Geophysical Research Abstracts
Vol. 14, EGU2012-10771, 2012
EGU General Assembly 2012

3D temporal evolution and modeling of ground deformation recorded on Mt. Etna from the 2007 to 2008 through the SISTEM method

A. Bonforte, F. Guglielmino, and G. Puglisi

Istituto Nazionale di Geofisica e Vulcanologia, Osservatorio Etneo, Catania, Italy (alessandro.bonforte@ct.ingv.it, +39 095 7165826)

A study of the ground deformation pattern of Mount Etna volcano, based on the results of the SISTEM (Simultaneous and Integrated Strain Tensor Estimation from geodetic and satellite deformation Measurements) integration method is reported.
The SISTEM enables integrating geodetic in situ ground deformation measurements (GPS) with satellite interferometric measurements (ENVISAT), in order to obtain high resolution 3D displacement maps, allowing to overcome the limitations of each technique and take advantage of the particular features of each of them.
In this work ground motion data provided by GPS surveys are integrated with the interferometric synthetic aperture radar (InSAR) Envisat data, collected from 2007 to 2008, to provide 3D displacements maps.
We imaged the time evolution of ground displacement measured along the Line Of Sight (LOS) of the Envisat satellite for both ascending and descending Envisat geometries.
The main deformation episode occurred on Mt. Etna during the 2007-2008 time period was the May 2008 dike intrusion and the following 2008-2009 eruption. It started on May 13th, 2008, with the opening of an eruptive fissure propagating inside the topographical depression of the Valle del Bove, where the lava flows expanded. The eruption produced a lava flow of about 6 Km length, and it was preceded and accompanied by strong seismic release, and lava fountaining activity.
The 3D temporal evolution of ground deformation was analyzed in order to define the dynamics preceding and accompanying the onset of the 2008-2009 Mt. Etna eruption. In particular, this analysis reveals a slight inflation visible on the upper western side of the volcano in the pre-eruptive period (form June 2007 to May 2008) characterized by a small amplitude of the ground deformation, except on the eastern flank. Data inversions detected a pressurizing source located beneath the western flank of the volcano at a depth of about 3Km bsl.
In the period encompassing the eruption onset, the main ground deformation occurred around the summit craters, in the nearby of the eruptive fissures. The displacement pattern reveals also a rapid decay of the deformation gradient with the altitude confirming the shallow depth of the intrusion. The northward dyke propagation, occurred after the beginning of the eruption, was well detected by the SISTEM integrated displacement maps; it was confirmed by on field structural surveys that revealed a dry fracture field, propagating from the summit area towards the NNW direction for about 2.5 km. The inversion results confirm a dike located under the vents of the eruption and extending towards NNW, westward dipping.
In the post-intrusion period (from May to July 2008), a deflation of the volcano was detected, according to a depressurizing source, localized by data inversion, beneath the summit craters.