Geophysical Research Abstracts,
Vol. 11, EGU2009-4738, 2009
EGU General Assembly 2009

Time-Lapse magnetotellurics : application to volcanological data

P. WAWRZYNIAK (1), P. SAILHAC (2), J. ZLOTNICKI (3), G. MARQUIS (4), and F SANTOS (5)

(1) IPGS-EOST, Université de Strasbourg, FRANCE, (pierrewawrzyniak@hotmail.com), (2) IPGS-EOST, Université de Strasbourg, FRANCE, (3) CNRS-OPGC, Clermont-Ferrand, FRANCE, (4) CanAlaska, VANCOUVER, CANADA, (5) Centro di Geofisica, LISBONNE

Time-lapse magnetotellurics aims at studying resistivity variations in the earth due to internal processes, especially when dynamics of geophysical fluids is involved. Reliable estimates of the uncertainties of the MT parameters are essential to determine accurately the occurrence and timing of a subsurface event.

We are testing the applicability of time-lapse MT on a data set acquired at Piton de la Fournaise (Reunion island) volcano in 1997-1998. The large amount of fluid involved in the eruptions leads to dynamical resistivity changes over a depth range well investigated by the data acquired at $\Delta t = 20$ s. Resistivities were computed each day with Chave and Thompson's RRRMT code (``Robust Remote Reference Code´´). Results display large resistivity decreases occurring during the eruption on most stations and several patterns are observed.

Chave and Thompson's estimation of errors is based on the internal dispersion of parameter estimates. We have run synthetic test to test whether the parameters and errors obtained by RRRMT are suitable for time-lapse studies. A measured magnetic field is convolved with known impedance tensors to generate a synthetic electric field entirely correlated to the magnetic field. Both MT fields are then input into RRRMT. The resistivity estimates and their errors are then compared to the known values and we found significant differences between RRRMT and expected results.

We have therefore designed a new and simple method to estimate errors. The 1D and 2D cases are relatively simple because the impedance tensor can be simplified in its antidiagonal form. For these cases, a simple formulation of errors can be obtained from magnetic and predicted telluric field at the frequences of interest. Our tests shows that this formulation leads to more realistic error estimates.

The 3D case is more complex because the impedance tensor cannot be made antidiagonal. In this case, we use a simple 2D quarter-space model and distorted its response by applying Groom and Bailey's decomposition backwards. Because we have to solve four unknowns (errors on the four componets of the tensor) with two equations, another methodology, based on stationnary test and requiring the delete-ones files, is being developed.