

# Summary of the objectives, activities and future plans of the ITU/UNESCO-IOC/WMO Joint Task Force on Green Cable Systems (JTF, Singapore, 2014)

**Christopher R. Barnes,  
Chair, ITU-WMO-UNESCO IOC Joint Task Force,  
Professor Emeritus, School of Earth and Ocean  
Sciences,**

**University of Victoria, Canada**

[crbarnes@uvic.ca](mailto:crbarnes@uvic.ca)

<http://www.itu.int/ITU-T/climatechange>

**Workshop on "Green cable systems: new developments and demonstrator project"**



# Establishing the JTF



- The International Telecommunication Union (ITU), World Meteorological Organization (WMO) and UNESCO Intergovernmental Oceanographic Commission (IOC) organized the 1<sup>st</sup> Workshop on Using Submarine Telecommunications Cables for Ocean and Climate Monitoring and Disaster Warning in September 2011, in Rome, Italy.
- This workshop closed with the adoption of a Call to Action inviting ITU, UNESCO IOC and WMO to establish and coordinate a *Joint Task Force (JTF)*:  
“To develop trans-ocean mini observatories to measure seafloor temperatures and hazards over several decades”



# Objectives: JTF Terms of Reference

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- Study and evaluate scientific, engineering, business, and societal benefits, opportunities, challenges and risks associated to the use of submarine telecommunications cables for ocean and climate monitoring and disaster warning, as well as legal aspects of such use;
- Develop a strategy and roadmap that could lead to enabling the availability of submarine repeaters equipped with scientific sensors for climate monitoring and disaster risk reduction such as pressure, temperature, salinity/conductivity, seismic, hydroacoustic and cable voltage in the near future;
- Analyze the development of projects that could include renovation and relocation of retired out-of-service cables for disaster warning, ocean and climate monitoring;
- Cooperate closely with the International Cable Protection Committee (ICPC) to investigate and report on the technical feasibility of incorporating the required scientific sensors into the design, manufacture, installation and operation of submarine repeaters in a safe manner without affecting cable systems and telecommunication signals, and avoiding risks that could affect the normal operation of the cables;
- Consider a business model of how sensor data from submarine cables could be provided and could be made available for scientific purposes and societal benefit;
- Identify financing models and opportunities to promote the development of ocean climate monitoring and disaster warning systems by the use of submarine cables;
- Consider ways to further promote the implementation of the legal regime, as reflected in the United Nations Convention on the Law of the Sea (UNCLOS) and other instruments, for the protection of submarine cables, including awareness building and mobilization of support at the national and global levels;
- Organize similar workshops to report on the progress;
- Ensure that the outcomes of the above efforts/activities take into account and are consistent with international law, as reflected in UNCLOS;
- Invite ITU to consider providing secretariat support for the joint task force.

# JTF Activities: Three benchmark reports commissioned by ITU in 2012

Rhett Butler

Kent Bressie

Stephen Lentz & Peter Phibbs



Using submarine cables for climate monitoring and disaster warning

**Strategy and roadmap**

Using submarine cables for climate monitoring and disaster warning

**Opportunities and legal challenges**

Using submarine cables for climate monitoring and disaster warning

**Engineering feasibility study**



# JTF activities: six standing committees; annual workshops

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- Executive Comm (Chris Barnes)
- Science and Society Comm (Rhett Butler)
- Engineering Comm (Bruce Howe)
- Business Model Comm (Michael Costin)
- Legal Comm (Kent Bressie)
- Publicity, Outreach and Marketing Comm (Nigel Bayliffe and Peter Phibbs)
  
- Annual JTF workshops: Rome 2011, Paris '12, Madrid '13 and Singapore '14

# JTF recent activities

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- [Madrid Workshop](#), Sept 2013: program and PPTs on website
- [2013 Annual Report](#) on website
- [Management](#): Bi-monthly Executive and Plenary **teleconferences**
- [Improved media communications](#): revised the website; produced logo, flyer, Blog, FAQs, and pull-up display
- [Presentations](#) at several conferences/workshops
- Science and Society [White Paper](#) completed (Butler et al.); others in prep.
- [Secured industry funding](#) for consultant studies on a) [Functional Requirements](#), b) [Wet Demonstrator](#) (both Mallin Consultants) and c) [Marketing/Business Plan](#) (David Ross Group); all completed, now under external review
- [Promoting two NASA workshops](#) (Oct 2014 and May 2015): *From space to the deep seafloor: Using “Green” submarine cable systems in the ocean observing system*
- [Special session at SNW 2014](#), Singapore (keynote and Q&A Forum)
- [2014 Workshop](#), Singapore, Oct 2014

# JTF: Green cable initiative – Main issues and Demonstrator Project

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- A wide network of micro-observatories could be established at many places across the world's ocean floors to measure these important parameters accurately over several decades
- The initiative addresses two main issues: a) need for sustained climate-quality data from sparsely observed deep oceans and continental slopes, but extending into coastal waters; and b) desire to increase the reliability and integrity of the global tsunami warning networks
- Presently, plans are being developed for a demonstrator project involving cable industry players and ocean observatory researchers



# Increases in global greenhouse gases 1984-2013

Between 1990 and 2013 there was a 34% increase in radiative forcing – the warming effect on our climate – because of long-lived greenhouse gases such as carbon dioxide (CO<sub>2</sub>), methane and nitrous oxide

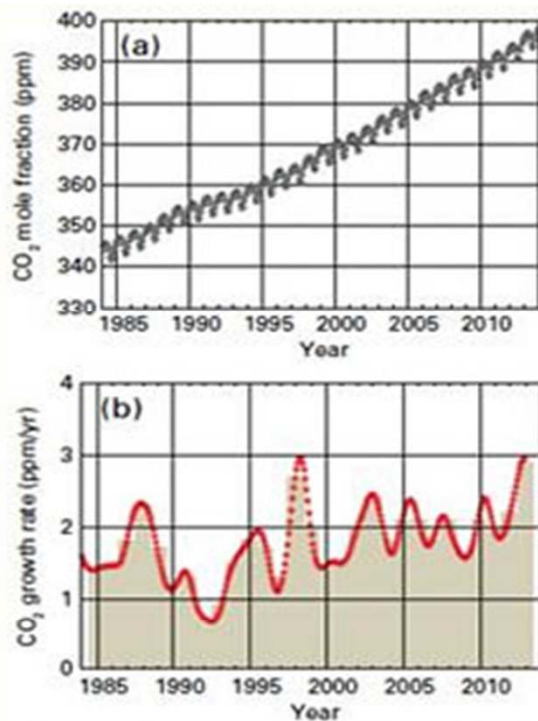


Figure 3. Globally averaged CO<sub>2</sub> mole fraction (a) and its growth rate (b) from 1984 to 2013. Differences in successive annual means are shown as shaded columns in (b).

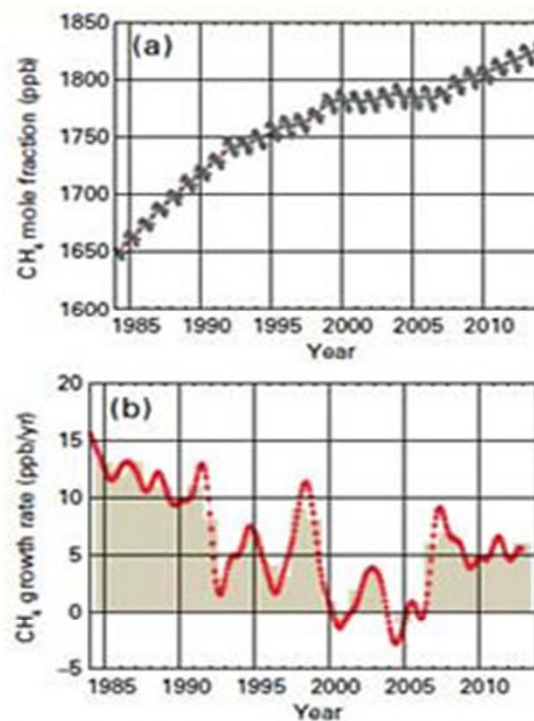


Figure 4. Globally averaged CH<sub>4</sub> mole fraction (a) and its growth rate (b) from 1984 to 2013. Differences in successive annual means are shown as shaded columns in (b).

