BASIC FEATURES AND NOISE SENSITIVITY OF MAGNETOTELLURIC INVARIANT IMAGES

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In this poster we give a comprehensive overview about the imaging properties of various magnetotelluric rotational invariants, on basis of systematic 3D numerical modelling results (by using the WSINV3DMT code (Siripunvaraporn et al. 2005a,b, PEPI, GJI)), and of field results. We considered the following invariants: resistivity based invariants (ρ_{detReZ}, ρ_{detImZ}, ρ_{ssqReZ}, ρ_{ssqImZ}, series and parallel resistivity); Bahr invariants (κ: Swift's Skew, μ: phase difference between the components of the magnetotelluric tensor, η: phase sensitive skew, and Σ: 2D indicator); WAL invariants (central impedances: I_1, I_2, and dimensionality indicators); phase tensor invariants (phase ellipses, comparison of phase tensor elements: Φ_{max}/Φ_{min}, Φ_{max}-Φ_{min}, phase invariants: Φ_{det}, Φ_{ssq}, Φ_{trace}). In the poster we present their imaging properties for various subsurface models, adding an increasing level of Gaussian noise to the response functions. It is well known that invariant images are independent of measuring directions, but it is a new result that they are much less sensitive to noise than the non-invariant tensor elements. The two-dimensional correlation coefficient (calculated between the model parameters and the invariant image at various periods) decreases systematically but in an invariant-specific way as a function of the noise intensity. Some invariants (mainly the resistivity and phase invariants) are almost insensitive to noise, some other invariants (mainly the higher-order invariants) are more noise-sensitive, but any of them is more robust than the individual tensor elements. The threshold values of dimensionality criteria in indicators (WAL method by Weaver et al, 2000; Bahr-Q methods by Martí, 2006) worth using only in case of low noise level and in case of simple and huge structures. It is also shown that the real- and imaginary tensor based invariants at the same period provide information from different depth domains. Based on the phase tensor imaging features, it was possible to estimate the maximum depth extension of the Middle-Hungarian tectonic line.

EM modelling, magnetotellurics, tensor invariants

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