Geophysical Research Abstracts
Vol. 13, EGU2011-8056, 2011
EGU General Assembly 2011

Using Empirical Mode Decomposition (EMD) for the processing of marine MT data

Jin Chen, Marion Jegen-Kulcsar, Max Moorkamp, and Bjoern Heincke
IFM-GEOMAR, Kiel, Germany (jchen@ifm-geomar.de)

Magnetotelluric (MT) method determines a frequency dependent impedance tensor using the spectra of associated time-varying horizontal electric and magnetic fields measured at the Earth's surface. In this abstract, we present a dynamic time series analysis method dealing the non-stationary MT data to infer the impedance tensor.

Most current methods to determine the spectra use Fourier transform based procedure and, therefore, assume that the signals are stationary over the record length. We introduce a new method for dealing with non-stationarity of the MT time series based upon empirical mode decomposition (EMD) method, a dynamic time series analysis method. Using EMD complicated data sets can be decomposed into a finite and small number of "intrinsic mode functions" (IMFs), which are mono-component signals and allow the calculation of physical meaningful instantaneous frequencies. EMD has no bias due to non-stationary of geomagnetic time series, since the IMFs are based entirely on signal characteristics and not on any given set of base functions such as sines and cosines in the Fourier transform or wavelets in the Wavelet transform.

We use the EMD method to decompose MT data into IMFs and calculate the instantaneous frequencies and spectra to determine the impedance tensor. The method is tested in synthetic and real marine MT data sets, the obtained estimate results are reliable compared to frequently-used BIRRP processing method. Furthermore, new method has the possibility of noise visualization and filtering, which is especially important in marine applications, where noise free time segments maybe short.