Atmospheric Chemistry and Physics Discussions

Atmos. Chem. Phys. Discuss., referee comment RC3
https://doi.org/10.5194/acp-2021-288-RC3, 2021

Comment on acp-2021-288

Anonymous Referee #1

Referee comment on "High concentrations of ice crystals in upper-tropospheric tropical clouds: is there a link to biomass and fossil fuel combustion?" by Graciela B. Raga et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2021-288-RC3, 2021

This study investigates the frequency and characteristics of extreme ice crystal events (EIE) based on extensive aircraft measurements and explores the factors contributing to the formation of the EIE. The data set reported in the manuscript is highly valuable. However, I have critical concerns about the data analysis which must be substantially revised before the manuscript may be considered for publication.

My most important concern is that almost all statements in the manuscript that attempt to link EIE to aerosol sources are NOT well grounded. Some examples are Lines 25-27, 291-292, 337-339, 356-358, 364-365, 381, 391, 396-397, 446-447, 450-451, 490. The authors repeatedly attribute the EIE to high aerosol concentrations nearby. However, according to Figure 6, the overall CO concentrations are even slightly lower in EIE as compared to the scenes with low ice concentrations. Besides, Figure 11 shows that, while some EIEs do occur in the vicinity of high AOD, even a larger number of EIEs occur in regions with quite low AOD. After reading the manuscript, my impression is that the current results can hardly support any causal relationship between the occurrence of EIE and the occurrence of high aerosol concentrations. Please carefully reevaluate all related statements throughout the manuscript and either remove them or provide convincing supporting evidence. Also, in view of the above comments, the last two objectives stated in Line 136-139 are not appropriate.

Specific comments:

Line 20: not only anthropogenic sources but also biomass burning

Line 168-171: Please provide more details about the SOFT-IO tool since most readers are probably not familiar with it. How does this tool link in situ detected CO to emission sources? What are the main inputs to the tool?

Line 205: Please show the spatial extents of these four regions in at least one figure in the main text.

Line 240: This paragraph can be moved to the Method section.

Line 386: Correct the typo here.

Figures and Tables: I suggest that the error bars be added to Figures 4 and 8. Tables 1-2 can be moved to the Supplementary Information.