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Morphological and kinematic evolution of a large earthflow: the Montaguto landslide, southern Italy

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We present the results obtained from the use of complementary monitoring techniques, which allowed us to investigate the long (multi-decadal) and the short (seasonal) term geomorphological evolution of the Montaguto earthflow, a 3 km long earthflow in the southern Apennines of Italy.

Following an analysis of the different methods and techniques available to measure the surface deformation caused by large earthflows, we selected a combination of monitoring techniques ranging from in-situ to remote sensing, including aerial and satellite optical imagery, multitemporal airborne LiDAR surveys, and three-dimensional topographic measurements captured by three Robotized Total Stations. The examination of the available aerial, satellite and hill-shade images revealed a cyclic, long-term behavior of mass movements of different types in the Rio Nocelle catchment occupied by the recent Montaguto earthflow in the 58-year period 1954 – 2011. The combined analysis of six DEMs generated from LiDAR surveys allowed measuring the material eroded from the landslide crown area (Volume $\sim$ 1.4 Million cubic meters) and deposited in the landslide toe area (Volume $\sim$1.2 Million cubic meters), in the period from 2004 to June 2011. The analysis of a large set of high-accuracy topographic measurements revealed the kinematical characteristics of different sectors of the active earthflow, and allowed for the reconstruction of the temporal and spatial surface deformation of the moving failure.

The insights obtained studying the Montaguto earthflow are significant for the geo-mechanical modeling of similar earthflows in the same geographical area, for geomorphological regional landslide mapping, and for the evaluation of the hazard and the risk posed by large earthflows in southern Italy and in similar physiographic regions.