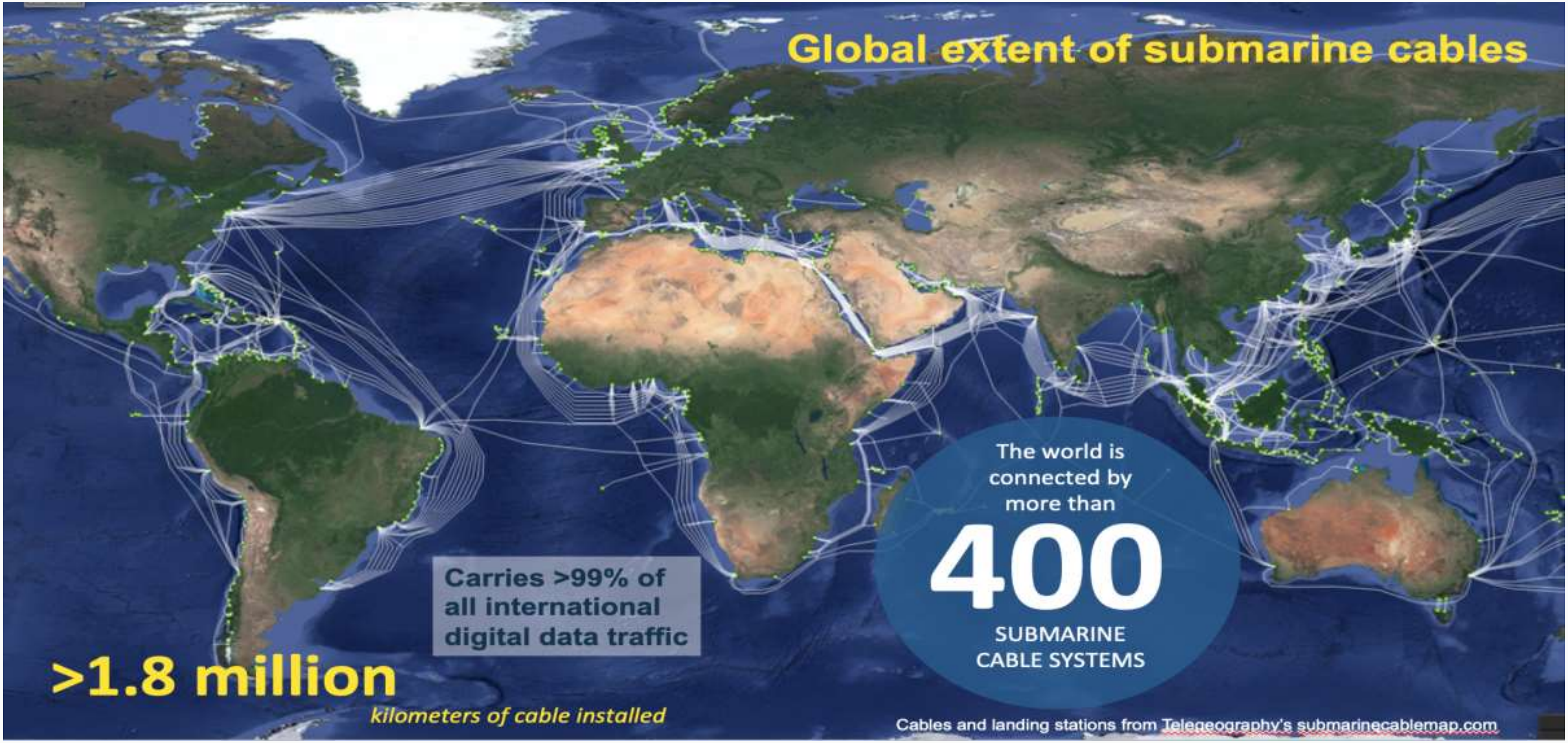
National Oceanography Centre

Marine Systems Modelling

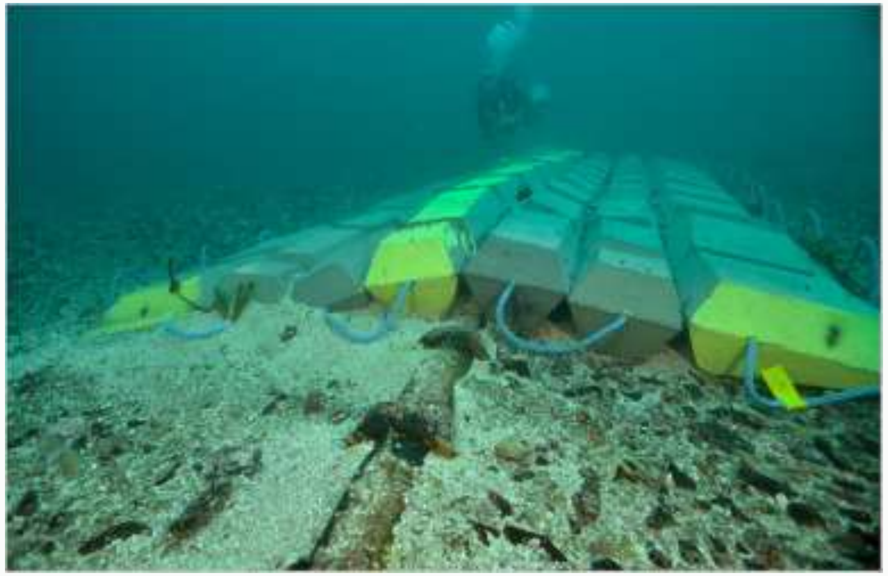
# Can waves break subsea cables?

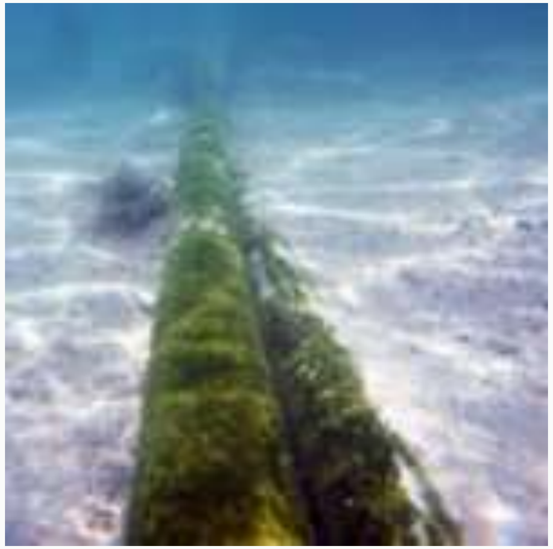
# Global network of subsea cables – Telegeography
https://www.submarinecablemap.com/



# What do the cables look like? .. And the breaks?

- Cables can be buried, anchored, armoured, or just lying on the seabed
- Can experience chafe when rubbing along rocky sea beds
- Scour can remove sediment from underneath, leaving cables hanging suspended

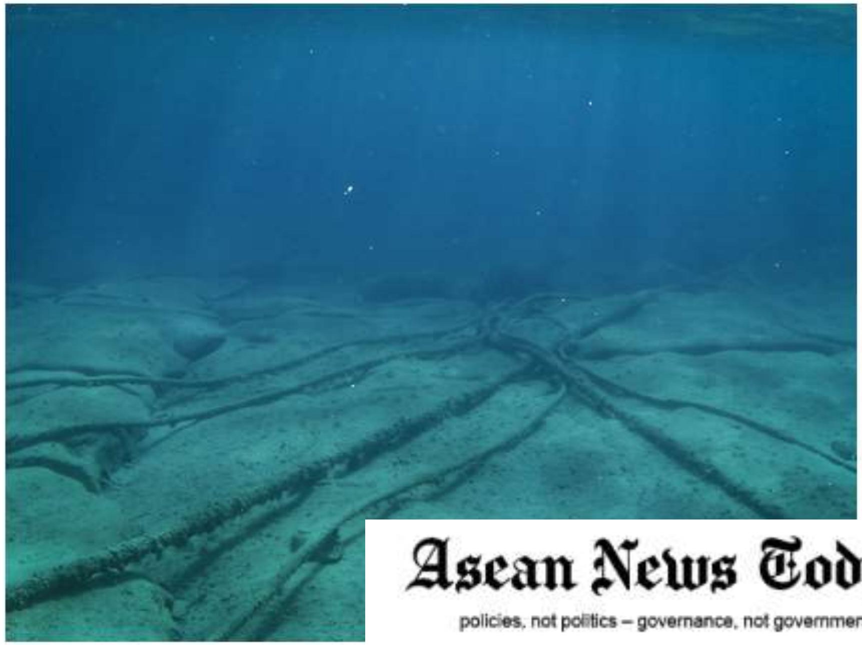




# Australia must do more to secure the cables that connect the Indo-Pacific

2 Aug 2022 | **Anthony Bergin** and **Samuel Bashfield**

SHARE



capacity News

# Caribbean Express subsea cable project

Natalie Bannerman February 18, 2021 04:42 AM


Asean News Today

policies, not politics – governance, not government

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# Undersea cable faults cause internet chaos in Vietnam, Cambodia & Lao PDR

