Holocene climate variability and associated paleoenvironmental changes in the eastern lowlands of Guatemala revealed by a lake sediment from Lake Izabal

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Sediment records have been widely used to reconstruct Holocene environmental and climate conditions around the world. As new Holocene records from Central America and the Caribbean have become available, new hypotheses have emerged to explain the complex hydroclimate variability in the region. Here we present results from a radiocarbon-dated sediment core recovered from Lake Izabal, eastern Guatemala, that covers the last ~9,500 years. We combined sedimentological, XRF elemental abundances, and principal component (PC) analyses to reconstruct changes in erosion/precipitation, lake productivity, and lake water chemistry during the Holocene. Our results indicate that during the early Holocene, Lake Izabal was a shallow lake with minimal catchment erosion/precipitation as indicated by the abundance of organic-rich mud, coupled with the lowest PC scores and titanium (Ti) abundance of the entire record. An overall increase in the PC scores and a progressive increase in Ti suggest that precipitation/erosion increased from 8,300 to 4,800 cal yr BP and remained high until 1,200 cal yr BP. There was then a significant reduction in erosion and precipitation at ca. 1,200 cal yr BP, as evidenced by a sharp decrease in magnetic susceptibility, terrigenous derived elements, and PC scores. We suggest that the transition towards wetter conditions from the early to the middle Holocene, followed by a stable wet climate until ca. 1,200 cal yr BP, was strongly influenced by a progressive increase in autumn insolation throughout the Holocene, which could have caused an increase in Caribbean sea surface temperatures, increasing moisture availability leading to greater precipitation amounts in the Caribbean coast of Central America.