

Distortion of the inter-site MT tensors by the wave effects

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SUMMARY

The MT theory is based on the quasi-stationary approximation, which neglects the displacement currents in the medium and implies that the EM wave propagation velocity is infinitely high ([Berdichevsky and Dmitriev, 2002](#)). Over conductive (up to ~10 kΩm) Earth this approximation is applicable for the majority of MT and AMT (up to ~10kHz) variations observed at a single site, but it might be invalid if the variations are observed at two remote survey sites simultaneously.

For instance, assume that some EM wave travels along the Earth surface from one AMT site to another with the speed of light $V = 300\,000$ km/s. Then, if these two sites are separated by the distance $D = 3$ km, the wave travel time between them would be $\Delta t = 0.01$ ms, which is comparable to the shortest periods (~0.1 ms) of the AMT exploration and thus is by no means negligible. As a consequence, we may expect that the telluric tensor, horizontal magnetic tensor and other inter-site transfer functions in some cases could show significant dependence on the direction to the predominant sources of high-frequency EM field.

In this paper we demonstrate the above effects on the AMT data from Kuluminskoe ore field, Russia.

Keywords: plane-wave approximation, source effect, horizontal magnetic tensor, telluric tensor.
