Atmos. Chem. Phys. Discuss., 11, C6025–C6028, 2011
www.atmos-chem-phys-discuss.net/11/C6025/2011/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Black carbon aerosol mixing state, organic aerosols and aerosol optical properties over the UK" *by* G. R. McMeeking et al.

Anonymous Referee #1

Received and published: 6 July 2011

Review of "Black carbon aerosol mixing state, organic aerosols and aerosol optical properties over the UK" by McMeeking et al for ACP

Aerosol composition, light absorption, rBC mass, and fraction of particles coated are analyzed using measurements from 3 flights over the UK. Results are generally consistent with previous findings. Limitations are due to an SP2 with a restricted size range compared to newer models, and light absorption measurements known to have a bias. Statistical authority derives from using data from an entire campaign rather than a few flights. On the other hand if the cases selected are representative it can yield a paper that is easier to read. There are interesting comparisons with coating rate and mass absorption efficiency measured at other locations. I recommend publication after the following comments are addressed – none of which should involve significant new

work.

P 14995 Method. What time of day were flights? How many flights in campaign? Why was the 1 flight on 16 April and 2 flights on 24 June selected for detailed analysis? If not already in text it should be made clear, that June data in Figures is for second flight on 24 June.

In discussion of instruments please indicate approximate RH at point of measurement. All that is needed is a determination of whether particles have been dried out. This may be of relevance in this paper for just the nephelometer and PSAP.

O3/NOx appears to satisfy the authors objectives in picking out plumes and background air. With only a ratio presented on a log scale, it was not possible to gain an appreciation of what gas phase concentrations were in the different air masses.

P 14995 line 21 nominal rBC range of approximately 5 – 300 fg. Please give mass equivalent diameter, which is 170 to 650 nm for a density of 2 g/cm3.

P 14996 thickly coated particles from time delay Please provide literature estimates of shell core ratio (as a function of size if necessary) that qualifies a particle as thickly coated from time delay data.

P 14997 line 29 – P 14998 line 1. "Correlation coefficients of 0.69 and 0.73 for CO and rBC were determined ..." What are these substances being correlated against? I would guess HOA, but it is not stated.

P 14998 line 13 Light scattering at 550 nm. McMeeking et al (2010) state that PSAP was at 567 nm. How was difference handled in constructing SSA? It is small. One over lambda or ignored are permissible answers.

P 14998, NOx measurements Is the temperature of the molybdenum converter (800 C) a misprint? 350 is a normal operating temperature. Above 500 C, NH3 will get oxidized.

On lines 24-26, it is recognized that the converter is not measuring just NOx. The measurement is called a “surrogate for nitrogen oxides” This is inappropriate terminology, especially because the NOx fraction probably changes from order 10% in rural area to order 100% in a fresh plume. Measurements called NOx should be referred to as NOy, with a definition given.

P 15001 Background CO of 150 ppb in April and 90 ppb in June. Background has many possible meanings. This appears to be an operational definition. How is background defined?

Regarding the trend with time of year. A decrease in the summer is consistent with OH chemistry. Is the large change from 150 to 90 ppb in agreement with OH variation at this latitude or is it due primarily meteorological factors (i.e. winds in relation to emission areas)?

P 15004 start of Section 3.4 It would be clearer to state in first sentence that f is lower in urban plumes. As it currently reads there is a connection to the observed O3 to NOx ratio and a connection to predicted transport. With CO and NOy measurements the urban plume should be identifiable, independent of model predictions.

P 15005 line 20-23 PSAP overestimate of light absorption I am familiar with Lack’s plot which shows PSAP artifact as a function of organic aerosol. I have not gone back to original papers. Is there any reason to expect that the artifact won’t occur for species other than organics? On P 15006 line 20 it is stated that there is no relation between MAE and OA mass. OA is often a minor fraction of total aerosol. Is there any relation between MAE and aerosol concentration?

P 15007 line 2 – 7. I don’t understand. What physical shift in the rBC core mass distribution would give you an increase in MAE? What is the mechanism?

P 15007 line 12-14. “Large amounts of small rBC below the detection limit of the SP2 could still play a role in explaining our results ...” Which results?

P 15008 “The coating may be partially absorbing, also reducing the absorption enhancement” Is it possible to give a short explanations? Statement seems counter-intuitive.

Figures 2 – 4 and 6. The color scale could be improved. I can only distinguish 3 colors, dark red, red and yellow in either the html or print friendly version.

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 14991, 2011.