Reply to reviewer 1

We would like to thank reviewer 1 for his constructive comments and suggestions that will help to improve our manuscript. Our answers to the reviewer's comments are written in purple, and the comments of the reviewer are in black.

Review for "Future changes in the mean and variability of extreme rainfall indices over the Guinea Coast and role of the Atlantic equatorial mode" by Worou et al.

Overview

The present manuscript investigates the current and future characteristics of West African rainfall according to an ensemble of 24 CMIP6 GCM models and further relates them to the development of the Atlantic equatorial mode (AEM), which has been a driver of rainfall over the Guinea Coast region. The authors use 12 ETCCDI rainfall indices to compare the nature of present-day rainfall with gridded observation data, i.e., CHIRPS, as well as with the rainfall behaviour in three future periods (near- term, mid-term, long-term) under the strongest SSP5 scenario (SSP5-8.5). By regressing CHIRPS rainfall indices to the AEM index, a reference is created in order to assess and quantify changes in therelationship between future extreme rainfall and the variability of AEM over the Guinea coast. The main results indicate increasingly less frequent but more intense rainfall over a gradually shorter period in the future. Furthermore, the AEM is suggested to have a diminished influence on future extreme rainfall over the Guinea coast region due to a decrease of AEM variability.

An increased knowledge about climate extremes over West Africa, especially that of rainfall, is of high importance for the assessment of current and future risk and subsequent development of risk mitigation strategies, action plans and decision making. In that regard, this study has the potential to be of high relevance for this part of the scientific community. However, as will be pointed out in more detail in the comments below, my biggest concern is the usage of CHIRPS for a study revolving around rainfall extremes, which potentially require a major revision. Furthermore, the study becomes diluted by the high number of rainfall-related indices, some of which are not particularly necessary to include in my opinion. Therefore, the presentation of the results somewhat suffers from an overload of numbers and a lack of structure. Overall, the topic of the manuscript is within the scope of WCD. Beingnon-native in English, language appears fine to me with only minor corrections to perform.

General comments/questions

- As mentioned above, by biggest concern is related to CHIRPS being the reference in a study about extreme rainfall. While it excels at interannual timescales over Africa (e.g., Camberlin etal., 2019), it struggles with the representation of rainfall in the extreme spectrum by showing substantial underestimation tendencies at a daily timescale (e.g., Sanogo et al., 2021; Ageet et al., 2022). Therefore, I do not think that relying on CHIRPS alone is sufficient to address theresearch question of this manuscript. Based on the outcomes of recent validation studies, I suggest to include the exercise with either GPCC-FDD (Becker et al., 2013) or one of the GPM products GsMAP or IMERG (Kubota et al., 2007; Huffman et al., 2015). This will allow tomake at least basic statements about the uncertainty that stems from the observational data themselves.

  Thank you for this constructive comment. We will include five additional observed rainfall datasets in our analyses: ARCv2, PERSIANN, REGEN, TAMSAT and GPCC_FDD_v2022. We do not consider GsMAP and IMERG datasets in the revised manuscript, as they do not cover our period of study (1995-2014). However, we consider them in Fig. R1.1, to compare their annual cycle characteristics to the other observations. This figure will be added in the supplementary material, and it shows that the annual cycles of the extreme indices in GsMAP and IMERG are consistent with the ones of the other datasets.

