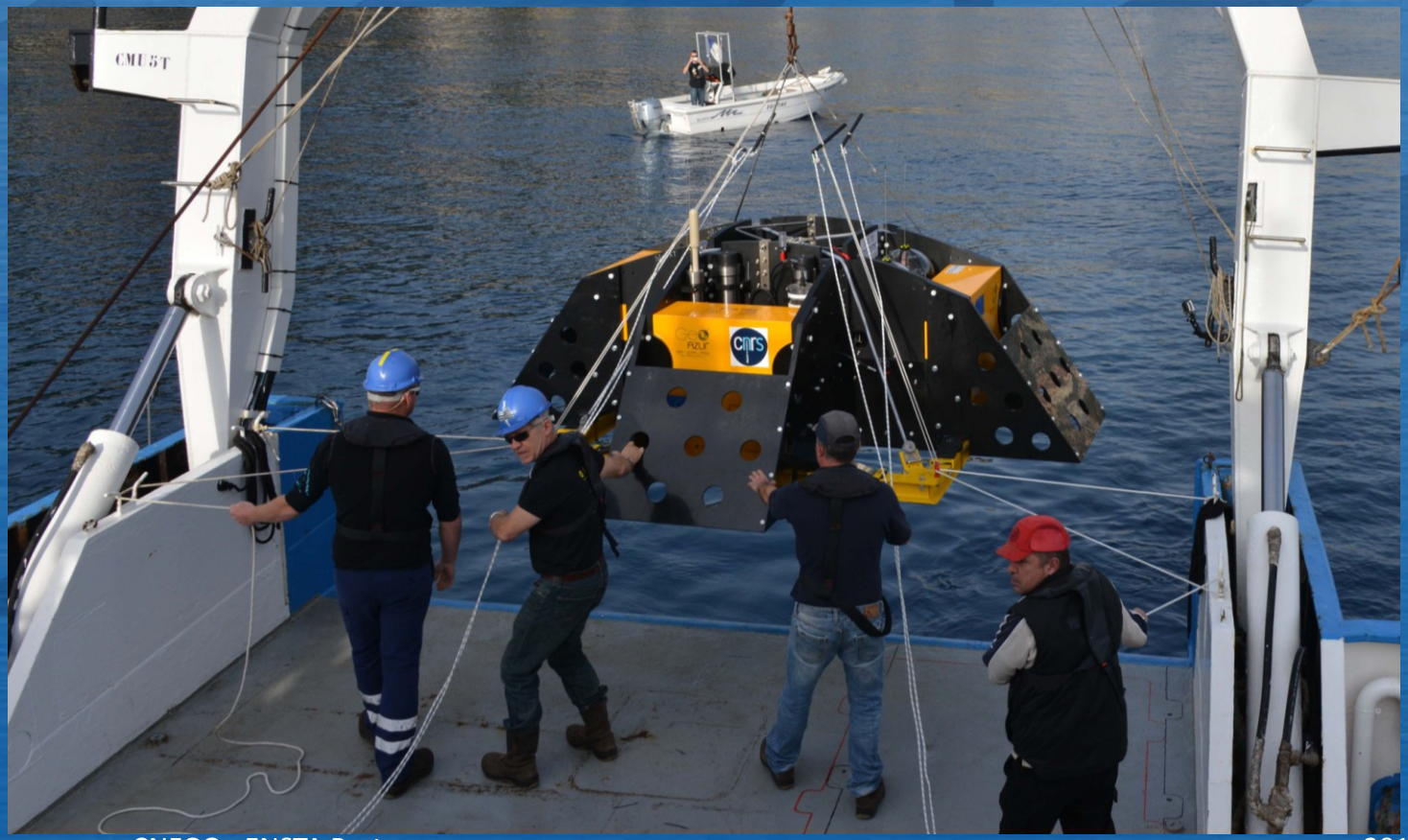
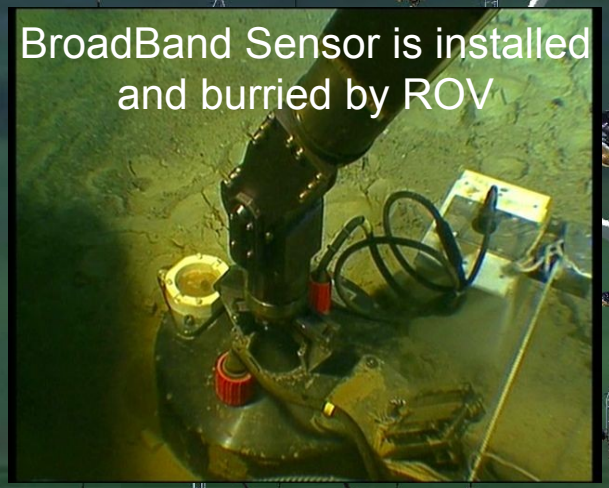
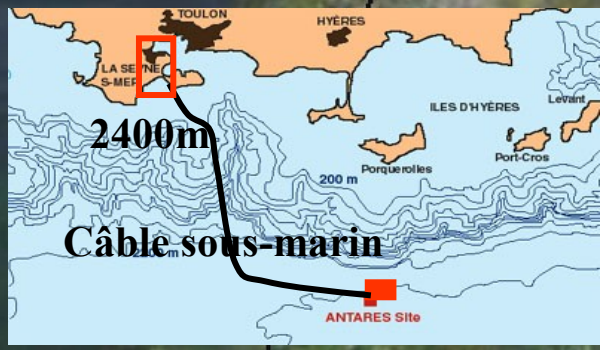
MUG-OBS - Multiparameter Geophysical Ocean Bottom System

- A new instrumental approach for monitoring earthquakes.



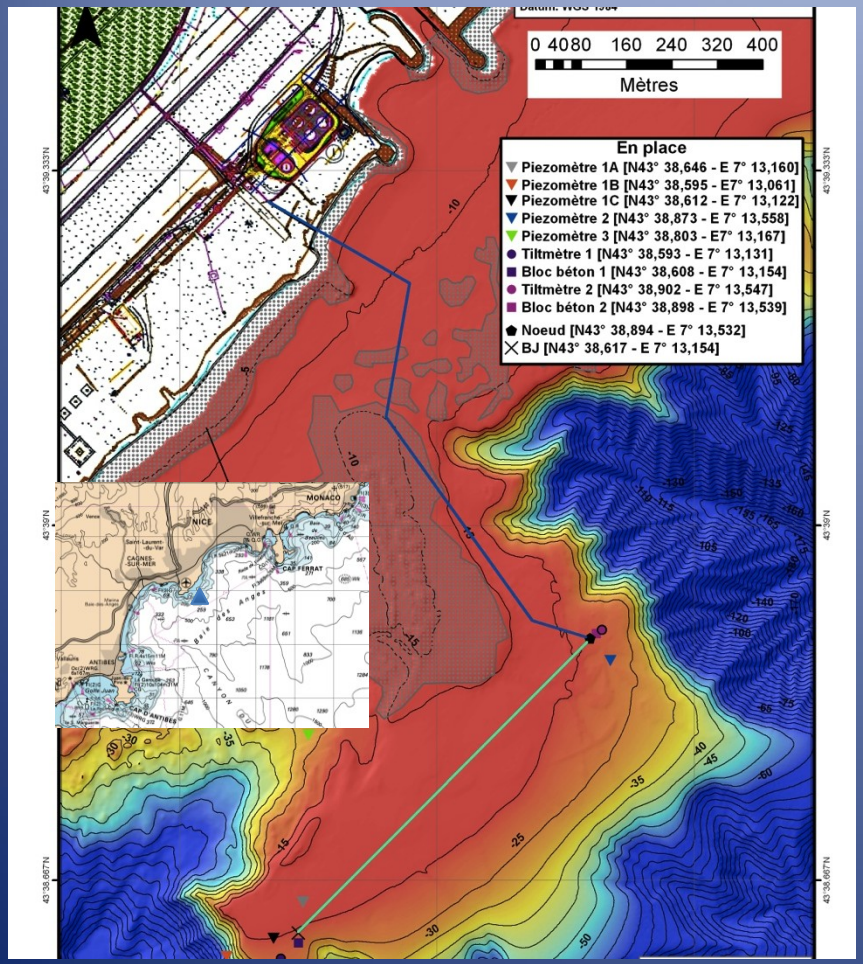
Real time cabled OBS are part of larger Observatories (Donet/Neptune), installed on limited sites – Installation is heavy and expensive.

