O-039

How snow fails

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Dry-snow slab avalanches start with a failure in a weak layer below a cohesive slab. Avalanche release models start with an initial crack which may propagate and, depending on the slope angle and the roughness of the fracture surface, lead to a whumpf or an avalanche. This initial crack is often assumed to be an inherent weak spot (or hot spot) within the weak layer prone for avalanche release. Based on field observations and laboratory measurements we propose a different approach and suggest that fractures within weak layers are transient phenomena, which appear due to an increased strain rate within the weak layer. Creep rates of the whole snowpack have been measured to be of the order of 10-6 s-1. The laboratory shear experiments we performed with different kind of weak layers show that 90% or more of the deformation is concentrated within the weak layer, leading to strain rates 100-1000 times the global strain rates. We found brittle behavior (catastrophic fracture) at strain rates faster than 10-3 s-1, which agrees with previous measurements on the ductile-to-brittle transition. The concentration of strain within a weak layer could allow brittle fracture and crack initiation in weak layers even due to creep deformation. These fractures may disappear again due to sintering or propagate and subsequently lead to the release of an avalanche.