

2007 CEDAR- DASI Workshop Schedule

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Student Workshop - Winds in the Upper Atmosphere: Physics, Observations, and Empirical Models

Zia, Sunday, June 24, 2007, 8:55 am – 4:00 pm

Conveners:

Romina Nikoukar, Univ. of Illinois at Urbana-Champaign
Mike Nicolls, SRI International

08:55-09:10	Student Welcome	J. Sojka (CSSC chair) and R. Behnke (NSF)
09:10-09:20	Agenda information; organizational details; activity information	R. Nikoukar and M. Nicolls (CSSC student reps)
09:20-10:20	Keynote Speech #1: Dynamics of the thermosphere	J. Forbes (U CO)
10:20-10:40	--- Break ---	
10:40-11:40	Keynote Speech #2: Neutral winds and their role in ionospheric electrodynamics	A. Richmond (NCAR)
11:40-13:00	Lunch on own at area restaurants	
13:00-13:30	Wind observations - Rockets	M. Larsen (Clemson U)
13:30-14:00	Wind observations - Meteor radars	S. Palo (U CO)
14:00-14:30	Wind observations – Measuring middle atmospheric winds with lasers	C. Gardner (U IL)
14:30-14:50	--- Break ---	
14:50-15:20	Wind observations - Passive optics	R. Kerr (Arecibo)
15:20-16:00	Neutral wind models	J. Emmert (NRL)
16:00	Adjourn	

Putting your degree to work

Anasazi South, Monday, June 25, 2006, 1:00 – 3:00 pm

Conveners:

Peter Fiske, PAX Mixer, Inc., peterfiske@yahoo.com
Michael Nicolls, SRI International, michael.nicolls@sri.com
Romina Nikoukar, University of Illinois, nikoukar@uiuc.edu

In this workshop Peter Fiske will present a thorough and practical overview to the process of career planning and job hunting in today's job market, from the perspective of a young scientist. He will cover specific steps that young scientists can take to broaden their horizons, strengthen their skills, and present their best face to potential employers. An important part of this is the realization that most young scientists possess a range of valuable "transferable skills" that are highly sought after by employers in and out of science. He will also cover all the specifics of job hunting, including informational interviewing, building your network, developing a compelling CV and resume, cover letters, interviewing, and more. With each topic he will discuss the particular challenges and opportunities faced by those with an advanced degree in science. It is a workshop up-beat in tone and positive in outlook. Students and young scientists are encouraged to attend.

Meteors and the upper atmosphere

Anasazi North, Monday, June 25, 2007, 1:00 – 4:00 pm

Conveners:

Lars Dyrud, Center for Remote Sensing

Sigrid Close, Los Alamos National Laboratory

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. For example, global yearly mass flux estimates are not constrained to within an order of magnitude. Of particular importance to the CEDAR community is that meteors account for all of the dust, metal neutral and ionized particles in the upper atmosphere (since there is no convection or diffusion of atoms or particles of this size from the ground all the way to 100 km). Further, meteoric dust is also thought to provide the condensation nuclei for polar mesospheric clouds PMC (high altitude clouds near 80 km), which is the focus of a current NASA mission (AIM). Yet it remains unclear whether variability in meteor flux generates variability in PMC occurrence. Additionally, CEDAR researchers have used radar reflections from meteor trails to remotely sense winds and temperatures near the mesopause (a very difficult place to take measurements, too high for lidar to low for Fabry-Perot measurements). With some success for winds but little success for temperatures. 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.

It is expected that much discussion and presentations during this workshop will center on large radar observations of meteors including observations from Arecibo, Jicamarca, and AMISR, as CEDAR researchers have made serious contributions to the field of meteor science and meteor aeronomy using these radars over the past decade.

Short period gravity waves and their effects in the MLT region

Zia, Monday, June 25, 2007, 1:00 – 3:00 pm

Conveners:

Jonathan Snively, Penn State University

Tai-Yin Huang, Penn State Lehigh Valley

Mike Taylor, Utah State University

This workshop will focus on short-period gravity waves (<30 min period) in the mesosphere and lower-thermosphere (MLT) at all latitudes, including new theoretical, numerical, and observational results. Short-period gravity waves comprise a significant fraction of wave energy at MLT heights. However, some challenges exist in the study of such short-period waves. Their excitation and propagation are strongly dependent on larger scale atmospheric structure, dynamics, and variability at all altitudes. Furthermore, their small scale size generally prohibits direct simulation in large-scale models, limiting our ability to study them numerically under realistic conditions. Due to these challenges, it is necessary to understand and quantify short-period gravity wave processes and effects in the MLT via observation and detailed numerical or theoretical modeling. It is also necessary to understand gravity wave interactions with observable atmospheric processes, an example being the modulation of nighttime airglow chemistry by gravity waves.

Talks will pertain broadly to short-period gravity waves in the MLT, and the techniques by which they are observed. Specific topics may include short-period gravity wave excitation, propagation, ducting, dissipation, breaking, and

nonlinearity in the MLT. Gravity wave effects on chemistry, modulation of airglow layers, and transport/deposition of energy and momentum are also of particular interest.

The workshop is organized as a series of short talks, beginning with general overviews of the present state of research, and progressing to contributed short presentations of ~10 min (~5 slides). Talks will focus on new research and recently-published results, while maintaining a format which is friendly to a broad audience. Student contributions are welcome and encouraged. Additional discussion time of 30 minutes will be allotted following the talks.

