Testing of a two-phase debris flow model using field data from the Illgraben observation station

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Observations of debris flows using video recordings from the Illgraben station (near Susten/Leuk, VS) show that the largest particles within a debris flow often travel more slowly than the surrounding debris flow material, especially upstream of the front of a surge. A simple model for two-phase flows, where the solid and fluid phases may have different velocities, was developed by Bozhinskiy and Nazarov (2000). We have developed a similar 1D model, also based on the equations of motion for granular material, to include solid-fluid interaction effects such as near-liquefaction of the solid phase (e.g. Lancaster et al. 2000; Iverson and Denlinger 2001) which may arise from the strong shearing of the granular sediment near the debris flow front. In our model, the coarse sediment phase is described as a Coulomb material and the fluid phase is described as a turbulent fluid, including suspended sediment, described using a Chezy friction relation. The phases are coupled with a momentum exchange coefficient. Here, the model results are compared with front velocity and flow depth (wetted area) data from the Illgraben torrent channel, where the water content is relatively well constrained, reducing the number of free parameters in the model.

References

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