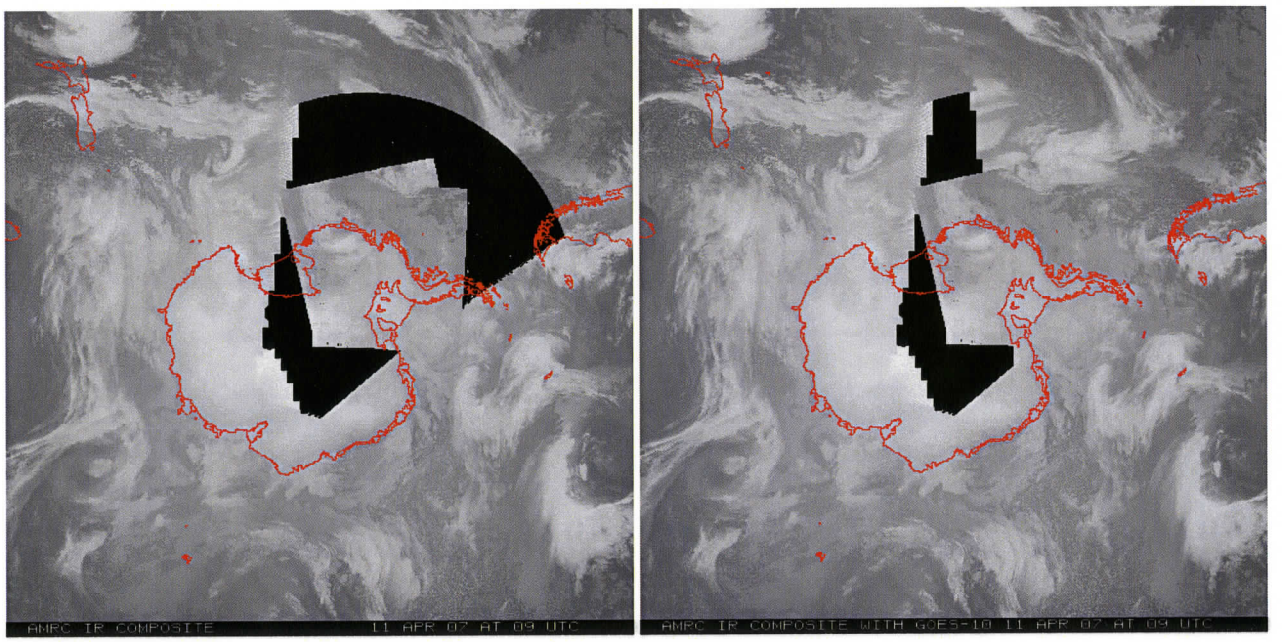
AMRC Annual Project Report: NSF-OPP Grant #0537827, June 1, 2006 to April 30,2007

Collaborative Research:

Antarctic Meteorological Research Center (2006-2009)

A Report to the Office of Polar Programs, National Science Foundation



Professor Charles R. Stearns, Principal Investigator
Dr. David B. Reusch, co-Principal Investigator
Matthew A. Lazzara, co-Principal Investigator and Meteorologist
Shelley L. Knuth, Meteorologist
Jonas V. Asuma, Student Meteorologist

Space Science and Engineering Center
University of Wisconsin-Madison

Earth and Environmental Sciences Institute
The Pennsylvania State University

Submitted on April 30, 2007

Annual Report for Period:06/2006 - 05/2007
Submitted on: 04/30/2007
Principal Investigator: Stearns, Charles R.
Award ID: 0537827
Organization: U of Wisconsin Madison
Title:
Collaborative Research: Antarctic Meteorological Research Center (2006-2009)

Project Participants

Senior Personnel

Name: Stearns, Charles
Worked for more than 160 Hours: No
Contribution to Project:
Dr. Charles R. Stearns oversees the Antarctic Meteorological Research Center (AMRC) as Principal Investigator.

