Issue # 53, March 2008

THE CEDAR POST

COUPLING, ENERGETICS AND DYNAMICS OF ATMOSPHERIC REGIONS

FROM THE CSSC CHAIR

The CEDAR Science Steering Committee (CSSC) welcomes you to the Spring 2008 edition of the CEDAR Post. The Post will undergo a transition over the coming years as Internet options are exercised for its publication. The 22nd CEDAR workshop introduced the use of wiki Internet functionality to organize and compile presentations and workshop material. Although unfamiliar to many of the attendees, the wiki format caught on quickly, enabled more rapid dissemination of information and provided ready access to those unable to attend the CEDAR meeting. We see this trend growing and, as we improve its utility, the wiki format will become an integral part of the CEDAR workshop, CEDAR Post and the CEDAR main website. We anticipate that with time the CEDAR wiki will truly be the collection of pages developed and monitored by the entire CEDAR community in a manner similar to Wikipedia, i.e. WikiCedia. As an "open editing" resource, material on WikiCedia should be considered acceptable for background information and a starting point for students and researchers. We will save the hard science for the peer-reviewed journals.

In addition, CEDAR has more than 20 years of success and it is time once again to initiate a plan for the next decade of CEDAR. The last CEDAR program document, CEDAR Phase III, was completed more than 10 years ago. This document served the important purpose of focusing our science efforts and consolidating resources to attack specific science questions. However, resources have evolved rapidly enabling a new view of geospace. This view is one of global perspective where the geospace environment can and must be analyzed as an entire system. In this issue the next phase of CEDAR is proposed by introducing the concept of "The Integrative Aeronomy Phase."

On behalf of the entire CEDAR community, I would like to thank Jan Sojka for his two-year term as CEDAR chair. Jan's leadership and abiding enthusiasm for all that is CEDAR has insured that CEDAR remain the world leading program in upper atmosphere physics.

Enjoy this Spring 2008 issue of the CEDAR Post!

~ Jeff Thayer, University of Colorado

INSIDE:

We look forward to seeing you at the 2008 CEDAR Workshop
June 16-21 in Midway, Utah!

An Update from NSF

This has been a particularly difficult budget year for the Upper Atmosphere Research Section at NSF. All the programs received a very small increase over last year's budget. As a result, the new funding available for the FY08 CEDAR competition was one of the smallest amounts to date: well under $1M. The Aeronomy Program has been similarly hard hit. The outlook for FY09 is somewhat better but it may well be another difficult year.

We at NSF are working closely with the CEDAR Science Steering Committee to explore ideas and strategies for the future. We are particularly interested in and impressed with the CSSC's ideas on "Integrative Aeronomy", or the systems science approach to our science, and its possible use as a new organizational aid for CEDAR.

As most of you know, the first AMISR deployment at Poker Flat, Alaska, now called PFISR (Poker Flat Incoherent Scatter Radar), has been producing spectacular measurements of the auroral ionosphere since it began operation in January 2007. We are looking forward to deployment of two more antenna faces at Resolute Bay, Nunavat, Canada, late in 2008. This will initiate a new era in studies of the polar ionosphere and its interaction with the magnetosphere and solar wind.

The outlook for Arecibo remains uncertain. While we are confident the observatory will remain operating, there are still significant challenges to overcome. We commend the Arecibo site director and the Space and Atmospheric Sciences group for their tireless efforts in confronting this issue while faced with the budget cuts imposed by the Astronomy Senior Review Committee. ATM has made a commitment to increase its contribution to the Arecibo budget so that the observatory can better meet its future operational costs.

The initiative to establish a new program to support small scientific satellite missions for space weather and atmospheric research has progressed rapidly within the last few months. A solicitation for cube-sat based missions has been drafted and is currently undergoing final review and approval. It is expected to be ready for public release shortly with a deadline for proposals in the mid-May to early June time frame. The first launch opportunity has been successfully negotiated with the Air Force Space Test Program on a Minotaur-IV rocket launch of the STP-S26 mission scheduled for December 2009. This first NSF sponsored nano-satellite will be a "triple (3U) cubesat" and will utilize the Poly-Picosat Orbital Deployer (P-POD) system.

See the following article in this issue of the Post for more details.

~Cassandra Fesen and Robert Robinson, National Science Foundation

NSF 2007 MRI Awards

Tom Slanger
SRI International

MRI: Development of a Compact Echelle Spectrograph for Aeronomical Research

Xinzhao Chu
University of Colorado

MRI: Development of a Mobile Fe-Resonance/Rayleigh/Mie Doppler Lidar

Brett Isham
Inter American University of Puerto Rico San Juan

MRI: Acquisition of a Full-Wave Interferometric Digital Radio System For Space Research and University Education

The NSF Small Satellite Initiative

NSF's ATM division has created a new program to support small scientific satellite missions. The overarching goal of the program is to execute small scientific satellite missions to advance space weather and atmospheric research. Equally important, it will provide essential opportunities to train the next generation of experimental space scientists and aerospace engineers. The program will support the development, construction, launch, and operation of small satellite systems as well as the distribution and analysis of the science data from the missions.

The first solicitation for mission proposals has just been released. It is titled: "CubeSat-based Science Missions for Space Weather and Atmospheric Research." Deadline for proposals for Fiscal Year 2008 is May 28, 2008. The solicitation can be found at the NSF web site.
http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=503172&org=ATM&from=home

To facilitate launch of the satellites as secondary payloads, the focus of the program is on CubeSat-based satellites to be launched in California Polytechnic's standardized CubeSat deployment system, the Poly Picosatellite Orbital Deployer (P-POD). CubeSat and P-POD design specifications and guidance are open-source community standards and can be found at: http://www.cubesat.org. Under this program it is expected that two to four P-PODS will be launched every year accommodating at least as many individual satellite missions.

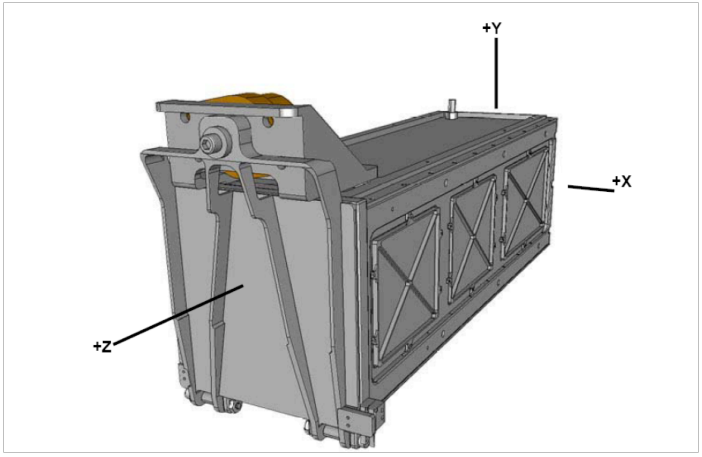
The first launch opportunity for this program has been manifested with the DoD Space Test Program for the launch of one 3U-CubeSat in a P-POD in December 2009. Additional future launch opportunities are being pursued.

Awards funded through the new solicitation will be for science missions to include design, construction, testing and operation of satellites as well as data distribution and scientific analysis. To be considered for an award, proposals must describe complete science missions, including all of the above components. Leverage of other funding sources is allowed and encouraged. The forming of appropriate collaborations that cover all the necessary areas of expertise within space science as well as aerospace engineering is strongly encouraged. Emphasis of the solicitation is on space weather research but proposals for missions within other areas of atmospheric sciences will also be considered.

Launch of the P-PODS will be as auxiliary payloads on DOD, NASA, or commercial launches. This will be arranged directly by NSF and is not part of the solicitation. Likewise the integration of satellites into P-PODS and final testing of the fully integrated payloads to satisfy the requirements of the launch provider will also be handled by NSF independently of the solicitation.

The NSF point-of-contact for the small satellite program is Therese Moretto Jorgensen (tjorgens@nsf.gov)

~ Therese Moretto Jorgensen, National Science Foundation



Poly Picosatellite Orbital Deployer

CEDAR 2007 Postdoc Awards

Title	Institution	Mentor	Postdoc
CEDAR Postdoc: Analysis and Modeling of Breaking Short Period Gravity Waves and Their Effects on the Dynamic Mesosphere and Lower Thermosphere	Utah State University	Taylor, Michael	Jonathan Snively
CEDAR: Post Doc: Signal Processing of O [II] Emission Spectra from Observations	University of Wisconsin-Madison	Nossal, Susan	Stan Briczinski
CEDAR Postdoc: Modeling Studies of Optical Properties of Sprite Streamers and their Chemical Effects on the Upper Atmosphere	Pennsylvania State Univ University Park	Victor Pasko	Ningyu Liu
CEDAR Postdoc: Determination of Charged Dust Characteristics in the Earth's Mesosphere Utilizing Radio Wave Modification	Center For Remote Sensing Inc	Dyrud, Lars	TBD (Chen accepted another position)

CEDAR 2007 Awards

Org.	Proposal	Proposal Title	Institution	PI Name
ATM	0737698	CEDAR: Quantifying Mesospheric Gravity Waves and Associated Temperature Variability Over the Andes	Utah State University	Taylor, Michael
ATM	0737605	Collaborative Research: CEDAR--High Time-Resolution Sprite Imaging	University of Alaska Fairbanks Campus	Nielsen, Hans
ATM	0737294	Collaborative Research: CEDAR--High Time-Resolution Sprite Imaging	United States Air Force Academy	McHarg, Matthew
ATM	0737705	CEDAR: Polar Mesospheric Clouds Using the Whole Atmosphere Community Climate Model 3	University of Colorado at Boulder	Mills, Michael
ATM	0737656	CEDAR: Mesospheric Dynamics with Airglow Imaging, Photometry and Meteor Radar	University of Illinois at Urbana-Champaign	Liu, Alan
ATM	0737713	CEDAR: Remote Oxygen Sensing by Ionospheric Excitation (ROSIE)	SRI International	Kalogerakis, Konstantinos
ATM	0737557	CEDAR: Low and Mid Latitude Imager Observations of Waves and Wave-Induced Phenomena in the Airglow	Aerospace Corporation	Hecht, James
ATM	0737618	CEDAR: All-Sky Mapping of E-Region Neutral Winds Above Poker Flat, Alaska	University of Alaska Fairbanks Campus	Conde, Mark

CEDAR Science Steering Committee Findings

The CSSC met for two days, November 13 and 14, at NSF to plan and organize the CEDAR 2008 meeting and to discuss the future direction of CEDAR. Details regarding the CEDAR 2008 meeting in Zermatt, Utah can be found later in this issue. CSSC members responsible for specific CEDAR 2008 meeting elements are:

- Prize Lecture Lead: Diego Janches and Jeff Thayer
- Poster Session Lead: Diego Janches
  - Assisted by: Rick Doe, Simon Shepherd
- Workshop Lead: Lara Waldrop
  - Assisted by: Joe Huba, Bill Bristow
- Tutorial Leads: Anthea Coster and Jorge Chau
  - Assisted by: John Plane
- Science Highlights Leads: Hanli Liu and Jeff Thayer
- Student Workshop Leads: Jonathon Fentzke and Romina Nikoukar

The CSSC discussed the future direction of CEDAR and concluded with three major findings that will serve to occupy the CSSC over the next few years. These findings will be offered to the CEDAR community for further vetting and, in the spirit of CEDAR, will be a community-involved activity.