Equatorial ionospheric challenges and the C/NOFS mission

Sunset, Monday, June 25, 2007, 1:00 – 3:00 pm

Conveners:

Odile de La Beaujardiere, Air Force Research Laboratory

Cheryl Huang, Air Force Research Laboratory

David Hysell, Cornell University

Michael Kelley, Cornell University

Robert Pfaff, NASA/Goddard Space Flight Center

Jorge Chau, Instituto Geofisico del Peru

John Retterer, Air Force Research Laboratory

This workshop will address the challenges in forecasting the equatorial ionosphere and irregularities within. The discussions will be related but not limited to the C/NOFS (Communication and Navigation Outage Forecast System) mission.

C/NOFS is a satellite mission dedicated to forecasting ionospheric densities, irregularities and scintillation. It will be launched in 2005, in a 13 degrees inclination, 710 x 375 km orbit. Its instruments will provide plasma parameters, electric & magnetic fields (AC and DC), density fluctuations, and neutral wind. It will also have a GPS receiver, and an RF beacon. Ground-based instruments and models, and space weather products are an integral part of the mission.

The purpose of this workshop is to:

- Address the main difficulties in forecasting the equatorial ionospheric behaviors
- Define collaborative projects that involve ground and space measurements
- Report on CNOFS validation plans and accomplishments

Poker Flat AMISR: The first six months

Anasazi, Tuesday, June 26, 2007, 9:30 – 11:30 am

Conveners:

Craig Heinselman, SRI International

Mike Nicolls, SRI International

The Poker Flat AMISR has been operating throughout 2007 in support of rocket campaigns (January-February) and normal user operations (beginning March 2007). By the time of the CEDAR workshop, it is anticipated that AMISR will have operated 960 hours in support of 24 individual experiments under 26 different researchers. Additionally, the ISR will have operated 2130 hours in a low-duty cycle mode for IPY support. The objective of this workshop is to highlight the science targeted in the first six months and to present some of the first results. Presentations will be solicited from the first AMISR users. User experiments have included support for several multi-day World Day runs, several meteor runs, joint experiments with the HIPAS HF Facility, optical campaigns, interferometry experiments, coordinated observations with GeoTAIL, THEMIS and SSUSI, Joule heating experiments, gravity wave momentum flux experiments, and others. The first experiments have led to the development of many AMISR observational configurations and analysis tools designed to compute products such as the electric field and E-region neutral wind vectors, in addition to standard incoherent scatter

products (e.g., temperatures and densities). AMISR operations and planning will be reviewed in the workshop. Future planned experiments and science goals, with both the Poker Flat and the Resolute Bay AMISRs, are also open areas of discussion.

Science opportunities with the lidar consortium

Zia, Tuesday, June 26, 2007, 9:30 – 11:30 am

Conveners:

Dave Fritts, NWRA/CoRA

Joe She, Colorado State University

This workshop will be structured to provide an overview of current science performed by CRRL lidars, outline research opportunities for CEDAR students and guest scientists, discuss possible future correlative research opportunities, and seek community inputs on future directions and measurement locations.

A brief outline follows:

1. current science activities (summarize previous and current studies) at the CRRL lidars ? including opportunities for student research and thesis topics
2. opportunities for other collaborative research activities - rocket programs, colocated instrumentation, satellite coincidence, visiting scientist opportunities, etc.
3. opportunities for new science - either existing sites or new locations (UIUC in S. America), seek community inputs

Data assimilation in space sciences: Methods and results

Sunset, Tuesday, June 26, 2007, 9:30 – 11:30 am and 1:00 – 3:00 pm

Convener:

Mihail Codrescu, NOAA Space Environment

Data assimilation is an integral part of any modern terrestrial weather prediction system. Even historical weather research uses data assimilation. The only debate left today is about what methods are best and how to implement them in different situations. In space sciences we are in the beginning of implementing data assimilation methods but rapid progress is being made and the first results from an operational implementation of a data assimilation scheme are already available. In this session we plan to review the state of data assimilation in space sciences and to present the latest results. Papers on the any aspects of data assimilation are welcome.

Virtual Solar-Terrestrial Observatory (VSTO)

Zia, Tuesday, June 26, 2007, 11:30 am – 1:00 pm – with deli lunch

Convener:

Peter Fox, NCAR

The Virtual Solar-Terrestrial Observatory (VSTO) is taking shape at HAO/NCAR. We will discuss the status of the project and the place of the CEDAR Database within the larger VSTO structure.

The Poker Flat 2007 Winter Campaign

Anasazi South, Tuesday, June 26, 2007, 1:00 – 3:00 pm

Conveners:

Miguel Larsen, Clemson University
John Craven, University of Alaska Fairbanks
Craig Heinselman, SRI International

In January and February 2007, a total of ten sounding rockets were launched from Poker Flat Research Range in Alaska. This was an unusually large number of launches, in part to take advantage of the new measurement capabilities provided by the AMISR radar, which was recently installed at Poker Flat. The campaign represents the first extended operation of the new incoherent scatter radar instrumentation at that site. A number of other radar and optical instruments were also operated during the campaign. The rocket experiments had a variety of objectives, but common themes were investigations of Joule heating, neutral circulation, and small-scale structure in the plasma and neutral flow. The campaign provided an exceptionally detailed view of the neutral dynamics, electrodynamics, and plasma physics of the high-latitude thermosphere and ionosphere. The workshop will deal primarily with the measurements obtained during the 2007 campaign, although other measurements or results that are relevant to the objectives of the campaign will also be included, as appropriate.

