The CEDAR Post

December 1998 Volume 35

FROM THE CEDAR SCIENCE STEERING COMMITTEE

The CSSC met at NSF on November 13 to discuss various topics of importance to the CEDAR community and to begin the planning for the June 1999 meeting.

IN THIS ISSUE

One of the primary topics was the continued rejection of funding by Congress for the Polar Cap Observatory (PCO). A letter from the CSSC was sent in October 1998 to the NSF Director, Dr. Rita Colwell, outlining our community's views of the issues associated with the PCO project and asking for her strong support. In her response, Dr. Colwell expressed her deep disappointment by the Congressional action on PCO and recognized the intellectual importance of the facility. She has delegated the responsibility for discussions with the community and assessment of future options to Dr. Robert Corell, Assistant Director for Geosciences. At this time, NSF is trying to determine the problems that need to be resolved with the PCO funding by Congress so that alternatives for implementing the PCO can be successfully proposed. It is hoped that the priority for the PCO, which has met the peer review and selection criteria, can be reestablished as an important component of the Congressionally-enhanced Arctic research program at NSF.

Amongst other matters, progress at NCAR on the Web-based access to the CEDAR Data Base was discussed. An interim system based on the current 'cmenu' capability has been made available for testing by the community. Work continues on a larger scale system called DODS which is planned for implementation on a longer term. The CSSC was unable to make a useful assessment of the work at this time. Further information on this topic is provided by NCAR in this newsletter.

The overall structure of the 1999 CEDAR meeting has been developed and is outlined in this newsletter. More time has been reserved for workshops, and a session on Solar-Terrestrial Coupling Processes that motivates an examination of a solar event from its development to its effects on Earth is being planned in coordination with scientists within the SHINE and GEM programs. Finally, a plan to coordinate the 2001 CEDAR meeting with SCOSTEP's Solar-Terrestrial Physics Symposium in Boulder has been encouraged and will be pursued.

Joe Salah (MIT - CSSC Chair)

FROM THE NSF

CEDAR COMPETITION:

NSF received 43 proposals by the 1 May 1998 deadline for the FY99 CEDAR competition. The total amount requested in first year funding was $3.4M. A part of this year's competition, as recommended by the CEDAR Science Steering Committee, included preparations for the CEDAR-TIMED collaboration (CEDAR Post, #33). A breakdown of the proposals submitted by category and funding levels is given in the table below, together with the award statistics. Success rate was 56% in numbers of proposals and 35% in dollars requested for first year funding. Note that the CEDAR-TIMED awards are one-year awards.

	CEDAR	CEDAR-TIMED	POST-DOC
Proposal Submitted	24	16	3
First-year funding request ($K)	2,060	1,230	135
Awards	13	9	2
First-year funding awards ($K)	680	420	90

The list of awards will be available in the February 1999 CEDAR Post issue.

ANNUAL AND FINAL PROJECT REPORTS THROUGH FASTLANE:

NSF has implemented a new electronic project reporting system, available through FastLane, which permits electronic submission and updating of project reports. Effective October 1, 1998, PIs are required to use the new reporting format for annual and final project reports. Information on the FastLane system can be found at URL: *www.fastlane.nsf.gov.*

GEOSCIENCES LONG RANGE PLAN:

The NSF Directorate for Geosciences, which includes the Upper Atmosphere Research Section (UARS), has developed a long-range plan for its science programs and its facilities. The facilities long-range plan (FY 1999-2003) is available at URL: *www.geo.nsf.gov/adgeo/fac_lrp/start.htm.* We encourage members of the CEDAR community to review this plan and to provide feedback to the NSF UARS program directors.

Su. Basu, R. Robinson (NSF)

MARK YOUR CALENDARS:

1999 CEDAR meeting, Boulder: 14-18 June 1999
2000 CEDAR meeting, Boulder: 19-23 June 2000
2001 CEDAR meeting, Boulder: 18-22 June 2001 (tentative)

Also Note:
1999 SHINE Workshop, Boulder: 14-18 June 1999
1999 GEM Workshop, Snowmass: 20-25 June 1999
1999 AGU Spring meeting, Boston: 31 May- 4 June 1999
2000 AGU Spring meeting, Washington D.C.: 29 May - 3 June 2000

PLANS FOR 1999 MEETING

The 1999 CEDAR meeting will be held on 14-18 June at the University of Colorado in Boulder, with a student workshop on 13 June. A template of the meeting schedule is given below. There is additional time for workshops since the poster session will be held in the evening of 15 June in the spacious UMC Glenn Miller Ballroom. A special plenary session on Friday 18 June and a workshop on Solar-Terrestrial Coupling Processes are being coordinated with SHINE and GEM program scientists (see page 4). Note that the SHINE program will be holding its meeting in Boulder concurrent with the CEDAR meeting in June 1999. A detailed schedule of the 1999 CEDAR meeting will be published in Spring 1999, and there will be calls for workshops and posters at that time.

1999 CEDAR MEETING PLAN

	Sunday 6/13	Monday 6/14	Tuesday 6/15	Wednesday 6/16	Thursday 6/17	Friday 6/18
A.M.		Intros. NSF Pres. Prize Lecture	Tutorial Science highlights Program reports	Tutorial Science Highlights Post-doc reports	Tutorial Science highlights Program reports	Solar - Terrestrial Coupling Processes
P.M.	Student Workshop	Workshops	Workshops	Workshops	Workshops	Workshops & Special S-T Workshop
Evening			Poster Session and Reception	Buffet at NCAR		

Coordinators for the meeting activities are as follows:

Overall Schedule:	*J. Salah, B. Emery*
Tutorials, Science Topics:	*C. Fesen, D. Hysell, J. P. St-Maurice*
Program Reports:	*J. Salah, J. She*
Workshops:	*M. Hickey, M. Sulzer, M. Taylor*
Poster Session:	*R. Smith, T. Van Eyken*
Student Session:	*A. Stephan, M. Hagan*
S-T coordinated session:	*M. Hagan, R. Heelis, R. Smith*

Please contact any of the above members for suggestions or comments in preparation for our annual meeting. Information on email and phone contacts for the CSSC members is provided at the end of this newsletter.

SOLAR TERRESTRIAL COUPLING PROCESSES

At the 1999 CEDAR meeting a one-day session on Friday, June 18, will be devoted to furthering our understanding of coupling processes in the solar terrestrial environment. Recently, comprehensive bodies of data have been gathered during periods when large solar events have been recognized and their effects on the magnetosphere and atmosphere have been studied. One of these "cradle-to-grave" events will be identified and serve as the foundation for tutorials on the fundamental physical processes to be presented by solar physicists, magnetospheric physicists, and atmospheric physicists. An overview of the key questions that can be addressed using such data sets, as well as outstanding problems requiring further investigation, will also be discussed. The opening session will be followed by a workshop aimed at identifying new initiatives that might be undertaken with existing and newly acquired data sets.

It is hoped that this session, that will appear on both the CEDAR and SHINE meeting agendas, will serve as a foundation for establishing collaborations that will embrace activities in the GEM, SHINE, and CEDAR programs.

R. Heelis (U.Texas, Dallas), M. Hagan (NCAR), R. Smith (U. Alaska)

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COORDINATED ISR WORLD DAY CAMPAIGNS FOR 1999

[*www.eiscat.no/URSI_ISWG/1999_schedule.htm*]

JAN 12-13: High Time Resolution Auroral Radar Convection, and Observations for Data Base: F-region broad latitudinal coverage.

