



Mixed-mode shear-compression failure criterion for weak snowpack layers

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The failure of a weak snow layer below a cohesive slab is a prerequisite for the release of a dry-snow snow slab avalanche. Once an initial failure in the weak layer reaches its critical size to become self-propagating, the slab will release as an avalanche – provided the slope is steep enough. However, the nature of the initial failure within the weak layer is still unknown – but strongly debated among avalanche researchers. Moreover, different avalanche release models assume contradictory failure criteria as input parameters. We analysed a unique data set stemming from laboratory experiments on snow failure with samples containing a weak snow layer of either depth hoar or buried surface hoar. Depth and surface hoar layers are the most relevant weak layers for avalanche release. The failure behaviour of these types of weak layers can well be described with a modified Mohr-Coulomb model. We therefore propose a mixed-mode failure criterion to be used in avalanche release models.