Spatiotemporal variations of organic matter sources in two mangrove-fringed estuaries in Hainan, China

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Mangrove systems represent important long-term sinks for carbon since they have much higher carbon burial rates than terrestrial forests or typical coastal ecosystem. However, quantifying the sources of organic matter (OM) in estuarine and coastal sediments, where mangroves occur but are not the only source of OM, is challenging due to the variety of OM sources and diverse transport processes in these dynamic environments. The sources of OM in surface sediments of two mangrove-fringed estuaries in Hainan Province, China, were investigated using the mangrove specific biomarker taraxerol and other lipid biomarkers, as well as stable carbon isotopes. Mixing models based on the concentration of taraxerol, plant wax n-alkanes and δ¹³C_OM indicate that terrestrial non-mangrove plant OM accounted for 52-72% of the OM in the two estuaries, aquatic OM from phytoplankton and/or seagrass accounted for 8-29%, and OM from mangroves comprised 16-26% of the total. Terrestrial plants contributed 16-20% more of the OM to sediments of Bamen Bay, which is on the wetter, eastern side of Hainan Island, than to Danzhou Bay, but aquatic OM (algae plus seagrass) fraction was 17% lower than that in Danzhou Bay sediments. In both estuaries, mangrove and aquatic OM fractions increased seaward while the terrestrial OM fraction decreased. Terrestrial fraction in BMB sediments is 12% higher in summer compared to autumn, which is offset by a comparable reduction in the mangrove OM fraction, as well as higher aquatic OM fractions in both estuaries. This may be caused by enhanced river discharge, more efficient mangrove leaf litter transport offshore, and/or higher aquatic productivity. The biomarker and carbon isotope approach used here can be applied to semi-quantitatively estimate spatial and temporal variations of the sources of organic carbon in tropical estuarine and coastal sediments, a major sink for carbon in the ocean.