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Hydroclimate and atmospheric circulation over North Africa through the last two climatic cycles reconstructed from dust deposited off West Africa

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On glacial to interglacial time scales, northern Africa fluctuated between arid to hyperarid states and much wetter conditions called African Humid Periods (AHP). These AHP are characterized by a major transformation of the Saharan hydrological cycle, favoring the development of vast fluvial networks, tropical flora and fauna in a region previously hyperarid. In the present-day context of global warming, it is crucial to understand the environmental mechanisms and responses associated with these dramatic swings between two extreme climatic states in order to improve the climatic projections. Numerous studies have been focused on the last AHP, which occurred at the beginning of the Holocene and corresponds to a period when insolation - governed by precession – and obliquity both reached their maximum almost synchronously, thus complicating the distinction of their respective roles. The study of older AHP corresponding to different orbital configurations is likely to provide some answers. However, finding climatic archives allowing the reconstruction of past changes in the Saharan hydrological cycle on longer timescales remains challenging (e.g., discontinuity of continental archives, preservation of tracers...). In this study, we propose to circumvent this difficulty by studying the Saharan dust deposited in marine sediments of the northeastern Atlantic tropical ocean. In fact, past modifications of Saharan dust deposited off West Africa can provide precious information on changes in environmental conditions in their source areas (aridity, weathering), as well as on changes in the characteristics of their atmospheric transport (pathways and strength). Here, we present a unique high-resolution (1 sample/200yrs) multi-proxy characterization of the dust deposited continuously through the last 240ka - a period punctuated by eight AHP - in the marine core MD03-2705 (18°05N; 21°09W; 3085 mbsl) retrieved from a bathymetric dome, 300 meters above the surrounding seafloor. Considering this particular environmental setting, the terrigenous fraction in this record is assumed to be predominantly of eolian origin. We combine the ^{230}Th-normalized dust flux[1] together with grain-size distribution, clay mineralogy and geochemical compositions in order to explore changes in the Saharan hydroclimate and atmospheric circulation over North Africa on millennial to orbital timescales, with a particular focus on the mechanisms associated with the recurrence of the AHP.

[1]Skonieczny et al., 2019 – Science Advances 5 (1) - eaav1887