The ITU/WMO/UNEP Focus Group AI for Natural Disaster Management and activities in support of DRR

Dr. Elena Xoplaki
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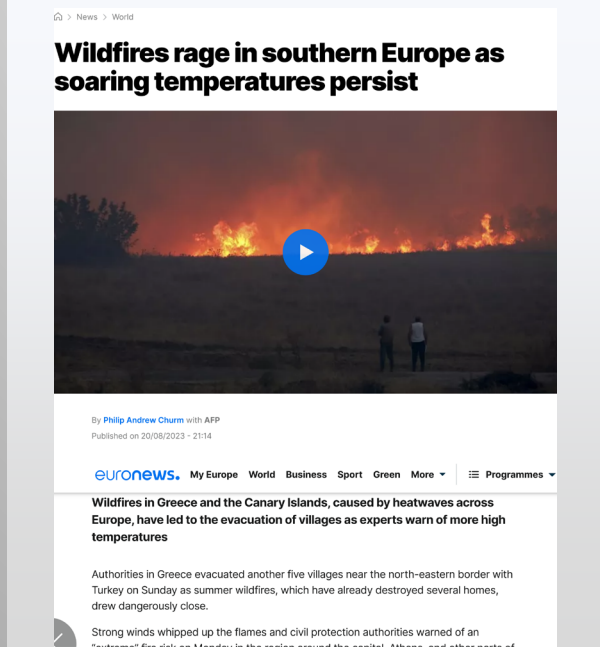
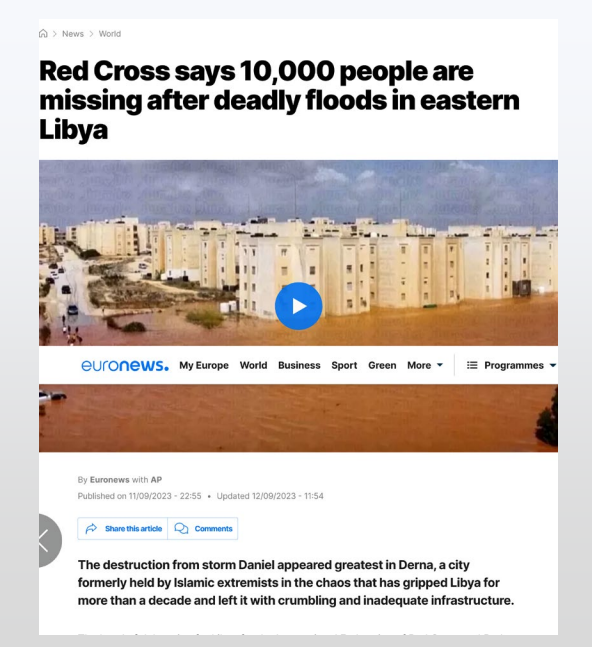
Webinar - "Disaster risk reduction in the digital transformation age: Leveraging emerging technologies"
13 October 2023

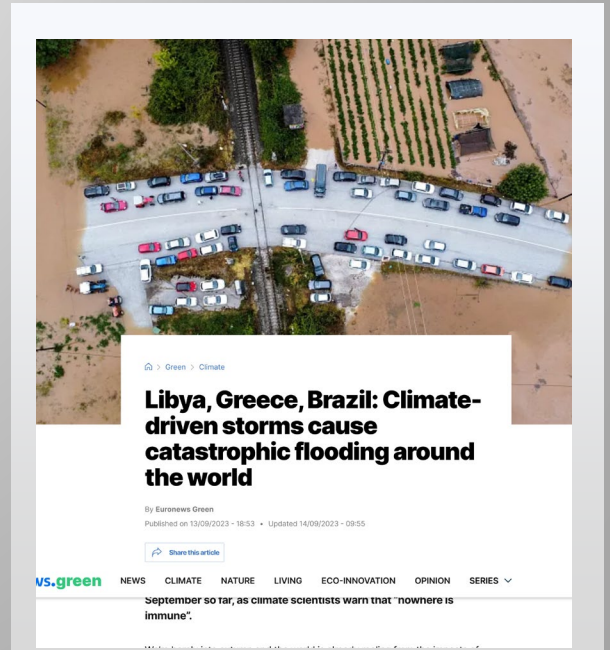
The challenge

Natural hazards can lead to disasters, widespread adverse impacts, related L&Ds to nature, society, and economy.

The situation is exacerbated in **certain regions** and for certain **populations** and is expected to **worsen**.







The questions

Through tapping the **potential of AI**, can we improve our **understanding** of natural hazards, our ability to **detect** events in real-time, our ability to **forecast** events, and our ability to effectively **communicate** an impending or ongoing disaster?

What are the **best practices** and **limitations for** AI?

