Natural Hazards in the Arctic

The hazards, data collection, data management

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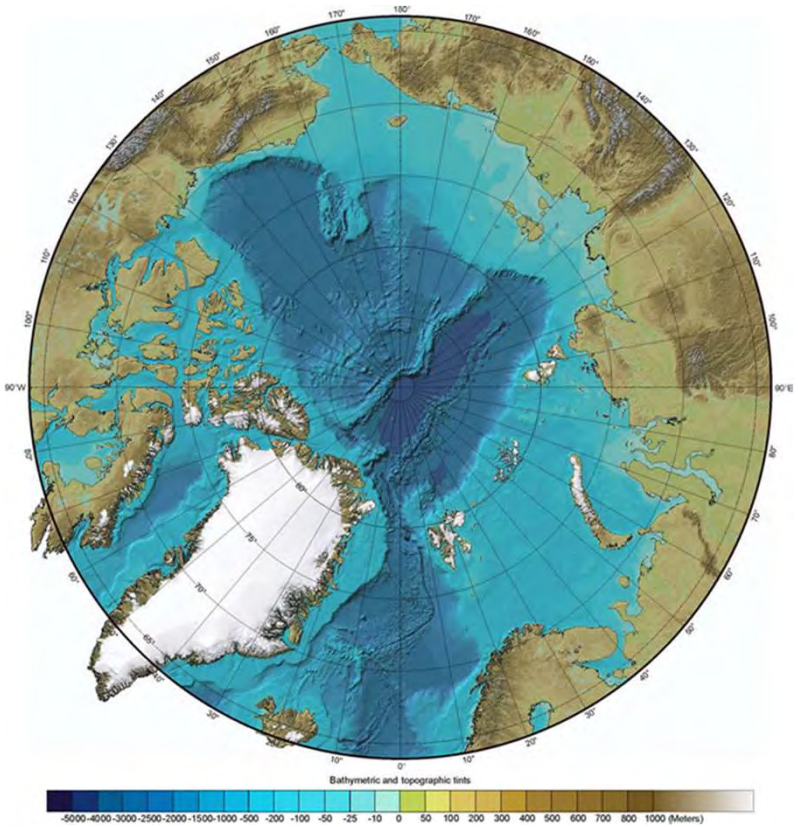
Natural hazards in the Arctic



(from NOAA)

«Direct events»

- Earthquakes
- Landslides/submarine slides/snow avalanches
- Volcanic eruptions
- Extreme meteorological events
- Floods

«Triggered events»

- Tsunamis
- Landslides/submarine slides/snow avalanches
- (Volcanic) earthquakes

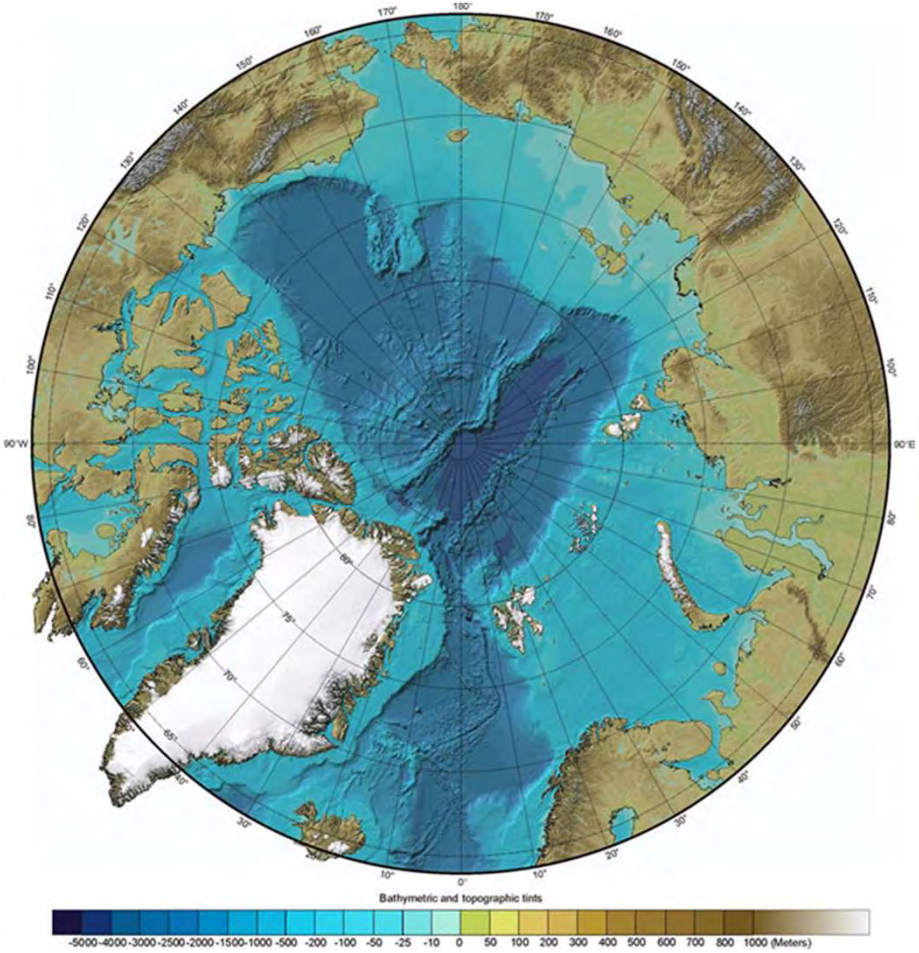
Climate change effects

- Thawing of permafrost
- Increased rainfall
- Melting of land ice
- Changes in sea ice cover
- …

Natural hazards become a problem when they interact with human infrastructure

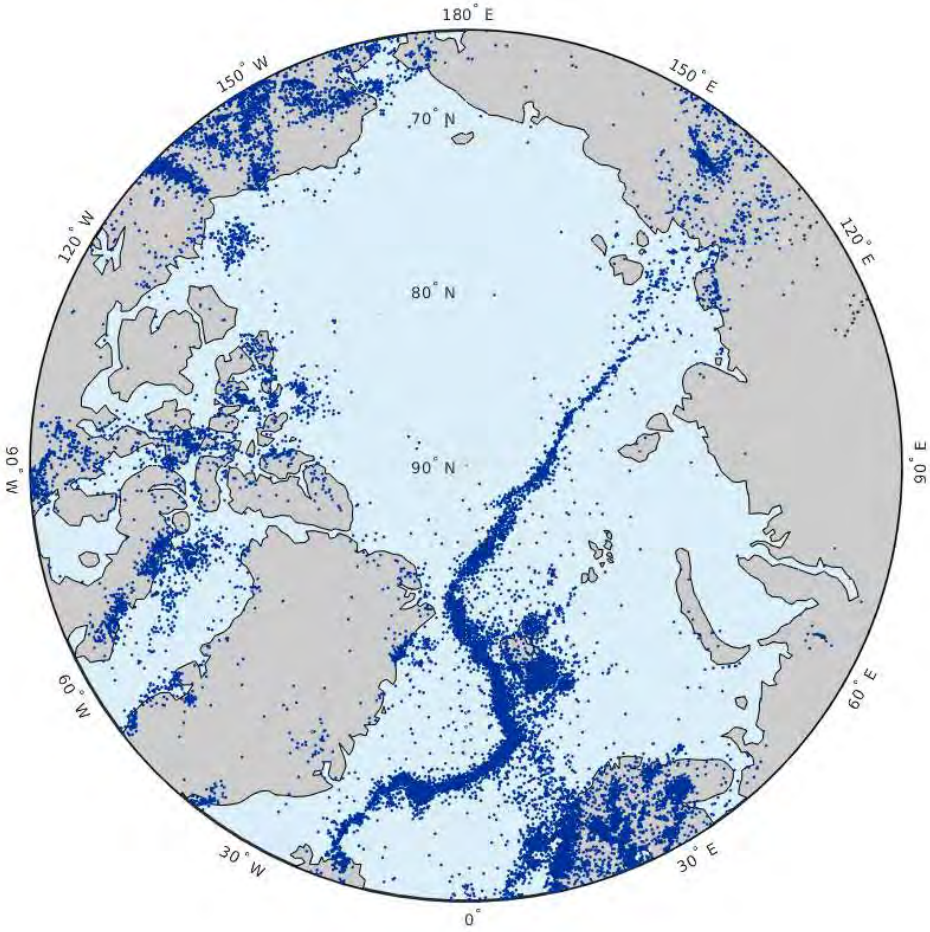
Large calving event in Greenland
https://www.youtube.com/watch?v=wcurEjHWs9g
(0:40)

European Plate Boundary in the Arctic



(from NOAA)

Seismicity in the Arctic



(data from INTAROS)

Earthquake activity Svalbard

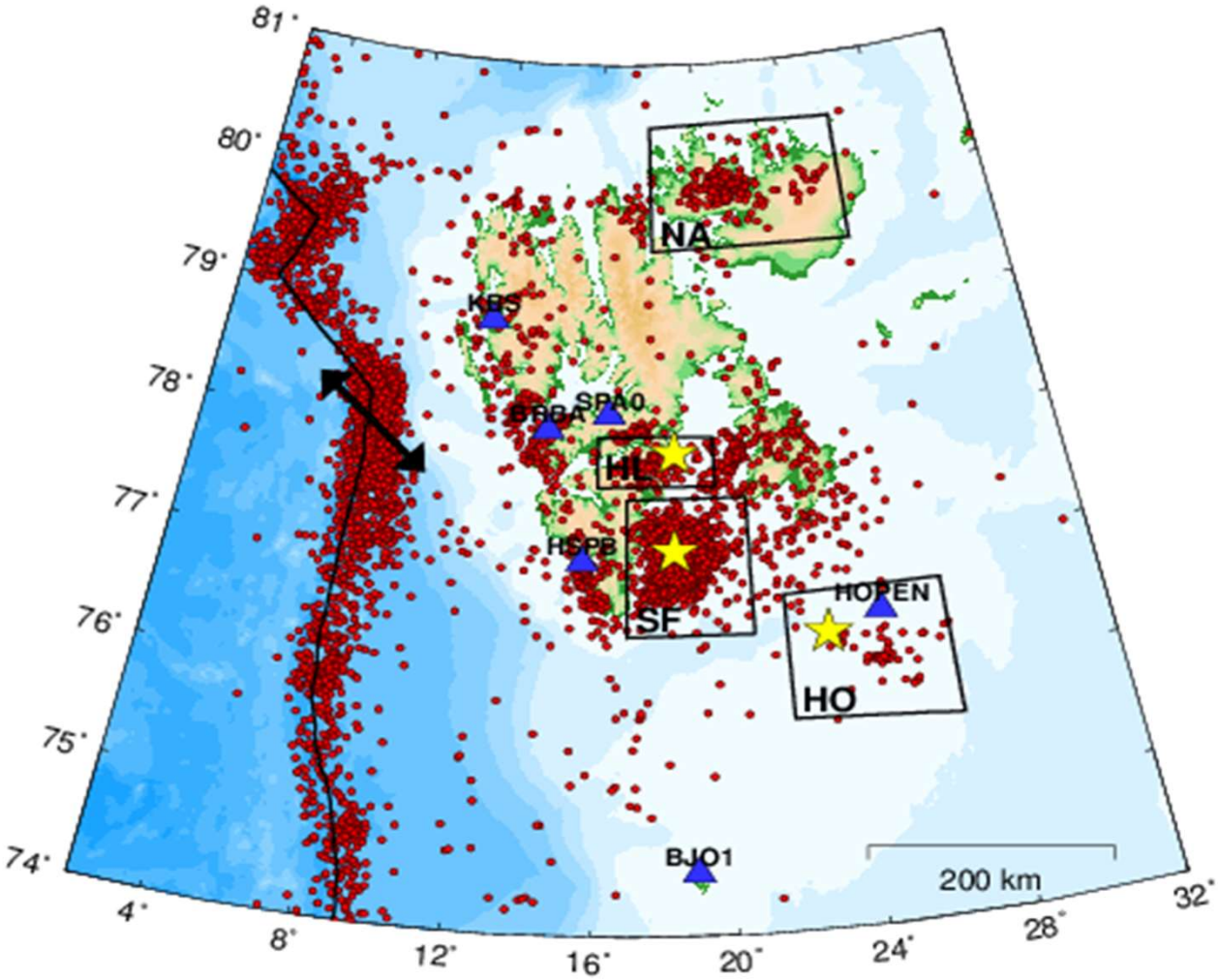
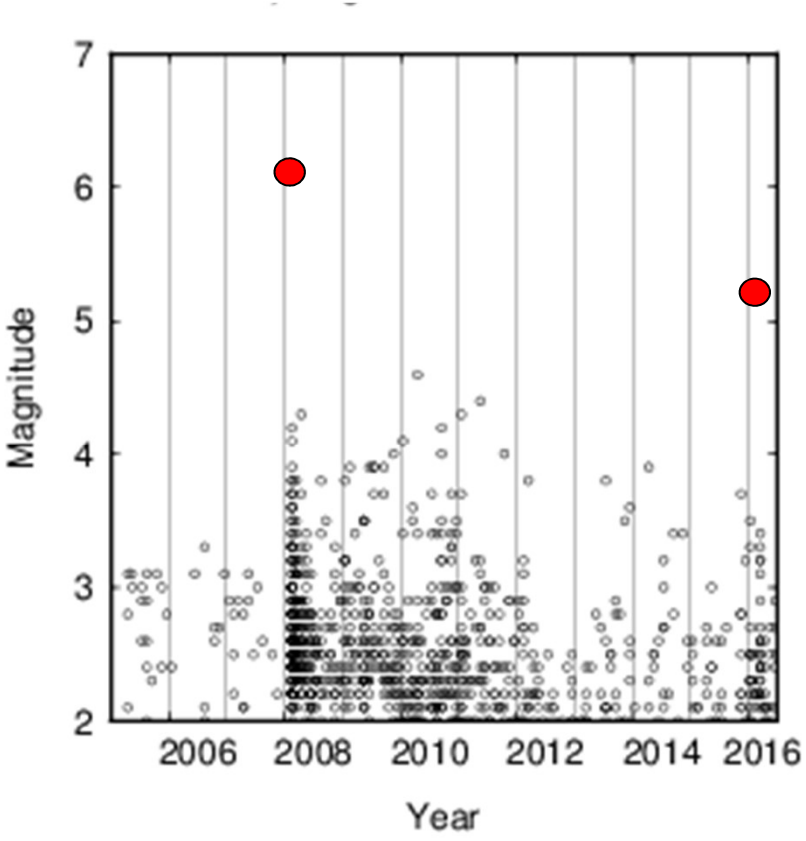
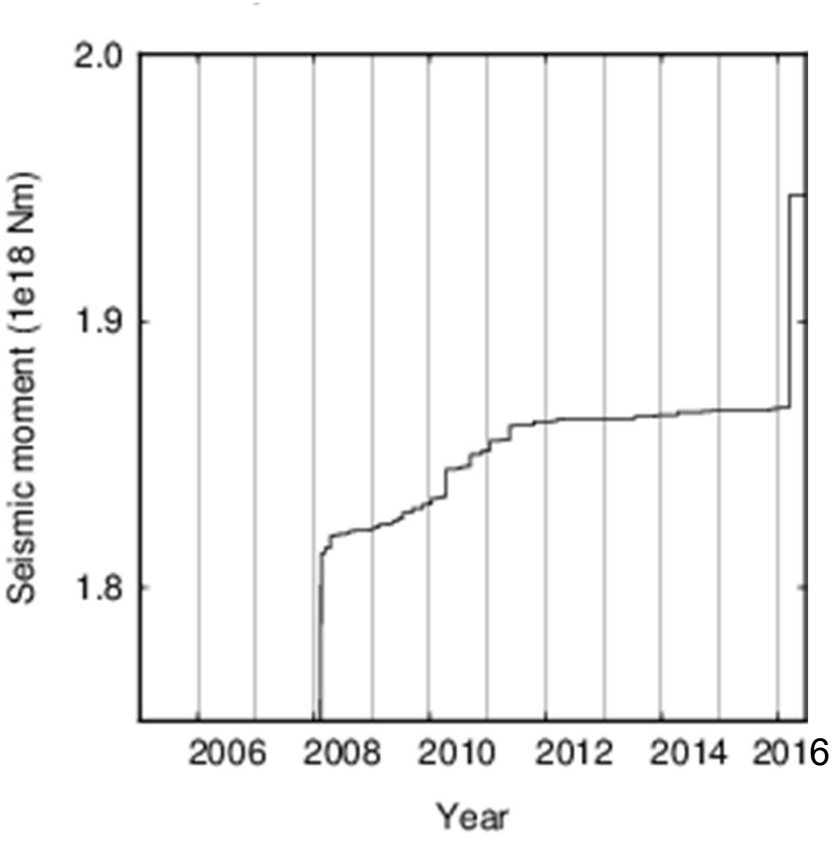


