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Atmospheric Chemistry and Physics Discussions

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

Anonymous Referee #2

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General comment

This paper reports results from the Weather Research and Forecast (WRF) model simulations of ideal tracers for meteorological conditions of December 19-26, 1992, taken during TOGA-COARE. Results suggest that different lateral boundary conditions (LBC) as well as the vertical large scale advection of tracers (VLSAT) can produce significant differences in model simulated fields, with implications for the small scale transport of chemical tracers. Overall, the authors provide an interesting and stimulating discussion and the paper brings new modeling elements about tracer transport at small scales. I recommend the paper for publication after some suggested revisions and clarifications.

Specific comments

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1) WRF is becoming a tool of choice for the study of the small scale meteorological phenomena. WRF was initially developed to extend the weather forecast at very small scales, reaching details that are generally not possible within the MM5 framework. WRF working groups are now exploring other applications of this model: tracer transport, cloud physics and dynamics, and atmospheric chemistry problems. A major task that WRF groups have, is the model validation in various case studies. In the introductory parts, the authors should review these current WRF efforts, and problems. A discussion on why WRF is used instead of a traditional CRM will be useful. Briefly, discuss the major differences between CRM and WRF. CRMs have been around for many years and several groups have refined the models and reported results (some additional suggested references can be included, especially those dealing with CRM simulations of TOGA-COARE cases: Wu et al., 1998; Andronache et al., 1999; Bechtold et al, 2000; Redelsperger et al., 2000).

Section 3. What can be illustrated about the vertical profiles of water mixing ratio and other simulated hydrometeors, for different LBC? Water is one TOGA-COARE available tracer that can be used for this time interval to show differences between various model simulations with different LBC.

Figure 3. Various predicted surface precipitation rates are compared with the observed precipitation rate. It appears to be good agreement between all simulations and observations. I suggest a discussion on the measurements errors associated with precipitation observations. Figure 4b suggests that significant differences in the vertical profiles of hydrometeors can be found for different LBC. How important are these differences, considering the current uncertainties in observations?

Figure 7. Differences between PLBC and SLBC might be caused by the fact that PLBC tends to smooth tracer concentration and to produce a better mixing. The SLBC impose a boundary profile at any given time and therefore the domain profile will be dominated by the LBC. I suggest a discussion on the general conditions for which PLBC are acceptable.

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Figures 10 and 13. What is the altitude of the highest convective cells or the altitude of the Cb top, both in model and in observations? A figure showing the diagnosed or observed Cb top altitude will be useful. This might help to explain why the tracer mixing is quite limited in Figures 10b and 10c.

Conclusion section: I suggest that authors include a longer and detailed outlook of possible strategy to address tracers transport with WRF, including model validation. Such outlook will be of interest to many within the WRF community.

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