The CEDAR Post

December 1997 Volume 32

DELAY OF THE POLAR CAP OBSERVATORY

Funding for the construction of the Polar Cap Observatory (PCO) at Resolute Bay was not approved by Congress as requested in the National Science Foundation FY1998 budget under the Major Research Equipment (MRE) program. NSF was directed to submit reports to Congress on the scientific justification for the project and an analysis of alternative sites for the location of the Observatory.

The problem that led to this setback occurred in the Senate Appropriations Committee review of the proposed project. The Committee directed the NSF to co-locate the PCO with the DoD HAARP heating facility at Gakona, Alaska. It was apparently deemed possible for the PCO at that location to provide diagnostic support for the HAARP heater as well as make measurements in the polar cap, thus eliminating duplicate financial investments. Unfortunately, Gakona's magnetic latitude of 63°N is far below that of Resolute Bay at 84°N, and the goals of the proposed PCO scientific research programs cannot be accomplished from that location.

It is our understanding that the reports requested by Congress are being prepared by NSF, and it is expected that the importance of the PCO location at Resolute Bay will be reaffirmed on the basis of its scientific merits. We are hopeful that the funding request for the PCO will be included in the NSF budget submission for FY1999.

NSF has received a proposal led by SRI International for the construction of the PCO, and a panel of experts has reviewed the proposal. The proposal is presently pending at the NSF. Consideration is being given to the feasibility of verifying critical components of the radar design during 1998 in order to minimize the delay in the PCO development schedule relative to solar maximum, but the availability of such funding outside the MRE account is uncertain at this time.

Joseph Salah, Chair, CEDAR
Science Steering Committee

IN THIS ISSUE

CEDAR AND COMMUNITY SUPPORT OF PCO

Researchers associated with the CEDAR program, as well as colleagues from the national and international upper atmosphere community, have responded strongly to the recent unfortunate situation associated with the relocation directive for the PCO. Many letters were sent to the NSF Director in support of the PCO and its location at Resolute Bay, and many of our colleagues have also written to members of Congress asking for the reversal of the decision to locate the PCO in Alaska. *Thank you for your support and for taking the time to write the letters.* In particular, we thank our colleagues in Alaska who have spoken in support of the PCO location at Resolute Bay on the basis of its scientific merit. Our efforts have been thwarted, hopefully temporarily, but the unanimity of the community as it rallied behind the PCO is gratefully appreciated.

Following the decision to delay funding of the PCO in FY98, the CEDAR Science Steering Committee (CSSC) has taken several actions to help restore the momentum for the PCO project:

•The CSSC met at NSF with Dr. Thomas Baerwald, Deputy Director of the Directorate for Geosciences, and with Dr. Richard Greenfield, Director of the Division of Atmospheric Sciences, and stressed the importance of any steps that could be taken to start the PCO project in FY98 in order to minimize the schedule delay relative to the solar cycle maximum.

•The CSSC has co-signed a letter with GEM (chair: Richard Wolf), NAS/CSTR (chair: Michael Kelley), and NAS/CSSP (George Siscoe), addressed to Dr. Richard Behnke at NSF, to be potentially used with the NSF reports requested by Congress. The letter affirms the scientific justification for the PCO and its location near the geomagnetic pole at Resolute Bay.

•The CSSC, together with GEM, CSTR and CSSP, have written a letter to the NSF Director, Dr. Neal Lane, soliciting his continued support of the PCO project, and affirming the community's unanimity in the support of the PCO and its location. Whether a meeting can be arranged with him to press these points and explain the urgency of the PCO schedule is uncertain at this time.

•The CSSC international representative, Dr. Gordon Shepherd, expressed the support of the Canadian scientific community for the PCO, and a letter to NSF from leading scientists and administrators in Canada is under consideration.

Joseph Salah

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NEWS FROM THE CEDAR SCIENCE STEERING COMMITTEE (CSSC)

Following the annual CEDAR meeting in June 1997, Dr. Michael Mendillo relinquished his chairmanship of the CSSC in order to concentrate his efforts as a co-PI of the PCO proposal and avoid any potential conflict. While he remains a member of the CSSC, the chairmanship was smoothly transitioned to Joe Salah, one year ahead of schedule. Editorship of the CEDAR POST has been transferred to the new chairman, but Boston University has volunteered to print and distribute the POST through June 1998.

At its meeting at NSF on 17 October, the CSSC formally presented the CEDAR Phase III report to the NSF Division of Atmospheric Sciences and the Geosciences Directorate. The NSF commended CEDAR members for their scientific initiatives and excellent planning and for the strong involvement of students in the research activities.

With the completion of the Phase III report, the CSSC adopted the following goals for the next 2 years:

- •Implement the CEDAR Phase III program.
- •Promote and monitor activities within CEDAR, PCO, TIMED, and associated programs.
- •Work closely with other national and international programs.
- •Prepare for the next solar maximum opportunity.

Three subcommittees of the CSSC were organized:

- ❑ *Annual Meeting 1998*: J. Chang, B. Emery, M. Hagan, R. Heelis, M. Mendillo, M. Taylor, M. Mendillo, M. Sulzer, D. Hysell, J. Salah, J. She.

- *Interactions with Other Programs*: R. Heelis (NSWP, GEM), M. Hagan (SunRISE, Solar Magnetics, UARS), G. Shepherd (SCOSTEP), T. Van Eyken (EISCAT/ESR, URSI), M. Hickey (TIMED).

- *Data Base*: D. Hysell, M. Sulzer, M. Taylor, T. Van Eyken, B. Emery.

The CSSC emphasized the importance of improving the CEDAR data base access by use of the Internet. NCAR (B. Emery) presented its plans, described elsewhere in this newsletter, and the CSSC established an important milestone for demonstrating the new data base capability by the June 1998 meeting. A mid-term review of the NCAR progress will be conducted by the Data Base subcommittee at the URSI meeting in January 1998.

Joseph Salah

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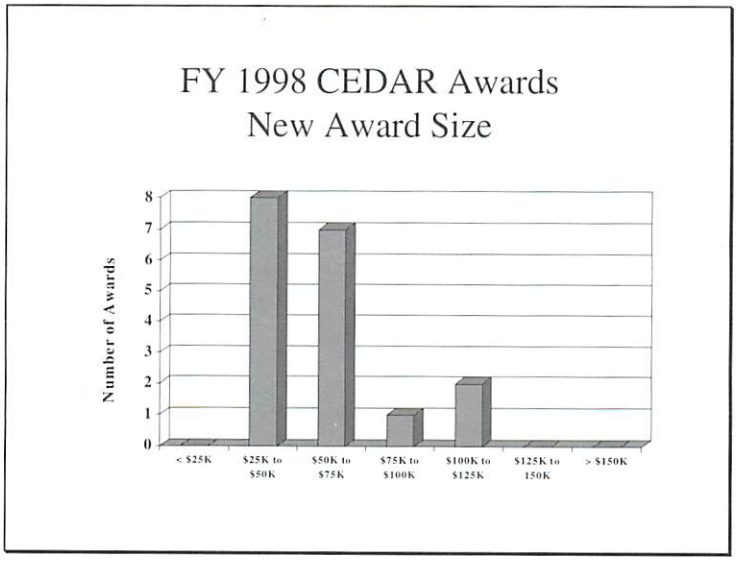
STATUS OF CEDAR GRANT AWARDS FROM FY1998 COMPETITION