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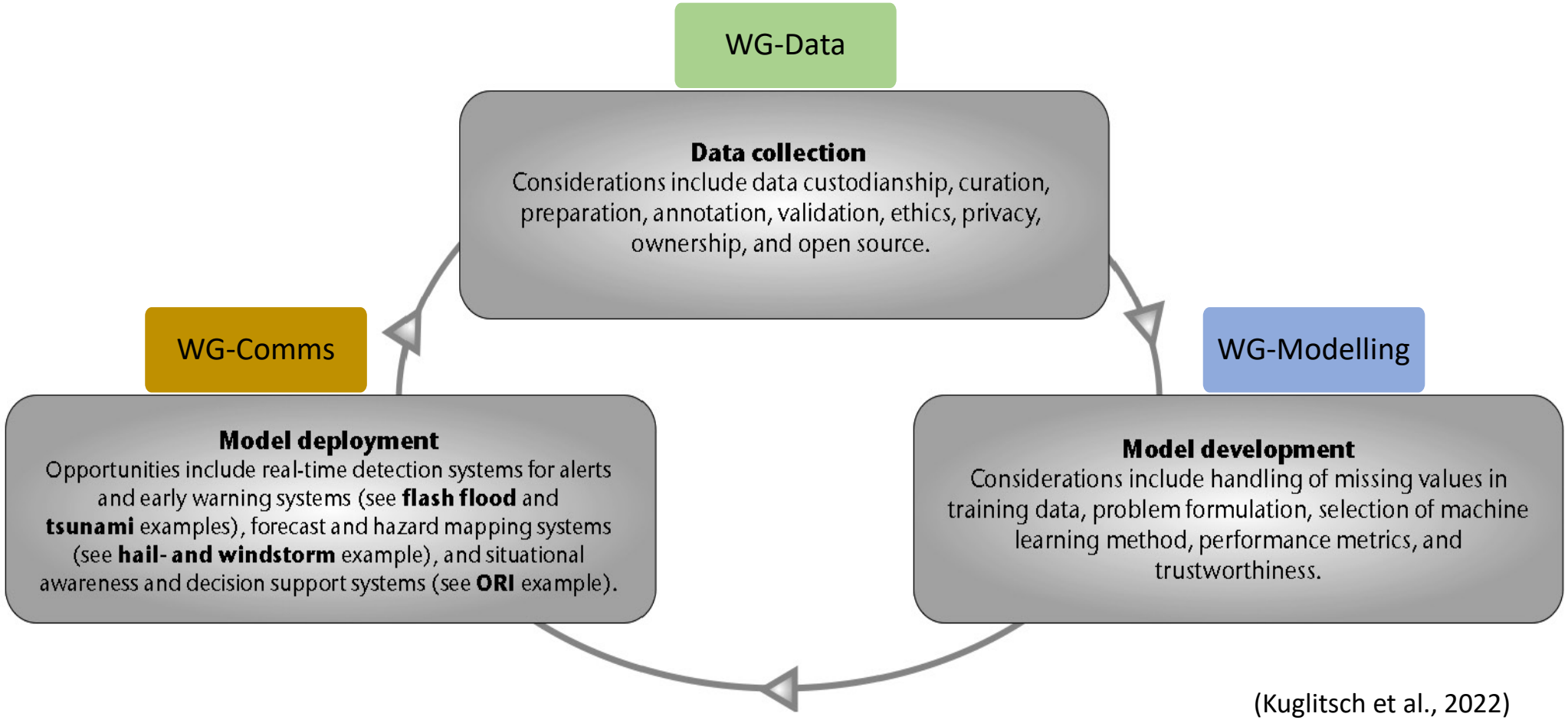
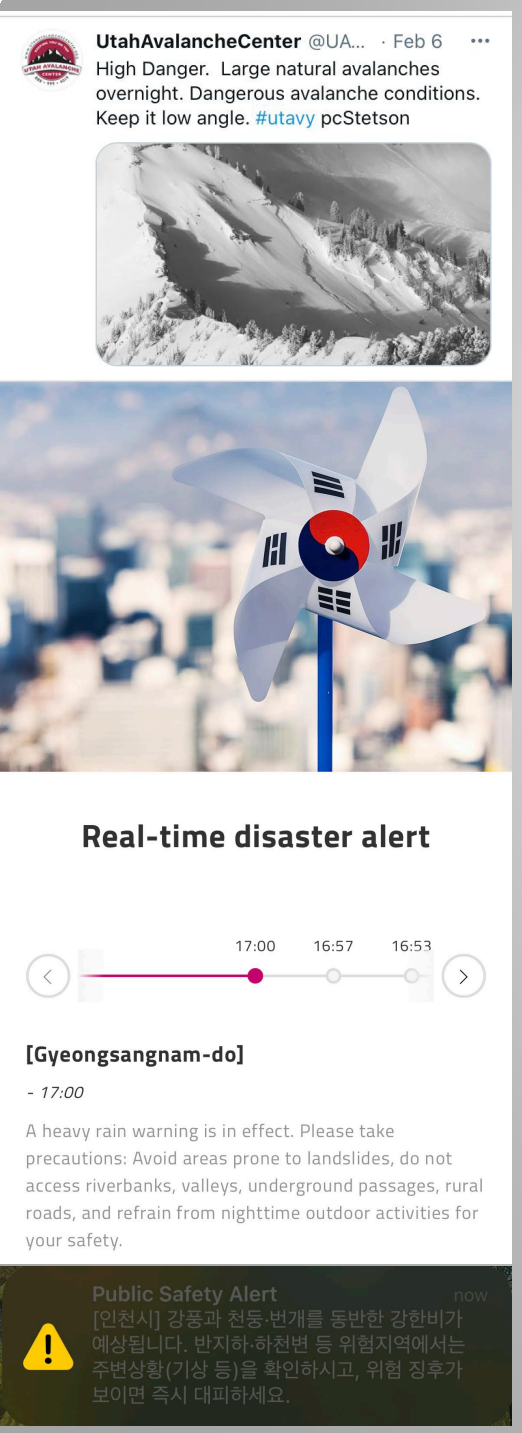
The goal

Explore best practices across the AI lifecycle



(Kuglitsch et al., 2022)



