

Sun-Earth Connections Virtual Conference Series

CAWSES, ILWS, IHY, eGY, ICESTAR, NSF, SEE

Our Goal is to Identify the “Grand Challenges” in Heliophysics

- We plan to hold the first of virtual conference series in 23-27 October 2006.
- This workshop is a testbed toward enabling the international community to address interdisciplinary “Grand Challenges”
 - We want to identify important science questions.
 - We want to identify the technology that must be present in our to carry out the workshop.
 - What works? How well does it work? What more do we need?

Needs Identified

The Big Problems

- **Characterizing the simultaneous couplings & feedbacks - requires large (international) data sets**
 - Need observations in a range of locations within the system
 - Micro- and macro- scales are both important in space & time
 - Need global specification of key parameters (snapshots not climatologies)
- **Identifying the physical mechanisms that underlie the system behaviors - accelerated by the use of high performance computers & cyberinfrastructure**
 - Global & assimilative models are the best (and possibly only) means of exploring the system behavior
 - Close coupling between data and models is necessary

New Tools

- **Cyberinfrastructure**
 - Virtual observatories
 - Data mining
 - Mapping between regions
 - Information commons
 - Electronic journals
 - Software
 - Empirical models
- **Virtual Conference/Workshop Facilities --> Distributed dynamic virtual collaborations - The Human Element/**
 - Utilize cyberinfrastructure to accelerate the pace of scientific discovery
 - Catalyze interdisciplinary research
 - Educate researchers about the key questions in other disciplines
 - Provide global context
 - Educate international students
 - Build science capacity in developing countries

Our goal is not to run another event study.

- Our goal is to define those problems and locate and analyze the data that enable us to address grand challenges in the study of the interaction of the Sun and Earth.
- In the following slide we provide an example of an event.



Selecting a Grand Challenge Problem in Heliophysics Provides Focus

Criteria

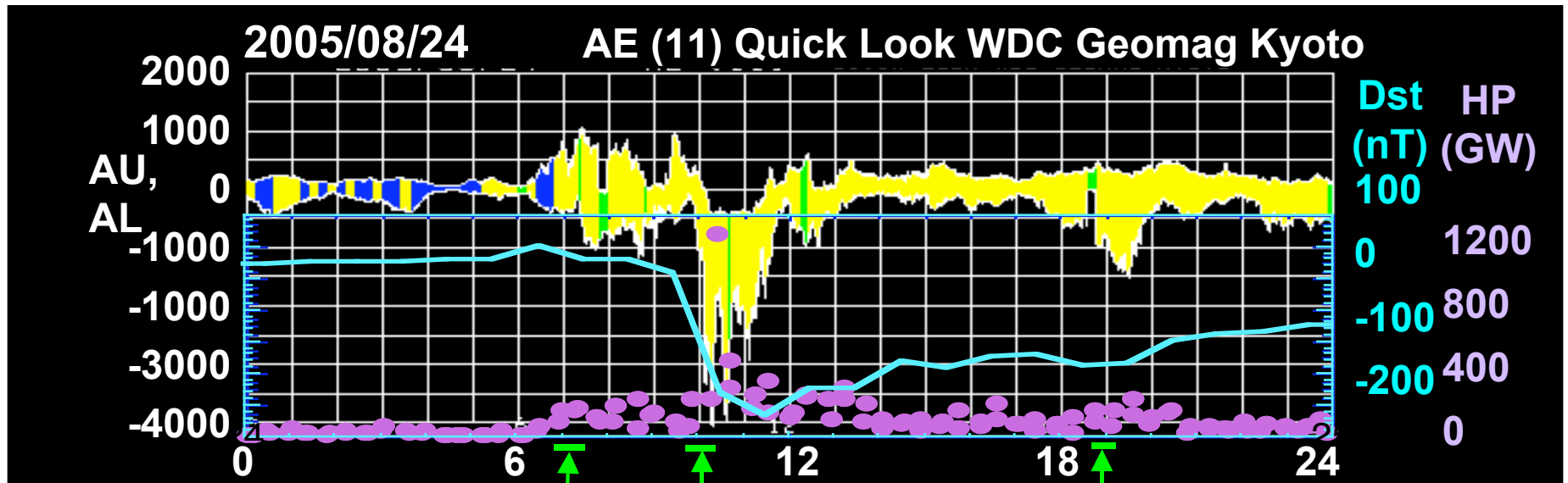
- Problem is interdisciplinary and on a large enough scale that community collaboration using large distributed data sets, and high performance computing are needed to make progress
 - No one team can address the issues.

Preliminary Selection

- Preliminary analysis of CAWSES campaign & comparison events in small interdisciplinary workshops (CEDAR 2005, Stanford CAWSES Space Weather Workshop 2005)
 - We want to build on these pathfinding meetings.

