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On the Heterogeneity of POC Transport Mode in the Four Largest Chinese Rivers

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The four largest river systems in China, namely, Zhujiang, Changjiang, Huanghe, and Heilongjiang, together export about 1,700 Mt/yr of suspended particulate matter (SPM) to the Ocean. Consequently, these mega rivers carry a significant amount of terrestrial particulate organic carbon (POC) that could be eventually buried in marine sediments, sequestrating atmospheric CO_2. The four largest Chinese rivers drain very contrasted basins in terms of geomorphology, lithology, climatic conditions, and anthropogenic pressure. The main control(s) on the genesis, transport, and fate of POC in these basins are explored according to these large-scale heterogeneities, especially deforestation and damming which have substantially intensified over the last few decades. The origin of POC and the dominant processes regulating riverine metabolism are explored using SPM grain size fractions collected along river depth profiles, taking advantage of hydrodynamic sorting in the water column. For each river system, two to five depth profiles were collected across the channel near the river mouth. Riverine SPM samples were analyzed for grain size and major/trace element contents as well as for total nitrogen, POC content, and dual carbon isotopic composition (^{13}C and ^{14}C). Notably, the Heilongjiang carries the most OC-enriched SPM and the youngest POC, while the Huanghe transports the most OC-depleted SPM and the oldest POC. The Changjiang and Zhujiang have intermediate values for both POC content and radiocarbon age. In addition, chemical heterogeneities of SPM are observed between the various depth profiles of a given river cross-section, except for the Changjiang. Catchment-scale analysis of geomorphic, lithogenic, climatic, and anthropogenic variables have been undertaken to understand the controls on POC content and composition (biospheric vs. petrogenic). This study improves our knowledge on the mechanisms of fluvial transfer of POC and its role in the global carbon cycle.