The Focus group on AI for Natural Disaster Management

- A growing community of experts and stakeholders
- Exploring the potential and limitations of AI/ML in:
  - understanding of natural hazards
  - detection of events in real-time
  - ability to forecast events
  - effective communication during ongoing disasters

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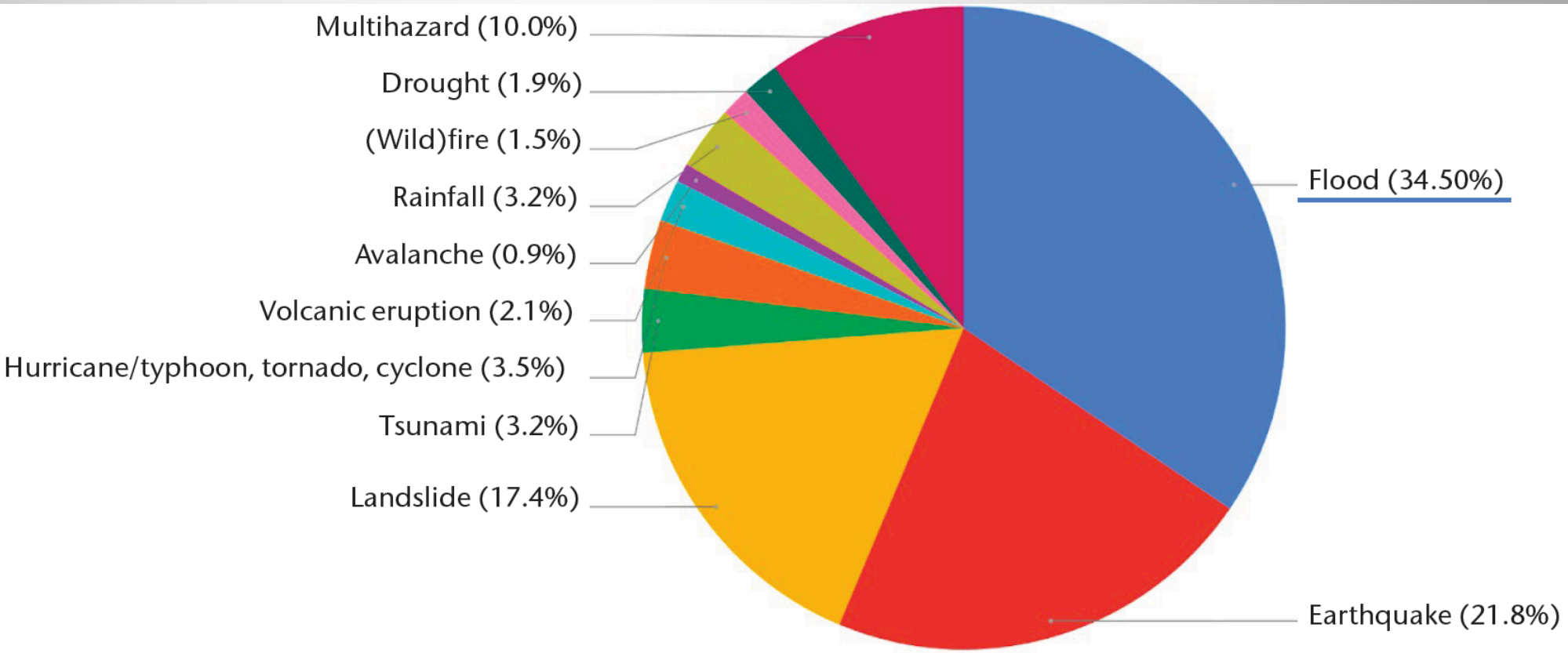
The structure

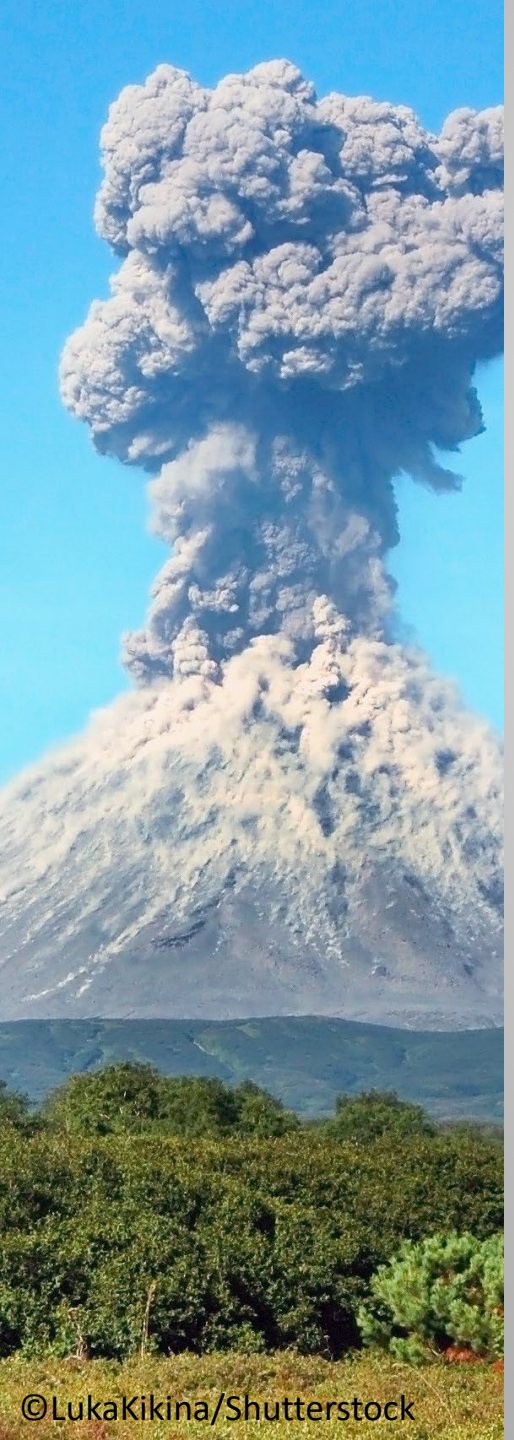
- Management Team
  - ITU TSB Secretariat
  - WG-Roadmap
  - WG-EduMat
  - WG-Data
    - TG-AI for Earthquake Monitoring, Detection, and Forecasting
    - TG-AI for Flood Monitoring and Detection
    - TG-AI for Geodetic Enhancements to Tsunami Monitoring and Detection
    - TG-AI for Insect Plague Monitoring and Detection
    - TG-AI for Landslide Monitoring and Detection
    - TG-AI for Snow Avalanche Monitoring and Detection
    - TG-AI for Wildfire Monitoring and Detection
    - TG-AI for Vector-borne Disease Forecasting
    - TG-AI for Volcanic Eruption Forecasting
    - TG-AI for Hail and Windstorm Hazard Mapping
    - TG-AI for Multihazard Communication Technologies
  - WG-Modelling
  - WG-Comms
  - WS-Glossary
  - WS-Tools