Finding #1: Satellite / Ground based Collaborations

Finding #2: Upper Atmosphere / Lower Atmosphere Scientific Ventures

Finding #3: CEDAR: The Integrative Aeronomy Phase

These findings are discussed in the next few pages of the Post and will be topics to be discussed more completely at the CEDAR 2008 meeting.

- Jeff Thayer,
University of Colorado

Finding #1:
CEDAR Support of Satellite/Ground-based collaboration

The CSSC is undertaking an examination of coordinated satellite/ground-based research in hopes of making recommendations to the NSF regarding possible future programs. While it may seem obvious that the NSF should support the good science that such programs will enable, it is important to ensure that programs make the best use of our scarce research dollars. As a first step, the investigation will examine the CEDAR/TIMED collaboration to look for successes and failures, and to look for what lessons can be learned from the program that would improve any future coordinated missions. Through this investigation we hope to develop metrics through which the CSSC can judge potential collaborations and make recommendations to the NSF. Measures of success in our field may include paper production, numbers of student theses, and production of data sets for community use. These are objective criteria that could be readily quantified. In addition to objective measures, we should allow for subjectivity, though perhaps through a structured mechanism. For example, investigators should be allowed to define their own criteria for success, but should provide a means for assessment of these criteria.

Combining observations from satellite instruments with those from ground-based instruments has been a very powerful method for the study of aeronomy. Since the early 1970s when all-sky camera data were used in conjunction with images of the aurora from the DMSP satellites, the strengths of the two techniques have been combined to gain a greater understanding than could be achieved by either observation in the absence of the other. The NSF has supported ground-based collaboration with satellite programs primarily through grants awarded in response to individual investigator's proposals without explicit NSF coordination with the NASA missions. The CEDAR/TIMED program was a departure from this practice and was the first time that a block of funding was allocated for research specifically in support of a satellite mission. Beginning in 1999, a five-year program combined money from NASA with money from the annual CEDAR competition to fund proposals specifically for ground-based support of the TIMED mission. Since that competition, there has been one other mission for which CEDAR support was specifically allocated. In 2006, about $300,000 per year for three years was dedicated to the Air Force C/NOFS mission, which is scheduled to launch in April 2008.

Coordinated research programs will require dedicating a significant portion of the funds from the annual CEDAR competition. Such programs can, however, bring resources to the CEDAR community that would not be available otherwise. CEDAR/TIMED was a five-year program that combined funding from both NSF and NASA and over the course of the program brought $3 million to CEDAR from NASA. In the first year of the program, $500,000 of NSF funding was earmarked from the CEDAR competition. In the following two years, $1 million per year came from NASA with an additional $500,000 per year from NSF. In the fourth year NASA and NSF both contributed $500,000 and in fifth and final year, $500,000 came from NASA with no funding match from NSF. The $500,000 per year commitment from the NSF represented roughly 1/8 of the total annual CEDAR budget. In the initial year, however, one half of the total roughly $1 million of new CEDAR awards were dedicated to the program.

In addition to financial resources, coordinated projects can bring long-term tangible benefits to CEDAR science. TIMED/CEDAR provides a useful example: because of the program, the TIMED investigators felt an impetus to attend the annual CEDAR meeting and have held a workshop at the meeting every year since a year before launch. Attendance of the investigators has enabled more interaction with the CEDAR community and has certainly facilitated communication and collaboration.

Satellite observations bring value to a ground-based investigation by either extending the observational range or the geographic coverage or by providing context. When the ground-based observations are of a similar nature and provide consistent observations over many intervals when the satellites are overhead, the collaboration provides a rich resource for "ground truth" or validation.

Ground/Satellite comparisons of observations from a single orbit pass during a campaign often may provide a tantalizing glimpse into the depths of a problem but more observations provide a deeper understanding. One particular area of collaboration enabled under CEDAR/TIMED was observations in conjunction with ISRs. The ground-based community may have realized through working with TIMED that there is a value in having long-term consistent sets of

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observations rather than collecting data mainly in campaign mode. This collaboration led to long-time continuous observations by the ISRs, such as the World Month observations. These are particularly valuable for satellite collaborations because of the nature of the data. Satellite observations are continuous, but sample a single location only periodically.

While the CEDAR/TIMED mission is considered by most to have been a success, there were frustrations that arose that can provide insights for possible future collaborations. One example is the nature of ground-based investigations versus satellite-based investigations. Many ground-based instruments address the needs of a community that seeks to address narrowly focused science goals. Ground-based instruments tend to have a wide variety of measurement options designed to enable the user to collect data in a mode optimized for their particular needs. Spacecraft instruments generally eschew complexity in favor of reliability. This often meant that modes selected by the ground-based experimenter varied widely from one satellite pass to the next, which made comparisons difficult when the observation mode changed. Satellite instruments often use a single observation mode, or a small set of modes that are cycled nearly continuously. This provides a good basis for comparison of observations at different times.

One major frustration with TIMED was the failure of TIDI to perform as expected during the time when the CEDAR/TIMED program was in operation. Without TIDI, much of the science that could be done with the three remaining instruments, GUVI, SEE, and SABER, was somewhat disconnected. SEE was monitoring the EUV coming from the sun, GUVI was observing UV emissions, which come primarily from the region above about 130 km, and SABER was measuring IR, and was primarily focused below 100 km altitude. It should have been possible to connect the observations using ground-based observations selected for the purpose. The investigations actually selected for CEDAR/TIMED did not necessarily serve this role when one of the four instruments was having difficulties.

Another source of frustration was the timing of funding. CEDAR/TIMED was a five-year program that was slated to begin in 1999 to give time for instrument development and deployment. Because of delays in the launch of TIMED due to the failure of the JASON project to deliver on time, the majority of funding for the CEDAR investigations was expended before any satellite data were available. TIMED data became available soon after launch; so TIMED results were fairly quick in coming. There was even a session at the 2002 CEDAR meeting, just six months after launch, where results were presented. However, because it takes time for a complete, validated data set to be produced and for a new user community to become familiar with and confident in the data, peak use of satellite data often does not occur for some time after the launch. The peak of publication output from missions may occur some five or six years after launch. All of the original CEDAR funds were expended before the prime time for the satellite studies. In addition, the extended missions periods for TIMED have meant that there has been an extended opportunity for collaborations, during which there was not a program for CEDAR/TIMED focused investigations. While it is certainly true that proposers could develop ideas for joint CEDAR/TIMED work, a dedicated program might send a message to the aeronomy community.

Some of the frustrations of the CEDAR/TIMED program might have been unavoidable and should be expected for future missions. Supporting a mission requires planning, and perhaps instrument development or deployment. An investigator may require funding a year or more in advance of a launch. It is not uncommon for launches to be delayed for extended periods, and funding from a typical 3 year NSF grant is likely to be expended during the delays. It may be that a particular mission is considered of such value to the

CEDAR community, that a longer funding cycle would be recommended, or that the program be of long enough duration that investigators could propose for additional funding to support extended mission phases.

Planning for support of missions must occur well in advance of launch dates. The NSF would require at least a year to plan for support, announce an opportunity, and review proposals. When this time is added to the time required by investigators to be funded in advance of a launch, the CSSC should be able to provide recommendations at least two or three years in advance of launch dates. The CSSC should maintain an awareness of upcoming missions and regularly discuss them through emails and at meetings.

Evaluation of CEDAR/TIMED is a first step in the

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process of evaluating future collaborations. We will identify people and/or groups that received NSF funding or NASA funding for the mission and examine how that support furthered CEDAR research goals. Community input will be sought through a forum on the CEDAR wiki, and though a workshop at the upcoming CEDAR meeting in summer 2008.

There is a dearth of new ITM focused missions in the coming years and behooves the CEDAR community to speak out for new ITM space missions. The last ITM mission planned under the Solar Terrestrial Probes line was the Geospace Electrodynamics Connections (GEC) mission, which had broad science goals that would have supported a large data analysis program. The NASA web site for GEC states "Due to recent budget cuts impacting the Solar Terrestrial Probes Program, the Geospace Electrodynamic Connections (GEC) mission is moved outside the near-term (5-year) budget planning window" which means that it is not likely to be launched for several years if ever. Under the Living With a Star line, the Ionosphere Thermosphere Storm Probes (ITSP) mission will address CEDAR science, however it to is not likely to be launched in the foreseeable future. During this time there may be SMEXs and MIDEXs that address ITM science. These missions, however, by their very nature tend to be highly focused. In addition, they are highly cost constrained and have small science teams with limited opportunities for outside participation. Nevertheless, SMEXs and MIDEXs that address ITM science will be of great value to CEDAR and should be supported as much as possible.

The aeronomy community needs to secure representation on the National Academy and work to get ITM missions into the NASA flight program. Strategic missions such as GEC and ITSP usually have yearly science budgets of the order of $4M or more, which would of course provide substantial benefit to the community. A united message from the CEDAR community and the commitment of the community to support future missions would demonstrate to NASA the broad support for ITM science, and could provide the motivation for new missions. This study represents a first step toward developing such a message.

- Bill Bristow, Geophysical Institute; Rick Doe, SRI International; Joe Huba, Naval Research Laboratory and Larry Paxton, The Applied Physics Lab at Johns Hopkins University

Finding #2: Upper Atmosphere / Lower Atmosphere Scientific Ventures

From CSSC's discussion with Cliff Jacobs, NCAR program manager, Anne-Marie Schmoltner, Head of Lower Atmosphere Research Section (LARS) and LARS program manager, Walter Robinson, it is found that there are science topics that are of mutual interest to the lower atmosphere and upper atmosphere communities but very little collaboration. It is also found that the NCAR Earth Observing Laboratory (EOL) facilities can be used to support the observational studies of the lower atmosphere/upper atmosphere coupling. For example, EOL can provide assistance with planning, operation, and logistics support for field deployment of observational facilities. The NSF/NCAR Gulfstream V (or GV, formerly known as HIAPER) has an upward-looking telescope port that can accommodate optical instruments for the upper atmosphere, while making simultaneous lower and middle atmosphere measurements. The NSF deployment pool pays for facility deployment and GV operation, once an instrumentation proposal to NSF is funded.

To further pursue the collaboration between CEDAR and the lower atmosphere community, it is important to identify key scientific questions that could be best addressed by combining the CEDAR and EOL observational facilities and other resources. A CEDAR workshop, with participation from LARS and probably also EOL, is being planned to explore ideas and possibilities.

-- Hanli Liu, National Center for Atmospheric Research

Finding #3: CEDAR: The Integrative Aeronomy Phase

The CEDAR program has maintained its prominence and longevity (for over 20 years) by continuously reviewing, evaluating, assessing and implementing strategic plans that capture the pressing scientific and technical issues of the time. In this evolution there are certain moments where a program shift or a program refocusing is warranted. In the formative years, the CEDAR program shifted and evolved through grass-root efforts by researchers within the upper atmosphere community. This grass-roots mentality continues today and is essential for the program to remain vibrant and current. However, the research has advanced rapidly and complementary technologies, not envisioned as contributors to CEDAR research in past years, are reshaping the research landscape. These exciting developments make CEDAR as essential as ever with the upper atmosphere research community actively spreading their influence into global research arenas that address issues of global change, space weather, satellite environments, cyberinfrastructure, communications, major research instrumentation, major research facilities, and distributed instrumentation, to name a few. However, as our influence expands so must the charter for CEDAR. Presently the questions posed by CEDAR are detailed and specific; however, the CEDAR community must complement these detailed questions with broader, more encompassing questions that involve the integrative role of the upper atmosphere in the entire planetary system. The more encompassing the questions, the further the CEDAR program will grow and open opportunities for other ventures – such as the concept for a Distributed Array of Small Instruments (DASI). This is the basis for the next step of the program, CEDAR: The Integrative Aeronomy Phase.

