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Natural Hazards and Earth System Sciences
Discussions

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

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This paper studies the run-up of pulse-like waves which propagate over a piecewise-planar beach. Specific focus is on the resonance phenomena which can influence the shoreline motion.

The topic of the paper is clearly of interest for the readers of *Natural Hazards and Earth System Sciences*. However, improvements are needed prior that final publication be granted.

In particular, being this a discussion paper, I find it essential that the authors discuss similar recent studies on the influence of the beach profile on the wave runup of any type (i.e. pulse-like, regular periodic, random).

In more details. It is fundamental to clarify that very recently Antuono & Brocchini (2010) ("Analysis of the Nonlinear Shallow Water Equations Over Nonplanar Topography", *Studies in Applied Mathematics* **124**, 85–103) have found an approach for solving the NSWE also for nonplanar topographies. This method does not require matching of solutions for the various pieces of the topography, rather a unique solution is obtained. Fundamental to the method is the extra forcing term in the momentum equation and the proper data assignment. The method, applied to a barred beach, reveals that the shoreline motion of a pulse-like wave over a barred topography is characterized by an "oscillatory tail" of trailing the largest runup-rundown pattern.

On the basis of the above-mentioned analytical solution, Soldini, Antuono & Brocchini (2013) ("Numerical modeling of the influence of the beach profile on wave run-up", *Journal of Waterway, Port, Coastal, and Ocean Engineering* **139(1)**, 61–71) validated/calibrated the NSWE solver of Brocchini et al. (2001) ("An efficient solver for nearshore flows based on the WAF method." *Coastal Engineering* **43(2)**, 105–129) and studied the effect of the beach bottom profile on the run-up of regular and random waves. Piecewise topographies were analyzed, similar to those of interest here, as well as equilibrium beach profiles. One important finding is the intrinsic difficulty of defining a single planar beach profile which gives a maximum runup equivalent to that forced by the piecewise-planar profile.

The "Further comments" which follow also require attention.

Further comments

1. page 566, text between equations (4) and (5). It is necessary to clarify that here $A = A(x)$. It is also necessary to clarify that using linear wave theory it is $x_s = x_0$ (where x_s is the shoreline position);

2. page 567, text introducing equation (8). Here various questions arise:

- at point $x = x_2$ some data assignment is made, rather than enforcing a matching condition. For such a data assignment more details must be provided, specifically on the procedure to assign the incoming signal;
- the problem described by solutions (6) and (7) is characterized by three free parameters (i.e. C_1, C_2, R). On the other hand, here the authors state that continuity of velocity and free surface is forced at two locations (i.e. $x = 0$ and $x = x_2$). This means that four conditions are provided for three free parameters, hence leading to an over-specified problem. Please clarify;
- finally, more details of the derivation of equation (8) must be explicitly given.

3. page 571, text following equation (17). The authors state that the flow properties at the shoreline (e.g. runup height) can be obtained with both linear and nonlinear solutions. However, this is only true for the analytical structure of the solution, but the solution in itself also depends on the data assignment (be it made as either an initial value or a boundary value problem). Antuono & Brocchini (2007) ("The Boundary Value Problem for the Nonlinear Shallow Water Equations" *Studies in Applied Mathematics* **119(1)**, 73–93.) have provided clear evidence that if such an assignment is made on the basis of the linear theory an underestimation of the near-shoreline dynamics is made. This should be properly acknowledged, with adequate referencing.

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