

Review of "How Rainfall Events Modify Trace Gas Concentrations in Central Amazonia" by Machado et al.

General

Machado et al. examined how rainfall events modify eight kinds of trace gas concentrations in an Amazon forest. The eight trace gases include CO₂, CO, CH₄, O₃, NO, NO₂, isoprene, and monoterpene. Their analysis is based on multiple year's measurement of these gases from the surface to 80 meters at tower in an Amazon forest. They divided these rainfall events into daytime and nighttime groups. They made composites for these two groups for each of the gases within a 4-hour window: from two hours before the peaking rainfall time to two hours after the peaking rainfall time. This involves a big effort in measurement and data analysis. The discussion is comprehensive. The presented results are valuable and can enhance our understanding of this research topic. Nevertheless, I have the following comments for the authors to consider when revising their paper.

The authors use a term, "fluctuation" of the trace gas concentrations, to show the rainfall impact without explaining how the fluctuation is defined. Is it the difference in the corresponding gas concentration at the time from the background concentration? If so, is the seasonal variation in the background concentration considered?

The authors provided the profiles in the daytime and nighttime for each gas during the rainfall event (Fig. 1). Can the authors also provide the background profiles without rainfall events?

I also believe that showing the actual ozone profiles during the rainfall events, in addition to their anomaly from the background, will help the authors to illustrate their points. Such profiles can be shown in the Supplement.

The authors used a 4-hour window that centres at "maximum rain rate". It is not clear how rainfall is distributed during the 4 hours. No rain at all except at the time with the maximum rain rate time?

As Figure 3 shows, the variation in rainfall is associated with changed in other meteorological elements (radiation, cloud cover, temperature, humidity, wind, boundary layer height, and GLM density). The authors discussed the impact of rainfall on the trace gas concentrations mainly based on the variations in other meteorological elements. The authors missed the discussion on direct rainfall impact on these gas concentrations through examining the solubility of these gases.

Line 282-290, "The decrease of CO₂ concentration within the canopy after the rainfall is directly linked to the simultaneous increase in humidity and cloud cover and decrease in temperature". The reduction in radiation is likely to be the main driver for the variation in CO₂ concentration, this is not explicitly mentioned. "Another possible reason could be associated with an increase in mixing within the canopy, destroying the stable layer within the canopy by mixing free

tropospheric air into the canopy.” Can the authors provide supporting evidence for this? This also applies for other discussions in the paper, the audience would be benefited if some pieces of supporting evidence are provided. If no supporting evidence, the authors can use phrases like: “we suspect”, “this study suggests”, or some expressions like that.

Minor

Line 245, 292, 327: Figure ??

Line 227, “Environmental”, “E” should be in a lower case.

Line 259, “Carbon Monoxide”, “C” and “M” should be in lower cases.

Line 349, Add “Fig.” before “5”.

Line 385, change “reported in (Pfannerstill et al. 2021)” to “reported in Pfannerstill et al. (2021)”. Similarly, in Line 392 and other places.

Line 348, can this reference be cited in this way? “Machado, L. and all: How the Amazonian Forest Produces New Particles, Submitted to Nature, XX, XX, 2023.”

Fonts for some figures are too small to read.