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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Anvil microphysical signatures associated with lightning-produced NO_x" *by* J. L. Stith et al.

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Referee Comment:

This manuscript is very well written and clearly presented. The paper presents very interesting results concerning the linkage of lightning NOx production with production of frozen droplet aggregates (FDAs). My only question concerns the processes by which NOx and the FDAs are produced and how they are represented in the paper. Does the FDAs production only require presence of a strong electric field, or do lightning discharges need to occur? NOx production definitely requires the lightning flashes to occur. The VHF source densities may be adequate to show the location of the strong electric field, but the actual NOx production would likely be better represented

by contour maps of the flash length derived from the LMA data. Providing the flash length information would be useful in comparisons of the magnitude of NOx from one storm to another and from the two cells in the 25-26 May case.

Author's response to referee comment.

We thank the referee for the helpful comments on the manuscript. Since the enhanced aggregation may be occurring via electrical forces, there is no requirement for lightning to occur, but Connolly et al. (2005) describes a threshold value of approximately 0.5 x 10ˆ5 V/m, which, depending on what is required for lightning initiation at the location of the aggregation, suggests that the two ought to often occur together or at least in close proximity.

The VHF sources arise due to the non-continuous nature of the electrical breakdown leading to a lighting flash and therefore indicate that the discharges have in fact occurred, so they serve our purpose of identifying the locations of the high electric fields and lightning. Lighting flash length would certainly be a worthwhile additional parameter to examine, which might, perhaps together with some measure of flash intensity, yield additional information on total amounts of NOx produced by the storms. While this appears to be a productive area for further research, we believe that the existing data serves our purpose adequately.

Author's changes to the manuscript.

We have added the additional clarifying comments on the threshold electric field, and we have added a sentence on the LMA section to better clarify the points discussed above.

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 31705, 2015.