Review of dos Santos et al

May 23, 2023

This article presents measurements in rain water samples collected at a high-frequency in inland tropical Brazil. The article focuses on the day-night contrast between the isotopic composition of the rain, which can mainly be observed in summer. The authors conclude on the importance of sub-cloud processes to explain the day-night contrast. This adds to the growing body of research showing the importance of sub-cloud processes in controlling the water isotopic composition. This paper is significant for the community of people interested in interpreting isotopic measurements for applications both for present-day processes and for paleoclimate reconstructions.

The paper is generally well-written and illustrated. However, although the title focuses on the day-night contrasts, the article presents results at various scales: seasonal, inter-event, intra-event, diel. This mixture of time scales is confusing (major comment). The structure of the manuscript could also be improved. Currently the discussion section is very redundant with the results section and does not bring any new element.

1 Major comment: Confusion between time scales

- The article emphasizes the high-frequency sampling of the precipitating systems (5-10 minutes). This should allow the analysis of intra-event variations with precipitating systems. Why aren't these variations analyzed?
- The article focuses on the diel contrast between precipitating systems occurring during the day and during the night. Why is high-frequency sampling useful for this goal? What not just sampling the precipitation twice a day, once at sunrise and once at sunset?
- In Fig 3 and 4, what do the markers represent? Individual samples at the 5-10 minutes scale? Does the variability across markers mix the intra-event variability and the inter-event variability? If so, isn't this confusing to mix the two scales of variability?
- Fig 4 and Table 1 aim at identifying relationships for a given season and for a given period of the day across samples that reflect intra-event and/or inter-event variability. However, most of the discussion focuses on the day-night contrast. So it's not clear how Fig 4 and Table 1 feeds the discussion on the day-night contrast.
- Make different sections in the paper, one devoted to the day-night contrast, and one devoted to the inter-event variability and/or intra-event variability? Alternatively, the paper could be focused on the day-night contrast only.

2 Minor comments

- l 43: "low-level convergence (stratiform clouds)": no, stratiform are rather associated with low-level divergence, since there is a mesoscale ascent above the freezing level and mesoscale descent below [Houze, 1989, Houze, 2004]
- l 70: also high-frequency within squall lines, e.g. [Taupin et al., 1997, Risi et al., 2010, Tremoy et al., 2014]
- l 108: clarify errors using the same format as l 107.
- l 108: what is the error on d-excess?

- l 137: “used calculations” -> “used for calculations”
- l 139: “data, for” -> “data were used for”
- l 185-186: confusing: why aren’t there any rainfall samples collected at night during spring? Because of Ovid restrictions or because convective events occurred predominantly during the day? What percentage of events are we missing due to covid restrictions?
- l 188-189: unclear logical link: why are there equal amounts of rainfall during the day and nights? Previous studies suggest that this diel distribution mainly depends on the convective organization, types of convective systems and their propagation, e.g. [Tai et al., 2021, Sato et al., 2009]
- l 211: “different meteorological scenarios for“ -> “meteorological factors controlling”
- l 226: clarify. It really depends on the meteorological variable. Clearly explain which variable is higher and which is lower.
- l 236-237: Risi et al 2019 and Hu et al 2022 are not appropriate here. The coincidence between LCL and cloud base has been known for many decades
- l 243: “less vigorous” -> “smaller”
- l 244: the logical link between cloud depth and time of interaction of raindrops with the ambient air is not clear. Only the link with the cloud-base altitude makes sense.
- l 249: remove “(not include vapor isotope data)”. Because a lot can be said about convective processes with precipitation data, e.g. [Risi et al., 2010]
- l 251-254: unclear. Could be removed.
- l 263: clarify where the wind comes from: e.g. Northwesterly.
- l 277: cite papers documenting the isotopic signature of evapo-transpired moisture, e.g. [Salati et al., 1979, Gat and Matsui, 1991, Risi et al., 2013, Shi et al., 2022]
- l 292: Clarify and/or simplify. If both night-time events and all events come from the Amazon, nothing is different.
- l 294(295: this is not specific to day/night. I recommend to tighten the discussion to demonstrate one or a few key messages. e.g. what explains the day-night contrasts. Anything that is not specific to day or night shouldn’t be discussed here.
- l 296: “Therefore”: the logical link is not clear. The 2 sentences seem to contradict each other.
- l 305-306: this appears to contradict the rest of the paper and the summary schematic in Fig 5. Basically, there are 2 kinds of processes that can explain the day-night contrast: (1) local processes, (2) regional processes. How do you quantify the relative importance of these 2 kinds of processes? A clear picture should emerge on which kind of process is most important, and it should be cosistent between different parts of the text and the summary schematic.
- l 308: “partial evaporation and isotope exchange of raindrops” -> “partial evaporation of raindrops and rain-vapor interactions”
- l 320-324: clarify this rationale. Previous studies on the diurnal cycle of convection in this region could also be cited to support or refute the rationale.
- Fig 1: for which seasons are the back-trajectories plotted? In the text, different origins depending on seasons are discussed, but this does not appear on this Fig.
- Fig 4p-t: how are the different types of systems defined? It would be useful to add a subsection on this classification in the Methods section.
- Fig 5: why are droplets smaller during the day? This represents stronger rain evaporation, but is it consistent with observations of rain size distribution?
- Sub-section 2.4 on “convective rainfall classification”: where is this classification used in the paper? If not used, remove

References

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