Natural Hazards and Earth System Sciences

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Discussions

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

A. Ezersky et al.

pelinovsky@hydro.appl.sci-nnov.ru

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Anonymous referee 1

1) The authors just briefly outlined the Makran tsunami event to compare their model results to a real case. On the other hand, I suggest to expand this part, by presenting clearly and more in detail the Makran event as a case study and the result obtained for it. The authors could slightly re-thinking the overall manuscript scheme, by properly introducing the Makran tsunami to the readers and which are the results corresponding to the this specific case (maybe they could dedicate a section to it, instead of presenting sparsely in the different sections). In fact, for example, it seems strange to me that in Figure 6, the quantities BR, R and U are presented for the specific case of Makran,

but it is mentioned only in the last line of the Conclusions, while in both the caption of figure 6 and at the end of section 4 (where figure 6 is cited) nothing is said.

Really, we did not study the 1945 Makran tsunami event. We chose the bathymetry from this region to demonstrate the influence of coastal resonances on the runup heights. The modelling of real Makran event requires 2D modelling and this is out of scope of given paper.

2) The authors analysed two waveforms and different slope angles. Why they did not consider also the variation of the horizontal length of the two last segments as possible controlling factor for the resonance? Amplification and Run-up are not affected by the horizontal dimension of slopes?

It should be noted that changing of angles for he fixed depths h0=4000m, h1=200m as it was done in the paper (Figs .4 and 5) means changing of horizontal length of the two last segments. No doubt, the amplification of run-up is affected by horizontal dimension of slopes.

3) I didn't understand if there was any particular reason to select exactly M = 7.7 and M=8.5. However, it could be interesting to give particular relevance to the results for magnitudes that can be associated to the Makran event (this actually is part of previous comment 1).

In Fig. 3 we presented comparison of results for different magnitudes of earthquake. The main idea is to demonstrate the qualitative differences of run-up: for smaller magnitude amplification of run-up is larger (although absolute value of run-up is smaller) than for large magnitude; oscillating tail appears for M=7.7. Values of magnitude have been chosen arbitrary with no association to the Makran event.

4) In Section 2, the author could briefly expand some paragraphs to better explain some mathematical passages. For instance in equation 3 has been obtained by using the hodograph transformation, it should be at least mentioned. Or it should be mentioned

what transformation they are using. I found also not completely clear how authors found out equation 8.

Done. In the revised version of paper we show on page 5 step by step how to obtain equation (8). It should be noted that equation (3) was obtained without any hodograph transformation. In the linear approximation, just trivial transformations are needed to perform system of equation (1)-(2) into one equation (3).

5) Legends in Figures 4 and 5 could be better positioned in order to fill less space in the Figures

Done. Figures 4 and 5 have been rearranged

Referee M. Brocchini

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

In the revised version (page 3, lines 6-9) we discussed the recent results. Additional references are indicated in list of references.

âĂć Antuono, M., Brocchini, M.: Analysis of the nonlinear shallow water equations over nonplanar topography, Studies in Applied Mathematics, 124, 85-103, doi: 10.1111/j.1467-9590.2009.00464.x, 2010. âĂć Soldini, L., Antuono, M., Brocchhini, M.: Numerical modelling of the influence of the beach profile on the waver run-up, Journal of Waterway, Port, Coastal, and Ocean Engineering, 139, 61-71, 2013. âĂć Brocchini, M., Bernetti, R., Mancinelli, A., Albertini, G.: An efficient solver for nearshore flows based on the WAF method, Coastal Engineering, 43, 105-129, 2001.

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 liner wave theory it is $x_s=x_0$ (where x_s is the shoreline position)

This part has been changed and all the necessary explanations are included into the text, see page 5, lines 9-13.

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

at point x2 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.

Details are presented now in the revised version, see page 6, lines 5-19.

The problem described by solution (6) and (7) is characterized by three free parameters (i.e. C1, C2, R). On the other hand, here the authors state that continuity of velocity and free surface is forced at two locations (i.e. is x=0 and x=x2). This means that four conditions are provided for three parameters, hence leading to an over-specified problem. Please clarify; In actual fact, the problem described by solution (4), (6) and (7) is characterized by 5 parameters (i.e. C1, C2, Ai, Ar, R). There are 5 constants and 4 boundary conditions.

Finally, more details of the derivation equation (8) must be explicitly given.

The details are presented now in the text, see pages 5 and 6.

3. page 571, text following equation (17). The authors state that the flow properties at the shoreline (i.e. run-up height) can be obtained with both linear and non-linear solutions. However, this is only true for the analytical structure of the solution, but the solution 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 non-linear shallow water equations Studies in Applied Mathematics 119 (1), 73-93) have provide clear evidence that if the such an assignment is made on the basis of the linear theory an underestimation of near-shoreline dynamics is made. This should be properly acknowledged with adequate referencing.

An adequate referencing is made, see page 3, line 7, and page 10, line 12 from the

bottom.

Anonymous referee 3

1. Page 563, line 6: In addition o he other references listed here, Kânoglu (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, Kânoglu (2004) should be acknowledged here.

Done.

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. Kânoglu & 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.

Done.

3. Page 564, line 6: Kânoglu (2004) does not present any piecewise geometry. Kânoglu (2004) considers propagation of different initial profiles over a sloping beach as an initial value problem. Therefore, clarification is needed here.

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We have changed this part.

4. Kânoglu & 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 andslope 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 Kânoglu & Synolakis (1998).

Done.

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

(a) Line 10ïĂžïĂăïĄĺ(x,t)=A(x)e(-iïĄůt) could be included.

Done.

(b) Then, in equations (6) and (7),wave height eta(x,t)) could be differentiated as eta(x,t)= AA(x)exp(-iomegat) and eta(x,t)= AB(x)exp(-iomegat) since A, actually A(x), is different in A and B.

We did not introduce additional index because function A(x) depends on coordinate x, and x is different in regions A and B.

(c) Matching conditions at x=0 and x=x2 could be written explicitly.

Done.

(d) Term with the Bessel functions in the numerator of equation (8) could be simplified using Wronskian (Abramovich & Stegun, 1964) as presented in Kânoglu & Synolakis

1998.

Done.

Please also note the supplement to this comment:
http://www.nat-hazards-earth-syst-sci-discuss.net/1/C754/2013/nhessd-1-C754-2013-supplement.pdf

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