FEB 9-12: Global Ionosphere-Thermosphere Coupling Study

MAR 2-12: Four-day floating period within 10-day 'alert period'; default: 8-12 March. Joint Observations of Effects of Storms in Lower Thermosphere

APR 20-22: Floating days to be selected one month ahead. Wide-Latitude Substorm Dynamics

JUL 6-8 : Global Ionospheric Convection

SEP 7-9 : Lower Thermosphere Coupling Study

OCT 4-29: Three-day floating period within month-long 'alert interval'; default: 12-14 October. Wide-Latitude Substorm Dynamics, and First-SRAMP Space Weather Campaign

OCT 8-9 : Plasmaspheric Observations of Light Ions in the Topside Ionosphere and Exosphere

DEC 14-15: Plasmaspheric Observations of Light Ions in the Topside Ionosphere and Exosphere.

Congratulations, Mike!

Professor Mike Kelley was recently named by Cornell President Hunter Rawlings as a Weiss Presidential Fellow, honoring "effective, inspiring and distinguished teaching of undergraduate students." The award — $25,000 over five years— is the highest honor awarded by Cornell for excellence in undergraduate teaching.

SCOSTEP'S SPACE WEATHER MONTH: OCTOBER 1999

The Space Weather working group of SCOSTEP's SRAMP (STEP Results, Applications and Modeling Phase) has designated the month of October 1999 as 'SRAMP Space Weather Month'. Phil Wilkinson (IPS, Australia) and David Boteler (Geolab, Canada) are coordinators for the special month. A slot has been reserved by Sunanda Basu (NSF) on the Incoherent Scatter Radar World Day Calendar for observations in support of this SCOSTEP project which has been designated as the 'First SRAMP Space Weather Campaign'. Additional information is available on the SRAMP Space Weather page at URL:*http://aoss.engin.umich.edu/intl_space_weather/*

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TIMED IS 'ON TIME'

A NASA TIMED Investigator working group meeting was held at the Johns Hopkins Applied Physics Laboratory on October 6-7,1998. Attendees included program managers from NASA Headquarters and Goddard Space Flight Center, project engineers in systems and operations from APL, the instrument PIs and Discipline scientists. Instrument PIs and integration engineers reviewed schedules for integrating the instruments to the spacecraft bus. The mission appears to be on schedule at this time, with a planned launch of May 2000. The satellite and mission are summarized on the TIMED web site at
http://sd-www.jhuapl.edu/TIMED/.

The group was given a tour of the TIMED assembly area where wiring harnesses and mechanical structure for the spacecraft were in the process of being assembled. In addition, a new spacecraft mission operations building which had just been assembled was visited. There were considerations to add real time data downlink and distribution capabilities, as has been requested by some of the investigators. Although this will be studied, it appears that it will be difficult to incorporate due to the maturity of the payload development. However, there is a ground array of satellite readout stations which can be activated to increase the access rate.

A key issue involves the TIMED data products and what would be distributed to whom and when. A number of the basic products will be available through web sites. TIMED scientists will be issued level 2 (specific pass data, in engineering units) on CD ROMS. Level 3 products (which are grid interpolated maps) will be more widely distributed, with heavy use of web tools and ftp facilities. It was pointed out that access to CDs may also be desirable for TIMED/CEDAR collaborators, but at this time it isn't feasible to issue these outside the TIMED community. It is planned that the list of specific data products available to the CEDAR community from TIMED will be defined on the web and be made available in the spring for those scientists writing CEDAR/TIMED proposals which are expected to be due May 1, 1999. Similarly, the availability of CEDAR data, and timeliness of processed data was discussed.

On day two of the meeting, scientific presentations were made by Ray Roble, Jeff Forbes, and Dave Fritts. Ray Roble focused on the TIMEGCM/CCM, Jeff on sampling and aliasing calculations regarding the recovery of tidal and other long period waves. Dave Fritts described the importance of small scale waves and described the need for correlative measurements.

Dr. Bob Robinson from NSF gave a preliminary count of 8 proposals which had been accepted as the 1st CEDAR/TIMED upgrade projects based on proposals submitted in the 1 May 1998 competition. The projects included radar, lidar, and passive optical instrument upgrades. In summary, as it currently stands, the plan and infrastructure for the CEDAR/TIMED collaboration between the NSF and NASA upper atmospheric programs are in place. NASA and NSF program directors are working out the details for the opportunity, which is planned to be available as a joint NSF-NASA Program Announcement in the February 1999 time frame. It will be up to the community to follow through and take advantage of this exciting opportunity!

Gary Swenson, (Univ. of Illinois) and Jeff Thayer, (SRI International)

RESULTS --- STUDENT SURVEY '98

A survey of CEDAR students receiving Ph.D.s in the last ten years or so has been underway since the time of our last meeting in June. The purpose of the survey has been to determine how readily our graduates are finding employment (in or out of their field of specialization), how well they are being trained, and generally how satisfied they feel about their involvement with CEDAR science. Concern was raised some years ago that young scientists were being produced as a byproduct of our research activities at a rate greater than our field could absorb them. It is of course not just advanced degrees that students seek but, more importantly, fulfilling careers that make use of their training while affording some degree of security and the promise of advancement. If indeed young scientists are being over produced, the emphasis CEDAR has historically placed on education would seem to be misplaced. Conversely, if our graduates generally are able to embark on successful career paths, CEDAR may well place education at the top of its list of accomplishments.

This is the second time a survey like this one has been given. The first was given in 1996 and had 30 respondents. The current survey has had 73 respondents at the time of this report. Both surveys consistently suggest that CEDAR graduates overwhelmingly have been able to find employment, 90% of respondents reporting constant employment since obtaining their Ph.D.s. Not only are they employed, but something like 85% report working in a field closely related to the one for which they trained. Similar numbers of respondents say that they make use of their training frequently in their work, that they were well prepared for it, and that they are generally satisfied with their graduate experience. Approximately 75% of respondents said that their graduate advisors were helpful with their job search. These findings seem to indicate not only that are CEDAR students being trained appropriately but also that room exists for them within the community should they desire to stay.

Most of the respondents to the survey graduated within the last 5 years, and just over half of them did within the last 2. Most finished graduate school in under 6 years, although nearly 1-in-5 spent 9 or more years there. Their job searches seemed to involve networking rather than mass-mailings of resumes, relying about equally on connections made at meetings and through their faculty advisors. In the end, the jobs held by our recent graduates divide evenly between post docs, non-academic research positions, and academic positions with only a very few (<10%) taking jobs in industry. Most respondents applied for and took postdoctoral positions at one time and held them for a duration of usually 2 years or less. Satisfaction levels reported for postdoctoral positions were generally somewhat less than for other kinds of jobs on average, and about as many respondents felt that their postdoctoral training ended up being unimportant to them as felt that is was absolutely required for their careers.

By correlating responses to different questions in the survey, we can derive a crude ranking of overall job satisfaction by job type. From most satisfying to least satisfying, respondents indicated non-academic research, academic research, post docs, and industrial positions. The general feeling seemed to be that, while salary and benefits may be good industry, there will likely be little time for research. Meanwhile, non-academic research was regarded as being particularly interesting, although respondents were somewhat deterred by perceived soft money aspects. Academic jobs were found appealing because of their mixture of research and teaching, although the tenure process was considered unattractive.

While encouraging, the results of this survey are not altogether conclusive. The sampling was neither uniform nor exhaustive and seemed favor the most recent graduates who were once very active in CEDAR and who have stayed close to the field. These are, after all, the individuals most likely to have been contacted about the survey. Likewise, recent graduates who are currently employed in CEDAR related areas are probably the ones most likely to take an interest in responding. The seeming disinterest in industrial positions reflects, in part, our failure to keep up with students who have gone off to companies. We often say at CEDAR that the skills endowed to our students will serve them well whether they remain in atmospheric science or not. While this survey indicates that many students will have the opportunity to stay in their field, it tells us little about how they fare when they leave. We simply do not keep track of those who do.

