INDIAN INSTITUTE OF TECHNOLOGY, GUWAHATI
SHORT ABSTRACT OF THESIS

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SHORT ABSTRACT

The interaction between surface and groundwater flow in a non-prismatic river has been a topic of interest among researchers since last three decades. Existence of piedmont zone in the river bed changes the downstream flow scenario significantly. Downstream flow situation assessed by routing of upstream hydrograph may yield erroneous flow assessment, if the existence of such piedmont zone is ignored. Moreover, most of the researchers, to reduce complexity, carried out hydrodynamic studies neglecting the infiltration zone in the river bed. Therefore, for reliable flow forecasting in a river passing through a piedmont zone, consideration of surface and ground water interaction in the modelling process is quite important.

To overcome above difficulties, a two dimensional coupled surface-subsurface flow model is developed, where surface and subsurface flow are linked via exchange of flux between two systems. Saint-Venant equation is the most common equation to describe free surface flow. In this study free surface flow considering piedmont zone in the computational domain is described by the Saint- Venant equation coupled with Green-Ampt. infiltration equation. The water infiltrated through the recharge zone moves as unsaturated flow and joins the mainstream at downstream. This process is modelled by the two dimensional Richards equation. The two dimensional shallow water equation and Richards equation are nonlinear equation which is not amiable to solve analytically without simplification. In this study Beam and Warming

implicit scheme is used to solve free surface flow equation with Green-Ampt. infiltration equation and Alternate Direction Implicit scheme is used for Richards equation.

Results obtained by the application of the model in a hypothetical river show that piedmont zone has significant effect on downstream surface elevation, depth hydrograph and discharge hydrograph. Because of piedmont zone peak depth and discharge attenuate by 5% and 7% respectively. Again water infiltrated through the piedmont zone, starts to contribute to main stream after 100 hour and because of this contribution the flow volume increases by 5.5%. To evaluate the field applicability of the proposed model, it is applied to a tributary of Brahmaputra River where such piedmont zone is reported (Goswami et al.1996). Double ring infiltration test was performed on the field to determine infiltration characteristics of the river.