Response to Referee #2's comments on egusphere-2023-819

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The Referee #2's comments are quoted below in blue and the authors' response are written in black

Response to Referee 2

The specific domain used here is the zonal channel on the beta plane. This is arguably slightly restrictive but nevertheless useful. The presentation is generally clear. What I think would be useful would be a explicit demonstration of how the numerical results approach the standard and well-known f-plane results, as β tends to zero. both for the time evolution and the final state. This would both provide confidence in the numerical scheme and provide insight into the effects of beta. Some f-plane results are provided, and but the physical patterns arenot shown except in figure 10 (which is showing something different).

Results on the f-plane ($\beta = 0$) are shown explicitly in figure 1 (dashed lines), figure 2 (the blue and red dots at $b = 0$), figure 9, and figure 16 (dashed lines) [but not in figure 10 as claimed]. Moreover, the harmonic wave theory (which neglects the term $-2by$) provides exact analytic solutions on the f-plane in the 1D case. Thus, the harmonic eigenfunctions (shown by the dotted lines in figures 3 and 6), as well as the harmonic spectrum (shown by the dotted lines in figures 5 and 8), are all f-plane results. Furthermore, the same authors have recently published a paper on the geostrophic adjustment on the f-plane (Yacoby et al, 2021; PoF), in which they employed the same initial conditions and similar channel configurations. Given this overlap, we believe that including additional results on the f-plane in the current manuscript would be superfluous. However, following this comment, an additional reference to the geostrophic adjustment on the f-plane has been added to the manuscript at the end of subsection 5.1.

Relatedly, potential vorticity is presumably conserved, and conserved pointwise in the linear problem. This is the basis for how the final state is calculated in the original Rossby problem. Some discussion of how PV enters into this problem and provides constraints on the evolution and final state would be welcome. Or if potential vorticity is not conserved or is somehow not relevant, some discussion of that would be useful.

This basic issue is now addressed in the paragraph following equation (30). Briefly, we derive the linearized local changed in q (i.e. equation 7) directly from the governing equations and not from the nonlinear Lagrangian conservation of Q. Differentiating Equation (7) WRT y yields the local conservation equation (28).