CEDAR 2006 Plenary/Workshop Schedule & Abstracts

Student Workshop – Introduction to Incoherent Scatter Theory, Techniques

Zia, Monday, June 19, 2006, 8:45 am – 4:00 pm

Conveners:
Mike Nicolls (mjn25@cornell.edu)
Carlos Martinis (martinis@bu.edu)

08:45 – 09:00	Student welcome	Jan Sojka (CSSC chair) and Rich Behnke (NSF)
09:00-09:10	Agenda information; organizational details; activity information	Mike Nicolls and Carlos Martinis (CSSC student reps)
09:10-09:40	Incoherent scatter radar related science: Past, present, and future	Bob Robinson (NSF)
09:40-10:40	Keynote: Radar remote sensing of the ionosphere	John Sahr (U WA)
10:40-11:00	--- Break ---	
11:00-12:10	An interactive introduction to incoherent scatter	Josh Semeter (BU) and Phil Erickson (MIT)
12:10-12:40	Lunch provided for everyone	
12:40-13:00	Student Introduction to AMISR	John Kelly (SRI)
13:00-13:30	IS coordinated science at high latitudes	Jeff Thayer (U CO)
13:30-14:00	ISR coordinated science at equatorial latitudes	Jorge Chau (Jicamarca)
14:00-14:20	--- Break ---	
14:20-14:50	IS coordinated science at low latitudes	Nestor Aponte (Arecibo)
14:50-15:20	IS coordinated science at mid latitudes	Anthea Coster (MIT)
15:20-16:00	Student involvement with ISR science, intro to student posters, and IS-related activities at CEDAR	Elizabeth Gerken-Kendall (SRI)
16:00	Adjourn	

Frontiers in CEDAR Science: A workshop to develop campaigns that advance the frontiers in CEDAR Science

Anasazi, Tuesday, June 20, 2006, 10:00 am – 11:30 am (continued with lunch Friday, 11:45-12:45, Anasazi South)

Conveners:
Richard Collins (University of Alaska, rlc@gi.alaska.edu)
Eric Donovan (Universiy of Calgary, eric@phys.ucalgary.ca)

At the annual CEDAR Science Steering Committee (CSSC) meeting the members of the committee discussed the fact that much of the progress in CEDAR science has been associated with organized campaign studies. Recent community reviews and assessments have shown that campaign studies are associated with increases in the number of published studies and enhanced collaboration between investigators. The conveners invite members of the CEDAR community to develop concepts for campaign studies or initiatives. These initiatives should comprehensively address (employing observational, modeling, and theoretical techniques) outstanding scientific questions. The goal of the workshop would be to provide a forum for presentation of these campaigns in the 2006 CEDAR meeting and stimulate community discussion. We hope that such new collaborative campaigns will spur the next generation of discoveries in middle and upper atmosphere science. At this stage we envisage several presentations that would each focus on a possible CEDAR science initiative. We encourage presentations that present an integrated comprehensive approach that allows attendees assess collaborate opportunities, synergisms, and outcomes. Presenters are encouraged to develop these concepts ahead of the CEDAR meeting (not resort to a 5-minute AGU style bright idea presentation) and work with workshop convenors. The workshop would be scheduled to allow time for audience comment, discussion and response.

Equatorial Ionosphere and Scintillation Workshop

Anasazi South, Tuesday, June 20, 2006, 13:00 pm – 15:00 pm

Conveners:
Odile de La Beaujardiere (AFRL, odile.delabeaujardiere@hanscom.af.mil)
David Anderson (NOAA)
Chin Lin (Boston College)
David Hysell (Cornell University)
Michael Kelley (Cornell University)
Jorge Chau (Jicamarca Radio Observatory)

Equatorial ionosphere and scintillation are two active research areas that are closely related to the primary objectives of the Communication and Navigation Outage Forecast System (C/NOFS) mission. The workshop will address: (1) observational techniques and data analysis from ground-based instruments including networks of GPS receiver, digital sounders, magnetometers, optical imagers and scintillation monitors. (2) New results provided by satellites (TIMED, DMSP, CHAMP, GRACE, SAC-C, IOX, ROCSAT-1, Demeter and others). (3) Numerical modeling and simulations. (4) Theory and observations of prompt penetration electric fields. (5) Campaigns such as C/NOFS validation campaigns, Intensive Observation Campaign of Formosat-3/COSMIC, scintillation "pre-cursor" observations for 2-4 hour forecasts.

Ground-Based Coordination with the AIM Satellite Mission

Anasazi North, Tuesday, June 20, 2006, 13:00 pm – 15:00 pm

Conveners:
Michael J. Taylor (Utah State University, mtaylor@cc.usu.edu)
James M. Russell III (Hampton University)
Scott Bailey (University of Alaska)

The Aeronomy of Ice in the Mesosphere (AIM) mission is a new NASA Small Explorer satellite (PI: J. M. Russell) designed to investigate why polar mesospheric clouds (PMC) form and why they vary. Polar mesospheric clouds consist of microscopic ice crystals that can form and grow in the extremely cold high-latitude summer mesopause region. Models of PMC formation suggest that super-saturated conditions must be present before cloud nucleation occurs. However even this basic hypothesis remains untested because we have no comprehensive knowledge of the chemical/ thermal environment in which PMC form. AIM will obtain the first simultaneous measurements of mesospheric temperature, H2O, PMC content (and other trace gasses and aerosols) at high-latitudes essential for quantifying PMC formation. This mission is especially timely in view of the upcoming International Polar Year (2007-08) and the much heightened scientific and public interest in these clouds due to their role as possible harbingers of climate change, observations of increasing brightness and frequency of occurrence, recent observations at mid-latitudes, and their possible association with rocket exhausts. AIM will carry three instruments: SOFIE (Solar Occultation For Ice Experiment), an IR solar occultation differential absorption radiometer, CIPS (Cloud Imaging and Particle Size experiment), a panoramic UV imager, and the CDE (Cosmic Dust Experiment) that will be used for in-situ dust detection.
This workshop will introduce the AIM mission and the primary science goals followed by an open forum discussion on research opportunities for coordinated measurements. The Aim mission is scheduled for launch in the fall 2006 and will make measurements in both the northern and southern hemisphere summer seasons over the next two years. Coordinated ground-based measurements will provide excellent opportunities for synergistic cooperative science, allowing new objectives to be addressed as well as data validation studies. Our goal for this workshop is to bring together the ground-based CEDAR community and the AIM science team to develop collaborative plans for joint observations during the AIM mission.