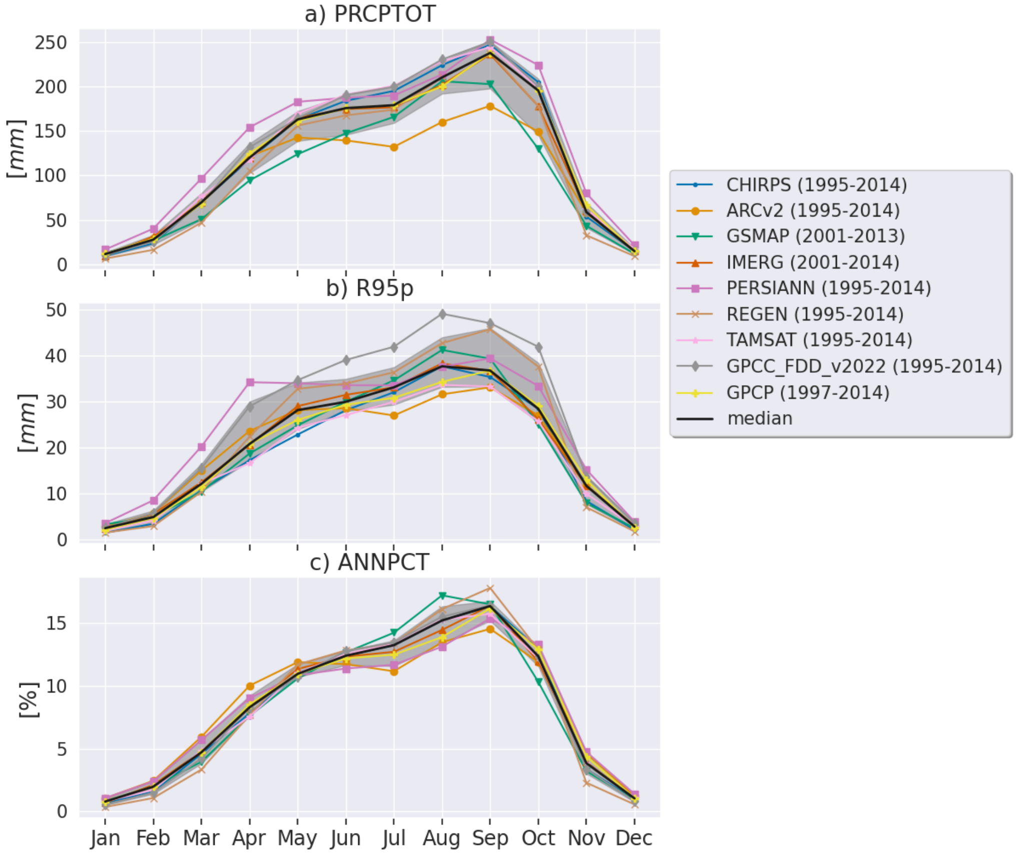


Figure R1. 1 Annual cycle of the (a) total wet day precipitation (PRCPTOT), (b) very wet days precipitation (sum of the daily rainfall over days when the rainfall exceeds the 95^th percentile), and (c) contribution of the total monthly rainfall to the total annual rainfall, for nine different observational datasets. The period considered for each dataset is displayed in the legend. The ensemble median of the observations is indicated by the black curve. The grey shading shows the 10^th to 90^th percentile range of the observations.

- How did the authors choose the study periods? I was wondering why the long-term future wasselected such that it exhibits a 20-year gap to the mid-term future, while the latter directly follows up to the near-term future. Can the authors elaborate on that?

  We choose the different periods of the future according to some defined periods in the IPCC AR6, more specifically, Table SPM.1 (page SPM-17 of the summary for Policymakers, in the IPCC AR6 WGI). We will add this information in the revised version of the article.

  These periods can be easily found in the IPCC Working Group I Interactive Atlas (https://interactive-atlas.ipcc.ch/regional-information#eyJ0eXBlIjoiQVRMQVMiLCJjb21tb25zIjp7ImxhdCI6OTc3MiwibG5nIjo0MDA2OTIsInpvb20iOjQsInByb2oiOiJFUFNHOjU0MDMwIiwibW9kZSI6ImNvbXBsZXRlX2F0bGFzIn0sInByaW1hcnkiOnsic2NlbmFyaW8iOiJzc3A1ODUiLCJwZXJpb2QiOiJmYXIiLCJzZWFzb24iOiJKdW5BdWciLCJkYXRhc2V0IjoiQ01JUDYiLCJ2YXJpYWJsZSI6IlJ4NWRheSIsInZhbHVlVHlwZSI6IlJFTEFUSVZFX0FOT01BTFkiLCJoYXRjaGluZyI6IlNJTVBMRSIsInJlZ2lvblNldCI6ImFyNiIsImJhc2VsaW5lIjoiQVI2IiwicmVnaW9uc1NlbGVjdGVkIjpbXX0sInBsb3QiOnsiYWN0aXZlVGFiIjoicGx1bWUiLCJtYXNrIjoibm9uZSIsInNjYXR0ZXJZTWFnIjpudWxsLCJzY2F0dGVyWVZhciI6bnVsbCwic2hvd2luZyI6ZmFsc2V9fQ==) :

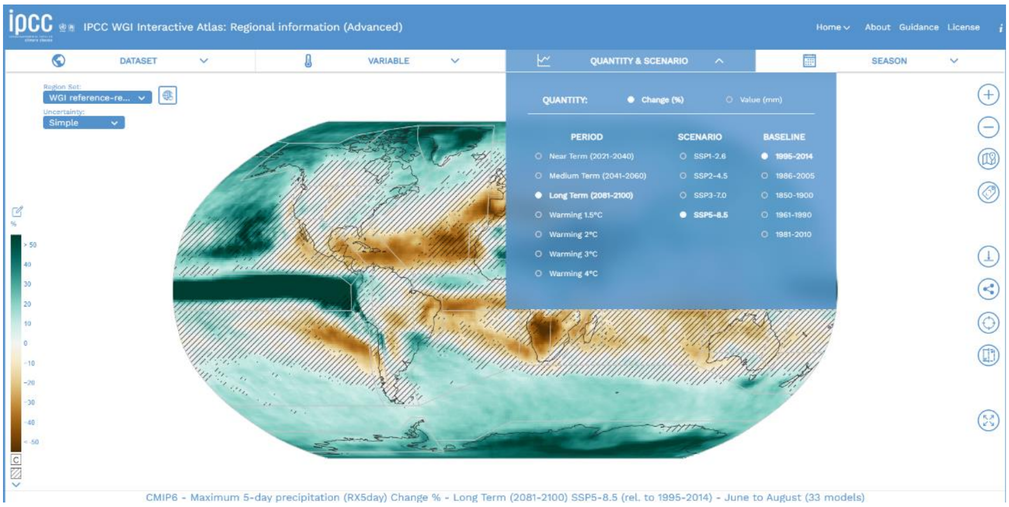


Figure R1. 2 An example of the defined periods in the IPCC AR6. The near-term, medium term and long-term futures correspond to 2021-2040, 2041-2060 and 2081-2100 periods, respectively.

- The study somewhat suffers from the plethora of indices and/or the lack of a structured presentation of their results. For instance, is it necessary to include both the 95th and 99th percentile (same for R10mm and R20mm)? Is it worth to include PRCPTOT when SDII is basically the same but defined as a rate? Regarding the structure, with these many indices, it can become difficult for readers not familiar with these to keep track of the arguments being made and being confronted with too big panels. I understand that the current structure followsa logical build-up going from the current situation to the perspective in the future followed by the link to AEM. However, the authors may consider to form groups, e.g., extreme precipitation indices (R99p, R20mm, RX1day, …) and frequency (R99pf, CDD, CWD, …), and analyze their current and future characteristics in their own subsection. I believe that this will particularly improve the readability of the tables, which currently mixes indices with differentunits together.

