The Cedar Post

October 1995 No. 26

The TIMED Satellite Mission: Implications for CEDAR

Good news looks to be forthcoming at last! The TIMED mission is on the verge of Congressional approval as a new start in the FY 96 budget. We were selected by NSF to represent the ground-based community on issues concerning the collaboration of TIMED science with the network of ground-based instruments. We have attended the TIMED Science Working Group meetings over the last year, and this has given us the opportunity to watch the various processes at work that attend the startup of an important mission such as TIMED. In September, funding for TIMED as the first probe in the Space Physics Division Solar Connections Program was allocated in the Senate version of the NASA budget. The House version left out TIMED altogether so these two versions must be reconciled. If TIMED does not survive this year's budget process, we are hopeful that NASA will include TIMED as a new start in the FY97 budget to be submitted to Congress next January.

Although TIMED has been descoped into a single satellite with a two-year lifetime mission, perhaps the CEDAR community does not yet realize that NASA funding has already been awarded to the four PI institutions (Michigan, NCAR, NASA Langley Research Center, and Aerospace) to start instrument definition for the four TIMED instruments (TIDI, SEE, SABER, and GUVI). This indicates a firm commitment from NASA Headquarters to give the TIMED mission the highest priority for new starts in the Space Physics Division. The scientific contributions to global change and space weather that TIMED measurements would provide were other important drivers in selling TIMED to the Congress. Furthermore, TIMED promises to provide educational opportunities of major scope through the utilization of the "information superhighway." Almost instantaneously, preliminary TIMED results would be channeled to students and the general public as a part of an educational outreach program to enhance the scientific literacy of the public.

In spite of the currently depressed budget climate, the argument that TIMED represents the space physics community's response to the mantra of NASA Administrator Goldin (*"faster, quicker, cheaper"*) was a major factor bringing TIMED to this juncture. Now that TIMED looks to be a reality with a launch scheduled for the spring of 1999, the question that comes up is *"How will CEDAR/NSF contribute to, and participate in, the TIMED mission?"* Because atmospheric and space science have evolved in

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Multi-instrumented Studies of Equatorial Thermosphere Aeronomy (MISETA)

The development of the MISETA/CEDAR initiative was motivated by the need to improve our understanding of equatorial electrodynamics with special attention given to these two important issues: (1) understanding the development of the coupling between the neutral and ionized constituents of the thermosphere (which constitutes the F-region dynamo); and (2) identifying possible sources of variability for equatorial spread-F.

Of particular interest is the role played by both small and large scale dynamics of the neutral atmosphere in governing the formation of large scale structures ("bubbles") in the equatorial F-region plasma. Although the possible contribution to equatorial spread-F development by gravity waves has been extensively considered, knowledge of what role a large scale, neutral structure (such as the midnight temperature anomaly) might play, has been missing.

In order to answer these questions, the MISETA initiative supports a variety of measurements, combined with improved modelling of the observations. Modelling is considered especially important. C. Fesen (Dartmouth College) and D. Decker (Boston College) have provided leadership concerning large scale and local scale questions of neutral and plasma dynamics in the equatorial thermosphere region.

The first MISETA measurement campaign took place in the South American sector at the magnetic equator and the southern Appleton anomaly, between 24 September and 8 October 1994. This campaign was conducted in coordination with an Air Force effort located in Chile (E. Weber, Phillips Lab).

At the Arequipa station in southern Peru, measurements of winds and temperatures were made with a Fabry Perot interferometer (Meriwether, Clemson U; Biondi, U of Pittsburgh). All sky imaging observations were obtained at several wavelengths with the Boston University CCD imaging system. At Ancon, zonal scintillation drift measurements were obtained with spaced beacon receiver system (Valledares, Boston College). All these instruments were designed to operate automatically.

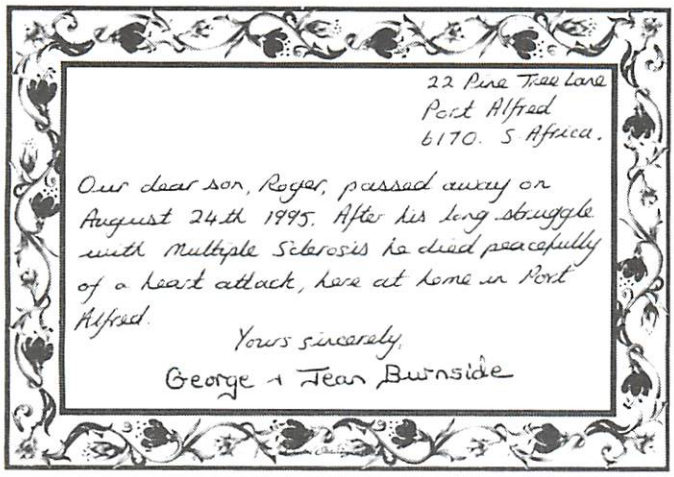
A major highlight of these observations was the continual operation of the Jicamarca incoherent scatter radar over the two weeks of the measurement campaign, for local time periods of 14 LT to 03 LT. This allowed observation of the vertical distribution of backscatter power and zonal plasma drifts with interferometric techniques (Kudeki, U of Illinois; Hysell, Clemson U).

The Air Force effort centered upon all-sky airglow observations (Weber, Phillips Lab), scintillation drift measurements (S. Basu, Phillips Lab), and digital ionosonde observations (Bullett, Phillips Lab).

This two-week period proved quite productive, as the scintillation activity was highly variable from night to night. The weather was extremely clear for both the Arequipa and Chile optical sites, with a major magnetic storm occurring the night of 2/3 October, 1994. Analyses of the scientific data from these observations is well underway, with first results already presented at both the CEDAR MISETA workshop, and the IUGG meeting in Boulder this summer. A special 1996 issue of the *J. of Geophys. Res.* will publish results from this effort, as well as other highlights from equatorial aeronomy observations. A session at the Fall 1995 AGU meeting will present further details from the separate analyses which are underway.

Plans for the future call for another measurement campaign effort in March/April of 1996 to observe the dynamics at a time when the direction of the meridional wind is reversed from that of the first campaign. A third campaign during the June-July period should allow observation at a time when scintillation activity is expected to be sporadic.

