

# Science Monitoring And Reliable Telecommunications

## SMART Subsea Cables

for Climate Monitoring and Disaster Risk Reduction:

A contribution to  
the UN Decade for Ocean Science for Sustainable Development



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ASEAN Briefing on UN ESCAP ESNB  
Maritime Sector Strategies to Augment Tsunami Monitoring  
31 March 2021





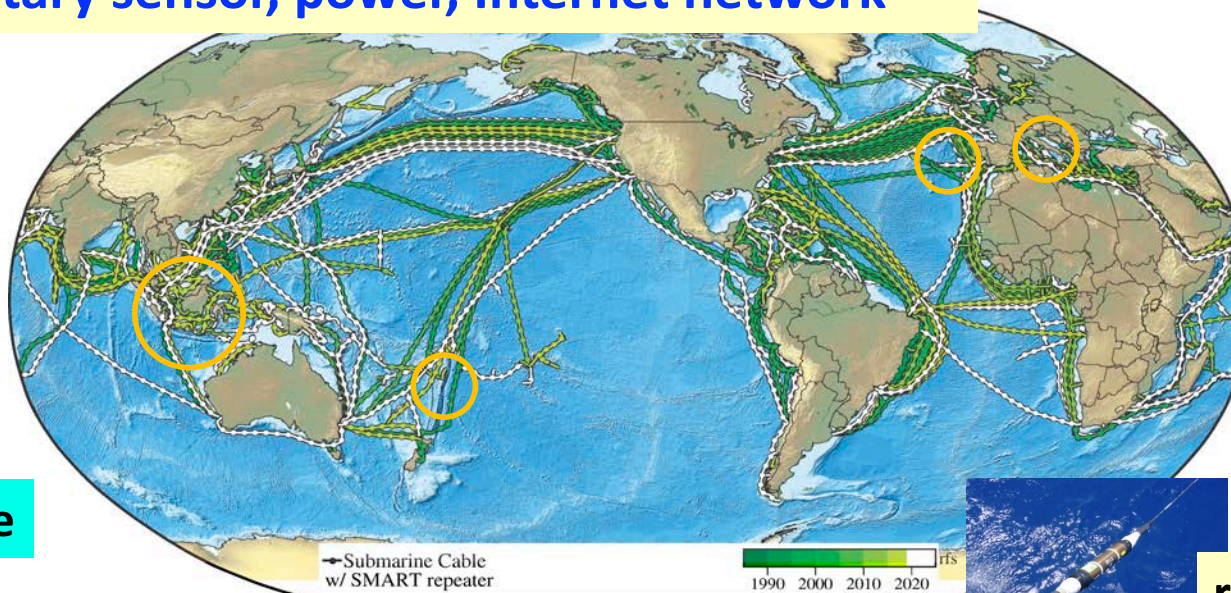
# SMART Subsea Cables



**Global Scale: Climate, Oceans, Sea Level, Earthquakes, Tsunamis**

**Create a Planetary sensor, power, Internet network**

*1<sup>st</sup> order  
addition to  
Ocean-Earth  
observing  
system*



*Share  
submarine cable  
infrastructure  
Telecom + science  
↓ \$*

**1.2+ Gm  
~20,000 repeaters  
20 year refresh**

**repeaters ~70 km**

**UN Decade**

**1st**

**SMART CAM2: Portugal-Azores-Madeira  
3700 km, Gov't, €120M, install 2024**

**Bottom pressure, temperature,  
acceleration → Power/Internet nodes**





# Societal Benefits

## Climate change – humanity's greatest existential threat

### Societal and environmental issues

#### UN Decade of Ocean Science

Climate  
SDG 13



– **Climate change** – ocean temperature, circulation  
direct impact on societies, short and long term

Ocean  
SDG 14



– **Sea level rise** – hazard for coasts, islands, cities

UN  
DRR

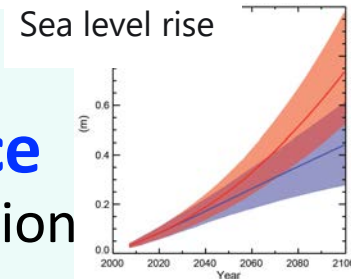


– **Disaster Risk Reduction** – tsunami  
and earthquake monitoring  
throughout ocean basins and coastal margins

