Geophysical Research Abstracts
Vol. 20, EGU2018-16443, 2018
EGU General Assembly 2018

A novel approach to define and differentiate debris flows Rainfall Thresholds at regional scale in Emilia Romagna Region (Northern Italy) using ROC curves

Giuseppe Ciccarese and Alessandro Corsini

University of Modena and Reggio Emilia, Department of Chemical and Geological Sciences, Modena, Italy (giuseppe.ciccarese@unimore.it)

In recent years, some areas of the northern Apennines in the Emilia Romagna Region have been affected by debris flow occurrences during persistent intense rainstorm events. Specifically, the events of Parma province in October 2014 and Piacenza province in September 2015 highlighted the need for specific debris flow warning procedures in the frameworks of emergency management. As a matter of fact, in accordance to the definition of persistent-intense rainstorm given by the national Civil Protection Department, a recent regional warning system decree of 2017, defines rainfall values of 30mm/1h or 70mm/3h as values to be used for rainstorm warning for the whole regional area that, also, can induce debris flows occurrence. However, the spatial distribution of debris flow triggering points during the Parma and Piacenza events, with respect to rainfall peaks recorded at various rainfall duration, highlights the possibility to integrate such framework by using a data-based approach to define tailored rainfall thresholds for debris flows in Emilia Romagna Region.
The basic idea behind this study is to differentiate debris flow triggering thresholds across the regional area, by considering the level of anomaly of rainfall that proved capable to trigger debris flows during such recent events in comparison to the “ordinary” rainfall values in these areas. More specifically, the identification of thresholds is based on: (i) definition of rainfall values (derived from calibrated radar data, and computed for time windows from 30 min to 6 hours) with the best capability to discriminate the spatial occurrence of debris flows during the events of 2014 and 2015, as a result of ROC curve analysis that returned rainfall classes associated to maximum Thread Score Index (Max_TSI) and maximum ratio between TP_rate and FP-rate (Max_Dist); (ii) normalization of Max_TSI and Max_Dist rainfall classes, in the different time windows, by computing their Exceedance Percentage with respect to rainfall value of return period 10 years in same time windows; (iii) the computation of potential Max-TSI and Max_Dist rainfall values in each point of the region, by applying the computed Exceedance Percentage to the 10 years return period rainfall characterizing each specific zone, thus allowing to spatialize and differentiate rainfall threshold over the whole area of Emilia Romagna.
Finally, in order to prompt warning procedures, results obtained with spatial continuity over the regional area, have been summarized by thresholds curves on a rainfall intensity-duration plots including three different threshold curves: one derived by values reported in the Regional decree (30mm/1h and 70 mm/3h), used for the warning level “yellow” (Attention); another interpolating rainfall values associated to Max_Dist (that, in some areas, reach maximum values of 88mm/1h and 197mm/3h), used for a possible warning level “orange” (Pre-Alert); a last one interpolating rainfall associated to Max_TSI (that, in some areas, reach maximum maximum values of 161mm/1h and 350mm/3h), as possible warning level “red” (Alert). Such rainfall thresholds plots have been computed for each Warning Sub-Zone and Municipality of Emilia Romagna Region, thus providing an operational tool for early warning over the whole regional scale.