Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Controlling Wavebreaking in a Viscous Fluid Conduit[1] DALTON ANDERSON, MICHELLE MAIDEN, MARK HOEFER, University of Colorado Boulder — This poster will present a new technique in the experimental investigation of dispersive hydrodynamics. In shallow water flows, internal ocean waves, superfluids, and optical media, wave breaking can be resolved by a dispersive shock wave (DSW). In this work, an experimental method to control the location of DSW formation (gradient catastrophe) is explained. The central idea is to convert an initial value problem (Riemann problem) into an equivalent boundary value problem. The system to which this technique is applied is a fluid conduit resulting from high viscosity contrast between a buoyant interior and heavier exterior fluid. The conduit cross-sectional area is modeled by a nonlinear, conservative, dispersive, third order partial differential equation. Using this model, the aim is to predict the breaking location of a DSW by controlling one boundary condition. An analytical expression for this boundary condition is derived by solving the dispersionless equation backward in time from the desired step via the method of characteristics. This is used in experiment to generate an injection rate profile for a high precision piston pump. This translates to the desired conduit shape. Varying the jump height and desired breaking location indicates good control of DSW formation. This result can be improved by deriving a conduit profile by numerical simulation of the full model equation. Controlling the breaking location of a DSW allows for the investigation of dynamics independent of the boundary.

[1]Support provided by NSF CAREER DMS-1255422 , NSF EXTREEMS

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Date submitted: 31 Jul 2015 Electronic form version 1.4