John W. Meriwether, Clemson University



22 Pine Tree Lane
Port Alfred
6170. S Africa.

Our dear son, Roger, passed away on August 24th 1995. After his long struggle with Multiple Sclerosis he died peacefully of a heart attack, here at home in Port Alfred.

Yours sincerely,
George + Jean Burnside

Dr. Roger Burnside

Dr. Roger Burnside died of a heart attack August 24 after a long struggle with multiple sclerosis. Due to his illness, he left Arecibo a few years ago to return to the home of his parents in South Africa (*see note from his parents*).

Dr. Roger Burnside worked at the Arecibo Observatory after graduating from the University of Michigan. It was at Arecibo that he compared the neutral winds derived from the Fabry-Perot and incoherent scatter radar and deduced the "Burnside" multiplicative factor for the 0+ 0 collission frequency. He cut a wide path in a short time and will be missed by many colleagues.

CEDAR Implications re: TIMED *(continued from page 1)*

complexity to the point where further understanding and progress require multi-disciplinary approaches, the scientific questions that pertain to the region of 60 to 180 km (long called the "ignorosphere") that is the focus of the TIMED mission, cannot be resolved by orbital measurements alone. In fact, the ground-based instrument network is listed as part of the instrument complement that makes up the remote sensing capability of TIMED. The CEDAR network and the TIMED satellite would be used together 1) to observe and explore the temperature, density, and wind structure of the mesosphere and lower thermosphere (MLT) region; and 2) to investigate and quantify the importance of the radiative, chemical, electrodynamical, and dynamical sources and sinks of energy that exist. Since the CEDAR network's contribution to the TIMED mission is regarded as essential to TIMED success, NASA and NSF plan to provide significant funding support to CEDAR scientific investigations relating to TIMED. NASA and NSF intend to make an announcement of opportunity to be released approximately 18 months prior to launch.

The CEDAR network of optical and radar observatories will contribute to the TIMED mission in a variety of ways. The descoping of the original formulation of the TIMED mission goals resulted in the unfortunate loss of TIMED capability to observe plasma drifts, plasma composition, and other ionospheric parameters. Where these parameters are necessary for the resolution of scientific questions, the ground-network, as the "fifth instrument," would plug the gap left by these shortcomings. However, the CEDAR network, with its diversified matrix of ground-based instrumental capabilities, brings to the TIMED collaboration many attributes that did not previously exist in space science. Specific topical areas where the ground-based program of CEDAR would contribute to the success of TIMED are the following:

Validation *of TIMED measurements to ensure accuracy and consistency.*

Validation checks provide greater confidence in inversion algorithms, and establish the required consistency when mixing measurements in assimilation algorithms. As an example of the importance of validation, systematic errors hitherto negligible are likely to be significant because TIMED aims to determine profiles of winds and temperature with accuracies on the order of 2-3 m/s and < 1K.

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New CEDAR Science Steering Committee (CSSC)

At the conclusion of this year's workshop, Miguel Larsen, Timothy Killeen, and Clark Miller completed their terms on the committee. We are indebted to them for their leadership, service, and commitment during the past three years.

We welcome Michael Mendillo (CSSC Chair-elect) and Joe Salah as new members to the committee. Todd Valentic replaces Clark Miller as student representative.

Listed below are the names and addresses of the current CSSC members for 1995-96. You are invited to contact any of these individuals as a means of bringing matters to the attention of the CSSC committee.

Dr. Cassandra G. Fesen
Dept. of Physics & Astronomy
6127 Wilder
Dartmouth College
Hanover, NH 03755-3528
(603) 646-3629
fesen@tides.dartmouth.edu

Dr. Jeffrey Forbes
CSSC Chair
Department of Aerospace Engineering Sciences
University of Colorado
Boulder, CO 80309-0429
(303) 492-4359
forbes@zeke.colorado.edu

Dr. John Holt
MIT/Haystack Observatory
Off Route 40
Westford, MA 01886
(617) 981-5625
jmh@chaos.haystack.edu

Dr. Robert Kerr
Boston University
Center for Space Physics
725 Commonwealth Avenue
Boston, MA 02215
(617) 353-6139
kerr@moe.bu.edu

Dr. Michael Mendillo
CSSC Chair-elect
Department of Astronomy
725 Commonwealth Avenue
Boston University
Boston, MA 02215
(617) 353-2629
mendillo@bu.edu

Dr. John Sahr
404 Electrical Engineering Building, FT10
University of Washington
Seattle, WA 98195
(206) 685-4816
jdsahr@ee.washington.edu

Dr. Joe Salah
MIT/Haystack Observatory
Off Route 40
Westford, MA 01886
(617) 981-5411
jes@wells.haystack.edu

Dr. Gary Swenson
Lockheed Research Laboratory
Department 91-20 B-255
3251 Hanover Street
Palo Alto, CA 94304
(415) 424-3297
swenson@agena.space.lockheed.com

Dr. Jeffrey Thayer
Geoscience and Engineering Center
SRI International
Building G, Room 284
333 Ravenswood Avenue
Menlo Park, CA 94025
(415) 859-3557
jeff_thayer@qm.sri.com

Dr. Sunanda Basu
ex officio
Program Director, Aeronomy
National Science Foundation
GEO/ATM
Room 790
4201 Wilson Boulevard
Arlington, VA 22230
(703) 306-1529
sbasu@nsf.gov

Dr. Robert Robinson
ex officio
Program Director,
Upper Atmospheric Facilities
National Science Foundation
GEO/ATM
Room 790
4201 Wilson Boulevard
Arlington, VA 22230
(703) 306-1531
rmrobins@nsf.gov

Mr. Todd Valentic
student representative
Department of Electrical Engineering
Campus Box 425
University of Colorado
Boulder, CO 80309-0425
(303) 492-4290
valentic@boulder.colorado.edu

Update to the Arecibo Incoherent Scatter Radar Data

During the past year, we updated the Arecibo F-region data stored at the NCAR CEDAR Database for the period from October 1985 to the present. The new data also includes composition information for $[H^+]$ and $[He^+]$ of the upper F-region. This is in addition to the original information on electron and ion temperatures, electron concentration, and line-of-sight velocity for the altitude range between 144 to 660 km. Information about the data processing can be found in the accompanying header file, or in paper form, upon request.

