



## **Modelling tidewater glacier calving: from detailed process models to simple calving laws**

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The simple calving laws currently used in ice sheet models do not adequately reflect the complexity and diversity of calving processes. To be effective, calving laws must be grounded in a sound understanding of how calving actually works. We have developed a new approach to formulating calving laws, using a) the Helsinki Discrete Element Model (HiDEM) to explicitly model fracture and calving processes, and b) the full-Stokes continuum model Elmer/Ice to identify critical stress states associated with HiDEM calving events. A range of observed calving processes emerges spontaneously from HiDEM in response to variations in ice-front buoyancy and the size of subaqueous undercuts, and we show that HiDEM calving events are associated with characteristic stress patterns simulated in Elmer/Ice. Our results open the way to developing calving laws that properly reflect the diversity of calving processes, and provide a framework for a unified theory of the calving process continuum.