Sydney Chapman coined the term aeronomy over 50 years ago to establish this area of research as a discipline studying the physics and chemistry of the upper atmosphere. It was recognized during the early formation of the CEDAR program that the upper atmosphere was driven by processes from above and below leading to a strong emphasis on coupling between atmospheric regions. This effort was led by an active instrumentation development phase and the detailed science of the upper atmosphere evolved, embodied by the CEDAR Phase I and II documents.

The CEDAR Phase III document is the latest CEDAR document and was completed more than 10 years ago. This document served the important purpose of focusing our science efforts and consolidating resources to attack specific science questions: Coupling with Lower Altitudes, Solar-Terrestrial Interactions, Polar Aeronomy and Long-term Variations and sub-questions therein. However, resources have evolved rapidly enabling a new view of geospace. This view is one of global perspective where the geospace environment can and must be analyzed as an entire system if we are to fully understand its response to external and internal stresses and its subsequent impact on other parts of the whole earth system. This holistic view is certainly underway in other parts of the Earth system and in other disciplines. The Integrative Aeronomy Phase is to provide a plan for CEDAR in this new and evolving research landscape. Integrative Aeronomy is the study of the physics and chemistry of the upper atmosphere and its integrative role in the planetary atmosphere-space system. The integrative aspect enables broader and more encompassing questions to be addressed. This is not to state that integrative activities have not been ongoing within CEDAR but that, as a program, a more explicit statement and unified direction is the goal.

A discussion of this nature began at the CEDAR-DASI 2007 meeting in the Friday morning DASI workshop. Presentations by Jeff Thayer, Eric Donovan and Maura Hagan emphasized the need for CEDAR to take a systems science perspective. Probably the most well developed holistic approach has been in the study of the human body. Today, cognitive system science and integrative physiology disciplines focus on the integrative function of the body at the molecular, cellular, tissue, and organismic levels, i.e. cross-scale coupling. These disciplines use a system science approach to address such issues as the body's response to external stresses and the internal processes that serve to regulate the system. A system science approach to geospace has strong parallels to these disciplines and these more familiar concepts can be used to explain to the broader public the need to study the geospace environment.

Framed in the integrative aeronomy approach, broader questions begin to emerge that put in context the specific science problems addressed by the CEDAR Phase III document.

Continued…

Suggested science questions would be:

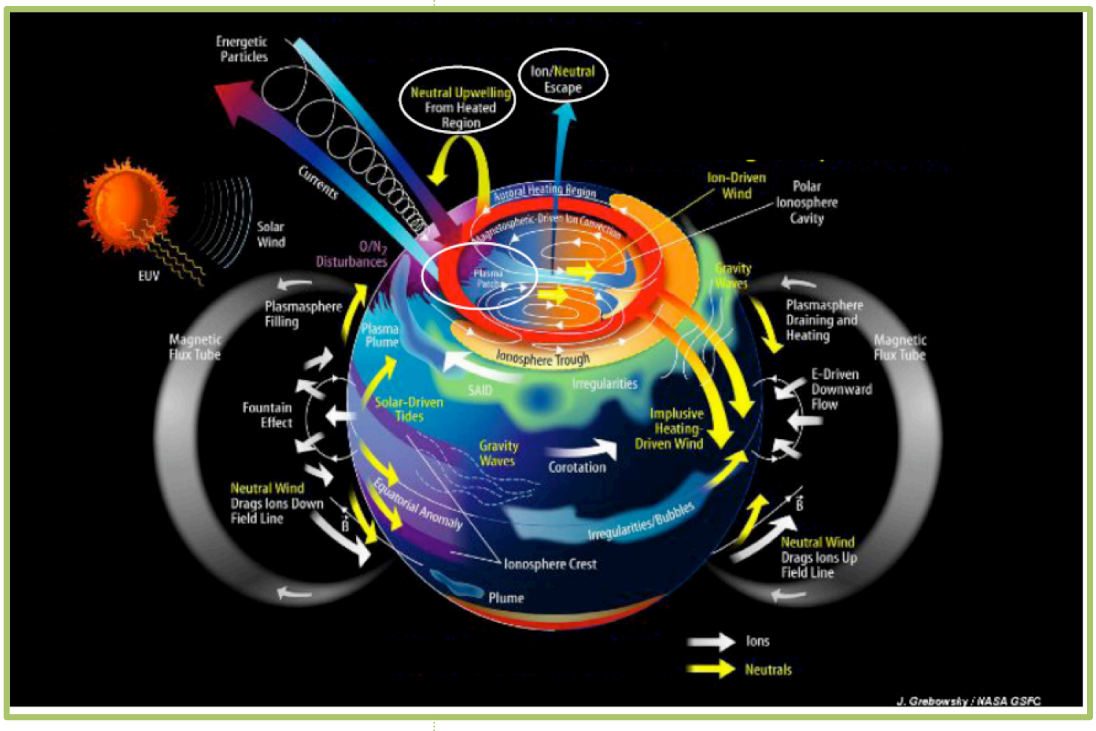
- How might preconditioning and regulatory circuits within the geospace system serve to process the external stresses imposed by solar disturbances?

- How do positive and negative feedback processes act to maintain stability in the geosystem in spite of these often-variable external influences?

- How is energy deposited and distributed through the geospace environment?

These questions involve the upper atmosphere but have relevance to others working in the lower atmosphere or magnetosphere. In fact, it requires their involvement to address these questions. These broader questions also encompass the more detailed questions posed by the Phase III document and the more recent 2006 Frontiers workshops that spawned over 30 specific science questions for CEDAR study.

It is important that we begin to formulate these broader questions, as they will undoubtedly move the CEDAR program forward and in step with similar approaches being taken by other Earth systems programs, such as in the atmosphere-ocean-ice research programs.



Once the broader science endeavor of the CEDAR Integrative Aeronomy Phase is established, enabling technologies and infrastructure can be developed that considers the needs and specific functionality required by the science. This is the systems engineering approach to the problem. Systems engineering is defined as an interdisciplinary approach and means to enable the realization of successful systems or networks. It focuses on defining needs and required functionality of the system early in the development cycle, documenting requirements, and then proceeding with design synthesis and system validation while considering the complete problem. Systems engineering has evolved into a discipline as it relates to applying engineering techniques to the engineering of systems. The DASI initiative has elements of this approach. The selection and deployment of DASI instruments must insure their capabilities and strategic deployments cover the needs of the system – in this case the state measurements of the geospace environment and its external influences and internal processing. Thus, the Integrative Aeronomy Phase of CEDAR must be developed to enable a broader and more extensive role of upper atmosphere physics that will naturally lead to demands for more extensive observing networks, modeling efforts, new collaborations and exciting new science.

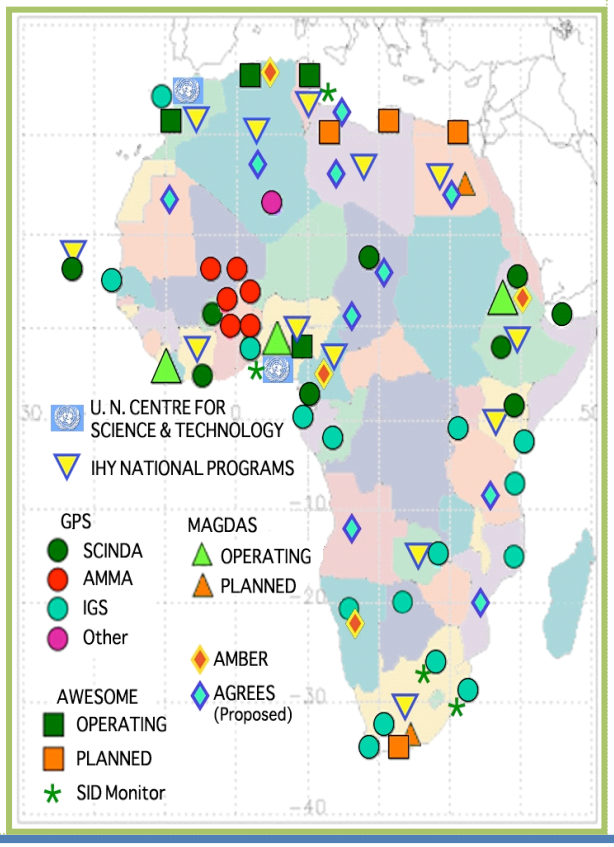
-Jeff Thayer, University of Colorado

Community Corner

Report on the IHY-Africa Space Weather Science and Education Workshop, Addis Ababa, Ethiopia, 11-16 November 2007

The IHY-Africa Space Weather Science and Education and the SCINDA 2007 Workshops were organized and hosted by Addis Ababa University, Bahir Dar University and the Ethiopian Physical Society. The Workshops were held during 11-16, November 2007, at Ghion Hotel in the city of Addis Ababa, Ethiopia. Under the auspices of IHY, the Workshops were conducted in cooperation and collaboration with eGY, AMMA and AFREF. We are privileged to acknowledge generous financial support of NASA, NSF, EOARD, ICTP, AFOSR, ONR, AFRL, CAWSES and COSPAR. There were 63 African scientists, including several post-docs and graduate students, representing 20 different African nations and 40 scientists representing the other nations of the world. Several post-docs and graduate students were part of the US contingent. NSF was responsible for funding many of our US colleagues. The International Scientific Organizing Committee was Co-Chaired by Sunanda Basu, Boston University and Tim Fuller-Rowell, NOAA.

The objectives of the workshops were to facilitate scientific interaction and promote space science and education in Africa. The space science community is currently exploring ways to increase the observational infrastructure in the African sector, and to encourage scientists in sub-Saharan Africa to become involved in the near-space science objectives and to host instruments at their institutions. The new observational infrastructure will facilitate the study of space weather, spark interest in space science education and research, and encourage the next generation to become interested in the space sciences. The deployment of many such instrument arrays, like GPS receivers, magnetometers and low frequency receivers, has already been initiated as shown below in the map of Africa. The first experimental campaign using these instruments will be undertaken during the IHY-supported Whole Heliosphere Initiative (WHI) covering the solar Carrington rotation 2048 period of March 20-April 16, 2008.



- *Sunanda Basu, Boston University*

Awards, Achievements and Accolades

Congratulations to Tim Killeen for his election to the National Academy of Engineering.

Congratulations to Jeff Forbes (CU) Tom Slanger (SRI) and Tony Lui (JHUAPL) for their election to the 2008 class of new AGU Fellows.

Congratulations to Ronald Woodman for his election as a foreign associate of the US National Academy of Sciences.

Community Corner

CEDAR Workshop 2008

The 2008 CEDAR Workshop will be held at the Zermatt Resort in Midway, Utah beginning on Monday, June 16 with the Student Workshop. This year's student theme is Space Weather. CEDAR Plenary sessions and regular workshops will begin on Tuesday, June 17 and end early in the afternoon of Saturday, June 21. An NSF-sponsored Space Weather Modeling Workshop involving the CEDAR / GEM /SHINE communities will take place all day on Sunday, June 22.

