COUPLING, ENERGETICS AND DYNAMICS OF ATMOSPHERIC REGIONS

The Cedar Post

Winter 2010 Issue 58

Notes from the CSSC Chair

I find it both interesting and challenging to step in as the CSSC Chair at a time when the CEDAR community will be adapting to and adopting a new Strategic Plan. Our Plan calls for us to open our eyes to a new dimension in how we view and address our research and its interconnections and context within the larger realm of geospace and modern society. The processes, measurements, and modeling which form the basis of much of CEDAR research all address parts of the larger system. It is through addressing the complexity, cross-scale coupling, and interaction region (boundary layer) processes that we gain a better understanding of the whole.

Our new CEDAR Strategic Plan results from years of discussion and community input at the CEDAR Workshops and via e-mail and the CEDAR Wiki, combined with years of dedicated hard work by Jeff Thayer and those community members who volunteered their time to formulate, write, and refine the document. Jeff and those who worked along side him deserve our thanks for their efforts on our behalf. It is now up to us, the CEDAR community, to take the Plan and to make its vision a reality. This will take hard work on everyone's part - our students, researchers, the CSSC, and the NSF - since the Plan exorts us to step back and to take a new look at what we do and how we go about doing it. Some of the words used and concepts described may be unfamiliar to many of us - but therein lies the challenge and the promise of what we can gain as we modernize and expand our view of Aeronomy and CEDAR science.

It is interesting to me to reflect on the evolution of the role of the CSSC over the 30-some years that an aeronomy steering committee has been active within the NSF-supported community. The initial committee focused on ground-based optical aeronomy (GBOA) and how to coordinate and solidify funding for that field. Several years of extensive community input and committee negotiations, wrangling, and writing resulted in an expanded view of our coordinated research area, and CEDAR was born. 2010 marked the 25th year of CEDAR and the very-successful CEDAR Workshops. Over those 25 years the CSSC has become increasingly involved with planning and running the annual meeting. Notable exceptions to that trend resulted the valuable mid-term (Phase III) and recent (New Dimension) planning documents. The task for the CSSC over the upcoming several years is serious and ambitious, as we work with the community to interpret and implement our new Strategic Plan. I am confident that the members of the CEDAR Science Steering Committee, the CEDAR community, and our NSF representatives will work together and rise to meet the challenge of making CEDAR, aeronomy, and geospace science vital and viable research areas long into the future.

John Foster

Recent CEDAR Awards

CEDAR: Global and Local Measurements of Lightning-Mesosphere Interactions
AGS AERONOMY 12/15/2010
Cummer, Steven NC Duke University $78,004.00

CEDAR: Physics of the Hydrogen Geocorona
AGS AERONOMY 09/15/2010
Mierkiewicz, Edwin WI University of Wisconsin-Madison $89,606.00

CEDAR: Interactions of Short-Period Gravity Waves with the Horizontally-Inhomogeneous Structure of the Mesosphere and Lower Thermosphere (MLT) Region
AGS AERONOMY 08/15/2010
Snively, Jonathan UT Utah State University $75,470.00

CEDAR: Dynamics of the Neutral Upper Atmosphere and Coupling to the Topside Ionosphere
AGS AERONOMY 02/15/2010
Kerr, Robert MA Scientific Solutions Incorporated $150,120.00

CEDAR: Investigating Atmospheric Effects of Energetic Particle Precipitation Using Whole Atmosphere Community Climate Model (WACCM)
AGS AERONOMY 01/15/2010
Randall, Cora CO University of Colorado at Boulder $85,609.00

CEDAR: Investigation of Baroclinic Disturbances in the Polar Wintertime Middle Atmosphere
AGS AERONOMY 01/15/2010
Thayer, Jeffrey CO University of Colorado at Boulder $100,817.00

CEDAR: Natural and Rocket-Triggered Lightning in the Mesosphere-Lower Thermosphere-Ionosphere (MLTI) System
AGS AERONOMY 01/15/2010
Moore, Robert FL University of Florida $95,525.00

Collaborative Research: CEDAR--Application of the RENOIR System in Brazil to Study the Gravity Wave Trigger Mechanism In the Production of Equatorial Spread F and Scintillations
AGS AERONOMY 01/15/2010
Makela, Jonathan IL University of Illinois at Urbana-Champaign $65,235.00

CEDAR: Quantitiative Assessment of Proton Aurora Using State-of-the-art Models
AGS AERONOMY 01/15/2010
Chakrabarti, Supriya MA Trustees of Boston University $244,780.00

CEDAR: Effects of Orographic Forcing on the Southern Mid-Latitude Mesosphere
AGS AERONOMY 01/01/2010
Smith, Steven MA Trustees of Boston University $60,132.00

Collaborative Research: CEDAR--Tomographic Array for Lightning and Ionospheric Studies (TALIS)
AGS AERONOMY 12/15/2009
Close, Sigrid CA Stanford University $76,000.00

CEDAR: Mechanisms and Effects of Terrestrial Gamma-ray Flashes
AGS AERONOMY
10/01/2009 Gill, John CA Stanford University $300,000.0

CEDAR Postdoc: Aeronomical and Spectroscopic Studies of Key Airglow Features at High/Low Latitudes
AGS ICER, AERONOMY 10/01/2009
Slanger, Tom CA SRI International $221,088.00

CEDAR Postdoc: Coordinated Optical and Radar Observations of the Ionosphere and Thermosphere
AGS AERONOMY 09/01/2009
Talaat, Elsayed MD Johns Hopkins University $238,072.00

Update from NSF

–Farzad Kamalabadi, NSF, fkmalab@nsf.gov
–Kile Baker, NSF, kbaker@nsf.gov

CEDAR competition

30 proposals, representing 26 projects, were submitted in FY2010.

CEDAR Postdoctoral Research Program

Effective FY2011, the traditional CEDAR PD program will undergo several changes. The award will become known as a Postdoctoral Research Fellowship (PRF) and will be granted directly to the postdoctoral candidate, who will be the Principle Investigator of the proposal, instead of the hosting institution. Proposals will be solicited by all disciplines across the Atmospheric and Geospace Science Division, and ~10 awards are expected to be made each year.

The deadline for proposals is April 11, 2011. In future years the deadline for proposals will be Feb. 2 of each year.

Unlike most proposals, these proposals are NOT submitted through a university. There are some special things that need to be noted about this program.

Eligibility: Applicants must be U.S. citizens or be legally admitted permanent residents of the U.S. (i.e. green card holders). The applicant must either currently be a graduate student or have held a PhD for no more than 3 years prior to the award start date.

Institution: It is anticipated that the research will be conducted at an institution other than the proposer's PhD-granting institution. Proposers who choose to remain at their PhD-granting institution should include an explanation of how this choice benefits their research and career development. Note that although the proposal is to submitted to NSF by the applicant, the Fellow must affiliate with a host institution(s) for the entire two-year duration of the Fellowship.

Applicants - Registered as Individual Awardee:

Because the proposal is submitted to NSF directly by the applicant and not through the institution where the research is to be performed, the applicant must be able to use the NSF FastLane system. In order to do that the applicant must be registered as an individual awardee. To register you must first go to the following FastLane web page to accept the "Rules of Behavior:"

https://www.fastlane.nsf.gov/cgi-bin/N1CheckROB

Detailed instructions for submitting a proposal to the PRF go to FastLane web page for NSF Postdoctoral Fellowships and Other Programs:

https://www.fastlane.nsf.gov/jsp/homepage/postdoc_fel.jsp

Applicants should download the full text of the Program Solicitation (http://www.nsf.gov/pubs/2011/nsf11521/nsf11521.pdf) and read it carefully before starting to prepare a proposal. In addition to the full text of the PRF solicitation it is strongly recommended that the applicant also download the full text of the Grant Proposal Guide

(http://www.nsf.gov/pubs/policydocs/pappguide/nsf11001/gpgprint.pdf). You must follow all the requirements and rules set forth in the GPG except where specific conditions of the PRF Solicitation override the general rules set forth in the GPG. Failure to comply with the requirements and rules will result in the proposal being returned without review.

A full proposal consists of many parts and requires input from the Fellowship applicant, the proposed sponsoring scientist(s), and the proposed host institution(s). Applicants are advised to begin the proposal well in advance of the submission deadline.

