

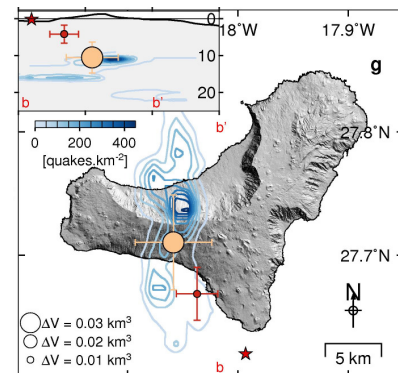
## High temporal and spatial resolution of volcano-tectonic surface deformation

Researcher: Pablo J. González

Dates: from 4 November 2013 to 15 November 2013.

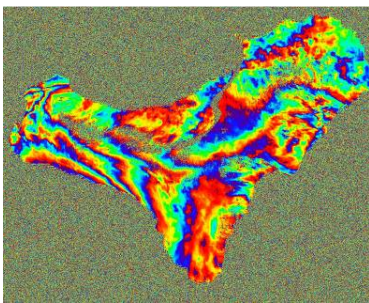
The aim of the visit of Dr. Pablo González to CNR-IREA was the study and the modeling of surface deformation due to volcano-tectonic activity at El Hierro, Canary Islands, Spain by using high temporal and spatial resolution satellite radar data.

To this end, we have acquired and processed a large amount of high-quality data from the advanced Italian COSMO-SkyMed (CSK) satellite constellation. These CSK data span a period of almost 2 years (September 2011 to August 2013) characterized by the start of a submarine eruption (October 2011) that ended in March 2012. Subsequently, short and strong swarms of seismic events (up to ~200 earthquakes/day) occurred with a pseudo-periodicity of ~3 months (**Fig. 1**).



**Fig. 1.** Sketch of the magmatic system during the El Hierro submarine eruption [González et al., 2013]

Preliminary computation and interpretation of surface deformation using CSK data carried out during the visit have revealed deformation patterns associated with multiple shallow intrusions of magma beneath El Hierro Island, at an unprecedented temporal and spatial scale (**Fig. 2**). Those results extend the previous work of the team, which established the basic understanding of the magmatic system before and during the 2011-2012 eruption and discussed wide implications to similar volcanic areas [Gonzalez et al., 2013].



**Fig. 2.** CSK differential interferogram spanning 4 days [25 to 29 June 2012] showing intense deformation (fringes) associated with magma intrusion and migration

Dr. González also processed radar images from the German TerraSAR-X (TSX) satellite, which has characteristics similar to CSK, although with lower temporal sampling. The TSX data showed that seismic swarms were accompanied by significant ground deformation. This confirmed the importance of analyzing the temporal denser CSK data to obtain enhanced deformation measurements. This will provide more details on how magma moved through the magmatic system, and its effects on volcano-tectonic structures.

The work done during the visit settled down a well defined research program aiming at a detailed modeling of how the magma migrates at El Hierro and at understanding under which conditions the magma migration leads to an eruption.

Furthermore, during his visit Dr. González gave a talk entitled: “Taking the pulse of the Earth through DInSAR: volcano, earthquake and anthropogenic hazard applications” in order to present his recent studies and to stimulate further cooperation with researchers of IREA-CNR.

**References:**

González P.J., Samsonov S., Pepe S., Tiampo K.F., Tizzani P., Casu F., Fernández J., Camacho A.G., and Sansosti E. (2013), Magma storage and migration associated with the 2011-2012 El Hierro eruption: Implications for shallow magmatic systems at oceanic island volcanoes, *Journal of Geophysical Research – Solid Earth*, 118, 4361–4377, doi:10.1002/jgrb.50289.