Figure from L.Ottemöller

Storfjorden seismicity over time



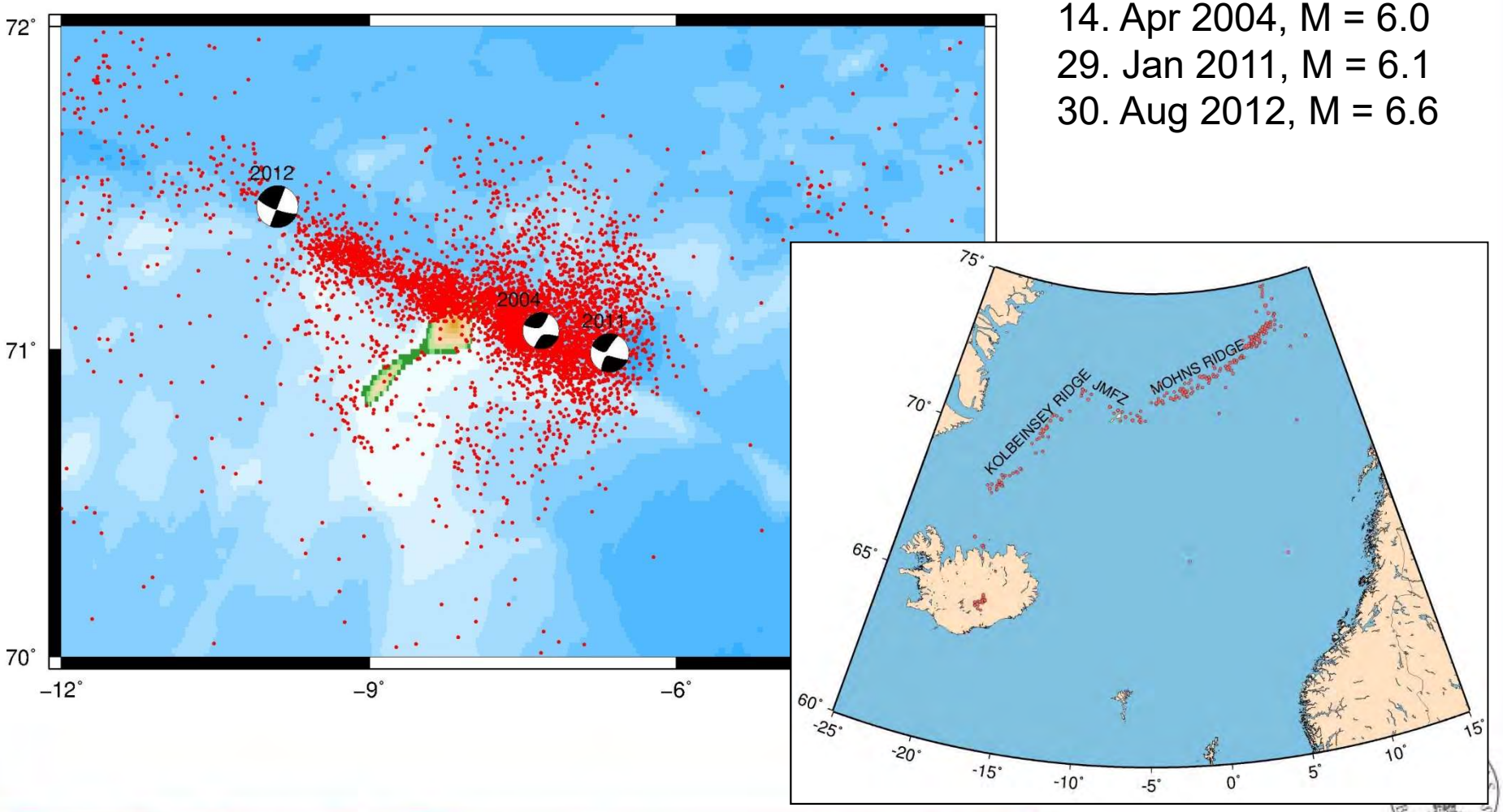


Magnitude

Seismic Moment

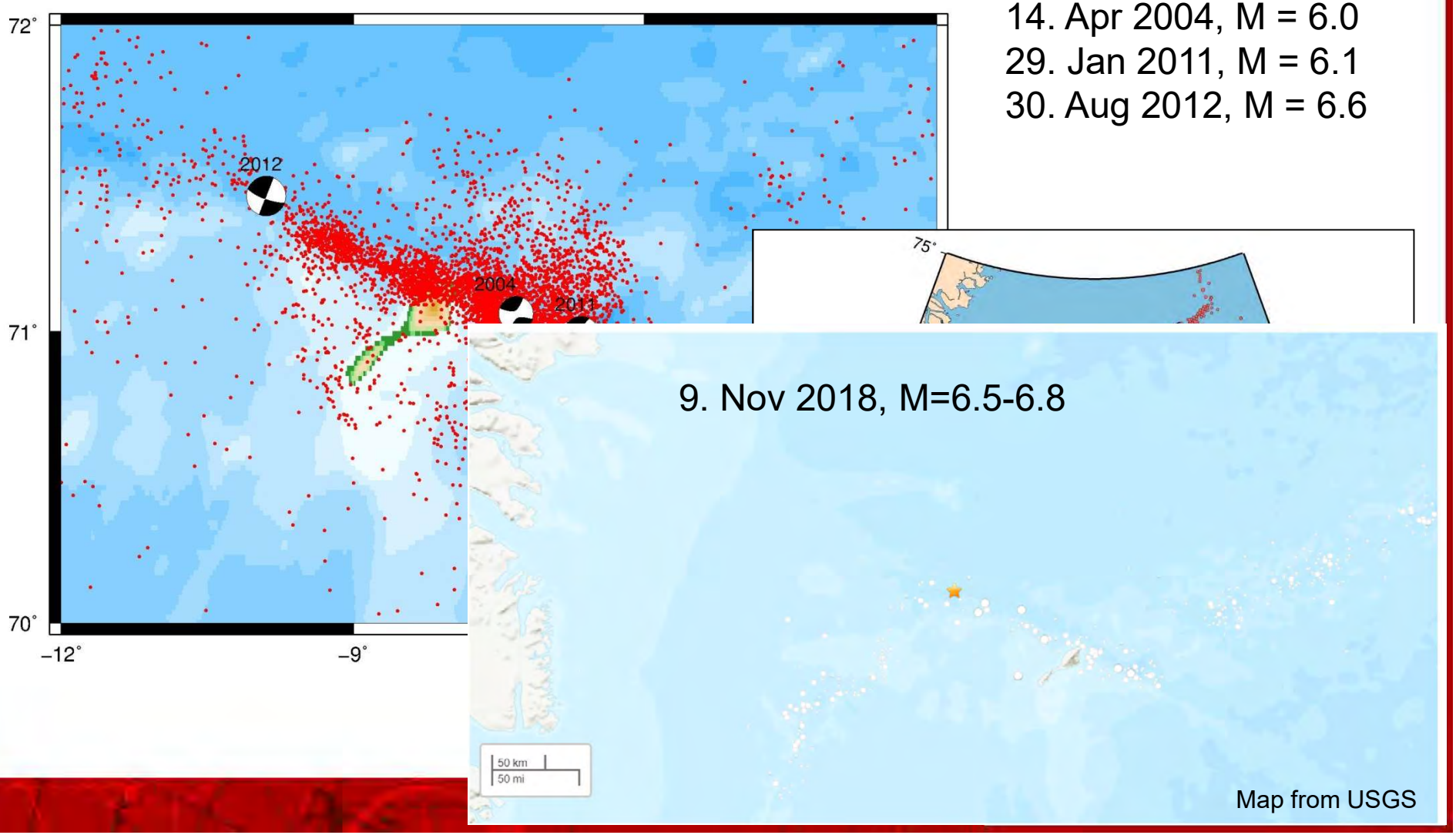
Figure from L.Ottemöller

Jan Mayen earthquakes



14. Apr 2004, M = 6.0
29. Jan 2011, M = 6.1
30. Aug 2012, M = 6.6

Jan Mayen earthquakes



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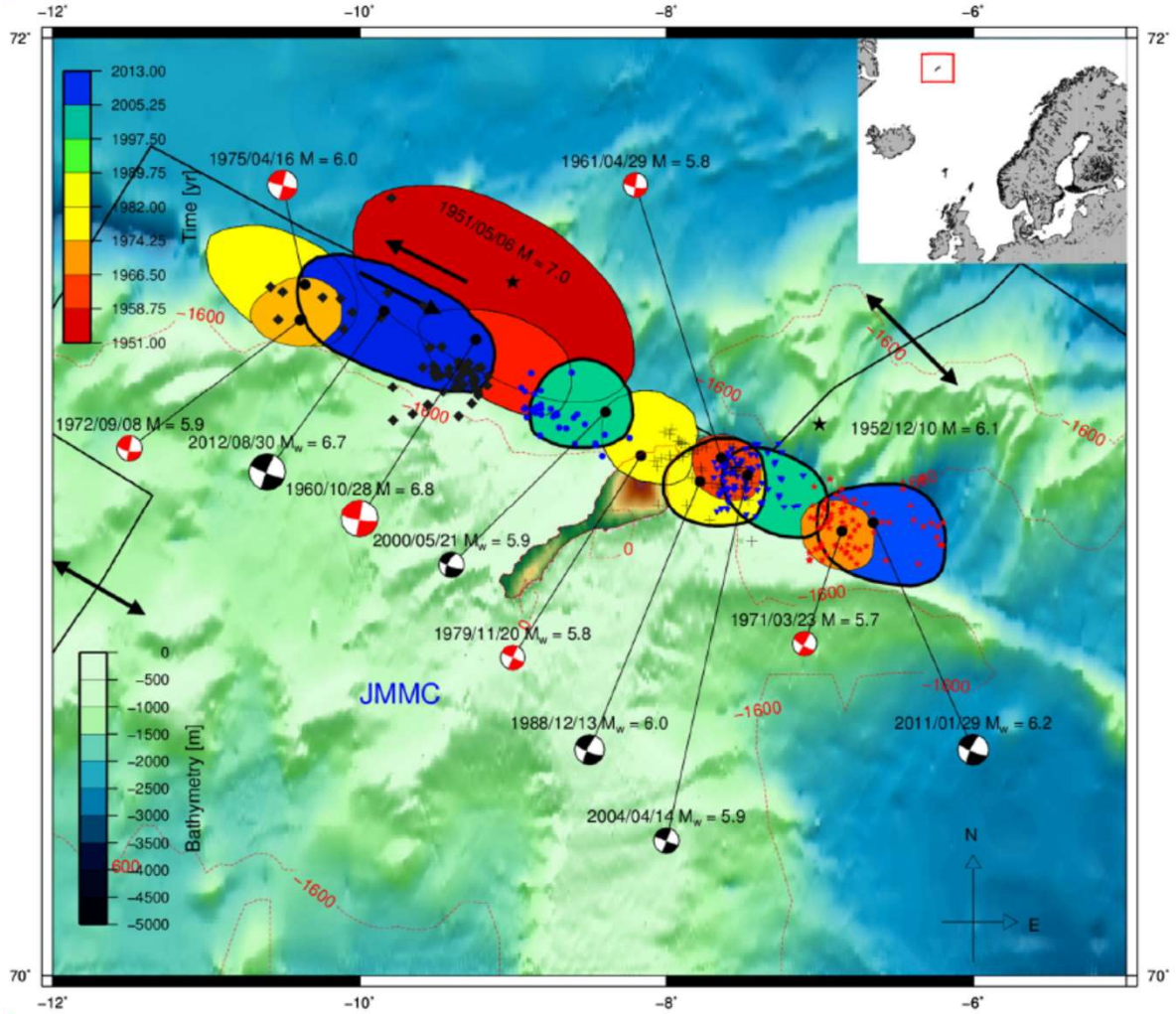
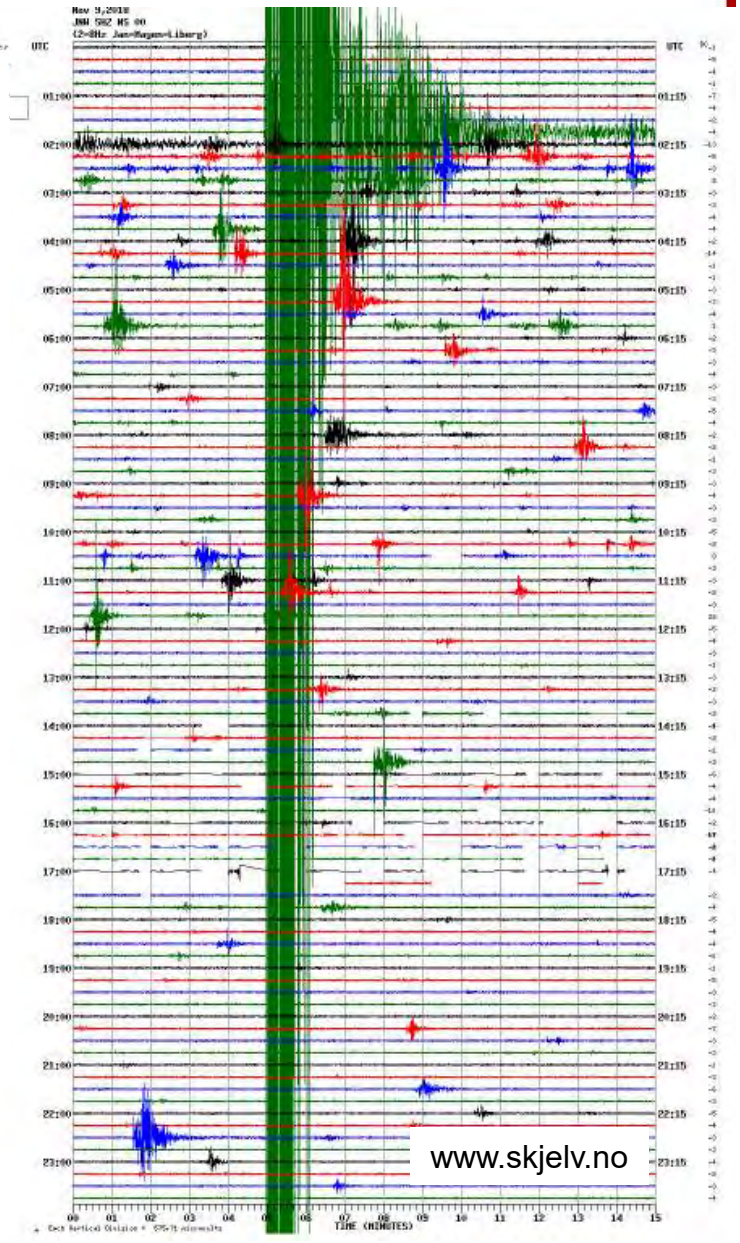
