OECD Workshop on Digital Technologies in the Ocean Economy: Exploring the Future

ITU/WMO/UNESCO IOC Joint Task Force on SMART cables

Climate Monitoring and Disaster Warning Using Submarine Cables

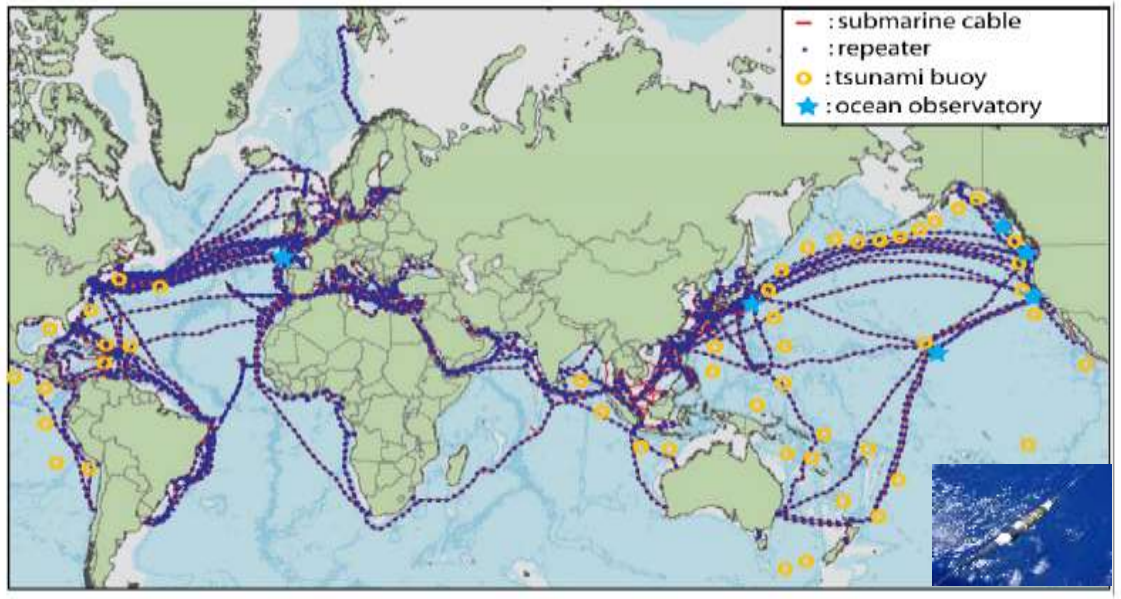
Brussels, 20-21 November 2019

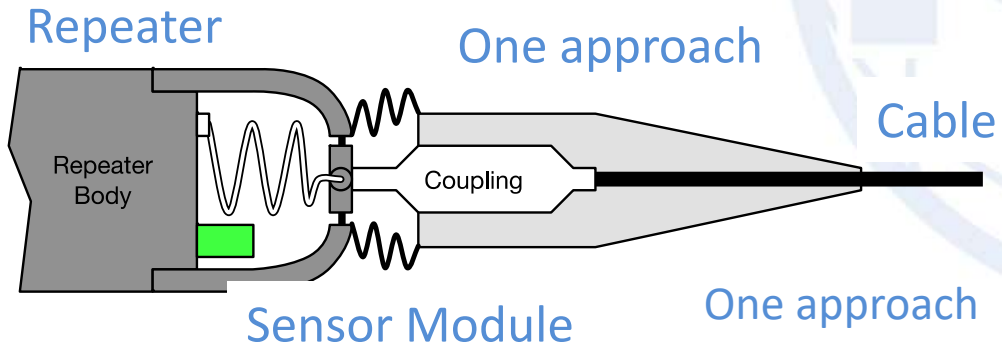
Hiroshi OTA, International Telecommunication Union (ITU)

SMART Cables - Basic Concepts

SMART (Scientific Monitoring And Reliable Telecommunications) cable systems for Climate Monitoring and Disaster Mitigation

SMART cables: first order addition to the ocean-earth observing system, with unique contributions that will strenathen and complement satellite and in-situ systems