NSF received 33 proposals by the May 1, 1997 deadline for the FY 98 CEDAR competition. The total amount requested in first year funding was $2.4M. This year's science theme, as recommended by the CEDAR Science Steering Committee, was 'Chains and Clusters' (CEDAR Post, #30). The number of submissions by category was : 8 'Chains,' 12 'Clusters,' and 13 'Other.' The proposals went through the usual two-stage review process; first by mail, then by panel. In the final analysis, 18 awards were recommended, totaling $1.1M. Because they are currently in process at NSF, we are unable to release the individual PI award list until the next edition of the CEDAR Post. The accompanying histogram provides a distribution of the award amounts. The vast majority of the awards were under $75,000. Many of the proposal requests were negotiated down in an effort to fund the majority of the highly meritorious proposals submitted. The distribution, in terms of category, was 3 'Chain' awards, 10 'Cluster' awards, and 5 'Other.' In other words, 2/3 of the awards were on the broad science theme of 'Chains and Clusters' - an important concept within the CEDAR Program.

In addition to the 33 CEDAR proposals, six were submitted to the CEDAR Post-Doctoral Program. Three awards of $45,000 per year for two years have been offered. The names of the winners will also appear in the next edition of the CEDAR Post.

Sunanda Basu, Bob Robinson (NSF)



HEADS UP! CEDAR COMPETITION for 1 MAY 1998

In addition to soliciting proposals that pursue the CEDAR Phase III Program objectives, the CEDAR FY99 grant competition, with proposals due on 1 May 1998, will encourage proposals aimed at preparations for the CEDAR-TIMED opportunity. Such proposals must justify the needed improvement of ground-based instrumentation, the enhancement of data product delivery, or the augmentation of models that will all help meet the goals of CEDAR-TIMED collaboration. The various interactions between the CEDAR and TIMED groups have stressed the need for the CEDAR community to be prepared to take advantage of the TIMED collaborative opportunity and to strengthen its contributions, and the CSSC recommends the inclusion of this theme in the FY99 CEDAR competition. The total funding level for these CEDAR-TIMED proposals will not exceed $0.5M, and the duration of the awards will be for one year only. Selection of the awards will be based on the potential for the activity to contribute to the scientific efforts identified for the CEDAR-TIMED collaboration [*sd-www.jhuapl.edu/TIMED/News*]. It is expected that five to ten awards will be made. More details will be provided in a special CEDAR announcement to be issued early in 1998, but it is not too early to begin the necessary planning. Further information about the status of the TIMED program and the CEDAR-TIMED collaboration is given in a later section of this newsletter.

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NATIONAL SPACE WEATHER AWARDS FOR 1997

The National Science Foundation has announced the 16 awardees of the FY1997 round of awards in the annual National Space Weather Program competition. A panel of 24 scientists met and evaluated 64 Space Weather proposals on June 23 and 24, 1997. On the first day the panel was divided into 3 subpanels: one each for aeronomy, magnetospheric physics and solar/solar wind. The second day was spent in joint discussions and finalizing the reviews. In addition to the regular NSF review criteria, panelists were asked to place equal weight on the potential of each proposal to advance the objectives of the NSWP.

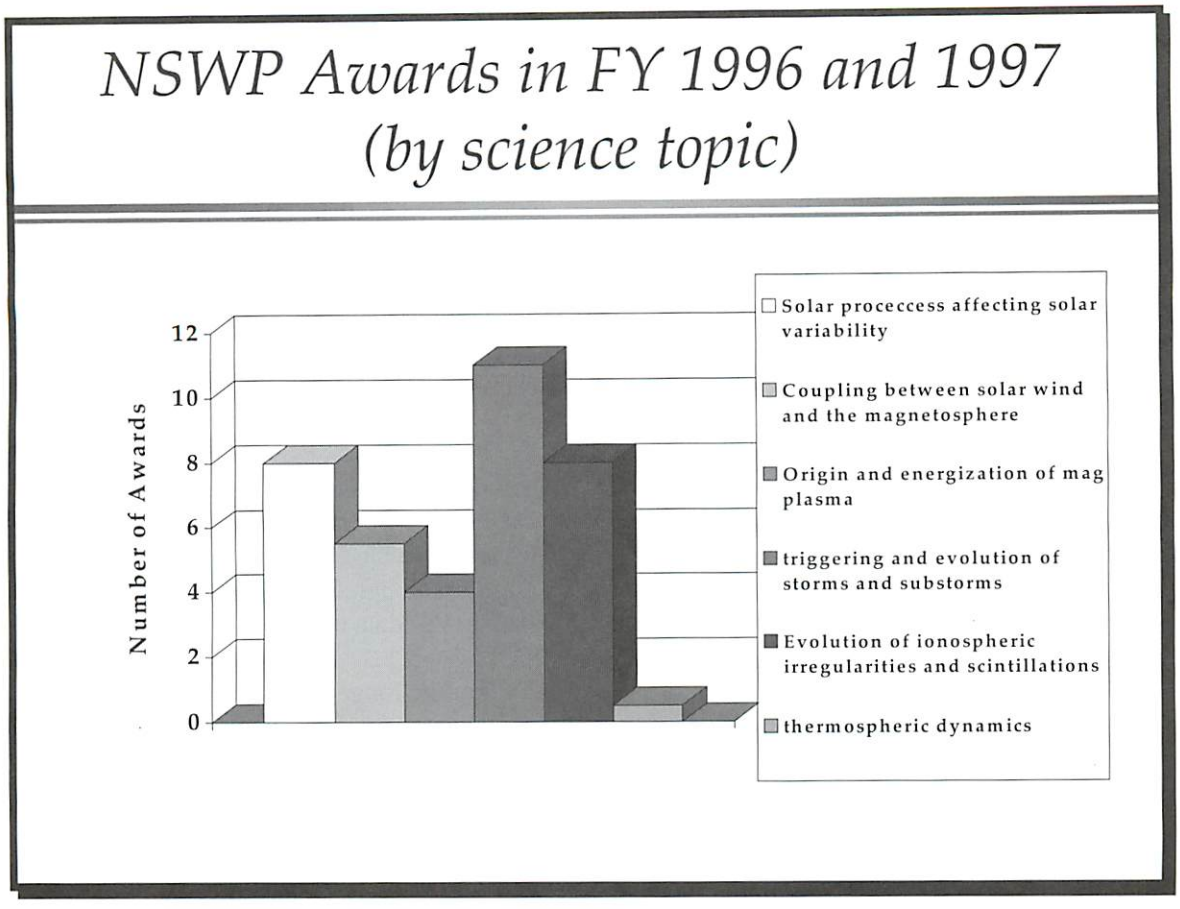
The total funds made available to the community for this competition was approximately $1.0 M and included contributions from NSF, the Office of Naval research and Air Force Office of Scientific Research.

