# Submitted Abstract

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## Abstract

Risk assessment of rain-induced landslide over large areas is quite challenging due to the complexity of the phenomenon. Standard methods of 3D slope stability analysis (i.e., LEM, FEM or FDM) cannot be efficiently applied over extended areas with high resolution, in addition the monitoring changes in soil saturation is a key aspect in the landslide analysis. However, there is no simple relationship between the water content into the soil and the hydraulic conditions of the slopes at the depths at which the landslides develop, so the knowledge of the actual soil moisture should be monitored. Hence, to create a warning system for monitoring and forecasting landslide susceptibility to measured/forecasted rainfalls, LAMP (LAndslide Monitoring and Predicting) system has been developed (Bovolenta et al., 2016). In the frame of the INTERREG-ALCOTRA project called AD-VITAM, LAMP has been applied to several sites located in the Alpine territory on the Italian-French border.

LAMP is based on a physical based Integrated Hydrological Geotechnical (IHG) model (Passalacqua et al., 2016) fed by a low-cost and self-sufficient Wireless Sensor Network (WSN), allowing quasi-real time analyses.

The IHG model is designed to describe the response to susceptibility to landslides (specifically debris and earth slides) of a few square kilometres, typically at scale 1:5.000. Implemented in GIS environment, the modelling is completely 3D, the spatialization being made possible through appropriate data interpolation and extrapolation methods from in situ investigations and geotechnical surveys (Passalacqua et al., 2013). The site characterization requires the knowledge of piezometric measurements, stratigraphy, physical parameters, soil strength and permeability.

The model is fed by monitoring data (rainfall, temperature, soil water content) which vary both in space and time, considering the wetting condition of the soil and the water table oscillation in the previous days.

Soil moisture data are measured using capacitance sensors that allow an extremely fast response and a little request of maintenance. The use of low-cost sensors in landslide areas can allow the monitoring of large territories, but appropriate calibration is required. Multiple installations (along vertical alignments) of capacitance sensors are placed in the nodes of the monitoring network. They provide real-time water content profiles in the shallow layers (typically in the upper meter) of a slope. The integration of such monitoring system in the IHG model may be useful for the analysis and prediction of landslides triggered by rainfalls and could be of real support in risk management.