Friends of Arecibo

Anasazi North, Tuesday, June 26, 2007, 1:00 – 3:00 pm – video conference

Convener:

Sixto Gonzalez, Arecibo Observatory

There will be a videocon starting at 1 PM for about 1 hour in length on Tuesday with Arecibo Observatory for a town hall meeting of visiting NSF managers and Observatory staff related to the astronomy senior review. This review recommended a two-stage reduction in funding for the astronomical activities at Arecibo Observatory from \$10.5 million per year to \$8 million and finally to \$4 million. How can the Observatory continue to run with only \$4 million per year for astronomical activities? The videocon will explore all possible options.

CEDAR Lidar Technology Workshop

Zia, Tuesday, June 26, 2007, 1:00 – 3:00 pm

Conveners:

Xinzhao Chu, University of Colorado at Boulder
Joe She, Colorado State University
Gary Swenson, University of Illinois at Urbana-Champaign

Resonance and Rayleigh lidars have the unique capability to provide high-resolution, range-resolved measurements of fundamental atmospheric parameters in the middle and upper atmosphere. These lidar measurements have made great scientific contributions to the CEDAR and Aeronomy community on dynamics, structure, composition, chemistry, microphysics, inter-hemispheric difference, and global trend, etc. Supported by NSF, a Consortium of Resonance and Rayleigh Lidars (CRRL) has been established in August 2006, and a lidar Consortium Technology Center (CTC) within CRRL is being developed in Boulder, Colorado. Through collective effort of CRRL and CEDAR community, our goals are to ensure each lidar group reaching the highest technology potential with maximum science return, to advance lidar technology to the next generation and extended measurement range, to reach out to the CEDAR community to increase the usage of lidars and lidar data, and to train next-generation lidar researchers.

This workshop will focus on the CEDAR lidar technology. It will provide an overview of the current status of wind and temperature lidar technology and measurement capability, present the recent technology improvements for transmitter and receiver, and explore the new technology for extending lidar detection to the thermosphere and for measuring wind and

temperature from ground to the mesosphere and lower thermosphere. We will also discuss the CRRL web page and the proposed lidar school.

A brief outline follows:

1. Current status of wind and temperature lidar technology and measurement capability
2. Technology improvement for Na and K Doppler lidars
3. Exploration for extending lidar measurement capability
4. CRRL lidar web page and proposed CEDAR lidar school.

I-T challenges based on continuous observations through the IPY (or PRIMO II)

Zia, Wednesday, June 27, 2007, 9:30 – 11:30 am

Conveners:

Jan Sojka, Utah State University

Tony van Eyken, EISCAT Scientific Association

Craig Heinselman, SRI International

John Holt, Massachusetts Institute of Technology

The International Polar Year (IPY) has begun. On March 1, 2007 an extremely aggressive ISR observational campaign began. The European EISCAT and NSF AMISR Incoherent Scatter teams are planning on running the EISCAT Svalbard and AMISR Poker Flat ISR on a low duty cycle continuously for the IPY. The NSF's other ISR facilities will complement this unique data base with, where possible, twice per month 32 hour runs. As these observational data streams grow and scientific analysis proceeds, the stage is set for a particularly exciting community wide, observation-model-theory challenge.

The IPY occurs during a period of extremely weak geomagnetic activity; hence, the conditions are ideal to investigate how coupling from the lower atmospheric regions affects the ionosphere and thermosphere (I-T). This is an invitation for all I-T modelers to get involved in modeling the IPY, forecasting the remaining IPY period, and comparing their results with others, both models and observations.

This workshop will promote a "PRIMO" format in that all modelers and observers including, but not limited to, the above mentioned ISRs are relevant participants. At this kick-off workshop the observing community will provide an overview of the first 3 months of IPY including an exposé of the unexpected. The modelers will be given the opportunity to identify themselves as well as present their first predictions for the IPY year long observations. The open workshop format is then to take input and debate from those present. It is hoped that this is the first of several such workshops over the IPY period. Although focused on the unique high latitude IPY aspect, the relevance to eGY and IHY is appreciated and not excluded.

To get involved, contact Jan Sojka at: sojka@cc.usu.edu, or one of the other organizers. (If you are too young to know about PRIMO, definitely attend.)

Radar chain, satellite observations and modelling of Nov 2004 storm

Sunset, Wednesday, June 27, 2007, 9:30 – 11:30 am and 4:00 – 6:00 pm

Convener:

Mike Kelley, Cornell University

A number of superstorms have been studied in the last five years including the Bastille Day and Halloween events. The November 2004 event is unique in that World Day operations occurred in the last half of the storm. Strong evidence exists for periods of over and under-shielding as well as a disturbance dynamo (DD) at the Jicamarca location. A number of effects on generation of equatorial spread F can be related to these electric field variations which included record upward drifts (<120 m/s). Satellite data indicate very low equatorial densities and molecular ions at high altitudes. These and other

factors will be compared to models such as the TIMEGCM and the AFRL spread F predictions. Researchers familiar with other storms are very welcome to participate.

