

Electrodynamics of the solar wind-magnetosphere-ionosphere-atmosphere coupled system

- What links the auroras and electric currents in space?
- How does the solar wind impact the terrestrial environment?
- Use multiple space- and ground-based systems to understand geomagnetic activity

Level	PhD
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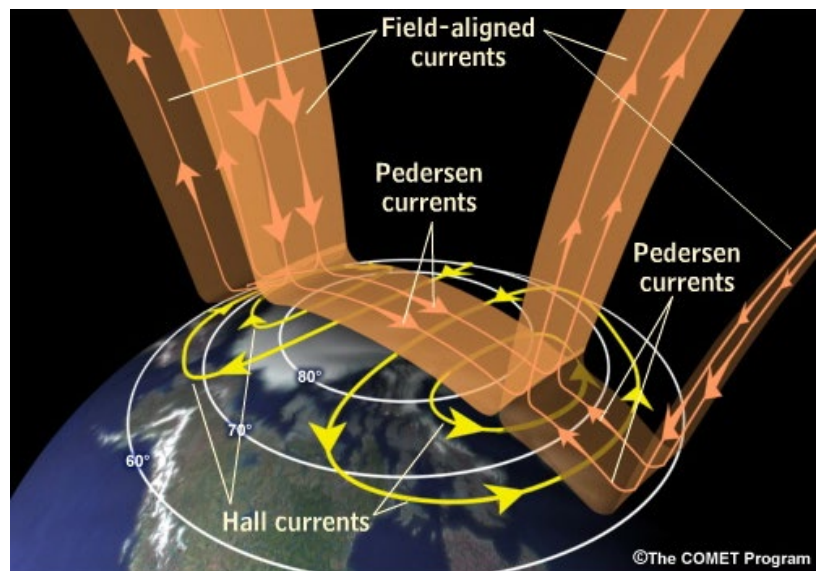
Project Details:

The interaction of the solar wind with the Earth's magnetic field leads to dynamic phenomena in near-Earth space, including the energization and circulation of plasma within the magnetosphere and ionosphere – the most visible manifestation of which is the polar auroras – which lead to a hostile environment for space- and ground-based technologies.

There are currently two theoretical frameworks in which the interaction and dynamics are understood. The “open magnetosphere” model proposed by Jim Dungey in the 1960s - which invokes magnetic reconnection as the process by which terrestrial magnetic field lines become connected and disconnected from the interplanetary magnetic field embedded within the solar wind - has been highly successful in explaining many aspects

of magnetospheric dynamics. Alternatively, the dynamics can be thought of as driven by electric currents generated at the magnetopause and diverted into the ionosphere and inner magnetosphere, forming current loops that transmit stress from the solar wind to the magnetospheric plasma. These two paradigms are clearly different aspects of the same phenomenon, but as yet there is no consensus of how the two pictures fit together.

Until recently, progress has been hampered by an inability to measure the spatial and temporal variations of the current systems of the magnetosphere. However, a new measurement technique that exploits magnetometry from the Iridium satellite constellation of nearly 70 spacecraft – the Active Magnetosphere and Planetary Electrodynamics Response Experiment (AMPERE) – provides an unparalleled opportunity to study the electric currents systems linking the magnetosphere and ionosphere, and to understand their role in the larger solar wind-magnetosphere-ionosphere-atmosphere system. This project will exploit data from AMPERE, space-borne auroral cameras, and many other space- and ground-based observatories, together with theoretical modelling, to gain a fuller understanding of the electrodynamics of our near-Earth environment and its response to solar wind disturbances. A key aim is to study the variability of the auroras, how they are generated, and what this tells us about the structure and dynamics of the magnetosphere.



Electric currents from space

References:

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