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Flooded area characterization and losses estimation for water balance and hydrological functioning over the Niger inland delta, Mali

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Water availability is an ongoing challenge for West African countries in general and Niger River basin in particular. Niger Inland Delta undergone an annual flood events from the Niger and Bani Rivers. During such events the flooded area can overs a surface of about 40,000 km2 and extends around 350 km in length and 100 km width in Mali. The processes that occur in NID are not fully incorporated in the conceptual development of many hydrological models under Niger Basin runoff. While these processes in NID can have considerable influence on downstream flow regimes due water losses impacting significantly the water availability. Although several studies in this region developed conceptual models to represent hydrological processes in that system. But the models have been criticized for their limitation and simplicity in conception for representing explicitly all the hydrological processes. This paper presents an attempt to assess the hydrological processes by taking into account more physical knowledge of the NID system. This is in view of incorporating wetland processes into an existing hydrological model to improve model simulations on the basin. The approach is mainly water balance based on large units that account for the system over the NID.
Digital elevation model (DEM), satellite data, observed climate and hydrological parameters allowed the assessment of spatiotemporal variations of the flooded area, and then the quantification of evaporative and infiltration fluxes. Characterization of the extent of the flooded area is obtained from monthly-\hspace{0pt}scale inflow data and remote sensing derived flood maps within a non-linear regression Model based. The modelization of the spatiotemporal extension of the flooding of the NID show that the flooded areas vary between 25 000 km2 in wet period and 2 000 km2 in dry period. Time series of input water volumes in the Niger Inland delta and of the water losses through the NID show that the percentage of volume of annual water losses, due to the intense evapotranspiration, is approximately 30%. This basic analysis of in situ discharges validates this impact of the Niger Inland delta area on the discharge of the streamflow at the downstream compared to the upstream flow of the delta. For the hydrological water balance over the NID, in addition to the monthly actual evapotranspiration (AET) losses from the NID; we also estimate the approximate monthly infiltration losses, the contribution of volume of rainfall and abstracted water. The change of storage within the NID area is inferred from the hydrological balance.