

## **Progressive aridity impact on the hydrological regime in the Volta River basin in Benin (West Africa)**

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**Abstract** The Volta River basin within the Soudano-Sahelian climate zone in Benin is experiencing progressive aridity, of which the impacts on surface water runoff are large. In this context, it is necessary to understand the hydrological regime change to provide the best decision tools for water managers. For this purpose, methods of statistical variability analysis, calculation of aridity index based on the UNEP classification and discontinuity detection on rainfall and flow series were used over the period 1961–2010. The water deficit index, the base flow index and the seasonal irregularity index were calculated. This study revealed that since 1975 the Volta basin in Benin has experienced a drought persistence leading to an increased climate aridity (20% from 1961 to 2010). Rainfall decreased by 13% while the aridity index varies from 0.01 to 2.66, indicating dry sub-humid climate to hyperarid climate at the monthly scale. Indeed, annual variation in flow decreased by 41% in the sub-basin of Porga and 32% in that of Tiele over the period 1975–2010 compared with 1961–1975. Also, an increased base flow index of 0.6 to 0.8% at Porga, 0 to 0.1% at Tiele supported by very marked seasonal irregularity were relevant indicators of hydrological drought and surface water scarcity. The sensitivity of the hydrological regimes to the change of aridity in the Volta basin should be a basis for sustainable water management strategies development in the Sudano-Sahelian area of Africa.

**Key words** hydrological regime; aridity index; surface water scarcity; sustainable management; Volta River basin; Benin