Nonlinear Processes
in Geophysics
Discussions

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Interactive comment on "Shoaling of internal solitary waves at the ASIAEX site in the South China Sea" *by* K. G. Lamb and A. Warn-Varnas

Anonymous Referee #3

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Review of

Shoaling of internal solitary waves at the ASIAEX site in the South China Sea by Lamb and Warn-Varnas (npg-2014-54)

This study presents a series of 2D, nonhydrostatic model experiments of shoaling internal waves with various amplitudes, model resolutions, 2D bathymetries, rotation, stratification, and viscosity. The simulations are of high resolution of 33 m and 400 layers and show impressive and detailed structure. Novel results are the comparison of the simulations with adiabatic shoaling waves computed using the DJL equation. Can the authors explain what causes the differences between the DJL and numerical model solutions?

The paper feels a little long with its 23 figures, and many of the texts accompanying the figures are too descriptive with too much detail. Maybe reduce the text and omit Figures 3a, 4, and 11 (merge with 2), and 21 (merge with 20 and consider one density?). My main criticism is that the justification for this paper is lacking in the introduction. Why is this paper relevant? What does it add to the existing literature that is missing? Including some questions/objectives may improve the focus of this paper. Moreover, it is not always clear why the sensitivity experiments were performed. Maybe mention these reasons in the first lines of each new section? (why use different density profiles? why use different initial depths? why use different viscosities?) The readability is further improved if a brief summary is added at the bottom of each experiment section with the "take-home message". This extra text can be offset by omitting some of the descriptive details.

The figures do not have titles describing experiment cases and times of snapshots, as well as colorbars, legends, transect labels (e.g. Figure 6), etc. It is tiring for the reader to go back and forth between the caption and the figure. I suggest making all figures easier to read by including these things.

I recommend major revision.

P1164, l25. Z&A ref year is 2006!

P1166, l1. Buijsman and others (see Alford et al 2011) found that westward currents were not the cause of the a and b waves. Simulations indicate eastward currents.

P1166, l4. Typo? "...sloping front have"

P1166, l8. Correct English? "KdV extended ..."

P1168. L19-l5. Omit this detailed description on the bathymetry?

P1170. Section 2.4. Is this discussion on alpha relevant for the rest of the paper? Maybe omit?

P1170, l27. "approachED"?

P1172, l3. "Feature". At what km? Mark in figure?

P1172, l7. Same for "pedestal". At what km? Mark in figure?

P1172, l16-18. Propagating used twice in one sentence.

P1172, l25. "stronger currents THAN".

P1173, l6. How did you "calculate" ISWs?

P1174. Section 3.1 and Figure 10d. It seems that there is a large difference in shallow water between DX=50 and 33 m. I wonder if the model simulation has converged with a resolution of 33 m? Can you do a test for DX=15 m, or at least make a statement about the model convergence in this section?

P1177. Section 3.2. It is not explained in this section what causes the deviation between the DJL solutions and the simulations. Is it the nonlinear advection terms in the momentum equation? Wave breaking? How does the supercriticality (=slope angle over beam angle) of the slope affect these differences? Do the simulations become exactly the same as the DJL simulations when a subcritical slope is used (that would be a fun experiment)? The criticality of the slope is nowhere discussed in the paper and its relevance for the simulations and evolution of the solitary wave (see Klymak et al 2011, JPO)?

P1177, l12. Typo: "long small amplitude shelf"?

P1178, l10. "energy increases". Is this energy increase for the same wave as it shoals? Where is this energy coming from? This somewhat contrasts with the statement on l20. Please explain/rewrite.

P1180, l6. "increase more slowly" What causes this difference?

p1186, section 3.7. What is the relevance of this section to the reader? Why not use

summer and winter stratifications? Remove/shorten this section?

P1190. l28. Typo? "as THE shoal"

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