

## Review

### 1. Does the paper address relevant scientific questions within the scope of HESS?

This paper fully addresses one of the main hydrological questions of the African Sahel, the hydrological Sahelian paradox and its spatial and temporal extension and significance. It addresses an important scientific issue to be clarified in the CC context and the deep environmental and Human changes observed in Sub Saharan countries: the respective role of natural and anthropic actions in the water cycle evolution.

### 2. Does the paper present novel concepts, ideas, tools, or data?

The paper does not present special novelties; however it attempts to answer a scientific dilemma by robust and recognized methods and using partly original data sets ; ideas and tools are original in his context, although some works of Mahé et al (Mahé et al., 2011 and Mahé et al., 2013; no cited) investigated previously the spatial extension of hydrological behaviours through West Africa.

- (1- Mahé, G., Lienou, G., Bamba, F., Paturel, J-E., Adeaga, O., Descroix, L., Mariko, A., Olivry, J-C., Sangaré, S., Ogilvie, A., Clanet, J-C., 2011. Le fleuve Niger et le changement climatique au cours des 100 dernières années. *Hydro-climatology variability and change (Proceedings of symposium held during IUGG 2011, Melbourne, Australia)*; IAHS pub. n° 344, 131-137.
- 2 -Mahé, G., Lienou, G., Descroix, L., Bamba, F., Paturel, J.E., Laraque, A., Meddi, M., Moukolo, N., Hbaieb, H., Adeaga, O., Dieulin, C., Kotti, F., Khomsi, K., 2013. The rivers of Africa: witness of climate change and human impact on the environment. *Hydrological Processes* 27, 2105–2114, DOI. 10.1002/hyp.9813)

The main problem of this paper lies in the quality of the data set; or more precisely the status of part of the data set; as it was highlighted by my colleagues Daniel Sighomnou (WMO) and Ansoumana Bodian (St Louis University, Senegal) during the discussion process, it is necessary to describe more precisely the status, quality and lacks in the data set. Particularly, you have to remove the sentence (page 5087) “all these data have been subject to quality control before being included in the study” and provide a table giving the number of lacks in the series, making a special status to the stations with a lot of lacks which were fulfilled by reconstituted data; this also can be the opportunity to test your proposed methodology as a re analysis of a data set, with, and then without the reconstituted data (specially for the Niokolo Koba and the Bébélé stations).

There are few documented basins, thus it is important to try to use all the available data sets; however it is worth to verify its significance and accuracy.

### 3. Are substantial conclusions reached?

Yes, the paper, although this is not the first way that Sahelian and Sudanian basins behaviour are opposed, it constitutes an interesting paper using a classical approach in order to investigate the different hydrological functioning in tropical basins.

### 4. Are the scientific methods and assumptions valid and clearly outlined?

Yes, methodology is consistently used to highlight hydrological functioning and, firstly, their spatial and temporal evolution; the paper is clear and easy to read and understand

5. Are the results sufficient to support the interpretations and conclusions?

At my sense, yes ! I am not sure that 14 basins in the studied statistical set are sufficient to ensure in any case representativity and accuracy, as well statistical justification; but I know that this is very uneasy to gather such a data set in the area; the only concern is the need to better specify the data status, specifically the origin of data, their treatment (if so) their criticism and the number of lacks..

6. Is the description of experiments and calculations sufficiently complete and precise to allow their reproduction by fellow scientists (traceability of results)?

Yes ! The methods are yet well known and recognized, they constitute a robust scientific protocol; its application in the West African context (opposition between Sahelian and Sudanian areas, Sahelian paradox) proves that the methods is able to be reproduced.

7. Do the authors give proper credit to related work and clearly indicate their own new/original contribution?

There is a good state of the art (in spite of the lack of some recent publications) and the own new original contribution of the authors appears clearly; the providing of new data and overall the limitation of mid size basins allow determine the two main types of hydrological evolution in West Africa. Does the title clearly reflect the contents of the paper?

8. Does the abstract provide a concise and complete summary?

One of the comments of the discussion states that title is too much large giving the impression that all the west African basins will be treated; the reviewer thinks that the great geographical extension of the basins location let us consider that the sub-region is well represented by those basins. The biggest problem to be addressed is the very low number of Sahelian basins (3); however, as Mahé et al (2011) shown, there is very few equipped basins in West Africa overall on long time series.

9. Is the overall presentation well structured and clear?

Yes, the presentation is quite good, the text well structured and clear; Tables and figures are clear and sufficient to illustrate the demonstration

10. Is the language fluent and precise?

No !! it remains a lot of grammar and syntax errors; however, as you can see, the reviewer is completely unable to propose corrections in English language; I just noticed some errors to be corrected:

Page 5088 line 23, change “other” by “order”

Page 5088 line 25: “Regarding” instead of “a regarding”

And some “frenchisms” such as:

Page 5089, line 25: “monitored” instead of “followed”

Page 5091, line 22: “wetness” instead of “humidity”

Page 5100, line16: “strong” or “quick” (??) instead of “galloping”

Otherwise, page 5096 line 16, and page 5102, line 3, replace “Briquet” with “Bricquet”

11. Are mathematical formulae, symbols, abbreviations, and units correctly defined and used?

Yes, the formulations are clear and correct

12. Should any parts of the paper (text, formulae, figures, tables) be clarified, reduced, combined, or eliminated?

No, at my sense, the manuscript is clear and equilibrated, after the changes yet proposed by reviewers nd realized by the authors.

13. Are the number and quality of references appropriate?

At my sense, the two cited references of Gil mahé and collaborators must be included because this scientist always attempted to collect and criticize all African hydrological data and these two papers (amongst more than 12 dedicated to West African hydrology);

I also recommend you to cite the following paper, probably not yet published when you firstly submitted your manuscript:

Valentin Aich , Stefan Liersch , Tobias Vetter , Jafet C. M. Andersson , Eva N. Müller and Fred F. Hattermann; Climate or Land Use?—Attribution of Changes in River Flooding in the Sahel Zone. *Water* 2015, 7, 2796-2820; doi:10.3390/w7062796

Although these authors only consider the same basins that (cited) Descroix et al (2012) , demonstrating the difficulty to find new data set..... and although they only consider sahelian basins, this paper is to be referenced because it also considers as you done, land use changes and climate changes in order to explain the hydrological functioning evolution.

14. Is the amount and quality of supplementary material appropriate?

*No supplementary material found*

## Summary of the review:

This paper seems me a good contribution to the studies on Sud Saharan hydrology and its sometimes surprising functioning evolution. It does not provide revolutionary methodologies; it rather provide a new lighting on the nowadays well known opposition between the sudanian hydrology and the sahelian one. It focuses on mid sizes basins, providing new data set.

However, it must be improved before publication (minor revisions) in the two following ways:

- Adding a table indicating the real status of new provided data, some of them being processed in order to fulfilled missing data; you must check that the statistical results and scientific assumptions are not influenced by the fact that some data were re constituted (ex removing the 3 more concerned stations: Niokolo Koba, Diaguiri and Bebele); iy should be interesting to compare the regional treatment with and without considering these three stations; in this ways, your last section (4-2) where you only use the basins of Burkina Faso is a good way to avoid some problems resulting of the data quality;
- Revising completely the English language to improve the global quality of this paper.