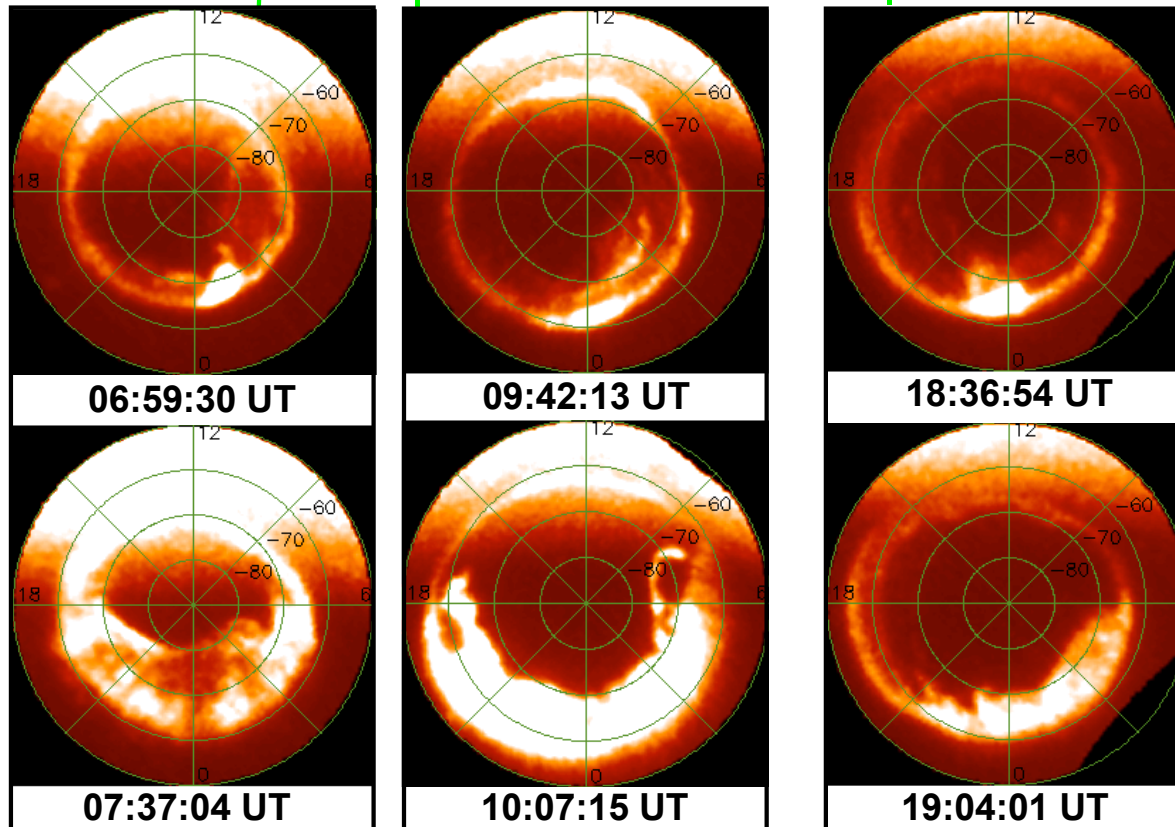
Final Selection of Questions:

- Carried out soon based on inputs from CAWSES, ICESTAR, ILWS, IHY, eGY organizers via the Internet
 - We solicit input from the community.

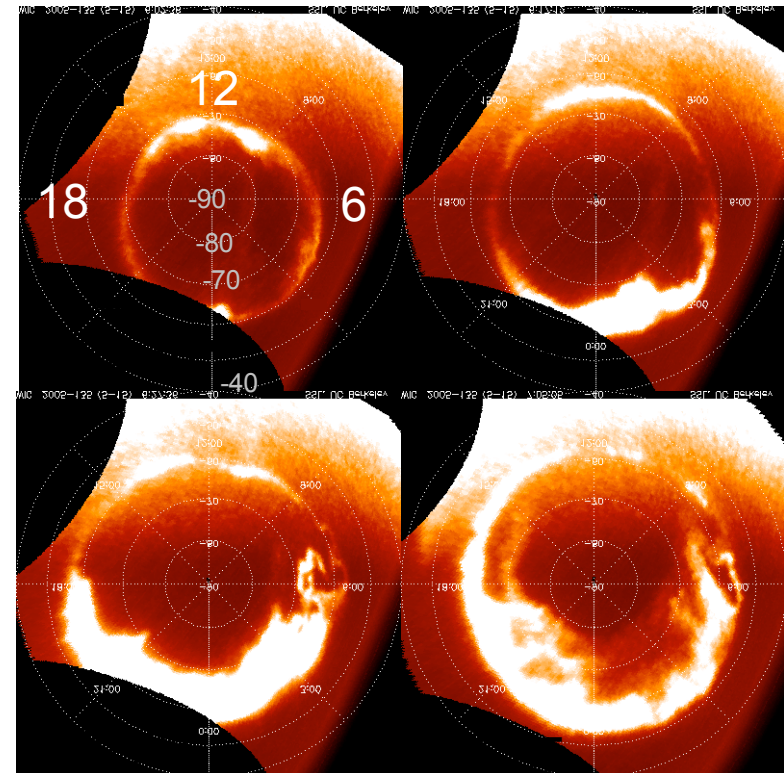
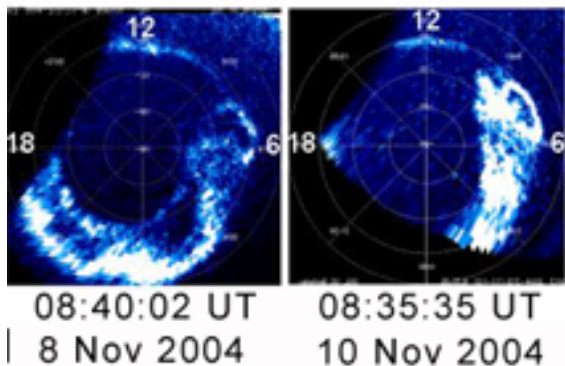
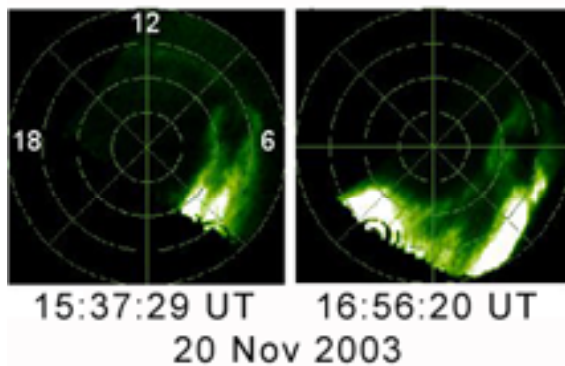
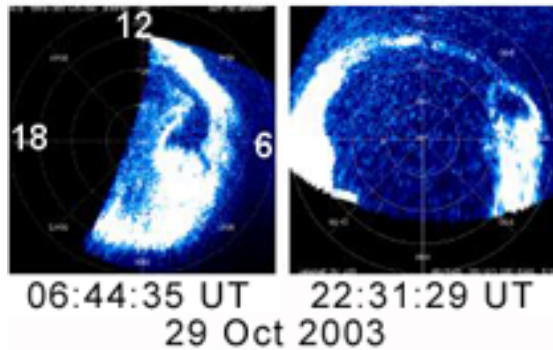


