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Evidence of an increase in pond surface during the multidecennial drought in pastoral Sahel

J. Gardelle, P. Hiernaux, L. Kergoat, and M. Grippa
CNRS, CESBIO, Toulouse, France (laurent.kergoat@cesbio.cnes.fr)

The Sahel region experienced the most important decrease in precipitation during the second half of the 20th century, with severe droughts having a dramatic impact on the population. However, in apparent contradiction with the negative precipitation trend, evidences of an increase in watertables level and in river discharge have been reported for some endorheic areas of the Sahel, as for example in the SouthWestern Niger ([1, 2]).
Getting a global picture of this phenomenon is quite difficult since not much information is available on this wide and remote region, especially in the northern pastoral areas. The aim of this work was therefore to provide some more details on the long term evolution of surface water in the pastoral region of Gourma, in Mali. The study was focused on the evolution of ponds over the 1954/2007 period and employed long time series of remotely sensed data.
Different remote sensing information acquired by different sensors and different support (satellite images such as those from FORMOSAT, SPOT, LANDSAT, TERRA/MODIS, CORONA as well as aerial pictures) were combined to get a coherent picture of the seasonal, interannual and long term evolution of the ponds investigated. The ponds' surfaces were estimated from these images using different classification methods that were
specifically adapted to fit each type of spectral resolution (lack or presence of a middle infrared band, panchromatic image) and spatial resolution (going from a few meters as for SPOT and FORMOSAT images to 250 meters as for MODIS images).
The classification results showed evidences of a general increase in the Gourma pond's surface over the last 50 years, despite the precipitation decrease recorded over the same region. Moreover we observed an important change in the hydrological regime of some ponds such as that of Agoufou et of Bangui Mallam that were temporary (filled with water during the rainy season but empty during the dry season) before the major droughts of the 70/80 and became permanent afterwards. A particularly striking example is the increase of the Agoufou pond's surface that, at the end of the raining season, had a size of less than 10 ha in the sixties, become a permanent pond in the nineties increasing to a size of about 60 ha and it is nowadays between 440 and 560 ha.
These results are in agreement with the increase of surface runoff reported for some other Sahelian region yet its causes are not yet fully understood. The intensification of agricultural activities suggested as a possible explanation for the Niger region ([3]) does not hold for the pastoral areas in the northern Sahel, like the Gourma, where agriculture has a minor impact and where, more likely, causes are to be sought in the changes of natural vegetation and in the modification of surface characteristics following the major droughts of the 70/80.

References

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