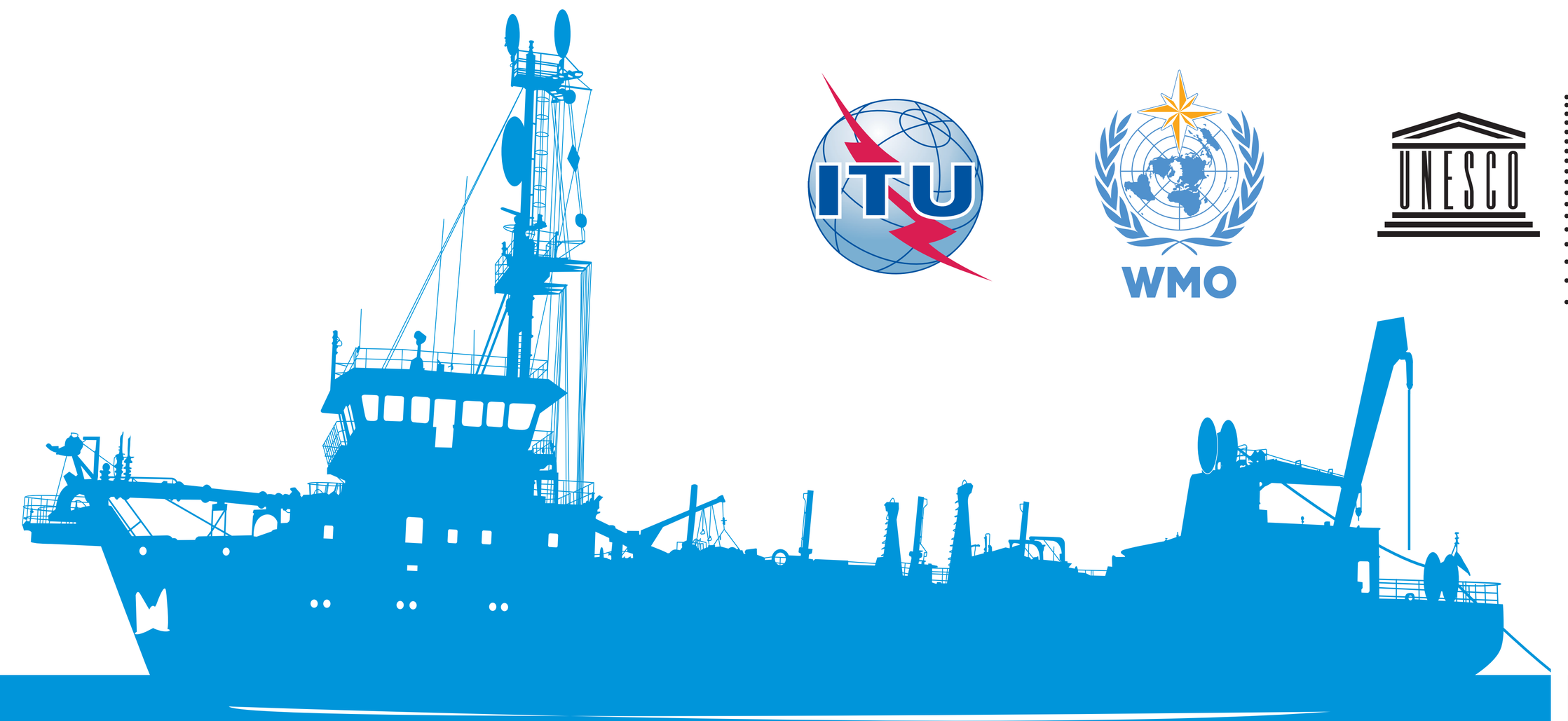

Green Submarine Cable Systems for Ocean/Climate Monitoring and Disaster Warning

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KEY ISSUES FACING THE PLANET: GLOBAL OCEAN HEALTH AND SOCIETAL SECURITY

Key ocean health issues: Include global warming, acidification, extinctions and loss of biodiversity

Long-term disruptions: Changes in ocean temperature, with global warming and sea level rise

Short-term disruptions: Coastal disasters and loss-of-life due to tsunamis arising from earthquakes and seabed avalanches

Monitoring: Health of marine environment and safety of coastal populations could be monitored globally in real-time through a new generation of ocean mini-observatories

2

JOINT TASK FORCE (JTF) ESTABLISHED BY ITU-WMO-UNESCO IOC TO PROMOTE NEW WAYS TO MONITOR OCEAN CLIMATE AND TSUNAMI HAZARD

The JTF was established in 2012 by the International Telecommunication Union (ITU), the World Meteorological Organization (WMO) and the Intergovernmental Oceanographic Commission (IOC) of UNESCO to examine novel uses for submarine telecommunication cables.

