

Interactive comment on “Meteorological context of the onset and end of the rainy season in Central Amazonia during the 2014–15 Go-Amazon Experiment” by Jose A. Marengo et al.

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Interactive comment on “Meteorological context of the onset and end of the rainy season in Central Amazonia during the 2014–15 Go-Amazon Experiment” by Jose A. Marengo et al.

Anonymous Referee #1

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This should be accepted (with some mandatory revision) because it was written by the great José Marengo.

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Response: Thanks, will work on the revision.

The comments that I would require to be answered before acceptance are the following:

Page 1, Line 31: "...and also helping the developing Hadley and Walker circulation." Please either correct or elaborate on this phrase. Why is the Hadley circulation developing? Do you mean within the context of the seasonal cycle? And how does Amazon convection participate in the Walker circulation? My understanding is that the Walker circulation is an Indo-Pacific phenomenon.

Response: It is in the context of the seasonal cycle and more relevant to the Hadley circulation. In fact, the reviewer is right, the Walker circulation is a Pacific phenomenon, and what we have in the Indian, African and South America are east-west circulations, not the Walker cell. We will correct the text.

P1, L35: Can you support your statement that Atlantic SSTs affect Amazon precipitation with a sentence or two, similar to your description of the Pacific influence? And I believe it would be of value to describe, again briefly, the nature of the teleconnections in both the Atlantic and Pacific. For example, I understand the Pacific teleconnection works by shifting the Walker Circulation to the east, so during El Nino there is more subsidence over the Amazon. Since I have no idea how the Atlantic influences the Amazon, it would be nice to have an idea. Again, nothing new here, just remind the reader what other studies have concluded with a physical explanation. It is nice to have a picture of what is going on.

Response: Rainfall variability Amazonia is linked to El Nino, but EL Nino is not the only responsible for rainfall variations in Amazonia, the tropical Atlantic Ocean also plays an important role. While we had several droughts in Amazonia linked to El Nino, as in 1925, 1983, 1987, 1998 and recently in 2015, some other droughts events have been reported in 1963 and 2005, not related to El Nino but to a warmer topical North Atlantic. There are several studies that show that and I have listed them in a review paper (Marengo and Espinoza 2016) published in IJOC, and the various studies on the

effect of tropical Atlantic in rainfall in Amazonia are listed in the reference list of that paper. When the tropical North Atlantic is warmer than the tropical South Atlantic, the intertropical Convergence zone is moved northward leaving less rainfall in the region. This may happen at the same time with El Nino (1983, 1998) or without an El Nino (2005). Every drought in Amazonia is different in terms of spatial coverage.

2-8: How have people's perceptions been changed? Please explain a little better with some detail.

Response: In Amazonia, drought is perceived by the population as anomalously low river levels during the peak season May-July, and not much as low rainfall during the peak season in February-April. Drought is an impact while deficient rainfall is the climatic forcing of this impact. May be for some ecological impacts or agriculture drought may be more related to less rainfall during the peak of the rainy season.

2-10: I think it should be the plural, "show" but it is a complicated sentence.

Response: Yes, correction will be made.

2-13: "has"

Response: Yes, correction will be made.

2-22: "Variability" sentence does not actually make sense. "Variability" suggests variation, not necessarily long-term change.

Response: Yes, correction will be made. It is long term variability, without going into climate change time scales.

2-24 "70s"

Response: Yes, correction will be made.

2-27: "While it is important to know how will be" - badly written

Response: Sorry, correction will be made.

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2-29: "season"

Response: Yes, correction will be made.

2-33: Explain what you mean by, "problems in the hydrology of the region."

Response: This refers to anomalously river levels due to a poor rainy season.

3-9: This sentence repeats itself: "This may be due to the poor representation of clouds and land surface-atmosphere interactions or due to role of aerosols and other particles, which are still not well represented in models."

Response: Yes, correction will be made.

3-14: What do you mean, " Li and Fu (2006) showed that weak and infrequent extratropical cold front penetrations during the transition season also contribute to a delay of the wet season onset?" I presume you mean weaker and less frequent than usual, but if you do, you need to be specific.

Response: Yes, the reviewer is right, correction will be made.

4-2: What? "On the regional scale circulation features, during DJF2015 it did not show signals of..."

Response: Sorry, we do not understand this comment. We did look at line 2 in page 4, and did not find the statement above mentioned on this page.

4-34: Liebmann and Marengo used gridded rain data.

Response: Yes, we are ware of that and correction and will make this clear in the text.

I give up on the writing. Suffice it to say that it is badly written and needs improvement.

Response: Sorry if the reviewer finds the text badly written. Once the review process is over we will submit to text to a proof reading specialist in the US.

Please use scaleable, or "vector" graphics. Your rasterized graphics appear fuzzy and

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thus unprofessional. Figure 2 is not of acceptable quality. In addition to printing it using scaleable graphics, it needs latitudes and longitudes, continental outlines one can see, and perhaps fewer vectors.

Response: Sorry, we have prepared these figures for the review process only, and we are preparing new and improved figures that will consider all suggestions from the reviewer.

6-2: horribly written sentence: " On the regional scale circulation features, during DJF2015 it did not show signals of El Niño in the tropical Pacific while the warm surface waters are already present during MAM 2015..."