Name: Lazzara, Matthew
Worked for more than 160 Hours: Yes
Contribution to Project:
Matthew Lazzara works on the day to day activities of the AMRC including program management, data management, data requests, consulting, product generation oversight and data flow. His role includes project lead, educational outreach and coordination with other associated communities including the WMO, NCDC, etc. In addition, he is coordinating the modernization of AMRC's computing systems.

Name: Knuth, Shelley
Worked for more than 160 Hours: Yes
Contribution to Project:
Shelley Knuth works on day to day activities of the AMRC, including data management, data requests, educational outreach activities and questions. In addition, she oversees the AMRC web and FTP sites, case study collection and is expanding into product generation and data flow management.

Post-doc

Graduate Student

Undergraduate Student

Name: Asuma, Jonas
Worked for more than 160 Hours: Yes
Contribution to Project:
Jonas Asuma's role has included the digitization of meteorological metadata records, assistance with web and ftp site management, data archival, and he is expanding into case study collections and satellite monitoring activities.

Technician, Programmer

Other Participant

Research Experience for Undergraduates

Organizational Partners

The Pennsylvania State University

This grant is a collaborative research project with Dr. David Reusch at The Pennsylvania State University, with our collaboration focusing on climatological applications of AMRC's signature satellite composite imagery. He has visited AMRC project team members and installed the processing software on AMRC's new computing resources to construct self-organized maps (SOMs) from the satellite composite imagery.

Other Collaborators or Contacts

The AMRC plays an active role in the Antarctic meteorological community, in particular with United States Antarctic Program (USAP) afflilated organizations including Raytheon Polar Services Company (RPSC), SPAWAR Office of Polar Program (SOPP), and other USAP grantees such as the Microscale and Mesoscale Meteorology (MMM) division at the National Center for Atmospheric Research, Byrd Polar Research Center at The Ohio State University, and University of Colorado-Boulder. In the first year of this grant, the AMRC project continues to complement the Arctic and Antarctic Research Center project at the Scripps Institute of Oceanography, University of California-San Diego.

The AMRC continues to keep in close touch with other important organizations for the USAP including the National Climatic Data Center, National Oceanic and Atmospheric Administration, World Meteorological Organization, British Antarctic Survey, etc.

Activities and Findings

Research and Education Activities:

The mission of the Antarctic Meteorological Research Center (AMRC) is to perform research in observational meteorology and the stewardship of meteorological data along with the ability to provide such data and expert assistance to the Antarctic community in support of research, education, and operations.

The following major activities have accented the first year of the grant:

1. The continuation of AMRC data collection, generation, archive and distribution efforts, including specialized data requests for Antarctic meteorological data, such as satellite imagery for research and education as well as for field programs. Efforts in the area of the Antarctic-IDD continue as well.

2. The modernization of AMRC computing equipment

3. Continued grassroots educational outreach efforts expanded beyond traditional K-12 students arenas to general public venues.

4. Engaged in collaboration with Dr. David Reusch at Penn State University.

Findings:

We began work on the four activities listed above. The status of this work is as follows:

1. The AMRC has continued its data efforts on all fronts of collection, generation, archive and distribution, including the upgrade and final installation of weather display in the Crary Lab at McMurdo Station. Also, the Antarctic-IDD continues to be an important community wide conduit for the sharing of Antarctic meteorological data and information.

2. Approximately one half of AMRC's computing has been modernized with more

equipment in the process of acquisition.

3. AMRC's educational outreach horizons have expanded into the general public with events at public libraries, cub scout pack meetings, etc.

4. Hosted a visit by AMRC's collaborator, Dr. David Reusch, established a framework for the climatological analysis of the satellite composites, assisted with computing resources needed for the project, etc.

