CEE HydroSystems™

# CASE HISTORY

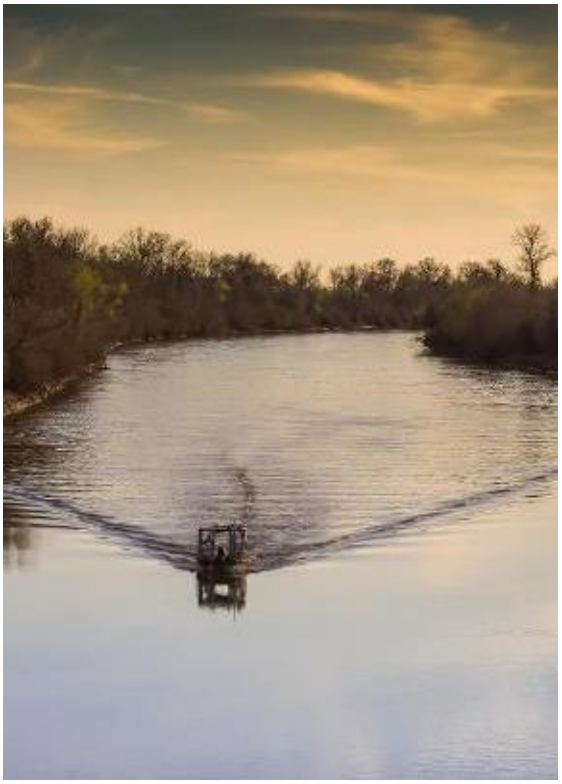
## CEE ECHO™ and CEESCOPE™ Used for USGS Waterborne Resistivity Surveys in the Mississippi Alluvial Plain.

*United States Geological Survey (USGS) scientists from the Lower Mississippi-Gulf Water Science Center in Nashville, Tennessee conducted an extensive groundwater survey in the South West USA with nearly 900 kilometers (550 miles) of river reach investigated. The USGS scientists used a towed resistivity array coupled to a CEESCOPE™ or CEE ECHO™ with Hemisphere ATLAS L-Band GNSS to provide real time water column height, position, and elevation that was needed to survey the river systems. The CEE approach offered simplicity in operation and met the special requirements for flexibility in data output required for the resistivity equipment.*

USGS hydrographers from the Lower Mississippi-Gulf Water Science Center undertook an extensive field program in 2017 to monitor continuous resistivity profiles along nearly 900 km of river reaches. Rivers surveyed included the Yazoo River, Floodway River, Sunflower River, and Black River. The resistivity data were used to investigate streambed hydraulic conductivity, with the goal of calibrating a regional groundwater model with focus on the interactions between surface and ground water.

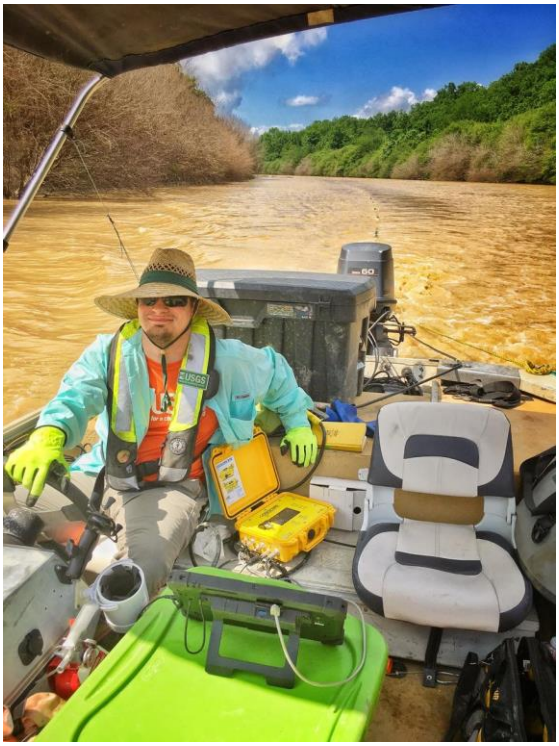
To measure resistivity, USGS scientists towed a multi electrode array that measures the voltage potential while transmitting a known current between electrodes spaced a known distance apart. This potential may be used to investigate groundwater below the river bottom. Meanwhile, the river water column height must be measured continuously using a survey echo sounder and all measurements need to be geo-referenced with a GPS system on the survey boat.

To first test the CEE equipment, the USGS used a rented CEESCOPE "all in one" echo sounder to provide the depth and position data they needed. This was later replaced by a dedicated CEE ECHO with a Hemisphere GNSS ATLAS Smart Antenna supplied by CEE.



Resistivity Survey (photo: Shane Stocks, USGS)

Two important features were needed from the echo sounder and positioning system: (1) simultaneous multiple outputs, to Eye4Software hydrographic acquisition software for a real time bathymetry display and directly to the resistivity equipment, (2) decimeter-precise elevation measurements to monitor the water height relative to an absolute datum over the reach.



Towing the resistivity array.

Using an RTK GNSS for centimeter-precise elevation would have been difficult over such a large survey area and would have added logistical complexity. As decimeter-grade elevation precision was adequate for the goals of the field work, the TerraStar L-Band signal available in the CEESCOPE and later the Hemisphere ATLAS L-Band signal was used for water surface height monitoring. The L-Band systems both offer a Precise Point Positioning (PPP) 20cm-accurate elevation measurement. Corrections signals are received from one of two equatorial satellites covering the USA, through the standard GNSS antenna with no requirement for a base station. The PPP approach was an ideal solution for the USGS study. The CEE equipment further simplified the field instrument setup by incorporating the positioning data into the echo sounder survey data in a single data acquisition process.


While the hydrographic survey-quality bathymetric precision of the CEE ECHO (and CEESCOPE) echo sounders was not a critical factor in the USGS study, ease of use, reliability, and advanced connectivity were key factors. With a substantial mobilization requirement and weather limitations, the USGS required a robust and easy-to-operate system.

To learn more about the USGS ground water, visit THIS LINK.