The joint GEM/SHINE meeting will also be at the Zermatt Resort with their student workshop beginning on Sunday, June 22. Their regular meeting will take place Monday, June 23 through Friday, June 27.
CEDAR will return to the Eldorado Hotel in Santa Fe, New Mexico in 2009 from Sunday, June 28 (Student Workshop) to noon on Friday, July 3.

Please continue to submit your announcements and any achievements/congratulations to the Post editor at Jeffrey.Thayer@colorado.edu.

Awards, Achievements and Accolades

Thank you to Sunanda and Santimay Basu who have established an endowed fund with a generous nucleus gift to support an International Early Career Award in Space Physics. The award will cover expenses for an outstanding young scientist from a developing nation who has worked under particularly difficult circumstances to present a paper at the Fall AGU Meeting. Jonathan Makela, from the University of Illinois, has kindly agreed to serve as chair for the selection committee.

Congratulations to Jan Sojka, elected to serve as President-Elect of the Space Physics and Aeronomy Section of AGU for the term starting July 1, 2008.

Community Corner

The Second AMISR Science Planning Workshop

June 20 – June 21, 2008
Zermatt Resort

The Second AMISR Science Planning Workshop is scheduled for June 20-21,2008, at the Zermatt Resort in Midway, Utah. The workshop will be held in conjunction with the 2008 CEDAR/GEM meetings, also at Zermatt Resort.

The purpose of this AMISR workshop is to highlight results from the first year of operations at Poker Flat AMISR (PFISR), provide an incoherent scatter basics tutorial, explain user access to AMISR data, and discuss plans for future operations at the Resolute Bay AMISR (RISR).

The Friday afternoon and Saturday morning sessions will be part of the CEDAR workshop, but all abstracts, including those for Saturday afternoon, can be submitted through the 2008 CEDAR registration website (when it is available) at http://cedarweb.hao.ucar.edu/wiki (click on 'Workshops' and 2008).

This AMISR science planning workshop is the second in a series of workshops planned to explore the range of science objectives that can be achieved with this new NSF facility. The First AMISR Science Planning Workshop was held in 2006 (prior to the start of PFISR operations) at Asilomar Conference Grounds near Monterey, California. Information on the first meeting, and other AMISR news, can be found at http://www.amisr.com.

ORGANIZING COMMITTEE:
Elizabeth Kendall, SRI International
Anthea Coster, MIT Haystack Observatory
Phil Erickson, MIT Haystack Observatory

PLEASE SEND ALL CORRESPONDENCE TO
amisr-workshop@sri.com.
WORKSHOP WEB SITE:
http://www.amisr.com/meetings/2008/

The Center for Integrated Space Weather Modeling Summer School 2008

Space Weather Phenomena, Consequences, and Modeling or Reality, Harsh Reality, and Virtual Reality

July 21 - August 1, 2008
Boston University

The 8th Center for Integrated Space Weather Modeling (CISM) Summer School will be held at Boston University from July 21 to August 1, 2008. The school will closely follow the model of the previous successful Summer Schools, which comprehensively immersed students in the subject of space weather, what it is, what it does, and what can be done about it. The CISM summer school supplements standard curricula relating to the physics, meteorology, and climatology of space with integrated overviews of the solar-terrestrial weather system from the Sun to the earth, its effects and consequences, and the state of the art in modeling it. A unique feature of the school is a series of three-hour computer labs where students use results from models developed by CISM to understand the space environment and to make space weather predictions. The team of instructors will be led by Jeffrey Hughes, Ramon Lopez, John Lyon, and Harlan Spence.

The school is intended primarily for students about to enter graduate school in the space sciences or early in their graduate careers. However, others with a professional interest in space weather have also attended and benefited from earlier schools. Further details and application materials, including a request for financial support, can be found on the CISM web site at www.bu.edu/CISM/ Applications are due by May 1. CISM is an NSF Science and Technology Center.

CEDAR Workshop 2007

Summary of the 2007 CEDAR-DASI Workshop

The CEDAR (Coupling, Energetics and Dynamics of Atmospheric Regions) Workshop for 2007 was held at the Eldorado Hotel in Santa Fe, New Mexico from Sunday June 23 through Thursday June 28, with Friday June 29 as the day for the DASI (Distributed Arrays of Small Instruments) Workshop. A total of 300 participants, 65 coming to CEDAR for the first time, came from 73 institutions, 13 outside the United States and Puerto Rico. There were 47 universities, 18 laboratories, and 8 small businesses. Of the 113 CEDAR students and post-docs, 21 were undergraduate students, and 6 came from universities or labs in Taiwan (1), Japan (2), Peru (1) and Korea (2).

This year, we instituted a wikipedia for the workshop available to all participants to upload their presentations and link them via editing, or to make comments on the Forum (http://cedarweb.hao.ucar.edu/wiki). Workshop conveners are encouraged to edit their workshop descriptions on the wiki in order that these descriptions, linked presentations, and forum comments become their final workshop reports. A draft of the 2008 CEDAR Workshop at Zermatt Resort in Midway Utah is also on the wiki. Many other sections of the CEDAR web pages have migrated to the wiki where members of the community can edit them.

The theme of the Student Workshop on Sunday was 'Winds in the Upper Atmosphere', arranged by Romina Nikoukar of the University of Illinois. The keynote tutorials were given by Jeffrey Forbes of the University of Colorado on 'Dynamics of the Thermosphere' and

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Arthur Richmond of HAO/NCAR on 'Neutral Winds and their Role in Ionospheric Electrodynamics'. These talks and others are available in PDF form on their respective session pages. After 4 PM, the students had free time for soccer in the park, or swimming and volleyball at the Fort Marcy Recreation Center under the direction of Michael Nicolls of SRI, who was the second year 'student' on the CSSC (CEDAR Science Steering Committee). Michael also arranged a workshop aimed at students featuring Peter Fiske who spoke on 'Putting your Degree to Work'. Peter's book, 'Put Your Science to Work: The Take-Charge Career Guide for Scientists' published by AGU was available at the workshop and could be ordered. The new student representative joining Romina is Jonathan Fentzke of the University of Colorado.

The CEDAR Prize Lecture was given in the Monday plenary session by John Plane of the University of Leeds in the UK on 'Meteoric Smoke - Where on Earth is it?'. For the first time, the tutorials were arranged around the MLT (Mesosphere-Lower-Thermosphere) theme of the Prize Lecture. Three tutorials were presented on the following days by Diego Janches of Colorado Research Associates ('The Micrometeor Flux in the MLT'), David Siskind of the Naval Research Laboratory ('State of the Art of Modeling the Mesosphere'), and John Meriwether of Clemson University ('State of the Art in Mesosphere Science'). These talks, the student keynote lectures, and supplementary materials are available in PDF form at http://cedarweb.hao.ucar.edu/wiki. These six long talks were videotaped and are available on DVDs. Please contact Barbara Emery (HAO/NCAR, PO Box 3000, Boulder CO 80307) if interested in obtaining hard copies and/or DVDs.

Miguel Larsen of Clemson University gave a science highlight on 'An Overview of the 2007 Poker Flat Sounding Rocket Campaign' and Craig Heinselman updated the community on the status of AMISR at Poker Flat (PFISR). Peter Fox of HAO/NCAR spoke on the 'CEDAR Database Update and Virtual Observatories'. Richard Behnke of NSF informed the community about NSF and the NSF Small Satellite initiative. This was followed by a workshop on Small Satellites on Wednesday that included a working pizza lunch.

We heard four CEDAR Post-Doc reports by Endawoke Yizengaw of the University of California in Los Angeles on Monday, Mitsum Eijiri of Utah State University on 'Momentum fluxes of mesospheric gravity waves and the background wind', Joseph Comberiate of Applied Physics Laboratory at the Johns Hopkins University on 'Coordinated Space-Based Observations of Equatorial Plasma Bubbles Using TIMED/Global Ultraviolet Imager (GUVI) and Defense Meteorological Satellites Program', and Ningyu Liu at the Pennsylvania State University on 'Modeling Studies of Optical Properties of Sprite Streamers and Their Chemical Effects On the Upper Atmosphere'.

Including the Student and DASI Workshops, there were 27 workshops total, one less than last year. Final reports for most of the specific workshops will be at: http://cedarweb.hao.ucar.edu/wiki.

There were 119 posters at the Monday and Tuesday poster sessions, including 74 student posters (14 less than last year), of which 59 took part in the student poster competition. Prizes were a certificate and a selection of classic books, most donated by Alan Peterson of Whitworth College. The judges picked first place winners from each session, Matthew Zettergren (POI-03) of Boston University who chose the two-book set by Banks and Kockarts, and Jeremy Riousset (SPR-01) of the Pennsylvania State University who chose a book by Houghton. The second place winners were Chad Carlson (ITI-04) of the University of Illinois (Chamberlain aurora book), and Ashley Wiren (MLT-01) of the University of Colorado (Humphreys book). Honorable mentions were Tzu-Wei (Vicky) Fang (EQU-03) of the National Central University in Taiwan who is visiting at NCAR (Johnson and Killeen edited book), Shasha Zou (STI-04) of UCLA (Omholt book), Chunmei Kang (MLT-04) of the University of Colorado (Brasseur and Solomon book), and Alexander Hassiotis (GWM-02) of the Pennsylvania State University (Gossard and Hooke book). A special undergraduate award was also given to Roger Varney (GWI-02) of Cornell University (Deepak book). Thanks to Alan Peterson and all the judges who spent so much of their time judging the posters.

We took a 48-passenger bus from Boulder, Colorado to Santa Fe and back with between 8 and 13 passengers. This bus was then used for trips and to take students back and forth between Fort Marcy Suites and the Eldorado Hotel. We took the bus for a shopping expedition at Tin-Nee-Ann's Trading Company on Monday, and to a Santa Fe Destinations tour of Chimayo and the view from White Rock by Los Alamos.

~ *Barbara Emery,*
National Center for Atmospheric Research

The 2007 CEDAR Prize Lecture

CEDAR Prize Lecturer John Plane (U Leeds, UK, right) receives his certificate from CEDAR Science Steering Committee Chair Jan Sojka (USU, left).

This year's prize lecture was awarded to Professor John M.C. Plane from the University of Leeds. Professor Plane is a world leader in modeling the physical chemistry of the mesosphere and lower thermosphere. His work has a tremendous impact on CEDAR science. Professor Plane's modeling work has resulted in the explanation of many observational results, both optical and radar, from CEDAR instruments at all latitudes.

Prof. Plane's prize lecture was titled: Meteoric Smoke: Where on Earth is it? The topic of Prof. Plane's lecture focused on theoretical and observational evidence of meteoric smoke distribution in the mesosphere and stratosphere. He discussed a meteoroid flux and a new model of meteoric ablation. He also discussed the possibility for meteoric dust to serve as condensation nuclei for the formation of ice particles in the polar mesosphere. Prof. Plane also explained the current issues with mesospheric metal layers, satellite retrievals of the Na layer, noctilucent clouds and Space Shuttle exhaust plumes.'

Thank you John for a terrific and informative lecture.