= 27 use cases

Natural hazards with AI application

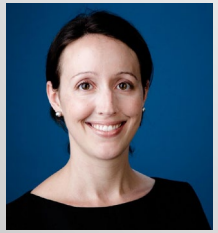


(Kuglitsch et al., 2022b)

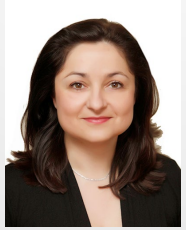


The leadership

Management Team

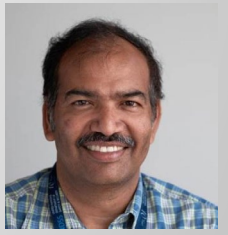


Chair
Monique Kuglitsch
Fraunhofer HHI, Germany



Vice Chair
Elena Xoplaki
University of Giessen, Germany

Vice Chair
Juerg Luterbacher
WMO



Vice Chair
Muralee Thummarukudy
UNCCD

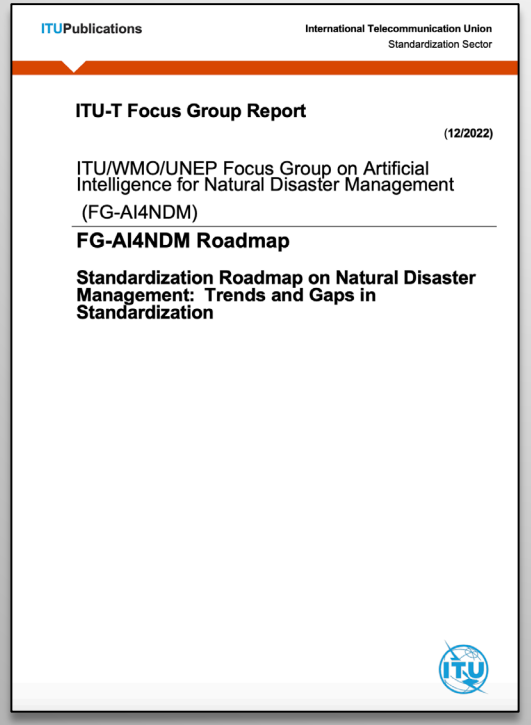
Vice Chair
Srinivas Chaganti
DOT, India

Vice Chair
Rakiya Babamaji
NASRDA, AfSTAG-DRR, & UNDRR-GRAF, Nigeria

Vice Chair
Yan Chuan Wang
China Telecom, China

Selected accomplishments

- 1 **technical report** (AI for communications)
- 1 **glossary** (524 terms)
- 1 **roadmap**



ITUPublications

International Telecommunication Union
Standardization Sector

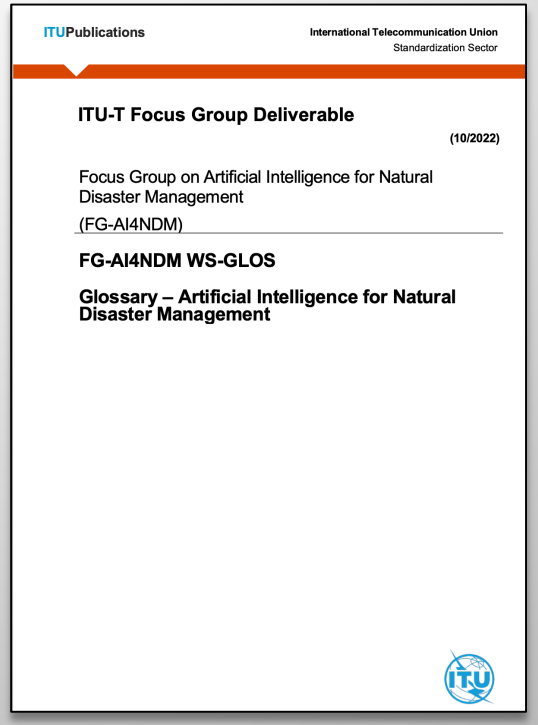
ITU-T Focus Group Report

(12/2022)

