Geophysical Research Abstracts,
Vol. 10, EGU2008-A-07299, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-07299
EGU General Assembly 2008

Considerations on debris-flow hazard analysis, risk assessment and management.

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Debris flows are a common type of mass movement in the mountainous area. They consist mostly of a fully saturated mixtures of water, sediment and debris that can travel, in a series of surge, long distances. They are widely recognized as one of the dominant geomorphic processes in steep mountainous terrain and may constitute a dangerous natural hazard for the people and infrastructures downslope. Knowledge on the debris-flow processes have been substantially improved over the last 30 years, nevertheless little is known about the scouring process during the run-out of the debris flow.

Several issues have to be drawn up to manage the risks associated to these processes at the catchment scale. These issues are presented in this contribution, taking a large debris flow event that occurred in August 2003 in the Faucon catchment as a representative case study:

(1) The debris-flow hazard analysis needs a multidisciplinary approach (quantitative geomorphology, sedimentology, climatology, soil mechanics, fluid mechanics . . .) in order to define both the potential triggering areas and the potential scour rate of the debris track. Morphological evidences and laboratory tests performed on the deposits and the source material of the August 5, 2003 debris-flow show that this event started as granular flow, bulked increased in fine elements by incorporating marly sediments along the torrential paths and transformed into a muddy debris-flow. The hazard associated to such types of complex debris flows are still very difficult to quantify.

(2) The risk assessment has been conducted in two steps. Firstly, the physical characteristics of the debris-flow hazard (location of potential triggering areas, intensity of the debris flow in terms of velocity, flow height, frequency and probability of occurrence) have been estimated according to field investigations, historical data analyses and debris-flow run-out and spreading modelling. Secondly, a GIS database has been constructed for the Faucon torrent concerning the social, economical and environmental dimensions of vulnerability and exposure.

(3) The last step of this work consists in improving the risk management procedure in terms of mitigation with protective works. In this work, the analyses of the mitigation strategies consisted mostly to evaluate the protection efficiency of the old dams, and more specifically to analyse the preferential locations of the dams regarding their influence on debris-flow dynamics (velocity, discharge and flow height). This has been performed using some debris-flow modelling scenarios. Finally some considerations about the comparison between the characteristics of check dams, the morphological aspects of the debris track and the scoured sediments are discussed.