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Resitivity variations associated with the 1998 large eruption at La Fournaise volcano inferred by continuous MT monitoring

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Time-lapse magnetotellurics aims at studying resistivity variations in the earth due to internal processes, especiallywhen 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 developed a new method, named the Error Tensor Method, to estimate the errors on the impedance and apply it in this study.

We are testing the feasibility of time-lapse MT on a data set acquired at Piton de la Fournaise (Reunion Island) volcano in 1997-1998 at a sampling frequency of 25mHz. In 1998, the volcano erupted during 6 months and expelled 60Mm3 of lava. This large amount of fluid could lead to dynamical resistivity changes in a depth range that can be investigated by the data.

First, the time resolution of the method was estimated using the uncertainties obtained by the Error Tensor method on sub-datasets. Then, resistivities were computed each day with BIRRP code. Results display apparent resistivity variations of large amplitude during the eruption and illustrates different regimes of activity.

Finally, apparent resistivities were continuously inverted using a 1D approximation and a reference resistivity model infered from AMT survey done during a quite period preceeding the Eruption. Inverted time-depth profiles show evidences for a deep upward migration of conductive material during the eruption. Those results are compared to other studies and bring complementary information to the knowledge of the 1998 eruption.