Interested users can obtain these data directly from the CEDAR Database or from the Arecibo Observatory.

We are also in the process of updating the high resolution (600 m) electron concentration data for the altitude range between 60 and 500 km. Compared with earlier results, the new [Ne] data have improved accuracy for altitudes below 150 km. The new electron concentrations will soon be available in the CEDAR Database.

Qihou Zhou and *Mike Sulzer*
Arecibo Observatory, Arecibo, Puerto Rico

ALOHA/ANLC-93

8-12 May 1995

Below are the smiling participants of the ALOHA/ANLC-93 Workshop held at the Manele Bay Hotel, Lana'i during 8-12 May 1995. Front row (l.r.) Xin Tao, John Plane, Jun Qian, Yiyun Gu, Herb Carlson, Chet Gardner, Ed Dewan, George Papen, Usama Makhlouf. Back row (l.r.) Mike Hickey, Rudy Wiens, Mark Coble, T.F. Tuan, Gary Swenson, Francisco Garcia, Bob Vincent, Mike Taylor, Bob Lowe, Pat Espy, Dave Turnbull, Jim Hecht, Ray Roble, Larry Radke, Phan Dao, Gamini Munsinghe. The Oct. 15 issue of *Geophysical Research Letters* will include papers describing the initial scientific results of the ALOHA/ANLC-93 (1993 Airborne Lidar and Observations of the Hawaiian Airglow/Airborne Noctilucent Cloud) Campaigns. The Campaigns were supported in part by the CEDAR Program.

CEDAR Implications re: TIMED *(cont. from page 3)*

Collaboration *on the study of the Earth's large scale dynamics of the mean global circulation system, tides and planetary waves.*

A major priority in the TIMED scientific objectives is the investigation of the mean zonal and meridional circulations that closely relate to the momentum imbalance imposed by dissipating gravity waves at high latitudes. Here the CEDAR contribution is particularly important since it can remove or amelerіorate the sampling difficulties that pertain to TIMED's inability to sample the global wind and temperature fields at different local times within the short time period required to maintain the stationary balance of the mean circulation structure. Aliasing arising from the slow sampling by TIMED, relative to the local time changes in the mean zonal circulation system, can cause spurious tidal harmonics. Because the ground network can observe the global circulation at many different local times, potentially these measurements can complement the measurements by a single satellite to achieve a true picture of the morphology of the Earth's large scale dynamics.

Investigation *of global energetics*

Joule heating, equatorial electrodynamics, auroral/magnetosphere substorms, and solar flare effects are examples of the specific phenomena (all closely related to "space weather concerns") that would be addressed in this area. The study of Joule heating, in particular, will require the ground network's participation because the global reconstruction of the current systems and high-latitude convection electric fields for the auroral and polar regions requires input from many ground-based stations. A data assimilation scheme that can combine the above ground-based and space-based observations is essential to the determination of the spatial and temporal distributions of Joule heating rates.

Observation *of small scale dynamics within the MLT regions*

Two examples are gravity waves and the electrodynamics of the polar and auroral regions relating to auroral morphology. The imaging capability of TIMED to observe fine scale structure, combined with the profile measurements of winds and temperatures from TIMED with neutral and ionospheric parameter measurements from ground-based CEDAR stations, represent new opportunities to gain understanding of the many physical processes that enter into the development of fine structure in the upper atmosphere. CEDAR measurements of seasonal/ latitudinal/ longitudinal climatologies of gravity wave characteristics, not only for the MLT region but also for the source region of the troposphere, would provide an important context for TIMED measurements and help determine the estimation of gravity wave energy transferred from the troposphere to the upper atmosphere.

These four areas by no means represent the full range of possible TIMED/CEDAR investigations. This list should, however, provide a sense of the important role that CEDAR could play in contributing to the success of the TIMED mission.

Following the selection of participants, it is envisioned that a TIMED/CEDAR workshop would establish topical initiatives in various areas. Observations could begin as early as the 12-month period prior to launch and continue throughout the two-year lifetime of the TIMED mission. The organization of topical initiatives established in the TIMED/CEDAR workshop effort could be similar to that of existing CEDAR initiatives (i.e. the LTCS, ALOHA, and MISETA) that have emphasized collaborative instrumental and theoretical studies. A close coordination effort will be necessary to organize observing efforts among the CEDAR radar and optical communities, and to work closely with the TIMED instrumental PIs to determine optimal observing strategies for specific scientific goals. TIMED interdiscplinary scientists would work closely with the CEDAR modelling community to provide appropriate response to the variety of modelling needs that will appear once the extensive TIMED/CEDAR database of observations become available for analysis. Since the ground-based plan for participation within the TIMED mission

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1995 CEDAR Workshop, NIST/NCAR

June 25-30, 1995

The 1995 CEDAR Workshop was held in Boulder between Sunday, June 25, and Friday, June 30, just before the 2-week IUGG conference. CEDAR participants totalled 315. Forty universities and 33 research installations were represented, with 16 institutions in 12 countries outside the U.S. NSF supported the on-site expenses for all 142 students who attended, including students from England and Spain, and also paid travel expenses for students coming from U.S. institutions. Two students arrived a week early to work on a CEDAR Data Base project: Ron Caton from the University of Alabama in Huntsville looked for signatures of ion outflows in density and temperature, while Ingo Mueller-Wodarg from the University College, London sought wind and temperature models and data for the middle atmosphere.

Dave Fritts gave the CEDAR Prize lecture, on gravity waves. The tutorial presented jointly by Chet Gardner and Richard Walterscheid also covered gravity waves. Two additional middle atmosphere tutorials on global change and modelling were given by Gary Thomas and Kevin Hamilton. The remaining two tutorials covered space weather, presented by Dan Baker and Bob Schunk. Hard copies of the transparencies are available, as are videotapes of these talks. Please contact Barbara Emery (emery@ncar.ucar.edu, HAO/NCAR, PO Box 3000, Boulder CO, 80307) if interested.