*By Stella-maris Ewudolu on June 2, 2020*


HIGH SPEED

# How submarine cable will slash Internet cost

*It will improve speed more than five prior cables*

by VICTOR AMADALA

**In Summary**

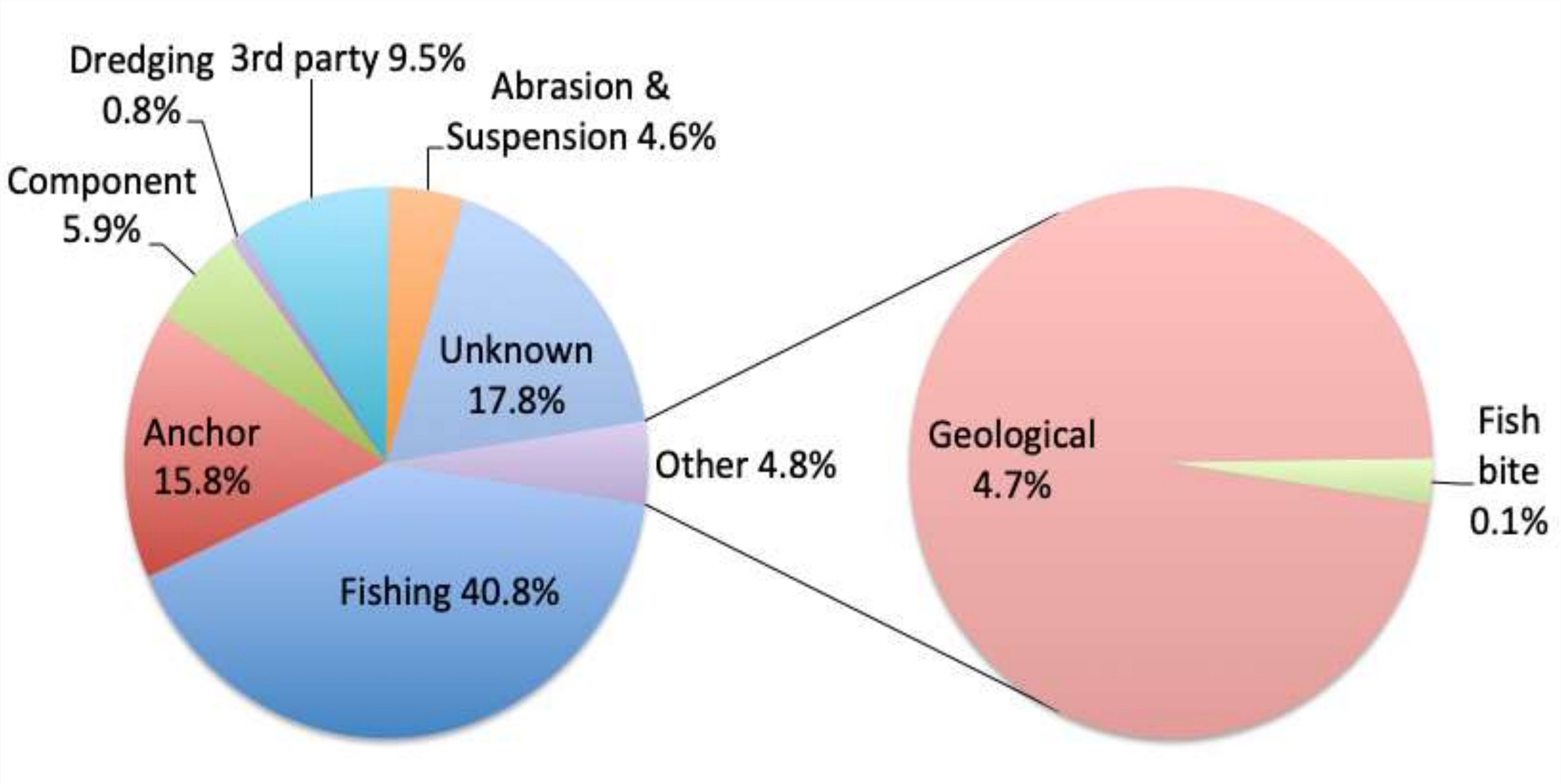
- While Kenya has the second-highest internet connectivity in sub-Saharan Africa after South Africa, costs are almost five times compared to Europe
- A survey puts monthly Internet costs in Kenya at an average of Sh2,800 for 10mbps, way above global average of Sh2,100

# Where are they vulnerable?


The cables cross whole ocean, from deep abyssal plains, over mid ocean ridge, and then come onshore

It is in the shallow waters that the cables are exposed to multiple natural hazards – landslides, waves, and fast currents

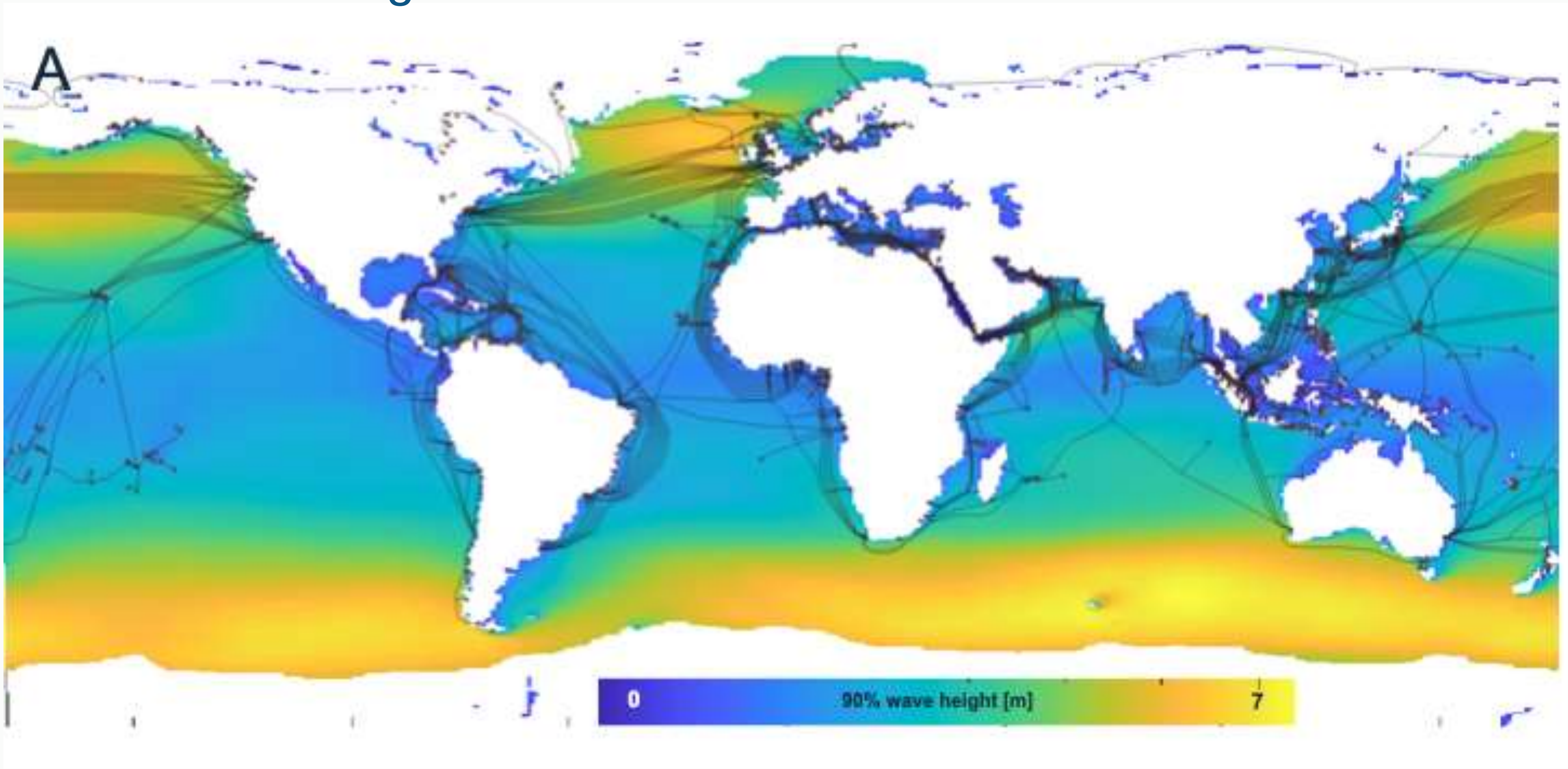
# What breaks submarine telecommunications cables?