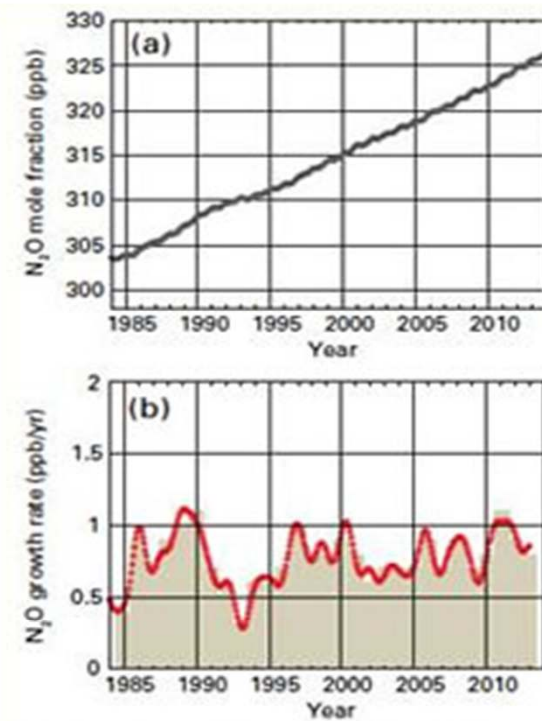


Figure 5. Globally averaged N<sub>2</sub>O mole fraction (a) and its growth rate (b) from 1984 to 2013. Differences in successive annual means are shown as shaded columns in (b).

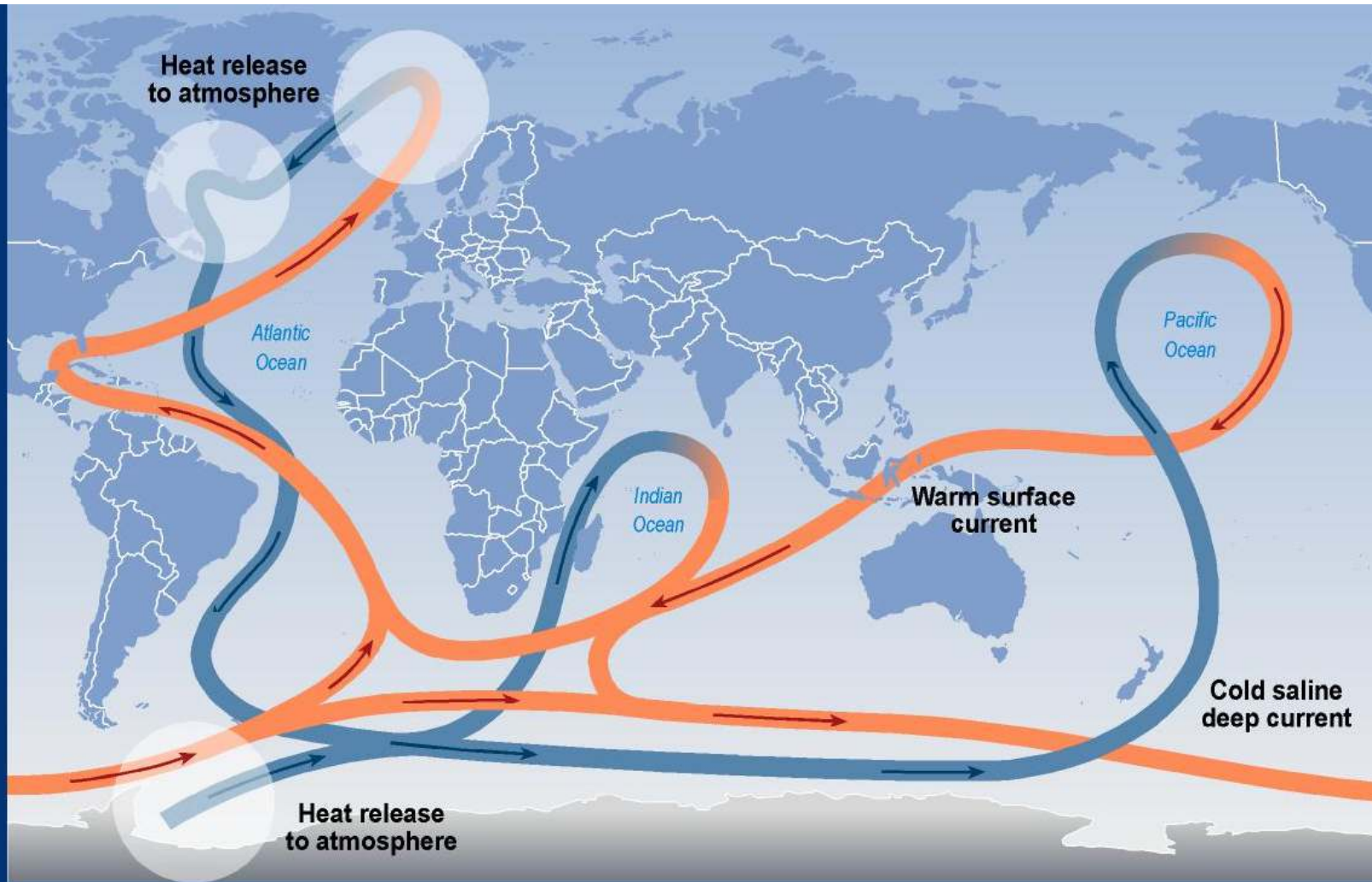


# UNEP warns of catastrophic permafrost melt by 2100

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- Melting permafrost could account for 40% of global greenhouse gas emissions and must be considered by governments, warned the UN Environment Programme (UNEP) (Doha, 2012).
- Researchers have found that melting permafrost could emit 43 to 135 gigatonnes of carbon dioxide by 2100 and up to 415 gigatonnes by 2200.
- This would blow apart hopes of keeping global warming below 2°C on pre-industrial levels.

# Great ocean conveyor belt



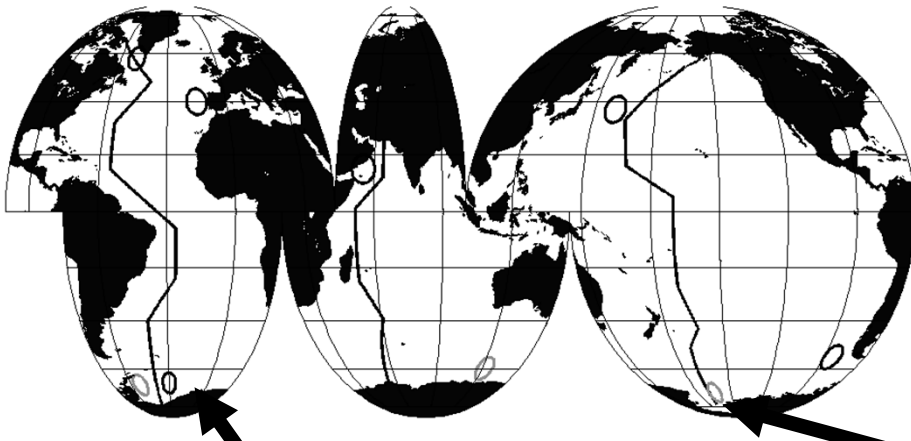
SYR - FIGURE



# Antarctic Bottom Water (AABW) dominates the abyss

(Johnson, 2008)