For general questions about the AGS PRF program please contact the cognizant AGS Program Officer, Dr. C. Susan Weiler, telephone: (703)292-4708, email: cweiler@nsf.gov.

For questions specific to the discipline within AGS that would have interest in the project please contact the appropriate AGS Program Officer. For the SPA community that is familiar with the previous CEDAR, GEM and SHINE Postdoc program, the program officers are:

Aeronomy Program, Dr. Farzad Kamalabadi, (703) 292-4692, fkmalab@nsf.gov

Magnetospheric Physics, Dr. Kile Baker, (703) 292-4690, kbaker@nsf.gov

Solar Physics, Dr. Paul Bellaire, (703) 292-7436, pbellair@nsf.gov

For other AGS Program Officers see the AGS staff list at:

http://www.nsf.gov/staff/staff_list.jsp?org=AGS&from_org=AGS

National Space Weather Program

In FY2010, 5 awards were selected from 16 proposal submissions (13 projects). Owing to the increasingly mainstream pursuit of space weather related research, the Space Weather competition has been officially discontinued, effective FY2011. Traditionally, $1 million has been set aside from the Aeronomy, Magnetospheric Physics, and Solar-Terestrial Research Programs for these awards. Discussions are underway regarding the redistribution of NSWP funds.

NSF proposal submission requirements

Effective January 18, 2011, all proposal submissions to NSF require a supplementary document of no more than two pages describing a plan for managing data produced by the project. Proposals without a Data Management Plan (DMP) will not be accepted by FastLane. Items that should be included in the DMP are: (1) products of the research, (2) the data format, (3) data access and sharing practices and policies, (4) policies for re-use, re-distribution, and production of derivatives, (5) data archiving

Update Cont.

plans, and (6) cost of implementing the DMP. In some cases, the Data Management Plan (DMP) may contain a statement such as "a data management plan is not relevant to the proposed activities"; such statements must be explained by the proposer. For more information about this requirement, consult the revised version of the NSF Proposal and Award Policies and Procedures Guide (also known as the Grant Proposal Guide, NSF 11-1). Also note that this new proposal submission requirement is in addition to the existing requirement for documentation describing: (1) the use of Facilities, Equipment, and Other Resources, and (2) a Mentoring Plan for postdoctoral researchers involved in the project (if applicable).

FY2010 CEDAR Postdoctoral Competition

The FY2010 CEDAR Postdoctoral solicitation received 10 submissions, from which 3 awards were made. Congratulations to the successful candidates listed below:

Robert Marshall, from Boston University. He will work with Supriya Chakrabarti on his project, "Fully electrodynamic 3D time-domain model of lightning-ionosphere interactions".

Marco Milla, from the University of Illinois. He will work with Erhan Kudeki on his project, "Study of the effects of Coulomb collisions on H+ and He+ plasmas for topside incoherent scatter radar applications at Jicamarca".

Kim Nielsen, from Computational Physics, Inc. He will work with Dave Broutman on his project, "An investigation of Antarctic mesospheric gravity waves utilizing a high altitude numerical weather prediction system".

Update on the Upper Atmospheric Facilities Program

–Bob Robinson, NSF (rmrobins@nsf.gov)

The current portfolio of the Upper Atmospheric Facilities (UAF) Program includes six incoherent scatter radar facilities, the U. S. component of the SuperDARN program, the Consortium for Resonance and Rayleigh Lidars, and the Community Coordinated Modeling Center at NASA Goddard Space Flight Center. Generally, facilities supported by UAF feature some combination of multi-user aspects, political or technical complexity, and significant financial investment that warrants more careful NSF oversight than traditional grants. Most, but not all, of the facilities in the program are funded through cooperative agreements between NSF and the managing institutions.

The two newest incoherent scatter radars are the AMISR systems at Poker Flat, Alaska, (PFISR) and Resolute Bay, Canada, (RISR). Both are operating routinely and producing excellent scientific data. More information can be found on the AMISR web site at http://isr,sri.com/iono/amisr/. Plans are moving forward to construct a second AMISR face at Resolute Bay with funding to the University of Calgary from the Canada Foundation for Innovation. That facility is expected to be operational next winter. Three exceptional features of the AMISR systems are (1) the ability to remotely operate the radars with no on-site personnel, (2) the ease and cost effectiveness with which they can be relocated to other locations, and (3) the ability to operate them in low duty cycle modes that allow for continuous measurements throughout the year.

Plans are still on track for relocation of the AMISR system at Poker Flat to Argentina, near the Arecibo conjugate point. An NSF Major Research Instrumentation award has been made to Juan Arratia of Universidad Metropolitana in Puerto Rico to install 16 AMISR panels at a site near Buenos Aires in advance of the PFISR relocation. This would allow for the early establishment of scientific collaborations between U. S. and Argentine scientists and students. We are also seeking alternative strategies for deploying AMISR panels to Argentina that would allow for maintaining some radar capabilities at Poker Flat.

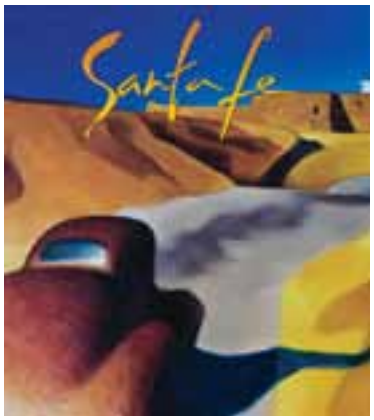
The success of AMISR has inspired world-wide interest in deploying similar systems at other locations. NSF is currently reviewing a proposal to construct a new AMISR system at McMurdo in the Antarctic. This proposal would be jointly funded with the Office of Polar Program, which has been supporting advanced planning activities for this exciting new initiative. Also, U. S. incoherent scatter radar scientists and engineers are working closely with counterparts in the EISCAT community as plans to construct the next generation EISCAT-3D system move forward. Given the increasing demand for global measurements of ionospheric properties, the UAF program is considering ways to implement a more strategic process, based on broad community input, to determine future deployments of AMISR systems.

As many of you know, NSF is currently competing the management of the National Astronomy and Ionosphere Center, which operates the Arecibo Observatory with joint funding from the Division of Atmospheric and Geospace Sciences and the Division of Astronomical Sciences (AST). We are in the middle of the review process at this time, so there is little to report. The new five-year cooperative agreement will begin October 1, 2011. The UAF contribution to the operation of Arecibo will ramp up to 50 percent of the total funding by the last year of the award. This contrasts with the historical contribution of 15 percent when the investment from AST was at its maximum. The AST contribution has been decreasing over the last several years as a result of the AST Senior Review.

Other news related to Arecibo is the continuation of work to construct a new heating facility at the observatory with contributions from NSF, Air Force Office of Scientific Research, and Office of Naval Research. The expected completion date is now scheduled for Fall of 2011. The new heating facility will provide new science opportunities for Arecibo and result in a significant increase in the observatory's user community.

The Geospace Section (GS) is in the midst of several activities that may potentially expand the facilities portfolio beyond those activities currently funded by UAF. These include management and operation of the National Solar Observatory and the Advanced Technology Solar Telescope, the AMPERE project, and the CubeSat program. Given these efforts and uncertainties in NSF's budget for FY11 and future years, there are certainly challenges ahead. GS program officers and staff from the facilities met in October in Roanoke, Virginia, to exchange information and discuss ways to plan more strategically to address these challenges. A number of attendees from the UAF user community also attended the workshop to provide input on how the facilities could improve data products and services.

There will be further updates on UAF program activities in future issues of the CEDAR Post.



The CEDAR-GEM Joint Meeting in Santa Fe, New Mexico, June 26 - July 1, 2011

–Mike Ruohoniemi (Taskforce chair) mikeruo@vt.edu

Theme: Exploring Connections in the Geospace System

First Call to Propose Joint Workshops

In 2011 the annual CEDAR (Coupling, Energetics, and Dynamics of Atmospheric Regions) and GEM (Geospace Environment Modeling) workshops will be held as a Joint Meeting in Santa Fe, New Mexico. In the interests of promoting meaningful scientific interaction and collaboration in areas of common interest, the two scientific steering committees have agreed to integrate significant portions of their scientific, student, poster, and social programs. The Meeting theme given above has been defined to emphasize this integrated aspect of the 2011 Joint Meeting. A CEDAR-GEM joint taskforce has been established to facilitate the coordination of shared activities. The members of the taskforce are listed at the end of this notice. Please direct questions regarding the joint program to any member.