Infrastructure  
SDG 9, 11

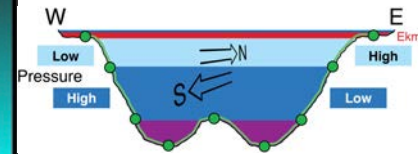
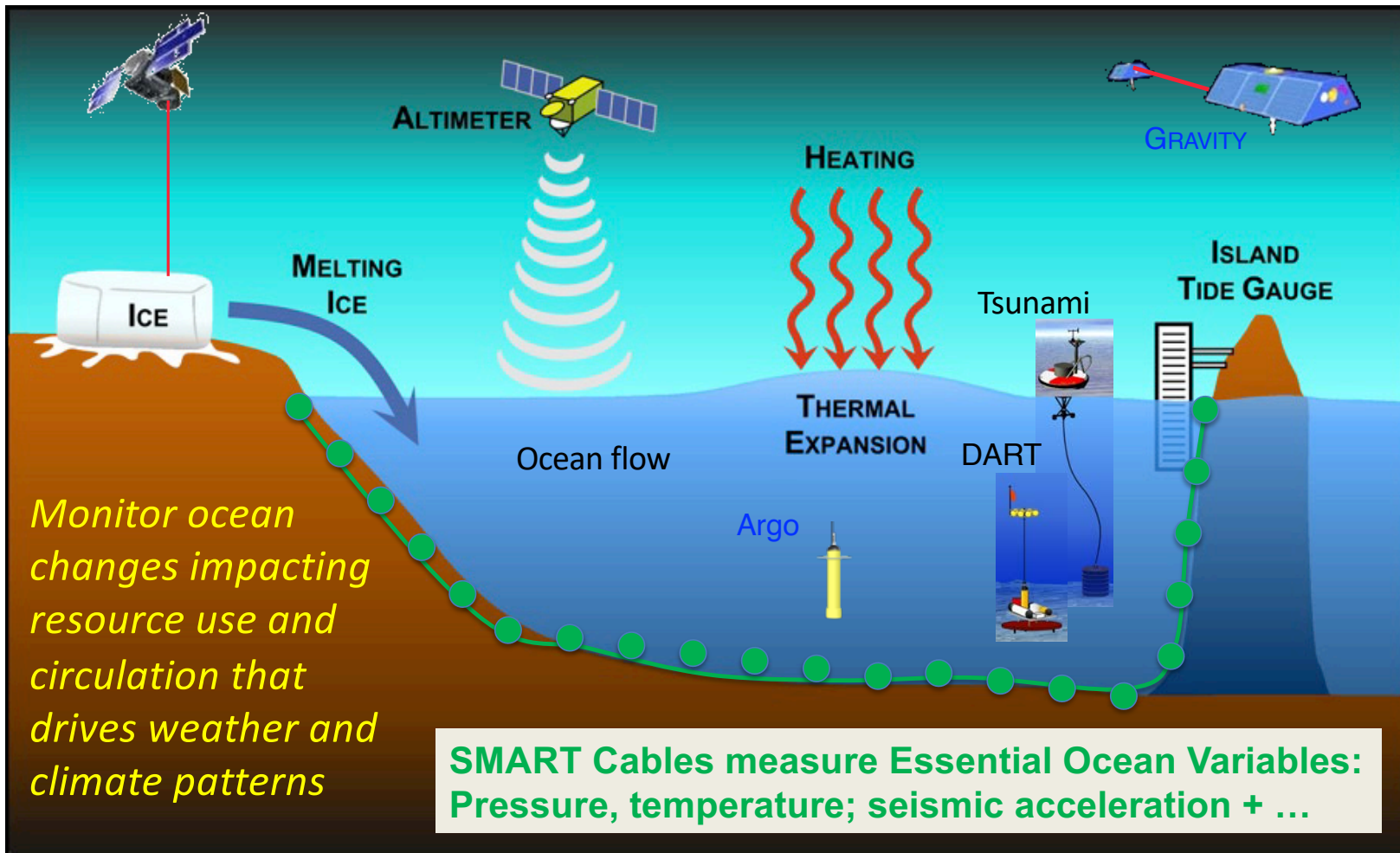


– **Societal Connectivity** – Enable progress with  
resilient and sustainable telecom infrastructure





