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Deployment of a seismic array for volcano monitoring during the ongoing submarine eruption at El Hierro, Canary Islands

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On 17 July 2011 there was an important increase of the seismic activity at El Hierro (Canary Islands, Spain). This increase was detected by the Volcano Monitoring Network (Spanish national seismic network) run by the Instituto Geográfico Nacional (IGN). As a consequence, the IGN immediately deployed a dense, complete monitoring network that included seismometers, GPS stations, geochemical equipment, magnetometers, and gravity meters. During the first three months of activity, the seismic network recorded over ten thousand volcano-tectonic earthquakes, with a maximum magnitude of 4.6. On 10 October 2011 an intense volcanic tremor started. It was a monochromatic signal, with variable amplitude and frequency content centered at about 1-2 Hz. The tremor onset was correlated with the initial stages of the submarine eruption that occurred from a vent located south of El Hierro island, near the village of La Restinga. At that point the IGN, in collaboration with the Instituto Andaluz de Geofísica, deployed a seismic array intended for volcanic tremor monitoring and analysis. The seismic array is located about 7 km NW of the submarine vent. It has a 12-channel, 24-bit data acquisition system sampling each channel at 100 sps. The array is composed by 1 three-component and 9 vertical-component seismometers, distributed in a flat area with an aperture of 360 m. The data provided by the seismic array are going to be processed using two different approaches: (1) near-real-time, to produce information that can be useful in the management of the volcanic crisis; and (2) detailed investigations, to study the volcanic tremor characteristics and relate them to the eruption dynamics. At this stage we are mostly dedicated to produce fast, near-real-time estimates. Preliminary results have been obtained using the maximum average cross-correlation method. They indicate that the tremor wavefronts are highly coherent among array stations and propagate across the seismic array with an apparent slowness of $\sim$0.8 s/km and a back-azimuth of 135ºN. These estimates have remained approximately constant since the onset of volcanic tremor, indicating a unique source and thus a single, continuing eruptive center.