Atmos. Meas. Tech. Discuss., 8, C4087–C4091, 2015
www.atmos-meas-tech-discuss.net/8/C4087/2015/

Atmospheric Measurement Techniques Discussions

Interactive comment on "LOAC: a small aerosol optical counter/sizer for ground-based and balloon measurements of the size distribution and nature of atmospheric particles – Part 2: First results from balloon and unmanned aerial vehicle flights" *by* J.-B. Renard et al.

Anonymous Referee #2

Received and published: 26 November 2015

Overall this is a clearly presented paper describing a range of initial results provided by a newly developed instrument, LOAC, designed to measure aerosol size and type, which has great potential to provide novel results. The paper achieves the goal of describing a range of new measurements, though some of the measurements, specifically the aerosol speciation index, need to be more clearly explained, and uncertainties in the observations should receive more attention. This should be easily achieved by modifications to the article. Although there are a lot of plots in this paper, they are all

relevant to the topic of the article and straightforward to navigate through.

Speciation Index Plots

The first time the reader comes across data relating to the speciation index is p10066 L2, yet the authors have not explained what this data actually means or shows, other than a brief mention at the start of section 2. For example, what do the range of numbers (such as in Fig 9) ranging from 0.1 to 4 mean? How do these separate different aerosol types? What conclusions can be taken from the figures when the black data points fall in zones covered by more than one aerosol type? The black data points/line should be included in the figure captions. What is the uncertainty in the speciation index observations?

Although the authors provide a brief overview of how the instrument works and observations provided at the start of section 2, it would be useful to expand this a little more to summarize the main findings of part 1 paper, and in particular expand on the speciation index as described above.

Minor Comments

10061 L17-18 – It would make more sense to report these values as, "up to ∼3000 particles cm-3 smaller than 1 um" and the same for "20 particles cm-3 greater than 1 um" rather than the order of wording as used currently.

10063 L6 – do the authors mean, "ejected from" instead of "rejected inside"?

10063 L7-9 – sentence starting "Some lights. . ." – what does this sentence mean? It makes no sense to me.

10064 L20 – should be 'submicron'?

10064 L23 – "4 times smaller at 220m" – this is not clear on the plot due to the log scale used. In general, the log scales used on figs 3, 5, 8, 13, 15 and 17 are useful for showing differences of large magnitudes, such as between the different size bins

and for order of magnitude changes of aerosol loading in individual size bins, but not changes of the order of say a factor of 4, as shown here. Are the authors able to provide additional plots, perhaps as a supplement, which better illustrate these changes?

10065 L1 – is the inlet operated when the instrument is flown on the UAVs as well?

10065 L21 – replace 'on the opposite' with 'contrastingly'

10065 L27 – remove 'between'

10065 L28-29, 10066 L1 – it is not clear from the size distributions showing dN/dlnD that the pollution mass is dominated by the smallest particles, since the larger particles, although fewer in number, will contribute more to the mass. Please include a plot of dV/dlnD or dM/dlnD overlaying the dN/dlnD plots to demonstrate that this is the case.

Section 3.4 – it would be useful to add 'with drifting balloons' to the title for this section to help keep the reader informed with which measurement operation was used in each section/campaign described throughout the paper.

Section 3.4 – are drifting balloons retrieved? If so, how is this done logistically?

10066 L26 - and following ambient wind directions and speeds, presumably? If the ambient dust/air layer is slowly descending, will the balloon also descend with the layer, or remain at a particular altitude?

10067 L10 – change 'been' to 'be'

10067 L24 – change 'save up' to 'conserve'

Figure 12 – a colour bar should be included

Figure 13 – please use a more useful time for the x-axis, such as time of day, hour of day. . .

Figure 13, and other plots showing dN/dlnD – what are the uncertainties in these values? It would be useful to show these on the plots.

Figure 13 – Can the authors comment on the changes in dN/dlnD in the largest sized particles shown in the plot and any reason for these changes? Or are the variations within the uncertainty of the measurements?

Fig 13 – as stated above, it's difficult to see small changes in size distribution in the plots due to the log scale used. It would be useful to include a size distribution plot, say contrasting a few points in time from the measurements, such as at the start and end of the data shown in fig 13.

10068 L9-12 – '..suggesting no significant sedimentation of large particles during the flight or compensation by particles from above' – or it is possible that deposition to the layers below was equally compensated for by deposition from the layers above. If the layer is slowly descending, will the balloon follow this descent?

10068 L12-14 – these results of large particles being retained during mid-long range transport are consistent with those found by Ryder et al. (2013), Weinzierl et al. (2011) and Denjean et al (2015) who reported similar measurements, and should be cited.

10069 L9 – how do the authors know the particles are sulphuric?

10069 L11 – see comments above about order of notation (change to 'below 1 particle cm-3 greater than 0.2 um').

10070 L4-7 – for what reason are mineral dust particles originating from the surface ruled out?

10072 L15-20 – Nicoll et al. (2011) also performed observations of charge in dust layers – this publication should be cited here.

General questions about LOAC – it would be useful if explanations to these questions could be covered somewhere in the manuscript:

Is the instrument affected by passing through cloud? Do clouds need to be avoided?

Could the instrument detect/isolate biological aerosol particles or pollen particles?

It seems that the instrument would be useful in detecting dust particles at high altitudes in the atmosphere which may act as ice nuclei particles, which are normally notoriously difficult to measure. Can the authors comment on the instruments applicability for this?

References

Denjean et al., Size distribution and optical properties of mineral dust aerosols transported in the western Mediterranean, Atmos. Chem. Phys. Discuss., 15, 21607–21669, 2015, doi:10.5194/acpd-15-21607-2015

Nicoll, K. A., R. G. Harrison, and Z. Ulanowski (2011), Observations of Saharan dust layer electrification, Environ. Res. Lett., 6(1).

Ryder, et al., Impact of Atmospheric Transport on the Evolution of Microphysical and Optical Properties of Saharan Dust, 2013, Geophys. Res. Lett., 40, 10, 2433-2438, doi:10.1002/grl.50482.

Weinzierl et al., Microphysical and optical properties of dust and tropical biomass burning aerosol layers in the Cape Verde region-an overview of the airborne in situ and lidar measurements during SAMUM-2, Tellus B, 63, 589–618, doi:10.1111/j.1600-0889.2011.00566.x, 2011.

Interactive comment on Atmos. Meas. Tech. Discuss., 8, 10057, 2015.