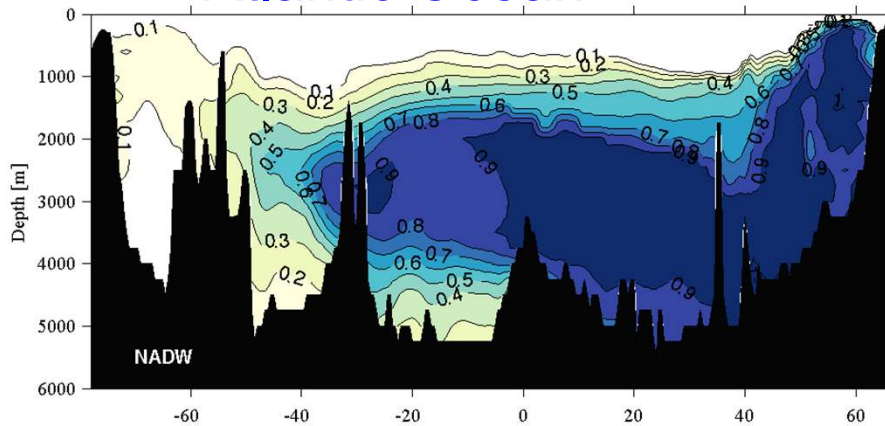
- AABW twice NADW volume
- Spreads north from Antarctic
- Dominates SW Atlantic Abyss
- Dominates entire deep Pacific
- AABW twice NADW volume



Atlantic Ocean

Pacific Ocean

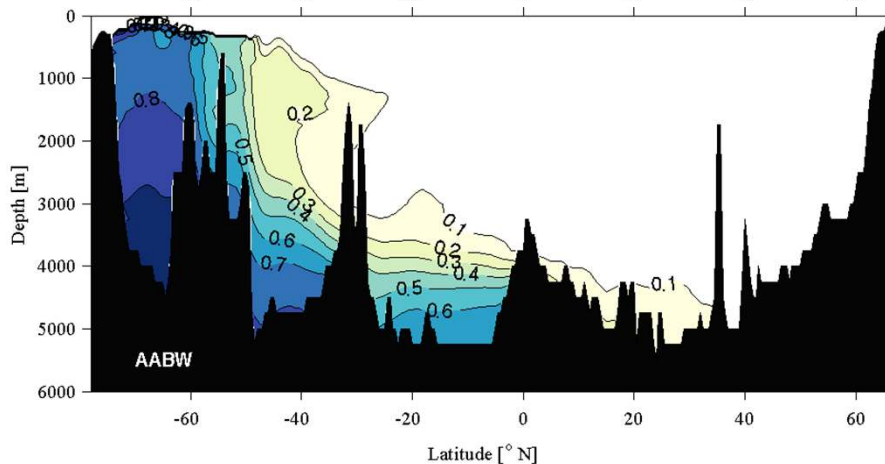
NADW



Depth [m]

NADW

AABW



Latitude [° N]

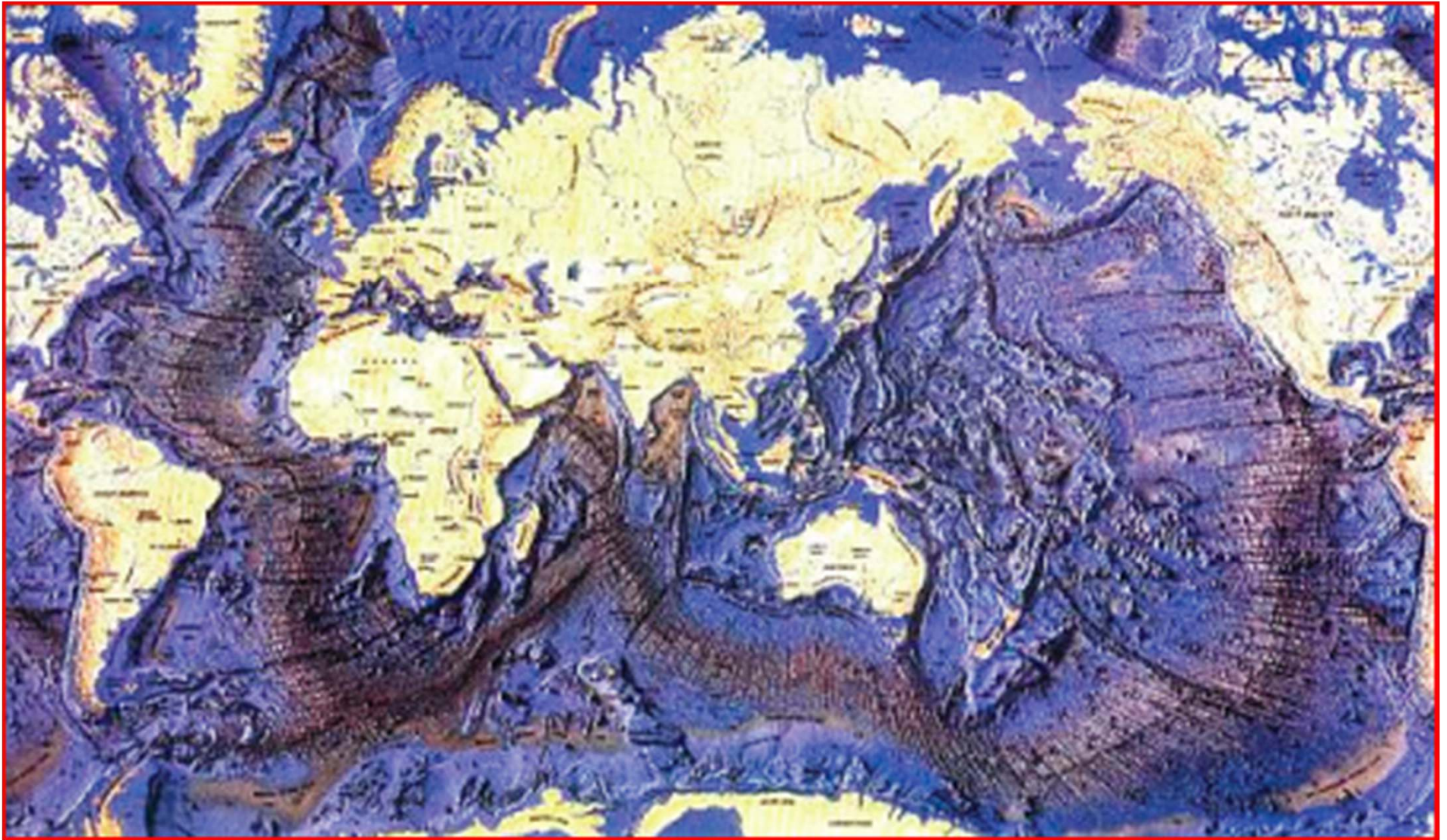
Depth [m]

AABW

Latitude [° N]

