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TITLE: Inversion of Magnetotelluric Data in Anisotropic Media Using Maximization of Mutual Information

PRESENTATION TYPE: Assigned by Committee (Oral or Poster)

CURRENT SECTION/FOCUS GROUP: Study of Earth's Deep Interior (DI)

CURRENT SESSION: DI05. Understanding the Electrical Conductivity of Earth's Mantle: Insights from Imaging, Experiments and Joint Interpretation

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ABSTRACT BODY: Regularization in inverse geophysics problems has been used extensively, due to the necessity to constrain the model space and to reduce the ill-posedness of several problems. Magnetotelluric (MT) problems suffer from severe non-linearity and ill-posedness, which makes MT inversions extremely challenging.
The use of a reference model has been used by many authors in order to drive the inversion process to converge on a model that shares features with the reference, as a result reducing non-uniqueness and improving the model resolution.

In our work the reference model drives the inversion keeping the conductivity distribution close to that of the velocity using variation of information as measure of distance between the two pictures. In this way the electrical conductivity and seismic velocity can be compared from a statistical point of view, without the necessity of a common parameterization or a strict geometrical similarity. Our work involves the inversion of MT long-period data, which are sensitive to electrical conductivity, using shear wave velocity maps as reference model in a 1D anisotropic domain. Computation of variation of information is performed through the generation of the joint probability distribution, which allows exploration of the relation between models that fit seismic data and models that fit electrical properties.

An approximate agreement between geoelectric strike direction and seismic fast axis have been recognized in different continental lithospheric areas, suggesting a common cause for both the seismic and electric anisotropic behavior. We present an application of this inversion approach to a real dataset from Central Germany, discussing pros and cons of this approach in relation to similar studies on the same area. Due to the minimal assumptions required by this approach, it highlights the possibility of application to different tomography techniques.

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INDEX TERMS: [3260] MATHEMATICAL GEOPHYSICS / Inverse theory.