2015 Workshop: Storms and Substorms Without Borders

Long title
Grand Challenge: Storms and Substorms Without Borders (SSWB)
Grand Challenge
Conveners
Naomi Maruyama
Tony Mannucci
Mike Ruohoniemi
Jo Baker
Phil Erickson
Simon Shepherd
Description

This Grand Challenge workshop is the first year of the 4 year workshop series, which was originally proposed in 2013 formerly named Geospace System Science during Storms and Substorms.

Main Science Questions

(1) Energy flow in the disturbed M-I-T system: what are the prime characteristics and relationships during storm-time processes promoting energy flow and exchange between the magnetosphere and the I-T system?,

(2) How do energetic particle precipitations (EPPs) affect the energy distribution, chemistry and transport of the upper/middle atmosphere?,

(3) What are the effects of EPPs on ionospheric structure, atmospheric heating, the formation of irregularities, and the generation of atmospheric gravity waves?,

(4) How do shielding processes in the inner magnetosphere and current feedback mechanisms between the magnetosphere and ionosphere impact ionospheric electrodynamics (e.g. subauroral electric fields – SAPS) and

mesoscale ionospheric plasma and temperature structure (e.g. storm enhanced densities – SEDs)?,

(5) What are the controlling influences on field aligned mass coupling and flows linking the plasmasphere and ionosphere?

We invite short, workshop style presentations with ample time allocated for discussion. We particularly welcome “big picture” (or system level) perspectives that motivate science questions and their relevance to the understanding of coupling processes within the magnetosphere-ionosphere-thermosphere.

Our GC science questions will be addressed by emphasizing participant discussions that bring new views of the M-I-T system made available by expanded observation capabilities from various ground-/space-based measurements. Furthermore, we will encourage participants to combine and synthesize resources from observations, modeling, theory, and data assimilation.

2015 Campaign Focused Workshop

This year, we will have a workshop mainly focused on the campaigns. We encourage participants to bring all the available observations and model simulations from both CEDAR and GEM communities for the selected events.

Justification

CEDAR Science Challenge

Our CEDAR Science Challenge is to develop an improved understanding of the geospace system response to storms and substorms. 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).

In 2013, the inaugural session of this workshop was very successful with many participants. At the end of the wrap-up discussion there was general agreement that our effort to address the science questions identified in our session proposal should be continued as a multi-year effort. We anticipate continuing the workshop for four years in order to encompass analysis of events through the current period of solar

cycle maximum and to synchronize with related Focus Group efforts at GEM. The 2013 Joint GEM-CEDAR workshop led us to recognition that in order to investigate the geospace system as a whole, we need to look at the geospace system from various perspectives. Synoptic interpretations are required across a broad range of expertise to understand the underlying mechanisms that control various levels of coupling. This requirement has become more important since our observational capabilities have expanded from various ground-/space based measurements and from various techniques.

Relevance to the Decadal Survey and Strategic Plan

1. Decadal Survey:

Our session goal is very well aligned with one of the science goals for the next decade identified in the 2012 Decadal Survey for Solar and Space Physics from the National Academy of Sciences: "*Determine the dynamics and coupling of Earth's magnetosphere, ionosphere, and atmosphere and their response to solar and terrestrial inputs*".

2. CEDAR Strategic Plan:

The advantage of the "systems perspective" in addressing the coupled M-I-T system is identified in the "CEDAR The New Dimension, Strategic Vision": "The intellectual framework of the system view enables transferable concepts across systems and disciplines to advance and facilitate progress in understanding our whole Sun-Earth system".

Approach

1. How the questions will be addressed:

We would like to achieve this goal by bringing together all the available observations from both ground and space, and from the ionosphere, thermosphere and magnetosphere (e.g., recent space missions including Van Allen Probes, THEMIS, etc.). Coordination with the GEM community is required to tackle the identified challenges from a systems perspective. We need to work on the same selected events to gain deeper physical understanding of system interactions between magnetosphere, ionosphere, and thermosphere across multiple temporal and spatial scales.

2. What resources exist, are planned, or are needed:

We have already coordinated joint campaigns with the GEM FG Storm-Time Inner Magnetosphere-Ionosphere Convection (SIMIC) led by Baker, Ruohoniemi and others. The detailed plan of the campaigns is described in the session description below. We also have initiated discussions for possible coordination with another GEM FG, “Geospace Systems Science” led by Joe Borovsky et al, which started in 2014. We have invited both FG leaders at our session last year to discuss our collaborations.

3. How progress should be measured:

We envision this workshop as part of a multi-year series with steady progress on specific questions within the main topics. Identification of these questions during discussion is an expected and ongoing outcome of workshop activities. We encourage proposals for how these specific science questions can be addressed using various modern and historical resources, and we expect our activities to motivate new cross-disciplinary collaborations and new observational capabilities. To facilitate these aims, we will allocate time within the workshop for discussion of metrics and quantification of progress on identified science topics.

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