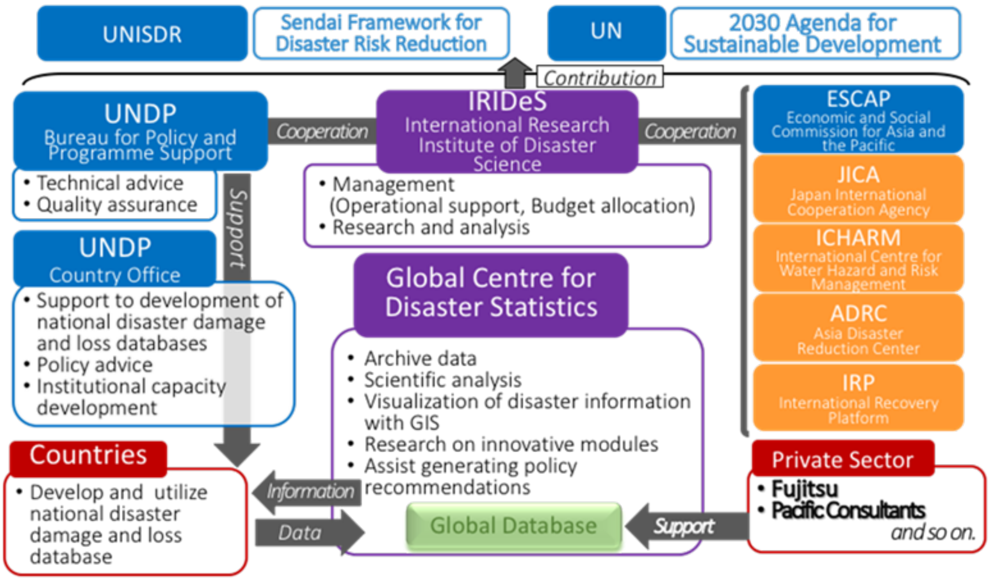
A1.5.1 Global disaster statistics (Japan)[82]

The Global Centre for Disaster Statistics (GCDS, see **Figure 31A** for a detailed scheme) was established in partnership with the International Research Institute for Disaster Science (IRIDeS) at Tohoku University, Fujitsu, and other organizations with a view to implementing the Sendai Framework for Disaster Risk Reduction 2015-2030 and achieving the Sustainable Development Goals. The following outputs are expected:

i) national capacities to produce disaster statistics are strengthened;
ii) a global information platform is developed for the analysis of disaster statistics; and
iii) independent scientific analyses are conducted of progress towards achievement of the Sendai Framework global targets and the Sustainable Development Goals.

In terms of academic contributions, the GCDS will publish a special issue of the *Journal of Disaster Research* on the development of disaster statistics.

Figure 31A: Detailed scheme of the GCDS



A pilot phase started in 2017, with UNDP and IRIDeS working with Cambodia, Indonesia, the Maldives, Myanmar, Nepal, the Philippines and Sri Lanka, which had been selected by the UNDP Asia-Pacific Hub, to increase their capacities in disaster statistics and convening regular meetings to share experiences. In terms of ICT, Fujitsu has developed a global database to store disaster loss and damage data. The GCDS has started to collect and store data from the pilot country governments. **Table 5A** shows the progress made in that respect.

[82] ITU-D SG2 Document SG2RGQ/74+Annex from Japan

Table 5A: Data collection progress

Indonesia	The API* developed by the BNPB** is stored in the database (22 442 data).
Myanmar	The GCDS has commenced proceedings to collect data to store in the database.
Philippines	The GCDS has commenced proceedings to collect data to store in the database.
Cambodia	The GCDS has commenced proceedings to collect data to store in the database.
Sri Lanka	The GCDS has commenced proceedings to collect data to store in the database.
Nepal (Republic of)	The GCDS plans to commence proceedings in this fiscal year to collect data to store in the database.
Maldives	The GCDS plans to commence proceedings in this fiscal year to collect data to store in the database.

*API: Application Programming Interface
**BNPB: National Agency for Disaster Management in Indonesia

Consultations with UNDP regional hubs have resulted in the countries listed in **Table 6A** being nominated as priority countries for GCDS implementation.

Table 6A: Priority countries for GCDS implementation

Africa	Uganda, Mozambique, Rwanda, Niger, Angola
Arab States	Djibouti, Egypt, Iraq, Lebanon, State of Palestine under Resolution 99 (Rev. Dubai, 2018), Somalia, Sudan, Tunisia
Central Asia	Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan, Georgia, Armenia
Latin America and the Caribbean	Peru, Paraguay, Chile, Cuba, Ecuador, Mexico, Nicaragua, Dominican Republic

The GCDS is now planning to take advantage of Fujitsu's Cloud Service K5. Needless to say, ICT is vital to connect numerous stakeholders. The GCDS mission will be achieved all the more effectively and efficiently in that it goes beyond various resource restrictions.

A1.5.2 Pre-positioned emergency telecommunication systems (Japan)[83]

When disaster strikes, damaged telecommunication equipment may lead to telecommunication blackouts or telecommunication traffic may become congested. When this happens, emergency telecommunication systems prepared in advance can rapidly restore important telecommunication services, e.g. for the police, fire department, local government and hospitals. They can also send safety confirmation messages to people in disaster areas. Using the systems in normal times, i.e. not in a disaster, can avoid problems such as system unavailability. In addition, emergency telecommunication systems can provide communication services in rural areas where service would otherwise be insufficient.

[83] ITU-D SG2 Document SG2RGQ/188(Rev.1) from Japan

The Japanese Government Cabinet Office's Strategic Innovation Programme plans to implement research results society-wide. One of its projects was a field trial of an MDRU initially designed as a disaster communication tool in the Republic of Nepal in February 2019.

The Republic of Nepal is a rugged country that is over 60 per cent hills and mountains. Many schools in remote villages in the hills and mountains have few resources and learning materials. Schools are closed for long periods during the monsoon and winter seasons because teachers and students cannot reach them. Remote education is one way to overcome the geographical conditions in Nepal, serve areas that are hard to access and encourage the participation of students and other stakeholders in education.

With the assistance of Japan, Educating Nepal, a Nepalese NGO, conducted a field trial in which an MDRU was used to provide remote education in the rural community of Jholunge, Indrawati Rural Municipality, in the hilly region of Sindhupalchowk District, roughly 85 km from Kathmandu.

The MDRU was used to connect the elementary school and two nearby villages, as shown in **Figure 32A**. The school was the main venue, while the two other locations were remote venue A and remote venue B. **Figure 33A** shows the geographical conditions of the trial.

Figure 32A: Testing remote education in the Republic of Nepal

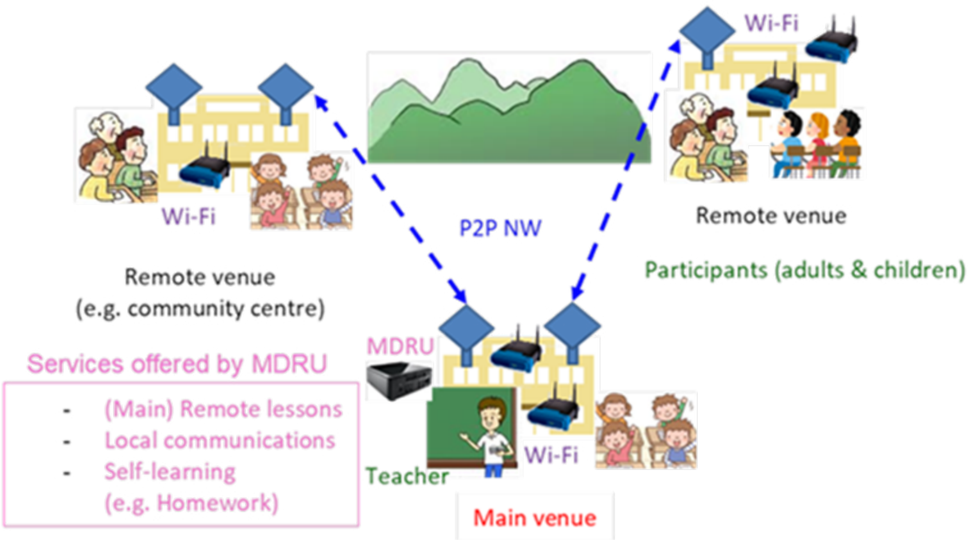


Figure 33A: Geographical conditions of Jholunge village

During the trial, remote teaching and learning were demonstrated to elementary school pupils, and remote consulting and agricultural support were tested for adults, especially farmers.

The results of the trial were evaluated by means of a questionnaire and interviews of key participants and observers. They show that the MDRU was very effective for remote education at a general level. Adult remote learning received the highest scores, followed by overall self-learning and then student remote learning. The MDRU user experience in terms of effectiveness, relevance and innovation received higher scores, while MDRU convenience and suitability for daily use received lower scores. The MDRU is therefore an effective tool for remote education that should be installed in various places to provide effective education through distance or e-learning.

The results also showed that it can be useful to redesign the dedicated user application or interface for remote learning, since the current application was fully tailored for disaster communication and was therefore at one point a little inconvenient to use for remote education. Apart from that one niggle, the MDRU obtained commendable test scores for its effective use in remote education.

Disaster-management solutions such as emergency telecommunication systems can be used for remote education in rural areas without enough telecommunication infrastructure in ordinary times. This has the added advantage of ensuring that children and farmers will know how to use the emergency telecommunication system when disaster strikes, as they will have been "trained" in its use in ordinary times.

A1.5.3 Fighting the Ebola virus disease (Democratic Republic of the Congo)[84]

Telecommunications are being used in the Democratic Republic of the Congo (DRC) to fight an outbreak of Ebola virus disease in the province of North Kivu in the east of the country and a threatened outbreak in the neighbouring countries of Rwanda and Uganda. The Democratic

[84] ITU-D SG2 Document 2/252 from the Democratic Republic of the Congo

Republic of the Congo is affected by different kinds of disaster, the most common being those related to illnesses such as cholera and Ebola.

The main participants in the fight against Ebola are:

- the Office of the President of the Republic, through the anti-Ebola technical committee;
- the Ministry of the Interior and Security, through the DRC National Police, which provide security at sites and centres where patients are treated and cared for;
- the Ministry of National Defence, through the DRC Armed Forces, which are pursuing the armed groups that operate in the eastern part of the country and regularly attack medical and other health-care personnel, hospitals and members of the public;
- the Ministry of Health;
- the Ministries of Humanitarian Affairs and of Social Affairs;
- the Ministry of Posts and Telecommunications, through the regulatory authority;
- NGOs active in the field of humanitarian and health services;
- civil society, for public education and outreach campaigns;
- religious communities, in particular the Catholic Church (assistance is provided by the Vatican).

Given that armed groups are operating in the area where the Ebola epidemic has taken root, in the east of the Democratic Republic of the Congo, and that the epidemic has reached alarming proportions, with more than 2 000 cases, the Government has launched an epidemic response strategy, one of the pillars of which is telecommunications. Thanks to telecommunications, people in epidemic-affected areas can inform friends and relatives, the public authorities and humanitarian associations about the onset of disaster, the public authorities can issue alerts and plan relief operations, and rescue teams can coordinate their operations from the initial alert to the intervention process.

The telecommunication sector of the Democratic Republic of the Congo, which was opened to competition under the framework law of 16 October 2002, currently comprises the following:

- four mobile telephone operators (Vodacom Congo S.A, Airtel Congo S.A, Orange and Africell);
- one wired fixed telephone operator (the public/incumbent operator);
- one wireless fixed telephone operator (Standard Telecoms);
- about 20 Internet service providers;
- over 150 radio stations and about 60 television channels across the country, in urban and rural areas;
- over 10 national digital terrestrial TV channels;
- private telecommunication networks (operated by private organizations and NGOs).

Other forms of communication being used in the fight against Ebola include visual media such as banners, streamers, posters and T-shirts displaying public health advice.

In short, there are two types of telecommunication network being used in the fight against Ebola:

- **public networks**: mobile telephone networks, fixed telephone networks, radio and television broadcasting networks and Internet access networks;
- **private networks**: private companies, NGOs, etc.

These various telecommunication networks enable and facilitate:

- early warnings for prevention or intervention;

- the circulation, exchange and sharing of information and data among the different players involved;
- prompt decision-making so as to reduce the threat of the disease;
- planning and coordination of relief operations on the ground.