The survey itself, along with the raw results, can still be taken and examined through the URL *http://landau.phys.clemson.edu/SURVEY.html.* Comments about its content and interpretation would be appreciated.

Dave Hysell (Clemson University)

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CEDAR DATA SERVICES

The last six months have been very busy at HAO for CEDAR database related activities. Substantial progress has been made on improving the access to CEDAR data sets and a major update was made to the data holdings. Presentations on new services were made at the CEDAR workshop in June. The version 1 web interface was released to the CSSC and selected members of the community on September 1. After receiving a considerable amount of constructive feedback and suggestions for improvements, the version 1.1 release occurred November 9, 1998 for 233 members of the CEDAR community who have already signed off on the Rules of the Road in the CEDAR database access form and have a current e-mail address. This version featured a more easily accessible, and re-designed CEDAR home page (see *http://cedarweb.hao.ucar.edu/*).

Thanks go to Patrick Kellogg, Roy Barnes, Ed Smith, Jose Garcia and Leonard Sitongia in these efforts. The web interface in version 1.0 is purely HTML 3.2 and thus is accessible to a very large number of users in the U.S. and around the world. Suggestions for the interface are always welcome and further information on planned improvements is available upon request.

By the time you read this article you should have received an electronic mail message explaining the new access procedures for the CEDAR database as well as a confirmation of your access username and a password. If you did not receive this information, please visit *http://cedarweb.hao.ucar.edu/menu.html* and "Apply for new account".

Also on this page are the CEDAR Rules of the Road and On-line Help to acquaint you with the new web access.

Since the release of version 1.0 of the web interface coincided with the implementation of the UCAR network security firewall a number of restrictions have been placed upon access to cedar.hao.ucar.edu from the internet (i.e. access through the gatekeeper, gate.ucar.edu). For the time being, the traditional method of accessing the CEDAR database (using the cmenu program) will continue to be available through the end of December 1998. After that time, interactive logins for the purposes of accessing the CEDAR database will be phased out in favor of the web-based access (except for users with special needs). More information will be sent to individual account holders early in December.

With the expected increase in data holdings, and the web access, several infrastructure improvements have, or are being made to improve access speed and reliability. The cedar computer and its network connection are being upgraded and the cmenu program is being updated to run from any of the major compute and data servers in HAO to distribute the access load to the CEDAR database.

Now we turn to an update on the next release, version 2, which will feature a DODS interface (described in the December 1997 issue of the CEDAR POST) to the CEDAR database. Specifically this will enable more intelligent selection and subsetting of datasets. For example, it is possible to return only those variables you are interested in for a certain instrument, kind of data, and within a specific time period. The request can be limited even further by restricting the altitude range (for example) of that variable, or a set of variables.

The DODS interface is in beta test at this time and will be released for limited community evaluation sometime in December. This interface consists of an object oriented CEDAR database Application Programming Interface (API) written in C++, including class libraries and extensive documentation. DODS filter programs in turn create the DODS data stream and descriptor information using the HTTP protocol. A particularly powerful aspect of the DODS approach is that client programs, i.e. the ones a user develops or an application, like IDL, can be easily re-linked to receive a DODS data stream - enabling network access to CEDAR data directly within your analysis programs.

In the area of application programs, HAO has developed an IDL interface to facilitate data selection from DODS servers and then export the data structures directly into IDL. This interface is in beta test and will be demonstrated at a display booth at the AGU meeting in December. The version 1.0 release of the IDL interface is expected early in 1999. As a result of the re-vamped CEDAR DB effort in conjunction with the DODS development, HAO has developed a set of strategic recommendations, in the form of a white paper, to the CSSC in a number of areas related to the CEDAR DB. These recommendations relate to development and use of metadata within the CEDAR DB format, suitability of the physical record structure of the CEDAR DB, and general enhancements to the CEDAR DB format, e.g. adding independent and dependent variable metadata to enhance the self-describility of the CEDAR DB.

In regard to extended use of the CEDAR Data Base, the NASA TIMED satellite mission includes a ground-based component, which will probably have some of its data dispersed via the CEDAR Data Base. Preparations for this include the DODS server, which will be capable of transforming data in the CEDAR format to data in some other format known by DODS, such as the netCDF format which is used by the TIMED mission. In addition, updates to the database currently take place about twice a year. The TIMED mission motivates that they can be done more frequently, and plans are in place to make the present processes for populating the database more automatic. If needed, it may be possible to update once a week or once every two weeks as long as no problems exist within the data sets that require editing. Additional preparations will probably include a different set of 'Rules of the Road' for TIMED data sets.

The HAO team wishes to thank the CSSC and interested parties, particularly Dave Hysell, for their support and encouragement over the past few months. We look forward to a bright future for the CEDAR data services effort.

Peter Fox (HAO/NCAR - pfox@ucar.edu)

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SPARC
(Space Physics and Aeronomy Research Collaboratory)

History of UARC

The six-year UARC (Upper Atmosphere Research Collaboratory) Project successfully demonstrated how modern collaboratory tools could transform the modus operandi within a science domain, providing for capabilities in global-scale experimental work and in rigorous data-theory comparisons that simply did not exist prior to the project. The initial UARC configuration provided for interaction at a distance with a multi-instrument data stream emanating from a single location - Sondre Stromfjord in Greenland. By the end of the project, the data streams from a suite of six large incoherent scatter radar facilities (located in North America, South America, and Europe) were combined in real time with data from various NASA and DoD satellites, large- scale numerical models running on parallel machines, global suites of digisonde and magnetometer arrays, and a set of High Frequency radars in the Arctic and Antarctic. UARC provided for the coherent, real-time integration of a significant portion of the global complement of ground-based and space-borne research facilities devoted to the study of the near-Earth space environment. This collaboratory was delivered to the international community of space scientists over the web using standard browsers, enabling at-a-distance, synchronous and asynchronous planning, experiment implementation and post facto analysis. A successful, on- line, real-time demonstration of UARC capabilities was provided at NSF headquarters on April 29, 1998, during a science campaign centered on use of the incoherent scatter radar facility chain.

UARC to SPARC

SPARC will extend the UARC system to include outputs from a suite of state-of-the-art, predictive theoretical models, real-time data streams from NSF's new Polar Cap Observatory and NASA's new satellite systems IMAGE, ACE and TIMED, in addition to many other experimental systems distributed globally. The expanded set of experimental and theoretical assets will enable a full space weather predictive modeling scheme to be tested and validated through collaborative efforts, a feat that would have been unthinkable even a few years ago. Such a predictive system, illustrated below, will have important practical benefits for satellite operational systems, communications pathways and power grid systems. In this endeavor, SPARC will support the efforts of the newly funded inter-agency project designed to develop a National Space Weather Service (NSWS). In addition, the extended SPARC collaboratory will incorporate interactive archival data base visualizers, high granularity campaign recall and replay capability, electronic workshop support, digital library interfaces to the literature, incorporation of results from state-of-the-art visualization tools, and new educational and outreach products that provide students and the public with the taste of space research. The SPARC system will be built on the body of experience gained during the UARC project and will rely heavily on a large community of technically literate and highly motivated experimental and theoretical space scientists including John Foster (MIT), John Holt (MIT), John Kelly (SRI), Ennio Sanchez (SRI), Frank Toffoletto (Rice), Robert Spiro (Rice), Xiaoqing Pi (JPL), Anthony Manucci (JPL), Ulf Lindqvister (JPL), and Geoff Crowley (SwRI) amongst others.

