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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Wet and dry spells in Senegal: Evaluation of satellite-based and model re-analysis rainfall estimates" *by* Cheikh Modou Noreyni Fall et al.

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General comments

- The language of this manuscript is imprecise and altogether not of acceptable quality, which makes it difficult to review in the first place
We understand the reviewer's opinion. To correct these errors we had the entire article proofread by a native English speaker. We have thus made significant changes to the text to ensure that it is in line with the journal's requests.

- Interpretation and putting into context of the presented work / comparison with existing

literature on dry and wet spells in the region is essentially entirely missing
We partially agree with the reviewer. Significant efforts have been made to better contextualize this work in relation to previous work. However, the bibliography on this topic in this region is very limited and we have focused on the articles that are relevant to this study. Through the review, no specific study is proposed. We hope that the integrated articles will be satisfactory for reviewer.

- The goal of evaluating the performance of different datasets for dry spell and wet spell identification was not achieved as there is hardly any information that goes beyond a pure description of given plots, leaving it to the reader to come up with a conclusion
Here again, we partially agree with the reviewer. Indications on the quality of detection of wet and dry spell have been made in this study and, in the conclusions, recommendations are made. However, we agree with both reviewers that it is necessary to do a better synthesis work to avoid too much descriptions and to discuss in more detail the conclusions and origins for these results. This is why a large effort has been made in section 3 (results, simplified in the new version) and section 4 (discussion, where the consequences and possible reasons for these results are discussed). The conclusion section has also been modified to highlight the most significant results.

- Figures need to be revised (axis, overall readability, caption descriptions, annotations and plots cut off)
All figures have undergone quality control to meet the requirements of the journal.

- Conclusion only summarises plots all over again
As previously mentioned, the conclusions has been entirely rewrote to focus on the key results of this study.

Specific comments, which are not exhaustive:

p5 Methodological approach: This section is too short – were the metrics calculated on the entire time series / per month / per pixel etc? Please also say something about the

usefulness of those metrics. For example, WS99P seems to be an unnecessary metric as, per definition, the "number of extreme days" is will be 1identified >=1mm wet days.
We agree, this section needs to be developed, particularly on the indicators developed. Indeed, all DS and WS indicators are calculated for each pixel from the daily data. The usefulness and the objectives of having a large spectre of indices (from mild to the most extreme definitions) is now better justified. WS99Ps are the most extreme events we could detect in our analysis. Because of their potentially extreme impact we have to include them in our analysis even if they are rare.

- Could you state the rationale behind looking at 90 - 99th centile 'wet spells' only, rather than including lower thresholds that are agriculturally relevant?
That is a relevant question. The purpose of this paper is to provide a wide range of potentially high-impact event indicators. Thus, we focused on potentially impacting wet (WS) and dry (DS) events. DS are studied because their presence and duration can generate a rain deficit and droughts that can impact yields. WSs are able to destroy seedlings and crops through heavy rainfall or subsequent flooding. The detection of DS is based on previous studies that define these periods as periods of non-precipitation.

- Please show the number of rainy days per dataset as that's what the other metrics are based on
This information is already provided by the distribution of dry days (Figure 3) and the distribution of cumulative rainy days (Figure 10). The text has been revised to clarify this point.

p5 ll 25-26: "The duration categories of wet spells are chosen to correspond to the different synoptic systems causing rain in West Africa (Froidurot and Diedhiou, 2017)." What does that mean? How does it address the "different synoptic systems"?
In this sentence, we justify the durations of the wet spells according to previous studies that highlighted synoptic origins of the rainfall. One of the most important drivers of the mesoscale convective systems is the African Easterly Jet. This perturbation generate a signal at around 3 to 5-d period. Nevertheless. We have completely modified this

paragraph to clarify this point.

p6 ll13-14: why does the TRMM radar explain this?
The TRMM satellite is the first satellite with an active radar instrument onboard. It is a powerful added value since it provides a profil of the rainfall activity. This is especially important over tropical region where unsateurated downdraft and evaporation of the rainfall is important. It is also important since the rainfall estimates is not based on a proxy of the top of the convective cells. This estimation is quite common and derived from passive radiometer but shows some bias (overestimation) during the collapsing period of the convective cells. This point is now clarified in the document.