Are there specific regulations governing the use of telecommunications in the event of disasters in the Democratic Republic of the Congo?

While the answer to that question is "No", the Government has established provisions in the licensing agreements for telephone operators requiring them *inter alia* to help relief teams use their networks free of charge in their operations. To that effect, holders of licences for a public telecommunication service are required to organize free-of-charge emergency call services, in particular for the national police and relief services in the operating area of the service licensed.

In addition, the general regulations on telecommunications grant favourable terms for the possession, movement and use of satellite terminals such as Thuraya, Iridium and so on by NGOs. By virtue of agreements signed with the Government, NGOs are also exempt from any and all taxes and levies on telecommunication equipment and materials that they have and use for the fulfilment of their mission. All these various measures serve to increase and reinforce the relief capabilities of NGOs.

The mobilization of significant telecommunication resources has led to an improvement in the management of the Ebola epidemic in recent months, as confirmed by the encouraging results reported by medical sources. As control over Ebola is established, the number of positive diagnoses is decreasing and there are even cases of recovery.

A1.5.4 Disaster Maps programme (Facebook, United States)[85]

(1) Introduction

The enormous number of people using social networks such as Facebook means that extensive geospatial information is available on connectivity that is difficult to capture quickly through conventional methods. Many apps rely on location services data collected via smartphones. In the case of Facebook, people have the option to provide this information. Location data are used to provide myriad features, such as targeted alerts and prompts to check in as "safe" after a hazard event to allay the concerns of friends and family. In addition to powering product crisis response features, location data, when aggregated and anonymized, can provide insights into how populations are affected by crisis events.

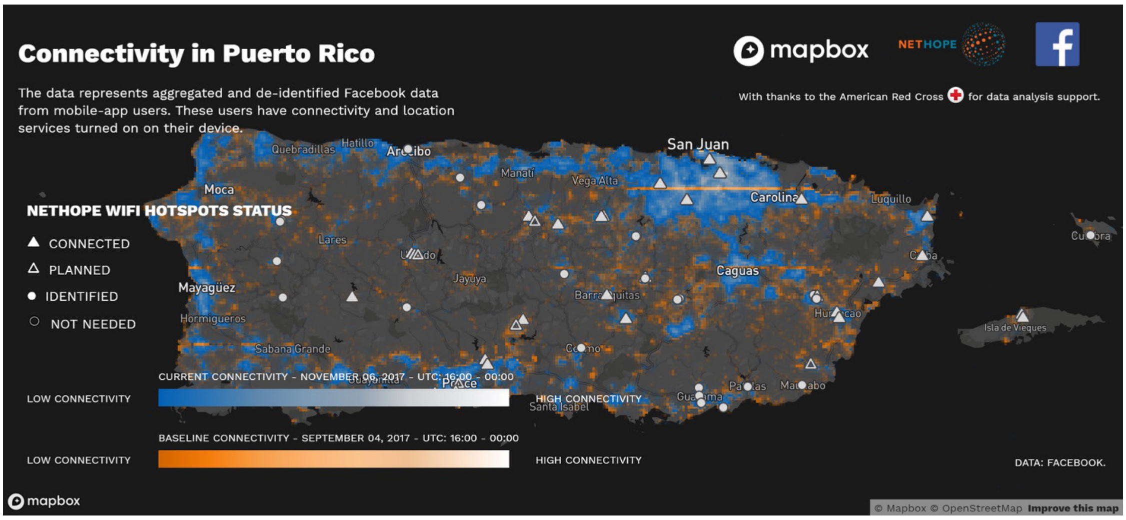
Beginning in 2017,[86] Facebook began providing aggregated geospatial data sets to crisis response organizations and researchers to help fill information gaps in service delivery. These Disaster Maps utilize information about usage in areas impacted by natural hazards, producing aggregate pictures of how the population is affected by and responding to the crisis. The maps include insights into evacuations, cell network connectivity, access to electricity and long-term displacement. Since their launch, Disaster Maps have been activated for over 500 crisis events and made available to over 100 partner organizations. The connectivity maps in particular have proven to be instrumental in aiding emergency communication efforts.

85 ITU-D SG2 Document 2/308 from Facebook (United States)
86 Molly Jackman. Using Data to Help Communities Recover and Rebuild. Facebook Newsroom, 7 June 2017.

(2) Case Study: Hurricane Maria

In the aftermath of Hurricane Maria in Puerto Rico in 2017, response organizations were in desperate need of information for rescue operations and aid coordination. The storm had knocked out the majority of communication services, including cellular Internet service, on the island. NetHope crews were quickly deployed and worked to restore connectivity, to enable responding organizations to coordinate rescue and aid efforts. Their challenge was how to target efforts to the areas of highest need. As shown in **Figure 34A** below, Disaster Maps data were used to show drops in connectivity on a daily basis by comparing the aggregate number of users connecting to Facebook before the storm and the number able to connect in the days after the hurricane.[87] The data helped NetHope identify the areas of greatest need and efficiently prioritize its relief efforts.

Figure 34A: Example connectivity map generated with Facebook Disaster Maps data by NetHope



The Disaster Maps programme was developed in a cross-functional effort by research, design, engineering, legal and policy teams to ensure that useful data are reliably provided to vetted NGOs and research organizations. The programme is ongoing and seeks to reach more people in need after a crisis, increase the data types surfaced in each Disaster Map and improve the accuracy of existing Disaster Maps data sets. Of particular note is the emphasis on ensuring that the privacy-protecting methods (such as aggregation and spatial smoothing) used in Disaster Maps are published openly. Companies in the tech sector draw on a wide range of privacy-protecting methods when considering how to share data, and these must be weighed against both technical limitations and legal requirements. These considerations require considerable effort and time. By publishing the solution that works for it, the company has dramatically reduced the barrier of entry for other entities to provide similar data sets in order to create a more complete picture for crisis response organizations.

(3) Facebook's data-sharing approach

Facebook generates and shares Disaster Maps as part of its Data for Good programme, which shares data sets externally with humanitarian response organizations while preserving user

[87] NetHope Blog. Unlocking insights from data: Collaboration with private sector creates cutting-edge maps for disaster response, 9 October 2018.

privacy. While building these efforts, the company developed key lessons and resources that can lower barriers for other companies to participate in similar crisis response data-sharing efforts.

- Facebook published the privacy protection methods it uses in Disaster Maps, which include aggregation, spatial smoothing, dropping small counts, and other techniques, as part of the proceedings of the 16th International Conference on Information Systems for Crisis Response and Management, in May 2019.[88]This open publication represents a critical contribution made in order to stimulate other private sector companies to consider providing similar data sets to crisis response organizations. Determining an acceptable privacy protection threshold in geospatial data sets is a complex undertaking, and it is Facebook's hope that by openly publishing its methods, it will lower barriers to entry for other private sector agencies to move forward with similar data-sharing efforts.
- The company launched improved displacement maps at the October 2019 NetHope Global Summit in Puerto Rico. These maps help non-profit and research partners better understand the volume of people displaced after a natural disaster and where they have been displaced.
- The company launched simplified and improved network connectivity maps in December 2019 based on feedback from existing emergency communication partners wishing to better understand where network connectivity was completely out following a natural disaster rather than simply reduced. These new network connectivity maps show where users have cellular connectivity of a 2G, 3G or 4G connection type based on the speed and latency of data being sent between the user's device and the servers hosting the mobile app.

(4) A collaborative approach

The goal of the Disaster Maps programme is to empower crisis response organizations and researchers with data that improve delivery of life-saving interventions while preserving user privacy. The programme also seeks to drive innovation in crisis response and emergency communication efforts that extends beyond the company. To date, Facebook has partnered with over 100 NGOs and research organizations through Disaster Maps, and a number of its NGO partners also work to share derivative products with broader coalitions of response agencies, including federal, state and local entities. These crisis response organizations are experienced in engaging government agencies and providing them with geospatial data. The company's programme model is to empower such partners with new data sources rather than displace their role in coordinating with governments directly. This has proven very successful and scalable. All Facebook partners complete a data license agreement in order to be granted access to Disaster Maps data.

When specific crisis response data gaps emerge, the company seeks organizations to work with closely, to guide its research and development of new or improved data sets. For example, the methodology for the improved displacement maps released in October 2019 was co-created by Facebook and the Internal Displacement Monitoring Centre (IDMC), which works on measuring numbers of internally displaced people. The company's Data for Good team continues to work with the IDMC to compare the insights derived from displacement data from recent crises in 2019, such as Cyclone Idai in India/Bangladesh and Typhoon Hagibis in Japan, and to compare displacement data with more traditional sources in order to refine and educate ongoing development efforts.

[88] Paige Maas et al. (Facebook). Facebook Disaster Maps: Aggregate Insights for Crisis Response and Recovery. WiPe Paper – Social Media in Crisis and Conflicts (ID 176), in Zeno Franco et al. (Eds). Conference Proceedings, 16th International Conference on Information Systems for Crisis Response and Management. Valencia (Spain), 19-22 May 2019, pp. 836-847.

Collaboration with crisis response organizations in the emergency communication space has also led to new network connectivity maps. A specific example is the collaboration and feedback received from NetHope and its member organizations on the need to simplify the nature of coverage map generation for efficient operational decision-making. Critical questions facing these organizations included whether people had cellular connectivity, where drops in cellular connectivity had been observed in disaster-impacted areas, and how certain they could be that there had been a drop in cellular connectivity in a disaster-impacted area. To answer the first question, Facebook developed a simple coverage map showing the grid tiles that had network coverage on a given date. To address the second question, it surfaced a map that shows which grid tiles had not seen network connections on that date but had coverage during the 30-day baseline period. The company's teams addressed the third question by publishing the probability of a grid tile receiving network coverage on that date based on 30-day baseline observations.

(5) Testing and usability

All Disaster Maps undergo testing with users in order to ensure that new data sets are clear to understand and fit within the workflows of crisis response organizations. The company's Data for Good team has invested heavily in usability research with organizations across the spectrum of geospatial experience. For example, research with advanced users was a key part of refining and improving the format of data set files to enable customized analysis methods across a range of GIS applications. This research also included one-on-one interviews with novice users of Disaster Maps, to test early prototypes and determine the best means to visualize complex displacement data in vector format. Based on this feedback, the company's Data for Good team updated visualizations to allow for filtering by outbound or inbound displacement for a given location. In addition, the team improved the depth of documentation on the statistical methods used to compare pre-crisis connectivity levels with those observed in real time.

(6) Creating an enabling policy and regulatory environment for sharing information during a disaster

Facebook supports policies that protect and promote user privacy, especially during times of increased vulnerability such as following an emergency crisis. It recognizes that protecting privacy while improving the effectiveness of potentially life-saving response efforts requires concerted efforts and time by technical and programmatic teams.

The company and its partners encourage other entities from across the public and private sector to share geospatial data sets that preserve user privacy. A variety of collaborative approaches, including data governance frameworks, should be considered for scaling data-sharing efforts across private sector companies, so as to avoid overwhelming response organizations with additional data. The Data Collaboratives framework provided by GovLab has proven extremely useful in helping to ensure that decision-makers are able to be more data-driven and collaborative with the private sector.

Collectively, the emergency response community should advance policies and programmes that encourage a transparent approach to privacy protection and afford continued collaboration for improved humanitarian operations.

A1.5.5 ICTs in the fight against the COVID-19 pandemic (China)[89]

(1) Introduction

In the face of the COVID-19 pandemic, China has launched emergency communication measures to fight the pandemic from the perspectives of government and companies. First, more resources have been provided, to help telecom operators meet people's needs for more broadband Internet connectivity and telecommunication services. Second, during the pandemic, some countries have adopted measures to reduce and abolish telecommunication fees, cancel the upper limit of fixed broadband or mobile Internet access, abolish all telecommunication late payment fees, provide free calls or increase the data flow of tariff packages, so as to ensure the normal use of the telecommunication lifeline by users. The third is to provide decision-making support in the form of big-data analysis. The fourth is to develop new applications and launch a number of cloud services, which have played an important role in supporting services.

