Abstract Submitted
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Lubricated gravity currents of power–law fluids[1] AYALA GYLLENBERG, ROIY SAYAG, Ben Guirion University — The discharge of ice from polar ice sheets into the ocean has the potential to induce climate change and a catastrophic rise in sea level. Significant ice discharge can occur via ice streams, bands of fast–moving ice lubricated by a mixture of water and clay. We present a fluid–dynamical model for such lubricated gravity currents that describes the axisymmetric spreading of a viscous, power–law fluid, such as ice, under its own weight on top of a viscous, Newtonian fluid. Both fluids are discharged at the origin at a time–dependent flux of a general power–law form. We investigate the model solutions by combined analytical and numerical methods. We find that the model admits self–similar solutions only in specific cases, such as when the top fluid is Newtonian or when the fluids are discharged at a certain time–dependent flux. When the flux is constant, similarity solutions are present when the viscosity of one fluid is much greater than that of the other fluid, as in the case of an ice sheet lubricated by water. In that case we find that the front of the lubricating fluid outstrips that of the power–law fluid, a phenomenon that has been observed in laboratory experiments.

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