

Nonlin. Processes Geophys. Discuss., referee comment RC2
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Comment on npg-2021-16

Magda Carr (Referee)

Referee comment on "The effect of strong shear on internal solitary-like waves" by Marek Stastna et al., Nonlin. Processes Geophys. Discuss.,
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In this paper numerical experiments are used to investigate the effect of background shear on internal solitary waves (ISWs). Cases of wave propagation both with and against a background shear current (travelling from left to right) are considered by using a numerical domain in which a stratified adjustment problem in the centre of the domain generates both leftward (against shear) and rightward (with shear) wave propagation. The waves are classified with respect to classical DJL theory. The paper shows that ISWs generated by stratified adjustment in the presence of background shear are not necessarily free waves and can differ markedly from DJL solutions. In particular they can have a propagation speed close to the maximum value of the background current and can exhibit strong recirculating cores.

The paper raises and asks important questions on how classical theory and simulations may be linked to the field; it highlights the need for more investigation in this area. The work is original, clearly presented and of significant interest to communities including physical oceanographers and fluid modellers. As such I have no hesitation in highly recommending this paper for publication in NPG subject to the minor comments/revisions given below.

line 60 typo and and

A figure/graphic showing the initialisation of the numerical simulations would aid the reader. I didn't fully understand the stratification adjustment until I saw fig 3(a).

fig 2 and fig 3 - these are really interesting results. Can the authors give a physical explanation why the leftward propagating waves (those going against the shear) are steeper, shorter and have larger amplitude than the right ward ?

fig 4 (a) The N^2 plot is interesting but doesn't show anything that can't be discerned from 4(b) and as such I wonder if illustrating density (like fig 3) would be more appropriate ?

fig 6. The authors say these waves look more like Stokes waves than typical solitary waves - can they give more justification or an appropriate reference. Could a comparison be drawn to cnoidal waves ?

fig 7. This is fascinating - what causes the instability in the top layer ? The waves are out running the manifestation of the instability so if the waves are not the cause (or continual cause) what is ? Is the rigid lid in the simulations important ?

fig 9 caption (c) is not detailed

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