

Sediment characters and movements of barrier-lagoon system in the Nakdong River Estuary, Busan, South Korea

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The Nakdong river estuary on the southeastern coast of Korean Peninsula is an enclosed type with two large estuarine dams. The construction of these dams has led to the geomorphological evolution of barrier islands within the estuary since 1930s. The estuary has been characterized as a barrier-lagoon system with various subenvironments and micro-tidal ecosystem and a mean tidal range of 1.07 m. The sediment characteristics and hydrodynamics were investigated to understand sedimentary processes in the barrier-lagoon system of the Nakdong river estuary. The surface sediments generally showed sand sediment was dominated along the seaward side of the barrier islands and muddy sand sediment was dominated within the lagoon. The short-term sedimentation rates for a year showed that deposition dominated the tidal flats between the mainland and Jinudo (JW-line) and the mainland and Sinjado (SJ-line), with net deposition rates of 10.09 and 12.38 mm/year, respectively. Erosion dominated the tidal flat for two years at the southern end of Eulsukdo (ES-line), which is located on the eastern side of the system, at an annual rate of -12.76 mm/year. The surface sediments along three lines were generally deposited in spring and summer and eroded during autumn and winter. The current speed and direction were measured in channels during ebb and flood tides. Tidal currents were ebb-dominant during spring tides. The direction of ebb tide was mostly southwest in channels. During flood tide, the current flowed towards the north-northwest at western channel, the northwest or north at middle channel and the north-northeast at eastern channel in the system. Four 12.5-hour anchoring surveys conducted at the inlets and channel revealed that net suspended sediments were transported to the open sea during a tidal cycle in summer. Seasonal variations in sedimentation and characteristics of suspended sediments revealed that the barrier-lagoon system in the estuary was dominated by redistribution of sediments based on relative input energy from waves, tidal currents, and dam discharges. Sediments in the estuary system were transported into the lagoon through inlets during flood-tide conditions without dam discharge. Sediments in the lagoon moved westward and/or northwestward and mostly deposited sediments on the tidal flats and in the channels near the dams under low energy conditions. During ebb tides, fine-sediments flowed out to the sea with discharges from the Nakdong Dam. Along the eastern side of the system, changes in the geomorphologies of subenvironments such as sand shoals, spits, tidal flats, and marshes were more influenced by waves than by tidal currents. The results of the study will provide an important baseline for future assessments of the environmental impacts of open dams.