The CEDAR and GEM meetings both conduct topical workshops that are focused on particular research objectives. The traditions differ in that GEM workshops are usually organized by the coordinators of empanelled Focus Groups of several years duration while CEDAR workshops are proposed and approved annually in the lead up to the meeting. With this notice we encourage GEM Research Area Coordinators and Focus Group Leaders and CEDAR attendees to begin to develop and propose joint workshops. These should have both GEM and CEDAR co-conveners. The following links may be helpful.

http://aten.igpp.ucla.edu/gemwiki/index.php/GEM_Focus_Groups gives a listing of the current GEM focus groups and their leaders.

http://cedarweb.hao.ucar.edu/wiki/index.php/2010:Workshop:Workshop_List gives a listing of CEDAR workshop themes and their conveners from the 2010 meeting.

This cross-listing is not meant to be restrictive; attendees may propose novel and promising themes for joint sessions. Research areas that do not lend themselves to integration will be organized and conducted in the usual way by the CEDAR and GEM organizing committees, and will be solicited later.

Potential workshop conveners are asked to either (i) notify the taskforce that you have identified a theme for a joint workshop and colleagues in the other community to serve as co-conveners, or, (ii) notify the taskforce that you have identified a suitable theme and request that the taskforce assist you with the identification of potential co-conveners. At this stage, we are requesting that you provide the theme of your proposed joint workshop, a brief description, and at least the beginning of a list of conveners. Direct this information to a member of the taskforce by January 31, 2011 or submit the information via the appropriate link on the CEDAR Wiki at http://cedarweb.hao.ucar.edu/wiki/index.php/2011_Workshop:Main.

Consideration of proposals for joint workshops including discussions with proposers will be carried out in January. The program of the Joint workshops will be finalized in March.

Looking forward to an exciting meeting in Santa Fe!

For CEDAR-GEM Taskforce members:	
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Summary of the CEDAR 2010 Workshop

–Barbara Emery, HAO/NCAR, (emery@ucar.edu)

Millennium Hotel and University of Colorado, Boulder, CO, June 20-25

The 25th anniversary CEDAR (Coupling, Energetics and Dynamics of Atmospheric Regions) Workshop was held in 2010 at the University of Colorado from Sunday June 20 through Friday June 25. The 25th anniversary celebration banquet was held Monday evening on June 21 at the Millennium Hotel. Many of the 11 former CEDAR Science Steering Committee (CSSC) chairs attended and received an award for their service. Three of them gave short talks. Perfect attendance awards were given to 6 who had gone to all 25 annual CEDAR Workshops. A significant number more had been to over 20 Workshops. The CSSC also honored Barbara Emery with the CEDAR Service Award, which was a surprise and a pleasure. Various pdf files of this ceremony plus over 300 photos from 1986 to 2009 are available on-line, on the wiki at http://cedarweb.hao.ucar.edu, and on the DVDs for our 25th annual workshop.

A total of 399 participants, 107 coming to CEDAR for the first time, came from 77 institutions, 20 outside the United States and Puerto Rico. There were 49 universities, 23 laboratories, and 5 small businesses. Of the 152 CEDAR students and post-docs, 34 were undergraduate students compared to 42 in 2009, and about 25 in previous years. There were 19 students from foreign universities or labs in Brazil (4), Taiwan (4), Peru (3), Japan (3), Argentina (2), UK (1), Russia (1), and Ethiopia (1), which is three times more than the 6 students last year. There were 55 more participants this year in Boulder compared to last year in Santa Fe, with 14 more students and 41 non-students.

The theme of the Student Workshop on Sunday was "Equatorial Aeronomy: Phenomena and Outstanding Questions" arranged by Elizabeth Bass of Boston University. Keynote talks were by Dave Hysell of Cornell University and Odile de la Beaujardiere of the Air Force Research Lab and the C/NOFS satellite. Four talks on the ionosphere, meteor science, and the equatorial electrojet and spread F were given by students or recent graduates. These talks and others are available in .pdf form via the agenda on the wiki. After the workshop, the students had free time for the annual soccer game followed by pizza. The student social events were mostly arranged by Marco Milla of the University of Illinois (now at the Radio Observatorio de Jicamarca in Peru), who was the second year student on the CSSC (CEDAR Science Steering Committee). The new student representative joining Elizabeth is Roger Varney of Cornell University.

The 21st CEDAR Prize Lecture was given in the Tuesday plenary session by Paul Bernhardt of the Naval Research Laboratory on "Using Active Experiments to SEE and HEAR the Ionosphere". The first CEDAR Distinguished Lecture was given on Wednesday morning by Raymond Roble of the National Center for Atmospheric Research on "The NCAR Thermospheric General Circulation Models (TGCMs): Past, Present and Future". The CEDAR Prize lecture focuses on research within the last 4 years, while the CEDAR Distinguished lecture honors sustained contributions over 10 years to the CEDAR community. Edwin Mierkiewicz gave the sole tutorial on Thursday morning on "The Earth's Hydrogen Corona", and we heard two memorial lectures from Michael Mendillo of Boston University and Richard Behnke of NSF honoring the lives and contributions of Henry Rishbeth and Bill Gordon, respectively. For the first time, the four science highlight talks by Phil Erickson of MIT/Haystack, Liying Qian of NCAR, Ja Soon Shim of the Community Coordinated Modeling Center (CCMC) and Josh Semeter of SRI were video-taped and are available on DVDs as well as in pdf files on-line. Other video-taped events were the 25th anniversary celebration on Monday evening, and the WACCM tutorials and the CEDAR Mini LIDAR School workshops on Thursday afternoon. For the first time ever, we will have the approximately 11 hours of video-tape as on-line video H.264-MPEG4 files, but please contact Brian Day of Daylight Productions and Rentals (brian@daylightav.com) if you are interested in obtaining DVDs and copy in Barbara Emery (emery@ucar.edu).

The CEDAR Science Steering Committee present and future chairs, Jeff Thayer of the University of Colorado, and John Foster of MIT/Haystack, along with Bob Robinson of NSF, talked about CEDAR strategic planning for the next decade. We heard four final CEDAR post-doc reports from Yue Deng from NCAR (now at the University of Texas at Arlington), Guiping Liu of the University of California at Berkeley, Stan Briczinski of the University of Wisconsin (now at the Naval Research Lab), and Jonathan Snively of Utah State University. Most of these talks are available in .pdf form from the agenda. Including the Student Worskhop, there were 30 workshops total, 5 more than last year, where the workshop descriptions and some of the talks given are available in

.pdf form in links from the workshop list. Workshop conveners and speakers are encouraged to add their talks to the wiki to make the meeting archive more complete and useful.

There were 156 posters at the Tuesday Mesosphere-Lower-Thermosphere (MLT) and Wednesday Ionosphere-Thermosphere (IT) poster sessions, 4 more than last year. The poster session was held at the beautiful (and expensive) Stadium Club on the 5th floor overlooking the football field. There were 98 student posters, 13 with undergraduate first authors, which is down by 6 undergraduates from last year. 77 posters were in the student poster competition, which is 7 more than last year. Prizes were a certificate, and text books for the first and second place winners. The judges picked first place winners Loren Chang with MLT MLTT-02 and Angeline Burrell with IT-EQIT-11. Loren Chang, PhD student of Scott Palo at the University of Colorado, got a copy of "Comparative Aeronomy" from Space Science Reviews (November 2008) by the International Space Science Institute (ISSY) with editors Nagy, Balogh, Cravens, Mendillo, and Muller-Wodarg, courtesy of Andy Nagy of the University of Michigan. Angeline Burrell, PhD student of Rod Heelis at the University of Texas at Dallas, got a copy of "Ionospheres: Physics, Plasma Physics and Chemistry" by Schunk and Nagy, courtesy of Bob Schunk at Utah State University. Second place winners were Chihoko Yamashita (second place winner in 2009) with MLT-MLTG-11, PhD student of Xinzhao Chu at the University of Colorado, and Brent Sadler, PhD student of Marc Lessard at the University of New Hampshire with IT-POLA-05. Chihoko got a copy of "Mesoscale Dynamics" by Yuh-Lang Lin courtesy of the University of Alaska, while Brent got the second copy of "Comparative Aeronomy".