Unusual Auroral Oval

24 Aug 2005 Min
 $B_z \sim -55$ nT;
 Duration of $-B_z \sim$
 1.5 hrs; Min Dst \sim
 212 nT; $V_{sw} \sim 600$
 km/s; Max $P_{dyn} \sim$
 35 nPa



Systematic Signature of Super Substorms



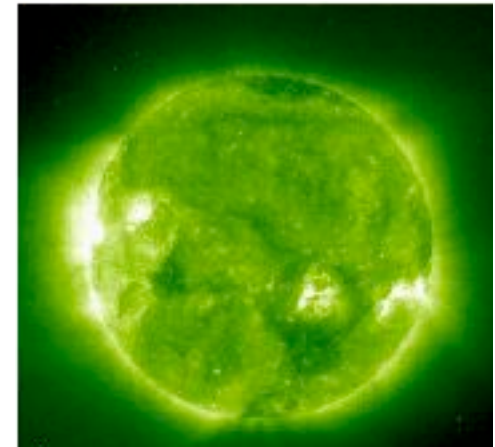
May 15, 2005

Min Bz ~ -40 nT Duration of -Bz ~ 3hrs
Min Dst ~ -250 nT Vsw ~ 900 km/s
Max Pdyn ~ 40 nPa

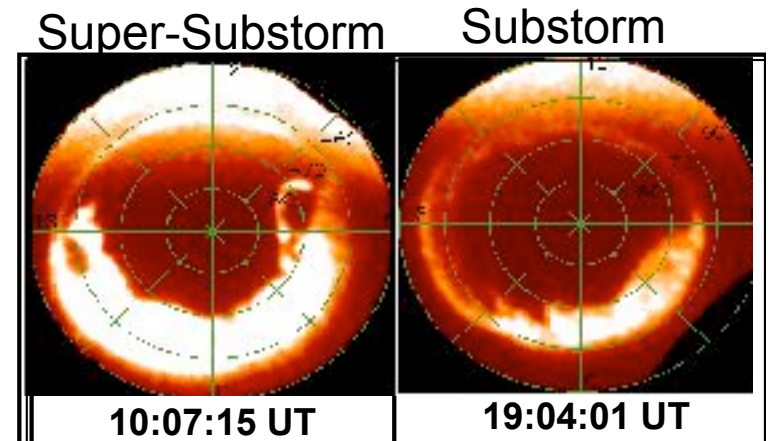
Unusual Signatures throughout the Sun-Earth System

PRELIMINARY ANALYSIS

- AR 798 anemone active region.
[Ayumi Asai, NSRO, 2005]
- Produced CME with high velocity;
high dynamic pressure in the sheath
- A major substorm was triggered just
as the IMF Bz reached it's minimum
values
- Unusual auroral oval configuration
with large vortex on the dawn side
and double oval structures (possibly
another vortex) on the duskside.
Thick nightside oval & very thin
dayside oval. [Kozyra et al., Spring
AGU, 2006]
- Evidence for new type of storm-
substorm coupling



20 Aug 2005, 00:50 UT
Anemone Active Region [Asai,
Stanford Workshop, Dec. 2005]



[Kozyra et al., Spring AGU, 2006]

Return to the Auroral Oval on a voyage of discovery that commemorates the 50th Anniversary of IGY- Be a Part of History

- **Power of IGY's Past and Present:** In 1957/58 during the International Geophysical Year (IGY) a global picture of substorm phases emerged
- **Related New Discovery:**
 - In 2005, an unusual auroral oval configuration, not previously reported.
 - Appears to occur systematically during large substorms in the main phase of superstorms ..
- **What are the processes at the Sun that produce these extreme disturbances?** In the May and August 2005 events, active regions on the sun were closely associated with coronal holes. How configuration produced? How effect CME release?
- **Does the transit across interplanetary space cause significant modifications to the disturbance?** Short-lived spike of extreme southward IMF
- **Has geospace crossed the threshold to a different state?**
 - Extreme southward B_z - Does short time frame changes how energy distributed throughout geospace?
 - Large vortex-like structure on the dawnside oval. If mapped to the equatorial plane has implications
 - For mass and energy transfer from the solar wind into the magnetosphere,
 - For new modes of coupling between storms and substorms,
 - For new types of stormtime energy dissipation within geospace,
 - Consequences throughout the coupled ionosphere/atmospheric system.

