

Hydrogen isotopic compositions of n-alkanes in Hongyuan peat core over the last 13 kyr

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Paleoenvironmental reconstructions based on various proxies show that the Holocene Climate Optimum (10.5 to 6 ka) was a warmer and wetter period in eastern Asia. The East Asian Summer Monsoon, which affects most regions north of the Himalaya Mountains, is generally interpreted to have intensified and extended farther inland from their Pacific Ocean source of moisture. The Indian Ocean Summer Monsoon concordantly intensified to increase precipitation south of the Himalaya Mountains and on the Tibetan Plateau. Results of our compound-specific stable hydrogen isotope analysis of plant-wax hydrocarbons extracted from a radiocarbon-dated peat core from the Hongyuan bog in Sichuan Province, China, show that the Indian Ocean Monsoon intensified to displace the Eastern Asian Monsoon in some areas north of the Tibetan Plateau during the Holocene Climate Optimum. We determined hydrogen isotopic ratios of the C₂₃ and C₂₅ n-alkanes produced by submerged water plants and of the C₂₉ and C₃₁ n-alkanes diagnostic of sub-aerial plants. An invariant hydrogen isotopic difference of about 20 per mille between the subaqueous and subaerial biomarkers indicates that the effective precipitation has not changed since 11 ka except for Younger Drays period. However, doubling of peat accumulation rates, coupled with a remarkable increase in the TOC content, reveals that climate was wetter at this location during the Holocene Climate Optimum. A marked decrease in the sub-aqueous hydrogen isotopic ratios from -230 to -260 per mille between 11 and 10 ka signals a change in the origin and amount of the moisture that was delivered to southwest China during this period. We infer from the smaller hydrogen isotopic ratios that precipitation removed deuterized water during transport over the Himalaya Mountains, signifying delivery of moisture by the Indian Ocean Monsoon. A combination of lower peat accumulation rates, decrease in TOC content and subaqueous hydrogen isotopic ratios that increase to -245 per mille indicate diminished delivery of moisture by the Indian Ocean Monsoon north of the Tibetan Plateau after 6 ka.