National Institute of Technology Rourkela

Departmental Seminar

Seminar Title	: Conference Return Seminar: Turbulent dynamics and their impact on river morphological processes in meandering channel with non-uniform sand beds
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Venue	: Civil Engineering Seminar Hall
Date and Time	: 23 Sep 2024 (09:30 AM)
Abstract	: This work represents comprehensive experimental investigations into the turbulent flow characteristics within a trapezoidal meandering channel containing a non-uniform sand bed. The study aims to replicate steady flows over a non-uniform sand bed channel in a laboratory model, maintaining a constant water discharge and Froude number. To ensure the fidelity of the experimental conditions, Froude number data were collected from the Mahanadi River site, and the same bed material from the river was employed in the laboratory model. The objective of the current work is analysis of various turbulent parameters, including three-dimensional velocity profiles, and higher-order turbulent parameters. The experimental conditions were designed to match the specified Froude number, bed material, and sinuosity found in the natural river environment. The analysis of turbulence data in the flow shows a significant rise in bursting events across the flow layer, especially along the outer bank of the meander path. This increase in bursting events is crucial as it strongly influences bank erosion. Furthermore, the study reveals that ejections and sweeps near the bed exhibit greater persistence than those near the free surface. Analysis demonstrates an upward downstream flux of turbulent kinetic energy near the bed, leading to the prevalence of sweep events. Additionally, the influence of sediment movement near the bed flow intensifies turbulent kinetic energy fluxes. This heightened turbulence production correlates with an increase in bed load transport and local velocities, resulting in a reduction in turbulent kinetic energy dissipation. In essence, our study provides a comprehensive understanding of turbulent flow characteristics in meandering channels with non-uniform sand beds, elucidating the underlying mechanisms governing bank erosion, river bed morphology, and bed load transport dynamics. The findings have significant practical implications for river management and hydraulic engineering, emphasizing the significance of understanding and controlling and understanding the turbulence behaviour in natural river systems.