

Earth Observation for Disaster Risk Management

Monitoring Coastal Erosion on Ko Phi Phi Don, Thailand: A Multi-Temporal Satellite Imagery Approach

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INTRODUCTION & AIM

Tropical island coastlines are increasingly threatened by coastal erosion, climate change, and tourism pressure. This study investigates shoreline change on Ko Phi Phi Don (Thailand) between 2004 and 2024 using Google Earth Engine (GEE), Landsat, Sentinel-2, and GIS. The objectives were to quantify shoreline change, identify erosion and accretion hotspots, and evaluate the effectiveness of cloud-based Earth observation for long-term coastal monitoring.



Fig. 1. Study area and historical shoreline change on Ko Phi Phi Don, Thailand.
(a) Location of Ko Phi Phi Don; (b) Satellite imagery of the island; (c) Historical photographs illustrating coastal change

METHOD

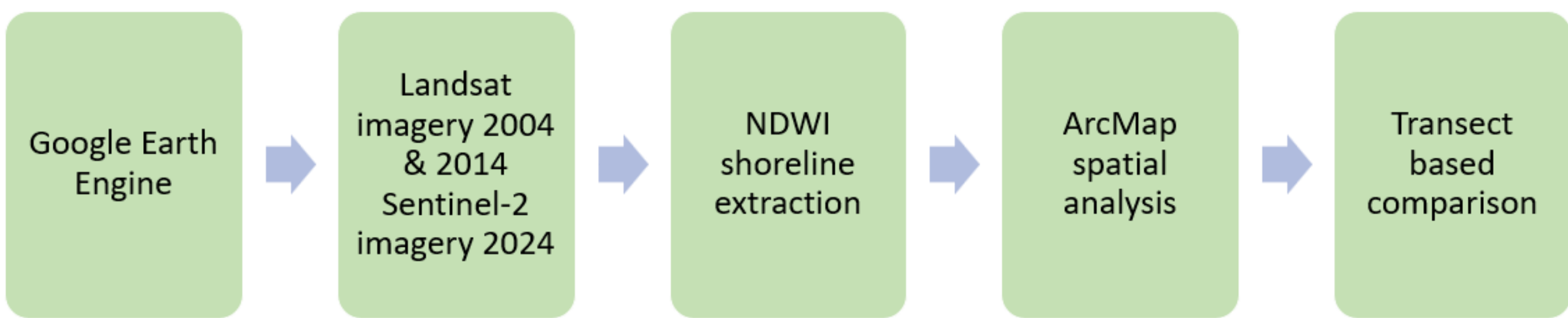


Fig. 2. Workflow for multi-temporal shoreline extraction and analysis

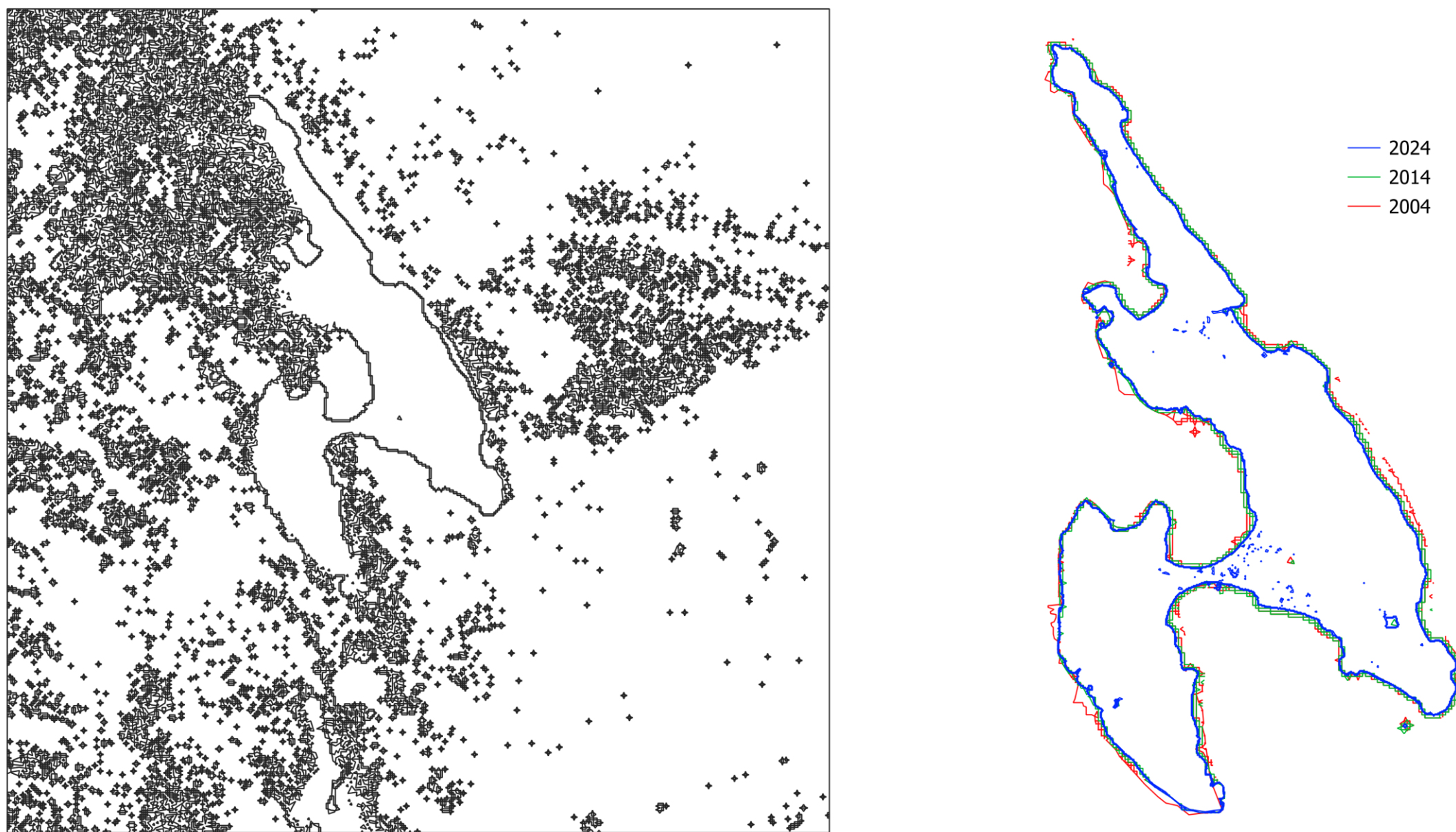


Fig. 3. Shoreline Extraction and Multi-Temporal Shoreline Change.
(a) Raw vectorized shoreline data before noise removal (2004); (b) Shoreline positions for 2004, 2014, and 2024.