# Ocean Observing Tools



**Now:**  
**Very few**  
**bottom obs**

**Future:**  
**Add SMART**  
**Cables**  
**Augment and**  
**complement**  
**present**

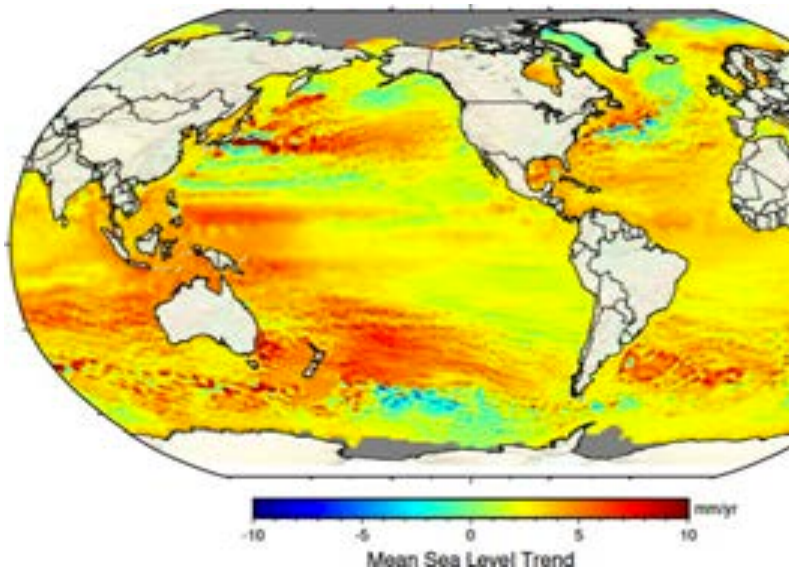
Adapted from Nerem, 2016



# Sea level rise + ocean heat content

## Sea level rise

Not uniform – time and space, accelerating



Islands disappearing  
Coastal inundation  
Changing ocean circulation  
El Nino

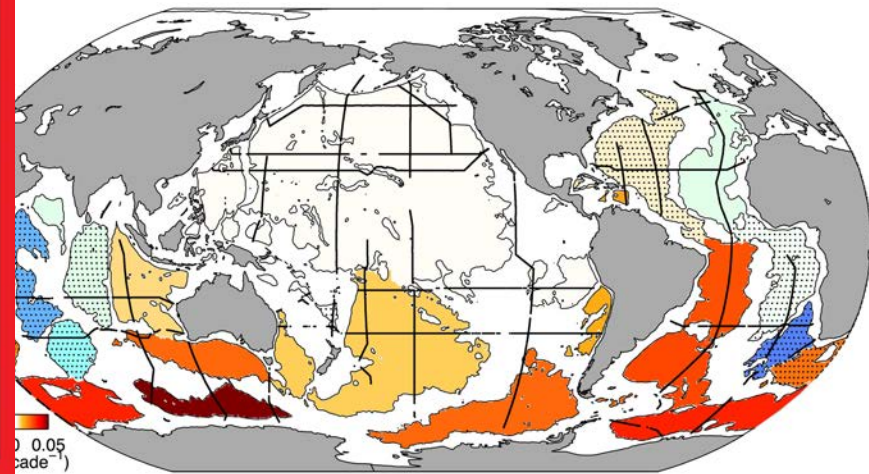
**Global 4.8 mm/y**

2100: 8 mm/y, 1 m

Growing coastal populations

## Ocean Temperature

Increasing, heat reservoir, water expanding



Purkey and Johnson, 2010

In deep ocean (4000 m)  
10s of mK / decade  
Climate  
Ecosystem impacts





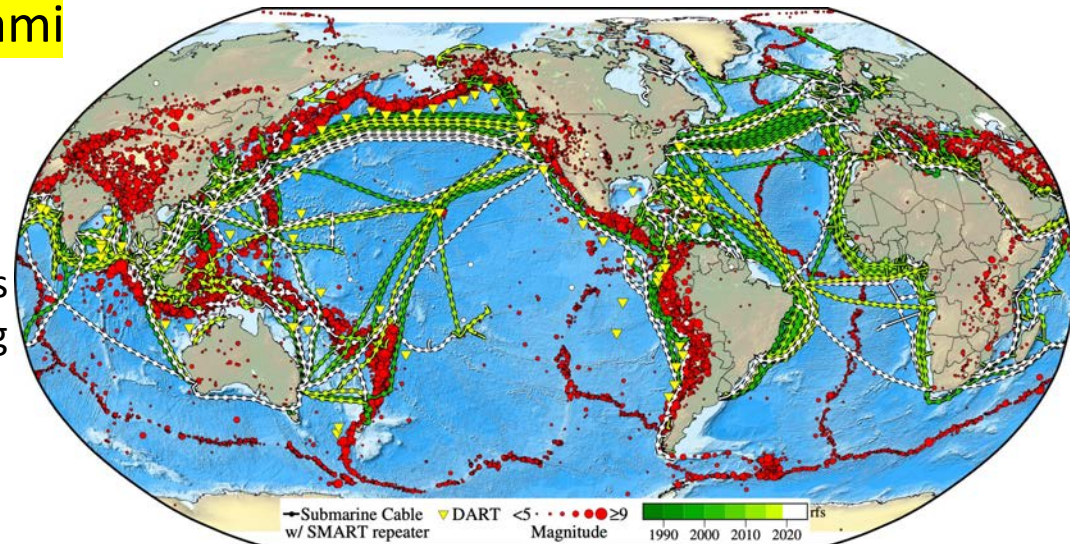
# Earthquakes and Tsunamis



Earthquake warning: time to “Drop, Cover, and Hold On!”  
Survive to escape Tsunami



