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Info-gap decision making and uncertainties in debris flows risk management

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As it has been widely demonstrated worldwide, the characteristics of debris flows events change greatly from place to place, according to the different hydrological, gemorphological and geological conditions. Consequently, as far as hazard assessment is concerned, the sediment volumes involved in the processes, the maximum flow peaks, the total duration of the flows are generally statistically correlated, by means of some empirical mathematical formulas, which are generally obtained by interpolating samples of data derived from field measurements and rough estimations. Only instrumented watershed basins allow a better quality of data, that reduce the uncertainties of hazard assessment, even if the results obtained can not be directly extrapolated to geomorphologic and geographic situations which are not similar to those in which they were obtained. A wide variability has been also observed in the rheological characteristics of the water-sediment currents belonging to different events, which can show different behaviours even though they have occurred in the same watershed basin; they may show different rheological characteristics even during the different stages of the debris flows, that is during triggering, propagation and deposition. In this frame, the debris flow risk management in the fan areas generally relies on scenarios that are generated by means of different simulations, each of them obtained with different boundary conditions, different rheological parameters, different triggering hypothesis.
The obtained scenarios should, to some extent, allow the decision makers to found the best actions to take which can encompass either the protection of endangered areas (even if to a partial degree), allowing the permanence of people on debris fan, or the estimation of the probability of occurrence and the magnitude of the debris flow that will be used to alert the population. Referring to the worst possible conditions (or scenarios) can lead to unworkable countermeasures, such as moving without real need thousands of people from the endangered areas or building oversized structures.
Especially in areas where there are not recordings of recent debris flows, the necessity to manage the uncertainties to either minimize risks or to maximize the opportunity to keep people on the fan areas is urgent. Info-gap decision theory can offer some elements to manage the uncertainty in decision making, especially in sever uncertainty conditions.