

Abstract

Sea-level rise (SLR) and shoreline dynamics along the eastern coast of India are examined in this thesis through an integrated analysis of long-term sea-level trends, future projections, and coastal vulnerability across three key metropolitan regions: Puri, Chennai, and Visakhapatnam. Using satellite altimetry, tide-gauge observations, and CMIP6 model projections, the study identifies a consistent and accelerating rise in sea level, with observed trends ranging from 4.5 to 5.2 mm/yr and a marked intensification after 2010, alongside projections approaching 1 m rise by 2100 under high-emission scenarios. Complementing this, shoreline change analysis based on multi-temporal satellite imagery reveals significant spatial variability in erosion and accretion patterns: Chennai and Visakhapatnam exhibit dynamic, often erosion-dominated coasts. At the same time, Puri shows relatively higher accretion but remains highly sensitive to coastal processes. Building on these datasets, a Dynamic Vulnerability Index (DVI) framework incorporating hazard, exposure, and adaptive capacity highlights that vulnerability is not uniform but strongly influenced by urbanization, low-lying topography, infrastructure concentration, and socio-economic factors, with Chennai emerging as the most vulnerable among the studied cities. The findings establish a clear link between accelerating SLR, shoreline transformation, and increasing urban coastal risk, emphasizing the need for integrated geospatial approaches, city-scale assessments, and region-specific adaptation strategies for sustainable coastal management.

Keywords: SLR; Shoreline Change; Dynamic Vulnerability Index; Coastal Hazards