NERC-funded Research Experience Placement (REPs) Summer 2025

Project title

An inventory of radar data to study North-South asymmetry in response to space weather

Lead supervisor

Ingrid Cnossen

Project description

Space weather arises from the interaction of the solar wind that flows outwards from the Sun with the Earth's magnetosphere-ionosphere system. Space storms are a highly dynamic feature of this interaction and most strongly impact the polar regions, where they can produce beautiful auroral displays. However, extreme space weather also poses serious hazards to satellites operating within the Earth's upper atmosphere and to technological systems on the ground. It is therefore important to understand how both hemispheres are affected by space weather.

Measurements from the Super Dual Auroral Radar Network (SuperDARN) have been widely used to characterize the electric field in the polar ionosphere, which is key for understanding the response of the upper atmosphere to space storms. There are more SuperDARN radars in the Northern hemisphere than in the Southern hemisphere, primarily due to greater accessibility, so the data coverage in the Northern hemisphere is much better. Consequently, Northern hemisphere data have primarily been used for analyses of space weather effects, often with the assumption that the Southern hemisphere responds symmetrically or with mirror symmetry. Interestingly, recent studies indicate that this is not quite true; there may be systematic differences in the ionospheric response to space storms in the two hemispheres.

The main objective of this project is to create an inventory of space storms for which sufficient SuperDARN data coverage is available in both hemispheres, which could enable us to investigate potential North-South asymmetries further. Existing lists of storms (available in the literature) will be used as much as possible. Criteria to determine what counts as "sufficient" coverage will need to be developed together with supervisors. Depending on the outcome of the main objective, the student's interests, and the remaining time available, it may be possible to conduct preliminary analyses of North-South differences based on either the selected SuperDARN data (if deemed sufficient) or simulation data from the Thermosphere-Ionosphere-Electrodynamics General Circulation Model (TIE-GCM). Some simulation data is already available, but the student will be offered the opportunity to learn how to run this model and produce their own data if interested. Supervisors will also provide further background on solar-terrestrial physics as required for the project, tailored to the student's needs and interests.

Project restrictions

None.

Working arrangements

The student will work within the Space Weather and Atmosphere (SWA) team at the British Antarctic Survey (BAS). We have a regular SWA meeting slot on Tuesday morning, which is either a management meeting (once a month), a slot reserved to attend an online seminar of the Magnetosphere-Ionosphere-Solar-Terrestrial (MIST) community (once a month) or an informal talk given by a SWA team member, or occasionally a visitor (the remaining slots). The student will be welcome to join this meeting (online or in-person) and will be invited to present their work towards the end of the placement. They can also join other BAS events and talks on a variety of topics, with many offering an online option.

Full-time attendance at BAS is not required, but in-person attendance for at least some of the time would likely be beneficial for interactions with supervisors and offer wider learning and networking opportunities with SWA team members and other BAS staff and students. However, if required, the work could be fully carried out remotely. In this case, we will make every effort to assist the student through online meetings as needed.