Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

Suspension and transport of sediment under a plunging wave breaker XINHUA LU, State Key Laboratory of Water Resources and Hydropower Engineering Science, Wuhan University, XIN GUO, Department of Mechanical Engineering & St. Anthony Falls Laboratory University of Minnesota, Twin Cities, YI LIU, American Bureau of Shipping, LIAN SHEN, Department of Mechanical Engineering & St. Anthony Falls Laboratory University of Minnesota, Twin Cities
— To understand the mechanism of suspension and transport of sediment under breaking water waves, we perform large-eddy simulations of a plunging breaker over seabed. The breaking water surface is captured by a coupled level-set and volume-of-fluid method. The mass exchange of sediment between the water region and the bottom is computed through the local upward erosion and downward deposition fluxes. The erosion flux is modeled based on the local shear stress at the bottom, and the deposition flux is estimated based on the sediment concentration near the bottom. We analyze in detail the instantaneous velocity and sediment concentration fields, the erosion and deposition fluxes near the bottom, as well as the bottom deformation under breaking waves. It is found that the sediment is mainly picked up from the bottom at the early stage of wave breaking, brought upwards, mixed by the turbulent motion, and then transported in the wave propagation direction by the current generated by the breaker. The wave breaking significantly enhances the horizontal transport of the sediment. It is also found that the air pocket entrained by the breaking wave plays an important role in the suspension, transport, and redistribution of sediment.

Xin Guo
Department of Mechanical Engineering &
St. Anthony Falls Laboratory University of Minnesota, Twin Cities

Date submitted: 02 Aug 2013 Electronic form version 1.4