(2) Network guarantee

The Chinese Government has provided overall guidance to operators to ensure the construction of designated high-quality hospital communication networks within the shortest possible time. The operators completed the construction of telecommunication facilities at Huoshenshan, Leishenshan and shelter hospitals in Wuhan, overcoming various difficulties, and put into operation the 5G base station in Huoshenshan Hospital within 36 hours, providing full coverage of 4G/5G signals. The network deployment at Leishenshan Hospital was completed within 24 hours and can meet the concurrent telecommunication needs of 30 000 people. The wireless network coverage and optimization of Wuhan shelter hospitals was completed within 48 hours.

(3) Service guarantee

At the request of the joint prevention and control regime and relevant departments, the Chinese Government has organized operators to send tens of billions of public short messages on pandemic prevention and control, effectively supporting prevention and control efforts in various places. In areas where the situation was severe, operators offered convenient services, such as non-stop service and emergency start-up, and services enabling users to handle telecommunication issues without leaving home. Some areas connected people with the health and pandemic prevention agencies, and reduced the telephone charges for medical staff lending a hand in Hubei Province. Internet companies have been helped and encouraged to give full play to their respective advantages and provide public services such as online diagnosis and treatment, an e-commerce platform, teleworking and online education, so as to help realize "working without going to work, schooling without going to school", contributing greatly to the fight against the pandemic.

(4) Big-data analysis application

China can provide strong, accurate and comprehensive decision-making support for real-time pandemic prevention and control by using telecommunication big-data analysis. Since the outbreak, it has organized industry experts to carry out big-data analyses and established a telecom big-data analysis model for the pandemic.

[89] ITU-D SG2 Document SG2RGQ/220(Rev.1) from China

The sharing and combining of big data on communication with data from health and disease control and prevention centres are important sources of support for the advance study and assessment of pandemic spread and prevention trends, contributing to dynamic prediction and early warning of the overall pandemic situation.

Telecommunication administrations of all provinces (autonomous regions and municipalities) have actively communicated with local COVID-19 prevention and control organizations, trying to understand the local needs for big data on pandemic prevention and control, organizing local operators to carry out big-data analyses, and providing detailed data support for pandemic prevention and control from the source and at grass-roots level, and for accurate government policy formulation.

Drawing on mobile user data, operators have cooperated with relevant departments on joint prevention and control, focusing on the dynamic analysis of people flows in key areas such as designated hospitals, fever clinics and points of assembly, and providing big-data analysis support services for population flows related to pandemic prevention and control. The results of big-data analyses related to pneumonia research released by Internet companies independently have also provided a useful reference for relevant government agencies in their decision making.

(5) Development of new applications and services

To fight the pandemic and help people resume work, production and school, Chinese operators have launched a number of cloud services that have played an important support role. In terms of cloud command, operators are free to launch "cloud conference" services for hundreds of parties online, for an unlimited number of times and for extended periods, thereby meeting the needs of governments at all levels, medical institutions and other agencies fighting COVID-19 in terms of command, dispatch and videoconferencing.

To facilitate cloud health care, the medical cloud system has been successfully applied in many areas during the pandemic. For example, China Mobile helped the General Hospital of the People's Liberation Army in Beijing and the Huoshenshan Hospital in Wuhan make the first critical remote diagnosis: medical experts at the General Hospital were kept on alert with the "5G telemedicine system" 24 hours a day. By using two medical trolleys in the infection division, Huoshenshan Hospital achieved interconnection and interoperability with the General Hospital wards using cloud video equipment and thus enjoyed real-time, professional and efficient diagnosis and treatment of difficult and severe cases at a distance of 1 200 kilometres, fully demonstrating the benefits of smart medicine. The successful application of the medical cloud system will facilitate the improvement of smart medicine and its widespread use in China.

To help people return to work and production, the information and communication industry has made full use of its technological advantages, fully promoted "cloud" services and helped enterprises to overcome difficulties, so as to ensure that both pandemic prevention and work can be carried out without delay. During the pandemic, many teleworking software and cloud services (e.g. collaborative offices, videoconferencing, document collaboration and equipment management) were launched, providing strong support enabling enterprises to quickly resume their work and production. In order to fully cooperate with COVID-19 prevention and control agencies and speed up the resumption of work and production, the Ministry of Industry and Information Technology made rapid arrangements for the China Academy of Information and Communications Technology and three operators, namely, China Telecom, China Mobile and China Unicom, to jointly launch the Telecommunication Big Data Travel Card, which uses communication big-data technology. Under strict provisions for the protection of personal information, domestic mobile phone users can check information on places they have visited (including overseas countries or regions) in the past 14 days for free, through SMS, mobile apps, the WeChat miniprogram, webpages and others. At the same time, the Telecommunication Travel Card app, which uses internationally accepted Bluetooth technology, alerts close contacts of confirmed COVID-19 patients, providing strong support for pandemic prevention and control.

In order to help students return to school, the Ministry of Industry and Information Technology, together with the Ministry of Education, made arrangements to network school operations and thus support "schooling without going to school" during the pandemic prevention and control period. Services across the country covered nearly 180 million primary and middle school students learning at home. The Ministry of Education has launched the national primary and secondary school network cloud platform. Baidu, Alibaba, China Mobile, China Unicom, China Telecom, Network Host and Huawei have provided technical support and coordinated the deployment of 7 000 servers with a bandwidth of 90 TB, enough to support 5 000 students going online at the same time, ensuring a smooth online learning experience.

A1.5.6 COVID-19 response (United States)[90]

(1) Introduction

To support COVID-19 response efforts, the United States Congress made available funds from the Coronavirus Aid, Relief, and Economic Security (CARES) Act for the COVID-19 Telehealth programme and the Education Stabilization Fund, to help students learn from home during the pandemic. The CARES Act, passed by Congress in March 2020, provides over USD 2 trillion in economic assistance to American workers, families and small businesses, to preserve jobs and help the economy during the COVID-19 emergency. The independent and collaborative efforts undertaken by the Federal Communications Commission (FCC) to maintain communications, provide important information to the public and support public health providers are summarized below.

(2) FCC actions in response to the COVID-19 pandemic in the United States

The COVID-19 pandemic has significantly increased voice and Internet traffic globally as lives and economies around the world move online. Teleworking, distance learning, online commerce and e-governance all rely on the availability of robust broadband and mobile technologies. Governments have had to quickly develop and implement strategies to ensure broadband availability as a cornerstone of economic life.

In the United States, the FCC took a number of actions to help keep consumers online and address the digital divide. FCC actions in this regard helped wired and wireless networks handle the surge without significant service disruptions or declines. Throughout the pandemic, the FCC helped increase national broadband penetration and provide additional support to consumers, businesses, schools and health-care providers.[91]

The FCC COVID-19 broadband strategy was largely based on three principles. First, anticipating that a large portion of American life would be moved online, the FCC determined that access to the internet would be the top priority. Second, the FCC determined that it would secure

90 ITU-D SG2 Document SG2RGQ/283 from the United States
91 See the coronavirus page on the FCC website

market participation before using government mandates. And third, the FCC took action to expedite existing FCC processes and partner with other agencies to develop new initiatives. Using these principles as a foundation to build upon, the FCC was able to help keep the United States population connected, help the health-care sector remain effective and efficient, and protect consumers.

(3) Keeping Americans connected

In March 2020, FCC Chairman Ajit Pai announced the Keep Americans Connected Pledge. Under this initiative, broadband and telephone service providers were called on to enter into a voluntary commitment to: (1) not terminate service to any residential or small business customer because of an inability to pay bills due to the disruptions caused by the coronavirus pandemic; (2) waive any late fees that residential or small business customers incurred because of their economic circumstances related to the coronavirus pandemic; and (3) open their Wi-Fi hotspots to any American who needed them.[92] More than 800 service providers agreed to the voluntary terms and took the pledge, with several going above and beyond the original request. One company, for example, provided unlimited Internet data to all customers with home Internet; another offered four months of free broadband service for new customers with telehealth, education and work-from-home needs; while others offered free Internet service and installation for certain low-income families with students, or families living in rural areas where Internet service was unavailable. Actions taken pursuant to the pledge were in effect through 30 June 2020. Thereafter, the FCC encouraged broadband and telephone service providers to take additional steps to help American consumers and small businesses stay connected. Several companies agreed to place customers into pro-rated payment plans for up to 12 months, defer device payments, waive a portion of unpaid balances or, in cases of extraordinary hardship, work with customers on an individual basis. Many also agreed to provide free service to customers in low-income housing through the end of July and to keep Wi-Fi hotspots open until the end of 2020.

As the pledge was nearing expiration, the FCC Chairman sent a letter to Congress seeking to collaborate on legislation to help consumers and small businesses stay connected. He informed Congress that the public-private partnership reflected in the pledge had been critical to maintain connectivity for American consumers and access for low-income families, teleworkers, veterans, and students participating in remote learning. He requested Congress to provide additional funding for telehealth expansion, broadband mapping and an end to American reliance on manufacturers posing a threat to the integrity of the ICT supply chain.

In addition to working with communication providers to secure the pledge in March 2020, the FCC simultaneously took measures to make sure that carriers had sufficient spectrum to meet the anticipated spike in demand for mobile and broadband services caused by quarantine. It issued special temporary authority licences granting mobile carriers access to additional spectrum to serve Puerto Rico and the U.S. Virgin Islands,[93] help Americans participate in telehealth, distance

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92 Statement of Chairman Ajit Pai, Federal Communications Commission, Hearing on the Oversight of the Federal Communications Commission Spectrum Auctions Program, Fiscal Year 2021, before the Subcommittee on Financial Services and General Government, U.S. Senate Committee on Appropriations, 16 June 2020.

93 FCC. News Release. FCC Grants AT&T Temporary Spectrum Access for Puerto Rico and U.S. Virgin Islands to Meet Growing Broadband Needs during Covid-19 Pandemic. 26 March 2020.

learning and telework, and meet the needs of first responders[94]. The FCC also granted a number of such licences to wireless Internet service providers in rural communities and elsewhere.

The FCC also took action to ensure that Tribal lands in the United States remained connected. In March 2020, it granted special temporary authority licences for 2.5 GHz of spectrum to the Zuni Pueblo Tribe[95] and the Navajo Nation[96]. Additionally, the FCC partnered with the Institute of Museum and Library Services to support using USD 50 million in funding from the CARES Act to work towards bridging the digital divide during the pandemic. Both agencies worked together to inform libraries and Tribal organizations of the funds and resources available to them. They also ensured that libraries across the country were aware that community use of Wi-Fi networks supported by the FCC's Universal Service Fund E-Rate programme was permitted during library closures.[97] The goal of these partnerships was to make sure that rural communities, the Tribes, and organizations serving and representing Native Hawaiians had the resources to respond to the pandemic in ways that met the immediate and future needs of the communities they served.

(4) Public safety and health-care support

Those teleworking, attending class from home or working in the health-care sector need immediate and continued access to mobile and broadband services. Additionally, individuals have increased their reliance on connected care to get virtual medical attention and consultation. To assist with health-care support, the FCC implemented the COVID-19 Telehealth programme, which provided USD 200 million in funding[98] for Americans to safely access vital health-care services. This funding helps health-care professionals provide connected care services to patients at their homes or mobile locations. It provides immediate support to eligible health-care providers responding to the COVID-19 pandemic by fully funding their telecommunication and information services, and devices necessary to provide critical connected care services. The FCC approved 539 funding applications in 47 states, Washington, DC, and Guam, which included recipients in both urban and rural areas of the country, and from coast to coast.[99] To further ensure that health-care providers had the resources they needed, the FCC adopted an order to fully fund all eligible Rural Health Care programme services for the current funding year.[100] The order will enhance connectivity and promote telehealth solutions for patients during this global health emergency.[101]

The FCC also implemented changes to the Rural Health Care[102] (RHC) and E-Rate[103] programmes, to make it easier for broadband providers to support telehealth and remote learning efforts during the pandemic. It waived certain rules to allow service providers to offer, and RHC and

94 FCC. News Release. FCC Provides T-Mobile Temporary Access to Additional Spectrum to Help Keep Americans Connected during Coronavirus Pandemic. 15 March 2020.
95 FCC. News Release. FCC Grants Temporary Spectrum Access to Support Connectivity on Tribal Reservation during Covid-19 Pandemic. 30 March 2020.
96 FCC. News Release. FCC Grants the Navajo Nation Temporary Spectrum to Meet Increased Wireless Broadband Needs during Covid-19 Pandemic. 30 March 2020.
97 FCC. News Release. FCC Partners with Institute of Museum and Library Services to Address Digital Divide during COVID-19. 21 May 2020.
98 Funding appropriated by Congress as part of the CARES Act
99 FCC. News release. FCC Approves Final Set of COVID-19 Telehealth Program Applications. 8 July 2020.
100 FCC. News Release. Chairman Pai Welcomes Increase in Rural Health Care Funding. 13 March 2020.
101 Ibid.
102 The Rural Health Care programme provides funding to eligible healthcare providers for the telecommunication and broadband services needed to provide healthcare.
103 The FCC's E-Rate programme makes telecommunication and information services more affordable for schools and libraries by providing discounts for telecommunications, Internet access and internal connections to eligible schools and libraries.

