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FROM THE EDITOR

With the change in editor of CEDAR Post that occurs every two years, I am taking my turn to assemble materials and collate them for the next six issues. Over the years, the Post has evolved to a publication of 15 to 25 pages and a single highlight color. You may have noticed that the color has changed slightly with this issue.

The purpose of the Post is to keep you informed and up-to-date on CEDAR and CEDAR-related issues. Much of this information relates to the CEDAR Workshop activities and announcements from our program directors or the CEDAR Science Steering Committee. Occasionally, there are articles submitted from within the CEDAR group. Whatever the contribution, I will be dependent on you for timely delivery of materials that you would like to see in the Post. Please keep in mind that the Post is published three times a year and the deadline dates are 14 December, 8 April and 20 July. The newsletter is mailed to everyone on the CEDAR list and is also published electronically on the CEDAR web page: cedarweb.hao.ucar.edu/commun/cedarcom.html.

The CEDAR meetings calendar contains important CEDAR dates and pertinent notes. This calendar can be extended with items that you submit. Email these items to roger@gi.alaska.edu. The electronic version on the CEDAR web page will be updated more frequently.

CEDAR is now over 16 years old; this is both a cause for celebration and an opportunity for renewal. Our Phase 3 document was issued four years ago. I plan to work with the CSSC to examine our progress towards the Phase 3 goals and to see how we should grade our performance. Parallel with this, we need to take a look at where we expect aeronomy and ionospheric physics to be headed in the next few years and compare with our present directions.

We will be helped by two special AGU sessions at the fall meeting that will deal with CEDAR achievements and the future of aeronomy. We shall also be assisted by the results of the Decadal Study in MIA (Magnetosphere, Ionosphere and Atmosphere). Having these resources at our fingertips, we will be well placed to produce an interim report on Phase 3 and recommendations for upcoming years.

There are several ways in which we are making long-term progress that points the way to the future. Two examples are the building of the RAO (Relocatable Atmospheric Observatory) and the inclusion of our circulation models in the CCMC (Community Coordinated Modeling Center). These projects will allow us to couple our science with that of our colleagues in magnetospheric physics and meteorology.

In my mind, there should be several stages for this review, beginning with planning at the next CSSC meeting in November, then follow-up activities in the ensuing months with reporting and further input in the 2002 CEDAR Workshop. The 2003 CSSC fall meeting would be a target time for reviewing a draft written report.

If you have input to make to the CSSC, please contact your favorite committee member.

Roger Smith, CSSC Chair

The 2001 CEDAR-SCOSTEP Meeting

The 2001 CEDAR Workshop was held June 17-22 at the Raintree Plaza Hotel Conference Center in Longmont, Colorado in conjunction with the SCOSTEP (Scientific Committee on Solar-Terrestrial Physics) 10th Quadrennial STP Symposium. A total of 385 persons from 124 institutions, 65 outside the United States and Puerto Rico, attended.

The combined meeting got its own complementary logo, created by Gregory Urbanski, brother to Janet Kozyra. The logo was placed on complementary convention bags and T-shirts, and an embroidered version went on polo shirts that were for sale at the meeting.

This year's meeting was well attended by students: A total of 106 students came from 33 universities and three research labs, including 17 students from countries such as Japan (5), the United Kingdom (4), Canada (3), Taiwan (2), Korea (2) and India (1). The total number of students dropped by three from last year, although the number of foreign students nearly doubled.

The 2000 CEDAR workshop was attended by 305 persons from 72 institutions, 17 outside the United States and Puerto Rico. So, combining with SCOSTEP's symposium increased the numbers by 80 and the foreign participation immensely.

The student workshop on Sunday, organized by CEDAR student representative Rebecca Bishop of the University of Texas at Dallas, looked at "Exploring the Mesosphere, Lower Thermosphere, and Ionosphere (MLTI) Region." This topic was picked because of the imminent launching of the TIMED spacecraft. The new CEDAR student representative is Pamela Loughmiller of Cornell University.

The SCOSTEP General Meeting also took place on Sunday at the NCAR MesaLab. Reports were heard from the adherent (national) representatives concerning SCOSTEP work done throughout the world.

The CEDAR Prize Lecture was given by Hans Mayr of Goddard Space Flight Center on "Modeling Wave Driven Non-linear Flow Oscillations: The Terrestrial QBO, and a Solar Analog."

Instead of four tutorial speakers, we had ten: one each morning, and one each afternoon at the start of the sessions with SCOSTEP. The morning sessions were shared with SCOSTEP, except for the latter half of Monday morning when the two groups split. Afternoons were for CEDAR workshops and the continuation of invited and contributed talks for SCOSTEP.

The initial tutorial given Monday morning was the keynote talk by Eugene Parker, emeritus from the University of Chicago, on "What We Need to Know about Solar Variability." The other nine tutorial talks were given by K. Shibata of Kyoto University in Japan, K. Labitzke of the Free University of Berlin in Germany, J. Haigh of the Imperial College of Science, Technology and Medicine in the UK, R. Heelis of the University of Texas at Dallas, F. Sassi/R. Garcia of CGD/ADC NCAR, A. Smith of ACD/NCAR, S. Miyahara of Kyushu University in Japan, R. Schwenn of the Max Plank Institute of Aeronomy in Germany, and H. Koskinene of the University of Helsinki in Finland. These 10 tutorials and the CEDAR Prize Lecture were videotaped, and hard copies of eight of the 11 talks were available by the end of the meeting. Hard copies of the remaining three talks will be available soon, while the videos will be available later. You can contact Barbara Emery (emery@ucar.edu, HAO/NCAR, PO Box 3000, Boulder CO 80307) if interested in obtaining hard copies and/or videos.

There were 24 workshops, including the student workshop, that were available in the afternoons, as well as SCOSTEP afternoon sessions of talks. There were 32 thirty-minute invited topical talks given in the plenary morning sessions and the afternoon SCOSTEP sessions. Any of these invited talks, as well as the longer tutorials and prize lecture that are in PowerPoint or can be scanned in from viewgraphs, will be put onto a CD by SCOSTEP.

Lou Lanzerotti gave a programmatic talk to the plenary session about the national decadal survey of solar and space physics, and two of the workshops invited input from the community on various aspects of this decadal survey.