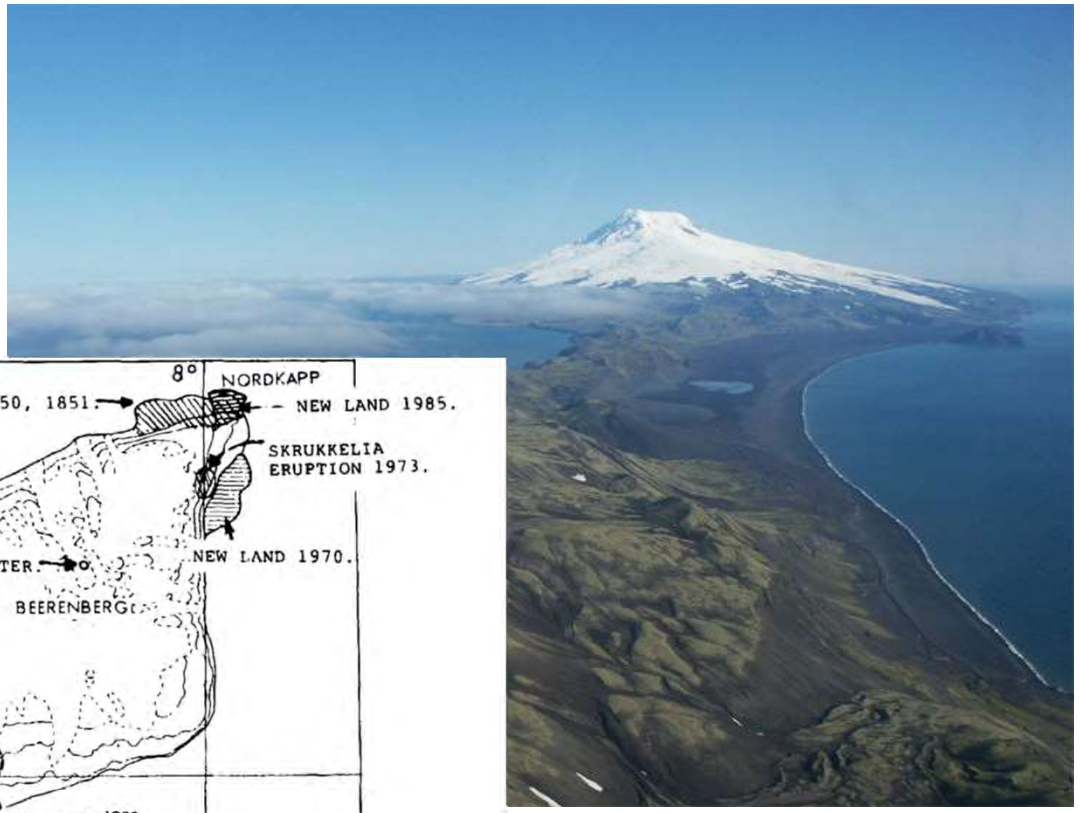
2018 Jan Mayen earthquake

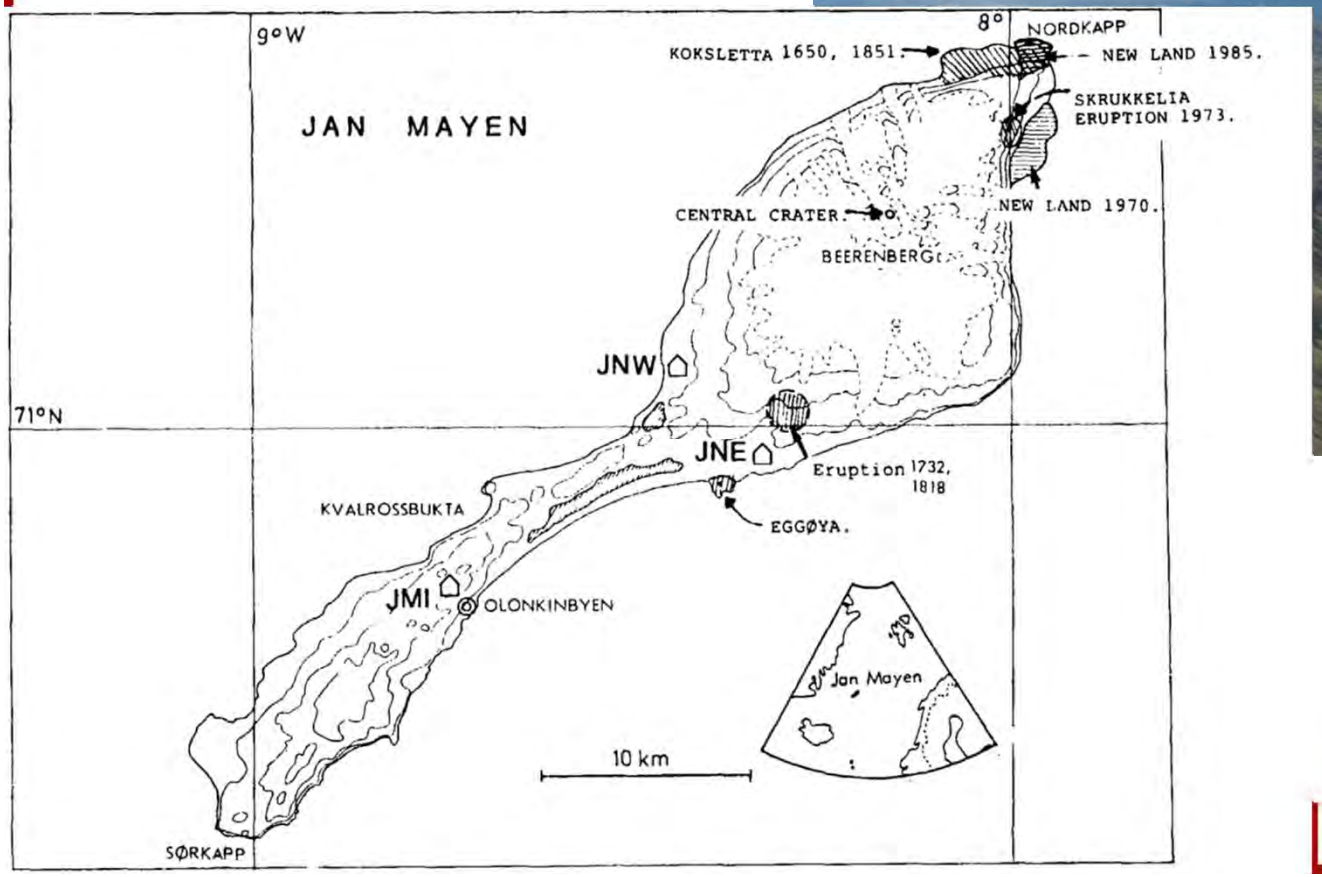


Rodriguez-Perez and Ottemöller, 2014



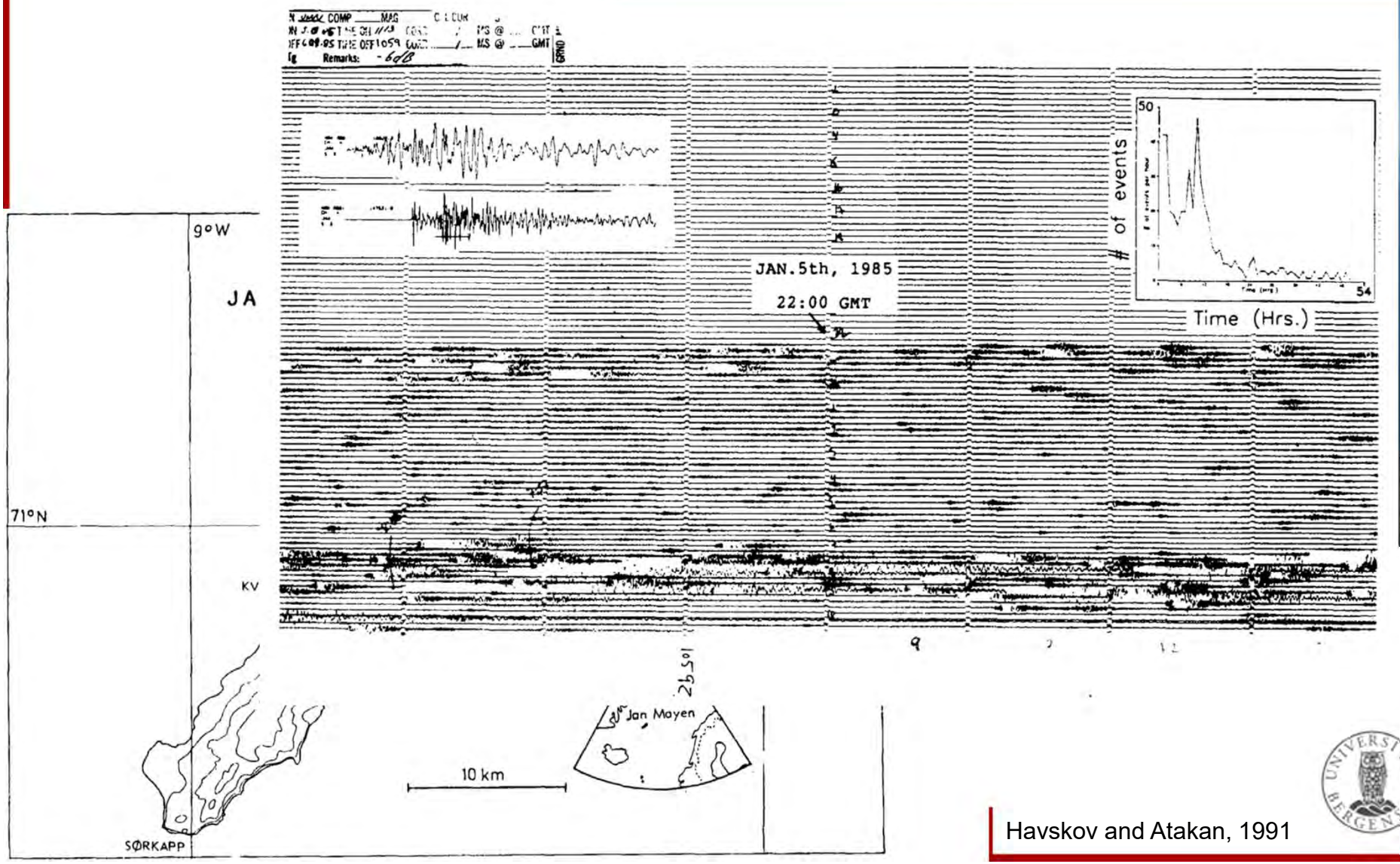
Volcanic activity at Jan Mayen





Havskov and Atakan, 1991

Volcanic activity at Jan Mayen



Havskov and Atakan, 1991

17.06.2017 Greenland landslide

- Energy release corresponding to M4.2 earthquake
- Triggered large tsunami
- 3 villages severely affected, 4 people killed