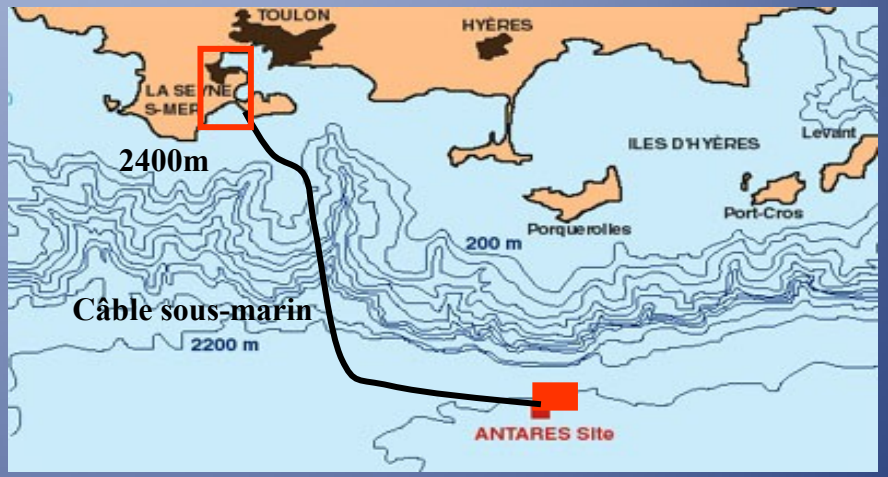


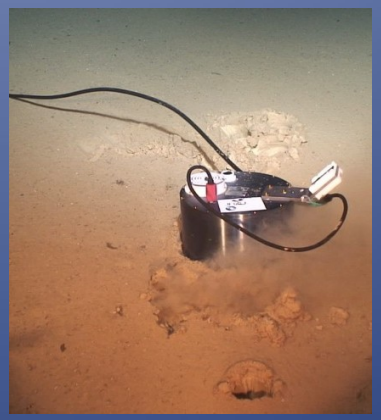


Coopération GéoAzur, OOV, UCA, CPPM, IFREMER

Real Time two Broadband Cabled seimometer in Mediterranean







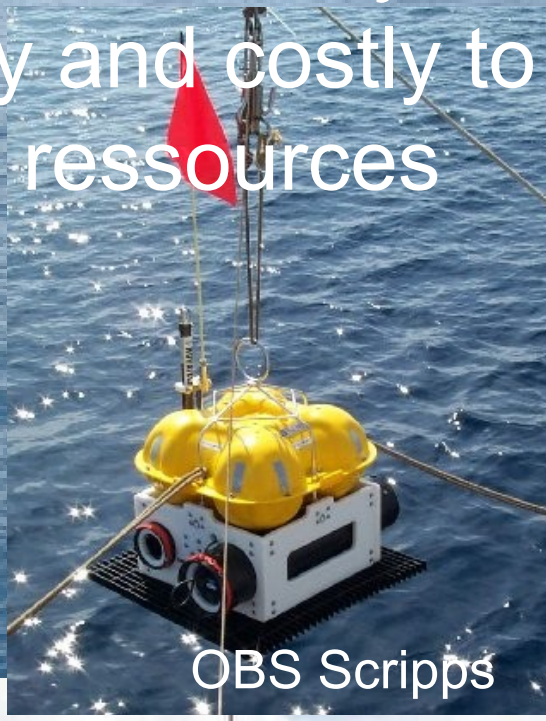
CMG3T/5T Guralp Broad Band

OBS – Short Term Network, few months to a year or two with no control of data quality and costly to operate in shiptime and human's ressources

Hippocampe-Geoazur

MicrOBS Ifremer

An attempt to isolate the Broadband sensor from the chassis for a better coupling and response.