Only four programmatic talks were given in the half-morning CEDAR-only session. There were 116 contributed papers, 15 of which were 15-minute oral presentations given mostly in the afternoon SCOSTEP sessions. The remaining contributions were posters that were highlighted during one of the two evening poster/dinner sessions Monday and Wednesday. The food was described as awesome, while the quality of the posters was high. There were 42 student first author posters, of which 32 were in the student poster competition. Two student posters received honorable mention: Helen Middleton of University College Wales in the UK and Tomoko Matsuo of HAO/NCAR and SUNY (State University of New York). Four student posters received copies of the Schunk and Nagy 2000 book on ionospheres from Bob Schunk, as well as $50 toward other books. The winners were: Lars Dyrud of Boston University (a repeat winner), Mitsumu Ejiri of Nagoya University in Japan, Rohini Indiresan of the University of Michigan, and Yoshiyuki Takahasi of Tohoku University in Japan.

The extra-curricular activity for the 2001 CEDAR-SCOSTEP meeting was a tour of the Anheuser Busch Brewery in Fort Collins.

Barbara Emery, HAO/NCAR

Jicamarca Amigos Workshop

Convener: Wesley E. Swartz

The theme of the Jicamarca Amigos CEDAR Workshop this year was "Looking Towards the Future." The chair (Wes Swartz) opened the discussion with a brief overview of a number of open questions concerning equatorial aeronomy relating to the Jicamarca Radio Observatory (JRO) and what it might take to make progress. These included the following:

1) Non-linear physics of type-1 irregularities a. What controls their phase velocity and amplitude? b. What are the aspect sensitivities of type-1 and -2 spectra? Can a quantitative theory be developed? c. How do ion composition and temperature affect electrojet behavior? Rocket measurements of the ambient electric field, the electron and ion temperatures coupled with simultaneous radar measurements are needed.

2) Are Larsen type wind shears present at the equator? If so, what are the consequences?

3) What is needed to develop a theory for the "150 km" echoes?

4) What causes the day-to-day variation in equatorial spread-F? (This is a very old question, but many details are still not understood.)

5) What tests of the ISR coulomb collision theory are still needed? (Note that this issue goes beyond IS theory!)

6) How good are the equatorial models?

Dr. Jorge Chaw then described a great many improvements to the JRO facilities that included:

1) 15-base line interferometer for imaging E and F region irregularities.

2) New wide and narrow beam westward looking radars that can provide additional information on the E and F regions simultaneously with the vertical looking main radar.

3) The status of the move of the SOUSY radar from Germany to Peru.

Drs. John Meriwether and Lynette Gelinas next gave an overview of a NASA sounding campaign that is being planned for 2004. Its components are to include studies of a variety of phenomena:

1) nighttime equatorial electrojet electrodynamics,

2) electrodynamics of the 150 km irregularity region,

3) mesospheric turbulence in the equatorial region,

4) coupling between E-region neutral winds and electric fields,

5) the prereversal (sunset) vortex in the F region,

6) bottomside equatorial spread F.

The workshop proceeded with a number of short presentations:

1) Dr. Nestor Aponte — Testing coulomb collision ISR theory.

2) Dr. Joe Huba — Comparison of the SAMI2 model with JRO observations, including a prediction of high altitude holes.

3) Dr. Charlie Chen — Described results from a lower atmospheric project and proposals to use instrumented personal aircraft.

4) Dr. Paul Bernhardt — Outlined the objectives of shuttle engine burns over Jicamarca.

5) Dr. Cesar Valladares — Described his modeling efforts over a few degrees north and south of the equator with GPS TEC and JRO data.

There was active participation by many of the 50-plus attendees.

Wesley E. Swartz, Cornell U.

Arecibo Friends' Workshop

Convener: Sixto Gonzalez

Attendance was about 60 or so (it was standing room only in the Apache room). Arecibo has a long tradition of being a user facility where individuals or groups of scientist carry out their experiments. Our main goal was to interact with those users.

The first half of the workshop was used to provide our users with an update on the progress in the last year on both the radar and lidar fronts. In particular, a detailed description of the progress and performance of the Gregorian system was given by Mike Sulzer.

We also discussed likely dates for an on-site dual beam workshop. This would be a short (2 day) workshop in which early results would be shown and new (or potential) users could get hands-on experience with the new system.

Sixto Gonzalez, NAIC

IS Scheduling Workshop

Convener: Tony van Eyken

The IS workshop was held after the extended/rescheduled RAO workshop and about 15 people were present. As a result of discussions during the week, a strawman 2002 schedule was prepared before the meeting. The business was conducted swiftly, efficiently and amicably. With some reorganization of the unallocated slots in the strawman proposal, a draft 2002 schedule emerged. The result is present on the URSI ISWG web page at http://www.eiscat.uit.no/URSI_ISWG/2002_schedule.html. The draft schedule is still open for comments but will soon be forwarded for inclusion in the 2002 Geophysical Calendar.

Tony van Eyken, EISCAT

High Latitude Electrodynamics Workshop

Conveners: Art Richmond and Mike Ruohoniemi

Abstract: Electric fields and currents in the high-latitude ionosphere, along with auroral electron and ion precipitation, are important drivers of global thermospheric and ionospheric dynamics through ionization, plasma convection, ion drag, and Joule heating.

Quantitative estimates of these time-varying electrodynamic features on a global basis are needed for realistic thermosphere/ionosphere simulation models. Widespread ground- and space-based observations, together with data assimilation procedures, are beginning to provide such global estimates, but require further development and validation.

Particularly important for estimations of Joule heating are quantitative evaluations of the influences of small-scale electrodynamic structures, spatial correlations between conductivities and electric fields, and influences of neutral winds. This workshop was intended to facilitate information exchange and coordination of efforts among scientists working in this field.

Review: The workshop took place at Raintree Plaza Hotel, Longmont, Colorado, from 4:00 pm to 6:00 pm on June 22, 2001, immediately following the workshop on M-I coupling. About 50 people attended the workshop. There was some overlap with earlier workshops and plenary presentations from earlier in the day. Some papers were moved around and others abridged.