Please come to our workshop to learn more about participation in the AIM mission. If you would like to contribute a short presentation outlining your interests in this program please prepare it Power Point (or overhead viewgraphs) and contact Mike Taylor at mtaylor@cc.usu.edu to arrange presentation.

Available Abstract:

The Cloud Imaging and Particle Size (CIPS) Instrument for the AIM Mission by David Rusch; other authors, James Russell, Scott Bailey, William McClintick

We will describe the CIPS instrument on the AIM mission. CIPS is a four camera imager with a large field of view. It is designed to measure scattering of sunlight by polar mesospheric clouds. The large field of view allows easy coordination with ground based measurements.

Sensitivity Study in Global Thermosphere/Ionosphere Simulations and Comparison with Observations

Sunset, Tuesday, June 20, 2006, 13:00 pm – 15:00 pm

Conveners:
Yongliang Zhang (APL/JHU, yongliang.zhang@jhuapl.edu)
Wenbin Wang (NCAR, wbwang@ucar.edu)

Global simulations have made significant contribution to the understanding of thermosphere/ionosphere response to the forcing in the solar wind and magnetosphere, and the feedback effect of the thermosphere-ionosphere system on the magnetosphere. There are always agreement/disagreement between simulations and observations. Some of parameters in simulations are usually adjusted to improve the disagreement. However, there is lack of systematic sensitivity study of the inputs on the simulation results. With tremendous global thermosphere/ionosphere observations in recent years, it is the time for the simulation community to work together to address the issue including but not limited to following specific questions: (1) What are the most important and least known input parameters needed in the global simulations? (2) How do the observations currently available help to constrain the simulations? (3) What kinds of observations are needed in the future to better the models? (4) Is it helpful to couple global magnetosphere MHD models with global thermosphere/ionosphere models? What have we learned so far?

Available Abstract:

Comparison between GUVI observations and TIMEGCM runs by Yongliang Zhang; other authors, Wenbin Wang, Larry J. Paxton

TIMEGCM runs were carried out for two magnetic storms, April 2-4, 2004 and May 15, 2005. We will compare the simulation results, such as changes in the themospehric O/N2 and aurora hemispheric power, etc, with the observed data from GUVI.

Continuing on Towards an Integrated Data Environment with the Virtual Observatories

Zia, Tuesday, June 20, 2006, 13:00 pm – 15:00 pm

Conveners:
Michele Weiss (APL/JHU, michele.weiss@jhuapl.edu)
John Holt (MIT Haystack Observatory)
Peter Fox (NCAR), Daniel Morrison (APL/JHU)
Stuart Nylund (GSFC)

Progress during the next era in space science will greatly benefit from an integrated data environment and will become critical to the success of the newly awarded Virtual Observatories (VOs). That integrated data environment should address researchers' needs to readily locate, assimilate and analyze information from a wide comprehensive variety of distributed scientific sources and models to perform data-intensive scientific research. It is vital at this stage for the space sciences community to understand this data environment development process and to provide input. This session is a continuation of a successful 2004 CEDAR workshop as well as ongoing AGU sessions that provides the opportunity to discuss issues and challenges for future data environments. CEDAR provides a good forum for modelers and data systems experts to interact with the science community as well as each other, in order to understand the needs of the community so they can build better systems. It is intended to provide a forum for the space sciences community to discuss issues and visions of a data environment that will suit their needs and to bring together space science data centers and data management facilities to share visions, approaches, technologies, procedures and practices.

Topics of discussion will include, but are not limited to, presentations by the Virtual Observatories identifying and addressing the needs of the various space science communities as well as reminding the community of the growing need for an integrated data environment, with a follow-up forum for data providers and users to understand how and what the VOs can do for them as well as identifying their concerns; and presentations on how models fit into an integrated data environment followed by a forum for modelers and data users. These are valuable inputs in the design of data centers, Virtual Observatories and the campaign efforts of eGY.
List of selected presenters:

- Peter Fox (NCAR)
- Daniel Morrison (APL/JHU)
- Bill Rideout (MIT Haystack Observatory)
- Tony van Eyken (EISCAT)
- Maria Kuznetsova (CCMC/GSFC)

Available Abstract:

Community Coordinated Modeling Center Support of science needs for integrated data environment by Maria Kuznetsova

Space science models are essential component of integrated data environment. Space science models are indispensable tools to facilitate effective use of wide variety of distributed scientific sources and to place multi-point local measurements into global context. The Community Coordinated Modeling Center (CCMC) hosts a set of state-of-the-art space science models ranging from the solar atmosphere to the Earth's upper atmosphere. The majority of models residing at CCMC are comprehensive computationally intensive physics-based models. To allow the models to be driven by data relevant to particular events, the CCMC developed an online data file generation tool that automatically downloads data from data providers and transforms them to required format. CCMC provides a tailored web-based visualization interface for the model output, as well as the capability to download simulations output in portable standard format with comprehensive metadata and user-friendly model output analysis library of routines that can be called from any C supporting language. CCMC is developing data interpolation tools that enable to present model output in the same format as observations. CCMC invite community comments and suggestions to better address science needs for the integrated data environment.

New Research Opportunities with the AMISR and Co-Located Instruments at Poker Flat Alaska

Anasazi South, Tuesday, June 20, 2006, 16:00 pm – 18:00 pm

Conveners:
John Kelly (SRI International, kelly@sri.com)
Brenton Watkins (University of Alaska, watkins@gi.alaska.edu)

The recent installation of a new phased-array incoherent-scatter radar (AMISR) at Poker Flat Alaska will provide new research opportunities for the science community. The objective of this workshop is to give a brief overview of AMISR system capabilities, and examples of planned and future possible science. The availability of numerous co-located instruments provide important complementary data and will foster collaboration with a variety of AMISR users.

Ionosphere-Thermosphere Research Using Measurements in Space -- What's Needed? What's Possible? What's Realistic?