p6 p15: Please indicate on the map where the Peanut Basin is
The basin is now indicated in the map as suggested

Figure2: While larger patterns are reflected in the datasets, local differences in the transition zone can be large. Please consider to show all datasets as a difference from OK (since OK is used as reference dataset later on) to help the reader spot biases more easily
Modified as suggested

p6 17-19: how was this "dry day" when the entirety of Senegal is < 1mm?
Thank you for the question, this percentage of dry days is the number of dry days compared to the total number in each month averaged from 1998 to 2010 and on all pixels in Senegal. Note that a dry day is defined as any rain <=1 mm. This has been clarified in the caption of the figure and in the text.

- Generally, please consider adding 1-2 further maps that can take into account the extreme rainfall gradient and illustrate regional differences in those metrics
As suggested by the reviewer, additional figures have been added in the supplementary material to address this point. Nevertheless all types of uncertainties and case cannot be discussed and plotted in the main document.

p 6 l24: why is this a paradox? Also, what is the take-away message for the reader from this section?
The paradox is illustrated by the fact that the products with the lowest number of dry days in our study (namely TAMSAT and CHIRPS) tend to underestimate seasonal accumulation. This is particularly true in the South. The take away message, related to the uncertainties of the detection of wet and dry spells, and about the quality of each product, is clearly provided in conclusion.

p6 l26: " Fig. 3 also illustrates a higher variability from the seasonal scale to intraseasonal scale." please explain more clearly
The idea is to show that despite a fairly good agreement on the spatial distribution of seasonal accumulation, the intra-seasonal distribution of dry days shows larger disparities between products. The sentences have been rewritten to clarify this point.

Figure 4 has boxes cut off – please replot
Corrected as suggested

p7 ll11-12: "The seasonal cycle of dry spell shows slight differences between products which confirm that this events characterize false start and early cessation of season in Senegal. " Please explain more clearly
In this sentence, we relate the detection and the anomaly of dry spells and some other characteristics of the rainy season, namely the false start (when a dry spells occurs just after the first rainfall event of the season) and cessation. As mentioned previously, this paragraph has been rewritten to clarify this point.

p7 ll13-14: what does illustrate the severity of DSC and DS? What is this severity?
These rainy breaks (dry spells) can be detrimental to yields, especially when they occur at the beginning of the season, causing farmers to lose seedlings. In addition, they can occur in the middle of the crop maturation season to generate water stress by lowering the WS (Water satisfaction) of the plants. The severity of dry spells defines their potential to be dangerous. Due to the nature of the precipitation values, it is not

possible, unlikely wet spells, to assess this severity by using the intensity of the rainfall during dry spells. So they are only estimated by the duration of events. In this study, we have selected the longest and therefore the most severe DSC and DS.

P7 l16 It's rather within the seasonal cycle than at a given date
Corrected

Figure 6: what is the x axis? Where does the "0" belong? Please provide complete descriptions in your figure captions
Figure 6 is a typical Taylor diagram. Radius expresses the standard deviation, the angle the correlation and the distance from the bottom right point, the RMSD. The caption has been clarified as suggested.

Figure 10: why does the daily rainfall only start at about 15mm per day?
Sorry for the missing information. We started the analysis with precipitation above 10mm. This is now mentioned in the text and in the caption.

P9 l5: worth to note that WSM 99P is only the rarest because it is the only defined wet spell metric that does not have a predefined number of occurrences per definition of percentile thresholds
This is correct. We have mentioned that in the modified version.

p9 ll 8-9: please explain the part with the fraction more clearly
The fraction related to the total number of data available has been clarified. Due to the comment of the first reviewer, this paragraph has been deeply modified.

Generally, this is a section when having a map would be interesting in order to see in which region the dry spells are particularly hard to catch for certain datasets
We thank the reviewer to point out this good remark. This map has been added

Figure 12: It's very difficult to make out the different datasets in this plot (please improve)
We agree there is a lot of information in that figure. Nevertheless, we have modified it.

and the last two years of OK look rather questionable - can you comment on that? Please explain where you see a clear increase in this.
As suggested, we have discussed the issues of the recent years using OK that could be due to the missing datasets.

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