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Formulation of ground water simulation model in restricted area and calibration of the model using optimization technique with particular reference to Vavuniya

A study is being carryout for a restricted ground water catchment about 73.8 km2 in Vavuniya to find out an operational policy of minor and medium Irrigation schemes to recharge the ground water system to increase the economic pumping.

Twenty one wells were identified as observation wells within the study area of 73.8 sq.km to represent the aquifer. This study area was divided into twenty one Thiession polygons by connecting the perpendicular bisectors of adjoining observation wells with four year seasonal collected water levels and three years seasonal historic water levels.

A ground water simulation model was formulated for this polygonal net work using integrated finite difference method in spreadsheet. The model was calibrated to find the hydrogeological parameters such as Transmissibility, Storage coefficient, Recharge coefficient for Irrigation scheme, Recharge coefficient for irrigation field, Recharge coefficient for rainfall and the Withdrawal factor for agro and domestic pumping using optimization technique.

A complete water balance study for each polygon for each season was carried out. Twenty one error models were prepared for the water balance, for each polygon for all the season. Each error model is a function of Transmissibility, Storage coefficient, Recharge coefficient for Irrigation scheme, Recharge coefficient for irrigation field, Recharge coefficient for rainfall and the Withdrawal factor for agro and domestic pumping.

To avoid the negative & positive errors get cancelled, the squares of each seasonal error were added and minimized with suitable constrains. Practicable range for Transmissibility, Storage coefficient, Recharge coefficient for Irrigation scheme, Recharge coefficient for irrigation field, Recharge coefficient for rainfall and the Withdrawal factor for agro and domestic pumping were given during minimization as constrains. MATHCAD2000 was used for this optimization.

Using the results obtained a prediction run was carried out to predict the water levels of last season from previous season. The model successfully predicted the water levels with very little error (less than three percent).

As formulation of this integrated finite difference model in spreadsheet & calibration by optimization technique is very simple and less time consuming and can be used even for partial aquifer system the Vavuniya restricted aquifer can be represented by this model for any study to develop the system.