Geophysical Research Abstracts
Vol. 16, EGU2014-6689-2, 2014
EGU General Assembly 2014

Insights Into The Dynamics Of Aeolian Volcanic Islands From DInSAR COSMO-SkyMed Observations

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Differential Synthetic Aperture Radar Interferometry (DInSAR) is a remote sensing technique that allows investigating earth surface deformation phenomena (with centimeter to millimeter accuracy) by exploiting the round-trip phase components of Synthetic Aperture Radar (SAR) images relative to an area of interest.
In particular, we refer to the Small BAseline Subsets (SBAS) technique, which relies on the use of small baseline differential SAR interferograms and on the application of the singular value decomposition (SVD) method. This technique can generate deformation velocity maps and time-series of the area of interest; moreover, it has the peculiarity to be able to work at two-scale resolution in order to investigate both spatially large deformation phenomena and localized displacements.
Here we focus on the Aeolian Islands, one of the most tectonically and magmatically active zone in the Mediterranean Sea area, hosting several active volcanoes. We present preliminary results on deformation field on Lipari, Vulcano and Stromboli islands by exploiting COSMO-SkyMed (CSK) data both from ascending and descending orbits, generating time series extending from 2008 to 2013. We further combined ascending and descending data (low resolution, 20 meters) in order to separate the vertical and horizontal components of the deformation velocity.
First results show that all the three islands are deforming. Lipari is principally affected by non-volcanic deformation such as gravitational instability phenomena mainly located in correspondence of coastal cliffs. On Vulcano island, we observed subsidence of the volcano La Fossa of about 4-5 cm/yr and also gravitational instability phenomena. However, the most important deformation feature is found on Stromboli along 'La Sciara del Fuoco' feature, in correspondence of lava flows. In this case, we observed subsidence of few cm/yr.
By comparing InSAR results with recent structural data collected on the field at Lipari and Vulcano, we find that some of the deforming areas spatially correspond with measured fractured zones on the field. These preliminary findings suggest that some of the measured long-term features are actively deforming.
Stromboli CSK data used in this study have been processed at IREA-CNR within the SAR4Volcanoes project under Italian Space Agency agreement n. I/034/11/0, while Lipari and Vulcano CSK data have been processed in the framework of IREA-Civil Protection Department agreement.