As in FY 1996 increased emphasis was placed on six areas of research where significant gaps in our present understanding need to be addressed early in the Program. These include:

- understanding and prediction of processes affecting solar activity, such as coronal mass ejections (CMEs) and solar flares;
- coupling between the solar wind and the magnetosphere;
- the origin and energization of magnetospheric plasma;
- the triggering and temporal evolution of substorms and storms;
- improved global ionospheric specification and forecast and the evolution of ionospheric irregularities, including the onset of low latitude ionospheric irregularities; and
- improved specification of thermospheric dynamics and neutral densities.

A bar chart showing the distribution of the awards in these areas for the years FY 1996 and FY 1997 is shown below. Government agencies leading the NSWP will soon make a determination for the date of the next Solicitation hopefully early in 1998.

Richard Behnke (NSF)



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PREPARATIONS FOR THE JUNE 1998 CEDAR MEETING

The annual CEDAR meeting will take place on 7-13 June 1998 at the University of Colorado in Boulder. An outline of the schedule will be prepared and disseminated in the February 1998 CEDAR POST and via the CEDAR email list. Community feedback has been an important input for the continuation of the successful CEDAR meeting, and efforts will be made this year to allow more time for discussions in the spirit of a true workshop.

The student workshop is planned for Sunday June 7 in the University Memorial Center (UMC) Forum room. The workshop will emphasize presentation skills (both oral and written), and will provide an introduction to the CEDAR meeting so that the students will be better prepared. Consideration is being given to the possibility of a joint session with GEM on Saturday June 13, or for a meeting on the theme of "models in the new millenium", which could also be with GEM. Consultation with the community is on-going and no final decisions have been reached .

The poster session is planned for Tuesday June 9 at the UMC Glenn Miller Ballroom which will provide for spacious displays and interactions, and a full afternoon is reserved for the session.

A firm deadline will be set for the science workshops and their number will be limited to allow adequate time for interactions. A set of guidelines will also be established to enhance the productivity of the workshops, drawing on the experience from those that have been successful in the past year or two. In 1998, the CEDAR Class-I facilities will be organized along 2 workshops, combining the lower latitude facilities (Jicamarca, Arecibo) in one and the higher latitude facilities (Millstone Hill, Sondrestrom, EISCAT/ESR) in the other.

The subcommittee members for planning the CEDAR meeting and their responsibilities are:

- Overall Coordination and schedule: *J. Salah ,B. Emery*
- Tutorials, Science topics and panels: *M. Hagan, R. Heelis, J. She*
- Workshops*: M. Mendillo, M. Sulzer, M. Taylor*
- Posters: *D. Hysell*
- Student session: *J. Chang*

Calls for workshops, posters, science topics, prize nominations etc., will be issued via the CEDAR email list in early 1998. If you have ideas or suggestions on any of the listed meeting categories, do not hesitate to contact any of the above CEDAR SSC members (see list at end of this newsletter).

Joe Salah (MIT), Barbara Emery (NCAR)

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CEDAR DATA BASE DEVELOPMENTS AND PLANS

Since the last CEDAR Workshop in June, we have been working on developing web pages for all the data in the CEDAR Data Base. These web pages can be accessed from the CEDAR home page at: *http://www.hao.ucar.edu/public/research/tiso/cedar/cedar.html*.

A map with instrument locations is on this page. Click on the name of the location to access the web page for that instrument. Static summary plots are available showing much of the data available in the CEDAR Data Base. These plots don't show all the data, since only some directions are plotted for instruments like IS radars or Fabry-Perot Interferometers. Links to other web sites are available for some instruments. For indices and models, there are a few selected plots accessible after the map of locations. More model results will be added later. Please send your comments about the pages to Barbara Emery at *emery@ucar.edu*. We are currently getting about 300 hits per month on the CEDAR home page.

The static plots will be added to as the Data Base is updated, which is about twice a year now. It is not yet possible to access the data values on the web. For now, data values can only be obtained by filling out a data request form, or by getting a cedar login and downloading the data. [Contact Barbara Emery at *emery@ucar.edu* or submit an access form from the CEDAR home page.]

The web-based facility to get data should be available by the next CEDAR Workshop, and will be very similar to the cmenu interface which login users have now, but with the additional ability to chose only part of the data in each logical record, rather than all the data. Since we have 'Rules of the Road' for data access, we will also have authentication software on the web to ask users to agree to follow the guidelines, and to keep statistics of data use.

For the longer term, beginning next year, we expect to evaluate some middleware. Middleware is the term used for software between the client (any Data Base user) and the server (the cedar computer at NCAR). Middleware will allow a more flexible and distributed access to the CEDAR data by allowing several data formats. Users could thus request the data to be delivered in IDL or MATLAB format to use directly in their analysis programs. Other formats could be netCDF, CDF, HDF, or the CEDAR Data Base format. The development of more sophisticated search and query procedures would be facilitated. The middleware we will investigate first is the Distributed Oceanographic Data System (DODS) which was developed at the University of Rhode Island. The DODS home page is located at: *http://dods.gso.uri.edu/DODS/home/home.html*. The final middleware we use may not be DODS, but may be based on Common Object Request Broker Architecture (CORBA) or other products.

These developments should lead eventually to a more distributed data system, in which not all data need reside physically at NCAR, but could be stored in other formats at other sites. These aspects would be transparent to the user. We are also considering CD-ROMs, Digital Video Disks (DVD) etc for distributing data in the CEDAR Data Base in the future.

Barbara Emery (NCAR)

COLORADO STATE NARRBOWBAND SODIUM LIDAR DATA IN THE CEDAR DATA BASE

Since the first report on the temperature measurements in the mesopause region using the two-frequency narrowband Na temperature lidar [She et al., 1990] developed with CEDAR support, active research continues. The lidar technique and instrumentation have been described in detail [Bills et al., 1991; She et al., 1992]. Initial midlatitude temperature climatology of the mesopause region over Ft. Collins, CO and Urbana, IL were reported [Bills and Gardner, 1993; She et al., 1993; Senft et al., 1994; Yu and She, 1995].

Along with 4 and 5 nights of initial observations, respectively, in Springs of 1990 and 1991, quality regular nighttime temperature measurements, i.e., on average four to five nights a month with 4 hours or more observations each night, were made at Fort Collins, CO (41°N, 105°W) starting May 29, 1991. By March 30, 1997, a total of 300 nights of data were taken and analyzed, leading to a unique six-year data base in the mesopause region, which is being used in the investigation of a number of basic and applied scientific/geophysical issues.

To impact a broader community and to stimulate collaborative efforts, we have now placed all hourly and nightly mean Na density and temperature profiles (with the respective measurement precisions) for the year 1993 into the CEDAR data base. There are 51 nights of quality observation evenly distributed throughout the year. The monthly mean Na density and temperature profiles have been deduced from the running averages with a Hanning window. The mean Na density and temperature height-month contour plots for 1993 are shown here for visualization. Although variability exists from one year to the next and there is some latitude dependence, the Na density distribution is in general agreement with early midlatitude lidar observations in the northern hemisphere [Gibson and Sandford, 1971], and the temperature distribution in general agreement with observation at Illinois [Bills and Gardner, 1993; Senft et al., 1994].

