

European Parks et Projets



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European OBS Parks

- 10 parks in 6 countries
 - 2 Germany, 3 France, Spain, UK, Italy, Portugal
 - New parks planned in Denmark (funded), Poland
- 389 OBSs
 - 9 Broadband (seismometer out to at least 120 s at -180 dB)
 - 127 Wideband (seismometer typically 40-60 s, or 120s "compact")
 - 163 can be deployed for at least 1 year
 - Of which 88 wideband and 9 broadband



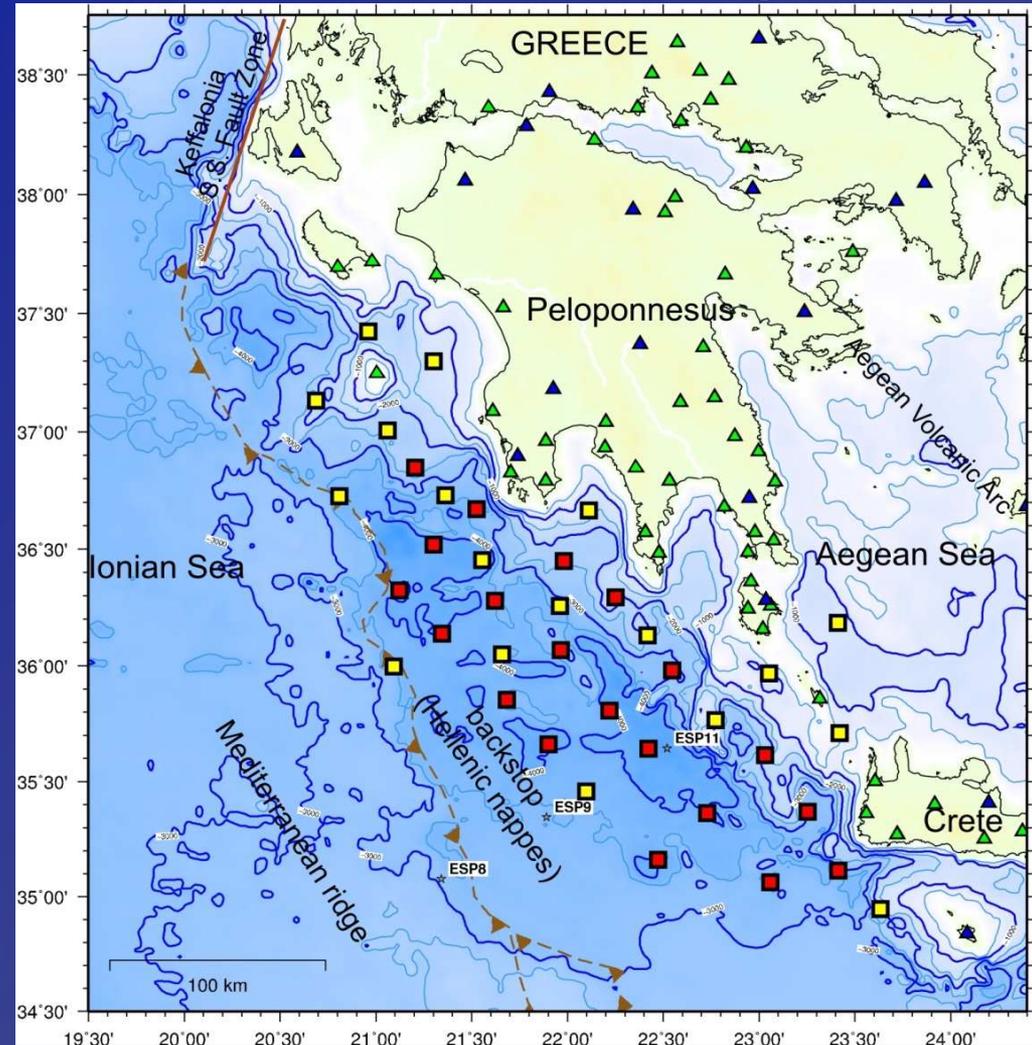
OBS Park resources by country

Country	OBS	Broadband	Wideband	>= 1 year
Germany	160		77	~120
France	141	9	20	9
UK	50		15	
Spain	20		3	20
Portugal	10		4	6
Italy	8		8	8