There were 22 workshops this year, including the second annual student workshop, where some people from industry shared what they look for in job applicants. Sixty-nine posters were shown during two poster sessions, with fifty eligible for judging because students were first author. There were 4 poster prize winners who received a copy of the book, Theory of Planetary Atmospheres by Joseph Chamberlain and Don Hanton. First place winners were Julie Chang (University of Colorado), who presented meteor radar results from Christmas Island, and Joshua Semeter (Boston University), who showed tomographic inversions of emissions from COTIF. Second place winners were Thomas Immel (University of Alaska), who showed atomic oxygen variations, and Todd Valentic (University of Colorado), who compared meteor radar results from Buckland Park, Australia. Incidentally, Todd is our new student representative on the CEDAR Steering Committee (valentic@boulder.colorado.edu) and will help plan next year's student workshop. Please contact him with suggestions.

The 1996 CEDAR Workshop will be held entirely at the University of Colorado, between Sunday, June 16, and Saturday, June 22. Plenary sessions will be held in Math-100 and the workshops in the Engineering Building. The dorms will be at nearby Kittredge. The 1997 CEDAR Workshop is scheduled for June 15-21, also at the University.

Barbara Emery, HAO/NCAR

CEDAR Implications re: TIMED *(cont. from page 6)*

is still in its formative period, we invite all interested members of the community to communicate their ideas and suggestions to us. We will insure that all such input is carefully considered by the TIMED Science Team.

The timing of the TIMED mission with the beginning of solar maximum could hardly be more propitious for the CEDAR community. The CEDAR initiative has been under extensive development over the last decade, and an impressive list of capabilities representing state-of-the-art technology and modelling has been achieved. The TIMED mission represents a wonderful opportunity to demonstrate that this very substantial national investment, coupled with similar international initiatives developed by other nations has all been worthwhile. The union of observations from the ground-based network with the global perspective that TIMED measurements can provide will broaden the scope of our overall scientific studies to a substantial degree. Such efforts would truly be worthy of the vigorous new thrust in Space Science in the 21st Century.

John W. Meriwether, Clemson University
Joseph E. Salah, Massachusetts Institute of Technology

A Report on the CEDAR LTCS Workshop - Status and Plans

A Lower Thermospheric Coupling Study Workshop was held on Tuesday afternoon during the CEDAR Meeting this summer, with approximately 32 participants. This was the first LTCS workshop for the past two years, so we had quite a bit of catching up to do on the activities of participating scientists and future individual and group plans. This article is meant to update the CEDAR community as a whole, and to remind participants of the status of the LTCS and our future plans.

The Lower Thermospheric Coupling Study was organized as a CEDAR project in 1987. Since then, researchers active in LTCS have participated in 11 different global observation campaigns focusing on the lower thermosphere (see the following list of campaigns), contributed to special issues of JGR Space Physics and JATP, participated in special sessions at COSPAR and AGU, and published numerous papers relating to LTCS activities.

	Core Interval	Ap Range
	LTCS 1 September 21-25, 1987	10-46
	LTCS 2 December 5-10, 1988	3-8
	LTCS 3 May 30-June 4, 1989	9-19
	LTCS 4 February 12-16, 1990	6-50
MLTCS 1	LTCS 5 March 14-20, 1991	6-13
MLTCS 2	LTCS 6 December 4-10, 1991	5-15
MLTCS 3	LTCS 7 March 20-April 3, 1992	6-32
MLTCS 4	LTCS 8 July 30-August 5, 1992	4-35
MLTCS 5	LTCS 9 January 20-30, 1993	4-25
MLTCS 6	LTCS 10 August 9-18, 1994	4-27
MLTCS 7	LTCS 11 May 1-5, 1995	3-49

Upcoming Experiments

MLTCS 8	LTCS 12 October 23-27, 1995
MLTCS 9	LTCS 13 March 19-22, 1996
MLTCS 10	LTCS 14 October 8-12, 1996
MLTCS 11	LTCS 15 January 1997 (date not yet determined)

From its inception, Jeff Forbes acted as the coordinator of LTCS research and workshop activities. At his request, Cassandra Fesen and Roberta Johnson agreed to take on responsibility for LTCS coordination activities. We intend to facilitate productive collaborative studies based on previous and up-coming LTCS experiments. Please contact us at the following addresses:

Dr. Cassandra Fesen
Dept. of Physics and Astronomy
6127 Wilder Lab
Dartmouth College
Hanover, NH 03755
voice: 603-646-3629
fax: 603-646-1446
email: fesen@tides.dartmouth.edu

Dr. Roberta Johnson
Space Physics Research Laboratory
The University of Michigan
2455 Hayward
Ann Arbor, MI 48109-2143
voice: 313-747-3430
fax: 313-763-0437
email: rjohnson@umich.edu

Prior to the LTCS Workshop, participating scientists were asked to prepare updates of the status of their LTCS-related activities, and also to share ideas for future community-wide collaborative studies or scientific objectives on which LTCS should focus. Previous topics (several of which are continuing activities) have included a detailed analysis of the lower thermosphere during LTCS-1 utilizing both modeling and observational results, studies of the lower thermosphere during December, utilizing LTCS-2 and -6 datasets, and a study of lower thermosphere and upper thermosphere coupling. In addition to these topics, several science objectives were proposed in the original

white paper for the LTCS. These included studies of the global scale circulation in the lower thermosphere, electrodynamic coupling, upwardly propagating tides and planetary waves, waves and turbulence, and geomagnetic storm effects.

Table 1 summarizes the status of LTCS-related activities provided by the respondents to this inquiry.

Table 2 summarizes the current on-going LTCS projects and near-term plans of these repondents.