Natural hazards-related faults include geological, and also abrasion and suspension faults; the latter primarily relating to the effects of seabed currents - from ICPC (2021).

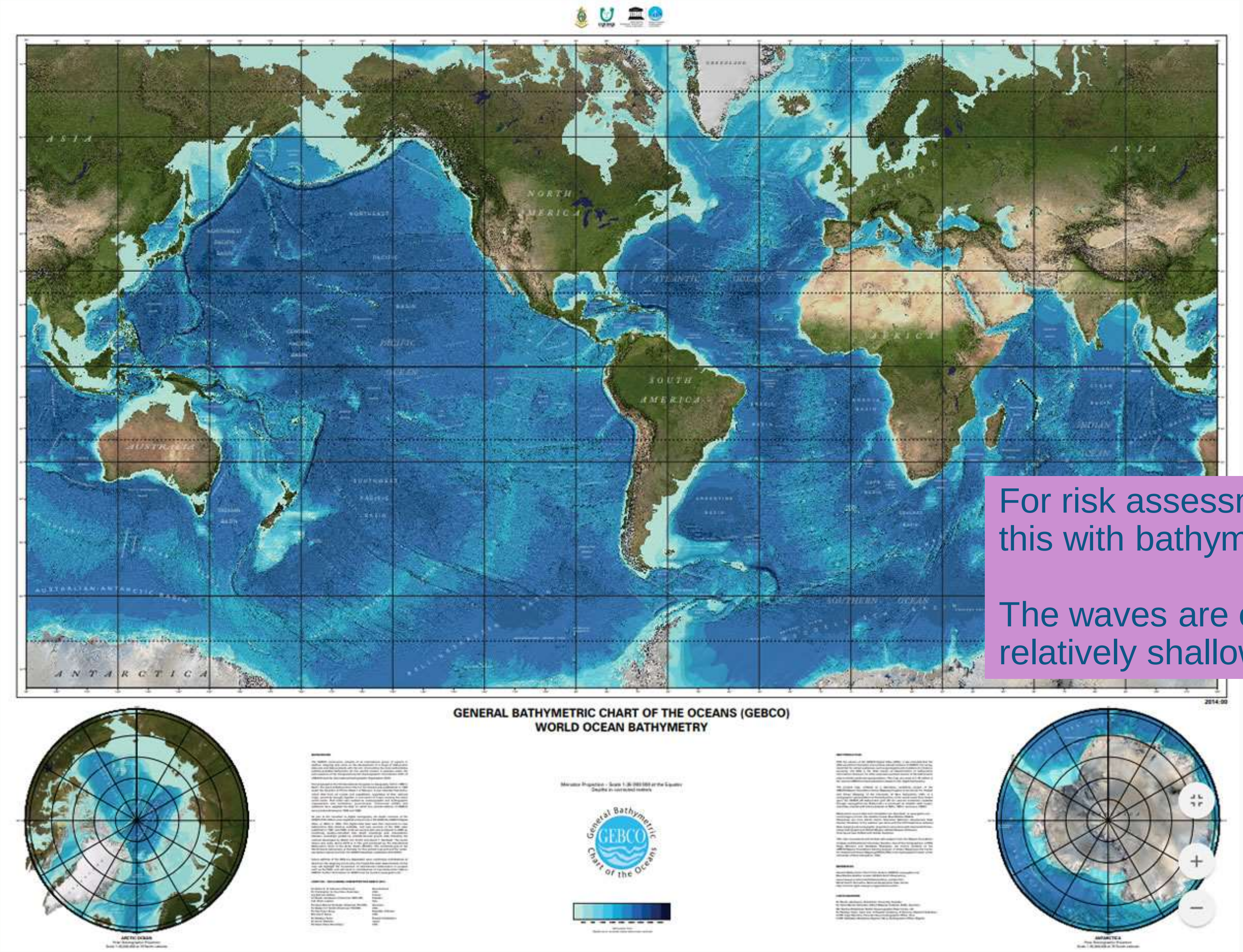
Damage related to fish bites has not occurred since 2006 as a result of revised cable designs.

# Global wave height and cable locations




North Atlantic and North Pacific identified as particular risk areas.
Also in tropical cyclone / hurricane / typhoon regions

# GEBCO - The General Bathymetric Chart of the Oceans



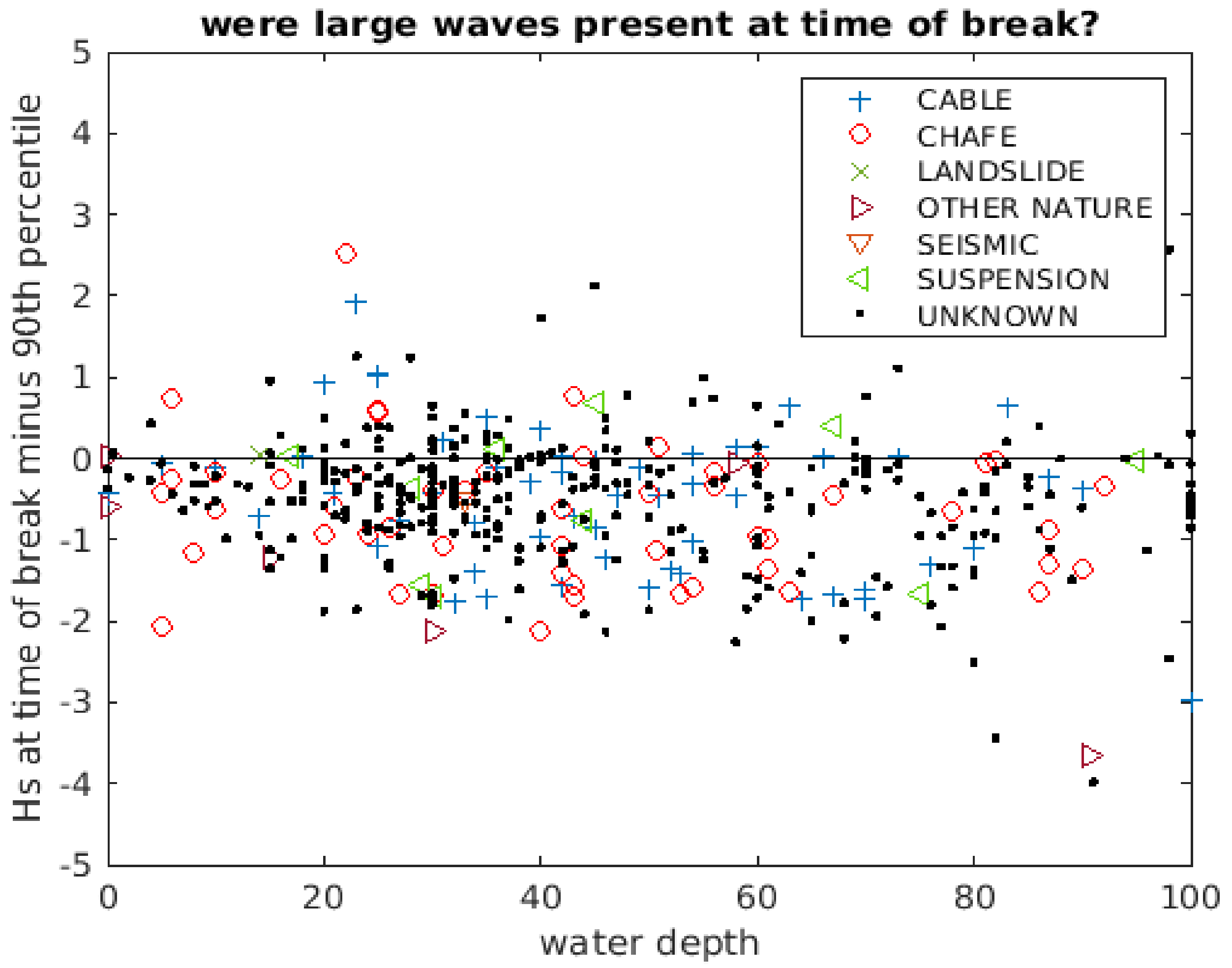

For risk assessment we have to combine this with bathymetry:

