Transdimensional Bayesian inversion of 2D magnetotelluric data with static shift

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Magnetotelluric (MT) data offers valuable insights into regional structural patterns and the dynamics of tectonic processes. The conventional gradient-based approaches for estimating subsurface conductivity from the MT data often fall short due to subjective model regularization, leading to an incomplete capture of the non-linear relationship between the model and the data. Additionally, there is limited information on the uncertainty associated with estimated model parameters. The presence of static shift can distort subsurface imaging if not properly accounted for. To address these limitations, we employed a transdimensional Bayesian approach for 2D MT data inversion. This approach utilizes multiple interacting Markov chains to generate an ensemble of conductivity models that fit the data within the noise levels. The number of Voronoi cells used to describe the subsurface is treated as unknown, allowing the model complexity to be dictated by the data itself. Furthermore, we incorporate additional unknown site-dependent parameters for the static shift, which are then estimated during the inversion process. The efficiency of the algorithm is demonstrated to image the variations in subsurface conductivity along with the static shift parameters. Additionally, the algorithm provides a quantification of uncertainties in the estimated model parameters, thereby bolstering confidence in the inversion solutions.

Keywords: Magnetotelluric, transdimensional Bayesian inversion, static shift