E-Rate programme participants to solicit and accept, improved connections or additional equipment for telemedicine or remote learning during the outbreak, thus ensuring that telehealth and remote learning efforts remained available and accessible.[104] In addition to providing support for telehealth services, the FCC and the Department of Education announced efforts to promote remote learning using funds from the CARES Act Education Stabilization Fund.[105] Through this effort, the agencies will work with governors, states and local school districts to leverage funding to help students learning from home during COVID-19. Funding from this initiative may also be used to finance educational technologies, including, hardware, software and connectivity.[106]

As part of utilizing pre-existing programmes to manage the crisis, the FCC took steps to help ensure that no American would be involuntarily removed from the Lifeline programme during the coronavirus pandemic. This programme provides a monthly discount on either a wireline or a wireless service. Lifeline also supports broadband Internet access service and broadband-voice bundles to low-income consumers.[107] To keep consumers connected, the FCC waived several rules that would have otherwise removed subscribers from the programme. The order also waived the programme's usage requirements and general de-enrollment procedures, and extended a recent waiver of its recertification and reverification requirements initially until 29 May 2020 and then until 30 November 2020.[108] The FCC stated that it would continue to monitor the situation to determine whether any additional extension of these waivers was appropriate. Ensuring that individuals already enrolled in the Lifeline programme remain, along with extending access to those recently affected by the pandemic, provides relief to millions of Americans who otherwise would have lost mobile and/or broadband services.

Since the start of the pandemic, many private and public sector employees have been working from home and students have shifted to taking classes online. Employees and students alike have had to rely heavily on platforms that host videoconference services to attend meetings and classes. Under normal circumstances, the sharp increase of users on these platforms would have caused additional rules to be placed on the companies that host them. To mitigate this, the FCC specifically issued a temporary waiver of its access arbitrage rules[109] for one of the telecommunication companies that hosts the traffic for two of the nation's largest conference calling providers. This waiver prevents companies that host applications for videoconferencing from facing financial consequences under the rule. Prior to the waiver, the massive increase of users on applications like Zoom and WebEx would have caused the companies who host these service providers to be deemed an "access-stimulating" carrier under the FCC's rules. Normally, if triggered, this would add additional financial burdens that could impede their ability to host companies providing such video services.[110]

104 FCC. News Release. FCC Waives Rural Health Care and E-Rate Program Gift Rules to Promote Connectivity for Hospitals and Students during Coronavirus Pandemic. 18 March 2020; see also FCC. Order. E-Rate and RHC COVID-Related Waivers Extended. 3 September 2020.
105 USD 16 billion in funding is to come from the CARES Act and was announced in April 2020.
106 FCC. News Release. FCC and U.S. Department of Education promote remote education so students can continue learning. 27 April 2020.
107 FCC. Consumer Guide. Lifeline Support for Affordable Communications. Accessed 27 August 2020.
108 FCC. News Release. FCC Acts to Keep Low-income Americans Connected during Coronavirus Pandemic. 30 March 2020; see also FCC. Order. WCB Extends Lifeline Program Waivers Due to COVID-19., 17 August 2020.
109 The FCC's arbitrage rules are aimed at preventing telecom companies from exploiting the intercarrier compensation system by generating inflated call volumes to pad their bottom lines.
110 FCC. News Release. FCC Waives Rules to Ensure Consumers Can Continue Accessing Conference Calling Services From Zoom And WebEx During The Covid-19 Crisis. 27 March 2020.

(5) Consumer protection and safety

To maintain relay services for individuals who are deaf, hard of hearing, deaf-blind or have a speech disability during the pandemic, the FCC granted temporary waivers to Telecommunications Relay Service (TRS) providers allowing American Sign Language interpreters to work from home.[111] As a result of the pandemic and states' responsive emergency regulations, traffic levels have increased, challenging the ability of TRS providers to properly staff call centres and answer and process TRS calls. Temporary emergency waivers of the FCC's speed-of-answer requirement, at-home video relay service (VRS) call-handling rules, VRS subcontracting restrictions and provisions of the emergency call handling rule have given TRS service providers greater flexibility to provide valuable services during the pandemic.

Broadcasters have also contributed substantially by making voluntary public service announcements in English and Spanish about social distancing, airing educational programming to help with distance learning, expanding the news coverage of COVID-19, and holding fundraisers to help those facing financial hardship due to the virus.[112] Broadcasting companies have also offered teaching services and tools for students in grades 6-12 along with special programming on the coronavirus. The National Association of Broadcasters offers a coronavirus toolkit in both English and Spanish.

Unfortunately, scams related to Coronavirus fears have increased in the United States and around the world. To combat this, the FCC is raising awareness of the dangers of these fraudulent activities, and of how consumers can mitigate home network and mobile device security issues. It is keeping Americans informed about the types of schemes being used, and how to identify and avoid them. The FCC's Coronavirus Scam webpage identifies text messages, robocalls and contact tracing as the three such schemes used most often to target individuals who may be considered at risk of the virus. The FCC also provides information to consumers through its Consumer Help Center and through the FCC Scam Glossary. In partnership with FEMA, it offers tips for communicating during an emergency, including how to prepare for a power outage. Finally, the FCC has issued guidance on how to optimize the performance of consumer home networks and how to safely sanitize mobile devices.[113]

In a collaborative effort with the Federal Trade Commission (FTC), the FCC has worked to protect consumers from robocalls and provided important information on the dangers of contact tracing scams. On 20 May 2020, both agencies required gateway providers allowing COVID-19-related scam robocalls to cut off this traffic or phone companies would be allowed to block all traffic from those gateway providers' networks. Scams being routed to American consumers included fake COVID-19 refunds, Social Security Administration COVID scams, and Loan Interest Rate Reduction scams. Within 24 hours of the notice, three gateway providers had complied with the demands. This came after a similarly successful push in April 2020 from the agencies that effectively terminated other robocallers' access to American phone networks.[114] Additionally, the FCC has worked hard to inform the public about the dangers of giving information to individuals falsely claiming to be involved in contact tracing. Both the FCC

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111 FCC. News Release. FCC grants flexibility to relay service providers to preserve communications access for Americans with disabilities. 16 March 2020.

112 For example, one company raised USD 275 000 for a relief fund for COVID-19 related economic hardship and another raised USD8 million for coronavirus relief via a virtual music concert.

113 See FCC. Consumer. Home Network Tips for the Coronavirus Pandemic. Updated 1 July 2020.

114 FCC. News Release. FCC, FTC demand robocall-enabling service providers cut off COVID-19-related international scammers. 20 May 2020.

and FTC warn consumers that contact tracing is typically carried out by state health departments and is not a federal programme. These initiatives help prevent users from falling victim to one of these scams.

Finally, the FCC's Broadband Deployment Advisory Committee (BDAC), which is a multistakeholder committee that provides advice and recommendations to the FCC on how to accelerate the deployment of high-speed Internet access, was called upon to provide support for COVID-19 relief initiatives. The BDAC Disaster Response and Recovery Working Group is comprised of representatives from across a broad spectrum of public and private organizations, and includes individuals from states and localities, industry, and consumer and community organizations.[115] In April 2020, it was tasked with assisting the BDAC in documenting the various strategies and solutions being developed and implemented by public and private stakeholders to address the deployment-related challenges presented by the pandemic. The Working Group will use the data collected to report on best practices and lessons learned from the response in order to prepare for and respond to any comparable future crises. The first report and recommendations of the current Working Group were presented to and approved by the full BDAC on 27 March 2020, outlining the strategies for emergencies related to planning, responding and restoring communication access.

[115] FCC Public Notice. DA 20-420. FCC Tasks BDAC Working Group with Addressing COVID-19 Challenges. 16 April 2020.

Annex 2: ITU intra-Sector and inter-Sector mapping

A2.1 Collaboration with other Questions in ITU-D Study Groups 1 and 2

This section provides a list matching ITU-D Question 5/2 to other Questions being examined by ITU-D Study Groups 1 and 2. The list was reviewed and discussed at Question 5/2 meetings, after which the table below was agreed without any further comments.

Table 7A: Matrix of ITU-D Study Group 1 and 2 intra-sector coordination

	Q1/1	Q2/1	Q3/1	Q4/1	Q5/1	Q6/1	Q7/1	Q1/2	Q2/2	Q3/2	Q4/2	Q6/2	Q7/2
Q5/2	X	X	X	X	X			X	X	X		X	

A2.2 Mapping of ITU-T and ITU-D Questions

Based on ITU study group activities, with the assistance of the three Bureaux the ITU General Secretariat has developed mapping documents[116], including the mapping of ITU-D and ITU-T Questions.[117]

116 ITU. Inter-Sector Coordination Group (ISCG) documents. Mapping Tables.
117 ITU. ISCG. Mapping of ITU-D SG1 and SG2 Questions to ITU-T Questions.

Table 8A: Matrix of ITU-D Question 5/2 and ITU-T Questions

		Q5/2			Q5/2
ITU-T SG2	Q1/2		**ITU-T SG9**	Q1/9	
	Q3/2	X		Q2/9	
	Q5/2			Q4/9	
	Q6/2			Q5/9	
	Q7/2			Q6/9	
ITU-T SG3	Q1/3			Q7/9	
	Q2/3			Q8/9	
	Q3/3			Q10/9	
	Q4/3		**ITU-T SG11**	Q1/11	
	Q6/3			Q2/11	
	Q7/3			Q3/11	X
	Q9/3			Q4/11	
	Q10/3			Q5/11	
	Q11/3			Q6/11	
	Q12/3			Q7/11	
	Q13/3			Q9/11	
ITU-T SG5	Q1/5			Q10/11	
	Q2/5			Q11/11	
	Q3/5			Q12/11	
	Q4/5			Q13/11	
	Q6/5	X		Q14/11	
	Q7/5			Q15/11	
	Q8/5				
	Q9/5	X			

		Q5/2			Q5/2
ITU-T SG12	Q2/12		**ITU-T SG16**	Q8/16	X
	Q3/12			Q13/16	
	Q4/12	X		Q14/16	X
	Q5/12			Q21/16	
	Q6/12			Q24/16	
	Q7/12			Q26/16	X
	Q8/12			Q27/16	
	Q11/12			Q28/16	
	Q12/12		**ITU-T SG17**	Q1/17	
	Q13/12			Q2/17	
	Q16/12			Q3/17	
	Q18/12			Q4/17	
	Q19/12			Q5/17	
ITU-T SG13	Q1/13			Q6/17	
	Q5/13			Q7/17	
	Q6/13			Q8/17	
	Q7/13			Q9/17	
	Q16/13			Q10/17	
	Q17/13			Q11/17	
	Q18/13			Q13/17	
	Q19/13		**ITU-T SG20**	Q1/20	
	Q20/13			Q2/20	X
	Q21/13			Q3/20	X
	Q22/13			Q4/20	X
	Q23/13			Q5/20	
ITU-T SG15	Q1/15	X		Q6/20	
	Q11/15			Q7/20	
	Q12/15				
	Q16/15	X			
	Q17/15	X			

A2.3 Mapping of ITU-R and ITU-D work

The mapping with ITU-R[118] is detailed below:

Table 9A: Matrix of ITU-R working parties and ITU-D Question 5/2

R\D	WP 1A	WP 1B	WP 1C	WP 3J	WP 3K	WP 3L	WP 3M	WP 4A	WP 4B	WP 4C	WP 5A	WP 5B	WP 5C	WP 5D
Q5/2		X	X					X	X	X	X	X	X	X

R\D	WP 6A	WP 6B	WP 6C	WP 7A	WP 7B	WP 7C	WP 7D
Q5/2	X	X	X			X	

[118] ITU. ISCG. Mapping of ITU-D SG1 and SG2 Questions to ITU-R Working Parties.

