Geophysical Research Abstracts, Vol. 7, 08405, 2005
SRef-ID: 1607-7962/gra/EGU05-A-08405

Simulations of dry-snow avalanches observed in the full-scale test site Ryggfonn, Norway

D. Issler (1)*, M. Barbolini (2), F. V. De Blasio (3), C. B. Harbitz (3), G. Khazaradze (4), K. Kristensen (1), K. Lied (1), J. N. McElwaine (5), A. I. Mears (6), A. S. Moe (1), M. Naaim (7) and R. Sailer (8)

(1) Norwegian Geotechnical Institute, P. O. Box 3930 Ullevål Stadion, N–0806 Oslo, Norway.
(2) University of Pavia, Hydraulics and Environmental Engineering Dept., Via Ferrata 1, I–27100 Pavia, Italy.
(3) Inst. for Geosciences, University of Oslo, P. O. Box 1047 Blindern, N–0316 Oslo, Norway and International Centre for Geohazards, c/o NGI, P. O. Box 3930 Ullevål Stadion, N–0806 Oslo, Norway.
(4) University of Barcelona, Dept. of Geodynamics and Geophysics, c/Martí i Franquès s/n, E–08028 Barcelona, Spain.
(5) H0.15, Department of Applied Maths. and Theoretical Physics, Centre for Mathematical Sciences, Cambridge University, Wilberforce Road, Cambridge, CB3 0WA, England.
(6) 555 County Rd. 16, Gunnison, CO 81230, USA.
(7) CEMAGREF, UR ETNA, F–38402 St–Martin–d'Hères, France.
(8) Inst. für Wildbach- und Lawinenforschung, Rennweg 1, A–6020 Innsbruck, Austria.
(Contact E-mail: nadescor@bluewin.ch)

Twelve well-documented dry-snow avalanches with initial volumes between 20'000 and 100'000 m^3 from the instrumented Ryggfonn path in western Norway were selected for back-calculations with several currently available dynamical avalanche models. An important feature of the Ryggfonn path is a 16 m high and 100 m wide retention dam in the run-out zone that is often overflowed by avalanches but retains a considerable fraction of their mass. Two quasi-analytic models (PM and FSB), four one-dimensional hydraulic models (VARA-1D, AVAL-1D, NIS, BING), a one-dimensional particle model including snow entrainment (PLK), and two advanced two- or three-dimensional two-layer models (N2L and SAMOS, also with entrainment modules) were included in the comparison. For each model and each avalanche separately, the optimum friction parameters were determined for reproducing the measured

run-out distance with the dam and the front velocity near the end of the avalanche gully from the measured initial conditions. The same parameters were then applied to a modified path profile without the dam.

For most models, a very wide range of friction parameters was needed to reproduce the twelve events. None of the models reproduces the deposit distributions of all avalanches with fair accuracy. Both shortcomings can be traced in part to the inability of the models to distinguish between the dense core and the much more mobile and dilute fluidized layer preceding and overriding it. VARA-1D and AVAL-1D predict a run-out shortening induced by the dam of only 10–15 m whereas extra friction due to centrifugal forces in the NIS model leads to an average shortening of 40 m. A heuristic momentum reduction prescription built into the PLK model proves to be very sensitive to the dam, predicting a shortening by 100 m on average. The results clearly show that reliable modeling of avalanche interaction with obstacles is not possible with any of the codes used in this study. However, future models containing three layers or allowing for density variations may simulate the pressure and deposit variations in the run-out zone much more realistically and with a smaller range of friction parameters than hitherto.