~ *Diego Janches, NorthWest Research Associates, CoRA Division*

Summary of the 2007 CEDAR Tutorials

This year workshop tutorials were selected to provide more in-depth review of the background, state-of-the-art research and knowledge of the topic that was selected for the prize lecture given by Dr. John Plane. Diego Janches (CORA division of NWRA) gave the leadoff tutorial on the topic of meteor observations titled "The micrometeor flux in the MLT". Beginning with a summary highlighting the significant milestones involving meteor observations within the CEDAR community (including his CEDAR postdoc award in 2001), Diego listed the reasons why meteors are of interest to CEDAR: (1) they tell us about the neutral winds and large-scale atmospheric dynamics, (2) they are the source of mass input for various atmospheric phenomena, (3) they allow us to study meteor plasma physics, and (4) they are a space hazard.

The remainder of Diego's tutorial focused on the questions of "How much mass is coming?" "Where is it coming from?" and what is the CEDAR community doing to solve these questions. Diego showed that current models for the mass flux do not accurately predict the total mass input over the range of observations. He then showed that the two questions were actually linked and that source of the meteors had a big impact on the observations. He discussed the importance of understanding observational biases and showed promising modeling results which give good agreement with observations when the relative contributions of the sources of meteors, atmospheric effects and instrument response functions are taken into account.

David Siskind, of the Naval Research Laboratory, presented the second tutorial, entitled "State of the Art of Mesospheric Modeling". It began by discussing the various three dimensional global models of the mesosphere, emphasizing the differences between climate models and weather models. He gave a specific example of each, with the NCAR/WACCM model being representative of the former and the NRL/NOGAPS-ALPHA (Navy Operational Global Atmospheric Prediction System-Advanced Level Physics High Altitude) being representative of the latter. He then gave a brief summary of recent WACCM work in modeling trends in middle atmospheric ozone, temperature and water vapor based upon a recent publication in JGR by Garcia et al. In brief, the simulated trends in ozone and temperature were in good agreement with historical observations, but the water vapor trend was not. This may be due to low frequency interannual atmospheric variability not yet accounted for by the WACCM model.

The rest of his talk was an in depth discussion of recent work using NOGAPS-ALPHA to hindcast unusual mesospheric meteorological conditions observed in recent NH winters. The data come from the NASA/TIMED-SABER instrument and they show a 30 km vertical displacement of the winter stratopause in early 2006 and 2004. These years also coincide with enhanced transport of nitric oxide from the thermosphere to the stratosphere. Siskind summarized several NOGAPS-ALPHA simulations with various different parameterizations of orographic and non-orographic gravity waves. He concluded that the filtering of these waves during the strong stratospheric warming of late January and early February 2006 led to the anomalous mesospheric wind and temperature patterns. Since the filtering of mesospheric gravity waves is governed by the large scale stratospheric flow and since these waves, in turn, ultimately impact the degree to which NO from the thermosphere is transported to the stratosphere, the study of mesospheric variability adds a new paradigm to solar-terrestrial studies. Rather than simply considering various solar and geomagnetic cycles, Siskind concluded that one needs to consider the meteorological state of the entire atmosphere as an important mediating factor in solar-terrestrial coupling.

The third tutorial was presented by John Meriwether of Clemson University on the "State of the Art in Mesosphere Science." This talk provided a short summary of the basic fundamentals of the mesosphere and of the instrumental techniques used for mesosphere observations. This topic was chosen by the CSSC for one of the tutorial lectures following the theme of expanding the meteor research presented by John Plane in the prize lecture. The mesosphere is the entry region of meteoric debris. It is a region of 20-30 km thickness with marginal dynamical stability. The dynamics are highly influenced by gravity and tidal waves. This talk also described MLT dynamics in regard to the formation of (1) mesosphere inversion layers (MIL) and (2) instability layers with an emphasis placed upon experimental observations obtained by CEDAR instrumentation such as the lidar and all sky imaging system. The viewgraphs for this lecture, along with additional material on this subject, are available on the CEDAR website.

~Bill Bristow, Geophysical Institute; Anthea Coster, Haystack Observatory and Simon Shepherd, Dartmouth College

Summary of the 2007 Student Poster Competition

Anthea Coster, Rick Doe, and Diego Janches of the CSSC, with the help of Barbara Emery, Susan Baltuch, and the support of the 11 volunteer poster judges organized this year's poster competition. The competition was organized so that each poster was seen by a minimum of two judges, and each student had at least one judge stopping by their poster to discuss it with them. There were a total of 59 student posters (of approximately 120 posters in total). There were 28 posters in the Ionosphere-Thermosphere-Magnetosphere (ITM) section and 31 posters in the Mesosphere - Lower Thermosphere (MLT) section. Eight undergraduate students participated in the competition. One student Roger Hale Varney of Cornell University was recognized with a special undergraduate award, for the poster: "Observations of Electric Fields Associated with Internal Gravity Waves." In addition, this year each section had a second place winner and two honorable mentions.

First Place:

MLT - Jeremy Andre Riousset, "Physical Mechanisms of Blue Jets and Gigantic Jets", Pennsylvania State University

ITM - Matthew Zettergren, "The Aeronomy of Auroral Ion Upflow", Boston University

Second Place:

MLT - Ashley Wiren, "E-Region Ion Motion and Related Thermospheric Properties", University of Colorado

ITM - Chad G. Carlson, "A 1083 nm lidar for observations of temperature in the upper thermosphere", University of Illinois at Urbana-Champaign

Honorable mentions:
MLT - Chunmei Kang, University of Colorado
MLT - Alexander Hassiotis, Pennsylvania State University
ITM - Tzu-Wei Fang, Institute of Space Science, Taiwan
ITM - Shasha Zou, Univ of California at Los Angeles
Special Undergraduate Award – MLT – Roger Varney, Cornell University

The poster judges recognized a number of very high quality posters this year making the decision process difficult. Nevertheless, they provided their opinions as to what factors, other than the quality of the research, that were important to them in their judging. Their advice to students who plan on entering next year's competition is given here:

- Show up to competition.
- Don't make graphics too small.
- Graphs need captions.
- Labels must be legible.
- Text should be visible from 3 feet away (including axes).
- Poster objectives should be prominent.
- State the methods in your abstract.
- Don't cram an entire JGR paper onto poster.
- Each section should be summarized.
- Do a dry run and proof read poster.
- Posters should be both stand-alone and complement the oral presentation.
- Include historical context and highlight this at the outset.

We would like to thank Barbara Emery, our judges, and all of the students who participated in this year's competition.

- Anthea Coster, Haystack Observatory; Rick Doe, SRI International and Diego Janches, NorthWest Research Associates, CoRA Division

Summary of the 2007 CEDAR Student Workshop

This year's Student Workshop was entitled "Winds in the Upper Atmosphere – Physics, Observations, and Empirical Models". The basic idea was to target CEDAR newcomers and provide them with a broad overview of various elements that make CEDAR such a multi- disciplinary field. We chose neutral winds as the focal theme since they play a significant role in the electrodynamics of the upper atmosphere. Neutral winds are strongly linked to plasma processes and they are difficult to measure; as such, they remain an active topic of research.

The workshop started with two keynote speeches in the morning. Jeff Forbes (University of Colorado) delivered the first keynote speech entitled "Dynamics of Thermosphere" which provided an overview of the neutral dynamics of the upper atmosphere. The second keynote speech was given by Art Richmond (National Center for Atmospheric Research) and was entitled "Neutral Winds and Their Role in Ionospheric Electrodynamics". The presentation primarily focused on ion-neutral interactions, the ionospheric wind dynamo, and thermospheric-ionospheric coupling.

The afternoon workshop started with a series of tutorials on wind measurement methodologies. In particular, presentations were given on Rocket-based measurements (Miguel Larson from Clemson University), Meteor radar wind experiments (Scott Palo from University of Colorado), Lidar wind observations (Chet Gardner from University of Illinois) and Fabry-Perot wind measurements (John Meriwether from Clemson University). The main motivation behind these talks was to introduce students to different instruments, measurement techniques, and data as well as their relationship to the physics of different regions. The final tutorial of the Student Workshop, devoted to Neutral wind models, was provided by John Emmert (Naval Research Laboratory**).** Empirical wind models, in particular the Horizontal Wind Model, were the main focus of the presentation, although physics-based models were also discussed.

~ *Romina Nikoukar,*
University of Illinois Urbana-Champaign

Sunday 24 June 2007 CEDAR Student Workshop, Tutorial by Jeff Forbes (U of Colorado)

Summary of 2007 CEDAR Topical Workshops

The workshop organizers have provided these reports. Complete details of the workshop can be found at http://cedarweb.hau.ucar.edu/wiki.

Monday, June 25

Short period gravity waves and their effects in the MLT region with conveners Jonathan B. Snively, Tai-Yin Huang, and Michael J. Taylor

Organized with the goal of reviewing new results from recent years, this workshop consisted of five very interesting presentations on gravity waves and their effects in the mesosphere and lower-thermosphere (MLT). Focus was placed on the behavior and effects of gravity waves of relatively small scale, and short period. These talks, given by David Fritts, Gary Swenson, Richard Walterscheid, Robert Schunk, and Yonghui Yu, covered a range of relevant topics, including numerical and theoretical modeling, calculation of wave properties and effects from airglow data, effects of acoustic and evanescent waves, wave influence on the ionosphere, and gravity wave ducting, respectively.

Gravity waves comprise a significant fraction of wave energy and momentum at MLT altitudes. Their excitation and propagation are strongly dependent on the larger scale atmospheric structure, dynamics, and variability at all altitudes. Their momentum and energy flux contributions are controlled by these large-scale dynamics, and likewise influence these dynamics. Short-period gravity wave processes and effects are studied principally at local scales, via all-sky airglow imaging, and numerical and theoretical modeling. This provides a detailed local-scale perspective, from which we can estimate global-scale effects. Similarly, three of the presentations focused on numerical model results, one focused on analysis of airglow data, and one on the integration of gravity wave forcing with ionospheric models.

Dr. Fritts presented "High-frequency gravity wave propagation and dissipation in the MLT", and discussed high-resolution numerical results for three-dimensional simulations of breaking gravity waves. It was noted that wave instability and breakdown could occur even below convective instability, generating both turbulence and secondary wave motions.

Dr. Swenson presented "Gravity waves and vertical wavelength from airglow phase", describing a model for the calculation of gravity wave vertical wavelength, damping rates, and momentum flux. Rather than relying on a single airglow layer at one altitude, this approach uses multi-layer image data and chemistry models to determine vertical structure.

Dr. Walterscheid presented "Acoustic waves and acoustic wave processes in the lower thermosphere", on localized ionospheric heating by dissipation of vertically propagating acoustic waves. Acoustic waves may be excited at lower altitudes by turbulent flow over mountains, and propagate vertically to produce hotspots as they dissipate. He also presented on the importance of wind and thermal structure in providing strong ducts for large-magnitude "bore" waves.

Dr. Schunk presented "A Thermosphere-Ionosphere-Plasmasphere data assimilation model component for a seamless ocean-atmosphere model". He discussed the use of global-scale weather model data with ionospheric models, to improve ionospheric forecasts

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with the use of realistic lower-atmospheric forcing.

Dr. Yu presented "Ducted gravity waves simulated with their energy flux", and reported numerical simulation results for a spectrum of ducted gravity waves, propagating within model temperature and wind profiles. The vertical energy flux for non-ideally ducted wave packets is found to be periodic, as wave energy propagates between the upper and lower duct boundaries.

