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Atmospheric Chemistry and Physics Discussions

Interactive comment on "In-situ measurements of tropical cloud properties in the West African monsoon: upper tropospheric ice clouds, mesoscale convective system outflow, and subvisual cirrus" *by* W. Frey et al.

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The authors would like to thank Grant Allen for his helpful comments and constructive suggestions. The issues raised are discussed below and most comments have been incorporated in the revised version of the manuscript. The questions and comments related to shattering and performance of the cloud particle probes are discussed in a separate reply with the title "On the issues of instrument performance and shattering artefacts for the FSSP and CIP" in order to avoid redundancies and streamline with the comments by Darrel Baumgardner and the other two referees. We proposed

to the editor to supply this separate document in a suitably modified form as online-supporting-material to our paper if accepted. The introduction and the summary were shortened, streamlined, and hopefully improved following the referees suggestions.

Major points:

Introduction/Summary and conclusions:

Introduction and summary are shortened, improved along the referee's suggestions and more focused on the scope of the paper.

Approach to particle shattering and FSSP and CIP spectra:

The corresponding arguments are described in detail in our separate reply. The bottomline is that the volume of data which have been selected out from analysis (due to poor overlap of FSSP and CIP measurements) is very small. "Poor overlap" conditions mostly occurred when the aircraft was performing "strange manoeuvres" like sharp turns, or when it flew through mixed phase clouds below 10 km. From the collected number of size distributions above 10 km only a few size distributions needed to be rejected.

Use of potential temperature: . . . **I am concerned that the use of 10 K bins in the UT is a little too wide. Could the authors consider a change in their binning**. . .**?**

In Figure 1 of the revised manuscript we changed the two lowest bins from 10 K to 5 K bin-width for potential temperature. At higher altitudes too few measurements are available (i.e. between 365 K and 375 K) and a higher potential temperature resolution seems not appropriate. Additionally, the geometric altitude change at those potential temperature levels is smaller. Therefore, the resolution with respect to potential temperature is maintained as in the submitted version for the higher altitude bin.

Minor points:
Section 4.3.4: Entrainment in relation to the NPF peak: Wouldn't any mixing be isentropic, rather than isobaric?

Yes, valid point. If one indeed looks at the data from Table 3 the pressure difference between the two layers is 6h Pa while potential temperature only changes by 4K and the ambient temperature is constant at 201K. In the revised version we removed the term “isobaric” and refer indiscriminately only to “mixing”. The quoted reference from Khoshrawi and Konopka (2003) describes mixing of two sub-saturated (with respect to H_2SO_4) cloud free air masses resulting in a supersaturated mixed air mass. Without a model calculation, however, such considerations remain speculative, and we pointed this out in the revised version, too.

P. 749. Line 9: The authors state that moist convection in a background dry adiabatic profile is deeper with larger hydrometeors. This is an extrapolation and does not take into account aspects such as wind shear and the role of entrainment – deep convection in moist free air can actually be enhanced by entrainment of moisture rich background air in rapid updrafts in the lower regions of the cloud. This sentence is intended to place importance and context on the role of West African MCSs so perhaps the authors could do this by removing (or completing) this thermodynamic discussion whilst retaining the references to TRMM measurements which show that West African MSCs are observed to be deeper with larger hydrometeors than others. Also, large hydrometeors (comparable to AMMA) were seen on occasion in ACTIVE and SCOUT-03 so this contrast in the observations is not clear.

This part of the introduction has been changed.

Technical points:
The technical points are all considered and the text is changed accordingly in the revised manuscript.

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 745, 2011.