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Surface waves dispersion measurements at north of the Gloria fault using seismic ambient noise.

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The Gloria fault is a major strike-slip oceanic plate boundary fault, which links the Azores triple junction, in the west, to the oblique convergent boundary between Iberia and NW Africa, in the east. This fault hosted some of the largest strike-slip earthquakes in the oceanic domain, notably the 1941 M8.3 earthquake. In 1975, a M8.1 earthquake hit the intraplate region south of the Gloria fault, in the intersection between an old transform fault and the Madeira-Tore rise. In spite of its seismo-tectonic relevance, the Gloria fault has remained poorly studied, due mostly to its remote location in the north Atlantic.
The dataset of the Deep Ocean Test Array (DOCTAR) project encompasses data collected for 10 months at 12 broadband (60-sec) ocean bottom seismometers (OBSs) located about 100 km north of the Gloria fault. This dataset was used to image crustal and mantle discontinuities using receiver function analysis and to infer the S-wave velocity structure of the oceanic lithosphere north of the Gloria fault from P-wave polarization. The seismic structure studies indicate a typical oceanic crustal and mantle structure, influenced by the nearby Gloria fault. In particular, these studies indicate a slight crustal thickening towards the Gloria fault, as well as an increase in uppermost mantle S-wave velocities towards the fault.
In this work, we further explore the crustal and uppermost mantle oceanic structure North of the Gloria fault by applying the techniques of ambient noise tomography. We extracted the empirical Green's functions from ambient noise phase cross-correlation (Schimmel et al., 2011), followed by time-frequency phase weighted stack (Schimmel et al., 2007) of continuous seismic and hydrophone data recorded at the array. Our results indicate that the EGFs have a higher signal-to-noise ratio when they are computed from hydrophone-hydrophone or hydrophone-vertical channel data. Pairs of stations oriented NE-SW, show a much highly symmetric cross-correlation on both sides. In HH, HZ, ZH, and ZZ, the record sections highlight a move-out velocity of 1.3 km/s while in the RR and TT shows two different waves with velocities of $\sim$1.3 and 3.2 km/s, respectively. Observed dispersion curves of group velocity over the period range 2 – 25 sec show almost a constant velocity until 15 seconds. After 15 s, we do not obtain reliable dispersion measurements. We compared our results with synthetics computed using a local velocity model, which results from the combination of two different velocity models proposed for the region, and locating the source at 1 m depth in the sediments. The synthetics thus obtained show a good agreement with our observations, suggesting that an ambient noise tomography can be computed from this ocean bottom dataset.

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