Session 4A - In situ Sustained Eulerian Observatories

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OceanObs'09 Ocean information for society: sustaining the benefits, realizing the potential
21-25 September 2009, Venice, Italy

This presentation:

1: Rationale behind fixed platforms

2: Current state

3: A vision for the future

- **In order to explore the time changing properties of the oceanic environment, sustained observations are essential at a sufficiently high frequency**

- **These provide the means to examine complex interrelations between processes and properties:**

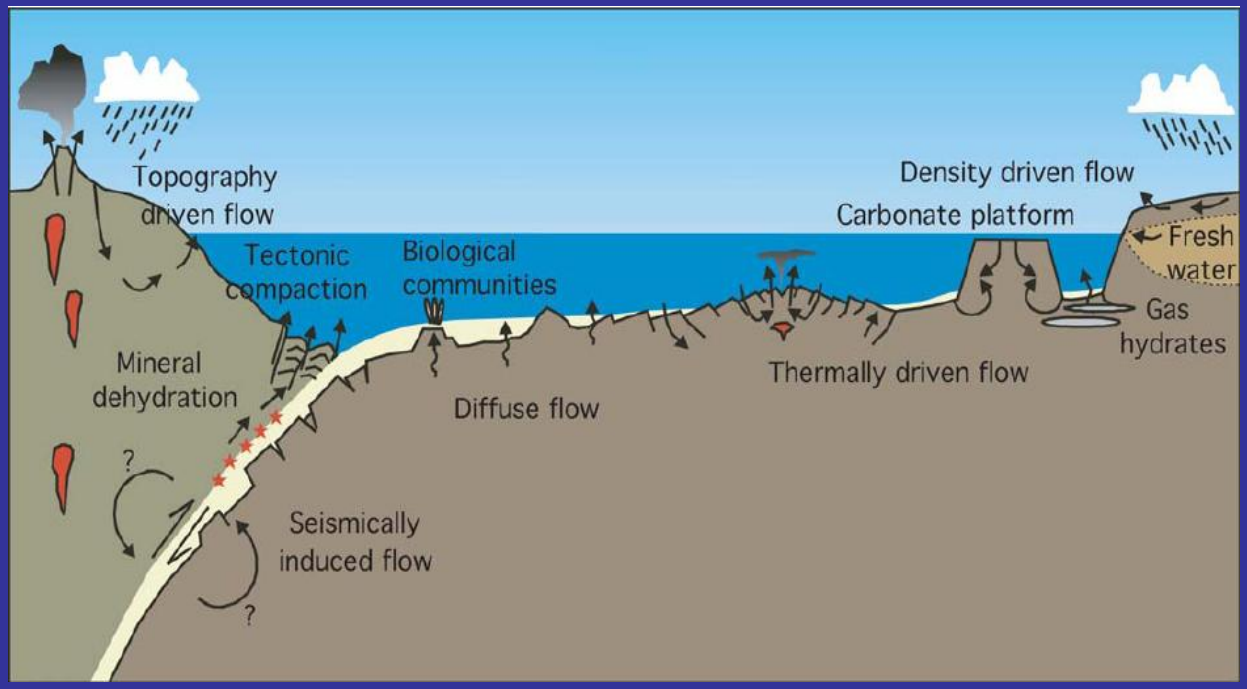
  - Short-time scales (minutes, hours to days)

  - Longer-time scales (annual to decadal)

- **A key attribute of many current fixed observatories is that they are real-time multidisciplinary interactive and some cover several environments from the top of the ocean to the seabed beneath**

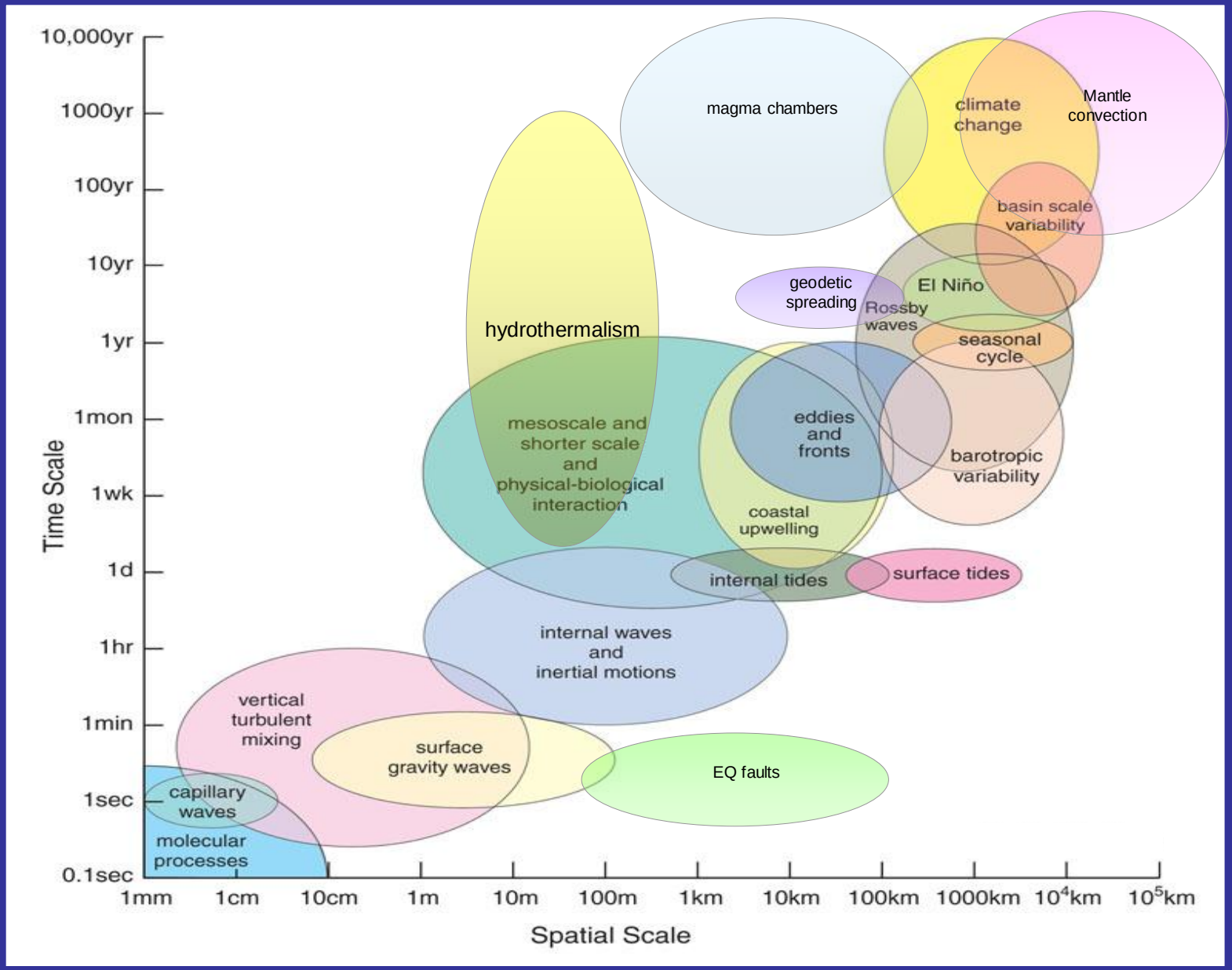
Scientific Themes

- Role of the Ocean in Climate
- Turbulent mixing and Biophysical interactions
- Ecosystem dynamics and Biodiversity
- Fluids and Life in the Ocean Crust
- Dynamics of lithosphere and Imaging Earth's interior



http://www.oceanleadership.org/ocean_observing

Time & Space scales of major ocean and earth processes



Redrawn from figure courtesy of Dudley Chelton, Oregon State University (see also Dichey & Chang, 2001)

Interdisciplinary research priorities

- **Physical oceanography**

water mass characterisation, water column processes, thermodynamics, ice cover, climatology, and impacts on climate change

- **Biogeochemistry**

global carbon cycle and elemental cycling within the ocean through both physical and biological processes, and ocean acidification

- **Marine ecology**

distribution and abundance of sea life, ocean productivity, biodiversity, ecosystem function, living resources, and climate feedbacks

- **Geoscience**

transfer from Earth's interior to the crust, hydrosphere and biosphere, fluid flow and gas seepage through sediments and gas hydrate, non-living resources, sediment transfer to deep-sea and climate change

- **Geo-hazards**

earthquake and tsunami hazard, volcanic hazard, slope instability and failure

Benefits

Public Policy

– Environmental
– Resources
– Public health and safety
– Security

Economic Development

– Growth of marine technology industry
– Innovative technologies
– Tourism

Education and Public Engagement

Fixed platforms are required for:

- high power requirements
- real-time requirements
- sample collection
- deep ocean
- benthic boundary layer studies
- seafloor processes (i.e. interactions geo- bio- hydro-sphere)

What are fixed stationary platforms?