CAWSES Focus for IGY Celebration

- **Join a Historical Effort:** Contribute to the historical 50th anniversary by
 - Joining with other scientists worldwide to investigate the state of the Sun-Earth system during extreme events.
 - Test how the human element in science can join together and use cyberinfrastructure to attack grand challenge issues.
 - Explore new electronic capabilities: virtual conference, virtual observatories, assimilative models, global sun-to-Earth models, etc.
- The IGY presents an important opportunity to explore this state using international assets and scientific talent
- Join in a worldwide effort to define the state of the sun-Earth system crossing the threshold to super substorms

What is the state of the Sun-Earth System during Extreme Events?

SUN & HELIOSPHERE

- What effect does close proximity to an coronal hole have on the release & propagation of CMEs?
- Does an active region leave a “fingerprint” on the CMEs? Do they have common characteristics?
- How important was propagation in producing extreme spike of IMF Bz?

MAGNETOSPHERE

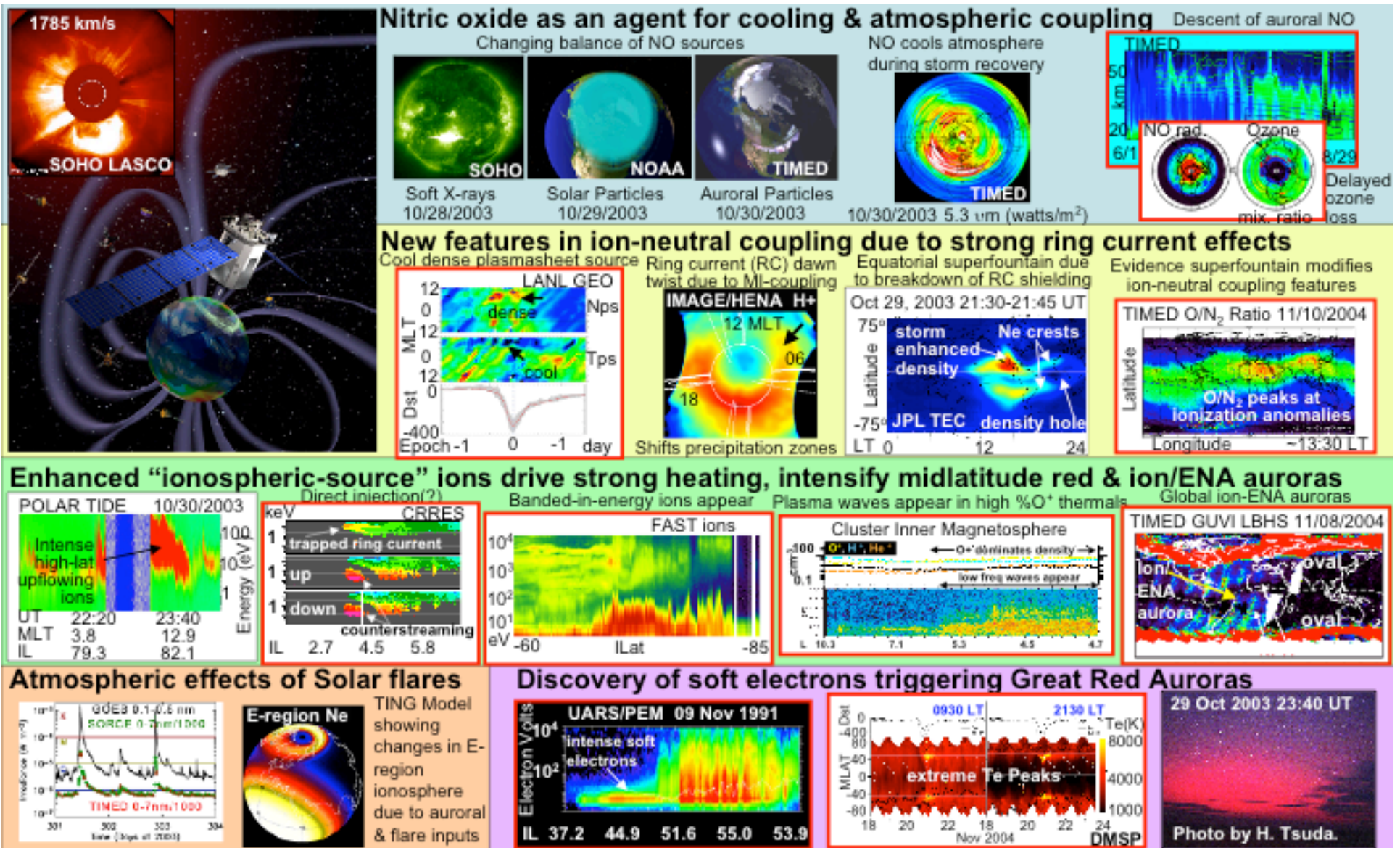
- How important is the duration of the IMF Bz in how energy is apportioned?
- Do vortices have implications for mass & energy transport from solar wind into magnetosphere
- Do super substorms reflect a new state of the magnetosphere

- Underlying physical processes?
- Explain some of the unusual features of superstorms?
- New form of storm substorm coupling? New energy dissipation?

IONOSPHERE - ATMOSPHERE

- How do these large current vortices effect the state of the ionosphere-atmosphere
- Strong sources of Joule heating?
- Produce upwelling or other feedbacks to the magnetosphere?
- Dawnside neutral wind vortices?

