Response to Reviewer 2 (version 3)

Review of "Simulations and observation of nonlinear internal waves on the continental shelf: Korteweg-de Vries and extended Korteweg-de Vries solutions"
by K. O'Driscoll and M. Levine

Kieran O'Driscoll would like to thank the reviewer for their very thorough examination of the manuscripts.

2. I appreciate that rotational effects may not be large but after the times cited I would expect them to be apparent. See for example Figure 15(a) in Lamb and Warn-Varnas which shows differences after 23 hours at a latitude of about 20◦ N where rotational effects would be smaller than at the CMO site which is at 40◦ north. Figures 4 and 5 in Grimshaw et al. (JPO, 2015) also show differences by this time. Both of these papers are already cited. I do suggest a brief discussion of this be added.

Thanks, done. *The following sentences have been included in the discussion on* **3.1 Observations during the Coastal Mixing and Optics Experiment**
In the paragraph that starts There are also features of the observations that are not found ….
The sentence: Another possible generation mechanism is the nonlinear evolution of inertia-gravity waves forming behind internal solitary waves due to rotation, see further in Grimshaw et al. (2014) and Lamb & Warn-Varnas (2015).
Has been replaced with:
Another possible generation mechanism is the nonlinear evolution of inertia-gravity waves forming behind internal solitary waves due to rotation, see further in Grimshaw et al. (2014) and Lamb & Warn-Varnas (2015) who have shown that rotation effects can become important after one or more inertial periods. However, in this model to observation comparison, the waves have travelled for not much longer than one inertial period, and rotation has been ignored in the model runs.

2. Regarding 'solitary waves always travel faster than gravity waves, $V = c + \frac{\alpha\eta_0}{3}$. This is true for solitary waves propagating in an undisturbed medium but for solitary waves superimposed on other longer waves, e.g., and internal tide, they can propagate at less than c. For example if a solitary wave of depression with amplitude η_{ISW} < is riding on a wave of elevation with amplitude $\eta_{elev} > 0$ sufficiently large. Consider the KdV equation with $\eta \to \eta_{elev} + \eta'$ where η_{elev} is treated as a constant. Then η' satisfies the KdV equation with that same nonlinear coefficient but c replaced by $c + \alpha_{\eta elev} < c$.
Thank you. Yes, I agree.

3. Page 2, line 15: "Comparisons .... solutions are made."
Done.

4. Page 4, line 1. I would say it is the nonlinearity of fluid flow that causes the tidal waves to defore. Not the nonlinear terms in an equation.

Done. *Sentence now reads:* As the internal tide shoals, the nonlinearity of fluid flow can cause these tidal waves of finite amplitude to evolve into packets of high frequency nonlinear waves.

5. Page 5, line 16: Do you mean Q accounts for the horizontal variability of the ocean depth?
Yes, thanks. Done: The term in Q accounts for the horizontal variability of the ocean depth

6. Page 5, lines 17: M_0 and c_0 are not defined.
Done, *the sentence now reads* The term in Q accounts for the horizontal variability of the ocean depth (see, e.g., Zhou & Grimshaw (1989), Pelinovsky et al. (1977) and Holloway et al. (1997)) and is given by $Q = \frac{Mc^3}{M_0 {c_0}^3}$ with $M = \frac{h_1 + h_2}{h_1 h_2}$ where h_1 and h_2 are upper and lower layer thicknesses, respectively, and the zero subscript indicates a constant value at a predetermined starting position.

7. Page 8, line 11: “layer thicknesses at ...”
Done

8. Page 9, line 10: This needs rewording. Nonlinear waves are not prevented from developing into solitary waves because higher-order terms become of O(α) because here solutions of the KdV equation are being discussed and this equation has no higher-order terms to prevent the development of solitary waves.

Thank you, done.
The sentence: However, as $\alpha \to 0$ the nonlinear waves are prevented from developing into solitary waves, since higher order terms (neglected in the KdV) become of order α or larger and thus cannot be ignored, thereby rendering the KdV model invalid in this neighborhood.
has been replaced with: Approaching $l = 100km$, $\alpha \to 0$ and the nonlinear waves cannot develop into solitary waves.
And is followed by the sentence: At $l = 100km$ the packet certainly looks symmetrical about a horizontal axis, that is to say the waves are neither polarized as waves of depression nor elevation, since KdV solitary waves cannot exist when $\alpha = 0$.

9. Page 10, line 13: I suggest “so we expect a wave train to develop sooner ....” as the internal tide is nonlinear from the start.

Done

10. Page 10, line 15: “... dispersive KdV equation becoming ...”
Done

11. The author did change a number of statements like ’the leading face steepens’ without stating whether the leading face is the leading side of the crest or trough but there are a few places where this change wasn’t made: page 17, line 5; page 20k line 12; page 21, line 18

Done. *These now read:* page 17, line 5 … the leading face of the crest of the periodic sinusoidal wave slackens …
page 20 line 12 …. The internal tide steepens on the back face of its crest as it propagates shoreward …
page 21, line 18 … The leading face of the trough of the internal tide steepens …

12. Page 12, last line: I am not sure why this figure is Figure S1. Supplementary material? I would keep it in the main body of the article. It is only one figure.

Done. *This is now Fig. 5 and all subsequent figure numbers have been changed accordingly*

13. Page 11, line 20: I don’t see why the first 4–5 waves look like solitary waves and the rest like a dispersive packet. Should explain this

Done*, the sentence has been amended and appended as follows:*
Several nonlinear waves have formed by $l = 60km$ (mooring location) with the leading $4 - 5$ waves appearing like solitary waves of depression and the trailing waves looking more like a dispersive packet, i.e., the leading waves travel faster than c, to the left for increasing l in Fig. 4c.