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Risk analysis for debris flows – a case study from Cancia, Italy

S. Fuchs (1), L. Agosti (2), M. Dall'Amico (2), G. Rosati (2)

(1) Institute of Mountain Risk Engineering, University of Natural Resources and Applied Life Sciences, Vienna, Austria, (2) Department of Civil and Environmental Engineering, University of Trento, Trento, Italy (sven.fuchs@boku.ac.at)

Erosion and sedimentation processes are very important in evaluating the hazards due to debris flows. From a modelling point of view, they put severe constraints, since a morphological model requires a good description of the coupling between flow dynamic and bed evolution; fixed bed assumption seems to be no longer satisfactory. Thus, the depth averaged motion equations were integrated numerically in a two-dimensional domain. The model employed was based on a two-phase description of the flow with immediate adaptation of the transport to the local flow conditions and with a rheological closure valid in the grain-inertia regime. The set of partial differential equations form a hyperbolic system that was solved numerically by means of a second order Godunov-type finite volume scheme. The scheme used an approximated Riemann solver of LHLL type, which takes into account the non-conservative terms and an implicit discretisation of the bed shear-stress source terms. The model parameters were chosen by calibration and by means of analysis of the site material.

A real-case application showed the effectiveness of the code and how modelling could be integrated in hazard prediction and risk management. Therefore, data from the 1994 event was used to assess the losses and the associated vulnerability to buildings. These results were compared to a second set of calculations using the process modelling as an input. The two sets of calculation were compared to validate the model; therefore, a sensitivity study was carried out.