Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

High resolution simulations of down-slope turbidity currents into stratified saline ambient RAPHAEL OUILLON, SENTHIL RADHAKRISHNAN, ECKART MEIBURG, UC Santa Barbara, BRUCE SUTHERLAND, University of Alberta, Edmonton — In this work we explore the properties of turbidity currents moving down a slope into a stratified saline ambient through highly resolved 3D Navier-Stokes simulations. Turbidity events are difficult to measure and to replicate experimentally for a wide range of parameters, but they play a key role in ocean, lake or river sediment transport. Our objectives are to improve on previous numerical studies, obtain quantitative data in a more controlled environment than current experimental set-ups, and combine results with analytical arguments to build physics-based scaling laws. We validate our results and propose a simple scaling law to predict the velocity of the front down a slope for any stratification. We also compute a time and space dependent entrainment of ambient fluid and highlight its strong variability. We then introduce a predictable scaling law for the intrusion depth that does not depend on an averaged entrainment and uses it as a verification tool instead. Finally, we show that the ratio of Stokes losses in the local flow around individual particles to dissipative losses of the large scale flow determines the ability of the flow to convert potential energy into kinetic energy. For different parameters, either mechanism can dominate the dynamics of the flow.

Raphael Ouillon
UC Santa Barbara

Date submitted: 28 Jul 2016 Electronic form version 1.4