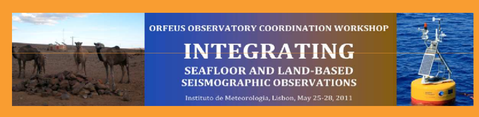
COBS: a Permanent Ocean Bottom Seismometer Integrated in the Catalan Seismic Network (NE Iberian Peninsula)

T. Frontera[1], C. Olivera[1], J. A. Jara[2] and X. Goula[1]

(1) Institut Geològic de Catalunya, c. Balmes, 209-211, 08006 Barcelona, Spain , e-mail: tfrontera@igc.cat.
(2) GEOCAT (Gestió de Projectes, S.A.), Avda. Josep Tarradellas, 34-36, 3ª planta, 08029 Barcelona, Spain.



COBS Contribution to the Catalan Seismic Network

The first initiative for long-term sea-floor seismic monitoring observation in Spain became a success on August 2005, when a permanent Ocean Bottom Seismometer (OBS) and a differential pressure gauge (DPG) were deployed 40 km offshore Catalonia (northeastern Spain) within the framework of a joint project between the *Institut Cartogràfic de Catalunya* (ICC) and the *Observatori de l'Ebre*, in collaboration with the Spanish oil company *Repsol Investigaciones Petrolíferas*. The OBS is located on sedimented sea-floor in shallow water (150 m in depth) at about 400 m from the Casablanca oil platform. The OBS is completely buried into the sediments (Fig. 2). The ocean-floor station was completely integrated into the Catalan seismic network (CSN) in October 2007, when satellite transmission allowed to have continuous and real time data available at the network data center in Barcelona (http://www.igc.cat).

Some earthquakes occur offshore which leads to some difficulty in surveying seismic activity with the inland stations only. Thus, the installation of a broadband OBS for real-time data acquisition might improve the performance of the network (Figs.1 and 3). Data provided by the sea floor sensor allow a whole waveform analysis and are used to perform the manual locations, which can be improved for local offshore epicentre events that would have a larger station gap without these data. Since COBS (international code for this station) is operative, some local, regional and teleseismic events have been recorded (Figs. 4 and 5).

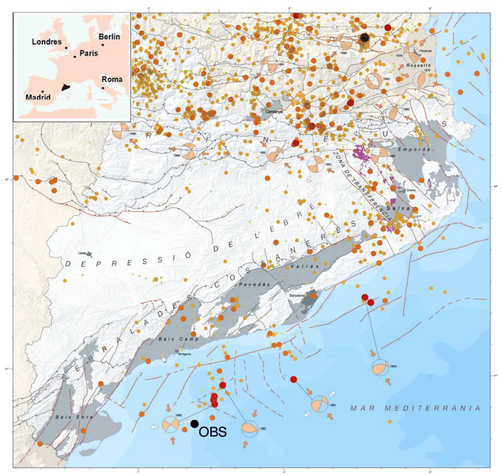


Fig. 1: Seismicity map of Catalonia (1977-1997) with the main geological features (ICC, 1999) and the location of OBS CASABLANCA station.

Fig. 2: Image of the seabed after the deployment and satellite antenna at the Casablanca platform.

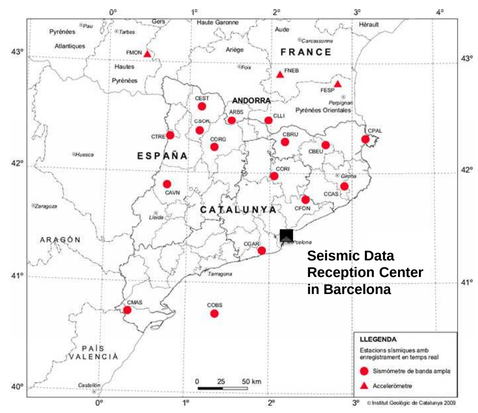


Fig. 3: Catalan Seismic Network (www.igc.cat)

