Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Spectral analysis of approximations of Dirichlet-Neumann operators and nonlocal shallow water wave models ROSA VARGAS-MAGAA, Univ Nacl Autonoma de Mexico, PANAYOTIS PANAYOTAROS, Departamento de Matemáticas y Mecánica, IIMAS-Univ Nacl Autonoma de Mexico — We study the problem of wave propagation in a long-wave asymptotic regime over variable bottom of an ideal irrotational fluid in the framework of the Hamiltonian formulation in which the non-local Dirichlet-Neumann (DtN) operator appears explicitly in the Hamiltonian. We propose a non-local Hamiltonian model for bidirectional wave propagation in shallow water that involves pseudodifferential operators that approximate the DtN operator for variable depth. These models generalize the Boussinesq system as they include the exact dispersion relation in the case of constant depth. We present results for the normal modes and eigenfrequencies of the linearized problem. We see that variable topography introduces effects such as steepening of normal modes with increasing variation of depth, as well as amplitude modulation of the normal modes in certain wavelength ranges. Numerical integration shows that the constant depth nonlocal Boussinesq model with quadratic nonlinearity can capture the evolution obtained with higher order approximations of the DtN operator. In the case of variable depth we observe certain oscillations in width of the crest and also some interesting textures in the evolution of wave crests during the passage from obstacles.

Rosa Vargas-Magaa
Univ Nacl Autonoma de Mexico

Date submitted: 31 Jul 2015 Electronic form version 1.4