Scenario DOCTORAL TRAINING PARTNERSHIP

NERC SCIENCE OF THE ENVIRONMENT

Forecast improvements from solar wind data assimilation

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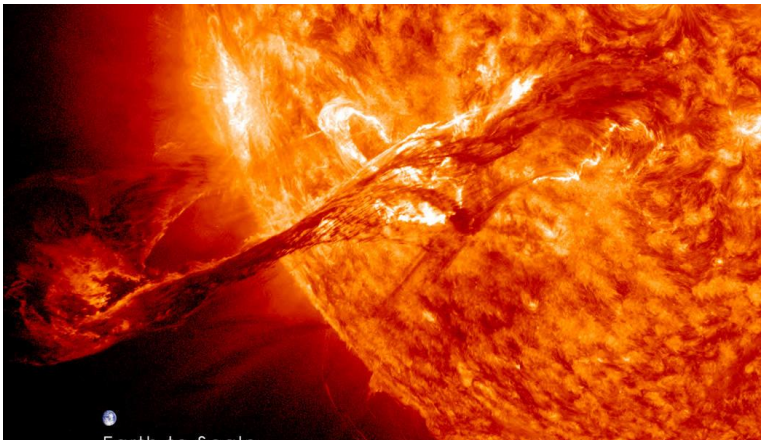
The solar wind is a continuous outflow of charged particles and magnetic field from the Sun's upper atmosphere. Variability in the solar wind conditions leads to space weather, which can adversely affect technological infrastructures, such as power grids and telecommunications networks, as well as the health of humans in space and on high-altitude flights.



A coronal mass ejection (CME), approximately a billion metric tons of material moving at around a million km/h, erupts into the solar wind. CMEs drive the most extreme space weather which can damage power grids and space hardware.

For space-weather forecasting, increased forecast lead time requires accurate prediction of the solar wind conditions in near-Earth space. At present, solar wind forecast models are "free running" without any observational constraints beyond the initial conditions. Data assimilation (DA) is the process of merging model and observational data to ensure an optimal estimate for reality. Numerical Weather Prediction has made huge strides in accurate forecast lead time through the expansion of the observational network and the application of DA.

At Reading, we've recently conducted the very first solar wind data assimilation experiments. However, we've yet to fully investigate the expected forecast improvements, which would form the focus of this PhD project. In particular, the project seeks to quantify the improvement provided by DA for space-weather forecasting in an operational setting and how forecast skill varies with available observations, in order to inform future space-weather mission design.

Training opportunities:
The student will have the opportunity to attend space physics and data assimilation summer schools in the UK and US. The student will undertake an extended placement the UK Met Office Space Weather Operations Centre.

Student profile:
This project would suit a student with a strong background in quantitative science (e.g., Maths, Physics or Engineering-related undergraduate degree). Previous experience with computer programming is desirable but not essential. Previous knowledge of solar/heliospheric physics and data assimilation is not required.

Funding particulars:
This is a CASE-sponsored project with the UK Met Office.