We are very much indebted to the speakers, and to the audience, for making this a productive and interesting workshop. Although we opted to eliminate the scheduled discussion time, allowing for longer talks and additional questions, we will look forward to an active panel discussion during the 2008 Workshop.

Tuesday, June 26

CEDAR Lidar technology workshop with conveners Xinzhao Chu, Joe She and Gary Swenson

This is the first lidar technology workshop hosted by the newly established lidar Consortium Technology Center (CTC) under the Consortium of Resonance and Rayleigh Lidars (CRRL), supported by the National Science Foundation. The workshop was structured to provide (1) an overview of the current status of Na (and K) lidars for MLT temperature and wind measurements, (2) recent improvements of Na and K Doppler lidars, and (3) technology exploration for extending lidar detection range. The workshop also discussed the CTC activities and how it will engage the CEDAR community.

The CTC director, Dr. Xinzhao Chu (CU), opened the workshop with an introduction of CEDAR lidar technology to the broad audience. She introduced the physical picture, basic configuration, and arrangement of lidar remote sensing, and then summarized the physical processes utilized in various types of lidars and the physical quantities to be measured by each type of lidar. She reviewed the temperature lidars: Doppler, Boltzmann, integration, and DIAL techniques, and the wind lidars: Doppler wind, direct motion detection, and geostrophic wind techniques. The direct detection Doppler lidar (DDL) has developed into many types, e.g., resonance fluorescence DDL, fringe imaging DDL, scanning FPI DDL, FPI edge-filter DDL, atomic and molecular absorption line edge filter DDL. By introducing so many exciting technologies, she hoped to attract more students and young scientists to the field.

Dr. Chiao-Yao She (CSU), one of the pioneers in Na wind/temperature lidar, gave the keynote lecture of this workshop - a comprehensive review of the Na and K Doppler lidar technologies, measurement capabilities, and scientific achievements. Currently, three Na and two K lidars are being deployed by the CRRL groups, the Arecibo Observatory, and the Leibniz Institute for Atmospheric Physics (IAP) to collect crucial data for the middle and upper atmosphere study. Dr. She's talk not only provided students the fundamental knowledge of Na and K spectroscopy and lidar technology, but also clearly stated where we stand, providing a foundation for the CEDAR lidar community to move forward.

Following this, three speakers talked about the improvements and innovations being made to the resonance fluorescence (Na, K, Fe) Doppler lidars. Dr. Wentao Huang (CU) presented the novel high-resolution Doppler-free spectroscopy being studied at CTC in Boulder, and introduced several new ideas for laser frequency locking using the spectroscopy.

Dr. Alan Liu (UIUC) presented the very good progresses made by the UIUC group for high efficiency receiver for the Na wind and temperature lidar, and the initial data collected by this lidar at Urbana. Dr. Josef Hoeffner (IAP) presented some amazing results obtained by the IAP scanning K and Fe Doppler lidars. On both lidars, he emphasized how to achieve high accuracy, i.e., un-biased measurements. He demonstrated the superb daytime measurement capability, especially for the scanning Fe Doppler lidar operating at 386 nm with three highly stable Fabry-Perot etalons in the receiver and very small field of view (50 mrad). He also reported Doppler wind measurements in the lower atmosphere with the Fe Doppler lidar.

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In the topic of extending lidar detection range, Dr. Rich Collins (UAF) introduced the N2+ lidar being developed at Poker Flat. Chad Carlson, a graduate student of UIUC, presented the lab test results of a Helium Doppler lidar. His initial results are very promising for making a cw-laser-based imaging lidar to measure the wind and temperature in the thermosphere. Dr. Andrew Gerrard (NJIT) reported a spectrally scanning receiver for middle and lower atmospheric wind measurements.

In the last part of the workshop, Paloma Farias and Johannes Wiig, two graduate students of CU-Boulder, reported the CRRL website, lidar simulation tools, and lidar DAQ and control suite being developed at CTC. Finally the workshop discussed a lidar school that CRRL is planning for summer 2009 and hoped to engage more students and researchers in the lidar activities.

Wednesday, June 27

Challenges Based on Continuous Observations Through the IPY (or PRIMO II) with conveners Jan J. Sojka, Tony van Eyken, Craig Heinselman, and John Holt

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 database 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.

Thirty-two workshop participants heard first from the ISR teams concerning the observations already made. IPY began March 1, 2007 and by CEDAR over three months of observations had been collected by European Svalbard Radar (ESR) and Poker Flat ISR (PFISR). Tony van Eyken and Craig Heinselman presented these observations respectively. In addition to these two radars the ISR at Sondrestrom and Millstone Hill are running on a regular schedule of about 32 hours each month and presentation of these observations were made by Craig Heinselman and John Holt respectively. John Holt also provided information that the Irkutsk ISR will be running long duration runs repeatedly during the IPY period. A series of 9 modelers then presented information about their interest and modeling capability for this IPY I-T challenge: M. Codrescu (CTIPe); L. Scherliess (USU-GAIM); L. Goncherenko (Millstone Hill modeling collaborations); D. Pawlowski (Univ. of Michigan); D. Siskind (NOGAPS-ALPHA); P. Richards (FLIP); V. Eccles (IFM); J. Sojka (TDIM); and C. Fesen (TIEGCM).

The workshop focused on how the large quantities of observations would be made easily accessible, i.e., through Madrigal but in higher level formats, for instance ISR level 4 reduced format. Another aspect was how the models should run to best simulate the IPY conditions. A number of resolutions were put forward:
A kp of 2+, F10.7 of 70, and F10.7 average of 70 should be used for climatology year long model forecasts;
Model runs should be made for each of the 5 ISR locations; where possible the NRLMSIS should be used. SuperDARN convection patterns should be made available for all modelers to use as the high latitude magnetospheric electric field driver for the IPY period.

On top of the success and enthusiasm for this IPY International Campaign Tony van Eyken also gave us the good news that his proposal to have an International Space Science Institute (ISSI) set of workshops on this topic has been approved. Hence, the participants will have multi-day dedicated workshop opportunities in Switzerland over the next few years to address the IPY I-T challenges.

Optical Calibration Techniques and Issues with conveners Susan Nossal, Jeff Baumgardner, and Mike Taylor

The CEDAR Optical Calibration Techniques and Issues workshop is becoming an annual opportunity for discussion of methods and strategies for calibration of passive optical instruments. Accurate calibration is important for facilitating inter-comparison between

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data sets, data-model comparisons, and the interpretation of long-term data sets. Careful calibration and accounting for correction factors can be challenging and time consuming but important for acquiring accurate data.

Josh Semeter began this year's workshop with a presentation of the use of an EMCCD (electron multiplier charge coupled device) camera for observations to detect fine scale structure in the aurora. In principle such detectors have no read noise, however the detector must be kept very cold to reduce dark noise. The EMCCD has high time resolution. There is a trade-off between spatial and temporal resolution. Semeter's EMCCD-based instrument is being used to observe the aurora in conjunction with the AMISR campaign.

One of the most exciting advances for the community is the development of a NSF aeronomy optical calibration facility at Boston University by Jeff Baumgardner who led a presentation about the facility at the workshop. The first phase is to provide a calibration facility where filters can be measured and characterized. Filters can degrade in sensitivity and the band pass can shift with time. The calibration facility uses a McPherson Spectrometer to characterize filters at different positions and tilt angles. Researchers are invited to send their filters to Boston University for characterization. Carl Schmidt, who is working with Baumgardner, presented a poster giving a progress report on the Boston University Calibration Facility for Optical Aeronomy. This poster is included on the wiki site for the optical calibration workshop.

The next phase planned for the calibration facility is to develop a portable "standard" spectrophotometer for brightness calibration. The importance of a portable, NIST traceable, spectrophotometer or alternatively a standard lamp was emphasized in a presentation made by Don Hampton of the University of Alaska. The planned Boston University portable spectrophotometer would have a spectral range of 3800-8400 Angstroms and a resolution of 9 Angstroms, suitable for the calibration of imagers and photometers, but not for high-resolution interferometry. Two sources will be built, one of which will be kept at Boston University for cross-calibration purposes, and the other shipped to the instrument to be calibrated.

Baumgardner also discussed a new background subtraction method for subtracting stars and the Milky Way from All-Sky Images. Traditional filtering methods do not work well for subtracting large saturated areas such as the Milky Way. The new method uses a Mercator projection of an all-sky image. A background image is constructed by remapping off-band images to the desired time before subtraction from the on-band image of the observation.

Steve Smith discussed the calibration of the Boston University Imaging Meridional Spectrograph. This instrument is used to investigate the OH layer and temperature at about 87 km. After dark subtraction and flat-field corrections have been applied, the dispersion relationship is determined using known spectral line positions and the absolute brightness is calibrated using a Tungsten reference lamp. Mesospheric temperatures are then calculated using intensity ratios of OH band lines. Smith showed comparisons between mesospheric temperatures obtained from the SABER instrument on TIMED and the Imaging Meridional Spectrograph that showed strong agreement between the two data sets.

Susan Nossal discussed the use of nebular calibration sources for calibrating observations of geocoronal hydrogen emissions over a time period spanning three solar minima. Nebular sources offer advantages of long-term stability, being line emission sources, and minimizing atmospheric corrections as both the calibration and observational sources are outside of the Earth's atmosphere. Observations of nebular sources at different zenith angles can be used to infer atmospheric transmission properties to correct observations for atmospheric extinction. Challenges to using nebular calibration include the requirements for identifying and calibrating a source with the spectral line of interest, accurate pointing and tracking capabilities, viewing of a wide spectral range, and that the nebular sources are not always visible. Nossal also discussed other data quality and correction factors important for multi-year comparisons, including the accounting for hydrogen emissions from the Galaxy that is one of the most important analysis considerations for obtaining accurate geocoronal hydrogen data.

One of the challenges for passive optics calibration is to accurately document methods to facilitate comparison between data sets and to pass on techniques to other researchers. Accurate documentation facilitates the ability of future scientists to compare their observations

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with present day observations. Pam Loughmiller has made important contributions toward addressing these challenges. She gave an overview of a comprehensive and rigorous document that she is writing to describe processing, calibrations and corrections applied to imaging data. Included in this document are procedures for filter characterization, radiometric calibrations to obtain absolute brightness measurements and spatial calibration of imaging data.

Following the presentations and associated discussions was a period of more informal dialogue, including small group discussions. One suggestion was to use the CEDAR wiki as a vehicle for continuing to share information about airglow calibration techniques and issues.

Also included on the CEDAR wiki are resources contributed by John French of the Australian Antarctic Division describing calibration of the OH spectrometer used to acquire a 12-year climatology of mesospheric OH temperatures from Davis, Antarctica. French, who was not able to attend the meeting, also includes a document detailing his calibration of a low brightness calibration source at the National Institute of Standards and Technology in Gaithersburg, Maryland.

Jicamarca Amigos with conveners David L. Hysell and Jorge L. Chau

Users and friends of the Jicamarca Radio Observatory held a workshop to review activities from the past year and to prepare for the upcoming one. The discussions divided into three categories of research: equatorial optical aeronomy, plasma instability theory, and the theory of incoherent scatter at small aspect angles. The session also included reviews of new educational and user support programs and hardware upgrades.