DART tsunami warning buoys  
Nov 2020, 20/70 not working



| 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   |
| Papua N. Guinea | 1998 | 7.1 | 15    | 2200    |
| Sumatra         | 2004 | 9.2 | 33    | 230,000 |
| 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    |

| Place   | Year | Mag | H (m) | Deaths | Cables cut          |
|---------|------|-----|-------|--------|---------------------|
| Algiers | 2003 | 6.8 | 3     | 2,244  | All Europe-Mid-East |
| Tohoku  | 2011 | 9.0 | 10    | 19,000 | ~10                 |

## Taiwan

Climate change increasing typhon number and intensity (e.g., Morakot 2009)  
+ earthquakes trigger submarine turbidity currents - Cut 42 cables 2006-2013





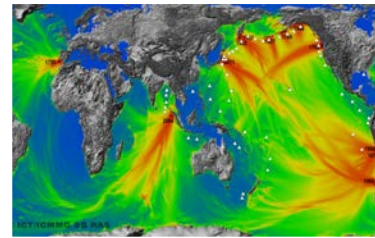
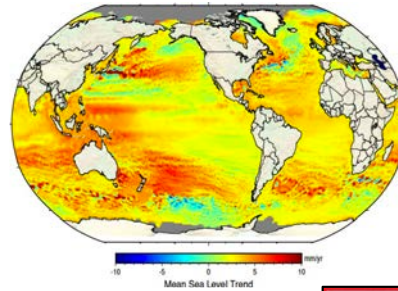
# UN Decade Challenges and Outcomes

## Innovative + Transformative

### Challenge 5: Ocean-Climate nexus

- Contribute to monitoring the atmosphere-ocean-climate-Earth system
- Ocean heat, circulation, time/space variability
- Secular changes of tidal coefficients

### Challenge 6: Early warning services



- Early warning earthquakes and tsunamis
- Mitigate coastal flooding, exacerbated by sea level rise.

### Challenge 7: Sustainable ocean observing system

- **Absolutely!**
- Potentially 1000s SMART repeaters
- Global, real time, long life, reliable, sustained, maintained, expandable
- QC'ed data to users
- Capacity building
- Programme office - all stakeholders

### Outcome 4: Predicted Ocean

### Outcome 5: Safe Ocean

### Outcome 6: Accessible Ocean





# SMART Cables

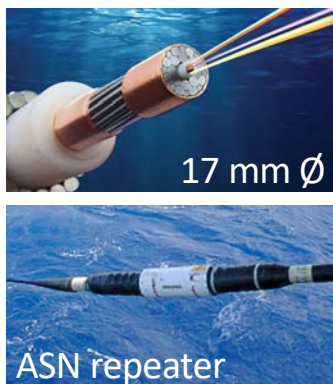
## Attributes

## Innovative + Transformative

## Next Steps

**Societal, science, cable benefits**  
**Global Ocean Observing System**  
**Blue Economy**

- Leverage \$5B/y cable industry, 150y
- ASN – press - will supply SMART
- Cable integrity – societal connectivity
- Power and comm nodes – future



**Request for Endorsement as a Programme is expected from UN Decade**

## Engaging Stakeholders and Funders

- Regulators:
  - ITU – SMART Resolution, WTSA
  - ITU – Global Symposium Regulators
  - European Digital Strategy
- Research and Education Networks
- Development Banks; Philanthropy
- NOAA, OSTP, ... Horizon2021
- **Wet demo, Portugal, Indonesia, WestMed, French Polynesia, ...**





# SMART Systems in Progress

- Wet demo – INGV Italy/Sicily, €2.4M, install 2022
- Portugal/Lisbon-Azores-Madiera CAM ring, 3700 km, €120M, 2024
- Indonesia in-country development, phasing, Makassar Strait 2024
- WesternMed, RFP in process, SMART option, commercial
- French Polynesia, RFP in process, SMART option, government
- Vanuatu/New Caledonia, some funds, Feasibility Study, government
- New Zealand-Chatham Islands, post workshop stage, government
- Project Koete Perth-Darwin-Jakarta-Malaysia announced, commercial
- Namaste Mumbai-Oman announced, commercial
- Cayman Islands, RFI stage, gov't/commercial
- Antarctica, NSF Workshop for science enabled by connectivity, SMART
- ***Alcatel ASN will supply SMART repeater cable systems***





## Concluding Remarks

- SMART Cables – innovative, transformative technology enables science and early warning, unique observations with societal benefit
- ***WE* need to work with telecom industry, telecom+science for societal benefit – well on the way, but need YOUR contributions**
- **UN Decade of Ocean Science – the Science we need for the Ocean we want.**
- **SMART available commercially (ASN), first delivery in 2024**
- **ASEAN – need to include in planning observing systems**
- **Well worth pursuing, our investment now, looking to decades and centuries into the future.**