Small Satellites

Anasazi, Wednesday, June 27, 2007, 9:30 – 11: 30 am, pizza lunch, and 1:00 – 3:00 pm

Conveners:

Dave Klumpar, Montana State University

Charles Swenson, Utah State University

Gary Swenson, University of Illinois at Urbana-Champaign

Keen interest in small satellites has been building in recent years based on their intrinsic capabilities to conduct science missions faster and cheaper than systems employing larger spacecraft. Whether individually or in constellations, small satellites represent a unique platform that provides significant scientific return while enabling users to test new technologies or to provide educational and training opportunities for students. This workshop is aimed at promoting the use of small satellites for remote or in-situ upper atmospheric sensing by providing a forum for members of the community to share their results, experiences, and recommendations.

In the morning session, invited talks will describe past and current missions as well as address systems engineering considerations and spacecraft operations, including launch systems and opportunities and funding resources.

Payload design, including novel sensor technologies, supporting CEDAR science will be explored in a series of invited talks during the lunch break following Session I. A pizza lunch will be provided in the Anasazi Ballroom for the audience.

In the afternoon session, the educational opportunities associated with small satellite design, construction, and launch will be described in a series of invited talks. A panel discussion will follow, in which audience members may participate by giving brief presentations (1-2 slides, 5-minute time limit). Those wishing to contribute material should contact Lara Waldrop before June 25.

Optical calibration techniques and issues

Zia, Wednesday, June 27, 1:00 – 3:00 pm, and Anasazi North, 4:00 – 6:00 pm

Conveners:

Susan Nossal, University of Wisconsin-Madison

Jeff Baumgardner, Boston University

Mike Taylor, Utah State University

Accurate calibration is important for comparing observations taken by different instruments, for model-data comparisons, and for acquiring long-term data records. This workshop will address techniques and issues associated with calibration of optical instruments and data. We welcome contributions on a broad range of topics including absolute and relative intensity calibration, line center calibration, inter-calibration of instruments, and approaches and tools for accounting for the influence of factors such as tropospheric scattering and viewing geometry. One of the topics for this year's workshop will be a discussion of the NSF optical aeronomy calibration facility being developed at Boston University. We have extended the workshop to four hours to enable more time for open discussion regarding the development of community strategies for coordinated calibration.

Impact of electric fields during ionospheric storms

Conveners:

Chaosong Huang, Massachusetts Institute of Technology
Tim Fuller-Rowell, NOAA Space Environment Center

Sunset, Wednesday, June 27, 1:00 – 3:00 pm

Magnetic storms can cause very large disturbances in the global ionosphere. The IMF is strongly southward during the main phase of intense storms, and the interplanetary electric field can penetrate to the low-latitude ionosphere. In the equatorial ionosphere, enhanced electric fields move the F-region plasma upward, creating extremely deep depletions of the plasma density over the a large latitudinal range. The ionospheric plasma density is significantly increased at lower midlatitudes on the dayside and near dusk, producing the positive storm phase. Large density enhancements occur in the dusk sector, and an enhanced TEC band extends from the low latitudes to polar cap. Although significant progress has been achieved in these areas, a number of outstanding problems have not been fully understood.

In this workshop, we will discuss the following problems. What are the lifetimes of penetration and dynamo electric fields during the different phases of a storm on the day and nightside? What is the relative importance of penetration electric fields and disturbance dynamo effects in the generation of global ionospheric plasma density disturbances? How can the relative contributions from electric fields and neutral disturbances to ionospheric storms be separated?

Speakers:

- John Foster (MIT): Conjugacy of ionospheric disturbances: what it tells us about stormtime processes,
- Mike Kelley (Cornell University): Suppression of a major SED event by a reversal of the y-component of the interplanetary electric field,
- Stan Sazykin (Rice University) : Modeling penetration electric fields with the Rice Convection Model,
- Naomi Maruyama (NOAA): Relative importance of penetration and disturbance dynamo using a self consistently coupled RCM-CTIPe model,
- Xiaoqing Pi (JPL/NASA): Assimilative modeling of Ionospheric Disturbances Caused by Electric Field Perturbations,
- Joe Huba (NRL): Storm simulation using a coupled SAMI3/LFM model,
- David Anderson (NOAA): Relating Interplanetary-induced Electric Field values with Low Latitude Electric Field values in the Peruvian, Philippine and Indian sectors under promptly penetrating electric field conditions,
- Chaosong Huang (MIT): Penetration electric fields in the evening sector and their effects on the generation of equatorial spread F.

Jicamarca Amigos

Anasazi South, Wednesday, June 27, 4:00 – 6:00 pm

Conveners:

David Hysell, Cornell University
Jorge Chau, Instituto Geofisico del Peru

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 COSMIC 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, the AMISR-7, and a long-baseline interferometer have appeared. The bistatic Jicamarca-Paracas link continues to run, and its exploitation also needs coordination. New optical apparatus may be coming to Jicamarca, and plans for an HF modification facility are taking shape. The status of

educational activities like the visiting scientist program, the intern program, and the upcoming LISN school will be reviewed. Finally, science highlights from the past year will be presented.

