

On the correctness of using plane-wave assumption and two-channel acquisition systems in MT exploration at high latitudes

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SUMMARY

In 2019 about 5,000 MT sites were acquired during an MT survey in the Russian Arctic across the area of 120x80 km with a uniform site distribution over the network of 1x2 km. A single remote site was used for the remote reference processing. In the summertime we got a record at the reference site with duration for more than three months. These data allow us to better understand the applicability of the plane-wave assumption in such regions, since some experts suggest that application of classic Tikhonov-Cagniard source model in polar latitudes could lead to erroneous results due to the peculiarities of the local MT field source and proximity to it.

The whole record at the reference site was processed by 1-day fragments. Careful analysis of the frequency-time sections and graphs of variations of amplitude and phase of the impedance for 3 months, and graphs of their spectral density, we conclude that in the area of work located about 72° N the source-effect on the impedance tensor estimations is insignificant. Classic data processing based on plane-wave assumption yielded stable values of the impedance tensor and MT curves.

Maps of the horizontal magnetic tensor for several characteristic frequencies showed that within the study area the distance at which the magnetic field varies for less than 5% in amplitude and 3° in phase is about 2-3 km. Within this distance it is possible to consider the magnetic field recorded at an adjacent station as that recorded at the survey site, which could be employed for data processing acquired by two-channel MT acquisition systems.

Keywords: the plane-wave assumption, high latitudes, two-channel acquisition system