Table 1

Institute	Int.	Anal.	Presented	Pub.	Comments
Durham	1-10	X	X some	X some	mean winds, tides, filtering/spectral analysis
Millstone	1-5	X	X	X	
	6	X	X		LTCS 2/6 study
	7,8				difficulties, reprocessing - LTCS 8 planetary waves
	9,10	X	X		
Sondrestrom	1	X	X	X	
	2,3	X	X		summary paper to be submitted
	4-10	X	X (6,9)		preliminary, reprocessing
TIEGCM	1-10				modeling completed

Table 2
Current Activities, Plans

Durham - **Ron Clark**
- collaboration with Millstone FPI/ISR
- basic experiments to clarify radar sampling - Meteor/ISR

Millstone - **Salah and Deng**
- reprocessing LTCS 8 data
- integrate ISR daytime data with FPI (green line and OH) to obtain 24 hr coverage and allow diurnal tides and long period waves to be obtained
- comparison of line of sight winds and drifts in common volume between Durham and Millstone

TIEGCM - **Fesen**
- comparison of model results with ISRs for LTCS 1-10
- write up modeling of LTCS 2/6 campaign - focus on Tn, neutral wind, average diurnal variations and tidal components
- investigate model representation of ionosphere (LTCS-9)

Sondrestrom - **Johnson**
- intensive work on resolving problems with Sondrestrom data for LTCS in general after LTCS 3
- proceed to analysis of LTCS data to get tides, waves, mean winds, analyse geomagnetic activity effects, local climatology, and augment global empirical model

CIRRIS - **Wise**
- testing TIME-GCM against CIRRIS data by simulating limb radiance data

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CEDAR Education for the 21st Century

by Clark Miller

DAR is both an NSF program and a community of scientists, faculty, and students—some of whom are, or have been funded, by the program. Although the program has a strong focus on the science of the mesosphere and thermosphere, NSF has always regarded education as a central mission of CEDAR. The CEDAR community reflects a broader set of shared goals, interests, and responsibilities, particularly with regard to educating the next generation of CEDAR scientists. CEDAR's effort to incorporate students into the program's activities at the summer workshop, and its inclusion of a student representative on the Science Steering Committee, testify to its ready recognition of these responsibilities.

However, CEDAR is faced with many challenges. General budgetary pressures (quite aside from the Republican revolution in Congress) have brought growth in scientific funding to a relative standstill, while at the same time, an increase in the number of research scientists seeking federal funding has cut the average grant size in half (or more). Cuts in defense spending have caused more people to return to universities for higher degrees and intensified the competition for scarce academic positions, while also reducing the number of jobs in industry. All of this has led to dangerously low levels of morale among young scientists and graduate students, as witnessed by the daily discussions on the Young Scientists Network. That CEDAR has managed, for the most part, to avoid this malaise is also testimony to the level at which discussions on these problems are already taking place in our community.

All of these issues, and more, were raised at this year's Student Workshop at the annual CEDAR summer extravaganza. Over 100 students and postdocs (and nearly a dozen senior scientists and faculty) turned out for a series of tutorials given by three of CEDAR's rising young stars, presentations by featured speakers from NSF and Radian Corporation, and a panel discussion on skills training within CEDAR graduate education that was, unfortunately, cut short by transportation requirements. [This brings up a quick point. Although the student workshop is organized explicitly with student participation in mind (tutorials which introduce topics likely to arise later in the week, discussions centered around job prospects and graduate student education) interested members of the community are encouraged to attend. This year, the organizers actively solicited participation by younger CEDAR scientists to increase their communication with students. We even managed to introduce a few of the young faculty to each other.]

Last year's enormously successful tutorials focused on basic measurement techniques, including passive and active optical and radar instrumentation. This year it was decided to continue the tradition of providing tutorials at the level of introductory graduate seminars since few schools have the luxury of teaching a large number of broad surveys. Hence, we invited presentations by John Sahr (U. Washington) on the auroral ionosphere, Tim Kane (Penn. State) on the mesosphere, and David Hysell (Clemson U.) on equatorial plasma physics. Specifically, we asked each of the presenters to tie their discussions in to CEDAR workshops later in the week. Tim set the stage nicely for the gravity wave discussions which followed. (These would have been entirely incomprehensible, but were only somewhat incomprehensible, thanks to Tim.)

Featured speakers at the workshop were Sunanda Basu from NSF and Gene Pfeffer from Radian Corporation. Sunanda discussed the basic structure and organization of the NSF Atmospheric Sciences Division, and its relationship to CEDAR, Aeronomy, and Upper Atmospheric Facilities. She also spoke briefly about the U.S. Global Change Research Program (a current source of CEDAR funding), and the new Space Weather Initiative (a potential source for new funds). Next year we hope Dr. Basu returns so we can get into the nitty-gritty details of how the proposal system works, what specific criteria is used to review proposals, etc.

Our young faculty participants admitted that proposal writing, and managerial activities such as committee work and overseeing graduate students, are an important part of their duties in the academic community and consume a significant amount of their non-teaching time. Furthermore, they confessed to feeling ill-prepared for these duties.

Gene Pfeffer discussed career employment opportunities within industry. Pfeffer is employed by Radian Corporation, one of the fastest-growing providers of environmental services to corporations, and state and federal governments. Radian has $600 million in annual revenues with offices in over half the states nationwide, and in more than 20 countries. They provide environmental analyses, as well as atmospheric and water pollution monitoring services and technologies. Pfeffer's division, for example, produces several different GHz band radar systems for atmospheric measurements. One might assume, therefore, as the CEDAR Interim Review suggests, that the kind of interdisciplinary research involving "theory, sophisticated

data analysis methods, numerical simulations, field measurements, and teamwork" carried out by CEDAR graduates would be precisely the background Radian would be looking for in its employees. Unfortunately, according to Pfeffer, this is simply not true. Radian, in fact, hires almost no PhD scientists, doing so only in two special cases: (1) when it encounters specific technical problems, Radian will generally hire a short term consultant; (2) Radian occasionally hires PhD scientists with several years of management experience (and often an MBA degree) into its upper management positions. Pfeffer also noted that the professional culture of researchers in industry is quite different from that of researchers in academia.

Pfeffer's comments seem to imply that placingCEDAR graduates in industry will be much more difficult than I and many others originally imagined. From my own efforts to bridge science and science policy, I can add that similar barriers will be faced in this arena as well. This only emphasizes the importance of CEDAR committing itself, in the next few years, to a realistic assessment of the community's goals for graduate student education for the 21st century, and CEDAR's role in facilitating those goals. Some questions to address include: what kind of skills training is CEDAR currently providing its graduate students? do these differ significantly across institutions? what kind of skills training will be required for graduates to succeed in launching future careers in different sectors? how can CEDAR help preserve opportunities for its students to obtain interdisciplinary educations (including management and/or policy training, if desired), while still concentrating on doing the best science? And finally, what differentiated roles should the CEDAR program and community play in examining and addressing these questions?

