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A new method to estimate hydraulic conductivity from surface resistivity measurements

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Since 1950, surface electrical measurements are widely and routinely used for qualitative estimates of aquifer properties (specific yield, hydraulic conductivity, and transmissivity) for engineering and hydrogeological applications but their applications in quantitative studies remain controversial. Also, the developed relations are empirical and semi-empirical relations.

Up to now, hydraulic conductivity could be determined only by time-consuming and expensive methods like pumping tests or sampling and laboratory investigations. The results are confined to few locations, and they depend on the scale of the investigation method.Measurements on rock samples in the laboratory can differ significantly from

well test result.

Measurements of aquifer resistivity are intuitively attractive for the estimation of aquifer hydraulic conductivity because of the fundamental relation between hydraulic conductivity and electrical conductivity through their common dependence on tortuosity and porosity , where surface conductance becomes the dominant electrical transport mechanism. Since apparent formation factor varies with the water resistivity, relations between apparent formation factor and hydraulic conductivity must also depend on groundwater resistivity.

The aim of the present work is to create a new method for direct estimation of hydraulic conductivity and consequently transmissivity in a quantitative manner from surface resistivity measurements definitely vertical electrical sounding using Shlumberger array. This direct method is achieved via a standard equation calculating the media electrical conductivity as an approach to hydraulic conductivity.