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Effect of Climate Change on Groundwater Recharge in a Sub-Humid Sub-Tropical Region of Eastern India

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Abstract : The study region of the reported study was in Eastern India, having a sub-humid sub-tropical climate and sandy loam soil. The rainfall in this region has wide temporal and spatial variation. Due to lack of adequate surface water to meet the irrigation and household demands, groundwater is being over exploited in that region leading to continuous depletion of groundwater level. Therefore, there is an obvious urgency in reversing the depleting groundwater level through induced recharge, which becomes more critical under the climate change scenarios. The major goal of the reported study was to investigate the effects of climate change on groundwater recharge and subsequent adaptation strategies. Groundwater recharge was modelled using HELP3, a quasi-two-dimensional, deterministic, water-routing model along with global climate models (GCMs) and three global warming scenarios, to examine the changes in groundwater recharge rates for a 2030 climate under a variety of soil and vegetation covers. The relationship between the changing mean annual recharge and mean annual rainfall was evaluated for every combination of soil and vegetation using sensitivity analysis. The relationship was found to be statistically significant ($p<0.05$) with a coefficient of determination of 0.81. Vegetation dynamics and water-use affected by the increase in potential evapotranspiration for large climate variability scenario led to significant decrease in recharge from 49–658 mm to 18–179 mm respectively. Therefore, appropriate conjunctive use, irrigation schedule and enhanced recharge practices under the climate variability and land use/land cover change scenarios impacting the groundwater recharge needs to be understood properly for groundwater sustainability.

Keywords : Groundwater recharge, climate variability, Land use/cover, GCM
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