HESS - Manuscript Review

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Author(s):
Nicolás Duque-Gardeazabal, Andrew R. Friedman, and Stefan Brönnimann

Title:
An Atlantic influence on evaporation in the Orinoco and Amazon basins

General Comments
This paper aims to describe the influence of Atlantic modes on evaporation in the Orinoco and Amazon basins and provide a description of the underlying physical pathway. The paper is well written and well-embedded in the current literature on this topic.
My main issue has to do with the chain of physical processes between the Atlantic modes and evaporation. The chain has some side branches that should be better explored. Figs 2-5 that present the main results are impenetrable. On the one had they show results that are not so much discussed and on the other hand the chain of physical processes is hard to follow with many variables plotted in the same panel. Another link in the physical processes is presented already in Fig1. This makes it very difficult to follow. I make some recommendations on how to improve this.

There are some more discussion points. To incorporate these points requires some work, but if discussed/implemented properly I do recommend publication of this paper.

Specific Issues

1. **Data – spatiotemporal scales**

   One of the attractive aspects of this paper is that it includes many data products. This fortifies the conclusions drawn as they are not hung up on a single methodology. In Section 3 the spatial extent of the AO regions are specified as well as the total timeframe (Dec1979-Nov2020) and the aggregated time resolution of the data (3 months). The information on spatial and temporal resolution and the method of aggregation of the underlying original data products is unclear or scattered over different sections and figure captions. As this is a data driven study, this requires attention. The most logical place for this is the Data section (Section 2).

   Specifically:

   - Spatial aspects:
     - Mention the spatial resolution of all the data products.
     - How did you deal with gaps in the spatial data (e.g. in the satellite products)
     - What is the common grid resolution that all products are projected on and how did you regrid data the data going to either coarser or finer resolutions
   - Temporal aspects:
     - Mention the temporal resolution of all the data products.
     - What was the method of aggregation to the 3-month products that you use in the analysis? For some variables such as ET and precipitation it can be sums or averages.
     - What was the method of aggregation from the 40-years of 3-month aggregated products filtered by O-phase. In the caption of Fig2 I see that precipitation is averaged but it is not clear if it this refers to a 40-year average of 3-month precipitation sums or averages. For ET no aggregation method mentioned.
     - The derived data products (e.g. MDiv, …) are based on non-linear relations. In which order did you do determine the 3-month aggregates? Did you determine MDiv based on 3-month aggregate fields of moisture or did you determine MDiv based on hourly data and aggregate those?
     - What about night-time data? For the relation between radiation and ET it matters whether you include night-time data or not.

I think a Table with an overview of the data products and their original spatial- and temporal resolutions would be a good addition followed by a description on how you bring these data together.

2. Atlantic mode to ET chain

In the introduction you state that links between the Atlantic mode and the hydrometeorology in the Amazon has been mainly studied from a statistical perspective and that one of the innovations of this paper is that you will explore the underlying physical mechanisms. In the methodology section you don't explain how you will do this, but at the start of section 4.2 you outline an Atlantic mode to ET chain that I interpret as a chain, your chain, of underlying physical mechanisms. Is that correct?

You outline the chain as:

atmospheric moisture transport anomalies → (moisture flux divergence, clouds and radiation + precipitation and Soil Moisture) → evapotranspiration.

Arrows indicate that variables change/impact the following variable(s). Variables between brackets are changing simultaneously.

If exposing the physical mechanisms is indeed the main goal, this chain should be better defined in the methods section and followed through in the presentation of the results.

To start, I see the chain not so much in a straight line but more of a branched chain:

- Atlantic-mode chain (external moisture)
  - atmospheric moisture transport anomalies → moisture flux divergence → clouds → (radiation + precipitation).
  - Precipitation → Soil Moisture.
  - Soil Moisture + Radiation → evapotranspiration
- Moisture recycling chain (local moisture)
  - evapotranspiration → clouds → transport → rain
  - evapotranspiration → Soil Moisture (negative feedback)

Moisture recycling is a well-known mechanism in the Amazon region. You make an effort to separate the Atlantic-mode effect from ENSO. Can you do the same for a direct Atlantic-mode effect versus the following moisture recycling that can be seen as a secondary effect? This deserves at least a discussion. Right now you mention the term moisture-recycling briefly around line 250 without giving an idea of its impact.