17.06.2017 Greenland landslide

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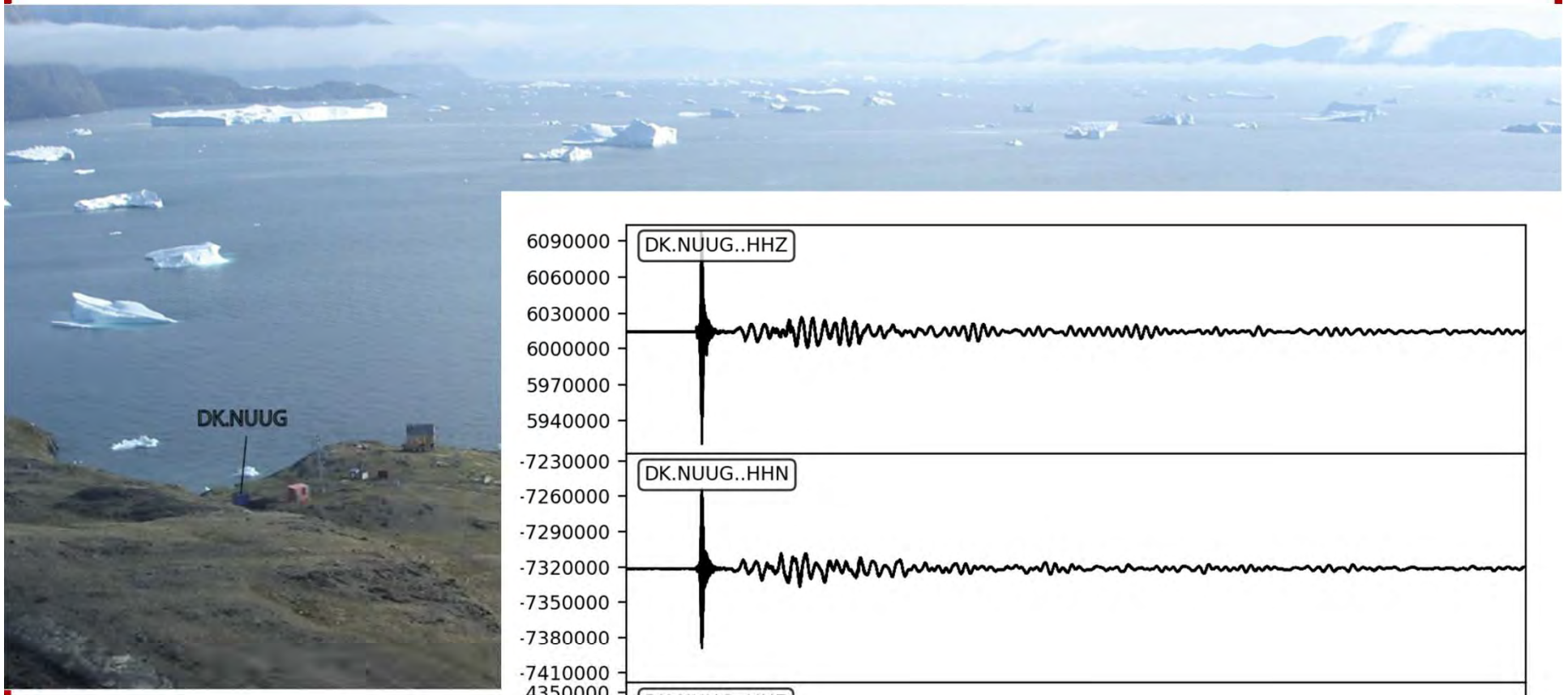
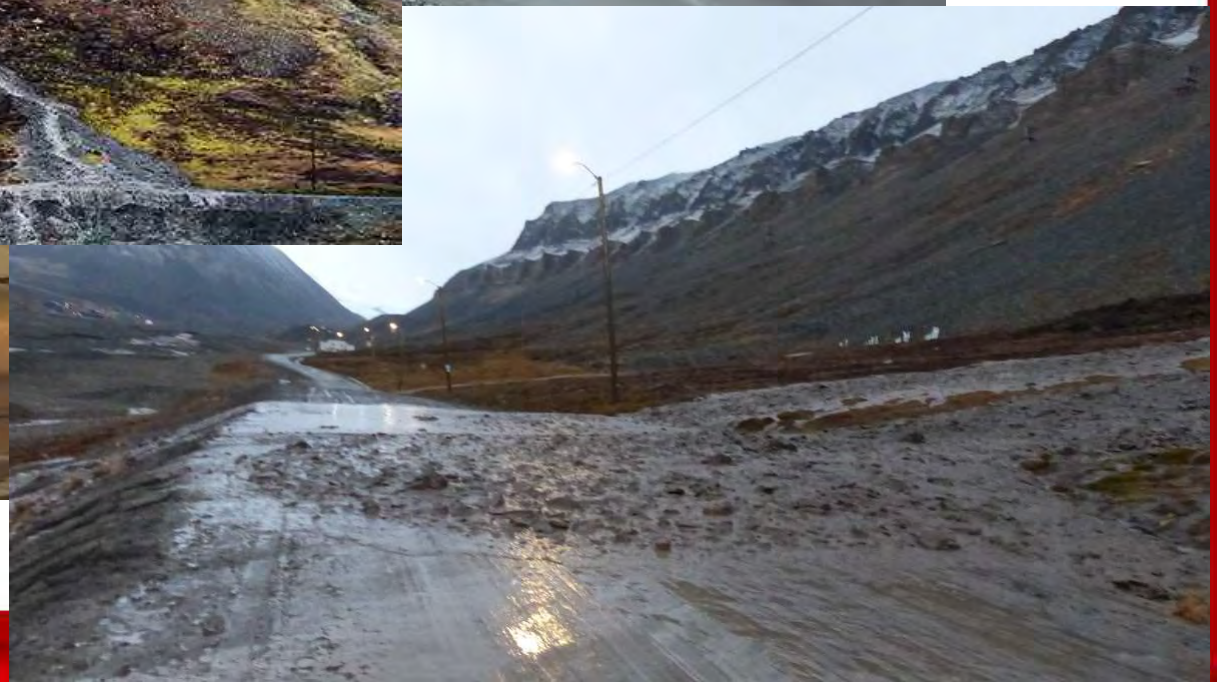


Debris flows and snow avalanches Longyearbyen

Debris flows and snow avalanches Longyearbyen



Monitoring – what are we looking for?

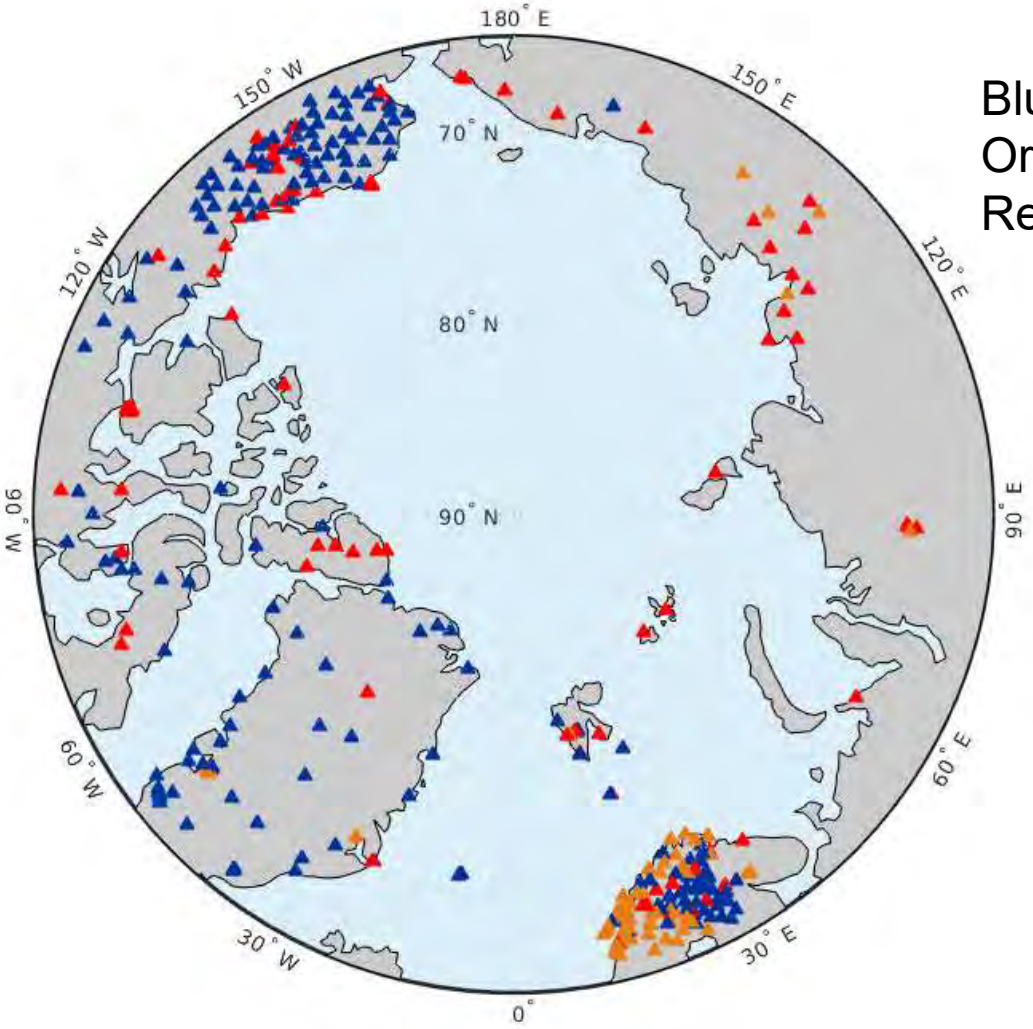
Observing events when they occur

Monitoring temporal changes

Mapping previous events

Forecasting and/or detecting precursors

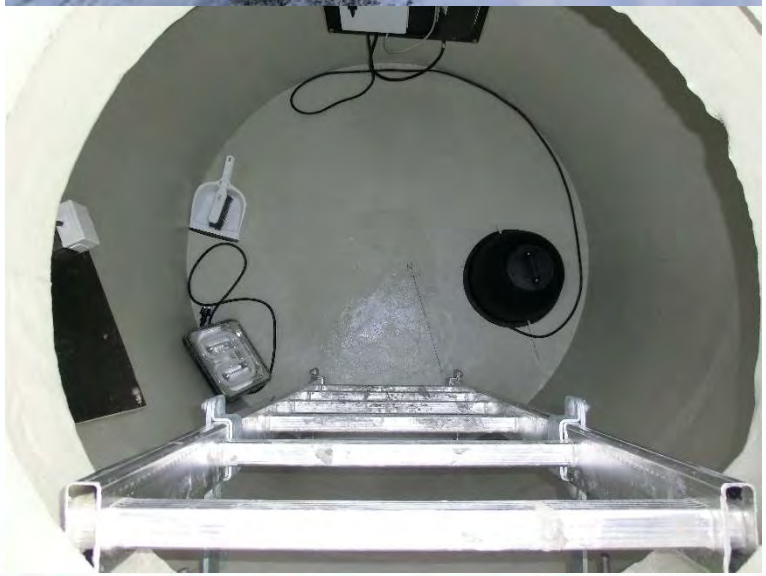
Monitoring: seismic networks



Jeddi et al., 2018

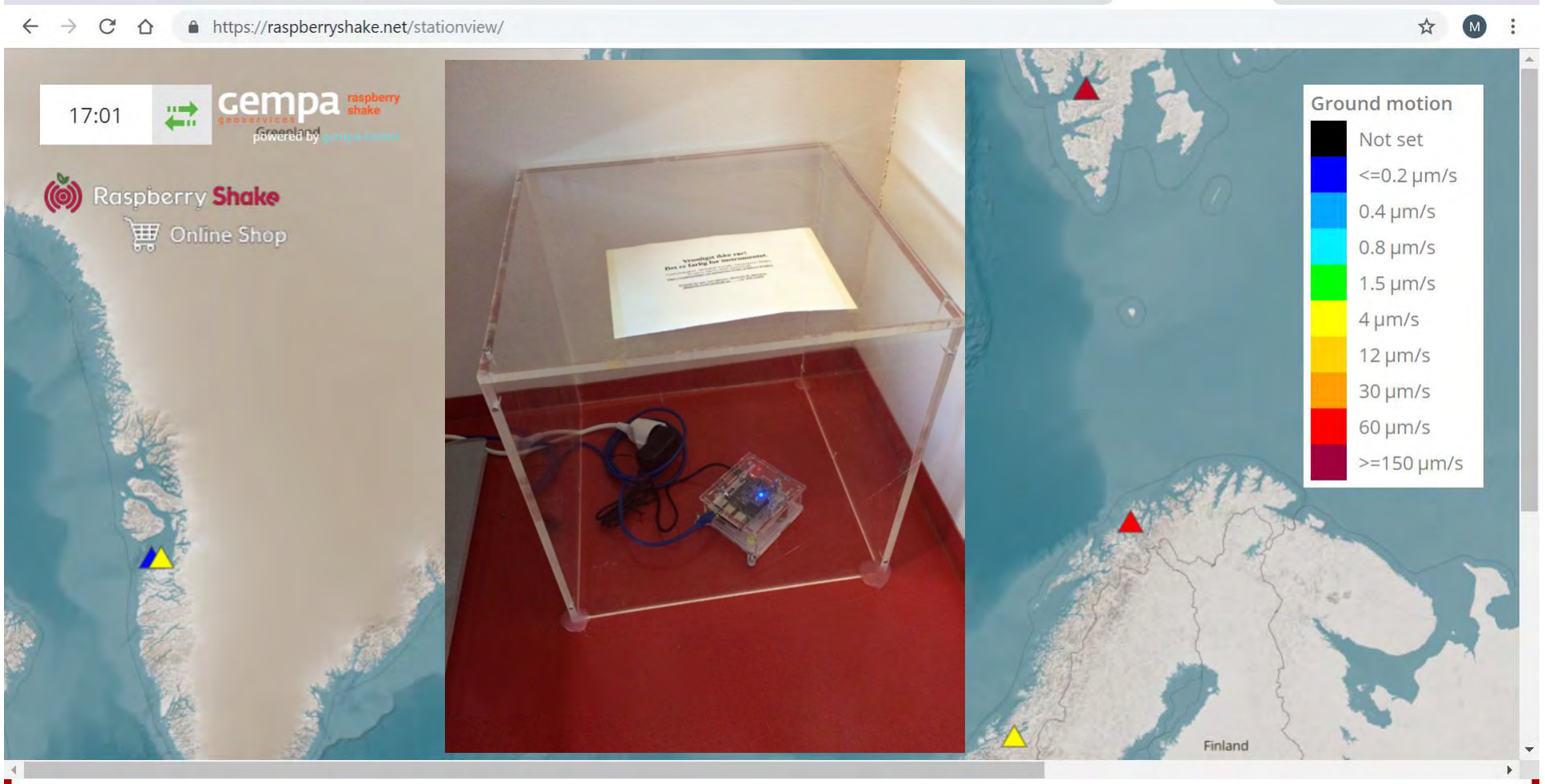
Blue: Currently active
Oragne: Restricted/unavailable data
Red: No data (station closed)