The session began with Ray Greenwald reviewing the work of the GEM M-I Coupling Campaign, which met in extended meetings at Snowmass earlier in the week. This campaign is coordinated by Greenwald and Jeff Hughes. Their current efforts are focused in two working groups, "Mass exchange" and "Electrodynamics."

Discussion at Snowmass had included the processes that energize outflowing ions and the impact of these outflows on magnetospheric processes. There had also been extensive discussion of cross-scale coupling and the impact of such linkages on action/reaction times in the M-I system.

Ray Greenwald emphasized that the overarching goal of the GEM campaign is to get the various elements together in order to make the comprehensive magnetospheric codes work. The linkages to ionospheric-thermospheric phenomena are important and naturally relate to well-established CEDAR themes.

Rod Heelis described the thermal plasma dataset of the DMSP satellites, extending from the F8 to F16 instruments for the years after 1987. He showed how this could produce profiles of velocity and ion composition. The database is being put on line by Marc Hairston.

John Holt reviewed the availability of Millstone Hill data from the Madrigal database and discussed the derivation of a convection model in the subauroral region that shows the presence of the polarization electrojet.

Jeff Thayer reprised some themes from his plenary presentation given earlier in the day. He described estimation of E region parameters from Sondrestrom observations and their application to the estimation of current density and conductivity.

Tomoko Matsuo gave a talk on characterizing the variability in measurements of electric field made with the DE2 satellite. She showed how the variability can be decomposed into a set of orthogonal functions.

Dirk Lummerzheim presented results on the derivation of conductance patterns and the impact of proton precipitation.

Tom Immel compared the auroral conductances for two substorms as inferred from observations with the IMAGE Far Ultraviolet Imager and concluded that proton precipitation factors strongly in substorm conductances.

Byung-Ho Ahn described a study of conductance based on coordinated analysis of ground magnetometer disturbances and ionospheric electric field data from the SuperDARN radars. He showed the results of applying four methods of calculating the conductance and concluded that consideration of the effect of FACs is necessary to clear up anomalies in the Pedersen conductance.

Delores Knipp then described the variability in the high-latitude electric field resolved with the AMIE technique. She found that it is especially pronounced for IMF Bz+ and found larger variances in DE2 velocities.

Mihail Codrescu continued this discussion by reviewing the need for variability information on the electric field in addition to the mean field determinations. He has modeled the impact of electric field variability on Joule heating.

Finally, E. Griffin made a presentation on thermospheric neutral temperatures involving measurements with a FPI.

A brief summation of the proceedings of the workshop was offered by the co-chairs. The session then broke up with much lively discussion carried on in small groups.

The two workshops on M-I coupling and High-Latitude electrodynamics highlighted important questions in current research and the increasing ability of measurement techniques and modeling efforts to provide answers.

As in the conclusion of the M-I workshop, interested CEDAR scientists are encouraged to pursue these themes in the coming Fall AGU GEM-CEDAR mini-workshop.

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HLPS Workshop

Conveners: Cesar Valladares, Jan Sojka, and Lie Zhu

The HLPS workshop on June 22 was organized around a series of presentations concerning the Millennium Campaign held from January 14-28, 2001. A key workshop objective was the assessment of whether the Millennium Campaign will provide sufficient observations to fire up HLPS/GAPS community collaborations, both theory-observation and international, in order to motivate and justify a Peaceful Valley 2002 Workshop.

The workshop got off to a great start with introductory remarks from two of the Millennium Campaign organizers, Cesar Valladares and Santimay Basu, who indicated how geomagnetic and weather conditions were excellent and the scientific quality of the observations was ideal.

Todd Pedersen led off the observation presentations by providing the overview for the ensuing presenters, as well as indicating the quality of the "patch" observations. His initial analysis indicated that the modulation seen in the TOI/patches was evidence of rapidly moving/changing electric fields in the cusp region. Santimay Basu (high resolution TEC and scintillation), Richard Doe (optical images and ISR), D. Pallamraju (dayside cusp images), and Cesar Valladares (SuperDARN, ISR, and all-sky images) completed the Millennium observational status updates.

A comparison of the sun-aligned arc and patch observations has already pointed to the possibility of distinguishing between these two sources of scintillation based upon TEC and scintillation signatures. Analysis of patch motion demonstrated that the optical structures moved at the same speed as the ionospheric plasma velocity.

The new technique to observe emissions in daylight produced the first cusp (daylight) observations from Sondrestrom. Combining imager data with SuperDARN convection data suggests that a transpolar arc may be embedded within a single cell and that the dawn-dusk motion of the arc may depend on the motion of that cell which, under northward IMF conditions, may even be driven by reconnection itself. Impromptu contributions from Brian Jackel (distribution of Canadian all-sky images) and Mike Ruohoniemi (SuperDARN) augmented these observational successes.

On the modeling side, Parvez Guzdar (3-D instability model), Bob Schunk (thermospheric structure model), and Jan Sojka (ionospheric model) indicated readiness and enthusiasm to participate. The 3-D instability modeling has also matured to the point of generating power spectra for the instabilities, which can lead to a direct prediction testable with campaign observations.

During the entire workshop, dialogue continued between the audience and presenters, elevating interest and assurance that the Millennium Campaign has delivered the hoped-for databases to fire up HLPS/GAPS collaborations and science. The chairman, Jan Sojka, will collect the presentations and other information from the workshop, create a CD-ROM of these materials, and distribute it to the HLPS/GAPS participants to begin the process of coordinated science leading to the future Peaceful Valley Workshop.

The workshop had over 30 participants, filled the room, and quietly ended when our courteous CEDAR host asked us to "move on" to vacate the room for the next workshop.

Cesar Valladares, Boston College

GIFT Workshop

Conveners: Jan Sojka, Tim Fuller-Rowell, Dave Anderson

This year the CEDAR/GIFT workshop addressed the global ionosphere and thermosphere from a different perspective. The workshop focused on data assimilation techniques - the merging of observations and physics theory through mathematical optimization.

The humble objective of the workshop was to educate, via tutorials and examples, how assimilation techniques are being applied to the ionosphere and thermosphere. Since this is a rapidly evolving field, and since our community lacks experts, the workshop focused on two educational/tutorial talks presented by younger researchers developing assimilation tools for the ionosphere/thermosphere community.