Unmanned, multi-sensor platforms to make measurements from above the air-sea interface to below the seafloor, and with different configurations related to the communications:

1) **Stand-alone and delayed mode**

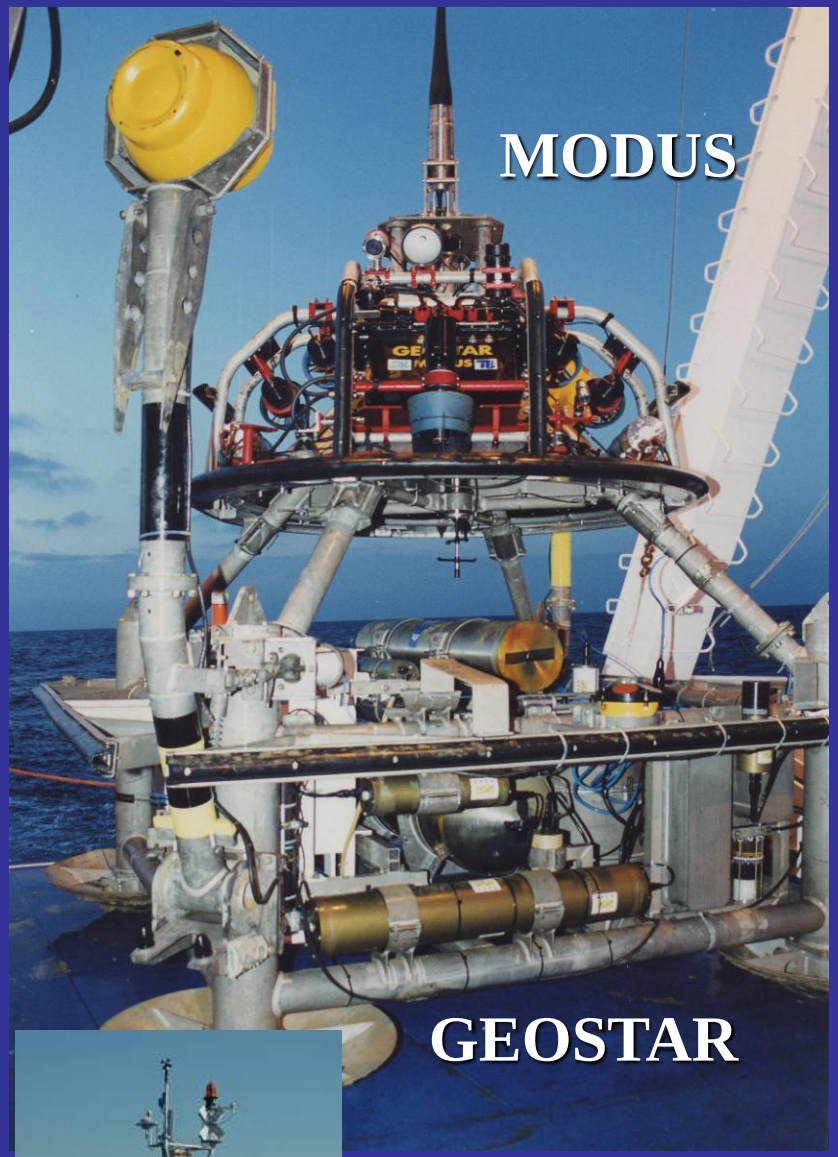
2) **Mooring and seafloor platforms with acoustic /cabled capabilities**

Surface to seafloor

- Temperature
- Salinity
- Currents
- Nutrients
- Chl-a
- CO_2
- Particle flux
- Benthic studies

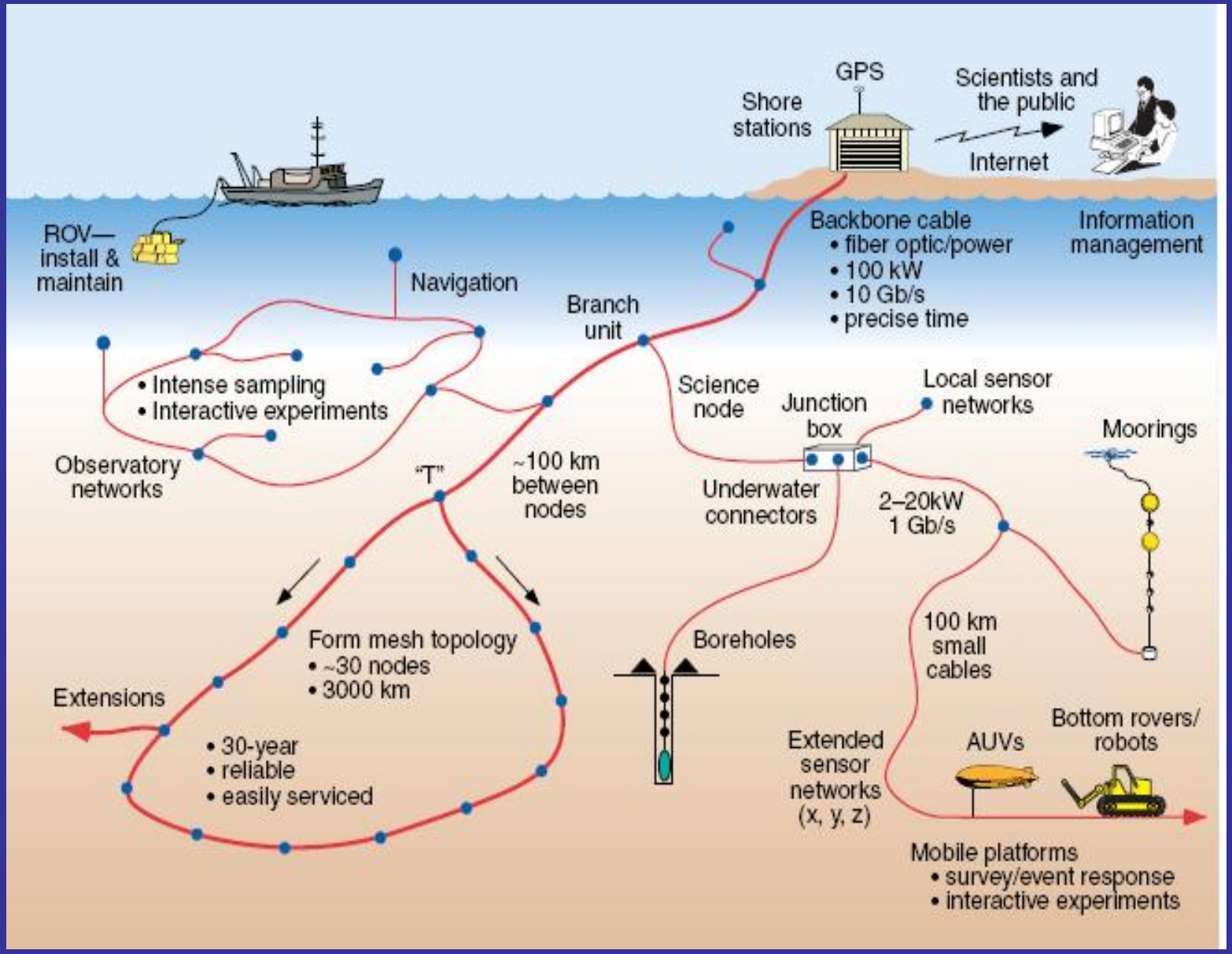
*Real-Time Telemetry

Mooring with satellite comm.



