

Reply to Reviewers of Description and evaluation of the Model for Ozone and Related chemical Tracers, version 4 (MOZART-4), Geosci. Model Dev. Discuss., 2, 1157-1213, 2009

Reply to Referee #1

Page 1160: potential users may want to know what approach to parallelism has been adopted (MPI, OpenMP, both?)

Both MPI and OpenMP have been used for parallelization, with the optimal configuration being a hybrid MPI-OMP simulation. A sentence has been added stating this (in Introduction, line 40 of new manuscript).

Page 1166/1167: the equation numbers here are confusing and should be removed; anyone wishing to cross-reference with the Guenther paper should have little difficulty identifying the relevant equations.

Done.

Page 1167, line 20: loose parenthesis in this equation. How does the scheme used here differ from that in the Guenther paper? An additional sentence of explanation would be valuable.

In Guenther et al., the temperature dependence factor makes use of the average temperatures for the previous hour, whereas we have used the previous months' average in both cases. Sentence added.

page 1170, section 3: given the number of studies involved, I find this section on recent applications of the model very brief. I would welcome an additional paragraph here noting the strengths and weaknesses of the model that these studies have uncovered, or comparison with earlier model versions or with observations.

It is quite difficult to generalize the results of the previous studies using MOZART-4 as they encompass many aspects of tropospheric chemistry, and prefer to leave the section as it is.

Page 1173, section 5.1: although OH is slightly less than the climatology, the profile also differs in shape (less of a bulge in the mid-troposphere.) What additional information about the simulation could this provide? Can the weakness be attributed to the meteorological fields used (humidity, cloud cover?) or is it likely to lie in MOZART algorithms? If OH has been evaluated with other met fields this might be more evident.

I hesitate to draw further conclusions about the modeled OH distribution, as I think there is some uncertainty in the Spivakovsky climatology. The comparison is made to it because it is the only such thing to evaluate this key species. The MOZART-4 results are very similar to the MATCH-MPIC results presented in Lawrence et al., 2001. A couple sentences have been added addressing this in Sec.5.1.

Page 1176: the final sentence of section 5.4 does not inspire confidence in the model. While it is good to speculate about potential weaknesses, it would helpful to indicate how these might be evaluated, tested or addressed.

The last sentence has been re-written to:

“Therefore, it is likely the Southern Hemisphere biomass burning emissions of aerosols are too low in this simulation. An additional uncertainty in the calculation of AOD lies in the definition of the physical or radiative properties of aerosols, which requires evaluation of the model with simultaneous aerosol size distribution, number density and composition along with radiation measurements.”

Page 1196, end of table 3: products have been omitted in the DMS reactions. Is this intentional, i.e., are other products (e.g., HCHO) neglected? If this is so, it would be helpful to state earlier in the paper that DMS is only included as a precursor for sulfate aerosol.

Yes, DMS is only included as a source of SO₂ as a precursor for sulfate aerosols, and other minor products are ignored. A sentence has been added to Section 2.2.

Page 1202, table 9: are the biogenic emissions of CO treated through MEGAN, or are these emissions independent? This should be noted in section 2.7.

Only isoprene and monoterpenes are calculated using the MEGAN formulation in the current version of MOZART-4. While this was already stated in the first sentence of Section 2.7, additional text has been added stating that all other biogenic emissions are currently from the POET inventory (which uses Muller and Brasseur, 1995, for CO).

Fig 4 and Fig 6: replace the internal run labels in the titles of independent figures with "MOZART-4"

Will change figures.

Fig 6: columns expressed in mixing ratio: over what depth is this an average?

The total atmospheric column is used. The word ‘total’ added to 2 more instances before ‘column’ in the figure caption.