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Dimensions of dry snow slab avalanches

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Dry slab avalanches release by a sequence of propagating fractures: first by shear fracture (mode II and mode III) in a weak layer at the base of the slab and second by tensile fracture through the crown after which release of the slab is imminent. In this paper, I provide field measurements of the important length parameters resulting from fractures for hundreds fallen slabs including: depth, length and width. The field data show that there are wide variations in the appropriate length scales for slabs including length, width and depth . Probability plots of all dimensions (length, width, depth) suggest they obey log normal probability density functions. Given slab dimensions, two applications are considered, based on the field data: 1. Estimates of total fracture energy consumed around the perimeter of the slab are given, where it is presumed fracture is mostly mode I , and along the base (weak layer) of the slab where shear fracture (mode II and III) is expected. For average characteristic dimensions, the analysis suggests that energy consumed on the perimeter is about half that in the weak layer. Even though fracture energy around the perimeter is expected to be higher than in the weak layer, the larger area fractured in shear at the base of the slab compared to area fractured in tension around the perimeter results in less total energy needed around the perimeter. 2. Approximate estimates of avalanche mass for average characteristic dimensions based on slab depth D (the only length known prior to avalanching) are made. The mass is considered related to destructive potential and simple guidelines are given to estimate avalanche size (destructive potential) or mass in relation to D : the only length known prior to avalanching. The model is validated by considering concurrent size estimates and estimates of D by mountain guides.