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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Climate change impacts on river discharge in West Africa: a review" *by* P. Roudier et al.

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=> We thank referee #1 for its useful comments which helped us to improve the paper and to submit a new improved version of the manuscript. We answer below to each comment point by point.

General Comment This is a very well-written review paper on the impact of climate change on runoff in West Africa. The authors show future runoff change in West Africa is very uncertain, by investigating 19 published papers (i.e. multiple GC, multiple scenario, multiple hydrological models). Because of such a large uncertainty, it is dangerous to judge a future trend of runoff in West Africa from the results of one or few studies. Therefore, I think the authors' work is useful. I recommend the paper to be

published in HESS after minor revision.

=> Thank you.

Specific Comments P2483, Title: I think this study is on "runoff" but not "river discharge". River discharge is a flux of water at a specific point in river channel. Therefore, I think the term "river discharge" may lead to misunderstanding of the results. For example in Figure 4b, "river discharge" of "the lower Niger" should be the summation of runoff in the "upper, middle and lower Niger", while "runoff" in "the lower Niger" only accounts for the runoff from "the lower Niger" area. I recommend the authors to change the word in the title.

=> We agree with reviewer #1 and we therefore changed the title to: "Climate change impacts on river runoff in West Africa: a review"

P2484, L10: "PET" Please don't use an abbreviation (PET) without mentioning it's full description in the abstract.

=> Corrections made as recommended by referee #1

P2484, L15: "an urgent need for integrated studies that quantify the potential effects of these processes on water resources in West Africa." Integrated studies are off course important, however improvement of climate model's accuracy is also essential given that the runoff change is mostly decided by projected future rainfall.

=> We agree on this point that we added in the manuscript.

P2489, L22: "Since such scenarios are within the range of potential evolutions simulated by the GCMs, we decided to include them in the database." Even though the scenario is within the range of GCM projections, inclusion of "okpara and Perumal 2009) may introduce a bias in the results because runoff change is dominated by rainfall change. I think if the scenario (-5% rainfall) does not have any scientific basis, it should be removed from the database.

=> Okpara and Perumal (2009) are indeed not using climate data based on GCMs or RCMs, but anomalies scenarios. We focus here on the scenario +2C/-5% of rainfall that is, as underlined by the last IPCC report (WG I, chapter 14) very close to the median future climate (temperature: +1.9 C, rainfall +3%, ranging from -8% to +8%) according to 42 climate models, in 2100 and for scenario RCP 4.5 over West Africa. We therefore believe that this approach makes sense and should be included in the database. Moreover, we underline that the delta methodology (or anomalies scenarios) is a common methodology, used for example in Sultan et al. (2013) or in the international project AgMIP (Agricultural Model comparison and improvement project) as long as the temperature and rainfall changes are within a reasonable range, defined by the climate models.

P2491, L6: "2 -CO2" It's better to clearly write "doubling CO2"

=> Corrections made as recommended by referee #1

P2492, L2: "we clustered river basins" If possible, please draw the boundaries of these clusters in Figure 1a.

=> Changes made as recommended by referee #1

Figure 1b: The colors for the Niger River are not clear. I recommend to change the colors. Figure 4(b) It's better to write the definition of "Niger" in the caption (i.e. no description on upstream or downstream in the original paper in the database). It's quite confusing.

=> We changed the colors and the definition of "Niger" following referee #1 suggestions

Figure 7 Please describe which colors (red or green) represents which signal (decrease or increase).

=> We added "increase" and "decrease" to figure 7

=> References

Sultan, B., Roudier, P., Quirion, P., Alhassane, A., Muller, B., Dingkuhn, M., Ciais, P., Guimberteau, M., Traore, S., and Baron, C.: Assessing climate change impacts on sorghum and millet yields in the Sudanian and Sahelian savannas of West Africa, Environmental Research Letters, 8, 014040, 2013.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 11, 2483, 2014.