



## **Hydroclimatology of the Volta River Basin in West Africa: trends and variability from 1901-2002**

**P.G. Oguntunde** (1,2), J. Friesen (2,1) and N. van de Giesen (1,2)

(1) TU Delft, CiTG, Stevinweg 1, 2628 CN Delft, The Netherlands, (2) Center for Development Research (ZEF), University of Bonn, Bonn, Germany (poguntunde@yahoo.com / Fax: +31 15 2785559)

Understanding trends and variations of current and historical hydroclimatic variables is pertinent to the future development and sustainable management of water resource of a given region. In this study, long-term historical record of rainfall, runoff and other climatic factors were used to investigate hydrological variability in the Volta River Basin over the period 1901-2002. Potential (PE) and actual evaporation (AE), rainfall variability index (RI), Budyko's aridity index (AI), evaporation ratio (ER) and runoff ratio (RR) 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. An increase of  $0.30 \text{ mm/yr}^2$  ( $p < 0.001$ ), for a total 102-year increase of  $31 \text{ mm/yr}$ , was observed in PE, whereas a decrease in rainfall of  $1.38 \text{ mm/yr}^2$  or  $13.2\%$  of the mean was estimated over the same period. Similarly, runoff and actual evaporation decreased at the rate of  $0.20 \text{ mm/yr}^2$  and  $1.78 \text{ mm/yr}^2$ , for the period between 1936 and 1998, respectively. Runoff showed the highest variability with coefficient of variation (CV) of  $38\%$  whereas the lowest CV of  $1.5\%$  was estimated for PE. Rainfall variability index showed that 1968 was the wettest year ( $\text{RI} = +1.75$ ) while 1983 was the driest ( $\text{RI} = -3.03$ ), with the last three decades being drier than any other comparable period in the hydrological history of the Volta. Over the 20th century, this basin has been experiencing a gradual increase in dryness as revealed by an increase of  $0.002/\text{yr}$  ( $15\%$  of mean) in aridity index. Possible causes, such as climate change and land cover change, on the detected changes in hydroclimatology are briefly discussed.