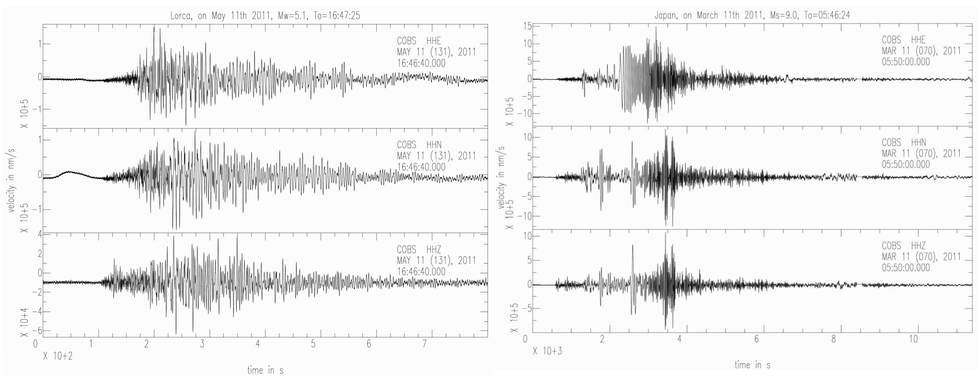


Fig. 4: Seismic recordings from COBS station for a regional (Lorca) and a teleseismic (Japan) event.

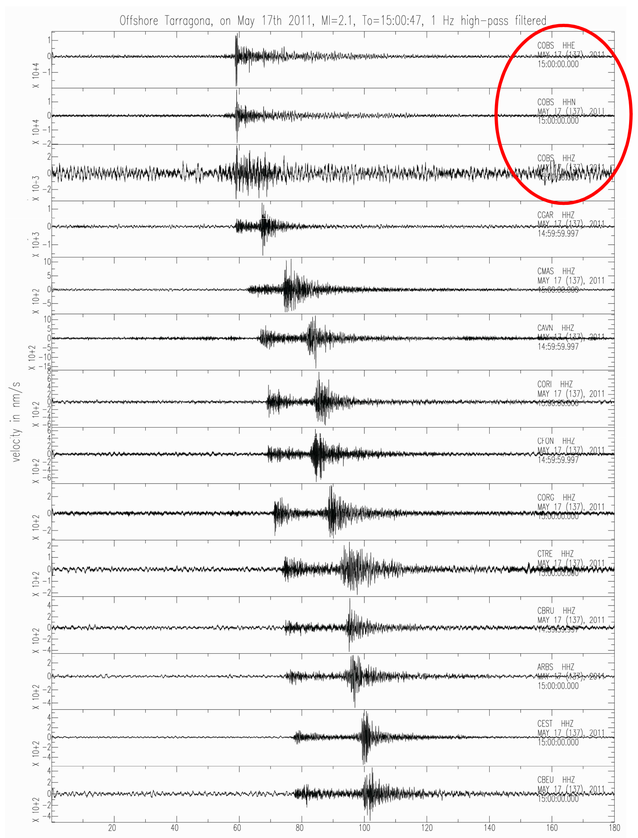


Fig. 5: Local event recorded by some stations of the CSN.

COBS Ambient Noise Analysis

A seismic ambient noise study from the OBS and the DPG recordings has been performed, showing that, as observed on most of the ocean-floor observatories, the noise level is quite large on all components. It can be observed that the COBS noise shows large temporal changes, especially in the microseism band, that are linked to seasonal variations. On the other hand, both the wind speed and the significant wave height have a great influence in the calculated noise levels on all the 3 components. This indicates that wind driven gravity waves are important sources of seismic noise (Fig. 6). Taking advantage of the high coherence between the OBS and DPG recordings, a low frequency noise correction has also been carried out, thus improving data fidelity (Fig. 7). A study of the OBS signal in terms of noise has been made and compared to the ambient noise levels of some land-based Catalan seismic network sites. It has been observed that the COBS, like most of the ocean floor stations, has a quite noisy behavior in comparison to land stations (Fig. 8)