Acoustically linked

Cabled configuration



NRC, 2003

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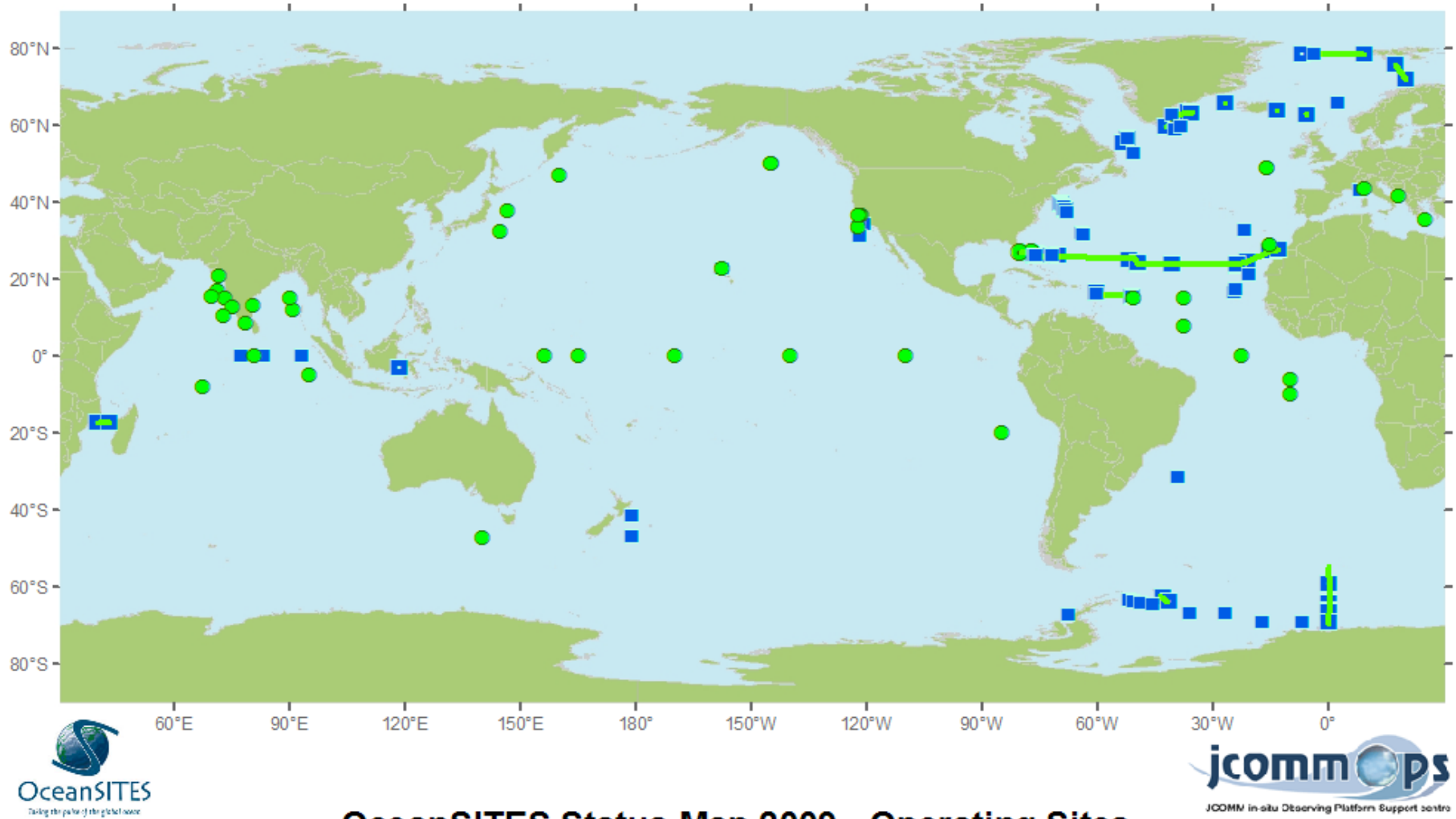
An example of coastal fixed observatories: US IOOS

A global network of Deep ocean Eulerian observatories

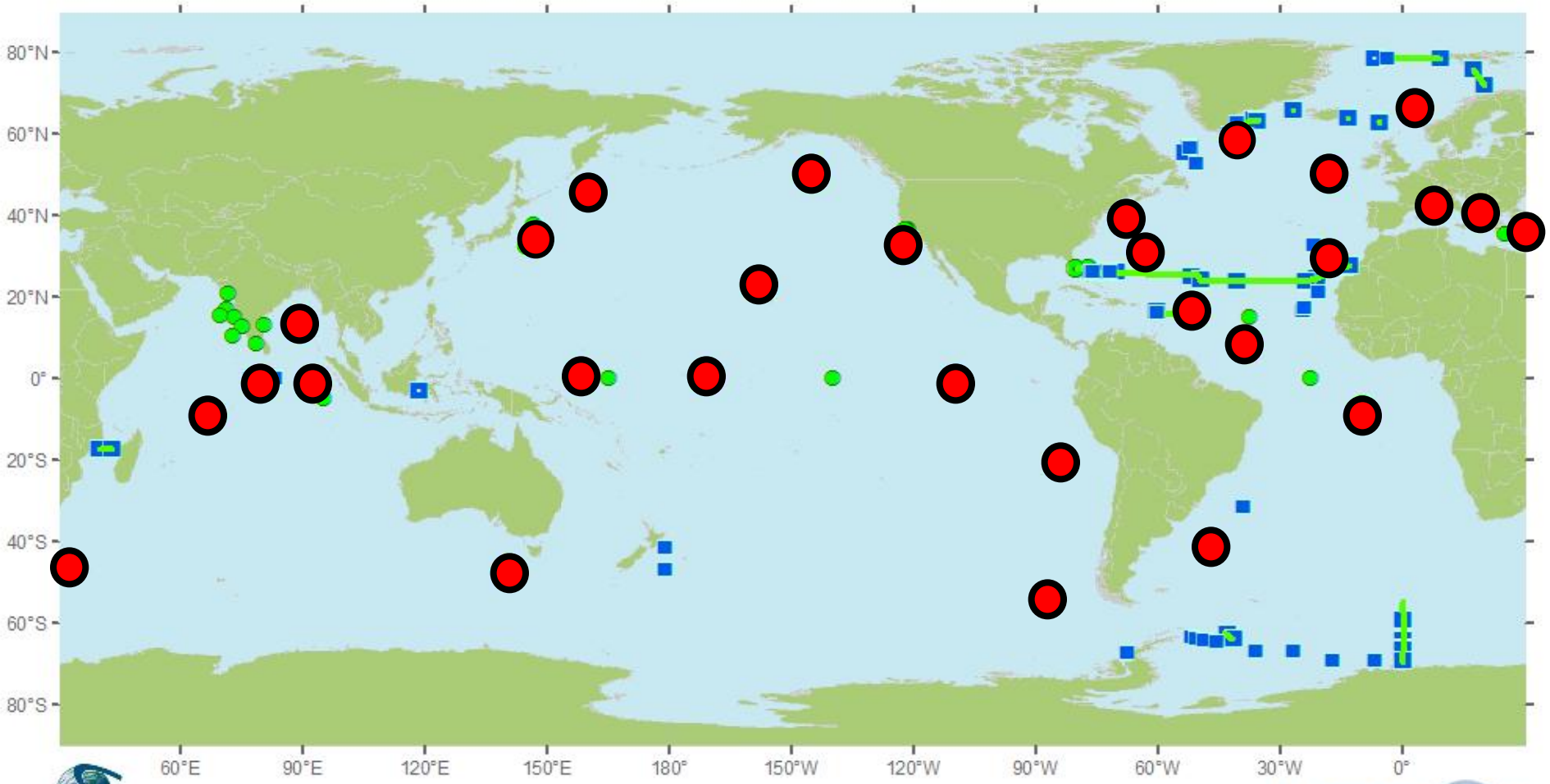


EuroSITES
European Ocean Observatory Network

List of Minimal Variable Set for OceanSites

1. Water current at 15m depth
2. CTD in and below upper mixed layer (UML) (>10 sensors)
3. PCO_2 near surface
4. O_2 in and below UML (~ 6 sensors)
5. Nitrate (one in UML and one below it)
6. Irradiance (above water and at two *in situ* depths)