After a brief introduction by Jan Sojka, Ludger Scherliess presented a tutorial on the fundamentals of Kalman filtering. He skillfully blended the Kalman basics with an easily understood 1-D ionospheric example of a traveling ionospheric disturbance (TID) set of simulations. These 1-D examples demonstrated the basics of a Kalman data assimilation.

Cliff Minter followed this introduction to Kalman assimilation with a presentation of other assimilation techniques, including the ensemble Kalman filter. In his excellent presentation, Minter emphasized its application to the thermosphere. Both presentations led to audience debate, and a workshop discussion extending well beyond the allocated two hours.

The workshop had about 30 participants. GIFT workshops in the future will continue to provide a forum in which data assimilation can be debated.

David Anderson, U. of Colorado

Polar Mesospheric Dynamics Workshop

Convener: Tom Duck

The CEDAR workshop on Polar Mesospheric Dynamics discussed a wide range of topics relating mostly to wave dynamics and turbulence in the Arctic middle atmosphere.

Four speakers gave presentations and led substantial discussions: Tom Duck, Nick Mitchell, Steve Eckermann, and Dave Fritts. Observations of inversion layers were discussed, and it was shown that their occurrence frequency and amplitudes diminish toward the Pole.

A systematic study of lidar measurements from many sites was said to be needed, and could be used for comparison with models predicting latitudinal changes in inversion layer characteristics. The relationship of inversion layers to tides was discussed.

It was shown using measurements that mesopause tidal amplitudes sometime increase with latitude, an effect that is not well described by the models. Background state winds in Arctic measurements were shown to be somewhat different from the climatologies, although the relevancy of mean wind measurements was questioned because of the rather high variability observed in the mesopause region. Models for the propagation of gravity waves from topographic sources into the middle atmosphere were also considered.

Although the models correlated well with stratospheric gravity wave measurements, it is currently unknown how models might perform at higher altitudes due to secondary wave generation during wave breaking. Nevertheless, an interesting case study showed that on one summer day, the location of an observed noctilucent cloud correlated with significant mountain wave propagation in that region.

Finally, the ways that the observations, models, and theory could be better combined to understand problems in mesospheric dynamics were considered. Although it was shown that each alone has had its triumphs, an important area in which they could each work together is in case studies. Such studies might yield more insight and physical understanding than previous statistical efforts.

Tom Duck, MIT-Haystack

PRIMAL Workshop

Conveners: C.G. Fesen, D.N. Anderson, D.L. Hysell

The first CEDAR/PRIMAL (Problems Relating to Ionospheric Modeling at low Latitudes) workshop was held on June 19 to explore interest in performing focused modeling studies on the low latitude ionosphere as observed by the Jicamarca Radio Observatory (JRO) and nearby instruments.

Approximately 55 people attended the workshop, which began with an overview of the types of measurements possible at JRO.

Promising new instrument developments may yield information on the zonal winds, electric fields and electron densities near 100-110 km.

Some measurements of high altitude (> 800 km) daytime spread F have also been obtained. In the F region, new observing modes can provide measurements of Ne, Te, Ti, H+, and He+ from about 150 to 1300 km and improved time- and height-resolution of the east-west ion drifts.

Eight modeling groups attended or expressed interest, representing the "Bailey" model, the Coupled Thermosphere/Ionosphere/Plasmasphere model (CTIP), the Field-Line Interhemispheric Plasma model (FLIP), the Global Assimilation of Ionospheric Measurements (GAIM), the Ionospheric Forecast Model (IFM), the Regional Ionosphere Forecast System (RIFS), another model of the ionosphere (SAMI2), and the Thermosphere/Ionosphere/Electrodynamic General Circulation Model (TIEGCM).

The first order of business for the modelers is to identify and define a particular geophysical period to simulate, such as summer, solar cycle maximum. Once the models are run, particular parameters (such as electron density or temperature) can be extracted and compared to JRO observations and to the electron density metric assembled by the NSWP.

The latest NSWP "metrics challenge" may also be relevant, which asks the theoretical models to predict electron densities each hour from 200 to 600 km for the 2001 World Days.

To make progress, suggestions were made which included the following: All observations should include error bars. Model results should be quantified, for example, by calculating root-mean-square differences between each model and the other models and between each model and the data points. Sensitivity studies by models would also be helpful, as well as attempts to model situations other than equilibrium conditions.

Several future satellite projects, such as COSMIC and EQUARS, may provide additional highly-detailed data on low latitudes and will benefit from careful modeling studies such as those proposed here.

We welcome any participation, questions, comments, and suggestions.

C.G. Fesen, U. of Texas, Dallas
D. N. Anderson , NOAA/SEC
D. L. Hysell, Clemson University

Convener: Evgeny Mishin

The workshop focused on "Plasma Structures And Turbulence" observations and theory/modeling of plasma wave coupling in the ionosphere-thermosphere system and their effects on momentum and energy transfer.

Topics of discussion included:

- Signatures of PSAT in the perturbed polar ionosphere
- Can plasma turbulence compete with standard Joule heating?
- Indications of plasma turbulence in the storm-time subauroral phenomena (trough/SAID/SAR arcs). How significant is its role?
- Formation of ionospheric irregularities.

Invited presenters were:

- Y. Dimant and G. Milikh "Farley-Buneman Instability and Electron Heating"
- G. Ganguli "Wave and Joule Heating in the Structured Ionosphere"
- P. Guzdar and N. Gondarenko "Turbulence and Transport in High latitude Plasma Patches"
- F. D. Lind, P. J. Erickson, J. C. Foster, J. D. Sahr "Radar Imaging

(CEDAR Student Workshop cont.)

CEDAR-SCOSTEP T-shirt. Following the activity, Dr. Dan Marsh gave an overview talk on the MLTI. This talk provided background information for the remainder of the workshop presentations.

The next talk was given by Dr. Sam Yee. Dr. Yee gave an excellent introduction to the TIMED mission (set to launch later this year) and various aspects of the MLTI regions.

The afternoon session began with a talk by Feng Li (University of Illinois) on gravity wave observations in the mesopause region.

Rob Wilson, from Clemson University, gave an introduction to sporadic E layers and associated quasi-periodic irregularities.

Following a short break, Lars Dyrud gave a talk on plasma simulations of meteor trails, including information about different simulation techniques.