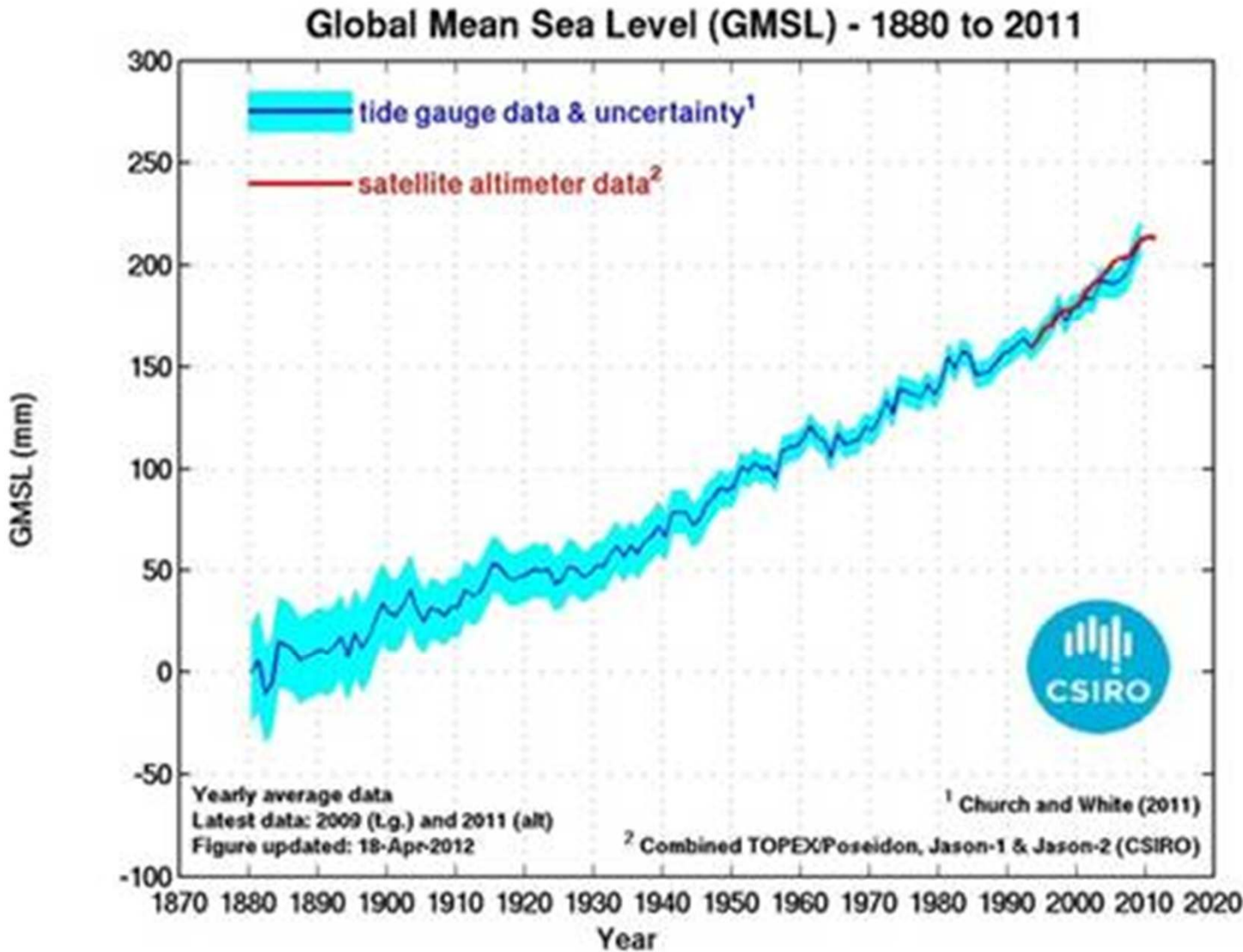


# Ocean floor topography: role of sensors



NASA/SEASAT

# Global mean sea level rise 1870-2011

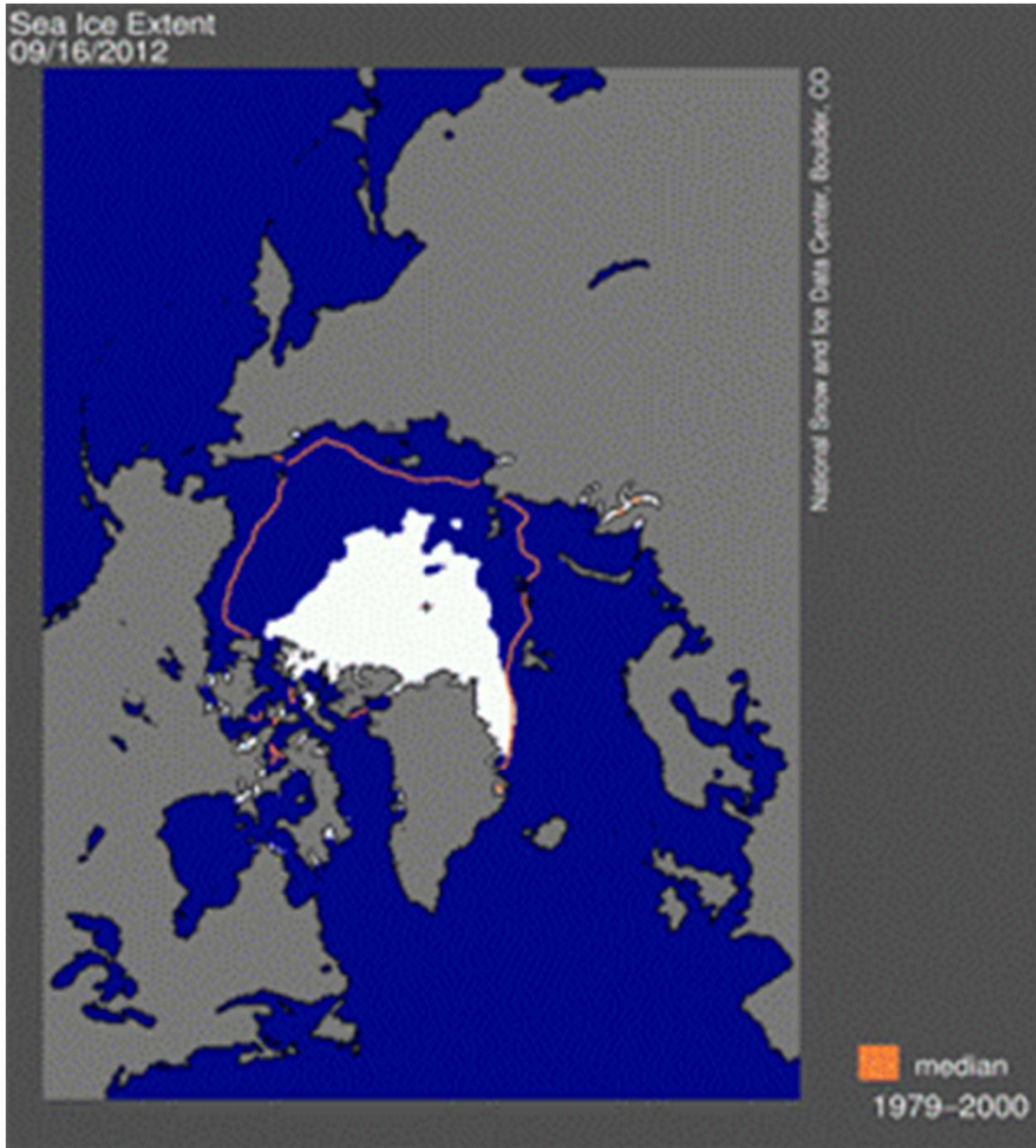


Sea levels are changing globally. More than 90% of the extra energy accumulated between 1971 and 2010 due to rising greenhouse gas concentrations went into the ocean.

WMO



# Loss of Arctic sea ice

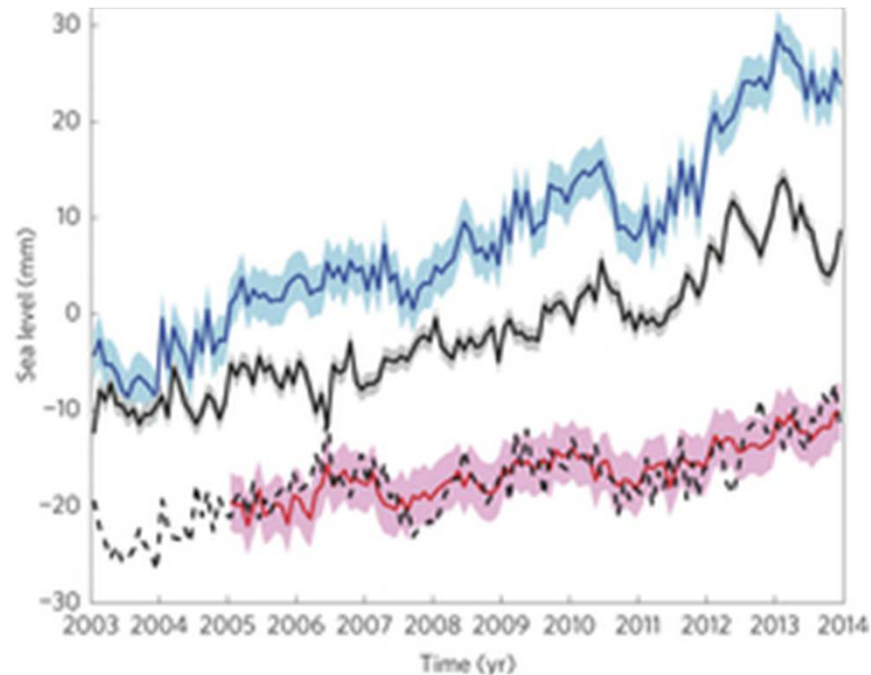


The 2012 minimum sea ice extent was 49 percent, or almost 3.3 million square kilometres (nearly the size of India), below the 1979–2000 average minimum. Some 11.83 million square kilometres of Arctic ice melted between March and September 2012.