Annex 3: Information from ITU-T and ITU-R

A3.1 Framework of disaster management for network resilience and recovery (ITU-T Study Group 15)

ITU-T Study Group 15 provided information on the establishment of the supplement ITU-T L.Sup35, Framework of Disaster Management for Network Resilience and Recovery, which summarized several architectural frameworks for network resilience and recovery aimed at ensuring continuity of communications as much as possible in the event of a disaster.

A3.2 Informative update in the area of disaster communications (ITU-R Disaster Relief Liaison Rapporteur)

The ITU-R Disaster Relief Liaison Rapporteur frequently provided updated information related to disaster communications in ITU-R and other organizations.

The Liaison Rapporteur provided a comprehensive and informative update of the disaster communication activities, reports, resources, deployments and programmes of ITU-R and numerous ITU, regional and industry partners through October 2017, including a comprehensive update on known Caribbean hurricane responses.

The Liaison Rapporteur also provided a comprehensive list of recent disaster-related activities noted across ITU Sectors, in regional organizations and in industry-specific groups.

The Liaison Rapporteur further provided information about a revision of Question ITU-R 77-8/5, on the needs of developing countries in IMT development and implementation.

Lastly, the Liaison Rapporteur provided a comprehensive overview of recent developments relating to emergency communications. The overview included WRC-19 outcomes, ongoing work in ITU-R and ITU-T and various activities by BDT to help countries prepare for and respond to disasters. It also stated that ITU had joined the Crisis Connectivity Charter, a mechanism created between the satellite industry and the wider humanitarian community to make satellite-based communications more readily available to humanitarians and communities in times of disaster.

A3.3 Remote-sensing systems (ITU-R Working Party 7C)

ITU-R Working Party 7C submitted a report on remote-sensing systems in which it noted that ITU-R was updating Recommendation ITU-R RS.1859, on the use of national remote-sensing systems for data collection in the event of disaster. The update would be finalized and sent to the parent group, ITU-R Study Group 7, in September 2018.

A3.4 Country national emergency telecom systems (ITU-T Study Group 2)

ITU-T Study Group 2 sought the review and comments of the Question 5/2 team on the contribution from Benin on improving the emergency telecom system in Benin, which proposes that a new work item be created in ITU-T on developing country national emergency telecom systems. The idea is to define norms and practices regarding countries and their level of development and to work on developing emergency telecommunication infrastructure.

A3.5 Terms and definitions for disaster relief systems, network resilience and recovery (ITU-T Study Group 2)

ITU-T Study Group 2 provided information on its work on E.TD-DR, Terms and definitions for disaster relief systems, network resilience and recovery.

ITU-T Study Group 2 also provided information about the finalized ITU-T Recommendation E.102 (ex E.td-dr), Terms and definitions for disaster relief systems, network resilience and recovery, and E.100-series Supplement 1 (ex. E.sup.fdr).

A3.6 Framework of disaster management for disaster relief systems (ITU-T Study Group 2)

ITU-T Study Group 2 informed the Question 5/2 meeting about E.SUP.FDR, Framework of disaster management for disaster relief systems. It was noted that section 6 of this supplement ("Overview of early-warning and disaster relief systems") is relevant to Question 5/2.

ITU-T Study Group 2 also informed the meeting that a new Focus Group on Artificial intelligence for natural disaster management (FG-AI4NDM) has been established under ITU-T SG2. The background and practical information can be found on the group's homepage: http://itu.int/go/fgai4ndm .

A3.7 Global broadband Internet access by fixed-satellite service systems (ITU-R Working Party 4A)

ITU-R Working Party 4A provided information on progress on Recommendation ITU-R S.1782, Possibilities for global broadband Internet access by fixed-satellite service systems.

A3.8 The fast deployment emergency telecommunication network (ITU-T Study Group 11)

ITU-T Study Group 11 provided information on its progress in drafting Recommendation ITU-T Q.ETN-DS, Signalling architecture of the fast deployment emergency telecommunication network to be used in a natural disaster, which focused on a number of emerging technologies.

ITU-T Study Group 11 reported that Recommendation ITU-T Q.3060 (former Q.ETN-DS) had been consented at its meeting in July 2020.

It was noted that the corresponding completed work item should be removed from the mapping table between ITU-D and ITU-T.

A3.9 Fixed wireless systems for disaster mitigation and relief operations (ITU-R Study Group 5)

ITU-R Study Group 5 provided information on its update of Recommendation ITU-R F.1105, Fixed Wireless Systems for disaster mitigation and relief operations.

A3.10 Satellite systems (ITU-R Working Party 4B)

ITU-R Working Party 4B, on interrelated activities of ITU-R and ITU-D, noted the update of Report ITU-R M.NGAT-SAT, on Key Elements for Integration of Satellite Systems into Next Generation Access Activities. It also provided information on the update of Recommendation ITU-R S.1782, Possibilities for Broadband Internet Access by Fixed Satellite Service Systems.

A3.11 Public protection and disaster relief (ITU-R Working Party 5A)

ITU-R Working Party 5A provided information on several ITU-R Recommendations and Reports that could be relevant to work on Question 5/2. All ITU-R Recommendations and Reports on PPDR, including those related to the role of the amateur service in disaster relief, are included in section 6 of the document entitled 'Guide to the use of ITU-R texts relating to the land mobile service, including wireless access in the fixed service'. Recently updated publications include Recommendations ITU-R M.2009 and ITU-R M.2015 and Reports ITU-R M.2377 'Radiocommunication objectives and requirements for Public Protection and Disaster Relief (PPDR)' and ITU-R M.2415 'Spectrum needs for Public Protection and Disaster Relief'.

A3.12 IMT Public protection and disaster relief (ITU-R Working Party 5D)

ITU-R Working Party 5D informed the Question 5/2 meeting that Report ITU-R M.2291, which addressed the use of International Mobile Telecommunications for broadband PPDR and had originally been completed by Working Party 5D in 2013 before being updated in 2016, had been updated again in March 2021. This report describes the benefits of using LTE to support PPDR radiocommunications. The current update addresses the use of IMT 2020 to support PPDR radiocommunications.

Annex 4: Information on workshops and panel sessions

A4.1 Panel session on early-warning systems[119]

Geneva, Switzerland

8 May 2018

Summary

Introduction

As part of the work of **ITU-D Study Group 2** on **Question 5/2,** and with the support of the administrations of Japan and the United States, the Question 5/2 meeting organized a **panel session on early-warning systems, including safety confirmation**, on 8 May 2018. The session was an opportunity to present a high-level introduction to numerous stakeholders involved in early warning, with activities including disaster prediction and detection, alerts, emergency information and safety confirmation. The discussion focused on identifying the lessons learned from the experiences of a diverse group of stakeholders. The discussion results were to be considered for further study as the Question turned to early warning in 2018, with key findings incorporated into the annual report of Question 5/2 for 2018 on early warning.

Session details

The session was opened by **Hideo Imanaka, Vice-Rapporteur of Question 5/2, NICT, Japan,** who briefly explained the background and objectives of the panel session.

Cosmas Zavazava, Chief, Project Support and Knowledge Management, BDT, delivered opening remarks on ITU activities on disaster relief. Panel sessions and workshops were very important for exchanging information and experience within ITU-D, with other ITU sectors and with other organizations. The conclusions and best practices from the panel session would be valuable for the work on Question 5/2.

Discussion

The panel session, led by **Joseph Burton, Co-Rapporteur for ITU-D Study Group 2 on Question 5/2, Department of State, United States,** discussed both current and emerging technologies for early-warning systems. The experiences of government, industry and research institute stakeholders in planning and preparation for detecting disasters and issuing alerts must continuously evolve based on lessons learned from previous disasters.

Xu TANG, Weather and Disaster Risk Reduction Service Department, WMO, briefly explained WMO activities that can benefit national early-warning and alert activities, including the Multi-Hazard Early-Warning Systems Checklist and the Climate Risk and Early-Warning Systems Initiative. WMO had also adopted the CAP (ITU-T X.1303) and the alerting platform called Alert Hub. The Global Multi-hazard Alert System aimed to provide authoritative information and advice for the operational and long-term decision-making processes of United Nations agencies and the humanitarian community.

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[119] For further information, see the panel session webpage.

Imani ELLIS-CHEEK SY, Federal Communications Commission, United States, provided an overview of the modernization of United States alerting systems, including the Emergency Alert System and Wireless Emergency Alerts. The Emergency Alert System delivered alert messages by broadcast radio and television, cable television and direct broadcast satellite. Wireless Emergency Alerts sent alert messages to mobile phones in targeted areas. It could also send Child Abduction Alerts.

Azar ZARREBINI, Iridium, United States, shared information about the importance of early-warning systems using satellite technologies. Satellites could provide timely emergency communications in the event of a disaster, but emergency deployments of satellite equipment were often hindered by licensing or regulatory issues. In the future, communication policy-makers should consider policies that would enable, and not delay, the use of M2M-based disaster detection applications, which had implications for early warning.

Yulia KOULIKOVA, EMEA Satellite Operators Association (ESOA), Belgium, introduced the activities of the ESOA Multi-hazard Early-Warning System. ESOA had a programme called SATLAS, which was co-funded by European Space Agency Advanced Research in Telecommunications Systems (ARTES). SATLAS was an incubator for developing satellite communication applications. Its target market was the Middle East and Africa, plus Europe. As with the flood early-warning system, the ESOA stand-alone flood monitoring solution used BGAN M2M, which could also be used to create a tsunami early-warning system whereby sensors monitored real-time changes in sea level and other parameters. The resulting data could be sent via specific platforms to systems able to trigger sirens to alert citizens to an emergency situation. The system was being tested in Thailand.

Yoshiaki NAGAYA, Ministry of Internal Affairs and Communications, Japan, briefly introduced the latest research activities on early warning in Japan. Real-time big-data analysis could be used to detect localized torrential rainfall. 3-D images captured by newly developed radars were analysed in a very short time and alert messages sent 20 minutes before the rainfall started. Analysing SNS messages could be helpful for disaster detection. The DISAANA (DISaster information ANAlyzer) system developed by NICT could analyse SNS (e.g. Twitter) messages, which were available in extremely large numbers and contained non-structured data. The outputs of DISAANA could be used to assess victim needs and monitor disaster-affected areas.

Conclusions and best practices

During the panel discussion, the representatives of Sudan, Niger, Benin, ATDI, Côte d'Ivoire, the United Republic of Tanzania, South Africa and Ghana engaged in an active discussion with the panellists and BDT. The following items were recognized as best practices (see **Section 7.1(A)** of this report for a complete description of each item):

- keep developing country needs in mind;
- ensure flexibility;
- ensure regulatory flexibility;
- adapt emergency alert systems;
- ensure connectivity;
- build capacity;
- develop enabling policies;
- continuously improve emergency procedures;
- be alert to technological advances;

Other areas for consideration were as follows:

- advance training on satellite systems;
- last-mile warning messages from local government to citizens, and the capacity of satellite systems;
- the ongoing pursuit of disaster risk knowledge, which can be expanded by systematically collecting data and assessing disaster risks (detection, monitoring, analysis and forecasting of hazards and possible consequences) and thus enable the communication of timely, accurate, relevant and actionable warnings with information on likelihood, impact and recommended action;
- the need for ongoing stakeholder coordination.

Contributions to Question 5/2 in 2018 that took early-warning system experiences and needs into account would be valuable for further consideration.

Sanjeev BANZAL, Co-Rapporteur of Question 5/2, Telecom Regulatory Authority of India, India, summarized the outcomes of the panel discussion, which had covered everything from regulatory issues to emerging technologies such as M2M and SNS, and the importance of the Multi-Hazard Early-Warning Systems Checklist. Early-warning systems were clearly of great interest to participants, who were encouraged to engage in further information exchanges, in particular by submitting contributions providing specific examples of the application of technologies to specific areas of early-warning systems, and of enabling policies, to the October 2018 meeting on Question 5/2.

Ahmad R. SHARAFAT, ITU-D Study Group 2 Chairman, Islamic Republic of Iran, closed the session by thanking the Question 5/2 management team, BDT, the panellists and the participants for their fruitful discussions.