ITU/WMO/UNEP Focus Group on Artificial Intelligence for Natural Disaster Management
(FG-AI4NDM)

FG-AI4NDM Roadmap

Standardization Roadmap on Natural Disaster Management: Trends and Gaps in Standardization



ITUPublications

International Telecommunication Union
Standardization Sector

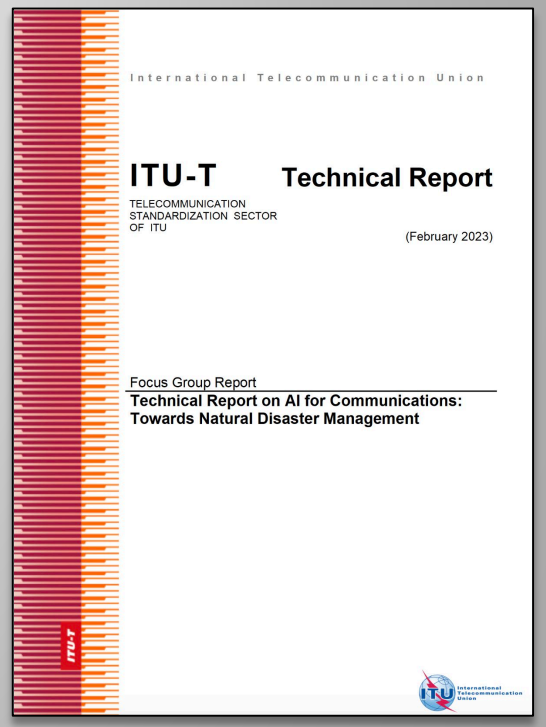
ITU-T Focus Group Deliverable

(10/2022)

Focus Group on Artificial Intelligence for Natural Disaster Management
(FG-AI4NDM)

FG-AI4NDM WS-GLOS

Glossary – Artificial Intelligence for Natural Disaster Management



International Telecommunication Union

ITU-T **Technical Report**

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

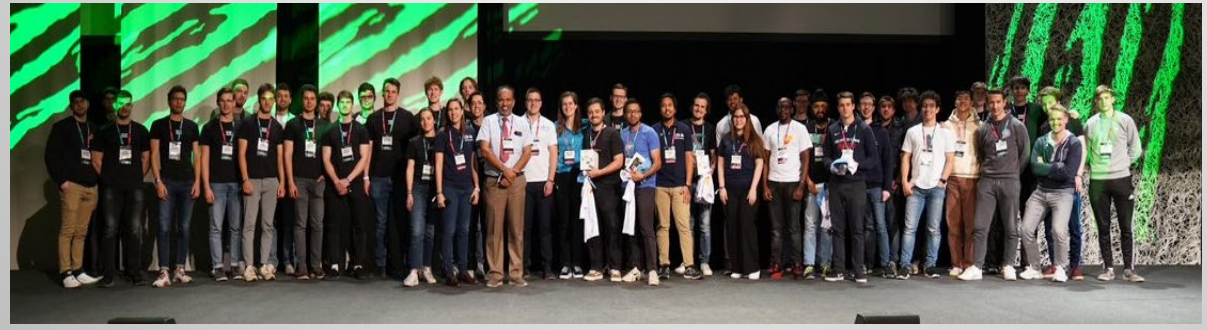
(February 2023)

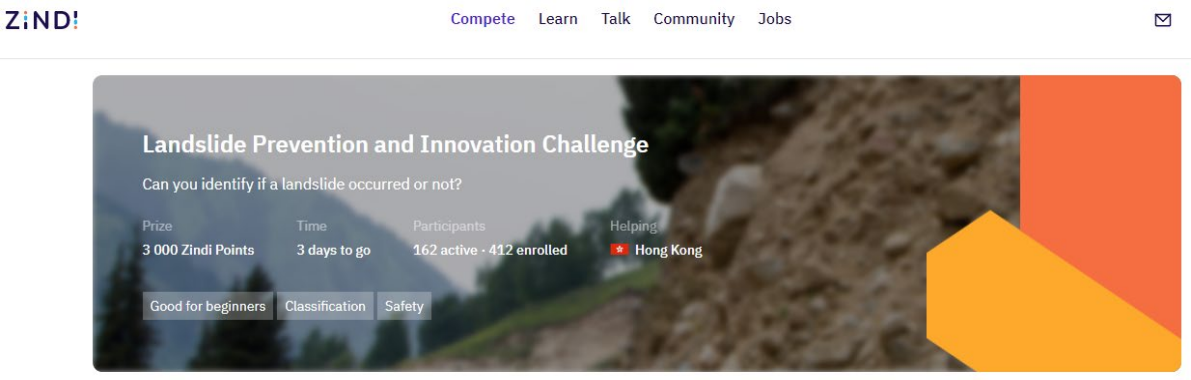
Focus Group Report

Technical Report on AI for Communications: Towards Natural Disaster Management

Selected accomplishments

- 1 NLP-based online **tool**
- 2 **hackathons** (Europe & Africa)
- 1 **training session** (India)





Selected accomplishments

- 5 **workshops** (avg. 430 participants)
- 1 **webinar**
- 3 scientific **publications**

Nature Communications

- **Expanding participation** in conferences and specialized committees to include experts from relevant disciplines and non-academic stakeholders.
- Predicating **research funding** on partnerships with end-users.
- Supporting **national** and **international efforts** to strengthen such partnerships.