Although only hourly and nightly mean profiles in 1993 are presently in the data base, we have published a list of all nights that we have data up to March 30, 1997 to encourage potential collaborations. The list may be found in the CEDAR web site:

http://www.hao.ucar.edu/public/research/tiso/cedar/cedar.html

There are three data files in this entry of Colorado State narrowband Na lidar data in the CEDAR data base:

(1). Hourly mean Na density and temperature profiles for the year 1993 [KINDAT=17001].
(2). Nightly mean Na density and temperature profiles for the year 1993 [KINDAT=17002].
(3). Monthly mean Na density and temperature profiles for the year 1993 [KINDAT=17003].

Interested individuals may contact us for further information: Joe She at 970-491-6261 [*joeshe@lamar.colostate.edu*] or Dave Krueger at 970-491-7381 [*krueger@lamar.colostate.edu*].

Chiao-Yao (Joe) She and David A. Krueger
Colorado State University, Fort Collins, CO

References:

Bills, E. E., C. S. Gardner, and C. Y. She, Narrowband Technique for Na Temperature and Doppler Wind Observations of Upper Atmosphere, Opt. Eng. 30, 13-21, 1991.

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Gibson, A. L. and M. C. W. Sanford, The seasonal variation of the nighttime sodium layer, J. Atmos. Terr. Phys., 33, 1675-1684, 1971.

Senft, D. C., G. C. Papen, C. S. Gardner, J. R. Yu, D. A. Krueger and C. Y. She, Seasonal variations of the thermal structure of the mesopause region at Urbana, IL (40°N, 88°W) and Ft. Collins, CO (41°N, 105°W), Geophys. Res. Lett., 21, 821-824, 1994.

She, C. Y., H. Latifi, J. R. Yu, R. J. Alvarez II, R. E. Bills, and C. S. Gardner, Two-frequency lidar technique for mesospheric Na temperature measurements, Geophys. Res. Lett. 17, 929-932, 1990.

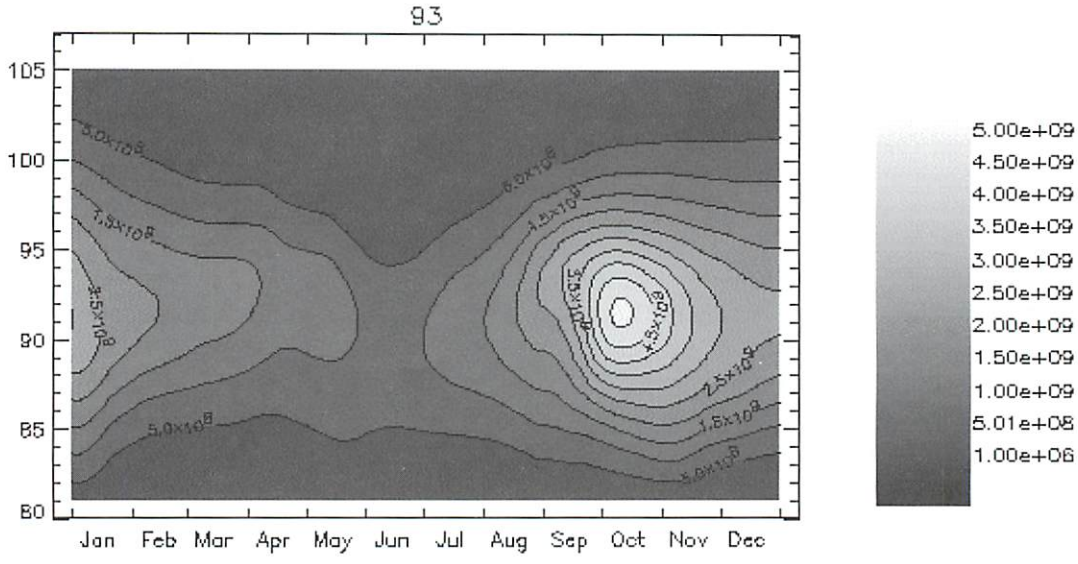
She, C. Y., J. R. Yu, H. Latifi, and R. E. Bills, High-spectral-resolution lidar for mesospheric sodium temperature measurements, Appl. Opt., 31, 2095-2106, 1992.

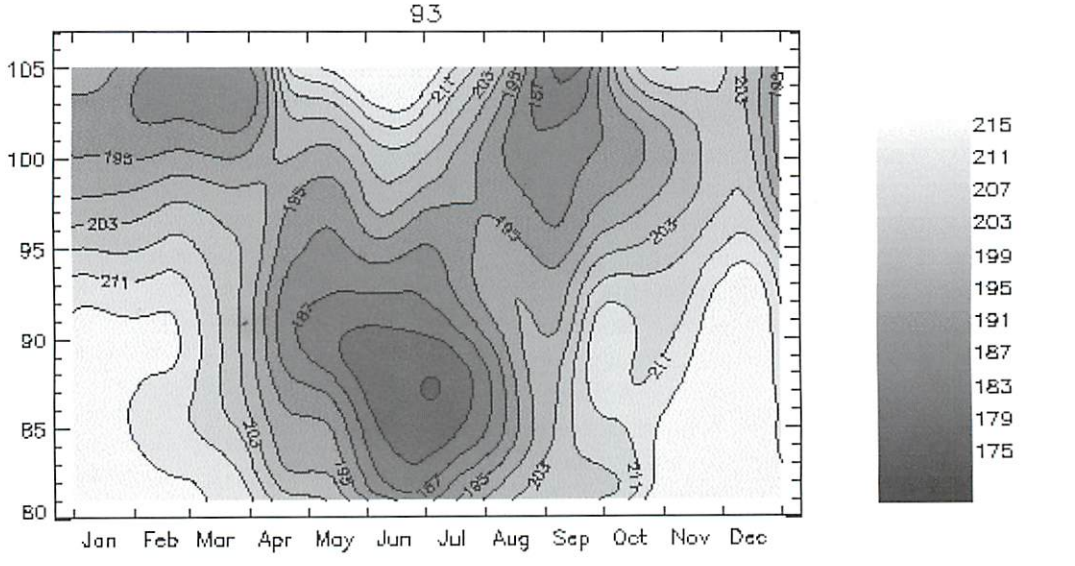
She, C. Y., J. R. Yu and H. Chen, Observed thermal structure of a midlatitude mesopause, Geophys. Res. Lett., 20, 567-570, 1993.

Yu, J. R. and C. Y. She, Climatology of a mid-latitude mesopause region observed by a lidar at Ft. Collins, CO (40.6°N, 105°W), J. Geophys. Res., 100, 7441-7452, 1995.

