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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 #2

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In this manuscript, the authors present a detailed trajectory study of air parcels reaching Barbados and argue for the importance of extratropical processes in controlling the atmospheric hydrologic cycle in the North Atlantic trade region. It's a timely paper, coming soon after the EUREC4A campaign, and quite relevant to several ongoing issues involving the links between clouds, circulation, and climate. I found the paper interesting and well-written. I have no major methodological concerns, but I have several questions and comments that I hope will strengthen the presentation and clarify some of the arguments the authors are making.

(1) What's the benefit of the isotopes to this study? Other than identifying some basic

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consistency between the back-trajectories and the isotopic measurements, what are we learning from the isotopes? In this setting, the variability in water vapor isotopic composition is very small and co-varies with the relative and specific humidities. so what's the added value of the isotopes? Figure 16 is an interesting part of the paper, but isn't discussed enough. Would you be able to generate a similar figure just using specific humidity instead of d-excess, or is the d-excess actually telling us something that we couldn't determine from other humidity fields? Given the expanding interest in water vapor isotopes in climate studies, this seems like a missed opportunity to 'sell' the audience on the value of such measurements.

(2) I am confused by the calculations involved in the moisture uptake analysis. When the authors say that moisture sources are located, for example, 2000 km away from Barbados, does this mean that the actual molecules of water that are measured in their Picarro were evaporated from the ocean surface that far away? That seems like a surprising result - I would certainly think that the vast majority of water molecules measured at BCO would have been evaporated from the sea surface not far offshore. If the water vapor is really evaporated so far away, would the isotopic composition of that water vapor reflect the SSTs that far upstream? Is that the case, or are the isotopic measurements mostly consistent with SSTs in the immediate vicinity? Or perhaps the SSTs don't vary enough along the trajectory to generate a measurable difference? Does the Sodemann model predict the isotopic composition of the water vapor? It seems that this would be an opportunity for the isotopes to provide some real-world constraints on a model result. In any case, some discussion on this point would be worthwhile.

(3) The authors refer to 'air parcels' and quantify frequencies of occurrence, but isn't the definition of air parcels here based on the frequency with which they are running the back trajectories? It's a minor point, I suppose, but doesn't that affect the frequency calculations? Would you get different percentages if the trajectories were run every 15 minutes or every 3 hours?

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