Dr. Lynette Gelinas of Cornell University gave a presentation on dusty plasmas. She also introduced the topic of artificial aurora using a video illustration of the phenomenon.

The final talk of the day was given by Dr. Tim Kane from Penn State University on instrumentation often used by CEDAR scientists. Dr. Kane injected humor and audience participation into his presentation, providing a great ending to the workshop day.

The traditional student social was held Sunday evening at Roger's Grove Park. Students walked the trails and participated in a game of ultimate frisbee. They also had the opportunity to view a model train layout created by Dr. Barbara Emery and her husband.

In addition to the positive feedback on workshop evaluation forms, the verbal feedback was upbeat. Next year's student workshop will be organized by Pamela Loughmiller of Cornell University.

Rebecca L. Bishop, U. of Texas-Dallas

Meteor Workshop

Conveners: John Mathews and Qihou Zhou

This year's meteor workshop (Meteors: Physics, Chemistry, and Observation Techniques) continued last year's themes with clear evidence of major theoretical and observational advances. The principal theme concerns the influx of meteoroid mass to the meteor zone—80-120 km—and the effect of this mass flux on the aeronomy of the region. Another important theme is the presence of both neutral and ionized atomic metals such as sodium, calcium, and iron form "tracers" of neutral and plasma processes, as evidenced by lidar observations of the neutral atomic metal layers and radar studies of "sporadic E."

Five presentations were made—John Mathews (co-authors: Q.-H. Zhou, D. Janches) led the presentations with a mini-tutorial on the large-aperture V/UHF radar techniques necessary to study meteors. In particular, a new Doppler technique was introduced that yields approximately 10 m/sec instantaneous Doppler resolution of meteors with typical speeds of 11-100 km/sec.

Additionally, a new result regarding the rapid instability-driven B-field alignment of the meteor trail plasma yielding field-aligned irregularity (FAI) scattering was noted. This process first came to light in results from the ALTAIR radar, was confirmed using the MU radar, and explains the long observed anomalous trail-echo.

The second paper, Theory and Simulations of Field-aligned Irregularities in Meteor Trails, was presented by Meers Oppenheim (co-authors: Lars Dyrud, Sigrid Close, Stephen Hunt). This paper updates successful efforts to explore instabilities within the evolving meteor trail that drive creation of small-scale plasma concentration irregularities that then appear to quickly field-align. This work has also identified a collision frequency dependency that appears to predict the observed low-altitude cutoff of this process.

The third paper, Correlation of Head Echo and Trail Parameters Using Simultaneous VHF/UHF ALTAIR Data, by Sigrid Close (co-authors: Meers Oppenheim, Lars Dyrud, Stephan Hunt) and presented by Lars Dyrud, gave a signature multi-frequency head/trail-echo observation showing the above-mentioned anomalous trail-echo and very accurate scattering cross-sections for the head-echo at each frequency. As ALTAIR is located near the geomagnetic equator, it was noted that the anomalous trail-echo was observed in the case of radar wave vector nearly perpendicular to the geomagnetic field as expected of FAI-scattering.

The fourth paper, Leonid Meteor Showers and the Ionospheric Effects Over Ahmedabad, was given by H. Chandra (co-author: S. Sharma) and returned to the question of shower effects on sporadic E. While the Arecibo results mentioned in the first paper indicate that the diurnal micrometeoroid flux is necessary and possibly sufficient to maintain the meteor zone atomic metal content, the question of shower effects certainly remains open.

A fifth paper by Joe Grebowsky discussed the altitude and global distribution of metal ions as observed by many rocket-launched mass spectrometer payloads. This paper pointed to the sporadic distribution of various metals and the lack of correlation among various species. The conclusion that electrodynamic redistribution of metal ions from the meteor zone is a very important process is inescapable.

Three poster papers also involved meteor topics—these were given by Stan Briczinski, C. A. Kruschwitz, and Lars Dyrud.

John Mathews, Penn State U., & Qihou Zhou, NAIC Arecibo Obs.

Conveners: Han-Li Liu and Mike Taylor

This new CEDAR workshop was stimulated by recent measurements and publications that show unexpectedly large, transient perturbations in mesospheric and lower thermospheric (MLT) airglow emissions, temperatures and winds around both the spring and fall equinox periods.

The goal of the workshop was to determine the observed variability in these parameters as measured by a variety of instrumentations, including satellite, lidar, radar, and imager from differing geographical regions. It was also intended to act as a forum to facilitate discussions on whether these variabilities are related and to try to identify what dynamical, chemical, and radiative processes may be involved by comparative studies between the observations and model simulations. The workshop was attended by over 100 persons and ten speakers lead discussions on different aspects of this exciting new topic.

Gordon Shepherd led with an informative summary of the "discovery" of the equinox transition effects on the airglow emissions using data from high latitudes in Sweden and Alaska where the springtime transition is known to create a remarkable and persistent "oxygen hole" resulting in the virtual disapearence of the OI (557.7 nm) emission.

Mariana Shepherd continued the springtime theme focusing on the temperature changes and presenting detailed results from a number of ground sites in both hemispheres over about five years, thereby expanding the study to a global scale, and comparing them to measurements from the UARS satellite.

Alan Manson presented MF radar data from Saskatoon which demonstrated the existence and struc) emo5em 72 50m(x1o0.040"ues "di mistng ge0.109nd sites in)TjT -0.0007 Tc- Tw(wiocusipringtime w(

New Polar Science/RAO Workshop

Convener: Mark Conde

The objective of this workshop was to present ideas for potential scientific studies and CEDAR observing campaigns that would become possible if the first face of the "Relocatable Atmospheric Observatory" radar were to be deployed in Alaska as is proposed.

Clearly, there is a high level of interest in this project across a broad spectrum of the CEDAR community. This is apparent from the large numbers of workshop presentations (19) and attendees (at least 76, based on the attendance sheet).

