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Coral-based reconstruction of river runoff dynamics influencing Miri-Sibuti Coral Reef National Park, Borneo, Malaysia

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Anthropogenic and climate-induced changes in sediment load entering the coastal realm are of great concern for the sustainability of tropical marine and terrestrial environments. The Maritime Continent which includes many humid tropical insular states in Southeast Asia has experienced fast urbanization during the past 30 years that was accompanied by accelerated deforestation which reached very high levels in the region in previous decades (Langner et al., 2007, 2009; Miettinen et al., 2011; Hansen et al., 2013). Furthermore, climate extreme events of global importance like the El Niño conditions in 1997–1998 led to unprecedented drought and strong wild fires causing dramatic forest loss in the SE Asian region. A better knowledge of the effect and magnitude of climate change and local human impacts affecting the marine environment across the Maritime Continent is needed to formulate best management strategies for sustainable use and protection of the marine resources.
Here, we reconstruct the spatio-temporal dynamics of sea surface temperature, light availability and oxygen isotopic composition of seawater based on paired stable isotope (oxygen, carbon) and Sr/Ca measurements on coral cores obtained from three sites within the Miri-Sibuti Coral Reef National Park, Borneo, Malaysia. Our results reveal distinct seasonality in skeletal oxygen and carbon isotopes reflecting the combined effects of sea surface temperature, river runoff and light intensity. Carbon isotopes indicate reduced photosynthetic activity of corals during the wet season under increased turbidity. Paired oxygen isotope and Sr/Ca analysis allowed us to reconstruct the oxygen isotopic composition of seawater related to freshwater runoff events reaching the coral reefs. We assess the suitability of coral proxies in recording past climatic and environmental variability through cross-validation with satellite derived SST and salinity products. Our study provides first baseline data on environmental change and variability affecting coral reefs in a previously under sampled region of SE Asia under increasing human pressures.

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