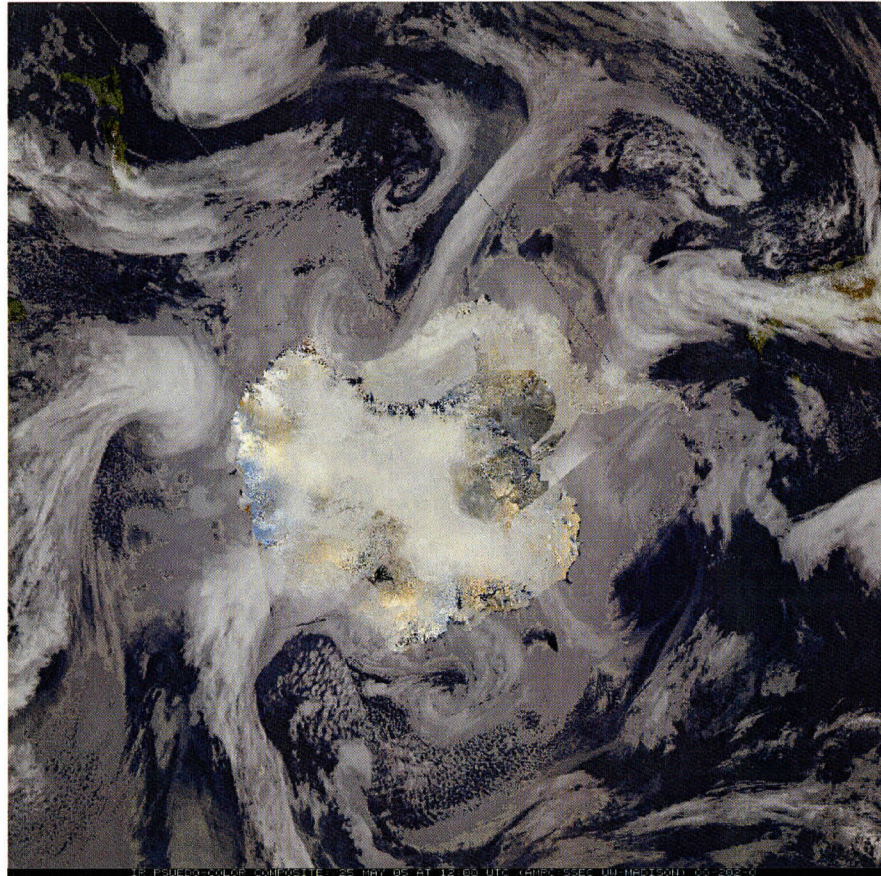


*AMRC Annual Project Report: NSF-OPP Grant #0126262, June 30, 2004 to June 30, 2005*

## **Antarctic Meteorological Research Center (AMRC) 2002-2005**

*An Annual Report to the Office of Polar Programs, National Science Foundation*



The Schwerdtfeger Library  
University of Wisconsin-Madison  
1225 W Dayton Street  
Madison, WI 53706

Professor Charles R. Stearns, Principal Investigator  
Matthew A. Lazzara, co-Investigator  
Shelley L. Knuth, Meteorologist

Space Science and Engineering Center  
University of Wisconsin-Madison

Submitted on June 2, 2005



**Annual Report for Period:** 06/2004 - 06/2005

**Submitted on:** 06/02/2005

**Principal Investigator:** Stearns, Charles R.

**Award ID:** 0126262

**Organization:** U of Wisconsin Madison

**Title:**

Antarctic Meteorological Research Center (AMRC) 2002-2005

The Schwerdtfeger Library  
University of Wisconsin-Madison  
1225 W Dayton Street  
Madison, WI 53706

**Project Participants**

**Senior Personnel**

**Name:** Stearns, Charles

**Worked for more than 160 Hours:** No

**Contribution to Project:**

During the grant, Dr. Charles R. Stearns has overseen the Antarctic Meteorological Research Center (AMRC) as Principal Investigator.

**Name:** Lazzara, Matthew

**Worked for more than 160 Hours:** Yes

**Contribution to Project:**

Matthew Lazzara has worked on the day to day activities of the grant including data management, satellite data requests and questions, development of new satellite products, and educational outreach. His role has expanded to become the project lead and has begun work on reaching out to other communities (WMO, NCDC, etc.), climatology activities, etc.