T.L. Killeen (Univ. of Michigan)

Space Weather Prediction Schemes, Facilitated by SPARC

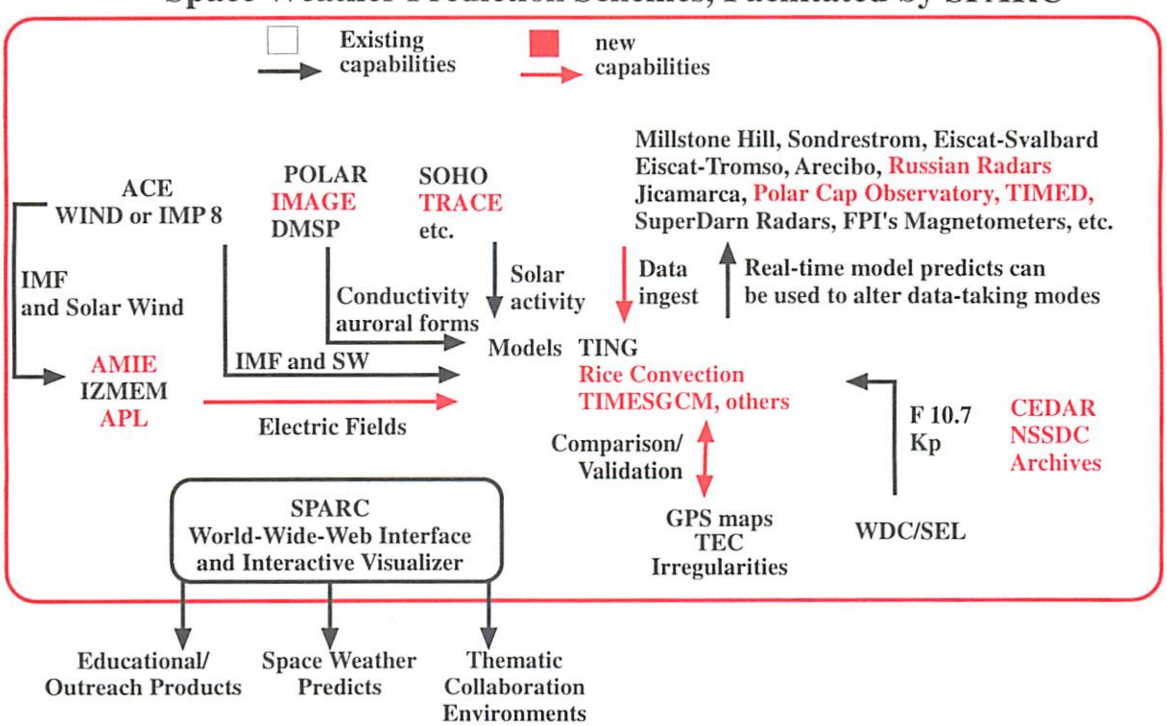


Diagram showing the connecting components of a Space Weather interconnected system. The SPARC graphical interface is flexible, providing collaboration environments to support integrated model development, model validation and tests, real-time campaign operations, electronic workshops, etc.

GAMMA-RAYS FROM MAGNETAR IONIZE THE UPPER ATMOSPHERE

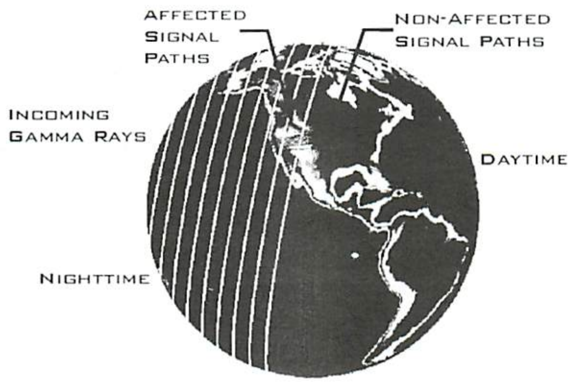
On August 27th, 1998, at about 3:22 PDT (10:22 UT), an extremely intense gamma ray flare passed through the solar system, rapidly ionizing the exposed part of the Earth's nightside upper atmosphere, producing ionization levels usually found only during daytime. This gamma ray flare originated at a faint X-ray star, located in the distant reaches of our Galaxy, some 23,000 light years away. This star, known as Soft Gamma Repeater (SGR) 1900+14, is a new kind of star called a Magnetar; a dense ball of super heavy matter, no larger than a mountain but weighing more than the Sun, with a magnetic field of 10^{14} Gauss, far greater than that known to exist anywhere else in the Universe. The gamma-ray flare lasted for about 5 minutes, and exhibited strong fluctuations at a rate of 5.16 seconds, believed to be the rate of rotation of the spinning Magnetar.

The observation of the intense ionization of the nighttime ionosphere by this flare constitutes the first direct evidence of a physical effect on the Earth's environment by a distant star, or by any star other than our own Sun. Ionization is the process by which streams of energetic photons (those which constitute gamma-rays and x-rays) knock electrons out of the atoms of air molecules and are absorbed in the process. The intense burst of gamma ray photons which impinged on our atmosphere during this event were absorbed at altitudes of 60 to 90 km, as they encountered the increasingly dense upper atmosphere. As they were absorbed, they ionized this region to a startling degree, to levels normally observed during daytime.

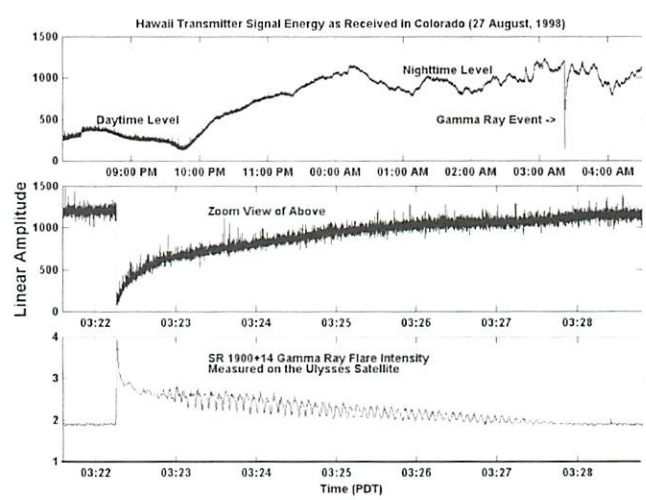
The sudden appearance of this new ionization was observed via its effects on very low frequency (VLF) radio signals propagating from Hawaii to Colorado, and from the Washington State to Colorado, alternately reflecting back-and-forth between the earth's surface and the ionized regions of the upper atmosphere, known as the lower ionosphere.

The VLF signature of the gamma ray flash event lasted for approximately 5 minutes, throughout which period the ionosphere remained ionized, roughly in proportion with the intensity of the gamma-ray flare. Careful analysis indicated that the ionization levels in the upper atmosphere exhibited a 5.16 second fluctuation, underscoring the fact that the upper atmosphere was dominantly under the influence of the gamma ray flare as it passed through the Earth.

The Stanford University observations of the ionospheric effects of SGR1900+14 were achieved in the course of continuous VLF observations conducted every night at a string of nine stations deployed in a north-south configuration at approximately regular intervals, ranging from southern Wyoming, across Colorado, to northern New Mexico. This network of observation sites constitutes the Holographic Array for Ionospheric Lightning research (HAIL). (For more information, see *http://www-star.stanford.edu/~hail/)* The VLF receiver systems are deployed at seven high schools and two colleges, providing opportunities for physics and engineering oriented students, and are fully automatic, being routinely interrogated over the Internet, for data retrieval and configuration changes. The ionospheric effects of the magnetar SGR 1000+14 were simultaneously observed at all nine of the HAIL sites, primarily in the same manner but with somewhat varying signatures. Careful analysis of the differences between signatures observed at different locations, in the context of quantitative models of VLF propagation in the earth-ionosphere waveguide will undoubtedly reveal new information about the response of the lower ionosphere to sudden introduction of intense radiation or ionization.



