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Multidisciplinary analyses for mapping and evaluating kinematics and stress/strain field at active faults and fissures at NE Rift, Mt Etna (Italy)

Susanna Falsaperla[1], Alessandro Tibaldi[2,3], Noemi Corti[2], Emanuela De Beni[1], Fabio L. Bonali[2,3], Horst Langer[1], Marco Neri[1], Massimo Cantarero[1], Danilo Reitano[1], and Luca Fallati[2]

[1]Istituto Naz. Geofis. Vulcanol., Sezione di Catania, Osservatorio Etneo, Catania, Italy (susanna.falsaperla@ingv.it)

[2]Department of Earth and Environmental Sciences, University of Milan-Bicocca, Milan, Italy

[3]CRUST- Interuniversity Center for 3D Seismotectonics with Territorial Applications, Italy

Strategies for disaster risk reduction in volcanic areas are mostly driven by multidisciplinary analyses, which offer effective and complementary information on complex geomorphological and volcano-tectonic environments. For example, quantification of the offset at active faults and fissures is of paramount importance to shed light on the kinematics of zones prone to deformation and/or seismic activity. This provides key information for the assessment of seismic hazard, but also for the identification of conditions that may favor magma uprising and opening of eruptive fissures.

Here we present the results of a study encompassing detailed geological, structural and seismological observations focusing on part of the NE Rift at Etna volcano (Italy). The area is situated at an elevation ranging between 2700 and 1900 m a.s.l. where harsh meteorological conditions and difficult logistics render classical field work a troublesome issue. In order to bypass these difficulties, high-resolution (2.8 cm) UAV survey has been recently completed. The survey highlights the presence of 250 extension fractures, 20 normal fault segments, and 54 eruptive fissures. The study allows us to quantify the kinematics at extensional fractures and normal faults, obtaining an extension rate of 1.9 cm/yr for the last 406 yr. With a total of 432 structural data collected by UAV along with SfM photogrammetry, this work also demonstrates the suitability of the application of such surveys for the monitoring of hazardous zone.