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ALS surveys to monitor an active volcanic area: the case of Stromboli Island (Italy)

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Airborne laser scanning is today the most effective data acquisition technology for the production of high resolution, high quality DTMs (Digital Terrain Models). The only competing technique might be aerial photogrammetry with direct camera orientation by GPS/INS (Inertial Navigation Systems) and DTM generation by digital image correlation; with aerial digital cameras the automation of the workflow should not be far from that of the laser scanner. Nevertheless, the preference for the laser scanner is clear and unlikely to be reversed. Because of its characteristics (first and last pulse, penetration rate in forested areas, narrow field angles, independence on shadows and object textur), laser scanning is indeed better suited and more versatile than photogrammetry for DTM production in urban areas as well as in forested areas.

Focused on the Island of Stromboli this work investigates whether airborne laser scanner systems can be effectively adopted to survey and monitor active volcanic areas. We present the results obtained from the analysis of ALS data collected on Stromboli Island before and after the last eruption at Stromboli occurred in February-April 2007. The analysis allowed to obtain quantitative data to identify the geometry of deformation features and evaluate the volumes of the displaced (failures and landslides) and emplaced (lava flows) mass along the of the Sciara del Fuoco slope. We focused on the capability of extracting accurate topographic data from ALS range measurements, despite the rough morphology, the presence of vegetation and the steepness of the island slopes. Beam intensity values were processed in order to identify different surface features related to lithology and roughness and to evidence changes induced by erosion and the lava effusion processes.