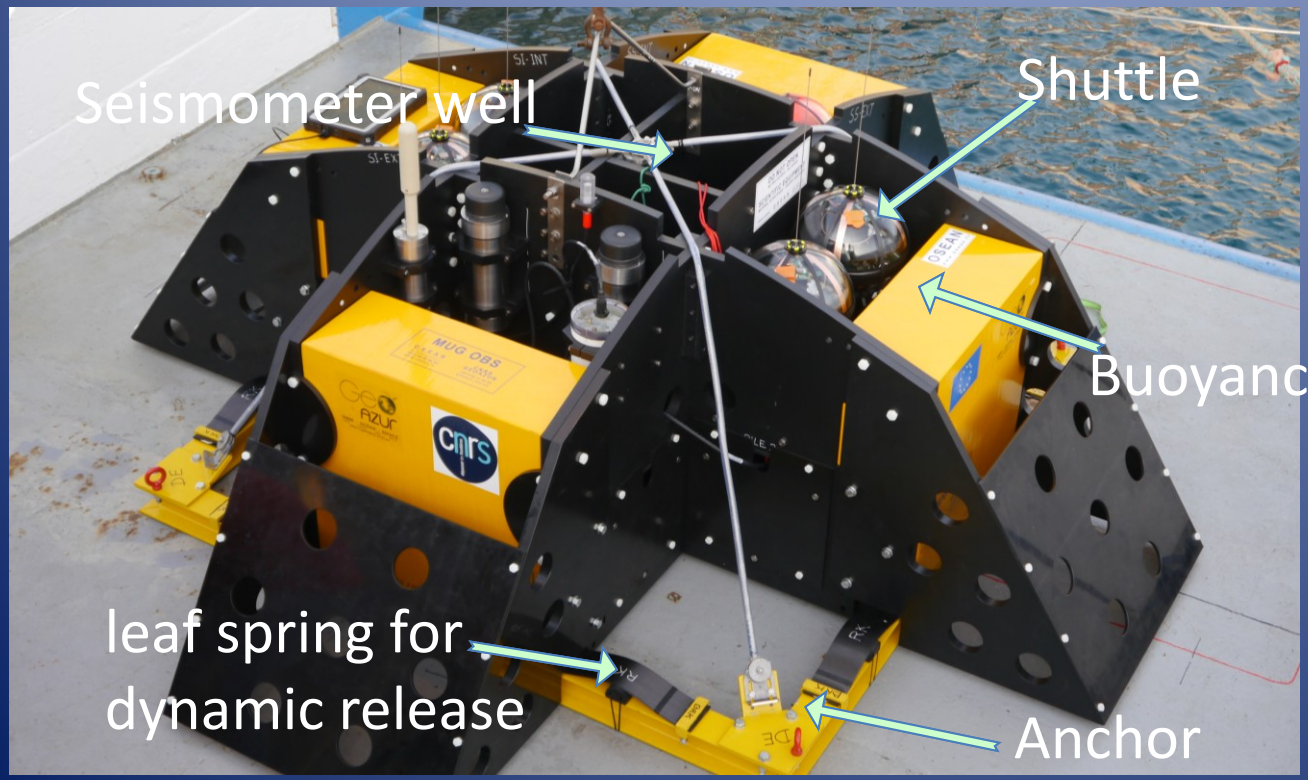
OBS Scripps

OBS GEOMAR

MUG is an alternative to real time observatory and short time OBS Network.

MUG-OBS is ideally suited to study subduction zones

Once installed we control the main parameters and data quality and later using a small vessel of opportunities recover data within autonomous shuttles released by acoustic,

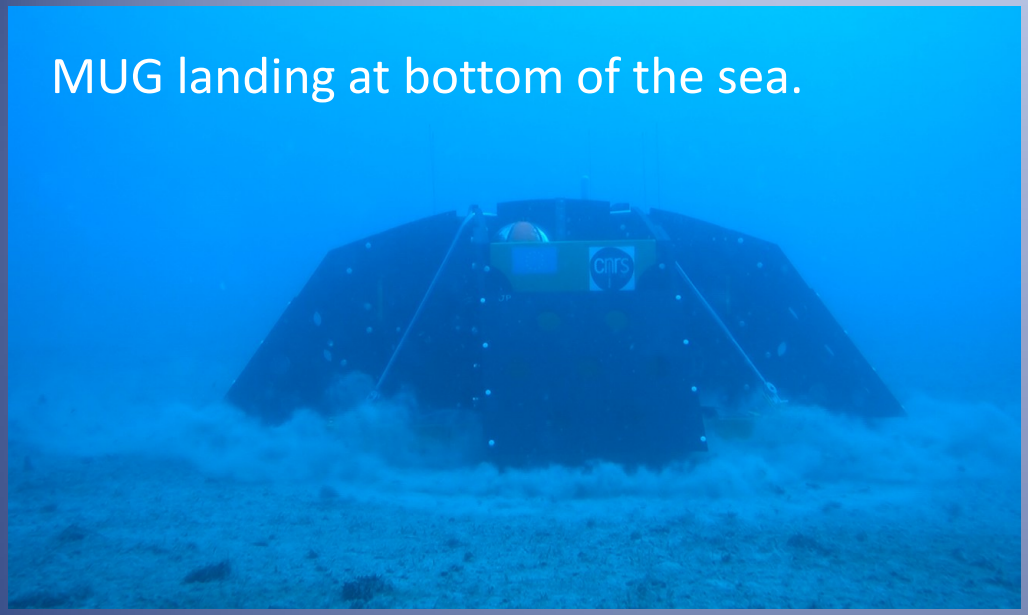


DIMENSIONS
2.9m x 2.9m x 1m.
Shaped to resist a trawling

MATERIAL
Non conductive material (Syntactic foam, Polyethylene, glass and Titanium)

Dead Weight Anchor
Steel with anodes

Weight in Air
1.5t (3307Lb)



DEEP OCEAN

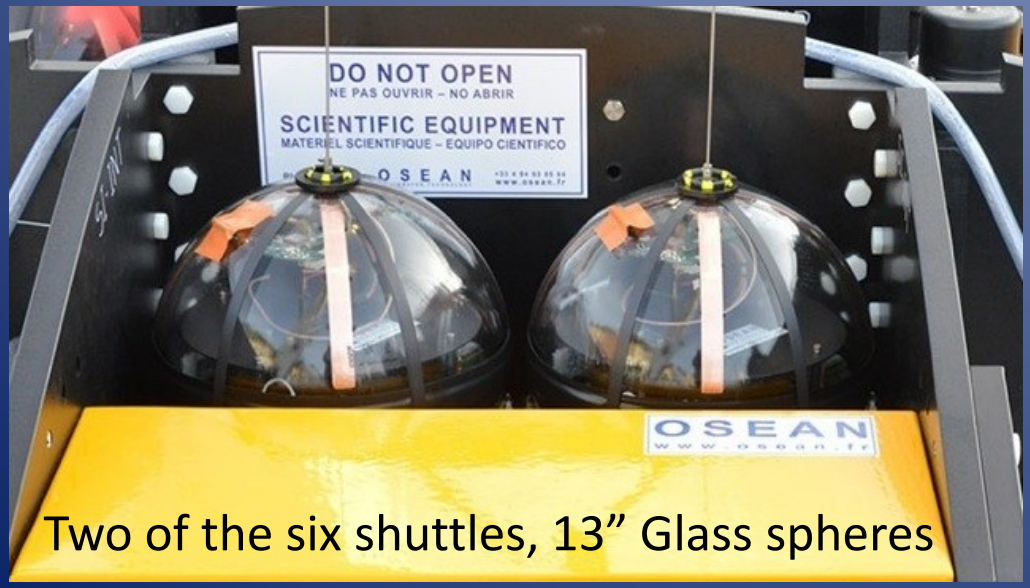
- 6000m depth rated (19,685Ft).

LONG AUTONOMY

- More than 3-years Autonomy (42 month - $LiSo_2$ batteries encapsulated in three containers).

COST EFFECTIVE & INNOVATIVE

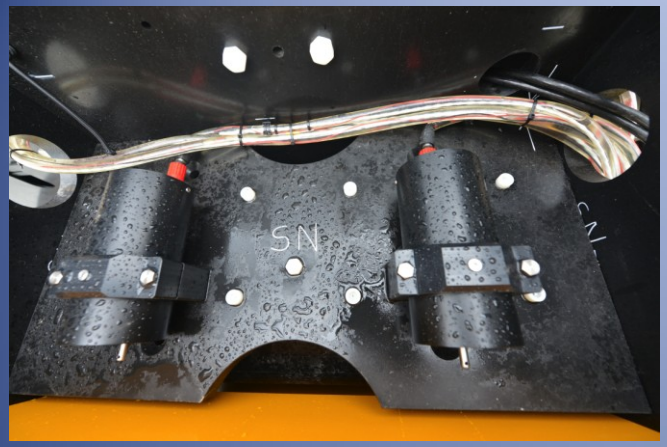
- 6 data shuttles with acoustic release. Redundancy for data back-up in the shuttles.

