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Atmospheric Chemistry and Physics
Discussions

Interactive comment on “Interpreting the Ultraviolet Aerosol Index observed with the OMI satellite instrument to understand absorption by organic aerosols: implications for atmospheric oxidation and direct radiative effects” *by* M. S. Hammer et al.

Anonymous Referee #1

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This paper estimates the effective absorbing optical property of “brown carbon” (BrC), which is a part of the bulk primary organic carbon (POC) emitted from biomass burning, by adjusting the spectral dependence of imaginary refractive indices of BrC and BrC/POC ratio in the GEOS-Chem simulation of UVAI to match the UVAI from OMI and reported AAE from literature. Then, the consequences of BrC absorption on tropospheric OH and aerosol direct radiative effects (DRE) are calculated with the GEOS-Chem model, which show significant reduction of OH and changes of DRE over major

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1. The term “primarily non-absorbing” or “primarily scattering” for OC is somewhat misleading. The imaginary refractive indices (k) of OC from OPAC is 0.005 – 0.008 in the 300-550 nm wavelength range, which means OC is absorbing, at least weakly absorbing. In fact, the k value of OC increases with the wavelength from 350 to NIR (about 0.4 at ~9000 nm), therefore OC should not be defined as non-absorbing aerosol even with the OPAC values. The problem seems mostly in the UV and shortwave VIS range where the absorption from OPAC is likely to be too weak and the AAE too low.

2. The relationship between k and BrC/POC ratio shown in Table 2 and Figure 3 is quite confusing. For example, at 350 nm, k=0.005 at BrC/POC=0, and it increases to 0.077 (0.11) at BrC/POC=0.5, but then it decreases to 0.037 (0.051) when the BrC/POC ratio further increases to 1. That sounds counterintuitive - should k increase with the fraction of BrC? Why should it go the opposite direction? I understand that you use the UVAI as a constraint; you have to choose a combination of k and BrC/POC ratio, i.e., if you use a higher k then you would have to use a lower BrC/POC ratio and vice versa, in order to match the same UVAI with OMI. However, this also means that you cannot independently obtain the k or BrC/POC ratio (and BrC density as well) from UVAI, since the four columns of case 2 in Table 2 give you exactly the same UVAI. What is the catch here? This question really should be explicitly discussed in the manuscript.

3. Related to the question above, what BrC/POC ratio is used in computing UVAI in Figure 4? If it does not matter as far as you use the consistent pair of k and BrC/POC (and density) to reproduce the UVAI, what is your recommendation to other models to use, especially not every model will be able to compute the UVAI in order to select the pair of k and BrC/POC?

Other comments:

Page 27411, line 23, "where k is the intercept": Intercept of what? I think you meant that log(k) is the intercept of linear fitting of log(AAOD) and log(lambda).

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 27405, 2015.