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Velocity structure of the Ligurian Sea (Mediterranean Sea) revealed by ambient noise tomography using ocean bottom seismometer data

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Abstract

The Liguro-Provençal-basin was formed as a back-arc basin of the retreating Calabrian-Apennines subduction zone during the Oligocene and Miocene. The resulting rotation of the Corsica-Sardinia block at roughly 32–24 Ma is associated with rifting, shaping the Ligurian Sea. It is highly debated though, whether oceanic or atypical oceanic crust was formed or if the crust is of continental nature, which was extremely thinned during opening of the basin.

In order to investigate the velocity structure of the Ligurian Sea a network (LOBSTER) of 29 broadband Ocean Bottom Seismometer (OBS) was installed jointly by GEOMAR (Germany) and ISTERre (France). The LOBSTER array measured continuously for eight months between June 2017 and February 2018 and is part of the AlpArray seismic network. AlpArray is a European initiative to further reveal the geophysical and geological properties of the greater Alpine area.

We contribute to the debate by surveying the type of crust and lithosphere flooring the Ligurian Sea. Because of additional noise sources in the ocean, causing instrument tilt or seafloor compliance, OBS data are rarely used for ambient noise studies. However, we extensively pre-process the data to improve the signal-to-noise ratio. Then, we calculate daily cross-correlation functions for the LOBSTER array and surrounding land stations. We use teleseismic events by correlating short time windows that include strong events. Those cross-correlations are dominated by earthquake signals and allow to derive surface wave group velocities for longer periods than using AN. Finally, phase velocity maps are obtained by inverting Green's functions derived from cross-correlation of ambient noise (AN) and teleseismic events.

In the course of this ongoing project we target to derive 3D velocity models of the adjacent Alpine belt region and its complex subduction geometry contributing to questions like the prolongation of the Alpine from beneath the Ligurian Sea.