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A 1700-year history of West African multidecadal sea surface temperature and rainfall variability

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Tropical Atlantic sea surface temperatures (SST) exert a major influence on the latitudinal position and intensity of the West African Monsoon and the tropical rainbelt. The impact of the Atlantic Multidecadal Oscillation (AMO) in particular has previously been demonstrated, but little information is available beyond the instrumental time period. We have reconstructed summer-fall SST and relative changes in the discharge of the Senegal River from a sediment core off southern Mauritania. Time series of SST and seawater-d18O (a measure of salinity and hence discharge) were estimated from planktonic foraminiferal Mg/Ca and d18O. The records are sufficiently resolved to infer multidecadal variability over the past 1700 years and centennial variability over the past 3300 years.
River discharge increases slightly over the entire time series. This can be brought into agreement with the general Sahel drying trend indicated by previous studies, when we assume a southward migration of the rainbelt that leads to locally enhanced rainfall over the southernmost Senegal River catchment area in Guinea. SST cooled by 1-1.5 °C between AD 1250 and 1500, more pronounced and somewhat earlier compared with the North Atlantic mean. Spectral analysis reveals several multidecadal periods (38, ∼45 and ∼62 years) where SST and Senegal River discharge are tightly coupled and are driven by the AMO. The exception is a 30-year periodicity in discharge that has no counterpart in SST, and is potentially linked to meridional tropical SST gradient anomalies. AMO signatures are present throughout the past 1700 years, but vary in amplitude. The most recent and persistent phase of enhanced AMO variability commences around AD 1250 contemporaneous with the transition from the Medieval Climate Anomaly to the Little Ice Age.