

USING CONVENTIONAL BOREHOLE GEOPHYSICAL LOGS TO MAP SALINITY VARIATIONS IN CARBONATE ROCK AQUIFER SYSTEMS

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Abstract. Conventional borehole geophysical logs, collected mostly from oil and gas test wells, are often the only means available for mapping regional salinity variations in an aquifer system. When log calculations are made from a single well the results are of interest locally, but when applied to a larger number of wells, it can be a valuable tool to help establish salinity patterns in a regional aquifer system and for mapping the approximate position of freshwater/saltwater interfaces. Challenges in using well logs to estimate salinity include (1) understanding what intervals along the log should be used in the calculation; (2) selecting appropriate coefficients for the most common types of the equations used; (3) estimating missing values where data for these parameters exists (specifically porosity); (4) determining lithology influences on the log response; and (5) correcting the values obtained from well logs for local variations in water chemistry. The first step in the analysis includes examining the overall log response across the interval of interest to ascertain any potential trends in salinity and identify the approximate freshwater/saltwater interface if the borehole is deep enough to intercept it. This critical step helps to focus the analysis on intervals where salinity changes are most important. Next, values are picked from the logs along sections of the borehole and initial values of salinity are computed using several alternative empirical methods for estimating salinity from well logs. Finally, the results of the analysis are corrected for local variations in water chemistry by comparison to nearby wells or produced water sample results to refine or determine the best empirical estimate of salinity from the geophysical log.