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Author: Mr. Harshaditya Gaur
Indian Institute of Remote Sensing, India

Ms. Shaifali Garg
Indian Institute of Remote Sensing, India

SHORELINE DELINEATION ANALYSIS AND ITS ENVIRONMENTAL IMPACT ASSESSMENT OF JUHU BEACH, MUMBAI USING SENTINEL-2 DATA

Abstract

Shoreline mapping is necessary to detect changes in the shoreline and see the delineation over the years. Understanding the evolution of the shoreline is critical for effective coastal management and hazard mitigation. The study aims to map the changes in the coastline from 2015 to 2023 using Sentinel-2 data for Juhu Beach, one of Mumbai's iconic coastal stretches, which faces significant environmental pressures due to urbanization, anthropogenic activities etc. The methodology incorporated Google Earth Engine with Python for data extraction and pre-processing. The tidal correction was done on all the shorelines by assuming the beach elevation to be constant over the study area. CoastSat, an open-source toolbox, was used for shoreline detection and extraction based on a user-defined reference shoreline position from the Sentinel-2 imagery for the training CoastSat classifier. The delineated shorelines are then analyzed using GIS tools to quantify shoreline changes, including erosion, accretion, and shoreline migration. The initial results indicate significant variability in shoreline dynamics along the Juhu Beach coastline over the study period. This reveals localized erosion and beach elevation areas have more variations than expected that cannot be made constant. Furthermore, the study explores the influence of seasonal variations, monsoon patterns, and tidal regimes on shoreline dynamics. It provides insights into the temporal variability of coastal processes and their impact on shoreline stability and coastal erosion/accretion patterns. The results give insights into long-term trends and patterns, aiding policymakers and urban planners in decision-making processes related to sustainable coastal development, disaster risk reduction, and climate change adaptation. In conclusion, the decadal shoreline delineation analysis underlines the importance of remote sensing technologies and geospatial analysis in monitoring and managing coastal environments. The study emphasizes the dynamic nature of coastal systems and the need for integrated approaches to address the complex challenges facing coastal regions in the context of rapid urbanization and climate change.