CEDAR-GEM JOINT WORKSHOP 2005 VIDEOS AND PLENARY ABSTRACTS INCLUDING SUNDAY STUDENT WORKSHOP SESSIONS

CEDAR has a tradition since 1987 of video taping our tutorial talks and the CEDAR Prize Lecture. Our tutorial talks are usually one hour, and we ask the speakers to speak at the student level. The CEDAR Prize Lecture was instituted in 1989 and honors an outstanding science contribution to CEDAR during the previous 3 years. We also have hard copies of these tutorials and lectures, and starting in 2000, have on-line versions at:http://cedarweb.hao.ucar.edu/workshop/videolist.html. The videos tapes can be ordered for any previous years, and have existed in DVD form since 2004.

In 2005, we will video 10-12 hours of the major CEDAR and joint CEDAR-GEM talks. The ppt talks will be converted to pdf and accessible from the URL above. Some are required before the workshop, so students and others can download them before the workshop. Here is a list of the 2005 video-taped talks, where the times are total, and include discussion time which is not included in the final videos.

Sunday (~4 hr):

(60 min) Robert L. McPherron, Magnetosphere Ionosphere Coupling: A Magnetospheric Perspective
(60 min) Rod Heelis, Magnetosphere Ionosphere Coupling: An Ionospheric Perspective
(30 min) John Foster, The Role of Ground-Based Instrumentation In M-I Coupling Research
(30 min) Cheryl Huang, Magnetosphere-Ionosphere-Thermosphere Coupling: Energy dissipation processes during superstorms
(30 min) Stan Sazykin, Magnetospherically-generated ionospheric electric fields
(30 min) Dirk Lummerzheim, Magnetosphere-Ionosphere Coupling in Aurora

Monday (~2 hr):

(30 min) Tim Killeen, History of CEDAR
(30 min) Chris Russell, Geospace Environment Modeling: A New Way of Doing Business
(45 min) Jim Hecht, CEDAR Prize Lecture, The Turbulent Oxygen Mixing Experiment (TOMEX) and Instabilities in the Mesopause Region

Tuesday (~1.5 hr):

(45 min) Bob Spiro, Sub-Auroral Electric Fields - An Inner Magnetosphere Perspective
(45 min) Janet Kozyra, GEM Student Tutorial, Mass and energy flows into the ionosphere from the plasmasphere-ring current interface: New views from superstorms.

Wednesday (~2.5 hr):

(50 min) Gang Lu,
Auroral boundaries: Finding them in data and models
(25 min) Mike Kelley, The Advanced Modular Incoherent Scatter Radar (AMISR): project review and initial results
(30 min) John Foster, DASI: Distributed Ground-Based Instruments for Space Science Research
(30 min) Vladimir Papitashvili, e-Science for Geoscience: Virtual Observatories in the Framework of 'Electronic Geophysical Year'
(30 min) Michael Wiltberger, Modelling the interactions between the magnetosphere, ionosphere and thermosphere
(30 min) Tomoko Matsuo, Understanding data assimilation: how observations and a model are weaved into the analysis via statistics

Thursday (~1 hr):

(60 min) Edward (Ted) LlewellynAtmospheric Tomography: The Odin/OSIRIS Experience

Sunday 26 June 2005, 10:10 a.m. – 11:10 a.m., LaFonda Ballroom

Magnetosphere Ionosphere Coupling: A Magnetospheric Perspective

Robert L McPherron (rmcpherron@igpp.ucla.edu)

Magnetospheric phenomena are driven by the solar wind. Convection electric fields developed in space as a consequence of tangential drag are mapped onto the ionosphere by the Earth's magnetic field and drive many ionospheric phenomena. Electric fields created in the ionosphere are mapped outward into the magnetosphere altering the field that would be present from the solar wind alone. In this tutorial we review the basic processes that create magnetospheric electric fields and show how these processes generate field-aligned currents that couple the magnetosphere to the ionosphere. For a given magnetospheric electric field the strength of the ionospheric currents depends on ionospheric conductivity. Conductivity is determined by solar illumination and particle precipitation. The pattern of particle precipitation depends on the configuration of the magnetic field which is a result of both normal and tangential stress applied to the magnetosphere by the solar wind. A step function increase in tangential stress normally produces a magnetospheric substorm. The substorm consists of an ordered sequence of processes that result in a sudden change in configuration of the tail and the generation of a new current system called the substorm current wedge. The substorm alters particle precipitation and hence ionospheric conductivity and also drives a current through the midnight ionosphere. The substorm is an internal magnetospheric process but it also drives a convection pattern nearly identical to that driven by the solar wind. The magnetosphere is almost never in equilibrium with the solar wind. Any change in solar wind conditions cause changes in the magnetosphere and later changes in the ionosphere. The time delays in the response of the magnetosphere and the ionosphere to these changes produce a variety of complex alternations in the basic processes.

