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Comment

## ***Interactive comment on “Aircraft testing of the new Blunt-body Aerosol Sampler (BASE)” by A. Moharreri et al.***

### **Anonymous Referee #1**

Received and published: 15 April 2014

Review of the AMT manuscript amtd-7-2663-2014 “Aircraft testing of the new Blunt-body Aerosol Sampler (BASE)” by A. Moharreri et al., 2014

The above manuscript deals with the airborne characterization of an interstitial aerosol particle inlet. The authors are doing right going into that direction, because inside cloud measurements in the past were “always” influenced by cloud droplet or ice crystal break-up particles. And measurements of the interstitial aerosol inside clouds are needed for a better understanding of clouds. Hence the topic of this manuscript is of high relevance for atmospheric research. Therefore I recommend accepting the manuscript with one medium and some minor revisions

General remarks: The development of BASE is a great step forward. However, my

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(only) medium concern is the underlying assumption of scatter particles staying in the inlet (or aircraft) boundary layer. In the past I might have agreed, but after I saw the videos by Alexei Korolov (<ftp://depot.cmc.ec.gc.ca/upload/hsvideo/>) I strongly doubt this assumption. Can you give a proof for this assumption? The assumption made in the manuscript is based on CFD modeling while the videos are based on reality. In any case you have to discuss this issue more in detail. Do you expect a difference between liquid droplets and ice crystals?

Specific issues are:

- p. 2664, abstract: please write out also the acronyms for the two measurement campaigns.
- p. 2664, l. 15: is “informed” the right verb here? I don’t think so. Same p. 2674, l. 25.
- p. 2665, l. 14: please add the following two papers from Alexei Korolev as references after “secondary particles”: Korolev, A. V., Emery, E. E., Strapp, J. W., Cober S. G., Isaac, G. A., Wasey, M. and Marcotte, 2011, Small Ice Particles in Tropospheric Clouds: Fact or Artifact?, Bull. Amer. Meteor. Soc. 91, 967-973, doi: 10.1175/2010BAMS3141.1; Korolev, A. V., E. F. Emery, J. W. Strapp, S. G. Cober, G. A. Isaac, 2013: Quantification of the Effects of Shattering on Airborne Ice Particle Measurements. J. Atmos. Oceanic Technol., 30, 2527–2553. doi: <http://dx.doi.org/10.1175/JTECH-D-13-00115.1>
- p. 2665, l. 28: is it really true that the scatter particles stay in the boundary layer of the inlet body? According to the videos or photos about cloud droplet scattering (e.g. on the DMT web page) you can see that the scatter particles well travel several centimeters crossing air stream lines. Hence I would say this requirement does not hold. Or is the velocity of your aircraft so low that it holds? I cannot imagine that, please discuss this point. And please provide the TAS of the C130 during your measurements somewhere in the text.

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- p. 2666, l. 15: please add also the geographic region of the PLOWS campaign.
- p. 2666, l. 23: how long is the flexible TSI tubing?
- p. 2667, l. 5: I tried to reach the web page for HIMIL (UCAR, 2005), but I was not successful. In the references you wrote it was last accessed 2005, i.e. nine years ago. Please provide a newer web reference or one that is working and if this is not possible provide a paper reference.
- p. 2667, l. 8: please be more specific concerning the mounting position of the inlets, how many meters behind the aircraft nose and how many meters apart?
- p. 2667, l. 19: what does “In designing BASE-I, the presence of only liquid droplets was considered” mean? What would be different, when considering ice crystals? And why restrict to liquid droplets only? Please explain this point in detail, i.e. in more than one sentence.
- p. 2668, l. 11: what are the cut sizes of the inlets? I would assume that the upper inlet cuts are at some micrometers and in this size range, the particle number concentration is so low that the different cuts do not make a big difference in CN. Or are there differences in the lower cuts?
- p. 2668, l. 21: I do not agree with this conclusion. Have a look at the right peak in Fig. 3. There are clear differences between BASE-I and SMAI, the latter inlet performing much better. Hence, please weaken you conclusion to something like “in principle the BASE-I design works, however, the uncertainties in the absolute numbers of interstitial aerosol particles are large.” That’s what I at least can see in this figure.
- p. 2669, l. 29: again, I believe the authors are too optimistic. The agreement between the measurements and the model results is not “excellent”. What is shown in the figure is that a more realistic turbulence model changes the model results into the right direction, but the new model overdoes. But still this new model helps the authors to understand what is going on, so good to have these results. Please weaken the “ex-

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cellent”. And please indicate to the reader, why the model predicts the flow separation (i.e. that  $C_p$  becomes flat), not everybody is a CFD modeler.

- p. 2670, l. 5: do you have any idea about reasons for the pressure differences at different inlet sides? How does the vicinity of the inlet look like? By the way, could you provide a photo showing all three inlets at the aircraft?

- p. 2670, l. 22: what does “range of normal velocities” mean? Please specify how large the range is and how this velocity range is distributed to the different particles sizes.

- p. 2670, l. 25: most research aircraft fly at TAS larger than 100 m/s, how does Fig. 7 look if you include 150 m/s or even 200 m/s data? This should be easily calculated in FLUENT.

- p. 2671, l. 8: it took me a while to understand Fig. 8 because on the contrary to Fig. 1 and 2 the interstitial inlet is mounted downwards. Is it possible to mirror the two graphs? And I was always looking which cross section you show and where the solid line of the “Blunt body housing” comes from. Maybe it’s easier to understand if you leave the solid line away here.

- p. 2672, l. 19: you write that for “one selected set of sampling conditions . . . the two sets of size distributions match reasonable well”, which would imply that the agreement is bad for all other conditions. What you likely mean is that “for any selected set of sampling conditions . . .” Or?

- p. 2673, l. 3: there is a space missing in-between “at least”

- p. 2673, l. 21: must be Fig. “12”, not “2”

- p. 2673, l. 25: how much lower are the BASE-II values? Please provide numbers.

Figures:

Fig. 1: caption, second line: must be “particles” not “inlets”. And again, I do not believe

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that the scattered particles stay within the inlet boundary layer.

Fig. 2: please use SI units, i.e. at least “cm”

Fig. 5: please insert two times “model” in the legend after “k-“omega” SST”

Fig. 6: please use SI units

Fig. 10: please write “k-“omega” SST transitional model” instead of “simulations” in the legend

Fig. 11: please insert “Model” in front of “predicted sampling efficiency ...” in the caption

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Interactive comment on Atmos. Meas. Tech. Discuss., 7, 2663, 2014.

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