Review of the manuscript hessd-19-1-2015: "Trends in West African floods: a comparative analysis with rainfall and vegetation indices" by Nka et al.

I. Recommendation: Minor revisions

II. General comments

This study examines the trends in West African floods. The evolution of two potential drivers of flood evolution (rainfall and Land-Use-Land-Cover by analyzing daily rainfall and NDVI indices) was also analyzed. The study concerns 14 catchments in West Africa and can be divided in three parts:

1. The analysis of flood evolution which consists in two steps: (i) extraction of extreme flow values: two sampling sampling methods from the Extreme Value Theory (*Coles*, 2001) were used to extract extreme values of river flow (Block Maxima and POT); and (ii) detection of non-stationarities in time-series by using two statistical tests : Pettitt (break) and Mann-Kendall (trend).
2. Same tests were used to detect evolution of daily rainfall and NDVI indices.
3. The statistical correspondence between flood evolution and indices evolution.

It is one of the first paper that address the issue of flood evolution in West Africa. Thus, the results obtained concerning the first part are original and I have no major comment on that. However, I consider that the second and the third part can be improved. Particularly, authors should be more cautious with the conclusions made from the results of part 3. Furthermore, the paper is well organized and well written.

In my opinion this paper can be published in HESS if the authors improve the manuscript following the specific comments and minor remarks below.

III. Specific comments

Spe. 1.

Along the paper, authors use regularly the attribution terminology to describe the results obtained in section "*4.3 Agreements between flood trends and NDVI index trends*" (p. 17):

- "*For the overall catch-ments studied, the maximum 5 day consecutive rainfall index (Rx5d) seems to follow the flood trend, while the NDVI indices do not show a significant link with the flood trends, meaning that this index has no impact in the behavior of floods in the region.*" (p. 2)
- "*The trends detected in flood time series were compared to the rainfall index trends and vegetation indices using contingency tables, in order to identify the main driver of change in flood magnitude and flood frequency*" (p. 2)
- "*We also investigate the relation between flood trends and climate and environmental trends in order to identify the main drivers of flood variability.*" (p. 4)
- "*where CD (correct detection) is the number ... and CR (correct rejection) is the number of catch-ments that present non stationary behavior for both indices.*" (p. 11-12)
- "*This allowed us to identify the factor with the greatest influence on flooding*" (p. 12)
- "*are more attributable to the evolution in mean rainfall since 1970.*" (p. 19)

All these sentences refer to the terminology used in attribution studies. However, the methodology used (contingency table, cramer index, Success Criterion) does not allow to attribute the main drivers of flood evolution. In fact, it is just statistical links between flood evolution and potential driver indices, while attribution terminology refers to more physical links. Thus, this kind of study allows to make hypotheses on the main driver(s) of change, which is a first step before complete an attribution study (by using physically-based simulations and attribution methods, see *Merz et al.*, 2012, for an opinion paper on flood attribution).

Moreover, I agree with authors' conclusion ("*However, limitations inherent to the rainfall-runoff relationship analysis using statistical tools derive from the fact that hydrological processes as well as their spatial and temporal variability are not taken into account. It is therefore important to use hydrological models, which have the advantage of more accurately accounting for certain hydrological processes.*" (p. 19)) and I suggest that authors use the same tone for the whole paper.

Spe. 2. In the "*3.1 Flood sampling*" (p. 8) section, Authors must discuss how missing values were treated, since it can have a strong impact on the extracted extreme values

Spe. 3. In order to improve the presentation of methods, I suggest to add a subsection for the second part of the actual subsection "*3.3 Trends and breaks in the time series*" (p. 10). In fact, the sentences "*then the trend obtained on each flow ... On the contrary, a value close to zero indicates that there is no agreement between the trends of the indices involved*" (p. 11-12) concerns the statistical correspondence between flood evolution and indices evolution and thus a new subsection p.11 (e.g. 3.4 statistical correspondence, 3.4 statistical agreement, ...) should be created in order to separate the two analyses and to facilitate the reading.

