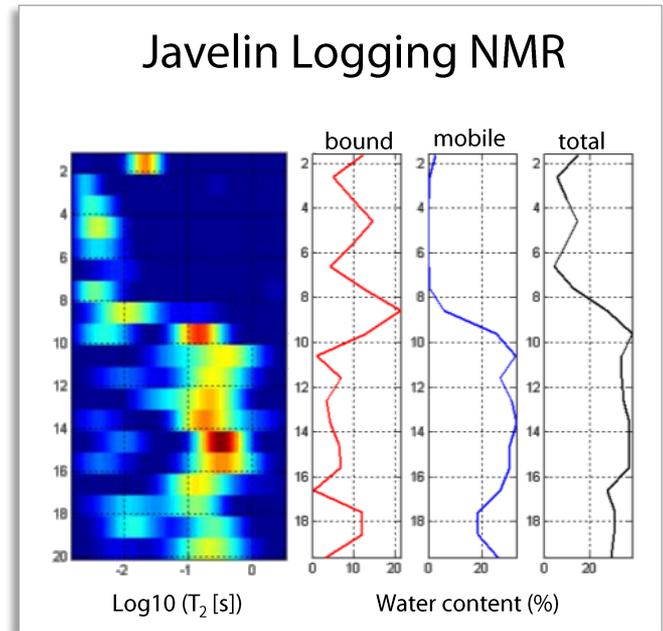
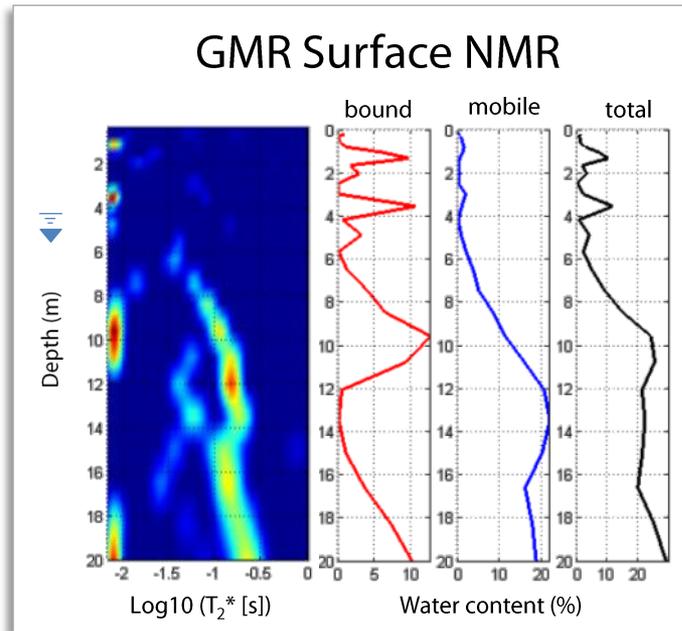


Combination of Logging and Surface NMR with short dead time

Client/Partner: Kansas Geological Survey and Stanford University

Location: Lawrence, Kansas

Instrumentation: GMR
surface NMR & Javelin NMR
logging - 1.7 inch probe



Both surface-based GMR and down-hole Javelin logging measurements were collected at the well-characterized Geohydrologic Experimental and Monitoring Site. The known subsurface structure

at the site consists of an upper clayey-silt layer overlying a sand aquifer located at around 9m; the water table is at 5m. Both the surface and logging datasets not only reflect the known subsurface structure, but are also remarkably consistent with one another. The two results show long decay times and high mobile water content in the lower sand layer, reliably identifying a productive aquifer. The surface-based GMR result also picks up regions with short decay times and considerable bound water content at ~9m, 4m, and 1m, which are corroborated by the Javelin log. Bound water detected above 5m actually reflects water stored in the dynamic unsaturated zone, an area of great interest to hydrogeologist that controls infiltration, evapotranspiration, and contaminant transport processes. Water in the unsaturated zone usually exhibits short decay times. While these short signals have not been detectable with previous surface NMR instruments, the wide-band receive electronics and short (4 ms) dead time of the GMR is capable of illuminating these critical signals. This case study demonstrates the capability of logging and surface based NMR measurements, each of which carry their own advantages. Javelin NMR logging enables the most precise measurement of NMR properties, while surface-based GMR measurements are entirely non-invasive, and can provide efficient characterization of subsurface properties over a wide area.