Developing a coordinated ground- and space-based community approach to understanding the I-T system

Zia, Wednesday, June 27, 4:00 – 6:00 pm

Conveners:

Tony Mannucci, JPL/Caltech

Larry Paxton, The Johns Hopkins University

The Phase III CEDAR Science Report stresses the importance of satellite measurements and recommends the vigorous pursuit of opportunities for collaboration with satellite programs. Recent developments at NASA suggest that satellite missions are becoming less frequent and there is a significant possibility that recently planned ionosphere/thermosphere missions will be delayed indefinitely. This workshop is to elicit discussion and develop a concrete plan to address CEDAR science by coordinating measurements from the ground and space, in light of these new developments. Several other recent developments are: the NSF Small Satellite Conference, reports from the Distributed Array of Small Instruments, opportunities to collaborate on international missions and announcements of opportunity from NASA planned for 2008. Fundamental unanswered questions in I/T science will be highlighted. How will we address these? What are the science questions that are best served by coordinating ground and satellite observations? In what ways do space-based measurements complement ground-based results? Justifying satellite missions that benefit the ionosphere-thermosphere community requires a cohesive and well-articulated community approach. A dedicated meeting is planned for this fall devoted to ionosphere/thermosphere measurements from space. This CEDAR workshop will begin with 2-3 brief presentations and will continue with a panel discussion. We look forward to input by community members, leading to a set of priorities and action items.

Monday Accompanying Posters:

MAN-01 Michi Nishioka, Temporal and spatial variations of plasma bubble studied with global GPS-TEC data

MAN-02 Richard Eastes, Global-scale Observations of the Limb and Disk (GOLD)

Opportunities for collaborative aeronomical research at Millstone Hill

Zia, Wednesday, June 27, 2007, 7:30 – 9:30 pm

Conveners:

Steve Smith, Boston University

Qian Wu, NCAR

A consortium of institutions - Boston University, Scientific Solutions Inc., HAO NCAR, and MIT Haystack Observatory - are planning to re-establish the optical aeronomical research effort at Millstone Hill. A high-resolution daytime echelle spectrograph and two new Fabry-Perot interferometers will be installed at the facility within the next 24 months, supplementing the Boston University all-sky imager and imaging spectrograph operating currently. In collaboration with the Millstone Hill ISR, the new instrument cluster will yield multi-diagnostic measurements of the mesosphere and thermosphere. Several initial investigations are planned. We are keen to hear from interested imembers of the aeronomy community about being involved in these and any other new collaborative projects at Millstone Hill. To begin with, a series of short (5-10 minutes) talks are planned to introduce the new planned facility and instruments. The second half of the workshop will be a discussion on the planned activities and any new ones offered up.

Friends of Arecibo

Anasazi South, Thursday, June 28, 2007, 1:00 – 3:00 pm

Convener:

Sixto Gonzalez, Arecibo Observatory

The Thursday workshop will begin with a 40 minute discussion of the status of the Arecibo Observatory/NAIC in light of the recent NSF astronomy senior review and the Tuesday videocon. Mike Sulzer will say a few words about the new HF facility. We will then proceed to hearing some highlights from the past year from some of our staff and users including: Nestor Aponte, Pedrina Santos, Shikha Raizada, Asti Bhatt, Mike Nicolls, Jonathan Fentzke, Lara Waldrop, John Noto and Romina Nikoukar

Ionospheric studies using radio occultation electron density profiles

Anasazi North, Thursday, June 28, 2007, 1:00 – 3:00 pm

Conveners:

Kerri Cahoy, Stanford University

Stig Syndergaard, UCAR

Theodore Beach, Air Force Research Laboratory

Ethan Miller, University of Illinois Urbana-Champaign

The radio occultation method retrieves profiles of electron density from 200-400 km altitude (F-region) with high vertical resolution and global sampling. Electron density profiles can be used to study ionospheric phenomena over daily or seasonal time scales that are geographically localized or global-scale.

This tutorial-format workshop covers the fundamentals of how the radio occultation method remotely senses Earth's atmosphere using low-earth orbiting constellations such as COSMIC / FORMOSAT-3 to receive GPS signals. We present specifics of how the UCAR Cosmic Data Analysis Archive Center (CDAAC) retrieves electron density profiles from the radio occultation measurements, followed by a tutorial on how to set up a system to download, read, and analyze data from CDAAC with netcdf and MATLAB. Three exciting examples using electron density follow: (1) assimilating electron density profiles into the GAIM ionospheric model, (2) setting up a system for long-term statistical studies of scintillation using CDAAC data that corresponds to ground site data, (3) fusing radio occultation data with ground-based airglow imagery using Google Earth for visualization of scintillation-causing irregularities in three dimensions.

