Influence of slab properties on human-triggered snow slab avalanche release

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Dry-snow slab avalanches involve the release of a cohesive slab over an extended plane of weakness. In most fatal avalanches the triggering of the initial failure occurred by localized rapid near-surface loading by people - followed by fracture propagation. Whereas a strength-of-material approach to snow slope failure does not take into account important parameters and processes such as the properties of the overlying slab and the fracture propagation, it has been successfully applied to assess failure initiation - and hence the frequency of skier triggering. The slab properties are crucial for fracture propagation as well as for failure initiation since the skier's impact will depend on the properties of the overlying slab. A strongly simplified FE model of static skier loading was used to assess the effect of slab properties. Compared to a uniform slab, the stresses at the depth of the weak layer can vary by a factor of 2 (larger and smaller). In particular, hard layers have a distinct effect and can either increase or decrease the skier's impact depending on their location in the snowpack in relation to the weak layer. These results were incorporated into an improved stability index and compared to actual skier-triggering situations. As stability indices are increasingly used in numerical snow cover models to assess snowpack stability, and are typically compared to the results of snow stability tests such as the rutschblock or compression test (that implicitly include the effect of the slab properties), it is essential to improve stability indices by considering the effect of slab properties.