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# Rapid deposition and erosion of the newly-built Huanghe (Yellow River) subaqueous delta and its linkage with dam impacts

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Among all the world's large rivers, Chinese Huanghe (Yellow River) has now become the only big system almost completely controlled by human activities rather than the mother nature. The regime of the Huanghe material delivery to the sea has changed dramatically since 2000, with a ∼90% decline in sediment load, ∼70% loss in suspended sediment concentration, and a completely dam-regulated flow seasonality. Since 2000, extreme flood peaks fed by the monsoon rains have been completely controlled by dams, and low flow (mostly lower a 1000 m3/s) dominates the discharge pattern for most time in a year. More than 50% of the annual sediment flux is delivered to the sea during the Water-Sediment-Regulation (WSR) with durations often less than 20 days. The hydrodynamic processes at the river mouth response sensitively to this dam-regulated sediment supply. In this study, we uncovered rapid deposition and erosion of the subaqueous delta based on long-term (1976-2015) bathymetric data.

For the Qingshuigou delta lobe, which was formed during 1976-1996, it prograded seawards rapidly with only minor lateral shifts of its depocenter. Up to 6.5 meters of sediment were deposited near the river mouth whereas a maximum of 4 m of sediments were also eroded from the area near the depocenter within a short period. Since 1996, the size and morphology of the subaqueous delta varies greatly. The newly-built subaqueous delta seemed to prograde slowly to the sea, whereas build its sedimentary body laterally. This can be explained by the decline in flood peaks (<4300 m3/s) which was confined by Xiaolangdi dam. The size of mouth bars were much smaller than before due to the curtailed sediment supply together with coarsening sediment to the sea. Slope gradient varies greatly both spatially and temporally, indicating a highly unstable sedimentary environment where deposition and gravity-associated erosion coexist. During 1996-2015, a maximum of 12 m thick sediments were deposited at the mouth area whereas erosion also was up to 4.8 m.

Since 2002, WSR is the first-order anthropogenic signal for the Huanghe material delivery to the sea. The highly dam-regulated sediment supply exert a large control on the evolution of the newly-built subaqueous delta. The lowermost reaches of the Huanghe shifted laterally every year, all of which occurred during the annually-performed WSRs. These rapid changes of river flow pathways lead to rapid shift of depocenters and short-lived sedimentary body dominated by rapid deposition and subsequent rapid erosion. The Yellow River and its delta system thus provide an excellent case of source-to-sink study in the context of global change.