Geophysical Research Abstracts
Vol. 19, EGU2017-1521, 2017
EGU General Assembly 2017

Bed erosion control at 60 degree river confluence using vanes

Ananth Wuppukondur (1) and Venu Chandra (2)

(1) Junior Research Fellow, Department of Civil Engineering, Indian Institute of Technology Madras, India (ananth.w.sharma@gmail.com), (2) Assistant Professor, Department of Civil Engineering, Indian Institute of Technology Madras, India (vc@iitm.ac.in)

Confluences are common occurrences along natural rivers. Hydrodynamics at the confluence is complex due to merging of main and lateral flows with different characteristics. Bed erosion occurs at the confluence due to turbulence and also secondary circulation induced by centrifugal action of the lateral flow. The eroded sediment poses various problems in the river ecosystem including river bank failure. Reservoirs are majorly affected due to sediment deposition which reduces storage capacity. The bed erosion also endangers stability of pipeline crossings and bridge piers. The aim of this experimental study is to check the performance of vanes in controlling bed erosion at the confluence. Experiments are performed in a 60^0 confluence mobile bed model with a non-uniform sediment of mean particle size d_{50} = 0.28mm. Discharge ratio (q=ratio of lateral flow discharge to main flow discharge) is maintained as 0.5 and 0.75 with a constant average main flow depth (h) of 5cm. Vanes of width 0.3h (1.5cm) and thickness of 1 mm are placed along the mixing layer at an angle of 15^0, 30^0 and 60^0(with respect to main flow) to perform the experiments. Also, two different spacing of 2h and 3h (10cm and 15cm) between the vanes are used for conducting the experiments. A digital point gauge with an accuracy of $\pm$0.1mm is used to measure bed levels and flow depths at the confluence. An Acoustic Doppler Velocitimeter (ADV) with a frequency of 25Hz and accuracy of $\pm$1mm/s is used to measure flow velocities. Maximum scour depth ratio R_{max}, which is ratio between maximum scour depth (D_s) and flow depth (h), is used to present the experimental results.From the experiments without vanes, it is observed that the velocities are increasing along the mixing layer and R_{max}=0.82 and 1.06, for q=0.5 and 0.75, respectively. The velocities reduce with vanes since roughness increases along the mixing layer. For q=0.5 and 0.75, R_{max} reduces to 0.62 and 0.7 with vanes at 2h spacing, respectively. Similarly, for the same discharge ratios (q), R_{max} reduces to 0.64 and 0.72 with 3h spacing between the vanes, respectively. Obstruction to the flow increases with an increase of vane angle which leads to decrease of bed erosion. Also, the bed erosion increases with an increase of spacing between the vanes. Hence, vanes placed at 60^0 vane angle and 2h spacing exhibit better performance.