Sunday 26 June 2005, 11:30 a.m. – 12:30 p.m, LaFonda Ballroom

Magnetosphere Ionosphere Coupling: An Ionospheric Perspective

Rod Heelis (heelis@utdallas.edu)

The Ionosphere responds to coupling currents from the magnetosphere at both large and small scales. We will briefly discuss the current systems that connect the ionosphere and magnetosphere and how their evolution on large and small time scales affects the ionosphere. Of particular importance are the way in which momentum transfer to the neutral atmosphere and conductivity gradients produced by precipitating electrons affect the electric field distribution that is common to both the ionosphere and the magnetosphere.

Sunday 26 June 2005, 2:30 p.m. – 3:00 p.m., LaFonda Ballroom

Magnetosphere-Ionosphere-Thermosphere Coupling: Energy dissipation processes during superstorms

Cheryl Huang (cheryl.huang@hanscom.af.mil)

During superstorms (Dst < -250 nT) intense field-aligned currents are observed repeatedly in the ionosphere by DMSP spacecraft. These FACs carry large amounts of Poynting flux into the ionosphere from the ring current, and represent a dissipation mechanism for the storm. The current carriers are low-energy electrons (E < 500 eV) which deposit their energy in the F layer. No Hall current is generated and thus there is no ground signature of these intense ionospheric currents. This has serious consequences for modelling of energy dissipation during storms.

Sunday 26 June 2005, 3:15 p.m. – 3:45 p.m., LaFonda Ballroom

Magnetospherically-generated ionospheric electric fields

Stanislav Sazykin (sazykin@rice.edu)

Convection electric field in the magnetosphere is transmitted to and modified by the ionosphere. The structure and physics of the global ionospheric electric fields generated by the magnetosphere-ionosphere coupling will be reviewed, with emphasis on how magnetospherically-generated electric fields cause re-distributions of ionospheric electron density at low- and mid-latitudes during geomagnetic storms, and how strong poleward-directed electric field structures known as Sub-Auroral Polarization Stream (SAPS) are created on the equatorward edge of the diffuse aurora.

Sunday 26 June 2005, 3:45 p.m. – 4:15 p.m. –LaFonda Ballroom

Magnetosphere-Ionosphere Coupling in Aurora

Dirk Lummerzheim (lumm@gi.alaska.edu)

The Aurora is a very obvious example of M-I coupling. It is a manifestation of energetic particles from the magnetosphere that move into the ionosphere to deposit their energy. Less obvious are the magnetospheric consequences of this process. The ionosphere is modified in the aurora, leading to increased ionization, heating, conductivity, and to up-flowing heavy ions. These ions move into the magnetosphere and provide a source of plasma. In this talk I will discuss these processes and draw some comparisons between Earth's aurora and aurora on other planets.

Monday 27 June 2005, 9:00a.m. – 9:30 a.m. – Eldorado Anasazi

Geospace Environment Modeling: A New Way of Doing Business

Chris Russell (ctrussell@igpp.ucla.edu)

Both the GEM and CEDAR programs were responses to establishment of the Global Change Program in the early 1980's. CEDAR was established first as it was more overtly connected to global change. In 1986 Juan Roederer proposed that aspects of solar-terrestrial research relevant to the total Earth system be incorporated as integral comxponents of the Global Geosciences Program of NSF. Thereafter a series of workshops were convened to define the GEM program. The first in August 1987 at UW in Seattle defined a community-wide program to systematically and comprehensively study the global dynamics of the magnetosphere that is responsible for the general circulation of the magnetosphere. The 1988 defining document described a series of three-year campaigns with up to three running in parallel to solve specific problems in magnetospheric physics. In turn the campaigns formed working groups to concentrate on aspects of the problem at hand. These working groups could be centered on observations, theory or numerical modeling. The output of the campaign was increased knowledge of how the magnetosphere worked so that it could be better modeled. The novel aspect of this approach is that campaigns have finite lifetimes. There is a window of opportunity to address each problem. Then a new problem is addressed. GEM may have followed CEDAR in time but was striking out in a new direction in its operating mode. GEM has struggled with this concept, as it is difficult to stop an ongoing effort when there is more to do. However, in fairness to problems waiting their turn, GEM has bitten the bullet and moved on. This renewal brings in new people, new approaches and new solutions and has proven itself repeatedly. GEM is now well into its fifth campaign.