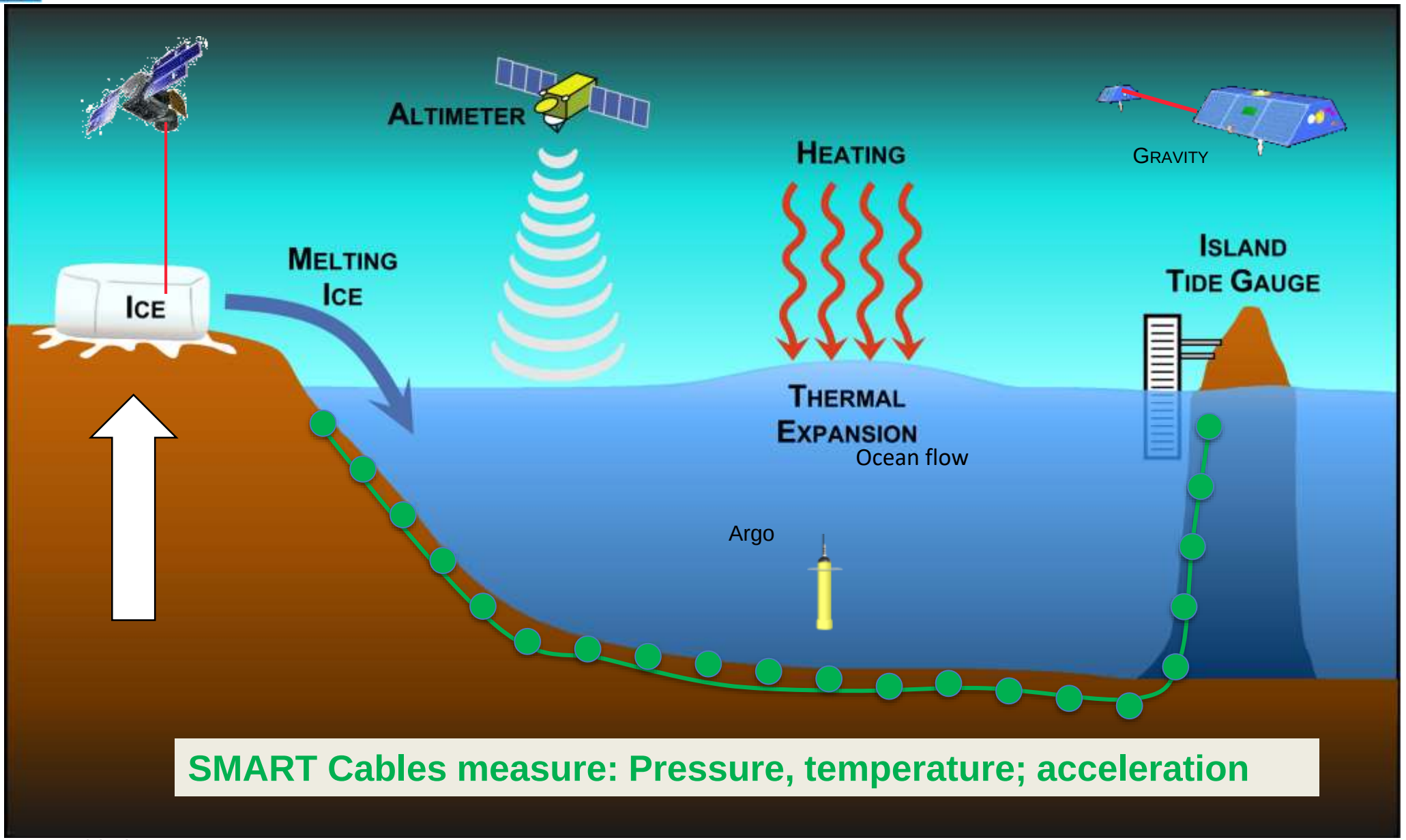
Install routinely on new cables
Deploy by cable ship, no maintenance

- **Telecom + science, shared infrastructure, $ ↓**
- Cable repeaters host sensors, not to interfere
- Potential: global spanning, trans-ocean, 1+ Gm
  ~10,000+ repeaters (~100 km)
  10-25 year refresh cycle
- Initially: **bottom pressure, temperature and seismic acceleration**; supplement later
- Share data internationally

