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Viscous grounding lines GRAE WORSTER, HERBERT HUPPERT, ITG, DAMTP, University of Cambridge, ROSALYN ROBISON, RAHUL NANDKISHORE, LUKE RAJAH, DAMTP, University of Cambridge — We have used simple laboratory experiments with viscous fluids to explore the dynamics of grounding lines between Antarctic marine ice sheets and the freely floating ice shelves into which they develop. Ice sheets are shear-dominated gravity currents, while ice shelves are extensional gravity currents with zero shear to leading order. Though ice sheets have non-Newtonian rheology, fundamental aspects of their flow can be explored using Newtonian fluid mechanics. We have derived a mathematical model of this flow that incorporates a new dynamic boundary condition for the position of the grounding line, where the gravity current loses contact with the solid base. Good agreement between our theoretical predictions and our experimental measurements, made using gravity currents of syrup flowing down a rigid slope into a deep, dense salt solution, gives confidence in the fundamental assumptions of our model, which can be incorporated into shallow-ice models to make important predictions regarding the dynamical stability of marine ice sheets.

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