



Detecting and locating structural changes during 2011 El Hierro (Canary Islands) submarine eruption

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In October 2011, a volcanic eruption started on El Hierro Island on its southern submarine flank. Several features characterize pre-eruptive volcanic phases, for instance, an increase of the seismic energy release, changes in surface deformation and rises in geochemical anomalies. Monogenetic volcanoes, as El Hierro, show those variations although the lack of structural symmetry makes monitoring more complicated in comparison with other kinds of volcanoes. Several active volcanoes have been monitored through cross-correlations of ambient seismic noise. Ideally, a dense station network is placed on top of the volcano, which is unfeasible for this submarine eruption. In this study, we show the potential of ambient seismic noise cross-correlation techniques to monitor a submarine volcano observing pre- and co-eruptive subsurface changes related to the eruption.

We work with eight seismic stations located in El Hierro Island during 2011 and 2012. This network deployment was completed only few days prior to the eruption, increasing the challenge to find precursors. We compute the phase cross-correlations of all station pairs and analyse its similarity with respect to different references, frequencies, and lag times. The similarity curves obtained show several variations that we attribute to different stages of the volcanic eruption, among them clear precursory signals. To ascertain the physical relevance of the observed fluctuations, we use a statistical approach. Furthermore, we use a probabilistic imaging procedure to locate the structural and mechanical subsurface changes beneath El Hierro Island for a period of two years.

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