Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Mixing Induced by Colliding Gravity Currents[1] QIANG ZHONG, CHRISTOPHER HOCUT, University of Notre Dame, FAZLE HUSSAIN, Texas Tech University, HARINDRA FERNANDO, University of Notre Dame — Colliding gravity current is a widespread phenomenon in complex-terrain meteorology. Nevertheless, only a few detailed studies have been conducted on the mixing and turbulent transport processes during collision, and no parameterization exists to incorporate the mixing effects of collision in mesoscale models. To this end, controlled laboratory experiments were conducted in a double lock-exchange configuration. Velocity and density measurements were made simultaneously using a PIV/PLIF system. Phase aligned ensemble-averaging was employed to elicit mean and turbulent quantities. Collisions cause localized instabilities both along the density interface and in the interior of gravity currents. The turbulence near the density interface induces strong mixing and, along with ambient fluid entrainment, produces strong fluctuations of buoyancy flux. A time scale for the evolution of ensuing turbulence as well as scaling for the entrainment velocity was delineated for the high Reynolds number cases. The flow was replete with turbulent vortices generated by the collisions, and they decayed exponentially with time.

[1]Funded by Office of Naval Research Award # N00014-11-1-0709, Mountain Terrain Atmospheric Modeling and Observations (MATERHORN) Program.

Qiang Zhong
University of Notre Dame

Date submitted: 31 Jul 2015 Electronic form version 1.4