



Definition of soil water content and rainfall thresholds for landslide occurrence

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In the last decades, rainfall thresholds for landslide occurrences were thoroughly investigated, producing several different test cases and relevant technical and scientific advances. However, a recent literature review on rainfall thresholds articles (Segoni et al., 2018), published in journals indexed in SCOPUS or ISI Web of knowledge databases in the period 2008-2016, highlighted significant advances and critical issues about this topic. Only in the 11% of the analysed papers (a total of 115) there were installed instruments for measuring physical parameters other than rainfall. The implication was that, in most cases, the occurrence of landslides was forecasted considering exclusively a rainfall correlation, completely neglecting soil characteristics.

A reanalysis dataset (ERA5-Land) providing a consistent view of the evolution of land variables over several decades at an enhanced resolution has been used to evaluate the soil water content. Reanalysis combines numerical model data with observations from across the world into a globally complete and consistent dataset using the laws of physics. A comparison between in situ measurements with the results of the model has been carried out for two sites in Norway (Eidsvoll, Morsa catchmen) with 3 different vegetation types: grass, bush, tree. The results showed a good agreement between the modelled soil water content layer 2 and 3 (respectively representing 2 - 28 cm and 28 -100 cm depths) and, respectively, in-situ measurements at 30 and 50 cm depths.

Then, 15 Norwegian basins with moraine and peat covers and, previous landslide occurrences in the period 2009-2018, have been selected for correlations. Combinations of rainfall and soil water contents that triggered and not-triggered landslides have been analysed. Rainfall-soil water content thresholds have been defined for the selected basins highlighting the important role played by soil water content, together with rainfall, in triggering landslides. The use of the soil water content contributed to increase the performance of the thresholds and to reduce the uncertainties of landslide forecast.

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