2011 Workshop: Multi scale MIT coupling

Long title
Nightside Multi-scale Magnetosphere-Ionosphere-Thermosphere (MIT) Electrodynamic Coupling during Geomagnetic Disturbances
CEDAR-GEM
Conveners
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Description

Field-aligned currents (FACs) are the essential mediator between the magnetosphere and the ionosphere. FACs modify the ionospheric conductivities by increasing or depleting the ionospheric density through associated particle precipitation and evacuation processes, respectively. The modified conductivity in turn regulates the magnetospheric drivers by changing the exerting forces and electric field distributions, including generating important structured electric fields, such as Sub-Auroral Polarization Streams / Sub-Auroral Ion Drifts (SAPS/SAID). The structured ionospheric density also provides important information about the location/polarity of the FACs and the energy distribution of the precipitating particles in the case of upward FACs.

Geomagnetic disturbances targeted in this joint session include, but are not limited to, substorms, PBIs, streamers and SMCs. These geomagnetic disturbances are associated with enhanced FACs and highly structured auroral forms. The characteristics of FACs, including their 2-D horizontal distribution and their development and evolution through the course of these disturbances, have never been directly observed at sufficient temporal resolution to resolve the intricacies of their dynamics. The newly available Active Magnetosphere and Planetary Electrodynamics Response Experiment (AMPERE) magnetometers will enable us to conduct for the first time 2-D imaging of the FACs distribution. Combined with the perpendicular currents calculated from existing models, they will be able to provide the global-scale 3-D current distribution in the ionosphere. In addition, the continental-scale THEMIS ground-based ASIs and the multi-spectral cameras will enable us to associate auroral forms with direct FAC measurements. Moreover, ground-based radars, including both coherent and incoherent scatter radars, can provide detailed information about the global convection flow and thus electric field patterns, as well as the altitude profile of electron density. Furthermore, with the increasing availability of ground-based GPS receivers, global-scale total electron content can be obtained and the effect of FACs in modifying the ionospheric electron density distribution can be readily evaluated. In the magnetosphere, the NASA THEMIS satellites enable investigation of the linkage between the physical processes in the magnetosphere and structures observed in the ionosphere and thermosphere. The effect of those geomagnetic disturbances on the thermospheric wind can also be monitored by the ground-based Fabry-Perot spectrometers. These instruments as a whole provide us with an unprecedented opportunity for imaging the MIT system in 4-D and for investigating the electrodynamic coupling of the MIT system during geomagnetic disturbances.

This joint session proposal is a call for a multi-instrument observational campaign, requiring close collaborations between both GEM and CEDAR communities. It is timely because of the availability of simultaneous observations from multiple instruments, including those mentioned above and many other instruments and models. In addition, the joint GEM/CEDAR workshop this year will provide us with an excellent opportunity to kick off this interdisciplinary research initiative and a forum for presenting results, discussing solutions and exchanging ideas.

Agenda

MIT coupling session schedule (pdf)

Justification

The MIT system behaves as a complex system characterized by coupling and feedbacks, preconditioning, and memory. This system is of great interest to both the GEM and CEDAR communities and includes a variety of important topics that are common to both initiatives. Understanding the MIT during periods of geomagnetic disturbances as an integrated system as well as from perspectives of each discipline is necessary to move the area forward.

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