Geophysical Research Abstracts,
Vol. 11, EGU2009-12730, 2009
EGU General Assembly 2009

3D surface deformation at Mt. Etna in the period 2005-2008 mapped by airborne stereo scanning

K. Gwinner (1) and M. Coltelli (2)

(1) German Aerospace Center (DLR), Institute of Planetary Research, Berlin, Germany (klaus.gwinner@dlr.de), (2) Istituto Nazionale di Geofisica e Vulcanologia (INGV), Catania, Italy

The 2006-2008 eruptive period of Etna volcano produced extensive lava flow fields and pyroclastic deposits inside Valle del Bove and on the upper east flank of the summit cone from the Southeast Crater and new fissure systems. Eruptive activity was accompanied by short phases of intensified ground deformation, in particular in conjunction with the opening of eruptive fissures in July and October 2006 at the southeast crater cone and in May 2008 on the upper western slope of Valle del Bove.

We mapped the distribution of associated surface displacements for the summit area of Etna (above about 2000 m above sea level) and for Valle del Bove based on multiple airborne stereo imaging campaigns (providing DEMs of 1 m resolution and orthoimages of 20 cm resolution) and multi-temporal sub-pixel image correlation. A filtering procedure allows us to detect correlation errors and to improve point precision at the expense of a small reduction of horizontal resolution. The displacements are separated into north, east and height components. According to internal estimates the precision is about 5-10 cm (10-15 cm for height). They are referred to an absolute reference system (WGS84) within the quality of the absolute geo-referencing of the stereo models (also in the range of 10-20 cm). The grid spacing of the maps is 5 m. Additional information comes from morphotectonic interpretation of image and DEM data, mapping of structures visible in these, and from field mapping. The derived displacement fields have also been compared to available GPS data.

While the displacements observed for the 2005-2007 period are confined to smaller local areas, the 2007-2008 period has produced an extensive displacement field that requires to consider important interior processes as causative mechanisms. The observed surface displacements locally attain maximum values of more than 1 m for both horizontal components and subsidence of more than 3 m. The lateral continuity and high spatial resolution of the maps allow us to identify strong lateral displacement gradients that are most likely related to the activity of well defined structures. While the deformation pattern observed along the surface trace of the May 2008 eruptive fissure (trending roughly to the NW) on the whole is compatible with extension associated with dike intrusion below the upper western slope of Valle del Bove, the displacement field observed on the upper NE-flank of Etna shows more complex characteristics and suggests to consider the interaction with other structures present in this area that marks also the boundary of the instable eastern sector of the volcano.