Sunset, Tuesday, June 20, 2006, 16:00 pm – 18:00 pm

Conveners:
Joseph Grebowsky (GSFC, joseph.m.grebowsky@nasa.gov)
Robert Pfaff (GSFC)

Scientific observations using in situ probes and remote sensing platforms in space have been at the forefront of Ionosphere-Thermosphere research since the earliest satellite and rocket-borne measurements of the upper atmosphere. Such observations reveal both the nature of the earth's I-T system, as well as the fundamental physics that determines its properties and dynamics, and are particularly powerful when carried out in conjunction with ground-based measurements. This CEDAR workshop will focus on starting a dialogue aimed at establishing the most significant and compelling scientific problems that can only be resolved with the aid of space-based measurements. We will discuss primarily what measurements are needed, not just from space experimentalists' points of view, but also from those of ground-based researchers, modelers, and theorists. As part of this effort, a major goal of the workshop is to develop a succinct theme that can be used to effectively articulate the compelling science of the ionosphere-thermosphere region and its importance in the Sun-Earth Connection to those outside the I-T community.

The forum will be a roundtable discussion with a few short presentations by Rod Heelis and Tim Fuller-Rowell at the start to help focus the workshop goals. All researchers interested in the future of I-T measurements in space are encouraged to attend. Brief additional presentations (consisting of 2-3 slides each) from community members are welcomed.

Ionospheric Effects of Lighting

Zia, Tuesday, June 20, 2006, 16:00 pm – 18:00 pm

Conveners:
Ningyu Liu (nul105@psu.edu)
Mark Stanley
Michael Taylor (mtaylor@cc.usu.edu)

This workshop will focus on the effect of lightning discharges on the ionosphere. In particular, empirical and model results will be presented in regards to electromagnetic pulse (EMP) and quasi-electrostatic (QE) effects from lightning. Large EMPs produced by energetic cloud-to-ground discharges have been observed to produce optical emissions well over a hundred kilometers wide centered at close to 90 km altitude in the nighttime D region ionosphere. These optical emissions are referred to as "elves". Recent analysis of elves spectral data has revealed a significant ionization signature. QE fields from lightning may sometimes lead to a net attachment of free electrons while in others instances lead to their exponential growth via air breakdown in the form of broad "sprite halos" and/or filamentary "sprite" discharges. Both the QE attachment and ionization effects may at times be very significant with a several order of magnitude change in electron density. The workshop will begin with an in depth introduction to the topic as well as presentations regarding the latest research on ionospheric modifications due to lightning. This will be followed by a panel discussion on the interpretation of existing data and models. The panel will also discuss relevant research plans for this year as well as promising areas for future research collaborations and proposals. Audience participation in these discussions is strongly encouraged.

Midlatitude Nighttime Ionospheric Structures: Theory, Modeling and Physical Explanations

Zia, Tuesday, June 20, 2006, 19:30 – 21:30

Conveners:
Jonathan Makela (University of Illinois, jmakela@uiuc.edu)
John Mathews (Pennsylvania State University)
John Meriwether (Clemson University)

For several decades now, nighttime F-region structure over Arecibo has been observed by various research groups using a myriad of instruments. Incoherent scatter radar has shown bands of density enhancement/depletions propagating overhead. Tilting filter photometer measurements have demonstrated intense gradients in 630.0-nm intensity. Allsky images have elucidated the two-dimensional structure while GPS measurements of total electron content show the presence of sharp gradients in electron density. For the most part, these structures have been interpreted in terms of the Perkin's instability, although serious shortcomings in this theory have been pointed out in the literature. Recent theoretical work has also suggested that coupling between the E and F regions is important.

The goals of this workshop are to:

1. Discuss recent developments in our understanding of these structures from a theoretical and modeling standpoint.
2. Plan experiments that could test these new theories.

The workshop will be a roundtable discussion. We invite participants to attend the discussion with a few viewgraphs that may be useful in the discussion, but we will not be scheduling any specific talks.

Postdoc #1: Comparative Aeronomy at Earth and Mars

Anasazi, Wednesday, June 21, 2006, 09:20 – 09:35

Authors:
Paul Withers (withers@bu.edu)
Michael Mendillo (mendillo@bu.edu)

X-rays from solar flares create enhanced electron densities in the ionospheres of Earth and Mars. I shall present the first simultaneous observations of the response of these two ionospheres to large solar flares and discuss the scientific value of such observations.

Postdoc #3: Monthly climatology of mean values and tides in mesopause region temperature and winds observed by sodium lidar in Colorado

Anasazi, Wednesday, June 21, 2006, 10:20 – 10:35

Authors:
Tao Yuan, presenter
David A. Krueger
Chiao-Yao She
With acknowledgement: Tao Li, Phil Acott, Jia Yue, Sean Harrell

Since May 2002, the Na-lidar group in Colorado State University (Fort Collins, CO 40.6oN, 105oW) has been observing the mesopause region in full diurnal cycle (weather permitted) for 4 years. With an average over 200 hours of data per month, we have been able to build monthly climatology for both mean fields (temperature, zonal and meridional wind)

and the tides (diurnal and semidiurnal) in a midlatitude mesopause. In this talk, we will first discuss our mean field climatology, and compare the temperature climatology based on these 4-year's diurnal data sets with the 8-year nocturnal temperature climatology. Then we will report the diurnal and semidiurnal tidal climatology deduced from lidar observation. Our observed climatology will be compared to selected model predictions.

Postdoc #4: Unlocking the meteor toolbox for aeronomy and planetary science

Anasazi, Wednesday, June 21, 2006, 10:35 – 10:50

Author:
Lars Peterson Dyrud, presenter

Every day billions of meteoroids impact and disintegrate in the Earth's atmosphere. Current estimates for this global meteor flux vary from 2000-200,000 tons per year, and estimates for the average velocity range between 10 km/s to 70 km/s. The basic properties of this global meteor flux, such as the average mass, velocity, and chemical composition remain poorly constrained. Because they are accessible with radar, meteor trails have been used, and show promise as a remote sensor for aeronomical properties such as neutral winds and temperature. We believe much of the mystery surrounding the basic parameters of the interplanetary meteor flux exists for the following reasons, the unknown sampling characteristics of different radar meteor observation techniques, which are used to derive or constrain most models. We believe this arises due to poorly understood radio scattering characteristics of the meteor plasma, especially in light of recent work showing that plasma turbulence and instability greatly influences meteor trail properties at every stage of evolution. We present our results on meteor plasmas simulations of head echoes using PIC ions, which show that electric fields strongly influence early stage meteor plasma evolution, by accelerating ions away from the meteoroid body. We also present the results of time domain electromagnetic simulations (FDTD) which can calculate the radar cross section of the simulated meteor plasmas. We expect these results to allow researchers to better characterize meteors based on their radar echoes, whether their using ISR class or smaller meteor radars.

