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Breaking the ice: an exploration of material behavior, boundary conditions, and (ice) failure in Antarctica.

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Iceberg calving —or the mechanical removal of ice from glaciers and ice sheets —remains an important yet unresolved aspect of the dynamic ice flow. Providing more confident projections on global mean sea level rise will depend on our ability to more accurately simulate how ice is discharged into the ocean. This presentation focuses on the role that basal crevasses (fractures that form on the bottom sides of floating ice) play in the disintegration of glaciers, and explores the connection between calving, ocean-driven melting, and changes in glacier dynamics.

We begin with observations of basal crevasses in Antarctica that motivate simple material models, and finish with the presentation of a numerical model that accommodates multi-material model ice dynamics, exploring the effects that different initial geometries and boundary conditions play in the formation of cracks in the ice for some idealized experiments. Finally, we test the numerical model in a more realistic scenario, simulating the formation of cracks throughout time for Thwaites Glacier, Antarctica. Good agreement between observations of the distribution of cracks at Thwaites Glacier and our simulations encourage the notion that the material model formulation in our numerical model is appropriate for further prognostic simulation of glaciers.