On Snow Avalanche Flow Regimes: Inferences from Observations and Measurements

Peter Gauer 1 Dieter Issler 1 Karstein Lied 2 Krister Kristensen 2 Frode Sandersen 2
1 Norwegian Geotechnical Institute / International Centre for Geohazards, Oslo, Norway; 2 Norwegian Geotechnical Institute, Oslo, Norway

Mixed dry-snow avalanches are commonly thought to consist of a dense core and a dilute suspension layer, even though observations and measurements from Canada and Russia have long indicated the presence of an intermediate-density layer (“light flow” or “saltation layer”). We summarize field observations and measurements from Norway and Switzerland, both from spontaneous events and from avalanches released at the test sites Ryggfonn and Vallée de la Sionne. Deposition patterns, highfrequency impact pressure records and radar measurements show that a substantial mass fraction of mixed dry-snow avalanches is flowing in this “fluidized” regime, particularly the head. Based on mechanical considerations, we suggest close correspondence with the grain-inertia regime observed in granular flows; however, the role that the interstitial air plays in avalanches is not clarified at present. Distinguishing between three avalanche flow regimes instead of only two may have important consequences in hazard mapping and the design of protection measures.