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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Aerosol composition of the tropical upper troposphere" *by* K. D. Froyd et al.

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We thank the anonymous referee for their comments and suggestions. We have modified the manuscript text in several areas. Replies to the referee's Specific Comments are detailed below.

1. The sentence was clarified by specifying 'accumulation mode' aerosols. Nuclei and Aitken mode aerosols in this region are products of new particle formation, coagulation, and gas phase condensation. Although it is assumed that these smaller aerosols are composed of varying mixtures of sulfate and organic material perhaps with ammonium and nitrate, it is difficult to speculate on the composition of aerosols below the PALMS detection limit.

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2. Misspelling corrected.

3. The convective influence technique was clarified, and specifically, modifications to Pfister et al. 2001 were noted. The convective influence parameter was more clearly defined.

4. A detailed description of aerosol type selection criteria are added to Section 2, p 9404.

5. The referee suggests that the Ekman et al., 2006 model may not be appropriate for marine convection and that aerosol losses may be overestimated. The reference to the Ekman model in Section 5.1.1 regarding soluble aerosol loss in marine convection was removed.

6. The authors recognize that the manuscript covers a broad set of topics and could be made more concise. This broader approach was chosen due to the limited data available for the tropical upper troposphere. Overall, we maintain that presenting this array of topics may be most beneficial to the community and that the partitioned ACP format can effectively present this material. However, we have condensed scientific discussion in Sections 5.1.1, 5.2 and 5.3.1. In particular, section 5.2 was reorganized and streamlined.

7. Regarding oxidative capacity of the TTL, sonde data from several sources suggest that the TTL is a significant O3 photochemical production region due to CO oxidation in the presence of NOx. Although enhanced actinic flux due to reflection from lower cirrus anvils may contribute somewhat to oxidative capacity, the unusually long residence times of the TTL probably have a larger influence on photo-oxidation of organic species. A statement and references to oxidative capacity and O3 vertical profiles was added to Section 5.3.2.

8. The lightning NOx mechanism may lead to HNO3 production in the TTL. As the referee noted, NOx conversion lifetimes of several days followed by HNO3 uptake life-

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times will blur a lightning source of aerosol nitrate but nevertheless may contribute to TTL HNO3. We have noted this mechanism in the text.

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