WMO

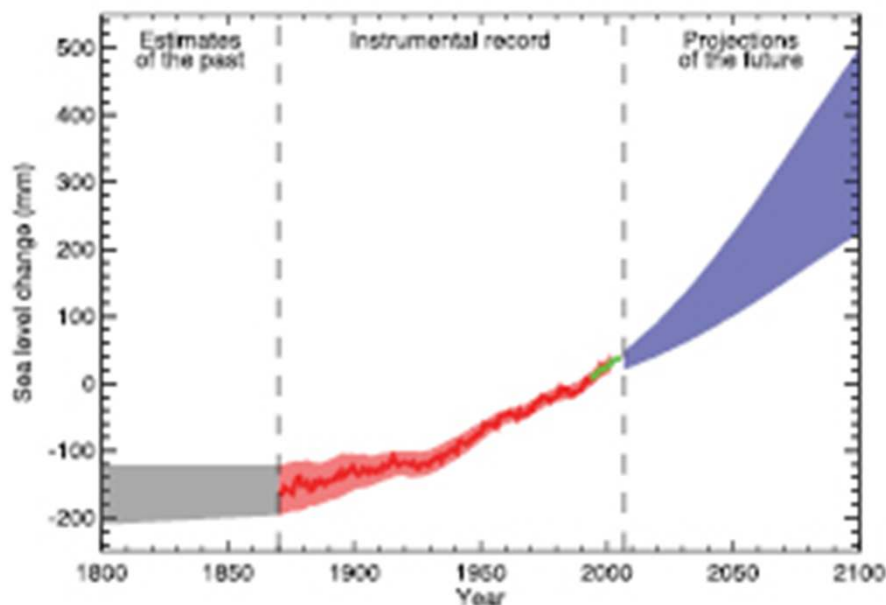


# Global mean sea-level variations



The estimates are observed variations by satellite altimetry (blue), ocean mass contributions based on GRACE data (solid black) and steric sea level based on *in situ* observations (red).

Llovel et al. 2014, Nature Climate Change.



Time series of global mean sea level (deviation from the 1980-1999 mean) in the past and as projected for the future. IPCC 2013.

Extensive and accurate sea level measurements can be made through pressure sensors on green cables

# Future flood losses in major coastal cities

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“Here we provide a quantification of present and future flood losses in the **136 largest coastal cities**. Using a new database of urban protection and different assumptions on adaptation, we account for existing and future flood defences. **Average global flood losses in 2005 are estimated to be approximately US\$6 billion per year, increasing to US\$52 billion by 2050 with projected socio-economic change alone. With climate change and subsidence, present protection will need to be upgraded to avoid unacceptable losses of US\$1 trillion or more per year. Even if adaptation investments maintain constant flood probability, subsidence and sea-level rise will increase global flood losses to US\$60–63 billion per year in 2050.**”

Hallegate et al. *Nature Climate Change* **3**, 802–806 (2013)

# Impacts of tsunamis and submarine slope failures

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- Several major tsunamis occurred in last decade, associated with megathrust earthquakes ( $M_w$  7.7 to 9.1) 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 anthropogenic, environmental and ecosystem damage
- Reducing such losses and mitigating damage is key factor in improving tsunami warning systems (Bernard and Robinson, 2009; Whitmore, 2009)





26 Dec. 2004  
tsunami, Indonesia  
from offshore  $M_w$  9.1  
earthquake





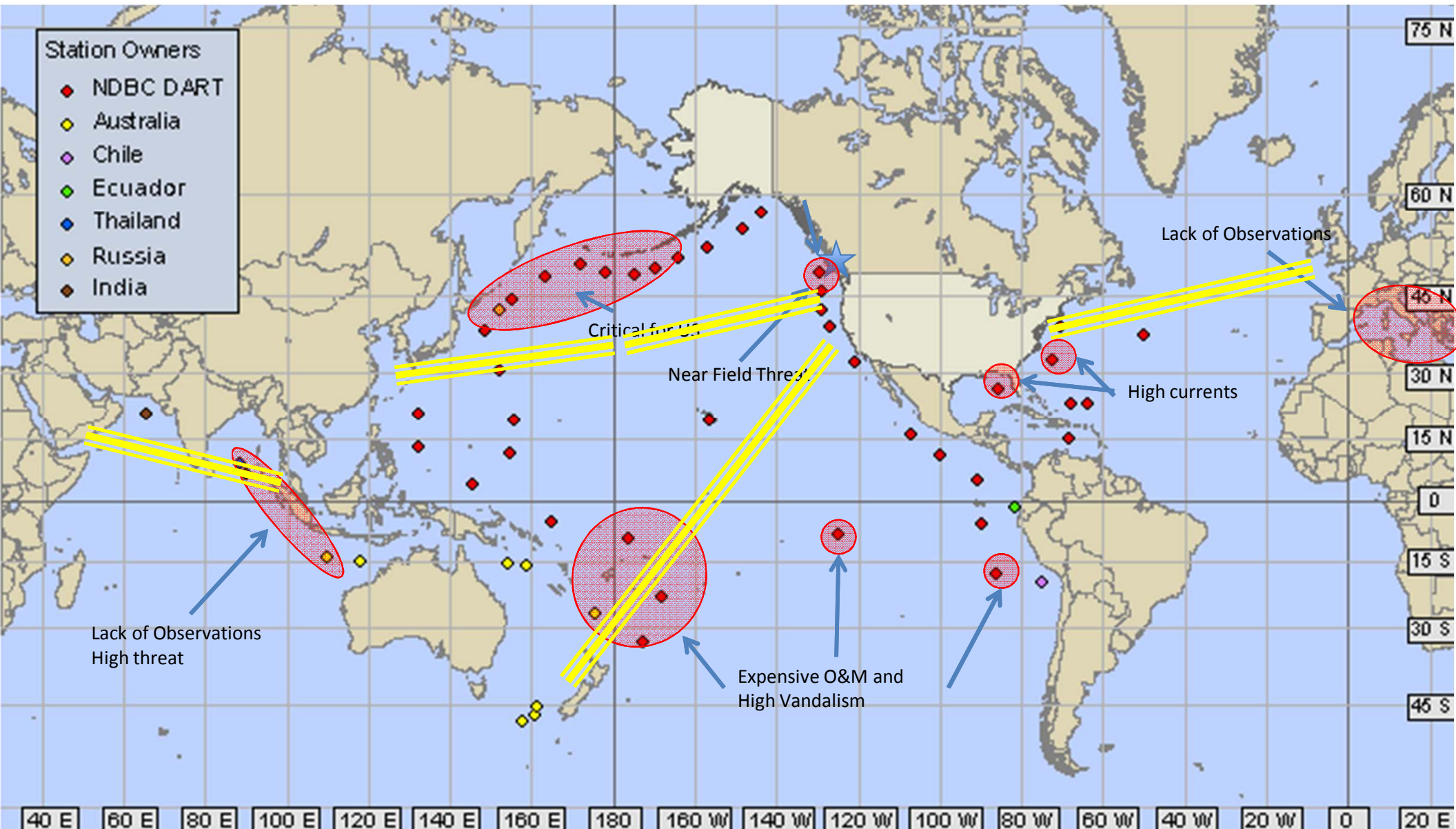


Devastating effects  
of 11 March 2011  
tsunami, Japan,  
from an offshore  $M_w$   
9 earthquake