Honorable mentions for the student poster competition were to: Jianqi Qin, PhD student of Victor Pasko at the Pennsylvania State University with MLT-SPRT-02, Elena Savenkova, PhD student of A. I. Pogoreltsev at the Russian State Hydrometeorological University with MLT-STRB-02, Katelynn Greer, PhD student of Jeff Thayer at the University of Colorado with MLT-COUP-02, Nicholas Pedatella, PhD student of Jeff Forbes at the University of Colorado with IT-EQIT-08, Henrique Aveiro, PhD student of Dave Hysell at Cornell University with IT-IRRI-01, and Yang-Yi Sun, PhD student of Jann-Yenq (Tiger) Liu of the National Central University in Taiwan with IT-EQIT-10. There were two undergraduate honorable mentions from the MLT session: Jonathan Sparks, undergraduate from the University of Colorado working with Diego Janches of CoRA/NWRA with MLT-METR-01, and Jonathan Pugmire, undergraduate student at Utah State University with Mike Taylor. Thanks to the chief judges, Mark Conde of the University of Alaska and Susan Skone of the University of Calgary, thanks to all their judges who spent so much of their time judging the posters, and thanks to all the students who participated in the student poster competition.

2011 CEDAR/GEM Joint Meeting in Santa Fe

In 2011, we go back to Santa Fe, New Mexico for a joint meeting with Geospace Environment Modeling (GEM) in the new Santa Fe Convention Center from Sunday June 26 (CEDAR and GEM Student Workshops at the Eldorado Hotel) to Friday shortly after noon on July 1. GEM objectives overlap with CEDAR in the area of connections to the solar wind and coupling of the upper atmosphere to the ionosphere and magnetosphere. The major focus of the meeting is to increase the interactions and networking between GEM and CEDAR through joint planning and closer physical proximity.

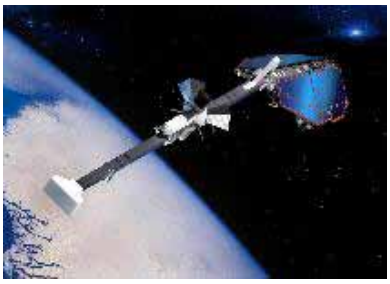
Everyone, including students, will be located in several nearby hotels (Eldorado, Hilton, and La Fonda), where the rooms are apportioned between both CEDAR and GEM. Students will enjoy a picnic together after the annual CEDAR soccer game on Sunday (enthusiastically open to GEM students) , while the whole community will share a banquet at the Santa Fe Convention Center on Monday evening with music by the HooDoos. The joint IT poster session will be held 4-7 PM on Thursday with snacks at the Convention Center, with separate but co-located MLT and GEM poster sessions held on Tuesday.

A joint CEDAR-GEM taskforce has been organized with the idea of closely integrating the scientific programs of the two workshops. Many details remain to be worked out but the general idea is that, to the maximum extent possible, sessions will be organized jointly with conveners from both the CEDAR and GEM sides. All Sessions will be open to members of both communities.

The chair of the joint taskforce is Mike Ruohoniemi who sits on both steering committees as the official GEM-CEDAR liaison. The CEDAR side includes John Foster (CSSC chair), Tim Fuller-Rowell, Josh Semeter, and Barbara Emery (logistics). On the GEM side the membership includes Mike Liehmohn (GEM chair), Bill Lotko, David Murr, Bob Strangeway, and Bob Clauer (logistics). Proposals for joint workshops should be submitted on-line at http://cedarweb.hao.ucar.edu/wiki/index.php/2011_Workshop:Main or sent to any member of the taskforce. We are looking forward to an exciting and very interactive joint workshop in Santa Fe!

Satellite-trio Swarm

–*Eigil Friis-Christensen, National Space Institute, Technical University of Denmark; efc@space.dtu.dk*
–*David Knudsen, University of Calgary; knudsen@ucalgary.ca*
–*Hermann Lühr, Deutsches GeoForschungsZentrum GFZ; hluehr@gfz-potsdam.de*



Science

The geomagnetic field is perhaps the most basic and important feature of the coupled I-T-M system. Moreover, it is surprisingly difficult to measure over its full dynamic range, and it is one of the few ionospheric parameters that cannot be measured reliably from the ground. Anyone who has tried to extract B-field data from a spinning spacecraft knows that even the most subtle sub-degree nutation can render the resulting signal useless. Yet, when high-resolution magnetic field data are combined with precision attitude measurements, field fluctuations or "δB" provide the key for determining the distribution of field-aligned current systems that connect and couple the I-T-M system. When combined with electric field meas-urements, "δB" can be used to deduce ionospheric conductivity [*Sugiura et al., 1982*], distribution of iono-spheric currents [*Amm, 1995*] and electromagnetic energy input through "DC" Poynting flux *[e.g. Kelley et al., 1991]*.

The European Space Agency's upcoming Earth-observing satellite mission "Swarm" will be the first to provide simultaneous measurements of vector **E** and **B** at a level of accuracy obtainable only from a 3-axis stabilized platform. And it will be the first to do so using multiple spacecraft, allowing simultaneous measurement of horizontal gradients in both the latitudinal and zonal directions, using a pair of side-by-side satellites separated by 1.5° in longitude. A third satellite will orbit at somewhat higher altitude, but separated by a varying local time during the mission life time, allowing separation of global and regional variations.

Swarm will use techniques de-veloped for previous magnetic field mapping missions including Ørsted and CHAMP.

Table 1 below summarizes the Swarm satellite orbital parameters.

Table 1 - Swarm Orbits	
Satellites	3
Launch	Mid 2012
Launcher	Eurockot
Altitude (km)	530 (x1) 450->300 (x2)
Inclination	88.0° (x1) 87.4° (x2)
Duration	4 years

Instruments

The three principal science instruments on Swarm are the magnetometer suite; the electric field instruments (EFI) - actually a suite of thermal plasma instruments; and the accelerometers. Overviews of each of these instruments is given below; a more detailed discussion can be found in *Friis-Christensen et al.* [2008].

a) Vector and scalar magnetometers.

The vector field assembly com-prises a fluxgate magnetometer accommodated together with 3-head star tracker on a rigid optical bench. Magnetic field readings are taken at a rate of 50 Hz with a resolution better than 0.1 nT. This assembly is mounted midway on a 4 m long boom. At the tip of the boom is a Helium vapor scalar magnetometer. This high-precision absolute instrument is primarily needed for calibrating the vector magnetometer on a daily basis.

b) Electric field instruments (EFI).

The EFI include Thermal Ion Imagers (TII) that will measure ion drift velocity $\mathbf{v}_i$ (from which electric fields are derived) and ion tem-perature T_i, and two Langmuir probes (LP) that will be used to determine spacecraft potential, electron temperature T_e, and plasma density ne. These parameters will be available at a rate of 2 per second with a corresponding spatial resolution of 4m.

The TII is based on a new concept that generates 1600-pixel, 2-D images of thermal ion distributions [*Knudsen et al.*, 2003]. Ion velocity and temperature are derived from moments of these images, partly on board and partly during ground processing, however the full distributions will be available once every few minutes in order to validate moment calculations and to update them if necessary. Extensive analysis and testing indicate that the EFI data accuracy and resolution will be competitive with the state of the art; a detailed error analysis is being prepared for publica-tion.

Validation of the EFI TII and LP data will require an inten-sive campaign shortly after launch in 2012 to collect coincident data from incoherent scatter radars. A proposal to support this activity will be submitted to the ISR community during the first half of 2011.

The EFIs are being built by COM DEV Canada under contract from ESA with sup-port from the University of Calgary and the Canadian Space Agency. The LPs are provided by the Swedish Institute for Space Physics in Uppsala.

c) Accelerometer.

Results from the CHAMP satel-lite [*e.g. Lühr et al., 2004*] have shown that spacecraft decelera-tion can be measured with a sensitivity sufficient to detect upwelling of the neutral atmosphere, even at altitudes of >500km. Each of the Swarm satellites will carry a tri-axial accelerometer similar to that flown on CHAMP. A proof mass of ~100g is kept floating

Swarm Continued

in a cavity by electro-static forces. The required restoring force is a measure of the experienced acceleration. The instrument has to be accommodated such that the proof mass is exactly in the center of gravity. This way all gravitational forces cancel out, and only nongravitational forces are measured. The instrument returns 3-axes accelerations at a rate of 1Hz with a resolution of ~10-9 m/s2.