Locations with core set of variables in 2 years

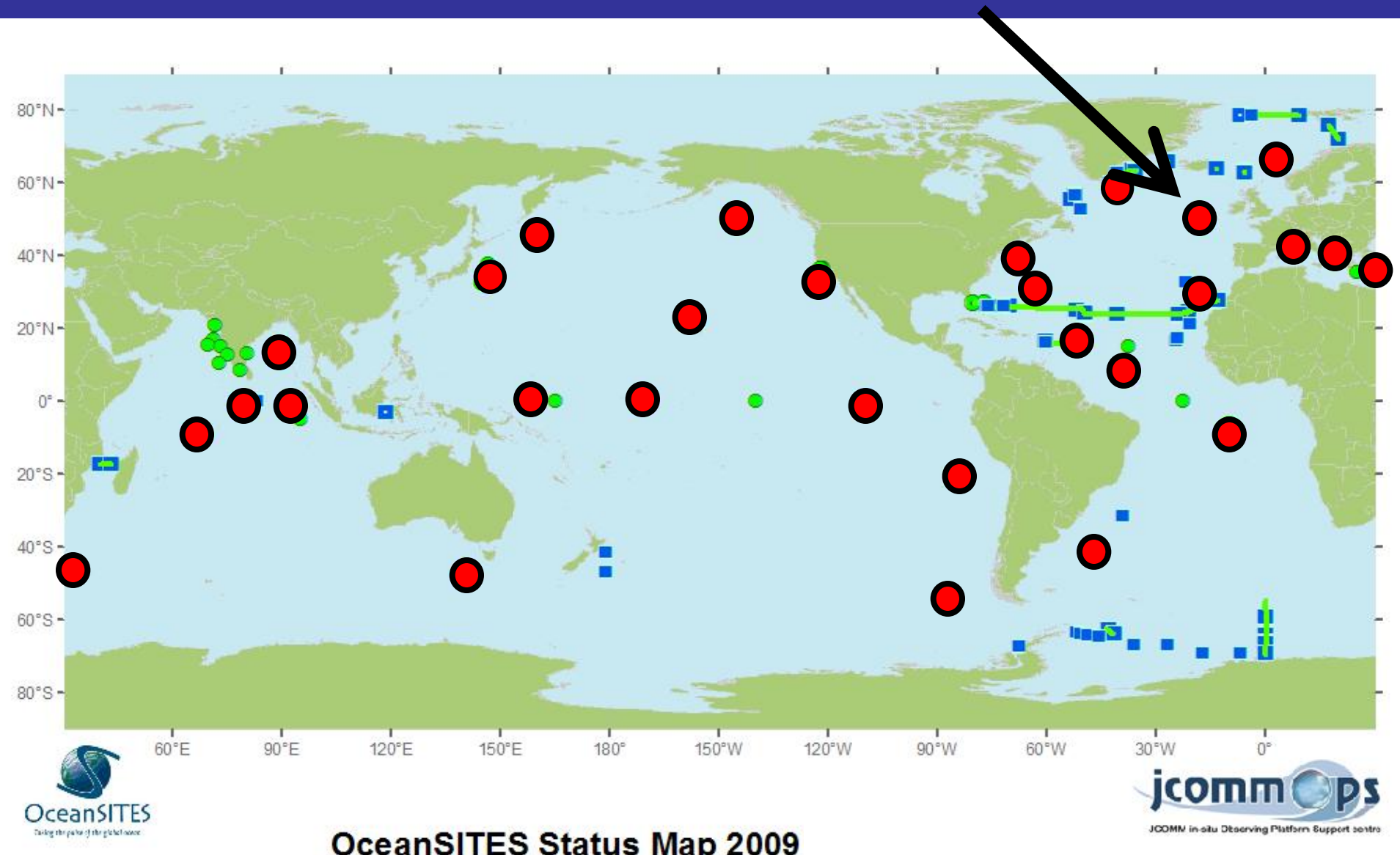


OceanSITES

jcommops

JCOMM in-situ Observing Platform Support Centre

OceanSITES Status Map 2009

