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A near real time scenario at regional scale for the hydrogeological risk

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The early warning systems dedicated to landslides and floods represent the Umbria Region Civil Protection Service new generation tools for hydraulic and hydrogeological risk reduction. Following past analyses performed by the Functional Centre (part of the civil protection service dedicated to the monitoring and the evaluation of natural hazards) on the relationship between saturated soil conditions and rainfall thresholds, we have developed an automated early warning system for the landslide risk, called LANDWARN, which generates daily and 72h forecast risk matrix with a dense mesh of 100 x 100m, throughout the region. The system is based on: (a) the 20 days -observed and 72h -predicted rainfall, provided by the local meteorological network and the Local scale Meteorological Model COSMO ME, (b) the assessment of the saturation of soils by: daily extraction of ASCAT satellite data, data from a network of 16 TDR sensors, and a water balance model (developed by the Research Institute for Geo-Hydrological Protection, CNR, Perugia, Italy) that allows for the prediction of a saturation index for each point of the analysis grid up to a window of 72 h, (c) a Web-GIS platform that combines the data grids of calculated hazard indicators with layers of landslide susceptibility and vulnerability of the territory, in order to produce dynamic risk scenarios. The system is still under development and it's implemented at different scales: the entire region, and a set of known high-risk landslides in Umbria. The system is monitored and regularly reviewed through the back analysis of landslide reports for which the activation date is available. Up to now, the development of the system involves: a) the improvement of the reliability assessment of the condition of soil saturation, a key parameter which is used to dynamically adjust the values of rainfall thresholds used for the declaration of levels of landslide hazard. For this purpose, a procedure was created for the ASCAT satellite data daily download, used for the derivation of a soil water content index (SWI): these data are compared with instrumental ones from the TDR stations and the results of the water balance model that evaluates the contributions of water infiltration, percolation, evapotranspiration, etc. using physically based parameters obtained through a long process of characterization of soil and rock types, for each grid point; b) The assessment of the contribution due to the melting of the snow; c) the physically based - coupling model slope stability analysis, GIS-based, developed by the Department of Civil and Environmental Engineering, University of Perugia, with the aim to introduce also the actual mechanical and physical characteristics of slopes in the analysis.
As result of the system, is the daily creation of near real-time and 24, 48, 72h forecast risk scenarios, that, under the intention of the Department of Civil Protection Service, will be used by the Functional Centre for the institutional tasks of hydrogeological risk evaluation and management, but also by local Administrations involved in the monitoring and assessment of landslide risk, in order to receive feedback on the effectiveness of the scenarios produced.