Nat. Hazards Earth Syst. Sci. Discuss.,
https://doi.org/10.5194/nhess-2019-182-RC1, 2019

Natural Hazards and Earth System Sciences
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Discussions

Interactive comment on "Nonlinear deformation and run-up of single tsunami waves of positive polarity: numerical simulations and analytical predictions" *by* Ahmed A. Abdalazeez et al.

Anonymous Referee #1

Received and published: 18 July 2019

The submitted manuscript considers the nonlinear deformation and run-up of single positive waves, both numerically and analytically. The work is based on solutions of nonlinear shallow water equations. Particular focus is on the effect of nonlinearity, and especially in the tsunami front steepness, on the eventual run-up. The work is generally clearly presented, but is not presented with sufficient generality to be widely interpreted (dimensional results are generally presented, which are then case specific, rather than a more proper dimensionless presentation which can be widely interpreted for tsunamis.) My suggestion is that the manuscript undergo a major revision, wherein the following specific comments are addressed:

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Section 2: The paper considers solutions to nonlinear shallow water equations. These are commonly utilized to describe tsunamis, but are also known to neglect dispersive effects. In this context, the recent work of Larsen and Fuhrman (2019), https://doi.org/10.1016/j.coastaleng.2019.04.012, would be relevant to mention. They have similarly performed CFD simulations (RANS equations + k-omega model for turbulence closure) involving the run-up of positive single waves, including full resolution of dispersive short waves (and their breaking) that can develop near a positive tsunami front (there similarly shown that this effect depends on the propagation distance prior to the slope, if a simple toe with a slope type of bathymetry is utilized.) This work shows that these waves have little effect on the overall run-up, and hence give additional credence to the use of shallow water equations in the context of the present paper. These results largely confirmed what was previously hypothesized by Madsen et al. (2008), that these short waves would have little effect on the overall run-up and inundation of tsunamis (though they found that they could signficantly increase the maximum flow velocities).

line 103: A minor comment, but as the sechˆ2 variation is not periodic, variable T should probably be called an "effective period".

line 121: That numerical dissipation is included is introduced here, and later (e.g. lines 170-171 "supported by the numerical dissipation", and perhaps line 187, and elsewhere) this is seemingly taken as representing a positive and/or a physical effect. Numerical dissipation is model error (hence dependent on the space and time step, etc.), and should not be presented as otherwise. If dissipation effects are intended to be incorporated or considered, then an additional bottom friction term should be added.

lines 168-169: It is stated that the numerical simulations give larger run-up than predicted analytically, which is explained as due to the wave reflection from the underwater slope. As I understand it, this effect is neglected analytically, but included numerically. Would reflection from the slope then not reduce the incoming wave height and hence the run-up? Please clarify this apparent contradiction.

Nonlinear deformation. Starting with Fig. 4, results go essentially directly to the run-up, and seemingly skip the nonlinear deformation, though this aspect is emphasized in the title. Can the authors please present some snapshots of the nonlinear deformation leading to the run-up. This would give a much more comprehensive picture of what is being simulated.

Figs. 4, 5, 6, 7, 8, etc.: All of these figures are presented in dimensional terms, making their interpretation limited to the specific cases (wave characteristics and bottom slope) considered. This severely limits the overall potential impact of the paper. Please utilize a proper non-dimensional parameterization of the results. There are several potential ways to do this. As inspiration, it can be noted e.g. that Madsen and Fuhrman (2008) and Madsen and Schaffer (2010) have parameterized run-up R/H vs. surf similarity parameter \xi, and shown that the non-breaking run-up leads to a family of curves in terms of H/h at the toe. Some form of non-dimensional parameterization needs to be utilized, such that the results presented can be interpreted as widely as possible.

Similarly, Fig. 10 results seem only valid for the A and T combinations presented. These need to be presented in a way that can be more widely interpreted.

line 225: The wave front steepness s, is presented as the maximum of d\eta/dt i.e. as a velocity. Should the steepness not also be defined in a dimensionless manner?

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