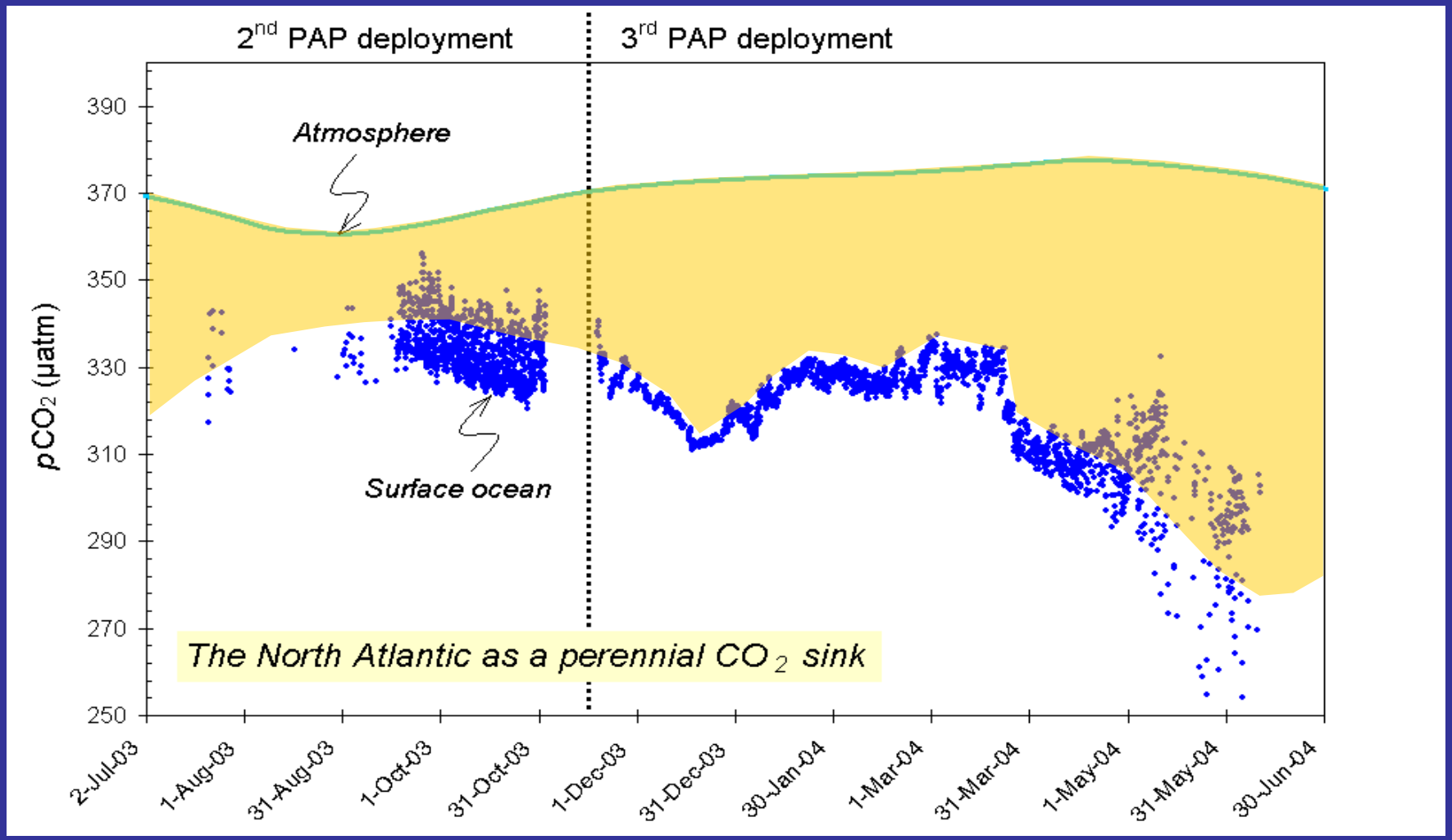


OceanSITES

jcommops
JCOMM in-situ Observing Platform Support Centre

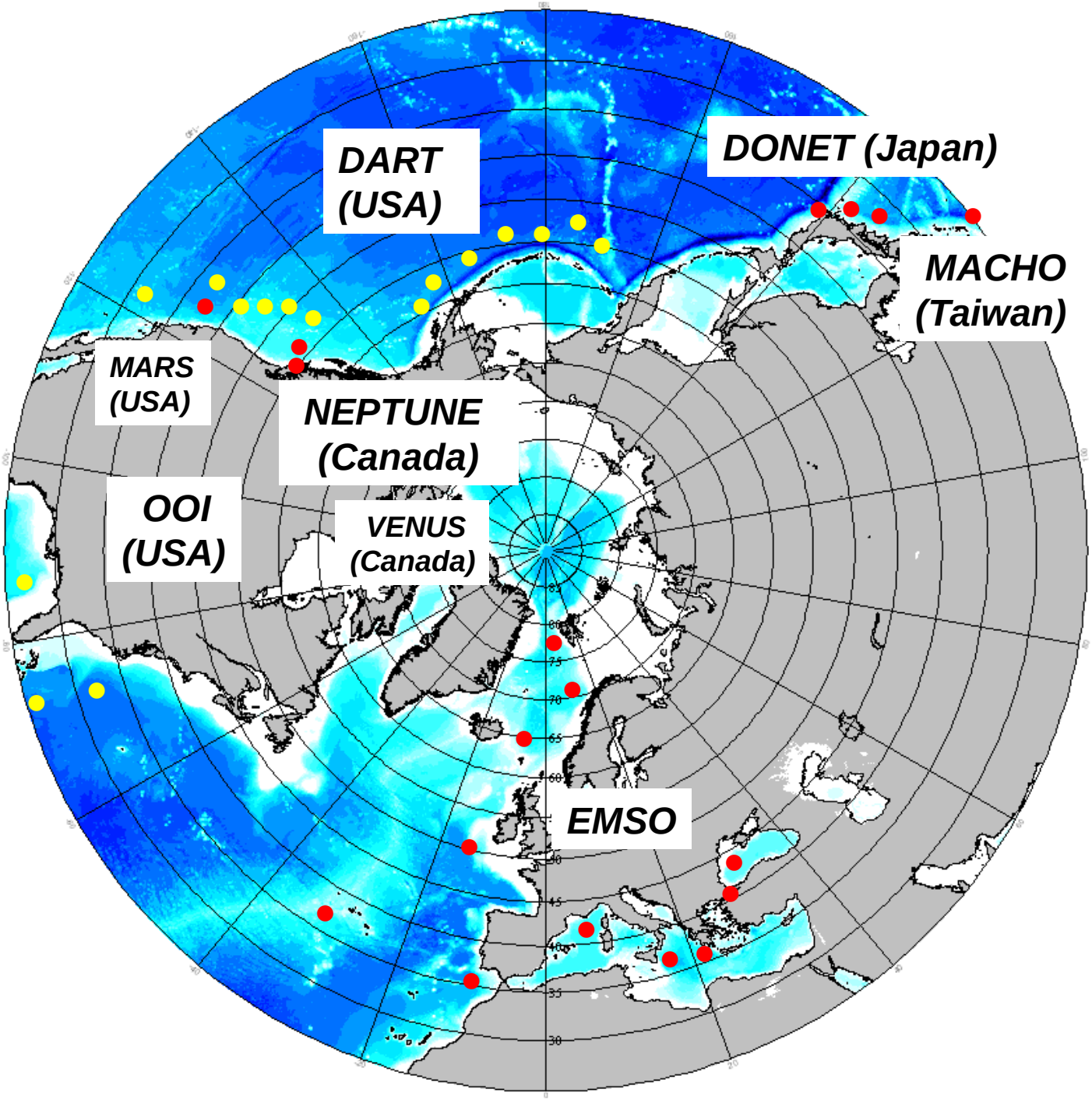
OceanSITES Status Map 2009

Surface PCO_2 at PAP (2003/2004)

