

## **Groundwater flow modelling in a canal command of Haryana State, India**

**VIJAY KUMAR<sup>1</sup>, K. J. ANANDHAKUMAR<sup>2</sup>, M. K. GOEL<sup>1</sup> & P. DAS<sup>2</sup>**

<sup>1</sup> *National Institute of Hydrology, Roorkee 247 667, Uttarakhand, India*

[vijay@nih.ernet.in](mailto:vijay@nih.ernet.in)

<sup>2</sup> *Central Ground Water Board, New Delhi, India*

**Abstract** Groundwater flow in part of the Western Yamuna Canal (WYC) command area in the Haryana state (India) has been simulated. An area of 7508 km<sup>2</sup> of the total 13 543 km<sup>2</sup> area of WYC command was selected for modelling. The groundwater in the selected area is under high stress. The block-wise groundwater development in the model area varies from 56% to 190% with 24 blocks (out of 32 blocks falling in the study area) having a groundwater development of more than 100%. The 3-D Modular Finite Difference Groundwater Flow Package MODFLOW, with Visual MODFLOW as an interface is used for model development. Conceptualization of the area was done based on the hydrogeology, bore hole lithology, the fence diagram and water level fluctuation in wells, as reported in the literature. The area is modelled as a three layer system with layer 1 representing upper phreatic aquifer, layer 2 representing confining layer and layer 3 representing confined/semi-confined aquifer. The area was discretized into 1 × 1 km grids. The eastern and southwestern side of the model area was represented by the river boundary, western side as no flow boundary and north and southern sides as flux boundaries. Major canals and drains were also simulated in the model as rivers, to account for their recharge/discharge to the groundwater system. The various model inputs, like hydrogeological parameters, areal recharge and groundwater abstraction, were assigned to the model based on the data available in literature. A total of 29 observation wells (20 in aquifer I and 9 in aquifer II) were used for model calibration. The model was run for three years (June 2002 to May 2005) consisting of 37 stress periods, with the first stress period under steady state conditions. Very good calibration is achieved for aquifer I (layer 1). But due to very limited data availability, mainly recharge and discharge, the calibration results achieved for the third layer (aquifer II) are not as good as those of layer I. The calibrated model was run further, for a period of 10 years (2005–2015) to see the impact of continuing with the present day groundwater withdrawal on the groundwater conditions in the year 2015. The results indicate that the present rate of groundwater pumping may lead to further deterioration in the groundwater situation. The results of the study will be useful to predict the sustainability of the groundwater resources of the study area and to evaluate possible management actions.

**Key words** groundwater; visual modflow; western Yamuna canal; India