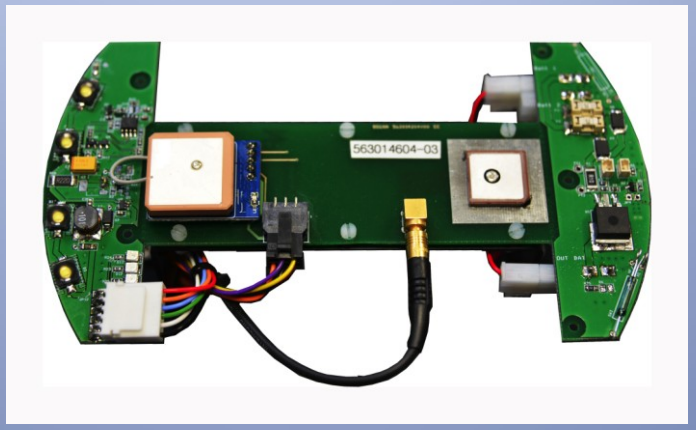


Two of the six shuttles, 13” Glass spheres

TIME MANAGEMENT

- 1.10^{-8} Real Time Clock.
- GPS Automatic time drift measurement when surfacing.

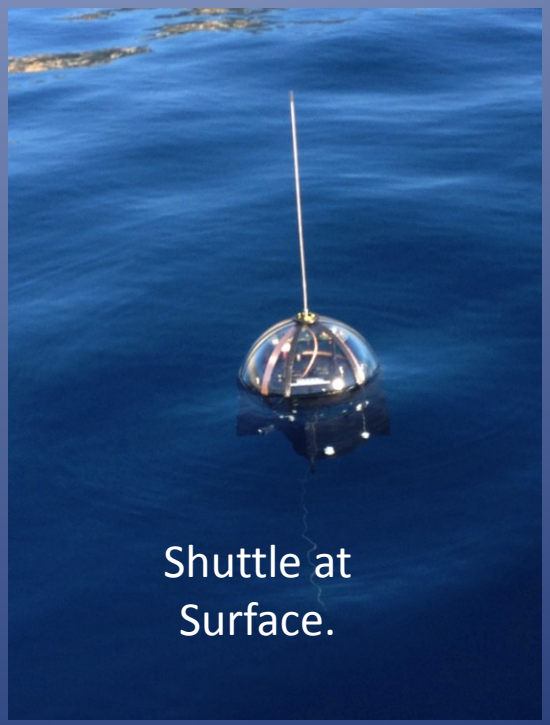




GPS / AIS/ Iridium/strobe light.

Digital Inductive communication

Shuttle at release heading to the Surface.



Shuttle at Surface.

6 SHUTTLES

DATA COMMUNICATION

Wireless Digital Inductive communication Station / Shuttles

TIME MANAGEMENT

- 1.10^{-8} Real Time Clock.
- GPS Automatic time drift measurement when surfacing.

SHUTTLES LOCALIZATION

- GPS / AIS
- STROBE LIGHT

DATA STORAGE

- A year

DATA TRANSMISSION

self-bulletin of detected major events by Iridium.

Acoustic communication and localization

GPS / AIS localization

GPS / Iridium antenna

Strobe light

Two acoustic containers

ACOUSTIC COMMUNICATION

- 2 independent channels in
- Two independent containers
- Diagnostic (Health bulletin)
- Distance & Positioning
- MUG and shuttle trigger for recovery.

STATION LOCALIZATION

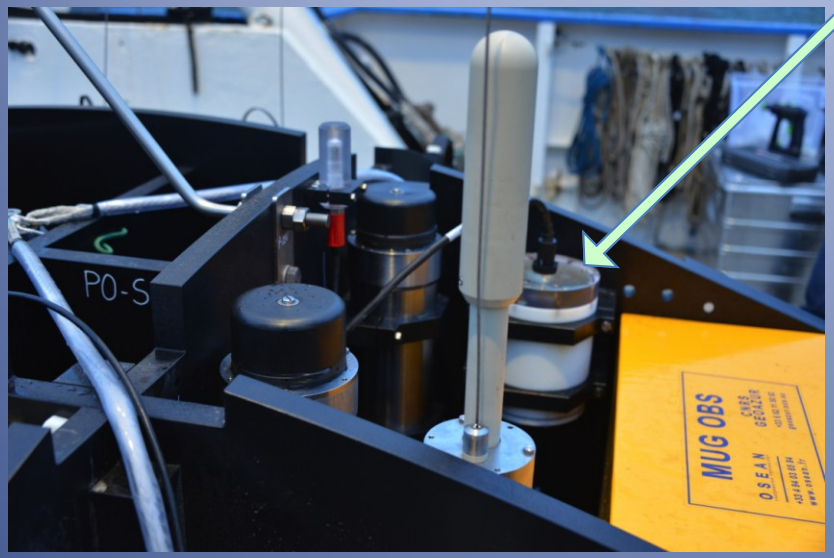
- GPS / AIS / Iridium
- Strobe light

PROGRAMMATION & PARAMETERS CONFIGURATION

- Ethernet Web Server
- GPS & NTP
- Optical Cable interface for real time application.

Sensors and communication

DPG - Scripps



SENSORS

	Type	Sampling rate
- 3-axis 120s Velocimeter	Trillium	100Hz
- 3-axis Accelerometer		100Hz
- Broadband hydrophone		100Hz
- Absolute Pressure		30s
- Differential Pressure		100Hz

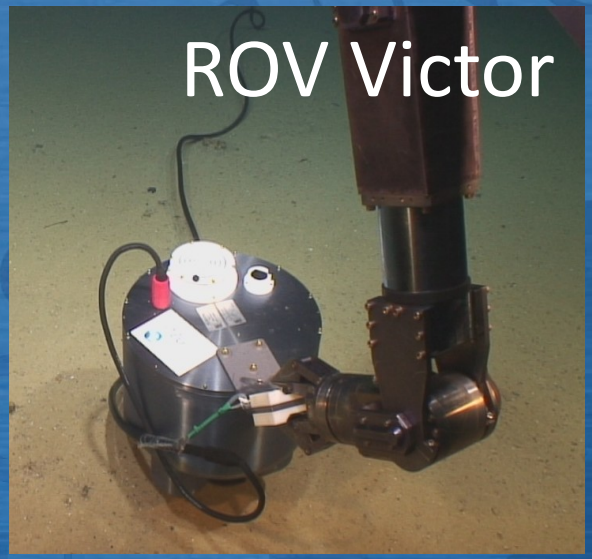
- 3-Axis Magnetometer for signal Orientation
- 2-Axis Tiltmeter on chassis.
- Temperature
- Humidity

