Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Fingers or fractures in viscoplastic gravity currents? Part I NEIL BALMFORTH, THOMASINA BALL, University of British Columbia — Experiments in which viscoplastic fluid such as an aqueous suspension of Carbopol is extruded from a vent into a shallow ambient layer of water suffer a dramatic pattern-forming instability: if the Carbopol is extruded onto a dry surface, and the spreading dynamics is dominated by shear, the gravity current expands axisymmetrically. However, when the Carbopol is extruded onto a surface coated by an ambient layer of water, the outer radial edge becomes non-axisymmetrical and the current develops into a regular petal-like pattern. In this talk, a theoretical analysis is presented of freely sliding viscoplastic gravity currents to examine whether they suffer an extensional flow instability that may rationalize the experiments. The theoretical analysis confirms the existence of instability and suggests that it is particularly strong at late times, if the fluid has a yield stress or is sufficiently shear-thinning.

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Date submitted: 28 Jul 2020 Electronic form version 1.4