

Network science quantification of space weather at earth

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Research at the Centre for Fusion, Space and Astrophysics (CFSA) focuses on plasma physics applied to the grand challenges of fusion power, space physics, solar physics, and astrophysics. Our work spans fundamental theory, observation, and the analysis of experimental data, combined with high performance computing. For more details of the CFSA see <http://www.warwick.ac.uk/go/cfsa/>

The near-earth space plasma environment, its magnetosphere and ionosphere, exhibit a rich range of non-linear phenomena, from turbulence to large-scale reorganization, leading to geomagnetic substorms with system-scale phenomenology such as the aurora. Direct driving by solar activity, such as coronal mass ejections, precipitates geomagnetic storms, but the magnetosphere responds to solar driving in a complex manner. This space weather, and its impacts on power grids, communications and satellite performance, is thus challenging to quantify.

Two key impacts of space weather are ground level magnetic disturbances and fluctuations in ionospheric plasma density. These are monitored by an extensive system of 100+ ground based magnetometers, and by using the ground signals from the Global Navigation Satellite System. The challenge is to characterise these high time resolution and spatially inhomogeneous observations with a few time-varying parameters that can be used to 'flag' and ultimately predict, the impactful aspects of space weather. This project will use these data to construct dynamic networks that capture spatial and temporal correlation, and will yield network parameters that quantify the system space-weather state. These network parameters may provide an operationally useful tool for systems that are impacted by space weather.

The project is part of an ongoing collaboration with lead experimenter sites NASA-JPL and JHU/APL, requiring visits to the USA.

We plan to interview in person at Warwick University in late February. We welcome informal enquiries and can discuss online before then.