Thank you for this comment. We will reduce the number of extreme precipitation indices in the revised version of the article. We will consider six indices, instead of twelve:

1. the SDII (simple daily intensity index), which describes the intensity of wet rainfall events;
2. the R95p (very wet day), which describes the intensity of rainfall events exceeding the 95th percentile;
3. the CWD (consecutive wet days), which describes the maximum duration of a wet event;
4. the RX5day (maximum 5 days precipitation), which is the intensity of an event over a duration of five days;
5. the FRQW (frequency of wet days), which describes the frequency of wet events;
6. R20mm (very heavy precipitation days), which is a measure of the frequency of rainfall events exceeding 20 mm, and which could have a high socio-economic impact.

- The introduction is too long, which inhibits a sharper formulation of the research question.Looking at each paragraph, the following topics are addressed:

1. Socio-economic impacts of extreme rainfall
2. IPPC AR6
3. Recent trends in AMJ daily rainfall in Guinea coast region
4. Recent trends in JAS daily rainfall in Guinea coast region
5. 3.) and 4.) for specific coastal areas
6. CMIP6 models behaviour of current rainfall characteristics over Africa
7. GCM behaviour of future rainfall characteristics over Africa

8. RCM behaviour of future rainfall variability on daily and seasonal timescale
9. MCSs, AEM, SST
10. Historical and current relationship between AEM and Guinea coast rainfall
11. Goal of study

Some of the paragraphs, e.g., 3-5, can be easily merged and stripped-down to the fundamental information. I advise the authors to revise and shorten the introduction. Also, Ibelieve that AEM should be introduced earlier to facilitate a better build-up to the research topic.

We will rewrite the introduction according to the suggestions. The AEM will be introduced earlier, the behavior of the observed extreme rainfall events over the Guinea Coast will be summarized, as well as their representations in the climate models. Overall, the introduction will be shortened.

- **The beginning of summary and conclusion** section lacks a systematic and brief recapitulation of the motivation and research question of the study, the data and methods used and a point-by-point summary of the key results. Also, some discussion was integrated in the result section, which should rather be shifted to the this section (see specific comments). Overall, I am somewhat missing the link of the presented results with existing literature, i.e., a proper discussion, and how they integrate, complement, or disagree with them. As mentioned, a part of it can be just shifted from the result section.

  We will provide a systematic and brief recapitulation of the motivation and research question, the data and methods used as well as a summary of the main results at the beginning of the summary and conclusion. We will also shift some discussions from the results section to the summary and conclusion section as suggested.

Specific comments/questions

L28: "…the exposure to river flooding events is expected to increase 4.6, 8, and 8.6 times morethan without climate change". Are these numbers related to the 1.5°C, 2.4°C and 3.5°C scenarios further down the sentence? It didn't get quite clear from the structure of the sentence.

Yes, these numbers are related to the 1.5°C, 2.4°C and 3.5°C scenarios. In the revised version of the article, this sentence will be rewritten as follows:

"According to the climate scenarios, for which future global warming is limited to 1.5°C, 2.4°C and 3.5°C respectively, people born in 2021 and leaving in the Sub-Saharan Africa will experience, during their lifetime, 4.6, 8, and 8.6 times more river flooding events than without climate change, respectively (https://myclimatefuture.info/, last access: 11-08-2022). This increase is two to fourfold higher than the flooding events experienced by people in the same area, born in 1960, and highlights the climate urgency in reducing our greenhouse gas emissions for future generations (Thiery et al., 2021)."

L32: "…for the safety of young people". Maybe better "future generations"?
Thank you for the suggestion, we will take it into account as discussed in the previous comment.

L49: "… which represents up to 4% of the seasonal daily mean rainfall". Do the authors meanthat the JAS mean daily rainfall has decreased by 4%?
Yes, the authors mean a negative trend which represents 4% of the JAS climatology, so a decrease of 4% of the JAS mean daily rainfall. We will rewrite the sentence accordingly.

L67: "Regional Climate Models (RCMs) forced with CMIP5 GCMs outputs…". Are they related toCORDEX Africa?

The cited article (Akinsanola et al., 2020) stated that the integrations were performed over the West African domain. These integrations are part of the CORDEX project, but it is not clear whether they were performed over the "CORDEX Africa" domain or another domain such as the "Middle East North Africa" domain, or a more reduced domain, West Africa as stated. In the revised version of our manuscript, we will just add that they are part of the CORDEX project, as stated in their article.

L107: "a mode characterized by anomalous warming and cooling in the eastern equatorial Atlantic basin". It should be additionally mentioned that the phenomenon refers to aninterannual variability.

We will mention that the phenomenon occurs on an interannual timescale.

L141-143: See general comment on the choice of the periods.

We will refer to the IPCC AR6 WGI definitions to motivate our choices of the different periods.

L150-151: "Only one realization of each simulation is considered for each GCM". Based on whatcriterion did the authors decide on the ensemble member per GCM?

Many studies have used one ensemble member and have shown that current GCMs can simulate relatively well some aspects of oceanic internal modes of variability in the tropical Atlantic (e.g. Kucharski et al.,2017; Richter et al, 2020; Worou et al.,2022; Crespo et al.,2022; Yang et al.,2022), tropical Pacific (e.g. Cai et al.,2015) and Indian Ocean (e.g. Cai et al.,2013,2018). We rely here on the same approach and use one realization in our study. We simply choose the first one for each model as we assume that all realizations are equivalent for the analyses we performed. However, a further perspective would be to increase the number of realizations for each model, if available, or to restrict the study to a few GCMs having 10 or more members for both historical and future simulations. This would help to understand how internal variability can impact the simulation of specific internal modes of variability such as the Atlantic equatorial mode of variability and its associated patterns. Such an analysis is out of the scope of our current study. We will add this perspective in our revised manuscript.

