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# Identification of cultural noise sources in magnetotelluric data: estimating polarization attributes in the time-frequency domain using wavelet analysis

Magdalena Escalas, Pilar Queralt, Juanjo Ledo, and Alex Marcuello

Institut Geomodels, Departament de Geodinamica i Geofisica, Universitat de Barcelona, c/Marti i Franques s/n, 08028 Barcelona, Spain

Magnetotelluric (MT) data acquired in industrialized areas show the presence of cultural noise. In order to obtain the most reliable results with the MT method it is necessary to identify the noisy data segments caused by the artificial sources in the recorded time series. These segments must be rejected, and therefore, only those segments with the best signal-to-noise ratio will be processed.

In a MT survey, the direction of polarization of the recorded signal can be examined in the time domain. In fact, this polarization analysis is an efficient way to identify the sources contributing to a signal because its polarization attributes (tilt angle, ellipticity and phase difference between the orthogonal components) depend on the character of the electromagnetic source. However, MT time-series are non-stationary signals, therefore, an estimate of the polarization attributes requires an evaluation of the time-frequency dependence of these parameters.

Wavelet analysis has proved to be a useful tool to obtain the time-frequency content of a signal, with variable resolution. Besides, taking into account the progressive and regressive components of the wavelet spectrum, the polarization attributes of a signal can be also obtained in the time-frequency domain.

We have developed an algorithm based on the wavelet analysis, which provides the time-frequency content of the MT time series, and their polarization attributes in that domain. This code has been tested with both synthetic signals and field data. These later have been acquired in the Hontomin CO2 test site in northern Spain. In this experiment time series were contaminated at different frequencies with consecutive emissions of a well-known artificial electromagnetic source, which consisted of two electric dipoles 1km long, arranged in N-S and E-W directions. The analysis of these field data has permitted to identify the contribution of the artificial source, and to analyze the different polarization attributes of both natural and artificial signals in the time-frequency domain.