

## ***Interactive comment on “ALADINA – an unmanned research aircraft for observing vertical and horizontal distributions of ultrafine particles within the atmospheric boundary layer” by B. Altstädter et al.***

**Anonymous Referee #2**

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### **Summary**

This paper is clear in its aims of introducing the ALADINA UAS platform and justifying the measurement need regarding small-scale vertical and horizontal ultrafine particle variability. It is a welcome addition to the growing uses of UAVs in atmospheric science and is within the remit of this journal. A good attempt is made to describe the platform and instruments and interpret of the measurements from the field study. I think the manuscript could benefit from more detail to highlight the changes made to the in-

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struments when integrating them into the UAV, and to discuss considerations given to possible inlet and flow path effects one might expect when airborne. More explanation of the observed new particles, particularly on the 8th, will help embed the results more firmly into the measurements made concurrently by more established techniques.

### **Specific Comments**

Aerosol and turbulence measurements from UASs are described in [Corrigan et al, Atmos. Chem. Phys., 8, 737–747, 2008], using a TSI 3007 CPC and Met One OPC, given the system similarities, this paper should be highlighted more in the literature review. Similarly, the AMT paper [Thomas et al. Atmos. Meas. Tech., 5, 243–257, 2012] should be included on page 12287, line 27 after ‘fluxes’.

The newest concept for this paper is the integration of a dual CPC system with modified size responses into a UAS, a description or diagram with details of the modified flow paths, any isokinetic inlet considerations, and thoughts regarding of the airflow around the UAS to allow the reader to fully understand the integration of the two CPCs and OPC into the UAS.

The authors give a clear, concise description of the aircraft. More information about or referencing the make and model of basic sensors used where appropriate: platinum wire probe, P14 rapid, data acquisition system, telemetry radio, also which data is sent via telemetry.

Repeated several times in this paper is the assertion that the difference between N18 and N11 is an indicator of new particle formation. In addition, modifying and integrating the CPCs to measure N18–N11 whilst flying is a difficult challenge. With these points in mind, the manuscript would benefit from more insight and analysis on Figs 15c (particularly) and 16c. Really to expand on Page 12298 line 14: “A continuous difference between CPC1 and CPC2...meaning there is a significant number of particles with a diameter of particles in the size range between 11 and 18nm.” Without more explanation some readers may dismiss Fig 15c as a systematic offset between CPCs. I think some

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discussion of formation mechanisms and transport through the column, to tie in with the theta stratifications, general meteorology and supporting aerosol measurements is warranted. It would be clearer to add a N18-N11 trace to Figs. 15c and 16c to help this analysis. In addition, can a comparison be made with the SMPS data and the CPCs by integrating the TSMPS over the size range of each CPC and OPC channel and at the time of low altitude/surface sampling (above 800nm should add little in the way of number conc)? This value could be added to Figs 15 and 16 at the appropriate altitude level to provide a visual quantitative assessment of system performance relative to surface instruments. Building such linkages described above between the UAV and ground data will build confidence in the system's abilities to make real-world measurements.

#### **Technical comments**

12287 line 28. A minor point, but low cost with respect to manned aircraft isn't always the case. For example, if you wanted a sub 25kg UAV that could go all the places a light manned aircraft could (airspace permitting), it might cost considerably more. Perhaps acknowledging this by changing 'low' to 'potentially lower' would suffice.

P12288, line 24 – I think "Save" should read "Safe"

P12289, line 28 'is' should be 'are'.

P12295 line 6, 'weaken' should be 'weakened'

P12297 line 1 – presumably 'mixing ratio' refers to 'water vapour mixing ratio', this should be specified here, line 9, and figure 11 caption (consider using 'q' to save repetition) .

P12297 line 18 'extend' should be 'extents'.

Figure 7: Top four panel's x-axis tick marks need aligning with those of lower panel.

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Interactive comment on Atmos. Meas. Tech. Discuss., 7, 12283, 2014.

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