Atmos. Chem. Phys. Discuss., 12, C11083–C11086, 2012
www.atmos-chem-phys-discuss.net/12/C11083/2012/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Impact of aging mechanism on model simulated carbonaceous aerosols" *by* Y. Huang et al.

Anonymous Referee #1

Received and published: 27 December 2012

Huang et al. investigate how carbonaceous aerosols are affected by an experiment-based aging parameterization that is a function of the concentrations of ozone and water vapor. Overall this paper is within the scope of ACP and deals with an important issue (aging process), but I have several comments including a few major comments are listed below. After addressing these issues carefully, this paper should be published.

Major comments

1. This study attempted to evaluation their BC and OC predictions with two BC/OC measurement sites and showed some improvement using the updated aging parameterization. The authors may intend to show the updated aging process as a more realistic mechanism than the fixed aging case, but their evaluation results (section 3.1)

were not so convincing mainly because of too few measurement sites used. I strongly encourage including more observation sites.

2. Did the control run use 1-day e-folding aging timescale? - I couldn't find the exact description for this. If so, I'd like to recommend adding another simulation that uses a longer e-folding aging timescale because 1-day e-folding is the shortest value used in global aerosol models, in my knowledge. This can give a better perspective on the potential biases in the BC/OC predictions using existing fixed aging timescales.

3. In my understanding, the new aging mechanism is chemistry-based aging, which doesn't include microphysics-based aging (via coagulation and condensation). If this is correct, this paper should state this clearly in the introduction/method section and also discuss carefully how model predictions with the new aging parameterization could be affected by missing microphysics-based aging mechanisms - one sentence in the conclusion section (P 29003; L 15) is not enough. This is an important issue because Riemer et al. (2004) present the microphysics-based aging process as the important aging process and neglect the photo-chemical-based aging based on results from Saathoff et al (2003). If the microphysics-based aging is significant, your BC/OC evaluation with the observation might be affected by missing microphysics-based aging process.

Specific comments

1. P 28995; L 3-5 – Can you rewrite the sentence or just change to "include direct emissions from fossil fuel"?

2. P 28995; L 16 – Instead of "around 1 day", can you provide the range of aging timescale used in references? Related to this, please add new column in Table 1 to

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provide the aging timescale assumed in each model.

3. P 28995; L 21-23 - Besides listing the control factors in the aging mechanism, I think, you should provide a brief description on the aging mechanism.

4. P 28995; L 26 – what's the value widely used in climate models?

5. P 28996; L 10-17 – Past verb tense might be correct one: "we used" and "we ran".

6. P 28998; L 9-12 – Please delete the sentence starting "Several studies. . ." as this doesn't provide any information.

7. P 28998; L 16-20 – Did you compare the updated aging parameterization with the 1-day aging timescale? Please provide the exact setup of the sensitivity simulations.

8. P 28999; L 2-4 – Is the 30% or 38% increase at HAVO and HALE really significant improvement? As it is mentioned, the model BC and OC are still severely underpredicted even with the updated aging parameterization, and this indicates other problems. Also missing marine OC source is not reasonable because this doesn't explain for the BC underprediction.

9. P 29000; L 15-17 – What is "BC climate forcing"? Is this direct radiative forcing? Please be specific. The sentence suggests a linear relationship between BC burden and forcing (i.e. 31% increase in global burden leads to 31% increase in forcing). Is this really reasonable?

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10. P 29001; L 25-26 – This sentence is a bit unclear. what do you mean by “on surface air”? Is this OC concentration in the lowermost layer? Please re-write this.

11. Figure 2 – Please bring the long/lat information to the first sentence and use full name of HAVO and HALE in the legend.

References

N. Riemer, H. Vogel, B. Vogel, “Soot aging time scales in polluted regions during day and night”, Atmospheric Chemistry and Physics 4, (2004), 1885-1893, SRef-ID: 1680-7324/acp/2004-4-1885.

Saathoff, H., et al. "Coating of soot and (NH4)2SO4 particles by ozonolysis products of ?- pinene." Journal of aerosol science 34.10, (2003), 1297-1321.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 28993, 2012.