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3D Crustal Structure of the North-Ligurian Margin: First Results of the GROSMarin Experiment

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The North-Ligurian rifted margin is singular in that it lies immediately next to the Alpine orogenic arc. It is furthermore seismically active and can experience destructive earthquakes such as in 1887 in the region of Imperia—an event that resulted in a tsunami and more than 600 casualties in spite of a coastal area that was much less densely populated than today. Out of such rare large events, the area undergoes a limited and diffuse seismic activity that can remain undetected and is generally poorly located. This results in a poor knowledge of active structures, especially at sea. Such knowledge is however required towards a quantification of the seismic hazard along the French Riviera and the Ligurian region. To this end, the GROSMarin project was undertaken with a dual objective: (1) to characterize the North-Ligurian margin from a structural standpoint—mode and degree of crustal stretching prior to oceanic accretion, segmentation along strike, subsequent evolution in an orogenic context—and (2) to identify zones of active crustal deformation at sea that are likely to generate earthquakes.

The programme is a collaborative work between GeoAzur and Dip.Te.Ris (University of Genova), with some support from INGV, IFM-GEOMAR and IFREMER. It took place from April to October 2008 and consisted in the deployment of 21 ocean-bottom seismometers (OBS) on a grid spanning 50 km along strike and 25 km across, located between Nice, France, and Imperia, Italy, and ranging from mid-slope to the deep basin. This array was extended on land by the permanent stations of the French and Italian regional networks, temporarily densified by 13 portable stations. These instruments recorded the shots of a marine seismic source towed from R/V l'Atalante and were left for more than 5 months for passive surveying. The active part of the programme aims at characterizing the main structures of the margin through crustal 3D tomography; the objective of the passive part is to decrease the detection threshold of marine microseismicity and to reach a precise location of events in order to map active faults. Some of the sea and land instruments were fitted with broadband sensors to allow for teleseismic imaging of deep lithospheric discontinuities.

We present the preliminary results of this experiment—in particular a first 3D tomographic model obtained from $\sim$31.500 travel times derived from our recording of active seismic shots by the OBS's. Passive data analysis is being under progress and first relocations have been obtained. These results give an insight into the variability of the crustal structure, both along and across strike.