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Application of discharge distribution equations in flood events

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Abstract

When the flows in natural or man made channel sections exceed the main channel depth, the adjacent floodplains become inundated and carry part of the river discharge. Due to different hydraulic conditions existing in main channel and floodplain of a river, the mean velocity in the main channel and in the floodplain are different. This leads to the transfer of momentum between the main channel water and that of the floodplain making the flow structure more complex. Reliable estimates of discharge capacity in main channels are essential for the design, operation and maintenance of flood protection measures such as dykes of a floody river.. In this study, Knight and Demetriou (1983) and Patra and Khatua (2007) relationships are used to compute flow discharge distribution in main channel and floodplains of three river compound channels. The results show that knight and demetriou equation (1983) has better estimates for discharge distributions in selected rivers.

Key word: Flow distribution, Discharge Distribution,flow hydraulics,floody river

1. INTRODUCTION

During floods, a part of the river discharge is carried by the main channel and the rest is carried by the floodplains located to its sides. Once a river stage overtops its banks, the cross sectional geometry of flow undergoes a steep change. The channel section becomes compound and the flow structure for such section is characterized by large shear layers generated by the difference of velocity between the main channel and the floodplain flow. Due to different hydraulic conditions prevailing in the river and floodplain, mean velocity in the main channel and in the floodplain are different. Just above the bank-full stage, the flow in the main channel exerts a pulling or accelerating force on the flow over floodplains, which naturally generates a dragging or retarding force on the flow through the main channel. This leads to the transfer of momentum between the channel section and the floodplain. At the junction region between the main channel and that of the floodplain, Sellin (1964) and Knight and Demetriou (1983) indicated the presence of artificial banks made of vortices, which acted as a medium for transfer of momentum(1,2). At low depths of flow over floodplain, transfer of momentum takes place from the main channel flow to the floodplain leading to the decrease in the main channel velocity and discharge, while its floodplain components are increased. And at higher depths over floodplains the process of momentum transfer reverses, the floodplain supplies momentum to the main channel. Due