Response to Reviewers

Authors' responses to reviewers' comments are distinguished by green text.

Reviewer 1

General

This is my second review of this work, where the authors employ a model hierarchy approach to examine the disconnect between interannual variations of the position of the subtropical jet and the edge of the Hadley cell — showing that this disconnect can be reproduced in an idealized dry GCM. The authors have appropriately addressed my concerns and I recommend the work for publication. A few minor comments and suggestions are listed below.

We appreciate that you've taken the time to review this paper a second time. Thank you for recommending the paper for publication.

Comments by line number in the tracked changes version

7 Indeed, the usage of 'accuracy' in the context of an idealized model is problematic. But 'sufficient' here is obscure. Sufficient in what aspect? Perhaps 'sufficiently realistic climatological basic state'?

Thanks for your note, we have implemented your suggestion in line 7.

8 not clear what are the 'features' being referenced. The metrics?

Agreed, we have edited the sentence in line 8 to be "... the robust disconnect between ϕSTJ and ϕHC across the model hierarchy reveals their differing sensitivities to midlatitude eddy momentum fluxes...".

19 Add space: CO2 (Davis...

See this edit in line 19.

60 same as in line 7

See the inclusion of "sufficiently realistic" in line 59.

67 analyses

See this edit in line 66.

101 treating ε and χ as two separate parameters in $\varepsilon\chi\sin\phi$ when in effect $\varepsilon\chi$ is a constant seems redundant, as both ε and χ have the same influence on T_{eq}.

Yes, we agree that for our purpose, it is redundant. However, we choose to remain consistent with prior work by keeping them as independent parameters, see McGraw and Barnes (2016) and Chen and Plumb (2014).

Reviewer 2

General comments:

Menzel et al. use reanalysis and several models of varying complexity to explore the disconnect between the Hadley Cell edge and the location of the subtropical jet in DJF. They find that the disconnection can be simulated without moist or radiative processes or a zonally asymmetric state. Based on correlations, they argue that the disconnection is due to different sensitivities to midlatitude eddies, with the Hadley Cell edge being very sensitive to mid-latitude eddies, and the subtropical jet location less so. This is a really interesting study and helps address a gap in our dynamical understanding of the global circulation.

My concerns from the previous draft have been addressed, thank you. I have made a few, final, minor comments below. Otherwise, I think this manuscript is ready for publication and will make a useful contribution to the literature.

Thank you for supporting publication of our manuscript.

Minor Comments:

Line 28: this sentence is a bit confusing to follow. Maybe a comma after 'is limited' would make it easier to read.

We broke up the sentence with a semicolon so that it is easier to understand, see line 28.

Line 47 and elsewhere: its not it's

Thanks for catching this typo! We have combed through the manuscript to correct any additional mistakes (lines 47, 94, 100, 233, 259).

Line 219/Figure 4: It would be good to remind the reader which is the default experiment in MB16 (delta = 10) to make it easier to compare results between figure 3 and 4. Noting that the correlation is marked in red is helpful, but insufficient as all MB16 experiments are similar red or orange shades, so it is not immediately clear which one(s) you are referring to.

Thanks for suggesting this clarification. We specify that we are referring to the default parameter of $\delta_z = 10$, marked by the dark red in Fig. 4, see line 219.

Fig 5. The caption should include that these values are zonal averages.

We have ensured all figure captions specify "zonal-mean" where appropriate.

References

Chen, G. and Plumb, A.: Effective isentropic diffusivity of tropospheric transport, Journal of the Atmospheric Sciences, 71, 3499–3520, 2014.

McGraw, M. C. and Barnes, E. A.: Seasonal sensitivity of the eddy-driven jet to tropospheric heating in an idealized AGCM, Journal of Climate, 29, 5223–5240, 2016.