INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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SHORT ABSTRACT

This thesis focuses on the spatiotemporal variability of sand bar dynamics in the large braided Brahmaputra River from 2000 to 2019 and its impact on the disorderness in the braided belt. A modified normalized difference water index (MNDWI) was used to detect the sand bar area, and an entropy-based intensity disorder index (IDI) was proposed to measure the disorderness of the braided reach. The study found that IDI varied from less than 0.5 to more than 0.9 for the study reach and displayed a declining trend in the first decade followed by an increasing trend in the next decade, indicating large-scale heterogeneity in the process-form interactions in the Brahmaputra. The relationship between IDI, stream power derivatives, and bar area classes was analyzed to understand the geomorphic adjustments. Additionally, the study aimed to understand the spatiotemporal heterogeneity in the vegetation-flow regime of the Brahmaputra using the Google Earth Engine (GEE) platform and advanced geospatial techniques. The results showed a significant increase in moderate and dense vegetation cover in the last decade and its role in the stability of the reach. A stability Trajectory Indicator (STI) was developed to identify the stability state of the braided reach using vegetation as a filter. Finally, experimental studies are conducted on a flume-scale mid-channel bar model with different vegetation cover arrangements to demonstrate the process-form-vegetation interaction. The experiments used natural plant forms arranged in a staggered manner in a submerged condition, and the flow-turbulence behavior was observed using a three-dimensional Acoustic Doppler Velocimeter (ADV). Results revealed that vegetation structure influences both velocity reduction and momentum transfer at different canopy zones, as well as the shear layer thickness. These findings may aid in a better understanding of channel dynamics near the mid-channel bar and support proper river health management.

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