Yichang station at the end terminal of the upper reaches of the Changjiang(Yangtze River), 40 km downstream of the TGD, decreased drastically to 70 million tons (Mt) in 2003-2006, or 20% of that during the pre-TGD period (1956-2002). Based on the annual sediment data for the last 51 years recorded at the key hydrographic stations in the mainstream and the major tributaries of the upper Changjiang, our study shows the TGD annually trapped about 154 Mt/yr during the period of 2003-2006 that is higher than both the values published by the Changjiang Water Resources Commission and that estimated by other authors. These differences are mainly resulted from the underestimation or neglect of the siltation in the backwater region of TGD. The sediment budget shows that 89% of the sediment deposited within the TGD Region from Cuntan to Yichang stations, the remaining 11% deposited in the upstream reaches from Pingshan to Cuntan owing to the effect of the extended backwater area than the proposed. Moreover, the sediment retention caused by the TGD explained only a minor part (36% or 153 Mt/yr) of the total sediment reduction of 422 Mt/yr at Yichang in comparison with that during the pre-TGD period. In contrast, the major part (64% or 269 Mt/yr) was ascribed to the decline of sediment loads supplied from the upper reaches into the TGD owing to dams construction and soil conservation works in the upper Changjiang basin, especially in the Jialingjiang and Jinshajiang basin.

The variation of annual sediment accumulation rate in the mid-lower reaches of Changjiang from 1958 to 2006 shows that the accumulation process was the dominant regime before 2002, but the riverbed erosion has been dominant process since 2002 with an averaged sediment erosion rate of 63 Mt/yr in 2002-2006. A significant relationship exists between sediment accumulation rate and annual sediment load at Yichang since the mid-1980s, which suggests that sediment load at Yichang is a primary factor controlling the sediment transport and storage in the mid-lower reaches of Changjiang. The mid-lower reaches degrade when the sediment load at Yichang became lower than a threshold level of 326 Mt/yr. Given the absence of the TDG, we estimate the sediment load at Yichang would be 225 Mt/yr during the period of 2003-2006, much lower than the threshold value. Therefore, the TGD only accelerated the downstream riverbed degradation rather than the decisive causation.

The theoretical trapping efficiency of the proposed cascade reservoir in the lower Jinshajiang River and the TGD has been calculated using the Brune's method. The result shows that the cascade reservoir and the TGD will collectively trap around 93% of the sediment loads from the upper Changjiang basin, therefore the annual sediment load at Yichang will decrease to ca. 16 Mt/yr, and then the sediment discharge from the Changjiang to the sea will decrease to about 95 Mt/yr in the coming decades. In the presence of low sediment discharge, profound impacts on the morphology of estuary, delta and coastal sea are expected.

## Use of grain size distribution patterns and textural parameters to distinguish different sedimentary environments in a deltaic plain, India

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A deltaic plain represents a mosaic of different sedimentary facies like river, beach, coastal dune, and tidal flat. The objective of this research is to differentiate these different depositional sedimentary deposits by grain size distribution pattern and textural parameters. The idea behind is the different magnitudes of transporting power of the transport media in the same regime of deposition. The density of air being less than the river water, its transporting capacity is less than that of the river water. Similarly, the density of river water is less than that of seawater; accordingly its transporting capacity is less than the seawater. With this idea, sand samples from different sedimentary environments in the Sunderban deltaic plain of India, were collected from different sites.

Grain size analysis was carried out for a total of 310 sediment samples by sieving and pipetting methods. Grain size distribution patterns were compared with two-model distributions: log-normal and log-skew-Laplace. A total of 72 sand samples were collected from four beaches (Sagar island, Junput, Bakkhali and Fraserganj), 88 nos of samples from the corresponding coastal dunes bordering the beaches, 24 nos of samples from the corresponding tidal flats and finally a total of 126 sand samples from the different rivers, both tidal (Hooghly, Bhagirathi) and non-tidal (Ajoy, Damodar and Usri) of the same deltaic plain.