Response: Sorry if the reviewer finds the text badly written. We will correct this other unclear statements along the text.

6-6: From what do you infer reduced northeasterly trades? Is it from the vectors, even though the quantity present by the vectors is the integral to 500 hpa, or is it from assuming flow nearly parallel to surface contours?

Response: While the anomaly vectors in Figure 2 shows the small wind anomalies suggesting weakened northerly flow, we will include a new figure for the low-level circulation patterns (850 hPa). The 850 wind maps from CPTEC INPE show in fact reduced Northeast trades during January to April 2015.

6-5: Assuming that you are using the vectors to make the statement, "The low level circulation over the tropical North- Atlantic and Amazon sectors (Figure 2) showed reduction in the Northeast trades....," I disagree (assuming my guess about the map domain is correct). Yes, along the equator (assuming Fig. 2 is centered on the Equator), there are westerly anomalies, but these are away from the coast (looking at DJF). Along the Atlantic coast and north of the equator, however, the anomalies are near zero. There are huge positive transport anomalies from the equator into the southern Amazon, which are consistent with above-normal precipitation to the west (south of the

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equator), as there appears to be anomalous convergence of moisture there (Fig. 2a). So, please explain why this is inaccurate and why your statement is correct.

We noticed some errors in our explanation and we thank the reviewer for making this visible to us, and we will work on corrections in the text. In fact, the correct test should be: "The low level circulation over the tropical North-Atlantic and Amazon sectors showed INTENSE in the northeast trades, suggesting HUGE POSITIVE moisture transport from the tropical north Atlantic into the Amazon region in austral summer and fall of 2015, which are consistent with above-normal precipitation to the west"

6-7: Why are Figures 1 and 2 made from seasonal averages, while Fig. 3 is from monthlies? Would it not be better and certainly more consistent to use seasonal averages in Fig. 3?

Response: Figures 1 and 2 provide the context of rainfall and circulation detected during austral summer and fall of 2014. Figure 3 is more concentrated on the months where the onset of the rainy season occurs, mainly for January 2015. We consider that having Figure 3 for seasonal time scale it may miss the signal of upward and downward motions linked to development of convection and rainfall along the equatorial region and over Amazonia.

6-10: The authors may have a valid point, but I believe they should hone in more on Brazil. Nothing is discussed east of the GM, so why not just show the longitudes of South America, plus or minus a bit? And perhaps the shading interval on the anomalous maps should be lowered, as with the present interval it doesn't look like much is going on over South America.

Response: We chose longitudes beyond South America because we wanted to see the signals of El Niño in 2015 in other regions as well as over Amazonia. We will change the shading interval as the reviewer suggested.

6-13: " Therefore, interannual variations of the wet season onset in the Amazon appear

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to be influenced by changes in large scale and regional circulation over the tropical and Pacific sectors."

Response: We realized that there is a missing word, it should be: Therefore, inter-annual variations of the wet season onset in the Amazon appear to be influenced by changes in large scale and regional circulation over the tropical Atlantic and Pacific sectors."

6-21: Instead of, "meaning a rainy season shorter than normal" how about, "meaning a rainy season that was shortened at both ends."

Response: Thanks, we will do as the reviewer suggested.

Figure 4 is a little disturbing to me because it does not appear the INMET and UEA records match very well the NOAA records. Looking at the bottom record (Manacapuru), there is no rainfall at all within several days of onset, and it continues to rain for at least a week or so after the NOAA end. I know Manaus is a long record and I assume so is Manacapuru, so why not use the daily station data to do the onset and end calculations? You know that the actual station data is the best record available, so I don't see any reason to use NOAA. I think your point could be made more succinctly and more accurately.

Response: We found daily rainfall from INMET data from Manaus from 1961 to 2016, while data from Manacapuru is available from 2008 to 2016. There are some gaps on the information so we have to make some analyses for data consistency and homogeneity. We will consider re making the figure using rainfall data accumulated in pentads and not n daily data. If the data is consistent and available for 204-2016, we will re-do Figure 4 and also re calculate the onset and end of the rainy season using Liebmann & Marengo's criterion but applied to the grid box that contains Manacapuru and Manaus, and no longer using the NOAA data for this.

6-25: "which are not common for the wet season." This cannot be stated without any

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sort of justification, such as a reference.

We will add some references to support this statement.

Conclusions: Please make sure your conclusions match your discussion in the Results section. For example, you discussed the change in moisture transport (which I disagreed with), but this discussion did not make it into the conclusions.

Response: Thanks, we will work on that.

Good luck - Brant Liebmann

Response: Thanks greater Brant, really appreciate your suggestions and input that will improve the paper.

General response: We are redoing some of the figures, and as soon as we get the comments from all reviewers we will incorporate them on the text and produce a new version, that will be sent to a professional proof reader for editing and text correction, and we will submit that revised version to ACP.

Please also note the supplement to this comment:

<http://www.atmos-chem-phys-discuss.net/acp-2017-22/acp-2017-22-AC1-supplement.pdf>

Interactive comment on Atmos. Chem. Phys. Discuss., doi:10.5194/acp-2017-22, 2017.

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