A small number of young faculty, scientists, postdocs, and graduate students interested in educational issues met briefly over dinner at the end of this summer's CEDAR workshop. We concluded that an important initial step is to add a second student workshop to next year's meeting. There simply was not enough time allotted for tutorials, speakers, and discussions to satisfy student interest adequately. In addition, we believe that student understanding would benefit from an opportunity to discuss events and questions at the end of the week.

We also suggest that the CEDAR community establish a standing committee to discuss the ideas and questions raised in this article. CEDAR is already looked upon by many as a leader in innovation regarding its educational policies, in part due to its inclusion of students at the summer workshop and on the steering committee. The scientific community as a whole will address many of these same questions between now and the year 2000. I believe the CEDAR community should seize the chance to play a leadership role in deciding how we educate the next century's scientists and citizens. Assumption of this role would undoubtedly benefit CEDAR as a program, as well.

Clark Miller was the 1994-95 student member of the CEDAR Science Steering Committee. He has now completed his PhD at Cornell University and is a postdoctoral research fellow at the Center for Science and International Affairs at Harvard University. His current research focuses on scientific policy and the implementation of conclusions reached at the 1992 Framework Convention on Climate Change.

LTCS Workshop *(continued from page 9)*

Workshop participants were invited to give brief reports on their activities, and many did so. Cassandra Fesen updated the community on the availability of NCAR TIEGCM modeling of the first 10 LTCS experiments. Steve Palo discussed the diurnal, semidiurnal, and quasi-two day waves observed at Adelaide, Christmas Island, and Kauai during the 10-day run; he also reviewed the availability of HRDI data during the experiment. Robert Stening described his work studying changes in global winds preceding intervals of reversed equatorial electrojet. Yuri Portnyagin discussed mean heating and acceleration in the upper mesosphere due to semidiurnal tidal dissipation based on a global climatological model. Roberta Johnson updated the group on the status of analysis of lower thermospheric data obtained from the Sondre Stromfjord ISR. William Ward briefly discussed the availability of WINDII during the LTCS-9 experi-

(continued on page 14)

CEDAR HomePage: Postdoctoral Opportunities

The CEDAR Program offers an opportunity for 2-year postdoctoral appointments at various institutions across the country where CEDAR research is being performed. The established procedure is for a an applicant to develop a research proposal jointly with a CEDAR scientist who will serve as mentor and advisor for the awardee. The following is intended to facilitate the process of matching potential post-docs with CEDAR scientists.

Student Resumes

Students nearing completion of the Ph.D. are invited to submit a short resume (1-3 pages) for access via the CEDAR HomePage. The resume should include name, address, and other contact information such as e-mail, fax, etc.; a statement of research interests and career goals; awards; publications; conference or workshop presentations; and Dissertation Abstract.

CEDAR Scientists

CEDAR scientists are invited to provide brief descriptions of research projects that might be of interest to potential CEDAR postdoctoral applicants.

Send your html inputs to Barbara Emery, emery@ncar.ucar.edu
Note: new CEDAR Homepage address: http://www.hao.ucar.edu/public/research/tiso/cedar/cedar.html

Incoherent Scatter Radar Workshop in Kharkov, Ukraine

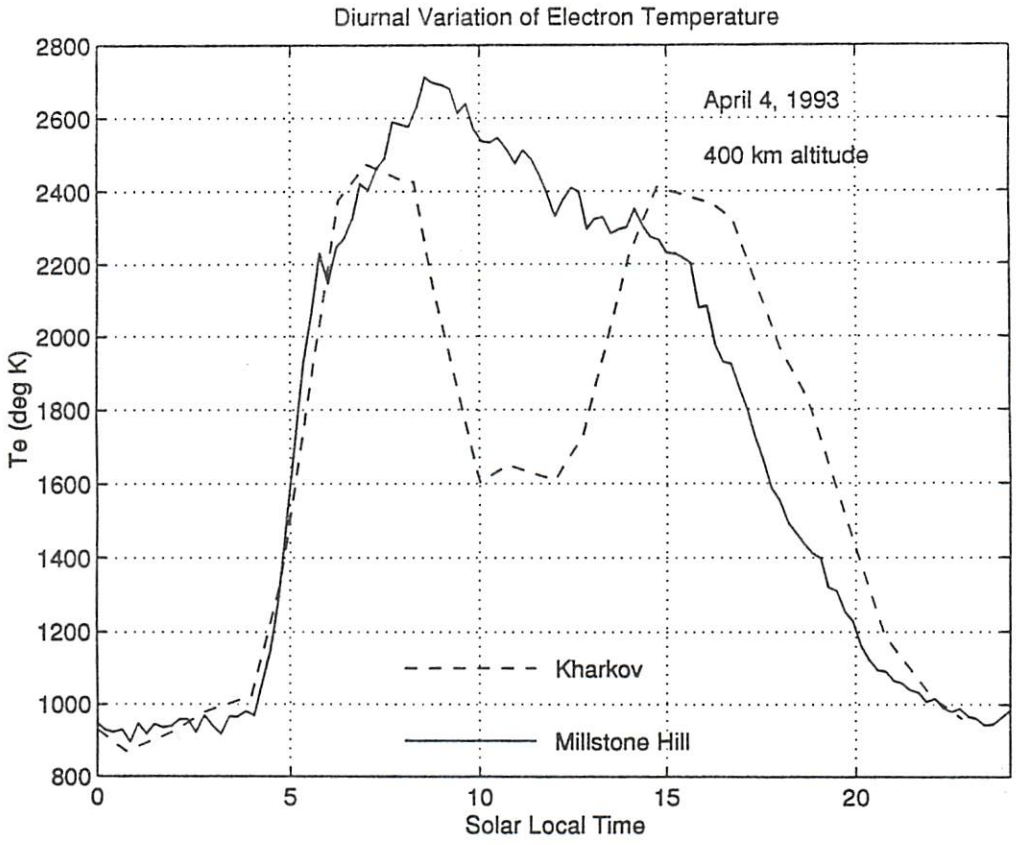
In August, 1995, eight U.S. scientists attended an URSI Incoherent Scatter Radar Workshop in Kharkov, Ukraine. The workshop was hosted by Prof. Vitaly Taran, Director of the Institute of the Ionosphere at Kharkov State Polytechnical University. Prof. Taran and his colleagues at the Institute are interested in collaborating with U.S. scientists in various areas. The Institute operates a radar facility 50 km south of Kharkov (49.7(N, 36.3(E). Among the instruments at the facility are a 150 MHz incoherent scatter radar and a high frequency ionospheric heating facility. The 150 MHz radar has four 1.5 MW transmitters and two antennas; a 100 meter, zenith-pointing, fixed antenna; and a 25 meter, fully steerable dish. The heating facility generates 40 to 100 MW effective radiated power of 5 to 12 MHz with a 300-m by 300-m wide-band antenna.

