Improving horizontal magnetic components in MT data using independent component analysis

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We carried out a MT survey in the Boso peninsula to investigate the resistivity structure of the area where the slow slip event have occurred at least five times within 20 years. Large artificial noise contaminated in the MT data and the resistivity and phase showed near field effect at the frequency band below 1Hz. To avoid the local noise, usually, we use the remote reference technique (Gamble et al., 1979), but the method was not so effective to eliminate the larger noise in this area. The remote reference method is based on the correlation between local horizontal magnetic field and the reference field. To apply a stronger technique, we attempted to use the independent component analysis (ICA). The ICA is stronger mathematical tool to extract the signal from the mixed data than the correlation.
ICA is one of the multivariate analysis methods and in which complicated data sets can be separated into all underlying sources without knowing these sources or the way that they are mixed. It assume that the mixing is liner, and yields the relation $x(t)=As(t)$ with input signals x(t), mixing matrix A and source signal s(t). In this study, to determine the matrix $W(=A^{-1})$, we used FastICA algorithm which was introduced by Aapo Hyvärinen (2000). It is based on a fixed-point iteration scheme for finding maximum of the nongaussianity of $W^{T}x(t)$.
We applied the ICA method to improve horizontal magnetic components in MT data using both the data observed in Boso area and the noise free magnetic data observed in Esashi (Iwate) or Memanbetsu (Hokkaido). After applying ICA, each component is not defined intensity scale. To extract noise free data in original data scale, kept the noise free components, and other component set to 0. (i.e. $x(t)=W^{-1}u'(t)$ Where u': components vector after ICA, x(t): the original data vector.) Finally we calculated the apparent resistivity and phases using the horizontal magnetic data processed as above.
In comparison between before and after the ICA processing, the noise components were removed. The apparent resistivity and phase improved by ICA were free from the influence of near-field phenomenon. These results revealed that ICA has the potential to handle noisy data. However we must more improve MT data to reveal the deep area, we also need to remove the noise of electric data.

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