Paper Number: 5601

Investigating and incorporating local scale heterogeneity for MAR in karst aquifers through a hydro-geophysical approach

Arora, T.,[1] Dar, F. A. [1], Ghosh, N.C.,[2] Shakeel, A.[1] and Grutzamer, G.[3]

[1] CSIR-National Geophysical Research Institute, Hyderabad-500007, India

[2] National Institute of Hydrology, Roorkee-247667, India (ncg@nih.ernet.in)

[3] Berlin Water, Berlin, Germany. (gesche.gruetzmacher@kompetenz-wasser.de)

Groundwater flow and managed aquifer recharge in karst areas is difficult to ascertain because it can be concentrated through conduits or along fracture zones. MAR is recommended to augment groundwater resources, but finding the favorable site for MAR is quite challenging in karst terrains. Raipur, the study area is a water stressed city and the urbanization of Naya Raipur is posing a threat by altering the hydrological properties in the area. This work highlights the efficiency of MAR by using hydro-geophysical techniques to characterize the unsaturated zones of karst terrain of Central India where soil cover is very thin. We used electrical resistivity methods at 12 sites to access the feasible conductive zones along the local drainage in the area. Vertical Electrical Soundings (VES) were used to capture the local resistivity variation in the area. After VES, profiling by Electrical Resistivity Tomography (ERT), with 4-10 m electrode spacing using Wenner-Schlumberger and gradient methods, was carried out. The area of interest remains limited to 35-40 m below the surface, however many strong lateral and vertical anomalies were found in the ERT surveys. The low resistivity in the unsaturated zone, compared to the high resistivity of limestone bedrock, is the main target for infiltration pathways. The low resistivity anomalies in the 2 D inverted sections could be water filled conduits or solution channels with uncertain geometry. These were confirmed with the lithology of drilled wells at 3 sites which correlated very well with the resistivity of ERT surveys. Lithological information confirmed that the solution activity has modified the hydraulic properties of the aquifer by widening fractures, bedding planes and developing solution voids. The local hydrogeological heterogeneity was mapped based on the resistivity variations thereby proposing favourable sites for construction of MAR structures. The Chokra Nala is the main drainage along which the MAR structures need to be proposed in the Telibandha area of Raipur. The results also confirmed the presence of hidden mafic dykes which have intruded the limestone after its deposition during past times.

Keywords: Electrical Resistivity Tomography, Managed Aquifer Recharge (MAR), karst aquifer, Chandi limestone