Compositional dynamics of organic carbon in surface sediments from the lower Pearl River to the coastal South China Sea

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As the second largest river in China, the Pearl River plays an important role in transporting terrestrial organic carbon (OC) to the South China Sea (SCS). However, the sources and compositional dynamics of OC along the Pearl River to the SCS are poorly understood. The main focus of this study was to delineate the OC sources and determine the fate of sedimentary OC from the Feilaixia Hydro-power Station to the Pearl River estuary and coastal SCS. Surface sediment samples were collected during a cruise in January 2012 for elemental, stable carbon/nitrogen isotope ($\delta^{13}C$, $\delta^{15}N$) and lignin phenol analyses. The OC from the up-stream sites were generally derived from vascular plants (higher C/N ratio, and more depleted $\delta^{13}C$) and soils. Additional input was attributed to in situ primary production (lower C/N ratio and more enriched in $\delta^{13}C$), which was enhanced near the dam-created reservoir. The mid-stream sites were characterized by insignificant variation in C/N and $\delta^{13}C$. The estuary/coastal sites witnessed hydrodynamically sorted riverine OC, which was diluted by marine primary production (lower C/N ratio and more enriched $\delta^{13}C$). The lignin concentration was the highest in the up-stream sites, kept relatively unchanged in the mid-stream sites and decreased significantly along the estuary/coastal sites, which followed well with the TOC variation dynamics. A comprehensive five endmember Monte Carlo simulation model suggested that previous studies have underestimated the C4 plant input by 14±11% and overestimated the riverbank soil input by 21±17%. The TOC and lignin mass accumulation rate in the coastal site was estimated to be about 1-5% of that in the estuary. Thus, our study provided valuable information necessary for more accurate source and mass balance studies of terrestrial organic matter transported to the SCS. Future work needs to better understand how the sources, decay and preservation of terrestrial derived OC affect the OC cycling in this river-continental margin system.