Crossing the Threshold to Superstorms



International and Interdisciplinary
Sun-Earth Connections Online Conference Series
**Grand Challenge Issues and Critical Underlying Processes in Sun-
Earth System Science**

**Session 1: 23-27 Oct 2006. The state of the Sun-Earth system during
extreme events. Data Exchange.**

**Return to the Auroral Oval for the 50th Anniversary of the
International Geophysical Year.**

[Other sessions in series](#)

Welcome to Session 1 of the SEC Virtual Conference, Return to the Auroral Oval. This event was designed to bring together researchers worldwide to investigate the state of the sun-Earth system during extreme space weather events in celebration of the 50th anniversary of the International Geophysical Year. The focus of this session is on understanding Sun-Earth interactions in the context of a complex natural system- from micro to macro level, in both space and time. Transformative science in this area lies at the edges and intersections of individual elements (the Sun, heliosphere, magnetosphere, ionosphere and atmosphere) whose collective behavior determines the global system response.. Continuing progress requires access to a vast developing cyber-infrastructure of large international data sets, high-performance computing and advanced visualization, and the development of new types of interdisciplinary and international research interactions (the human side).

Sponsored by: CAWSES, NASA/LWS, eGY, IHY, NSF, and ICESTAR

Goal: To catalyze interdisciplinary investigations among large groups of researchers worldwide in celebration of the 50th anniversary in 2007 of the International Geophysical Year during which worldwide resources will again be focused on accelerating the pace of discovery in Sun-Earth system science.

International and Interdisciplinary
Sun-Earth Connections Online Conference Series
**Grand Challenge Issues and Critical Underlying Processes in Sun-
Earth System Science**

Draft Series Schedule

- Oct 2006: Conf 1. The state of the Sun-Earth system during extreme events. Return to the Auroral Oval for the 50th Anniversary of the International Geophysical Year: Data Exchange.
- Feb 2007: Conf 2. The Quiet Sun and the Geospace Ground State: Data Exchange. (Collaboration with atmospheric coupling - Oct/Nov 2005: focus on wave influences on IT system - mesosphere-stratosphere meteorology on auroral NOx transport)
- Jun 2007: Conf 3. The state of the Sun-Earth system during extreme events. Return to the Auroral Oval for the 50th Anniversary of the International Geophysical Year: Theory and Modeling
- Oct 2007: Conf 4. The Quiet Sun and the Geospace Ground State: Theory & Modeling

Include standing session in all of these on analysis of CAWSES campaign results ?

Online Conferencing - Apply lessons learned by other groups

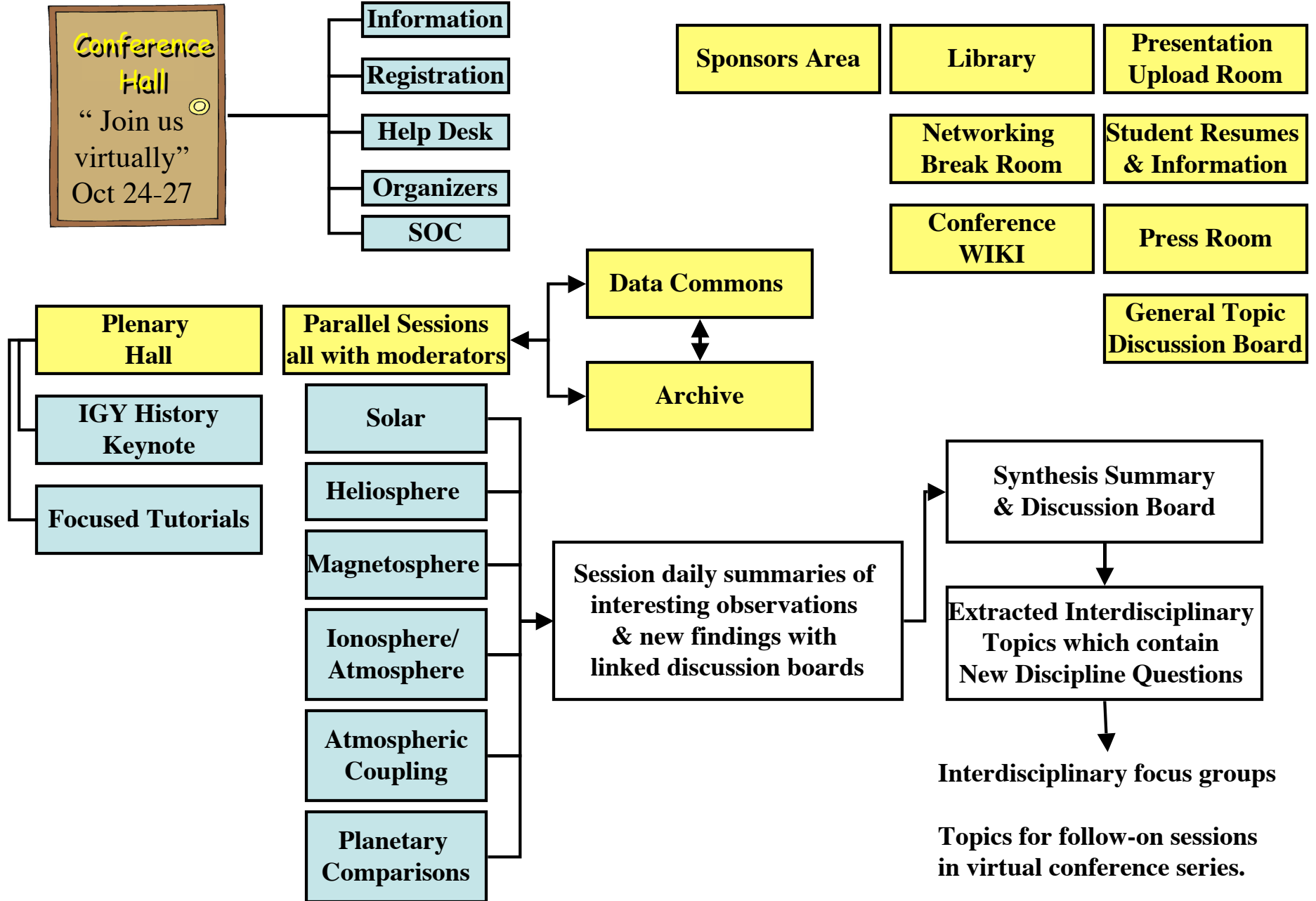
Pros

- **Cost effective** way to bring together geographically dispersed group
- **Maximize participation across nations and disciplines**
- Easy to source and circulate new material to participants digitally
- **Time for reflection:** Asynchronous systems give participants the time to review previous messages, check references, and take any amount of time to compose a message.
- **Freedom from time zones:** Because asynchronous systems allow 24-hr access, people can participate in local time.