Several collaborative efforts already

HELLENIC (2006-2008)

- Goals
 - Site of major historical EQs
 - Relocate seismicity
- Multinational
- Instruments
 - 5 OBS pilot experiment in 2006
 - 37 OBS + 30 landstations for 12 months in 2007-2008 (20 from GEOMAR and 17 from GeoAzur)



Several collaborative efforts already

NEAREST (2007-2008)

– Goals

- Structure and properties of potential tsunami sources
- Relocate and characterize local EQs

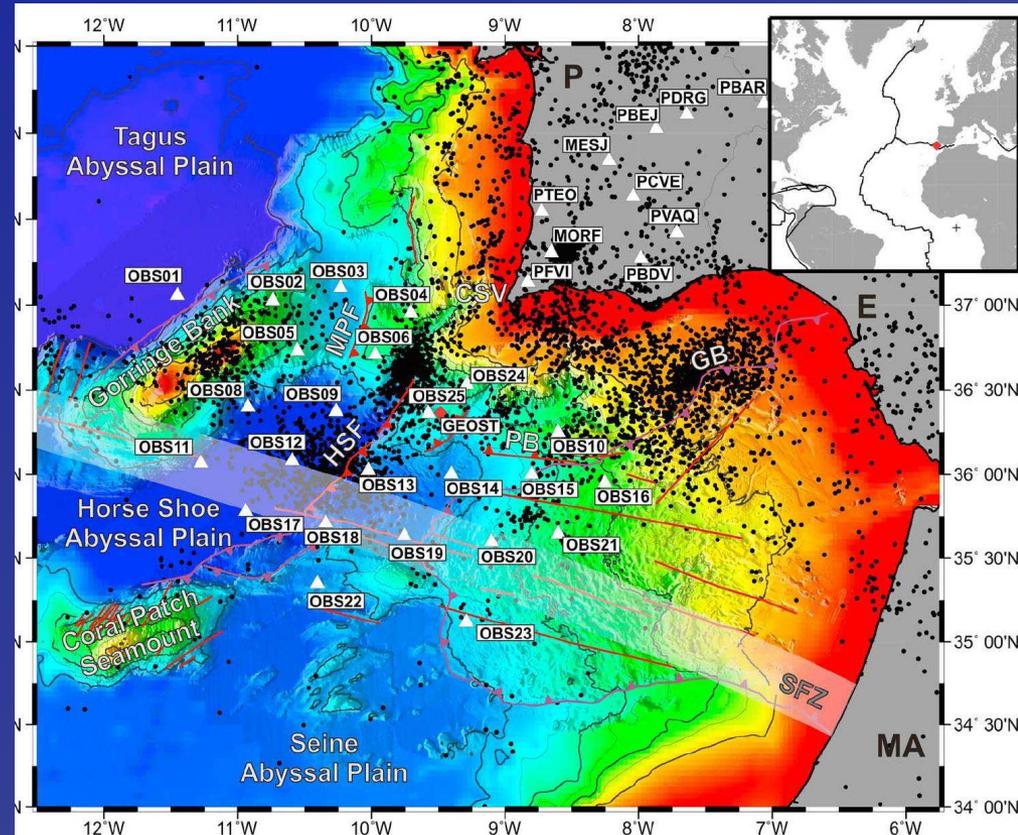
– Multinational

– Instruments (Passive)

- 24 AWI (Germany) OBSs for 11 months
- GEOSTAR station (Italy)
- Land stations in Portugal, Spain, Morocco

- Instruments (Active)