Data Availability

The measured quantities described in the Instrument section comprise the "Level 1B" data products. These data will be made available to the members of the international community in response to an Announcement of Op-portunity that will be solicited by ESA prior to launch. Level 1B data are calibrated readings in physical units provided on a satellite-by-satellite basis.

In order to take advantage of the unique constellation aspect of the Swarm mission, considerably advanced data analysis tools have to be developed. The average scien-tific user of data from the Swarm mission could therefore benefit signifcantly if derived products, so-called Level 2 data that take into account the constellation features were to be available for the scientific community. For this reason ESA has recently agreed with a European consortium of six research institutions to develop such a service within a proposed "Satellite Constellation Application and Research Facility" (SCARF). A number of data products have been defined including various models of the core field, the lithospheric field, the ionospheric field, and the magnetospheric field. In addition, derived parameters like the mantle conductivity, mass density and winds in the thermosphere, field-aligned currents, an ionospheric bubble index, the ionospheric total electron content and the dayside eastward electrical field will be calculated. After termination of the 30-month development phase this service is expected to operate for a period of 5 years after the launch of the Swarm Mission. All derived products will be available through the Swarm Payload Data Ground Segment (PDGS) located at ESRIN, the ESA Centre for Earth Observation in Frascati, Italy.

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CSSC – Aeronomy web page Project

–Mike Ruohoniemi, VA Tech, mikeruo@vt.edu

The Fall Meeting of the CSSC featured a presentation by Lara Waldrop on The Public Face of CEDAR. With many examples, she pointed out that the overall subject of Aeronomy is not represented very well on the internet. The Wikipedia offerings are weak and even prominent facilities lack very good web pages. In the follow-up discussion a number of possible remedies were discussed. One suggestion was to lay claim to the still-available web domain of Aeronomy.org (Aeronomy.com has an asking price of $6k.) and to populate it with general-interest items and useful links.

Mike Ruohoniemi bought the rights to Aeronomy.org and assigned Mr. Nathaniel Frissell, a Ph.D. student in the Virginia Tech SuperDARN group. Nathaniel has set up the site and populated the top level page and a few of the categories. To see the site, go to

http://www.aeronomy.org/

Nathaniel selected the color scheme, which is light blue (for sky, atmosphere) and green (for habitat).

To this point our philosophy has been to design a page that welcomes a range of users with the assumption that most know very little, if anything, about aeronomy on first contact. The user should find something that engages his interest and help finding topics at the appropriate technical level. To further boost interest and usage, the top page highlights current and recent news items and events that demonstrate the scientific value and societal relevance of aeronomy and related fields.

The site is open for beta-testing, additions, revisions, etc. Please use the contact information posted at the site.

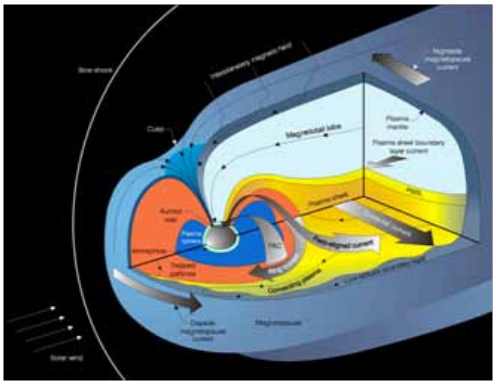
Note that we will want to coordinate this effort with the Aeronomy Wikipedia project, also initiated at the Fall Meeting of the CSSC.

DASI: Distributed Arrays of Scientific Instruments for Geospace and Space Weather Research

–John C. Foster, MIT Haystack Observatory

Overview

The new CEDAR Strategic Plan addresses Geospace as a coupled, complex system whose pieces and properties cannot be studied in isolation. Individual projects and missions address separate regions, topics and processes, but the big-picture view of Geospace is markedly data deficient. This article is based on a Decadal Survey concept paper proposing a phased implementation of a program to field and coordinate Distributed Arrays of Scientific Instruments (DASI) to support Geospace system and Space Weather research. DASI was a priority recommendation of the preceding Decadal Survey and some aspects of DASI are already underway, with separate regional observing arrays in place and operational. An initial effort to coordinate activities, facilitate data exchange and utilization, and to expand the data-user community within the North American region is suggested as a Phase I (developmental) implementation of DASI.



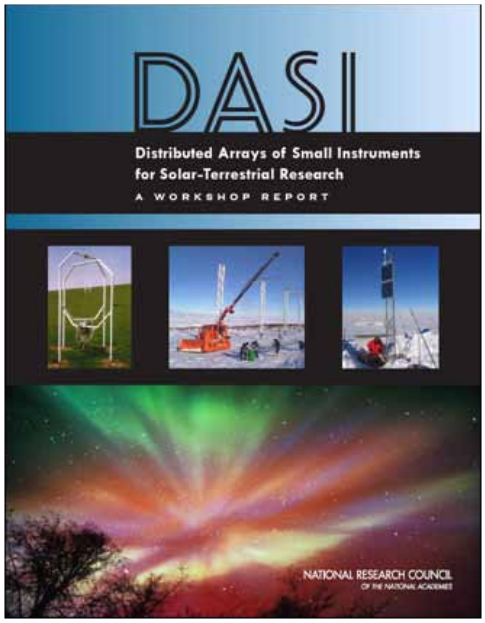
1. The Need for DASI

There is growing realization of the extent to which the sub-systems (the spheres) of terrestrial space science and the processes therein are interconnected, such that the composite of these regions, Geospace, acts as a coupled, complex system whose pieces and properties should not and cannot be studied in isolation. Whole-atmosphere models extending from interactions with the oceans and land masses below to the magnetosphere and solar drivers above are examples of the effort to understand the workings and interconnections of the system as a whole. Individual features and research topics contribute to the composite picture, but a larger-perspective point of view is needed to begin to appreciate how these components work together to shape our space environment, its dynamics, and variability. At present, this larger-picture view of Geospace is extremely data deficient. Individual projects and missions address separate regions, topics and processes. Flexible, coordinated, cost-effective observations of Earth's space environment are needed to provide the wide range of measurements with the spatial distribution and temporal resolution needed to support Geospace monitoring, research, modeling, and predictive activities. An initiative to undertake a phased implementation of a program to field and coordinate Distributed Arrays of Scientific Instruments (DASI) is a much-needed component of the Space Science research and development plan for the coming decade.

2. A Phased Approach to DASI

DASI is already underway, with many regional arrays in place and operational. The CEDAR and GEM research communities are familiar with and involved in many of these. This article does not attempt to describe the final global network of next-generation instruments and data infrastructure which is the goal of the DASI initiative, but strives to express the need to take the first steps to structure and coordinate activities in the planning and utilization of space research instrument arrays in support of the broad needs of Geospace system research and to provide the real-time data and analysis capabilities needed for Space Weather modeling and predictive activities.

An initial effort to coordinate activities, facilitate data exchange and utilization,



and to expand the data-user community within the North American region is suggested as a Phase I (developmental) implementation of DASI. Development of miniaturized instruments and efficient deployment strategies would lead to extended array coverage and capabilities while addressing cost efficiency - potentially during a DASI Phase II, which would involve increased funding and commitment. Incorporation of observations from small-satellite constellations, from extended ocean and remote-location instrument platforms, and strong international participation would be a goal for the implementation of DASI on the global scale (Phase III) needed to address the requirements of studying, understanding, and predicting Earth's coupled Geospace system.

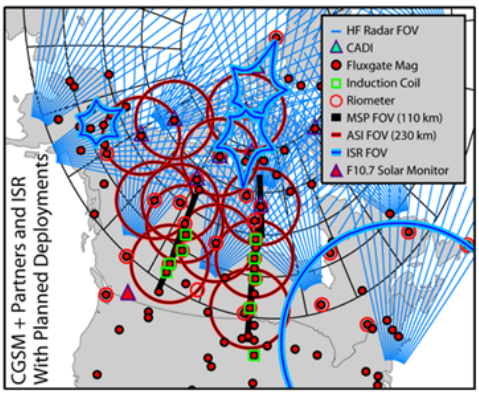
The enhanced observational capability and ready data availability provided by DASI will enhance and extend the scientific activities of the owners and users of the contributing arrays by providing access to correlated data and contributing phenomena observed over an extended (global) spatial scale, providing contextual information with which to interpret localized phenomena (e.g. the system history and context of specific events and observations). Wide-ranging, readi-

DASI Continued

ly-available data will support system-level research projects, extending the scope of new and ongoing research programs to incorporate Geospace system aspects and influences. For operational capabilities, the DASI concept addresses directly the needs of Space Weather research and operational products to have access to global real-time observations of atmospheric and space characteristics and phenomena. DASI is a part of providing an integrated space situational awareness capability.