Training and Development:

Project participants have seen training and development milestones reached in the following areas:

* One member's completion of a Masters Degree
* One member's near completion of a PhD Degree
* First hand experience in computing, meteorological data and interactive processing for the project's undergraduate student
* Computing, polar and satellite meteorology, public speaking for all project members

Outreach Activities:

One of the three pillars of the AMRC project is a grass roots educational outreach effort. The following lists AMRC's outreach efforts in the last year:

General Public:
---

* SSEC Public Tours, UW-Madison, Madison, WI
* E-mails answering questions, offering information or providing data to students and the general public including special reports to classrooms and the general public during field deployments.
* Mount Horeb Public Library, Mount Horeb, WI
* Wednesday Night at the Lab, UW-Madison, Madison, WI
* Mount Horeb Cub Scouts, Mount Horeb, WI
* West Madison Cub Scouts, Madison, WI

University/College:
---

* Madison Area Technical College, Madison, WI

Middle School:
---

* Lodi Middle School, Lodi, WI
* Waunakee Intermediate School Family Science Night, Waunakee, WI

Elementary School:
---

* Deerfield Elementary School, Deerfield, WI (2 visits)

McMurdo Station:

Wednesday Night Science Lecture

Additional events are planned including additional elementary school visits, weather club lectures, and working closely on a special geography project with an elementary school.

Journal Publications

Steinhoff, D.F., D.H. Bromwich, M. Lambertson, S.L. Knuth, and M.A. Lazzara, "A Dynamical Investigation of the May 2004 McMurdo Antarctica Severe Wind Event using
AMPS", Montly Weather Review, American Meteorological Society, p. , vol. , ( ). Submitted

Books or Other One-time Publications

Web/Internet Site

URL(s):

http://amrc.ssec.wisc.edu http://ice.ssec.wisc.edu ftp://
amrc.ssec.wisc.edu ftp://ice.ssec.wisc.edu

Description:

These web and FTP sites are the primary and secondary sites that host the AMRC database, including real-time meteorological data, historical data, and metadata. These sites are shared by AMRC's sister project, the Antarctic Automatic Weather Station Program. These sites are undergoing expansion as additional data is posted on these sites from the AMRC off-line archive as well as additional metadata and site specific resources are added.

Other Specific Products

Product Type:

Data or databases

Product Description:

The AMRC has collected and archived a variety of generated satellite composite datasets, automatic weather station obervations, polar orbiting satellite observations, numerical model analyses and forecasts, surface and upper air observations, GTS text data sets and USAP station data.

Sharing Information:

This data collection is increasingly available via the following means:

* Web site
* FTP site
* McIDAS ADDE server
* Antarctic-IDD/LDM system and Unidata's IDD/LDM system
* Metadata via the data interchange format (DIF) with the Antarctic Master Directory at the National Snow and Ice Data Center and NASA Global Master Directory
* Via "word of mouth" and as advertised via talks, presentations at professional meetings and lectures.

Contributions

Contributions within Discipline:

The AMRC contributes to the field of meteorology with its unique products and archive of

freely available datasets. In the last year the following have been provided datasets fromthe AMRC:

US:
* Dan Steinhoff, BPRC/OSU
* Mark Seefeldt, CU
* Gary Huffard, NWS-AK
* Doug MacAyeal, UC
* Santiago Gasso, NASA
* Larry Saranthus, Devon Gas
* Valerie Loeb, Moss Landing Marine Lab
* Annalisa Schilla, CU
* Gonzalo Hernandez, U. Washington

Australia:
* Steve Pendlebury
* Meraz Mostafa
* Clare Oatley
* Gabrielle Kelly

Germany:
* Wolfgang Rack

Austria:
* C. Riedl

UK:
* Gareth Marshall

Malaysia:
* N.C. Sheeba

Other:
* Serg Zarin

Contributions to Other Disciplines:

Historically, the AMRC has been a contributor to other disciplines, such as glaciology, oceanography, artists and writers, etc. This project continues this, as opportunities and interest arises.