Postdoc #5: Investigating mesospheric gravity wave propagation and momentum flux at low-latitudes using simultaneous Na lidar and temperature mapper measurements

Anasazi, Wednesday, June 21, 2006, 11:10 – 11:20

Authors:
M. K. Ejiri, presenter
M. J. Taylor, P. D. Pautet
Y. Zhao, K. Nielsen, A. Z. Liu

The US Maui-MALT program is designed to investigate the properties and dynamics of the low-latitude mesosphere and lower thermosphere region (MLT) in exceptional detail. A key component of this study is the investigation of short-period gravity waves and their propagation and dissipation characteristics at MLT height. High-resolution measurements of the background wind, temperature field using the University of Illinois Na wind/temperature lidar have been combined with simultaneous image measurements of the NIR OH and O2 airglow intensity and rotational temperature obtained by the Utah State University Mesospheric Temperature Mapper (MTM) to perform an in-depth investigation of five selected short-period (less than 20 min) gravity wave events. In each case, the waves were observed under differing background conditions and we have determined their intrinsic properties, and nature of propagation (i.e. freely propagating or ducted). This has allowed us to quantify their associated horizontal momentum fluxes at two different altitudes (87 and 94 km) within MLT.

Structure and Irregularities in the Mid-Latitude Ionosphere and Thermosphere

Anasazi, Wednesday, June 21, 2006, 13:00 – 16:00

Conveners:
J. Michael Ruohoniemi (mike.ruohoniemi@jhaupl.edu)
Robert Pfaff
Gregory Earle (earle@utdallas.edu)

The mid-latitude ionosphere and thermosphere are increasingly found to exhibit variable behavior. Some of the activity is related to the coupling of electric fields from the magnetosphere during geomagnetically active periods while other categories are specific to the plasma properties of the subauroral region. Techniques such as GPS are giving dramatic global views of the development of mid-latitude plasma structure while new ground-based systems are contributing observations of a wide range of mid-latitude ionospheric irregularities. In this workshop we will hear presentations on the occurrence and characteristics of structuring and irregularities in the mid-latitude ionosphere and thermosphere. Topics for consideration will include the development of large-scale density enhancements, the properties of mid-latitude plasma irregularities, the modeling of structuring and irregularity onset, and theories of plasma instability. We will review the existing and developing experimental methods for detecting and monitoring irregular behavior in the ionosphere and thermosphere and discuss applications to theory and modeling. Our aim is to bring together groups that are pursuing aspects of structuring in the ionosphere and thermosphere at mid-latitudes to review the overall state of knowledge of the field and to identify research thrusts and potential collaborations.

Topics and Speakers:

Group 1 (mainly overviews, ~20 min./presentation including Q/A):
Mike Kelley – *Overview – empirical evidence of midlatitude irregularities*
Charles Seyler – *Theories of midlatitude irregularity generation*
Greg Earle – *Longitudinal/Seasonal variations of midlatitude irregularities*
Brief overview of fall '06 MSF rocket experiment
Rob Pfaff – *Demeter satellite findings*
Ray Greenwald/Mike – *Mid-latitude temperature gradient irregularities*
Phil Erickson – *Storm enhanced density, SAPS, and mid-latitude density gradients*

Group 2 (systems &/or local observations, ~10 minutes/presentation including Q/A):
Rebecca Bishop – *Observations of midlatitude disturbances from weather systems*
Geoff Crowley – *TIDDBIT tristatic radar system*
Terry Bullett – *Dynasonde-21 capabilities*
Keith Groves – *Midlatitude scintillation measurement capabilities*
Qihou Zhou – *Arecibo observations of midlatitude irregularities*
Gary Bust or Trevor Garner – *GPS measurements of midlatitude TEC*

General Group Discussion & "Walk-On" Presentations – 'til whenever

Data Assimilation in Space Sciences

Sunset, Wednesday, June 21, 2006, 13:00 – 15:00

Convener:
Mihail Codrescu (NOAA, mihail.codrescu@noaa.gov)

Data assimilation is a new field for space physics, and is beginning to be widely used by the ionosphere-thermosphere community. As we move into this new era it is timely for the up and coming experts in this field to review the status and ensure we have community wide definitions for the field. For instance, there are many ways to improve the specification of the "state" of a data assimilation system, using techniques that range from a simple replacement of a model result by a 'raw' measurement at one location, to sequential statistical methods like the extended and ensemble Kalman filters, to the exclusive use of data as in tomography. Sometimes these techniques are referred to as ``Data Assimilation". However, it is not clear which of these techniques can be called Data Assimilation in the Space Sciences community, as different working groups may include only a subset of them in their definition. In this workshop we plan to have an open discussion of the issues and try to agree on community supported definitions for the term Data Assimilation in Space Sciences. Consultation with the GEM and SHINE groups will be part of the effort. A working group will be established to document and publish the agreed definitions.

Available Abstract:

Data Assimilation and the Thermosphere Ionosphere System by Mihail Codrescu

Modern technological systems like GPS and Galileo, HF communications, and radar ranging are affected by geomagnetic storms and can become unreliable during large events. Geomagnetic storms are caused by large increases, often associated with changes in the spatial distribution, of the high-latitude energy deposition from the magnetosphere. Wave surges, driven by impulsive energy inputs, propagate and interact globally, and are dependent on Universal Time (UT) and the time history of the source. Equatorward wind surges drive F-region plasma upwards and can initiate a positive ionospheric change. Expansion of high-latitude electrodynamic features into the mid-latitudes can also drive an initial positive response. The divergent nature of the wind field causes upwelling and changes to the neutral composition, that can be transported by the storm and background wind fields. Negative ionospheric phases result from increased molecular species. At low latitudes electrodynamic changes are initiated by penetration of magnetospheric fields followed by neutral wind dynamo effects. The changes in energy input have global consequences with undesirable effects on technological systems and they cannot be adequately modeled at the present time. For operational purposes these changes can only be specified and perhaps modeled using data assimilation schemes.

