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Driving factors of discharge decline in the White Bandama watershed, a socio-economic pole of development for the Northern Côte d'Ivoire

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Climate around the world has rapidly changed with air temperature near the surface of the earth increased by 0.74 °C over the last century. The White Bandama watershed in Northern Côte d'Ivoire, characterized by tropical transition regime, is not exempted from climate change. The area is subject to persistent drought (on average 6 to 8 months per year) and actual evapotranspiration represents at least 50% of the water budget. Thanks to its strategic geographical position (borders with neighbouring countries), the White Bandama watershed is characterized by increasing economic and agricultural activities together with rapid demographic growth.
A Student's statistical test on hydro-climatic parameters over the 1950-2000 period revealed decreasing precipitation since the 1970s and rising temperature and evapotranspiration since the 1980s. Thus, discharge begun to drop in 1974. The spatial variation of hydroclimatic variables analyzed by using the Mann-Kendall statistical test over the same period (1950-2000) shows an increasing trend for temperature and evapotranspiration and a decreasing trend for discharge over the whole study area at the significance level of α=0.05 and α=0.10. Precipitation has a decreasing trend over the basin at the significance level of α=0.05 and α=0.10, except in the center of the study area where no significant trend at the level of α=0.05 is observed.
We examined the driving factors of discharge decline through correlation comparison for precipitation and discharge for the periods before and after the abrupt discharge change in 1974. The Regression analysis between precipitation and discharge for the period before abrupt change is stronger than that in the period post 1974. This result suggests that during the period after the break year (1974), discharge was less influenced by precipitation and therefore could mainly be driven by human activities. In fact, the watershed area is more and more populated, increasing from 20 879 people in 1963 to 2 000 000 people in 2014. Furthermore, around 250 small reservoirs were built in the 1970s for irrigation and livestock development and also domestic uses in order to boost the development of the area. This situation added to evapotranspiration rise has caused discharge decrease around the White Bandama watershed.