Abstract Submitted
for the DFD09 Meeting of
The American Physical Society

Evolution of depressed and elevated tsunami waves H.J.S. FERNANDO, Arizona State University (ASU), C.A. KLETTNER, University College London (UCL), S. BALASUBRAMANIAN, Los Alamos National Laboratory, J.C.R. HUNT, UCL, S.I. VOROPAYEV, ASU, I. EAMES, UCL — Tsunamis differ greatly between positive (elevated) and negative (depressed) waves. These differences are explained using a hydraulic model based on the conservation of impulse. Laboratory experiments of depression waves, conducted using a novel wave-maker, are compared with model predictions. Over a sloping beach, they have a nearly constant V-shaped depression trailed by a growing lambda- shaped positive wave. The shoreline recedes (draw-down) over a significant distance, caused by shoreward water being drawn toward the V-shaped depression. When the lambda- shaped positive wave breaks (spills), an energetic hydraulic bore develops and moves up the beach. The model leads to general formulae for wave slopes, draw-down and run-up. The run up of negative waves can be larger or smaller than positive waves, depending on the wave amplitude and beach parameters. The predictions are consistent with videos and photographs taken during the 2004 Sumatra tsunami. Using the amplitude data in the new tsunami warning systems, the properties of tsunamis on beaches could be estimated in real time using the present work, thus improving emergency response strategies.

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Date submitted: 06 Aug 2009 Electronic form version 1.4