Vault design

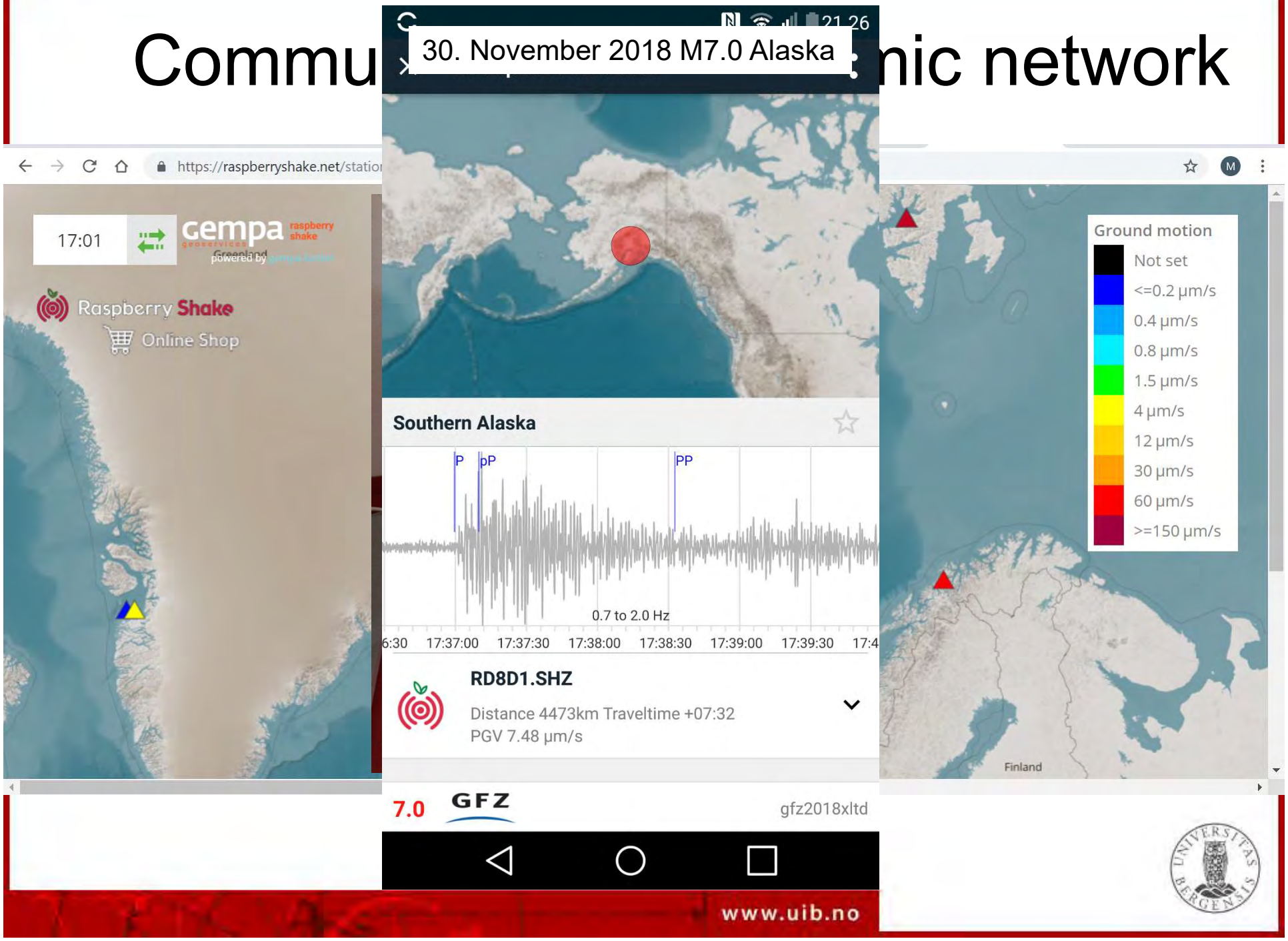


Community based seismic network

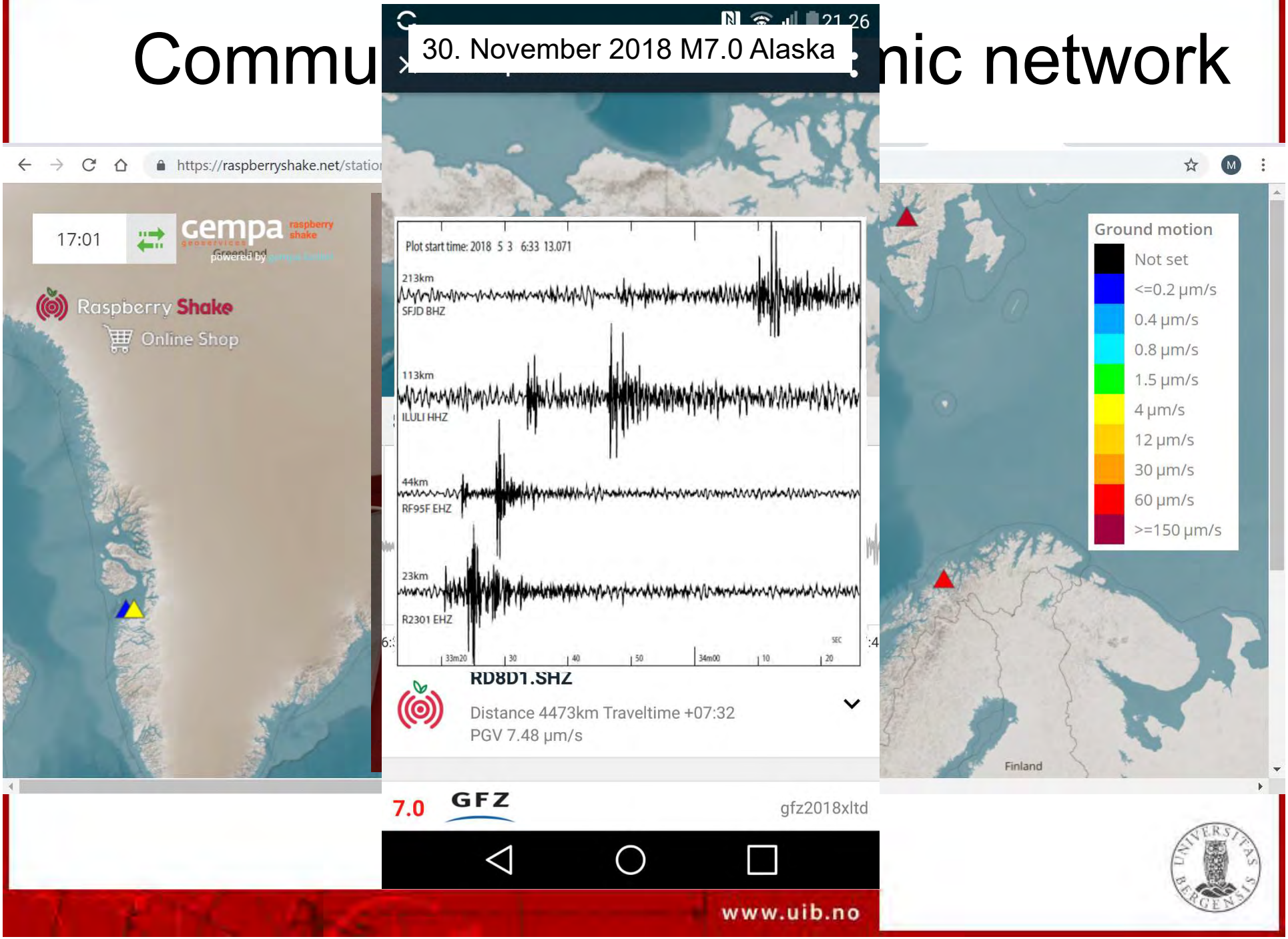
Community based seismic network



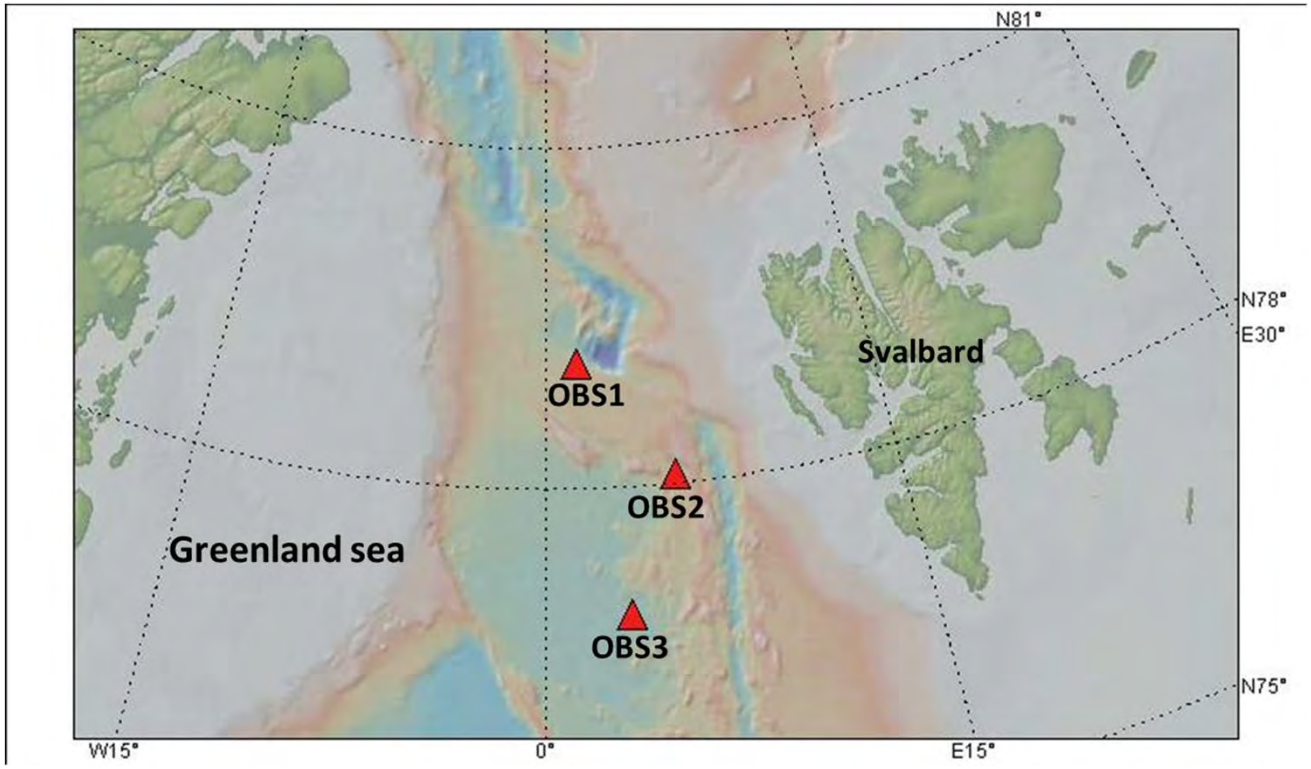
Commu nic network



Commu nic network



Ocean bottom observation



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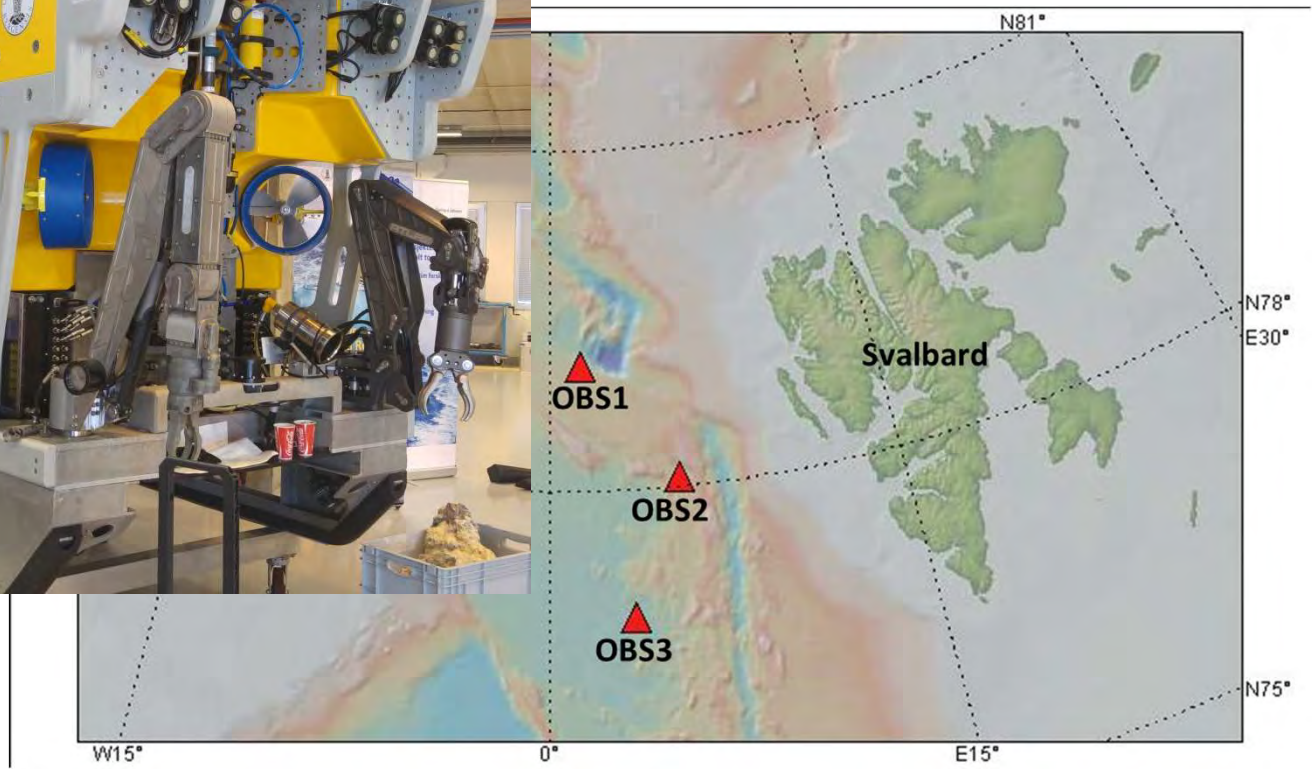

