Influence of irrigation-enhanced benthic fluxes on the estuarine mixing of solutes in the Jiulong River estuary, southeast China

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Sediment porewater serves as a third endmember in estuarine mixing. Here, we utilize the $^{224}Ra/^{228}Th$ disequilibrium approach to determine the benthic fluxes of solutes (DIC and NH_4^+) and their influence on the mixing of these species in the Jiulong River Estuary, southeast China. Fluxes of ^{224}Ra were calculated with a 1 D mass balance model. We demonstrated that irrigation was the dominant mechanism controlling the transfer of solutes across the sediment-water interface. Based on the mass balance of water column ^{224}Ra, site-specific residence times of water mass were estimated to be -44±8–2.8±0.2 d. The negative values were derived in the mid estuary, presumably resulting from the assumption of a negligible submarine groundwater discharge (SGD). By reconciling the water residence times, the contribution of SGD were distinguished with that of porewater injection.

The benthic fluxes of DIC, and NH_4^+ were estimated using the $^{224}Ra/^{228}Th$ disequilibrium approach. They can well support the addition of these solutes in the estuary. The average fluxes of DIC over the whole estuary were -172 mmol m^{-2} d^{-1}. which were comparable to the net export by SGD for DIC. In addition, they were equivalent to ~46% and ~129% of the riverine input. Hence, the results here highlight the essential role of sediment for the budget of solutes in estuary.