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Geoscientific
Model Development
Discussions

Interactive comment on "The 1-way on-line coupled atmospheric chemistry model system MECO(n) – Part 1: The limited-area atmospheric chemistry model COSMO/MESSy" *by* A. Kerkweg and P. Jöckel

Anonymous Referee #2

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This paper describes the coupling procedure between the Consortium for Small Scale Modeling (COSMO) and the Modular Earth Submodel System (MESSy). The paper documents the connection of the MESSy infrastructure to the COSMO model. The paper also describes some of the tracer transport properties of the coupled model. The paper describes a great deal of work on a very complex and valuable modeling system. There is no doubt that the ability of MESSy to connect to a variety of base models makes it a powerful tool. The publication of a supplemental document with details of the MESSy interface into COSMO and a complete list of modifications to

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Interactive Discussion

Discussion Paper

COSMO is commendable.

However, I really have to question if this paper needs to be published, at least in its present form. The first component of the paper involves changes in MESSy so that it can be implemented in COSMO. MESSy was previously for implementation in ECHAM5 so that the general code requires modification for COSMO. The fundamental attributes of MESSy are therefore described elsewhere. This paper concerns the technical details computation details of how MESSy is adopted for a new model. In my opinion these changes are of a technical nature and can easily be documented within the code description. An example some of the prominent changes described include the order of dimensions, the description of the outer loop and horizontal domain decomposition. These are changes obviously necessary to adapt MESSy from ECHAM5 to COSMO. However, I do not see how describing these details are of value to the science community at large. They do not help interpret the results from the model, nor do I see their general applicability to other modeling groups developing code.

The idea of this MESSy and its ability to couple to different models is a great one. I am questioning the details of what really should be published. Ultimately the editors of the journal probably should make this type of decision. There is obviously a continuum between what needs to be published about a model and what should be described in the model documentation. The latter should be made public, but not necessarily published in a journal. It is my opinion that much of the present paper belongs in the latter category. Two other papers regarding MECO are currently under discussion in GMDD, although I have not read them. In my opinion much of what is written here should be referenced as part of the code description and supplement in the other papers.

The second part of the paper describes tracer transport tests. I have one major comment with regards to this section and several more minor comments:

Major comment:

One crucial problem is that the advection code is not positive definite. The authors

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are to be commended for clearly identifying problems with their code, but they have not identified what type of problems the code can be used for. They state: "Thus, we have to accept at the moment that the tracer transport is neither fully mass conserving nor perfectly positive definite" and suggest there will be improvements in the future. Figure 5 shows conservation properties over the domain. For advection domain-wide conservation issues appear to exist. However, what are the valid scientific applications of this code at present? It seems to me if the code is not ready to be used then publication should be deferred. Based on our experiences we have found that even a very accurate code that is not positive definite will run into problems in tracer transport and chemistry applications. For example in regions of very large emissions (e.g., from biomass burning) this type of code will often produce large regions of negative concentrations. This type of problem can cause real problems when running with chemistry. Have the authors encountered problems of this type? Is the code ready for chemistry?

Minor Comments:

(i) In the tracer tests the impact of lateral, lower and upper boundary conditions on the tracer's mass is not clear to me. Does one expect the tracer mass to be conserved within the domain under inflow and outflow conditions using a perfect transport scheme?

(ii) Page 1332, line 22-23. It is not clear the extent to which the internal sources and sinks for a homogeneous tracer is important?. What are the maximum and minimum values of H within the domain?

(iii) I'm not sure Figure 7, 10 or 11 really give much new information. These figures look nice, but do not really give us any information about how good the tracer advection is. Figures 8 and 9 show qualitatively COSMO/MESSy looks reasonable, but is it possible to come up with more quantitative measures? What is the tracer maximum in the COSMO/MESSy domain versus that in ECHAM5/MESSy. Is there a change in the vertical distribution of tracer?

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