Figs. 2-5 are beautifully composed and very rich in the use of data products. They try to both show the chain of processes (panels on the left-hand side) and show ppt anomaly + temporal variability of ppt and ET over the Atlantic modes and when they coincide with ENSO (panels on the left-hand side). This too much and at the same time too little, as the chain is very difficult to follow because of lack of detail. For instance, the ET anomaly is at the end of the chain and its most direct drivers are soil moisture and radiation. The soil moisture anomaly is plotted clearly in a separate panel but the radiation anomaly is given as hard to distinguish contour lines in the ET panel. This suggests that the soil moisture anomaly is more important but Fig 1 shows that most of the region is energy limited.

Some suggestions to improve this:

- Move all the right hand panels that are hardly discussed to a separate section or supplementary materials. Maybe in the now very short Section 4.3 as these panels show the interplay with ENSO which is discussed in 4.3?
- Expand the left hand panels: VIMF and MDiv can be combined, but ppt, SM, Radiation and ET should have their own panels. Contours of driving variables could be added on top of a plotted variables, e.g. contours of rain on SM or contours of SM and Radiation on ET.
- In addition:
  - Black dots are explained for SM but not ET. I assume it means the same thing? Do you need it? It is hardly discussed.

- Net radiation, now plotted with contours, has relatively small (3 W/m2) anomalies. Is that because the night is included that contributes very little to the anomaly?
- Does it make sense to add a correlation between the ET anomaly and the radiation and soil moisture anomalies in line with Fig 1 to see which one is dominant in explaining the differences for each Atlantic mode? This could replace Fig1. Alternatively consider adding the ET regimes (Radiation or SM driven) marked in Fig1 to the ET anomaly panels of Figs2-5
- Variable names are missing in the Colorbar titles of panels a+b (precipitation) and g+h (ET). It is given for panels d+e (SM)

3. Figure1

If I understand well to the top panels give the maximum correlation of either SM or net radiation (Rnet). In the panels at the bottom the variable of maximum correlation is given. The "neither significant" seems to indicate pixels where the correlation with SM and Rnet are not sufficiently different to declare a winner. At the same time there are winners that have very low correlations with r2-classes going down to almost 0. Doesn't it make more sense to define "neither significant" as pixels where r2 is below a certain threshold (maybe 0.5 or 0.6)?

4. Tower data

You use model data and satellite remote sensing products that are models themselves (e.g GLEAM) or rely heavily on empirical calibrations procedures (e.g. Soil Moisture). Did you consider to do this analysis for in-situ tower data? There are now many, long-term tower sites in the Amazon, which can be filtered based on the same Atlantic mode index and evaluated for the rain-radiation-soilmoisture-ET chain. It would make the message stronger.

Minor issues:

1. Line 26: remove "planning" and replace "achiving" with "achieving"

2. Line 30: replace "…physical mechanism is..." with "…underlying physical mechanisms are …".

3. Line 37: replace "besides" with "as well as"

4. Line 50: previously you also mentioned TNA as relevant Atlantic mode. Motivate why you will not include that one in this study

5. Line 68: "related"??? Do you mean "relates"?

6. Line 73: You take the first soil layer, is that because the root-zone is defined in this layer?

7. Line 79-80: Incomplete sentence "MSWEP also uses ERA5 rainfall estimates but strongly in the extra-tropics whereas …"

8. Line 95: Rephrase "SM and net radiation are classified with a multi-linear regression slope,.." to "SM and net radiation are classified with the slope of their multi-linear regression against evaporation, .."

9. Title section 4.2: replace "… and the evaporation" to "..and evaporation"