3. Regional DASI

For a North American regional DASI, major space research instruments including incoherent scatter radar facilities, portions of the high-latitude and new mid-latitude SuperDARN HF radar networks, THEMIS GBO optical and magnetic observatories, as well as numerous small -instrument arrays are in place. Joint US and Canadian activities (AMISR radars at Resolute Bay, THEMIS GBO networks as well as a large body of active researchers addressing aspects of ground and space-based geospace research in the region speak to the readiness of this region to undertake an initial deployment of a regional DASI program.



The new AMISR IS Radars have been put into operation and their numbers are increasing with phased-array radars in place in Alaska and Resolute Bay with others underway in Argentina and a 2nd installation at Resolute Bay and another proposed for Antarctica. Combined with existing dish IS Radars at Sondrestrom, Millstone Hill, and Arecibo, the radars, whose operations are coordinated and data distributed to a broad user community via MADRIGAL, form a large-instrument backbone for a regional distributed-instrument capability for obtaining detailed real-time observations needed to address geospace science and space weather objectives.

North American regional DASI also provides many opportunities for international collaboration for the CEDAR and GEM research communities. Strong Canadian participation in DASI instrumentation and science is expected. Japan participates in the new sub-auroral SuperDARN array and with ground-based observatories situated at auroral latitudes within the region. The Chinese Meridian Project of space weather/geospace observatories arrayed along the 120 E meridian [Wang, 2010] is planned to extend with international participation into the Americas along 60 W in an globe-circling Meridian Circle Project.

4. Cost Considerations

Adopting a phased approach to DASI implementation would begin to reap the benefits of a coordinated approach while avoiding the unrealistic task of trying to design, cost, and coordinate the needed global observational capability without further developing DASI concepts, strategies, and instrument deployment based on the arrays and infrastructure already in place. Phase I - enhancing coordination and communication among existing regional arrays and users - would come at flexible, lower cost since the size and pace of such a prototype regional program could be scaled to the amount of support available. A second Phase for DASI could involve enhanced instrument development and deployment. This would involve appropriate levels of targeted funding. As the need and utility for DASI instrumentation becomes apparent as the program gains momentum, the scope of a global DASI Phase III and its final costs would scale with the priority given to such a program by the community.

It is worth noting that the CEDAR research program began 25 years ago as a no-new-funding Phase 0 effort to coordinate separate research activities in a way which would demonstrate the value added by having a common focus and goal. CEDAR Phases I, II, and III followed, each with enhanced levels of funding, community participation, and scientific contribution. The phased approach, which has been so successful for CEDAR, is recommended for the implementation of DASI.

5. Relevance to NSF and CEDAR Initiatives

Within the NSF research community, the GEO Division has issued a GeoVision plan which promotes the investigation of the Earth environment as a coupled system, with both the understanding of system processes and sub-system interconnections, and human-system interactions and effects (e.g. Space Weather and aspects of Climate Change) being important goals for GEO research. The DASI initiative addresses these cross-coupled objectives nicely in its objective to make space science observations readily available to the more-broad research, applications, and education communities. On a more-focused scale, a significant portion of ground-based space science research activities are supported by the Upper Atmosphere Research Section of the GEO Directorate's Division of Atmospheric and Geospace Sciences (AGS). Here, the CEDAR (Aeronomy/ITM) research community has put forward a new Strategic Plan which puts an emphasis on addressing the broader aspects of CEDAR research within the framework of Geospace system science. DASI by providing a wide spectrum of inter-related geospace observations with good spatial and temporal resolution is a key element in addressing the coupled-system aspects of Geospace. DASI, both with its instrument arrays and coordination and

dissemination of data, can be envisioned as a major observational capability supporting the implementation of the new CEDAR plan.

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Announcement of the International Incoherent Scattar Radar Summer Workshop

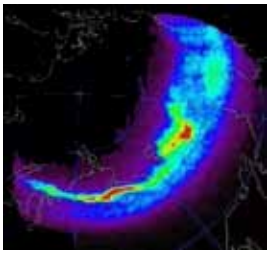
July 18-23, 2011 to be held near the Sondrestrom Research Facility in Kangerlussuaq, Greenland

In 2011, an international workshop aimed at providing students with hands-on experience in designing and running incoherent scatter radar (ISR) experiments will be held near the Sondrestrom Research Facility in Kangerlussuaq, Greenland, 18-23 July 2011.

This workshop is a collaboration between the annual AMISR workshop (the fourth of its kind) and the EISCAT summer school.

This workshop is suitable for graduate and advanced undergraduate students, as well as scientists new to the incoherent scatter radar technique. The workshop is jointly sponsored by the EISCAT Scientific Association and the US National Science Foundation through its Upper Atmospheric Facility Program within the Atmospheric and Geospace Sciences Division of the Geosciences Directorate.

Attendance is limited to 50 participants in total. For more information please go to www.haystack.mit.edu/edu/workshop.



The Center for Integrated Space Weather Modeling Summer School 2011

Space Weather Phenomena, Consequences, and Modeling or Reality, Harsh Reality, and Virtual Reality
July 18 – July 29, 2011 Boston University

This year the Center for Integrated Space Weather Modeling (CISM) Summer School will be held at Boston University, July 18 – July 29, 2011. The two-week school will closely follow the model of the previous successful Summer Schools, which comprehensively immersed students in the subject of space weather, what it is, what it does, and what can be done about it. The CISM summer school supplements standard curricula relating to the physics, "meteorology", and "climatology" of space with integrated overviews of the solar-terrestrial weather system from the Sun to the earth, its effects and consequences, and the state of the art in modeling it. A unique feature of the school is a series of three-hour computer labs where students use visualizations of computer model results being developed by CISM, along with data to understand the space environment and to make space weather predictions. The team of instructors will be led by Jeffrey Hughes (BU), and include experts from various institutions such as UCAR/HAO, SWPC and AFRL.

The school is intended primarily for students about to enter graduate school in the space sciences or early in their graduate careers. We encourage supervisors to recommend the school to their prospective or current students. However others with a professional interest in space weather have also attended and benefited from earlier schools. Further details and the application form (available beginning in March of 2011), including a request for financial support, can be found under Summer School on the CISM web site at http://www.bu.edu/CISM/. Applications are due by May 1. CISM is an NSF Science and Technology Center.

The Open Radar Workshop on Software Radar

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Philip J. Erickson, MIT Haystack Observatory, perickson@haystack.mit.edu
Jorge Chau, Radio Observatorio de Jicamarca, Instituto Geofísico del Perú, jchau@jro.igp.gob.pe

Workshop attendees in front of the Jicamarca 50 MHz ionospheric radar system.

Introduction

A recent workshop on Software Radar systems was held between October 4th and 8th of 2010 at the Jicamarca Radio Observatory outside of Lima Peru. The goal of the workshop was to set the basis for a collaboration between MIT Haystack's Millstone Hill Facility and the Jicamarca Radio Observatory (ROJ) for the development of next generation Geospace Software Radar systems. The workshop was attended by a total of 15 people who all participated in the presentations and discussions. At the workshop we reviewed approaches to Software Radar system design, discussed our goals, described technical methods for engineering Software Radar systems, and selected focused topics to pursue as initial steps in a joint effort. The last day of the workshop was dedicated to establishing the software tools and systems to help enable our collaborative efforts.

Workshop Overview

Intro and Next Generation Software Radar (F. Lind)

The workshop began with an initial welcome to the facility by Koki Chau (ROJ) and overview of the workshop schedule. Following this Frank Lind (MIT) provided a discussion of Next Generation Software Radar as an introduction to the future of radio science instrumentation. In this presentation a vision of all digital radar using highly flexible Software Radar systems was discussed and the role of Jicamarca as stepping stone towards such complex systems was highlighted. The Very Simple Radar (VSR) was also introduced as a conceptual tool for discussing Software Radar concepts and design ideas.

