INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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Programme of Study : Ph.D.

Thesis Title: River-Aquifer Interactions in Kosi Basin using Hydrological Models and Remote Sensing Inputs

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Thesis Submitted to the Department/ Center : Civil Engineering

Date of completion of Thesis Viva-Voce Exam : 21-08-2020

Key words for description of Thesis Work : River-Aquifer Interaction, Hydrological Models, Remote Sensing Inputs

SHORT ABSTRACT

River-Aquifer Interaction is a complex phenomenon that occurs through the sediment-water interface. Understanding the mechanism as well as quantification is an important aspect of the hydrological cycle for sustainable water management. The thesis aims to understand and quantify the river-aquifer interaction process in an agriculturally dominated basin of Kosi River, India. Among many techniques, Groundwater models to a certain extent utilize the physical processes to understand and quantify the interaction which needs accurate inputs (recharge, evapotranspiration) and parameters (riverbed and aquifer properties). In this study, prominence is given in accurately estimating recharge and riverbed hydraulic conductivity prior to groundwater modelling. In the present study groundwater recharge was estimated at sub-basin scale using semi-distributed surface water hydrological modelling (SWAT- Soil Water and Assessment Tool), Soil Water Balance (SWB) method, Water Table Fluctuation (WTF) and Rainfall Infiltration Factor (RIF). The results of the study showed that monsoonal recharge estimated using SWAT, WTF and RIF methods did not capture the wet and dry year effects. While SWB method improved the monthly groundwater recharge estimations and also captured wet and dry effects on groundwater recharge in the study zone. Another important component of groundwater modelling is riverbed hydraulic conductivity, which can significantly influence the river-aquifer interaction process. In this study, heat was used as a natural tracer to estimate the fluid flux and riverbed hydraulic conductivity along with analytical solutions of Hatch and Keery.by conducting a series of laboratory-based experiments were conducted in a sandbox with four different scenarios and condition. Using this estimated riverbed hydraulic conductivity groundwater modelling of Kosi river basin was carried out with SWAT simulated recharge (case I) and SWB based recharge (case II). The results showed that monthly groundwater levels as well as river-aquifer interactions simulated using SWAT recharge-based groundwater flow modelling (case I) were not able to capture the wet and dry year effects. Whereas, the model using SWB based recharge was able to capture the effects of wet and dry years on groundwater levels as well as river-aquifer exchange process. Overall, this inter-comparison of groundwater modelling results indicates, remote sensing inputs (recharge and evapotranspiration used in SWB method for estimating recharge) along with estimated riverbed conductance values can improve the assessment and understanding of the river-aquifer interaction process in an alluvial River Basin.