Wednesday 29 June 2005, 10:30 a.m. – 11:00 a.m. – LaFonda Ballroom

e-Science for Geoscience: Virtual Observatories in the Framework of 'Electronic Geophysical Year'

Vladimir Papitashvili (papita@umich.edu)

The International Geophysical Year (IGY, 1957-1958) was inspired by the realization that better and more complete information was needed about the Earth and surrounding geospace on which human society becomes more and more dependent. The Electronic Geophysical Year (eGY, 2007-2008; http//:www.egy.org) is an initiative of the International Union of Geodesy and Geophysics to provide (in 21st century terms) a forward boost to the 'e-Science for Geoscience' as did the IGY initiative for the global geophysics fifty years ago. The eGY activities range from digitization of old analogue records to establishment of a system of Virtual Observatories 'deployed' in cyberspace embracing all available and upcoming geophysical data (e.g., atmospheric, geomagnetic, geophysics, glaciology, ocean and climate, etc). This concept implies free access to all available geosciences data through the World Wide Web, establishing a worldwide 'Data Fabric'. At the same time, the existing World Data Centers would become a part of that distributed worldwide data source, dipping into the Data Fabric and extracting newly available data for the permanent archives. The data providers (or Data Centers) may digitally 'sign' produced (or archived) data sets, so the data users would know the quality of data spread through the World. Thus, by exploiting the power of modern communications and information management capabilities, eGY aims to establish open access by the world community to vastly better and more comprehensive information about the Earth and geospace. The eGY theme areas are: (a) electronic data access, (b) data discovery, (c) data release, and (d) data preservation, linked to programs of capacity building and outreach. Promoting the development of Virtual Observatories is a central feature of eGY - similar themes can be identified in the 'data and information' objectives of the International Polar Year (IPY, 2007-2008), International Heliophysical Year (IHY, 2007), International Year of Planet Earth (IYPE, 2007), Climate and Weather in Sun-Earth System (CAWSES, 20 05-2009), as well as in other relevant international activities. Therefore, the eGY concept provides a common thread to these international activities through the e-Geoscience data and information management.

Wednesday 29 June 2005, 11:30 a.m. – 12:00 p.m.– LaFonda Ballroom

Understanding data assimilation: How observations and a model are weaved into the analysis via statistics.

Tomoko Matsuo (tmatsuo@ucar.edu)

Data assimilation combines information from observations with the prior knowledge of the state specified often by a physical model (or empirical model) to provide improved estimation of the entire state of the system of interest. The promises of the improved state estimation as well as the increased understanding of the observing system design and the model make data assimilation an appealing next-generation scientific tool for the CEDAR/GEM community, as the community has just started benefiting from (real-time) global observing systems and increased computing resources.

In order for the data assimilation analysis to optimally extract information from the observational data, a method needs to be carefully designed with understanding of principles of statistical inference as well as physics and observations. I am going to introduce some statistical formulation that underpins many of commonly used data assimilation methods, and explain how the second moment statistics (covariance) or the information of the geophysical variability is incorporated into the analysis.

Advanced data assimilation methods are designed to incorporate the dynamical information provided by a physical model directly into the analysis. While the Kalman filter/smoother has been known to be one of ideal methods of advanced data assimilation, the computational cost of the problem makes its straight-forward application infeasible in a high-dimensional system. Ensemble methods serve as a computationally feasible alternative approach, which can take advantage of the flow-dependent (time-dependent) description of covariance. A brief introduction to the ensemble methods is given, followed by some of challenges and issues in data assimilation applications.

Thursday 30 June 2005, 9:00 a.m. – 9:20 a.m. Eldorado Anasazi

Investigation of Ionospheric Coupling to Atlantic Hurricanes and Tropical Depressions

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This talk provides a summary of a two-year study under a CEDAR post-doc fellowship that investigated the coupling between large tropical storms and ionospheric disturbances. It is generally believed that gravity waves generated from tropospheric weather systems can propagate into the upper atmosphere producing observable effects. However, connecting the exact source of gravity wave generation to the upper atmosphere effects is often difficult. Intense, localized storms, such as hurricanes and tropical storms, should provide an ideal opportunity to examine the thermospheric/ionospheric connections. Since 1968, 220 hurricanes/tropical storms have passed within 500 km of an operational ionosonde or incoherent scatter radar. Five of these storms, starting in 1999, have been studied in detail over the past two years. In order to ascertain the source of any ionospheric variations observed coincident to a tropical storm, a number of instruments have been utilized: ionosondes, incoherent scatter radars, GPS receivers, and microbarographs. Specific observations include two nights of observations at the Arecibo Observatory coincident to passage of Tropical Storm Odette to within 700 km of the radar. The measurements showed a significant disturbance in the F-region plasma drifts at the same time that microbarograph data indicated the presence of intense gravity generation. Observations during the other storms studied provide mounting evidence that hurricanes and tropical storms can produce large localized effects into the E- and F-regions of the ionosphere.