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An experimental operative system for shallow landslide and flash flood warning based on rainfall thresholds and soil moisture modelling

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On November 2011 a thunderstorms became almost exceptional over the North-East part of the Sicily Region (Italy) producing local heavy rainfall, mud-debris flow and flash flooding. The storm was concentrated on the Tyrrhenian sea coast near the city of Barcellona within the Longano catchment.
Main focus of the paper is to present an experimental operative system for alerting extreme hydrometeorological events by using a methodology based on the combined use of rainfall thresholds, soil moisture indexes and quantitative precipitation forecasting.
As matter of fact, shallow landslide and flash flood warning is a key element to improve the Civil Protection achievements to mitigate damages and safeguard the security of people. It is a rather complicated task, particularly in those catchments with flashy response where even brief anticipations are important and welcomed.
It is well known how the triggering of shallow landslides is strongly influenced by the initial soil moisture conditions of catchments. Therefore, the early warning system here applied is based on the combined use of rainfall thresholds, derived both for flash flood and for landslide, and soil moisture conditions; the system is composed of several basic component related to antecedent soil moisture conditions, real-time rainfall monitoring and antecedent rainfall.
Soil moisture conditions were estimated using an Antecedent Precipitation Index (API), similar to this widely used for defining soil moisture conditions via Antecedent Moisture conditions index AMC. Rainfall threshold for landslides were derived using historical and statistical analysis.
Finally, rainfall thresholds for flash flooding were derived using an Instantaneous Unit Hydrograph based lumped rainfall-runoff model with the SCS-CN routine for net rainfall.
After the implementation and calibration of the model, a testing phase was carried out by using real data collected for the November 2001 event in the Longano catchment.
Moreover, in order to test the capability of the system to forecast thise event, Quantitative Precipitation Forecasting provided by the SILAM (Sicily Limited Area Model), a meteorological model run by SIAS (Sicilian Agrometeorological Service) with a forecast horizon up to 144 hours, have been used to run the system.