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An approach for volcano-tectonic features extraction using optical and radar remote sensing data

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Volcanic and tectonic features significantly differ depending on the eruption styles and on the tectonic processes from which they were originated.

We present here a study focused on the identification and characterization of Earth volcanic and tectonic structures by analyzing a combination of airborne and satellite optical images and Synthetic Aperture Radar (SAR) data. Our work is aimed at developing a robust approach to compare Earth and other terrestrial planet's surface features, and to constrain their nature and occurrence in relation to volcano-tectonic activity.

We focus on the Mt. Etna and the Aeolian Islands, which host several active volcanoes (*e.g.*, Stromboli and Vulcano) and represent one of the most tectonically and magmatically active zones in the Mediterranean Sea area. Indeed, Etna, Vulcano and Stromboli, despite their geographical proximity, provide examples of very different volcanic activities and thus of diverse complex morphologies.

The first stage of this study includes the processing of Pleiades tri-stereo acquisitions and high resolution DEMs of the regions of interest. This dataset will be analyzed through a novel automatic feature extraction algorithm that identifies the most common structures originating from natural processes, *i.e.*, volcano-tectonic activities, and strong erosions.

Pyroclastic cones, lava flows and fissures are some of the signs that we can detect and compare with accurate volcano-tectonic maps and geological maps. This further step will allow resolving their nature and origins, distinguishing features based on geometric criteria and according to the volcanic and tectonic processes that generated them.

Moreover, the processing of COSMO-SkyMed (CSK) and Sentinel intensity data will be carried out to determine if the most relevant extracted features match those visible on high-resolution Digital Elevation Models from Airborne photogrammetry and Lidar Surveying. This analysis is also devoted to understand how SAR observation capabilities vary with sensor resolution, geometric distortion and surface roughness.