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Mt. Etna ground deformation detected by SISTEM approach using GPS data and multiple SAR sensor

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The availability of both multiple SAR datasets and GPS stations over Mt. Etna during the 2009-2010 time span, allowed us to apply the SISTEM integration in order to capture a more complete figure of the ground deformation affecting the volcano.
In particular we use both ascending and descending views of C-band ENVISAT and X-band COSMO-SkyMed sensors, and the ascending view of L-band ALOS sensors. The SAR data have been analyzed by using a time series approach, based on the SBAS technique.
Moreover, thanks to the availability of dense (105 benchmarks) geodetic in situ data collected on Mt. Etna, it was possible to validate and integrate the SAR data with the GPS ground deformation data applying the SISTEM approach.
The SISTEM approach simultaneously integrates all the available datasets (i.e. GPS displacement vectors on sparse benchmarks and SAR displacement maps), providing a high-resolution 3D displacement map by taking advantage of the positive features of each datasets, i.e. the availability of multiple view geometries of COSMO-SkyMed and ENVISAT data, together with the high temporal and spatial resolution of the COSMO-SkyMed data, the good coherence of ALOS L-band interferometric data, and the full 3D displacement components provided by GPS with sub-cm accuracy level.
The preliminary results are consistent with the geophysical and volcanological background knowledge of the Mt. Etna dynamic during the 2009-2010 period, showing a general inflation of the entire volcanic edifice coupled with the ESE sliding of the eastern and southeastern flank.
The displacement pattern, resulting by applying the SISTEM integration method, provides an accurate spatial characterization of ground deformation, well constrained by the multiple SAR data and ground GPS measurements.
ALOS and COSMO-SkyMed SAR data were acquired in the framework of SAR4Volcanoes research project under Italian Space Agency agreement n. I/034/11/0. The ENVISAT data were acquired in the framework ESA CAT.1 5843 project.