Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Miscible Viscous Gravity Currents[1] BRUCE SUTHERLAND, KRISTEN COTE, Univ of Alberta, YOUN SUB HONG, Univ or Toronto, LUKE STEVERANGO, McGill University, CHRIS SURMA, Univ of Alberta — Full- and partial-depth lock-release laboratory experiments are performed examining the evolution of a glycerol solution being released into an ambient fluid of either fresh or salty water. The advance of the current front and the depth of the current from its head back to the lock are tracked over time. While the viscosity of pure glycerol is sufficiently high to retard mixing between the current and ambient fluid, where mixing does occur the viscosity reduces significantly so permitting more turbulent mixing to occur. Meanwhile viscous stresses at the bottom of the current introduces shear within the boundary layer which extends vertically over a significant fraction of the current's depth. Thus, even though there is no evidence of a lubrication layer below the current, the current nonetheless advances initially at speeds close to those of effectively inviscid gravity currents. As the viscous boundary layer depth becomes comparable to the current depth in the tail the fluid slows dramatically while the turbulent front continues to advance, slowing as it becomes depleted of fluid.

[1]NSERC Discovery Grant

Bruce Sutherland
Univ of Alberta

Date submitted: 01 Aug 2017 Electronic form version 1.4