

## **Reply to comments from Reviewer Jeffrey Kavanaugh.**

Rachael Rhodes et al.

We are grateful for Prof. Kavanaugh's assistance with the mathematical formulations included in our study. His input has greatly improved our manuscript.

Prof. Kavanaugh outlined 6 points where edits were required. We don't repeat his text here (the equations don't reproduce easily) but indicate where the requested changes have been made. Line numbers refer to the Tracked Changes version of manuscript.

[1] Equation 8 (L213) has been re-written as advised. Layer thickness units are all now metres.

[2] The correct derivation of our previous Eq. 9 (for vertical velocity) is now included in the manuscript. An additional intermediate equation provided by the Reviewer is now Eq. 9 (L217) and the new equation for  $v(z)$  is Eq.10 (L220). Now it is clear to the reader where the negative sign comes from – thank you.

What was previously Eq. 11 has been deleted as it is not needed. This change doesn't seem to show up in Tracked Changes.

[3] The definition of distance  $x$  has been improved (L193-194).

[4] Manuscript now clearly states that a Lagrangian coordinate system is used – apologies for lack of understanding here (L232) and thank you for persevering on this point.

[5] Manuscript has been edited to accurately reflect Nye model assumptions (L215).

[6] Formatting errors related to equations have been corrected.