



## **Geological-geomorphological characterisation and monitoring activities of a large slope instabilities in Upper Graveglia Valley (Ligurian Apennine, Italy)**

Francesco Faccini (1,2), Franco Marco Elter (1), Paolo Allasia (2), Luca Berruti (3), Danilo Godone (2), Davide Notti (2), and Flavio Poggi (3)

(1) DiSTAV, Università degli Studi di Genova (Italia), (2) CNR-IRPI, sede secondaria di Torino (Italia), (3) Settore Interventi Difesa del Suolo, Regione Liguria (Italia)

Large slope instabilities is a recent research field with significant implications either for scientific knowledge or for the most engineering issues.

The landforms and processes recognition that characterize large slope instabilities requires a multidisciplinary approach, from basic geology to applied geomorphology, from thematic mapping to geotechnical engineering.

The new techniques of remote sensing have allowed in recent years a better identification of these large slope phenomena, which can feature different degrees of hazard and risk for the inhabited areas and infrastructures.

In this research we present the geological-geomorphological study and the monitoring activities of the large-scale landslides on which the villages of Arzeno and Prato di Reppia in Upper Graveglia Valley are settled. This is a well-known territory from the Earth Sciences researchers as the Upper Graveglia Valley is internationally recognized for its exceptional ophiolitic sequence with its sedimentary covers and for the mining activity.

The Upper Graveglia valley, in the part between the Biscia Pass, Mt. Chiappozzo and the Reppia stream, which includes the villages of Prato di Reppia, Arzeno and Case Soprane, shows several morphological evidences that could be linked to a Mountain Slope Deformation.

In the upper sector, remarkable wetlands can be observed in flat areas, which can be associated with trench filled by swampy deposits.

For decades there have been reports of slope instability phenomena in the villages of Arzeno, Prato di Reppia and Case Soprane, which are outlined by several indirect kinematic indicators.

As a result of a project funded by Regione Liguria with the 2015 yearly geohydrological risk mitigation works regional program, drilling activities were carried out to identify the stratigraphic sequence and to set up monitoring network.

In 2015, a first geognostic survey was carried out in the village of Arzeno, characterized by n. 4 boreholes with piezometric cases, which showed a complex stratigraphy and hydrogeology.

In 2016, an extensive geophysical survey was launched in order to properly plan the second geognostic survey carried out in 2017 and composed by 6 boreholes: n. 2 inclinometer cases were installed (one with robotized system) and n. 4 piezometric cases.

The monitoring instrumentation was completed with the installation of a weather station and n. 2 GPS benchmarks, to make a crosscheck of the displacements.

The monitoring activities also included the damage degree of buildings survey by measurement of cracking in facades and the use of the PSInSAR<sup>TM</sup> displacement rate data delivered by the National Environmental Remote Sensing Project.

The field survey and monitoring activities show a complex situation for the studied slope: an evolution of the large slope instabilities in several compartments with different kinematics and hydrogeological set-up is recognized, as well as a good convergence between satellite, GPS and inclinometric monitoring data.