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Interactive comment on "How Rossby wave breaking modulates the water cycle in the North Atlantic trade wind region" *by* Franziska Aemisegger et al.

Anonymous Referee #1

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General Comments

The manuscript addresses important questions regarding the influence of Rossby wave breaking on precipitation events that take place in the tropical North Atlantic. The questions belong to the more general framework of better understanding the interaction between low-level clouds in tropical regions and the large-scale circulation, which remains an outstanding problem in our current understanding of the climate system. The work presented here is based on a series of analyses conducted using a combination of reanalysis and a Lagrangian model, as well as data collected during a 24-day observational campaign that took place in Barbados in 2018. Notably, the data include

water vapor and liquid water isotopes. The authors show that Rossby wave breaking can play an important role in the water cycle at Barbados, and they identify and analyze patterns and mechanisms through which this can happen. I think that the paper addresses important questions with a sound methodology. The findings are very relevant, particularly as they show how high-resolution collection of water isotopes can provide useful information to advance our understanding of the climate system. I recommend the paper to be published after the authors have addressed a series of minor comments that are outlined below.

Specific Comments

- I understand that during the observational period, the "tropical flow regime" did not occur with a high frequency. However, in principle this does not imply that this flow regime could not occur with a higher frequency at other times. Would you consider including some discussion about that instead of neglecting it?

- Lin 138: This way of defining residence time does not seem to distinguish between parcels that are above a certain latitude continuously or in discontinuous intervals (provided that the totals are the same, obviously). Does this have an impact on your study?

- Judging by Figure 3, it would appear that 2018 is anomalous with respect to the climatology analyzed. Could you provide some explanation of why that is, maybe connecting it to large-scale modes of variability in the Atlantic?

- Line 407: The interpretation appears sound, but I do not understand the mechanism you are proposing. Cold pool gust fronts tend to be separated by the rain shafts of the clouds that generate them. How can they be influencing the re-evaporation of rain drops? Did you mean cold pools from another cloud?

- I found the fact that cloud patterns are associated with different deuterium excess very fascinating, although this is very briefly discussed in the manuscript. Would you consider expanding the discussion around Figure 16 (b) a little?

Technical Comments

- Line 146: Do I see correctly that Figure 3 is referenced before Figure 2? In this case, I would recommend switching the order.

- Figure 11, 12, 13: Please include axis labels

- Could you please ensure that the figures are color-blind friendly?

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