1993 Monthly Mean Sodium Density and Temperature Distributions

Fort Collins, CO (41°N, 105°W)





STATUS REPORT ON TIMED AND CEDAR-TIMED COLLABORATION

The TIMED program is progressing rapidly and well, as the development of the four spacecraft instruments moves toward completion. The four instruments (GUVI, SABER, SEE and TIDI) have either passed or will soon be undergoing their critical design reviews. This implies that the design effort has been completed, and the fabrication and testing phase can begin, leading to the integration of the four instruments with the spacecraft at the Johns Hopkins Applied Physics Laboratory. Delivery of the instruments to APL is due by March 1999, and the launch date has been scheduled for the first quarter of 2000. Information about the instruments, the spacecraft, and the TIMED science objectives may be found at URL: *http://sd-www.jhuapl.edu/TIMED.*

The CEDAR and TIMED communities have interacted closely over the past two years, and it is time to begin the detailed planning of the ground-based contributions to the CEDAR-TIMED scientific collaborations. Initial one-year proposals can be submitted as part of the CEDAR grant competition for FY99 to prepare instruments, models and data that will benefit the CEDAR-TIMED research programs. As discussed elsewhere in this newsletter, these proposals are due on 1 May 1998, and a funding level of $500K has been recommended to support this initial pre-launch preparation effort. In subsequent years, in response to a joint NASA and NSF announcement that is expected to be released in early 1999, and under joint NASA and NSF funding, grants will be awarded to winning proposals that address scientific issues pertaining to the studies enabled by the joint TIMED and CEDAR observations. As presented by Dr. Sunanda Basu at the June 1997 CEDAR workshop, the anticipated funding profile for the joint program is projected as follows:

	FY1999	FY2000	FY2001	FY2002	FY2003
NSF	$0.5M	$0.5M	$0.5M	$0.5M	-
NASA	-	$1.0M	$1.0M	$0.5M	$0.5M
Total	$0.5M	$1.5M	$1.5M	$1.0M	$0.5M

It is expected that there will be three rounds of competition. Round #1 would be for FY99 for $0.5M from NSF — the so-called preparatory grants described above. Round #2 would be scheduled for FY00 and would fund one-, two- or three-year grant awards under the joint NSF-NASA support. Round #3 would be scheduled for FY02 and would fund one- or two-year grant awards.

The primary objectives of the CEDAR-TIMED collaboration are to explore the dynamical and thermal structures as well as the energetics and composition variations of the mesosphere and lower thermosphere (MLT) region (60-180 km). It has become clear that a strong collaborative effort between CEDAR and TIMED would greatly enhance the scientific results. Hence, the CEDAR ground-based instruments have often been referred to as the "TIMED fifth instrument."

A planning workshop held last April at APL identified four major areas of concentration for the CEDAR-TIMED collaboration: small scale waves, large scale waves, ion-neutral coupling, and validation needs. The working groups that discussed these areas were led respectively by M. Hickey, M. Larsen, G. Crowley and S. Franke, and the documentation of the discussions prepared by these leaders has been placed on the Web for community review at: *sd-www.jhuapl.edu/TIMED/News/.* See also the summary following this article. A planning white paper prepared by Jeff Forbes for the TIMED Science Working Group (SWG) may also be downloaded from that site. It describes the SWG's view of the TIMED major needs for supplementary measurements of winds, temperatures, energetic particle fluxes, and magnetic and electric fields from CEDAR and the international ground-based communities.

Although several opportunities have already been available for interactions, further detailed discussions between CEDAR and TIMED scientists are necessary to continue the development of a clear picture of the needs that both CEDAR and TIMED have for ground-based observational data products before the first NSF deadline of 1 May 1998 for CEDAR proposal submissions, and before the release of the joint

NSF-NASA Announcement. A second special workshop will therefore be scheduled in the February-March time period at APL for this purpose. An announcement will be made in early 1998.

It is of course premature to identify what will constitute a successful proposal, but proposals that address needs emerging from the joint workshop discussion groups will be well aimed. The important point to note is that a CEDAR-TIMED proposal should address key scientific questions for which progress could not be made with just CEDAR measurements or with just TIMED measurements alone. As usual, the proposals must be well supported by strong science justifications common to the TIMED and CEDAR objectives, and proposals that simply address data collection will not likely be competitive. Teaming arrangements amongst researchers and groups are encouraged to address proposed scientific topics in a well-coordinated manner, and enterprising leaders are encouraged to take the initiative to form such teams. Issues related to the availability of data from CEDAR Class-I facilities and the development and deployment of instrumentation remain to be addressed. A review of the relevant topical areas also indicates that considerable work will be needed in the area of modelling and data assimilation of satellite and ground-based data. Some effort will also be necessary to place the relevant community codes in a form that can be accessed through the Web; examples might be composition, wind, temperature, and gravity wave fluxes. Some consideration in the next workshop will be given to the generation of a prioritized list.

It is finally important to mention the important topic of data exchange. NASA and TIMED are committed to the idea of providing access to TIMED data within several weeks after collection. This may not be possible in the first few months after launch while analysis algorithms and calibration are being checked. However, once the observations become routine, it is expected that most TIMED data can be retrieved rapidly.

It has also become increasingly clear that further discussion is essential regarding the question as to how CEDAR data should be processed, archived, and transmitted to TIMED users. One model that has been advocated is to use the CEDAR data base at NCAR as a means for reformatting, publishing, and archiving CEDAR data. Another model is based on the concept of distributed access, whereby CEDAR data are made available by the PI through posting via the Web and remote retrieval. There are pros and cons for both approaches and the issues need further discussion within the TIMED-CEDAR community.

Another matter for consideration deals with how quickly CEDAR data should be made available to support CEDAR-TIMED investigations. TIMED objectives would require that CEDAR data be online in a much shorter time frame than at present. How this can be achieved, whether it should be achieved, and what CEDAR resources should be provided to accomplish this goal are outstanding questions. Furthermore, there is the unresolved issue pertaining to community access to CEDAR data not directly supported by the joint CEDAR-TIMED initiative. Such data may not have been analyzed according to the specifications and schedule to which CEDAR-TIMED data are subjected. These matters concerning data handling should all be clarified as we move closer to the launch date. Similarly, an educational process will be necessary for CEDAR users to learn how to use the TIMED measurements in support of their own CEDAR science objectives.

Finally, please note that Jeff Thayer (SRI) has replaced Joe Salah as one of the two CEDAR/ground-band instrumentation representatives on the TIMED Science Working Group, effective 1 August 1997.

John Meriwether (Clemson University),
Joe Salah (MIT), Jeff Thayer (SRI)

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Brief Summary of CEDAR-TIMED Working Group Discussions highlighting the key issues:

Small-scale waves

- Altitude variations of gravity wave fluxes, momentum fluxes, sensible heat fluxes, and energy fluxes between atmospheric regions,
- Profiles of minor constituents as affected by gravity wave fluxes.
- Spatial and temporal variability of wave forcing as connected to the source production of such waves and with the filtering of such waves by the mean winds and tides.

Since TIMED will not provide any data pertaining to these crucial issues, it is envisioned that CEDAR measurements, primarily based upon lidar, spectral all-sky imaging, FPI, and radar techniques, will provide the necessary measurements at the existing instrumental clusters represented by the major CEDAR facilities. The mode of campaigns at such instrumented clusters scattered throughout the lifetime of the TIMED spacecraft at different latitudes will be desirable.

Large-scale waves

- Determination of the global planetary wave and tidal structures, combined with an assessment of the seasonal, day-to-day, and spatial variability of such structures.
- Sources of variability that might include variations in the mean winds, troposphere/stratosphere/in situ forcing, and gravity wave momentum flux forcing.

While the longitudinal distribution of CEDAR and international observatories for measuring MLT winds and temperatures is thought to be satisfactory at midlatitudes, coverage poleward and equatorward of 30 degrees latitude is particularly important. Recommendations made by this group also highlighted the need for the development of assimilation codes to incorporate and integrate measurements from various instruments into a global numerical model for tidal and planetary wave structure.

