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In-situ measurement of the mechanical energy associated with crack growth in weak snowpack layers and determination of the fracture energy.

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Recent experimental and theoretical work has shown that the volumetric collapse of a weak snowpack layer plays a key role in the formation of dry snow slab avalanches. We use field measurements of the displacement field caused by cracks artificially created in weak snowpack layers to determine changes in the mechanical energy prior to self-sustained fracture propagation. The fracture energy of the weak layer is thus obtained without using the Young's modulus of the snow slab. The measurements show bending of the slab prior to fracture propagation, with average slope normal displacement on the order of 0.2 mm. The method also allows for the separate determination of an equivalent elastic modulus of the slab by comparing the measured displacements field of the slab with that of a homogeneous, isotropic and fully elastic Timoshenko beam. The equivalent elastic modulus is then used to calculate the fracture energy of the weak layer by means of the anticrack model. The theoretical values of fracture energy are compared with the experimentally measured values.