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Volcanic signatures in time gravity variations during the volcanic unrest on El Hierro (Canary Islands)

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Gravity changes occurring before the 2011–2012 El Hierro submarine eruption are interpreted in terms of the pre-eruptive signatures during the episode of unrest. Continuous gravity measurements were made at two sites on the island using the relative spring gravimeter LCR gPhone-054. On September 15, 2011, an observed gravity decrease of 45 μGal, associated with the southward migration of seismic epicenters, suggests that a lateral magma migration occurred beneath the volcanic edifice, an apparently clear precursor of the eruption that took place 25 days later on October 10, 2011. High-frequency gravity signals also appeared on October 6–11, 2011, suggesting that an interaction between a magmatic intrusion and the ocean floor was occurring. These important gravity changes, with amplitudes varying from 10 to -90 μGal, during the first three days following the onset of the eruption are consistent with the northward migration of the eruptive focus along an active eruptive fissure. An apparent correlation of gravity variations with body tide vertical strain was also noted, which suggests that concurrent tidal triggering occurred during the initial stage of the eruption.