Geophysical Research Abstracts
Vol. 17, EGU2015-397-1, 2015
EGU General Assembly 2015

Analogue Models Of Volcanic Spreading At Mt. Vesuvius

Ada De Matteo (), Raffaele Castaldo (2), Luca D'Auria (2,3), Michael James (4), Steve Lane (4), Bruno Massa (3), Susi Pepe (2), and Pietro Tizzani (2)

(2) Consiglio Nazionale Ricerche, Istituto per il Rilevamento Elettromagnetico Ambiente, Napoli, Italy, (3) Istituto Nazionale di Geofisica e Vulcanologia, Osservatorio Vesuviano, Napoli, Italy, (4) Lancaster Environment Centre, Lancaster University, Lancaster, UK.

Somma-Vesuvius is a quiescent strato-volcano of the Neapolitan district, southern Italy, for which various geophysical and geological evidences (e.g. geodetic measurements, geological and structural data, seismic profiles interpretations and surface deformation analysis with Differential Interferometric Synthetic Aperture Radar (DInSAR)) indicate ongoing spreading deformation. In this research we investigate the spreading deformation and associated surface deformation pattern by performing analogue experiments and comparing the results with actual ground deformation as measured using DInSAR data recorded between 1992 and 2010.

Somma-Vesuvius consists of a volcanic cone (Gran Cono) lying within an asymmetric caldera (Somma). The Somma caldera is the result of at least 7 Plinian eruptions, the last of which was the 79 CE. Pompeii eruption. The current cone of Mt. Vesuvius grew within the caldera in the following centuries as the effect of continued explosive and effusive activity of the volcano. The volcano lies on a substratum consisting of a Mesozoic carbonatic basement, overlapped by Holocene clastic sediments and volcanic rocks.

Our analogue models were built to simulate the shape of the Somma-Vesuvius top a scale of about 1:100000, emplaced on a sand layer (brittle behaviour) laid on a silicone layer (ductile behaviour). Models are based on the Fluid-dynamics Dimensionless Analysis (FDA), according to the Buckingham-Π theorem. In this context, we considered few dimensionless parameters that allowed the setting of a reliable scaled model. To represent the complex Somma-Vesuvius geometry, an asymmetric model was built by setting a truncated cone (mimicking the topography of Somma edifice) topped by another small cone (mimicking the Gran Cono) shifted off the axis of the main cone. Different experiments were carried out in which the thickness of the basal sand layer and of the silicone one were varied.

To quantify the vertical and horizontal displacements the models were monitored with three synchronised digital cameras, enabling sequential 3-D models to be derived using a photogrammetric technique.

Finally, our models were compared with the 1992 - 2010 SBAS DInSAR measurements of ground deformations obtained using ERS-ENVISAT satellite images. The results show that analogue models are able to reproduce different styles of volcanic spreading and to reproduce the observed surface and deformation pattern. At the end our models show a deformation rather similar to the actual deformation pattern of the Somma-Vesuvius, both in the direction and in the intensity. Further studies will be devoted at find the best combination of parameters (silicone layer thickness and viscosity) to fit observations and to introduce a tridimensional rigid based topography. These studies will be implemented also with new structural and surface deformation (DinSAR) data and will be integrated with a numerical modelling.