The waves are only likely to do damage in relatively shallow water

# Could it have been the waves?

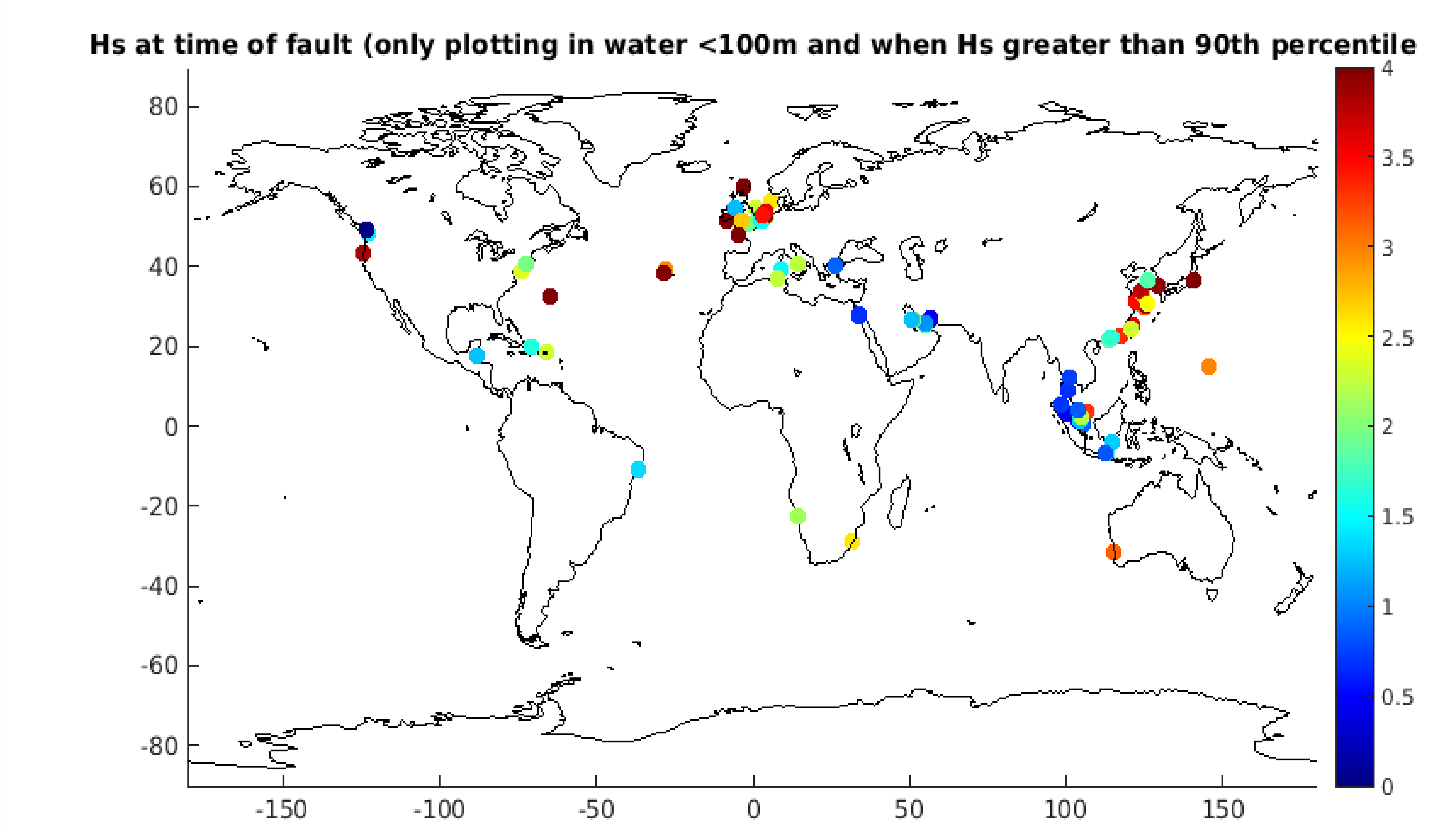
Method to select candidates
- Water shallower than 100m
- Waves bigger than local 90% Hs

| Category | Total analysed | Meets criteria |
|---|---|---|
| Cable | 106 | 18 |
| Chafe | 154 | 7 |
| Landslide | 37 | 1 |
| Other nature | 49 | 1 |
| Seismic | 172 | 0 |
| Suspension | 49 | 4 |
| Unknown | 777 | 67 |