Ion-neutral coupling

- High latitude mechanisms of Joule heating
- Altitudinal variation of the momentum transfer to the neutral atmosphere, composition changes, and gravity wave sources
- Low latitude electrodynamics and superrotation of the equatorial atmosphere
- Stormtime effects on composition and winds, and variability of electric fields and ion drifts at various latitudes.

Intercomparison of measurements

- Careful design of intercomparison experiments that would consider commonality between ground and space measurement volumes and statistical analysis of joint observations.
- Accurate analysis of random and systematic errors, and consideration of small-scale wave effects.
- Statistical information on horizontal gradients of winds.

The timely scheduling of ISR facilities, and availability of CEDAR wind products were issues brought up in these discussions. It was concluded that future discussion of intercomparison of measurements should be included within the particular science topics instead of a separate activity, and hence this working group will be integrated within the other three science groups in the future.

BEYOND THE SOLAR-TERRESTRIAL ENERGY PROGRAM: RECENT SCOSTEP ACTIVITIES

The Scientific Committee on Solar-Terrestrial Physics (SCOSTEP) recently launched four post-STEP programs; S-RAMP (STEP-Results, Applications, and Modeling Phase), PSMOS (Planetary Scale Mesopause Observing System), EPIC (Equatorial Processes Including Coupling), and ISCS (International Solar Cycle Studies). The symbiotic connections between them have led to the establishment of both formal and informal links. The CEDAR community is already represented in the four collaborative projects, but additional CEDAR participation is welcome. The objectives of the programs are briefly summarized in the following paragraphs. Further detail can be provided by the steering committee (SC) chairs also identified below.

Dan Baker (*baker@lynx.colorado.edu*) chairs the S-RAMP SC whose membership includes Sunanda Basu. The broadest S-RAMP program objective is to facilitate and enable the detailed study and understanding of the coupling mechanisms between regions of the Sun-Earth system via effective transfer of data and information and feedback between the experimental, theoretical, and computer modeling communities. Notably, S-RAMP plans to lead the International Space Weather effort with GEM and CEDAR participation. STEP projects which are as yet incomplete will be finalized under the auspices of S-RAMP.

PSMOS is intended to extend our understanding of dynamical processes in the atmosphere, particularly as they relate to atmospheric variability, to long-term trends, and to the improvement of models. It will do this by establishing a global mesopause observing system for the observation of planetary scale disturbances through zonal distributions of ground-based stations. PSMOS SC co-chairs Gordon Shepherd (*gordon@windii.yorku.ca*) and Maura Hagan (*hagan@ncar.ucar.edu*) provide details about the project via the PSMOS home page (*http://www.cress.yorku.ca/~gordon/psmosweb.htm*). The next PSMOS meeting will be held in concert with the International Symposium on Dynamics and Structure of the Mesopause Region (DYSMER) during March 1998 at the Radio Atmospheric Science Center(RASC), Kyoto University, Japan.

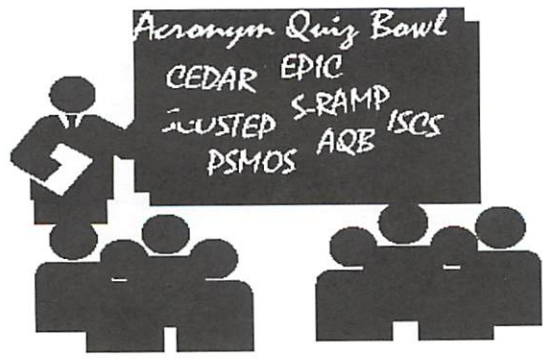
The broad scientific objective of EPIC is to understand equatorial processes occurring in the middle atmosphere and upper atmosphere/ionosphere on all spatial and temporal scales. The EPIC purview also includes studies of vertical coupling with regions above and below the middle and upper atmosphere as well as horizontal coupling with the atmosphere/ionosphere at extratropical latitudes. The EPIC SC is chaired by Shoichiro Fukao (*fukao@kurasc.kyoto-u.ac.jp*).

ISCS aims at understanding of the solar processes during the rising and maximum phases of the upcoming 23rd solar cycle and their effects on the interplanetary environment. Working groups for studies of Solar Energy Flux, Solar Magnetic Field Variability, and Solar Emissions have been established. Anyone interested in participating in these studies should contact S. T. Wu.

(*wus@cspar.uah.edu*).

This report has in part provoked the CEDAR Science Steering Committee to consider holding an Acronym Quiz Bowl (AQB) during the next annual workshop. Have your University/Laboratory team study the info herein with great care to increase their chances of winning!

Maura Hagan (NCAR), Gordon Shepherd (York University), and Sunanda Basu (NSF)



THIRD WORKSHOP ON WIND MEASUREMENTS IN THE MIDDLE ATMOSPHERE

The Third Workshop on Wind Measurements in the Middle Atmosphere was held at the University of Michigan in Ann Arbor, MI during October 6-8, 1997. This was the final event in a series of meetings that began in Paris in November, 1994 (hosted by CNES), and was followed in May, 1996 by a meeting hosted in Toronto by York University. The Ann Arbor meeting was attended by approximately 60 people from all over the world, and about 50 papers were presented in the following sessions: Longitudinal variations in the dynamics of the middle atmosphere, Dynamical effects on the airglow - implications for atmospheric composition, Gravity wave effects in the middle atmosphere, Seasonal and interannual variability in MLT dynamics, Planning a new reference model for the middle atmosphere, and Understanding the limitations of different wind measuring techniques.

By the end of the meeting, it was clear that over the last 3 years or so great advances have been made in the documentation of planetary scale mesosphere and lower thermosphere dynamics. This is largely due to the availability of the first satellite direct wind measurements in these regions, made with the High Resolution Doppler Imager (HRDI) and the WIND Imaging Interferometer (WINDII) on the Upper Atmosphere Research Satellite and the interactions of those analyzing the satellite data with both ground-based investigators and modelers in an extend community. These UARS instruments have identified important, but previously unknown, phenomena, and are providing the most comprehensive and effective tests of global numerical models yet possible. Consequently, the understanding of the wave motions which dynamically couple the various atmospheric regions has made significant progress.

The format of this meeting was such as to facilitate lively discussion and debate. One important continuing issue (which was first raised at the Paris workshop in 1994) was that of the UARS/MF radar wind speed discrepancy. It has been a persistent finding that UARS winds, and consequently tidal amplitudes, (particularly above an altitude of approximately 85 km) are larger than indicated by the MFRs, while the directions are generally in excellent agreement. The bias factor, which lies in the range 1-2, depends on the particular MFR employed in the comparison, and on the altitude (some radars show no bias below about 85 km). At the meeting in Ann Arbor it was pointed out that the tidal perturbations detected in the O(1S), O_2, and OH nightglow emissions can only be reconciled with the larger wind amplitudes observed by UARS. This along with other recent results us causing the MFR community to re-examine their systems and analysis techniques, in order to understand the differences between some stations, and between different altitude regimes.