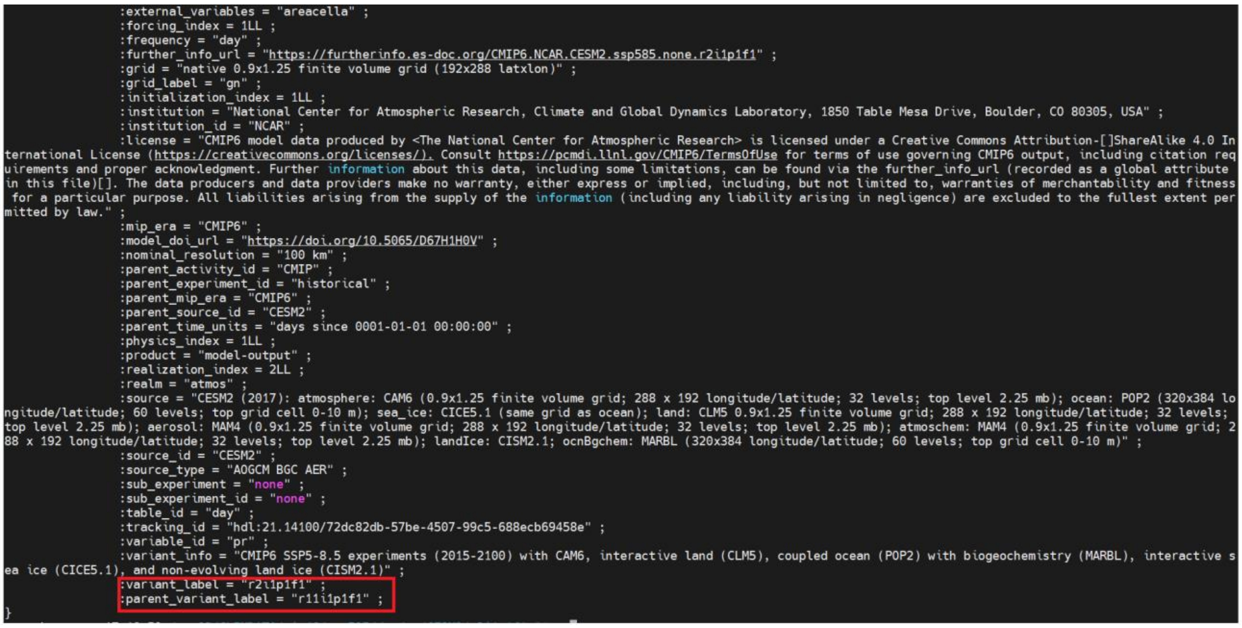
Table 1: The meaning of the metadata IDs (r, i, p, f) should be explained in the caption or in the text.

Why do the historical members differ from SSP5-8.5 members for some models?

The meaning of the variant-id in CMIP6 metadata will be provided:

- "r" represents the realization index,
- "i" represents the initialization method,
- "p" represents the physics and
- "f" represents the forcing.

In the SSP5-8.5 outputs, the parent_variant_label does not necessarily correspond to the variant_label. We then read thoroughly the metadata in future simulation outputs and associate them to their corresponding parents, from which they were branched. Please, find below a print screen of the metadata in the daily precipitation file from the SSP5-8.5 simulation performed with CESM2. Both the variant_label (r2i1p1f1) and its associated parent (parent_variant_label) are highlighted with the red rectangle. We will add this information in the revised manuscript.



```
                :external_variables = "areacella" ;
                :forcing_index = 1LL ;
                :frequency = "day" ;
                :further_info_url = "https://furtherinfo.es-doc.org/CMIP6.NCAR.CESM2.ssp585.none.r2i1p1f1" ;
                :grid = "native 0.9x1.25 finite volume grid (192x288 latxlon)" ;
                :grid_label = "gn" ;
                :initialization_index = 1LL ;
                :institution = "National Center for Atmospheric Research, Climate and Global Dynamics Laboratory, 1850 Table Mesa Drive, Boulder, CO 80305, USA" ;
                :institution_id = "NCAR" ;
                :license = "CMIP6 model data produced by <The National Center for Atmospheric Research> is licensed under a Creative Commons Attribution-[]ShareAlike 4.0 In
ternational License (https://creativecommons.org/licenses/). Consult https://pcmdi.llnl.gov/CMIP6/TermsOfUse for terms of use governing CMIP6 output, including citation req
uirements and proper acknowledgment. Further information about this data, including some limitations, can be found via the further_info_url (recorded as a global attribute
 in this file)[]. The data producers and data providers make no warranty, either express or implied, including, but not limited to, warranties of merchantability and fitness
 for a particular purpose. All liabilities arising from the supply of the information (including any liability arising in negligence) are excluded to the fullest extent per
mitted by law." ;
                :mip_era = "CMIP6" ;
                :model_doi_url = "https://doi.org/10.5065/D67H1H0V" ;
                :nominal_resolution = "100 km" ;
                :parent_activity_id = "CMIP" ;
                :parent_experiment_id = "historical" ;
                :parent_mip_era = "CMIP6" ;
                :parent_source_id = "CESM2" ;
                :parent_time_units = "days since 0001-01-01 00:00:00" ;
                :physics_index = 1LL ;
                :product = "model-output" ;
                :realization_index = 2LL ;
                :realm = "atmos" ;
                :source = "CESM2 (2017): atmosphere: CAM6 (0.9x1.25 finite volume grid; 288 x 192 longitude/latitude; 32 levels; top level 2.25 mb); ocean: POP2 (320x384 lo
ngitude/latitude; 60 levels; top grid cell 0-10 m); sea_ice: CICE5.1 (same grid as ocean); land: CLM5 0.9x1.25 finite volume grid; 288 x 192 longitude/latitude; 32 levels;
top level 2.25 mb); aerosol: MAM4 (0.9x1.25 finite volume grid; 288 x 192 longitude/latitude; 32 levels; top level 2.25 mb); atmoschem: MAM4 (0.9x1.25 finite volume grid; 2
88 x 192 longitude/latitude; 32 levels; top level 2.25 mb); landIce: CISM2.1; ocnBgchem: MARBL (320x384 longitude/latitude; 60 levels; top grid cell 0-10 m)" ;
                :source_id = "CESM2" ;
                :source_type = "AOGCM BGC AER" ;
                :sub_experiment = "none" ;
                :sub_experiment_id = "none" ;
                :table_id = "day" ;
                :tracking_id = "hdl:21.14100/72dc82db-57be-4507-99c5-688ecb69458e" ;
                :variable_id = "pr" ;
                :variant_info = "CMIP6 SSP5-8.5 experiments (2015-2100) with CAM6, interactive land (CLM5), coupled ocean (POP2) with biogeochemistry (MARBL), interactive s
ea ice (CICE5.1), and non-evolving land ice (CISM2.1)" ;
                :variant_label = "r2i1p1f1" ;
                :parent_variant_label = "r11i1p1f1" ;
}
```

