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Late Holocene variability of Saharan dust mobilisation: relation to ocean circulation and human activity

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High-resolution sediment records from ocean margin settings offer the opportunity to study the response of continental climate to changes in ocean circulation. We constructed a 3,200-year record of dust deposition and thermocline ventilation off northwest Africa by investigating the quality and quantity of terrigenous sediments as well as the stable isotopic composition of benthic foraminifera at marine site GeoB9501 from 323 m water depth. This site is located directly under the West African dust plume and is bathed in Atlantic central waters, which allows monitoring the contemporaneous variations of dust input and thermocline properties. The evolution of the bulk geochemical signature at Site GeoB9501 indicates significant changes in the source of terrigenous sediments over the past 3,200 years. From about 1200 BC to about 200 AD sedimentation is dominated (78%) by fine-grained fluvial sediments. The following 700 years are characterized by a gradual increase in dust deposition and grain size, stabilizing around 900 AD. From the fourteenth century onwards, dust deposition rises again with the steepest increase of the entire record occurring after the early nineteenth century. We find that the overall increase in dust deposition during the past 3200 years is associated with an increase in carbon isotope values in benthic foraminifera until about the 18th century AD. This pattern can be explained by a gradual strengthening of the subtropical high, which increases the thermocline ventilation due to stronger westwinds and a contemporaneous increase in NE trade winds with an increased dust input to Site GeoB9501. At the beginning of the nineteenth century, a sharp increase in dust deposition parallels the advent of commercial agriculture in the Sahel region. Our data suggest a tight coupling between West-African dust generation and North Atlantic surface hydrology for much of the past 3,200 years with a significant increase in human dust mobilisation during the past 200 years.