MT 法のサンプリング定理

歌田 久司 [1]; Rung-Arunwan Tawat[2]; Siripunvaraporn Weerachai[3]
[1] 東大・地震研; [2] Mahidol Univ., Thailand; [3] Mahidol University, Thailand

The magnetotelluric sampling theorem

Hisashi Utada[1]; Tawat Rung-Arunwan[2]; Weerachai Siripunvaraporn[3]
[1] ERI, Univ. Tokyo; [2] Mahidol Univ., Thailand; [3] Mahidol University, Thailand

Here we consider a general case of Magnetotelluric (MT) study to reveal three-dimensional (3-D) distribution of the electrical conductivity within the Earth based on measurements of electromagnetic (EM) fields by a two-dimensional (2-D) array. MT array observation can be regarded as a sampling of MT responses (impedances), and each observation site can be regarded as a sampling point. This means that the array configuration must follow the sampling theorem. This paper discusses how the sampling theorem is applied to MT array studies, with special attention to the resolutions in the space and spatial wavenumber domains. Spatial Fourier transform of impedances in an array helps us to relate the EM scattering theory with spatial distribution of observed EM fields. The EM fields measured at a site are composed of their primary and secondary (scattered) components. The DC component of spatial Fourier transform relates the primary components of electric and magnetic fields. The scattered components are responsible for the spatially variable (AC) component of the impedance, and can be separated into signals that are resolvable by the array and noises (distortions) that are spatially too localized to be resolved. The regional (undistorted) field can be expressed by a combination of the primary component and signals of the secondary components. It is shown that an accurate estimation of the DC component is possible under the presence of galvanic distortion by using ssq rotational invariants. It is also suggested that the spatial and spatial wavenumber resolutions constrain a proper range of frequency for the analysis of MT array data.