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Atmospheric Chemistry and Physics Discussions

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Interactive Comment

Interactive comment on “Modelling tracer transport by a cumulus ensemble: lateral boundary conditions and large-scale ascent” *by* M. Salzmann et al.

Anonymous Referee #1

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This paper is a very useful sensitivity study of convective tracer transport in the framework of cloud resolving models. Since comparisons with observations are not reported, argumentation can only follow the usual "better physics - better results" lines. While this is a drawback, it does not at all reduce the value of the study. Basically the results indicate that for tracer transport in a convectively active environment specified BCs are superior to periodic BCs and that large-scale tracer advection needs to be corrected for if the lifetime of the tracer exceeds a limit specified by the model domain. The model set-up will be of specific value in connection to comprehensive field experiments and for evaluation of currently state of the art convection parameterisations.

Some specific comments follow which might be considered at the transition from ACPD

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to ACP:

1. While it always is useful to study the effects of different resolution on the model results, the introduction of different domain sizes may not be very helpful in the interpretation of the results nor for their evaluation. Since it distracts the reader from the main line of the paper, these discussions might be omitted.

2. To explain the cold bias in T (Fig. 4a) just with deficiencies of large-scale advection seems to be overly simplistic. How then could the very different results for water vapour (Fig. 4b) be interpreted?

3. In the interpretation of Fig. 5 the difference between squall line structures and single clouds might be explained to the reader not used to such diagrams. A measure of convective activity of squall lines versus single clouds might be given since this is of most importance to organized convective transport. How do such diagrams look like in the 3D case? 2D simulations by definition prefer linear structures and these shall be expected to be stronger for PBC, while SBC introduce some noise and reduce squall line frequency. An objective measure for the difference/similarity of the diagrams would be pattern correlations. Of importance also would be if there occur shifts in the daily cycle of convective activity.

4. Figure 6 and 7 c: I guess that &ISO means &TLSA?

5. Figure 9: If or not air-containing tracers is ``pulled away'' by convective cells remains a speculation unless wind vectors indicate this. Is the resolution of 2 km enough to capture the entrainment of ambient air into the cloud (which normally is expected to take place in the middle troposphere)? What are the differences between 2D and 3D runs?

6. The given interpretation of Fig. 12 needs to be substantiated by either the total tracer mass in the model domain or by a figure indicating the total advection out of the domain in dependence of the altitude.

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7. The statement that PBCs plus TLSA would lead to overestimation of tracer mass in the UT is not substantiated by any results of the study (p.10, 1§)

8. p11, 3§: Is it meant to compare with single column versions of large scale 3D models that contain a single mean convective cloud?

Interactive comment on Atmos. Chem. Phys. Discuss., 4, 3381, 2004.

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