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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Modeling the transport of very short-lived substances into the tropical upper troposphere and lower stratosphere" *by* J. Aschmann et al.

Anonymous Referee #1

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Review of Modeling the transport of very short-lived substances into the tropical upper troposphere and lower stratosphere. By Aschmann et al.

This proposal presents an idealized 3D Chemical Transport Model of short lived bromine species (Bromoform and Methyl Iodide) focused on the role of convection in the TTL. The study is interesting and topical for ACP. It is generally well thought out and well written, and should be publishable in ACP subject to minor revisions and a few general comments that I detail below.

In general, there are a few more references that can be cited, and a few clarifications necessary. The most substantive question I have is regarding the effect of freezing

on soluable species (Bry degradation products). If there is HBr and HOBr in solution and cloud drops freeze, what happens? Is the Bry not ejected? And the authors hint at this, but is Bry able to attach to or be bound in ice clouds that form in situ (not from convective detrainment). These factors would seem to affect the conclusions and should be discussed.

Detailed comments:

Pg 1, Intro, para3: When discussing the level of zero radiative heating, you might want to give a reference. E.g.: Gettelman et al 2004 or Corti et al 2005

Pg2, 2nd para: A sentence or two on the other bromine models (Kerkweg, Gettelman) would be appropriate here.

Pg2. Sec 2.1, 3rd para: Why did you pick 20 days for Bromoform, not 26?

Pg3, equation 1: I must have missed something, but the units of eq 1 seem strange:

f (tracer flux) has units of kg-tracer/s ?

then f= dc (kg-air/s) * m (kg-air) * [X] kg-tracer/kg-air

Seems to me the 'm' term is not necessary here. What did I miss?

Pg3, 2.3, water vapor. The relaxation to a maximum seems strange, and seems a bit pathological (maybe), I assume you will not have a H2O sink if H2O > 6.8 ppmv? Why did you not just use something like dH2o/dt = 2*[CH4]/tau?

Pg4, end of sect 2: Does methyl iodide work the same way?

Pg 4, sect 3.1.1: "There is in general good agreement..." please make 'good' quantitative. Can you put the model standard deviation for example on the plots? This would help (you could test for the difference of means, or state they are not statisitically different).

Pg4, sect 3.1.1: "notable differences" : what are they?

Pg4, sect 3.1.1": "high biase in the observations" relative to what? It seems dangerous to assume your model is unbiased. Mostly this is a semantic argument, unless you have reasons to believe there are problems with the measurements for this campaign. If so, please state them. It might mean that there is VSL well above the tropopause and the model is wrong.

Pg4, section 3.1.2: can you separate the differences between convective transport and chemistry with regard to ozone? This could be critical for evaluation of the model. What about biases in transport outside of convection?

pg 5, end of 3.1.3: "more realistic treatment of dehydration": You might look at citing Gettelman et al 2002a and/or Read 2008.

pg5, section 3.2: regions of ttl dehydration: a better reference than Holton & Gettelman would be Gettelman et al 2002b (which does show regions).

pg 6, end of section 3: Careful. You have earlier said convection is not necessary up to the top of the TTL. Also you might want some references for the regions where convection is deepest:

Try Liu & Zipser 2005 or Gettelman et al 2002c

Conclusions: There are now several estimates from simulations of the estimated quantity of VSL bromine into the stratosphere. Can you summarize these results in the context of that other work. Does it agree or not? I think the answer is that it does agree. Should the earlier estimates be increased due to some soluable species?

References:

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