The director of the observatory, Jorge Chau, presented research highlights from the past year including:
New mesospheric wind capabilities using a specular meteor radar (JASMET). This meteor system complements the mesospheric winds obtained with the classical MST mode by allowing nighttime measurements and higher altitudinal coverage (80-100 km, instead of 65-85 km).

Multi-frequency observations of spread F and meteor echoes using the main Jicamarca VHF system and the 7-panel AMISR prototype. The preliminary results indicate that echoes from topside plumes appear to be weaker than expected at UHF.

First clear observations of cats-eye and fossil turbulence structures using the high resolution capabilities of the SOUSY system at Jicamarca. These results are in excellent agreement with recent results from numerical simulations.

New hardware developments: New antennas have been and are being set up for improved north-south interferometric measurements of ionospheric irregularities. Using off-the-shelf digital receiver cards, JRO can now utilize up to 12 digital receiver channels simultaneously, allowing, for example, three dimensional imaging of ionospheric structures with very high angular resolution.

A new generation of optical instrumentation is emerging in Latin America, and this is contributing to research in both background and irregularity physics. John Meriwether reviewed findings from Arequipa and elsewhere concerning the midnight temperature maximum and proposed a model involving convergent thermospheric winds and subsidence. Andy Gerrard presented an update on the SOFDI FPI project, showing promising results from tests conducted in New York. SOFDI will be critical for providing thermospheric wind and temperature information needed to complete our understanding of ionospheric dynamics, current circulation, and stability. Jonathan Makela compared optical imagery of spread F depletions with radar observations and showed how common features could be collocated and tracked.

Next, Joe Huba showed simulations of equatorial spread F made with a new model that incorporates much less numerical dissipation than has been necessary in the past. The morphology of the depletions that emerged in simulation was remarkably similar to what is seen in optical imagery. Meers Oppenheim then showed finely detailed particle-in-cell simulations of Farley Buneman waves. The simulations incorporated new particle heating diagnostics that made it possible to compare the phase

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speed of the primary waves with the theoretical ion acoustic speed. Three-dimensional simulations that could further close the gap between the two figures are planned.

Jicamarca is unique among the upper atmospheric facilities in its ability to measure incoherent scatter at very small aspect angles. This complicates the theory enormously but also permits certain unique measurements to be made. Marco Milla reviewed the theory and discussed the simultaneous measurement of power, electron and ion temperature, and drifts at small aspect angles. Fabiano Rodrigues compared electron density profiles measured at small aspect angles with Faraday rotation measurements and also reviewed recent hydrogen gyroresonance measurements. Finally, Pablo Reyes showed how to measure the absolute scattering cross section of mesospheric irregularities by incorporating simultaneous incoherent scatter measurements.

A new summer student program has been instituted at Jicamarca, and its first graduate, Akshay Malhorta, shared his experiences. Akshay has been working with range-spread meteor echoes and has shown how the echoes arrive from the locus of perpendicularity. A remote reserving site has been constructed near the main observatory to assess how the range-spread echoes appear given different scattering geometries. Akshay has returned to Jicamarca several times, and the student program appears to be an effective means of enlarging the Jicamarca user community.

More details about the activities at the observatory can be found at the bimonthly Newsletter ``Inside Jicamarca'' http://jro.igp.gob.pe/newsletter.

Thursday, June 28

Ionospheric studies using radio occultation electron density profiles with conveners Kerri Cahoy, Stig Syndergaard, Theodore Beach and Ethan Miller

The successful launch and operation of the GPS radio occultation receivers on the SMIC/Formosat-3 constellation, in addition to the availability of data from long-term precursor missions such as CHAMP, have substantially augmented the number, geographic and temporal resolution of electron density profiles available to the community. This workshop focused first on a general introduction of the method and the profile retrieval, and followed with examples of how these data compliment and support both modeling efforts and analyses with other instruments, such as incoherent scatter radar and airglow imagery.

K. Cahoy (Stanford) introduced the session and presented the planetary exploration heritage of the radio occultation method, and how the "classic" geometry used for capturing profiles of planetary atmospheres from an orbiter or during a fly-by was updated for application to remote sensing of our own Earth's atmosphere, using GPS signals.

S. Syndergaard (UCAR) followed up with a detailed discussion of how electron density profiles are retrieved from the radio occultation observables, starting from the Appleton-Hartree (Appleton-Lassen) equation and progressing through how TEC can be calculated using the combination of L1 and L2 phase paths. Different boundary (auxiliary) conditions were discussed for different experimental configurations (e.g. CHAMP versus OSMIC/Formosat-3). A brief description of OSMIC/Formosat-3 and the Cosmic Data Analysis and Archival Center (CDAAC) were also presented, as well as previews of some seasonal studies being done using this data by postdoctoral students at UCAR.

The workshop completed its general background and tutorial segment with an introduction of the different centers that currently have publicly available electron density profiles, such as CDAAC and the JPL Genesis system as well as often the home institutions of the spacecraft mission. The NetCDF file format was briefly discussed as well as simple ways that MATLAB and other computational analysis software suites could be used to simply query the data.

B. Wilson (JPL) discussed how to assimilate COSMIC occultation data into a global ionosphere model (JPL/USC GAIM), and 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.

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T. Beach's (AFRL) presentation (via proxy, due to the Texas flooding at the (time) focused on how to determine which electron density profiles would be most useful for comparative studies (with specific examples using incoherent scatter radar). The geometry and the atmospheric volume sensed during each radio occultation experiment were discussed, improving understanding of the paths traveled by the signals from which the resulting electron density profiles were retrieved.

E. Miller (UIUC) closed the session with a particularly cool visualization of ionospheric scintillation, 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 were used.

The workshop brought together researchers from various communities (simulation, optical measurements, radar measurements, and others). The tutorial-style initial format successfully segued into more detailed applications, allowing researchers unfamiliar with the data to not only get a quick-look of how it was acquired and made available, but also how it could be applied in comparative studies with other models, campaigns and data archives. K. Cahoy would like to thank all presenters for their expertise, enthusiasm, and much-appreciated contributions.

Application of SuperDARN radar observations to CEDAR research with conveners Bill Bristow (UAF), Mike Ruohoniemi (JHU/APL), and Simon Shepherd (Dartmouth College)

This workshop presented an opportunity for CEDAR participants to become aware of the availability of data and derived products from the SuperDARN HF radars that can be applied to CEDAR science. In addition to the well-known ionospheric convection products, these include space weather, meteor winds, atmospheric tides, gravity waves, plasma structuring and PMSEs. The ongoing expansion of SuperDARN into the polar region and the mid-latitude zone made it timely to review, for the benefit of old-timers and students alike, the range of ionospheric and atmospheric processes that are accessible to the radars.
The workshop kicked off with a comprehensive review of SuperDARN by Bill Bristow (UAF). He looked back over the history of the HF backscatter technique and traced the evolution of the methods for mapping plasma convection in the high-latitude ionosphere. He explained the multinational workings of the collaboration and described plans for continued expansion of the network. He was followed by Mike Ruohoniemi (JHU/APL), who elaborated on the push into polar latitudes with the PolarDARN system of radars, which is a project directed by the University of Saskatchewan. He showed results from the new Rankin Inlet radar that illustrated the richness of effects in plasma convection and plasma structuring in the polar cap. He also described results on mid-latitude effects such as SAPS seen with the new mid-latitude radar at Wallops Island and reported that the newest mid-latitude radar operated out of Hokkaido by StelLabs is producing exciting observations of convection and gravity waves.

Jan Sojka (USU) spoke to the modelers interest in acquiring extensive convection electric field measurements as an essential input for modeling the ionosphere. He emphasized the need for actual measurements as opposed to climatological model predictions to properly capture the full range of dynamic behavior. He lead a brief discussion of the incorporation of SuperDARN velocity data into the modeling effort related to the IPY, which commenced on March 1 of this year.
Elsayed Talaat (JHU/APL) shifted the discussion to the neutral atmosphere. Specifically, he described analysis of meteor wind data from SuperDARN that showed dramatically the effect of atmospheric tides and planetary waves. He showed that with the long time series available from some of the radars it is now possible to examine trends over a solar cycle.

Stephen Mende (SSL) described the NASA THEMIS mission, which is directed towards solving the substorm timing problem by combining measurements from multi-satellite conjunctions in the magnetotail with extensive ground-based observations of substorm effects in the ionosphere over North America. The prime period for substorm conjunctions will begin in February 2008; however, the spacecraft are aloft and are collecting data.

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He showed an example of a substorm onset from this year (March 23) that was observed in Alaska while the satellites were conjugate to the Siberian ionosphere. The timings of effects between the satellites were discussed and the simultaneous SuperDARN data were reviewed. The radar data showed very clearly the impact of the onset and the effect on convection in the southern hemisphere was particularly dramatic. There was also a discussion of THEMIS radar modes.

Phil Erickson (MIT Haystack) described a joint experiment between the Millstone Hill radar and the Wallops SuperDARN radar. The combined measurements reveal that a category of low velocity subauroral HF backscatter is due to irregularities generated in the crossed temperature and density gradients of the mid-latitude trough that might serve as a marker of the plasmapause.

After the break Mike Ruohoniemi (JHU/APL) spoke briefly on observations of PMSEs carried out by Japanese colleagues. Simon Shepherd (Dartmouth) then made a presentation on behalf of Robin Barnes (JHU/APL) on the availability of SuperDARN data products at the JHU/APL website http://superdarn.jhuapl.edu/"
It was shown that users have direct and easy access to summary plots for browsing purposes and to a range of the more commonly sought data in digital form, such as the convection maps.

UCLA student, Shasha Zou, then described her personal experience as an outside user in accessing SuperDARN data and demonstrated its application in an ongoing study of substorm effects in nightside convection.

Students from the University of Alaska Fairbanks, Todd Parris and Gwen Bryson, reported on several methods of extracting meteor wind data from SuperDARN observations. They described innovations in hardware and signal processing that will be implemented at all radars equipped with digital receivers to greatly improve spatial resolution.

Eric Donovan (U. of Calgary) reviewed the role of ground-based instrumentation for the study of substorms in the THEMIS era and discussed how the integration of data from multiple sources that is realized in SuperDARN is a model for the newer systems.

Marc Hairston (UTD) explained the capabilities of the DMSP drift meter and presented examples of joint SuperDARN-DMSP observations of ionospheric convection that raised questions about the intercalibration of data from disparate techniques.

Simon Shepherd (Dartmouth) illustrated the space weather monitoring capabilities of the SuperDARN network by showing an example of the ionospheric response to the geomagnetic storm that occurred on April 6, 2000. Global aspects of the disturbance included an increase in the polar cap potential, increased convection velocities, increased number of radar returns, and expansion of the convection region to lower latitudes. In addition, near simultaneous response was observed at all eight radars in the northern hemisphere and all five radars in the southern hemisphere; spanning over 15 hours of local time. The rapid expansion of the polar cap to lower latitudes demonstrated the need for expansion of radars to lower latitudes (StormDARN) to track the progression of ionospheric responses during geomagnetic storms.

Bill Bristow (UAF) reviewed work on thermospheric gravity waves inferred from SuperDARN observations of traveling ionospheric disturbances. He discussed the observations and how a gravity wave propagating in the neutral atmosphere produces a signature in radar observations. Much of the material presented was review of work from several years ago, however Bill showed some new results from Keisuke Hosokawa (DICE/UCE) using the new Hokkaido radar in conjunction with the Japanese GPS network observations of TEC. These new observations showed waves propagating all the way from Alaska to the southern end of Japan.

