Cities on Volcanoes 9
November 20-25, 2016
Puerto Varas, Chile
'Understanding volcanoes and society: the key for risk mitigation'

Long-term dynamics across a volcanic rift: 20-year microgravity and GPS observations on the S flank of Mt. Etna

Alessandro Bonforte [1]; Giovanni Fanizza [2]; Filippo, Greco [1]; Alfredo Matera [2]; Roberto Sulpizio [2]

[1]Istituto Nazionale di Geofisica e Vulcanologia, Sezione di Catania – Osservatorio Etneo. Piazza Roma, 2 – 95125 Catania (Italy)

[2]Dipartimento di Scienze della Terra e Geoambientali. Via Orabona 4, 70125, Bari (Italy)

Keywords: Rift zone; time-series; surveys; volcano-tectonics; ground deformation; microgravity

In this paper an integrated analysis of microgravity and ground deformation is performed over a 20-year time span (1994-2014). Gravity variations have been first corrected for the free-air effect using the GPS observed vertical deformation and the experimental vertical gravity gradients measured at each station. The free-air corrected gravity changes were then reduced from the high frequency variations (noise) and the seasonal fluctuations, mainly due to water-table fluctuations. This long-term dataset constitutes a unique opportunity to examine the behavior of Etna in a period in which the volcano exhibited different styles of activity characterized by recharging phases, flank eruptions and fountaining episodes. The gravity and deformation data allow investigating the response of the volcano in a wider perspective providing insights into the definition of its dynamic behavior and posing the basis to track the unrest evolution. The joint analysis highlights common periods in which the signals underwent contemporaneous changes occurring mainly in the central and eastern stations. Specifically, it was possible to distinguish three different sectors of the profile, showing different deformation and gravity patterns over different sectors characterized by different correlation between the two time series: the western sector, lying West of the South Rift, a central one lying between the South Rift and the 1989 fracture zone, and an eastern one lying East of the 1989 fracture system. Indeed, the integrated analysis of the spatio-temporal variations of the gravity and the ground deformation data highlights different volcano-tectonic processes controlling the dynamical behavior of Etna volcano in the southern sector.