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Secondary microseism sources in Cape Verde archipelago

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Cape Verde archipelago consists of 9 inhabited volcanic islands and a few small islets, located in the eastern Atlantic Ocean, 500 km from the African coast. Geologically, it presents an intriguing distribution of the islands in a horseshoe shape, with a general age progression from east to west and it is built on top of one of the largest bathymetric anomalies in ocean basins, the Cape Verde Rise.

The physical properties of its crust have largely remained undetermined so far. We intend to better characterize the crustal structure beneath Cape Verde, by computing a 3D model from ambient seismic noise tomography. The uncertainties in the ambient noise source locations can become a challenge when interpreting results from ambient noise studies, so a better knowledge on the location of the noise sources around the study area and their variabilities may help us to improve the methods used to image the Earth structures.

We processed three-component data records from two different temporary broadband networks - YW and CVPLUME. First one, with seven stations, was conducted from 2002 to 2004. The other one, composed by thirty-nine stations, was continuously recording from December 2007 to September 2008.

Secondary microseisms (SM) are the dominant seismic noise signals all over the world. Although its generation is not totally understood, it is accepted that SM generation depends on the interaction of two opposite ocean gravity waves, with the same frequency. When the waves meet, the standing waves induce pressure fluctuations into the ocean bottom. The resultant energy is immediately converted into seismic energy on the seafloor.

To analyze and characterize the secondary microseismic sources, we used the time-frequency dependent polarization analysis method (Schimmel et al., 2011), in the frequency band 0.10 - 0.20 Hz. This new technique allows us to detect polarized signals which are characterized by the degree of polarization (DOP) and the back-azimuth (BAZ) of Rayleigh waves, as a function of time and frequency.

The presence of SM signals is clear and visible in all the stations, all over the years. The results are consistent in both deployments. The BAZ shows, at least, one clear and strong main source, with just small variations mainly correlated with climate changes. In some cases a second source was detected, especially in the summer months, pointing towards Africa. This source can be related to the rising precipitation, the strong wind or the sandstorms from Sahara desert, very common in this period of the year. The main source, which points to the middle of the archipelago, may result from the interaction of the incoming swell with the waves reflected on the coast.

To validate our observations, we will compare the BAZ results with the theoretically determined sources obtained through the numerical ocean wave model IOWAGA (Ardhuin et al., 2011).

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