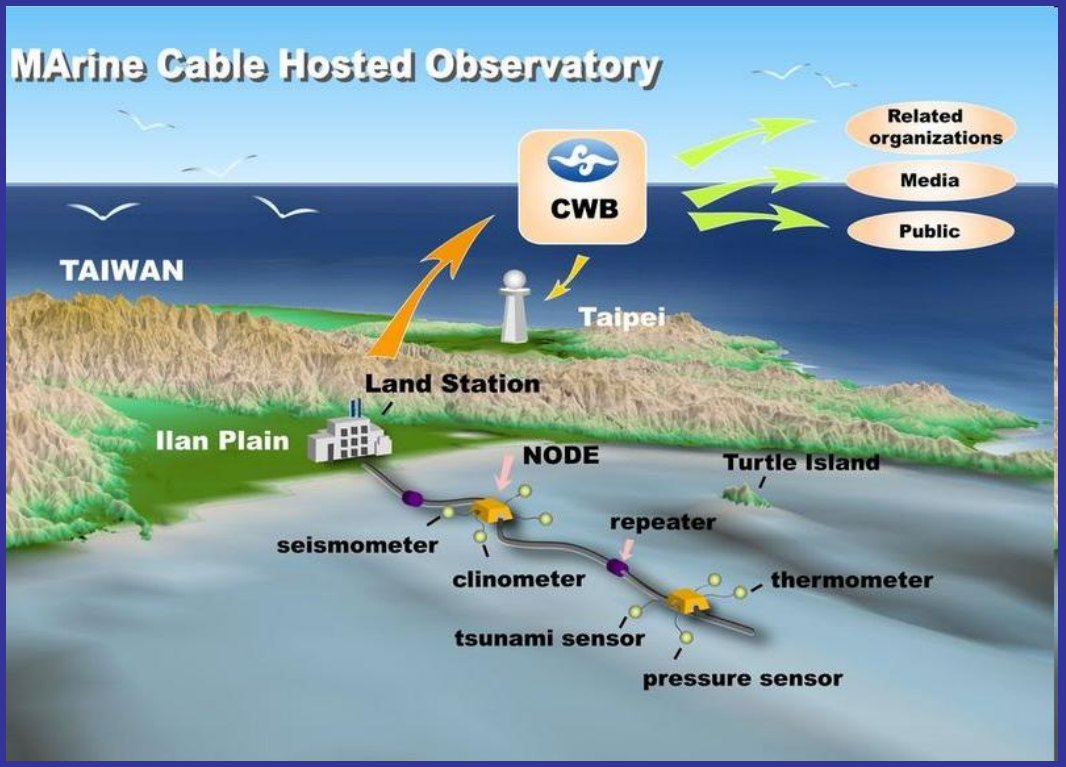


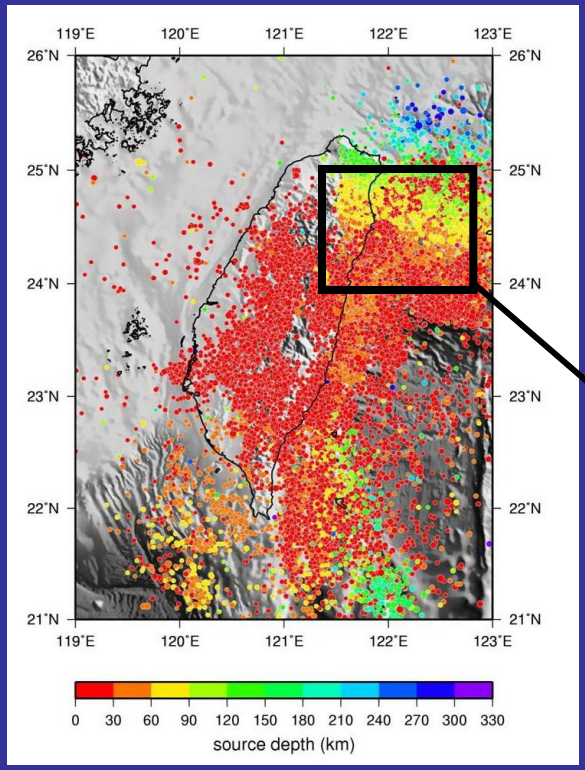
Körtzinger et al., 2008t

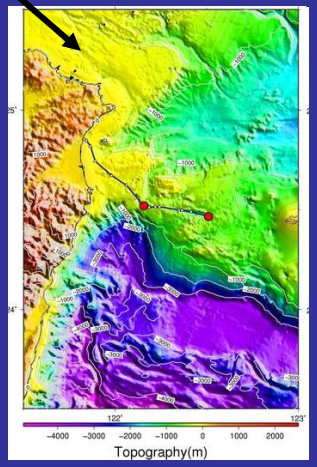
International Seafloor Observatories

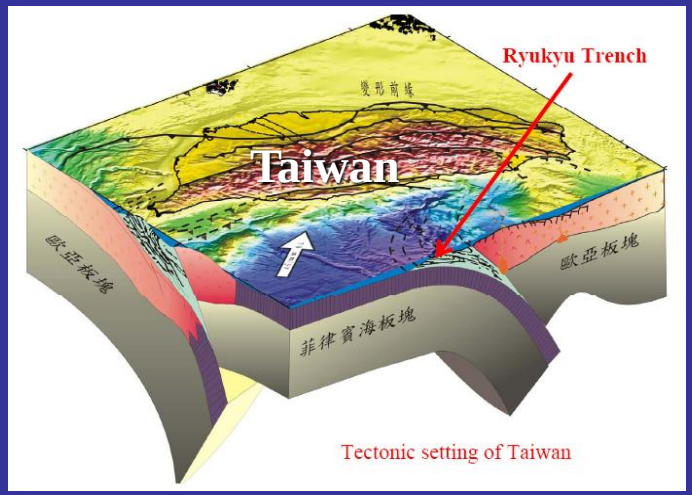


MACHO





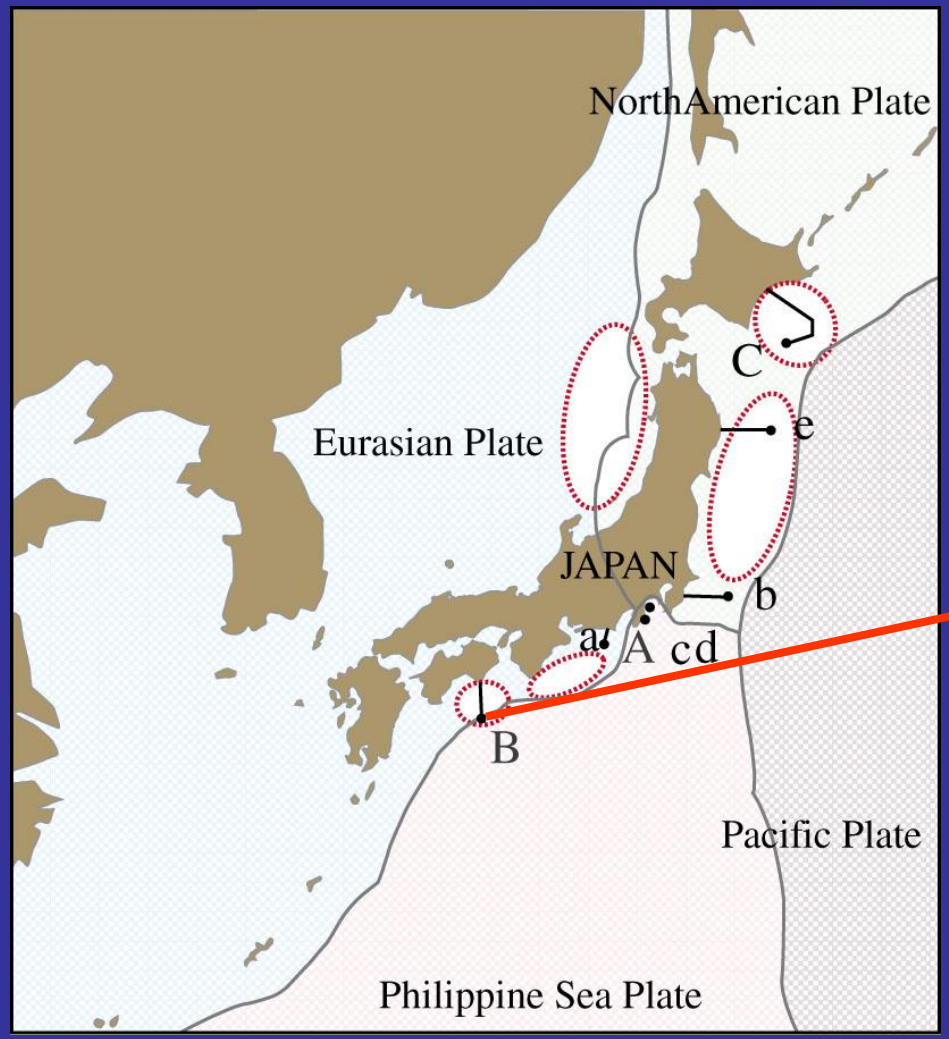


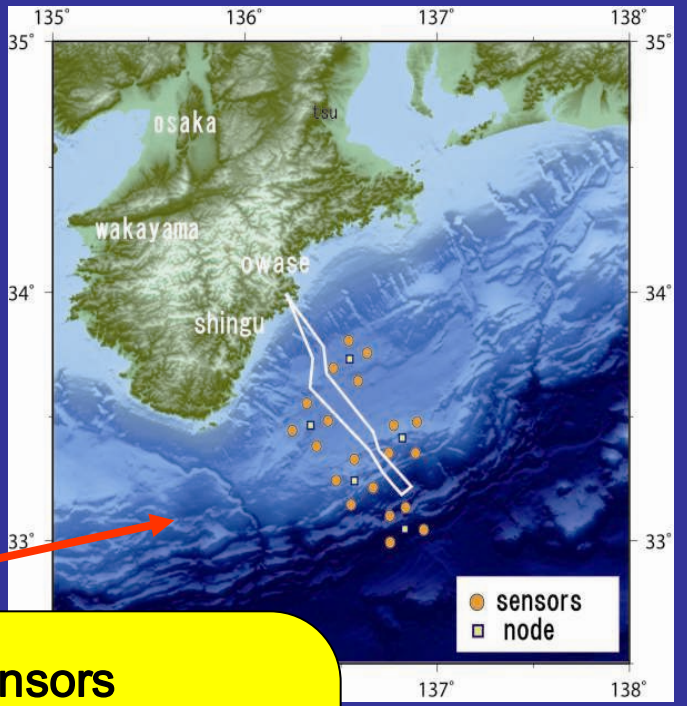


1999-2004 M ≥ 3

http://macho.ncu.edu.tw/

JAMSTEC initiatives , the example of: DONET - Dense Oceanfloor Network system for Earthquakes and Tsunamis





