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Rainfall-triggered shallow landslides: the case of the Prenestini Mts. (Rome, Italy)

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On May 21st 2008, after a period of heavy rainfall, 107 shallow and deep-seated landslides involved the eastern slope of the Prenestini Mts. (40 km east of Rome). Many buildings of San Vito Romano (3.500 inhabitants) and most of the surrounding main roads were heavily damaged. All the shallow landslides occurred between 6 and 11 a.m.. The pluviometric data record showed a total rainfall of 196 mm in the previous three days, and a peak of 72 mm during the above time interval.

The study area is characterized by a monotonous lithology, made of intercalation of marls and sandstone, upper Tortonian in age. Boreholes drilled in colluvial and eluvial covers showed variable thickness (from 20 cm to more than 2 meters), but comparable mechanical properties and permeability. Because of the nature of involved material and steepness of slopes, a large number of fast moving landslides were triggered. Field investigation allowed to recognize the main landslide predisposing factors, such as the occurrence of recently chopped down woods (45 debris flows), old-fired woods (12 debris flows), and road-cuttings (22 soil slips and 12 debris flows).

In order to establish relationship between the occurrence of landslide and the amount of rainfall, an inventory of all the landslides occurred in the area has been carried out by field survey and archive investigation at the Province of Rome, the San Vito Romano, Pisoniano and Gerano municipalities, as well as at road, water and gas network agencies. Moreover, a 30 years historical pluviometric record has been examined.

The data analysis shows a strict relationship between rainfall intensity, duration of rainstorms, and antecedent rainfall. In detail, only 11% of landslides occurred with precipitation lower than 150 mm during the previous month while 57% of landslides occurred with precipitation above 200 mm landslides occurred in the same time. Anytime monthly precipitation was more than 350 mm there were landslide events. 87% of landslides occurred with 50 mm rainfall in the previous 3 days, and 56% with 120 mm in the previous 10 days.

From all the collected data, the first remark for the study area is that both intensity and duration of storm events start to play an important role only with an antecedent monthly rainfall of 200 mm. Beyond this threshold value, the frequency of landslide occurrences shows to be proportional to the intensity of the storm events. This clearly results analysing the May 21st 2008 event, during which a 72 mm/5 hours rainfall (never recorded in the last 30 years) triggered a very high number of landslides notwithstanding the monthly rainfall value of 340 mm (recorded several times in the considered time interval).