As shown above, the HAIL network typically monitors signals from four different transmitters, located in Hawaii, Washington State, Maine, and Puerto Rico. In view of the location (in the sky) of the Magnetar SGR 1900+14 which produced the gamma ray flash, only the upper atmosphere above the hemisphere of the Earth indicated by the rings was exposed to the intense gamma ray radiation. The affected signal paths, shown in red, only originate from the VLF transmitters in Hawaii and Washington State. The line of separation between the exposed and unexposed regions of the upper atmosphere happened to lie just to the west of the HAIL array, as shown. Accordingly, no new ionization was produced in the upper atmospheric regions that were not exposed. Indeed, no detectable effects were observed in the amplitude or phases of the two VLF signals originating in Maine and Puerto Rico (black-colored paths).



The upper panel of the above figure shows the variation of the amplitude of the 21.4 kHz signal from the Hawaii transmitter as observed in Colorado, over a 10 hour period, illustrating the lower signal levels during the day and substantially higher levels (about 10 times) during the night. The gamma ray burst event is seen to occur near 3:22 am PDT, and is shown on an expanded scale in the middle panel, time aligned with the intensity of the gamma ray burst as observed on the Ulysses satellite (lower panel). We see that the signal amplitude reduced to levels at or below daytime, indicating that the lower ionosphere was ionized to levels normally observed during daytime. The recovery of the VLF signal amplitude tracks the intensity of the burst, once again indicating that the lower ionosphere was dominantly under the influence of the SGR 1900+14 gamma ray burst as it passed through the Earth.

Umran S. Inan (STAR Laboratory, Stanford University)

"FIRST LIGHT" AT THE CLEMSON RADAR

A new HF coherent scatter radar is now operating near the campus of Clemson University in Clemson, South Carolina. The 30 MHz radar is being used to observe backscatter from field-aligned plasma irregularities in sporadic E layers as well as from meteor trails. The radar incorporates solid-state amplifiers and operates at modest peak power levels (between 4 and 8 kW) but recovers sensitivity through the use of very long coded pulses and a high duty cycle. The data acquisition system is contained within a PC and can sample and store raw data from the outputs from four quadrature receivers continuously. Real-time data processing capabilities are provided by a networked unix workstation. Interferometric capabilities with multiple baselines are being added presently.

Throughout the month of August, the radar made numerous evening observations of quasiperiodic E region echoes much like those first seen at the Middle and Upper Atmosphere (MU) radar in Shigaraki Japan. Despite the low power of the system and due to the large scattering cross section of the irregularities at this wavelength, the signal-to-noise ratios observed were as large as 30 dB. A high incidence of similarly intense meteor echoes was also observed during the Perseid meteor shower.

The coherent scatter radar is part of the Clemson Atmospheric Research Laboratory (CARL) which includes a boundary layer radar, a digisonde, and an ST wind profiler (under development). Information about the CARL can be found at the URL *http://landau.phys.clemson.edu.*

Dave Hysell (Clemson University)

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"FIRST LIGHT" FOR MANASTASH RIDGE RADAR

In late August the first auroral electrojet echoes were detected by the Manastash Ridge Radar, a completely passive VHF coherent scatter radar. The echoes were detected at ranges from 800 to 1000 km, and the power spectrum was estimated with 1 km range resolution, and about 10 m/s Doppler resolution, from 5 second averages of the receivers. The echoes resembled "type 2" or "type 3" features previously observed by 50 MHz and 140 MHz radars. Examples of data and descriptions of the radar may be found at *http://rcs.ee.washington.edu/spp*

The Manastash Ridge Radar was operating at 99.9 MHz, in the middle of the commercial FM broadcast band, and the radar transmission was the ordinary broadcast of station KISW FM, which serves the metropolitan Seattle area with 100 kW on horizontal and vertical polarization.

By fortunate accident, commercial FM broadcasts radiate signals which permit range resolution of about 1 km, as well as Doppler resolution of a few m/s. Furthermore, the average power of these transmitters is frequently 50 to 100 kW, which makes them comparable in power to incoherent scatter radar transmitters. These enormous transmitters are available "for free" for atmospheric radio science.

In order to detect the weak scatter, an accurate copy of the transmitted signal must be recorded, and receiver suitable sensitive to detect the weak scatter must also be operated. Although it is possible in principle to build a single receiver with huge dynamic range, we elected to build a bistatic receiver system. One receiver (the reference) is at the University of Washington campus in Seattle, and the other is located at the Manastash Ridge (astronomy) Observatory, 150 km east, beyond the Cascade Mountains. The data from both receivers is sent via Internet to computers at the UW for analysis. The processing is intensive; for real-time processing one needs about 20 GFlops, but 90 percent of the processing is quite simple, so special hardware and the natural progress in computational hardware will shortly bring real time operation into reach. In a separate project we expect to demonstrate real time processing in March 1999.

Because the radar is completely passive, having no transmitter to purchase, our radar is very expensive (about $20k to replace the hardware) and it is also very safe to operate. We expect to use the radar to study auroral electrojet irregularities, as well as meteor scatter (such as the Leonids, 17-18

November) and other phenomena in the middle and upper atmosphere. An article describing this "first light" is being prepared for GRL, and a longer article describing the radar details appeared in Radio Science (32, 2345-2348,1997).

John Sahr (Univ. of Washington)

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RECENT PSMOS ACTIVITIES

Planetary Scale Mesopause Observing System (PSMOS) Working Groups are currently assessing the feasibility of studies proposed to address a series of scientific objectives which were identified at the DYSMER (Dynamics and Structure of the Mesopause Region) Symposium in March 1998. On-going PSMOS objectives are to conduct collaborative investigations of:

Transient Nature of Planetary Waves; Tidal Variability
- Initial focus on periods between 2 and 16 days in January and March
- Modulation of tidal amplitudes at planetary wave periods
- Investigate plausible sources, propagation characteristics, dissipation

Non-Migrating Tidal Effects
- Develop 1-month climatologies of the diurnal tide as a function of longitude in latitude bands; minimum of 3 "separated" locations; 7 locations optimum
- Investigate plausible sources, propagation characteristics, dissipation (as above)

Climatological Study of the Mesopause Region
- Acquire improved diagnostics of monthly temperature
- Conduct in-depth analysis of the energy budget of the mesopause region

Planetary-Scale Diagnostics of "Meso" and "Micro" Scale Phenomena
- Develop synoptic maps of "Gravity Wave Activity"
- Deconvolve propagation characteristics
- Investigate [O] response

CEDAR scientists are invited to participate in all PSMOS collaborations.

Analyses of the March/April 1998 PSMOS campaign to study the so-called "Springtime Transition" in the global distribution of atomic oxygen as the circulation changes from northern hemisphere winter to summer is continuing. To learn more about springtime transition studies visit:

http://www.cress.yorku.ca/~gordon/transweb.htm

or contact Jacek Stegman (*jacek@misu.su.se*) or Gordon Shepherd (*gordon@windii.yorku.ca*) who led the PSMOS campaign effort.

In September 1998, a Japanese PSMOS workshop was held at Nagoya University, Japan. Presentations focused on the preliminary analysis of results obtained during the January-March 1998 PSMOS campaign. An overview of the workshop which includes abstracts of the papers presented at the workshop is at:

http://www.kurasc.kyoto-u.ac.jp/radargroup/psmos/psmosj/meeting/psmosws98rep.html

For additional information contact Takuji Nakamura (*nakamura@kurasc.kyoto-u.ac.jp*).

A more detailed description of PSMOS activities and objectives is accessible from the PSMOS home page:

http://www.hao.ucar.edu/psmos/home.html

Maura Hagan (NCAR), Gordon Shepherd (York University)

VALIDATION OF EMPIRICAL DETERMINATION OF THE O^+-O COLLISION FREQUENCY

The collision frequency between an oxygen atom and its singly charged ion controls the transfer of energy between the solar radiation and the thermosphere. The factor F, often called the Burnside factor, has been defined as the ratio of the empirical to the theoretical collision frequencies whose deviation from unity is a measure of inconsistency between theory and observation. Assuming given values for the theoretical parameters, a new study has applied the observational data to the empirical determination of this factor. The data were taken at the Millstone Hill Observatory, and were separated into two distinct sets of data A and B.