Contributions to Human Resource Development:

The AMRC's visibility, especially via the internet and other means, attracts many questions and requests. Our offering of expertise and answers to students and the general public raise awareness of the Antarctic and the important role it plays in the Earth system.

Within the project team, human resource development can be exemplified via the graduation of one team member with a Master's degree, and the on-going development of computing and meteorology skills for an undergraduate student team member.

Contributions to Resources for Research and Education:

The Antarctic Meteorological Research Center is a central polar meteorology center within the University of Wisconsin-Madison, Space Science and Engineering Center. This project compliments other projects within SSEC, offering an Antarctic point of view on a variety of activities taking place within the center, such as interactive processing, satellite meteorology, etc.

Contributions Beyond Science and Engineering:

The datasets the AMRC has invested time and effort into collecting are becoming increasingly critical for research projects exploring a wide range of topics from glaciology to climate in the Antarctic, and logistical decision making within the USAP. This effort continues into this project. More will be reported in future reports.

Special Requirements

Special reporting requirements: None
Change in Objectives or Scope: None
Unobligated funds: $ 0.00

Animal, Human Subjects, Biohazards: None

Categories for which nothing is reported:

Any Book

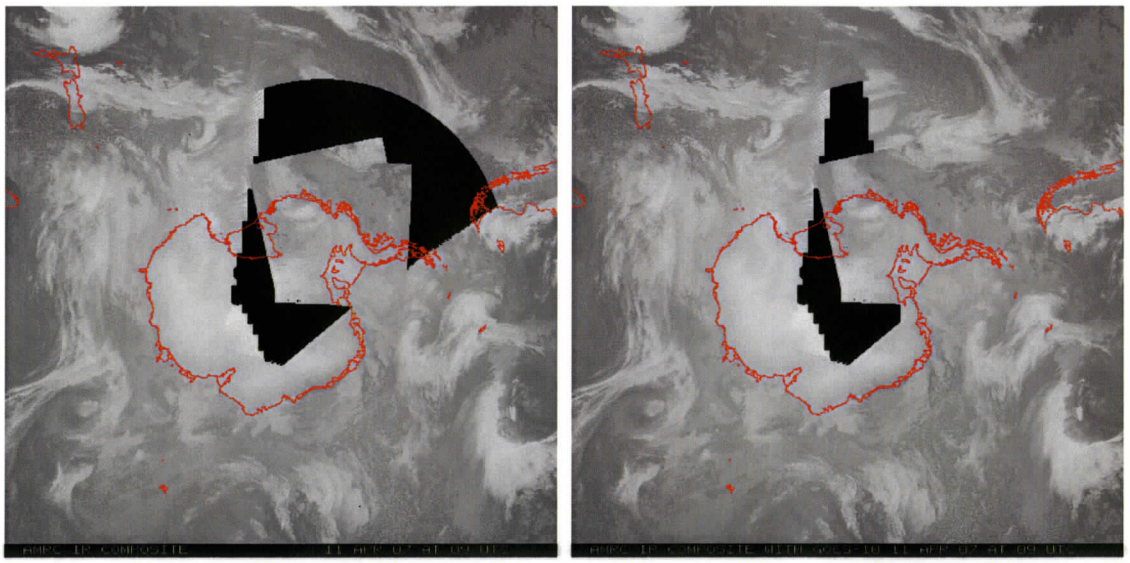


Figure 1. A sample composite made without GOES-10 (left) and with GOES-10 (right), which demonstrates the value of the GOES-10 imagery. In the near future, GOES-10 imagery, which is available on a more frequent basis, will be used to make composites on an hourly basis.

Figure 2. Educational outreaches to public groups, such as this Mt. Horeb Public Library book club are a focus of the AMRC grassroots educational outreach program (*Photo Courtesy of the Mt. Horeb Public Library*).