John You, Nature, 2010 – Harnessing telecoms cables for science

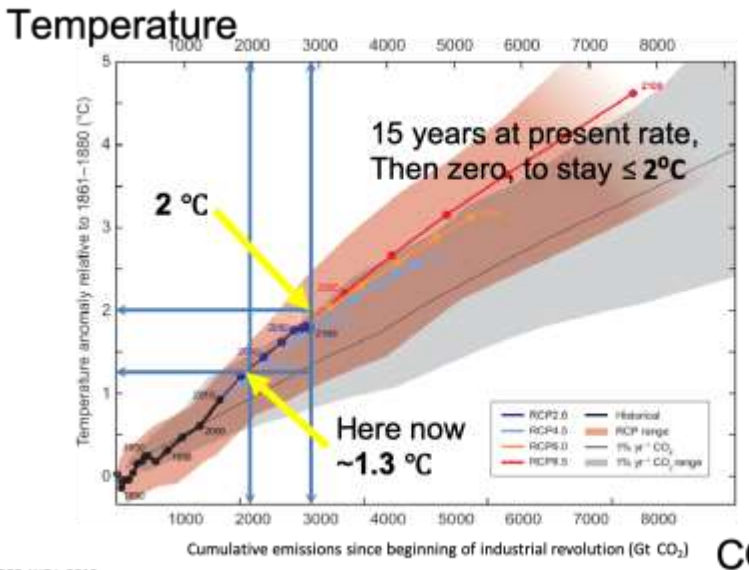
https://www.itu.int/en/ITU-T/climatechange/task-force-sc/Pages/default.aspx

SMART cable system



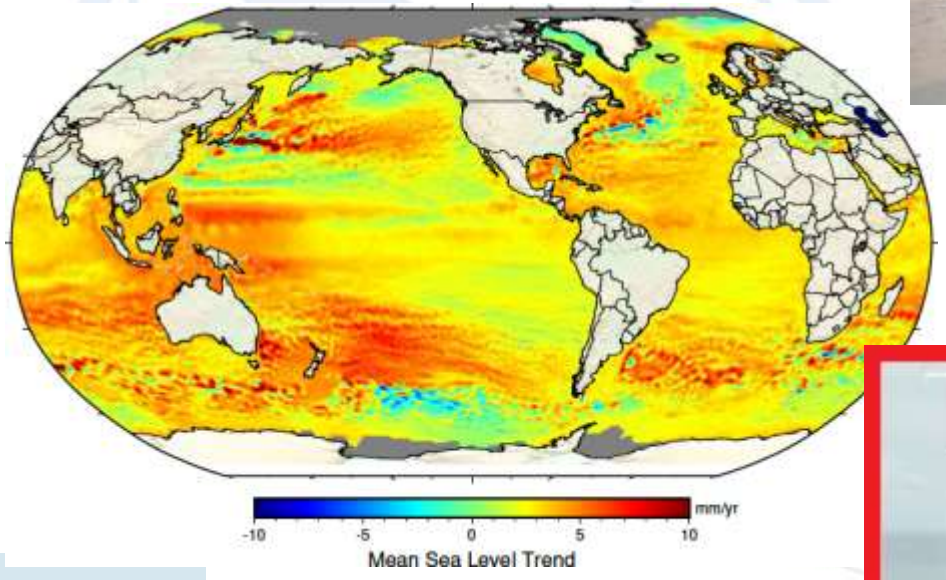
Adapted from Nerem, 2016

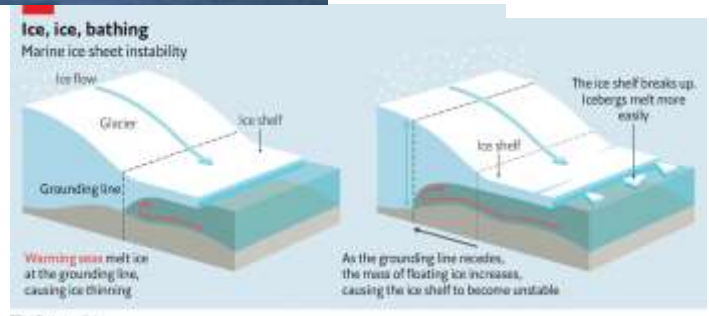
Climate Change – Global warming – Sea level