Applications of the Consortium of Resonance and Rayleigh Lidars to CEDAR Science

Zia, Wednesday, June 21, 2006, 13:00 – 15:00

Conveners:
Jeffrey Thayer (jeffrey.thayer@colorado.edu)
Xinzhao Chu (Xinzhao.Chu@Colorado.edu)
David Fritts
Joe She (joeshe@lamar.colostate.edu)
Gary Swenson (swenson1@uiuc.edu)

State-of-the-art resonance and Rayleigh lidars have the unmatched capability to provide range-resolved measurements of fundamental atmospheric parameters, such as winds, temperatures, aerosols, gravity waves, and densities in the stratosphere, mesosphere, and lower thermosphere, resulting in exciting, new, and unique scientific contributions to the

NSF CEDAR and Aeronomy research community. These contributions cover a broad range of topics including dynamics, structure, chemistry, microphysics, trends, global change, inter-hemispheric differences, and other fields, as detailed in the NSF CEDAR lidar self-assessment document. This community report also recommended further advancements in middle and upper atmosphere lidar technology and the development of a center of excellence for lidar technology. This workshop seeks to address the future direction of the research community using lidars, the status of operating lidars used for CEDAR research, and planned technological advancements. The workshop will also serve to introduce a new paradigm in CEDAR lidar coordination and advancement by describing the creation of a Consortium of Resonance and Rayleigh Lidars (CRRL) under the auspices of the Upper Atmosphere Facilities Program at NSF.

Jicamarca Amigos

Zia, Wednesday, June 21, 2006, 19:30 – 21:30

Conveners:
David Hysell (dlh37@cornell.edu)
Jorge (Koki) Chau (jchau@jro.igp.gob.pe)

Users and friends of the Jicamarca Radio Observatory will be holding a workshop to review activities from the past year and to prepare for the upcoming one. Both long-duration and rapid response runs are increasingly being requested, and Jicamarca's response to these and other important programs, especially C/NOFS and LISN, need to be discussed and planned. A number of new experimental modes are coming online at Jicamarca which need to be coordinated to optimize observing time. New hardware including more digital receivers, an absolute calibration system, SOUSY, and the AMISR-7 have appeared. The bistatic Jicamarca-Paracas link continues to run, and its exploitation also needs coordination. The status of educational activities like the visiting scientist program, the intern program, and the recent radar school will be reviewed. Finally, science highlights from the past year will be presented.

Opportunities of Research in Aeronomy in Latin America

Anasazi, Thursday, June 22, 2006, 09:30 – 11:30

Conveners:
Diego Janches (diego@cora.nwra.com)
Carlos Martinis (martinis@bu.edu)

In the 2002 National Research Council report The Sun to Earth and Beyond: A Decadal Research Strategy in Solar and Space Physics it was highlighted that a global array of instrumentation is needed in order to fully understand the causally coupling of the solar atmospheric phenomena to the Earth s atmosphere-ionosphere- magnetosphere (A-I-M) system. The need for global coverage originates from the fact that each latitudinal region has its own physical character. Understanding the energy transfer between regions is crucial for accurate prediction of the ionospheric response to Space Weather as is the understanding of the energy transfer from below to above via gravity, tidal and planetary waves. In particular, the upper atmosphere in the South-American sector presents a unique geometry compared to the rest of the globe. The location of the magnetic equator has the maximum departure from the geographic equator in the western part of South America while in the eastern Brazilian sector this difference is minimum. Also, the magnetic declination spans from ~ 0 deg in the west coast of South America to ~ 25 deg in the Brazilian sector. Many thermospheric- ionospheric processes in the region will be strongly affected by these particular conditions. South America also offers the opportunity for ground-based instrumental platforms at a more southerly location than any other on the American continent. This creates a convenient base for installing and operating instrumentation to overlap the science performed with instruments currently operating in the antarctic and those operating at middle and low latitudes. It provides a site that is at the geomagnetic conjugate of Arecibo and is also closely conjugate (geographically and geomagnetically) with other heavily

instrumented sites in the northern hemisphere and sites located below the South Atlantic Magnetic and Appleton anomalies.

The proposed workshop will focus on describing existing, planned and foster research opportunities in Latin America. The format of the workshop includes 2-3 brief invited talks, followed by short presentations which will address key scientific issues in the region. The contribution from Latin-American scientists is encouraged. A final period of open discussion is also planned.

Thermospheric Density and Composition

Sunset, Thursday, June 22, 2006, 09:30 – 11:30

Convener:
Arthur Richmond (richmond@ucar.edu)

The density and composition of the thermosphere are strongly dependent on variations in solar XUV radiation, on high-latitude Joule heating, on thermospheric dynamics, and on dynamical, chemical, and radiative coupling with the lower atmosphere. As part of the Living With a Star program, a coordinated research effort is underway to advance our understanding of the variability of thermospheric density and composition, with a view toward improving the modeling of satellite drag and of ionospheric effects. This workshop will consist of a summary of the research plan, progress reports by members of the research team, and discussion by all interested persons about how best to accomplish the goals of the research plan. Web versions of the research plan and progress reports will be made available in advance of the meeting.