A4.2 Session on disaster drills and emerging technologies on disaster management[120]

Geneva, Switzerland

3 October 2018

Summary

Introduction

As part of the work of **ITU-D Study Group 2** on **Question 5/2**, the Question 5/2 meeting organized a **session on disaster drills and emerging technologies on disaster management** on Wednesday, 3 October 2018. The session consisted of three detailed workshops and aimed to present and exchange information on disaster drills, exercises and emerging technologies. The discussion focused on identifying lessons learned based on the experiences of a diverse group of stakeholders. The discussion results would be considered for further study as the Question turned to disaster drills in 2019, with key findings incorporated into the annual report of Question 5/2 for 2019 on disaster drills using ICTs.

Note: All presentations for this session are available on the event website.

[120] For further information, see the panel session webpage.

Session details

The session was opened by **Sanjeev Banzal, Co-Rapporteur for Question 5/2, India**, who welcomed participants, then briefly explained the background and objectives.

Workshop 1: Experiences of disaster drills using emergency telecommunication systems

Workshop 1 was moderated by Hideo Imanaka, Vice-Rapporteur for Question 5/2, NICT, Japan. Its objectives were:

- to explore experiences of actual disaster drills using ICTs;
- to consider the lessons learned from those experiences and the effectiveness of the drills in emergency situations;
- to discuss the key objectives of drills, and how stakeholders were involved.

Lars Bromley, United Nations Institute for Training and Research (UNITAR), presented UNITAR's role in disaster preparedness and drills, briefly explaining UNITAR and UNOSAT activities for disaster drills and assessment of disaster-affected areas using satellite imagery analysis technologies. The Triplex exercise, a large-scale field simulation exercise focusing on strengthening preparedness and response in regard to coordination and effective emergency response held in Norway in 2016, had simulated hurricanes and floods and been attended by over 100 participants from several organizations, including UNOSAT, which had hosted the Virtual Onsite Operations Coordination Centre. The exercise had shown that frequent drills were important for ensuring that emergency systems were available and operational when needed.

Jeffrey Llanto, Central Visayas Information Sharing Network Foundation (CVISNet), Philippines, gave a remote presentation on the Use of emergency telecommunication systems in disaster-management drills: the case of the Philippines, which provided an overview of CVISNet's emergency telecommunication drills, exercises and training courses in the Philippines. MDRUs had been used in ITU projects in the Philippines in 2014. Because of the dual benefits of regularly utilizing this technology and bringing connectivity, CVISNet was considering using MDRUs to provide connectivity between disasters.

The representative of **India** asked how MDRUs connected with communication networks. **Mr Llanto** responded that MDRUs had interfaces with ordinary telephone networks and the Internet.

Hiroshi Kumagai, NICT, Japan, gave a presentation on Emergency communication drills in metropolitan areas, which introduced MDRUs, the "NerveNet" (ad hoc network system) and actual disaster drills using ICTs held in Japan. The lessons learned from the drills were that the battery capacity of ICT equipment was a significant factor; that it was important to ensure a power supply in disasters; and that NerveNet and MDRUs could be utilized in disasters.

The representative of **India** asked how big the MDRU was. **Dr Kumagai** responded that there were several types of MDRU, some as large as containers, others fitting into attaché cases (the moderator showed the participants an actual attaché case-type system). No additional equipment was needed when MDRU software was installed on smartphones. In reply to a question from the representative of the **United States**, he said that MDRUs could be pre-positioned before a disaster and deployed post-disaster.

Akihiro Nakatani, Astem, Japan, gave a presentation on Disaster relief applications for broadcasting services, introducing an IPTV-based translation system for persons with impaired hearing, called "Eye Dragon", which combined sign language and captions with live terrestrial TV programmes to assist persons with disabilities. The system could provide significant information to such persons in the event of a disaster. Thanks to the system and to the experience of disaster drills, the lives of persons with disabilities had been saved during the Great East Japan earthquake and the tsunami of March 2011.

In reply to a question from the representative of **Nigeria**, Mr Nakatani said that IPTV broadband networks were needed to receive sign language translation for live television; the service could not be provided on over-the-air television (terrestrial TV).

Workshop 2: Emerging technologies on disaster management

Workshop 2 was moderated by **Abdulkarim Ayopo Oloyede, Vice-Rapporteur for Question 5/2, Nigeria**. The discussion points were as follows:

- understand how technologies are being applied;
- policies that enable the advancement and deployment of evolving technologies;
- explore examples and types of new emerging disaster-management technology, including recent and expected technological evolutions.

Emily Yousling, Google, United States, gave a presentation on The role of the Loon project in disaster risk reduction. She explained how Google Loon had been used after Hurricane Maria in Puerto Rico and floods in Peru, and how it could be used around the world to provide access to telecommunication services before, during and after a disaster. It was important to pre-position communication capacity, and not wait until disaster struck to take action to ensure communication redundancy, as it took some time to restore network infrastructure.

The representative of **India** asked whether Loon's altitude (20 km above ground) posed flight path issues, how licensed spectrum for LTE services would be obtained for deployments, and how power was supplied to Loon (which was considered a "base station-in-the-sky") in the rainy season and at night, given that Loon was solar powered. **Ms Yousling** responded that due care was taken to ensure that the Loon network did not interfere with flight paths and that the spectrum utilized was that of existing telecom operators for whom Loon had been deployed. Regarding power supply, the fact that multiple Loons were deployed enabled consistent service.

Salma Farouque, Emergency Telecommunications Cluster (ETC), WFP, gave a presentation on the Practical use of drones in disaster response and recovery. The ETC was the part of the United Nations Cluster System responsible for telecommunications. In certain disasters, it could provide secure communications through VHF and Internet connectivity thanks to quick deployment of satellite terminals and Wi-Fi. It could also provide user assistance and help support communication coordination and information management. Other potential services included liaison with government authorities, preparedness assistance and services for communities, including drone coordination. Drones could be used for multiple humanitarian purposes, including mapping, monitoring, search and rescue, delivery, and providing communication during the response and recovery phases.

Yuichi Ono, Tohoku University, Japan, gave a presentation on the Global Centre for Disaster Statistics. He described the use of big data in emergency situations, noting the need for statistics/record keeping on the impacts of disasters in different countries of the world. The data collected could be used by a country during the recovery process. The Centre had helped different countries to prepare and plan in order to shorten the recovery process and mitigate future disasters.

Vanessa Gray, ITU/BDT, gave a presentation on Disruptive technologies and disaster management. ITU supported Member States with capacity-building assistance to promote preparedness and post-disaster recovery. Technology should be used to assist in all phases of disaster management. ITU was putting together a disaster-management toolkit and drafting guidelines for emergency communication planning that could be adapted by Member States.

Workshop 3: Disaster management and drills using ICTs

Workshop 3 was moderated by **Joseph Burton, Co-Rapporteur of Question 5/2, United States**. The objectives were as follows:

- provide examples of the range, scope and frequency of emergency communications exercises and drills;
- understand how exercises and drills can increase preparedness, and ways to increase the effectiveness of drills;
- how to tailor drills and exercises to national conditions and complex emergencies;
- identifying potential participants and enabling robust stakeholder engagement;
- discuss the use of innovative technologies in preparedness exercises and of old technologies in innovative ways to support preparedness and response.

Salma Farouque, Emergency Telecommunications Cluster (ETC), WFP, gave a presentation on Coordinating communications drills and exercises – setting the stage. She discussed the range of communication exercises that might be considered, from a table-top exercise to a functional exercise, to perform a full-scale drill like WFP's "opEx Bravo". The purpose of an exercise was to test procedures and enhance preparedness, by documenting and verifying existing procedures and identifying and addressing gaps. Among the factors and steps to consider when planning an exercise, it was important to set objectives in advance, and to hold not only a debriefing or an after-action, but also to draft an action plan to address and fix any issues identified. Exercise participants might include the regulator, the Ministry of Communications, the national disaster-management agency, meteorological and geophysics departments (or other hazard-warning entities), communication service providers, power utilities, humanitarian organizations and community stakeholders.

Rod Stafford, International Amateur Radio Union (IARU), gave a presentation, Communications drills and exercises – the amateur radio perspective, in which he described the use and application of amateur radio in a range of communication drills. When communication infrastructure was down, amateur radio might be the only way to communicate in certain areas. It was therefore important to incorporate amateur radio, which might provide communication redundancy, into drills and exercises. Communication technologies used by amateur radio included HF, VHF, microwave frequencies and amateur radio satellites.

The representative of **Japan** noted that amateur radio enabled SIDS to communicate across many islands and great distances. Many participants agreed that young people were often unaware of the existence of amateur radio; that generation gap should be overcome. **Ahmad Sharafat, Chairman of ITU-D Study Group 2, Islamic Republic of Iran**, suggested that the IARU submit a white paper on the benefits and operational modes of amateur radio.

Preeti Banzal, India, gave a presentation on India's experience executing a mega drill in the Western Himalaya region, to provide the perspective of communication officials coordinating part of a national disaster (earthquake) exercise. The scenario had enabled a detailed review of preparedness, training and coordination between national and state officials. The exercise had not only tested the response capabilities of various agencies across all levels of government, it had also identified gaps in policies, procedures and training for further action, and helped facilitate preparation of response plans at all levels of government.

The representative of **Intel** stressed the importance of educating people about back-up/ redundant means of communication.

Conclusions and best practices

Sanjeev Banzal, Co-Rapporteur for Question 5/2, India, summarized the outcomes of the workshop discussions in terms of lessons learned and best practices related to disaster drills and exercises, and the use of emerging technologies for disaster management (see **Section 7.1(B)** of this report for a complete summary). He thanked all the speakers, moderators, participants, BDT staff and interpreters for their active support and contributions.

A4.3 Session on conducting national-level emergency communications drills and exercises: Guidelines for small island developing States and least developed countries[121]

Geneva, Switzerland

7 October 2019

Summary

Introduction

The session on national emergency ICT drills and exercises was held on Monday, 7 October 2019, in conjunction with the Question 5/2 Rapporteur Group meeting on Utilizing telecommunications/ICTs for disaster risk reduction and management.

The session was opened by **Doreen Bogdan-Martin, Director, BDT, ITU,** who had just returned from the Bahamas, where she had witnessed the devastating damage in Abaco and Grand Bahamas caused by Hurricane Dorian. ITU had identified numerous opportunities to provide disaster preparedness capacity-building support to the Bahamas and other Member States, including for the advance consideration of policies/regulations to enable roaming in disasters, the implementation of the ITU Global Guidelines for Drafting National Emergency Telecommunications Plans, and guidance from ITU partners on the conduct of ICT drills and exercises. ICT preparedness planning was a universal need, hence the importance of holding continued ICT preparedness-focused workshops. She thanked the panellists for coming to Geneva, highlighted the importance of drills and exercises for testing and refining policies and plans, and outlined the session programme and objectives.

Session methodology

The session featured three workshops, each moderated by Question 5/2 Co-Rapporteur Joseph Burton. Workshop 1 featured presentations by Vanuatu and Haiti, followed by a guided table-top exercise. In addition to a presentation by each panellist, an open discussion among panellists

[121] For further information, see the panel session webpage.

was held in Workshops 2 and 3, which reflected the phases of drills and exercises, from planning to after-actions and translating lessons learned into updated policies.

The session then introduced capacity-building resources and tools that BDT had recently developed in coordination with partners such as the Emergency Telecom Cluster, to help Member States develop a robust emergency communication framework and preparedness programme, including NETPs and ICT drills and exercises.

The outcomes of the discussions would be incorporated into the annual report by Question 5/2 on guidelines for conducting ICT drills and exercises.

Workshop presentations

Workshop 1. Small island developing State and least developed country experiences of planning disaster drills

- **John Jack, Office of the Government Chief Information Officer**, Vanuatu, gave a presentation on Vanuatu's experience of exercises and drills.
- **Gregory Domond, Conseil National des Télécommunications (CONATEL)**, Haiti, gave a presentation on earthquake and tsunami drills and exercises in Haiti.
- **Joseph Burton, Cyber and International Communications and Information Policy**, United States, led participants through a table-top simulation exercise developed by the ETC and ITU for the 2019 Global Symposium for Regulators, on the role of the regulator in disaster management.