L153: See general comment on CHIRPS.

We will add five additional datasets for the observed daily rainfall and we will modify the section accordingly.

L161-162: “This study is focused on the July-September season (JAS), when the Guinea Coast rainfall covariability with the AEM is at its maximum in the current climate models”. I believe that this covariability in JAS was not mentioned in the introduction!? For the Guinea coast region, JAS largely falls within the little dry season over the Guinea coast region, thus outside of the two rainy seasons. Have the authors also investigated April-June (AMJ) and/or September-November (SON) when MCSs are more prevalent in the coastal region?

If so, I think it would be worth a few sentences (e.g., in the conclusion) on how futureextreme rainfall develops in these seasons.

The maximum covariability between the AEM and the GCR over JAS was previously mentioned in the Methods and will be shifted to the introduction section.

We don’t focus our analysis on the specific contribution of MCSs to the rainfall over the Guinea Coast, as there are different types of rainfall over the region (Maranan et al 2018). Although the MCSs have an important contribution to the GCR during AMJ and SON, the annual cycle of the R95p index (very wet days index) across different observations indicates the highest values during July, August, September and October (Fig. R1.1 (b)). The total wet day precipitation (PRCPTOT) and the contribution of the monthly rainfall to the annual rainfall (ANNPCT) also show their highest values over these months (Fig. R1.1 (a),(c)). We will therefore keep the JAS season as the focus of our study but we will add a short discussion about the prevalence of MCSs in the AMJ and SON seasons over the Guinea Coast, without additional analyses. Besides, the “little dry season” is not pronounced in the annual cycle of the average of the total rainfall (PRCPTOT) over the region that we defined as the Guinea Coast in the present analysis (20°W - 15°E,4°N -10°N) and over the 1995-2014 period, as can be seen in the figure R1.1 (a), and also mentioned by Worou et al. 2020. We will add this information to the revised manuscript.

L162-165: This text snippet looks like it could also be shifted to the introduction.

We will shift this text to the introduction. Thank you for the suggestion.

L167: Have the authors tested the sensitivity of R10mm and R20mm on the choice of the resolution? I would think that different resolutions lead to different outcomes with indiceswhere the threshold is an absolute value (e.g., 1mm for a wet day).

We will do not analyze the R10mm in our revision. Figure R1.3 shows the annual cycle of the 6 selected indices during the 1995-2015 period. Two GCMs (among 24) provide low (CNRM-CM6-1, MPI-ESM1-2-LR) and high resolution (CNRM-CM6-1-HR, MPI-ESM1-2-HR) outputs. The analysis of Fig. R1.3 reveals that the low-resolution version of CNRM-CM6 model simulates more frequent rainfall events exceeding 20mm (R20mm) compared to the high-resolution version, mainly between June and November. The five other indices also have higher magnitudes in the low-resolution version of this model, compared to the high-resolution simulations. This is not the case for the model MPI-ESM-2 which simulates an annual cycle with a similar magnitude in its two versions, for the different indices except the maximum consecutive wet days (CWD) and frequency of wet events (FRQW). In these latter cases, the low-resolution simulation shows higher values compared to the high-resolution values. Therefore, we can not make a general statement about the impact of resolution on the simulation of the R20mm. We can also say that both the low-resolution versions of CNRM-CM6-1 and MPI-ESM1-2 models simulate higher CWD and FRQW, compare to their high-resolution versions. We will add this information in the revised version of the article. We will also test the sensitivity of our results to the changes in the 1mm threshold used to define a wet day event, by setting it to 0.5mm and 2mm, respectively.

