



Analysis of ten year return period floods in west african rivers

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In West Africa, flood and flow are usually determined by using methods advocated by the FAO (1996) and developed by ORSTOM and CIEH researchers in the 1960s. However, the 1970s, 1980s, 1990s decades were characterized by very low precipitation amounts, leading to low stream flows in river basins, except in the Sahelian region where the impact of human activities led to a substantial increase of floods in some catchments. More recently, studies pointed out an increase in the frequency of intense rainfall events and an increase of flood events. Consequently, the reliability of conventional methods for flood estimation is questionable.

In this work, we analyzed the trends of the ten-year return period rainfall and stream flow events for several catchments in the Sahelian and Sudanian regions. We used eleven tributaries of large river basins (Niger, Nakambe, Senegal, Gambia) for which daily rainfall and flow data were collected from national hydrological services of four countries over West Africa (Burkina Faso, Mali, Niger, Senegal). The conjoint use of rainfall and flow data allowed us to analyze the possible causality link between the two variables.

Mann–Kendall, Pettitt and Hubert tests were used to detect trends and abrupt change points in the annual maximum time series. The quantification of change was assessed by computing 10-year return period rain and flow values on sliding sub periods in the long-term maxima time series with the GEV distribution.

Trend tests on annual maximum flows time series showed mixed results depending on the location of the catchments: generally speaking, a decrease is observed for Sudanian catchments and an increase is observed for Sahelian catchments. On a period of 50 years (1950 – 2010) we pointed out an increase of 72% of the mean value of flood 10-year return period for a station like Kakassi in the sahelian region, with respect to the period before the detected disruption; while for a soudanian catchment like Fadougou, the average value is diminishing by 40%.