Cons

- **Restriction of text-based communication:** Communication in such an environment, without visual or auditory cues that form 70% of F2F communication, does not come naturally to most people.
- **Challenges with group synergy:** More difficult to socialize or form a connection with other participants than in an F2F forum. Use of photos helps with this.
- **Lack of a captive audience:** The greatest benefit of online conferencing- flexibility of access - becomes a liability if you're trying to move to a more profound analysis of a topic.

Virtual Conference Organization





Plenary

Plenary Session

Keynote: Short history of auroral substorm observations beginning in the IGY 1957-58 and continuing up to new signatures 50 years later.

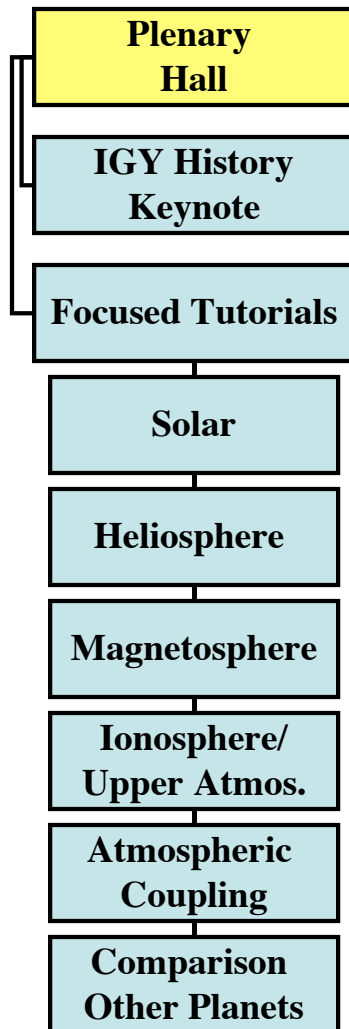
Focused Tutorials:

On processes and outstanding problems of the various system components from sun-to-Earth with emphasis on aspects relevant to the topics of this conference.

Purpose:

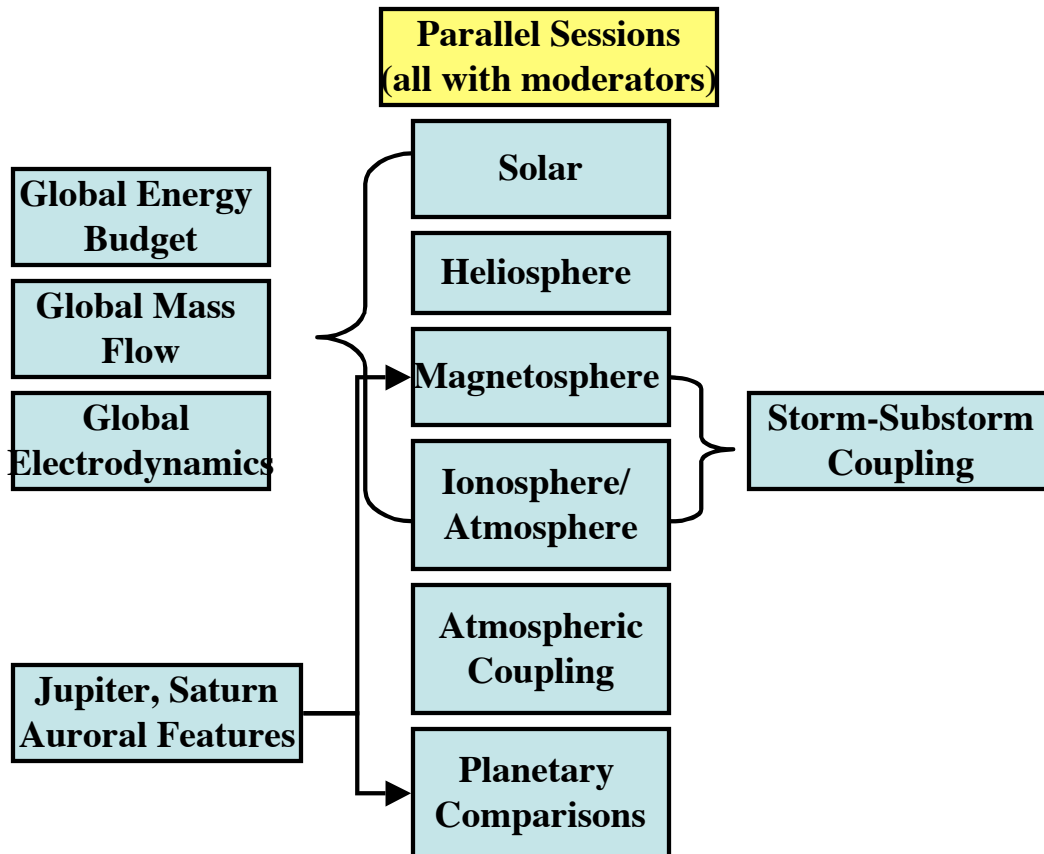
To educate scientists in other disciplines