A number of speakers highlighted the opportunities for synergistic collaboration between an Alaskan RAO radar and other facilities and programs of interest to CEDAR, such as:

- The CEDAR lidar network - *She/Kane*
- LTCS - *Johnson*
- SuperDARN - *Bristow*
- The American ISR chain - *Foster*
- EISCAT - *van Eyken*
- Sounding rockets - *Meriwether/Lummerzheim*
- Communications Research Laboratory, Japan - *Ishii*
- Ionospheric tomography chain(s) - *Bust*
- Poker Flat and HAARP - *Smith*

The topics presented covered most of the traditional CEDAR interest areas, including:

- Atmospheric composition and transport - *Swenson/Hecht/Kane*
- Gravity wave dynamics – *Taylor/Kane*
- Atmospheric tides – *Johnson/van Eyken*
- Auroral processes - *Foster/Semeter/Ganguli/Conde*
- Thin Layers - *Heinselman/Conde*
- Joule heating – *Sivjee/Ishii*
- Cross-polar transport - *van Eyken/Bristow*
- Ionospheric processes – *Heinselman/Bust/Ganguli/Bristow/Ishii*

Time constraints precluded discussing specific CEDAR campaigns focused upon applying the RAO radar and other potentially relocatable instruments to studying these topics. Nevertheless, it was apparent from the talks that were presented that the need for such campaigns would be a natural consequence of building this radar.

Mark Conde, GI-UAF

Presenter	Affiliation	Topic
Session One		*Wednesday, June 20, 13:15 - 16:15 (including break)*
Tony van Eyken	EISCAT	EISCAT/RAO collaboration
Roger Smith	GI-UAF	Synergy between the RAO and other Alaskan aeronomy programs
John Foster	MIT Haystack	Auroral and sub-auroral physics with RAO
Joe She	CSU	New lidar techniques
Tim Kane	Penn State	Potential for combined RAO radar and lidar studies from Poker Flat
Craig Heinselman	SRI	Radar and lidar studies of thin sporadic layers
Roberta Johnson	NCAR	Opportunities for study of the lower thermosphere from the RAO
Mamoru Ishii	CRL Japan	Collaboration between the RAO and CRL instrumentation at Poker Flat
Abas Sivjee	ERAU	Detection of Joule heating effects with RAO radar and passive optics
Mike Taylor	USU	RAO-coordinated investigations of mesospheric wave processes at auroral latitudes
Josh Semeter	SRI	Radar-optical studies of the aurora by RAO
Mark Conde	GI-UAF	RAO studies of auroral thin layers and of "black aurora"
Session Two		*Thursday, June 21, 13:15 - 15:15 (merged with IS scheduling workshop)*
Gary Bust	ARL-UT	Collaboration with the Alaskan ionospheric tomography chain
John Meriwether	Clemson	Potential synergy between an incoherent scatter radar and a rocket range collocated at high latitudes
Dirk Lummerzheim	GI-UAF	Radar pointing requirements to support rocket experiments
Bill Bristow	GI-UAF	SuperDARN/RAO collaboration
Gurudas Ganguli	NRL	Ionospheric source for auroral flicker
Jim Hecht	Aerospace	Thermospheric composition studies with RAO and optics

Space Weather Month Workshop

Campaign Aims: Space Weather Month is a two-month long campaign interval during September and October 1999, conceived and coordinated under the auspices of SCOSTEP's S-RAMP program. It also includes two other storms for comparative studies: the April 2000 event and the Bastille Day storm.

There are four major aims of this campaign: 1) to study space weather events from their initiation on the sun to their impacts at the Earth; 2) to investigate the effects on space-based and ground-based worldwide assets; 3) to assess the accuracy of forecasting techniques; and 4) to make comparative studies of different events that appear similar in some ways, but differ in others.

The Workshop: Although this workshop was initiated at the 2000 SCOSTEP meeting in Japan, it was decided to conduct the campaign in a new electronic workshop format. The workshop at CEDAR represented the kickoff meeting for the electronic phase of the Space Weather Month Workshop.

The Workshop was held from 4-6 pm on Thursday. After the aims of the workshop were summarized by Janet Kozyra, Peter Knoop made a presentation describing the format of the electronic workshop pages and the process of signing on for the electronic portions of the workshop. The relevant material can be accessed at the URL http://worktools.si.umich.edu .

A number of science presentations followed:

- Sunanda Basu - Penetration Electric Fields
- Johnathon Makela - Arecibo and Space Weather Month
- Wenbin Wang - TING Model Runs During Space Weather Month
- Yongliang Zhang - Bastille Day Storm

The workshop ended with a 40-minute discussion comparing results and data sets.

The presentations listed above described a number of developing efforts related to the Space Weather Month Campaign in the ionosphere and neutral atmosphere. Other efforts related to this campaign are being undertaken in subjects away from CEDAR's main areas of interest (an example of one such subject that is being pursued primarily by researchers who are not normally involved in CEDAR is the study of space weather effects on human systems such as geomagnetically induced currents in power lines). Thus, it was not possible to include discussion of all of the subjects addressed by the Space Weather Month campaign at the CEDAR meeting, but the campaign as a whole promises to produce important interactions involving researchers in all aspects of space weather research and Sun-Earth interactions.

During the course of the workshop, a number of people were signed on for its electronic phase, and the techniques and intentions of the electronic phase were described. Thus, the main aims of this kickoff workshop were achieved.

Alan Burns, U. of Michigan
Space Physics Research Lab

News & Announcements

UPCOMING SESSIONS

Two sessions of interest to the CEDAR community are fast approaching:

1. Fall AGU, Dec 10-14, SA02: A Celebration of Research on Atmospheric Coupling: NSF/CEDAR Accomplishments and New Thrusts (with AE and HGC). For information, contact Cassandra Fesen via email (fesen@tides.utdallas.edu) or Roger Smith (roger.smith@gi.alaska.edu). See also http://www.agu.org/meetings/fm01top.html and http://www.agu.org/meetings/fm01call.html.

2. 2002 URSI, Boulder, Jan 9-12: Lightning Effects in the Ionosphere. For more information, contact Steve Cummer (cummer@ee.duke.edu). Go to http://cires.colorado.edu/ursi for more information.