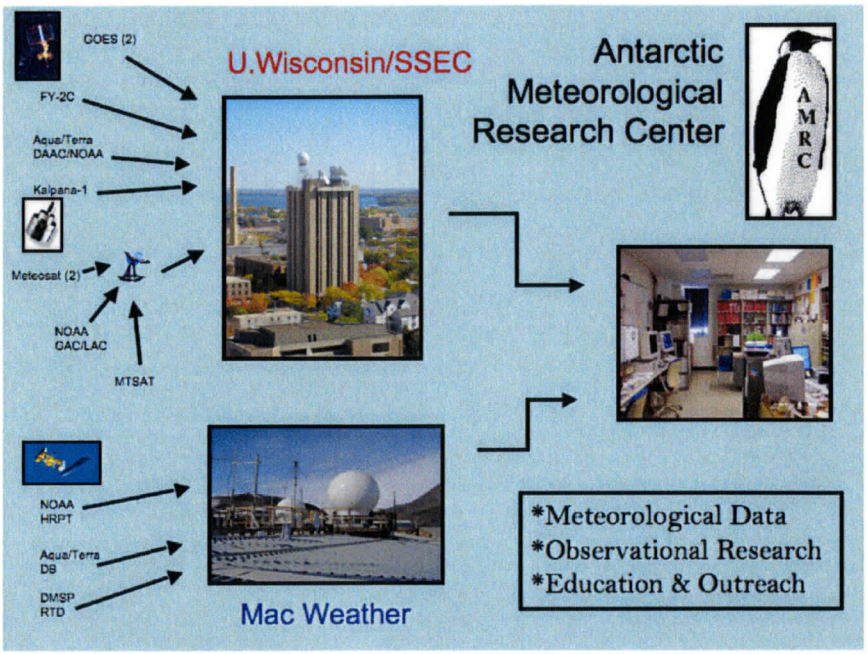


Figure 3. A graphical depiction of the partial data flow shows the Antarctic satellite composite input data sources (missing from the figure are input from Palmer Station, Antarctica).

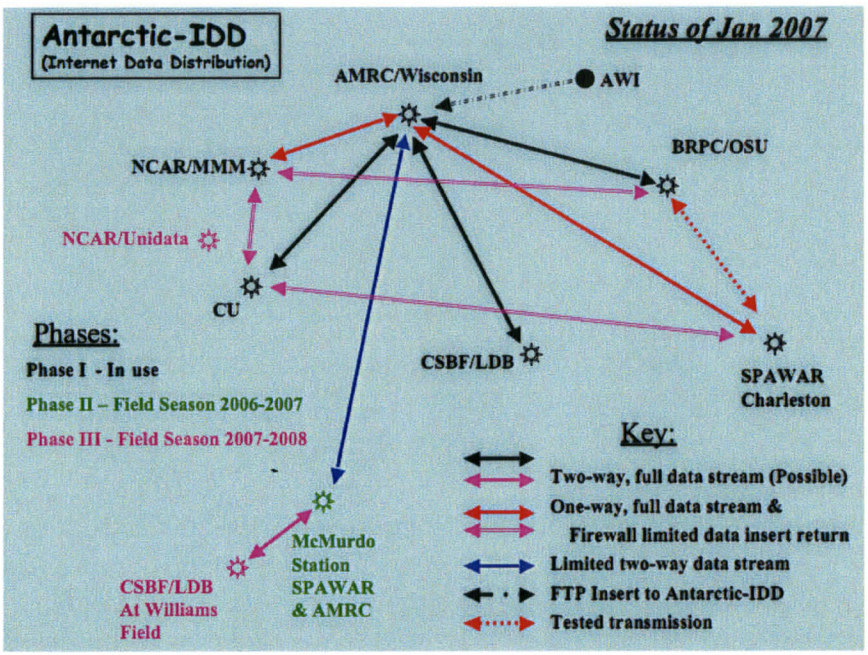


Figure 4. A schematic of the Antarctic-IDD as of January 2007 showing the path of data sharing and exchange among members of the USAP and beyond.

