

## ***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.***

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### **Summary:**

This paper by Altstädter et al describes a novel measurement platform (drone aircraft) for the measurement of ultrafine aerosol in the Earth's boundary layer. The study describes the technical details of the new platform and its instrumentation (together co-denamed ALADINA), and validates the particle measurements against ground-based instrumentation in a small field trial.

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As this work demonstrates new technology and a clear potential for future atmospheric science, it is very well placed for publication in AMT. It is an excellent resource for those using these type of measurements in the future and for helping to drive this emergent measurement technology forward for wider use.

An excellent literature review of ultrafine aerosol science culminates in a well-expressed need for this new type of local-scale sampling to enable physico-chemical process studies for the first time. There follows a rigorous description of the OPC, CPC, and meteorological, instrumentation and its adaptation for use on a UAV platform. Finally, a well-designed, well-executed and nicely-interpreted field trial at a well-equipped GAW site is used for validation and proof of concept. The instrumentation used is reasonably well understood (and expanded on in this work by validation and testing) and so the study is about confirming its utility on a UAV platform. The article is very well written (the best I've read for quite some time - and very few typos - thank you). Plots and structure are appropriate and good quality. I highly recommend this study for publication and I have just a few recommendations and minor technical comments below.

### **Specific comments:**

1/ It would be useful to add a summary of the quantitative results of the validation to the abstract and conclusions (e.g. "accurate to within X% in total number concentration at typical ambient levels", "1.3 s response time" etc). This is key information.

2/ As suggested in the conclusions, ozone is one of the many modulating controls on ultrafine particle bursts and it would be useful to briefly mention that it will be important to measure many atmospheric chemistry parameters simultaneously and coincidentally to enable particle-burst process studies earlier on in the introduction and literature survey. You could reference the following shamelss plug in your literature survey as another promising measurement approach to measure these kind of synergistic properties:

Illingworth, S.M., Allen, G., Percival, C., Hollingsworth, P., Gallagher, M.W., Ricketts,

C4427

R., Hayes, H., Ładosz, P., Crawley, D., Roberts, G.: Measurement of Boundary Layer Ozone Concentrations On-board a Skywalker Unmanned Aerial Vehicle, *Atmos. Sci. Lett.*, 15(4), 252-258, DOI:10.1002/asl2.496, 2014.

3/ Inlet design is often difficult for aerosol particles. Can you confirm (and/or otherwise include in the text) that the inlet is isokinetic for the size range of the particles of interest? Was this tested and/or confirmed? I.e. is the response rate potentially different for different size particles and could there be differentiation in the size distribution due to streamlines around the inlet tip? I suspect these effects will be very small at the slow speeds of the UAV and small aerosol sizes under consideration but it does need to be understood and confirmed. In summary, it would be useful to see more information on the inlet design and characterisation in the text.

Technical comments:

1/ Change "earth's" to "Earth's" on p.12285 line 21 and check for other instances.

2/ Figure 6: Top panel legends are too small to read. Also, are these taken direct from wetter3.de (they look very similar to those available publicly there)? If so, that site (or the original producer) should be credited. Either way, text needs to be enlarged. I would recommend an easier option of removing these panels if necessary as they don't add too much information that isn't already described in the text concerning the synoptic situation. In other words, a plot of GFS data is not needed to illustrate what is already well-expressed in the text for the purposes of this study.

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