

Atmos. Chem. Phys. Discuss., referee comment RC1  
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## Comment on acp-2021-79

Anonymous Referee #1

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Referee comment on "Measurement report: In situ observations of deep convection without lightning during the tropical cyclone Florence 2018" by Clara M. Nussbaumer et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2021-79-RC1>, 2021

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This manuscript describes the atmospheric chemistry observations from the HALO aircraft during flights into a tropical storm and a tropical wave during the CAFE-Africa field mission. The tropical wave contained lightning and as a result significant enhancement of NO was noted. However, the tropical storm contained little or no lightning, and NO was not enhanced. Other chemical species that were considered include CO, O<sub>3</sub>, DMS, CH<sub>3</sub>I, and H<sub>2</sub>O<sub>2</sub>. The findings for all of these species were as expected, with enhancements of CO, DMS, CH<sub>3</sub>I, and H<sub>2</sub>O<sub>2</sub> noted in the air parcels affected by deep convective transport from the marine boundary layer. O<sub>3</sub> minima were also noted in the upper troposphere resulting from convective transport of low O<sub>3</sub> boundary layer air.

The authors claim that this is the first report of in-situ chemical observations in deep convection in tropical cyclones with and without lightning. This is not entirely true. The authors need to reference the following papers and discuss their results in relation to them:

Newell, R., et al., (1996) Atmospheric sampling of Supertyphoon Mireille with NASA DC-8 aircraft on September 27, 1991, during PEM-West A, J. Geophys. Res., 101, 1853-1871.

Roux, F., et al. (2020) The influence of typhoons on atmospheric composition deduced from IAGOS measurements over Taipei, Atmos Chem. Phys., 20, 3945–3963, 2020  
<https://doi.org/10.5194/acp-20-3945-2020>.

The Newell results show NO enhancements due to lightning (discussed further by Davis et al., 1996) in some portions of the storm (near eye wall), but not throughout the storm system. However, the observations reported by Roux et al. do not include NO, but should also be referenced.

The authors need to modify this claim in both the introduction and summary.

Detailed Comments:

Lines 12-13: The ITCZ is not a broad area spanning +/- 20 degrees from the equator. It most often lies within this belt, but the convection associated with the ITCZ covers a much smaller range of latitude. Tropical cyclones may develop from ITCZ convection, but often they are not associated with the ITCZ.

line 17: 15 km or higher

line 31: Deep Convective Clouds and Chemistry

line 33: ....downwards due to gravity in the presence of supercooled water.....

line 42: Add reference to Cecil et al. (2014, Atmos. Res.)

line 78: WWLLN: there are many journal references to WWLLN that are available to use here in addition to the website. Please include some of them.

line 78-79: Data from in situ chemical measurements in the upper troposphere are sparse.

line 83: ...evidence of the chemical impacts of deep convection....

Figure 2: It would be helpful to also show the 1200 UTC satellite image for MF12

line 125: Deep convective transport generally occurs....

line 132: There are many other references for enhanced NO from lightning, and some of

them should be given here. Examples:

Chameides et al., 1987 - JGR; Ridley et al., 1987 - JGR; DeCaria et al. (2000) - JGR;  
Ridley et al. (2004) - JGR; Pollack et al. (2016) - JGR

lines 140-141: ...concentrations were overall larger for MF10 and MF12 than for MF14....  
This makes more sense with regard to the following sentence.

line 145: ...was likely above... Line 121 says the aircraft was at similar altitude as cloud tops.

line 147: mention that the peak DMS on MF14 was ~50 ppbv, which is greater than on MF12

line 157: ...for MF10 and MF12 (outside of convection)....

lines 161-162: ...convective processes with upward transport of low NO air from the marine BL

line 189: ....ITCZ just south of the Cape Verde Islands. Lines 159-160 say it is due to lightning over West Africa.

line 227: Need to mention that WWLLN is only detecting some small fraction of the total lightning that occurred because it has a rather low detection efficiency. Need to reference papers on WWLLN detection efficiency. See the WWLLN webpage.