



Sediment characterization and dispersal analysis along a part of the meso- to microtidal coast: a case study from the east coast of India

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Abstract

Sediment trend analysis with temporal and spatial variations is appropriate to understand the sediment remobilization, temporal accretion-erosion sites, and change in the sea levels due to climate change and/or hydrodynamic modifications which will enhance our knowledge towards dynamic coastal resilience. Moreover, the complex processes like accretion-erosion are controlled by sediment motion and coastal erosion, and restoration measures applied will be inappropriate without a proper assessment of sediment trends. To understand this dynamic nature of grain size distribution and redistributions, a novel approach of studying spatial trends in grain size associated with net sediment transport directions of the beach sediments has been/was carried out along an arcuate (Bakkhali coast) and a straight beach (Talsari coast) region of east coast of India. Different statistical parameters like mean, sorting, skewness, and kurtosis for measuring grain size distributions were used for this purpose. Our results indicate from grain size distributions that dunes are spatially homogeneous and beach sediments characters are distinctly different, which are also supported by the multivariate principal component analysis (PCA). However, in individual locations, significant amount of mixing between dune and beach sediments is evident showing varied degree of homogenization in both beaches. Sediment transport pathways obtained on the basis of the trend analysis show that in the arcuate Bakkhali beach, transport trends are convergent with trends from eastern and western part converges towards south, while in the straight Talsari beach, sediment movement is directed towards the north east along the entire coastline. The study finds its universal application as the complex processes like accretion-erosion are controlled by sediment motion and coastal erosion and restoration measures applied will be inappropriate without a proper assessment of sediment trends.

Keywords Beach sediments · Textural analysis · Sediment trend analysis · East coast of India · Coastal resilience

Introduction

Erosion in coastal zones is a result of both natural phenomenon (i.e., sea level rise and storms; e.g., Boudet et al. 2017 and references therein) and human interference (embankment/seawall constructions, port building, sand excavation, and laying boulders; e.g., Jana and Bhattacharya 2013 and references therein). This leads to an imbalance to the coastal fluid dynamics and the sediment dispersal pattern both in short-term and long-term basis. The long-term changes in sediment dispersal pattern in the light of erosion results in destruction of the coastal zone through shoreline retreat and beach erosion (Ji 1996; Liu et al. 2011; Yincan et al. 2017). Such erosional (less accretional) process brings substantial changes in the coastal morphology and results in long-term consequences for the sustainability of coastal communities, structures, and ecosystems (Ferreira et al. 2006; Łabuz 2015;

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