IMPROVING THE HYDROGEOLOGIC FRAMEWORK OF THE MISSISSIPPI ALLUVIAL PLAIN USING TIME-DOMAIN ELECTROMAGNETICS

Drew Thayer, U.S. Geological Survey; Benjamin Bloss, U.S. Geological Survey; Burke Minsley, USGS; Paul Bedrosian, US Geological Survey; Carole Johnson, USGS; Eric White, USGS; Katherine Pappas, USGS; Colin Sweeney, USGS; Wade Kress, U.S. Geological Survey

The current characterization of the Mississippi Alluvial Plain (MAP) groundwater system is built on hydrogeologic frameworks that rely on information gained at sparsely distributed individual borehole locations. Extensive local borehole geophysical information exists for some hydrogeologic units underlying the MAP, particularly in areas of oil and gas exploration. However, borehole geophysical information with regard to the surficial Mississippi River Valley alluvial aquifer (MRVAA) tends to be sparse. It is not uncommon to see the truncation of shallow geophysical logs that intersect the surficial aquifer, mainly because the surficial aquifer is not of interest to most oil and gas exploration activities. When the initial hydrogeologic framework of the MAP groundwater system was developed, the information between these sparse (and often incomplete) borings was extrapolated over large areas, an assumption that can oversimplify the MAP groundwater system in unrepresentative ways. An enhanced characterization of the shallow hydrogeologic framework (upper ~250m) of the MAP groundwater system is required to improve forecasts of water sustainability at regional and site-specific scales.

Six east-west regional-scale profiles of time-domain electromagnetic (TDEM) measurements each comprising 10-20 TDEM soundings and spanning 100-200 km were conducted in the MAP study area, approximately traverse to the synclinal axis of the Mississippi embayment. The profiles were spaced north to south at about 100 km intervals, representing a total area of nearly 100,000 sq. km. TDEM is capable of measuring the electrical resistivity structure of the subsurface, which helps distinguish geologic units that possess different electrical properties. We have compiled TDEM soundings for these profiles and correlated the geophysical data with borehole data to refine understanding of the 3D aquifer structure for this portion of the MAP study area. In addition, these initial TDEM data will be used to guide the survey design and planning of a large airborne electromagnetic survey of the MAP region that will begin in early 2018.