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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Spectral absorption of biomass burning aerosol determined from retrieved single scattering albedo during ARCTAS" *by* C. A. Corr et al.

Anonymous Referee #1

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General Comments:

This paper discusses an analysis of irradiance, chemical, and aerosol optical data obtained during the ARCTAS field campaign. The data were obtained from aircraft measurements. The goal of this analysis is several fold:

(1) determine, from actinic flux measurements, the ambient aerosol optical properties, such as single scattering albedo (SSA), asymmetry parameter, and extinction. From these quantities the absorption angstrom exponent (AAE) is found over several wavelength pairs. This part of the analysis is noteworthy because of the high spectral resolution of the actinic flux measurements.

(2) find SSA at two wavelengths from aircraft measurements of aerosol scattering and absorption. These inferences of SSA are compared to the same found from the actinic flux measurements. This comparison reveals reasonably good agreement.

(3) relate AAE to aerosol chemical properties, and in particular, the oxidation state of the aerosol.

Important conclusions are inferred from the above analysis. These include:

(1) The AAE is large in the UV and near-UV wavelength regions, indicating significant absorption by organic aerosol (OA). The OA absorption was relatively large, about 55%.

(2) AAE is larger in an aged plume, perhaps due to aerosol oxidation. Surprisingly, the oxidation seems to affect the SSA more at visible wavelengths than the UV.

Although similar findings have been published prior to this paper, the paper is valuable for bolstering our knowledge of the absorption properties of OA, particularly in biomass plumes that meander over the arctic. I recommend publication with only minimal modifications.

Specific Comments:

I examined this paper carefully, looking for unaddressed issues that could adversely influence the analysis. For example, over snow-covered surfaces, the retrievals of aerosol optical properties from radiometric instruments are very sensitive to albedo (as opposed to bare earth, which often has a very low albedo for wavelengths less than 450 nm). The authors seemed to have anticipated this potential problem. The assumptions used for the analysis are spelled out clearly, and it's easy to understand how the authors went from assumptions to analysis to conclusions.

Here's the "minimal modification" I referred to under "general comments". In Tables 3 and 4, the contributions of OA to absorption are listed. Table 3 shows absorption derived from actinic flux measurements; table 4 from the scattering and absorption

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measurements made aboard the aircraft. Why are the absorption numbers so different between the tables? On line 26 of page 13983, the authors state that the OA contributions [to absorption] compare well [between the two tables]. The comparison does not look very good to me. Some additional explanation is needed here.

Technical comments:

(1) There aren't any error bars for the "in situ" measurements in Figure 3, even though these errors bars are referred to in the figure caption.

Editorial comment: I wrote this review without looking at any other review of this paper. Sometimes I notice that a second ACP reviewer will ape the comments of the first reviewer. This then makes me skeptical of the second review.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 13967, 2012.