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Processes of Compression-Expansion and Subsidence-Uplift detected by the Spatial Inclinometer (IESHI) in the El Hierro Island eruption (October, 2011)

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El Hierro Island (Canary Islands, Spain) has undergone a submarine eruption a few kilometers to its southeast, detected October 10, on the rift alignment that cuts across the island. However, the seismicity level suddenly increased around July 17 and ground deformation was detected by the only continuously observed GNSS-GPS (Global Navigation Satellite Systems – Global Positioning System) benchmark FRON in the El Golfo area. Based on that information several other GNSS-GPS benchmarks were installed, some of which continuously observed as well. A normal vector analysis was applied to these collected data. The normal vector magnitude variation identified local extension-compression regimes, while the normal vector inclination showed the relative height variation between the three benchmarks that define the plan to which normal vector is analyzed.

To accomplish this analysis the data was previously processed to achieve positioning solutions every 30 minutes using the Bernese GPS Software 5.0, further enhanced by a Discrete Kalman Filter, giving an overall millimeter level precision. These solutions were reached using the IGS (International GNSS Service) ultra-rapid orbits and the double-differenced ionosphere-free combination. With this strategy the positioning solutions were attained in near real-time. Later with the IGS rapid orbits the data was reprocessed to provide added confidence to the solutions.

Two triangles were then considered, a smaller one located in the El Golfo area within the historically collapsed caldera, and a larger one defined by benchmarks placed in Valverde, El Golfo and La Restinga, the town closest to the eruption's location, covering almost the entire Island's surface above sea level. With these two triangles the pre-eruption and post-eruption deformation suffered by El Hierro's surface will be further analyzed.