Using SPOT Images to Identify the Shoreline Changes over the Coastal Area in East Taiwan

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Introduction

The spatial and temporal changes shorelines were one of the most significant observations in coastal area monitoring (Bamdadinejad, *et. al,* 2021). Shoreline changes have played pivotal roles in both ecology and human society. One environmental factor that may induce rapid changes in shorelines was the sea-level rise caused by climate change (Adebisi, *et. al,* 2021). This research focused on the impact of rising sea-levels on the Eastern Taiwanese shoreline. A simple statistical approach was applied to the elusive changes over the coastal area in Eastern Taiwan.

Multi-spectrum satellite images (SPOT) were analyzed with the Normalized Difference Water Index (NDWI), the Normalized Difference Vegetation Index (NDVI), and the Green-Red Vegetation Index (GRVI) to identify the coastline (Abedelhady, *et. al*, 2022). Principal component analysis (PCA) was used to assist the classification of the image pixels. Cloud-free images taken between the years 2016 and 2021 were used in this study.

Methodology

Datasets:
- CSRSR/NCU-SPOT 6 & 7 Satellite Images: Red, Green, Blue, and Near-Infrared Bands

GIS Data Coastal Lines Detection:
- Revised the R script of Land Cover Change (Chen, *et. al,* 2019) to classify the land vs water pixels.

Calculation Methods and Tools:
- Indexes: NDWI, NDVI, GRVI
- Principle Component Analysis (PCA)
- Pixel Resolution: 6m x 6m

Tide Deviation Correction:
- CWB-Grouping based on high and low tide

Results

Figure 1 (Left). Shoreline Classification Plot
Figure 2 (Right). Amount of Water Pixels Outside Identified Shoreline Over Time

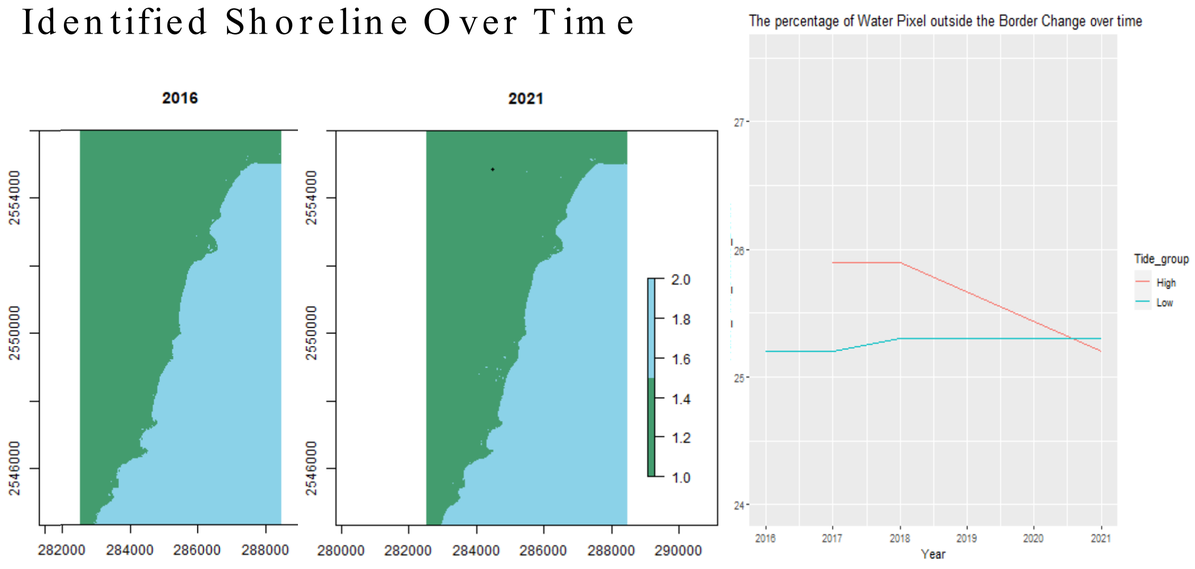

Table I. Land and Water Pixel Percentage Over Time

Year	Land Pixel Within Border (%)	Water Pixel Within Border (%)	Land Pixel Beyond Border (%)	Water Pixel Beyond Border (%)	Tide Group
2016	24.7	25.2	24.9	25.2	Low
2017	24.7	25.2	24.8	25.2	Low
2018	24.6	25.3	24.8	25.3	Low
2019	24.7	25.2	24.9	25.2	Low
2016	22.3	27.6	22.4	27.7	High
2017	24.1	25.9	24.2	25.9	High
2018	24	25.9	24.2	25.9	High
2021	24.7	25.2	24.8	25.2	High

Conclusion

- The investigated shoreline has no visible change from 2016 to 2021, as shown in Figure 1.
- The percentage of land pixels inside and the percentage of water pixels outside of the border were constant over time, which proved that the shoreline had only trivial changes (see Table 1).
- This identified minimal change in the Taiwanese Eastern shoreline was consistent with Lin & Weng's (2013) previous study of years 2009 to 2012.

Future Work

- The duration and area investigated in this research was relatively small, meaningful conclusions can only be drawn on a larger temporal and spatial scale.
- The Landsat 8 images could be analyzed as it has 11 bands, which would yield more accurate classification than SPOT images[3].

Reference

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