

## ***Interactive comment on* “Tidal modulation of two-layer hydraulic exchange flows” by L. M. Frankcombe and A. McC. Hogg**

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Our thanks to the referee for their thorough review. We have made substantial changes to the manuscript in this revision, and believe these changes have greatly improved the manuscript.

Our explanation of tidal resonance in this model was questioned by both referees, and we accept that we did not sufficiently investigate this effect in the first version of this paper. Since receiving the reviews we have performed additional tests on the data and taken advice from colleagues on this issue. This has resulted in a major change to the paper, namely that, through the addition of two new figures (figure 6 and 8 in the revised manuscript) we can now determine that the effects we observe are not solely due to resonance. Instead, we show that, while the effect of resonance dominates in one particular case, in other cases the internal dynamics of the baroclinic system

dominates the response to tidal effects. This result substantially changes the paper and adds to its significance.

Referee 2 also included a number of general comments in their review. These comments were taken on board in the substantial revisions:

- We agree that the small  $g'$  limit is closer to the rigid lid case. However, the new Fig. 8 shows specifically how the barotropic and baroclinic waves interact in this system and that the free surface plays a specific role here. Additionally, the data presented in Sect. 4 shows how small  $g'$  is a good approximation to geophysical flows.
- We agree that strait geometry is likely to be important in the time-dependent problem. We highlight the issue in a more general way in the second last paragraph of the manuscript: “. . . it would appear that an understanding of the time-dependent internal dynamics of the flow is required to exactly predict the time-dependent component of the flux.”

Finally, regarding the specific comments, we have modified the text in Sect. 3.1 to clarify that the nonhydrostatic and dispersive nature of the shocks is not adequately simulated, and have deleted the sentence comparing (the old) Fig. 8 with Phu (2001).

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Interactive comment on Ocean Sci. Discuss., 3, 1999, 2006.

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