



Spatiotemporal analysis and interpretation of 2003-2013 ground deformation at Campi Flegrei, Italy, observed by advanced DInSAR

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Studies identify Campi Flegrei caldera as one of the highest risk volcanic areas in the world because of its close proximity to the city of Naples, the third largest municipality in Italy with population close to 1 million inhabitants, making it one of the most dangerous volcanic areas on Earth (Orsi et al., 2004; De Natale et al., 2006; Isaia et al., 2009). The last major eruption occurred at Monte Nuovo in 1538, following a short term of ground uplift which interrupted a period of secular subsidence that continued after the eruption. Since that time, Campi Flegrei caldera has undergone frequent episodes of ground uplift and subsidence, with uplift phases accompanied by seismic activity (Troise et al., 2007). Well-established volcanic surveillance networks monitor changes in seismicity, gas emissions and active ground deformation occurring in volcanic areas as indicators of renewed volcanic/magmatic activities, potentially culminating in eruption. Since 1988, secular subsidence has continued at the historic rate of approximately 1.5 cm/yr. Surveys revealed significant gravity changes between 1981 and 2001, likely the result of dynamic changes in the subsurface magmatic reservoir (Dvorak & Berrino, 1991; Fernández et al., 2001; Gottsmann et al., 2003), changes within the subsurface hydrothermal systems (Bonafede & Mazzanti, 1998), or a combination (Gottsmann et al., 2005, 2006). In this study we apply the advanced Multidimensional SBAS (MS-BAS) InSAR technique to measure ground deformation with high temporal and spatial resolution, and with high precision. We used 2003-2010 ENVISAT and 2009-2013 RADARSAT-2 satellite radar images and produced time series for the vertical and horizontal (east-west) components of deformation. Ground deformation results cover the entire Naples Bay area and, in particular, Campi Flegrei. Starting from June of 2010 we observe a moderate uplift at Campi Flegrei caldera. The rate of uplift substantially increased in 2011 and further accelerated in 2012. Between 2010 and 2013, the maximum cumulative uplift reached about 13 cm. Horizontal motions of up to 7 cm also were observed. We model the observed ground deformation in order to determine source parameters and the implication for volcanic hazard reduction in the Campi Flegrei region.