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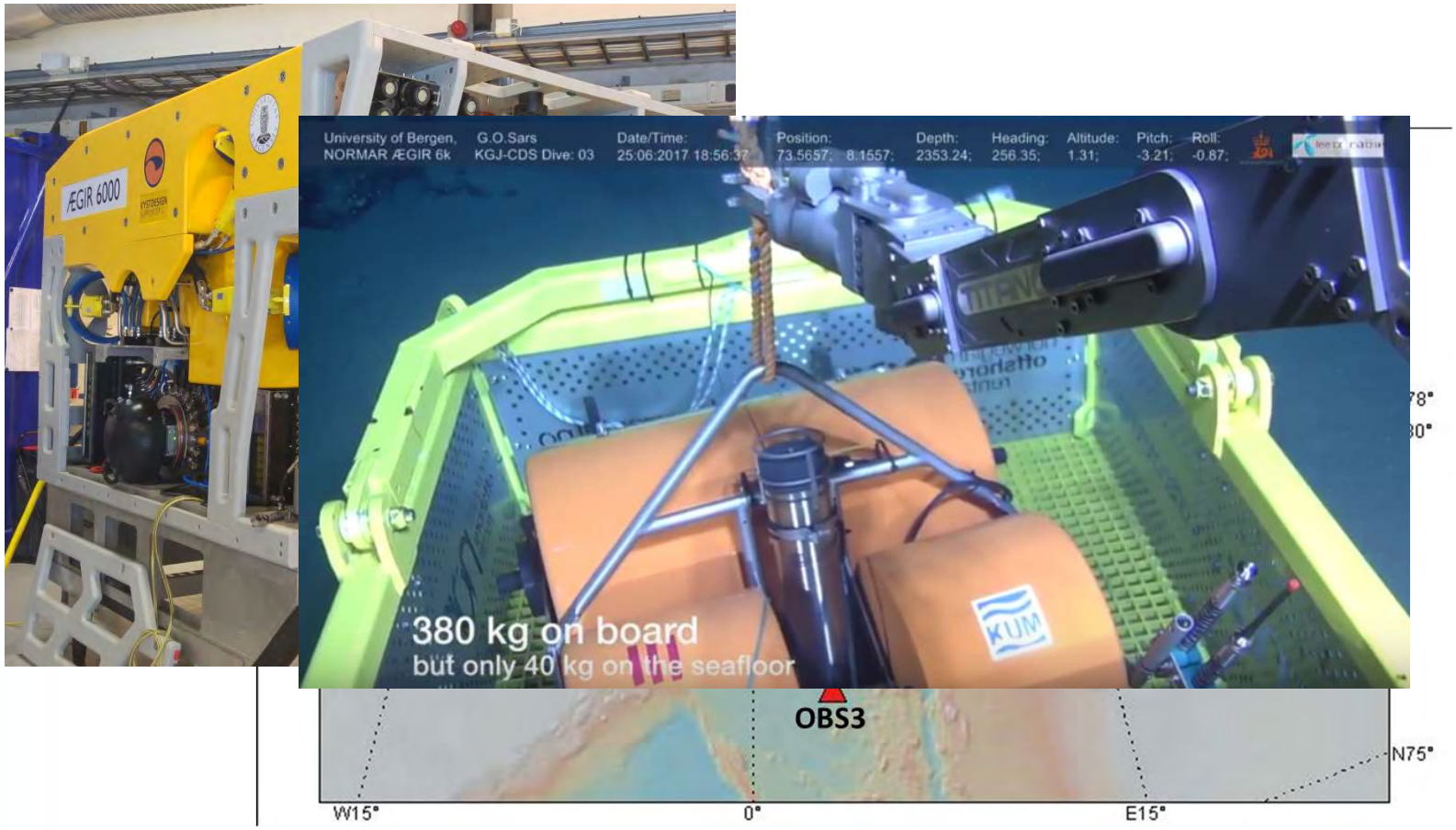

Ocean bottom observation

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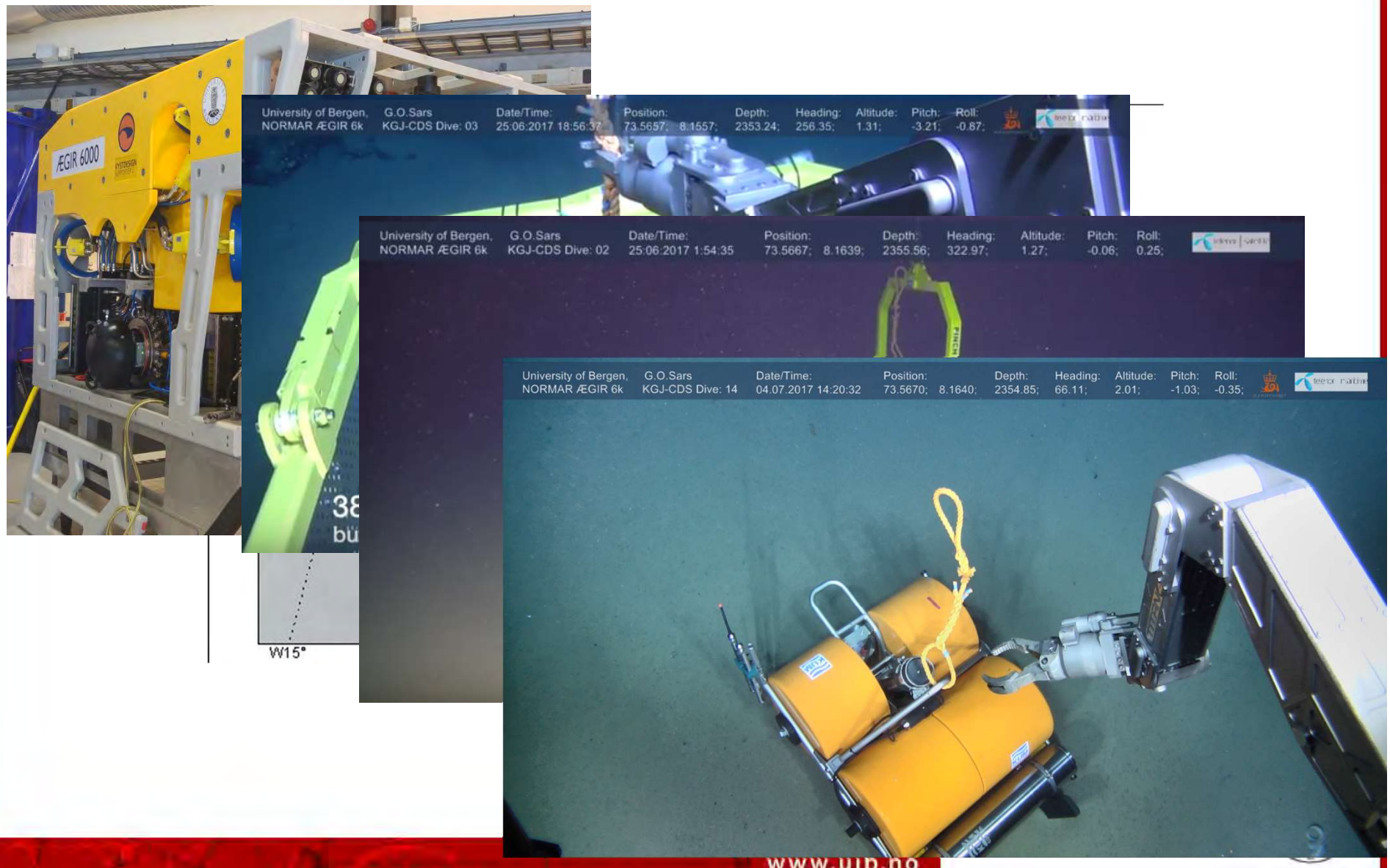
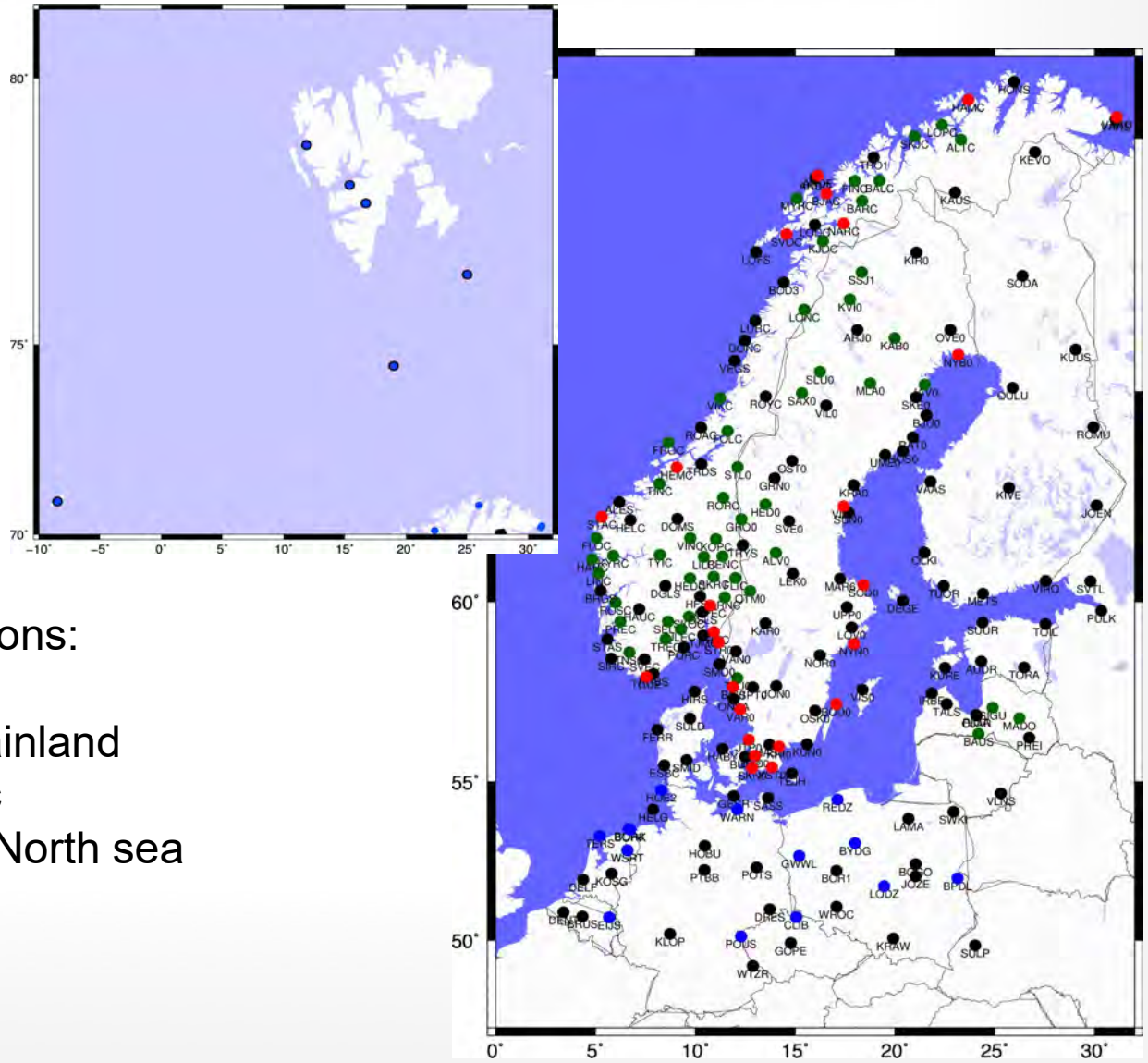


GNSS (GPS) infrastructure in Norway and Northern Europe



Kartverket GPS stations:

