Atmospheric Chemistry and Physics Discussions

Interactive comment on "Characteristics of particle size distributions in the tropical tropopause based on optical particle counter and lidar measurements" *by* S. Iwasaki et al.

Anonymous Referee #1

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Characteristics of particle size distributions in the tropical tropopause based on optical particle counter and lidar measurements

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Overview: In this manuscript the authors present data aerosol size distributions from a balloon-borne optical particle counter released in the vicinity of sub-visual cirrus clouds (SVCs). While the paper is technically well written, it appears to have some gaps that if filled, would make it a much more interesting submission. As it stands now the paper

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feels incomplete and difficult for the scientific community to apply. But, data such as this is rare, and if this paper is recast and some effort is made on the part of the authors I think it could be a good candidate for ACP.

Specific comments:

1) The title says this paper is about aerosol particle near the tropopause, the abstract aerosol particles in the vicinity of sub-visible cirrus. But going through the paper there are only 2 cases of sub visible cirrus. The paper need to get organized and be consistent all the way through.

2) Abstract and overall analysis: While the abstract says that this is a study using an OPC and lidar, we only see OPC data. The lidar is mentioned only for the detection of SVCs and only a maximum backscatter return is given. Inclusion of lidar data profile along with corresponding particle profiles from the OPC would be a logical addition to this paper. Similarly, given that this is a balloon, I would also expect some thermo-dynamic information. They do not present any soundings. This would really help the reader get some context for the measurements.

3) Section 2.1: Details on the OPC instrument could be beefed up. For example, this appears to be a closed celled system, but are there any heating or inlet issues? For example, how confident are the authors that aerosol particles are not modified in the sampling train. Also, they say there are 8 channels, but except for the total instrument minima and maxima, our only indications are from grabbing data in the figure. It would be nice if it was listed. They need to defend their index of refraction and their assumption that these particles are sulfuric acid. I can see ammonium sulfate and or smoke being pumped up to these altitudes. And (in relation to comment 2), what is the RH in the SVC layer? It is not necessarily 100%. If these particles are measured at near ambient conditions, I would expect the index of refraction to be lower than what was assumed. How sensitive is the instrument to refractive index or particle shape effects? Because the authors admit that they cannot differentiate between sulfate and

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ice particles, they assume channel 8 is ice, and all others are sulfuric acid. How do they justify this? Can they give us some indication or reference on why this was chosen? Getting ahead, it looks like from Figure 5 this is not necessarily a good assumption.

4) Section 2.2: In this section the authors state that the lidar sensitivity is 3x10ˆ-7 /m/str at 14 km. However, for the two cases of SVC presented the backscatter value is 2.5 and 4 3x10ˆ-7 /m/str at 17 km. This seems too close to the background noise. This is where showing the lidar profile couple with the thermodynamic profile form the balloon would be helpful in supporting their claims.

5) Section 3.2: I really don't understand the inclusion of relatively low quality GMS geostationary data here. If you could show an image that detects cirrus that would be one thing. But a simple black body temperature is very difficult to make any argument. The authors don't list the channel, and if it is 8-12 (which I suspect) how do they back out surface and other contributions. Looking at Figure 2, I don't see any connection between. What about MODIS or MISR cirrus detection. Can you get anything out of that?

6) Section 3.3-3.5: Instead of showing integrated number distribution, how about showing actual profiles? Also, show volume distributions as well-that is much more telling as to what is going on.

7) Section 3.6: Regarding "data not shown." Why is it not shown? Already they make a marginal case for sensitivity. They should come clean.

8) Section 4: Again, the claim that cirrus clouds were detected by the OPC would be much stronger if actual profiles were shown. Right now this is not entirely clear. Most of their discussion is unsupported with the data given.

Overall assessment: Looks like an interesting data set, but a great deal of work is necessary to make it coherent.

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 1595, 2007.