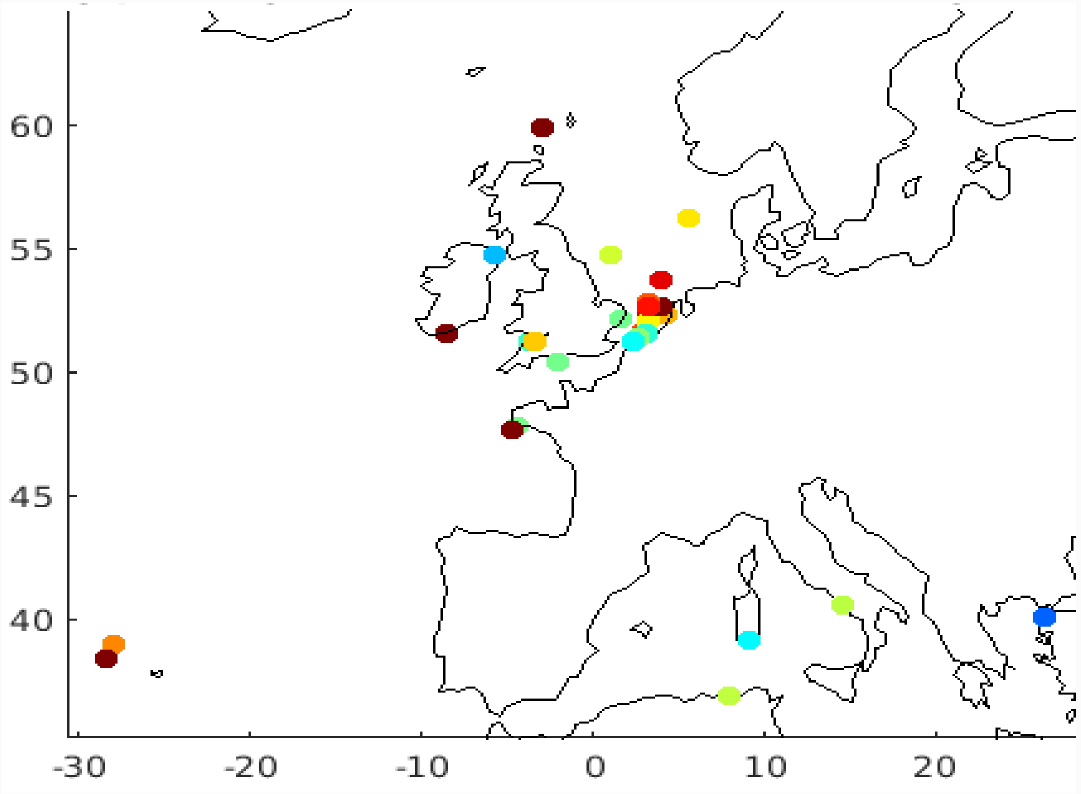


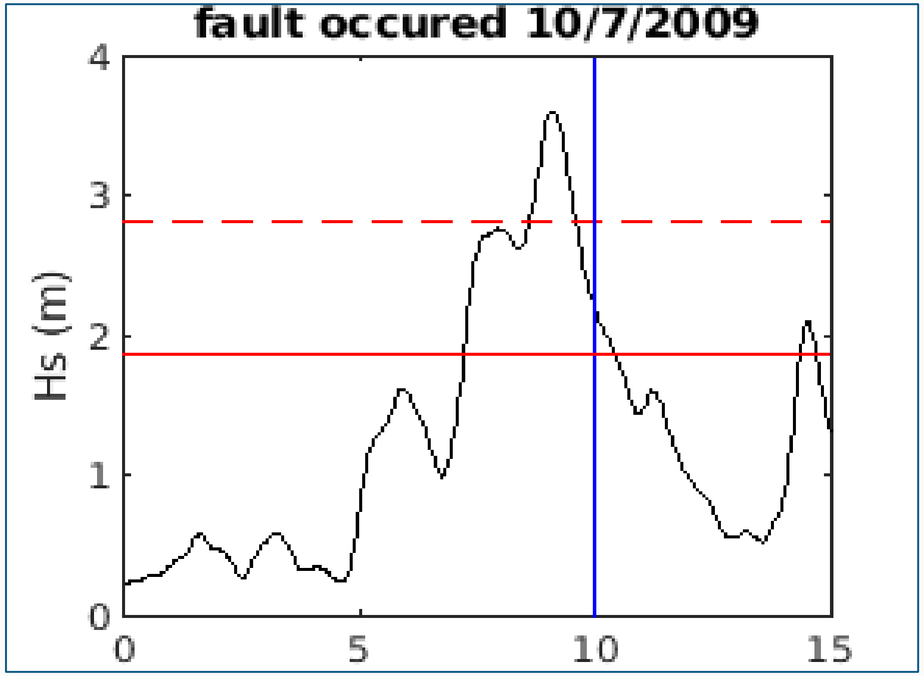

17% of those classified as ‘cable’ and 9% of ‘unknown’

# Where could it have been the waves?



# Likely candidates – attributing 'unknown' breaks to wave processes

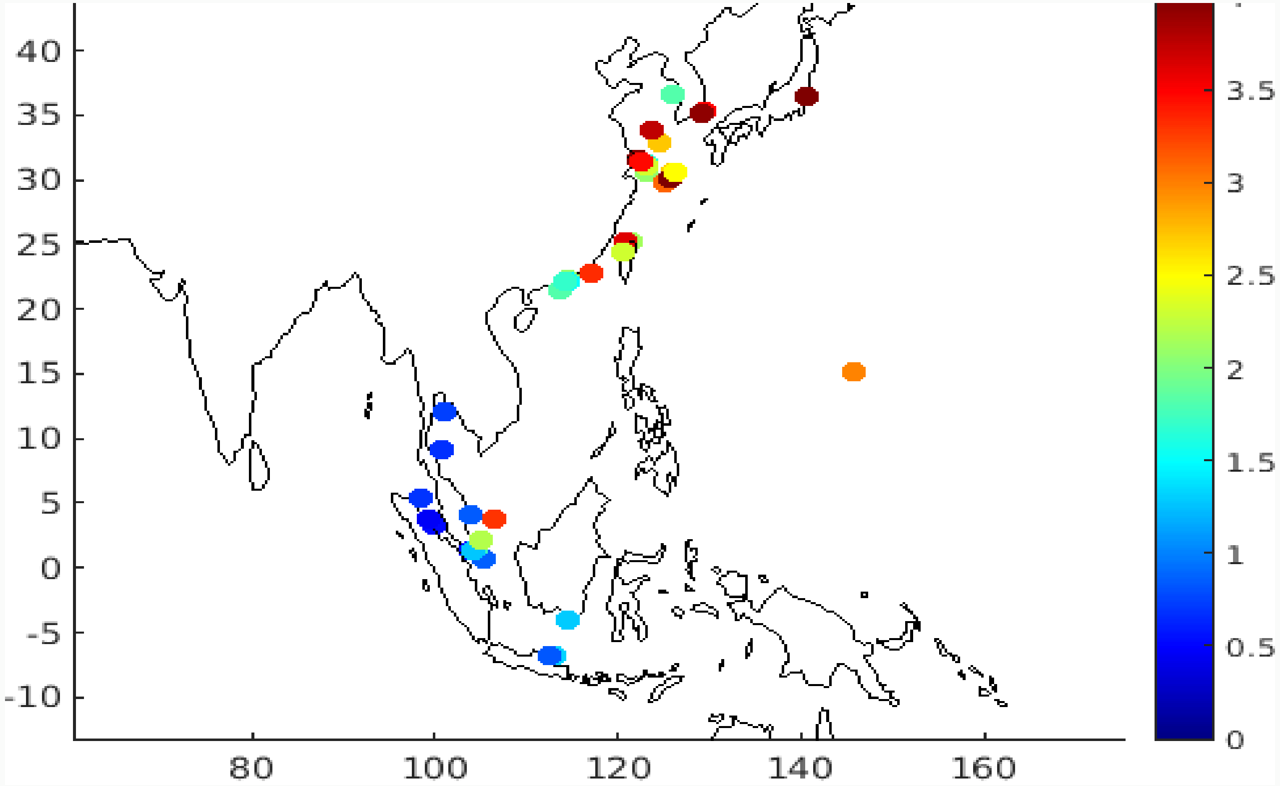


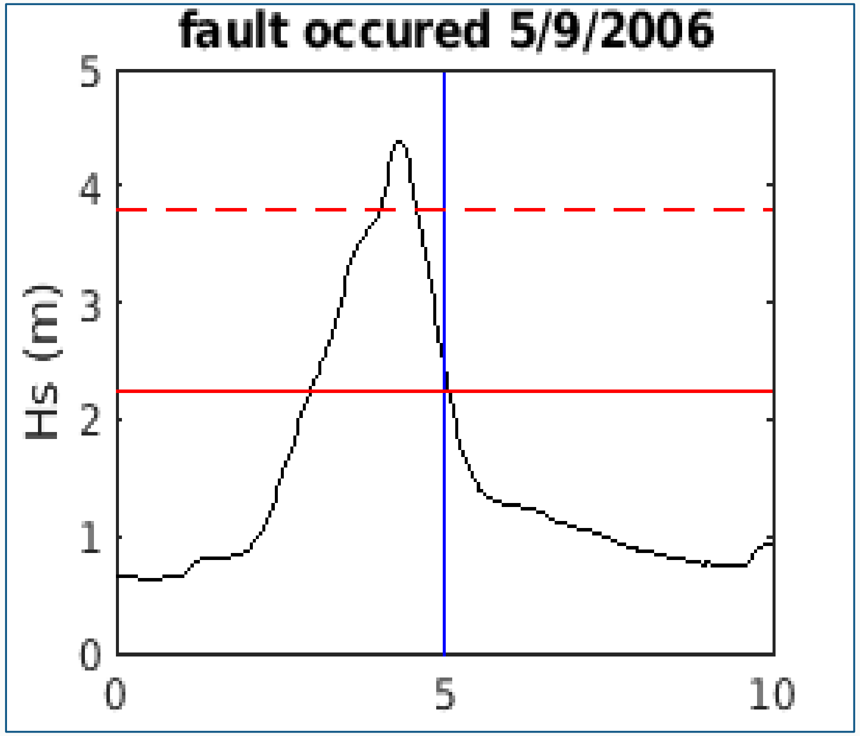




Hs time of cable break: Fault 383 (Southern North Sea 21/5/2009 at 3.9538 53.7388N).

The time series also highlights the local 90th percentile (solid line) and 99th percentile Hs dashed line

# Likely candidates – attributing ‘unknown’ breaks to wave processes




Hs time of cable break: Fault 349: Japan, 5/9/2006 at 140.7117, 36.3550N).

