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Atmospheric Chemistry and Physics Discussions

Interactive comment on "ARCTAS-A ground-based observational campaign and meteorological context, interior Alaska, April 2008" *by* D. E. Atkinson et al.

Anonymous Referee #3

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This is a useful data set of aerosol properties in the Arctic that encompasses four distinct synoptic and aerosol source classes. It would be more valuable if more context to the broader ARCTAS experiment were added. Somehow this data and analysis need to be linked to the broader objective of ARCTAS in the context of radiative forcing and climate change.

The title does not reflect the data or science of the manuscript. It is not only ground-based. It also includes remote sensing and sonde-based data. It focuses on aerosols and aerosol properties neither of which is mentioned in the title.

Given that the drum sampler and meteorological data are the most complete and useful

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to ARCTAS goals and that they have been or are being published elsewhere (a companion paper and Fuelberg 2010) the value of this particular manuscript is in question.

Significant revisions will be required to address the specific points enumerated below. The list is not exhaustive but point the direction of revisions that are needed.

P16501 Asian smoke This term is not clear. Based on the discussion I would recommend this be termed

P16503 “Epoch” isn’t quite the right word. I suggest rather “event”, eg., Identify the major atmospheric aerosol events . . ...

P 16504 observations (sp) Leave out mention of the radar if not used here. It is referred to in section 4 and supposedly section 4.1 but I cannot find that section or discussion.

P16505 The phenomenon of increasing d with particulate age occurs as the aerosol loses its moisture coating, exposing the irregular aerosol surface (Sassen et al., 1989). I would suggest that this is not the only mechanism for increasing d.

P16507 .. ingest.. I don’t understand this term in this context. Is aerosol inlet flow meant?

. . . differential mobility analyzer (DMA model 3071, TSI, St. Paul, MN, USA) . . . . condensation nucleus counter (CNC model 3010, TSI) . . .. . .

What was the inlet flow, to what RH was it desiccated, and how was this done? How was the charge neutralization done to achieve Boltzmann equilibrium charge distribution. Reference Wiedensohler (listed but not used) here in this context. I don’t understand the purpose of the ammonium sulfate aerosol. Were there two SMPS systems? Or are the ambient and sulfate aerosol alternated. The Wang and Flagan reference is an adequate description for most of the SMPS. Explain what is different here eg, inlet, desiccation, sulfate reference. Also what SMPS inversion program was used? Was a size calibration of the SMPS system done, eg., with monodisperse sulfate or latex sphere particles?

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Sun photometer and nephelometer are two very different types of instruments. What is meant and how do those relate to this study? If relation is minimal delete the sentences.

Terminology in section 3.1 is unusual. Opacity was not measured. I would term the four events to be - atmospheric aerosol events that differed significantly with respect to aerosol physical, chemical and optical properties. Quantify “significantly” here or later. The discussion revolves around aerosol types or events not aerosol activity – the term is usually reserved for cloud condensation activity if at all.

Items 1 through 4 here are simply terms applied to the identified events. Define these aerosol types broadly including what is meant by pristine and smoke. Biomass burning smoke, long range transport of urban and industrial emissions, etc.

P16508 The discussion in 3.2 relates to figure 2. State that early in the paragraph and refer to plots in figure 2 by date along with the discussion points. The lower panel in each plot is obviously depolarization ratio and the color scale is given. Is the upper plot backscatter signal? If so is it range corrected. This information should be in the figure caption. The dates in the figure caption are redundant with the heading on the plots themselves. Provide a quantification for the gray scale of the upper plot. Have the data been cloud cleared? Can a lidar ratio be applied?

P16509 Second paragraph answers some of above points. This paragraph should be earlier in the section or part of the instrument description as should the information about the overlap region. The color scale is at the top of figure 2 in the PDF file I received. In the discussion refer to color as well as altitude when point out depolarization events or layers for reader who are less versed in the interpretation of lidar data.

There is considerable redundancy in the discussion of the lidar data in 3.2. It should be consolidated.

“ weak boundary layer aerosol . . .” The aerosol is not weak. It is the lidar backscattering signal that is weak. Attention should be paid to the using best possible terminology

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throughout.

P 16510 “The displays for the afternoon of 21 April (Fig. 2e) reveal a shift to still more strongly backscattering and depolarizing aerosols.” Was the change in backscattering due to a change in particle size or concentration?

P16511 All of the aerosol concentrations obtained . . . All of the aerosol chemical mass concentrations obtained . . .

The peak mass concentration of sulfur is of little importance or interest. An event average would be more useful as a measure of the generally low species concentrations. This comment applies to later mention of spikes as well. The event average values, standard deviations and experimental uncertainties should be presented in a table as well as mentioned in the discussion.

“. . . nanograms per cubic meter . . . and . . . microns” can be abbreviated ng/m3 and μm, respectively, as in the figures.

Cloud processing and wet deposition are important over the time and distance scales of consideration here. Wet deposition is mentioned later with reference to this section but not mentioned here.

Which chemical size fraction is shown in figure 3? Section 2.2.3 only mentions one size increment. The caption in figure three should state the size range, eg., Drum sampler chemical species concentrations in the size increment x.xx to x.xx μm.

P16512 While SMPS data is highly valuable in general, the fragmented data set that was obtained here is of less value. The early and late periods should be specified with respect to how they fit in the four events. Given the limited data the principle component analysis is of no value and should be deleted. Simply present the size distribution and how it fits with the one OPC sonde data in the surface layer. Unfortunately the SMPS and Drum Sampler size ranges to not overlap well enough to allow any valid comparison of chemical mass with total volume or mass (assuming a density).

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Loading patterns (not shown) indicate smaller size fractions (126 nm– 1000 nm) . . .... This is not clear since the SMPS upper size limit was 280 nm.

P16513 3.5 Regional-scale climate This is not climate but regional to continental scale synoptic meteorology.

P16514 Figure 5 is a 925 mb geopotential height plot not a 'Pressure at 925 mb" - which does not make sense. Figure 6 caption should identify this as a geopotential height anomaly plot. The units of the scales should be included in the caption.

P16516 Without a size scale legend for the profiles in figure 9 it is impossible to make sense of the discussion. Reference is made to the high concentration of 100/cc. This is not high for remote continental conditions. The total aerosol number concentration should be given as well but not as a profile plot rather as the average for each identified layer. Figures 9, 10 and 11 are largely redundant and, given the log scales involved hard to interpret. Provide table of layer average values, total and for specific size increments, and figure 11 only.

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 16499, 2011.