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Geophysically constrained hydraulic conductivity estimation in crystalline hard rocks

Shakeel Ahmed and Subash Chandra

CSIR-National Geophysical Research Institute, India

The groundwater and electrical current flow rates in hard rocks are mainly dependent on the hydraulic and electrical conductivities of the formation respectively. The hydraulic and electric conductivities of a hard rock aquifer depend on several factors viz., pore-size distribution, grain size distribution, void ratio, roughness of mineral particles, fluid salinity or mineralization, degree of weathering, fissure density and interconnectivity, and water saturation, etc. But in case of hard rocks, the water saturated pores play a dominant role, among all affecting the hydraulic and electrical conductivities. The ions flow through some of the same paths as water and hence the electrical resistivity and hydraulic conductivity of aquifer are affected by similar factors. Both the flows take place due to the existence of potential gradients and hence the flow rates depend upon hydraulic and electric potential gradients respectively. Thus there is strong analogy between the two physical properties. Based on the above analogy, the Darcy's law for groundwater flow and Ohm's law for electric current flow in hard rocks have been coupled together yielding into a mathematical tool to translate geoelectrical parameters into hydraulic conductivity and transmissivity. Paper presents the theoretical development of geophysically constrained hydraulic conductivity estimation method followed by its validation and application in couple of watersheds in state of Karnataka and Telangana. The aquifer hydraulic conductivity and transmissivity obtained respectively from the geoelectrical parameters and pumping tests found in good agreement. This improves the groundwater simulation model by providing more dense data inputs with the better hydrogeological controls.

Biography

Shakeel Ahmed presently Chief Scientist at CSIR-NGRI is basically a Geophysicist from BHU, Varanasi obtained PhD in Hydrogeology from Paris School of Mines, France. He is also heading an International centre as Indo-French Centre for Groundwater Research at Hyderabad. He has executed a number of research projects mostly international and has to his credit about 100 SCI publications with highest citations among the scientists of CSIR-NGRI during last five years. He has supervised more than 30 students for their Doctoral research including foreign students; out of which 13 got the PhD degrees awarded. He has bagged many national and international awards.

shakeelahmed@ngri.res.in