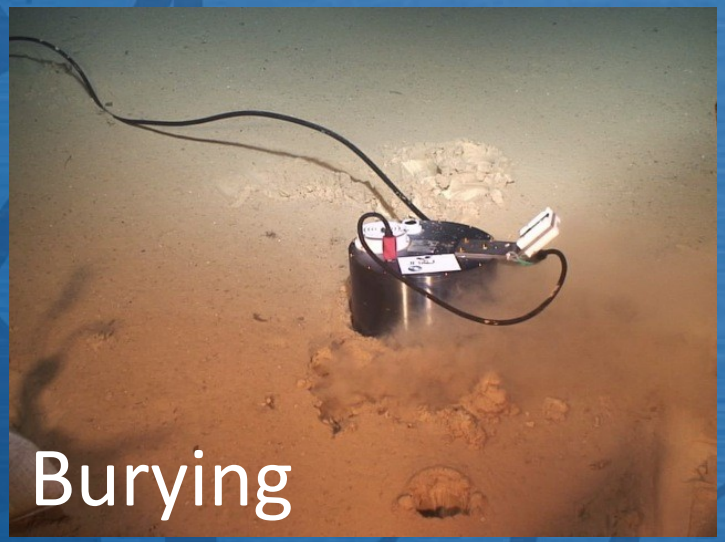
DATA MANAGEMENT

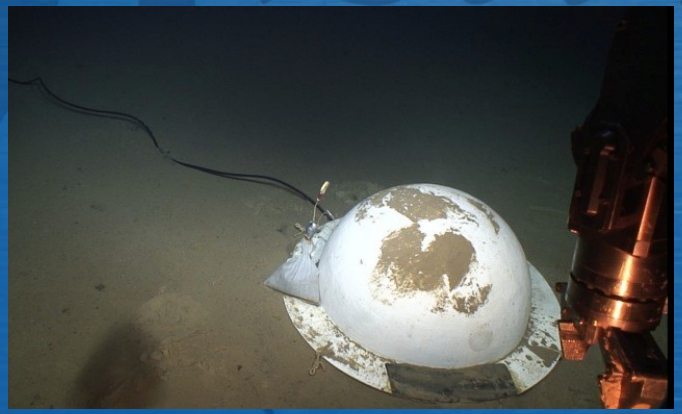
More than 3 years (42 month) continuous recording on SD-Flash memories.

Data format:
RAW/MiniSEED/SAC

BBand seismometer – Consideration for installation





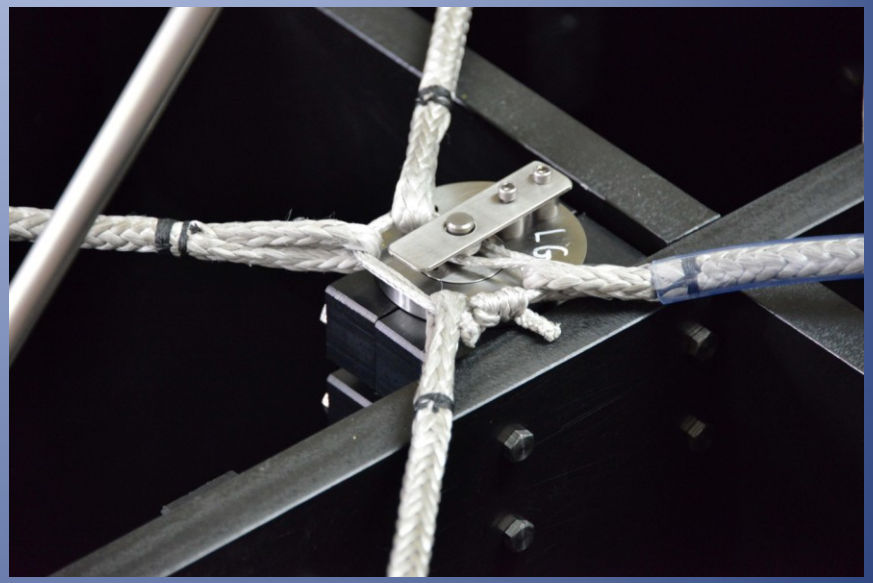


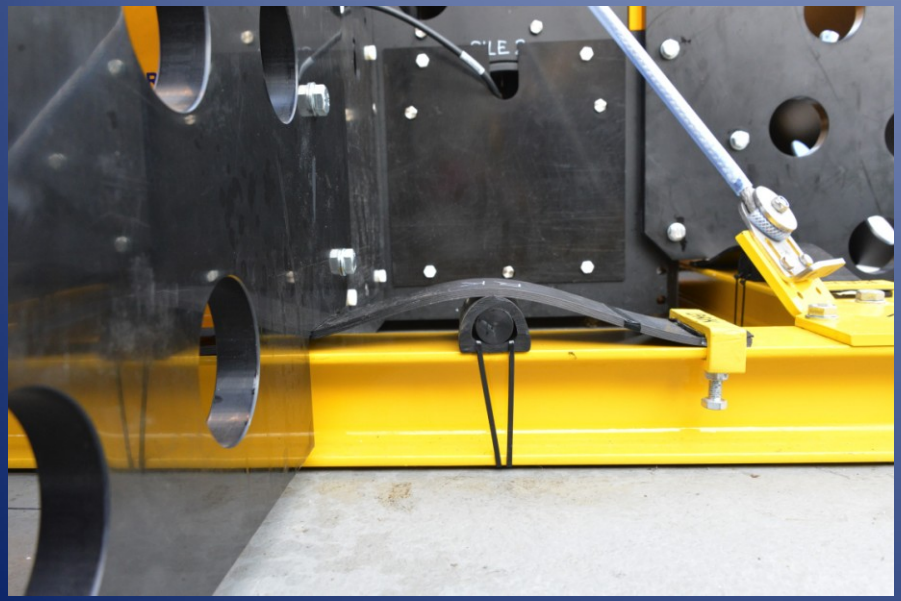
New features and specifications

- Main sensor is located inside a well, protected against current convection by top flaps and dissociated from the housing.

- Main sensor is released and activated by acoustic or timer.

- Main release is located on top of the station to avoid corrosion over long term deployment.