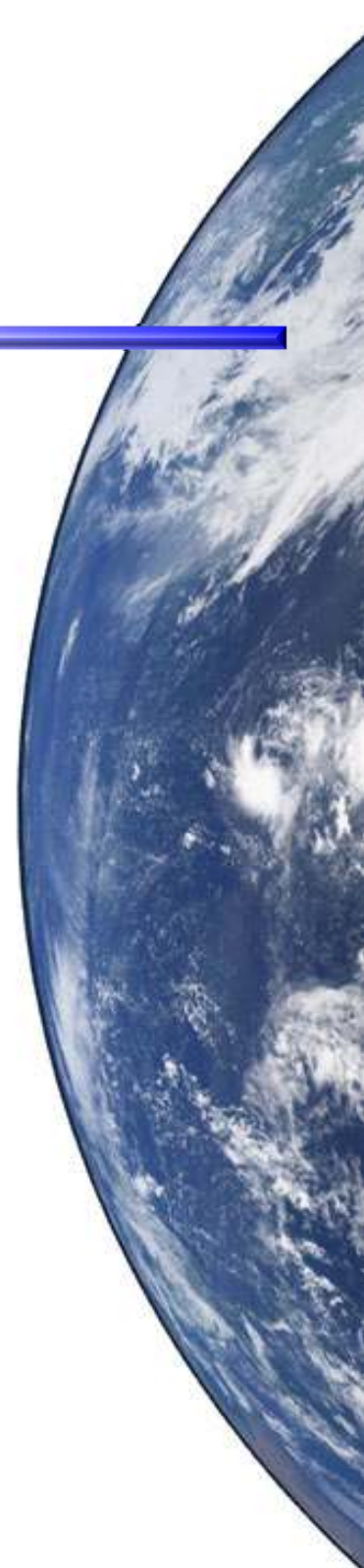
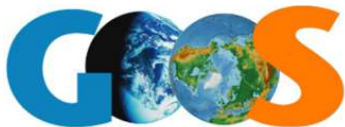
# Where do we need to measure?



# We cannot manage what we do not measure

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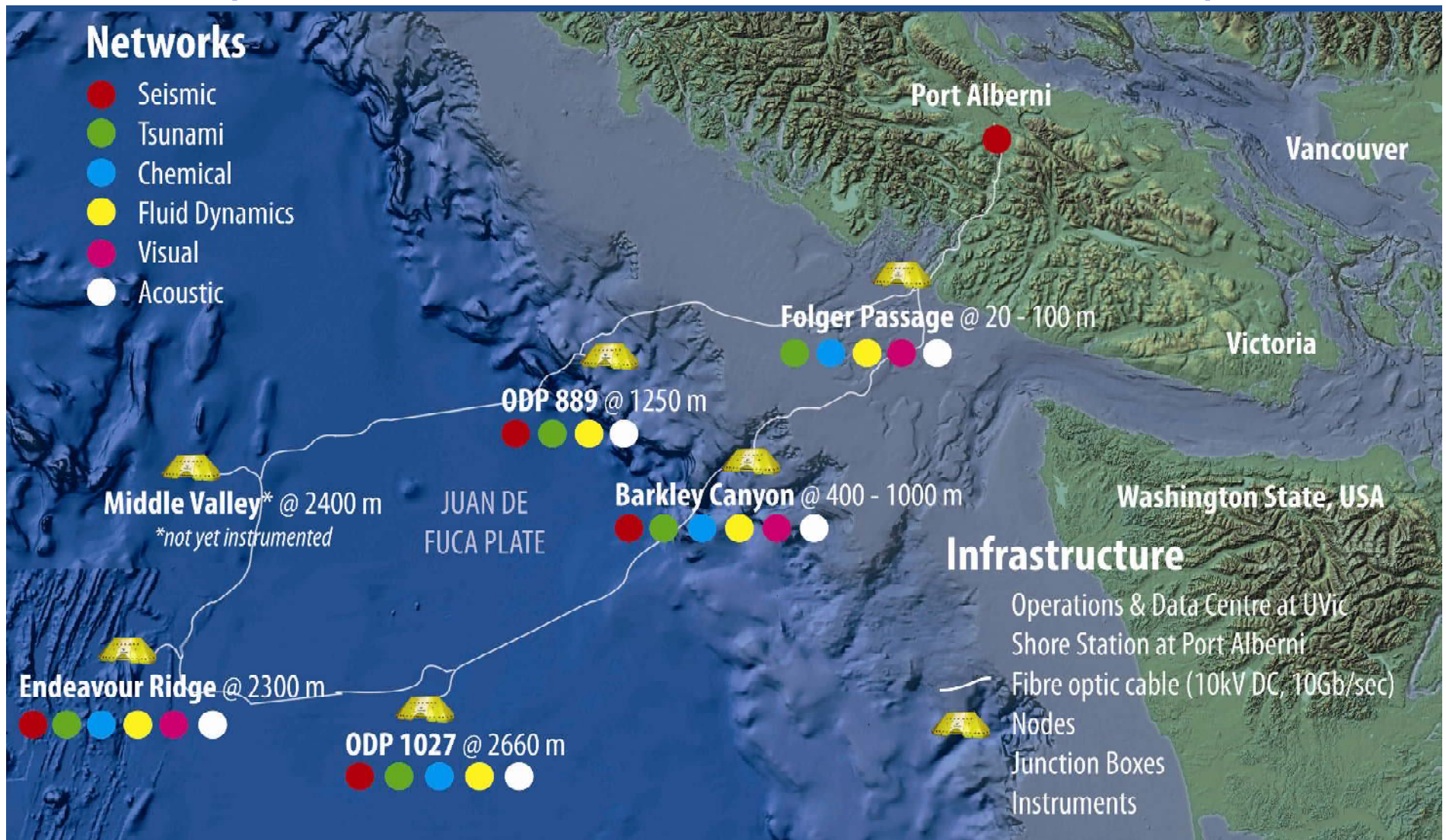
- **Sustained ocean observations** are necessary to:
- **Improve** scientific **knowledge** about the ocean climate and ecosystems, human impact, and human vulnerability
- **Apply** that **knowledge** through:
  - early warning for ocean-related hazards
  - climate forecasts and projections
  - ecosystem assessment and management
  - good ocean governance based on sound science – ensuring a healthy ocean and a healthy blue economy





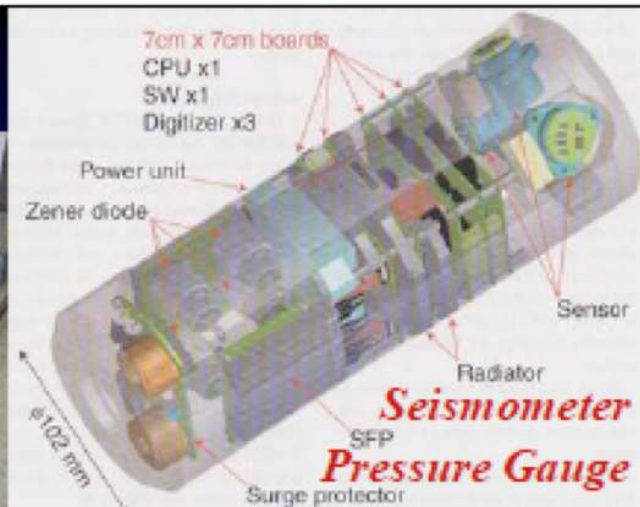
# Demonstrator testing potential: ONC's NEPTUNE observatory network

(+ DONET, OOI, EMSO, MACHO, China...)