(Kuglitsch et al., 2022a)

nature COMMUNICATIONS

COMMENT

https://doi.org/10.1038/s41467-022-29285-6 OPEN

Facilitating adoption of AI in natural disaster management through collaboration

Monique M. Kuglitsch[1✉], Ivanka Pelivan[1], Serena Ceola[2], Mythili Menon[3] & Elena Xoplaki[4]

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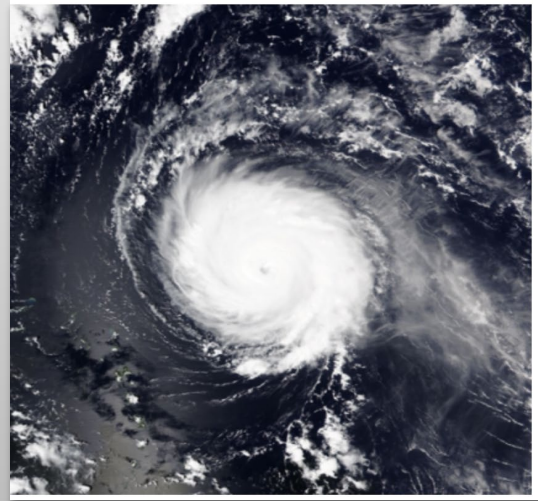
WMO Bulletin

- What **opportunities** does AI present? What are the **challenges**?
- How can we address the challenges and **benefit** from the opportunities?
- How can we use AI to **provide important information** to policy-makers, stakeholders, and the public to reduce disaster risks?



Artificial Intelligence for Disaster Risk Reduction: Opportunities, challenges, and prospects

Author(s): Monique Kuglitsch, Arif Albayrak, Raúl Aquino, Allison Craddock, Jaselle Edward-Gill, Rinku Kanwar, Anirudh Koul, Jackie Ma, Alejandro Marti, Mythili Menon, Ivanka Pelivan, Andrea Toreti, Rudy Venguswamy, Tom Ward, Elena Xoplaki, A. Rea & J. Luterbacher

Contact:

Theme: Disaster risk reduction

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(Kuglitsch et al., 2022b)

Environ. Res. Letters

IOP Publishing Environ. Res. Lett. 18 (2023) 093004 https://doi.org/10.1088/1748-9326/acf601

ENVIRONMENTAL RESEARCH
LETTERS

TOPICAL REVIEW

OPEN ACCESS

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When it comes to Earth observations in AI for disaster risk reduction, is it feast or famine? A topical review

Monique M Kuglitsch[1,*], Arif Albayrak[2], Jürg Luterbacher[3], Allison Craddock[4], Andrea Toreti[5], Jackie Ma[1], Paula Padrino Vilela[6], Elena Xoplaki[7,8], Rui Kotani[9], Dominique Berod[3], Jon Cox[3] and Ivanka Pelivan[1]

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5 European Commission Joint Research Centre, Ispra, Italy
6 UN Environment, Geneva, Switzerland
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Keywords: Earth observation, remote sensing, disaster risk reduction, artificial intelligence, machine learning

Supplementary material for this article is available online

(Kuglitsch et al., 2023)

