Application of InSAR to Volcano Deformation Studies

Paul Lundgren1 (818 354-1795; paul@dagobah.jpl.nasa.gov)
Riccardo Lamarri2 (+39 081 570 7999; lamarri@irece.na.cnr.it);
Giuseppe Puglisi2 (+39 081 570 44804; geo@ivv.ct.cnr.it);
Eugenio Sansosti3 (+39 081 570 7999; sansosti@irece.na.cnr.it);
Mauro Testa1 (+39 081 570 7999; testa@irece.na.cnr.it);
Giusep Franco Formaro3 (+39 081 570 7999; formaro@irece.na.cnr.it);
Alessandro Bonaforte3; Mauro Coltell3 (coltell@ivv.ct.cnr.it)

1 Jet Propulsion Laboratory, California Institute of Technology, 4800
Oak Grove Drive, Pasadena, CA 91103, United States
2 IRECE-CNR, Via Dei Colleoni, 328, Napoli 80124, Italy
3 Istituto Internazionale di Vulcanologia-CNR, Piazza Roma, 2, Catania
95123, Italy

Recent studies have demonstrated that interferometric synthetic aperture radar (InSAR) is an important technique for volcano deformation studies. We present new results obtained using InSAR to investigate the deformation of two distinct volcanoes in Italy: Mt. Etna and Campi Flegrei caldera. We demonstrate the potential for InSAR to monitor both the temporal and spatial changes in the deformation associated with each volcano. In particular we will show how the application of inverse techniques for a variety of deformation sources and through the joint inversion of ascending and descending interferograms allows us to distinguish between different types of sources. For each volcano we use SAR data from the ERS-1/2 satellites processed at either JPL or IRECE. In the case of Etna, we find that apparently dissimilar deformation patterns seen on descending and ascending InSAR data can be modeled by a combination of inflation of a spheroidal magma chamber below 5 km depth and elastic rebound beneath its NE flank. In contrast, five years of interferometry at Campi Flegrei show a similar elliptical pattern of subsidence. Joint inversion of similar time-span InSAR data are well fit by a simple 4 x 1.5 km deflation sill located 2.8 km beneath the caldera. Both of these examples demonstrate the contribution that InSAR can make towards volcano studies and the importance of having frequent InSAR data from two different look directions for distinguishing between the potentially complex and dynamic deformation found at volcanoes.