



Dynamics preceding and accompanying the 2008-2009 Eruption of Mt. Etna (Italy) imaged by integrated GPS and DInSAR data

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GPS and DInSAR data collected from June 2007 to June 2009 are analyzed in order to define the dynamics preceding and accompanying the onset of the Mt Etna eruption, occurred on 13 May 2008 and its evolution. Some short and long-term comparisons have been performed on both GPS and SAR data, covering similar time windows. The first GPS survey which we considered as reference in this study, was carried out in June 2007 on the entire Mt. Etna GPS network. The whole GPS network on Mt. Etna in 2007 consisted of 20 permanent stations and 83 benchmarks (mostly self-centering), installed all over the volcano and around it. 63 GPS benchmarks are surveyed in static mode by carrying out sessions lasting from at least 4 hours to 24 hours. A slight inflation is visible on the upper western side of the volcano by comparing the GPS surveys carried out on June 2007, February 2008 and May 2008. The emplacement of the eruptive dyke occurred on May 13, 2008 has been imaged by ENVISAT DInSAR pairs, an ascending one spanning from March to June 2008 and a descending one from May to July 2008, and by comparing two GPS surveys carried out on the uppermost part of the volcano on May 6 and 13, i.e. few hours after the beginning of the eruption, and on June 2008 again on the entire network. The short-term GPS (May 6-13) and DInSAR comparisons highlighted strong displacements localized on the summit area, quickly decreasing towards the middle flanks of the volcano; no significant ground deformation affected the volcano below about 1500 m asl. The longer period GPS comparison (May 6 – June 2008) allowed the syn-eruptive ground deformation to be imaged on a slightly more complete network. This dataset makes evident the lack of significant ground deformation on the southern, western and northern flanks below about 1700 m asl. On the contrary, deformation evidently propagates downwards to about 700 m asl on the North-eastern sector of the volcano. Long term analyses have been performed by comparing the June 2007 and June 2008 complete GPS surveys and by a DInSAR ascending pair from July 2007 to June 2008. A preliminary analysis of DInSAR data, covering a post-intrusion period, showed a clear anomaly in the fringe pattern, suggesting the presence of a depressurizing source localized beneath the upper south-western area. GPS comparison from May 13 to June 2008 confirms the local contraction of the summit part of the volcano accompanied by a significant motion of the NE flank. GPS surveys carried out in November 2008 on the NE part of the network and in June 2009 on the whole network, highlight a progressive slight deflation of the edifice and a still significant motion of its NE sector. In order to image the geometry of the feeding system of the volcano during the months preceding and accompanying the eruption, data inversions were also performed.