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Relative and probabilistic non linear relocation of the seismicity of El Hierro (Canary Islands, Spain): Implications for the 2011-2012 eruption.

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El Hierro Island (Canary Islands, SPAIN) has recently attracted the interest of the international volcanological community. During a prolonged period of seismic and volcanic unrest, between July 2011 and April 2013, the local seismic network recorded more than 15,000 earthquakes accompanied by a submarine eruption. In this study we present an exhaustive relocation analysis of the original seismic catalog using two well established methods double-difference relative relocation (HypoDD), and probalistic non-linear location (NLLoc). Our relocations are based on 3D velocity models that were obtained from an active-source tomography experiment in the Canary Islands. The relocations constrain the spatial and temporal distribution of seismicity, and help to shed light on the patterns of stress propagation, and areas of crustal weakness under the island. The results show that the seismicity each of unrest recorded during this period is located within a small region close to the center of the island and located around 12 to 14 km depth. Then, the seismicity migrates away from the island. We confirm the presence of a high-velocity block centered underneath El Hierro (up to 15km depth) observed by other authors. This block may represent a barrier to magma propagation and it corresponds to the location of the bulk of seismicity at the beginning of each phase.