Geophysical Research Abstracts,
Vol. 10, EGU2008-A-08971, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-08971
EGU General Assembly 2008

Modeling of nonlinear short gravity waves in the presence of an unsteady uniform current

S. Dubosq (1), M. Francius (1), M. Saillard (1), S. Grilli (2), H. Branger (3) and V. Rey (1)

(1) LSEET, University of Toulon, France, (2) University of Rhode Island, USA, (3) IRPHE, University of Marseille, France (francius.marc@univ-tl.fr / Fax: +33 494 142 448 / Phone: +33 494 142 992)

In recent years, there has been an increased interest in the possibility for tsunami radar remote sensing, owing to the effects of tsunami-induced changes on the propagation of short sea waves. Well before microwave radars, HF radars have been investigated to detect tsunamis (*Barrick*, 1979). But so far there has been no system proposed with an appropriate alert real-time mode, the effort being stressed on wind wave and sea surface study. Alternatively, the potential use of Ultra High Frequency (UHF) radar technology has been suggested based on recent observations of modulation processes in radar echoes, which indicates the possibility for the short wind waves to be affected by the tsunami (*Troïtskaya and Ermakov*, 2005).

In fact, when a tsunami reaches the continental shelf, the induced currents that are mostly depth-uniform greatly increases in speed (maybe up to 10-20 cm/s) and can induce significant Doppler shifts in ocean surface waves, particularly for those of smaller wavelength in the submetric ranges (high frequency). However, the identification and quantification of short-wave modulation processes in response to an incoming tsunami are very challenging. This is partly because some of these modulations can be related to wind-wave interactions, short-wave/short-wave interactions as well as long-wave /short-wave interactions.

In order to investigate the short-wave modulation processes induced by an incoming tsunami, we propose here to use a numerical approach based on a high-order spectral

(HOS) method to model fully nonlinear short gravity waves (down to metric length scales) in the presence of unsteady large-scale depth and current fields. Such current and depth fields can be obtained for selected case studies, e.g., from tsunami propagation modeling, using a standard long wave model. This paper presents initial results of this modeling study, in terms of Doppler shifts and wave shoaling/refraction caused by a slowly varying depth-uniform current. The numerical results are then compared with large-scale laboratory results from a wave-current interaction experiment, which has been performed in the FIRST basin (La Seyne, France).

[1] Barrick, A coastal Radar System for Tsunami Warning, *Remote Sens. Environ.*, 8, 353-358, 1979.

[2] Troitskaya Yu.I., S.A.Ermakov, Recording of the December 26, 2004 Tsunami in the Open Ocean Based on Variations in Radar Scattering Section, *Doklady Earth Sciences*, 405A, 1384-1387, 2005.