Electromagnetic Soundings in the Geothermal Environment

S. H. WARD, W. E. GLENN, B. D. SMITH, AND L. RIJO

Experimental electromagnetic soundings, with both horizontal and vertical magnetic dipole sources, were conducted at a shallow geothermal prospect near Roosevelt Hot Springs, Utah. Inverse interpretation of the field data is correlated with information from a drill hole which has yielded high temperatures, hot water, and steam at depths less than 100 m. Transmitter-receiver separations of 100 m and less in the electromagnetic soundings have yielded earth models which are consistent with models derived from Schlumberger soundings and with drill-hole information. The Schlumberger soundings involved current electrode spacings of order 10 times the transmitter-receiver separations for electromagnetic sounding. The inference is drawn that electromagnetic soundings are less affected by lateral inhomogeneities than Schlumberger soundings.

This latter notion is explored in relation to the design of electromagnetic and Schlumberger soundings for geothermal resources at depths of order 1 to 3 km. The frequency range and transmitter-receiver separations for typical cases are illustrated. The separations are consistently much less than maximum Schlumberger current electrode separations. Design criteria for Schlumberger resistivity and electromagnetic sounding in the geothermal environment are set forth.