# 2016 Workshop: MIT Coupling

Long title
Joint GEM-CEDAR Grand Challenge: Storms and Substorms Without Borders (GC-SSWB)
Grand Challenge
CEDAR-GEM
Conveners
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Description

The CEDAR Grand Challenge workshop “Storms and Substorms Without Borders” (SSWB) and the GEM focus group on storm-time inner magnetospheric convection (SIMIC) will hold two joint sessions at the 2016 summer CEDAR-GEM workshop. Our focus is to understand the response of the coupled magnetosphere, ionosphere, and thermosphere system to storms and substorms as a whole system. Specifically, we seek to identify and investigate the underlying coupling processes and cross-scale interactions between the magnetosphere and the ionosphere-thermosphere (the M-I-T system). This year, we will concentrate our efforts in two different ways:

(1) Session 1

Session 1 will examine results for our new SAPS Focus Study: SAPS has been one of the more important problems that both GEM and CEDAR have in common, for both modeling and observations. The list of questions that emerged from our previous effort is summarized as follows: what are the key physical processes leading to SAPS, and how well do models of SAPS compare with actual observations? Does the mid-latitude trough exist in the preceding interval, and how do the trough and SAPS channel relate to each other? Does SAPS generate the trough or is the trough a pre-existing condition for SAPS and does the SAPS then deepen the trough? What is the nature of the M-I-T feedback during events (i.e., does the inner magnetosphere simply drive the ionospheric effects or does the ionosphere respond back on the magnetosphere in a significant way)? How do model predictions of SAPS under less disturbed conditions (i.e., substorms only) differ? Comparison with observations is key. We invite data analysis and modeling results relevant to any of the topics listed above. The detailed description of the session will be sent out by CEDAR/GEM

mailing list (begining of May).

SAPS Focus Study

SAPS electric field structures are narrow channels of westward flows (poleward electric fields) encountered both in the subauroral ionosphere and the conjugate inner magnetosphere during a variety of geomagnetic conditions, including geomagnetic storms main and recovery phases, as well as during non-storm periods of variable convection and during substorms. These channels are localized primarily in the dusk-to-midnight local time sector equatorward of the auroral oval boundary. On some occasions, they are observed to persist for many hours. The spatial localization and the pronounced structured nature of SAPS channels make them an ideal focus for targeted investigations of our current understanding of the physics of the magnetosphere-ionosphere coupling processes involved in the generation and evolution of SAPS, and for testing the capabilities of numerical models to reproduce the observed phenomena.

We therefore invite theorists, modelers, and experimentalists to participate in a collaborative effort focused on the physics of SAPS, with the initial round of discussion taking place at the 2016 summer CEDAR-GEM workshop. For this first phase, we invite contributions that present simulation results of the subauroral ionospheric electric fields for several selected intervals. The intervals were selected based on available observations:

(1) March 16, 2013 04-10 UT (pre-storm SAPS);

(2) March 17, 2013 06-20 UT (main phase SAPS);

(3) March 20, 2013 04-10 UT (recovery phase SAPS);

(4) June 16, 2015, 06-10 UT (non-storm conditions);

(5) June 17, 2015, 06-11 UT (non-storm conditions).

Along with predicted subauroral electric fields in the afternoon to post-midnight MLT sector, contributions should include, if possible, relevant electrodynamic quantities such as ionospheric conductivities, inner magnetospheric particle and fields distributions, total electron content (TEC), field-aligned currents, magnetic field perturbations, or anything else that may help in unraveling the dynamics of plasma processes involved in the formation of SAPS.

At the workshop, we invite participants to engage in a robust discussion of the nature of SAPS, the role of plasma instabilities, the control of occurrence of SAPS by solar wind and IMF parameters, ionospheric preconditioning influence on SAPS appearance, and the role of the inner magnetospheric pressure-bearing plasma in determining SAPS lifetimes. In addition to numerical simulations, we welcome presentations that address observations of SAPS and related effects (both in the ionosphere and the magnetosphere) in the coupled M-I-T system relevant to the selected events.

Here is a brief description of the plot formats we use to directly compare between models and observations.

(2) Session 2

Session 2 will be organized along the lines of the 4 campaign events selected for joint studies and studied in 2015 and earlier CEDAR Storms/Substorms Without Borders workshops.

Event (1): March 17 -- 18, 2013

We have coordinated a special joint campaign with the GEM Focus Group: Storm-Time Inner Magnetosphere-Ionosphere Convection (SIMIC) led by Baker, Ruohoniemi and others, based on the wrap up discussions conducted in 2013. Supplemental studies on March 17--18, 2015 will be welcomed as a comparative study with the March 17, 2013 event. This year's workshop will concentrate more time on Event 1 because of the nature of the CEDAR-GEM special joint session opportunity.

Event (2): April 27 –- May 4, 2011

A CIR/HSS event.

Event (3): May 7 –- 14, 2012

Another CIR/HSS event, which has very similar solar wind driving to event (2), is included for comparison purposes.

Event (4): September 1 -– 5, 2012

This is an event of particular interest to SuperDARN.

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