Geophysical Research Abstracts
Vol. 19, EGU2017-8302, 2017
EGU General Assembly 2017


# Trend and variability in western and central Africa streamflow, and their relation to climate variability between 1950 and 2010

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Unprecedented drought episodes that struck western and central Africa between the late 1960s and 1980s. This triggered many studies investigating rainfall variability and its impacts on food production systems. However, most studies were focused at the catchment scale. In this study, we examine how rainfall variability has impacted on river flow at the subcontinental scale between 1950 and 2010, as well as the key large-scale controls on this relationship.

For the first time, we establish a complete, gap-filled, monthly streamflow data set, which extends from 1950 to 2010, over the western and central African region. To achieve this, we used linear regression modelling across and between ∼600 flow gauging stations (see initial database information at http://www.hydrosciences.fr/sierem/index_en.htm).

Streamflow trend and variability are then seasonally assessed at this subcontinental scale and compared to those observed in three different rainfall data sets (i.e. CRU TS3.24, GPCC V7, IRD-HSM). Long-term trends and variability in streamflow are mainly consistent with trends in rainfall. However, these relationships may have been moderated by: i) changes in land use; and ii) contributions from groundwater resources. In particular, we note that the recent post 1990s partial recovery in Sahel rainfall could have, at least partially, positively impacted river flows (e.g. the Senegal and Niger rivers).

Using multi-temporal trend and continuous wavelet analysis, the time-evolution of western and central African river flows are analysed, and are all characterized by very strong decadal fluctuations, which can be interpreted as modulations in the baseflow. These decadal fluctuations, which are also significantly detected in rainfall, are likely related to large-scale sea-surface temperature (SST) anomaly patterns, such as the tropical Atlantic SST variability, the Atlantic Multidecadal Oscillation, the Interdecadal Pacific Oscillation and/or the Pacific Decadal Oscillation. Furthermore, hitherto-poorly understood hydroclimatic processes related to these teleconnections at decadal timescales will be examined in this study. Influences of the catchment properties (e.g. size, shape, vegetation and landuse cover, soil type, ground-water level, direction of stream flow across climate zones) on these decadal fluctuations in river flows will also be assessed. This study therefore aims to improve the ability of current regional and global climate models to simulate such ranges of variability, to significantly improve regional hydroclimate understanding, as a means for improving the development of future scenarios for water resources in western and central Africa.