Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

Instability of the 2-D bottom boundary layer under a solitary wave MAHMOUD SADEK, PHILIP LIU, Cornell University, LUIS PARRAS, University of Malaga, PETER DIAMESSIS, Cornell University — Fully nonlinear 2-D simulations are used to investigate the temporal instability of the bottom boundary layer (BBL) driven by a soliton-like pressure gradient in an oscillating water tunnel (an approximation of the BBL under a solitary wave). As a function of the associated Reynolds number (*Re*), the base flow (BF) can be classified as unconditionally stable, conditionally unstable or unconditionally unstable. In the third regime, the BBL flow is unstable, regardless of perturbation amplitude. Two distinct unstable modes emerge in this last regime depending on the value of *Re*. In the unconditionally unstable regime, we identify the limiting *Re* value above which instability is observed in the acceleration phase of the BF. The BF profile in this phase lacks a deflection point, suggesting that the above instability is of viscous origin. A sensitivity analysis has been carried out to assess the effect of the different initial perturbation characteristics (i.e. amplitude, spectral shape, time of insertion, e.t.c.) and a variety of wave shapes on the BBL's instability properties for different *Re* values. In parallel with the fully non-linear simulations, the applicability of both modal and non-modal instability analysis is also examined.

Peter Diamessis
Cornell University

Date submitted: 02 Aug 2013 Electronic form version 1.4