MLT Structure and Dynamics in Tropical/sub-tropical Regions

Zia, Thursday, June 22, 2006, 09:30 – 11:30

Conveners:
Xinzhao Chu (xinzhao.cu@colorado.edu)
Jonathan Friedman (jonathan@naic.edu)
Gary Swenson (swenson1@uiuc.edu

Two tropical/subtropical sites, Maui and Arecibo, are separated only by 2.4 in latitude but by 90 in longitude. Lidar measurements from Maui Haleakala (20.7N, 156.3W) and Arecibo Observatory (18.35N, 66.75W) have revealed significant differences in the mesosphere and lower thermosphere (MLT) thermal structure, tidal waves, and mesospheric inversion layers (MIL). For example, while the Arecibo summer mesopause stays at a higher altitude, Maui shows a lower altitude similar to mid-latitude sites. Maui has much stronger tidal and MIL signatures than Arecibo. These results promote a series of interesting questions about the potential causes for these differences. Are there differences in non-migrating tides, gravity waves, tide-gravity wave interactions, or something else? Are there differences and similarities observed by other instruments? What do models predict in the tropical and subtropical regions? What role do the tropical and subtropical structure and dynamics play in the global picture? To address these questions and further understand the structure and dynamics in the tropical and subtropical areas, we invite scientists from CEDAR field to investigate these issues from modeling, theoretical, and observational aspects. The observational results may come from correlative measurements using different types of instruments, like satellite, radar, GPS, and groundbased optical instruments. Modeling work on tides and thermal structures will make a significant contribution to such discussions. This workshop will provide a great opportunity to bring modelers, theorists, and experimentalists together to clarify the differences and similarities in the tropical and subtropical MLT structure and dynamics, and help explain the observational results.

World Day Planning

Piñon, Thursday, June 22, 2006, 11:30 – 13:00 (Lunch included)

Convener:
Wesley Swartz (wes@ece.cornell.edu)

The URSI Incoherent Scatter Working Group (ISWG) is charged with the task of planning a series of coordinated experiments involving the world's upper atmospheric observatories. The days so scheduled are called World Days. New procedures for scheduling World Day observations for 2007 have been put in place and as described at <http://people.ece.cornell.edu/wes/URSI_ISWG/RequestingWD.htm> and other links including a sample proposal, written proposals have been requested for meeting specific research needs with the World Day observations. This planning meeting is for the ISWG and UAF staffs to review all the proposals submitted and determine how the global network of ISRs can best satisfy the approved observational requests. The proposer's presence during this discussion is not required.

Please feel free to consult with any facility staff member for clarification on this new process for requesting ISR observing time within the World Day program.

Meteors and the Upper Atmosphere

Anasazi South, Thursday, June 22, 2006, 13:00 – 16:00

Conveners:
Lars Dyrud (ldyrud@cfrsi.com)
Diego Janches (diego@cora.nwra.com)

Every year approximately 100,000 tons of meteoric material impacts Earth's atmosphere near 100 km altitude. However, many questions remain on this meteor mass and energy flux, and the impact of this flux on upper atmospheric chemistry and ionization. Additionally, researchers have used radar reflections from meteor trails to remotely sense winds and temperatures near the mesopause, but with mixed success, and using an unresolved theoretical basis. To address these issues, we invite presentations on the physics of meteors and their interaction with the atmosphere and ionosphere. Specific discussion is encouraged on the observation of meteors with NSF and CEDAR supported facilities, or the theoretical interpretation of such observations. We encourage contributions of research attempting to better understand meteors or general aeronomy via meteor observations, including upper atmospheric chemistry and metal layers. We also invite presentations of radar, Lidar and optical observations. Theoretical studies or simulations of the meteors and meteor trail interactions with the atmosphere/ionosphere are also invited. Finally, we request operators of meteor radars to present their winds and temperature data especially in comparison with other instruments such as Lidar and TIMED, with a view on how to improve these observations.

Available Abstracts:

Observations of Meridional Winds and Tides Over the South Pole Using a Meteor Radar (2001-2005) by Elias M. Lau; other authors, Susan K. Avery, James P. Avery, Scott E. Palo, and Nikolai A. Makarov

Deployment of instrumentation to the polar regions to study the atmosphere has lagged behind those made to lower latitudes. As a consequence the dynamics of the atmosphere over the polar regions is not as well understood. A meteor radar was installed at the South Pole to study the wind field in the mesosphere and lower thermosphere (MLT) over the South Pole. We present the winds and tides observed with this radar system for years 2001 through 2005.

Available Abstracts (cont.):

Mid-latitude Tide Analysis of the MLT Region Using Wind Estimates from Meteor Radars by Santiago de la Pena

We present a brief analysis of the 12, 24 and 48 hour wave in the Mesosphere and Lower Termosphere region derivated from wind estimated by the meteor radars located in Platteville, CO.

Incoherent Scatter Radar Long-Duration Experiments and CEDAR

Anasazi North, Thursday, June 22, 2006, 13:00 – 16:00

Conveners:
Shunron Zhang (shunrong@haystack.mit.edu)
Larissa Goncharenko (lpg@haystack.mit.edu)

A number of long-duration Incoherent Scatter Radar (ISR) experiments have been run in response to community requests. These experiments provide a unique opportunity to study aspects of important upper atmospheric phenomena which may not be captured by a shorter campaign. These phenomena include long-period thermosphere-ionosphere oscillations and waves, the upper atmospheric climatology, variability and disturbances, as well as long-lasting and short-lasting response to space weather events. The detailed datasets, covering both geomagnetically quiet and active periods under different solar activity conditions, constitute an excellent resource for the evaluation of current and future geospace modeling and data assimilation efforts. Considerable effort has been expended in providing these long-duration datasets for community use. The proposed workshop will consist of two complementary parts, and a 2-hour session is requested for each. Session A, "ISR long-duration experiment: Research opportunities for the CEDAR Community", will address the scientific value and importance of ISR long-duration experiments, overview the last runs, demonstrate the data accessibility, and discuss the feasibility of future continuous ISR operation. Session B, "ISR long-duration experiments: Coordinated studies" will emphasize the science analyses arising from the ISR long-duration campaigns and coordinated observations. We plan to discuss the use of the existing data for scientific analysis, modeling and data assimilation, and to facilitate a closer communication and collaboration among researchers. Results from a broad range of instruments and studies on events that occurred during any of the long-duration runs (October 2002, September 2005, and March 2006) are solicited for this session.

