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Atmospheric Measurement Techniques Discussions

Interactive comment on "Experimental characterization of the COndensation PArticle counting System for high altitude aircraft-borne application" *by* R. Weigel et al.

Anonymous Referee #2

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This manuscript describes a new condensation particle counter for operation on a high-altitude aircraft. It also shows calibration and some initial flight data.

This is suitable material for Atmospheric Measurement Techniques and should be published with revisions. I have two general comments and there are places the manuscript could be shortened.

General comments:

First, there is no discussion of why FC43 is better working fluid than butanol for aircraft operation. What physical properties of butanol are unsuited for low-pressure opera-

tion? Or is there a different reason?

Second, there are problems in scaling the NOx emissions of the Geophysica to the ER2. NOx emissions are very sensitive to the exact temperature history as combustion products cool after combustion. Even nominally similar engine designs can have very different NOx emissions. I do respect the attempt to derive some emission factors. Perhaps it would be better to just compare the CN/NOx ratios directly and not try to get an emission factor per unit of fuel burned. Or be very clear that you are only making an order of magnitude estimate of the emission factor. Are there water data with enough precision to see the water from combustion? That would lead to an emission factor.

Specific comments

The introduction is too long. The history of stratospheric aerosol measurements does not need to be reviewed for what is basically an instrument description paper. For example: shorten p. 323 lines 11-21, the entire discussion of Mt. Pinatubo (323-324) can probably be eliminated,

p. 327 line 21 discussion of 1.2 nm particles in the lab could be eliminated.

Section 3.3: Transmission efficiency will depend on the inlet being accurately oriented into the flow, especially with a sharp-edged inlet that can stall when the angle of airflow is large. How was the inlet oriented with the local airflow at the two locations on the Geophysica? Was the angle of airflow relative to the aircraft determined in flight by, for example, flying a 4-hole probe in place of the inlet?

p. 335 line 20: mentions table 3 for calculated results but Table 3 caption says it is experimental data.

p. 340. If 250 C does not fully evaporate ammonium sulfate, then why not go a little warmer? 300 C does fully evaporate ammonium sulfate and it would make results near the tropopause that much easier to interpret.

p. 347 discussion of relative fuel usage of ER2 and Geophysica: As mentioned above,

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when comparing different engines fuel flow is not a valid basis for estimating NOx emissions.

p. 348 discussion of not crossing the centerline of the plume. If the emission index is working properly, then it should account for differing dilution at the centerline and edges of the plume. However, this issue is small compared to the larger problem of assuming the Geophysica engines have similar NOx emissions.

p. 349 line 10: Use of a shroud is not likely to matter except for the largest particles, and there are few enough of those not to significantly affect a CN counter. On the other hand, bounce of ice off the shroud might create new problems.

Interactive comment on Atmos. Meas. Tech. Discuss., 1, 321, 2008.