

EGU22-2464

<https://doi.org/10.5194/egusphere-egu22-2464>

EGU General Assembly 2022

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## Morphodynamics of Brahmani River, Odisha, and its implication on Riverbank failure

**Aditya Kumar Anand** and Sarada Prasad Pradhan

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE, EARTH SCIENCES , India (aditya.crri@gmail.com, aanand@es.iitr.ac.in, saradaiitb@gmail.com )

In the middle and upper reaches of the Brahmani River, Odisha is prone to riverbank erosion and the avulsion process. The river devours a colossal landmass due to major floods and rainfall in the monsoon season. In the present study, morphodynamics of the Brahmani river has been studied for the past two decades (2000-2019). The study has been carried out using LANDSAT data to determine the changes in the channel belt of the river. Channel area, bar area, sinuosity, and braid-channel ratio have been determined to understand the avulsion and bank line shifting. The Brahmani River has been classified into ten classes based on their geomorphological and geological characteristics and further subdivided into 87 reaches. It has been observed that the middle and upper reaches (2000-2015) of the river depict variation in channel area and bar area. The variation in the channel area and bar area is less during 2015-2019 due to the construction of embankments and groyne on river banks. The higher sinuosity values are observed in the lower reaches of the Brahmani River. The major flood of 2011 had significantly affected the sinuosity pattern of the river. Similar trends have been observed in the braid channel ratio, which has been observed in the channel area. These parameters have been correlated with India Meteorological Department's gridded rainfall data ( $0.25^{\circ} \times 0.25^{\circ}$ ) and discharge data collected from the Department of Water Resources, Odisha. Avulsion threshold index (ATI) was determined to classify the 87 reaches into stable, moderately stable, Critical, and most critical zones. The soil samples have been collected from the critical zones of the Brahmani River to determine their shear strength properties. A detailed geotechnical investigation of riverbank soil samples has been done in the laboratory. The shear strength properties of soil samples have been determined in consolidated undrained (CU) and unconsolidated undrained (UU) conditions. The numerical simulation of bank slopes has been done using PLAXIS 2D software under different conditions. The results obtained from numerical simulation determined the potential zones of failures.