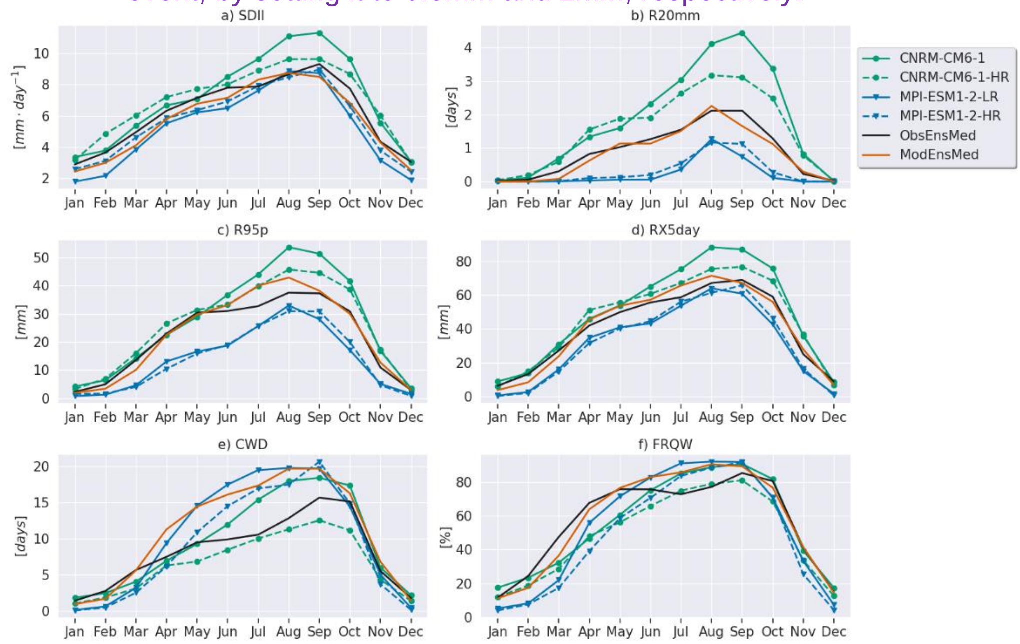


Figure R1. 3 Annual cycle of the extreme rainfall indices over the Guinea Coast, during the 1995-2014 period. Low and high-resolution outputs are analyzed for CNRM-CM6-1 and MPI-ESM1-2 models. The ensemble median for the 24 GCMs and the 6 observations are also shown.

L175: What remapping procedure (bilinear, bicubic, …) is used?

We used a bilinear remapping procedure with a routine from the climate data operator (CDO). We will add this information to our revised text.

Table 2: Mention again in the caption that the indices are based on ETCCDI. Is PR95/PR99calculated from wet days only or from all timesteps?

We will add in the table caption that the indices' definitions are provided by the ETCCDI. We will also mention that the PR95 is computed from only wet days timeseries over a considered period, for each month. Moreover, in this new version, we compute each index over each month before considering an average over a season. These modifications will be applied to Table 2. This thus considers the annual cycle of each index, which was not the case in the first version of the article.

L222: I think the TSS deserves a bit more explanation here about which combination of measures it attempts to create a skill score with (i.e., correlation coefficient and standard deviation). It is worth noting that these components can be weighted differently. For instance, deviations in the standard deviation can be penalized harsher than the correlation coefficient. I believe however that the standard formulation of the Taylor skill score is used here.

Thank you for having drawn our attention to the formulation of this performance skill. We used a modified version of the standard Taylor skill score, where the terms containing a correlation are to power 2 (instead of 1 in the standard formulation). The aim is to penalize models with low spatial correlation. However, there is an error in our text, where we missed the power 2 in the term $(1 + PCC_0)^2$ in the denominator. This will be corrected in our revised text.

$$TSS = \frac{4(1 + PCC)^2}{\left(\frac{\sigma_{cmip6}}{\sigma_{observation}} + \frac{\sigma_{observation}}{\sigma_{cmip6}}\right)^2 (1 + PCC_0)^2}$$

Moreover, we will mention in the new text that one can choose to penalize models with low correlations or low spatial variability by weighting differently the terms in the TSS equation.

L250: "… and 250 the percentage of bias reaches 0.98%, against −1.28% for RX1day". This isnot much, is it?

It is true that these bias percentages are very low. We will change the way we present these results, by simply stating that the biases are low instead of presenting the values.

L251-252: "Alongside, the wet days and extremely wet days (R95p and R99p) statistics over the entire Guinea Coast show positive biases that represent 14.66% and 24.10% of the observations". This potentially falls back again to the issues of CHIRPS and the question,whether this could rather be due to the deficiencies of CHIRPS to resolve extremes.

In the revised version, we will compute the biases of each model relative to each of the six observation datasets. The results of the median values of the biases across all the models and observations will be presented.

Table 3: How robust are these numbers? How much variance do they exhibit across the members?

The authors may consider expressing these numbers rather in a box-whisker plot toaccount for the uncertainty of the ensemble.

Thank you for this comment. In the revised manuscript, we will present these performance metrics in a box-whisker plot, considering six different observations.

L281-282: "The spatial distribution of the mean changes in R95p, R10mm and R20mm in our studyare different from the patterns obtained in the RCM-CMIP5 projections (Akinsanola and Zhou, 2019)". In what way? Please elaborate on that in more detail.

Akinsanola and Zhou (2019) found a robust increase in the mean June-September R10mm and R20mm over large areas in Guinea Coast in the long-term future projections. Our study shows insignificant mean July-September R10mm and R20mm over this region in the long-term future, compared to the present day. Moreover, in the western (eastern) Sahel, there is a projected robust long-term decrease (increase) in the R10mm in our analysis, whereas Akinsanola and Zhou found a robust and uniform decrease in the R10mm over the Sahel. Finally, we found an insignificant increase in the long-term mean of R95p, while Akinsanola and Zhou found a significant increase in R95p over almost all West Africa. We will add these differences in the revised manuscript, for the R20mm and R95p indices.

