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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Technical Note: Evaluation of the WRF-Chem "aerosol chemical to aerosol optical properties" module using data from the MILAGRO campaign" *by* J. C. Barnard et al.

Anonymous Referee #2

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Summary

The authors show that discrepancies in aerosol optical properties (B_scat, B_abs, and SSA) between the WRF-Chem simulation and measurements obtained during the MILAGRO campaign at the T1 site are not attributable to the module in WRF-Chem used to convert aerosol chemical properties to aerosol optical properties. Namely, by imposing speciated mass concentrations using detailed data from the T1 site, the WRF-Chem module performs within estimated uncertainties. The study is a very nice example of how measurements can be used to support model evaluation, how to consider

uncertainties from both the measurements and from the model when analyzing the comparisons, and how it is not enough to condemn models as simply a 'black box'.

General Comments

The authors show that the WRF-Chem chemistry-optics module is not to blame for the poor agreement shown in Figure 1. They also suggest that emissions input to WRF-Chem (full version, corresponding to Figure 1) are likely to blame. There are a some points related to this that I think the authors should clarify:

1. Please add a reference to the emissions inventories (fossil fuel, biomass burning, biofuel, etc.) you are using as input.

2. Since you are discussing surface comparisons, can you briefly state how you vertically inject emissions into WRF-Chem and whether this has any bearing on your conclusions?

3. How do the WRF-Chem diurnally averaged mass concentrations derived from that emissions inventory compare to the observed values presented in Figure 2?

4. If BC emissions are particularly bad, as you say in the Abstract, perhaps we need more information about the original WRF-Chem output than just Figure 1. Table 2, for example, could be expanded by one column to include the mean aerosol optical properties from the full (original) WRF-Chem simulation.

5. On p. 8947, lines 1-5, you say that you ran the full simulation using observed BC mass and that resulting SSA was 0.85 (compared to 0.78 from observation, 0.74 from aerosol module with observed inputs). Can you clarify what this 0.85 implies? Why is it so much higher than 0.74, for example? And why not run the full simulation with all observed mass concentrations to see how this affects the comparisons?

Specific Comments

1. p. 8232, lines 15-17: Your assumption about the BC refractive index is probably fine,

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but to be fair to Bond and Bergstrom (2006), you should add here that they suggest 1.85+0.71i as the midpoint of a range of values of refractive index at 550 nm and explicitly say in Section 9.1 that they make 'no statements about the nature of absorption at ultraviolet and infrared wavelengths' and in Section 9.2 say 'we emphasize that it [the refractive index] is likely to be much different' at infrared wavelengths. You should also add a note to Table 1 saying the same thing about your assumed 870 nm BC refractive index.

2. p. 8934, lines 13-15, Figure 2: How significant are the peaks and valleys in the diurnally averaged chemical concentrations compared to the variability (standard deviation) in the 4-6 day averages?

3. p. 8939, line 26: Figure 1 shows SSA, not BC concentration.

4. p. 8944, lines 15-26: Nice technique!

5. Table 1: Similar to the caveat about the assumed BC refractive index (my comment about p. 8232, lines 15-17), you should also add a note to Table 1 saying that the OC review by Kanakidou et al 2005 only summarized work for a wavelength range of about 300-800 nm.

6. Table 2, Figure 1, Figure 6: Add 'at 870 nm' somewhere in these.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 8927, 2010.