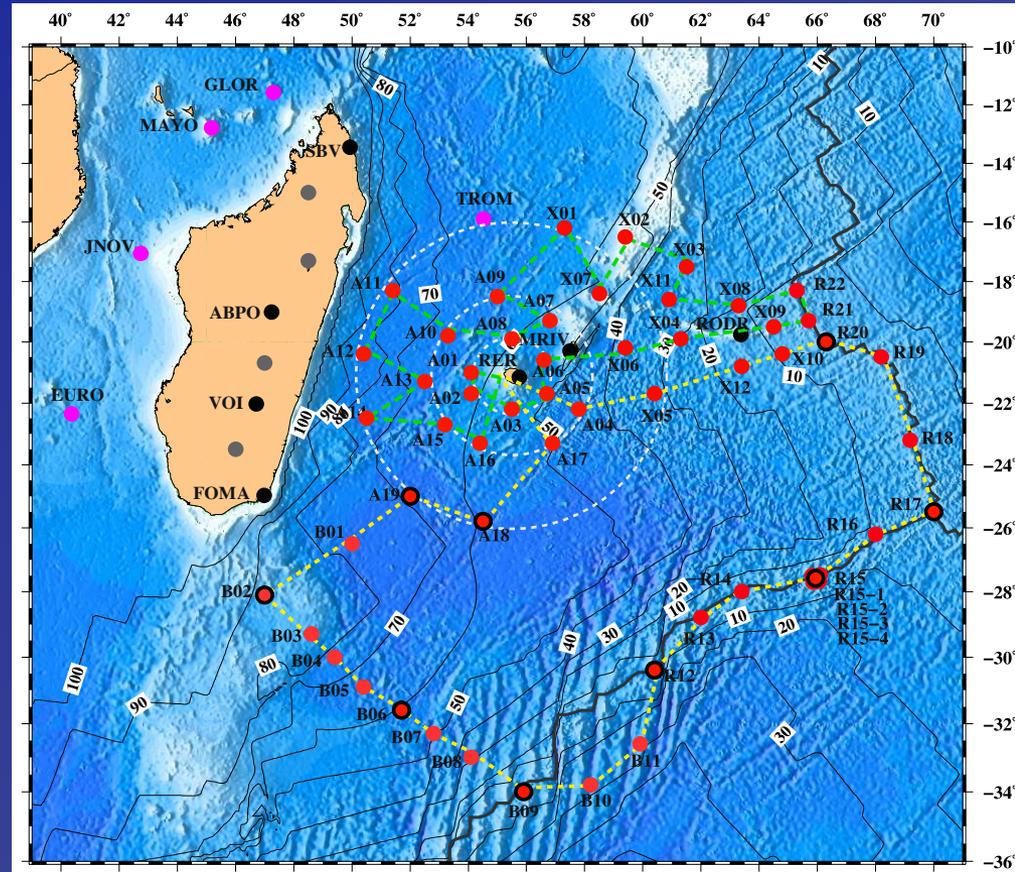
- 19 French-Ifremer-IUEM + 17 Spanish-CSIC OBSs
- Land stations in Portugal



