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Influence of check dams on debris-flow runout characteristics. Implications for hazard assessment.

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Debris flows are very dangerous phenomena claiming thousands of lives and millions of Euros each years over the world. Disaster mitigation includes non-structural (hazard mapping, insurance policies), active structural (reforestation, drainage systems) and passive structural (check dams, stilling basins) countermeasures. Since over twenty years, many efforts are devoted by the scientific and engineering communities to the design of proper devices able to capture the debris-flow volume and/or break down the energy. If considerable theoretical and numerical work has been performed on the size, shape and structure of check dams, allowing the definition of general design criteria, it is worth noting that less research has focused on the optimal location of these dams along the debris flow pathway.

In this paper, a methodological framework is proposed to evaluate the influence of the location of the check dams on the reduction of the debris-flow intensity. The variations of the debris-flow intensity are defined in term of runout characteristics (flow thickness, flow velocity). A debris-flow model is used to simulate the characteristics of the debris flow for several configurations of dams. The model uses the Janbu force diagram to resolve the force equilibrium equations; a Bingham fluid rheology is introduced and represents the resistance term. The model has been calibrated on two muddy debris flow events that occurred in 1996 and 2003 in the Faucon catchment (South French Alps).

Influence of the check dams on flow heights and velocities is quantified taking into account several check dams configurations (number and location) as input geometrical parameters. Results indicate that debris-flow characteristics are decreasing with the distance between the triggering area and the firsts check dams. The study demonstrates

that a small number of check dams located near the triggering area may decrease the debris-flow intensity on the alluvial fans.