ESONET
A NETWORK NOT ONLY FOR SCIENTISTS

Jean-François Rolin – IFREMER

Grateful to all the active participants to ESONET NoE

ITU Green Standards week
Rome
September 2011
Societal need for improved understanding of climate change, anthropogenic impacts, and geo-hazard warning drive development of ocean observatories in European Seas

Progress in Oceanography running header:
Open-Ocean Observatories in Europe

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Research Questions

- How can monitoring of factors such as seismic activity, fluid pore chemistry and pressure, and gas-hydrate stability improve seismic, slope failure, and tsunami warning?
- To what extent do seabed processes influence ocean physics, biogeochemistry, and marine ecosystems?
- How are physical and biogeochemical processes that occur at differing spatial and temporal scales related?
- What aspects of physical oceanography, biogeochemical cycling, and ecosystem function will be most sensitive to climatic and anthropogenic change?
- What are the factors that control the distribution and abundance of marine life and what will the influence of anthropogenic change be?
- Will there be important feedbacks of potential ecological change on biogeochemical cycling and ecosystem function which require policy intervention to avoid costly outcomes?
- How can industries using marine resources work in a more sustainable way and better respond to accidents?
Transformative Ocean and Earth Science

Socio-economically important topics which cross-cut the outlined science areas include themes spanning numerous spatial and temporal scales such as:

- Natural and anthropogenic change
- Interactions between ecosystem services, biodiversity, biogeochemistry, physics and climate
- Impacts of exploration and extraction of energy, minerals, and living resources
- Geo-hazard early warning capability for earthquakes, tsunamis, gas hydrate release, and slope instability and failure
- Connecting scientific outcomes to stakeholders and policy makers

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We recommend that regulations be considered which require *in situ* monitoring in areas of industry activity. Fishing, mineral and hydrocarbon exploration and extraction can have long-term impacts on the seabed and in the water column, especially in the case of accidents.

Policies to enable sustainable industrial activity are maturing and here we highlight both need and potential for improved monitoring related to the hydrocarbon industry.

- Industrial operations in the deep sea lack independent human witnesses.
- Open access observing systems to monitor industrial activity provide a means to increase the ability to understand and verify impacts.
- It is now feasible for future industrial operators to install real-time observing and sensing systems at appropriate locations around the area of potential impact.

Scientists developed this idea, supported by the ESONET assembly.
« Any country which can afford it should invest in observing the ocean for the long term » (John Delaney)

Let’s start with generic sensor packages

<table>
<thead>
<tr>
<th>Type of sensor</th>
<th>Range†</th>
<th>Accuracy†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conductivity</td>
<td>0 to 9 S/m</td>
<td>0.001 S/m</td>
</tr>
<tr>
<td>Temperature</td>
<td>-5 to +35°C</td>
<td>0.01 K</td>
</tr>
<tr>
<td>Pressure</td>
<td>0 to 600 bar</td>
<td>0.1 % FSR</td>
</tr>
<tr>
<td>Dissolved oxygen</td>
<td>0 to 500μM</td>
<td>5%</td>
</tr>
<tr>
<td>Turbidity</td>
<td>0 to 150 NTU</td>
<td>10%</td>
</tr>
<tr>
<td>Currents</td>
<td>0 to 2 m/s</td>
<td>2%</td>
</tr>
<tr>
<td>Passive acoustics</td>
<td>50 - 180 dB re 1 μPa</td>
<td>+/-3dB</td>
</tr>
</tbody>
</table>

### Variable

<table>
<thead>
<tr>
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<th>Geosciences</th>
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<th>Biogeochemistry</th>
<th>Marine Ecology</th>
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<tbody>
<tr>
<td>Temperature</td>
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<tr>
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<td>X</td>
</tr>
<tr>
<td>Dissolved O₂</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Turbidity</td>
<td>X</td>
<td>X</td>
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<td>X</td>
</tr>
<tr>
<td>Ocean currents</td>
<td>X</td>
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Specific Sensors/Parameters/Instruments

Seismic motion
Geodesy and Seafloor deformation
Gravity
Magnetism
Fluid related processes monitoring
Chemical and aqueous Transport (CAT)
Pore pressure
FluSO
Gas hydrate monitoring
Dissolved Fe, Mn and sulfide species
Particle flux
Acoustic tomography
Photosynthetically active radiation (PAR)
Specialized hydrothermal vent CTs
Methane
Hydrocarbons

pH, Eh, and alkalinity
Nutrient analyzers
Particle flux
Image based particle flux
Pigments
In situ Mass spectrometer
Osmosampler
Deep biosphere
Line-scan imaging
Holographic imaging
Video
Planar lasers and thin light sheets
Active acoustics
Zooplankton sampling
Flow imaging of particles & plankton
Molecular probes
In-situ respiration

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Legend:
3 - Technical supervision infrastructure
6 - Land sea communication segment – Satellite communication
7 - Buoy (node)
8 - Acoustic telemetry - Branch extension of the network
9 - Junction box
10 - Link to instruments
11 - Individual instrument

Stand Alone Acoustic

Stand Alone Umbilical Observatory (design phase only)
The research infrastructure case

- ESONET was successful in supporting the ESFRI project EMSO for a Preparatory Phase.

- Whereas ESONET prepares the community and the technical specifications of ESONET-EMSO observatories, EMSO works at implementing them, preparing the legal context of the infrastructure and legal bodies and looking for funding at national and international levels.

