2011 Workshop: MI Coupling at Middle and Low Latitudes

Long title

Electrodynamic Coupling of the Ionosphere and Magnetosphere at Middle and Low Latitudes

CEDAR-GEM

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Description

In the last decade, there have been many new development in understanding the electrodynamic coupling of the inner magnetosphere with the middle and low latitude I-T system. One of the great achievements was the identification and explanation of common magnetic-storm processes in plasmaspheric and ionospheric data and images, and the realization that disturbance dynamo and prompt penetration electric fields are not independent but interact with each other non-linearly. New developments continue to highlight the coupled nature of the system during quiet times as well as in response to magnetic storms. Significant gaps in our understanding still exist and lie in the need to quantify the various sources of electrodynamic variability at mid and low latitudes and the interactions and feedback between them. For instance, during quiet times, fluctuating winds in the thermosphere from sources in the lower atmosphere are likely to compete with fluctuation of magnetospheric sources, both in terms of driving winds and in imposing modest penetration electric fields. These sources of quiet-time fluctuations in the fields, render it extremely difficult to separate storm from quiet, since the background from one day to the next can be 50% of the signal. During storms the magnetospheric sources tends to dominate but lack of knowledge in the uncertainty in the quiet background can confuse interpretation of the storm response. This workshop is designed to bring together the CEDAR and GEM experts in the sources of mid and low latitude electrodynamics from the inner magnetosphere, thermospheric wind dynamo, and forcing from the lower atmosphere.

New science questions to lead discussions:

1) Response of low and mid-latitude ionosphere to penetrating magnetospheric fields vs. disturbance dynamo. During a storm, the effects of both penetrating magnetospheric fields and disturbance dynamo fields drive changes in the ionosphere. What's typical, what's not? Does the F-layer go up or down, at what local times and for how long after storm onset? During disturbances, can the effects be reasonably separated or predicted? Do the responses depend on solar flux conditions?

2) Contribution of magnetospheric sources to quiet-time variability at low and mid latitudes. During periods of low geomagnetic activity, the ionosphere continues to exhibit large variability. Is this due only to sources such as tropospheric forcing, or is the ionosphere more susceptible to forcing from magnetospheric sources, owing to the low ionospheric/magnetospheric densities of recent solar minimum conditions?

3) Storm-time wind dynamo electric fields in the inner magnetosphere. The thermospheric winds that develop during geomagnetic storms drive electric fields that have a profound effect on the ionosphere. This disturbance dynamo develops after storm onset and persists for many hours after storm drivers lessen. These storm-time fields develop on magnetic L-shells that are usually occupied by cold plasma, but stripped of that during storms. What do the storm time dynamo electric fields look like from the point of view of the inner magnetosphere? Are these important for post-storm plasmaspheric dynamics?

Justification

Critical aspects of the M-I system cannot be addressed in isolation. The CEDAR-GEM workshop is a perfect place for developing a broader understanding of the system where drivers originate in both regimes.

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