Three methods of analysis have been used. These are the method of linear-least-squares, a method due to Hines et al. (1997), and a third method based on lognormal distribution of the data. While the linear-least-squares and lognormal distribution methods are based on Gaussian and lognormal distributions, respectively, no distribution assumption is made in the Hines et al. method, and this makes the method more general. The linear-least-squares and the Hines et al. methods give consistent estimates for F, differing in values from each other by only a few units in their third decimal places. Using the collision frequency calculated by Pesnell et al. (1993) as the basis, the F estimates for the sets A and B are 0.91 and 1.06, respectively.

In addition, Hines et. al.(1997) and lognormal distribution methods set rigorous upper and lower bounds on the estimates of F. The bounds in the two methods are consistent with each other. Designating the true value of F by F^t, based on the collision frequency calculated by Pesnell et al., we obtain $0.89 < F^t < 1.02$, and $1.06 < F^t < 1.17$ for the two sets A and B, respectively. Thus, the inequalities for data set A brackets the correct value of $F^t = 1.0$. We have also shown that the deviation of F for each measurement from F^t is lognormally distributed.

We have found that a shift of about 15% of the F estimates between the two sets indicated above is principally due to systematic errors in the oxygen atom densities in the two sets, which is of the order of 11%.

To recommend a realistic formula for the user to calculate the collision frequency, without rigorous justification, we average the two estimates of F, leading to F=0.98. Since the Pesnell et al. formula is valid to two significant figures, we recommend their formula with an uncertainty of 8% attached to it, which is due to the difference between the two estimates of F.

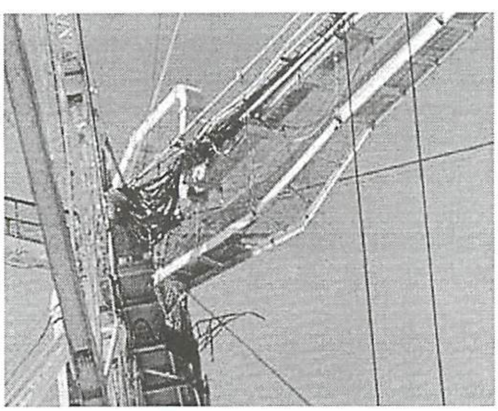
References:
Pesnell, W. D., K. Omidvar and W. R. Hoegy, Geophys. Res. Lett., 20, 1343-1346, 1993.
Hines, C. O., H. G. Mayr, and C. A. Reddy, J. Atmos. Sol. Terr. Phys., 59, 181-189, 1997.

K. Omidvar, R. Menard (NASA/GSFC), M. Buonsanto (MIT Haystack Obs.)

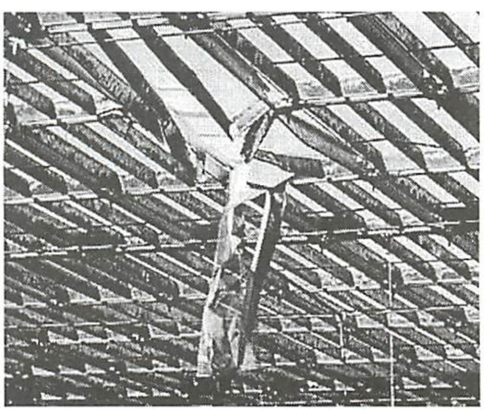
HURRICANE GEORGES VISITS PUERTO RICO

Hurricane Georges visited the Arecibo Observatory facilities during the evening hours on 21 September 1998 at about 6:00 pm and left the area at about 4:00 am early the next morning. The eye of the hurricane was expected to pass over Arecibo, but as we later learned, it turned south at the last minute sparing us from a direct impact. Nevertheless, Puerto Rico was hit very hard. Overflowing rivers engulfed many areas, and winds of up to 130 mph destroyed an estimated 60,000 homes. Agriculture was devastated. Several of the employees of the Arecibo Observatory lost parts of their homes and belongings, but damage to the Observatory itself and its surrounding areas was moderate. Many trees were down, or severely damaged around the site and on the roads leading to the site. There was a landslide onto the road going to our maintenance shop areas near the stairway that leads to our new Visitor Center. But, we are happy to report that no major damage was sustained by our radar/radio telescope, although several other areas need to be surveyed and repaired.

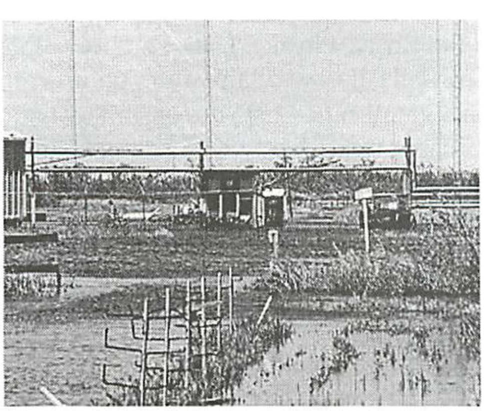
For example, the catwalk leading up to the triangular platform above the 305 m reflector was severely shaken and sustained heavy damage to many of its parts. In particular, the upper 35 feet of the catwalk floor frame and its gratings were mangled. The gratings came loose and damaged a total of 27 aluminum panels of the reflector below upon their impact. The cable car drive cable had to be replaced as well. Several sections of the 430 MHz waveguide that is located above the catwalk were badly damaged by the storm rendering the radar system non-operational for many days before needed repairs could be made. Our Ionospheric Interactions facility near the north coast was also severely damaged to the point that we have canceled the planned January 1999 heating experiment. The 32 antennas are nearly totally devastated. Nine towers of the 45 were broken and many others were badly bent. There still is no site power and this low-lying facility is currently under water.



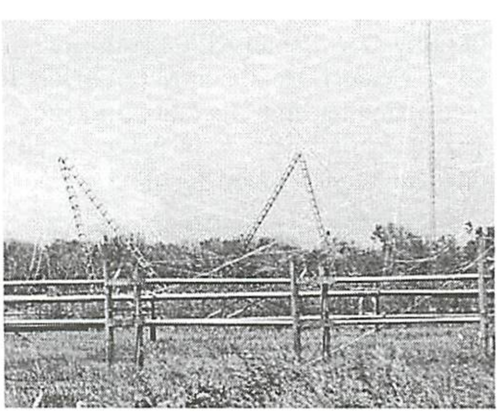
Catwalk



Reflector panels



Heating facility



Heating facility

On a more positive note we are happy that our new Visitor Center and Educational Facility with its large glass surfaces passed its test with high marks, damage being minimal. Both our Airglow Facility and our new Lidar Laboratory also survived the storm. Work has begun to build a receiver testing range, and we are acquiring a new telephone system that will allow direct dialing to any extension from the outside, as well as voice mail. This is part of our overall effort to improve communications at the Observatory, which will eventually include T1 voice and data links.

Of course, there were other setbacks. The Mesosphere and Lower Thermosphere Coupling Study (MLTCS), World Day experiment scheduled for 21-25 September was largely thwarted by the passage of Hurricane Georges. The waveguide damage mentioned earlier, combined with the loss of commercial power to the site, prevented us from obtaining high-quality incoherent scatter radar data for the campaign. However, during the MLTCS we did operate our lower-power 47 MHz radar on generator power using the two different observing modes described below.

