



## **An exhaustive approach for the alpine torrents processes estimation: the case study of Rio Frejus (Italian Western Alps)**

**L. Paro** and D. Tiranti

Arpa Piemonte (Regional Agency for Environmental Protection), Torino, Italy  
(l.paro@arpa.piemonte.it)

**Key words:** debris and hyperconcentrated flows, hazard and risk analyses, forecast and prevention measures, Rio Frejus river basin (Italian Western Alps).

This work focuses on the alpine torrents phenomena aiming to improve forecast and prevention measures. To formulate an effective evaluation of the torrent processes, in triggering, run out and deposition phases, a deepened knowledge of the whole aspects characterizing a river basin and their correct estimation, is essential.

The study carried out on the river basin of Rio Frejus (Italian Western Alps) underlines that a multidisciplinary approach, with integrated and consecutive steps, is necessary in order to rise an adequate level of awareness about this topic.

The case study of the Rio Frejus torrent processes is particularly meaningful considering the risk conditions existing in Bardonecchia, the mountain resort located on the whole Rio Frejus alluvial fan. The historical and recent data clearly indicate that these phenomena have high frequency and cause damages of different intensity.

The Rio Frejus is a river basin of about 22 km<sup>2</sup>, mostly composed by calcshistes and characterized by an elevated density of active landslides which sometimes involve the whole slopes (deep-seated gravitational slope deformations). The elevated frequency of mass transport phenomena is due to the debris abundance into the stream channels and to the meteorological features of the area. The triggering analysis of the mass transport phenomena of the last century, highlights different frequencies for different types of processes: debris flows (with an average occurrence of more than one year) and hyperconcentrated flows (with an average occurrence of less than one year).

Therefore, it is important to discriminate the process typologies since each one has different features characterizing different hazard and risk levels. For instance, the temporal characterization of the processes allows an improvement of the pluviometric analysis, distinguishing different rainfalls that trigger different mass transport phenomena; whereas, the analysis of deposit distribution in the river basin and in the alluvial fan allows the evaluation of the risks for the anthropic area.

These considerations are very important for forecast and prevention actions, both for alert thresholds application and mitigation works planning.