Figure 3: "… diagonal bars…". Better use "hatching".

We will use "hatching" instead of "diagonal bar". Thank you for the suggestion.

L290: "The changes in the near-term period relative to the present-day conditions are not clearfor the majority of the indices". How is this seen from Fig. 4?

We see this from the error bars associated with each change. If for a variable and a specific period in the future, the error bar around the mean change covers negative to positive values, this means that we cannot see a clear increase or a clear decrease in the considered variable. This is the case for the majority of the near-term changes in mean and standard deviation for different indices. In the revised manuscript, this figure will be replaced by a box-whisker plot (Figs. R1.4-R1.5).

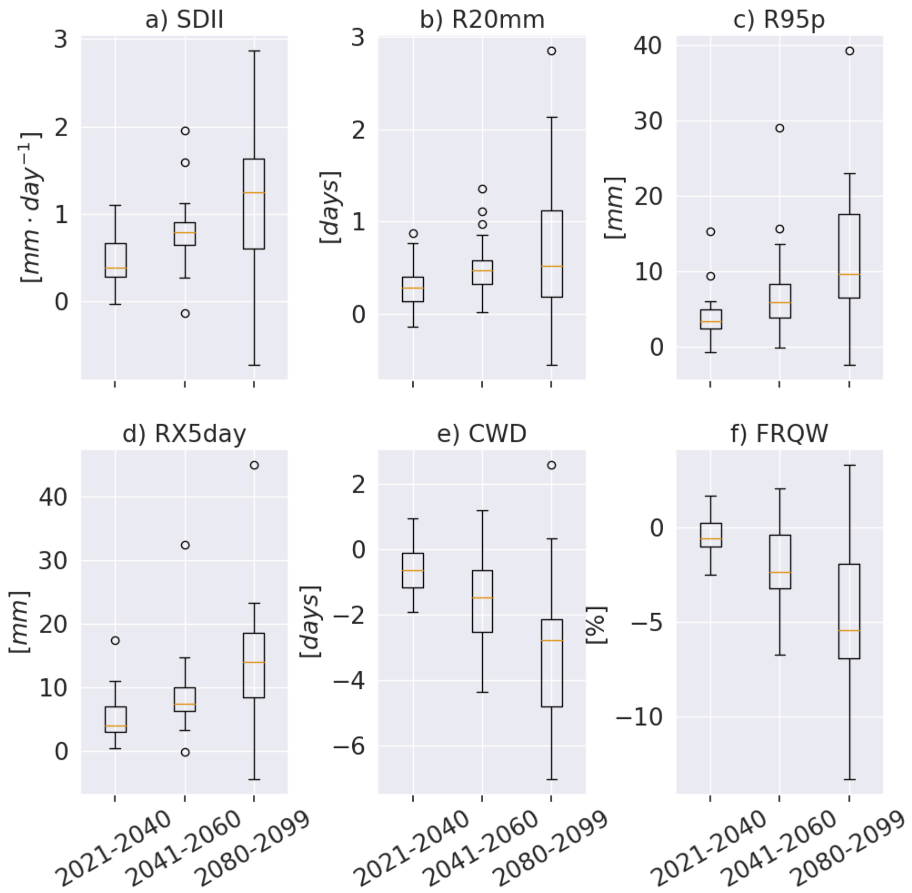


Figure R1. 4 Change (relative to 1995-2014) in the mean JAS extreme rainfall indices averaged over the Guinea Coast.

