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Application of InSAR to Volcano Deformation Studies

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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 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 eastward slip on a basal decollement 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 deflating 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.

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