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On ice rifts and the stability of non-Newtonian extensional flows on a sphere[1] ROIY SAYAG, Ben-Gurion university, Dept. of Environmental physics and Dept. of mechanical engineering — Rifts that form at the fronts of floating ice shelves that spread into the ocean can trigger major calving events in the ice. The deformation of ice can be modeled as a thin viscous film driven by buoyancy. The front of such a viscous film that propagates over a flat surface with no-slip basal conditions is known to have stable axisymmetric solutions. In contrast, when the fluid propagates under free-slip conditions at the substrate, the front can become unstable to small perturbations if the fluid is sufficiently strain-rate softening. Consequently, the front will develop tongues with a characteristic wavelength that coarsens over time, a pattern that is reminiscent of ice rifts. Here we investigate the stability of a spherical sheet of power-law fluids under free-slip basal conditions. The fluid is discharged at constant flux and axisymmetrically with respect to the pole, and propagates towards the equator. The propagating front in such a situation may become unstable due to its failure to sustain large extensional forces, resulting in the formation of rifts. This study has implications to understanding the cause of patterns that are observed on shells of floating ice in a range of planetary objects, and whether open rifts that sustain life were feasible in snowball earth.

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