The time series also highlights the local 90th percentile (solid line) and 99th percentile Hs dashed line

# Likely candidates: not just 'unknown' but cable, chafe, suspension (?) too

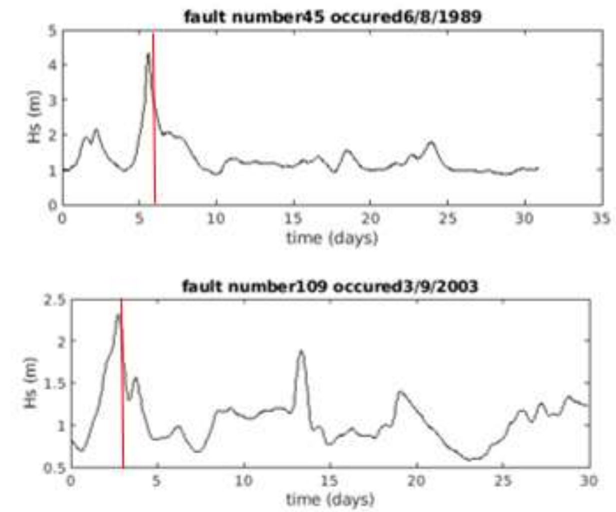



Figure: time series relating to CHAFE faults 49,109

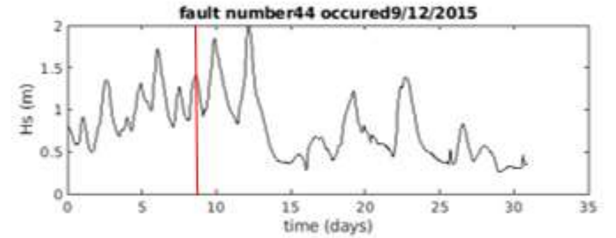



Figure: time series relating to SUSPENSION fault 44

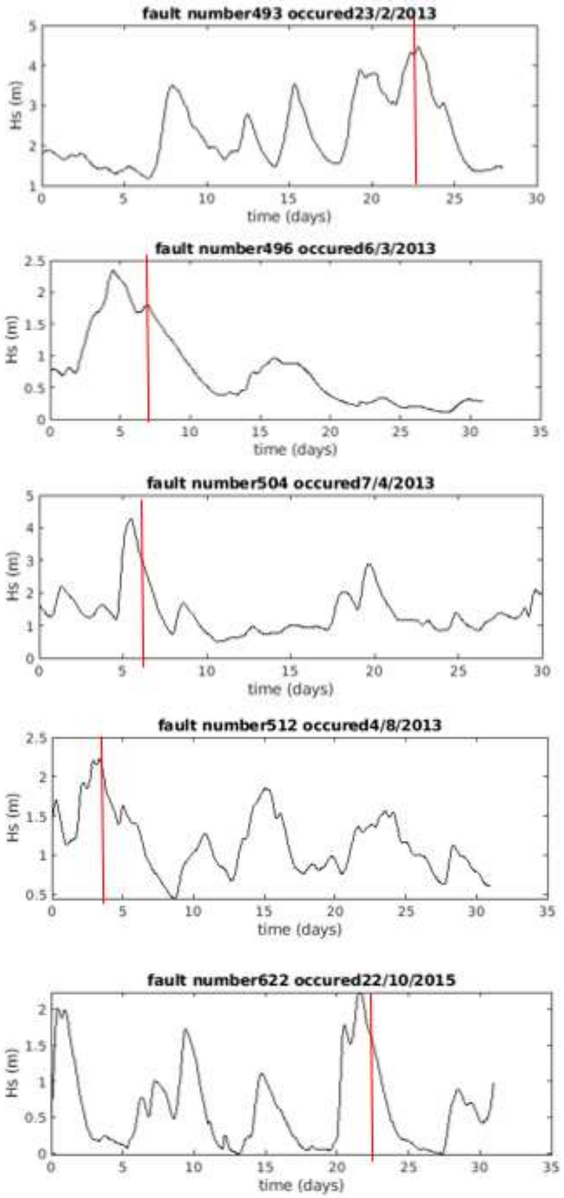



Figure: time series relating to 26 UNKNOWN faults

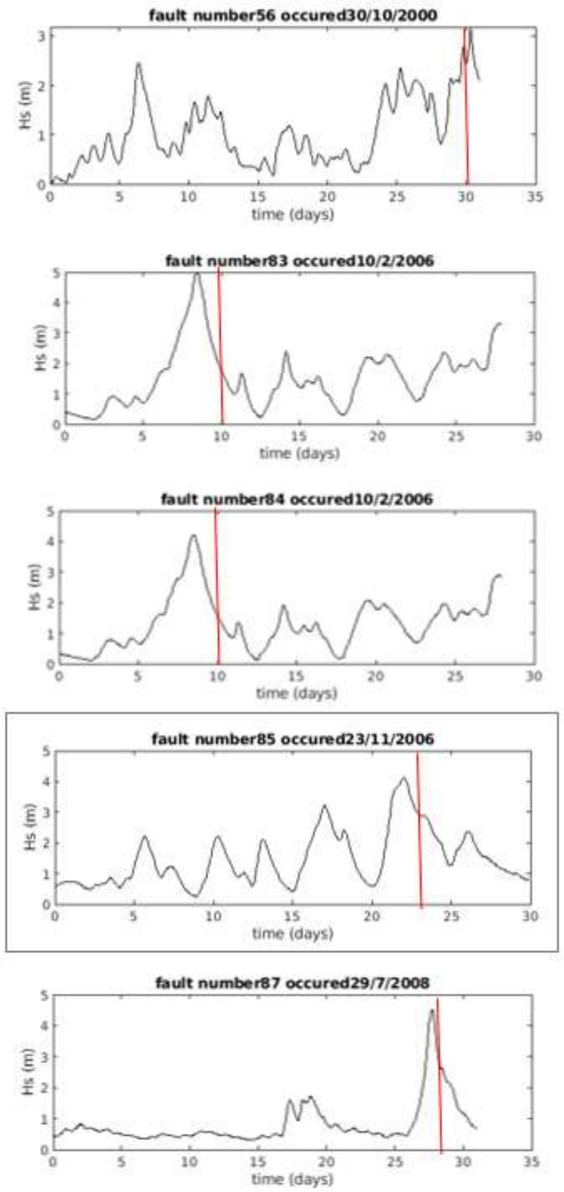
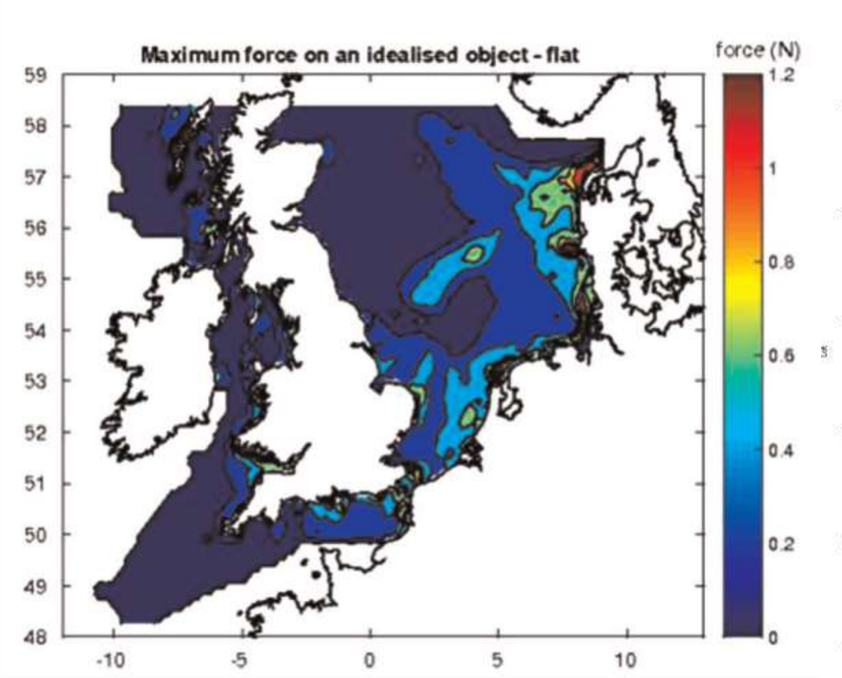
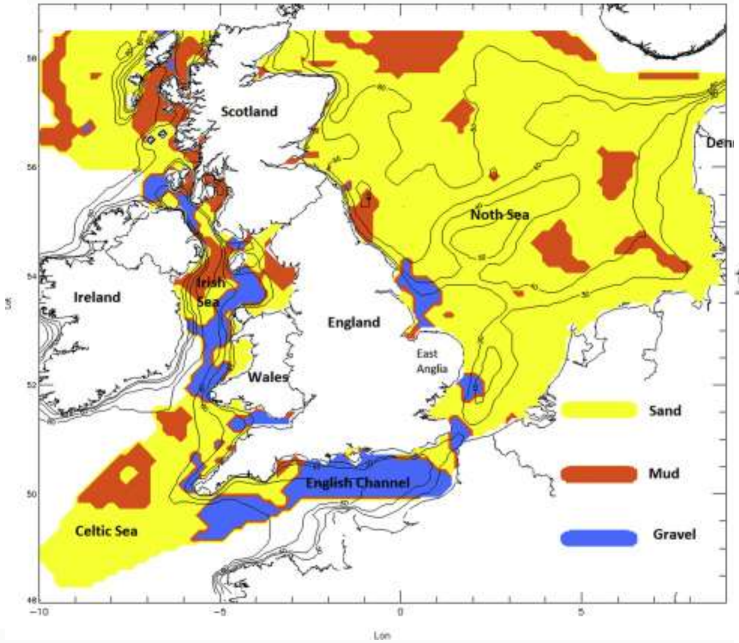