- 13:00-13:15 - Exploring the solar system with radio occultation (K. Cahoy, Stanford). The planetary heritage, math, and physics behind the radio occultation method, and how it has been applied on earth using GPS and low-earth orbiting satellites.
- 13:15-13:45 - Retrieval of electron density profiles (S. Syndergaard, UCAR). How radio occultation measurements are used to derive electron density profiles at CDAAC.
- 13:45-14:00 - Download and analyze electron density profiles (K. Cahoy, Stanford). Introducing the CDAAC data tool and how to download and analyze electron density profiles using netcdf and MATLAB.
- 14:00-14:20 - Assimilating COSMIC occultation data into a global ionosphere model (JPL/USC GAIM) (B. Wilson, JPL). How the high vertical resolution and global coverage of COSMIC radio occultation measurements will enable ionospheric data assimilation models to specify the 3D ionosphere (electron density altitude profiles) much more accurately.
- 14:20-14:40 - Ionospheric scintillation applications to complement GPS ground site data (T. Beach, AFRL). This application takes into consideration the geometry of selecting useful occultation lines of sight near ground sites, and how you would automate data retrieval from CDAAC for long-term statistical studies.
- 14:40-15:00 - Visualization of ionospheric scintillation (E. Miller, UIUC). Fusing ground-based airglow imagery and estimated scintillation indices from radio occultation receivers to localize scintillation-causing irregularities in

three dimensions, with special emphasis using MATLAB and Google Earth tools. Data from the COSMIC / FORMOSAT-3 mission and a field-aligned airglow imager at Cerro Tololo, Chile.

We welcome our colleagues to bring their own applications and topics for group discussion.

The Global-scale Observations of the Limb and Disk (GOLD) Mission

Zia, Thursday, June 28, 2007, 1:00 – 3:00 pm

Convener:

Richard Eastes, University of Central Florida

The Global-scale Observations of the Limb and Disk (GOLD) mission will provide the first large-scale observations of temperatures in the lower thermosphere, in addition to more familiar measurements such as auroral locations and energy inputs; peak electron densities in the nighttime ionosphere; and atomic oxygen to molecular nitrogen (O/N₂) ratios. GOLD can provide nearly continuous real-time observations of one hemisphere. Combined with the current models of the ionosphere and thermosphere, measurements from GOLD will revolutionize our understanding of the global-scale response of the thermosphere and ionosphere to geomagnetic and solar forcing. The goal of the workshop is to 1) Describe the anticipated observations by the GOLD imager, which is being considered for flight by NASA as a Mission of Opportunity; 2) Examine potential for use of GOLD observations by the CEDAR community; and 3) Examine possibilities for use of ground based observations for validation of GOLD observations. Data and capabilities from the CEDAR community will play a critical role in enabling measurements from GOLD to enhance space weather specification and forecasting capabilities.

Application of SuperDARN radar observations to CEDAR research

Sunset, Thursday, June 28, 2007, 1:00 – 3:00 pm and 4:00 -6:00 pm

Conveners:

Bill Bristow, University of Alaska Fairbanks

Mike Ruohoniemi, Johns Hopkins University Applied Physics Lab

Simon Shepherd, Dartmouth College

Over the past two decades the international network of HF radars, that is now known as SuperDARN (Super Dual Auroral Radar Network), has been making measurements of ionospheric electric fields associated with plasma drifts primarily in the polar F-region ionosphere. The current network of 20 radars (13 in the northern and 7 in the southern hemisphere) are capable of making measurements on spatial scales ranging from less than 100 km to near simultaneous coverage of the high-latitude, and at time scales as low as several seconds. Over these years SuperDARN has contributed greatly to CEDAR science in many ways by providing spatially distributed measurements of electric fields during rocket campaigns, satellite over-flights, and for space weather now-casting.

The network has recently experienced a wave of expansion with a radar pair operated by the University of Saskatchewan, Saskatoon situated to look over the northern magnetic pole and two new radars operated by JHU/APL and Virginia Tech. in the mid-latitude region. As coverage by SuperDARN continues to expand, the opportunities to learn more about the dynamic ionospheric processes that can span these different regions (polar, high-latitude, mid-latitude) increases with the combined use of measurements from a variety of instruments, including SuperDARN.

This session is intended to illustrate the role SuperDARN can and has played in CEDAR research. We are asking for participating from those in the CEDAR community who have used SuperDARN over the years or who would like to learn more about its capabilities.

Following an overview of the SuperDARN system and recent expansions, it is anticipated that a series of brief presentations and discussion be given by researchers using SuperDARN measurements in the areas of space weather, meteor winds, modeling, planetary waves, plasma patches, gravity waves, ionospheric currents, and other related CEDAR science.

Tentative Schedule

- 13:00 - 13:30, Bill Bristow (UAF), SuperDARN overview: technique, history, AMISR, rocket campaigns, Antarctic expansion
- 13:35 - 13:45, Mike Ruohoniemi (JHU/APL), Midlatitude/StormDARN and PolarDARN
- 13:50 - 14:00, Elsayed Talaat (JHU/APL), Planetary Waves
- 14:05 - 14:15, Todd Parris (UAF) and Gwen Bryson (UAF), Meteor Winds and Meteor processing
- 14:20 - 14:30, Bill Bristow (UAF), Gravity Waves
- 14:35 - 14:45, Jan Sojka (USU), Modeling
- 14:50 - 15:00, Open for Discussion
- 16:00 - 16:10, Mike Ruohoniemi (JHU/APL), PMSE/PMC
- 16:15 - 16:25, Stephen Mende (UCB/SSL), THEMIS
- 16:30 - 16:40, Eric Donovan (U Calgary), Substorms
- 16:45 - 16:55, Marc Hairston (UTD), DMSP
- 17:00 - 17:10, Simon Shepherd (Dartmouth), Space Weather
- 17:15 - 17:25, Phil Erickson (MIT/Haystack), Millstone/SuperDARN observations
- 17:30 - 17:40, Shasha Zou (UCLA), Accessing SD data
- 17:45 - 18:00, Open for Discussion and other topics

Other topics to fit in: calibration (Bernhardt NRL), Conductivity from magnetometer/SD (Simon Shepherd), Patches (Cesar Valladares)

Workshop Abstract:

Marc Hairston, *Combining DMSP and SuperDARN observations of polar and midlatitude ionospheric convection*

The two direct means of measuring the ion flows in the ionosphere are with the ground-based radars of SuperDARN and with the in-situ instruments on the DMSP polar-orbiting satellites. Each system has its own advantages and limitations with respect to temporal and spatial coverage. We have been working together for several years comparing the two datasets and working towards a means of combining them in order to provide a more comprehensive view of the ionospheric convection pattern. This talk will review our work examining the polar convection pattern as well as work with the new midlatitude Wallops radar.

