Geophysical Research Abstracts
Vol. 16, EGU2014-9861, 2014
EGU General Assembly 2014

A depth-averaged 2D model for turbulent flow and morphological change in a channel with permeable groins

You-Cheng Chen, Hsun-Chuan Chan, and Ping-Cheng Hsieh

Department of Soil and Water Conservation, National Chung Hsing University, TaiChung, Taiwan
(mozenpee7@yahoo.com.tw)

The pile group is widely applied in the river channel, such as permeable pile groins and protective means. The resistance and the contraction of flow induced by pile group vary the flow field into complex. Thus sediment transport is affected by flow condition. When flow contracted and concentrated, the sediment carrying capacity is increased with the turbulence enhencing. On the other hand, the flow is blocked by pile group, and then the sediment trend to settling with the flow velocity decreasing. The interaction between hampered flow and distribution of scour hole is discussed in this study by the numerical simulation, and verified with laboratory experiments. The numerical model solved the depth-integrated continuity and momentum equations for shallow water with the k-ε turbulent model and associated with the governing equation of sediment transport. The finite volume method is employed in the present model. Furthermore, the laboratory experiment is conducted in a 20 m long and 1 m wide rectangular flume with a fixed slope of 0.001. The permeable pile groins are arrayed in a 0.2 m $\times$ 0.2m region and set at one side of the flume with varied densities. The result indicates that the turbulent kinetic energy at the pile group zone is reduced and it is rising at the water zone, because the occupation of river cross section would accelerate the main flow velocity. The flow of high-density pile group case erodes the exterior margin of the region to a deep groove, while low-density one do not, but partial erosion of pile appears more obvious effects on the entire group region. The simulation result is agreed well with the experiment, beside an accumulation mound after pile region near flume wall only exists in the high-density case of experiment. Partial flow is divided and flow downstream along the flume wall with lower friction, and sediment is carried farther downstream. In general, the predicting results are satisfactory, and the result is expected to provide for future river management.