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Performances of satellite rainfall products in landslide forecasting

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The accurate estimation of rainfall is the primary task in landslide forecasting. The use of rain gauges for rainfall monitoring is widely used but it is not applicable in many parts of the world in which ground-based networks have very low density, or even they are absent. The availability of satellite rainfall products spanning the last 30 years and having a global scale coverage together with adequate spatial and temporal resolution permits to overcome the problem.

In this work, we propose a comparative analysis of satellite-based rainfall product with rain gauge measurements in Italy, where the rain gauge network is dense. The proposed procedure allows us to evaluate the capability of different rainfall products to forecast the spatial-temporal occurrence of rainfall-induced landslides using rainfall thresholds. Specifically, the assessment is carried out in terms of skill scores, and receiver operating characteristic (ROC) analysis. The procedure is applied to rain gauge measurements and to four different satellite rainfall estimates: 1) the Tropical Rainfall Measurement Mission Multi-satellite Precipitation Analysis, TMPA, real time product (3B42-RT), 2) the SM2RASC product obtained from the application of SM2RAIN algorithm to the Advanced SCATterometer (ASCAT) derived satellite soil moisture (SM) data, 3) the Precipitation Estimation from Remotely Sensed Information using Artificial Neural Network (PERSIANN), and 4) the Climate Prediction Center (CPC) Morphing Technique (CMORPH). For the comparative analysis, we used a catalogue listing 1414 rainfall-induced landslides in Italy in the period 2008-2014.

As expected, satellite rainfall products underestimate rainfall with respect to ground observations. However, the satellite rainfall thresholds, in particular 3B42-RT, are able to identify the occurrence of landslides. Overall, we believe that satellite rainfall products might be an important data source for developing continental or global landslide warning systems based on thresholds.