Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Lubricated gravity currents of strain–rate softening fluids, and the formation of ice-streams[1] ROIY SAYAG, Ben Gurion University, PRAMODA KUMAR, Ashuka University, SHAHAR ZURI, Technion — Ice–sheet instabilities are believed to be closely associated with the flow of ice streams, bands of fast–flowing ice that carry most of the mass flux towards the edge of the ice sheet, where it ultimately melts or calves. The formation and evolution of ice streams is believed to be controlled by a complex hydrological network under the ice that sets the dynamic boundary conditions on the base of the ice. Fluid mechanically, such a system can be modelled as a viscous gravity current of strain-rate softening fluid lubricated by a relatively inviscid and denser Newtonian fluid. We present an experimental study of such flows that were discharged axisymmetrically at a constant rate. We investigate the evolution of the fronts of the viscous and the lubricating fluids, and how the patterns they form depend on the main dimensionless groups of the flow. We find two distinguished classes of patterns. In the first class, both fronts remain axisymmetric throughout the flow. In the second class, the initially axisymmetric front of the lubricating fluid evolves into a set of localised fingers, which drive the initially axisymmetric flow of the viscous fluid to develop patterns that are reminiscent to ice streams.

[1]German-Israeli Foundation I-2404-301.8/2015

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Date submitted: 01 Aug 2019 Electronic form version 1.4