3

BACKGROUND STUDIES

The JTF is making good progress, guided by three studies on engineering feasibility, opportunities and legal challenges, and future strategy and roadmap (ITU 2012; on JTF website)

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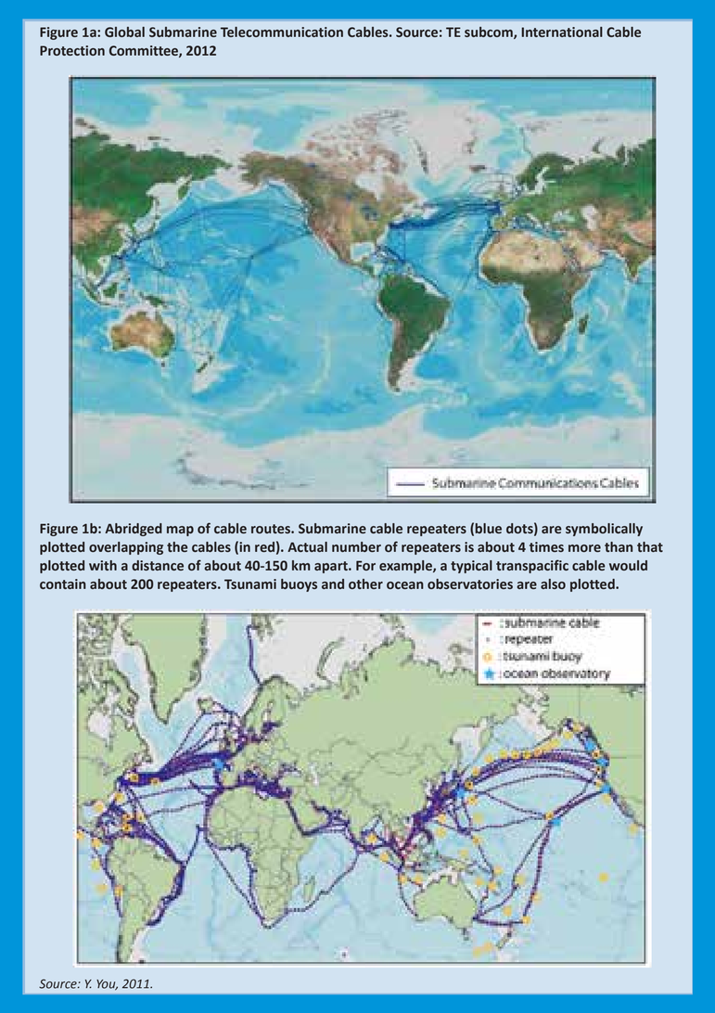
THE GREEN CABLE INITIATIVE



The JTF's Green Cable Initiative proposes to develop a network of sensor packages (pressure, temperature, acceleration) hosted on trans-ocean telecommunication cables forming mini-observatories to monitor changing seafloor temperatures and hazards over several decades.

It addresses two main societal needs for a) sustained climate-quality data from sparsely observed deep oceans and continental slopes, and b) increased reliability and integrity of the global tsunami warning networks.

The JTF is planning two studies with industry support: a) a Functional Requirements Study that will meet the detailed evaluation needs of the telecommunication industry, and b) a Business Model Study to establish the financial basis for the demonstrator project and operational phase. These will help companies undertake detailed engineering and budget analysis for the integration of environmental sensors in their particular repeaters.

Both JTF Science and Engineering white papers will provide substantial justification and technology specifications.

Plans are being developed to launch a wet demonstrator project involving the cable industry and ocean observatory researchers.

A key challenge is to find a cost model for the cable operators that can compensate for the initial development efforts.