~ 200 stations on the Norwegian mainland

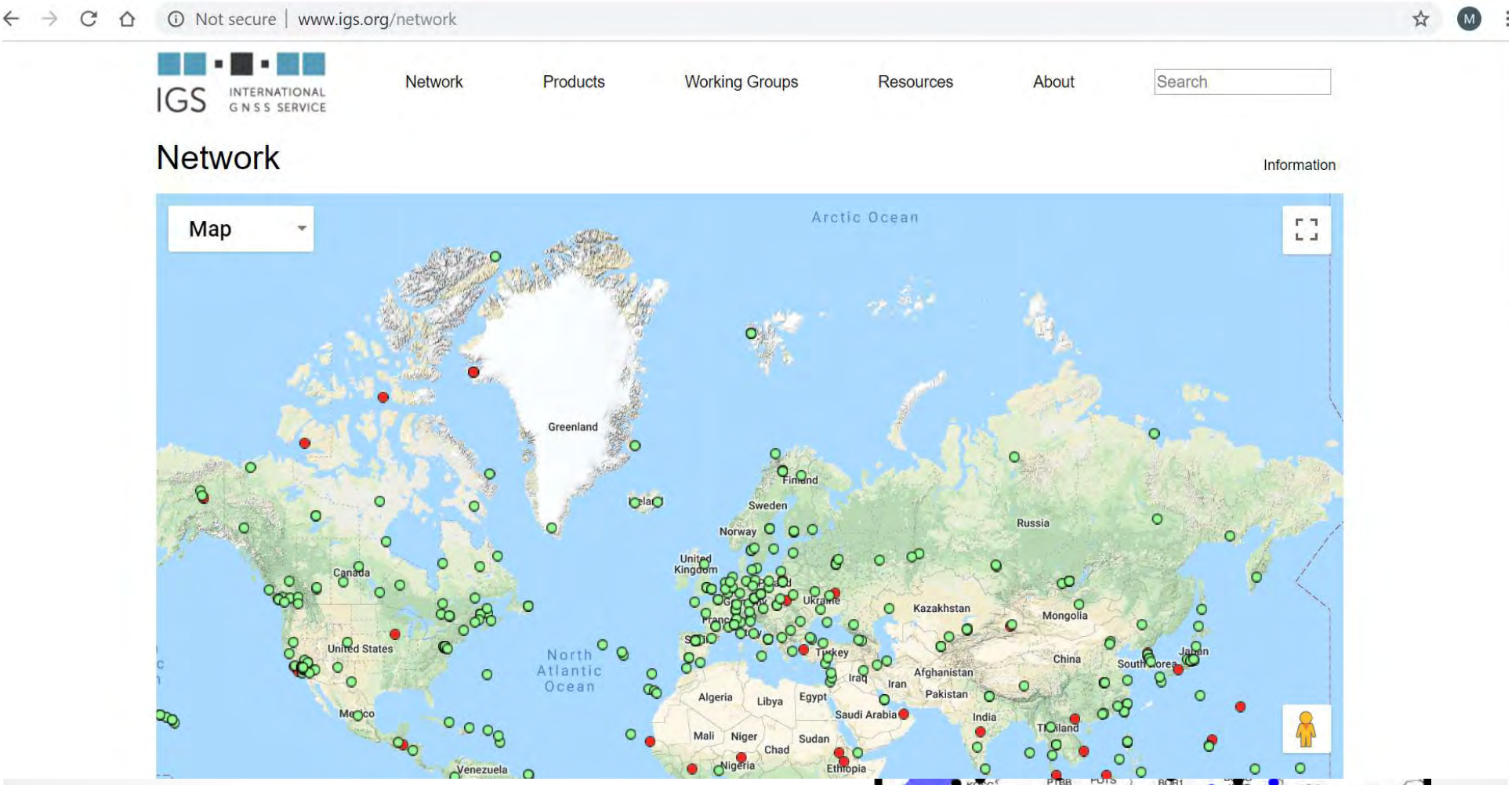
~ 9 stations in Arctic

~ 25 stations in the North sea

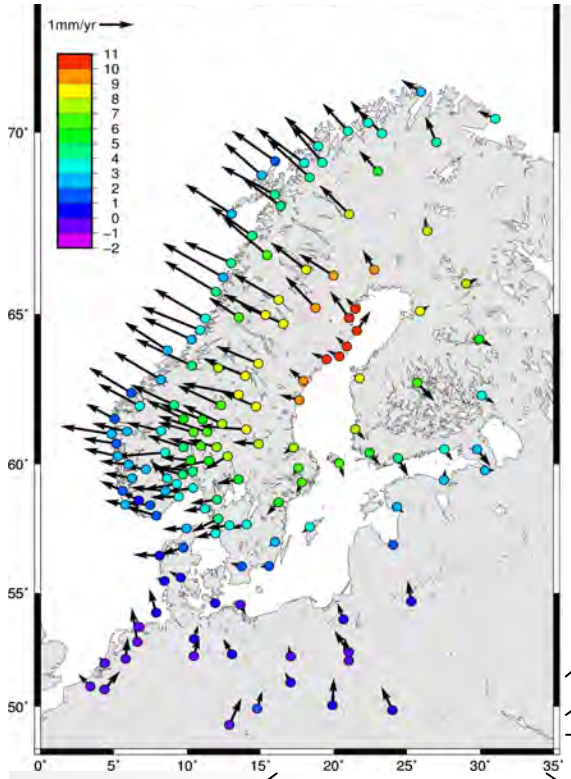
Kartverket

H. Kierulf

GNSS (GPS) infrastructure in Norway and Northern Europe

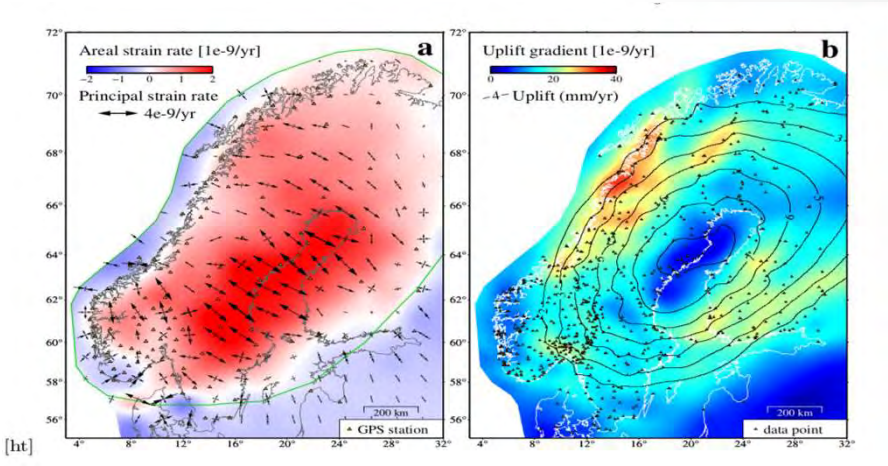


GPS derived velocity fields have several geophysical applications



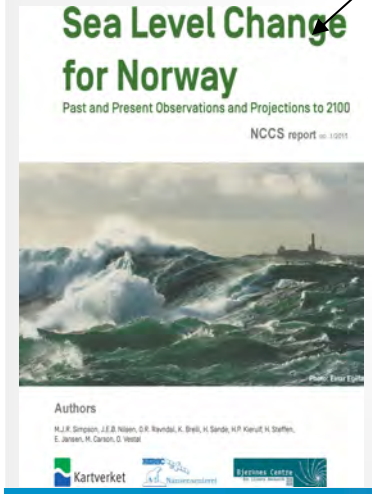
Neotectonic

Glacier massbalance



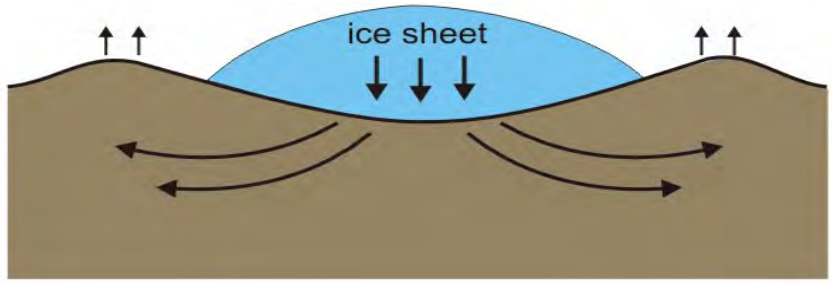
Strain rate (from keiding etal 2015)

