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20th-Century River Course Changes and Their Relation to Sediment Carbon Distribution Patterns in the Yellow River Delta

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Abstract : Most of the world's coastal alluvial plains can be significant carbon (C) eservoirs in which upland sediments are deposited and bury former topsoil, thereby contributing to soil C preservation, especially in river-controlled deltas like the Yellow River Delta, China. These deltas are affected by the continuous large amount of sediment transport and strong river dynamics from the upper reaches, which makes the river course in the deltas change frequently. However, the impact of varying river course changes on C stocks in these estuary wetlands is unclear. To investigate this, we drilled five 2 m cores along a sediment deposition sequence of the Yellow River Delta, which shifted its main course flow in the delta several times throughout the 20th century. Covering 80 years of sediment deposition, we explored both soil C stocks and their potential sources, and identified key soil physicochemical and hydrometeorological variables that correlate to C density and deposition rate. Further, the spatiotemporal C distribution and its relationship with these variables was examined. Our results showed that sediments at a soil depth of 200 cm in the main courses of the Yellow River corresponded to deposition ages ranging from 1942 to 1989. The oldest course has the lowest C stocks and showed C-enriched compared with younger courses. Contributions of soil C stemming from fresh particulate organic carbon from deposited upstream sources were significantly higher than local, in-situ vegetation. In addition, the carbon of the oldest and relatively young courses tends to be affected by interaction effects of hydrometeorological and physiochemical varibales, and that of the middle courses tends to be affected by independent variables. Our findings can help prioritize conservation efforts across different river courses and provide quantitative support for global carbon emission reduction by assessing sediment carbon reservoirs.

Keywords : alluvial plains, coastal wetland, core drilling, course diversion, organic carbon, sediment deposition rate, soil deposition

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