Sensors

Broadband seismometers

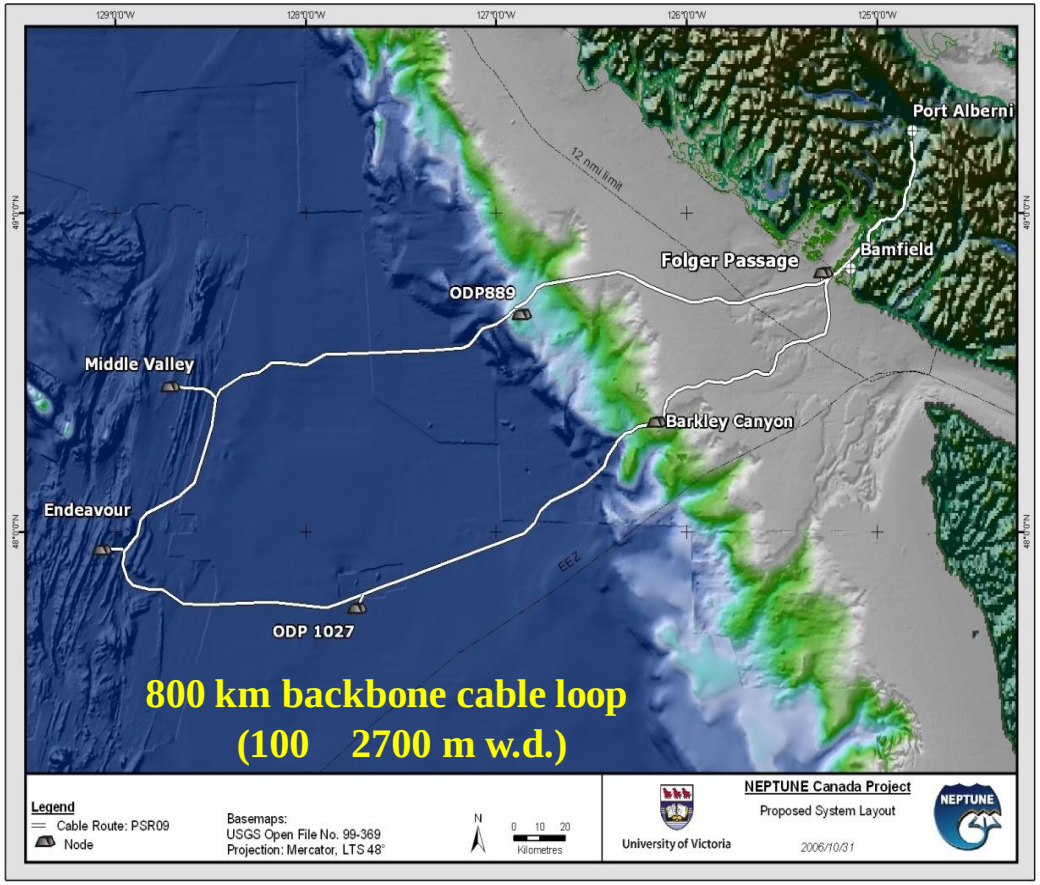
Accelerometers

Pressure gauges

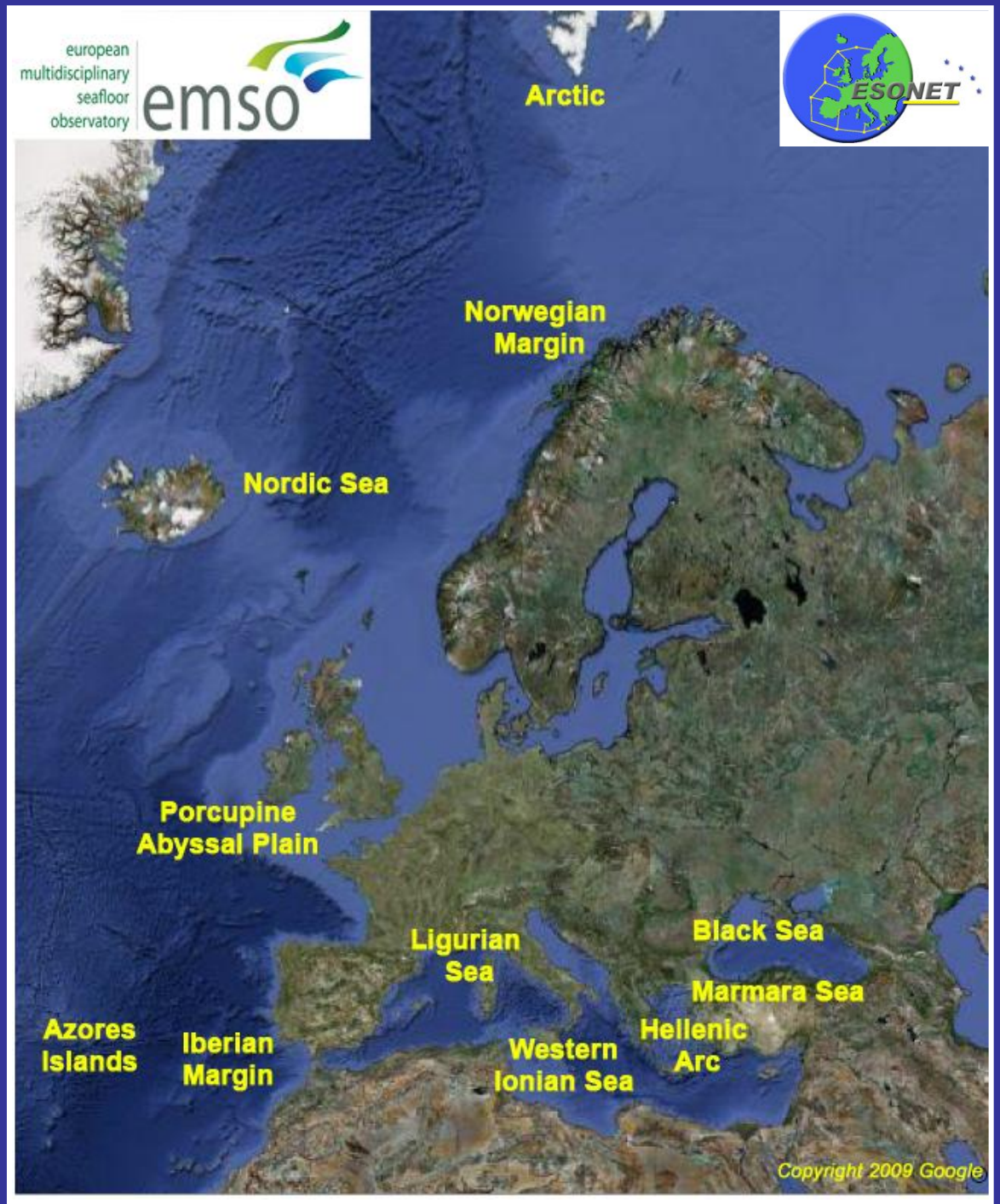
http:// www.jamstec.go.jp/jamstec-e/maritec/donet/

