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Analysis of an ordinary bedload transport event in a mountain torrent (Rio Vanti, Verona, Italy)

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The correct simulation of the sediment-transport response of mountain torrents both for extreme and ordinary flood events is a fundamental step to understand the process, but also to drive proper decisions on the protection works.

The objective of this research contribution is to reconstruct the 'ordinary' flood event with the associated sediment-graph of a flood that caused on the 14^{th} of October, 2014 the formation of a little debris cone (about 200-210 m^3) at the junction between the 'Rio Vanti' torrent catchment and the 'Selva di Progno' torrent (Veneto Region, Prealps, Verona, Italy).

To this purpose, it is important to notice that a great part of equations developed for the computation of the bed-load transport capacity, like for example that of Schoklitsch (1962) or Smart and Jaeggi (1983), are focused on extraordinary events heavily affecting the river-bed armour.

These formulas do not provide reliable results if used on events, like the one under analysis, not too far from the bankfull conditions. The Rio Vanti event was characterized by a total rainfall depth of 36.2 mm and a back-calculated peak discharge of 6.12 m^3/s with a return period of 1-2 years. The classical equations to assess the sediment transport capacity overestimate the total volume of the event of several orders of magnitude. By the consequence, the following experimental bedload transport equation has been applied (D'Agostino and Lenzi, 1999), which is valid for ordinary flood events (q: unit water discharge; q_c: unit discharge of bedload transport initiation; q_s: unit bedload rate; S: thalweg slope):

$$\frac{q_s}{S^{3/2}} \cong 0,04 \cdot (q - q_c)$$

In particular, starting from the real rainfall data, the hydrograph and the sediment-graph have been reconstructed. Then, comparing the total volume calculated via the above cited equation to the real volume estimated using DoD techniques on post-event photogrammetric survey, a very satisfactory agreement has been obtained. The result further supports the thesis that the bedload transport in boulder-bed torrents is characterised by an important threshold, which corresponds to a high variation of the sediment discharge due to the bed-armour breaking.