



Geomorphological characterisation and PSInSARTM monitoring activities of a large slope instabilities in the External Liguride ophiolites (Northern Apennine, Italy)

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This work presents the case-study of a large slope instabilities along the left orographic side of the Gramizza Stream (Upper Aveto Valley). This area represents the most well-known and typical part of the Aveto Natural Park (Mt. Penna and Mt. Aiona area) for its valuable geodiversity that features it.

The interest in this slope is both basic geology – for its lithological and tectonical setting and geomorphological features – and engineering geology, owing to the extensive presence of instability phenomena. These movements frequently involve with man-made structures, as showed by the number of damages that can be observed on the buildings in the Magnasco and Cerisola hamlets.

The geomorphological interpretation of these areas is not easy and univocal, because of the number of existing landforms and processes. Such a situation often led to discordant interpretations given by various Authors who studied this area in the past (i.e. the large covers featuring the entire slope that have alternatively been interpreted as either glacial deposits, landforms related to a crionival environment or gravity-induced deposits). Similarly, the scarps that can be observed on the northern slope of the Mt. Aiona are still commonly interpreted as cirques, despite the scarce scientific evidences supporting the hypothesis of a glacial landform.

This complexity mainly depends on the particular geological and tectonic-structural setting: in this sector, indeed, flysch deposits, ophiolitic and ultramafic masses, associated with heterogeneous breccias and olistolithes, detached from their original site (Ottone Tectonic Unit – External Ligurides), crop out.

The field survey shows that the entire sector features landforms, processes and deposits due to gravity, running waters, structural elements and periglacial processes. These originated large-scale landslide, favoured by geomorphological features of the rock masses, highly fractured and jointed, due to the heterogeneous nature and structural characteristics of the External Ligurides geological formations. It is hypothesised that the entire system ridge-slope-valley is characterized by a deep-seated gravitational slope deformation; several geomorphological evidences have been detected (double ridges, reverse slope, trenches, closed depressions, etc), involving extensive ridge portions, remobilizing and revising deposits of various origin. Some landform seems to be refer to periglacial processes (wetlands, endoreic depressions, block stream, etc.) show out that the environment has typical periglacial dynamics.

The followed methodology includes a preliminary bibliographic and maps research, carried out both for engineering geomorphological scientific notes and for land-planning tools; bibliographical data have been integrated by an accurate geological and geomorphological field survey. The photo-interpretation of aerial photographs and the development of digital stereoscopic models preceded the survey.

Geophysical surveys has been realized to evaluate the thickness of the large landslide and to obtained a preliminary engineering geological model.

Further indications for the interpretation of the kinematic mechanism and state of activity of the phenomena were obtained from the analysis of the satellite-monitoring data PSInSARTM (Permanent Scatterers) radar interferometric technique.

The obtained results have been included in the applied geomorphological map of the slope bounded by the mounts Penna, Aiona, degli Abeti and the Gramizza stream. This geoenvironmental map, of recognized scientific value, currently represent a useful tool for the correct land planning and management, the natural hazards mitigation and the planning of works for environmental and soil protection.