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Nonlinear Processes
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Interactive comment on "On the interaction of short linear waves with internal solitary waves" *by* Chengzhu Xu and Marek Stastna

Anonymous Referee #1

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General comments

The paper contains new results about an interaction between a large-scale, fully nonlinear internal solitary waves (ISW) and small-scale linear internal waves. Resonant behavior is found for some wavelengths, when the energy is transferred from small amplitude relatively short wave into the ISW. This effect is new and is important for further understanding of properties and dynamics of fully nonlinear internal solitary waves and for practical applications.

The topic, title, abstract and text of the paper are appropriate for the Nonlinear Processes in Geophysics Journal. A good review of the problem context is given in the Introduction. All figures are necessary and of good quality, except for minor misprints (q.v. Technical Corrections). Conclusions are clear and concise.

The paper can be published after minor revision.

Specific comments

1. The arguments are made in general terms such as Âńwaves that are short in comparison to the ISW length". It would be good to give the spectrum of the solitary wave to see where are the wavenumbers of the considered small-scale monochromatic waves with respect to characteristic wavenumbers in ISW spectrum, its width, etc.

2. Particular solitary wave is considered in the paper, and the amplitude of linear waves is set to 1 mm for all cases (it is mentioned that simulations with an amplitude of 2 mm have produced quantitatively the same results). Only wavelength of the linear waves was changing. It would be interesting to tune the parameters of the problem, to investigate how they influence the process interaction and to find possible parameterization of the problem. For example, authors could try to change the width of the solitary wave (of course, together with its amplitude) keeping constant wavelength of the linear wave and saving the ratio of the length scales ("short" and "long" ISW in comparison to linear wave). Such tasks are claimed as a proposal for future research.

3. Also it is interesting to understand the amplitude-wavenumber limits of "linearity" of the "linear" waves. This would be interesting to discuss within the present paper.

4. Page 15, first paragraph: "According to the linear wave theory, the wave induced horizontal velocity is much larger than the vertical velocity" – this is true only for long waves, but linear waves considered in the paper are not proven to be long. In the theory of internal waves the criterion for waves to be long is based not only upon the ratio of wavelength and the total height of the water column (as it is for surface waves), but includes also some characteristic of the density stratification, and thus is weaker than that for surface waves, nevertheless authors should prove that their linear waves can be treated as long internal waves.

5. Authors state that "a critical layer is not present during the collision" based on the

linear criterion Ri > 0.25. But Figures 3 (at T=0.5) and 5 for O2 and H2 cases clearly demonstrate the presence of instability (at least instability of Rayleigh – Taylor), which manifests itself in an overturning, in contrast to Figure 4 for O6 case, where there is no any instability. How can this instability be explained?

Technical corrections

1. Not all variables and notations are described when the equations (1), (3) are formulated.

2. I can't see dotted horizontal lines, which are described in the annotation to Figure 6.

3. Line 7, page 17: what is the case B6, and why values of scaled PSD (in %) are not the same as in Table 4 at T=4 for both O6 and H6? Also, what are B2 and B6 in the legends in Figure 13?

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