Appraisal of Tectonic Activity Using Morphometric Assessment in Parts of the Kosi Basin, Bihar, Through Remote Sensing Data

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Abstract:

The Kosi River basin, often termed the "Sorrow of Bihar," is highly prone to flooding, waterlogging, and continuous river shifting—processes strongly associated with tectonic instability and anomalous drainage behaviour. This study investigates tectonic activity in the Kosi sub-basin, covering parts of Saharsa, Supaul and Khagaria districts lying between 26o 7′ 40″ and 25o 34′ 10″ North latitude 86o 25′10″ and 86o 44′ 15″ East longitude , through morphometric analysis within a GIS environment (ArcMap 10.3). Linear, areal and basin geometry parameters were analysed to assess tectonic influences on drainage evolution. The basin exhibits a fifth-order drainage system with a total area of 820.42 km² and a drainage density of 0.91 km/km², indicative of coarse drainage texture and limited surface runoff efficiency. A mean bifurcation ratio of 3.44, along with anomalous variations in stream length ratios, reveals structural disturbances and tectonic control over channel development. The elongated basin form, reflected by a low form factor (0.18) and circularity ratio (0.14), further suggests active tectonics and enhanced flood susceptibility. Overall, the results highlight the significant role of tectonic processes in influencing drainage alignment, stream lengths and bifurcation patterns, thereby shaping the hydro-geomorphic environment of the region. The integration of GIS-based morphometric assessment offers critical insights into the underlying causes of frequent flooding and channel instability in the Kosi sub-basin. These findings provide a valuable framework for disaster risk reduction, watershed management, and sustainable strategies to mitigate hydro-meteorological hazards in the basin.

Keywords:

Kosi River Basin, Morphometric Analysis, Tectonic Activity, Drainage Anomalies, , Remote Sensing, GIS.