Most presentations were followed by a series of lively questions, mainly pertaining to the extension of SuperDARN capabilities to polar and mid-latitudes and to the exploitation of SuperDARN measurements of interest to aeronomy and atmospheric dynamics.

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Global Observations of the Upper Atmosphere and Ionosphere Using Coordinated World Days with convener Wes Swartz

Establishing "World Day" (WD) schedules to coordinate experiments at all the incoherent scatter radars and associated instrumentation is one of the activities of the URSI Incoherent Scatter Working Group (ISWG).
The attendees of this workshop commented on the initial template for the 2008 schedule and changes were made to accommodate most, if not all, of the suggestions which can be viewed at: http://people.ece.cornell.edu/wes/URSI_ISWG/2008WDschedule.htm.

Proposals for the 2008 World Days were requested as for the year before and the schedule was based on the requirements stated in the proposals and the discussion during the workshop. A number of the comments made during the workshop are worth repeating here followed by brief summaries of the experiments placed on the 2007 schedule. More details for each of these experiments are available on the web at the above link.
A description of the proposal procedure can be found at: http://people.ece.cornell.edu/wes/URSI_ISWG/RequestingWD.doc.

Summary of Attendee Comments:
The International Polar Year (IPY) is continuing until at least March 1, 2008. The EISCAT Svalbard radar has been running 24/7 for the full year, with Millstone Hill and Sondrestrom running a day every two weeks. Hence it was suggested that the World Days for January and February should coincide with the cadence established during 2007. Also it was suggested that the 10-day run to study stratospheric warming should take advantage of the days allocated for the bi-weekly IPY runs. All agreed that the enormous data set being produced during the IPY would be invaluable. The attendees' thanks went to Tony van Eykin for his role in initiating this series of experiment.

Summary of the proposed 2008 World Days:
International Polar Year: Continuation of year long observations with the EISCAT Svalbard ISR (ESR)
Key Objectives:
(1) To provide an unprecedented data set with multiple applications. (2) To provide correlative data for other instrumentation and models committed to the IPY.
Background Conditions: Anything that comes along.
ISRs Needed: ESR, and others as resources permit.
Parameters to Measure: Standard.
Contact: Tony van Eyken.

TEC Mapping: ISR/GPS Coordinated Observations of Electron Density Variations
Key Objectives:
(1) To study latitudinal variations of the ionosphere in the American longitude sector. (2) To examine time and latitudinal variations of electron content in the plasmasphere. (3) To test the GPS TEC mapping function.
Background Conditions: A range of magnetic activity is preferred but not required. A summer week (5 days) with some magnetic activity would be good to complement the measurements of 2007 March 1-5 (which was magnetically quiet). We plan similar experiments for years ahead so that we can pick up different months for different years.
ISRs Needed: All.
Parameters to Measure: Standard ISR basic parameters, e.g., Ne, Ti, Te and line-of-sight ion velocity. Inferred parameters, such as meridional thermospheric winds and local electric fields, are desirable at least for Millstone Hill.
For our analysis, we need good height coverage and height/range resolution. The idea is to have a good ISR profile for both the bottomside and topside. Our intent is to determine the plasmaspheric content from the difference between the GPS TEC and the integrated ISR electron content. Because of this, the value of the F2 peak, and of the electron density above and below it, are very important for our analysis. Using a single very long pulse to make ISR measurements may result in significant smearing effects and would cause measurements below 200 km unusable for our study. We suggest either a short pulse with a long dwell (integration) time or a long pulse with interleaved Alternating Code. A time resolution of up to 30 min is acceptable.
We will use Millstone Hill's zenith and MISA data, taken almost simultaneously, to test how the slant TEC is mapped to the vertical TEC. So both local measurements and wide coverage are requested. The elevation scan is preferred.
For high latitude sites, we prefer elevation scans towards the South. First, that would generate line-of-sight TEC that can be compared with GPS TEC (few GPS satellites are overhead or in the north at high latitudes). Second, in the American Sector, combined

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Millstone and Sondrestrom data could provide good latitudinal coverage over subauroral and auroral areas.
For other sites, vertical observations would be fine. We ask for high altitude measurements from Arecibo.
Contacts: Shun-Rong Zhang, Anthea Coster.

C/NOFS: Communications / Navigation Outage Forecasting System
The primary purpose of C/NOFS is to forecast the presence of ionospheric irregularities that adversely impact communication and navigation systems through improved understanding of the physical processes active in the background ionosphere and thermosphere in which plasma instabilities grow; the identification of those mechanisms that trigger or quench the plasma irregularities responsible for signal degradation; and determining how the plasma irregularities affect the propagation of electro-magnetic waves. A satellite, now scheduled for launch in June of 2008 into a low inclination (130), elliptical (~ 400 x 700 km) orbit will be solely dedicated to the C/NOFS objectives. It will be equipped with sensors that measure ambient and fluctuating electron densities, ion and electron temperatures, AC and DC electric fields, magnetic fields, neutral winds, ionospheric scintillations, and electron content along the lines of sight between C/NOFS and the Global Positioning System (GPS) satellite constellation. The orbit will have a 45-day repeating precession. Complementary ground-based measurements including the Jicamarca and Altair radars are also critical to the success of the mission. Coordination with the World Days periods starting in August 2008 will be expected. (Requests for additional UAF radar time beyond the currently scheduled World Days are to be made directly to the respective observatory staffs' once orbital characteristics are known.)
Contacts: Odile de La Bedaujardiere, David Hysell, Wes Swartz

QP TIDs: Coordinated Study of Quasi-Periodic Medium-Scale Traveling Ionospheric Disturbances with Extended Latitude Coverage
Key Objectives:
(1) To determine whether gravity-wave induced medium-scale traveling ionospheric disturbances (MSTIDs) consistently observed at high geomagnetic latitudes under quiet geomagnetic conditions are at all related to the continuum of quasi-periodic thermospheric waves observed at both Arecibo, Millstone, and perhaps AMISR Poker Flat.
(2) To Firmly establish the geophysical parameter range over which these quasi-periodic MSTIDs-that currently appear to defy theoretical explanation-exist.
Background Conditions: Low to moderate geomagnetic activity, New Moon.
ISRs Needed: All except Jicamarca, for three 48-hour runs.
Parameters to Measure: Continuous or near-continuous vertical power profiles through the E/Fregions (100-800 km) with the best time resolution possible. We must have 5 minute or better time resolution power profiles in order to properly filter the data to separate small amplitude waves from the normal variations of the ionosphere.
Secondary Parameters to Measure: Dual-beam ion velocities commensurate with the primary objective.
Contact: J.D. Mathews, F.T. Djuth, D. Livneh, I. Seker, M.P. Sulzer, C.A. Tepley, S.M. Smith, W.A. Bristow, J.C. Foster, and M. Nicolls.

Strat-Warming: Dynamics and Temperature of the Lower Thermosphere During Sudden Stratospheric Warming
Key Objectives:
(1) To measure neutral wind (zonal and meridional components) and electron and ion temperatures in the lower thermosphere before and during sudden stratospheric warming. (2) To compare variations in temperature and winds to average variations observed by ISRs during the winter. (3) To compare variations in temperatures and winds to mesospheric response as given by MF and meteor radars and lidars. (4) To extend studies of stratospheric warming effects to the lower thermosphere and investigate possible coupling with the ionosphere. (5) To examine the mechanisms responsible for variations in lower thermospheric dynamics and temperatures and investigate to what degree they can be related to sudden stratospheric warming.
Background Conditions: The observations need to be made before and during the sudden stratospheric warming. A 10-day campaign is requested, based on an alert to be issued either in January or February.
ISRs Needed: All, although the response at Arecibo and Jicamarca may be weak.
Parameters to Measure: LTCS mode - electron and ion temperatures from lowest possible altitude throughout the F-region, zonal and meridional components of neutral wind in the lower thermosphere (95-140km), F-region meridional wind. Temporal resolution can be sacrificed and data integration period increased in

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order to obtain data at lower altitudes.

Contacts: Larisa P. Goncharenko, Irfan Azeem, William Wardr.

Synoptic:
These synoptic experiments are intended to emphasize wide coverage of the F-region, with some augmented
coverage of the topside or E-region to fill in areas of the data bases that have relatively little data.
Contact: Wes Swartz, Jan Sojka.

Lightning effects on the upper atmosphere with conveners Mark Stanley, Mike Taylor, and Ningyu Liu

The Lightning Effects on the Upper Atmosphere workshop was held on Thursday, 28 June 2007 in the Zia room. The workshop focused on the effects of lightning discharges on the mesospheric and lower ionospheric regions, including discussions of transient luminous events (sprites, sprite halos, jets, elves) and terrestrial gamma ray flashes (TGF). Two invited talks opened the session with an in depth introduction to the topics as well as presentations regarding the latest research on the modifications of the upper atmosphere due to lightning. A contributed talk followed the invited talks. The workshop ended with a well-participated panel discussion on the interpretation of existing data and models.

The first invited talk consisted of two parts. The first part was given by Dr. Matthew G. McHarg (USAF Academy). He showed the most recent observations of sprites and their filamentary structures, streamers, using high-speed ground-based imagery. The 10,000 fps video observations support previous results that the onset altitude of sprites is about 75-80 km altitude and that the downward development of positive streamers precedes the upward propagation of negative streamers. Emission rates in individual streamer heads are estimated to be in the range of 1021 to 1024 photons/s. Takeshi Kammae (UAF) gave the second part. He presented the spectra of emissions from sprite streamer heads at 10,000 fps. A slitless spectrograph was utilized to obtain the spectra. The reported spectra lack blue signatures from Nitrogen and Nitrogen ions. The speaker suggested that this result is due to Rayleigh scattering because the sprite event is 650 km away from the observation site.

The second invited talk was given by Jingbo Li (Duke). He conducted coordinated analysis of delayed sprites with high-speed images and electromagnetic fields. During a sprite campaign in the summer of 2005, about 50% of observed sprite events were delayed more than 10 ms after the lightning return stroke. The phenomenological features of long-delayed sprites were presented, including the initiation altitude and charge moment change of the parent lightning discharges. The speaker reported simulation results of the electric field produced by lighting discharges using a 2-D FDTD model. Comparison of the measurements and simulation results indicated that the slow intensification of lightning current plays an important role in sprite initiation for the long delayed sprites.

Dr. Nikolai Lehtinen (Stanford) reported Monte-Carlo simulation results for the propagation of gamma-rays through the atmosphere. The model includes Compton scattering, photoelectric absorption, pair production and subsequent position annihilation process. The speaker presented the conditions and constraints on the production of TGFs by analyzing the modeling results.

The panel discussion was very successful. Questions regarding fundamental physics and characteristics of sprites were raised by the audience and answered by the panel of experts. The importance of comparing the existing data with sprite streamer models was greatly appreciated during the discussion. Further experimental exploration of sprite streamers is necessary to verify and validate of the modeling results. The participants acknowledged the challenges of studying the chemical, thermal and electrical effects of lightning on the upper atmosphere. Examples of re-ignition and long delayed sprites demonstrated that physical and chemical processes, which are triggered by lightning discharges, proceed with a much longer timescale than that of sprites in the mesosphere and lower ionosphere regions. More investigations of those processes have to be carried out in future research.

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