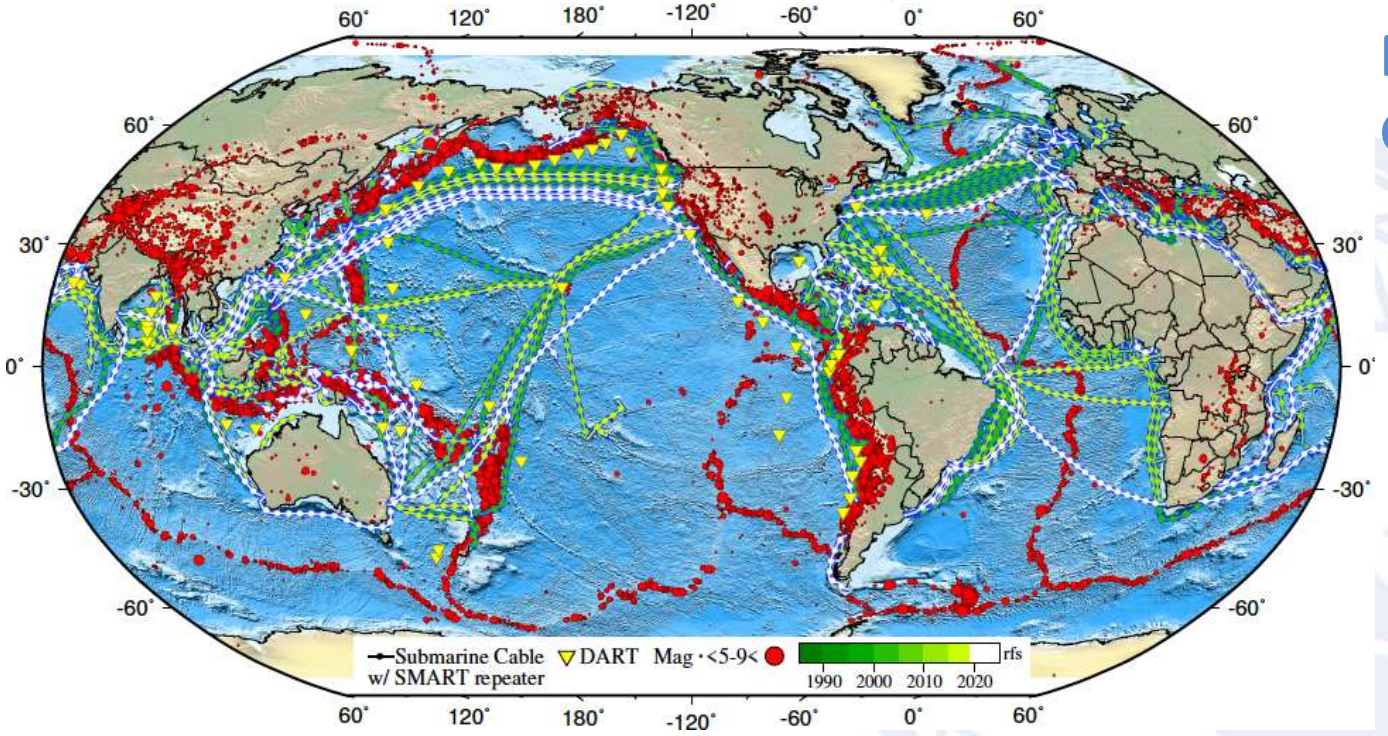
IPCC, WG I, 2013

Climate change is a remorseless threat to the world's coasts
Economist, August 2019





Tsunamis



Red earthquakes
Green/white cables

Place	Year	Mag	H (m)	Deaths
Chile	1960	9.5	25	6000
Alaska	1964	9.2	30	132
Mindinao	1976	7.9	9	7,800
Tumaco	1979	8.1	6	350
Hokkaido	1993	7.8	30	250
Papua New Guinea	1998	7.1	15	2200
Sumatra	2004	9.2	33	230,000
Solomon Island	2007	8.1	12	52
Samoa	2009	8.1	14	189
Maule, Chile	2010	8.8	3	525
Tohoku	2011	9.0	10	19,000
Palu	2018	7.5	7	~2000?

The SMART Cable Opportunity

Better observe the ocean

Flywheel of Climate, Source of Hazards

More Sensors

A global network of
ocean floor observation stations

Less Money

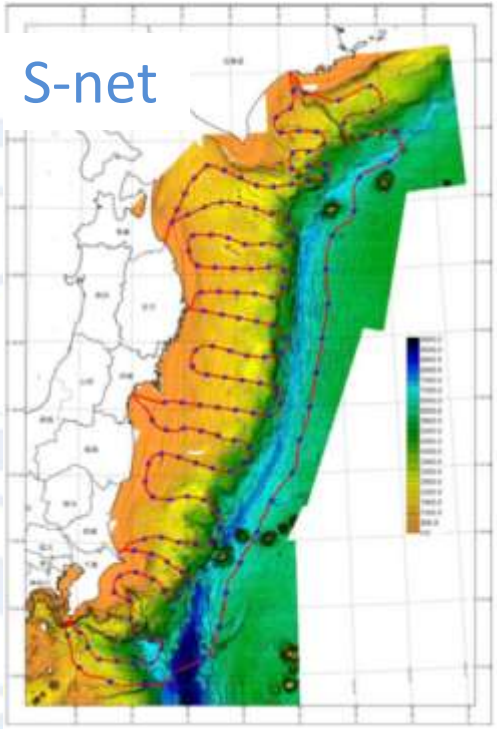
Harness 3rd party investment
to save millions in deployment costs