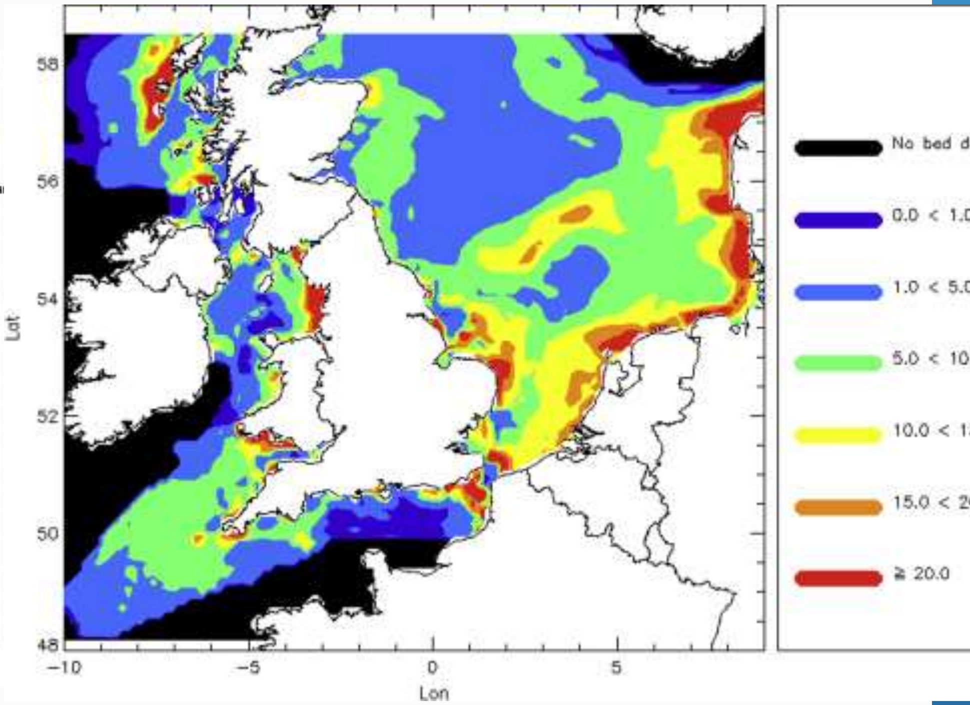

Figure: time series relating to CABLE faults 56,83,84,85,87

In summary, yes: plenty!

# Where are they vulnerable? Mobile seabeds



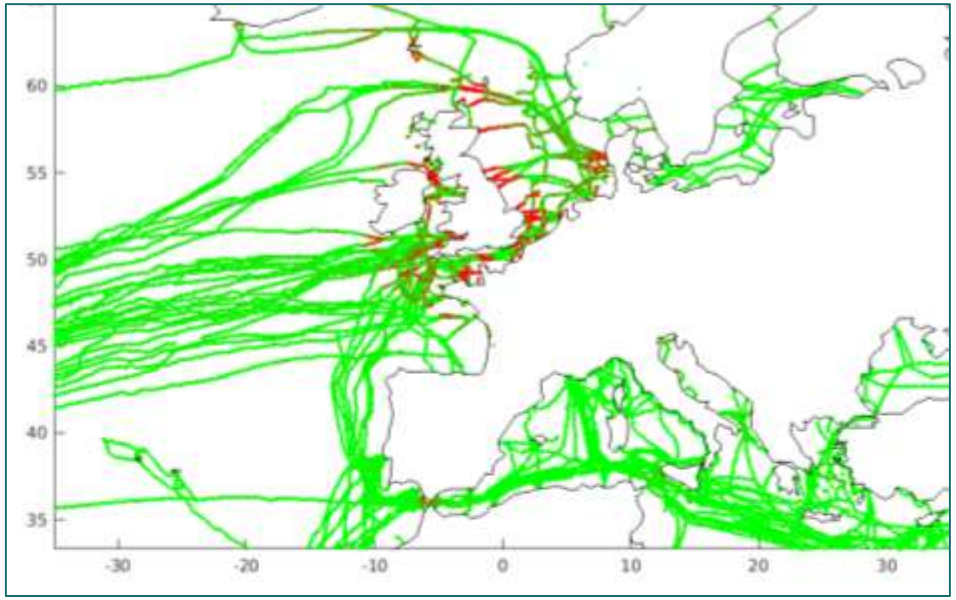

Left: map of combined stresses around the UK waters: POLCOMS / WAM combined data (Bricheno et al. 2015)

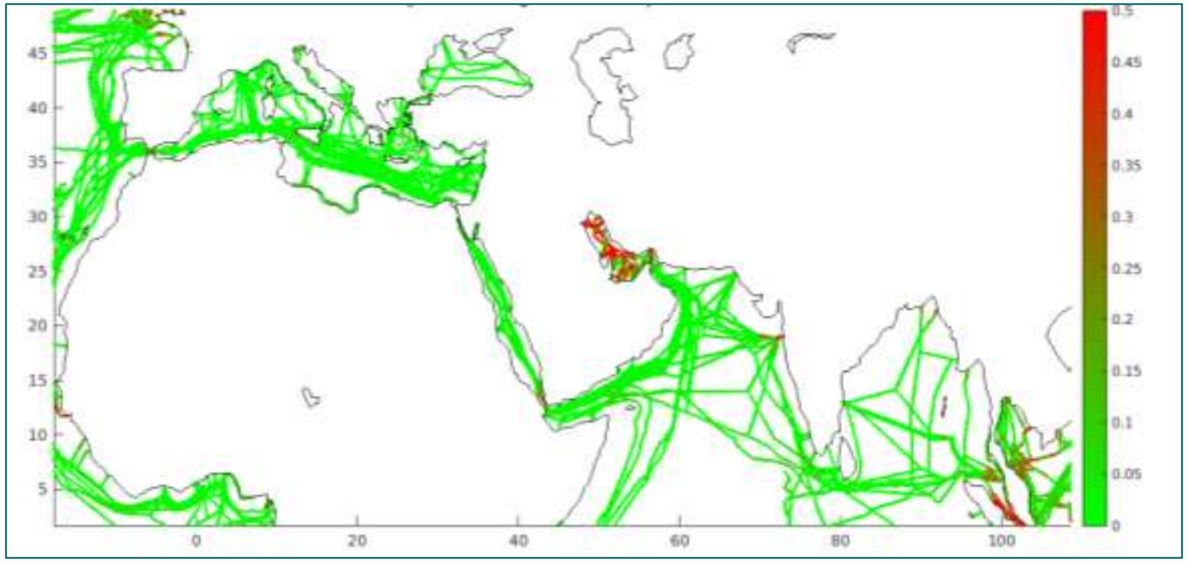
Middle sediment types (Aldridge et al. 2015)