Workshop 2. Conducting drills: a guided discussion with panelists and participants

- **Antwane Johnson, FEMA**, United States, gave a presentation on IPAWS and the use of alert and warning in drills and exercises.
- **Rod Stafford, International Amateur Radio Union**, gave a presentation on Amateur radio – prepared for drills and exercises.
- **Justin Williams, Network Disaster Recovery, AT&T, United States**, gave a presentation on Leveraging ICTs for disaster and response: what have we learned.
- **Dulip Tillekeratne, Mobile for Humanitarian Innovation, GSMA**, gave a presentation on engaging with mobile network operators on drills and exercises.

Workshop 3. The wrap-up: capturing and turning lessons learned into action

- **Ria Sen, Emergency Telecommunications Cluster (ETC), WFP**, introduced the ETC-ITU table-top simulation exercise guide, which was soon to be finalized.
- **Maritza Delgado, BDT, ITU,** presented the range of available ITU capacity-building assistance. BDT developed information resources to increase overall ICT preparedness and response coordination, including by utilizing the recently developed *Guidelines for national emergency telecommunication plans*, in addition to other preparedness services developed in partnership with the ETC for Member States.

Note: Most of the presentations for this session are available on the event website. Best practices and lessons learned from presentations (and workshop discussions) will be reflected in the Question 5/2 session outcome document on guidelines for conducting national ICT drills and exercises.

Session outcomes

Preparations for the session resulted in a draft outcome document containing guidelines for conducting national ICT exercises and drills that could be tailored to meet the unique needs of SIDS and LDCs. Co-Rapporteur Joseph Burton presented the draft in Document SG2RGQ/

TD/12 during the Rapporteur Group meeting for Question 5/2 held on 8 October 2019. The guidelines will be updated with key learnings, including lessons learned and best practices from workshop discussions. Input from workshop participants is welcome. The final draft of the guidelines will be incorporated into the annual report of Question 5/2 on ICT drills and exercises. (See **Section 7.1(C)** of this report).

A4.4 Public webinar on enabling policy environment for disaster management, including for COVID-19 response[122]

Virtual meeting

14 July 2020

During the study period, Question 5/2 conducted a public webinar, Enabling Policy Environment for Disaster Management, including for COVID-19 response, chaired by Ahmad Reza Sharafat, Chairman of ITU-D Study Group 2. The main objectives of the webinar were to:

- discuss the constituent elements of an enabling policy environment for increasing emergency telecommunication preparedness, network resilience, disaster risk reduction and disaster management;
- provide examples of policies that enable flexibility when deploying emergency communication equipment and successful disaster preparedness and response with respect to telecommunications and ICTs;
- share ITU member experiences and lessons learned in developing and implementing enabling policies and NETPs.

During the webinar, expert panellists discussed the importance of implementing measures and polices that would ensure the continued functioning of communication networks during disasters, such as declaring telecommunication networks as essential services or performing organized drills. The webinar also featured examples of policies for preparedness and different responses observed around the globe during the COVID-19 pandemic.

Juan Roldan, Luxon Consulting Group, initiated the presentations by discussing the challenges that come with developing an NETP. An effective NETP accounted for multiple hazards, used multiple technologies, contained multiple phases and was supported by multiple stakeholders. NETPs needed political will and support, and governments must clearly identify which specific department or agency was responsible for emergency telecommunications.

Continuing on the theme of cross-sectoral collaboration, **Chris Anderson, CenturyLink Global Network**, advocated for public-private partnerships, declaring them to be necessary for effective disaster management. Such partnerships should always be assembled during the "blue sky scenario", meaning before disaster actually struck, since it was much harder to bring the necessary people together during a crisis.

Concluding the first segment of the webinar, **Paul Margie, *Télécoms Sans Frontières* (TSF)**, explained that, while disaster management was never one-size-fits-all, commonalities could be observed in the countries where TSF worked. These included training beforehand, formally recognizing ICTs as critical infrastructure, publicly identifying points of contact for ICT response, developing procedures so that experts could enter quickly, and adopting mechanisms within

[122] For further information, see the panel session webpage.

the telecom regulator to speed decision-making. In that respect, special temporary authorities could enable rapid changes to be made when they were most needed.

COVID-19 responses from around the globe

The second segment of the webinar focused on COVID-19 responses observed in different countries worldwide. **Maritza Delgado, ITU Programme Officer,** explained that tracking and analysing such responses was one of the main objectives of REG4COVID, an ITU initiative designed to help communities stay connected during crises and to prepare medium- and long-term recovery measures. The Global Network Resiliency Platform was just one example.

Kathryn O'Brien, Chief of Staff, International Bureau, Federal Communications Commission (FCC), United States, shared some of the FCC's guiding principles, the first being to set clear priorities. It was also important to work with the private sector. Technology must go hand-in-hand with policy to produce effective disaster responses.

Ryosuke Shibasaki, professor, University of Tokyo, Japan, focused on information on people flows and population density statistics for better-informed decision-making. Open-source analysis software could use big data from mobile serial data to support COVID-19 responses by measuring movements. The software's development had originally been triggered by ITU in 2015, and it was now in operation in several African countries.

Funke Opeke, MainOne CEO, Nigeria, shared the challenges faced by developing countries in coping with COVID-19.

Rahul Vatts, Chief Regulatory Officer, Bharti Airtel Limited, India, explained that traffic had surged by up to 50 per cent during the pandemic, creating infrastructure challenges for India at a time when maintenance staff found it difficult to move because of lockdowns. Telecommunication service providers had overcome the challenge thanks to the special permissions from the Government and the regulator to move telecom staff across critical sites. To address maintenance concerns, the telecommunication service providers worked with over-the-top providers, as network optimization was an ongoing necessity. The Government had directed providers to change the ring-back tone and ringtone of all landlines – nearly 987 million working phones – to a special COVID-19 message asking subscribers to stay home and practice social distancing.

Lessons learned: Enabling policy today saves lives tomorrow

Access to a robust, resilient and secure ICT infrastructure worldwide is critical in a pandemic and in any kind of disaster. ICTs are essential for power, security, health and sanitation – essential services in a global emergency. However, their ability to perform as needed required an enabling policy environment able to do many things, from granting temporary authority for additional spectrum use to giving complimentary recharge margins for emergency calls.

Among the many other lessons learned from the COVID-19 pandemic was the fact that the world's telecommunication networks and digital infrastructure must be better prepared for disasters of all kinds. Collectively, drills had to be carried out and rapid response measures prepared, since future disasters – including pandemics – could occur anytime, anywhere, and with little to no warning.

Any negative consequences of disasters could be diminished if robust and resilient networks and disaster-management tools were in place well ahead of time.

(See **Section 7.1(D)** of this report)

Note: All presentations for the webinar are available on the event website.

Annex 5: List of contributions and liaison statements received on Question 5/2

Contributions on Question 5/2

Web	Received	Source	Title
2/420	2021-03-15	Co-Rapporteurs for Question 5/2, Vice-Rapporteur for Question 5/2	Proposed liaison statement from ITU-D Study Group 2 Question 5/2 to ITU-R Working Party 5D on the Output Report on Question 5/2
2/419	2021-03-15	Co-Rapporteurs for Question 5/2, Vice-Rapporteur for Question 5/2	Proposed liaison statement from ITU-D Study Group 2 Question 5/2 to ITU-R Working Party 5A on the Output Report on Question 5/2
2/418	2021-03-15	Co-Rapporteurs for Question 5/2, Vice-Rapporteur for Question 5/2	Proposed liaison statement from ITU-D Study Group 2 Question 5/2 to ITU-T SGs, ITU-R SGs, UN organizations and external organizations on the Output Report on Question 5/2
2/410	2021-03-03	Inmarsat	Input Contribution to the Draft Output Report on Question 5/2
2/401	2021-03-02	National Institute of Information and Communications Technology (NICT) (Japan)	Proposal of communication technologies and its use case of an autonomous distri-buted information and communications system "Die-Hard Network" for disaster countermeasure
2/397 (Rev.1)	2021-03-15	Co-Rapporteurs for Question 5/2, Vice-Rapporteur for Question 5/2	Proposed liaison statement from ITU-D Study Group 2 Question 5/2 to ITU-T Study Group 2 and FG-AI4NDM on the Output Report on Question 5/2 and future of the Question
2/TD/36	2021-02-23	Co-Rapporteurs for Question 5/2, Vice-Rapporteur for Question 5/2	Proposed liaison statement from ITU-D Study Group 2 Question 5/2 to ITU-T Study Group 2 and FG-AI4NDM
2/391 +Ann.1	2021-02-17	EMEA Satellite Operators Association (ESOA/ GSC)	Proposed observations and suggestions for final report
2/388	2021-01-28	BDT Focal Point for Question 5/2	ITU-D activities in disaster risk reduction and management
2/384	2021-01-28	Algeria	Exercise to simulate the implementation of the civil security plan for telecommuni-cations
2/383	2021-01-28	China	Suggestions for adding ICT to respond to major epidemics in the new research period Qx/2 subject

(suite)

Web	Received	Source	Title
RGQ2/TD/29	2020-10-15	Algérie Télécom SPA (Algeria)	Proposed liaison statement from ITU-D Study Group 2 Question 5/2 to ITU-R Working Party 5B on utilizing telecommunications/ICTs for disaster risk reduction and Management
RGQ2/TD/24 (Rev.1)	2020-10-14	Co-Rapporteurs for Question 5/2	Proposed liaison statements from ITU-D Study Group 2 Question 5/2
RGQ2/283	2020-09-22	United States	FCC Actions in Response to COVID-19 in the United States
RGQ2/279 (Rev.1)	2020-09-22	BDT Focal Point for Question 5/2	ITU-D activities in disaster risk reduction and management
RGQ2/262	2020-09-20	National Institute of Information and Communications Technology (NICT) (Japan)	Proposal for case studies of a chatbot system "SOCDA" for disaster countermeasure
RGQ2/237	2020-08-20	EMEA Satellite Operators Association (ESOA/GSC)	Satellite Connectivity for Climate Monitoring & Early Warning
RGQ2/228	2020-08-16	China	Considerations and practices related to disaster preparedness, reduction, and response from an Operator's perspective
RGQ2/222	2020-08-07	Burundi	The contribution of ICTs in managing the effects of floods in Burundi
RGQ2/220 (Rev.1)	2020-08-06	China	Contribution of ICT to the fight against the COVID-19 pandemic
RGQ2/207 +Ann.1	2020-05-05	AASCTC (Sudan)	Global Open Science Cloud for Disaster Risk Reduction (GOSC-DRR)
2/TD/33	2020-02-27	Co-Rapporteurs for Question 5/2	October workshop concept for discussion: "The Enabling Policy Environment Increased Emergency Telecommunication Preparedness, Network Resilience, Disaster Risk Reduction and Disaster Management"
2/TD/32	2020-02-26	Co-Rapporteurs for Question 5/2	Draft guidelines for conducting national level emergency communications drills and exercises for Small Island Developing States (SIDS) and Least Developed Countries (LDCs)
2/TD/31	2020-02-26	Co-Rapporteurs for Question 5/2	Updated Document: Draft annual report of Question 5/2 on Early-Warning Systems, including Safety Confirmation

(suite)

Web	Received	Source	Title
2/327 (Rev.1)	2020-02-11	Loon LLC (United States)	Regulatory considerations when enabling innovative preparedness and emergency communications solutions
2/310	2020-01-24	BDT Focal Point for Question 5/2	ITU-D activities in disaster risk reduction and management
2/309	2020-01-27	Japan	Proposal for case studies of locally accessible cloud system for disaster coun-termeasures
2/308	2020-01-24	Facebook	Sharing Mobile Application Data to Empower Disaster-Response Organizations
2/277	2020-01-03	China	Use of telecommunication/information and communication technology (ICT) for disaster prevention, mitigation and res-ponse
2/269	2019-12-31	India	The role of social media platforms in disaster mitigation, response and relief
2/252	2019-12-16	Democratic Republic of the Congo	Utilizing telecommunications/ICTs to manage Ebola virus disease in the Democratic Republic of the Congo
RGQ2/TD/12	2019-10-07	Co-Rapporteur for Question 5/2	Draft guidelines for conducting national level emergency communications drills and exercises for Small Island Developing States (SIDS) and Least Developed Countries (LDCs)
RGQ2/190	2019-09-23	World Food Programme	Standardization forum: emergency tele-communications
RGQ2/188 (Rev.1)	2019-09-24	Japan	Proposal for case studies of e-education in rural areas through ordinary use of emergency telecommunication systems
RGQ2/183	2019-09-23	China	Analysis of emergency communication key service requirements and technology development
RGQ2/182 +Ann.1-2	2019-09-23	World Food Programme	ETC-ITU Emergency Telecommunications Preparedness Checklist
RGQ2/152 +Ann.1	2019-08-22	United States	Integrated Public Alert and Warning System Open Platform for Emergency Networks (IPAWS-OPEN) on stan-dards-based alert and warning
RGQ2/150	2019-08-22	United States	Remote-sensing activities in ITU-R
RGQ2/148	2019-08-22	BDT Focal Point for Question 5/2	ITU-D activities in disaster risk reduction and management

