SWIGS: A New UK Research Consortium to Study 'Space Weather Impacts on Ground-based Systems'

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The British Geological Survey is leading a new UK Natural Environment Research Council funded study into 'Space Weather Impacts on Grounded Structures' (SWIGS), through a four-year research project that started in May 2017. The SWIGS consortium of ten UK institutes and universities will research links between the magnetosphere and ionosphere, research the generation of geo-electric fields, through interaction of geomagnetic variations with the solid Earth, and research the impact of enhanced geomagnetic activity on ground infrastructures such as high voltage power grids, rail and pipeline networks. SWIGS is supported by an industry stakeholder group and a group of international project partners from FMI, NRCan, UK Met Office, North China Electric Power University, and the Universities of Cape Town, Otago, Trinity College Dublin, Frankfurt, Gottingen, John Hopkins and Beihang. In addition to research that improves physical models of the space weather interaction with Earth's space environment and the space weather threat to ground level technologies, SWIGS will also promote workshops and other meetings.

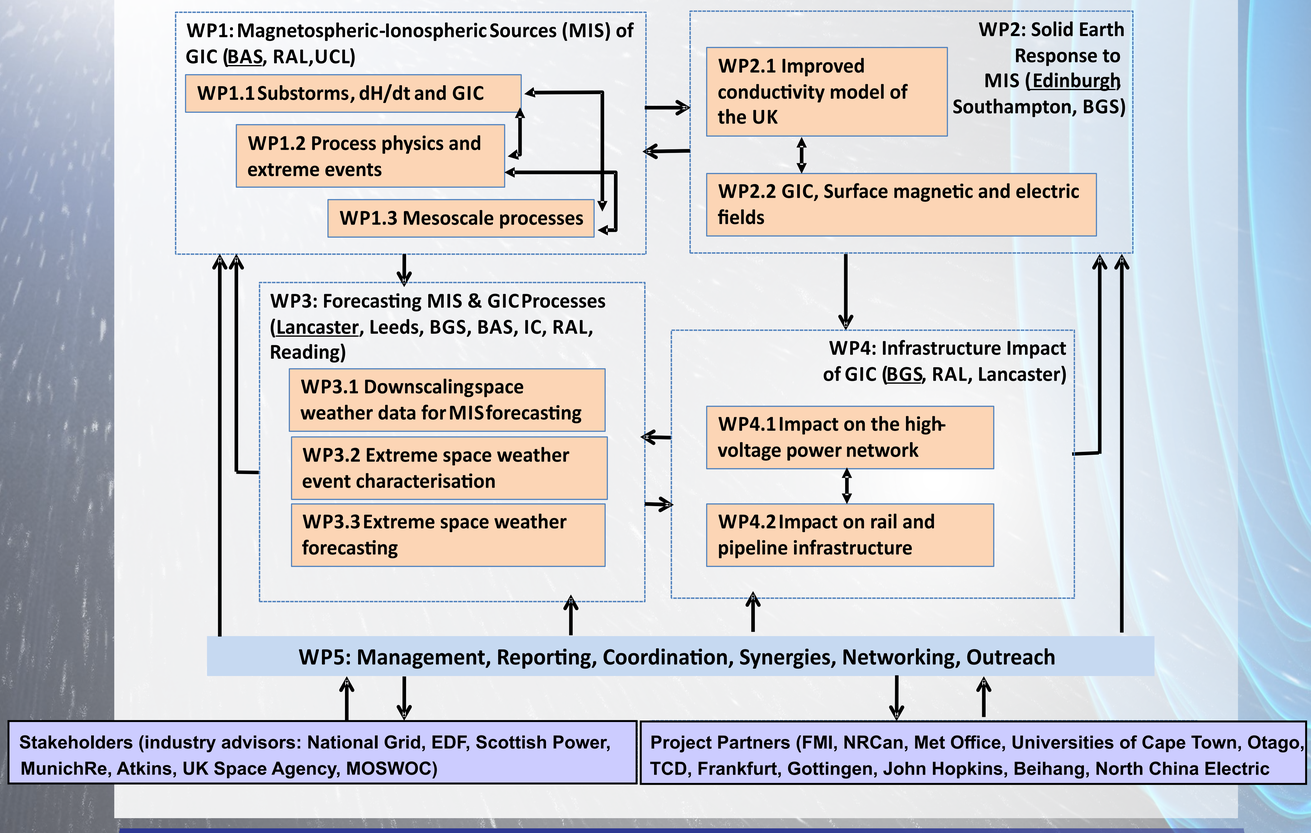
Aims and Objectives

We aim for radical improvements in the accuracy of coupled ionosphere-magnetosphere models, and the solid Earth response to these GIC sources, that leads to major advances in accurate numerical now-casting and forecasting of GIC in ground-based infrastructures

Our objectives are to

- Produce new insights into the structure and dynamics of ***magnetospheric-ionospheric*** sources of GIC, including the ring current, field-aligned currents and auroral electrojets, especially during extreme space weather
- Develop realistic modelling of the ***surface electric field***, as the source of GIC, from these step-change improvements in our understanding of **external geomagnetic fields** and from improved knowledge of shallow to deep Earth **conductivity**
- Validate models of surface electric fields and of GIC in transformers through ***field work and measurements***
- Develop **new UK capabilities in space weather forecasting** of geo-electromagnetic variations and GIC
- Produce **new insights into extreme events**, their cause and impacts, from modelling and statistical analysis, and addressing emerging industry and insurance 'worst case' requirements
- Understand better the **role of the Earth's main magnetic fiel**d, generated in the liquid core of the planet, as a control on space weather impact location and severity
  Explore and quantify the **GIC hazard** to the UK electrical transmission, railway and gas transmission pipeline networks

Work Packages and Links



The project consists of four work packages focussing on

- **WP1: Magnetosphere/Ionosphere Modelling**
- **WP2: Solid Earth conductivity and surface magnetic and electric field measurements**
- **WP3: Forecasting magnetic field changes and extreme event analysis**
- **WP4: Impact on ground infrastructures including high voltage power systems, rail and pipelines**

The figure shows the interactions and linkages between the work packages and the primary institutes leading them (underlined). We have included numerous industry stakeholders and project partners to gather data and expertise and allow the project to have direct impact through industry into society.

www.geomag.bgs.ac.uk/research/SWIGS/home.html

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