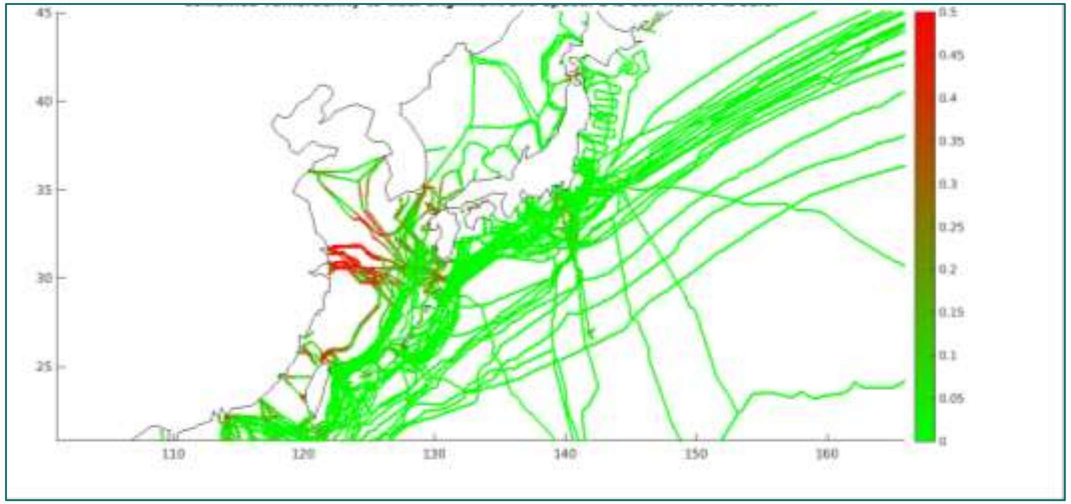
Right: Peak wave-current bed stress ($Nm^{-2}$) based on observed grain size and meteorological data for 2008.

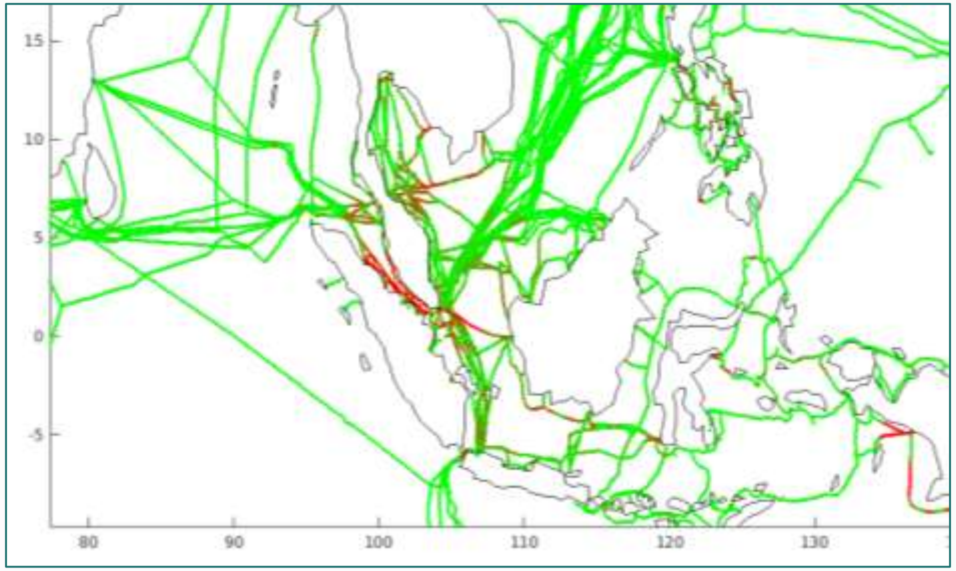
Calculated using a wave-current interaction model (Soulsby et al., 1993) (Aldridge et al. 2015)

# Combined wave and current data required



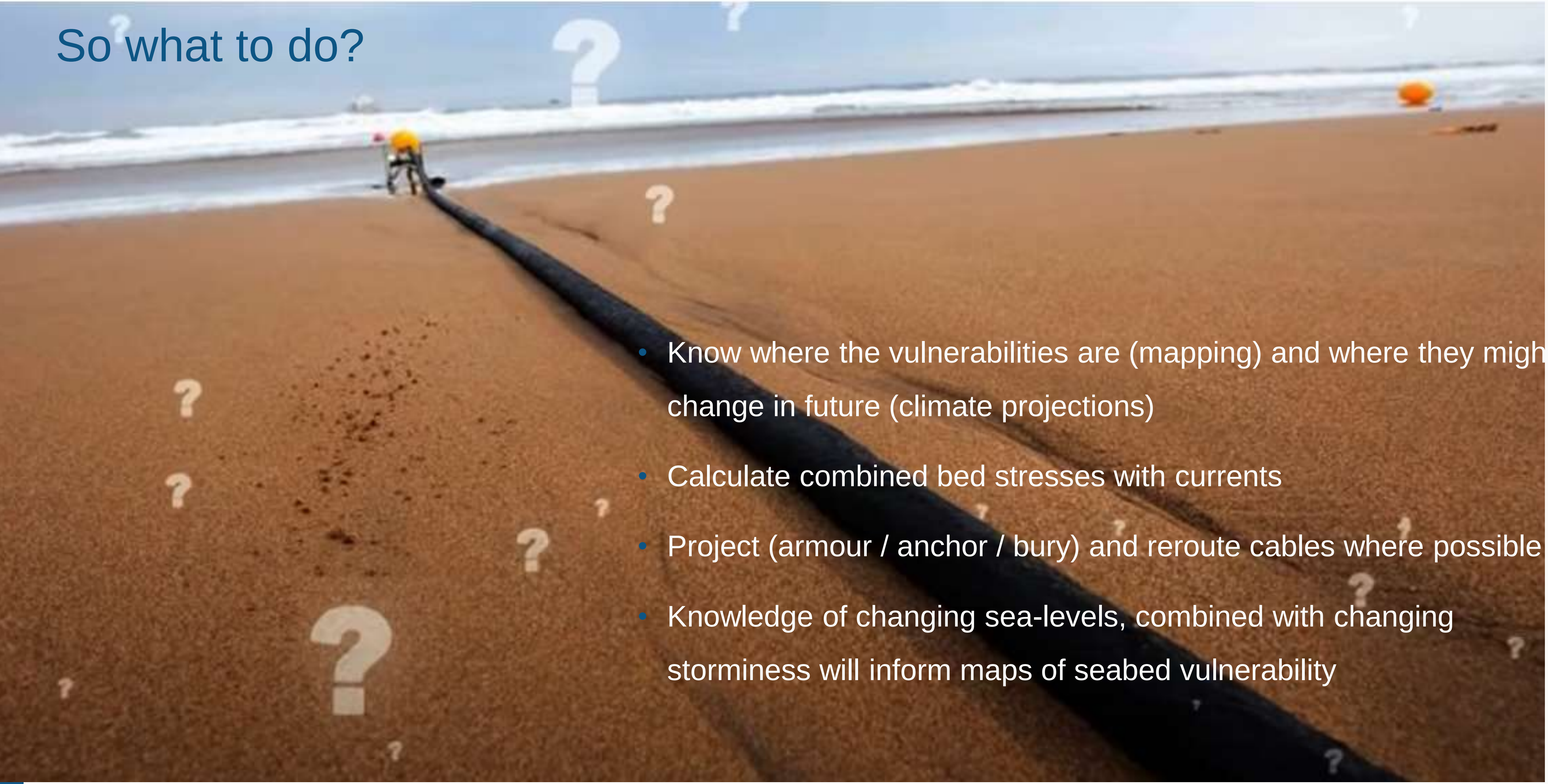




Also important to identify where fast currents move across cables.

These map shows where tidal currents are both fast and orthogonal to subsea cables

# So what to do?



- Know where the vulnerabilities are (mapping) and where they migh change in future (climate projections)
- Calculate combined bed stresses with currents
- Project (armour / anchor / bury) and reroute cables where possible
- Knowledge of changing sea-levels, combined with changing storminess will inform maps of seabed vulnerability

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