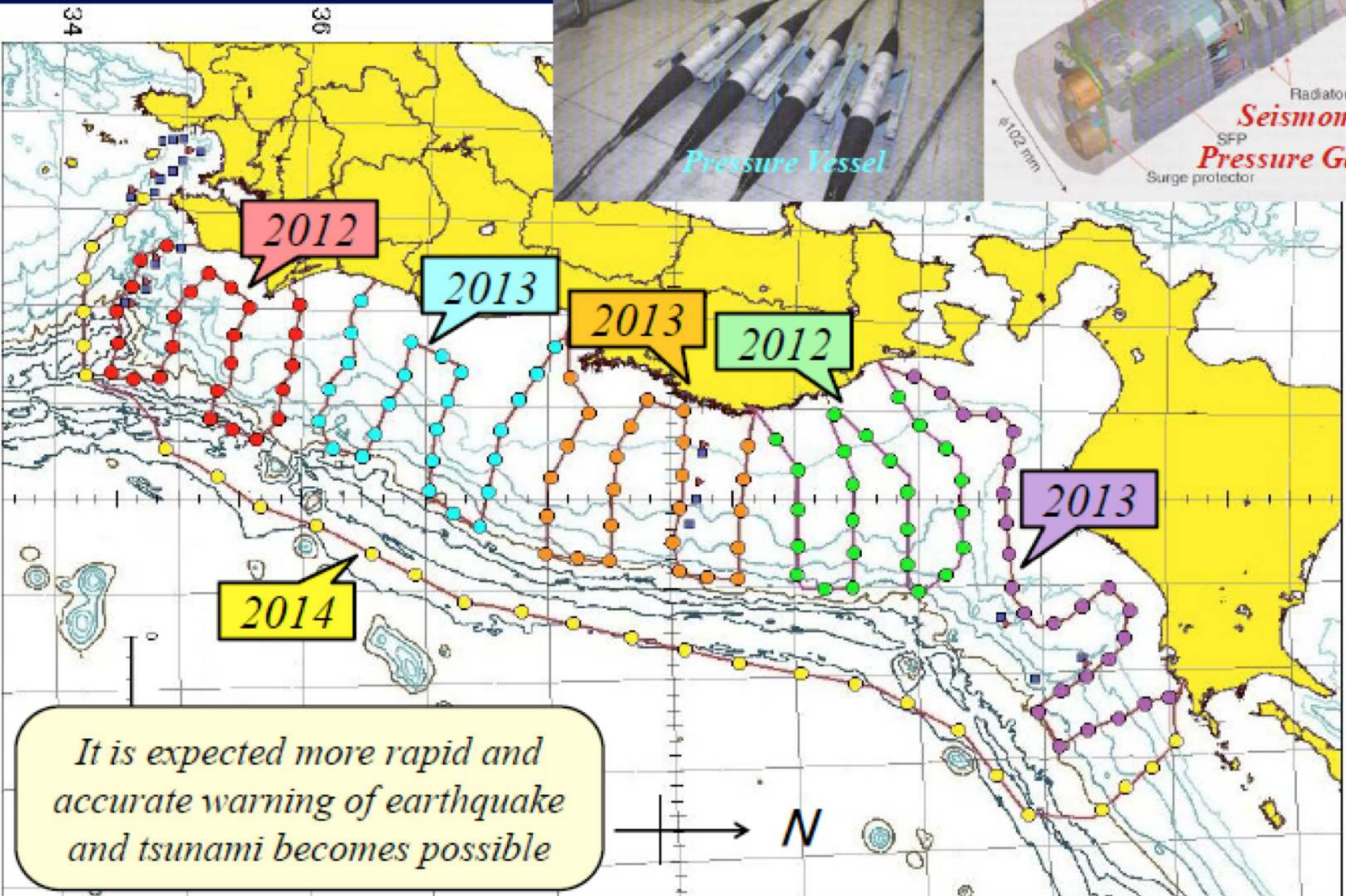




# Ocean bottom cabled network along Japan trench



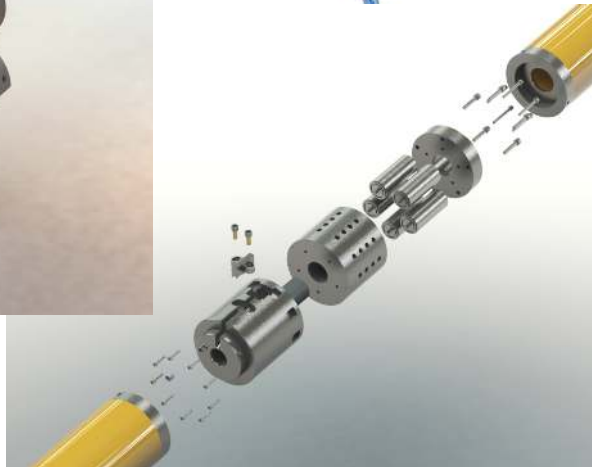
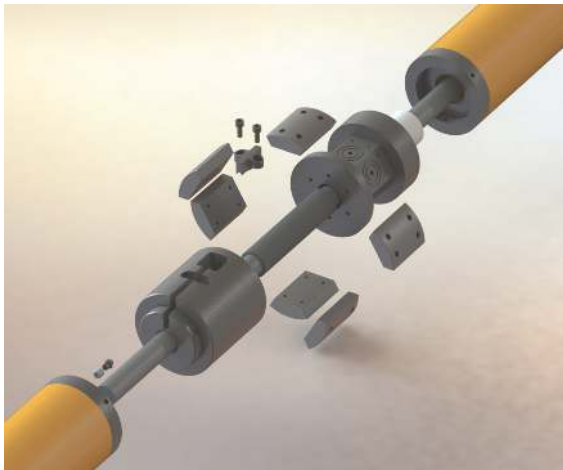
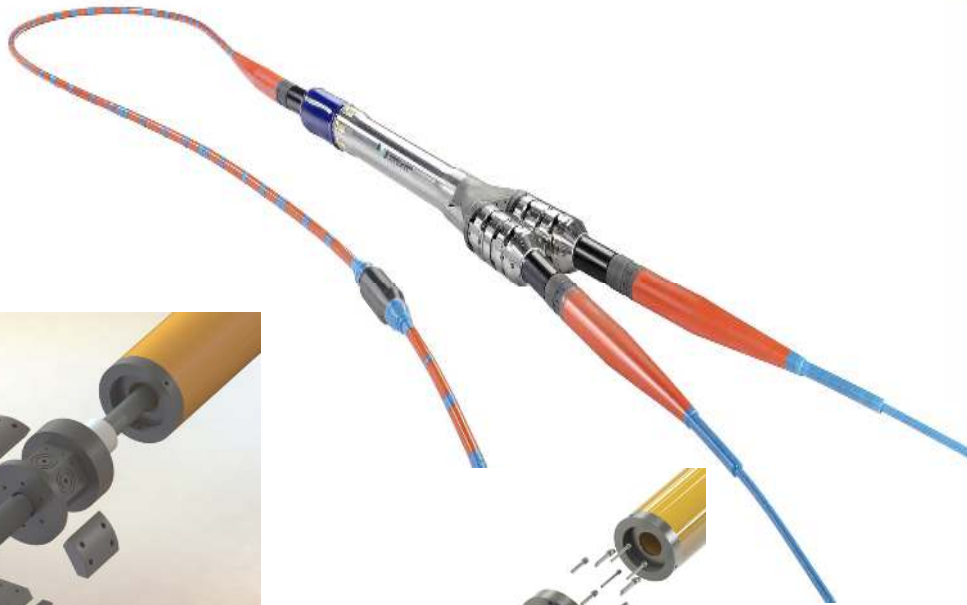
日本海溝海底地震津波観測網



*It is expected more rapid and accurate warning of earthquake and tsunami becomes possible*