Annual Report for Period:06/2006 - 05/2007
Submitted on: 05/01/2007
Principal Investigator: Reusch, David B.
Award ID: 0538064
Organization: PA St U University Park
Title:
Collaborative Research: Antarctic Meteorological Research Center (2006-2009)

Project Participants

Senior Personnel

Name: Reusch, David
Worked for more than 160 Hours: Yes
Contribution to Project:

Post-doc

Graduate Student

Undergraduate Student

Technician, Programmer

Other Participant

Research Experience for Undergraduates

Organizational Partners

University of Wisconsin-Madison
This grant is a collaborative research project with members of the Antarctic Meteorological Research Center (AMRC) in the Space Science and Engineering Center (SSEC). The AMRC is providing data, computing and analysis support with respect to the AMRC's satellite composite imagery that is being analyzed in my part of this collaborative project.

Other Collaborators or Contacts

Activities and Findings

Research and Education Activities:
The following items have been completed:
- getting access to the AMRC computing system
- installing the required application software for the core self-organizing map (SOM) analysis (additional software may still be needed for analysis of the results and additional visualization)
- a project meeting was held in March in Madison

In the course of the visit to Madison:
- A project planning meeting was held to better define the data requirements and how to go about filling them. This included Matt Lazzara, Shelley Knuth and Linda Keller of the AMRC and was very productive.
- I presented at the SSEC seminar series a talk on applications of SOMs in the study of polar climate.

- I also spoke with other members of the SSEC (not on this project) about my work with SOMs (e.g., Steve Vavrus).

As a result of the above visit, a pilot of the SOM analysis is underway using satellite data from June 2004 over a reduced domain in the Amundsen-Bellingshausen Sea region. This work will help establish the overall methods/steps required and validate the analysis software's ability to work with these large datasets.

The overall project plan and early results from the above pilot will be presented at the 2nd Antarctic Meteorological Observation, Modeling and Forecasting Workshop to be held in Rome, Italy June 26-28, 2007.

Note, two unplanned-for events have changed the flow of work/results on this project since the proposal was originally submitted. First, the award start-date was moved up by three months. Second, in December 2006, I took on unexpected teaching duties for the current spring semester (early Jan - early May). While the latter has disrupted my research, it has offered an unexpected and very useful opportunity for sharing my knowledge and expertise in climate analysis with undergraduates in our Geography and Meteorology departments (plus a Geography PhD student). These activities benefit from the same skills needed to be successful on this project.

Findings:

Training and Development:

Outreach Activities:

I presented a talk in the Wisconsin SSEC seminar series on my work applying self-organizing maps (SOMs) to a variety of problems in polar climate.

'Nonlinear (paleo)climatology: Applications of self-organizing maps', Space Science and Engineering Center, University of Wisconsin, March 2007.

Expertise applicable to the work of this project has been used in the course of teaching a Penn State undergraduate, writing-intensive geography course on global climates during the spring semester, 2007.

Journal Publications

Books or Other One-time Publications

Web/Internet Site

Other Specific Products

Contributions

Contributions within Discipline:

Contributions to Other Disciplines:

Contributions to Human Resource Development:

Contributions to Resources for Research and Education:

Contributions Beyond Science and Engineering:

Special Requirements

Special reporting requirements: None
Change in Objectives or Scope: None
Unobligated funds: $ 0.00

Animal, Human Subjects, Biohazards: None

Categories for which nothing is reported:

Activities and Findings: Any Findings
Activities and Findings: Any Training and Development
Any Journal
Any Book
Any Web/Internet Site
Any Product
Contributions: To Any within Discipline
Contributions: To Any Other Disciplines
Contributions: To Any Human Resource Development
Contributions: To Any Resources for Research and Education
Contributions: To Any Beyond Science and Engineering