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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Observations of ozone production in a dissipating tropical convective cell during TC4" *by* G. A. Morris et al.

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This manuscript examines a very interesting instance of an ozone sonde which ascended near a deep convective cell, got caught in successive downdrafts and condensation events, and ended up ascending and descending between 2.5 and 5 km several times over about a two hour period. This gave the opportunity to examine the change in ozone mixing ratio during this period, and to determine that a substantial increase in ozone occurs. Analysis of aircraft data during this campaign shows that changes of this magnitude during a couple hours are rare. It appears that the ozone increase can be attributed mostly to the production of ozone from lightning-produced NOx, as well as a possibly direct production of ozone by lightning.

I have reviewed a previous version of this manuscript for another journal (with a positive

recommendation, though it was apparently rejected due to critical comments from another referee). In this revised version, the authors have already done a commendable job of incorporating every one of my (extensive) previous comments, as well as improving the manuscript to account for several of the comments of the other referees. On the whole I find this an interesting and convincing analysis which contributes to a long-running discussion of the role of convection and lightning in the tropospheric ozone budget. I only have a few minor criticisms of the current version, and definitely recommend publication once these (and the helpful comments of the other two referees) are taken care of.

The discussion and summary section should be split into two sections: discussion (up to the last paragraph), and conclusions (final paragraph); furthermore, as suggested by the other referees, it would be valuable to extend the conclusions section to indicate the authors' conclusion (and reasoning behind it) for which effect or combination of effects is most likely to make the dominant contribution. Also, the direct production of ozone by lightning (LdO3) is a significant hypothesis, but it is only mentioned in the text and not clearly distinguished from LpcO3 in the conclusions; this definitely needs to be done.

P 18954 L 22-23: "...role of lightning *and convection* in..."

Section 2 would better be named "Methods" or similar – to me, "Background" implies the history and previous literature and basic theory, which are all given in the introduction.

Table 1 is a nice overview, but would be more valuable if it were put in some kind of sensible order (at least chronological, though some sort of topical sorting would be far better). For instance, the first 5 entries include Lelieveld, Lawrence and Doherty, three closely-related studies, interspersed with studies by Price and by Zhang, which are on completely different topics.

P 18961 L 14: "Estimated vertical velocities are derived..."; what are these values?

(only the horizontal, easterly winds of 10 m/s are mentioned later)

P 18965 L 15: “Morris et al., 2010” – what is this paper? (It is not in the references, nor mentioned earlier, as far as I could find)

The notation “LO3” (and “LdO3” and “LpcO3”) to denote ozone production (due to lightning) can be quite confusing, since in equation (3), “L(O3)” is used to denote photochemical ozone loss (this is very common notation and should not be changed in Eq. 3). I suspect the "LO3: stems from the commonly-used “LNOx”, but would suggest another notation here, e.g., LtO3 (LtO3d, LtO3pc), or LTO3 (LTdO3, LTpcO3), etc.

P 18973 L 8: “in *the* tropical Pacific”

P 18975 L 19: “reflective” should be “representative”

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