



Ground deformation pattern at Mt. Etna: 2004 and 2006 eruptions imaged by GPS and DInSAR data modelling

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After the end of the 2002-2003 eruption, Mt. Etna activity was characterized only by gentle degassing at the summit craters and some moderate earthquake swarms in the SE flank; no magmatic activity was observed at the summit craters. Despite this low energetic release suggested from volcanic activity, the GPS networks and DInSAR interferograms measured very intense ground deformation patterns after the 2002-03 eruption until July 2004, specially on the eastern flank of the volcano. Suddenly, an eruption started on September 7, 2004 in complete absence of summit crater volcanic activity, seismicity or seismic tremor, and ground deformation. The eruption lasted until March 12, 2005. From 2004 to 2005, a marked deflation of Mt. Etna volcano is measured by GPS surveys. During the 2004-2005 eruption a degassed magma was emitted, that was already resident inside the volcano after the previous eruptions, at shallow depths. Thus the appearing of the magma at the surface was due to its passive intrusion in the shallow part of the volcanic pile, induced from the exceptional extension on the summit area as revealed by GPS and DInSAR. This unusual deformation was caused by the high sliding rate of the eastern flank of the volcano pushed by the big intrusion occurred on 2002 along the north-east rift zone. The modelling of GPS data encompassing the eruption (from 2004 to 2005) defines a sill-shaped source located at a depth of about 4 km b.s.l. beneath the upper south-eastern flank of the volcano. During the 2005-2006 period, the volcano restarted to inflate, showing a ground deformation pattern opposite to that detected during the 2004-2005 eruption. A vertically elongated pressurizing source was located by GPS data inversion at a depth of about 3 km b.s.l. The goodness of this model has been tested also by producing the corresponding synthetic interferogram which was compared with the real DInSAR

data available for the same period. The modelling of the inflation measured for the 2005-2006 time interval indicates a refilling of the plumbing system of the volcano by magma upraising from depth. In fact, the ellipsoidal pressurization source is vertically elongated well reproducing a vertical storage volume from the western side of the high Vp body towards the summit area.