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Dynamic fracture mechanics in dry snow slab avalanche release

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Field observations and measurements show that dry snow slab avalanches initiate by propagating shear fractures within a relatively thin weak layer sandwiched between a planar, stronger, thicker slab above and stronger material below. After initiation, the weak layer fracture can propagate up and down slope for distances which range from about 10 to 100's of meters to cause tensile fracture through the body of the slab which results in avalanche release. In this paper, dynamic fracture mechanics is applied to slab tensile fracture after which avalanche release is imminent. Two mechanisms for production of tensile stress are explored employing field measurements of slab properties and lab measurements. The first considers inertial effects related to quasi-brittle fracture near the tip of a propagating weak layer shear fracture. The second is concerned with the tensile stress generation from the stress drop behind the crack front as the fracture propagates in the weak layer. Analysis suggest that both mechanisms can contribute to produce the tensile fracture line which precedes avalanche release. Even though both mechanisms may operate together, they are analyzed separately in this paper.