Sediment dynamics of the Mekong River and coastal erosion

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The Mekong River is one of the largest world’ s rivers, flowing over 4600 km through six countries. Accelerated human disturbances on the river catchment, such the hydropower and irrigation dams and river sand mining, are considered to have influenced the river sediment and water dynamics. However, the large system makes it difficult to understand the situation. In the Mekong delta, developed where the river discharges into the South China Sea, serious coastal erosion has occurred, and consequently the total delta area has shrunk since 2005. While the coastal erosion is supposed to be direct evidence of the decline in coastal sediment supply, its direct causes remain uncertain. Here, the coastal erosion of the Mekong delta is discussed in the light of long-term (decadal- to millennial-scale) coastal evolution revealed by geological methods.

The Mekong delta represents a typical mixed-energy delta with spatially variable contributions of fluvial, wave, and tidal processes to sediment transport; tide-modulated wave processes dominate the open coast, whereas distributary channels are characterized by an upstream to downstream transition from fluvial to tide-dominated estuarine processes. All regions are influenced by strong contrasts between the winter and summer monsoons, which define an annual sedimentary cycle; the weaker southwesterly summer monsoon causes river flooding and sediment supply, whereas the northeasterly winter monsoon is dry and stronger, associated with limited fluvial sediment supply and asymmetric longshore sediment drift toward the southwest. The coastal erosion exhibits spatial heterogeinity; updrift erosion and downdrift deposition appear to balance in the sandy river mouth area while downdrift muddy coast has been eroded remarkably.

Behaviors of the sandy coast are characterized by 200–600-year cycles in which an emergence of river mouth bar causes a jump of elongate barrier shoreline several kilometers offshore. This sporadic nature introduces uncertainties in estimate of sediment budget from short-term shoreline mapping just over several decades and highlights need for monitoring subaqueous topography. The serious erosion of the downdrift coast has continued for > 100 years and is not attributable to river dams and sand mining in the last decades. It may have reflected land-use changes in the catchment, construction of canal networks on the delta plain, and/or climate changes. The human activities are being further accelerated, with completion of the largest upper-reach dam in 2012 and further expansion of river sand mining. Dynamics of riverine water and sediment in the Mekong River is a socio-economic issue and should be better understood through multiple approaches, such as remote sensing, numerical modeling, and thorough, quantitative monitoring.

Keywords: River dam, Sediment deficit, Southeast Asia, River sand mining, Human activity