(suite)

Web	Received	Source	Title
RGQ2/147	2019-08-21	India	Importance of ICT early-warning system for saving life and property: case of extremely sever Cyclone 'Fani'
RGQ2/145	2019-08-21	New Zealand	Implementation of Common Alerting Protocol (CAP) in New Zealand
RGQ2/121	2019-07-09	Haiti	Emergency telecommunication system in Haiti
2/216	2019-03-12	Co-Rapporteurs for Question 5/2	October workshop concept for discussion: "Guidelines for Conducting National Level Emergency Communications Drills and Exercises for Small Island Developing States (SIDs) and Lesser Developed Countries (LDCs)"
2/212	2019-03-12	BDT Focal Point for Question 5/2	ITU-D activities in disaster risk reduction and management
2/184	2019-02-12	Co-Rapporteurs for Question 5/2	Output Document: Draft annual report of Question 5/2 on Early-Warning Systems, including Safety Confirmation
2/176	2019-02-07	Co-Rapporteurs for Question 5/2	Proposed revised work plan for study Question 5/2
2/159	2019-02-05	China	Development and practices of intelligent emergency telecommunications
2/158	2019-02-05	China Telecommunications Corporation (China)	Thinking and Practices of Operator's Disaster Preparedness, Disaster Reduction and Disaster Response
2/157 (Rev.1)	2019-02-05	China	Disseminating emergency alerts via new signalling pathways
2/134	2019-01-11	Cameroon	Support for regional implementation of the National Emergency Telecommunications Network project
RGQ2/TD/7	2018-10-01	Russian Federation	ITU-D SG1 and SG2 coordination: Mapping of ITU-D Study Group 1 and 2 Questions
RGQ2/83	2018-09-18	BDT Focal Point for Question 5/2	ITU-D activities in disaster risk reduction and management
RGQ2/78	2018-09-18	India	The role of Information and Communication Technology (ICT) in disaster mitigation, prediction and response
RGQ2/77	2018-09-18	India	Trial runs for implementation of Common Alert Protocol-based early-warning system

(suite)

Web	Received	Source	Title
RGQ2/74 +Ann.1	2018-09-18	Japan	Global Centre for Disaster Statistics - a joint initiative with UNDP contributing to the Sendai Framework for Disaster Risk Reduction and SDGs
RGQ2/61	2018-09-13	China	Emergency telecommunication drill
RGQ2/60	2018-09-13	National Institute of Information and Communications Technology (NICT) (Japan)	Early warning and early data collection of disaster information; recent development in Japan
RGQ2/33	2018-08-16	Brazil	Emergency, public calamity and disaster alerts using telecommunication services - Brazil's implementation
2/TD/4	2018-04-27	WMO	Multi-Hazard Early-Warning Systems: A Checklist
2/93 (Rev.1)	2018-04-24	BDT Focal Point for Question 5/2	ITU-D activities in disaster risk reduction and management
2/70	2018-04-23	India	The role of information and communication technology (ICT) in disaster mitigation, prediction and response
2/59	2018-03-23	United States	Draft work plan for Question 5/2
2/56 (Rev.1)	2018-03-21	China	Operators' consideration of disaster preparedness, disaster reduction and disaster response
2/50	2018-03-21	China	Further enhanced studies on emergency telecommunications as well as related knowledge and experience sharing
2/36	2018-02-19	India	Implementing a common alert protocol-based Earthquake Early-Warning system in North Region of India

Incoming liaison statements for Question 5/2

Web	Received	Source	Title
2/422	2021-03-15	ITU-R Working Party 5D	Liaison statement from ITU-R Working Party 5D to ITU-D Study Group 2 Question 5/2 on utilization of telecommunications/ ICTS for disaster preparedness, mitigation and response
2/365	2021-01-12	ITU-T Study Group 2	Liaison statement from ITU-T Study Group 2 to ITU-D SG1, ITU-SG2 Question 5/2 and Question 6/2 on establishment of a new ITU-T Focus Group on Artificial Intelligence for Natural Disaster Management (FG-AI4NDM) and first meeting (Virtual, 15-17 March 2021)
2/362	2020-11-20	ITU-T Study Group 11	Liaison statement from ITU-T Study Group 11 to ITU-D SG2 Q5/2 on Disaster Relief Use Cases
2/361	2020-11-23	ITU-R Working Party 5B	Liaison statement from ITU-R Working Party 5B to ITU-T Study Group 11 (copy to ITU-D SG2 Q5/2) on Disaster Relief Use Cases
2/359	2020-11-04	ITU-R Disaster Relief Liaison Rapporteur	Report from the ITU-R Disaster Relief Liaison Rapporteur
2/357	2020-10-21	ITU-R Working Party 5D	Liaison statement from ITU-R Working Party 5D to ITU-T Study Group 11 (copy to ITU-D SG2 Q5/2) on Disaster Relief Use Cases
2/355	2020-10-21	ITU-R Working Party 5D	Liaison statement from ITU-R Working Party 5D to ITU-D SG2 Q5/2 on utilization of telecommunications/ICTs for disaster risk reduction and management
RGQ2/286	2020-07-14	ITU-R Working Party 5D	Liaison statement from ITU-R Working Party 5D to ITU-D SG2 Q5/2 on utilization of telecommunications/ICTs for disaster risk reduction and management
RGQ2/225	2020-08-07	ITU-R Working Party 5A	Liaison statement from ITU-R Working Party 5A to ITU-D SG2 Q5/2 on utilization of telecommunications/ICTs for disaster risk reduction and management
RGQ2/224	2020-08-07	ITU-R Working Party 5A	Liaison statement from ITU-R Working Party 5A to ITU-D SG2 Q5/2 on Disaster Relief Use Cases
RGQ2/211	2020-07-17	Disaster Relief Liaison Rapporteur	Report on Disaster Relief
RGQ2/206 +Ann.1	2020-03-25	ITU-T Study Group 11	Liaison statement from ITU-T SG11 to ITU-D SG2 Q5/2 on disaster relief use cases

(suite)

Web	Received	Source	Title
2/256	2019-12-05	ITU-R Study Group 5	Liaison statement from ITU-R SG5 to ITU-D SG1 and SG2 on consideration of the needs of developing countries in the development and implementation of IMT
2/245 +Ann.1	2019-11-22	ITU-T Study Group 11	Liaison statement from ITU-T Study Group 11 to ITU-D Study Group 2 Question 5/2 on disaster relief use cases
RGQ2/130 +Ann.1	2019-07-22	ITU-T Study Group 15	Liaison statement from ITU-T SG15 to ITU-D SG1 and SG2 on inter-Sector coordination
RGQ2/124 (Rev.1)	2019-07-18	ITU-R study groups - ITU-R Working Party 4B	Liaison statement from ITU-R WP4B to ITU-D SG1 and SG2 on interrelated activities of ITU-R and ITU-D in response to Resolution ITU-R 69 (RA-15)
RGQ2/120	2019-07-09	ITU-R study groups - ITU-R Working Party 4B	Liaison statement from ITU-R WP4B to ITU-D SG1 and SG2 on interrelated activities of ITU-R and ITU-D in response to Resolution ITU-R 69 (RA-15)
RGQ2/116 +Ann.1-2	2019-05-29	ITU-T Study Group 20	Liaison statement from ITU-T SG20 to ITU-D SG1 and SG2 on ITU inter-sector coordination
RGQ2/114 +Ann.1-2	2019-06-12	ITU-T Study Group 5	Liaison statement from ITU-T SG5 to ITU-D SG1 and SG2 on ITU inter-sector coordination
RGQ2/112	2019-04-19	ITU-R Disaster Relief Liaison Rapporteur	Report from the ITU-R Disaster Relief Liaison Rapporteur
2/TD/18 +Ann.1	2019-03-20	ITU-T Study Group 11	Liaison statement from ITU-T SG11 to ITU-D SG2 Q5/2 on disaster relief use cases
2/TD/13	2019-03-15	ITU-T Study Group 2	Liaison statement from ITU-T SG2 to ITU-D SG2 Q5/2 on Terms and Definitions for Disaster Relief Systems and Framework of Disaster Management
2/183	2019-02-11	ITU-R Study Group 5	Liaison statement from ITU-R Study Group 5 to ITU-D Study Group 2 Question 5/2 on Recommendation ITU-R F.1105-4 (Fixed wireless systems for disaster mitigation and relief operations)
2/124	2018-11-09	ITU-R study groups – ITU-R Working Party 5A	Liaison statement from ITU-R SG5 WP5A to ITU-D Study Group 2 Question 5/2 on disaster relief systems
2/120	2018-10-30	ITU-R Disaster Relief Liaison Rapporteur	Report from the ITU-R Disaster Relief Liaison Rapporteur

(suite)

Web	Received	Source	Title
RGQ2/ TD/3	2018-09-28	ITU-R study groups – ITU-R Working Party 7C	Liaison statement from ITU-R WP7C to ITU-D SG2 Q5/2 on utilization of telecommunications/ICTs for disaster preparedness, mitigation and response
RGQ2/17 +Ann.1	2018-08-02	ITU-T Study Group 11	Liaison statement from ITU-T SG11 to ITU-D SG2 Q5/2 on disaster relief use cases
RGQ2/14 +Ann.1	2018-07-18	ITU-R study groups – ITU-R Working Party 4A	Liaison statement from the ITU-R WP 4A to ITU-D Study Group 1 and 2 on interrelated activities of ITU-R and ITU-D in response to Resolution ITU-R 69 (RA-15)
RGQ2/12 +Ann.1	2018-07-18	ITU-T Study Group 2	Liaison statement from ITU-T SG2 to ITU-D SG2 Q5/2 on E.sup.fdr "Framework of disaster management for disaster relief systems"
RGQ2/11 +Ann.1	2018-07-18	ITU-T Study Group 2	Liaison statement from ITU-T SG2 to ITU-D SG2 Q5/2 on E.td-dr "Terms and definitions for disaster relief systems, network resilience and recovery"
RGQ2/10	2018-07-17	ITU-R study groups – ITU-R Working Party 4B	Liaison statement from ITU-R WP 4B to ITU-D SG1 Q1/1 and Q2/1 and SG2 Q1/2 and Q5/2 on interrelated activities of ITU-R and ITU-D in response to Resolution ITU-R 69 (RA-15)
RGQ2/2	2018-05-23	ITU-R Disaster Relief Liaison Rapporteur	Report from the ITU-R Disaster Relief Liaison Rapporteur
2/32	2017-11-24	ITU-R Disaster Relief Liaison Rapporteur	Report from the ITU-R Disaster Relief Liaison Rapporteur
2/31	2017-11-24	ITU-R study groups - Working Party 7C	Liaison Statement from ITU-R Working Party 7C to ITU-D Study Group 2 Q5/2 on the utilization of telecommunications/ICTs for disaster preparedness, mitigation and response
2/20	2017-11-24	ITU-T Study Group 2	Liaison Statement from ITU-T SG2 to ITU-D SG2 Question 5/2 on national emergency telecommunication system in developing countries
2/16	2017-11-24	ITU-R Disaster Relief Liaison Rapporteur	Report from the ITU-R Disaster Relief Liaison Rapporteur
2/15	2017-11-22	ITU-T Study Group 15	Liaison Statement from ITU-T SG15 to ITU-D Study Group 2 Q5/2 on new Supplement on the framework of disaster management

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