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Analisis Spasial Dinamika Garis Pantai Wilayah Pesisir Provinsi Kalimantan Timur pada Periode 2000-2025
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INTISARI

Wilayah pesisir merupakan lingkungan yang dinamis dan rentan mengalami perubahan akibat interaksi proses alami dan aktivitas manusia. Provinsi Kalimantan Timur memiliki karakteristik pesisir yang kompleks berupa Delta Mahakam, kawasan mangrove, perairan dangkal, serta suplai sedimen yang tinggi, disertai tekanan pembangunan kawasan industri, pelabuhan, dan Ibu Kota Nusantara (IKN). Kondisi tersebut menyebabkan dinamika garis pantai yang bervariasi secara spasial dan temporal, sehingga diperlukan pemantauan perubahan garis pantai secara multitemporal. Sehingga, dilakukan analisis spasial perubahan garis pantai, laju abrasi dan akresi, serta evaluasi metode ekstraksi garis pantai pada wilayah pesisir Provinsi Kalimantan Timur periode 2000-2025.

Analisis perubahan garis pantai dilakukan menggunakan citra satelit Landsat multitemporal periode 2000-2025 melalui integrasi *Modified Normalized Difference Water Index* (MNDWI), *Otsu Thresholding*, dan *Canny Edge Detection*. Ekstraksi garis pantai dilakukan dengan MNDWI untuk membedakan daratan dan perairan, *Otsu Thresholding* untuk menentukan nilai ambang secara otomatis, serta *Canny Edge Detection* untuk mendelineasi batas garis pantai. Analisis laju perubahan garis pantai dilakukan menggunakan *Digital Shoreline Analysis System* (DSAS) melalui parameter *End Point Rate* (EPR) dan *Linear Regression Rate* (LRR). Validasi hasil ekstraksi garis pantai dilakukan menggunakan matriks konfusi (*confusion matrix*) dengan parameter *Overall Accuracy*.

Hasil penelitian menunjukkan bahwa perubahan garis pantai di wilayah pesisir Provinsi Kalimantan Timur terjadi secara dinamis pada seluruh periode pengamatan dengan panjang garis pantai yang mengalami pergeseran sebesar ±896,449 km. Perubahan paling dominan ditemukan pada ROI 6, sedangkan perubahan paling kecil terdapat pada ROI 3. Analisis DSAS menunjukkan bahwa 32,9% transek mengalami kecenderungan abrasi dan 67,1% mengalami kecenderungan akresi, sehingga proses akresi lebih dominan pada wilayah penelitian. Hasil validasi yang dilakukan menggunakan perbandingan Garis Pantai RBI menunjukkan nilai *Overall Accuracy* rata-rata sebesar 85,00%, yang menunjukkan bahwa integrasi MNDWI, *Otsu Thresholding*, dan *Canny Edge Detection* mampu menghasilkan ekstraksi garis pantai dengan tingkat ketelitian yang baik.

Kata-kata kunci: dinamika garis pantai, abrasi dan akresi, Landsat, DSAS, Kalimantan Timur.

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ABSTRACT

Coastal areas are dynamic environments that are highly susceptible to changes resulting from the interaction between natural processes and human activities. East Kalimantan Province has complex coastal characteristics, including the Mahakam Delta, extensive mangrove areas, shallow waters, and high sediment supply, along with increasing development pressures from industrial areas, ports, and the Nusantara Capital City (IKN). These conditions contribute to spatial and temporal variations in shoreline dynamics, highlighting the need for multitemporal shoreline monitoring. Therefore, this study aims to analyze shoreline changes, shoreline erosion and accretion rates, and the performance of a shoreline extraction method in the coastal area of East Kalimantan Province during the 2000-2025 period.

Shoreline change analysis was conducted using multitemporal Landsat satellite imagery from 2000 to 2025 by integrating the Modified Normalized Difference Water Index (MNDWI), Otsu Thresholding, and Canny Edge Detection. MNDWI was applied to distinguish land and water surfaces, while Otsu Thresholding was used to automatically determine the optimal threshold value and Canny Edge Detection was employed to delineate the shoreline boundary. Shoreline change rates were quantified using the Digital Shoreline Analysis System (DSAS) through the End Point Rate (EPR) and Linear Regression Rate (LRR) parameters. The extracted shorelines were validated against the RBI shoreline data using a confusion matrix, with Overall Accuracy as the primary accuracy measure.

The results show that the coastal area of East Kalimantan Province experienced dynamic shoreline changes throughout the observation period, with approximately 896.449 km of shoreline undergoing positional shifts. The most dominant shoreline changes occurred in ROI 6, whereas the smallest changes were observed in ROI 3. DSAS analysis indicated that 32.9% of transects exhibited an erosional trend, while 67.1% exhibited an accretional trend, indicating that accretion was more dominant across the study area. Validation against the RBI shoreline data resulted in an average Overall Accuracy of 85.00%, indicating that the integration of MNDWI, Otsu Thresholding, and Canny Edge Detection provides good accuracy for multitemporal shoreline extraction.

Keywords: shoreline dynamics, erosion and accretion, Landsat, DSAS, East Kalimantan.