Plasma Structures and Turbulence (PSAT)

Sunset, Thursday, June 22, 2006, 13:00 – 16:00

Convener:
Evgeny Mishin (evgenii.mishin@hanscom.af.mil)
Anatoly Streltsov (anatoly.streltsov@nrl.navy.mil)

The objective of this workshop is to discuss current state-of-the-art in observations, theory, and modeling of multi-scale wave dynamics and plasma turbulence in the thermosphere-ionosphere-magnetosphere system with an emphasis on the energy and momentum transport between different altitudes. During this workshop the discussion will be mainly focused on three related topics: (1) theoretical studies of nonlinear electromagnetic waves in the thermosphere-ionosphere-magnetosphere system, (2) observations of electromagnetic and plasma structures in the ionosphere, and (3) modeling of wave dynamics and plasma turbulence in the Earth's magnetosphere and ionosphere. Presentations containing theory/model/observations related to the small-scale and intermediate-scale wave/plasma processes in the auroral and sub-auroral zones (like SAPS, SAIDs and SAR arcs), plasma structuring in the polar cup patches and equatorial plasma bubbles are also relevant to the theme of this session.

Available Abstracts:

Stormtime PSAT and their effects at subauroral latitudes by Evgeny Mishin

Satellite observations of mesoscale wave structures and microscale plasma turbulence and their effects in the ring current-plasmasphere overlap region and in the conjugate ionosphere are analyzed. In particular, during the magnetic storm of 5 June 1991 CRRES and DMSP satellites observed a rich variety of wave phenomena. These were simultaneous with enhanced fluxes of low-energy (< 1 keV) electrons and ions in the region of ring current/plasmasphere overlap and the conjugate topside ionosphere. Earthward of the plasma sheet boundary, ULF electromagnetic wave-structures with spatial wave-lengths 500 to 1000 km and magnitudes of ~1-3 mV/m dominated. The latter seemed to modulate also the plasmaspheric density. At about the same time the DMSP armada observed highly-structured SAPS in the topside ionosphere coincident with precipitating ring current ions, enhanced fluxes of suprathermal electrons and ions, elevated electron temperatures, and deep highly-irregular density troughs. Overall, these events represent the so-called strong wave-SAPS phenomenon (SAPSWS). A likely mechanism of the SAPWS generation is the so-called current-convective instability.

Near the inner edge of the ring current, located a few thousand km Earthward of the plasma sheet (~100-km equatorward of the SAPSWS), the strongly-structured meridional component of the electric field reached a maximum of 4 mV. Here, the wave activity was dominated by lower hybrid waves, and the electron and ion distributions were dominated by the low-energy particles. The formation of elevated electron temperatures at the equatorward side of the SAPS can be explained in terms of the electron heating by lower-hybrid waves. Those are generated due to a lower-hybrid drift instability driven by the diamagnetic current, consistent with strong lower- and upper-hybrid plasma wave-activity and intense fluxes of the low-energy electrons and ions near the ring current's inner edge.

Small-scale density structures in the upper ionosphere produced by nonlinear Alfven waves by Anatoly Streltsov

Results from a numerical study of generation of small-scale density structures in the upper ionosphere by intense, nonlinear Alfven waves are presented. Computations reveal that the ionospheric feedback instability driven by the large-scale, slowly-evolving downward current can generate a variety of small-scale, intense electromagnetic structures at low altitudes when the ionospheric conductivity is low. One of the main parameters defining perpendicular scale-size, frequency, and amplitude of these structures is a ratio between wave impedance and the Pedersen conductivity of the ionosphere. The most intense structures are generated at low altitudes inside the ionospheric Alfven resonator when the background ionospheric conductivity matches the wave conductance. In this case, magnetic field-aligned current in the resonant Alfven waves produces small-scale density perturbations in the upper ionosphere with amplitudes up to 5-10 % (~ 1000 cm-3) of the background value.

Recent Progress in Fabry-Perot Applications to CEDAR Science

Zia, Thursday, June 22, 2006, 13:00 – 16:00

Conveners:
John Meriwether (john.meriwether@ces.clemson.edu)
Rick Niciejewski (niciejew@umich.edu)

Fabry-Perot interferometry has progressed within the CEDAR community over the past several years since the last FPI workshop was held at Longmont, CO, in 2002, New observatories, new instruments, and new science issues have surfaced during this period. The TIDI instrument on the TIMED satellite has proved successful in making interesting science contributions. Moreover, most FPI observatories have upgraded their instruments to achieve enhanced sensitivity with the bare CCD detectors, and new problems in data analysis arise as a result of the adoption of imaging for the detection of Doppler widths and Doppler shifts. In regard to new science, opportunities for interesting studies in the daytime, twilight, and nighttime periods for both nightglow and auroral emissions have appeared, especially with the enhanced science that

the imaging detector technology provides. The potential contribution to be gained from the networking of FPI observatories continues to be of great interest to the Space Weather community.
This 2006 CEDAR FPI workshop covering three hours (1-4 Thursday afternoon) would be split into two parts. The first part would be focused upon a series of presentations and discussions bearing on these instrumentation and science topics to provide updates for the community. The second part would represent an open period of discussion addressing a range of topics such as benefits of FPI networking, how to achieve improved distribution of FPI measurement results, and questions regarding calibration and analysis of CCD images.

Radar Meteor Studies: Where Next?

Zia, Thursday, June 22, 2006, 19:30 – 21:30

Conveners:
John Mathews (jdmathews@psu.edu)
Sigrid Close (Los Alamos National Laboratories)
Lars Dyrud (Center for Remote Sensing)

Large-aperture radar study of meteors has matured greatly in the approximate decade since the first observational being reported. However, many questions remain including the radio science and plasma instability issues implicit to the head-echo and range-spread trail echo scattering mechanisms and the possible influence of meteor-trails on E-region electrodynamics. The purpose ofor new radar capabilities. Large-aperture radar study of meteors has matured greatly in the approximate decade since the first observational being reported. However, many questions remain including the radio science and plasma instability issues implicit to the head-echo and range-spread trail echo scattering mechanisms and the possible influence of meteor-trails on E-region electrodynamics. The purpose ofor new radar capabilities.