5

SPECIFIC THREATS TO SOCIETY EMPHASIZE THE NEED FOR IMPROVED SCIENTIFIC DATA

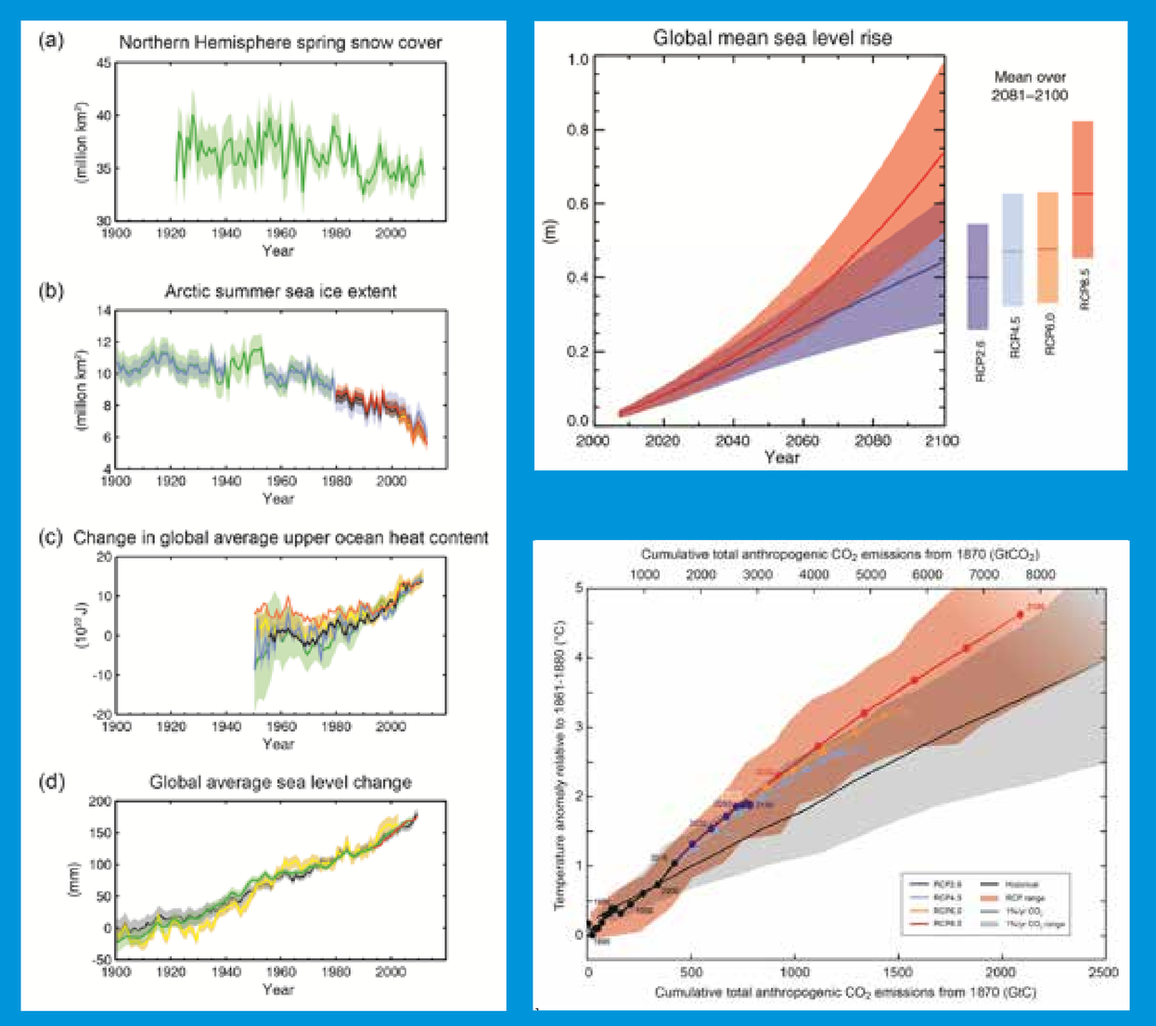
Anthropogenic forcing and earth system response (World petroleum use set a new record in 2012 of 88.9 million barrels/day), with resulting:

- Global temperature increase
- Polar ice cap melting
- Ocean circulation change
- Sea level rise

Natural threats and hazards:

- Tsunamis
- Slope failures

What effects are reversible, over what timeframe, and what is sustainable and affordable?