Resource for students worldwide





Parallel Sessions



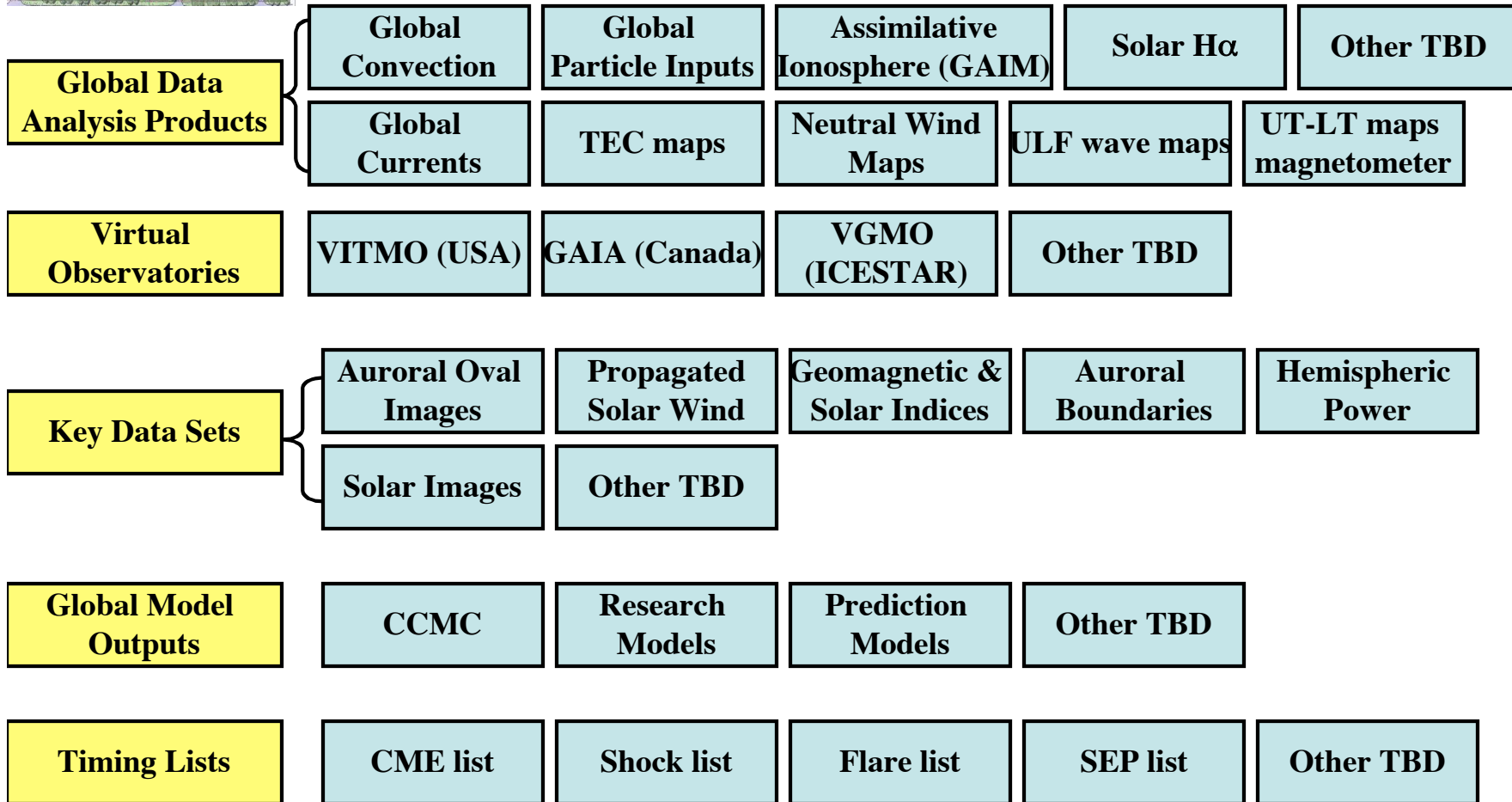
Flexible session structure

Create cross-disciplinary sections where needed to attack major issues

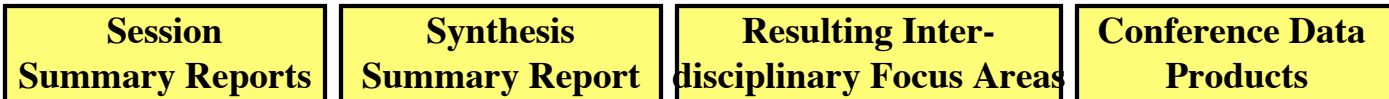
Moderators create session summaries updated daily



Data Commons



Archive



The CCMC Has Made a Commitment to Support the Information Commons



The screenshot shows the homepage of the Community Coordinated Modeling Center (CCMC). The header features the CCMC logo on the left, the title 'The Community Coordinated Modeling Center' in yellow, and a list of partner agencies: NASA, AFMC, AFOSR, AFRL, AFWA, NOAA, and NSF. A NASA logo is on the right. The main content area is titled 'Special Sun-Earth Connection Events' in large white text on a dark background. Below the title is a paragraph explaining that these events are typically large storms or series of storms that attract significant attention in the space science community. The page lists three categories of events: Big Storms, SHINE Campaigns events, and CAWSES Internet Campaign events, each with a list of specific storm dates and names.