Software Radar Applied to Geospace Science (P. Erickson)

Using the VSR model, Phil Erickson (MIT) next introduced the flexible Software Radar framework as an answer to the complexity of geophysical problems, system analysis, and constant change in computer software configurations. The Software Radar approach is built of functional multi-use/generic blocks with well defined boundaries and configuration management. Use of this paradigm encourages better adaptive and iterative problem solutions with good long term documentation and improved information extraction. Several examples were given of common use cases (e.g., radar range/time/intensity monitoring, plasma parameter extraction) which are readily suited to a single common software chain, applied to multiple diverse incoherent scatter radar systems. Elements of these processing chains were also shown to be easily adaptable to other radio science use cases such as passive radar and satellite beacon analysis. Finally, the necessity of well defined data formats and documented software application programming interfaces was highlighted.

JRO Tour and Operations Demonstration

During the workshop the Jicamarca staff provided a full tour of the facility, demonstrated the operation of the main radar, and showed examples of the realtime monitoring which is currently possible at the facility. The large number of radar systems, variety of digital receivers, and the complexity of potential experimental configurations provides a challenging basis for developing comprehensive Software Radar approaches at the Facility.

Discussion of Participant Goals and Experiences

At the end of the first day, we had a nice discussion about our experience on radar systems. In addition, the participants expose their goals and expectations of the workshop. Everyone agreed that more collaboration between observatories is needed and that we should work together in different projects.

Software Development Methods (B. Rideout)

Bill Rideout (MIT) introduced software development methods useful for both large and small scale projects. The Python open source language was presented as an easy to learn, object oriented tool which helps the programmer focus on algorithm perfection before performance optimization. A number of useful scientific, plotting, and other toolkits are available as well. Bill reviewed standardized naming conventions and performed several interactive debugging demonstrations addressing problem identification and management, using Python and the open source Eclipse integrated development environment. The provision of a uniform software environment using the Pacman open source package manager was also discussed and demonstrated using the VSR framework as an example.

Team Coordination and Design Reviews (P. Erickson)

A common challenge in starting collaborative projects is finding effective mechanisms for team coordination and periodic design reviews. Phil Erickson (MIT) discussed several suggested approaches to maximizing efficiency in collaborations in a manner which will be active and mutually beneficial for the entire UAF community. Team workflow strategies were discussed along with procedures for formal unit and stress testing

of software modules and useful coordination patterns. Several tools available in open source including mailing lists, documentation wikis, revision control systems, and bug tracking systems were presented as fluid enablers of radio science collaboration. Finally, specific examples from the Millstone Hill software team's development cycles were presented to highlight the real world operation of these practices.

F. Lind (MIT) and J. Chau (ROJ) lecture on the first day of the workshop.

Pattern Languages and Software Design (F. Lind)

In the vein of discussing approaches to software engineering and high level architecture a presentation by Frank Lind (MIT) highlighted Patterns, Pattern Languages, and approaches to managing design complexity. Examples from both Architecture and Software Radar were discussed with an example pattern of "Coherence" being discussed along with approaches to implementing this pattern and the consequences of each approach.

Multicore Signal Processing, Grids, and Clouds (P. Erickson)

As radio science moves to higher captured RF bandwidths for enhanced geoscience remote sensing, the scaling of computing requirements as the cube of the bandwidth causes problems to quickly exceed traditional monolithic computing approaches. Phil Erickson (MIT) presented information on applying the rapid emergence of multicore signal processing, computing grids, and computing cloud technology to efficiently solve current and future radio science challenges. In particular, the map/reduce paradigm was introduced as a strategy which maps readily into new powerful computing architectures such as graphics processing unit (GPU) accelerators, while encouraging intelligent design of algorithms which separate parallel and serial portions of the software radio/radar tasks needed. Several examples were given of lightweight toolkits available which ease the programming burden of using acceleration assets most efficiently.

Jicamarca Parallel Computing Applications (M. Milla)

In recent years, new high-resolution and multi-beam radar experiments have been developed at Jicamarca. The analysis of the data collected in these experiments, however, requires a large amount of computation preventing us from obtaining results in real-time. To reduce the data processing time, parallel processing algorithms are being tested at the observatory. A pair of these applications, Spread-F imaging and F-region drift estimation, were presented by Marco Milla (ROJ). The algorithms developed are implemented using the MPI (Message Passing Interface) library and run in a small cluster of computers built at the observatory. In addition, future applications, including the Monte-Carlo simulation of charged particle trajectories for the study of the effects of Coulomb collisions on the ISR signals, were also discussed.

Software Radar Tools and Techniques (R. Schaefer)

Bob Schaefer (MIT) next provided an extensive discussion of specific software radar tools and techniques available in the open source community, again using the VSR framework to illustrate specific points. Within the OpenRadar framework, several topics either have recent development experience or are being evaluated. Bob discussed in particular distributed file systems and document databases as a means of both providing wide access data and recording system state and other metadata. A topic of current research involves the utility and specific implementation of distributed message queues / protocol buffers as a means of triggering agents across computers and networks to provide command and control functions for a software radar system. These practices have the potential to provide generic, deterministic control architectures which promote reuse and which can be implemented not only at Jicamarca and Millstone Hill but across UAF systems.

Jicamarca Experiments, Software, and Workflows (L. Condori)

Luis Condori (ROJ) described the different operational modes of the Jicamarca radar. The Jicamarca modes are classified in incoherent scatter (IS) and coherent scatter (CS) modes. The IS modes are sub-classified according to the direction in which the antenna beam is pointed, thus, we have oblique and perpendicular to B modes. These radar modes are characterized for the use of high power transmitters and large antenna arrays. On the other hand, the CS modes use low power transmitters and smaller antennas. One of the most commonly used modes is the JULIA (Jicamarca Unattended Long-term investigations of the Ionosphere and Atmosphere) mode. Different ionospheric phenomena are observed with JULIA, during daytime, the equatorial electrojet and the 150-km echoes, and during nighttime, the Spread-F. Sample antenna connection diagrams, radar pulse schemes, and signal processing workflows were presented for each radar mode. In addition, plots of the sampled data and results corresponding to the different radar modes were shown.

Jicamarca Radar Experiment Design, Radar Timing, and Digital Receivers (R. Yanque)

In designing a radar experiment, there are many system parameters that have to be defined and set up to make a radar run as desired. Ramiro Yanque (ROJ) presented some of the tools developed at Jicamarca for the designing of radar experiments. The main tool is the Pulse Design program that allows the configuration of complicated pulse sequences in

a few simple steps. In addition, Ramiro presented the new acquisition system developed at Jicamarca. JARS (Jicamarca Acquisition Radar System) is an eight-channel digital receiver system that can sample data at 1 MHz per channel.

Small groups from MIT and ROJ worked together to set up common collaboration software tools.

Representing RF Signals (F. Lind)

Frank Lind (MIT) provided an overview of the issues surrounding the representation of RF signals in Software Radar systems. Important aspects of the voltage level data pattern, analog to digital conversion process, and RF data and metadata representation were discussed. Frank also described the difference between higher "application" level array oriented block formats and lower "transport" level streaming representations. The ANSI/VITA Radio Transport standard was discussed for use as a streaming level format while the Millstone RF Signal Object was described as a block level HDF5 format for RF data.

Software Radar Signal Chains (P. Erickson)

Phil Erickson (MIT) next introduced the concept of Software Signal Chains as a series of limited scope agents which form a data pipeline for software radar processing. The paradigm encourages generic, reusable agents with well defined boundaries which are ideal for a distributed development enviroment. Examples of successful as well as unsuccessful software radar signal chains and practices were given using the Millstone Hill MIDAS-W software development experience over the last decade. Phil also emphasized the importance once again of rigorously defined data formats as well as traceable configurations of software agents in building useful signal chains.

Representing Data and Metadata (B. Rideout)

Bill Rideout (MIT) covered best practices in data management for radio science. As observing systems collect ever increasing amounts of information with complex associated metadata, successful reanalysis or even determination of configuration for experiments taken years or decades in the past depends on good data organization and careful selection of appropriate metadata. Bill discussed the details of namespace construction as well as hierarchical data formats such as HDF5 as useful patterns to implement these goals, along with the need to carefully define these items in a community oriented fashion.