# Sensor packages integrated with repeaters: Technical challenges can be handled



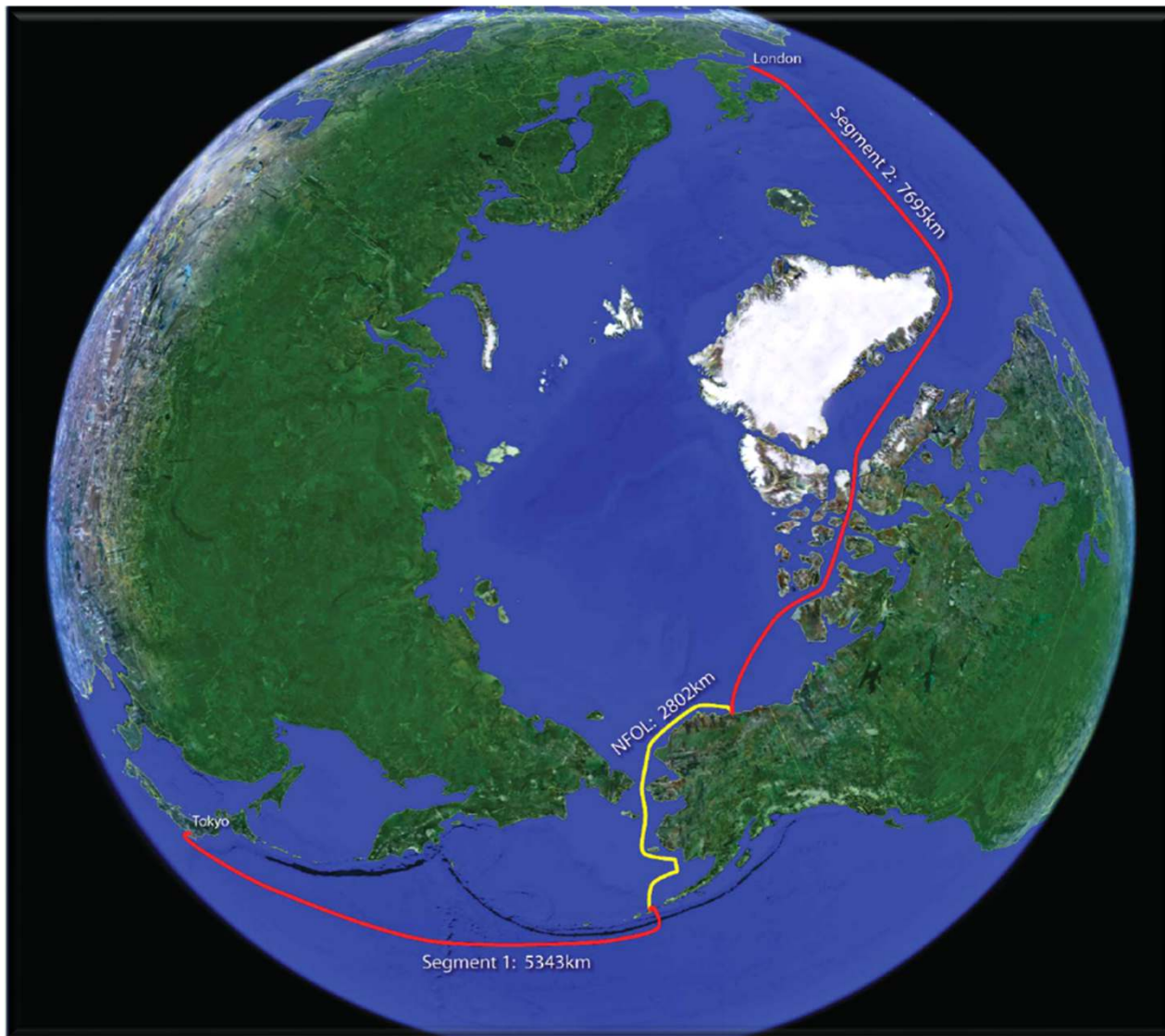
HMN

# Examples of proposed submarine cables: SubPartners APX cable systems

- **APX-East** is a four fibre-pair system using state of the art ultra-long haul design delivering 10Tbps per fibre pair. It will connect **Sydney, Australia to California, USA** with branches to several Pacific Islands. The 12,700km system has initial design capacity of up to 40Tbp/s and *can be deployed with seabed sensor technology enabling the early detection of seismic events*. It is expected to be Ready for Service (RFS) Q2 2017.
- **APX-Central** subsea cable, independent of all existing trans-Australia routes, will offer true diversity, security and connectivity into poorly served states such as **Tasmania with future options for South Australia**.
- **APX-West** is a four fibre-pair system using state of the art ultra-long haul design delivering much needed capability and resiliency to the region. It will connect **Perth, Australia to Changi North, Singapore** with planned branches to Jakarta, Indonesia and Christmas Island. The system is 4,700km long, with initial design capacity of up to 32Tbp/s. It is expected to be Ready for Service (RFS) by Q2 2015.



# Future systems: Proposed Arctic Fibre cable route - Japan to UK



# New Latin America – U.S. Subsea Cable

- 10 October 2014: Algar Telecom (Brazil), Angola Cables (Angola), Antel (Uruguay) and Google have announced plans to build a new undersea fiber-optic cable connecting the key cities of Santos and Fortaleza in Brazil with Boca Raton, Florida, US. TE Connectivity SubCom is the selected provider for the project.
- The new route will be 10,556 km (6,560 miles) long and have six fiber pairs. According to estimations, it will increase the overall bandwidth of existing subsea cable systems by 64 Tbps (Terabits per second).





# Technical feasibility of green cable systems

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- Appears technically feasible at this stage
- More iterations required to match science goals with telecom requirements
- Next steps:
  - Detailed technical requirement documents are being produced (Mallin Consultants) and a Marketing/Business Plan (David Ross Group)
  - Pursue ongoing improvements in sensors (Sci/Soc & Eng Comms + industry)
  - Trial deployment required to demonstrate feasibility and value of data (Demonstrator Project; observatories + industry)



# Commercial feasibility of green cable systems

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- Solicited industry funding for studies: Functional Requirements; Demonstrator; and Business Models/Marketing (with 6-month NDA embargo); released in Q2 2015
- Estimates of 4-8% increase in cable construction costs to add sensors
- Project costs main assumptions:
  - Marine Installation and Marine Maintenance costs are not affected by sensors:
    - Sensors do not sensibly affect repeater reliability
    - Repeaters with faulty sensors are not replaced
- Project maintenance costs are similar to non Green Cables over the 25 year design life
- Next steps
  - Establish the scope, schedule and costs of the demonstrator project
  - Apply to potential sources for demonstrator and development funds
  - Collaborate on proposed cable systems with capacity for sensors

# Conclusions

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- The JTF concept of green cable systems is timely and achievable, responding to urgent societal needs
- To be successful it requires:
  - technical support from industry
  - cooperation from owners and suppliers
  - iteration between scientists, observatories and industry
  - clarification of legal implications
  - engagement with diverse user community
  - funding for demonstrator project
  - operational business model, refined as costs are better known
- Science and society are looking to industry to make green cables a reality
- The new global data are critical for understanding and managing ocean health, ecosystems, and for mitigation strategies for future climate change and natural hazards

# JTF: Links and further information

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- ITU/WMO/UNESCO-IOC Joint Task Force <http://itu.int/ITU-T/climatechange/task-force/sc/index.html>
- ITU-T and climate change  
<http://www.itu.int/ITU-T/climatechange>
- JTF Workshop (2014, Singapore) on "Green cable systems: new developments and demonstrator project"  
<http://www.itu.int/en/ITU-T/Workshops-and-Seminars/jtf-itu-wmo-unesco-ioc/Pages/default.aspx>
- The Secretariat of the ITU/WMO/UNESCO IOC Task Force is provided by ITU and can be contacted at: [greenstandard@itu.int](mailto:greenstandard@itu.int)



Thank you....

....any questions?