Reconstruction of Val Molinara 2010 debris flow and validation of the hazard mapping methodology

Nadia Zorzi, Lorenzo Begnudelli, and Giorgio Rosatti

Department of Civil, Environmental and Mechanical Engineering University of Trento Via Mesiano 77, I-38123, Trento, Italy (lorenzo.begnudelli@ing.unitn.it)

In this work, a real debris flow over an urbanized conoid is studied and reconstructed using the bidimensional finite-volume mathematical model Trent2D (Armanini et. al, Computer & Geosciences 2009). The event occurred in August 2010 in the village of Campolongo (Province of Trento, Italy) as a result of torrential rains and is particularly well documented thanks to the availability of aerial pictures, ground surveys, sediment deposition measurements, and data of two nearby rain gauges as well of radar. The 2D mathematical model adopted in the study is based on a two-phase description of the debris flow with immediate adaptation of the transport to the local flow conditions. It adopts a rheological closure valid in the grain-inertia regime. The equations are solved on a structured quadrilateral grid using a Godunov-type scheme, where inter-cell fluxes are evaluated using a MUSCL-Hancock approach with second order spatial and temporal accuracy.

In order to reconstruct the event, the following tasks have been carried out: a) computation of liquid discharge through a rainfall-runoff model; b) evaluation of the debris flow discharge (and therefore of the discharge of solid mass); c) estimation of the model's parameters; d) execution of simulation and comparison with available data. Model's predictions are compared with surveys in order to show its capabilities as well as understand its possible limitations arising from the hypothesis the model is based on. Moreover, the sensitivity of model to variations of parameters and boundary conditions (i.e. discharge) is tested showing interesting results. Finally, the hazard map for the area is generated adopting the standard procedure as required by national and local regulations in order to study how predictive simulations compare to the results of a back analysis process.