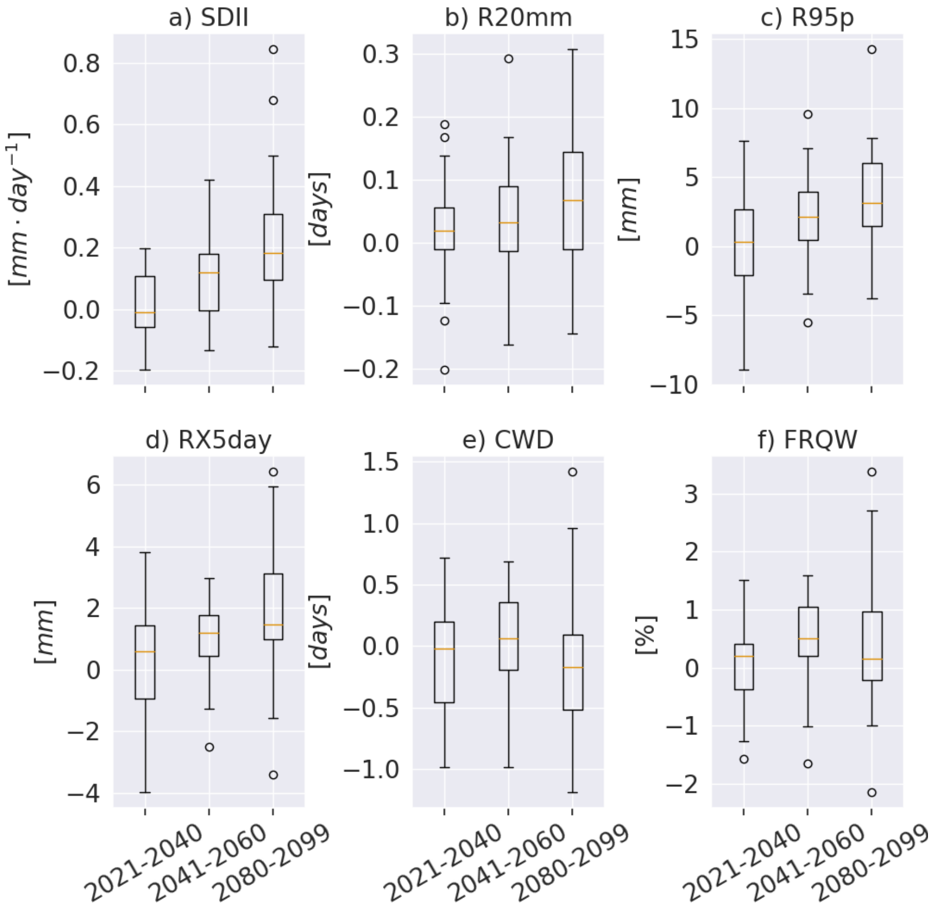


Figure R1. 5 Change (relative to 1995-2014) in the standard deviation of the extreme rainfall indices averages of the Guinea Coast.

L291: "The mid-term and long-term changes indicate a clear increase in mean and standard deviation…". Again the question from the general comments about how much of an impacton the increase the 20-year jump has from the mid-term to long-term future period!?

We could have used two 30 years periods in the last decades of the 21st century, as in Worou et al (2022). This would cancel the gap between the mid-term and long-term future periods. However, the main message of our study would not have changed, which is the reduction in the AEM contribution to the variability of the extreme rainfall events over the Guinea Coast. In the revision, we will add in supplementary material the mean changes in 2061-2079 compared to 1995-2014, and we will plot these changes together with the changes in the main three future periods defined in our manuscript. We can also quantify the changes from the 2061-2079 period to the long-term (2070-2099) period. We will add a comment about the outcomes in the main revised text.

Figure 4: Which significance test was used?

We did not make a test of significance in the difference between of the multi-model mean of an index when comparing a future period to the historical period. Rather, we computed the mean difference and we associated an error bound in the estimation of the mean difference (across the different models), at a confidence level of 90%.
In the revised version of the manuscript, we will modify this figure by showing the box plot of the changes in mean and standard deviation, as indicated in Figs. R1.4 and R1.5. We will also apply a Kolmogorov-Smirnov test to the distribution of an index in two different periods, which will allow us to confirm if there is a significant change.

L320: "… there is overall a good spatial distribution of the SDII and PRCPTOT anomalies overWest Africa". Do the authors mean a "good agreement"?

Yes, we mean a "good agreement". We will modify the text accordingly. Moreover, we no longer consider PRCPTOT in the newly selected indices for the revised manuscript.

Figure 5: While the structures of the indices pretty much look alike for EnsMean, the spatial variability for CHIRPS is visibly higher in Fig. A2. Can the authors elaborate on the sourcesof these differences?

In the revised manuscript, we will compare the spatial distribution of the extreme indices responses to the AEM phases for the 6 different rainfall datasets. This will help to see if the responses are similar in the different data, or if there are differences among them. This will help in the analysis of the differences with the multi-model ensemble mean response. Furthermore, in the revised manuscript, we will consider the multi-model ensemble median, instead of the multi-model ensemble mean, to avoid any impact of outliers.

Table 4: This is again a comparison with CHIRPS, correct? Then it should be mentioned in thecaption as such.

Yes, this is a comparison with CHIRPS. In the revised manuscript, this table will be replaced by a figure with different boxplots of the models performances relative to the six rainfall observations. We will adapt the caption accordingly.

L363-375: This belongs in the conclusion section in my view.

We will move this point to the conclusion as suggested. Thank you.

Figure 7: Please explain in more detail in the text on what you computed here with respect to one standard deviation of the AEM. You varied AEM by one standard deviation and quantifiedthe difference?

Let's consider the AEM index computed from monthly SST anomalies (detrended linearly) over the ATL3 box and averaged over JAS. For the 1995-2014 period, for instance, we obtain a timeseries of 20 timesteps. Then, this index is divided by its standard deviation. When we regress a grid point value of a variable onto the above-described AEM index, we obtain a pattern of anomalies related to one standard deviation of the AEM index (or the standardized AEM index).

In Figure 7 of the submitted manuscript, we computed the changes in the regression coefficients of the different indices related to the standardized AEM index. Then, the changes in the regression coefficients are averaged over the Guinea Coast for each model. Figure 7 shows the multi-model ensemble mean changes in the area-averaged regression coefficients and the associated 90% confidence interval. In the revised manuscript, this figure will be replaced by a box-whisker plot, using six indices instead of twelve.

L439: One "a" too many.

Thank you for the correction. We will suppress one "a".

Table 5: "… of the proportion of the variance explained by the AEM". What exactly does that mean?

Are the median values of the indices potentially calculated from different sample sizes?

For each period and for each index (anomaly) averaged over Guinea Coast, we computed the proportion of variance explained by the AEM for each model. We obtain 24 different values from 24 GCMs. Values in Table 5 represent the multi-model median from each of the 24 values, each period and each index. In the revised manuscript, Table 5 will be replaced by a box-whisker plot.

Summary: See also general comment on the summary and conclusion section. It does not get clearwhat the source of the rainfall indices are, which SSP scenario was taken, that the link ofextreme rainfall to AEM in current and future period is investigated, etc. This should be more carefully and meticulously summarized right in the beginning.

We will improve the summary and conclusion section. We will clearly describe at the beginning of this section the different rainfall datasets used for the observations, the CMIP6 historical simulations and the SSP5-8.5 scenario. Thank you for the comment.

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