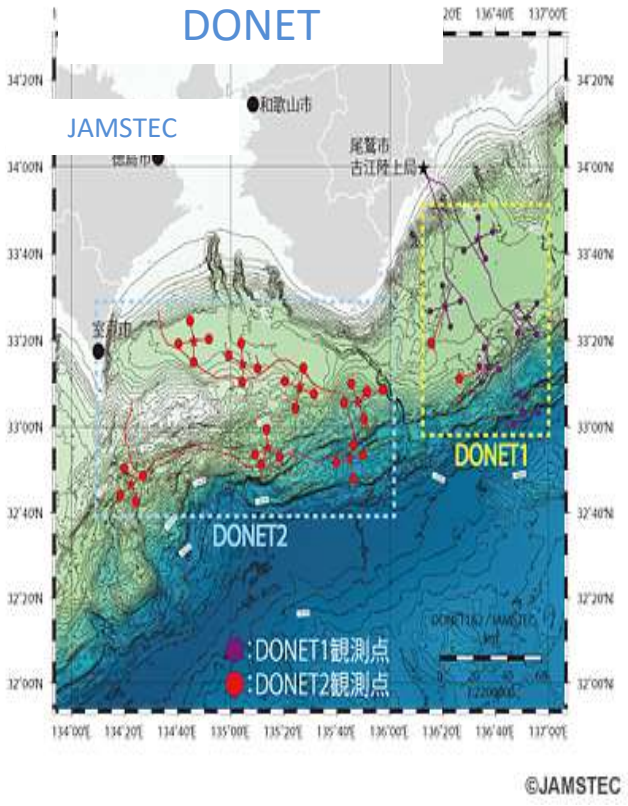
Societal and environmental issues:

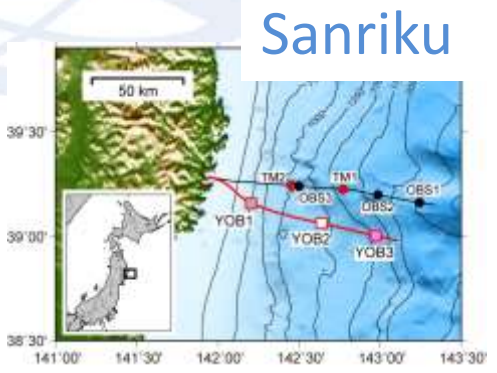
- **Climate change** – ocean temperature, circulation – direct impact, short and long term
- **Sea level rise** – hazard for coasts, island, cities
- **Disaster warning**– tsunami and earthquake monitoring throughout ocean basins and coastal margins

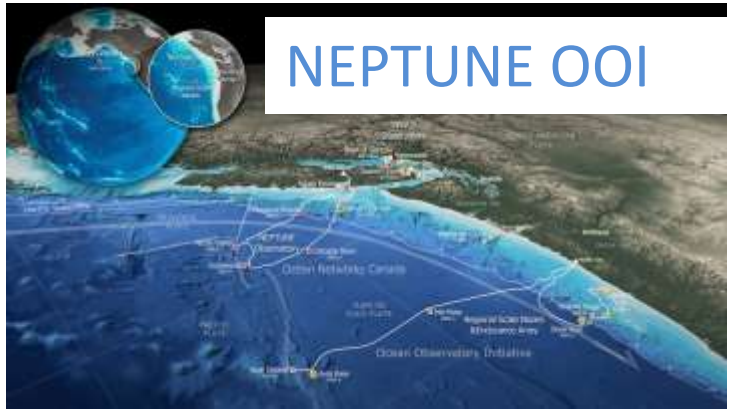
Existing technology components

- Dedicated cable systems
  - Existing and proven:
    - S-Net, Sanriku
    - DONET, perhaps NEPTUNE, OOI-RCA (high power, ROV)
    - *N-Net – new*
  - Sanriku: lower cost, close to SMART
- Or use Branch unit on commercial cable – wet demo