Transition to global initiative

Mar 2029

Mar 2024

Mar 2021

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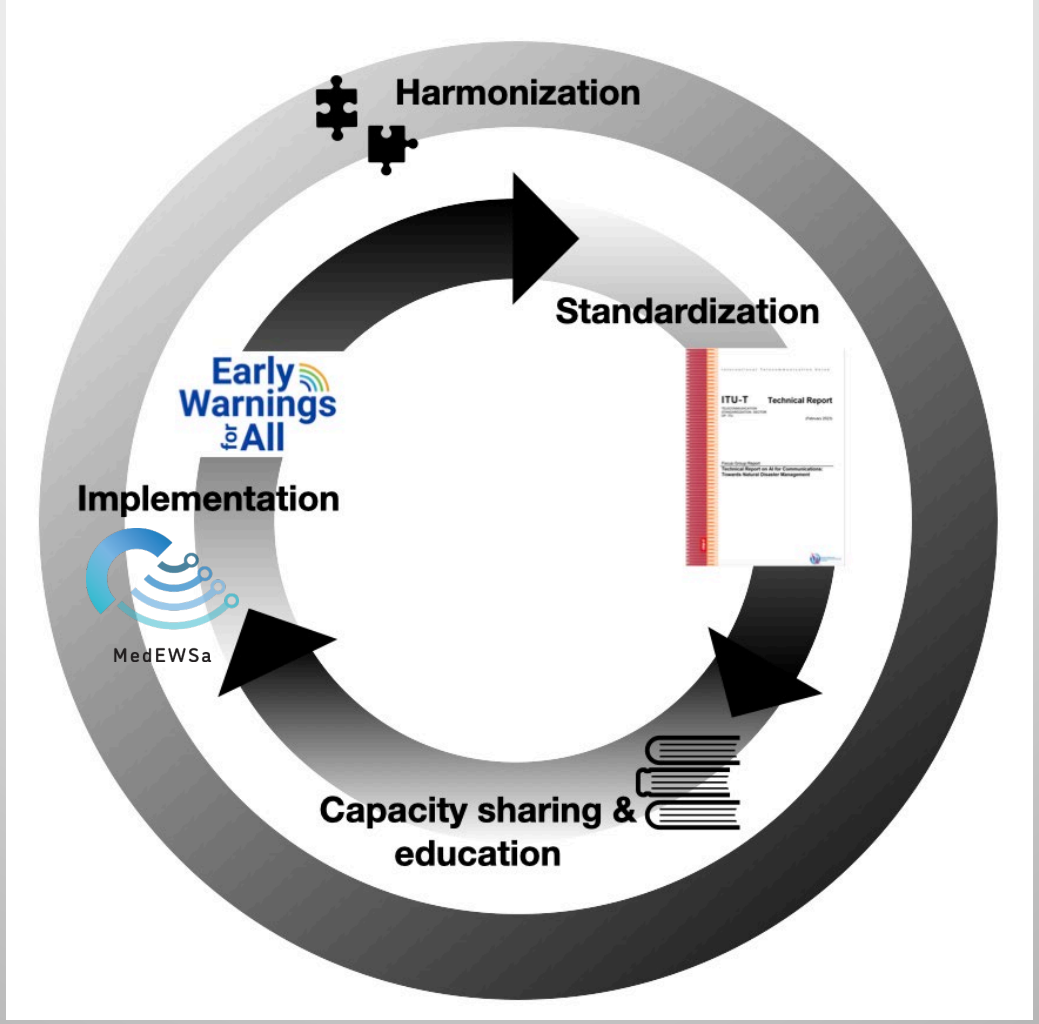
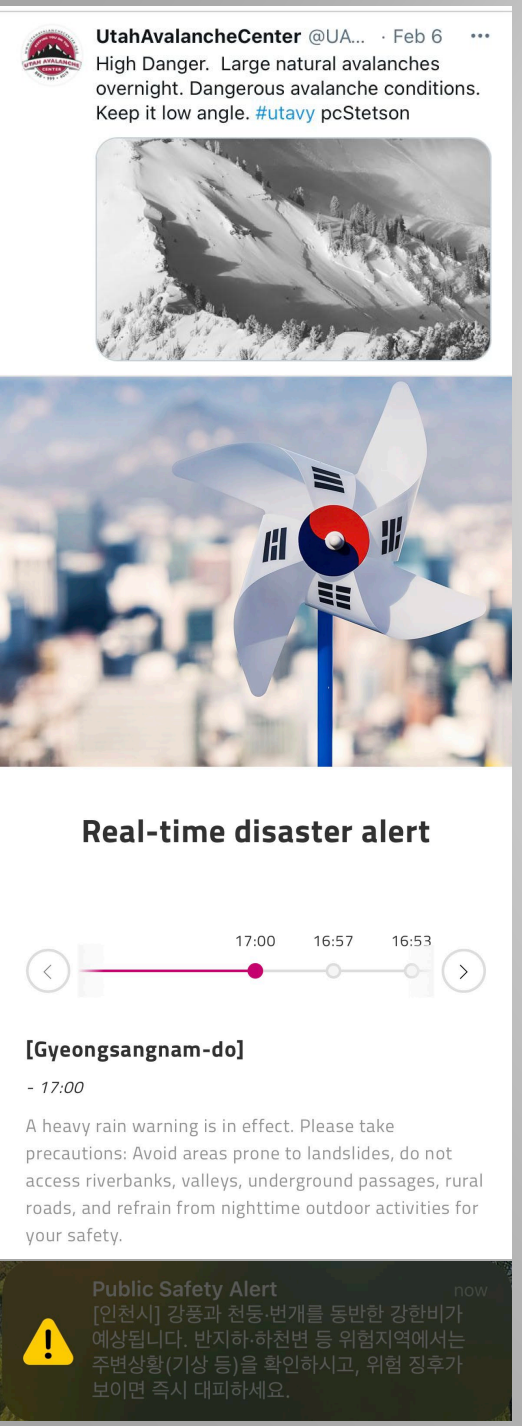
Objectives


Harmonization
Standardization
ITU-T Technical Report
Capacity sharing & education
Implementation
MedEWSa
Early Warnings for All



Mediterranean and pan-European forecast and Early Warning System against natural hazards

MedEWSa

WORLD METEOROLOGICAL ORGANIZATION

1873 2023

IMO-WMO

European Commission

MedEWSa - offers

- **Multi-hazard capacity building for emergency responders**
- **Timely handle unexpected cascading effects**
- **Efficient response mechanisms to extreme events**
- **Fully address the early warning cycle, from data and models to public safety**

MedEWSa - concept

MedEWSa

CROSS-CUTTING TECHNOLOGIES

- Data spaces/ Datacubes with diachronic data, federate data from other event logs & portals
- High-resolution NWP forecasts & km-scale nested grids in pilots
- Existing operational platforms (e.g., FireHub for fire prediction, smoke dispersion models, MOSE etc.)
- AI (Impact assessments, multi-level decision support, cascading effects prediction)

HAZARDS

1. Wildfires, extreme weather events (droughts, wind)*
   Precursors Amplificators / Feedback loops
2. Coastal floods, storm surges, extreme precipitation*
   Precursors Amplificators / Feedback loops
3. Floods, landslides*
   Precursors Amplificators / Feedback loops
4. Heatwaves, droughts and wildfires*

TWINS

Greece (Attica)	Italy (Venice)	Slovakia (Košice)	Spain (Catalonia)
Ethiopia (National parks)	Egypt (Alexandria / Nile Delta)	Georgia (Tbilisi)	Sweden (countrywide)
Impacts on: Critical infrastructure, power plants, factories, cultural heritage, food supply, PV panels, energy, agriculture, residential buildings, national parks	Impacts on: Society (casualties, population relocation), urban landscape, agriculture, tourism, groundwater deterioration, cultural heritage, soil erosion	Impacts on: Agriculture, critical infrastructure, food supply, energy, soil erosion, society (casualties, relocation, property damage)	Impacts on: Forestry, public health (respiratory diseases, food-borne and water-borne diseases), agriculture, water quality