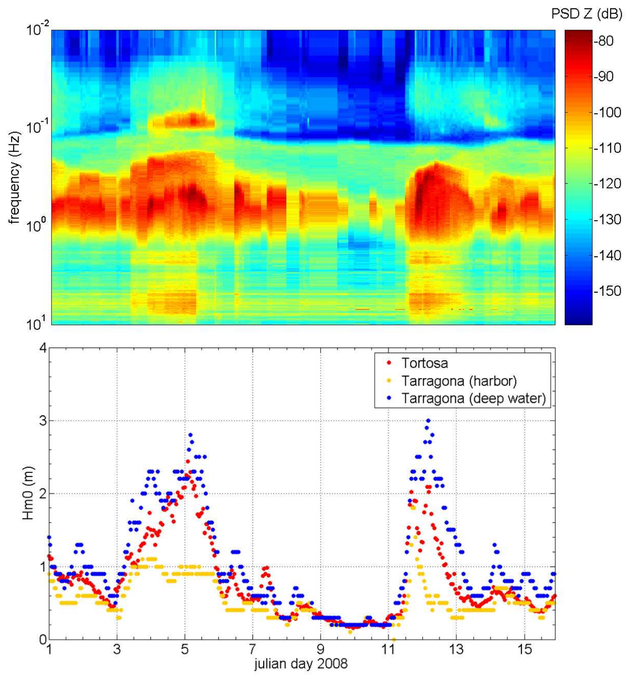


Fig. 6: Vertical-component spectrogram for two weeks of COBS data together with the variation of the spectral significant wave height measured at Tarragona deep water, Tarragona harbor, and Tortosa buoys.

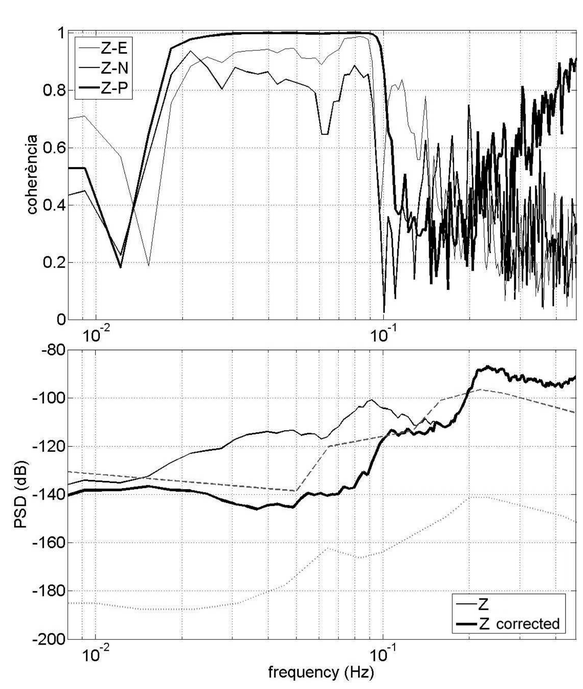


Fig. 7: Coherence between horizontal, pressure data and vertical component calculated for the time period between 1:00h and 1:59h of January 4th, 2008 (top) and vertical-component PSD before and after low frequency data removal (bottom).

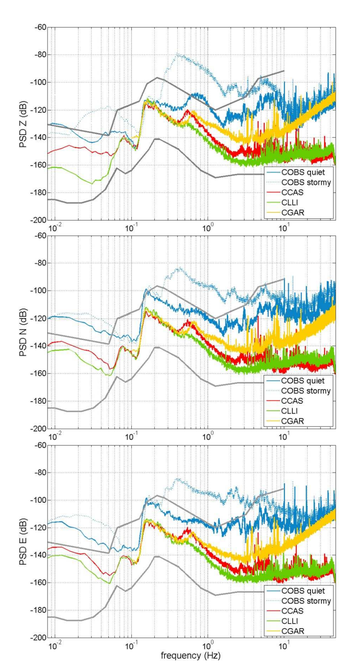


Fig. 8: Comparison of noise levels recorded at COBS (for a quiet and a stormy day) and three land stations of the Catalan Seismic Network.

Final Considerations

Although the implementation of ocean-floor seismic stations is a difficult task and such deployments require solving important technological and logistical issues, long-term ocean-floor seismic observatories can contribute to the investigation of global-scale geophysical processes and to better constrain regional tectonics. In this way, COBS station contributes with broadband seismic data in real time to the Catalan seismic network and to the scientific community through the ORFEUS data sharing tools and through the IGC by request.

References:
Institut Cartogràfic de Catalunya (1999). Mapa de sismicitat de Catalunya 1977-1997.*Institut Cartogràfic de Catalunya*, Barcelona