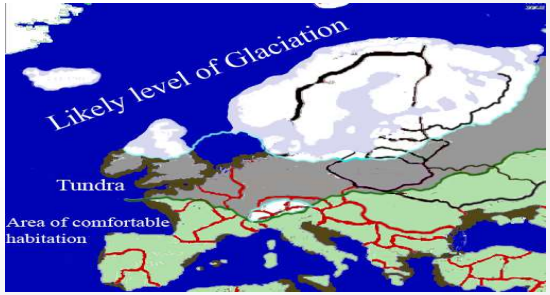
Earthquakes



Hydrological loadings

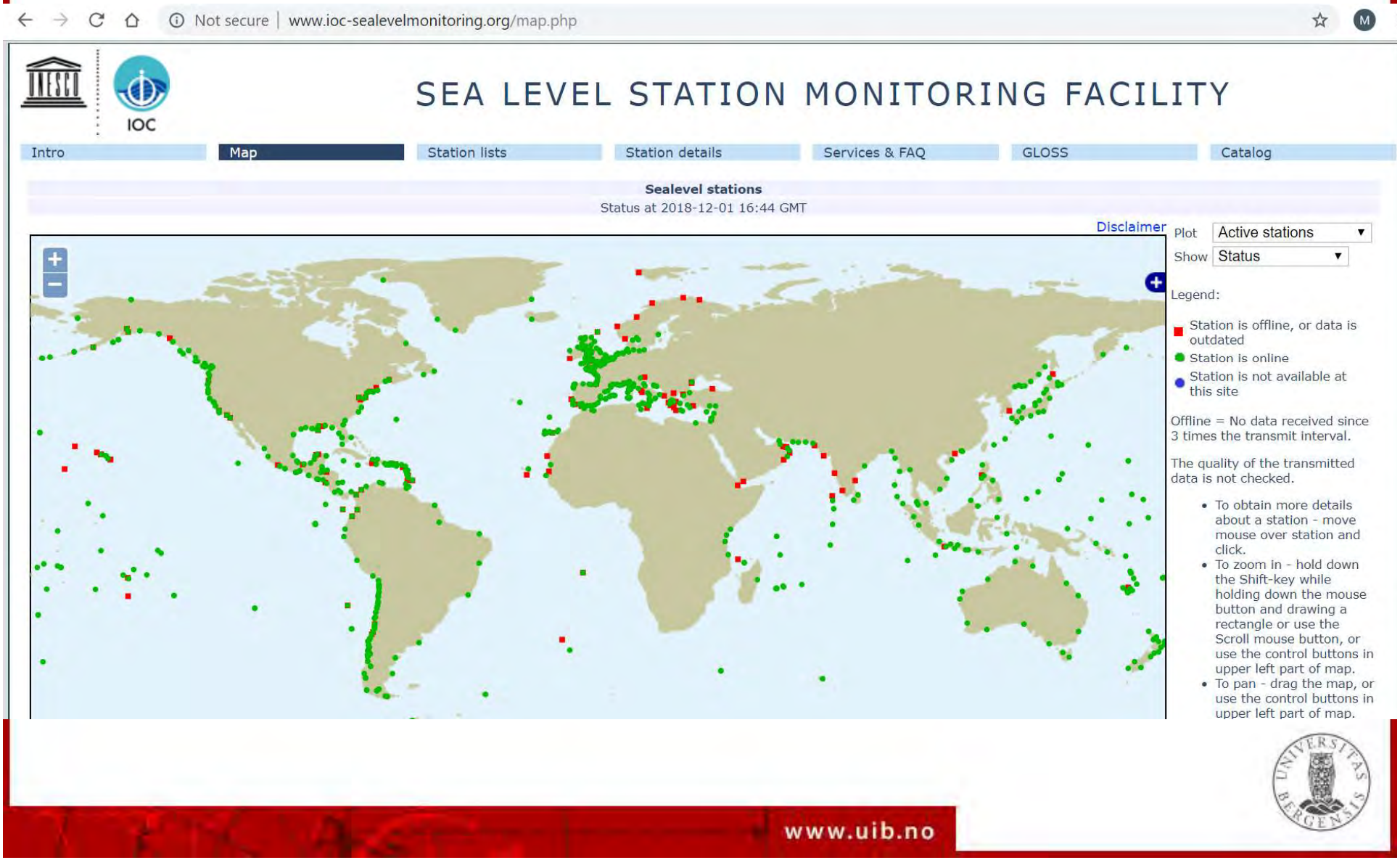
GIA, Ice history and rheology



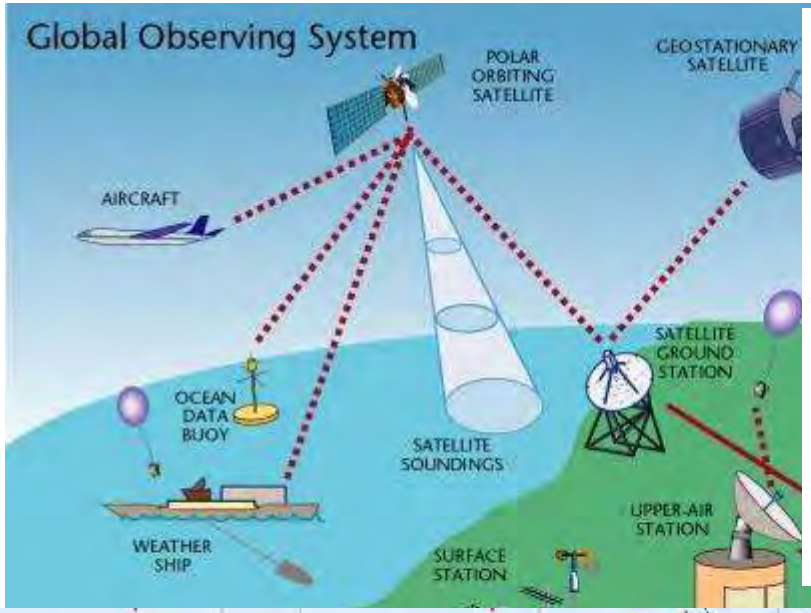


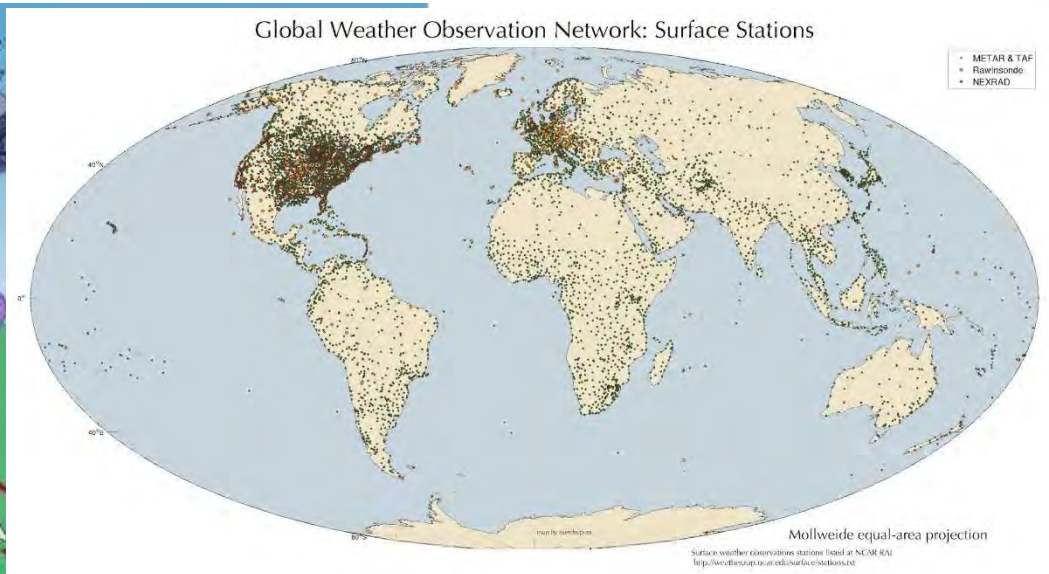
H. Kierulf, Kartverket

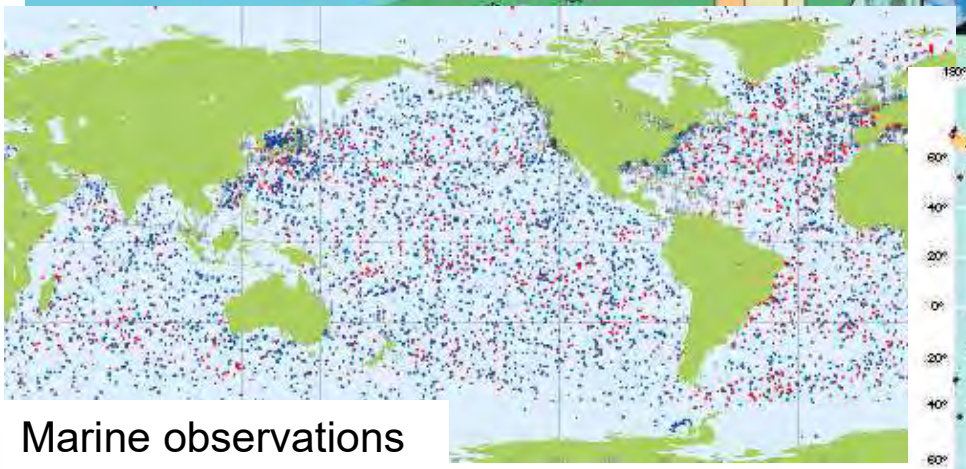
Sea level monitoring



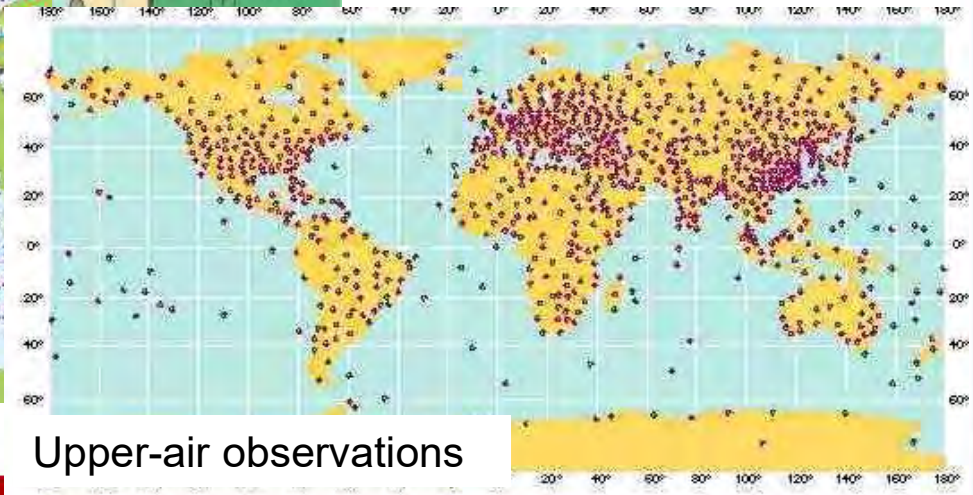
Global Weather Observation Network





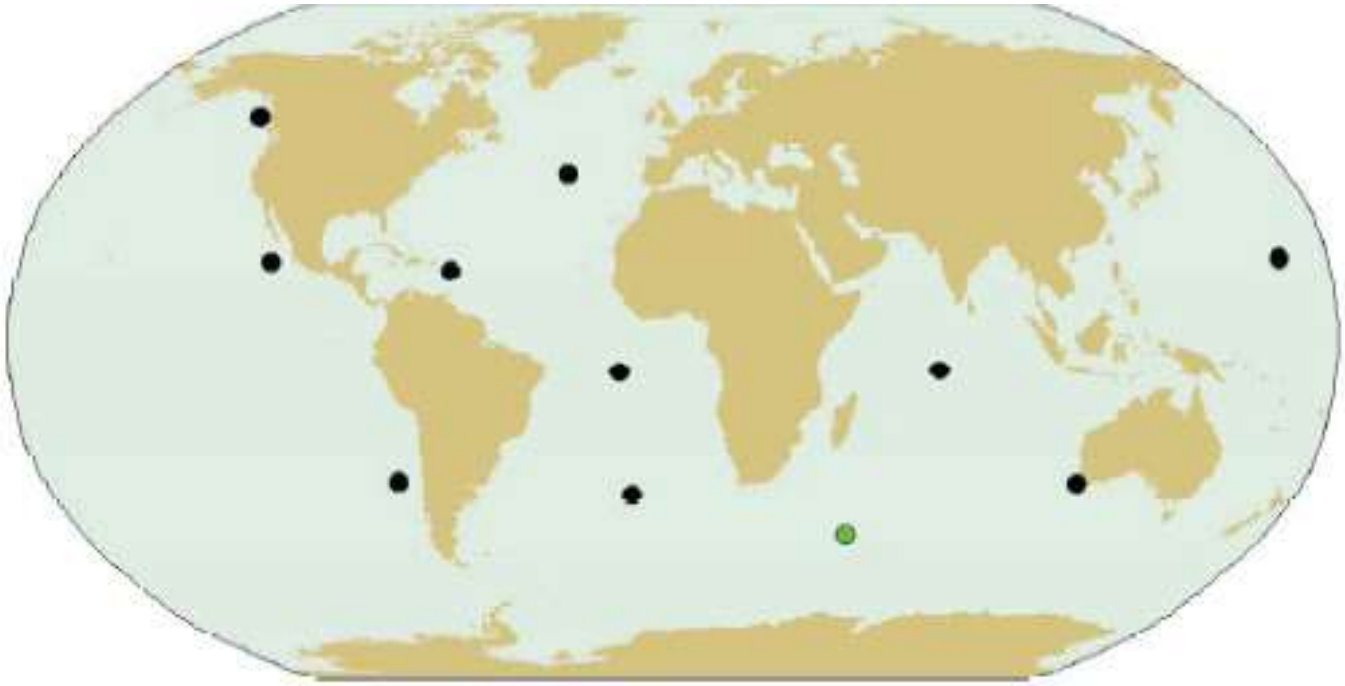


Marine observations



Upper-air observations

Acoustic data for natural hazards



CTBTO IMS hydroacoustic network
Detects earthquakes, volcanic eruptions, tsunamis - and explosions

Data management and access to data

- Very extensive datasets, growing data volume
- Getting access to data may be problematic due to data policy and/or logistical reasons
- Increasing focus on open data and data availability
- Repositories are developing within many fields
- Practical issues related to data access are still a problem

Online data platforms are developing

https://catalog-intaros.nersc.no

mathildes 0

INTAROS

Datasets Organizations Groups About Search

Search data

E.g. environment

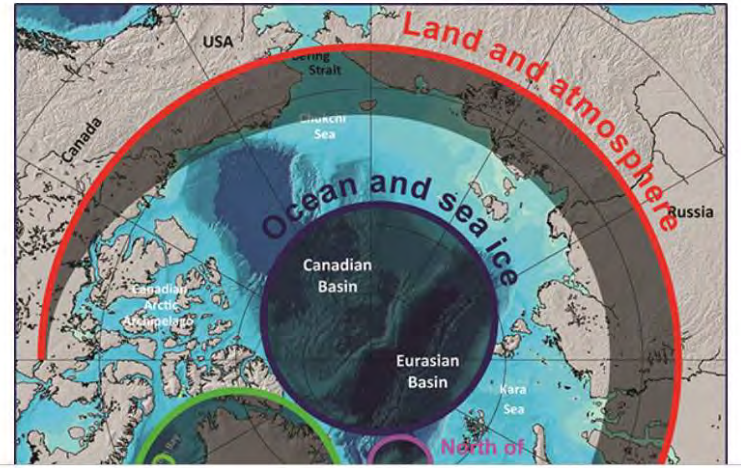
Popular tags climate research HAUSGARTEN Hansbreen

INTAROS Data Catalogue statistics

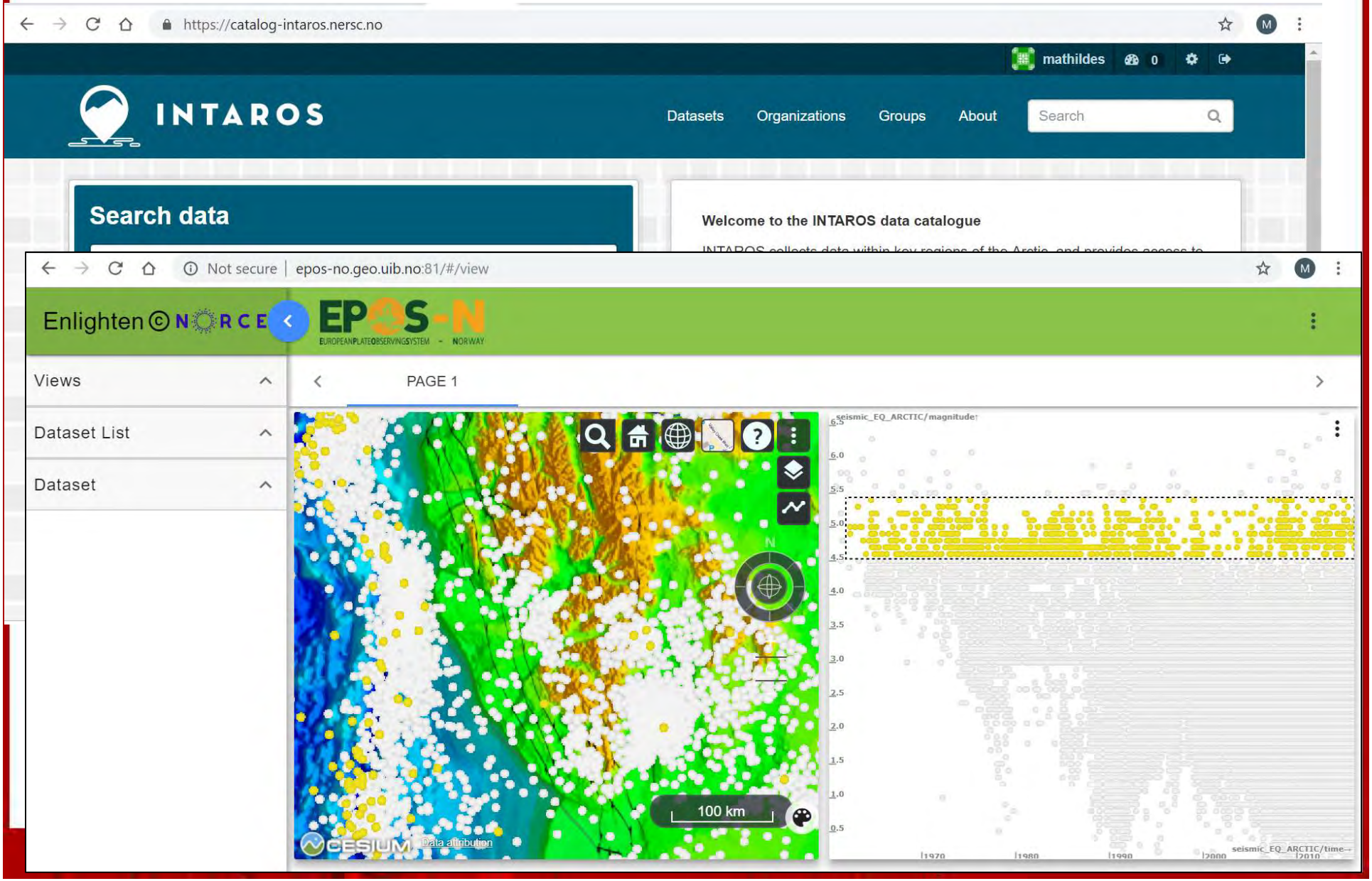
38 datasets 20 organizations 0 groups

Welcome to the INTAROS data catalogue

INTAROS collects data within key regions of the Arctic, and provides access to these datasets and other datasets of relevance to our targeted stakeholders.



Online data platforms are developing



Questions?

mathilde.sorensen@uib.no