The first operational mode involved running the VHF radar to receive coherent echos from the lower atmosphere. Despite the problems Georges caused, the storm offered a golden opportunity to study the structure of the lower atmosphere within a hurricane. Throughout the night of the hurricane, Monique Petitdidier (CETP/CNRS, France) and Carl Ulbrich (Clemson) ran the radar to measure the wind structure of the troposphere and stratosphere. Combined with the National Weather Service's Nexrad radar located in Cayey, PR, and other site deployed meteorological instrumentation, they were able to obtain some very impressive wind data as the eye of Georges passed only a few miles south of the Observatory. Analysis of these unique observations of the storm continues.

From September 22nd on, Qihou Zhou (NAIC, Arecibo) operated the VHF radar in the so-called meteor mode at night while daytime periods were devoted to maintenance and repair. The meteor data will be most useful to study the interactions of meteoroid input with the upper atmosphere near the mesopause. However, we will attempt to derive the winds from these meteor trails, albeit such trails at the time were very sporadic. It is unfortunate that our participation in this major World Day campaign was minimal, but we trust that some good science will result from this unique data set.

More photographs of the damage due to the hurricane are available at NAIC's web site:
www.naic.edu/georg/images.htm

Craig Tepley (Arecibo Observatory)

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FINDING CONJUNCTIONS BETWEEN SATELLITES AND CEDAR STATIONS

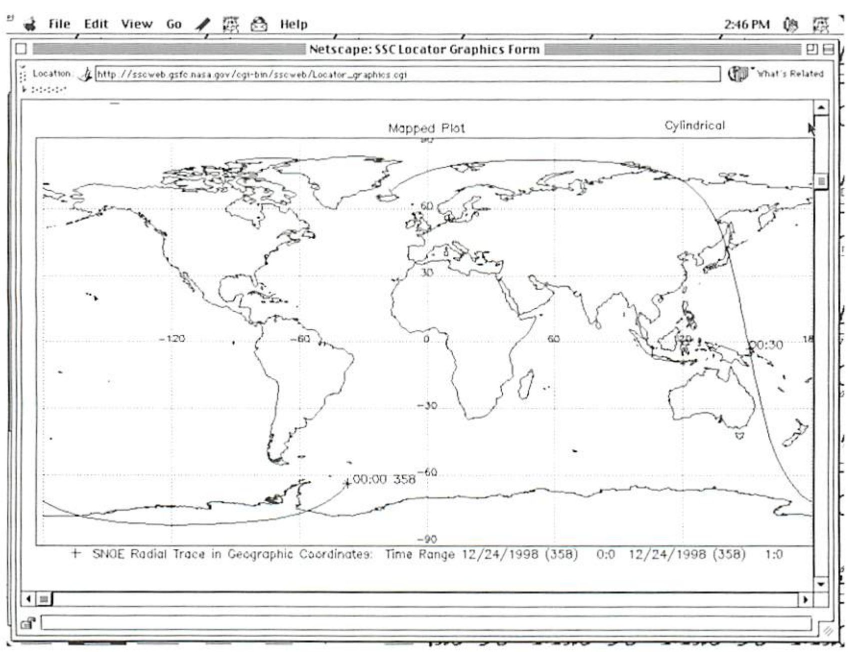
We would like to inform the CEDAR community that we have now added about 40 CEDAR ground stations (with data in the CEDAR Data Base) to the list of stations available from the Satellite Situation Center Web (SSCWeb) service at: *http://sscweb.gsfc.nasa.gov*

The Satellite Situation Center (SSC) software was developed by the Space Physics Data Facility (SPDF) and the National Space Science Data Center (NSSDC) at GSFC and is partially hosted at this time on a machine of the ISTP Science Planning and Operations Facility (SPOF). Among many other list, query and graphics options, SSCWeb lets users find periods of magnetic conjunction between spacecraft (one or more) and ground stations. Conjunctions can be also found for time periods when the satellite(s) occupy certain ionospheric/magnetospheric regions.

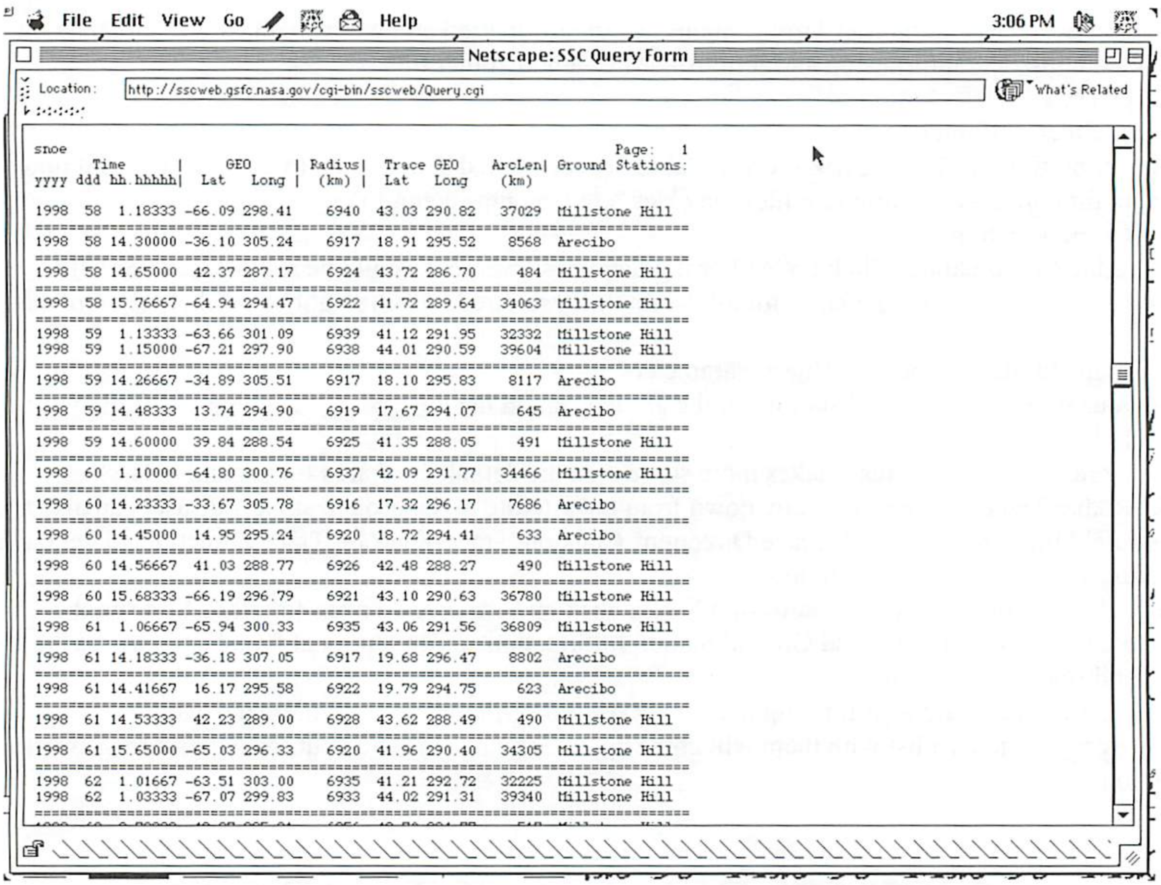
Tutorials guiding a user through sample SSCWeb sessions can be reached by clicking the 'Tutorial' links at the bottom of the SSCWeb Table. To get a list of conjunctions between satellite(s) and ground station(s), a user needs to do the following (written by Barbara Emery):

- In the Table SSCWeb, 'Navigation Tips' contains useful information about how to click on more than one selection (satellite or station) using a MacIntosh or PC, among other tips.
- Click on 'Query'
- Click on satellite(s) of interest
- Enter Start/Stop times (NOTE: Click the 'Available Spacecraft and Times' icon to get a list of valid times. Orbit parameters for currently orbiting satellites may lack a few months behind.)
- Click on 'Ground Station'
- Under Satellite Combination, Click on 'At Least _ Satellites', where _ should be set to 1. ('All Satellites' means must have a simultaneous conjunction for all the satellites selected, which might be unlikely if more than one satellite is selected.)
- Under 'Command Menu', click on 'Query Parameters'
- Click on your selection of ground stations in the ground station list ordered by geographic latitude from the South to North Poles.
- Click on 'circle' conjunction area (makes more sense than the default 'box' area for ground radars).
- Click on 'Radial Trace' to trace vertically down from the satellite to the ground station. A user can also trace along magnetic field lines in a specified 'Trace Direction'. Click on 'Trace Type' or 'Trace Direction' to get more information about the different options.
- To change the default conjunction radius of 400 km, click on 'Advanced' under 'Interface Style' in the 'Command Menu' Box, then click on 'Edit/Add Ground Station Information' under 'Optional Input' and change the radius for each ground station as desired.
- Click on 'Submit query and wait for output' under 'Execution Options' in the 'Command Menu'.
- If there are conjunctions, a list with them will come up, which can be printed out from your browser using the print option.

