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Dansgaard-Oeschger-type subsurface temperature oscillations in the tropical NE Atlantic during the last glacial

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Dansgaard-Oeschger (DO) cycles, characterized by rapid warming (interstadial) and more gradual cooling (stadial) stages, are apparent in many high-resolution paleoclimatic records worldwide and are particularly pronounced during Marine Isotope Stage 3 (MIS3). Although it is generally accepted that density-driven variations in the Atlantic meridional overturning circulation (AMOC) were responsible for this millennial-scale climatic variability, it is still debated how these density changes were triggered. We will present high-resolution temperature records for the last 50 kyrs obtained from core GeoB7926-2, recovered from the major upwelling region along the northwestern African continent (20°13'N, 18°27'W, 2500 m water depth). To estimate temperature variations, we applied two organic paleothermometers: the alkenone unsaturation (UK'37) index and TEX86-H. UK'37 temperature estimates varied between 18ºC and 22°C over the last 50 kyrs. The most prominent cooling occurred during the Younger Dryas and Heinrich Events 1 and 3, with lesser distinct cooling phases during Heinrich Events 2 and 4. The TEX86-H record revealed a much wider range of temperature variation, from 16ºC to 23°C, and the most striking feature is the distinctive sequences of abrupt warming and cooling with amplitudes of up to 6° during MIS3, which are not seen in the UK'37 record. The different temperature amplitudes observed in our UK'37 and TEX86-H records during MIS3 indicate that the UK'37 and TEX86-H proxies must reflect different tropical NE Atlantic temperatures under glacial conditions. At our core site, we consider that low TEX86-H values during the last glacial reflect subsurface temperatures, whilst UK'37 represents surface mixed-layer temperatures. Statistical analysis shows that the reconstructed strong cooling of subsurface waters is consistent with a positive relationship to enhanced AMOC and prominent surface warming over Greenland during DO interstadials. We hypothesize that reduced downward heat transfer by diffusion related to internal oceanic process was the driving force for subsurface cooling in the tropical NE Atlantic. This is supported by climate model simulations that revealed the existence of self-sustained oscillations in AMOC during the last glacial. Internal oceanic processes rather than high-latitude external freshwater forcing may, therefore, trigger density changes in the northern North Atlantic and thus in AMOC, governing DO cycles during the last glacial.