RESULTS & DISCUSSION

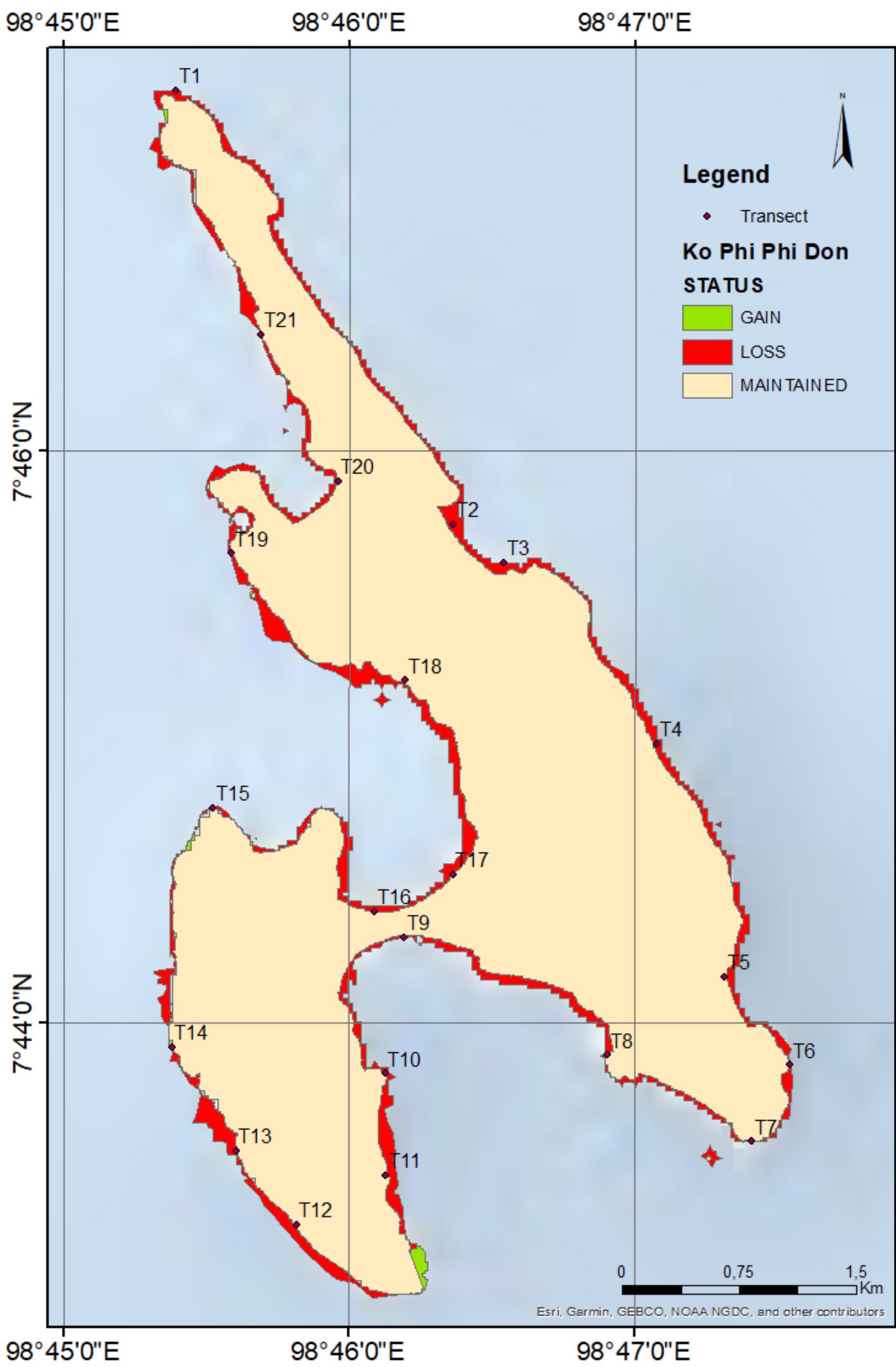


Fig. 4. Spatial distribution of shoreline change and transect locations, 2004–2024.

Transect	Location	2004-2014	2014-2024	Total 2004-2024	Change type
T1	North coast	-29,8	-29,8	-59,6	erosion
T2	Northeast coast	-66,5	-42,1	-108,6	erosion
T3	Northeast coast	-29,8	-39,9	-69,7	erosion
T4	East coast	-42,1	-49,5	-91,6	erosion
T5	East coast	-67	-8,3	-75,3	erosion
T6	East coast	5	-9	-4	accretion / erosion
T7	South coast	0	-62	-62	stable / erosion
T8	South coast	-67,8	0	-67,8	erosion / stable
T9	Tombolo South	-34,7	-19,8	-54,5	erosion
T10	South coast	-42	0	-42	erosion / stable
T11	South coast	0	-63,3	-63,3	erosion
T12	Southwest coast	-42	0	-42	erosion / stable
T13	Southwest coast	-60	-40	-100	erosion
T14	Southwest coast	-79,9	0	-79,9	erosion / stable
T15	Southwest coast	-15	-27,5	-42,5	erosion
T16	Tombolo North	0	-38	-38	stable / erosion
T17	West coast	-97	-20	-117	erosion
T18	West coast	-40	-45	-85	erosion
T19	Northwest coast	15,7	0	15,7	accretion / stable
T20	Northwest coast	41,5	-29,7	11,8	accretion / erosion
T21	Northwest coast	0	0	0	stable

