CHARACTERIZATION OF SUBSURFACE HYDRAULIC PARAMETERS USING GEOPHYSICAL SIGNATURES

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The characterization of subsurface hydro-geologic properties such as porosity, permeability, and hydraulic conductivity provide integral parameters in the design of subsurface structures. Unaccounted for flow characteristics of groundwater can have adverse affects on any engineering design such as decreasing the bearing capacity of foundations, jeopardizing the stability of a slope, increasing the spread of contaminants, and increasing the likelihood of frost heave. Due to the intrinsic variability of both the geologic and hydraulic parameters of the subsurface a large cross section of samples are required to accurately characterize an area. Often collecting theses samples is costly and environmentally invasive especially in remote areas. One alternative is the inversion of a limited physical data set in conjunction with geophysical signatures resulting from electro-magnetic tomography (EMT) and seismic surveys. The root relationships between geophysical signatures and physical parameters controlling fluid flow will be explored though statistical parameterization of the data. Using the derived relationships a hydro-geological model based on statistical simulations pattern learning methods will be developed to map variability of hydraulic parameters within an area. The accuracy and reliability of the non-parametric geophysical and hydro-geologic relationship based model will be tested though the downscaling of the model to areas of lower physical data concentration. The statistical analysis and modeling will illustrate the feasibility of the application of geophysical signatures with respect to hydro-geological parameters.