The Institute of the Ionosphere has conducted investigations of the natural and artificially-perturbed ionosphere using incoherent scatter radar techniques since 1970. Observations have been made in coordination with the incoherent scatter World Days for a number of years. Typical World Day experiments provide zenith profiles of plasma density, temperatures, ion composition, and vertical drift between 150 km and 600 km altitude with 15-30 min. temporal resolution. At the present time, measurements of ionospheric parameters continue to be made and new VHF transmitters, receivers, and control systems are being put into operation that will extend the measurements to 2000 km altitude and allow 3 - 5 minute time resolution.

A strength of these facilities is the co-location of the powerful heater and radar diagnostics. Scientific investigations include the study of the artificially heated ionosphere, the behavior of the mid-latitude ionospheric E and F regions, longitudinal effects in coordination with Millstone Hill measurements, and magnetic conjugate effects. An example of electron temperature measurements is shown in the accompanying figure. (Note the difference in the local time variation in temperature between Millstone Hill and Kharkov.)

U.S. investigators interested in collaborating with scientists in Kharkov may contact Prof. Vitaly Taran at iion%polyt.kharkov.ua.

Other large upper atmosphere research facilities are located in the Kharkov area. The Institute of Radio Astronomy of the Ukrainian Academy of Sciences, known as RIAN, operates the world's largest decameter radio telescope. Called UTR-2, the facility has a phased



Kharkov, Ukraine *(continued from page 12)*

array antenna 2 km in length and a network of radio interferometers with baselines ranging from 42 km to 951 km. UTR-2 operates at frequencies from 10 to 25 MHz.

Radio physical studies at RIAN are centered around applied electrodynamics and radio wave propagation through natural media. The Institute also conducts studies of electromagnetic emissions from lightning, including Schumann resonances, and VLF radio propagation through the Earth-ionosphere waveguide. U.S. scientists interested in this facility may contact Dr. Yuri Yampolski at yampol@rian.kharkov.ua.

In addition to these institutes, Kharkov State University has a Department of Space Radiophysics that conducts both radar and lidar studies of the atmosphere. Attendees at the Incoherent Scatter Radar Workshop also included a group from the Institute of Solar Terrestrial Physics in Irkutsk, Russia, and the Fedorov Institute of Applied Geophysics in Moscow.

The U.S. attendees at the Workshop were impressed by the breadth of research being conducted in the former Soviet Union and the capabilities of the facilities. It is obvious that a great deal can be gained by initiating mutually productive collaborations between the U.S. and FSU researchers. There are several programs through which U.S. scientists can apply for support to enable these collaborations. A brief description of these is provided in an accompanying article (*see page 14*), along with instructions on how to get more detailed information.

Bob Robinson and *John Foster*
rmrobins@nsf.gov and *jcf@hyperion.haystack.edu*

Opportunities for Collaboratory Investigations with Scientists of the Former Soviet Union

U.S. scientists wishing to establish collaborations with researchers in the former Soviet Union may be interested in the programs below.

The Division of International Programs (INT) at the National Science Foundation provides travel and participant support costs to establish new collaborations between U.S. and FSU scientists. Funds can be obtained in one of two ways. Firstly, U.S. investigators may propose directly to INT to establish new programs involving FSU scientists as part of collaborative research projects. These proposals are typically joint-funded between INT and the relevant discipline program within NSF, with the INT contribution limited to travel and participant support costs. Alternatively, current NSF investigators may request supplements to their existing awards to support collaborative efforts with FSU scientists. These collaborative efforts must be consistent with the objectives of the existing grant. The supplement request should be addressed to the NSF Program Officer administering the existing grant. In both of these two funding mechanisms, the travel can involve either an FSU scientist visiting the U.S., or U.S. scientists traveling to the FSU. Information about these programs can be obtained through NSF.

Another program for supporting scientific collaborations with F.S.U. researchers is sponsored by the National Research Council's Office for Central Europe and Eurasia (CEE). These awards are also for establishing new research partnerships with colleagues from CEE. They support travel for either foreign scientists or U.S. scientists, although only U.S. scientists can apply. Both short and long term grants are available. Information can be obtained from the National Research Council at (202)334-3680, or by e-mail from ocee@nas.edu.

The third opportunity for support of FSU scientists has been enabled by the recently formed U.S. Civilian Research and Development Foundation for the Independent States of the Former Soviet Union. The CRDF was announced by President Clinton on May 10 and was established by NSF under a congressional authorization. Start-up funds for this foundation were provided by philanthropist George Soros and the U.S. Department of Defense, each providing $5M. The Foundation will support basic and applied research efforts, and promote defense conversion and development of market economies in the countries of the FSU. Proposals can be written by either U.S. or FSU scientists, however, collaboration between a U.S. scientist and his/her counterpart in the FSU is necessary. Proposals will be selected competitively through merit review. The deadline for proposal submission will be announced by the CRDF in the near future.

Bob Robinson

LTCS Workshop *(cont. from page 11)*

ment. Vince Wickwar discussed optical results from Bear Lake, which show a suppression of the diurnal tide in 1994. Kent Miller described his study of the height variation of sporadic E layers and the relationship to the semidiurnal oscillation. Maura Hagan mentioned the availability of a new global tidal model.