Characteristics and causes of MLT spatial and temporal variabilities

Anasazi South, Thursday, June 28, 2007, 4:00 -6:00 pm

Conveners:

Jeng-Hwa Yee, Johns Hopkins University Applied Physics Lab
Elsayed Talaat, Johns Hopkins University Applied Physics Lab

The combination of ground-based and satellite observations under the TIMED/CEDAR program is providing unprecedented spatial and temporal 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. TIMED observations also provide pressure, density, and other geophysical parameters critical to understanding MLT energetics. When combined, these two data sets can provide true mean fields and a higher-time-resolution 3-D picture of atmospheric waves, especially tides, in order to understand the processes that govern MLT coupling to the lower and upper atmosphere and ionosphere. In addition, CEDAR investigators have collected MLT data over almost two solar cycles with >5 years of coincident, continuous TIMED observational data. The focus of this workshop is to foster collaboration between satellite, ground-based, and modeling teams to study the MLT energetics and basic structure, including zonal mean, tides, and planetary waves and the causes of their temporal variabilities (on daily, seasonal, QBO, and solar cycle time scales). We encourage people to present recent observations and research findings that can lead to fruitful collaborations.

Tuesday Accompanying Posters:

- YEE-01 Tao Yuan, Seasonal variations of semidiurnal tidal-period perturbations in mesopause region temperature, zonal and meridional winds above Fort Collins, CO (40.60N, 1050W)
- YEE- 02 Larisa Goncharenko, An analysis of mid-latitude neutral wind in the lower thermosphere: comparison of fall and spring equinoxes
- YEE-03 Amrita Vijay Masurkar, Spectral Characteristics of Neutral Wind in the Lower Thermosphere at Middle Latitudes: Comparison of September 2005 and March 2006 Data

Global observations of the upper atmosphere and ionosphere using coordinated World Days

Anasazi North, Thursday, June 28, 2007, 4:00 – 6:00 pm

Convener:

Wes Swartz, Cornell University

The URSI Incoherent Scatter Working Group (ISWG) will have its usual planning meeting at CEDAR to coordinate the World Day experiments involving the world's upper atmospheric observatories. The procedures for scheduling World Day observations are described at http://people.ece.cornell.edu/wes/URSI_ISWG/RequestingWD.htm, and the other links referenced therein which include a sample proposal. Written proposals are requested for meeting specific research needs using the World Day observations. These proposals should be submitted by June 12 (an extended date). The 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, but all are welcome, especially students.

The global network of incoherent scatter radars (ISR) provides observations of fundamental properties of the atmosphere, ionosphere, and magnetosphere. Use of these radars is open to all qualified scientists, and the data are freely disseminated to a broad community of users for research and in the development and validation of models and instrumentation.

Radar observing time is allocated (1) to individuals or groups through either formal or informal requests to the institutions responsible for operating the facilities, and (2) for World Day observations coordinated through a plan developed annually by the URSI Incoherent Scatter Working Group (ISWG).

The high demand for ISR observations, in particular for extended multi-day and multi-radar operations, requires certain procedures to help ensure that the highest priority scientific research is addressed by the coordinated World Day schedule within the limits imposed by the cost and technical restrictions of ISR operations.

The process begins with the development of a baseline schedule of general-purpose experiments that fall within the operating constraints of the radars. The baseline World Day schedule for 2008 and its updates will be available at http://people.ece.cornell.edu/wes/URSI_ISWG/2008WDSchedule.htm. If you are planning extended duration and/or multiple facility ISR experiments in 2008, you should review this schedule carefully to determine whether your observational requirements can be met by the provisional baseline observations. If not, and if your experiment cannot be easily accommodated through requests to individual radar facilities, you will need to submit a proposal for additional or modified operations to the Chair of the ISWG (see below). The deadline for the receipt of such proposals has been extended to June 12, but the sooner they are received the better. Instructions for preparing your request and a sample proposal are available at: http://people.ece.cornell.edu/wes/URSI_ISWG/SampleWDproposal.doc. If you are unsure whether or not your experiment requires the submission of a proposal, please contact the ISWG Chair or any staff member of an ISR facility. The ISWG will review these proposals along with any external reviews at its usual planning meeting at CEDAR to schedule the World Day experiments for calendar year 2008. The ISWG group will determine how the global network of ISRs can best satisfy the approved observational requests and will ensure that the experimental configurations, numbers of radars involved, time distribution and total time allocated are appropriate for the specified science goals. Although the proposer's presence during this discussion is not required, it is often useful for quick answers to additional answers that arise. Students are also welcomed.