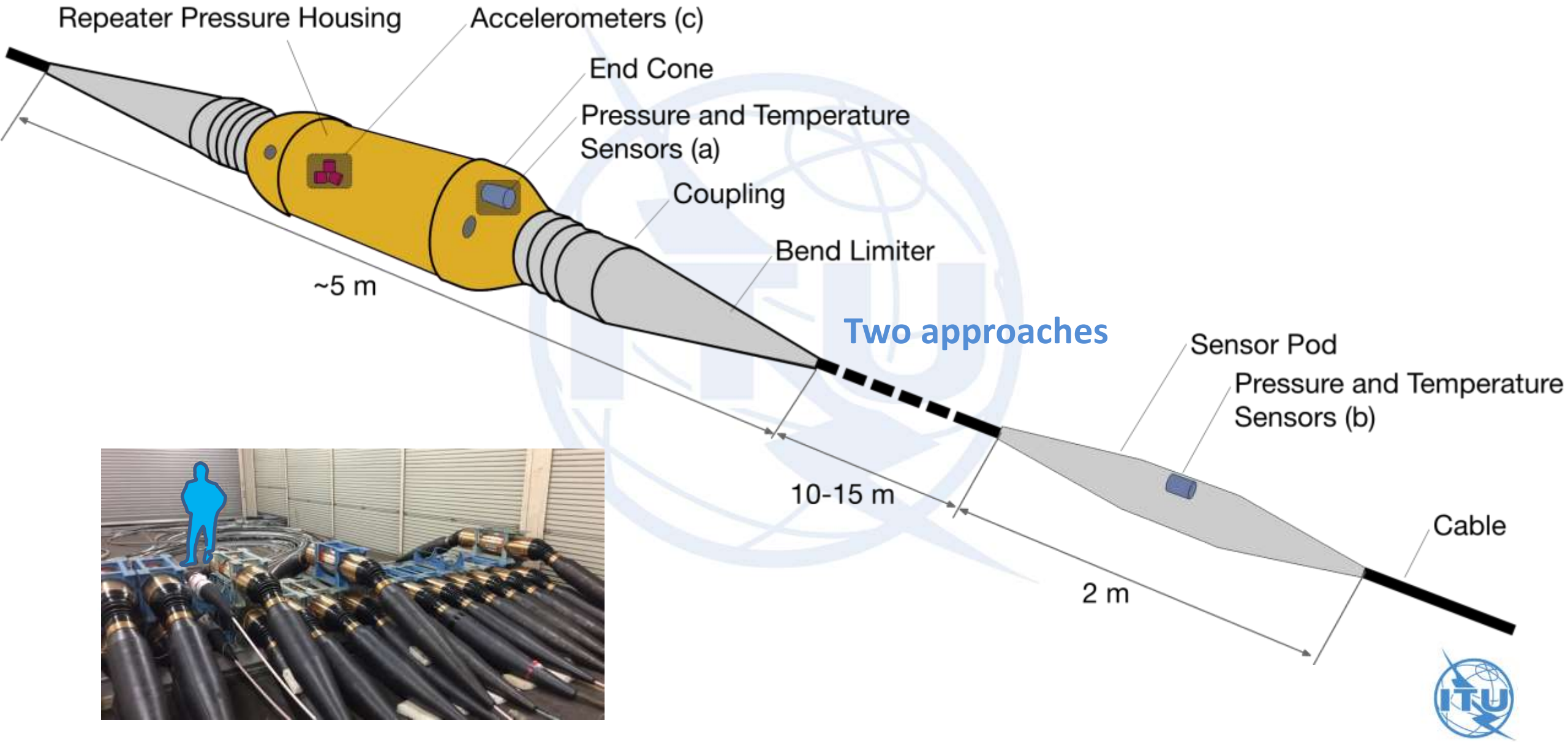






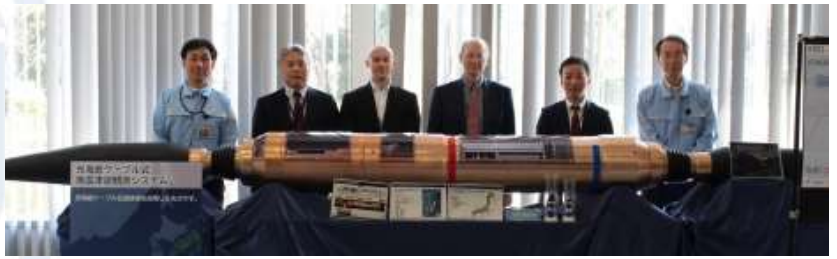


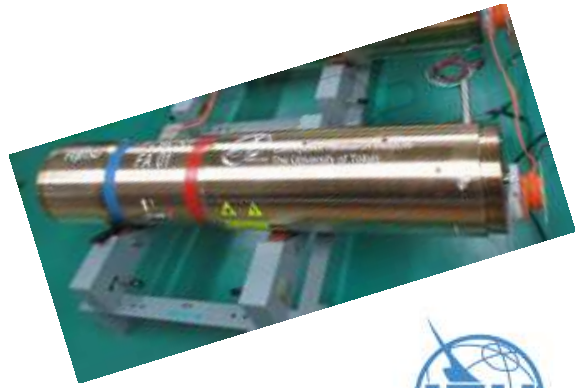
SMART Repeaters



Costs

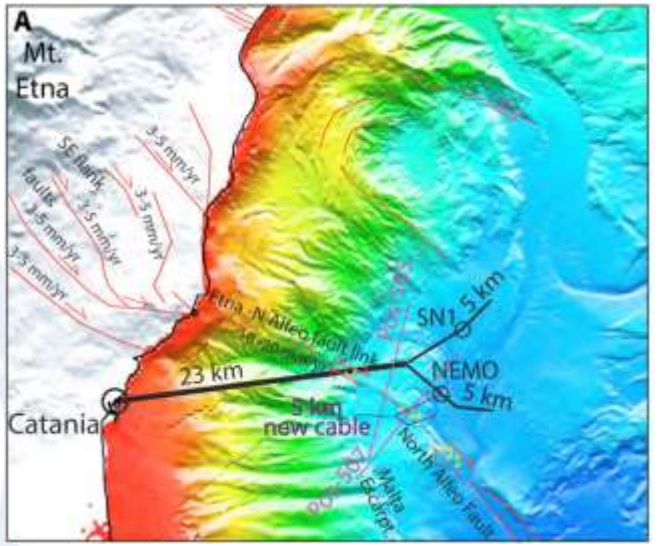
- Dedicated single purpose early warning systems (S-net, N-net) and plug and play science systems (NEPTUNE-Canada, US OOI-RCA, DONET) are expensive
- **SMART**
  - *Expect **lower cost***
  - Share/incremental costs only, with telecom
  - Assume no wet maintenance for SMART part
  - Pick and choose which systems
  - Build up coverage over time

