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Atmospheric Measurement Techniques Discussions

Interactive comment on "A tandem approach for collocated in-situ measurements of microphysical and radiative cirrus properties" *by* Marcus Klingebiel et al.

Anonymous Referee #1

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The paper demonstrates a new facility to measure vertically displaced but horizontally and temporally matched observations of radiation and microphysics.

The paper was well written. I could understand it all. Another proof read would capture the last of any outstanding typos and gramatical errors. I think that the paper would benefit from ending with a list of pros and cons about the system in terms of its scientific capability (e.g. improved heating rates) and operational deployment (e.g. only allowed in military flight areas).

In general I think the paper needs to emphasise the usefulness of the system more. I have one main point that it would be good to see resolved (see line 358-360 comment),

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but otherwise i think that the paper is publishable subject to minor changes.

Specific points:

On reading the abstract i was not convinced why i needed to use this system. I think the paper needs to do a bit more to convince the reader that this is a useful technique.

line115. Does this mean that certification is limited to one payload and any changes require another certification?

section 2.6. It would seem more natural to move this section to just after section 2.3 or 2.4. Or move the flow simulation earlier. At the moment the flow simulation section sits in the middle of sections describing instrumentation.

line 260 0ppb - is it really that sensitive?

line 295 - do you mean smaller ice crystals nearer the top (lower fallspeeds and hence longer residence times at that altitude) ?

line 307. What was the relative humidity with respect to ice? Can you reconcile the 2D imagery in figure 6 with the diffusion grown images in Bailey and Hallett 2009 JAS fig5 for your temperature and humidity range?

line 358-360. This is the heart of the reason for flying a tandem formation. If you have one platform within cloud measuring the downwelling radiation and another platform slightly below measuring the same radiation then the difference between those two signals is going to provide information about the intervening cloud. It should not matter that one platform is not at cloud top. Perhaps the errors in the radiation measurements are too large to do this with the separation that was being used? Could a calculation be done to estimate what thickness is required?

It should now be possible to do a closure study where the microphysical information from AIRTOSS is assumed to represent a column of cloud between AIRTOSS and the Lear. An average along the leg could be used. This column can then be modelled with

a radiation code to estimate the effect on the radiation. The radiative response of this column of cloud can then be compared with the measured radiative difference. To me this would be the unique selling point of this system- the ability to carry out this type of analysis. This sort of closure study could be used to try and constrain unobserved quantities such as crystal roughness.

Fig8. Yes, this plot is good. The advantage of using the tandem platform for heating rates over single platforms should be emphasised more in the abstract.

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