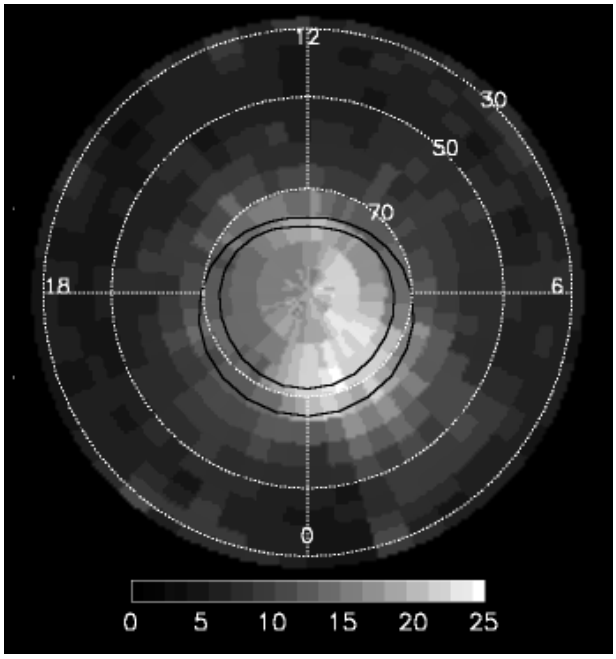
This joint session is being organized by Commissions G and H: Lightning Effects in the Ionosphere. It will cover all aspects of coupling between lightning and the ionosphere/thermosphere/mesosphere system. Papers will be presented on recent experimental and theoretical results in studies of energetic coupling of tropospheric thunderstorms to the mesospheric and ionospheric regions. Sprites, Jets, Elves and related electromagnetic effects and their local and global consequences will also be discussed. For more information, go to http://cires.colorado.edu/ursi.

THE DECADAL STUDY

The MIA panel for the Decadal Study continues to work towards a final draft of their report. CEDAR has provided input through the CEDAR website (http://cedarweb.hao.ucar.edu/decadal.html), the meeting at the CEDAR workshop and by email contacts with panel members. These inputs have been important to the thinking of the panel and have been used in revising the list of recommendations. The MIA panel will be meeting again on September 14 and 15, 2001 to finalize its work.

If you have further input, you can submit by using the CEDAR website, or by direct contact with Mike Kelley, John Foster or Roger Smith.

Thermospheric Vertical Wind Activity Mapped by the Dynamics Explorer-2 Satellite



Twenty years after its launch in 1981, the Dynamics Explorer-2 (DE2) satellite mission is still yielding new insights into Earth's thermosphere. The Wind And Temperature Spectrometer (WATS) instrument aboard DE2 measured thermospheric zonal and vertical neutral winds between approximately 300- and 650-km altitude with global coverage.

While the WATS zonal wind measurements have greatly advanced our knowledge of thermospheric dynamics, the vertical wind (V_z) measurements have received relatively little attention. This is most likely because there is a slowly varying DC offset in the WATS wind measurements, making their absolute zero value uncertain by 50 m/s or more, an amount that exceeds typical V_z values.

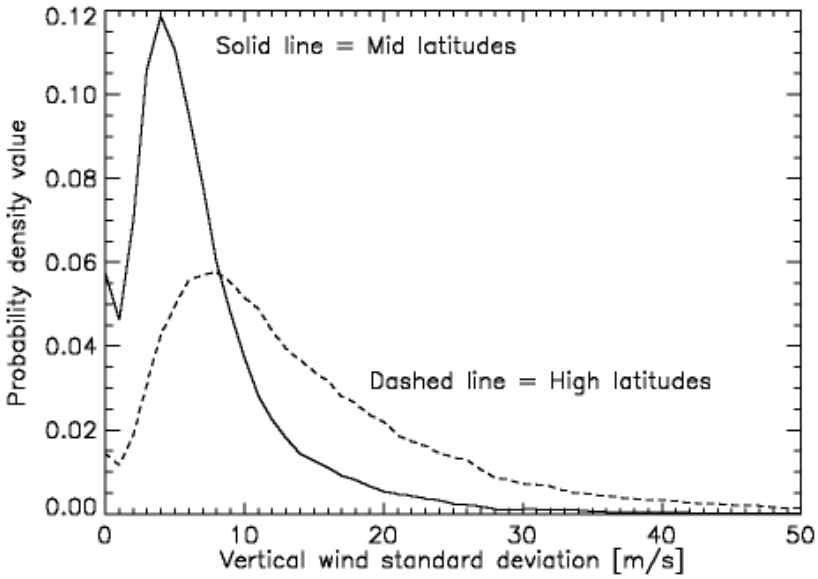
However, it is known that thermospheric vertical winds appear quasi-stochastic; they are better characterized by their fluctuations than by their mean value. Thus, rather than using the directly measured V_z values, here we have mapped the *standard deviation* of the vertical wind, $\sigma(V_z)$, using an ~900-km sliding window of orbital track length (Figure 1). $\sigma(V_z)$ is of course insensitive to any DC offset present in the original V_z time series.

We interpret this map as indicating, in a magnetic latitude/local time frame, the average spatial distribution of vertical wind activity in the Earth's thermosphere. Figure 1 combines all measurements poleward of 25° magnetic latitude, including both hemispheres and all altitudes below 650-km. The grayscale bar indicates $\sigma(V_z)$ values in m/s. A nominal Q=2 auroral oval is superimposed for reference.

We believe this is the first map showing Earth's thermospheric vertical wind activity. We had expected to find greatest activity near the auroral oval. Instead, it appears that elevated $\sigma(V_z)$ values occur throughout the polar cap, with greatest activity occurring in the midnight-dawn sector. To better quantify the dependence on geomagnetic latitude, Figure 2 shows histograms of normalized $\sigma(V_z)$ occurrence frequency for middle latitudes (between 25°- 60°, solid curve) and for high latitudes (above 60°, dashed curve). The distribution for high latitudes peaks at a larger $\sigma(V_z)$ value and exhibits a "tail" that extends to much higher $\sigma(V_z)$ values.

Our interpretation is that the observed spatial distribution of $\sigma(V_z)$ arises due to thermospheric gravity waves being generated in the post-midnight auroral oval and propagating preferentially poleward due to the near ubiquitous anti-sunward horizontal wind that prevails at this local time. We are currently preparing a more detailed study of the influences on $\sigma(V_z)$ due to altitude, magnetic activity, solar illumination, and hemispheric asymmetries.