Penetration Electric Fields and Ionospheric Storms

Anasazi South, Friday, June 23, 2006, 09:30 – 11:30

Conveners:
Chaosong Huang (cshuang@haystack.mit.edu)
Stanislav Sazykin (sazykin@rice.edu)

The global ionospheric plasma density distribution can be greatly changed during magnetic storms; the F-region plasma density increases and decreases are termed the positive and negative phases of ionospheric storms, respectively. However, many extremely large storm-time ionospheric disturbances cannot be explained with the "conventional" positive and negative storm phases related to neutral wind disturbances. For example, enhanced ionospheric electric fields move the equatorial F-region plasma upward, enhancing the fountain effect and creating a very deep depletion of the plasma density and total electron content (TEC) over the equator in the evening sector. The ionospheric plasma density is significantly increased at lower midlatitudes, particularly in the Atlantic sector near dusk, and TEC (e.g., over Florida) can be increased from a quiet-time value of 40 TECu to a storm-time value of 200-300 TECu. The enhanced ionospheric plasma density is convected toward local noon, forming an enhanced TEC band termed the ionospheric plume. The high plasma density from the low latitudes enters the polar cap and generates the polar tongue of ionization. Although significant progress has been achieved in this area, a number of outstanding problems remain unsolved.

In this workshop, we will discuss the following problems. How long can penetration electric fields exist? Does the shielding process work during the main phase of magnetic storm? What determines the fraction of the interplanetary electric field that penetrates to the low-latitude ionosphere? How well do the current theories and models describe the phenomenon of electric field penetration? What causes the positive phases of ionospheric storms at higher midlatitudes in the noon sector? What is the relative importance of penetration and disturbance dynamo effects? How can the relative

contributions from electric fields and neutral disturbances to ionospheric storms be separated? New observational and simulation results that address the above problems will be presented.

The speakers and topics of the workshop are:

1. John Foster (MIT), Localized stormtime enhancement of TEC at low latitudes in the American sector.
2. Tim Fuller-Rowell (NOAA), Indication of timescales and characteristics of the disturbance dynamo from physical models.
3. Mike Kelley (Cornell U.), Strong evidence for By-dependent penetrating electric fields without Bz variation.
4. Chaosong Huang (MIT), Penetration electric field: Efficiency, time scale, and effects during ionospheric storms.
5. Stan Sazykin (Rice U.), Penetration electric fields and preconditioning of the magnetosphere.
6. Joe Huba (NRL), Modeling storm-time penetration fields.
7. Ray Greenwald (JHU/APL), title to be determined.
8. Dave Anderson (NOAA), Interplanetary electric fields and their relationship to observed low latitude electric fields under disturbed conditions.
9. Tony Mannucci (NASA/JPL), The dayside superfountain effect: Observations and modelling results.

Climatology / Long-Term Trends

Zia, Friday, June 23, 2006, 09:30 – 11:30

Conveners:
Jan Sojka (fasojka@gaim.cass.usu.edu)
Jeffrey Thayer (Jeffrey.thayer@colorado.edu)

The CEDAR community has, from its inception, viewed the interpretation of Aeronomy long term trends - climatologies as one if its goals. To this end, the CEDAR community has sponsored and maintained the CEDAR database to both make available CEDAR measurements and to guarantee their longevity through their archives. In the CEDAR Phase III document long-term trends was identified as one of the four main themes for CEDAR science. Most recently the concept and development of a Virtual Observatory (VO) for solar terrestrial research offers new opportunities to extend the CEDAR database holdings by automatically accessing data in other archives.

The workshop invites inputs and discussion on long-term trends and the scientific measurements that are most critical to these studies. These discussions will also provide background science rationales and justifications for CEDARs' long term archival strategy. Even the term "long term" is open for discussion. For example, with the CEDAR ISR network running month long studies, do these represent a "long term" database?

TIMED/CEDAR Collaborative Atmospheric Dynamics

Anasazi North, Friday, June 23, 2006, 09:30 – 11:30

Conveners:
Elsayed Talaat (elsayed.talaat@jhuapl.edu)
Jeng-Hwa Yee (sam.yee@jhuapl.edu)
Scott Palo (palo@colorado.edu)
Irfan Azeem (azeem71d@erau.edu)

The coordination of ground-based and satellite observations under the TIMED/CEDAR program has provided unprecedented coverage of the Mesosphere and Lower Thermosphere (MLT) region. The ground-based instruments provide measurements of MLT winds and temperatures at specific geographic locations over many local times and complement the TIMED instruments, which provide similar measurements globally at one or two local times on any given day. These two data sets can be combined to obtain the true mean fields and a higher-time-resolution picture of atmospheric waves, especially tides-addressing the aliasing in measurements obtained by spaceborne instruments. It is the

focus of this workshop to coordinate datasets to study of scientific topics that can be examined through multiple datasets including the zonal mean, tides, and planetary waves and causes of their variabilities including semi-and interannual oscillations and stratospheric warmings. We also encourage discussions that address techniques for combining datasets and overcoming aliasing.

Optical Calibration Techniques and Issues

Anasazi South, Friday, June 23, 2006, 09:30 – 11:30

Conveners:
Susan Nossal (nossal@wisp.physics.wisc.edu)
Michael Taylor (mtaylor@cc.usu.edu)
Thomas Slanger (tom.slanger@sri.com)

This workshop will address methods and issues associated with calibration of optical instruments. Calibration is important for comparing observations taken by different instruments, for model-data comparisons, and for acquiring long-term data records. As at past workshops, we will include a few mini-tutorials to highlight specific techniques for absolute and relative intensity calibration and for spectral calibration. At this year's workshop, we plan to have a greater focus on discussion of strategies for inter-calibration of instruments. Please contact Susan Nossal (nossal@wisp.physics.wisc.edu; 608-262-9107) if you would like to contribute a short presentation.

Global Electrodynamics and Storm Effects at Mid and Low Latitudes

Anasazi North, Friday, June 23, 2006, 09:30 – 11:30

Convener:
Timothy Fuller-Rowell (tim.fuller-rowell@noaa.gov)

Recent observations have recently revealed that the response of the mid and low latitude ionosphere and thermosphere to geomagnetic storms is much more dynamic and dramatic than previous envisaged. In particular, understanding the role of global electrodynamics in plasma redistribution is a topic of intense interest. One of the Focused Science Topics in the LWS TR&T program is the study of global electrodynamics and storm effects at mid and low latitudes. This workshop will review the specific science questions that are confronting this field and outline the specific steps required to answer these questions over the next three years.