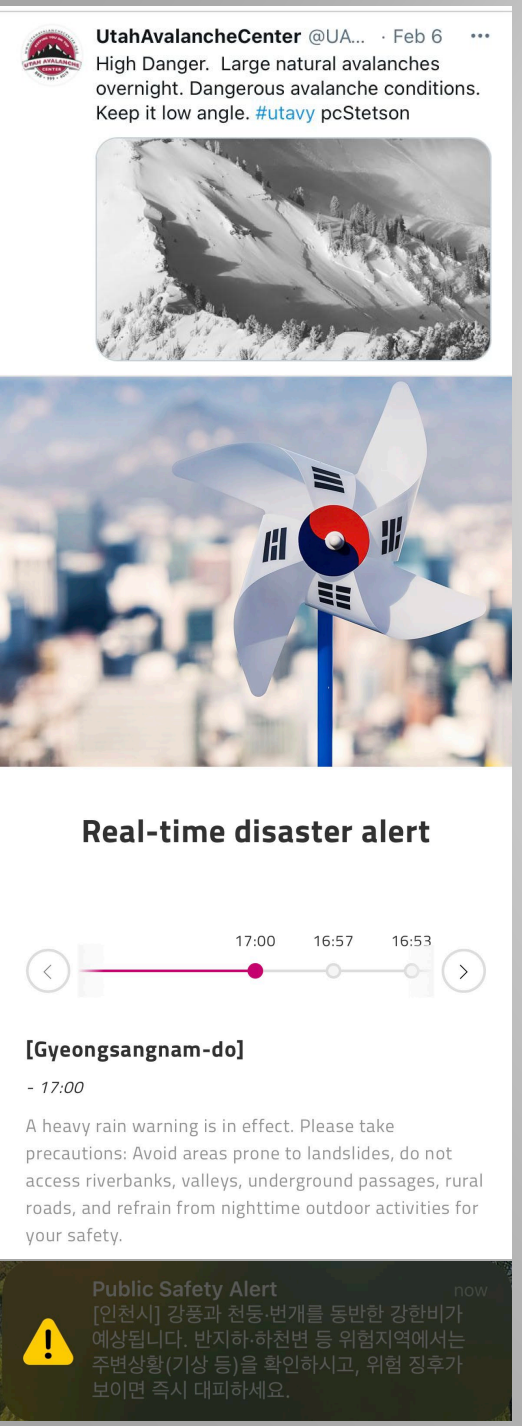
potential volcanic eruptions will be included across all pilots/twins due to the large-scale impact

Multi-level Decision Support EWS: provision of alerts, reports and tailored dissemination information
MedEWSa DSDS (Pillar 1)

Interfaces for multi-hazard and cascading effects
Multi-hazard dynamics analytics
MedEWSa forecasts & impact assessments (Pillar 2)

Risk modeling
Risk transfer mechanisms
Independent triggering mechanisms
MedEWSa risk transfer solutions (Pillar 3)

Complex information to actionable knowledge
Outreach channels optimization
MedEWSa societal support (Pillar 4)

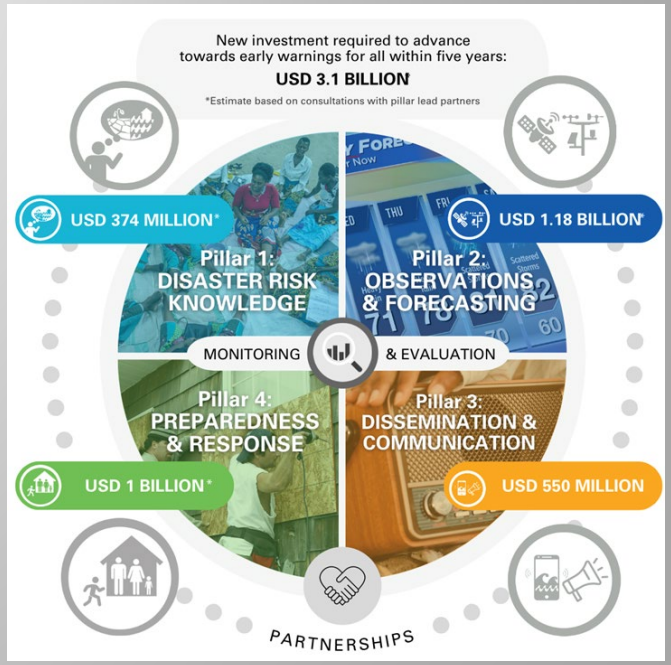


MedEWSa – EW4ALL

MedEWSa

Early Warnings for All

- Offers hazard information/risk analysis for meaningful EW
- Contributes to impact-based forecasting
- Develops a fully integrated impact-based multi-hazard EWS
- AI-based decision-support solutions for improved multi-hazard impact prediction
- WMO research efforts to extend EWS to vulnerable and underserved regions, and communities



(WMO, 2022)

MedEWSa – highlights

MedEWSa

- Coordinated, integrated multihazard system covering entire early warning process.
- Builds on existing systems and tools, leveraging cross-cutting technologies (e.g., AI) where they bring added value in the four pillars.
- Connects a broad geographical region (Europe-Mediterannean-North Africa) including an EW4ALL priority country (Ethiopia) and works closely with local stakeholders to ensure the sustainability of the project.
- Bridges private sector, research organisations, local stakeholders in support towards effective, tailored EWS.

Scan to learn more & contribute:

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