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An objective analysis method in applied avalanche modeling

J.-T. Fischer (1) and M. Granig (2)

(1) Federal Research Centre for Forests (BFW) - Departement Natural Hazards, Innsbruck, Austria, (2) Austrian Service for Torrent and Avalanche Control - Centre for Snow and Avalanches, Schwaz, Austria

The snow avalanche simulation toolbox SamosAT is used as a supporting tool for hazard mapping questions in Austria and some other European countries. SamosAT comprises two different model classes. A two-dimensional, depth averaged model for the description of dense flow avalanches and a three-dimensional, two-phase (air and ice particles) model for powder snow avalanches. The toolbox allows to compute and display the space and time evolution of the main avalanche flow variables such as flow height, -velocity or concentration from initiation to run out.

On the one hand displaying the multidimensional data in natural terrain provides the basis for an intuitive result interpretation by the user. Clearly this is helpful for case studies and decision making. On the other hand the complexity and huge amount of result data makes an objective comparison of a high number of different simulation results challenging. This however is the basis of sophisticated model analysis and evaluation, such as sensitivity analysis, calibration, comparison to other models etc.

Here we present new methods to analyze and objectively compare a high number of simulation results with respect to their practical relevance. Thus the variation of simulation results due to sources of variability and uncertainty can be displayed in a clearly arranged and objective way. The following steps are considered:

- Automatization for SamosAT to enable a high number of simulation runs only outputting the relevant results.
- Definition of avalanche quantities with practical relevance. Here the spatial distribution of the maximum impact pressure serves as a basis to define geometric (run out and shape) and dynamic (mean impact pressure) quantities.
- Development of a technique to map the simulation results computed in a global coordinate system on a coordinate system aligned with the avalanche flow path. Thereby we achieve comparability and generalization for arbitrary avalanche paths.

Finally case studies of the European avalanche test sites are presented employing the new methods. Release height variations as well as model parameter Monte Carlo simulations are investigated with respect to their influence on the result distribution. The methods presented here aim at supplementing expert result interpretation and providing the basis of an additional enhanced analysis for multidimensional models.