Dieter Bilitza (NASA/GSFC)



Predicted SNOE orbit for December 24, 1998 using the LOCATOR GRAPHICS option.

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snoe                                                         Page:   1
     Time         |      GEO      | Radius|  Trace GEO    ArcLen| Ground Stations:
yyyy ddd hh.hhhhh|  Lat     Long |  (km) |  Lat    Long    (km)

1998  58  1.18333 -66.09 298.41     6940  43.03 290.82   37029  Millstone Hill
==========================================================================
1998  58 14.30000 -36.10 305.24     6917  18.91 295.52    8568  Arecibo
==========================================================================
1998  58 14.65000  42.37 287.17     6924  43.72 286.70     484  Millstone Hill
==========================================================================
1998  58 15.76667 -64.94 294.47     6922  41.72 289.64   34063  Millstone Hill
==========================================================================
1998  59  1.13333 -63.66 301.09     6939  41.12 291.95   32332  Millstone Hill
1998  59  1.15000 -67.21 297.90     6938  44.01 290.59   39604  Millstone Hill
==========================================================================
1998  59 14.26667 -34.89 305.51     6917  18.10 295.83    8117  Arecibo
==========================================================================
1998  59 14.48333  13.74 294.90     6919  17.67 294.07     645  Arecibo
==========================================================================
1998  59 14.60000  39.84 288.54     6925  41.35 288.05     491  Millstone Hill
==========================================================================
1998  60  1.10000 -64.80 300.76     6937  42.09 291.77   34466  Millstone Hill
==========================================================================
1998  60 14.23333 -33.67 305.78     6916  17.32 296.17    7686  Arecibo
==========================================================================
1998  60 14.45000  14.95 295.24     6920  18.72 294.41     633  Arecibo
==========================================================================
1998  60 14.56667  41.03 288.77     6926  42.48 288.27     490  Millstone Hill
==========================================================================
1998  60 15.68333 -66.19 296.79     6921  43.10 290.63   36780  Millstone Hill
==========================================================================
1998  61  1.06667 -65.94 300.33     6935  43.06 291.56   36809  Millstone Hill
==========================================================================
1998  61 14.18333 -36.18 307.05     6917  19.68 296.47    8802  Arecibo
==========================================================================
1998  61 14.41667  16.17 295.58     6922  19.79 294.75     623  Arecibo
==========================================================================
1998  61 14.53333  42.23 289.00     6928  43.62 288.49     490  Millstone Hill
==========================================================================
1998  61 15.65000 -65.03 296.33     6920  41.96 290.40   34305  Millstone Hill
==========================================================================
1998  62  1.01667 -63.51 303.00     6935  41.21 292.72   32225  Millstone Hill
1998  62  1.03333 -67.07 299.83     6933  44.02 291.31   39340  Millstone Hill
==========================================================================
```

Results from a QUERY asking for magnetical conjunction between SNOE and the Jicamarca, Arecibo and Millstone Hill incoherent scatter radars during the first 100 days of the SNOE mission; only the first part of the final listing is shown here.

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PASS THE WORD TO UNDERGRADUATES: RESEARCH INTERNSHIPS IN ATMOSPHERIC SCIENCES AVAILABLE FOR SUMMER 1999

The following institutions provide summer research internships in upper atmospheric physics under the NSF Research Experiences for Undergraduates (REU) program. Students should check directly with individual REU sites regarding application deadlines.

University of Alabama at Huntsville
Contact: James Horwitz *horwitz@cspar.uah.edu*
205-895-6276 ext. 273

University of Alaska, Geophysical Institute, Fairbanks
Contact: Roger Smith *roger.smith@gi.alaska.edu*
907-474-7416

MIT Haystack Observatory, Westford, MA
Contact: Judy Signorello *jsignorello@haystack.mit.edu*
781-981-5410 *www.haystack.mit.edu/reu/*

University of Michigan, Space Physics Research Laboratory, Ann Arbor
Contact: Michael Combi *mcombi@umich.edu*
313-764-7226 *www.sprl.umich.edu/SPRL/REU*

NAIC/Arecibo Observatory, Puerto Rico
Contact: Jill Morrison *morrison@astrosun.tn.cornell.edu*
607-255-3735 *www.naic.edu*

National Center for Atmospheric Research, Boulder, CO
Contact: Cindy Worster *cmw@ucar.edu*
303-497-1552 *www.hao.ucar.edu/public/inside/summer.html*

NASA Goddard Space Flight Center
Contact: Carol Crannell *crannell@stars.gsfc.nasa.gov*
301-286-5000

****

MEMBERSHIP OF THE CEDAR SCIENCE STEERING COMMITTEE FOR 1998-1999

Cassandra Fesen	University of Texas at Dallas	(972) 883-2815	*fesen@tides.utdallas.edu*
Maura Hagan	National Center for Atmos. Research	(303) 497-1537	*hagan@ucar.edu*
Roderick Heelis	University of Texas at Dallas	(972) 883-2822	*heelis@utdallas.edu*
Michael Hickey	Clemson University	(864) 656-4275	*hickey@hubcap.clemson.edu*
David Hysell	Clemson University	(864) 656-4349	*daveh@vlasov.phys.clemson.edu*
Joseph Salah *	MIT Haystack Observatory	(978) 692-4764	*jsalah@haystack.mit.edu*
Joseph She	Colorado State University	(970) 491-6261	*joeshe@lamar.colorado.edu*
Michael Sulzer	NAIC Arecibo Observatory	(787) 878-2612	*msulzer@naic.edu*
Michael Taylor	Utah State University	(801) 797-3919	*mtaylor@cc.usu.edu*
GEM Liaison:			
Roger Smith	University of Alaska, Fairbanks	(907) 474-7416	*roger.smith@gi.alaska.edu*
International Representatives:			
Anthony van Eyken	EISCAT Scientific Association	47-77692166	*tony@eiscat.uit.no*
Jean-Pierre St.Maurice	University of Western Ontario	(519) 661-3778	*stmaurice@danlon.physics.uwo.ca*
Student Representative:			
Andrew Stephan	Boston University	(617) 353-5611	*astephan@veebs.bu.edu*
Ex-officios:			
Sunanda Basu	National Science Foundation	(703) 306-1529	*sbasu@nsf.gov*
Robert Robinson	National Science Foundation	(703) 306-1531	*rmrobins@nsf.gov*

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The CEDAR Post is published three times a year and is mailed to more than 1000 scientists worldwide.

J. Salah, Editor (jsalah@haystack.mit.edu)
H. Johnson, Assistant Editor (hjohnson@haystack.mit.edu)
-- Printing by Printing Solution and distribution by M.I.T. --