Plinius Conference Abstracts,
Vol. 11, Plinius11-13, 2009
11th Plinius Conference on Mediterranean Storms

Analysis of rainfall-induced shallow landslides and debris flows in the Eastern Pyrenees

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The inventory of rainfall-induced mass movements, rainfall data, and slope characteristics are considered the basis of the analysis determining appropriate rainfall thresholds for mass movements in a specific region.

The rainfall-induced landslide thresholds established in the literature for the Catalan Pyrenees have been formulated referring to the rainfall events of November 1982, September 1992, December 1997, and others occurred after 1999. It has been shown that a rainfall intensity greater than 190 mm in 24 hours without antecedent rainfall would be necessary to produce mass movements (Corominas and Moya, 1999; Corominas et al, 2002) or 51mm in 24h with 61 mm of accumulated rainfall (Marco, 2007).

Short duration-high intensity rainfalls have brought about several mass movements in some Catalonian regions throughout the course of twenty-first century (Berga, Bonaigua, Saldes, Montserrat, Port-Ainé, Riu Runer, and Sant Nicolau). Preliminary analysis of these events shows that it is necessary to review the thresholds defined so far and redo the existing inventory of mass movements for the Catalan Pyrenees.

The present work shows the usefulness of aerial photographs in the reconstruction of the inventory of historic mass movements (Molló-Queralbs, 1940; Arties-Vielha, 1963; Barruera-Senet, 1940 and 1963, and Berga-Cercs, 1982, 1997 and 2008). Also, it highlights the treatment given to scarce and scattered rainfall data available inside these Catalonia's regions, and the application of Geographic Information Systems (ArcGIS) in the management of the gathered information.

The results acquired until now show that the historic rainfall events occurred in the Eastern Pyrenees have yielded many more mass movements than those reported in the literature. Besides, it can be said that the thresholds formulated for the Pyrenees are valid for longstanding regional rainfalls, and not for local downpours. In the latter cases it should be necessary to take into account the rainfall intensity of short duration (mm/h, mm/min.) and maybe the role played by the antecedent rainfall.