Several collaborative efforts already

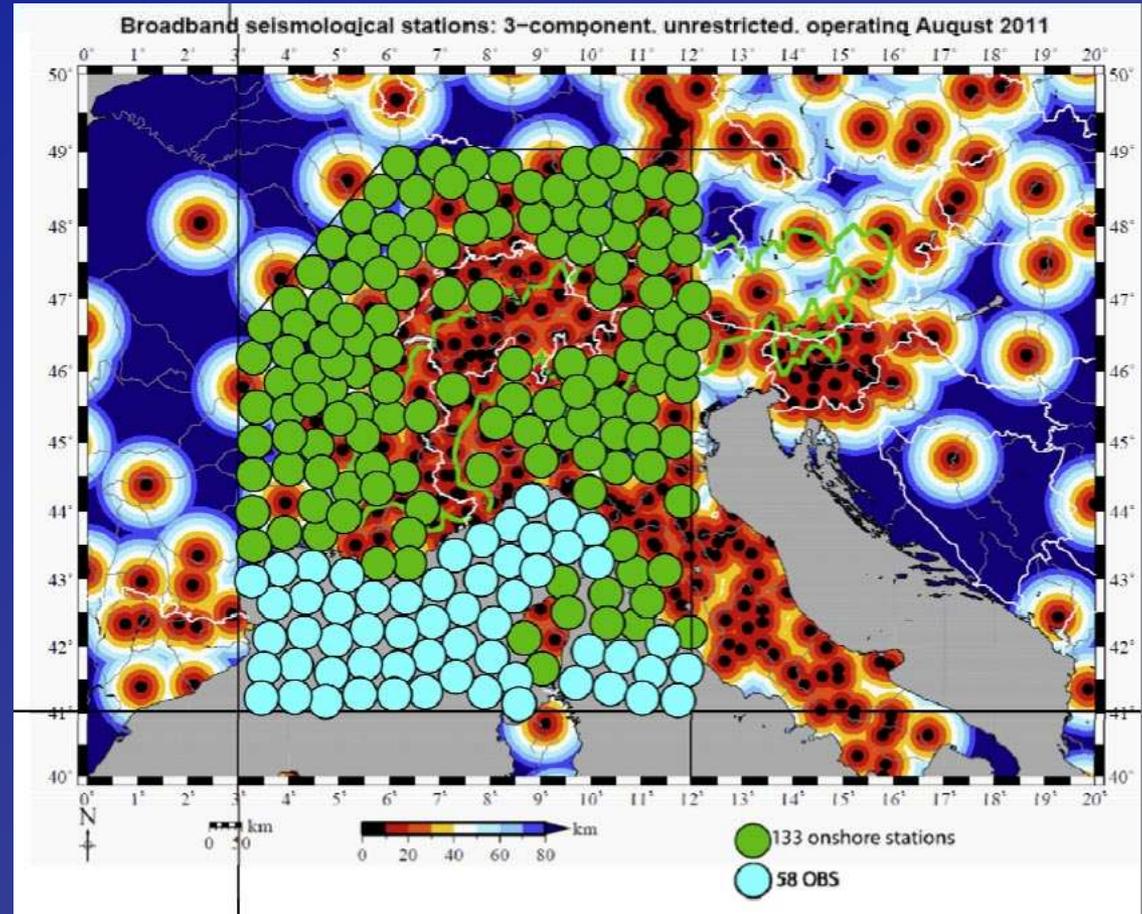
RHUM-RUM (2012-2013)

- Goals
 - Understand plumbing of Reunion hotspot and lithospheric changes around
- Multinational
- Instruments (Passive)
 - 48 wideband OBS AWI (Germany) + 9 broadband INSU (France)
 - 1 year deployment starting this september

