

Using magnetotelluric and differential magnetometer data to quantify Space weather risk in the UK high voltage power transmission grid

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SUMMARY

Geomagnetically induced currents (GICs) that occur during severe geomagnetic storms have been identified as a hazard to ground-based modern infrastructure like the power grid, gas pipelines and railways. During past extreme space weather events, disruption to the electricity supply in several mid- and higher latitude countries have been reported. In order to monitor, model and forecast GICs, sophisticated models of the ground electric field and the network topology are required in a multi-disciplinary approach. EM geophysics can provide realistic ground electric field estimates using magnetotelluric data and/or models of electrical conductivity of the earth.

We present a detailed analysis of newly collected differential magnetometer (DMM) and MT data in the UK that allow the verification and validation of our network model for the UK power transmission grid. Combining the observation of line GICs measured with DMM at several sites in the UK in the past four years and the electric fields derived from the MT data show an excellent fit of prediction and observation of GICs. This validation of the network model and electric field calculation allows us to use it with confidence for real time modelling and forecasting as well as extreme event analysis.

Keywords: Space Weather, Geomagnetically induced currents (GICs), Differential magnetometer method, geoelectric field model