Mark Burrage (University of Michigan), Marvin Geller (State University of New York at Stony Brook), and Gordon Shepherd (York University)

[Editor's note: The following article on a recent space weather workshop is aimed at keeping the CEDAR community informed of developments in space weather research activities in order to strengthen the CEDAR link to the National Space Weather Program. One of the goals of the CEDAR Phase III Program Plan is the study of Solar-Terrestrial Interactions and specifically calls for close coupling with space weather applications. Acknowledgement is due to Dr. Sunanda Basu at NSF for promoting these useful program interactions.]

SPACE WEATHER EFFECTS ON PROPAGATION OF NAVIGATION AND COMMUNICATION SIGNALS: A Workshop Held at COMSAT Corporation, October 22-24, 1997

The National Science Foundation (NSF) and the National Oceanic and Atmospheric Administration (NOAA), in collaboration with the Air Force Research Laboratory (AFRL) and the Office of Naval Research (ONR), sponsored a Space Weather workshop held in Bethesda MD in late October. Organized by Northwest Research Associates (NWRA), the workshop was attended by 133 individuals from companies, DoD and civilian agencies, government laboratories, research institutes, and universities. The agenda included 13 review talks from the research and applications communities, followed by extensive specialized discussion periods, and a poster session displaying 28 sets of user-oriented research results and space-weather products.

Following an overview of The National Space Weather Program by Rich Behnke (NSF), Mike Kelley (Cornell) presented An Introduction to Space Weather in the Ionosphere. In a mere forty minutes, Mike sketched the tenuous-plasma nature of the ionosphere, its relation to neutral-atmospheric dynamics at middle and low latitudes, and the dominant influence of the solar wind and magnetosphere at high latitudes. Important for the goals of the workshop was imparting an appreciation for structuring of the ionospheric plasma on many scales. Mike did so via a minimum of equations and a judicious choice of visual aids - even including a novelty-store rendition of a Hele-Shaw cell to illustrate the Rayleigh-Taylor instability. Specific ionospheric effects were reviewed by Tony Mannucci (Jet Propulsion Lab), who described Group Delay and Phase Advance due to Ionospheric Total Electron Content (TEC), and by Ed Fremouw (NWRA) and Santi Basu (AFRL), who characterized The Signal Statistics and Climatology, respectively, of Transionospheric Scintillation.

Comparable to Mike Kelley's mini-review of ionospheric physics was a description of Communication Satellite Systems and the Ionosphere by John Evans (COMSAT). Concentrating on systems whose performance could be degraded by ionospheric effects, John described imminent and envisioned "Little LEO" systems intended to provide data-messaging services to small terminals at VHF/UHF and "Big LEO" systems for mobile telephony via handheld radios, most of which will operate at L Band. The effects of greatest concern are those produced by intensity and phase scintillation. Much attention was given at the workshop to the Global Positioning System (GPS), following An Overview of GPS by Keith McDonald (Sat Tech Systems) and a description of its Wide Area Augmentation System (WAAS) by Rich Domikis (Federal Aviation Administration).

Descriptions of space-environment requirements and services in the Department of Defense were given by Gretchen Lindsay (Aerospace Corp.) for Russell Kutzman (Air Force Space Command, AFSPC), Gus Lott (Naval Postgraduate School), Michael Cristie (AFSPC), and Dave Anderson (AFRL). Services and issues in the civilian sector were described, respectively, by Joe Kunches (NOAA Space Environment Center) and Tom Tascione (Sterling Software).

The meeting facilities graciously provided by COMSAT proved to be very well-suited for in-depth discussions by three breakout groups: one each for Navigation, Communications, and Commercial Space Weather Services. Each discussion group was served by a facilitator and two recorders, who reported back to the re-assembled participants on the last morning of the workshop. Based on those reports, the participants reached consensus on the following key conclusions:

1. Validation of space-weather models & products and development of metrics for quantifying their accuracy and reliability are crucial.

2. GPS users want scintillation to be characterized in terms of

- the duration and recurrence rate of fades as functions of their depth;
- the rate-of-change and acceleration of phase; and
- the spatial extent of scintillation patches (number of GPS satellites affected).

3. Development of a test bed and standards for testing the response of GPS receivers to scintillation is to be encouraged.

4. The ability of WAAS 5x5-deg grid to capture operationally relevant TEC gradients needs to be assessed.

5. Ionospheric monitoring systems should be operated through solar maximum as inputs to nowcast and forecast models. Examples identified included

- continued transmission of phase-coherent VHF/UHF signals from the Transit satellites of the Navy Ionospheric Monitoring System;
- ground-based sensors such as chains of Transit receivers for TEC tomography and latitudinal mapping of scintillation, networks of GPS receivers for TEC measurement, and ionosondes for ionospheric profiling;
- a low-inclination satellite orbiting modestly above the F-layer peak and carrying a suite of instruments for monitoring the electrodynamics and plasma structuring of the equatorial ionosphere, such as that proposed by AFRL to the Air Force Space Test Program (STP); and
- a UV instrument in geostationary orbit capable of imaging night-time TEC with sufficient resolution to detect and track scintillation-prone regions, such as that proposed by the Navy to the Air Force STP.

6. Continued operation of the ACE satellite at the Earth-sun libration point throughout its five-year design lifetime (presently assured for only two years) would represent an extremely cost-effective means to provide data that are crucial for detection of space-weather events nearing Earth.

7. Creation of a Rapid Prototyping Center for space-weather products, such as that envisioned for NOAA's Space Environment Center, is needed to foster development of a space-weather industry in the private sector.

Ed Fremouw, NWRA

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EVENT-DRIVEN OPERATIONS AT SONDRESTROM FOR SPACE WEATHER RESEARCH

Incoherent scatter radars are unsurpassed in their ability to provide comprehensive ground-based measurements of the basic and perturbed state of the Earth's ionosphere. Moreover, these radars are versatile in their ability to observe specific ionospheric properties over a significant latitude range for extended periods of time. However, IS radars, due to their expense and complexity, are not simple monitoring instruments, but rely on scheduling and planning that embody logistics, maintenance, and operations. Experiments have thus typically been planned well in advance in anticipation of satellite conjunctions, new moon periods, ancillary instrumentation availability, organized global campaigns, and so on. Such experiments constitute the majority of all measurements performed by the Sondrestrom radar. The opportunity to observe space weather events in their entirety has been limited, partly due to the radar's campaign-driven status, but mostly because of unreliable forecasts of impending space weather events. The recent unprecedented satellite coverage of the sun, solar wind, interplanetary space, and magnetosphere by SOHO, WIND, POLAR, GEOTAIL, ACE, and other spacecraft enables unique monitoring capabilities for space events as well as a chance to notify and predict more reliably their geoeffectiveness. Radar operations in conjunction with identified space weather events, such as coronal mass ejections (CMEs), can complete the "cradle to grave" scenario with the ionospheric measurements providing the final link in the solar-terrestrial chain of cause and effect.

