Response to anonymous referee #2 – 18th of August

In this revised manuscript the authors have done a good job at responding to the comments of both myself and Reviewer 1. The paper remains enjoyable and the revisions have improved its clarity. Where they have declined to act upon a reviewers's comment, the authors have given a good explanation in their response. I have added a few minor comments below that the authors may wish to address. However, there is no reason why these would require another round of review.

There are some interesting questions remaining, which I hope to see the authors take up in future publications. In particular, it would be interesting to explore the how roughness characteristics, such as the variance of the bottom height and horizontal scale, interact with the dynamics of the ACC. The authors have concentrated on eddy saturation in this paper, but I see potential for bottom roughness to also impact upon eddy compensation (reduced sensitivity of the residual MOC to wind stress). Whether sufficient roughness can offset the need for high bathymetry in eddy saturation scenarios would also be interesting, given some of the results of their earlier work (Jouanno et al., 2016).

We acknowledge the reviewer for the time taken to perform this second round of review. We follow the suggestions. We also acknowledge the reviewer for the encouragements to pursue our efforts on this topic.

Minor Comments

lines 82, 83, 107, etc : As noted by Reviewer 1, in a few places the authors continue to use notation of the form 2.10-4, rather than the standard form of 2x10-4.

We corrected the notation here and elsewhere (6 occurrences)

line 125 : "with p_b the pressure", don't need the with at this point.

Corrected.

line 140-144 : The transport of Abernathey & Cessi's (2014) flat bottomed configuration is mentioned here, but not that of their configuration with a ridge (~70Sv, from eyeballing their Figure 8). Other model with ridges produce similar transports, ~90Sv, such as those in Munday et al. (2015) and Marshall et al. (2017).

Thanks, we add these references and corresponding transports.

line 161 : I would say that bottom roughness forces near zero flow at the bottom. In Figure 4 we can see that it isn't quite zero. I imagine there is potential for quite a lot of spatial variation in the bottom flow too. It might be worth reinforcing that it is both the mean and eddying flow that is near zero.

We agree and corrected the sentence.

line 268 : confined TO THE east

Corrected.

line 284 : manifestation OF baroclinic instability

Corrected.

line 286 : mean state leadS to negative

Corrected

line 290-296 : An important caveat to mention regarding Constantinou et al. (2019) is that the regime in which their results indicate barotropic saturation is unlikely to apply to the real Southern Ocean.

In their set of simulations, barotropic saturation occurs for regime II, with wind stress of order 0.1 N m^{-2} which corresponds to observed wind stress in the Southern Ocean. It therefore seems delicate to us to challenge this study just on the basis of this argument.

Section 4.2 : An extremely relevant reference to this section is Youngs et al. (2017). This paper looks at the energetics of meanders in great detail, highlighting that barotropic energy (conversions) are important to their dynamics and that baroclinic instability is insufficient to do so.

Thank you for pointing out this study. We completed Section 4.2 with the following sentence: "The analysis of the energetics of an ACC standing meander in Youngs et al. (2017) reveals that barotropic instability plays a leading role in the energy

budget of the meander and suggests that baroclinic conversion alone is insufficient to describe both the stratification and distribution of EKE."

lines 326-333 : The experiments of Marshall et al. (2017), which the authors cite elsewhere, also investigate the role of bottom friction and its role in eddy saturation.

Thanks, we now mention that a similar result was observed in Marshall et al. (2017).

References

Jouanno, J., X. Capet, G. Madec, G. Roullet, and P. Klein, 2016: Dissipation of the energy imparted by mid-latitude storms in the southern ocean. Ocean Sci., 12, 743–769, doi:10/5194/os–12–743–2016.

Munday, D. R., H. L. Johnson, and D. P. Marshall, 2015: The role of ocean gateways in the dynamics and sensitivity to wind stress of the early Antarctic Circumpolar Current. Paleoceanography, 30, 284–302, doi:10.1002/2014PA002675.

Youngs, M. K., A. F. Thompson, A. Lazar, and K. J. Richards, 2017: ACC meanders, energy transfer and mixed barotropic-baroclinic instability. J. Phys. Oceanogr., 47, 1291–1305, doi:10.1175/JPO–D–16–0160.1.