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Assessing the solid-liquid discharge and rheological behavior of debris flow. A numerical model of a case study.

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The Friuli Venezia Giulia (FVG) region, located in the northeast of Italy, is characterised by frequent heavy precipitations that recurrently trigger debris flow phenomena. On August 2003, an intense rainfall concentrated in the north-eastern Julian Alps of FVG produced several floods and debris flow events, widespread on the entire basin of the Fella river watershed, with great economic damage and some casualties.

In the light of this, forecasting tools for the debris-flow analysis are useful with a view to a territorial planning. The general aim of our research is to develop a hydro-morphodynamical framework to study debris flow phenomena, which includes the hydrological modelling of the rainfall triggering event, the estimate of the solid-liquid discharge of the debris-flow and the hydraulic modelling of its propagation.

While previous works have accomplished the hydrological analysis, in the present study we focus on the evaluation of the solid-liquid discharge and the simulation of its propagation down the slope till its stop. Specifically, we considered a sub-basin of the Fella river watershed, the Uque at Ugovizza, and, in particular, a sub-area of the basin from which the debris flow that swept the village of Ugovizza in 2003 came off. The resulting liquid discharge obtained from the previous hydrological analysis was the input data to derive the solid-liquid discharge of the debris flow, which was assessed by using a formulation proposed in literature.

In order to study the propagation of the debris flow, we first identified a rheology model suitable to represent this kind of events. This was then implemented into an in-house numerical model, which integrates the bidimensional shallow water equations by means of finite volume techniques. Furthermore, an appropriate runout criterion was also assessed, so that the final stages of the phenomenon can be represented.

The first results of the application of the developed hydro-morphodynamic framework to this case study are presented and discussed.

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