

Interactive comment on “Intensification of the hydrological cycle expected in West Africa over the 21st century” by Stella Todzo et al.

Stella Todzo et al.

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We thank the reviewer for the constructive comments. We particularly appreciate the comment on the potential impact of aerosols, which is a very important issue for Africa. We also appreciate the inputs on the writing style, which considerably improved the manuscript. All the comments have been accounted for.

Comments from Reviewer 1

This study investigated the hydrological cycle over West African region using CORDEX-AFRICA data between 2006 and 2099. To achieve their purpose, authors used the known ETCCD indexes combined with hydroclimatic indice. They found that West African region is expected to be warmer than the global average per decade (0.5o C vs

C1

0.3o C). Also precipitations are expected to become more intense and less frequent. This is a very interesting work and address relevant scientific questions in the scope of ESD. Data and methodology are clearly stated as well as main findings. However the writing style is too amorphous from beginning to the end making this interesting fining a bit boring on reading. Please below see my suggestions to improve the manuscript.

Major comment

* Comment 1: Authors discussed how the MCSs may impact precipitation distribution over the studied though these MCSs were not considered in the CORDEX data. A similar attempt should be done for others forcing such as aerosols especially dust that are abundantly present in the region and known to impact West African climate through their radiative forcing: Konare, A., et al. "A regional climate modeling study of the effect of desert dust on the West African monsoon." *Journal of Geophysical Research:Atmospheres* 113.D12 (2008). N'Datchoh, E. T., et al. "Dust induced changes on the West African summer monsoon features." *International Journal of Climatology* 38.1 (2018): 452-466. Yoshioka, Masaru, et al. "Impact of desert dust radiative forcing on Sahel precipitation: Relative importance of dust compared to sea surface temperature variations, vegetation changes, and greenhouse gas warming." *Journal of Climate* 20.8 (2007): 1445-1467. Silué et al., (2019) Evidence of Long-Term Trend of Visibility in the Sahel and Coevolution with Meteorological Conditions and Vegetation Cover during the Recent Period. *Atmospheric and Climate Sciences*, 9, 346-368. doi:10.4236/acs.2019.93025.

-> Response: We agree with the reviewer, and such a discussion is now included in the revised manuscript as follows: “Similarly, the impacts of atmospheric aerosols, particularly abundant over West Africa due to seasonal desert dusts (Konare et al. 2008, N'Datchoh et al. 2018), are only partially accounted for in CORDEX AFRICA due to the simplified parameterization schemes for aerosols in this dataset. However, because aerosols are expected to affect temperature and precipitation in this region (e.g. Konare et al. 2008, N'Datchoh et al. 2018), we suggest that our results are also

C2

limited by this simplified representation of aerosols. Additional simulations at higher resolution and using a more complex parameterization scheme for aerosols would be required to identify the impact of MCSs and aerosols on our results, which is beyond the scope of our study.”

Minor comments

* Comment 2: L30 - L32 "Growing season": I guess it refers to agriculture however, as stated links are that clear for the reader. I suggest authors to include a sentence relating precipitation to the agriculture before this statement.

-> Response: Thank you for pointing this out. This is now clarified in the revised manuscript as follows: "Particularly relevant for agriculture, changes in precipitation are also projected during the growing season, expected to become shorter, as torrid, arid, and semi-arid climate conditions are expected to extend (Sylla et al., 2016)."

* Comment 3: L36: Authors stated "tropospheric moisture and precipitation is highly complex" Is it in the world or very specific to the studied region? Please specify it.

-> Response: Global, this is now clarified in the revised manuscript.

* Comment 4: L72: please change "Following" by or "base on" it looks quite monotone to use "following"

-> Response: The revised manuscript has been altered accordingly.

* Comment 5: L92: Please add a connector between statements to make the text flow

-> Response: Thank you for this point, the following sentence has been added in the revised manuscript: "Results are shown in Supplementary Figures 1 and 2, and summarized here. Each for the 18 CORDEX simulations satisfactorily reproduces the spatial distribution of the CHIRPS daily mean precipitation...".

* Comment 6: L102: please replace "than" by "with"

C3

-> Response: The revised manuscript has been altered accordingly.

* Comment 7: L112 – L114: please edit the sentence by making it more clear. The statement is confusing and look more like figure label.

-> Response: We agree with the reviewer, the revised manuscript has been altered as follows: "Trends (2006-2100) of air surface temperature (°C per decade), mean precipitation (mm/day per decade), INT (mm/day per decade), RR1 (days per decade), CDD (days), and CWD (days) are shown in Figure 1, as multimodel mean maps. From Figure 1, temperature...".

* Comment 8: Across the entire manuscript, authors stated "according to" more than 10 times when commenting and discussing figures. It makes the manuscript quite monotone I suggest some of these should be change may be rewrite a little bit differently using statement such as: From Figure : : : Figure : : : suggests /implies : : : (Not exhaustive)

-> Response: We agree with the reviewer, the revised manuscript has been modified throughout accordingly. Here are a few examples: E.g. 1: "Mean precipitation is expected to increase on average by + 0.03 mm/day per decade over the Guinea Coast, and decrease on average by - 0.015 and - 0.001 mm/day per decade over West Sahel and Central Sahel, respectively (Figure 1b). INT is expected...". E.g. 2: "Trends (2006-2100) of INTn, DSLn, and HY-INT are shown in Figure 2, as multimodel mean maps.". E.g. 3: "In addition, whereas DSL is expected to increase over the Sahel on average by + 0.05 (5 %) per decade with a latitudinal increase northward that reaches + 0.1 (10 %) per decade over the western part of the Sahel, negligible changes are expected over the Guinea Coast (Figure 2b). As a result, HY-INT is...". E.g. 4: "Annual values (2006-2009) of mean precipitation (mm/day), RR1 (days), and INT (mm/day) are shown in Figure 3, plotted against the corresponding annual mean values of air surface temperature (°C), and as averaged over a) West Sahel, b) Central Sahel, and c) Guinea Coast." E.g. 5: "As seen in Figure 3, even though...".

C4

* Comment 9: Though the active form writing style is correct and show the authors efforts and work, it may be interesting to have some variation in the manuscript with the passive form too. Similarly, all figures comments start by "Figure xx shows" however these statements can be write differently to allow the manuscript to be more alive. For example, L158- L160: Statement can be rewrite as: "The annual values : : . are shown in figure 4"

-> Response: We agree with the reviewer, the revised manuscript has been modified accordingly throughout. For example, the sentence you noted now reads as follows: "Annual values (2006-2009) of INTn, DSLn, and HY-INT are shown in Figure 4, plotted against..."

* Comment 10: L162: All three regions please replace by "all the three regions"

-> Response: The revised manuscript has been altered accordingly.

* Comment 11: L169: please write "explain about"

-> Response: The revised manuscript has been altered accordingly.

* Comment 12: L170: please replace "as for" by "similarly to"

-> Response: The revised manuscript has been altered accordingly.

Interactive comment on Earth Syst. Dynam. Discuss., <https://doi.org/10.5194/esd-2019-38>, 2019.