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ID# NH41C-1244
Location: Poster Hall (Moscone South)
Time of Presentation: Dec 17 8:00 AM - 12:20 PM

Local rainfall thresholds for the possible initiation of landslides in Italy. The Abruzzo test case.

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In Italy, more than 5×10^5 landslides were identified by a recent nationwide mapping survey. Most of the mapped slope failures are known or believed to be triggered by intense or prolonged rainfall. Determining the amount of rainfall that, when reached or exceeded, can result in landslides is important to forecast the possible occurrence of landslides in Italy. The Italian national Department of Civil Protection (DPC) intends to implement a national landslide warning system based on rainfall thresholds. We are working with the DPC to design and implement such system. For the purpose, we have compiled a database of 753 rainfall events that have resulted in documented landslides in Italy since 1841, including 77 rainfall events in the Abruzzo Region, in the period 2002 to 2009. The Abruzzo Region was recently affected by a severe earthquake that has resulted in more than 100 seismically-induced landslides, chiefly rock falls. For each event in the database, we have collected information on the total amount of rainfall, the rainfall duration, the day and (when available) the time of the failure, the geographical location of the landslide, the number of landslides when more than a single failure was reported, and climatic information, including the mean annual precipitation (MAP) and the average number of rainy days in a year (RDs). We have developed and tested two methods to define objective Intensity-Duration rainfall thresholds, for Italy and for the Abruzzo Region. The first method exploits Bayesian statistical inference, and the second methods adopts a Frequentist approach to estimate lower thresholds for the possible occurrence of rainfall induced landslides. The rainfall thresholds are used in a prototype warning system that uses rainfall measurements and forecasts to predict landslide occurrence.