Spe. 4. I disagree with the terminology used in the methods concerning statistical tests ("*3.3 Trends and breaks in the time series*" (p. 10)) and acceptation/rejection of hypotheses: e.g. "*the null hypothesis is accepted*" (p. 11), "*the computed date of change is accepted*" (p. 11). When using a statistical test, the null hypothesis can not be "accepted": the hypothesis is "rejected" or "not rejected". I suggest thus to remove all "accept, accepted, ..." terms.

Similar remark in the abstract: "*The Mann–Kendall trend test and the Pettitt break test were used to assess time series stationarity.*" (p. 2). A stationary test does not assess stationary, but detect non-stationarity.

Spe. 5.

"*In this case, the mean SDII value was higher in the second subperiod, meaning that rainfall events over the catchment were less frequent but more intense, which was also observed in previous studies (Le Barbé et al., 2002; Descroix et al., 2013; Panthou et al., 2014)*" (p. 17). The results obtained in this study and by cited studies are based on daily rainfall. Thus, no conclusion can be drawn concerning the frequency and the intensity of rainfall events which affect the region (mainly mesoscale convective systems). Different changes of event characteristics (spatial extension, internal and external frequency, intensity distribution, ...) may lead to less frequent but more intense daily rainfalls.

Thus, please replace "rainfall event" by "daily rainfall".

Spe. 6.

"*The methodology applied allows us to confidently assert that regional trends can be observed on flood magnitude and flood frequency.*" (p. 18)

The West Africa is a huge region, with many different catchements. Different processes take place at different scales and different places. I don't think that with a sample of 14 catchements, this study allows to describe entirely the regional trends in term of flood evolution over West Africa. I suggest to discuss a little more this point: which scales, places, processes, ... have been documented here ? which are not ? and implication for further researches ?

IV. Minor remarks

T1."*West Africa's main climate zone*" (p. 1) –> "West Africa's main climate zones"

T2."*characterized by a greater contribution of extreme precipitation to the annual total rainfall (Descroix et al., 2013; Panthou et al., 2012)*" (p. 3). I think that authors have confused *Panthou et al.* (2014) with *Panthou et al.* (2012). While *Panthou et al.* (2014) concerns effectively the evolution of extreme rainfall in West Africa (and the ratio heavy rainfall total / annual totals), *Panthou et al.* (2012) focus on the spatial distribution of extreme rainfalls without analyzing their temporal evolution. Thus, please cite *Panthou et al.* (2014) instead of *Panthou et al.*, 2012 in this sentence.

T3."*The study domain refers to the region of West Africa ... representative of the hydroclimatic diversity of West Africa.*" (p. 5). It would be useful to provide additional information about the hydroclimatic conditions of West Africa. I think that a brief description of the different precipitation regimes and hydrological processes which take place over sahelian and sudanian catchments would be helpful for readers who don't work on this particular region.

T4."*The Cramer Index is also associated with ... the tests.*" (p. 11) –> "the test."

V. References

Coles, S. (**2001**). "An introduction to statistical modeling of extreme values". London;New York: Springer.

Merz, B., Vorogushyn, S., Uhlemann, S., Delgado, J., and Hundecha, Y. (**2012**). "More efforts and scientific rigour are needed to attribute trends in flood time series". Hydrology and Earth System Sciences. Vol. 16. no. 5, pp. 1379–1387.

Panthou, G., Vischel, T., Lebel, T., Blanchet, J., Quantin, G., and Ali, A. (**2012**). "Extreme rainfall in West Africa: A regional modeling". Water Resources Research. Vol. 48. no. 8, pp. 1–19.

Panthou, G., Vischel, T., and Lebel, T. (**2014**). "Recent trends in the regime of extreme rainfall in the Central Sahel". International Journal of Climatology. Vol. 34. no. 15, pp. 3998–4006.