Jicamarca Databases and Data Requirements (M. Urco)

Recently, the Jicamarca Radio Observatory has become the headquarters of LISN (Low-latitude Ionospheric Sensor Network). Thus, in addition to the IS radar, Jicamarca operates a large group of geophysical instruments distributed across South America. Magnetometers, ionosondes, GPS receivers, optical devices, and other equipment are continuously taking data that is processed, analyzed, and stored at the Observatory. Miguel Urco (ROJ) described in detail how the Jicamarca database is organized, how the data can be accessed, and show some examples of the visualization programs that have been developed to display the geophysical data.

Initial Collaborative Efforts

RF Signal Export in HDF5

The first joint project which will be pursued by the two observatories is the development of an HDF5 export format for voltage level RF data. Millstone Hill has recently completed development of such an HDF5 export format for RF Signals and Millstone Hill specific system status information. This format attempts to encapsulate both the RF signal voltage data and the necessary instrumental context via metadata. The overall goal is to enable an end user of the raw voltage data to analyze it independent of additional knowledge about the Millstone Hill system. An extension of this format to support Jicamarca specific requirements and instrumental context will improve the availability and uniformity of voltage level data from both facilities. The format is similar enough to that used by AMISR that end users will see little difference in the tools and approaches needed to process voltage level data from the facilities. Data export tools from Millstone Hill will be modified and improved for use in the export of Jicamarca data once the format is fully specified and documented.

Planning for HDF5 support of JRO data in Madrigal

An area identified as of great importance but too large for an initial effort was full support of HDF5 by the Madrigal database as a native format. A smaller initial effort to begin planning an HDF5 format and translation tool appropriate for Millstone Hill and Jicamarca Observatory use were identified as a short term goal which could be accomplished. This initial effort would consist of planning of the organizational structure for HDF5 data, prototyping of methods to enable easy data translation, and experiments with Madrigal indexing of HDF5 files.

Development of a Flexible Incoherent Scatter Analysis Framework

The development of a generic, modular, and modern framework for the analysis of incoherent scatter data was identified as the most ambitious initial joint proj-

ect. After some discussions, a working group identified a generic incoherent scatter spectral generator as one of the first projects for the 'traditional' case, useful for the case of magnetic aspect angles greater than ~0.5 to 1 degree from perpendicular. Magnetoionic effects, ion-neutral collisions, and application of recent progress in small aspect angle perpendicular electron-electron collision theory are expected as later refinements, along with decision tree based fit algorithms and full profile analysis codes.

Summary

The Open Radar Initiative is a project to develop reliable and reusable technology for radio science applications. The initiative provides a resource for the development of radio science systems, strives to reduce the duplication of effort in the community, provides a means for distributing innovative techniques, and hopes to lower the expense and difficulty of developing new experimental systems. A recent workshop was held to discuss Geospace Software Radar systems at the Jicamarca Radio Observatory. This workshop was an initial step towards collaboration on the development of next generation Software Radar by the two facilities. Initial projects were identified for development effort, the goals and scope for these efforts were defined, and a general approach to team coordination was established. This effort is being coordinated through www.openradar.org and presentations from the 2010 Software Radar workshop are all available online at that site.

Third Annual AMISR workshop held at the MIT Haystack Observatory

– Anthea Coster, MIT Haystack Observatory (acoster@haystack.mit.edu)

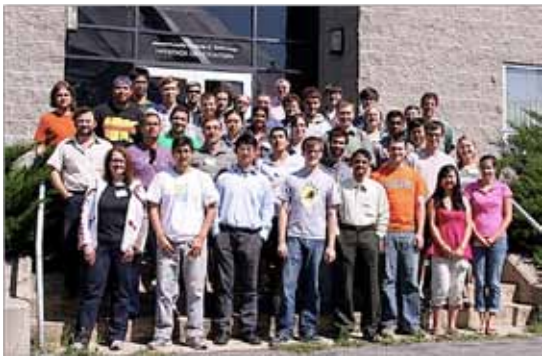

Figure 1. Students and Staff of the 2010 AMISR summer school.

For the week of 26-30 July 2010, 25 students (a mix of both undergraduate and graduate students) from 23 different universities attended the AMISR Summer School held at the MIT Haystack Observatory. This was the third annual school of its kind.

The aim of the summer school is to turn students and young scientists into confident users of Incoherent Scatter Radar systems and data. The one-week program covers ISR theory, pulse coding, and signal processing, and provides introductions to ionospheric and plasma physics and Bragg scattering processes. Students also get hands on experience, by learning how to efficiently access the Madrigal database with simple database searches, and with more advanced scripting. Groups of 5-6 students design their own experiments by specifying science goals, determining pulse patterns and writing proposals for radar time. Every group gets to run their own experiment, and subsequently obtains the data, processes it, and presents their work and result at the last day of the school.

Figure 2. A student group from 2010 actively engaged in data analysis.

Position Available

Canada Research Chair in Radio-Plasma Physics, Tier II, Faculty of Science
Job ID 9354 Location: Calgary
Functional Area: Teaching and Research Faculty: Faculty of Science
Position Type: Continuing With Tenure Unit: Department of Physics and Astronomy
Experience Required: Intermediate Level Education Required: Ph.D.

Department Description

Applications are invited from emerging leaders in the area of Radio-Plasma Physics, for a Tier II Canada Research Chair position at the University of Calgary. As part of the university's strategic focus on Energy and Environment, the incumbent will join a world-class team of scholars as well as research scientists who are involved in Space Plasma research with a focus on the effects of the sun and the solar wind on the Earth's space environment. This is a tenure track position in the Faculty of Science and is conditional on a successful CRC application.

The chair will be based in the Department of Physics and Astronomy and will be part of the Institute for Space Imaging Science, established in 2008. The successful applicant is expected to build an internationally prominent research program in radio-plasma physics involving the Canadian component of the Resolute Bay Incoherent Scatter Radar (RISR-C), scheduled to become operational in 2012. RISR-C will probe the ionosphere over the Canadian arctic land mass, complementing the extensive Canadian GeoSpace Monitoring (CGSM) array of auroral all-sky cameras, photometers, radio monitors, magnetometers, and SuperDARN radars. This network will be further augmented by the launches, also in 2012, of the Canadian enhanced Polar Outflow Probe satellite; and of the European Space Agency's three Swarm satellites, each of which will carry a Canadian Electric Field Instrument.

Position Requirements

The University of Calgary is a major partner and/or leader in all of the ground and space-based missions listed above. Together these experiments will comprise the most comprehensive set of diagnostics ever brought to bear on the arctic ionosphere, a critical region through which massive amounts of energy originating in the solar wind are channeled into the upper atmosphere and throughout geospace. This flow of energy has a profound affect not only on our atmosphere, but on technology-based systems involving satellites, navigation and GPS, communications, and power transmission.

The chair holder is expected to build a dynamic research team that will include undergraduate and graduate students (M.Sc. and Ph.D.), post-doctoral fellows; and collaborations with fellow professors and researchers in the Department of Physics and Astronomy, and at other institutions throughout Canada and abroad. Experience with radar operations and science will be considered an asset for this position. The successful applicant will be appointed at the assistant or associate professor level, depending on relevant experience, and is conditional upon a successful CRC application.

Applicants must submit a curriculum vitae, statement of research interests, a teaching dossier (including a statement of teaching interests and philosophy, teaching history, and/or evidence of teaching effectiveness), five recent publications and the names, addresses, phone numbers and email addresses of at least three referees. Consideration of applicants will begin on January 3, 2010.

Please send applications to:

Dr. Robert Thompson, Head
Department of Physics and Astronomy
University of Calgary
2500 University Drive, N.W.
Calgary, AB T2N 1N4
Email: admin@phas.ucalgary.ca

All qualified candidates are encouraged to apply; however Canadians and permanent residents will be given priority. The University of Calgary respects, appreciates, and encourages diversity.

Haystack Observatory Tips its Hat to the CEDAR Research Community

– John Foster, MIT Haystack Observatory, jfoster@haystack.mit.edu

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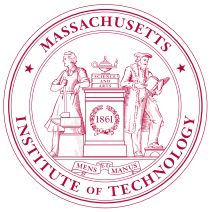

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