

Interactive comment on “Unprecedented strength of Hadley circulation in 2015–2016 impacts on CO₂ interhemispheric difference” by Jorgen S. Frederiksen and Roger J. Francey

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We thank the Referee for the thoughtful comments which have led us to examine a large number of other trace gases and their relationships to our dynamical indices. We have carried out extra seasonal correlations between the Mauna Loa minus Cape Grim difference in trace gas species (CH₄, CO, H₂, N₂O) routinely monitored by CSIRO with the our dynamical indices. We have also included corresponding correlations using NOAA SF₆ data. In each case we have briefly examined biogeochemical factors that influence differences in inter-hemispheric fluxes from one species to the next.

We believe that our findings detailed in the associated Supplement provide very strong

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evidence of the relationships between the Mauna Loa minus Cape Grim difference in trace gases (CO₂ presented in the main paper) and dynamical indices of eddy and mean transport.

We agree with the reviewer that changes in surface fluxes can be a very important component in the interhemispheric differences in these trace gases as is now discussed in the Supplement. We thank the reviewer for providing an unpublished draft that addresses this issue. It should be noted that it is after 2006 that the anomalies that underpin our study become most apparent and more clearly reveal that changes in eddy and mean transport also play an import role in the interhemispheric difference in trace gases.

We now provide in the Supplement detailed evidence of the role of topographic Rossby waves during the 17 February 2015 episode of wave trains seen in the OCO-2 data. We also discuss the role vertical uplift during that event. We consider the coincidence of timing, location, orientation and wave number of the Rossby waves observed by OCO-2 with dynamical theory as being compelling evidence for our interpretation.

Please also note the supplement to this comment:

<https://www.atmos-chem-phys-discuss.net/acp-2018-203/acp-2018-203-AC1-supplement.pdf>

Interactive comment on Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2018-203>, 2018.

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