These brief presentations were followed by a group discussion of future plans for LTCS, including new and continuing research topics, desirable experiment intervals, publications, external workshops, etc. Extensive discussion focused on the following questions:

(1) Given the current state of LTCS-related research (completed and ongoing), where do we go from here?
(2) Have we completed the objectives of the LTCS, or is there interest in the community for continuation of this collaborative research effort?
(3) Should we revise the initial objectives of LTCS?
(4) Are there new, community-wide research topics we should consider?

Participants agreed that we have barely begun to see the possible results and advances that could be accomplished through the vehicle of the LTCS. Initial objectives of the program are still valid, and several new and previously initiated research objectives upon which the group could focus its efforts were identified. We reached a consensus that we focus our immediate activities on the presentation and publication of the LTCS-9 study results. Another high priority is completing the analysis of existing, older data.

(continued next page)

A NEW STATISTICAL MODEL OF HIGH-LATITUDE CONVECTION

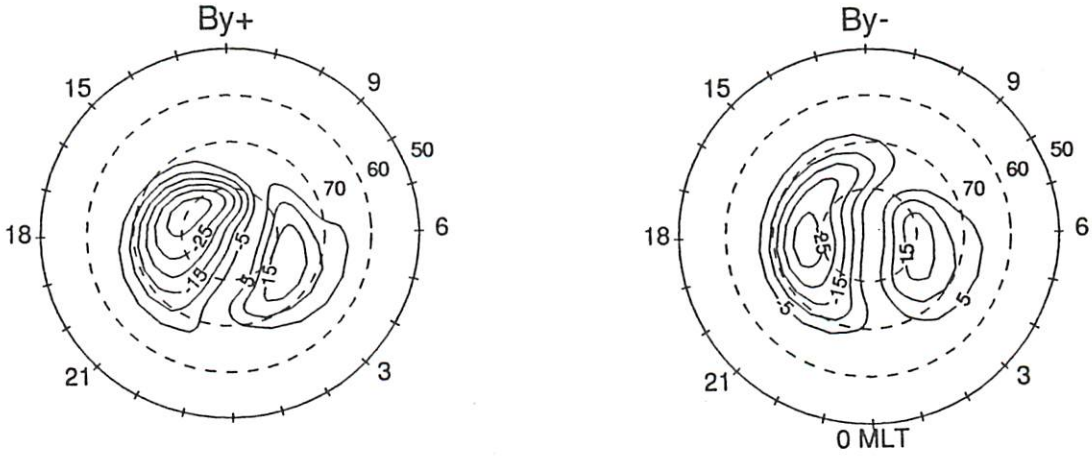
We announce the availability of a new high-latitude convection model of general interest to the CEDAR community. It is based on data collected with Goose Bay HF radar over the period 1987-1993. The model is suitable for any application that requires estimation of the large-scale convection and provides a point of comparison with the satellite-based models that have been developed recently.

The accompanying figure shows plots of the electric potentials for the two signs of the MIF By component under conditions of $|By| > |Bz|$ and Kp = 2+ / 3− .

(The potentials at latitudes beyond the range of the measurements, 65° – 85°Λ, were solved by applying Laplace's condition with zero potential at 60°Λ.) The two-cell pattern is strongly modulated by the sign of By. In particular, the dusk/dawn cell is more elongated in MLT for By-/By+. The difference in the potential variations associated with the two cells is larger for By+.

The model is expressed as an expansion in spherical harmonics. Depending on the application, the model output can be parameterized by IMF, Kp, and day-of-year (season). Tables of coefficients can be obtained from the authors at mike_ruohoniemi@jhuapl.edu or ray_greenwald@jhuapl.edu.

Mike Ruohoniemi and *Ray Greenwald*
JHU/APL



LTCS Workshop *(cont. from page 14)*

Research objectives and possibilities discussed included:

- utilization of the analysed LTCS data for the development of a climatological model
- completion of previously initiated coordinated efforts, such as the study of upper thermosphere-lower
- thermosphere coupling, and the LTCS 2/6 intervals
- calculation of mean heating and acceleration due to semidiurnal tidal dissipation
- comparison of TIEGCM model results with data sets
- development of a list of LTCS data availability for each campaign, and maintenance of this as a data base
- focus on long duration campaigns to study waves, tides, and variability (LTCS 8,9,10)
- a joint MISETA study
- availability of MSX IR cooling data during future LTCS campaigns
- joint Sondre Stromfjord LIDAR/ISR studies
- a new initiative for study of gravity wave spectra
- a study of the growth of tides from the ground through the thermosphere
- a campaign in response to intense geomagnetic activity
- a study of longitudinal tidal variations
- inter-instrument comparison of tidal and mean wind climatologies
- common-volume experiments

By the end of the session, there seemed to be consensus that completing climatologies, studies of longitudinal variations, and common volume experiments were of particular importance to the group.

The Cedar Post

Prof. Jeffrey M. Forbes
Aerospace Engineering Sciences
CB 429
University of Colorado
Boulder, CO 80309-0429

Address correction requested.

Barbara Emery
NCAR
High Altitude Observatory
P. O. Box 3000
Boulder, CO 80307-3000

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J. M. Forbes, Editor.
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UPDATE: 10-DAY WORLD CAMPAIGN

The first-ever 10-day World Day campaign during January 20-31 1993 has received considerable attention over the last few years and was the subject of several CEDAR-related workshops. At the last January 1993 CEDAR workshop, four broad areas of effort were identified and are listed below, along with the coordinator for each, and his/her email address. A preliminary list of 18 papers dealing with these science topics was assembled; preparation of these papers represents the current activity of the group.

Arrangements are being made for the campaign papers to be published in a special section of the Journal of Geophysical Research - Space Physics; the tentative deadline for submission is February 1, 1996; watch JGR for details.

Anyone with data and/or modeling results to contribute to this analysis effort is more than welcome. If you would like to participate or have questions or contributions, please contact the appropriate coordinator below or C. Fesen.

Science Topic	*Coordinator(s)*	*Email address*
Mesoscale/electrodynamics at Arecibo	C. Miller	clarkm@ee.cornell.edu
Global/large scale dynamics/ electrodynamics	C. Fesen	fesen@tides.dartmouth.edu
Tides and planetary waves	J. Salah	jes@newton.haystack.edu
Gravity waves	M. Hickey and M. Taylor	hickey@ssl.msfc.nasa.gov