

## ASSESSMENT OF SHORELINE VARIATION IN THE EASTERN COAST OF SRI LANKA USING SATELLITE REMOTE SENSING

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The assessment of shoreline variations is important in the planning and design of sustainable coastal developments. However, the absence of relevant measurements and/or information on shoreline variations is a major obstacle for such assessments. In view of these considerations, a study was conducted to examine shoreline variations on Sri Lanka's eastern coast through high-resolution satellite remote sensing techniques using Google Earth Engine (GEE) and CoastSat tools. The focus was on the popular tourist destinations of Kattankudy and Nilaveli Beaches, with significant potential for further development, over a 25-year period (2000-2025), with the aim of assessing erosion and accretion patterns, identifying their underlying cause as well as making recommendations on coastal management and climate change adaptation options.

The study relied on the broad spatial coverage and repeated visits associated with Landsat 5, 8, and 9 (30m resolution) and Sentinel-2 (10m resolution) imagery, accessed through GEE and CoastSat. GEE and CoastSat algorithms, as well as K-means clustering and AI-driven methods of cloud masking, pansharpening, and sub-pixel resolution, greatly improved shoreline detection accuracy to the 10 m target. The integration of evolving multi-sensor satellite data with an automated shoreline extraction technique has the potential to improve the advanced methods of achieving continuous monitoring. Frequent cloud cover during the monsoons caused gaps in these time series (for example, between 2010 and 2012), which highlighted the need for complementary information such as SAR or UAV survey data.

The results of the study reveal that monsoons are the primary drivers of the observed seasonal spatial and temporal variability. Kattankudy, a region which continues to suffer from rapid urbanisation with unplanned constructions, was particularly hard hit and eroded at an alarming rate. In contrast, Nilaveli beach was able to sustain its geomorphology and is relatively resilient, probably as a result of limited anthropogenic activity as well as the presence of protective coral reefs. The results obtained may be used for a variety of purposes. The data obtained from the study can be used to support the construction of site-specific, robust structures like breakwaters and seawalls, customised for the specific erosion hazard of the site. Results can also be used by policymakers for the integration of climate change adaptation plans and provide the ability to triage high-risk areas for either defence or managed retreat. The research also promotes community-based sustainable tourism and monitoring for the enhancement of local resilience.

This research offers Sri Lanka a pioneering universal geospatial database and its methodology for shoreline monitoring, plugging possible elemental gaps in the coastal governance framework of the country. The findings also sustain the advocacy for balanced socio-economic development and responsive conservation of the environment in the wake of climate change. Future coastal governance should include more precise metrics, like high-resolution datasets, and direct greater focus on anthropogenic influence, alongside more comprehensive spatial and temporal research.

**Keywords:** CoastSat, Erosion, Google Earth Engine (GEE), Landsat, Shoreline

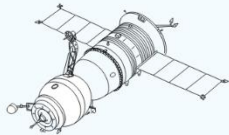
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## Methodology

- SatelliteData LandSat 5,8,9



- Google Earth Engine (GEE)  
+ CoastSat toolbox



- Time series shoreline positions



Pansharpening



Sub-pixel  
detection



Transects



Time-series

## Findings

- Resilient Site: Nilaveli (coral reef protection, low human impact)
- Urbanized Impact: Kattankudy (construction-driven erosion)



NE Monsoon  
erosion



SW Monsoon  
accretion/stability



## Implications



Engineering:  
site-specific  
seawalls/brekwaters



Policy:  
climate adaptation  
& zoning



Sustainable  
tourism &  
community moitoring