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Time series analysis of 44 years of daily-observed flows of the Nile River

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Flow time series of the main Nile (North of Khartoum) and its main tributaries within the Sudan: Blue Nile and White Nile were analysed. The time series were analysed using long-term daily-observed flow data of 44 years (1965-2009). The flow data of key stations: Eddeim and Khartoum on the Blue Nile, Malakal on the White Nile, and Dongola on the main Nile were analysed. The time series were analysed based on hydrological year (June-May).

Results show that the annual flows of the main Nile and the Blue Nile show increasing linear trends. While the annual flows of the White Nile show a decreasing linear trend. Furthermore, we analysed the time series of low and high flows. The main Nile shows a decline linear trend of low flows and an increasing linear trend of high flows. The Blue Nile shows increasing linear trends for both low and high flows, while the White Nile shows decreasing linear trends for both low and high flows.

Considering the long-term 95% flow percentile (based on 44 years of daily-observed flow) as a threshold of high flows, the frequency of high flows that are higher than the threshold increases for both the main Nile and the Blue Nile, and decreases for the White Nile.

The implications of this study are for climate change studies, water management and planning, and water sharing.