Flank dynamic of Mt. Etna by combining ascending and descending Permanent Scatterer analysis and GPS data.

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Abstract

The technology improvements of geodetic techniques and their increasing use for studying and monitoring the dynamic of Mt. Etna during the second half of nineties provided large amount of data for investigating the evolution of the deformation pattern of this volcano. The exploitation of SAR techniques and the spread use of GPS surveys represent the main features of this exiting period for the physical volcanology. Mt. Etna has been exploited as a very favorable volcanic test site for the application of the recently developed Permanent Scatterer SAR technique (PS) thanks to the fruitful cooperation between the INGV of Catania and the Politecnico of Milano. The PS technique allows overcoming most of the limitations of the classical SAR interferometry as the impossibility to identify isolated coherent scatterers and to exploit interferometric pairs with very large baseline. Moreover the PS technique allows estimating and removing the atmospheric phase contribution that may generate mis–interpretation of the Etna volcano deformation. Thanks to the PS technique, a very detailed map of the Etna active faults motion and ground compaction phenomena has been produced. More recently the PS technique has been applied to repeated ERS images taken from ascending and descending satellite passes. Particular care has been devoted to the estimation of the atmospheric profiles even on areas where just a few PS where identified, thus getting a very reliable ground motion estimation along different lines of sight. After an accurate co–registration of the two populations of PS on the same geographic reference grid, the E–W and the Vertical components of the PS displacement velocity have been discriminated. This analysis shows that the E–W motion component of the eastern flank of Mt. Etna is by far the dominating measured deformation. Thanks to the absence of radial or eccentric eruptions from 1993 to 2001 the studies of Mt. Etna through this period focused on the dynamics related to long–living phenomena as those produced either by the deep volcanic sources or the tectonic / volcano–tectonic features. The performed studies based on geodetic and geological data highlighted that the dynamic of the eastern and southeastern flank of Mt. Etna are quite different with respect to a radial pattern expected in a central volcano as Mt. Etna is. All data set confirm that the movements on these flanks are larger than expected and increase at lower altitudes. In this speech we show as the integration between the PS analysis and the GPS data could largely improve the capability to investigate the movements on Mt. Etna, both at large and small scale.