Dynamic damage model of crevasse opening, and application to glacier calving

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We present a formulation of continuum damage in glacier ice that incorporates the induced anisotropy of the damage effects but restricts these formally to orthotropy. An ice-damage model, valid at low stresses, is proposed. The model describes the damage itself, the rheology of the damaged ice and the damage evolution. All constitutive relations are in conformity with the second law of thermodynamics. The model parameters are inferred from published data of laboratory experiments.
The model is implemented in a finite element code and applied to the destabilization of an ice chunk from a hanging glacier. Numerical results show good agreement with field measurements. The influence of the anisotropy is further analyzed.