Grain size distribution patterns indicate that for beach sands, log-normal distribution model fits better for 54.2% cases and log-skew-Laplace model for 45.8% cases. For dune sands, log-normal model fits better for 51.1% cases and log-skew-Laplace for 48.9% cases. For tidal flat sands, log-normal model fits better for 79.2% cases and log-skew-Laplace for only 20.8% cases. Difference between the two slopes ($\alpha \sim \beta$) in Laplace distribution for beach sands is 0.662, for dune sands 0.290, for tidal flat sands 2.408 and for river sands 0.299 indicating a wide variation of degree of sorting. Dune sands are better sorted (sorting, $\rho$=0.302$\varphi$) than beach sands ($\rho$=0.357$\varphi$), beach sands are better sorted than river sands ($\rho$=0.553 $\varphi$) which again is better sorted than tidal flat sands ($\rho$=1.604$\varphi$). Beach sands are negatively skewed in 31% cases and positively skewed in 69% cases, dune sands are negatively skewed in 20% cases and positively skewed in 78.8% cases, zero for 1.2% cases. Tidal flat sands are negatively skewed in 33.3% cases and positively skewed in 66.7% cases.

The statistical analysis of the river sands indicates that the grain size distribution of the tidal stretch of the Hooghly-Bhagirathi river system has a tendency of attaining a log-skew-Laplace distribution model whereas for the other three non-tidal rivers the log-normal distribution pattern is suggestive of a best-fit statistical model. When all the rivers are considered, log-normal statistical model is the best-fit statistical model in 79.2% cases. Kurtosis is a measure of peakedness of the size distribution. From the analysis it appears that both beach and dune sands exhibit high kurtosis values (>3) with fine to medium grain size indicating high-energy-level of reworking. Beach, dune and tidal flat sands are apt to be more positively skewed than the river sands indicating preponderance of finer fractions. Skewness and kurtosis measure the discrepancies in properties of materials of various sizes being deposited in the same environment at the same time. As such high skewness and kurtosis values in beach, dune and tidal flat sands can be generally interpreted as indicating that a large amount of reworking has taken place. Tidal flat sands are generally finer and poorly sorted than the beach, dune and river sands.

## Delta morphological processes in the Gulf of Carpentaria, Australia

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Deltas in large, shallow intracratonic basins affected by meso- to macro-tidal conditions and seasonal rainfall, such as the Gulf of Carpentaria, are characterised by a morphology that reflects significant reworking of the deltaic material by wave and tidal processes without losses of fluvial detritus to deeper water environments.

The mesotidal Gulf of Carpentaria in northeastern Australia receives sediment from numerous surrounding rivers during the annual December to March summer monsoon period but maintains a relatively straight coastline dominated by prograding beach ridges or cheniers. This is a result of relative importance of landward-directed wave and tidal sediment transport versus freshwater flooding.

During the three months of the monsoon period the gulf rivers discharge large quantities of sand and mud into the shallow offshore portion of the gulf. The muddy sediment forms a plume, extending at least 10 km offshore, that is redistributed by the clockwise tidal circulation pattern within the nearshore portion of the gulf. The sand is deposited as broad intertidal to subtidal deltas adjacent to the river mouths in water depths of less than 5 m. Being rapidly dumped, this detritus is very poorly sorted with large quantities of mud retained in the predominantly sandy nearshore subtidal deltas. As the monsoon-generated river discharge and the seasonal wind-driven sea-level set-up both decrease, wave and tidal processes start to dominate the delta areas.

Normal wave activity in the gulf is capable of moving sandy bottom sediment at least down to 5 m water depths. This wave activity produces a landward movement of fine and very fine sand that builds up as nearshore and intertidal shoals. These shoals are also subject to longshore movement from combined wave and longshore clockwise tidal current circulation. This supplies sand for the southward and westward elongation of beach ridges and cheniers around the eastern and southern shores of the Gulf of Carpentaria.

Large waves are only present in the gulf during periods of cyclone activity but these are too infrequent in any one part of the gulf to act as the main transport mechanisms within the nearshore regions. However, they do cause local scouring and short-term transport especially in the formation of the higher marine portions of the beach ridges where the sea-level set-up and increased wave run-up interacts with the aeolian deposits in the upper parts of the beach ridges.

Wave action also resuspends the mud from the