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Characterization of the seismicity prior to the 2011 El Hierro eruption

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The last eruption of the Canary Islands started on 10 October 2011, 2 km south of El Hierro. This submarine eruption was the first fully monitored volcanic eruption in this archipelago and was preceded by various precursory signals, the most evident of which was the seismicity that started in July 2011. This seismicity includes almost 10,000 low-magnitude earthquakes located during 81 days before the eruption which revealed a 20 km horizontal migration from the north of the island to the south at depths of between 10 and 17 km, the deeper events occurring further south. In this work we try to improve the quality of the seismic catalogue. We applied a relative location algorithm (hypoDD) to improve hypocentral locations. Tests performed to check the reliability of the results gave maximum uncertainties of 400 m in the relocations. Furthermore, new features were found, including the origin of the seismicity in the center of the island and the presence of two alternating seismogenic zones in the north of the island during the first month of activity. The first days of the unrest the seismic network was composed by only 2 seismic stations and almost no location was possible. We obtained information about location and magnitude of these events at the beginning of the seismic crisis by comparison of the waveforms by correlation with located earthquakes. We have also analyzed the baselevel seismicity of El Hierro from 1996 using digital data of a short period station. Manual revision of these data showed a considerably low number of earthquakes in the region before the unrest (less than one event per day).