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GNSS and InSAR study of the ground deformation of the eastern flank of Mount Etna from 2016 to 2019

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The geodynamic framework of Mount Etna volcano (Italy) is characterised by two superimposed tectonic domains: a compressional one, oriented N-S, and an extensional one, oriented approximately WNW-ESE. The combination of these two domains and the volcano activity, has generated a complex system of faults prevalently on the eastern flank of the volcano. The eastern flank is the most active area of the volcano in terms of deformation and seismicity. The velocities there are at least one order of magnitude greater than in the rest of the volcano flanks due to the eastward sliding of the eastern flank.

The monitoring and analysis of the acceleration occurring on the eastern flank of Mount Etna is the keystone to understand the volcano-tectonic dynamics that, apart from the tectonic and magmatic processes, involves the instability of this flank in a densely inhabited area.

In order to monitor the deformation, Istituto Nazionale Geofisica e Vulcanologia – Osservatorio Etneo (INGV-OE) and the GeoDynamic & GeoMatic Laboratory of the University of Catania integrate GNSS and InSAR products with twofold objective: to characterize the dynamics of the area and to analyse the deformation transients, this last in view of a possible use in the framework of an alert system.

Here, we analyse the ground deformation that occurred between 2016 and 2019 across the faults of the south-eastern flank of Mount Etna. On the south-eastern flank the deformation is accommodated by several faults which have different kinematics and behaviours. We discriminate the deformation transient and the activity of the Belpasso-Ognina lineament, Tremestieri, Trecastagni, San Gregorio-Acitrezza, Linera, Nizzeti and Fiandaca faults. The latter generated the 26 December 2018 earthquake, two days after the eruption of 24 December, which induced a clear post seismic deformation, detected by GNSS and InSAR data. In particular, we discriminate the deformation occurred along the San Gregorio-Acitrezza fault, which is accommodated by the Nizzeti fault, and we analyse the post seismic deformation along the Linera fault. We analyse the Slow Slip Events (SSE) that are observed in the GNSS and InSAR time series in the vicinity of the Acitrezza fault and we quantify and discuss the tectonic origin of the Belpasso-Ognina lineament that we interpreted as a tear fault.