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Derivation of critical rainfall thresholds for landslide in Sicily

Domenico Caracciolo, Elisa Arnone, and Leonardo V. Noto

Università degli Studi di Palermo, Dipartimento di Ingegneria Civile, Ambientale, Aerospaziale, e dei Materiali, Palermo, Italy (domecaracciolo@gmail.com)

Rainfall is the primary trigger of shallow landslides that can cause fatalities and economic losses in many areas of the world. For this reason, determining the rainfall amount responsible for landslide occurrence is important, and may contribute to mitigate the related risk. In particular, the definition of critical rainfall-triggering thresholds for landslide is one of the most used approach, which is based on empirical methods. The creation of the rainfall-landslide database represents one of the main efforts in this kind of analysis, which requires a perfect agreement between the rainfall and landslide information in terms of timing. This requirement is easily obtained in the case of the most recent landslide events (e.g. during last two decades) since hourly rainfall time series are usually available on a digital support. Whereas, in the case of older events, some issues may rise in recreate the exact rainfall triggering event at hourly time scale. In this case, converting rainguages charts recorded on paper tapes into digital format may be required.

Starting from this premise, the aim of this paper is deriving critical rainfall thresholds for landslide occurrence in Sicily, southern Italy, by creating a specific landslide-rainfall database. Historical landslide events occurred in Sicily from 1919 to 2001 were selected from the archive of the Sistema Informativo sulle Catastrofi Idrogeologiche, developed under the project Aree Vulnerabili Italiane. The corresponding triggering precipitations were screened from the raingauges network in Sicily, maintained by the Osservatorio delle Acque - Agenzia Regionale per i Rifiuti e le Acque. For all the events, daily rainfall data were available, whereas, for a subset, hourly rainfall data have been reconstruct throughout a specifically created tool which reads the charts recorded on paper tapes.

The rainfall thresholds at different exceedance probability levels 1, 5 and 50%, were defined in terms of cumulated rainfall event and rainfall duration. Moreover, the role of rainfall prior to the damaging events was taken into account by including in the analysis the rainfall fallen 5, 15 and 30 days before each landslide. The antecedent rainfall turned out to be particularly important in triggering landslides. The obtained rainfall thresholds resulted in agreement with regional curves proposed by other authors for the same area.