

Interactive
Comment

Interactive comment on “Tropical convective transport and the Walker circulation” by J. S. Hosking et al.

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The authors would like to thank the referees for their helpful comments and suggestions.

1. Additional information has now been added to Figure 2 to highlight the flow patterns. These clearly show the descending branch of the Walker Circulation at the Central Pacific and East Pacific border between 8 and 12 km. We have not however added the extra panels for the other 3 seasons; we think the figure serves as a useful example as it stands. The main results on the source-receptor relationships can be inferred using the matrices in Figure 4.

1.1 The comments regarding the Walker Circulation suppressing upward transport over

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the East Pacific have now been removed.

1.2. Figure 2 shows that the primary route for transport from the MC surface to the WP at the $Q_{clear}=0$ level is via the pathway $MC_{surf} \rightarrow MC_{Q_{clear}=0} \rightarrow WP_{Q_{clear}=0}$ as mentioned in the paper. Other combinations are possible but as we show using the matrices at the LRM level, transport to this height is primarily vertical with relatively less horizontal transport.

2. Key findings from Hosking et al. (2010) have now been mentioned in the manuscript to highlight that the convective mass fluxes and tracer transport are consistent. We have not shown this explicitly here as the mass flux diagnostics have already been published in Hosking et al. (2010). Tropical transport of short-lived tracers in this model is dominated by convection as shown by Hoyle et al. (2011), which we do not repeat here.

3. The sensitivity of results to the choice of a 10-day meaning period has been tested. The patterns of tracer transport visualised using the matrices are robust to different periods; for meaning periods of 5 to 10 days near the end of the simulation the figures stay unchanged. Text has now been added to the manuscript to state this clearly.

Specific Comments

3. Page 12230 Line 10, the line has been removed from the abstract. Other references to this have also been removed.

4. An outline of the meridional structure of the Walker Circulation, and how it varies with season and from year-to-year, has been included. We also compare our model findings with that of the published literature and to ERA-Interim model reanalysis.

5. Page 12232 Line 3 has been re-worded so that it is clear that only the deepest convection can exceed ~ 14 km.

6. Page 12232 Line 27. This has now been included and we hope is now much clearer. Thank you for the suggestion

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7. Page 12233 Line 25. “In contrast” now removed from sentence.

8. Page 12234 Line 17. Sentence updated to make clear that at this altitude there is no evidence of the Walker circulation as expected.

9. Page 12234 line 24 has now been reworded to make it clearer as suggested by the referee. We now also clarify the differences between the results of Levine et al (2007) and Russo et al. (2011) (Russo et al used the same model as used here).

10. Page 12234 Line 15. We now confirm that the modelled seasonality of the Walker Circulation strength agrees with the literature and with model reanalysis (ERA-Interim)

11. The comment on the disagreement with Liu and Zipser (2005) has been removed. However, there is still a difference in the temperature and water vapour mixing ratio near the tropopause so this has been mentioned as a possible reason for the differences in ice formation between the regions.

12. Figure 2 has been updated with an improved colour scale as suggested by the referee

Technical corrections to Figures 1 and 4 have been implemented

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 12229, 2012.

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