CCMC NASA AFMC AFOSR AFRL AFWA NOAA NSF

[Home](#)
[View Run Results](#)
[Search Simulation Results Database](#)
[Special Sun-Earth Connection Events](#)
[3D VRML Output for Selected Events](#)
[Sitemap](#)

Special Sun-Earth Connection Events

A Special Sun-Earth Connection Event is usually a big storm or a series of storms that attracts the attention of the space science community. Working groups such as Geospace Environment Modeling (GEM) sometimes identify Special Sun-Earth Connection Events. The CCMC provides model run results for these events.

▣ Big Storms

- [April 14-24, 2002 Storm](#)
- [March 31 - April 1, 2001 Storm](#)
- [July 14-16, 2000 Storm](#)

▣ SHINE Campaigns events

- [May 12, 1997](#)
- [May 1, 1998](#)
- [April 21, 2002](#)
- [August 24, 2002](#)

▣ CAWSES Internet Campaign events

Creator: [Mr. Anna Chulaki](#)
NASA Official: [Dr. Michael Hecht](#)
[Privacy, Security, Notices](#)

Joint IHY-CAWSES Observation Database - Netscape

Back Forward Reload Stop Search Print

Mail AIM Home Netscape Search Bookmarks

Joint IHY-CAWSES Observatio...

Joint IHY-CAWSES Observation Database

Registrant Information

Name: Email:

Observation Information

Date: Short Description:

Contact Name: Contact Email:

URL:

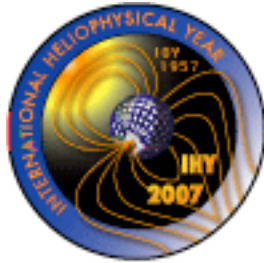
Longer Description

Something like: My data is really cool it has groovy numbers about many groovy things.

Observatory: Instrument:

Submit Query Reset

Sponsors/Partners



Possible Additional
Sponsors

SEE (??)
(Michail Panasyuk,
Igor Veselovsky)

ILWS (??)
(William Liu)

Planned Scientific Organizing Committee

- CAWSES Space Weather Panel and Subpanels, Gang Lu (CAWSES Atmospheric Coupling)
- IHY: Joe Davila, Alex Young
- eGY: Michele Weiss, William Peterson, Peter Fox
- NASA/LWS: Larry Zanetti, Nicola Fox, Danny Morrison, Robin Barnes
- ICES: Kristi Kauristie, Alan Weatherwax, Aaron Ridley
- Others?



Library

- Journal articles about, and relevant to, the selected events & focus areas:
 - AGU journals, JASTP, Annales Geophysicae, etc.
 - ✦ Began discussions with Judy Holoviak at AGU about a limited conference subscription
 - ✦ Other journal discussions to follow
- List of relevant books with links to publishers
- Preprints from participants



Student Resumes & Information

Post of Student Resumes

Student Job Opportunities

Summer Schools

University Space Science Programs

Fellowship Opportunities

Others



Break Room

Example Participants Information



Janet Kozyra

University of Michigan, AOSS Department, 1414A Space Research Bldg,
2455 Hayward, Ann Arbor, Michigan, USA 48109-2143

Email: jukozyra@engin.umich.edu, Phone: (734) 647-3550

Fax: (734) 647-3083, URL: <http://aoss.engin.umich.edu>

Research Interest: Geospace Coupling, Sun-Earth system science

- Interdisciplinary scientist, TIMED (Thermosphere, Ionosphere, Mesosphere Energetics and Dynamics) Mission.
- Co-Chair, CAWSES Space Weather Panel
- Moderator, Interdisciplinary Synthesis Sessions



Thomas Zurbuchen

University of Michigan, AOSS Department, 2429A Space Research Bldg,
2455 Hayward, Ann Arbor, Michigan, USA 48109-2143

Email: thomasz@umich.edu, Phone: (734) 647-6835

Fax: (734) 615-9723 , URL: <http://aoss.engin.umich.edu>

Research Interest: Theoretical models for all major phenomena in solar atmosphere and its expansion into the heliosphere, instrumentation for composition of space plasmas

- Instrument Scientist, Mercury Messenger

Tentative Schedule

Virtual Sessions

Virtual SEC Conference 1,
"Return to the Auroral
Oval for IHY", Oct 23-27

Virtual SEC
Conference 2, ~Feb 07

Virtual SEC
Conference 3, ~May 07

Virtual SEC
Conference 4, ~ Aug 07

Sep 06

Oct 06

Nov 06

Dec 06

Jan 07

Feb 07

Mar 07

Apr 07

May 07

Jun 07

Jul 07

Aug 07

Sep 07

Oct 07

Nov 07

Dec 07

Face-to-Face Sessions

SW-Magnetosphere
Mexico, Nov 4-8, 06

Sun-to-Earth session
at Fall AGU, Dec 11-15.

EGU Mtg, Austria
Apr 15-17

Spring AGU,
Mexico, May 21-25

Sun-Earth Session
at IUGG, Italy, Jul 2-13

Int'l CAWSES Sym-
posium, Japan, Oct 23-27

Fall AGU, USA
Dec 10-14

European Space Weather
Week, Belgium Nov 13-17

CEDAR, NM
Jun 24-29

SHINE workshop
~July-August

GEM, Snowmass
~Jun

Next Steps

- CAWSES, ICESTAR, ILWS, eGY2007, IHY2007 committees develop plan for science topics, presenters and themes for the Virtual Conference. Community input.
- Collaborators and Presenters fill the Information Commons between now and the eWorkshop
- Key data sets are selected for the Virtual Observatories
- Key data analysis products, tuned to the chosen questions, are produced & made available in the Information Commons (i.e., assimilative maps of potential, field-aligned currents, and electric fields)
- Tentative dates for the campaign is 23-27 October 2006.