

## ***Interactive comment on “Less rain, more water in ponds: a remote sensing study of the dynamics of surface waters from 1950 to present in pastoral Sahel (Gourma region, Mali)” by J. Gardelle et al.***

**Anonymous Referee #2**

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### General comments

This paper is very interesting and gives new insights on the rainfall/runoff changes occurring in the Sahel since several decades, lets say more runoff and less rainfall. Up to now these changes were assessed to be mainly due to the increase of agricultural areas, but this paper suggests that runoff has increased in areas only poorly cultivated. The material is rich, and the methodology is correct. Nevertheless, this paper needs to be improved in several ways. There must be clarified what is a pond's (hydrological) regime. To me in this paper what is discussed is the variability of the pond surfaces over

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years. In speaking of hydrological regime, we should see time series of discharges to the ponds. To be sure that the runoff coefficient has increased, one should calculate the ratio of runoff/rainfall. It should be possible to calculate the rainfall on the surface of the pond basins, and estimate the ponds volume. There are not clear hypothesis of why the runoff would have increased early in the 1990s. What has changed in the vegetation? It is very important to bring some features of the changes in the vegetation to support the conclusion that it is the main cause of the pond surface increase. Even if we know, from the rainfall time series, that the period extending from the years 1981 to 1993 was the worst drought period ever recorded in the Sahel. This should be also discussed more deeply, as the rainfall shortage is the main driver hypothesized for triggering the vegetation change. For instance the authors can show a rainfall time series longer than that presented on the figure 1. It is referred in the text to the variability of the surface of many other ponds, but one would like to see a table with detailed informations about these ponds.

For these reasons, I suggest the paper to be brought a number of minor revisions.

### Detailed comments

Abstract I1: "flood regime of ponds", this is not detailed in the paper. The topic do not seem to be the flood regime, but the variability of flooded areas. Studying the regime would mean that you present daily or monthly discharges to the ponds. Introduction p 5049, l22-24: It is referred to Descroix et al, 2009, that the land clearing in the Sudanian area did not provoked a runoff increase as in the Sahel. But both areas can not be compared in term of runoff/rainfall processes over basins. Groundwater do not participate in runoff in the Sahel (or occasionally during the rainy season, and with very low amounts), while they are a significant part of the runoff for Sudanian rivers. Several papers discuss the decline of the groundwater table in the Sudanian area and its impact on river runoff (several papers on the Bani river for instance). p 5050, l7-8: it should be good to give a definition of what is a flood regime of ponds. Chap 2.1. p 5053, l 1-4: it is said that ponds or lakes feed local shallow aquifers. It would be interesting to describe

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the mechanism of the feeding. Chap 2.2 p 5053, there are no data about water levels in ponds, nor about "flood regime" data, that could be interesting to present if they exist. Chap 4.3 p 5061, the interannual variability of the pond's surface is discussed. But it is difficult to interpret the figures, as we have not yet been presented the variability of the pond's surface. Chap 4.4 p 5061, l 14: the title should be modified, as, to me, the "pond's hydrologic regime", should refer to the variability of the input discharges. Chap 4.5 p 5062, l 18-19: the ponds' data should be presented in a table, as for now figures are given without any support. Chap 5.2 p 5065, l 1: "...it seems that red ponds did not increase as much as blue..." according to your results, they DID not, why do you write "seems" ? p 5065, l 11-17: why at the outlet plain of these rivers (containing red ponds), excess runoff water would be "absorbed" and not in blue ponds ? Conclusion p 506, l 24-27: the surfaces of croplands, herbaceous and woody vegetation should be mapped over time. Are there not enough images to map these surfaces ? p 5081, Figure 7: it is written that the change in pond regime started in the early 90s, but it seems much more difficult to assess this when you only show points for the years 1985, 1986, 1990 and 1996. Are there not values for the other years? Without these points it is very hard to give a year as being the start of the ponds change.

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