NEPTUNE Canada

North
East
Pacific
Time-series
Underwater
Networked
Experiments



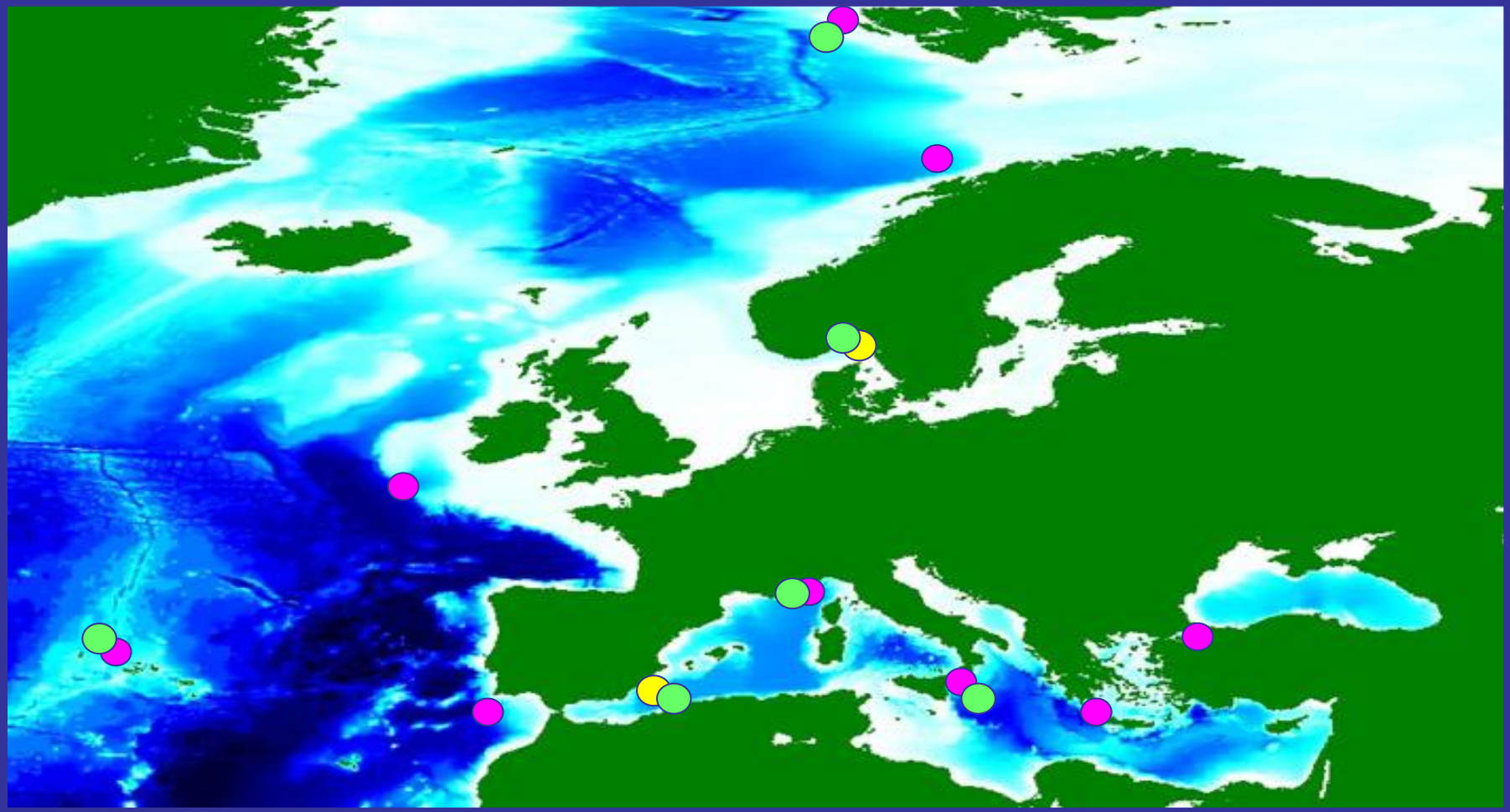
http://www.neptunecanada.com/



EMSO, a Research Infrastructure of the **ESFRI Roadmap (European Strategy Forum on Research Infrastructures)**, is the European network of seafloor observatories linked with ESONET-NoE

http://www.esonet-emso.org/

Advanced ESONET/EMSO sites

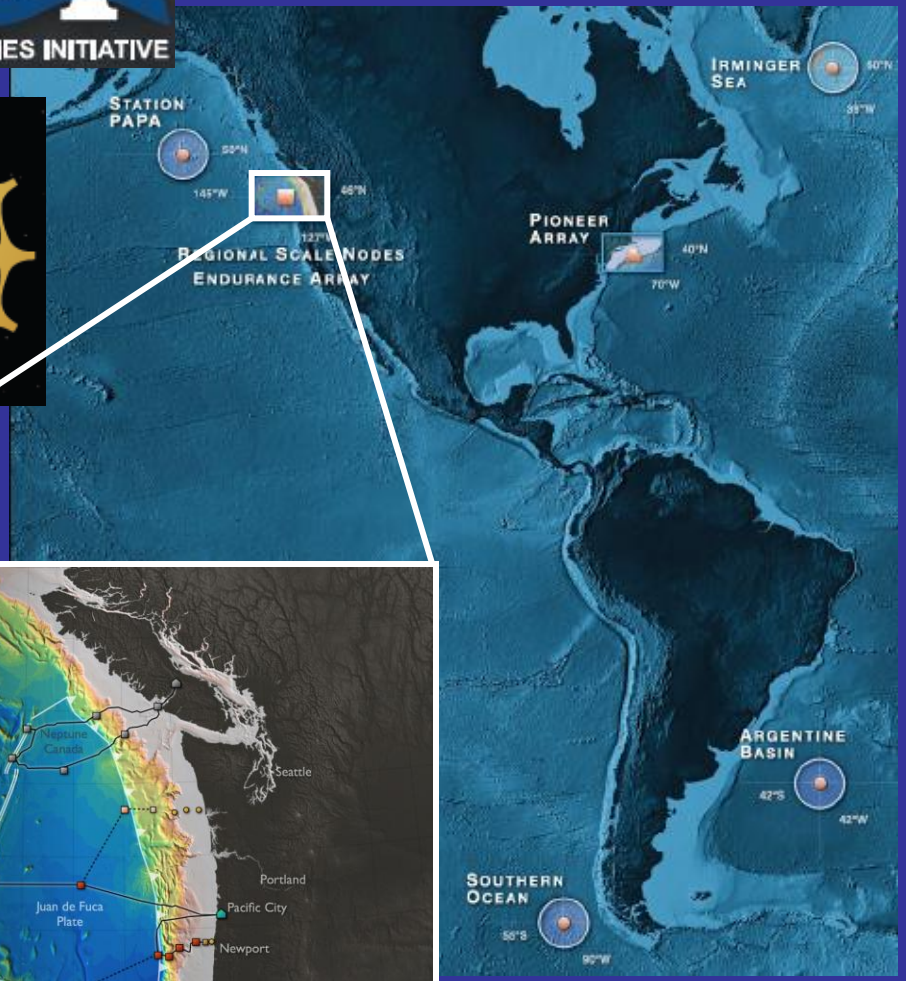


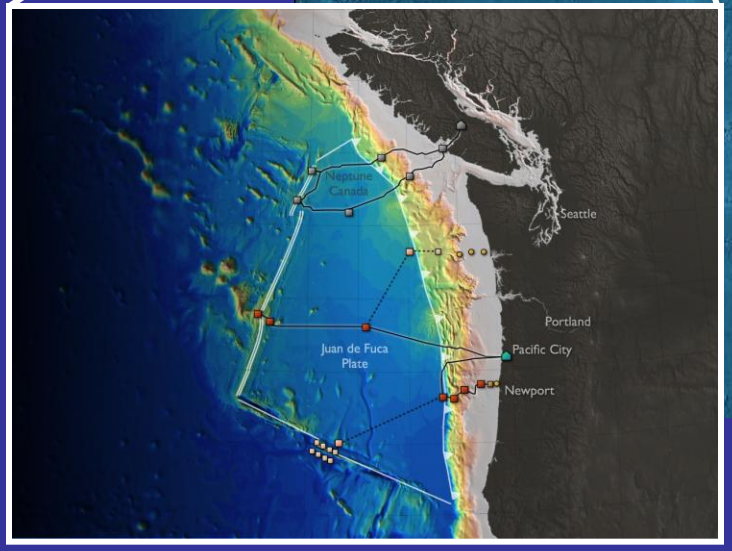
- Running S&T activities
- Permanent infrastructures
- Test sites (shallow water)

Ocean Observatories Initiative (USA)

OCEAN OBSERVATORIES INITIATIVE

NSF





OOI components:

1) **Global network of buoys**
2) **Regional Scale Nodes**
3) **Coastal**
4) **Cyberinfrastructure, connecting & coordinating the 3 OOI**

http://www.oceanleadership.org

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Goals

- Novel scientific achievements
- Technological innovation
- Data harmonisation and quality control so that all data is in the public domain immediately after collection
- Develop links with data users: modelling, operational and civilian communities, etc.
- Outreach so that the public and funding bodies use and appreciate the value of observatories

Vision

- The overall vision is to develop a global system of multidisciplinary and interdisciplinary sustained observatory networks

- Integrate and enhance the existing infrastructures

- With expansion of observatories in critical, representative locations in particular environments