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. (Dr. Wesley E. Swartz, Chair, ISWG of URSI Commission G, wes@ece.cornell.edu, TEL: 607-255-7120)

Lightning effects on the upper atmosphere

Zia, Thursday, June 28, 2007, 4:00 – 6:00 pm

Conveners:

Mark Stanley

Mike Taylor, Utah State University

Ningyu Liu, Penn State University

This workshop will focus on the effects of lightning discharges on the mesospheric and lower ionospheric regions. Results from observational, theoretical and modeling studies regarding the energetic coupling of lightning with the upper atmosphere will be presented. Of particular interest are contributions on thermal, chemical and electrical effects of lightning on the upper atmosphere. Electromagnetic energy provided by lightning discharges in these regions is converted to other forms of energy through heating of ambient electrons. Excitation, dissociation and ionization of neutral molecules during this process modifies the atmospheric environment. Transient luminous events (TLEs-sprites, sprite halos, jets, elves) are a direct manifestation of this modification. New results from experimental and theoretical studies of these phenomena and their related effects will be discussed. New techniques and advances in remote sensing of the upper atmosphere with lightning will also be examined. The workshop will begin with an in depth introduction to the topic as well as presentations regarding the latest research on the modifications of the upper atmosphere due to lightning. This will be followed by a panel discussion on the interpretation of existing data and models. Audience participation in these discussions is strongly encouraged.

Distributed Arrays of Small Instruments (DASI) Workshop

Anasazi, Friday, June 29, 2007, 8:00 am – 5:00 pm

Conveners:

Maura Hagan, NCAR

Michael Kelley, Cornell University

David Hysell, Cornell University

Rod Heelis, University of Texas at Dallas

John Foster, MIT Haystack Observatory

Eric Donovan, University of Calgary

Cesar Valladares, Boston College

Mark Moldwin, UCLA

Melissa Meyer, Michigan Technological University

Jan Sojka, Utah State University

The concept of solving major science questions by deploying a network of small instruments was endorsed by the National Research Council's Space Studies Board in their report, *The Sun to the Earth and Beyond: A Decadal Research Strategy in Solar and Space Physics*. Under the leadership of John Foster, from this committee, a detailed report from a Woods Hole Workshop on DASI science was created. The original DASI concept envisaged a single overarching entity with a high priority science question to be answered. However, this has evolved, at Woods Hole it became evident that DASI means different realizations to different communities. Aeronomy is a case in point with key independent science questions from the mesosphere, D-region, E-region, thermosphere, F-region, topside, as well as M-I coupling that can only be addressed by multi-point measurements.

This workshop provides a forum for these aeronomy communities to identify and discuss science questions and multi-point instrumentation schemes to address them. This workshop builds on last years CEDAR 2006 Workshop Frontier Science Session where over 35 CEDAR science questions were summarized. About 25 of these questions were, in essence, DASI science concepts that could be grouped into at least 3 independent CEDAR topical areas.

The format of the workshop still evolves with a broad outline that includes the following:

- Involve and invite community participation both formally and informally to discuss science questions that need DASI solutions.
- Advance the ideas presented last year in the CEDAR Frontier Science Questions session.
- Hear lessons learned from present day mini-DASI deployments.
- Strategize on how mini-DASI deployments and their infrastructure can be leveraged to create the overarching DASI.
- Hear from International colleagues on deployment issues of DASI beyond the U.S.
- Invite NSF participation and input on time lines and realization strategies.

The workshop provides an open forum for all CEDAR science questions that can potentially be addressed by DASI.

08:00-09:45	DASI Workshop – Morning Session <i>CEDAR Science Challenges for DASI</i> <ul style="list-style-type: none"> ▪ Introduction ▪ DASI Mission Overview ▪ Aeronomy Coupling to the Atmosphere Challenges ▪ Discussion Session I 	<ul style="list-style-type: none"> ▪ M. Kelley, Chair ▪ J. Thayer (CSSC Chair) ▪ E. Donovan (Calgary) ▪ M. Hagan (NCAR) ▪ all
09:45-10:15	---Break---	
10:15-11:30	<ul style="list-style-type: none"> ▪ Aeronomy Coupling to the Magnetosphere Challenges ▪ Discussion Session II 	<ul style="list-style-type: none"> ▪ J. Foster (MIT) ▪ all
13:00-15:00	DASI Workshop – Afternoon Session <i>Instrumentation and Implementation Challenges for DASI</i> <ul style="list-style-type: none"> ▪ LISN -- Lessons Learned ▪ Multi-Instrument Multi-Site Arrays -- Lessons Learned ▪ SuperDARN -- Lessons Learned ▪ International Deployment ▪ Discussion Session III 	<ul style="list-style-type: none"> ▪ C. Valladares and E. Donovan, Chairs ▪ C. Valladares (BC) ▪ E. Donovan (Calgary) ▪ J.M. Ruohoniemi (JHU/APL) ▪ J. Makela (U IL) ▪ all
15:00-15:30	---Break---	
15:30-17:00	<ul style="list-style-type: none"> ▪ NSF Small Satellites and DASI ▪ Assimilation of DASI Data Streams ▪ Discussion Session IV 	<ul style="list-style-type: none"> ▪ TBD ▪ TBD ▪ all
17:00	--- ADJOURN ---	