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Atmospheric Measurement Techniques Discussions
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Interactive comment on "X-band dual-polarization radar-based hydrometeor classification for Brazilian tropical precipitation systems" *by* Jean-François Ribaud et al.

Anonymous Referee #1

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The manuscript has been improved through the first round of comments. The approach to hydrometeor identification is very objective, in that the number of categories allowed and associated characteristics is driven by the data itself (that is, there are not 20 categories that may or may not be distinguishable by the given radar data). It is a novel way to compare the characteristics of the wet and dry seasons using X-band radar data. I think with some relatively minor further improvements, the manuscript will be ready for release.

Despite the authors' response to my question last time, I still believe that separating convective and stratiform echoes, and therefore hydrometeor types, is unnecessary.

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Discussion paper

Have the authors compared (via the violin plots; I really appreciate this presentation method in the paper!) stratiform and convective aggregates, ice crystals, rain, etc.? I also wonder if these differences would pop out of the algorithm at all if they were all included together.

I'm also not completely sold on the explanation for differences between the wet and dry season in terms of their radar characteristics of different hydrometeor types and physical underpinnings. Obviously knowing microphysically exactly what leads to the differences is difficult to verify and perhaps even beyond the scope of this paper. This is definitely very interesting to think about. Is there a possibility of eventually bringing in aerosol / CCN information from the field projects in the area?

Pg 6, ln 125: I think "dangerousness" could be sufficiently replaced by "danger". Pg 7, ln 128: I'm not sure I understand what "climatically radar-dependent" means. Pg 8, ln 166 / Fig. 2: Is there any significant blockage to be concerned with? Pg 9, ln 173: Was there reflectivity calibration performed during these two different seasons to look for any potential drift that might account for differences between the seasons? Pg 10, ln 203: Has the acronym AHC been introduced yet? Pg 11, ln 222: I don't follow what is meant by "The first four components of each object are based on the minimum-maximum boundaries rule." What are the objects? Pg 13, ln 263: It occurs to me to ask what the actual sensitivity to the linkage rule is, and if it is the only "tuning" parameter in the classification algorithm? Pg 13, ln 269: Is an "observation" a single radar gate? Pg 13, ln 270: Is the temperature information constant across the domain? Pg 15, ln 309: Do you perhaps mean "below" instead of "on top" of the aggregate mixture? Pg 18, top: What happens if no temperature is included in the clustering? Pg 23, ln 475: Is there a word/phrase missing here (such as "the same as")? Otherwise this is confusing that the AHC is putting out four clusters as fuzzy logic outputs. Pg 24, ln 480: Not to be picky, but Table 6 shows the value is 2.6% which exceeds 2%, so I would round up and say "none of the clustering outputs exceed 3%". Pg 26, ln 536: Change to "rain was four times" (e.g. add 's'). Pg 27, ln 551: It is a little odd to me to

be talking about “drizzle” and breakup processes. Perhaps using the “drizzle/light rain” nomenclature above in line 549 would be helpful. Pg 27, ln 553: “. . .presents a more favourable environment.”. . .For what? Pg 27, ln 558: “The general wet rain microphysical species distribution thus still contains drizzle/light rain observations. This puzzling rain partitioning. . ..” I am not sure what is being conveyed here. Pg 28, “the melting layer is mainly driven by warm rain”. This does not make sense; what does warm rain have to do with the melting layer? I would think the characteristics of the melting layer, and resulting radar bright band which is what we are really talking about here, is driven by the ice particles aloft which are melting. Therefore, in this context, larger Zdr values might be related to larger particles in the ice phase aloft melting? Pg 28, ln 579: Strictly speaking, aggregates are not formed through vapor diffusion but through aggregation of more pristine crystal types that are grown from vapor diffusion. There may be a second issue here in that the aggregates category represents more than just the process of aggregation? Pg 29, ln 598: This sentence confuses me. Perhaps you mean “the production of larger raindrops results mostly from ice microphysical processes?” Pg 30, ln 615: “the higher the aerosol concentration is, the more the coalescence process is suppressed (thus, leading to smaller particles).” Are you talking about in the warm (rain) phase here? I thought this discussion was related to aggregates and ice crystals. Additionally, this is only half the story. In the warm phase, coalescence may be suppressed with increased aerosol, but if updrafts are strong (as they tend to be in the dry season as stated in 611), more water may be pushed above the melting layer resulting in more mixed phase processes such as graupel production. . . but what is the effect on ice crystals and aggregates?

Table 2: Please define S, V, T, and n.

Fig. 1: Might I suggest adding the current study on the diagram to make it clear to the reader how it fits in to previous work?

Fig. 3: Is it surprising that 1 cluster explains 88% of the variance for most of the methods?

Fig. 4: The green and blue of 7S and 6S in panel (g) are nearly indistinguishable in my printed version.

Fig 6: I was somewhat surprised to see “liquid” up to 8 km. However, I looked up temperatures for the region that might be associated with 8 km, and found them to be only -10 to -15 C. 1) is that correct, and 2) perhaps a temperature reference for 8 km could be added in the text (e.g. ln 355) for reference for the reader?

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