



Harmonic Tremors and short-duration events recorded at the Galicia Margin, North Atlantic Ocean

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As part of the Compelling Special Action on the geo-environmental hazards carried out after the sinking of the 'Prestige' oil tanker, a network of 10 OBS from IRD-Géosciences Azur was deployed over a $0.3^{\circ} \times 0.3^{\circ}$ area surrounding the sinking zone, located in the western part of the Galicia Bank. The OBS deployment was active during 1 month, from August 23 to September 21 2003. All the instruments were equipped with 4 Hz, 3 component seismometers and 7 of them included also a hydrophone. The OBS operated in continuous mode and recorded very different signals, including air-gun shots, local, regional and teleseismic events, finback whale vocalisations and noise associated to ships. This presentation is focused in the analysis of two types of seismic signals observed in the datasets that can be described as harmonic tremors and short-duration events.

At some of the sites, intense monochromatic signals lasting for up to 4 hours are identified. Main features of these signals are: i) an amplitude well above the usual noise level, but with a wide range of values; ii) a coherent polarization; iii) an spectrogram clearly dominated by a characteristic frequency; iv) a duration ranging from 2 to 4 hours. The tremors are clearly recorded on the three components of the geophones, but do not appear on the hydrophone records. A time periodicity in the occurrence of those signals can be inferred, with a period close to 6 hours. This fact suggests a correlation with the tidal variation. The tremor intervals seem to correlate with the inter-tidal periods. Also, the fortnightly tidal variation can be correlated with the periods of maximum and minimum tremor activity. Even if the tremors are recorded at different sites within a time interval, their envelopes are not correlated, suggesting that the sources must be located at the vicinity of each receiver.

In most sites, a large number of very short and impulsive events have been identified, with properties similar to the Long Period Events (LPE) usually described in areas with volcanic or hydrothermal activity. Main features involve: i) sharp and impulsive onset; ii) frequency spectrum with one or two narrow picks usually in the range of 4 to 20 Hz; iii) very regular decrease of amplitude in the signal coda; iv) duration between 1 and 2.5 seconds. There are large differences in the number of events recorded at the different OBSs, ranging from a few tens to near 1000 events. The more active sites are located at the Eastern part of the array, where rough bathymetric variations are depicted. As for the tremors, the events are not recorded in more than one site, despite the very large amplitude of some of them. This fact suggests again a very local source. There seems to be no correlation between the occurrence of those events and the tidal variations. For each site, the events have been classified into families or clusters according to their waveform and spectral characteristics. In some cases, events with huge amplitude differences have very similar waveform and frequency spectrum.

We favour the interpretation of those seismic features as coming from the resonance of fluid-filled cracks induced by impulsive pressure transients, in agreement with the theoretical model of Chouet (1988). The observed harmonic tremors will be the result of sustained pressure fluctuations, probably related to the stress variations induced by the tidal change of the oceanic load, while the LPE are interpreted as the impulse response to the tremor-generating system.