Mark Conde & John Innis, GI-UAF



The Polar Aeronomy and Radio Science Summer School August 13-23, 2001

The Polar Aeronomy and Radio Science (PARS) Summer School is an annual event and was held this year for the second time in Fairbanks, Alaska. Participating students took part in hands-on experimental work at Poker Flat Research Range (PFRR), the High Power Auroral Stimulation (HIPAS) Observatory and the High-frequency Active Auroral Research Project (HAARP) site in Gakona, Alaska. Organization and attendance at the school was supported by HAARP funds supplemented by NSF.

The learning experience was designed around small groups of students, each with a faculty advisor. The school comprised eight full days, each of which had two extended tutorial sessions and scheduled visits to local sites for instruction and experiments. The presentation topics and tutorial leaders were:

- Thermosphere—Roger Smith
- Ionosphere—Bill Bristow
- Polar Summer Mesosphere—Mike Kelley
- Lidar Technology—Richard Collins
- Meteor and MF Radar—Denise Thorsen
- Auroral Oval—Charles Deehr
- Optical Techniques—Mark Conde
- Lidar Science—Richard Collins
- Radio Techniques—Umran Inan
- Incoherent Scatter Radar—Brenton Watkins
- SuperDARN—John Hughes
- Transionospheric Probing and Propagation—Ed Fremouw
- HAARP Transmitter—Ed Kennedy
- Plasma Structures—Evgeny Mishin
- Gakona Observatory—Ed Kennedy
- Space Weather—Bill Bristow
- HAARP Applications—Gene Wescott.

The program also included a day of travel between Fairbanks and Gakona. Participants toured part of Denali National Park and took the wilderness route (the Denali Highway, a 138-mile stretch of rough but scenic road) from Cantwell to Paxson.

Students and faculty members pose outside the Chatanika Lodge near Poker Flat (photo by Lee Snyder).

Attendance at the school was limited to 20 graduate and undergraduate students because of restrictions on the number of experiment opportunities. Total attendance was 41, including all faculty and students participating.

The students were selected through an application process that required them to submit experiment proposals. The proposals were evaluated by organizers.

Four positions were offered to ionospheric incumbents of Research for Undergraduates (REU) positions throughout the country. These students came from Augsburg College, the Massachusetts Institute of Technology, the University of California Los Angeles and Cornell University.

The experiments selected were:

- Lidar Investigations of the Mesosphere and Noctilucent Clouds (directed by Richard Collins)
- Detection of Polar Mesospheric Summer Echoes by FM station Transmissions (Camilo Ramos, Mike Nicolls and Mike Kelley)
- Detection of Summer Echoes Using the HAARP Transmitter (Rudolpho Cuevas and Mike Kelley)
- Generation of Artificial ELF Emissions to Bounce from the Magnetic Conjugate (Tim Chavalier and Umran Inan)
- Attempt to Measure Artificial ELF/VLF Transmissions at CLUSTER (Maria Salvati and Umran Inan)
- Observation of Ionospheric Heating Using SuperDARN (directed by Bill Bristow)
- VLF Remote Sensing of the D Region Electron Temperature Profile (Robert Moore, Tim Bell and Umran Inan).

Roger Smith, GI-UAF

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CEDAR Events Calendar 2001-2002

Item	Start Date	End Date	Notes
AGU Special Session Decision	July 6, 2001		We decided to go with History of Geophysics as cosponsor.
Decadal Study	July 9, 2001		Decadal Survey Committee meeting
CEDAR Post input deadline	July 20, 2001		Need all workshop reports and other items
AGU mailed abstracts due	August 30, 2001		Target date to submit papers for CEDAR special sesssion
AGU electronic abstracts due	September 6, 2001		Target date to submit papers for CEDAR special session
Decadal Study	September 14, 2001	September 15, 2001	Decadal MIA panel meeting
CEDAR Post publication	September 20, 2001		
CSSC meeting	November 5, 2001	November 6, 2001	Suggested dates for meeting
AGU Fall Meeting	December 10, 2001	December 14, 2001	No date for special session yet
CEDAR Post input deadline	December 14, 2001		
CEDAR Post publication	January 14, 2002		
CEDAR Post input deadline	April 8, 2002		Need all program and workshop schedules confirmed
CEDAR Post publication	May 6, 2002		
CEDAR Workshop 2002	June 16, 2002	June 21, 2002	

Keck Sky Spectra Report

Astronomical nightglow (sky) spectra from the HIRES echelle spectrograph on the Keck I telescope are now available on line as ASCII files at : http://www-mpl.sri.com/NVAO/download/Osterbrock.html.

The Keck I telescope is located on Mauna Kea, Hawaii (155°28'20'' W, 19°49'34'' N, 4207 m above mean sea level). The spectra cover the 400-900 nm range and are co-added from 168 roughly one-hour observations taken over the solar-minimum 1993-97 time period. The wavelength calibration is believed to be accurate to 0.0005 nm, and the resolution is about 37,000, or 0.02 nm at 750 nm.

For convenience in downloading, the spectrum is broken up into ten files covering 50-nm intervals. This spectrum is the best available nightglow spectrum in terms of wavelength coverage, spectral resolution, and the simultaneity of data collection during each one-hour observation.

The original spectra were obtained on clear nights with an average elevation angle of about 60 degrees, with few measurements below 40 degrees. Comparison of these spectra with others obtained near solar max show that in the latter case there are strong additional features that appear, from ionospheric processes that are enhanced in the equatorial anomaly region. Those interested in more than this single averaged nighttime spectrum are encouraged to contact us via email (tom.slanger@sri.com or david.huestis@sri.com).

The strongest features are the usual nightglow observables - OH, Na, the 0-1 O2(b-X) band, and the red and green lines of O. Amplification reveals many weaker features, including a great number of bands in the O2 Atmospheric Band system, many OH lines not previously seen in the nightglow, and atomic lines of H, O, N, and K.

Subsequent versions of these files will include intensity calibration after renormalization using the astronomers' spectra of standard stars.

The "continuum" baseline signal comes mostly from unresolved starlight and sunlight scattered by interplanetary dust and the moon into the field of view of the telescope, but has been normalized to unity in the co-addition. There may also be an atmospheric component.

The solar component can be verified by identifying the "down" peaks as Fraunhofer absorption lines. The background continuum is also demonstrated by atmospheric absorption in the Fraunhofer A-band region.

Tom Slanger & David Huestis, SRI

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