

Sources and ages of black carbon in large Chinese rivers and coastal ocean

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Rivers play important roles in mobilization and transport black carbon (BC) from land to the ocean. It is estimated that $26.5 \pm 1.8 \times 10^6$ tons of BC is transported in dissolved phase by the rivers each year, which accounts for $\sim 10\%$ of the global flux of dissolved organic carbon (DOC). The sources of this large amount of riverine dissolved black carbon (DBC), whether is from recent biomass burning or from ancient fossil fuel combustion is not clear. Here, we present results from radiocarbon (^{14}C) measurements of BC in both dissolved and particulate phases transported in several major Chinese rivers, and in coastal seawater and sediments. Our results show that two distinct BC pools (young vs. old) were carried by the rivers. In the rivers, the ^{14}C ages of DBC were much younger (475 to 1,510 years BP) than the ages of the particulate BC (PBC, 2,675 to 12,600 years BP). The ^{14}C ages of DBC in seawater and sediment porewater were also much younger than the PBC. Isotopic mass balance calculation indicates that the DBC transported in rivers contained a large fraction BC ($> 50\%$) derived from biomass burning while the PBC comprised mainly fossil fuel combusted BC. The great age differences of the two BC pools suggest that BC derived from biomass burning and fossil fuel combustion have different chemical structure. They also suggest those carbon pools are mobilized in different phases in the rivers, and cycled in different time scales in natural environments.