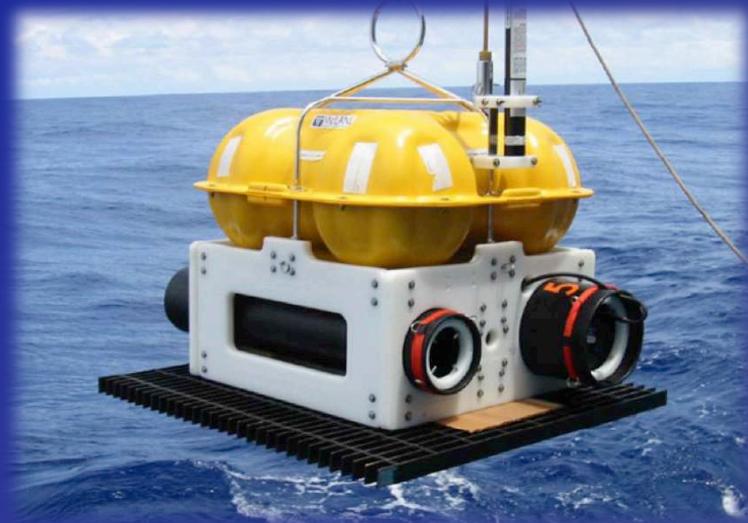


Future targets

- AlpArray
- Atlantic Lithosphere
- Subduction zones



Issues detected during collaborative work



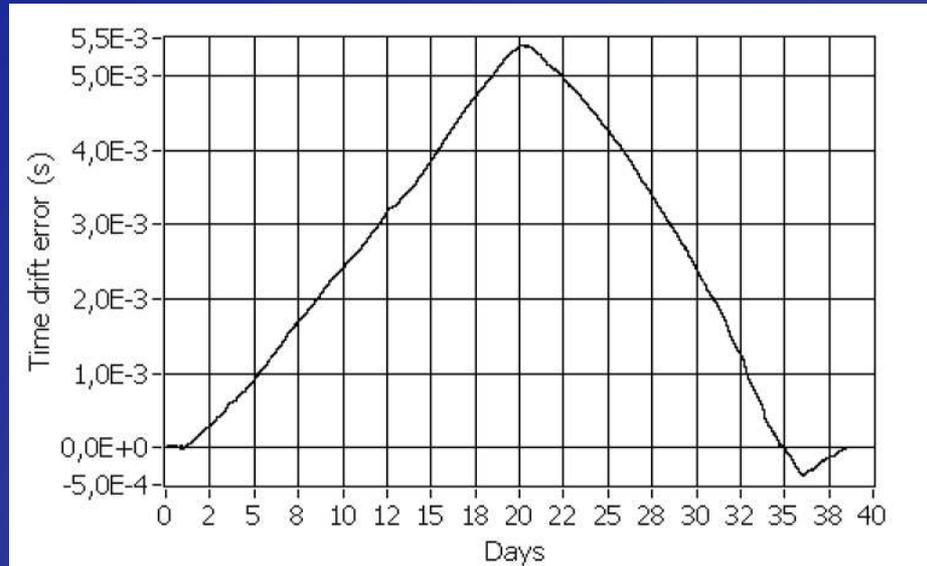
- Organizational
 - Need to request instruments and ship time; each country have different schemes for this
 - Each park has different usage rules, not always clear what they are!
 - Parks not easily accessible for outsiders in some cases
 - Data are saved in different formats
 - Data are often not available to data centers

Technical issues detected

- Technical

- Clock drift

- OBS have no clock synchronization during deployment, are synchronized before and after with a linear drift
 - Depending on clocks there can be problems regarding time or with whole-second jumps



- Noise

- Seafloor currents can create significant noise (5-10 Hz)
 - Some can be removed, some reduced using better mechanical designs
 - From ocean waves
 - Infragravity wave noise (<0.1Hz) can be removed with proper pressure measurements
 - Microseism noise (0.1-10Hz)

- Orientation

- Compasses deployed with the instruments are useless
 - Gyrocompasses expensive or inaccurate
 - Can orientate using seismic shots or directional information from teleseismic EQs

2012 European OBS Meeting

- Representatives of all the European OBS parks, and interested outside parties
- **White Paper** outlining goals for OBS park collaborations and what is needed to get there
- Set up a committee to help us there « Committee for the Harmonization of European OBS Parks (CHEOPS) »

Integrating Mobile European Plate Observing Systems: Seismology

Wayne Crawford, [Frederik Tilmann](#), Alex M. [Brisbourne](#) and the Committee for the Harmonization of European OBS Parks (CHEOPS)¹

Introduction

Mobile networks of seismometers are required to answer fundamental questions about the formation, structure and dynamics of the European plate and to evaluate important risks and resources. With the European plate surrounded on 3 sides by water and containing major seas, marine seismometers must be an integral part of this network. The efficient use of these instruments depends not only on their existence, but also on the ease of their access by the seismological community.

We propose actions to make marine seismographs more accessible to the seismological community. A major action is the standardization of methods for requesting these instruments and for providing the data. We also propose a framework for better communication between European parks, which should ease standardization and improve the quality and availability of instruments. This initiative falls within the EPOS (European Plate Observatory System) framework, complementing the EMSO (European Multidisciplinary Seafloor Observatory) initiative in the same way that land-based mobile instrument parks complement permanent stations.

