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The effect of Congo River freshwater discharge on Tropical Atlantic and Africa climate variability

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Eastern Tropical Atlantic (ETA) collects a huge quantity of freshwater due to discharge from several rivers. Every year, the Congo river alone releases 1270 km3 of freshwater into the ocean (Weldeab et al., 2007), which is the second-largest flow in the world second only to the Amazon River.
This study aims to understand the role of Congo freshwater discharge in driving circulation over ETA. In particular, the effect of the secondary peak discharge at Brazzaville river station is here analysed. This maximum occurs in late spring and releases freshwater into the Gulf of Guinea (GG) during boreal summer, namely the season characterized by the greatest sea surface temperature (SST) variability in the Gulf.
50-year observations show that large peak discharge positive anomalies are preceded by anomalously high SSTs over north-eastern Tropical Atlantic, linked with wet springs over Congo river catchment. Intense freshwater amounts into the ocean provoke a water warming beginning at the African coast in May and extending over the GG during June and July. This SST anomaly is related to highly wet rainy season over western Africa.
Conversely, low spring discharges are associated with noticeable positive SST anomalies over Tropical South Atlantic in winter, with maxima around 20-25° S, and warm temperatures persist through the summer. In these years, over April the African coast starts being subject to anomalously cold SSTs which extend to the GG during the succeeding months, with the coldest anomaly registered in June. Western Africa heads toward very dry summer, again suggesting a strong linkage with GG SSTs.
The long-term objective of this study is a better understanding of Tropical Atlantic variability and climate variability over Africa, through the introduction of a forcing, the continental freshwater discharge, often neglected by previous studies.