Shoreline changes	Average	-31,0	-24,9	-56,0
	Min	-97	-63,3	-117
	Max	41,5	0	15,7

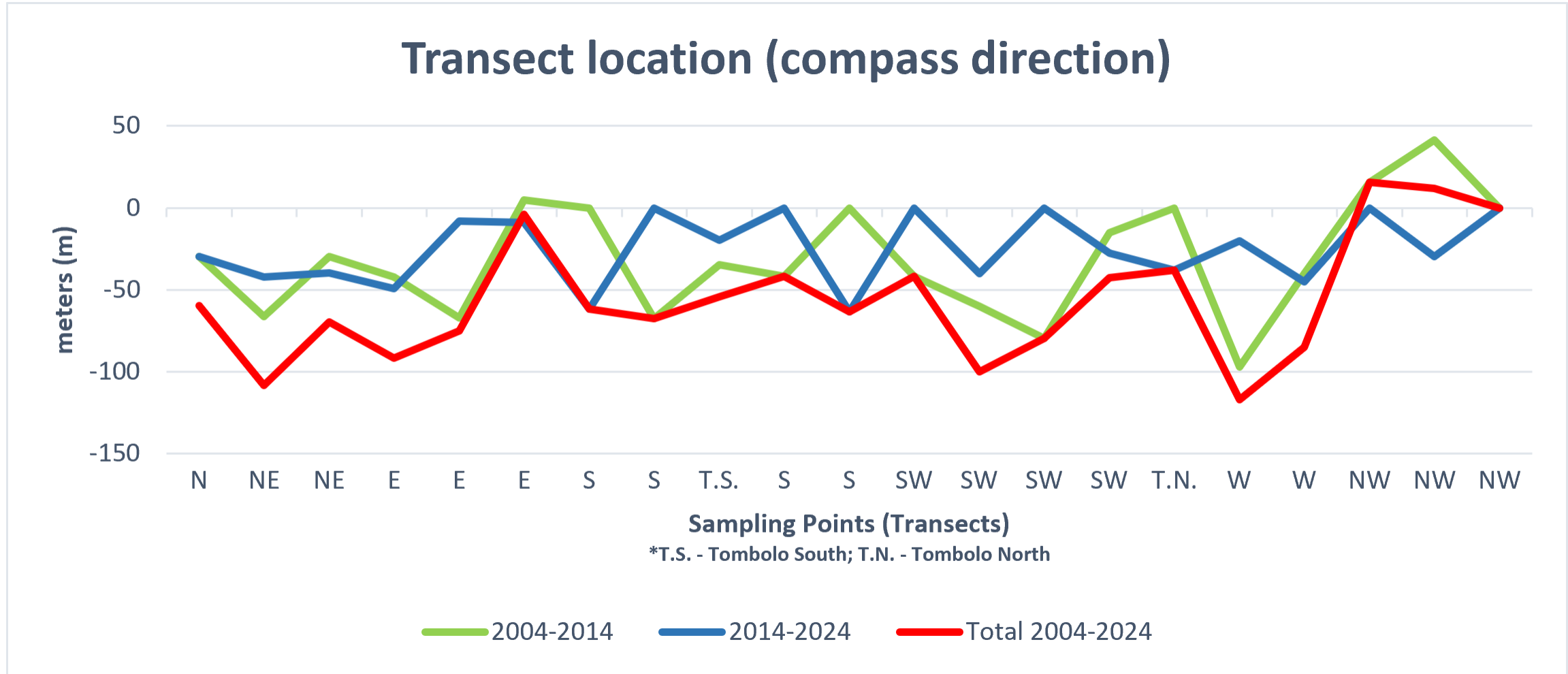


Fig. 5. Transect-based analysis of shoreline change, 2004–2024.
(a) Transect measurements; (b) Shoreline change by transect

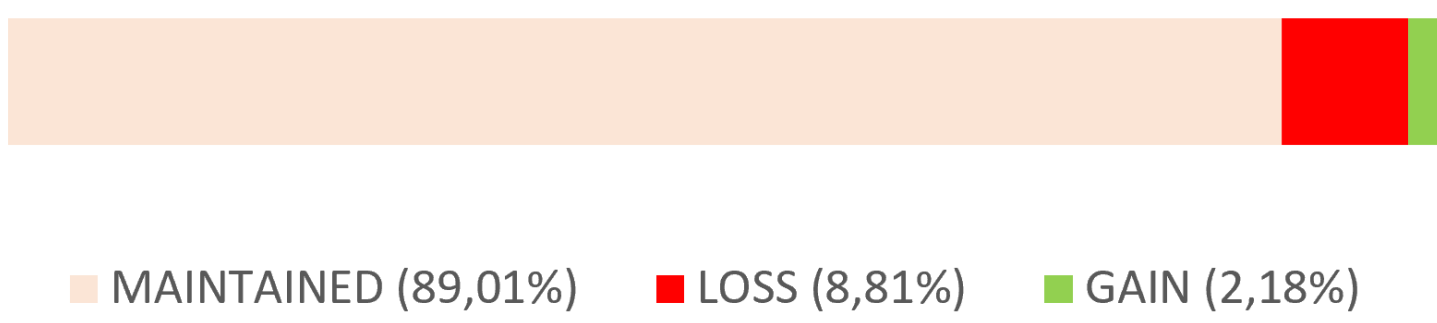


Fig. 6. Shoreline-change proportions, 2004–2024.

Key Findings

Maximum shoreline retreat:
117 m

Erosion area:
1,01 km²

Accretion area:
0.25 km²

Most affected coasts:
West, Northeast, Southwest

CONCLUSIONS

- ✦ **GEE** enabled efficient multi-temporal shoreline monitoring over two decades.
- ✦ **Coastal erosion** significantly exceeded shoreline advance.
- ✦ The **W, NE and SW** coasts experienced the greatest retreat.
- ✦ The workflow supports **sustainable coastal management**.

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