Joint inversion of magnetotelluric, seismic surface waves, and gravity data for Britain: progress and challenges

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SUMMARY

Models of current lithospheric structure are key to understanding the tectonic history of Earth. Geophysical methods image the Earth at different spatial scales, and resolve different properties, based on different physical principles. They can be combined in a joint inversion to improve the recovery of Earth's structure. In recent years, advances in computational capabilities allow us to apply joint inversion techniques in three dimensions. This can help to reduce significantly the ambiguity in inferred structures. However, there are still challenges in the application of joint inversion methods related, for example, to data and grid management, coupling approaches between different parameters, and the possibility of incompatible resolution and structures and unmodelled parameters.

With a recently acquired long-period magnetotelluric dataset and available seismic surface wave and gravity data, we conduct the first 3D joint inversion of these datasets to study the lithospheric composition and structure beneath Britain. We are using the joint inversion framework jif3D, which has been applied to a variety of geological contexts and combinations of geophysical data. Here, we discuss the challenges that uneven and different data sampling coverage represent, but also the advantages of using joint inversion in this scenario. We show preliminary comparisons between existing models from single-data type inversions and the joint inversion, and discuss some of the implications for the interpretation of anomalies in the crust and upper mantle.

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