

Interactive comment on “Model-based study of the role of rainfall and land use land cover in the changes in Niger Red floods occurrence and intensity in Niamey between 1953 and 2012” by C. Casse et al.

Anonymous Referee #2

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The paper describes a models study that studies the changes in the Red floods in the Niger over the period 1953 to 2012. The research tries to distinguish why the flood magnitude has changed by using a hydrological model to simulate observed discharge. The researchers use three precipitation products to study the trends in precipitation and check the sensitivity of the model to changes in the land use and land covers. Although the topic is interesting and the study in itself is interesting, I think that the improvements can be made regarding the methodology and analysis. Therefore, I recommend to do major revisions to the current paper to recommend it to be published in HESS.

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Major remarks Page 12047 Line 24-25 The authors mention that the area is characterized by intense rain rates with a very short temporal scale (less than an hour), resulting in high spatially and temporal variable patterns. When reading this line it is an concern to me given the fact that the hydrological modelling later in the paper is done on 0.5° resolution. This is clearly a spatial scale that cannot capture the rainfall pattern in the study area. Furthermore, the authors use three different dataset to simulate the potential magnitude of the Red floods. The first dataset consists of an observation based product that is derived 15-60 rain gauges (depending on the year). Given the fact that the model simulations at 0.5° resolution require 49 cells to cover the area (derived from Figure 4) this would result in 1 or even a lower number of stations per grid cell. The same can be said for the CPC dataset (even a lower number of gauges). Finally the satellite product that is used is said to provide 0.25° satellite precipitation estimates every 3-hours. I'm wondering if the PERSIANN product is able to capture this highly dynamical 1 hour precipitation events. So given this information, I think the authors should elaborate on the quality of the precipitation data to provide to run their hydrological model and the errors that might come from incorrectly capturing the precipitation events in the region.

Page 12048-12049 The authors state they use three independent dataset to validate the impact of the precipitation data. Following up on the previous remark, I'm not entirely sure that the product are independent of another. PERSIANN-CDR is corrected by monthly GPCP, which derived from gauges, the CPC also contains gauges as does KRIG. What percentage of the gauges overlap and how independent are the individual rainfall products. This has an impact on the statements regarding the impact of the changes in precipitation. So in short is it necessary to use three rainfall products if they are not fully independent.

Page 12053 Line 15-22 The authors mention trends in rainfall totals over the study period. I was wondering up to what degree these changes are a result of the decreased number of rain gauges over the last 20 years. Is some algorithm used to compensate

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for the loss of some of these gauges, since it can be important in which climatic region the missing gauges are located. I suggest the authors check this by using only the gauges that are available throughout the entire period or apply a correction algorithm to account for changes due to different gauge configurations.

Page 12057 Line 17-25 It is mentioned here that some of the discharge data is interpolated as a result of missing data. This made me wondering about the overall quality of the discharge observations. Is the quality of the discharge observations constant over time, is some quality control in place or is there a large uncertainty on the observations. For example, is the rating curve been tested in high and low flow conditions or was it established a decade ago. I suggest the authors mention the quality of the discharge observations somewhere, because a lot of the validation is dependent on this on observation time series.

Page 12060-12061. I think the LUCL sensitivity can be extended, at the moment it raises more questions than it might answer. The changes in LUCL, can be further explored and maybe the authors can also look at the spatial distribution of the changes. Furthermore, only the hydrograph for one year is provided (instead of the climatology for example), which might not be the most convincing year. I miss some in-depth analysis in this part that could really help to improve this section (e.g. spatial distributed LULC changes or 1953 LUCL compared to 2012 LUCL for the entire period).

Minor remarks Page 12041 Line 7 Westernmost seem to be one word

Page 12042 Line 14-15 I think this line doesn't add to the manuscript and the previous sentence suffice. Please remove.

Page 12051 Line 4-5 Can the authors provide the reviewer with a rough percentage estimate of the total contribution of the Ansongo inflow to the outflow at Niamey?

Page 12051 Line 11 – 13 The WFDEI are mentioned here, I cannot find another reference to this dataset. Are they actually used?

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Page 12051 Line 14 Sensitivity test are mentioned to the atmospheric forcing. Can a summary of these test be included, since they are important to understand the impact of changing precipitation on the model results.

Page 12052 Line 17 A change in land cover is mentioned, maybe it is good to provide a 1953 and 2012 LUCL map to understand the differences.

Page 12053 Line 1-10, maybe this should be moved to methods

Page 12056 Line 1-8 Research questions should maybe be moved to the introduction.

Figure 12 The Figure says SC, while the caption states RC

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