The evolution of mode-2 internal solitary waves modulated by background shear currents by Zhang *et al.*

The effect of a background shear current on the evolution of a mode-2 internal solitary wave is investigated using the MITgcm numerical model. Three features were identified due to the modulation of the mode-2 wave by the background shear, namely, (i) forward-propagating long waves, (ii) an amplitude modulated wave packet behind the mode-2 wave and (iii) an oscillating tail. The distance between the centre of the shear layer and the centre of the pycnocline was varied such that the distance went in incremental values from zero (no offset) to offsets in which the centre of the shear layer was below that of the pycnocline. It was shown that the forward-propagating waves were insensitive to the offset distance while the oscillating tail and the wave packet decreased in their respective amplitudes as the offset was increased. Implications for energy transfer and energy depletion of the original mode-2 wave are discussed and comparison to a related field study (Shroyer *et al*. 2010) are given.

The paper is original and makes some interesting findings, as such I am in favour of publication but unfortunately the paper is not suitable in it's present form. The following comments and suggestions are provided should the authors wish to rework the paper.

1) The paper is littered with grammatical and typographical errors. A thorough check is required.
2) Abstract lines 13-16 : this is not at all clear to the reader. The reader only knows what these features are AFTER reading the paper.
3) Abstract: The definition of delta is not clear e.g. which distance (shear or pycnocline centre) is divided by which ?
4) Abstract: long waves are said to be "robust" to delta. What does this mean ? Insensitive ? Not affected by ?
5) Introduction: Mode-2 waves have also been remotely observed please see and reference JACKSON, CHRISTOPHER R., et al. "Nonlinear Internal Waves in Synthetic Aperture Radar Imagery." *Oceanography*, vol. 26, no. 2, 2013, pp. 68–79. *JSTOR*, JSTOR, www.jstor.org/stable/24862037.
6) Introduction line 6: "in slope" not sure why the authors make specific reference to a slope here, e.g. can we infer that convex and concave are observed as much as one another in areas where there is not a slope ?
7) P4 line 4 - define viscosities, what do the sub scripts stand for ?
8) P4 line 19 - it would be useful to have a figure here explaining exactly what delta is. The authors may also like to consider adopting a similar definition and symbols to what others already use in the literature. For example see Neil Balmforth's work on identifying unstable modes in stratified flows.
9) Figure 1: The authors have chosen to set the centre of the pycnocline at mid depth but in the field this is not the case and others (e.g Olsthoorn et al 2013 and Carr et al 2015) have shown that the location of the pycnocline relative to mid depth has a crucial influence on the shape and form of a mode-2 wave. This warrants discussion.
10) Figure 2: The figure shows that the larger delta is, the smaller Ri can be. This is interesting. Can the authors explain this finding ? Has it been reported elsewhere ? Eg Balmforth again.
11) P 6 line 5. It is misleading to reference mode 1 work here as the initial condition (set up behind the gate) is different and in fact it is the initial condition that is crucial in generating a mode-2 wave (as opposed to mode-1). It would be more appropriate to reference just Brandt & Shipley along with mode-2 papers such as Olsthoorn et al 2013 and/or Deepwell & Statsna 2016, and/or Statsna et al 2015.

12) Figure 3: The authors have chosen to offset the shear centre downward of the pycnocline. Do they expect to see similar results (but symmetrically reversed) if it were to be offset in the upward direction ? Presumably as the pycnocline centre is at mid -depth. What would happen however if the pycnocline centre were not at mid depth ? Also the authors have chosen the shear such that the current in the top layer is in the same direction as the wave - this is similar to the overtaking cases in the work by Stastna et al 2015 and some comparison with that work should be given. Do the authors expect to see the same or different dynamics if the polarity of the shear current is reversed ?
13) P. 7 line 6 - it'd be useful if cp were given and/or c presented in non dimensional form.
14) Figure 4 caption: (a) "wave form" is this temperature ? What quantity and scale is the colour bar ?
15) Page 9 text and figures - it is difficult to see the forward propagating waves - can this be improved ?
16) Page 13 line 8 - what are x_r and x_l taken to be though ?
17) Page 14 line 19 - confusing grammar suggests mode-1 are also short lived
18) Page 17 line 22 - are the authors referring to the field here or their simulations ?
19) Figs 13 and 14 and related discussion. If shear instability is present would you not expect to see overturning isopycnals ?
20) Page 19 Line 6 onward. Nice discussion which makes things a lot clearer for the reader, may be this should be given much earlier in the paper.
21) Page 20 line 2. This is not clear - there was no background shear in the papers cited in line 1. What do the authors mean here by shear ?