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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Large-Scale Tropospheric Transport in the Chemistry Climate Model Initiative (CCMI) Simulations" *by* Clara Orbe et al.

Anonymous Referee #1

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The paper shows an intercomparison of tropospheric transport among several models participating in the CCMI project, using a suite of artificial tracers. The results reveal substantial inconsistencies in transport which can be attributed mainly to convective parameterizations. This is suggested by the qualitative comparison of the spread in tracer concentrations compared to the spread in large-scale winds, and supported by the fact that nudging the dynamical fields to reanalysis data the does not improve the comparison. The paper is well written and easy to follow, and provides an insightful overview of the degree of agreement on general tropospheric transport properties among state-of-the-art models. The following minor revisions are suggested before publication in ACP, which are points in the text that need clarification and figures that

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Discussion paper

need some improvement.

- P6 L15: the global tracers are also ‘idealized loss tracers’

- Fig. 4 : the legend is missing the purple points (ULAQ?)

- In all figures, several members are considered for some simulations. Please mention this somewhere. Also, there seem to be several members of the specified dynamics runs, what is the point of this if the dynamical fields are nudged and why do they differ substantially (e.g. Fig. 4b)?

- P6 L16-19: It is not clear to me why an inverse relationship is expected between the global and the midlatitude tracers, if all are emitted at the surface and subject to the same convective and isentropic transport? Could you explain why does the dilution argument only apply to the midlatitude tracers?

- P6 L16-19: I don’t see the blue and red curves being particularly low in Fig. 3a-b. This is true only for the comparison of these two curves with ULAQ. Could you clarify what you mean? Are you referring to the 30-50N band?

- Fig. 2 and 3- I suggest revising the legend to match the lines shown in the figures. What model does the orange solid line refer to? And the thin brown line? Figures 1 and 2: why are there solid lines in the REFC1SD panels corresponding to the EMAC model? Should these be dashed? Fig. 5: it is hard to distinguish the multi-model mean from the EMAC lines.

- P6 L31: That paper uses future runs, which cannot be Specified dynamics.

- P6 L33-34, Supplementary Figure 2 and Table 3: It would be helpful to briefly explain what exactly was (wrongly) implemented in the STE tracer for each of the runs.

P7 L 2-6: It would be easier for the reader if you pointed to specific longitudes when you refer to regions such as ‘over the oceans’, ‘downstream of the storm tracks’ or ‘over land’.

- Fig. 6c: The midlatitude convection box located over south-west Asia is not really capturing midlatitude convection, and there is not much convection over most of the box. Instead this box could be placed over central Europe, where there is significant summertime convection.

- Figs. 6 and 7: What are the units of CMF?

- P8 L2-4: Is this true also for the other tracers (X50 and e90)?

- P8 L16-18: Although a useful comparison of the large-scale flow, Supplementary Fig. 3 does not inform on the 'relationship between large-scale flow biases over NH midlatitudes and the transport differences among the simulations'. Could you rephrase or add information to justify the claim?

- P9 L12: Could you give an approximate % value of the bias?

- Fig. 11 caption: remove 'strong'

- Table 2: Its seems that some symbols have disappeared, please revise.

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