

On separation of S_q field and MT response estimation using seafloor MT array data and independent component analysis

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For estimation of electromagnetic (EM) response functions at the periods between 10^4 and 10^5 seconds from seafloor magnetotelluric data, the effects of complex external source fields (e.g., geomagnetic solar quiet daily variations (S_q) and tides) are necessary to consider. One of the ways to deal with this problem is to determine the amplitude and phase of time variation of observed field for known periods of S_q and tides and to subtract them from the data. However, the reduction of the effects seems not enough to obtain reliable EM responses (Shimizu et al., 2011). In this study, I applied independent component analysis (ICA) to separate S_q field from the observed magnetic data. S_q field is based on the current in the ionosphere, which is excited by heating of neutral atmosphere by Sun. Then, I may suppose that the simplest instantaneous mixing model can be applied by treating the data with local time of each station. I applied the ICA to the seafloor MT data collected from the Philippine Sea for about one year from November 2005. I detected the independent components that the mixture of the components explains the observed magnetic data in the period of quiet days qualitatively well by investigating the detailed time variation and power spectrum of each independent component and correlations of mixing coefficients to longitude and latitude. Further, the EM responses were estimated by using the horizontal magnetic field components that the detected components were subtracted. I will demonstrate the detail of the analysis and discuss the feasibility of the source separation and better EM response estimation.

Keywords: marine magnetotelluric array, independent component analysis, geomagnetic solar quiet daily variations