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Interactive Comment

Interactive comment on "Revision of the convective transport module CVTRANS 2.4 in the EMAC atmospheric chemistry–climate model" *by* H. G. Ouwersloot et al.

Anonymous Referee #1

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In the current version of the manuscript, Ouwersloot et al. modified the convective transport module (CVTRANS) in a atmospheric chemistry-climate model (EMAC). The CVTRANS module is a submodel using the bulk approach for vertical transport in the convective plumes. This is independent the cloud convection schemes used in the model since the convective mass updraft, downdraft fluxes and the corresponding entrainment and detrainment at every model level are calculated from the CONVECT submodel. Therefore, how to treat the convective tracer transport in the EMAC model becomes very important because it has not used the same vertical tracer transport as in the CONVECT scheme(s). There are a few modications to CVTRANS. They also investigated the impact of this modification on the idealised model tracers which have

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lifetimes ranging from 1000 s to 50 days. However, it is quite clear if this modification has any siginificant improvment for the tracer transport in the "real world". For example it would be better to show if this modification has significant changes for the Radon tracer transport and how that changes for different season. Some clarifications are required and specific comments see below:

The major comments:

1) It is still not clear how the sub times length is used in the model. I am not sure if I understand it correctly which can be caulated from equation (8) in Page 3122. Then the intermediate time steps will be the global time step in sub time stepes with length delta (t_sub). But the main problem is that the sub time steps will be different at each level or each location. Does the model call the CVTRANS submodel at every time step (12 minutes) steps?

2) It is mentioned that the "no nudging is applied to meteorological data during the simulation" in Line 7 Page 3125. Therefore, the results are from free running CCM simulations. However, I think it would be better to use the nudged model because you will have the same convective mass fluxes from the CONVECT scheme since the meteorological conditions are identical. That is more meaningful when you compare the results using different f_maxfrac.

3) Can you explain why there are high mixing ratio the 1day lifetime tracers in Fig1 (a) and Figure 2(a) from the standard model simulation (ORG)? It would be better to check the convective mass fluxes and/or PBL boundary layer mixing.

4) Why the relative mixing ratio is still high in the polar region in Figure 2b? It would be better to plot Figure 2a as a log scale in the mixing ratio, otherwise, it is hard to say why the relative difference in other plots are important.

5) I do not quite understand the Figure 5 and "instantaneous differences can be seignifincat et., of the order of 10% in the lowest kiolmeter of the atmosphere" and

Figure 5. Since the only change between "altered concentrations at updraft base" and "Analytic expression at cloud base" is to apply a factor (f_trans) below 2500m or below PBL height. So I thought the big changes should at that levels. But there are large changes even at 10 or 15 km.

6) This work seems to be important for the strong convection cases, therefore, the results should highlight some strong convection cases, rather than using the 1 year averaged presented here.

Some minor comments:

1) The quality of all Figures are not good.

2) Page 3122 Line 1, rewrite as "in the grid cells part affected by plumes".

3) Page 3126 equation (14), change it to "RMSD"

Interactive comment on Geosci. Model Dev. Discuss., 8, 3117, 2015.