APPLICATION OF THE SMALL-LOOP TDEM METHOD TO THE QUANTIFICATION OF BOTH ELECTRICAL AND MAGNETIC PARAMETERS OF THE SUBSURFACE

Cécile Finco, Sorbonne Universités, UPMC; Cyril Schamper, Sorbonne Universités UPMC - UMR 7619 METIS; Fayçal Rejiba, Sorbonne Universités UPMC - UMR 7619 METIS

The inductive electromagnetic geophysical method in the temporal domain (TDEM) allows, in certain conditions, the measurement of a signal integrating information from several physical independent parameters (electrical resistivity, magnetic viscosity, polarization). Being able to separate and quantify those physical and independent contributions is a real issue. It is particularly important when one of those contributions overwhelms the others which can happen depending on the geological context and the specific setup used.

The non-conventional use of this method with small transmission and reception loops (a few meters wide at most for the transmitter loop) increases the sensitivity to the magnetic viscosity in addition to the usual electrical resistivity. Through numerical modeling (notably search of equivalences through a neighborhood algorithm) and field tests, we are designing a setup geometry that would allow us to discriminate between the influences of these parameters on the signal. The most promising option would be to make a measurement in the central configuration, which is very sensitive to the magnetic viscosity, and another one with an offset between the two loops as the sensitivity to the magnetic properties decreases with the distance from the emission.

This use of small loops also increases the sensitivity to the noise from the system itself. The interactions between the loops and the measurement device create a distortion on the measured signal. This distortion depends on the setup geometry and on the electrical characteristics of the ground. Current work concerns the study of equivalent electrical circuits (using software such as LTspice) to model the mutual characteristic and complex impedance between both the transmitter and receiver coils. The accurate evaluation of the mutual impedance over a wide band of frequencies is necessary to model the instrumental response and separate it from the part of the measured transient signal coming from the subsurface.