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“Development on the margin”

Comparative Hydro-climatology in West African Basins from 1901 to 2002

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Abstract

Long-term historical records of rainfall (P), runoff (Q) and other climatic factors were used to investigate hydrological variability and trends over the period 1901–2002 in the prominent Ogun-Osun and Volta River Basins located in West Africa. Evaporation (E), rainfall variability index (δ), Budyko's aridity index (IA), evaporation ratio (CE) and runoff ratio (CQ) were estimated from the available Hydroclimatological records. Mann-Kendall trend analysis and non-parametric Sen's slope estimates were performed on the respective time-series variables to detect monotonic trend direction and magnitude of change over time.

Rainfall variability index showed that 1968 was the wettest year while 1983 was the driest, with the last three decades being drier than any other comparable period in the hydrological history of the Ogun-Osun and Volta. An average increase of 2.06 and 1.8 mm/yr² was observed in E in the 1901–1969 and 1970–2002 sub-series for Ogun-Osun and Volta respectively. Rainfall increased at the rate of 0.7 mm/yr² or 49 mm/yr between 1901 and 1969, whereas a decrease of 0.2 mm/yr² (6 mm/yr) was estimated for 1970–2002 sub-series. Runoff increased significantly at the rate of 1.46 and 0.8 mm/yr respectively for the two study areas. Runoff before dam construction was higher than the post-dam period. A 10 % relative decrease in P resulted in a 16 % decrease in Q between 1936 and 1998. Since 1970, all the months showed increasing runoff trends with significant slopes ($p < 0.05$) in 9 out of the 12 months. Possible causes, such as climate change and land cover change, on the detected changes in hydroclimatology are briefly discussed.

Keywords: Aridity index, Evaporation ratio, Hydroclimatology, ogun-Osun basin, Trends, Volta basin