Abstract

Integrating Satellite Soil Moisture and Rainfall Data on a Data-Driven Model for the Assessment of Shallow Landslides Hazard [†]

Claudia Meisina [1,*], Massimiliano Bordoni [1], Luca Lucchelli [1], Luca Brocca [2], Luca Ciabatta [2], Beatrice Corradini [1] and Valerio Vivaldi [1]

[1] Department of Earth and Environmental Sciences, University of Pavia, Pavia, Italy;
massimiliano.bordoni@unipv.it (M.B.); luca.lucchelli01@universitadipavia.it (L.L.);
beatrice.corradini01@universitadipavia.it (B.C.); valerio.vivaldi@unipv.it (V.V.)

[2] Research Institute for Geo-Hydrological Protection, National Research Council, Perugia, Italy;
luca.brocca@irpi.cnr.it (L.B.); luca.ciabatta@irpi.cnr.it (L.C.)

* Correspondence: claudia.meisina@unipv.it

† Presented at TERRAenVISION 2019, Barcelona, Spain, 2–7 September 2019.

Abstract: Shallow landslides are very dangerous phenomena, widespread all over the world, which could provoke significant damages to buildings, roads, facilities, cultivations and, sometimes, loss of human lives. It is then necessary assessing the most prone zones in a territory which is particularly susceptible to these phenomena and the frequency of the events, according to the return time of the triggering events, which generally correspond to intense and concentrated rainfalls. Susceptibility and hazard of a territory are usually assessed by means of physically-based models, that quantify the hydrological and the mechanical responses of the slopes according to particular rainfall amounts. Whereas, these methodologies could be applied in a reliable way in little catchments, where geotechnical and hydrological features of the materials affected by shallow failures are homogeneous. Moreover, physically-based models require, sometimes, significant computation power, which limit their implementations at regional scale. Data-driven models could overcome both of these limitations, even if they are generally built up taking into only the predisposing factors of shallow instabilities. Thus, they allow usually to estimate the susceptibility of a territory, without considering the frequency of the triggering events. It is then required to consider also triggering factors of shallow landslides to allow these methods to estimate also the hazard. This work presents the preliminary results of the development and the implementation of data-driven model able to estimate the hazard of a territory towards shallow landslides. The model is based on a Genetic Algorithm Model (GAM), which links geomorphological, hydrological, geological and land use predisposing factors to triggering factors of shallow failures. These triggering factors correspond to the soil moisture content and to the rainfall amounts, which are available for entire a study area thanks to satellite measures. The methodological approach is testing in different catchments of 30–40 km² located in Oltrepò Pavese area (northern Italy), where detailed inventories of shallow landslides occurred during past triggering events and corresponding satellite soil moisture and rainfall maps are available. This work was made in the frame of the ANDROMEDA project, funded by Fondazione Cariplo.

Keywords: shallow landslides; remote sensing; data-driven models; rainfall; hazard

---