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Interactive Comment

Interactive comment on "Resonance phenomena at the long wave run-up on the coast" *by* A. Ezersky et al.

Anonymous Referee #3

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The paper presents the resonance effect on long wave propagation over continental shelf and slope. The continental shelf and slope bathymetry is a very typical and realistic representation of near-shore coastal region. Understanding of long wave propagation over it could be very useful for the interpretation of the some field observations, i.e. unusual runup observations. Manuscript content will be of interest to the readers of the Natural Hazards and Earth System Sciences. However, I would suggest that Authors should address the comments given below:

Comments:

1. Page 563, line 6: In addition to the other references listed here, Kânoğlu (2004)

also presents propagation of a single Gaussian, Gaussian N-wave, solitary, and N-wave type presented in Tadepalli & Synolakis (1994) over a sloping beach as an initial value problem. Therefore, Kânoğlu (2004) should be acknowledged here.

2. Page 563, line 21: Most of the analytical solutions consider the canonical problem of a long wave propagating first over a flat ocean floor and then climbing on a sloping beach as in Synolakis (1987). However, there are several studies where wave propagation on different bathymetric profiles including continental shelf and slope geometry is considered. For example;

   Neu & Shaw (1987) studied filtering effect of submerged ridges and found filtering of tsunami wave energy only for very oblique angles of incidence and short periods. They also studied continental shelf and slope system and noted that shelf-slope system have definite resonance effect.

   Kânoğlu & Synolakis (1998) present formalism to wave propagation over piecewise linear bathymetries. Requiring continuity of wave amplitude and its slope at the transition point between adjacent linear segments, as presented here, they were able to present a matrix formulation. Their methodology could be applied on different bathymetries consisting of linearly varying and constant-depth segments for determining the amplification factor. They also studied spectral distribution like solitary wave evolution over piecewise linear topographies.

   These studies need to be acknowledged.

3. Page 564, line 16: Kânoğlu (2004) does not present any piecewise geometry.

Kânoğlu (2004) considers propagation of different initial profiles over a sloping beach as an initial value problem. Therefore, clarification is needed here.

4. Kânoğlu & Synolakis (1998) were able to evaluate maximum runup of solitary wave for continental shelf and slope bathymetry. They also benchmarked their formulation using laboratory data from an experiment that modeled wave evolution over the bathymetry with three piecewise sloping region connected to a constant depth and having vertical wall at the shoreline, Revere Beach. They derived a simple formulation for the maximum runup for continental shelf and slope and Revere Beach bathymetries. They concluded that runup is governed by the bathymetric features closest to the shoreline, i.e. slope closest to the shoreline in continental shelf and slope case, for large range of parameters. Evaluating the figures 4 and 5, it is possible to reach same conclusion from this study as well. It will be useful to reference to this feature presented in Kânoğlu & Synolakis (1998).

5. It will much better if the formulation is given in more detail, i.e.

   (a) Line10: $\eta(x,t) = A(x)e^{-i\omega t}$ could be included.

   (b) Then, in equations (6) and (7), wave height $\eta(x,t)$ could be differentiated as $\eta_A(x,t) = A_A(x)e^{-i\omega t}$ and $\eta_B(x,t) = A_B(x)e^{-i\omega t}$ since A, actually $A(x)$, is different in regions A and B.

   (c) Matching conditions at $x = 0$ and $x = x_2$ could be written explicitly.

   (d) Term with the Bessel functions in the numerator of equation (8) could be simplified using Wronksian (Abramowitz & Stegun, 1964) as presented in Kânoğlu & Synolakis (1998).

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References:

1. Abramowitz, M. & Stegun, I. A. 1964 *Handbook of Mathematical Functions.* Dover.

2. Kânoğlu, U. 2004 Nonlinear evolution and runup and rundown of long waves over a sloping beach. *J. Fluid Mech.* **513**, 363–372.

3. Kânoğlu, U. and Synolakis, C. E. 1998 Long wave runup on piecewise linear topographies. *J. Fluid Mech.* **374**, 1–28.

4. Neu, W. L. & Shaw, R. P. 1987 Tsunami filtering by ocean topography. *Ocean Phys. and Engng* **12**(1), 1–23.

5. Synolakis, C. E. 1987 The runup of solitary waves. *J. Fluid Mech.* **185**, 523–545.

6. Tadepalli, S. and Synolakis, C. E. 1994 The run-up of N-waves on sloping beaches. *Proc. R. Soc. Lond. A* **445**, 99–112.

Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., 1, 561, 2013.