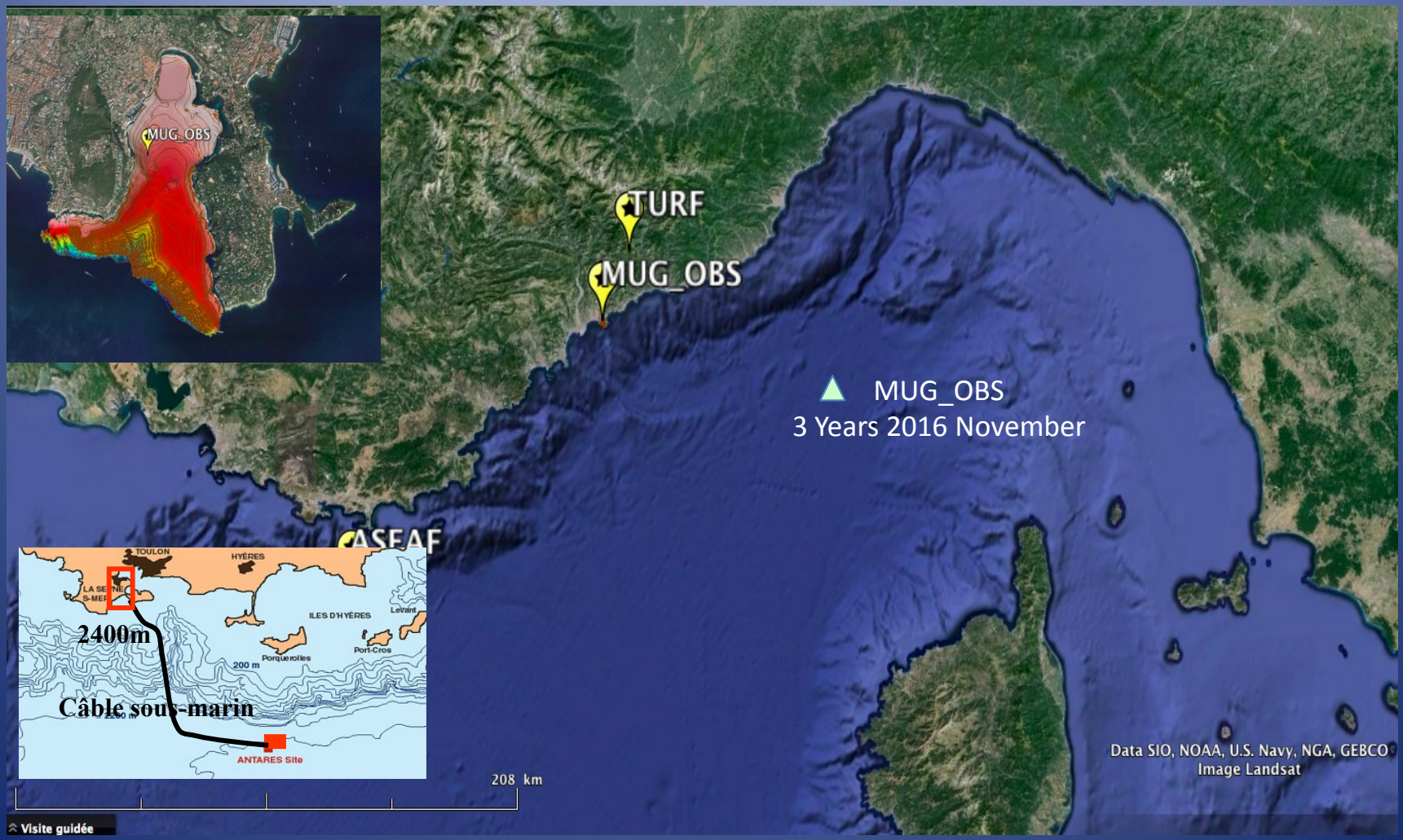




- 200 l for Buoyancy made of syntactic foam.

- Dynamic release system:
8 x 25kg leaf spring additional force

Tests Campaigns November 2015 and March 2016



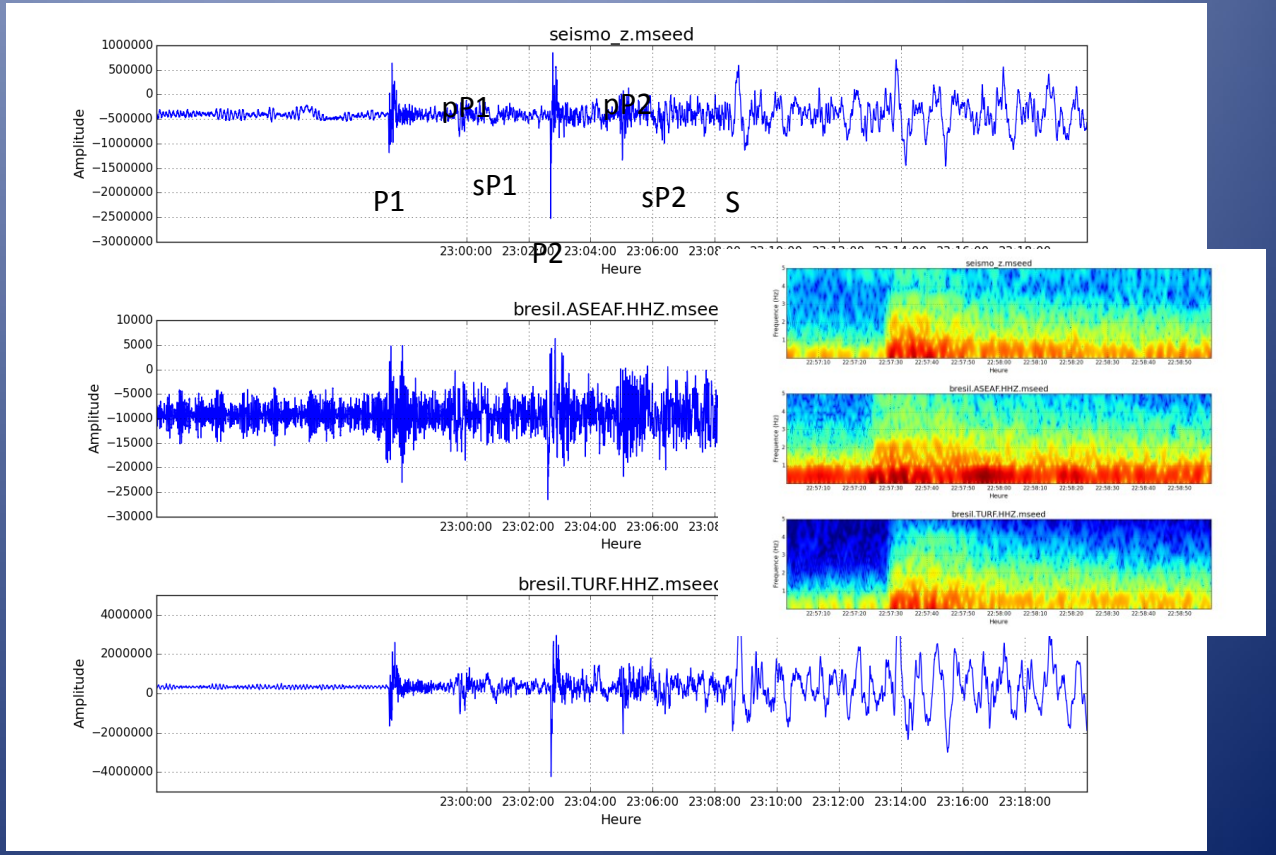
First recorded events during sea trial carried out at Villefranche sur mer - Depth 30m. 2015/11/24 at 22:45:38 “foreshock“ 7.4 magnitude and 2015/11/24 at 22:50:53 “Perou“ 7.6 magnitude

