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Large 3D resistivity and induced polarization acquisition using the Fullwaver system: towards an adapted processing methodology

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Driven by needs in the mineral exploration market for ever faster and ever easier set-up of large 3D resistivity and induced polarization, autonomous and cableless recorded systems come to the forefront. Opposite to the traditional centralized acquisition, this new system permits a complete random distribution of receivers on the survey area allowing to obtain a real 3D imaging.

This work presents the results of a 3 km^2 large experiment up to 600m of depth performed with a new type of autonomous distributed receivers: the I&V-Fullwaver. With such system, all usual drawbacks induced by long cable set up over large 3D areas – time consuming, lack of accessibility, heavy weight, electromagnetic induction, etc. - disappear.

The V-Fullwavers record the entire time series of voltage on two perpendicular axes, for a good determination of the data quality although I-Fullwaver records injected current simultaneously.

For this survey, despite good assessment of each individual signal quality, on each channel of the set of Fullwaver systems, a significant number of negative apparent resistivity and chargeability remains present in the dataset (around 15%). These values are commonly not taken into account in the inversion software although they may be due to complex geological structure of interest (e.g. linked to the presence of sulfides in the earth). Taking into account that such distributed recording system aims to restitute the best 3D resistivity and IP tomography, how can 3D inversion be improved?

In this work, we present the dataset, the processing chain and quality control of a large 3D survey. We show that the quality of the data selected is good enough to include it into the inversion processing.

We propose a second way of processing based on the modulus of the apparent resistivity that stabilizes the inversion. We then discuss the results of both processing. We conclude that an effort could be made on the inclusion of negative apparent resistivity in the inversion code.