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Identification of the Asian monsoon during the Oligocene using high-resolution isotopic analysis of fossil wood

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The Asian monsoon system is a major constituent of modern global atmospheric circulation, controlling the amount of precipitation that falls over Asia throughout the year. While the onset of the monsoon system is associated with uplift during the Tibetan-Himalayan orogeny, the strength of the monsoon during the Paleogene is widely debated. Isotopic records and climate reconstructions from fossil plant assemblages and mammals indicate the monsoon has likely existed at least throughout the Neogene; however, quantitative data for monsoon strength during the Paleogene (> 23 million years old) is lacking. Here, we present new high-resolution carbon isotope ($\delta^{13}C$) data on late Oligocene age fossil wood (n = 717) collected from Nanning Basin, Guangxi, China in order to reconstruct the ratio of summer to winter precipitation. The data reveal large decreases in $\delta^{13}C$ value within each ring consistent with significant summertime precipitation. Specifically, we calculate ~2.5 times more precipitation falling in summer than winter, based on a previously published model for assessing intra-annual changes in $\delta^{13}C$ value of modern and fossil wood (Schubert and Jahren, 2011, *GCA*, 75: 7291–7303). These data are similar to precipitation patterns recorded at sites in southeastern China today, suggesting presence of the Asian monsoon during the Oligocene. These data provide the first quantitative measure of precipitation seasonality in southeast Asia during the Oligocene, and provide critical data for assessing the relationship between regional topographic uplift and the onset of the Asian monsoon.