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Atmospheric Measurement Techniques Discussions

Interactive comment on "Thermodynamic correction of particle concentrations measured by underwing probes on fast flying aircraft" *by* R. Weigel et al.

Anonymous Referee #3

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General Comments

The authors present the derivation of a correction factor for measurement of particle concentration by cloud physics probes under the wings of a high-speed aircraft. This is a laudable goal, since airflow distortion can be large around such a measurement platform. However, the authors seem to be missing a critical part of such a correction: the deviation of particles from the streamlines that will occur for some cloud particles. In the larger size ranges, particle velocity isn't necessarily equal to the local velocity, as is assumed here. This deviation from streamlines can result in concentration changes from freestream that are substantially different from those calculated based

on changes in airflow/density alone. This is touched upon, but not quantified by the simple relaxation time approach mentioned. The other reviewers discuss this problem as well, so I'll only add that the authors should discuss and try to quantify this inertial effect. They should also refer to earlier work in this area, such as King, JTECH 1984, Norment, JTECH Dec 1988, Twohy and Rogers, JTECH 1993 and Dhaniyala et al., Aer. Sci. Tech, 2004.

Without a detailed discussion of the above issue, I don't think the paper can move forward. As one of the other reviewers suggests, computational fluids analysis would be the best way to address this for complex, potentially interacting probe configurations. Also, wasn't some CFD analysis already done for the HALO underwing locations, with the potential effect of airflow distortion on particle trajectories examined when the locations were first selected? This would provide mean flow conditions upstream of the probes, and potentially, any effect of the wing and fuselage themselves on the air streamlines and particle concentrations. Some discussion of these results should be included, even if not fully available in the open literature.

Minor Comments

You might consider moving some details of the equations or other aspects to supplemental material, and the paper seems rather long and will be longer when the discussion of particle inertia is included.

13425, lines 21-22: The reason why underwing locations are widely used for cloud measurements should be explained, as this has not always been recognized. Similarly, on page 13427, lines 4-5: why were these particular locations selected? Presumably because of relatively undisturbed airflow based on earlier computations at DLR, which should be mentioned.

13426, line 28: I believe "velocity" should be "speed".

13446: I found this section hard to follow. Were size distributions from the tethered

probe available to compare with those from the underwing probe to aid in evaluation of the correction factors? Or was only one probe available at any one time?

13446, lines 25-26: Again, I thought this was something that had been previously modeled when selecting these locations, and would be very useful information.

Trivia/Typos:

13428, line 6: The comma after “both” instead should be after “following”, and on line 7, the one after “measurements” should be removed.

13431, line 28: “expresses” should be “expressed”.

13444, line 14: I think “where” should be “were”.

Interactive comment on Atmos. Meas. Tech. Discuss., 8, 13423, 2015.