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Deep-sea temperatures across two early Eocene hyperthermal events based on clumped isotope paleothermometry

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The early Eocene (56–48 Ma) hothouse experienced the highest CO_2 levels of the Cenozoic, as well as the occurrence of multiple transient global warming events, so-called hyperthermals [1,2,3]. The deep ocean is the largest heat reservoir in the climate system and not subject to local seasonal, latitudinal and geographical induced variations in temperature. Hence, deep water temperatures compromise a robust setting to estimate global mean temperatures [4]. However, available early Eocene $\delta^{18}O$ and Mg/Ca-based deep-sea temperature estimates rely on uncertain assumptions [5,6]. Here, we apply the carbonate clumped isotope paleothermometer (Δ_{47}) on early Eocene benthic foraminifera to evaluate South Atlantic deep-sea temperatures across two hyperthermal events (ETM2 and H2; ~54 Ma) [7]. Our measurements indicate warmer deep water conditions (~11°C for background state) than estimated from foraminiferal $\delta^{18}O$ (~9°C), while they reveal similar warming during ETM2 and H2 (~4°C and ~2.5°C respectively) [7]. These Δ_{47}-based overall higher deep ocean temperatures provide new support for high Earth System Sensitivity during the past warm climate of the Eocene.

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