Motivation

The last two decades have seen an explosion in the availability and quality of mobile seismological systems. Whereas, 20 years ago, a "detailed" regional study might consist of deploying 10, mostly short-period, seismometers for a few months, the same region can now be studied using hundreds of smaller, easier to use and more sensitive systems. Also, collaboration between countries and their instrument parks allow more instruments to be applied to one problem. These advances allow seismologists to image sections of the European plate with unprecedented resolution. A recent example is the IBERARRAY-PYROPE experiment, in which Spanish and French seismometer parks combined forces to study the structure beneath the Iberian Peninsula and Pyrenees mountain chain.

Marine seismograph stations, commonly known as OBS for "ocean-bottom seismometer", have similarly advanced. Whereas, 20 years ago, there were no more than 100 academic OBSs in the world, almost all of them short-period, there are now about 1000 such instruments, many of them large- or wide-band.

Many studies aimed at studying seismic hazard, mapping the potential for natural resources, or addressing fundamental geodynamic questions should use a combination of land-based and marine seismometers. This is particularly true for Europe, which is surrounded on three sides by seas and which contains great inland seas. Europe's greatest seismic hazards are centered close to these seas and its most important energy resources are on continental margins. Even many land-based regions, such as the Alpine

¹ [Mechita Schmidt-Aursch](#), [Valenti Sallares](#), [Antonio Pazos](#), [Giorgio Mangano](#), [Tim Henstock](#) and [Wayne Crawford](#)

Good practices

- Archive OBS data in a European or national seismological data center that can provide data over the web in a seismological standard format
- Develop and distribute tools for standard OBS data preprocessing (e.g., component orientation, clock verification, noise removal)
- Encourage openness about data collection success rates and problems. Develop tools to evaluate these parameters.
- Lobby for a single (or at least coherent) process for funding and ship time.
- Encourage rapid response / ship time mechanisms in countries with OBS parks.
- Hold yearly technical and/or organizational meetings between the parks

Action Plan - Today

- Commission for the Harmonization of European OBS parks(CHEOPS)
 - Educate the seismological community about availability of OBS experiments and resources needed to collect high-quality data
 - Identify the need for OBS in important scientific targets and make sure that OBS parks can respond to these needs
 - Integrate OBS parks into national and EU initiatives and structures
 - Create a EU-level infrastructure dedicated to improving and harmonizing EU OBS parks (OBS access, data quality and data access)
- Develop tools for putting data/metadata into data centres
- Collaborate with existing European initiatives
 - EPOS "Ocean Bottom Instruments" Working Group

Action plan - Tomorrow

- EU COST proposal for coordination
 - Technical meetings at each park
 - Engineer exchange program
 - Young Researcher Training
 - Community Workshops
 - Travel grants for OBS-specific processing articles
- Future EU proposal to implement data processing/storage
 - 2 engineers et un administrateur pendant 3 ans
 - Install standard data/metadata tools
 - Develop post-processing codes to be applied at data center level
 - Lobby national and European decision-makers for a simplified/clarified OBS and ship request format, rapid response protocol

Future developments

- Instrumentation
 - Move towards wideband or broadband sensors
 - Define standard acquisition package needs
- Technological innovation
 - Reduce seafloor current noise
 - (independently measuring tilt/rotation, optimize mechanical design)
 - Orient seismometer components
 - (gyrocompass experiments currently underway at AWI pool)
 - Data shuttles
 - (recovering data without recovering OBS)
 - Multiparameter measurements
 - (take advantage of recording infrastructure in a remote area to measure other parameters: tilt, currents, magnetic field, temperature, salinity...)
 - High sampling rates
 - (allow studies of marine mammals, other near biological activity and very near surface phenomena such as hydrothermal vent flow)



Conclusions

- Equipment is there
 - 389 OBS
 - 97 broadband or wideband that can be deployed for at least one year
 - Collaborative efforts already even if they are in 10 parks with different rules
- Need organization
 - Data output needs to be standardized, put into seismological databases
 - Processing needs to be improved/harmonized
 - Ship/instrument requests need to be easier and more uniform
 - Collaboration in OBS development
- Need European-level funding
 - The countries/OBS parks won't do it by themselves

