



Implementation of a landslide early warning system based on near-real-time monitoring, multisensor mapping and geophysical measurements

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An early warning system has been implemented to monitor the Perarolo di Cadore landslide (North-Eastern Italian Alps), which is a slump whose induced risk is fairly high because a slope collapse could form a temporary dam on the underlying torrent and, therefore, could directly threaten the close village.

A robotic total station (RTS) measures, with 6h returning time, the positions of 23 retro-reflectors placed on the landslide upper and middle sectors. The landslide's kinematical behavior derived from these near-real-time (NRT) surface displacements is interpreted on the basis of available geomorphological and geological information, geometrical data provided by some laser scanning and photogrammetric surveys, and a landslide model obtained by means of 3D Electrical Resistivity Tomography (3D ERT) measurements. In this way, an analysis of the time series provided by RTS and a pluviometer, which cover several years, allows the definition of some pre-alert and alert kinematical and rainfall thresholds. These thresholds, as well as the corresponding operational recommendations, are currently used for early warning purposes by Authorities involved in risk management for the Perarolo landslide. It should be noted the fact that, as new RTS and pluviometric data are available, the thresholds can be updated and, therefore, a fine tuning of the early warning system can be carried out in order to improve its performance.

Although the proposed approach has been implemented in a particular case, it can be used to develop an early warning system based on NRT data in each site where a landslide threatens infrastructures and/or villages that cannot be relocated.