MUG Vertical velocity

Real Time CMG3T-Antares cabled OBS Vertical velocity

TURF – Land Station Vertical velocity

2015/11/24 complete sequence



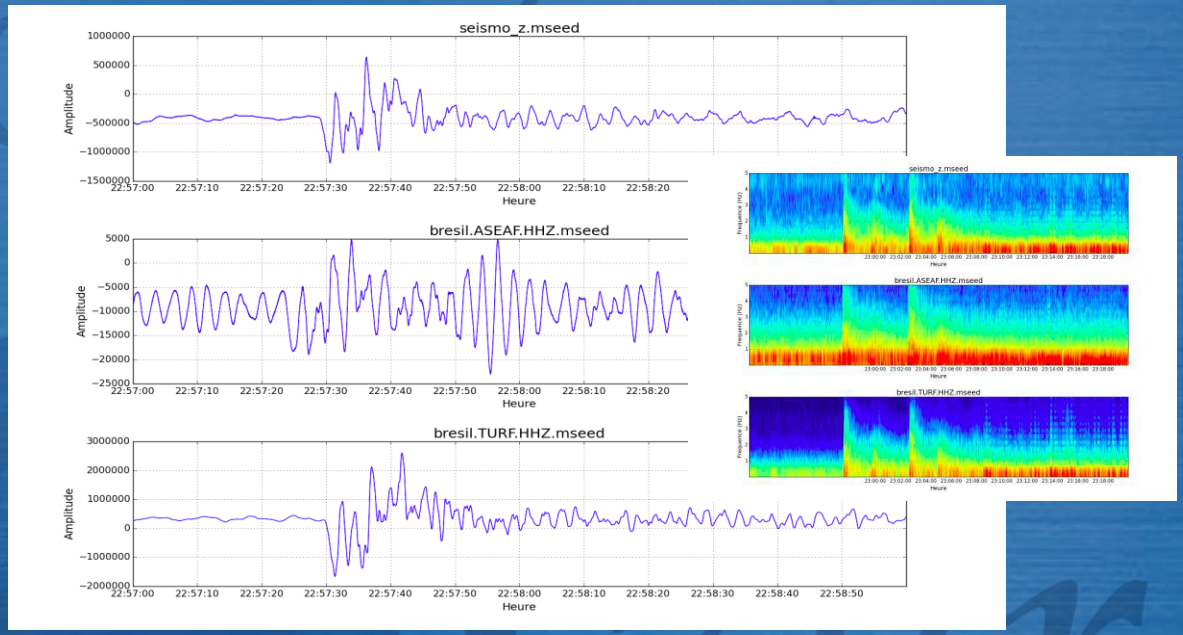
Details of the two events Perrou 2015/11/24

