



## ***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***

**V. Grewe (Editor)**

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Editor's review:

Dear Astrid and Patrick,

Thanks for the detailed reply. Based on the referee's comments, I like to express my concerns regarding the conclusions of the idealised tracer studies, i.e. its implication on the model performance.

A) Please state clearly (including explanations) in the beginning of 5.2.1. what kind of C1057

tests are performed (done) and what are the parameters and the benchmarks you are looking at (half done) and what kind of deviation is actually expected (only briefly done) for a perfect transport scheme.

Example: Homogeneous tracer H. If you are looking at the mass in the domain, this would, even for a perfect transport scheme, show deviations from a constant value if the mean surface pressure changes. For example if a high pressure system is moving through the domain, then the mass of H is increasing, even if the mixing ratio is constant. (for a global model, you would be right, the mass of H should be constant).

As far as I understood, the influx and outflux is not explicitly calculated and considered. Figure 5a only proves that none of the transport processes actually violates the mass budget, since all lines are on top of each other. this disagrees with your statement "Only those tracers without advection stay homogeneous." - This has to be clarified.

I suggest to replace (or add) the figure 5a by a figure showing (mass H in domain/ mass air in domain), i.e. the mean mixing ratio. This should be actually constant. Another possibility is the rms of the simulated field minus the constant mixing ratio, which gives a measure on the local deviation of the constant field. A deviation from 0 implies a local violation of the mass conservation, or a different calculation of transport between the core and the tracers?

Example V1 / V2. This case is even more tricky. Imagine a meteorological situation with convergence in low levels and divergence in high levels and no change in the mean surface pressure (total air mass constant). This implies for V1 that air masses with high mixing ratios are transported into the domain and the same amount of air, however with low mixing ratios is transported out of the domain. This implies that the two lines nt and a have to deviate for a perfect transport scheme. As far as I understand the way you interpreted the figures is probably suggesting a larger transport error than the model actually has. As far as I can see it, the only conclusion from V1 and V2 is that the non-advective transport schemes are performing well, since they are on top of

each other. For the advection, there is no benchmark and no conclusion can be drawn.

B) Figure 6 indicates a mass correction by TRACER\_PDEF. Could you explain how that is done. Globally? or only for the domain. Given the discussion above, I am not quite sure how it can work.

It would be good to have a qualitative conclusion from this studies, like how much individual parts of the transport are violating the mass conservation. To me it seems that the violation might be really small, which might support the conclusion that the model is actually ready to be used for chemistry integrations.

page 13 "The latter (inflow and outflow) are determined, at least implicitly, by the boundary conditions." Please be more specific: Did you calculate in- and outflow? Are they included in your calculation and figures?

"A violation of the homogeneity of the "H" tracer is equivalent with a violation of the conservation of the tracer mass. Unfortunately the latter is the case, if advection is involved. Only those tracers without advection stay homogeneous." Not supported by the figures? see above.

Conclusion/Abstract: You might think about including a statement on the usefulness of this work for non-MESSy groups.

Best regards, Volker Grewe

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