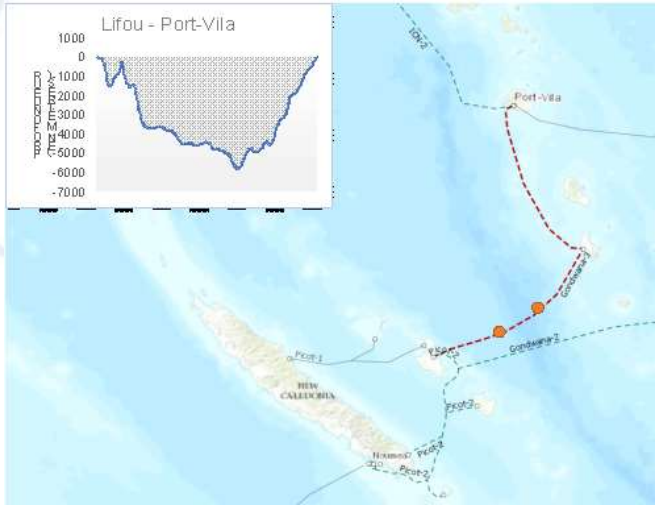




Ongoing projects

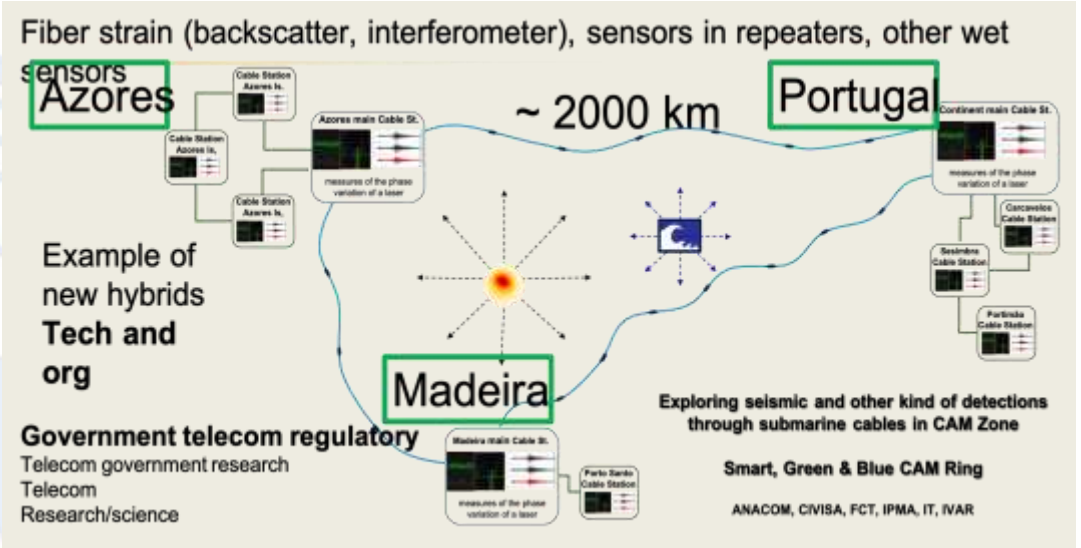
- National Institute of Geophysics and Volcanology (INGV, Italy): “Wet demonstration” project (Funded)
- New Caledonia –Vanuatu SMART Cable: Very modest (appropriate) scale pilot SMART system connecting New Caledonia to Vanuatu (300 km, 2 SMART repeaters) (Partially funded; work underway to obtain balance)

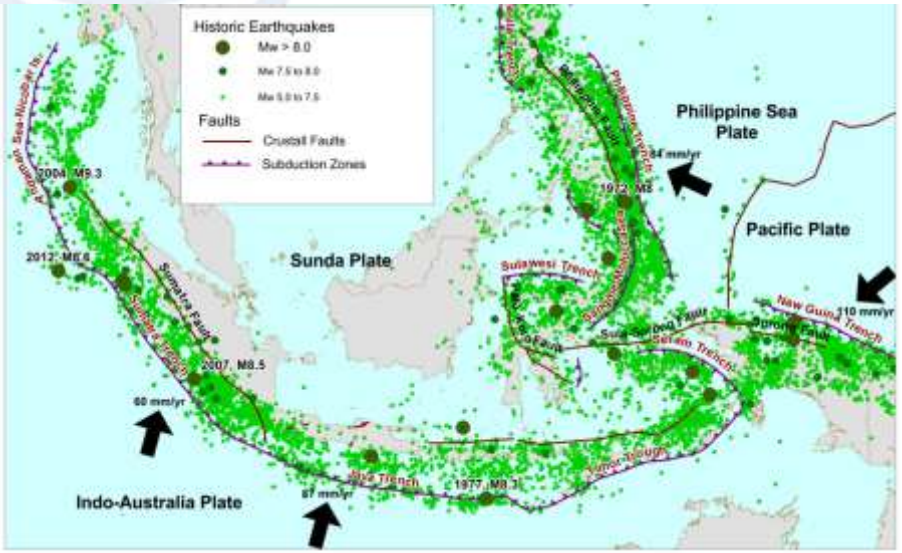




Proposed projects

- ANACOM (Portugal): Science/early warning + telecom system for Lisbon-Azores-Madeira-Lisbon
- Indonesia: “Cable-based tsunami warning system” based on SMART concepts





Challenges

- Reliability – SMART repeaters shall be designed to ensure that scientific sensors and telecommunication functions do not interfere with each other.
- Cost – Who pays the incremental cost due to sensors? Governments (climate, early warning), development banks (climate, disaster, connectivity)? Industry - CSR and/or a cost of doing business? Others?
- Legal issues – Telecommunication cables and marine data collection are governed by different legal regimes. If all countries involved with a system need and want the SMART capability, the deployment should be easy. If any country does not want SMART capability, we simply would not deal with that cable system.
- Starting small/modest/simple cases

Conclusion

- SMART cables provide alternative/complementary methods for climate change monitoring and tsunami early warning
- Technically feasible
- There are already ongoing (funded) and proposed projects on SMART cables
- ITU, WMO and UNESCO IOC are supporting Joint Task Force (JTF) on SMART cables.
  - Monthly e-meetings and yearly face-to-face events
  - Participation is welcome!
  - JTF web page at https://www.itu.int/en/ITU-T/climatechange/task-force-sc/Pages/default.aspx
  - Recent publication: “Frontiers in Marine Science" - SMART Cables for Observing the Global Ocean: Science and Implementation (August 2019) (https://www.frontiersin.org/articles/10.3389/fmars.2019.00424/full)


ITU