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Massive data collection in volcanic areas owing to photogrammetry-derived models: a key example from the NE Rift, Mt Etna (Italy).

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The collection of a conspicuous amount of data in volcanic areas is a key for a deeper understanding of the relationships between faulting, diking and superficial volcanic processes. A way to quickly collect huge amounts of data is to analyse photogrammetry-derived models (Digital surface models, orthomosaics and 3D models) using Unmanned Aerial Vehicles (UAVs) to collect all necessary pictures obtaining final models with a texture ground resolution up to 2-3 cm/pix.

In this work, we describe our approach to build up models of a broad area located in the NE Rift of Mt. Etna, which is affected by continuous ground deformation linked to gravity sliding of the eastern flank of the volcano and dyke injection. The area is characterized by the presence of eruptive craters and fissures, extension fractures, and normal faults, as well as by historical lava flows. The goal was to quantify the kinematics at extensional fractures and normal faults, integrating the latter with seismological data to reconstruct the stress field acting in this peculiar sector of the volcano. By the point of view of UAV surveying, the test area is challenging since it is located at an altitude ranging between 2700 and 1900 m a.s.l., and it is affected by extreme weather conditions, like a strong wind. Resulting models, in the form of DSM and orthomosaic, are characterised by a resolution of 11.86 and 2.97 cm/pix, respectively, obtained from the elaboration of 4018 photos and covering an area of 2.2 km^2. Thanks to these models, we recognized the presence of 20 normal fault segments, 250 extension fractures, and 54 single eruptive fissures. Considering all the above mention data, we quantified the kinematics at extensional fractures and normal faults, obtaining an extension rate of 1.9 cm/yr for the last 406 yr.