Title : Quantifying Relationships Between Point Bar Geometry and Channel Dimensions in the Ping River, Chiang Mai

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ABSTRACT

Point bars play a critical role in river stability, meander evolution, and sediment distribution. A better understanding of these riverine processes and dynamics provides a useful database for future river and water resource management. Furthermore, predicting point bar geometry is essential for assessing reserves in petroleum reservoirs and groundwater aquifers. The Ping River in Chiang Mai Province serves as a strong modern analogue for the fluvial systems of the Pattani Basin in the Gulf of Thailand. This is primarily because its channel dimensions and point bar development closely resemble the seismic interpretations of the Pattani Basin. Additionally, the Ping River exhibits a highly variable sinuosity comparable to the basin's fluvial system, which is characteristic of typical meandering channels. This study aimed to quantify the relationships between channel dimensions and meander geometry to validate the river's use as a geological analogue. Remote sensing techniques were utilized to analyze 110 meander bends along the river. High-resolution Google Earth satellite imagery was used for the precise manual digitization of channel parameters in ArcGIS. Additionally, bankfull depth data was obtained from the Department of Irrigation's gauging station datasets. Regression analysis of the extracted parameters demonstrated significant power-law correlations aligning with established empirical relationships. The correlation between channel width and the radius of curvature (R_c) across the 110 bends showed a moderately strong positive relationship (R^2=0.68). Furthermore, the relationship between channel width and depth, analyzed specifically at locations with active gauging stations, yielded a strong coefficient of determination (R^2=0.88). These quantitative findings statistically confirm that the Ping River exhibits predictable geometric behavior. The results support its validity as a surface analogue for the subsurface fluvial networks of

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the Pattani Basin and contribute to developing a method for predicting point bar volume to directly provide reserves assessment. Ultimately, understanding these fluvial dynamics provides a valuable database for predicting the fluvial landscape change and future river management.

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