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A multidisciplinary approach to study an active fault crossing densely inhabited areas through ground deformation data: the Trecastagni fault at Mt. Etna (Italy)

A. Bonforte (1), A. Carnazzo (2), S. Gambino (2), F. Guglielmino (1), F. Obrizzo (3), and G. Puglisi (3)

(1) Istituto Nazionale di Geofisica e Vulcanologia, Sezione di Catania - Osservatorio Etneo, Catania, Italy , (2) Provincia Regionale di Catania,Via Novaluce,67/A - 95030 Tremestieri Etneo (CT), Italy, (3) Istituto Nazionale di Geofisica e Vulcanologia, Sezione di Napoli - Osservatorio Vesuviano, Napoli, Italy

The Trecastagni Fault (TF) is a discontinuity that develops in the southern flank of Mt. Etna, between the Trecastagni and San Giovanni la Punta villages. This is an active structure with an approximately NNW-SSE trend characterized by continuous dynamics of normal and right-lateral type with intermittent accelerations, producing morphological escarpments and very shallow seismicity. The effects of the activity of the TF (creep) are visible on much of the provincial road 8/III and buildings. The fault has an important role in the instability affecting Mt. Etna's south-eastern flank and represents part of the southern boundary of the unstable sector. The seismicity of the TF is characterized by very shallow earthquakes with typical focal depths of 1-2 km. Evident co-seismic surface faulting occurred along the fault scarp in September 1980 and in November 1988. The motion of the fault between 2005-2011 been analyzed by using a multi-disciplinary approach involving terrestrial and satellite ground deformation data. At present, the systems that are able to investigate the fault of Trecastagni in detail are the extensometers installed in 2005, the levelling network installed in 2009 and InSAR remote sensing techniques. Levelling, InSAR and seismicity suggest that the activity of the TF should be related to the dragging effect of the sliding dynamics of the south-eastern flank of the volcano. The fault decouples a faster and south-eastwards moving block at east (hangingwall) from a slower and south-south-eastwards moving one at West (footwall). Two episodes of acceleration were recorded at the end of 2009 and during 2010. Data evidences that the acceleration episodes affected only portions of the fault and that stress may be accumulated and be periodically released. Acceleration of the eastern flank (to which the episodes of 2009 and 2010 seem to be related), can increase the stress accumulation inducing a seismic rupture on the fault; reservoir inflation and dyke intrusion seems to be a secondary cause of the TF accumulation and its release process.