2015/11/24 at 22:45:38 - 1st Event

MUG Vertical velocity

Real Time CMG3T- Antares cabled OBS Vertical velocity

TURF – Land Station Vertical velocity

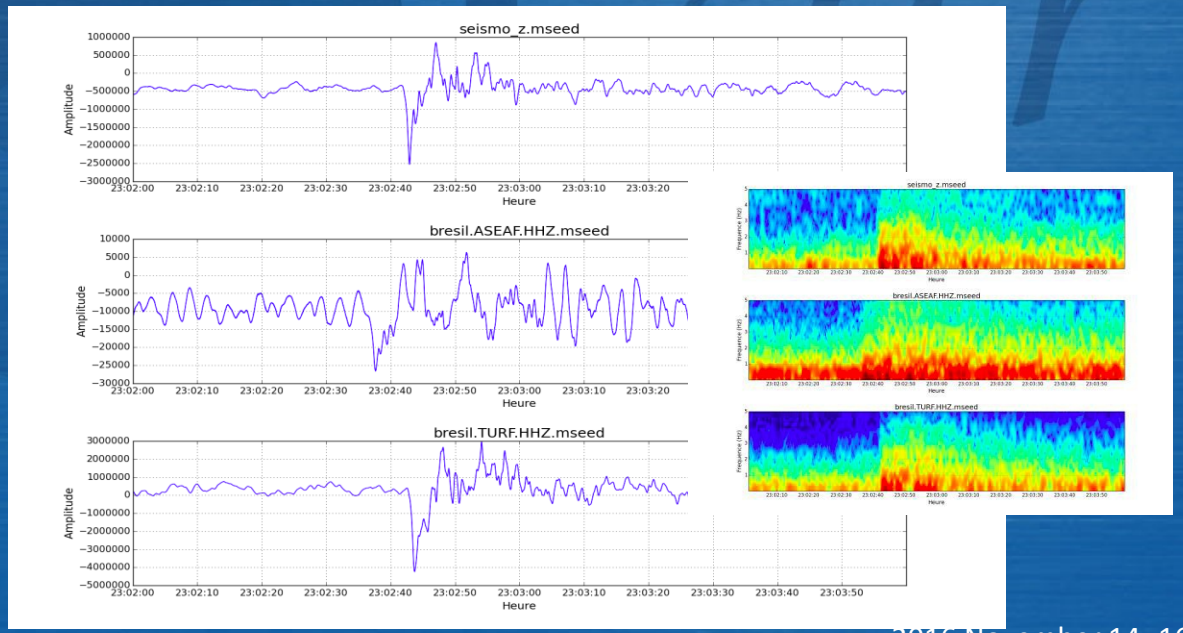


2015/11/24 at 22:50:53 – 2nd Event

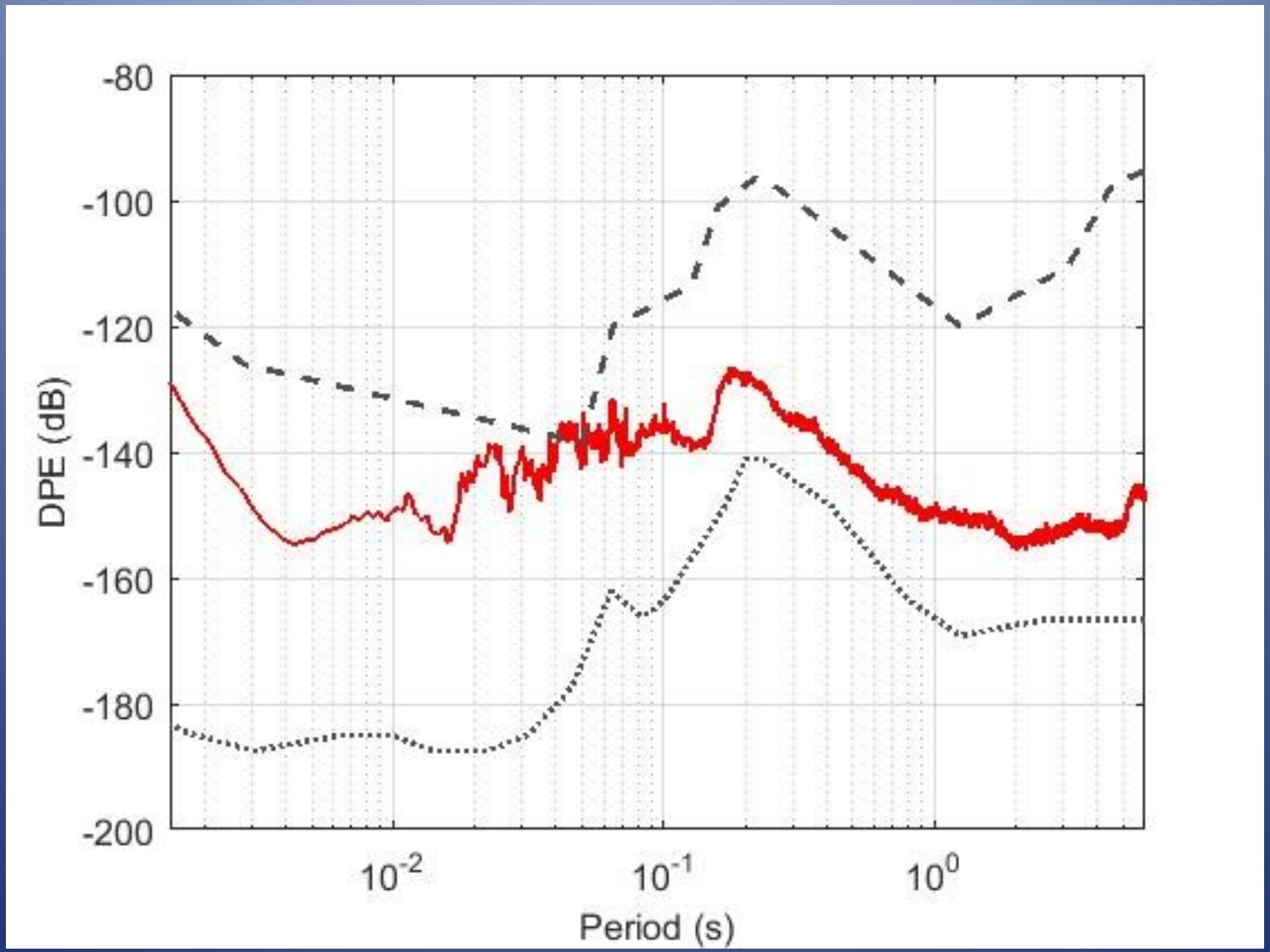
MUG Vertical velocity

Real Time CMG3T- Antares cabled OBS Vertical velocity

TURF – Land Station Vertical velocity



Low Noise Model



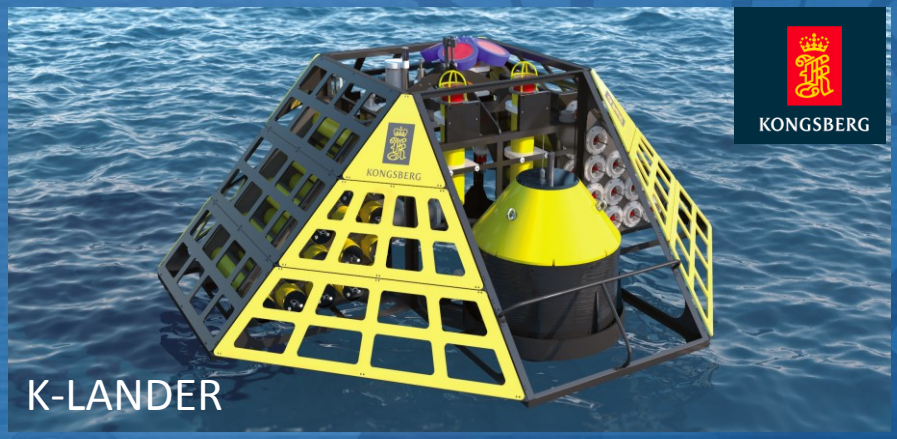
MUG_OBS main improvements.

- Use of Shuttles reduce the cost of ship-time
- and lowered the cost for recovering data.
- Data are collected on demand.
- Long term MUG_ OBS is the appropriate tool to meet the criteria for the:

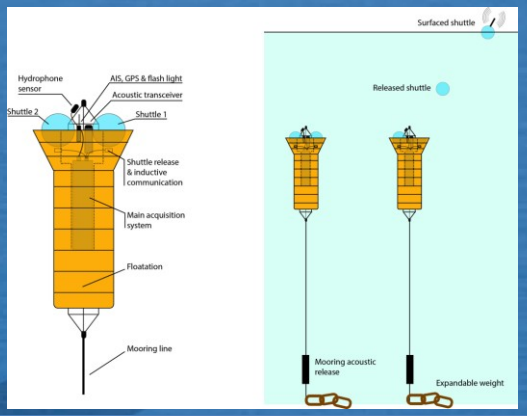
  Subduction Zone Observatory project.

Shuttle release sequence

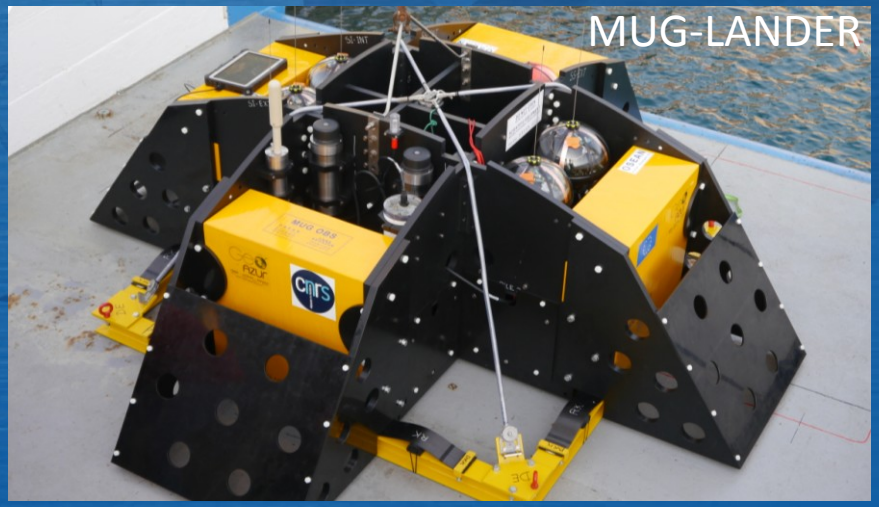
MUG - Multidisciplinary Plateform



- Rated 2000m Max
- **RECOVERY DEPTH** Depending on rope length and currents in deployment area

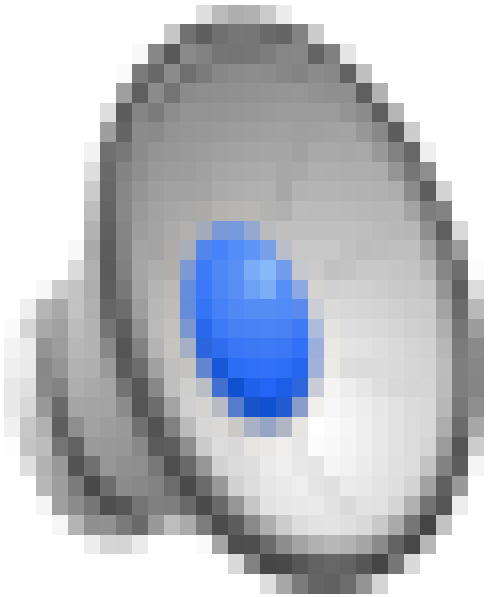


Mooring Hydroacoustic measurements for seismology and Mammals detection



Environmental , biological and Physics Sensors for Oceeanographie.

- CH4 Contros HydroC™ CH4
- CO2 Contros HydroC™ CO2
- Kongsberg Workhorse Long Ranger 75 kHz ADCP
- SBE41 - CTD
- Bband (10s – 50 Khz) Hydrophone

Thank you for your attention.

Y.Hello; P.Charvis; Diane Rivet - Geoazur
Manuk Yegikyan; Romain verfaillie - Osean SAS