A THOROUGH SYNTHETIC STUDY ON IP EFFECTS IN AEM DATA FROM DIFFERENT SYSTEMS

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IP effects in AEM data are subject of current research around the world, due to the recent recognition of their significance for exploration and general (hydro)geological mapping. There is however a need to study more accurately the boundaries of the effect and of its relevance. In this paper we present, based on synthetic modelling, a systematic, extended analysis of AIP effect from different AEM (TEM) systems in different pseudo geologies. Its goal is to provide a clear overview of possible AIP effects in the data space, without imposing simplistic assumptions (e.g., fixing some parameters to arbitrary values or limited boundaries). We produce 1D FWD responses with dispersive resistivity for hundreds of thousands of combinations of Cole-Cole model parameters and AEM system transfer functions. The results are analyzed using various metrics (e.g., sum of negative voltages, exponential fitting) that capture different AIP signatures in the transients. Experiments include half spaces, 2 and 3 layer models, combined with different waveforms, Rx types (dB/dt and B), Tx-Rx geometries, flying heights, transients' binning, base frequencies. The results, presented as 4D hyperspaces, each with 10^4 transients obtained from the combinations of 4 x 10 different Cole-Cole parameters, allow a clear assessment of the AIP effects over a wide range of geophysical situations. Some of the main observations are: AIP effects are increased by the presence of a resistive bedrock, using slow turn-off of the waveform and better observed recording the B field instead of its derivative and in any case adopting low base frequencies.