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Response of phosphorus distribution on bed sediment to complex hydrodynamics at channel confluences

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Channel confluences are critical regions for water treatment due to its important role in pollution transport in river networks. Laboratory experiments are conducted in a 90-degree confluence flume, and two cases with different discharge ratios are designed to investigate the effects of complex hydrodynamics on the phosphorus distribution at confluent zone. The results show that adsorption amounts of phosphorus spatially vary significantly with respect to specific hydrodynamic regions. Downwelling flow is beneficial to phosphorus enrichment as it can produce the hyporheic exchange. The strips of low adsorption of phosphorus mainly locate in the region of maximum velocity in both cases, indicating that flow with large velocities is reverse to phosphorus enrichment on bed sediment. The distribution pattern of phosphorus in the region of flow separation is different in two cases, which is attributed to the contributions of flow separation and cross-section secondary flows. In general, phosphorus enrichment is more serious for the large tributary discharge. Phosphorus distribution can be predicted when the flow structure is known in river confluence, which is significant for the water treatment of river networks.