In support of the National Space Weather Program (NSWP), we have begun to develop a protocol by which the Sondrestrom radar may operate to capture the onset, main phase, and recovery phase of a CME-related geomagnetic storm. The design and implementation of this protocol relies on the

identification and timely notification of a space weather event, choosing the proper radar mode to provide the best ionospheric data set for the event, scheduling site operations and crew, and providing access to and interpretation of the data. These procedural elements establish the measurement protocol for our event-driven operations. Presently, our efforts are focused on CME events only. The scientific justification for choosing CMEs as the event driver is that they are a known source of large-scale geomagnetic disturbances with extended duration. Also, CMEs are not uncommon solar phenomena. In the 14 months after the launch of SOHO there were numerous CME candidates identified by the SOHO team. Based on WIND satellite data availability, these events suggest that detectable CMEs are impacting the Earth at a rate of approximately once every two-and-a-half months. Over the past three months (September-November 1997) this rate has increased to approximately once a month.

A first attempt at testing the protocol was made on 27 September 1997 when we were notified by the SOHO team of a full halo CME that was potentially earthbound. Remaining in close contact with the SOHO and WIND teams for CME progress, we reviewed the operations schedule and consulted with the Sondrestrom site crew. Upon further review of the incoming satellite data, we initiated the turn-on sequence. The radar operated for 32 hours from 16 UT on 30 September until 01 UT on 2 October in a scanning mode that provided extended latitudinal coverage of the ionospheric plasma and electric field. This storm proved geoeffective on October 1 near 01 UT with the arrival of the magnetic cloud embedded within a strong southward interplanetary magnetic field. The main phase of the storm reached a peak (Dst ~ -90 nT) near 16 UT on October 1 and recovered to nominal levels by 23 UT on October 1. The radar operated throughout the event and captured the high-latitude ionospheric response through all phases of the storm.

A second test of the protocol came on 4 November 1997 when SOHO instruments detected another halo CME. This magnetic cloud became geoeffective near 00 UT on 7 November with a maximum in the main phase strength of -90 nT near 05 UT on the same day. The recovery phase of the storm lasted through the rest of 7 November. Upon SOHO notification and discussions with colleagues at the Millstone Hill Observatory, both the Sondrestrom and Millstone Hill radars operated for the duration of the event again capturing all phases of the storm.

The CEDAR and GEM communities have begun to benefit from the unprecedented satellite coverage to study more completely geomagnetic storms and their impact on the magnetosphere – ionosphere – thermosphere system through all their different phases. The Sondrestrom radar protocol extends this opportunity by providing a means by which community research concerning the ionospheric and aeronomic impact of geomagnetic storms can be carried out more effectively. This protocol could eventually lead to a database of storm-time effects covering all local times. We are soliciting participation and feedback from the CEDAR and GEM communities in hopes of further improving the protocol and to involve researchers interested in using this approach. Of course, our user-driven operations will continue as before, but our current and future users should consider the benefits of taking advantage of the results from these event-driven operations. Also, those interested in partaking in the notification process can request to be contacted by SRI concerning our plans for the event-driven operations. Although some information can be retrieved from our Web page *(http://128.18.44.75/iono/issmain.html)*, direct contact with Dr. John Kelly *(kelly@sri.com)* provides the most up-to-date information for such events.

Jeff Thayer, Ionospheric and Space Sciences Group, SRI International

SPACE WEATHER: RESEARCH TO OPERATIONS II

Meeting scheduled for February 5-6, 1998, in Boulder, CO.

Advances in space weather research, the availability of new real-time data, and efforts at the space weather operations centers to use new models and data operationally are all helping to realize the goals of the National Space Weather Program. A meeting to continue these efforts on the near-term and future transition of research models and data into operational use will be held in Boulder, CO, on February 5-6, 1998. The meeting is being jointly organized by the NSF Division of Atmospheric Sciences, the AF Research Laboratory and the NOAA Space Environment Center. Convenors are Terry Onsager (SEC), Greg Ginet (AF) and Rich Behnke (NSF).

The purpose of this meeting is to provide a forum for space environment modelers and other researchers to interact with people from organizations that provide forecasts and services to space weather customers and to address the science problems that are important for space weather activities. The meeting will provide an opportunity for modelers to describe tools that will soon be available for transition to space weather services, and will provide an opportunity for the space weather operations centers to describe the processes they are implementing to select, evaluate, and eventually graduate models/data into operational use. Among the issues that will be emphasized at this meeting are: data availability and data requirements for space weather models and standardization that could benefit both the research and the operations communities.

Additional details regarding the meeting agenda and logistics can be obtained by contacting *tonsager@sec.noaa.gov*.

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INTERNATIONAL WORKSHOP OF THE ICMA WORKING GROUP ON LAYERED PHENOMENA IN THE MESOPAUSE REGION*

at the Institute of Atmospheric Physics, D-18225 Kuehlungsborn, Germany, September 16-18, 1998.

Following previous workshops in Tallinn (1984), Boulder (1988), Tallinn (1988), and Boulder (1995), the next workshop will be the first in which the NLC/PMC and PMSE communities will participate together as equal partners. Subject areas will include in particular the following new developments:

Lidar measurements of NLC, simultaneous NLC/PMSE measurements, in situ dust impact measurements, particulate charging, southern hemisphere radar/rocket campaigns, satellite data and their intercomparisons (UARS, MSX, POAM, GOME, etc.), modelling activities (in particular of tidal variations and the effects of particulate charging), etc.

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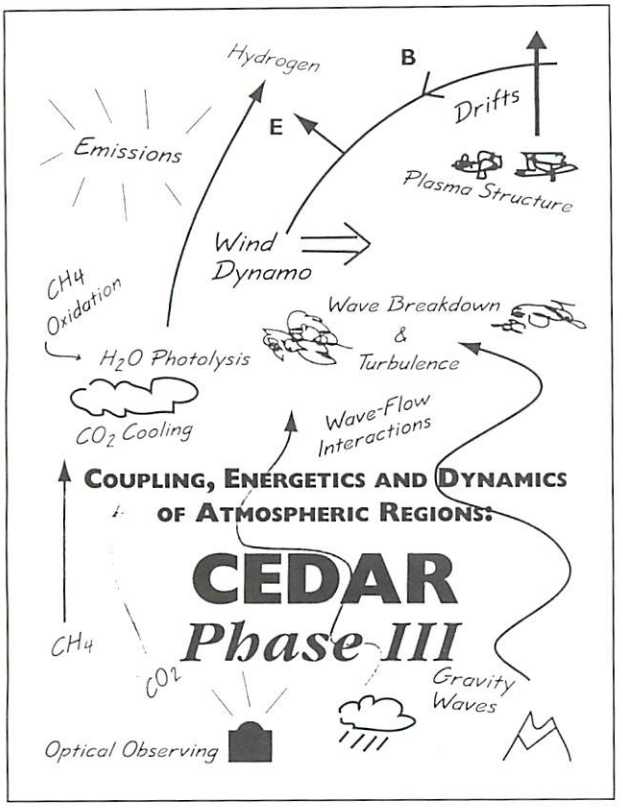

CEDAR Phase III Report Available

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CEDAR Baked Beans

In honor of the former Editor, we continue the tradition of inviting submissions to the CEDAR Baked Beans section of the Post. The purpose is to provide an informal forum for anyone to briefly address issues of general interest and provocative nature. Limited to 250 words. Replies to such commentaries are also welcome. Final selection for publication rests with the Editor.

The CEDAR Post

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