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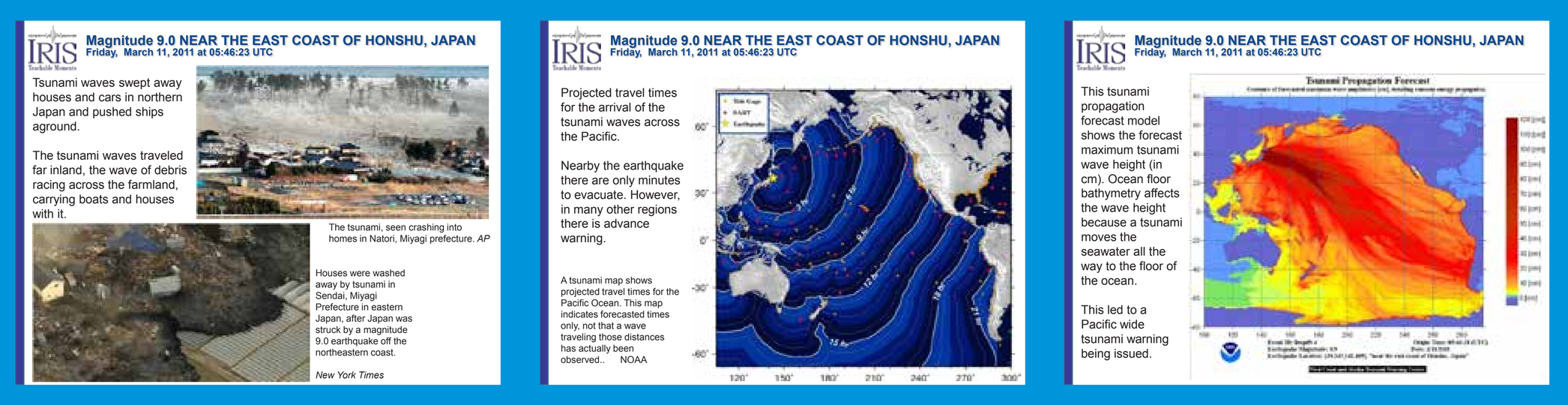
SHORT-TERM DISRUPTIONS: SOCIETAL IMPACT ON COASTAL POPULATIONS DUE TO TSUNAMIS

Major tsunamis occurred several times in last decade, associated with megathrust earthquakes between Mw 7.7 and 9.3 in Sumatra (2004), Java (2006), US Samoa (2009), Mantawai (2010), Chile (2010) and Japan (2011), resulting in severe loss of life and billions of dollars of damage to coastal infrastructure.

Improving our tsunami warning systems is key to reducing such losses and mitigating damage.



Source: IRIS Consortium - Teachable Moments Presentation.

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EVALUATION OF THE GREEN CABLE INITIATIVE

Benefits:

- Distributed seabed sensors across oceans (c. every 50km) have unique value
- Without such sensor networks we cannot fully understand ocean processes
- Submarine telecommunications systems offer a platform for these sensors; dual conductor cables have already been developed
- Supporting such sensors would be a positive gesture by system owners and suppliers

Challenges:

- Changes to repeaters are a serious issue
- Commercial and legal issues will be system specific
- Who pays is unresolved

8

THE BUSINESS PLAN (COSTS)

Project costs main assumptions:

- Marine Installation and Marine Maintenance costs are not significantly affected by adding sensors:
  - Sensors do not affect sensibly repeater reliability
  - Repeaters with faulty sensors will not be replaced

Project maintenance costs are similar to non Green Cables over the 25 year design life.

Construction costs will increase slightly:

- Depending on requirements and associated solution complexity, additional costs could be 4-8 % of a transoceanic system
- With sensors at every repeater
- Without NRE amortization
- Based on industry rules-of-thumb

Source: Alcatel-Lucent

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ATTAINING THE GOALS OF THE JTF

Macro Needs and Solutions are now well known:

- Permit challenges could be overcome
- Strategy, Legal & Engineering papers are clear
- Sensor Design is showing convergence
- Vendors can develop, manufacture and deploy
- Design, Development and Deployment achievable

All have a common issue: "Show me the money" – Funding

Source: Huawei Marine Networks

TECHNICAL FEASIBILITY

The concept appears technically feasible at this stage.

In October 2013, SubPartners with TE SubCom unveiled plans to build a submarine sensor network atop its planned APX-East cable linking Sydney to the US by late 2015. In tsunami monitoring, the Japanese government has contracted NEC to lay an 800 km cable network with 150 pressure and accelerometer sensors on Japan's northeastern continental shelf by 2016.

More iterations required to match science goals with telecom requirements.

Next steps:

- Detailed technical requirement document to be produced
- Continue improvements to sensors (smaller, cheaper, wider spectrum of variables)
- Trial deployment required to demonstrate feasibility and value of data through a demonstration project

A demonstrator project is being planned with the active involvement of cable industry owners and suppliers and ocean observatory researchers; expressions of interest or in JTF membership are invited. http://www.itu.int/en/ITU-T/climatechange/task-force-sc

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Conclusions

This JTF initiative promoting Green Cable systems has real merit and responds to urgent societal needs.

To be successful it requires:

- technical support and development from industry
- cooperation from owners and suppliers
- iteration between scientists and industry
- initial funding for proof of concept (demonstrator project; industry projects)
- operational business model once concept is proven and costs are better known

New global data are critical for understanding and managing ocean health, ecosystems, and for mitigation strategies for future climate change and natural hazards.

For more information,
E-mail : greenstandard@itu.int — International Telecommunication Union (ITU) Website: http://www.itu.int/ITU-T/climatechange