- From 2008, the two projects were coordinated. The two agendas have been synchronised and ESONET NoE has produced deliverables to EMSO (such as implementation plan).

- The difference between an infrastructure (EMSO) and “science as usual” is now well understood and promoted.
1 - LABEL DEFINITION AND IMPLEMENTATION
1.1 Definition
1.2 Rules applied
1.3 Attribution of the Label
1.4 Control of the label
1.5 Protection of the Label
1.6 Update of the label
1.7 Mitigating measures

2 - INFRASTRUCTURE
2.1 Recommendations on power
2.2 Connectors
2.3 Recommendation on stand alone observatories
2.4 Recommendations on materials

3 - GENERIC AND SCIENTIFIC MODULES
3.1 Generic Sensor module
3.2 Standard interface for scientific modules
3.3 Metrology issues
3.4 Redundancy and time overlap
3.5 Specific instrumentation

4 - QUALIFICATION AND TESTING
4.1 Define a life cycle of the equipment
4.2 Define the list of equipment parts to be tested
4.3 Define the type of tests to be performed
4.4 Define the needed testing facilities
4.5 Test archiving
4.6 Documents references

5 - DEPLOYMENT AND MAINTENANCE
5.1 Plan for deployment
5.2 Deployment methods
5.3 Equipment deployment
5.4 Maintenance
5.5 Standards that can be applied for deployment
5.6 Documents References

6 - DATA MANAGEMENT
6.1 Data policy access
6.2 Recommendations for ESONET sites data
6.3 Recommendations on interoperability
6.4 Recommendation on YellowPages
6.5 Documents References

7 - ENVIRONMENTAL IMPACT

8 - ESONET GLOSSARY

September 2011
ESONET is recommending the following points concerning data policy access:

1.0 Free and open access according to Aarhus Convention on environmental data as expressed by IOC Data Policy (International oceanographic Commission UNESCO) programmes is applied for basic data, especially the data requested for risk assessment in real time and delayed mode (mandatory).

2.0 Registration of users is highly recommended for downloading taking into account the protection of individuals as defined by Directive 95/46/EC and Regulation No 45/200 (optional).

3.0 Experimental data should follow classical scientific confidentiality rules: no more than 2 years restriction. A low resolution data set such as a display of images is proposed to the public in the meantime (recommended).

4.0 Data classified for security and environment protection reason, and other exceptions as defined by the INSPIRE directive and the Directive 2003/4/EC (on public access to environmental information), must at least be stored and be available as soon as they are declassified. Access to classified data will be granted on request to agreed scientists (mandatory).

5.0 Access to citizens is facilitated by implementation of specific tools (recommended).

6.0 Long term archiving (more than 20 years) policy and implementation has to be performed for all types of data, including classified data. Archived datasets should be citable with a mention of the observatory network (mandatory).

7.0 This archiving is assumed by data centres complying with Esonet data management plan and standards (recommended).

8.0 Training should be provided to the various levels of staff handling subsea observatory data (recommendation).

The use of a sensor registry is recommended (mandatory for a new infrastructure). It means the registration of sensors in an open standard machine- and human-readable format.
EsonetBremen meeting, January 2008

**services**

- discovery
- viewing
- download

**data centre**
- archiving

**local centres**
- processing

**observatory**
- data logging

**data capture**
- monitoring
  - Conversion to physical units
  - Communication

**QC policy**
- Define data domains
- In-situ time series, profiles
- Bio samples
- Picture
- Video
- Acoustics
- Geo-physical
- Fluxes

**data management council**
- certify data centres and observatories

**emso data portal**
- pangea, ifremer, ingv

**data centre**
- Marmara Sea EMSO

**data centre**
- SeadataNet
- QC manuel

**local centres**
- AFAD and ITU

**observatory**
- SBOx, P1, ...

**users**

- interoperability: geoss

**example**

Data warehouse (sensor registry)

**standards**

- OGC wcs wfs
- OpenDAP
- Web services
- SeadataNet
- QC Manuel
- SensorML

**other projects**

- interoperability: geoss

**Civil protection authorities, population warning**

**Autonomous Instruments time series**

**Civil protection authorities, population warning**

**Autonomous Instruments time series**
The complexity of European Commission Research programming may give birth to an enthusiastic achievement.

Inheritance and complementarity

ESONET CA (the concept)
ESONIM (the Celtnet example)

EMSO infrastructure detailed engineering
EMSO infrastructure construction

Multidisciplinary project consortia clusters
Geostar, Exocet/D, Alipor, …; Omarc, Assem /Orion, …

Core service Workshop
Core structure contract
Decision on sites

All Regions Workshop 1
All Regions Workshop 2
Core service Workshop

ESONET NoE (the team and the tools)

User community ESONET-Vi the vision

Legal bodies
Esonet groups
Esonet LABEL

Year 1
Year 2
Year 3
Year 4

All Regions Workshop 1
All Regions Workshop 2
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Final report

ESO NET PP (the plan and the solutions)

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ESO NET PP (the plan and the solutions)
ESONET Vi

A meeting “After ESONET NoE” held in December 16th 2010 defined an ESONET-Vi (Vi standing for “vision”).
The consortium agreement includes 4 working boards:
1- ESONET label
2- Scientific Council
3- Data management
4- Animation including website, Yellow Pages and Outreach
A steering committee will be formed with representative (s) from each board.

Esonet Vi is open to users, owners, stakeholders of fixed point subsea observatories
Thank you for your attention