**Name:** Knuth, Shelley

**Worked for more than 160 Hours:** Yes

**Contribution to Project:**

Shelley Knuth handles day to day activities of the AMRC, including data management, data requests and questions, web page maintenance, and case study collections. Her role has expanded into educational outreach activities as well.

**Post-doc**

**Graduate Student**

**Undergraduate Student**

**Name:** Staude, Jessica

**Worked for more than 160 Hours:** Yes

**Contribution to Project:**

This student helped update the video tape of composite images. In conjunction with this work, areas of significant cloud mass transport onto the continent were identified. She has been working on this project over the last few years, and has expanded into helping with developing displays of weather information in the AMRC web site.

**Name:** Kudick, Karen

**Worked for more than 160 Hours:** No

**Contribution to Project:**

Karen has assisted the project with miscellaneous supply, printing and photocopy requests.

**Name:** Lewis, Logan

**Worked for more than 160 Hours:** No

**Contribution to Project:**

Logan Lewis has assisted the AMRC in computer hardware and software maintenance during the last year.

**Technician, Programmer**

**Name:** Soundarapandian, Karthik

**Worked for more than 160 Hours:** No

**Contribution to Project:**

Karthik Soundarapandian has assisted the AMRC in computer hardware and software maintenance from 2002-2005.

**Name:** Woolf, Harold

**Worked for more than 160 Hours:** No

**Contribution to Project:**

Dr. Woolf assisted with the testing of the International ATOVS Processing Package (IAPP) at McMurdo during the 2004-2005 field season.

**Other Participant**

**Research Experience for Undergraduates**

Organizational Partners

Other Collaborators or Contacts

N/A

Activities and Findings

**Research and Education Activities: (See PDF version submitted by PI at the end of the report)**

The Antarctic Meteorological Research Center (AMRC) at the Space Science and Engineering Center (SSEC), University of Wisconsin-Madison (UW-Madison) has continued to follow its mission:

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 and operations.

In keeping with this mission, the AMRC continues its core activities and begins new initiatives. The core activities the AMRC continues include:

- \* Generation of Antarctic composite satellite imagery (both infrared and water vapor)
- \* Collection, archival and distribution of meteorological data from the Antarctic and adjacent Southern Ocean including:
  - POES/NOAA Local Area Coverage (LAC) data
  - POES/NOAA High Resolution Picture Transmission (HRPT) data {as backup for AMRC's sister center, the Arctic and Antarctic Research Center at Scripps Institute of Oceanography }
  - GMS and GOES satellite cloud drift and water vapor wind charts over the New Zealand/Ross Sea region
  - Synoptic/Manned station reports (especially from the USAP stations)
  - Meteorological aviation surface hourly report (METAR)
  - Upper-air reports (especially from the USAP stations)
  - Ship and Buoy observations (especially from the USAP research ships)
  - Numerical weather prediction forecasts and analyses from the National Center for Environmental Prediction (Global Forecast

System and Wind and Wave Forecast Model), European Centre for Medium Range Forecasts model, and United Kingdom Meteorology Office model

- \* Stewardship of the Antarctic Automatic Weather Station (AWS) program and other US AWS data.

All of this data is available to the public without charge.

As critical parts of this grant, the AMRC has embarked on new initiatives including:

- \* Improvements to the Antarctic composite satellite imagery (both infrared and water vapor)
- \* Inclusion of more satellite data into the composite imagery
- \* Potential development of Antarctic composite visible satellite imagery
- \* Case study collections of significant weather events
- \* Climatological analysis from the AWS, and other stations (complimenting the activities in the SCAR READER project)
- \* Investigation of preparing WMO CLIMAT reports for data distribution
- \* Test of International ATOVS Processing Package (IAPP) at McMurdo Station
- \* Assistance with the test and setup of the a system to process Aqua and Terra direct broadcast data from the new X-band system at McMurdo Station for research applications, product generation, specifically satellite cloud drift and water vapor feature winds using the MODIS sensor as well as cloud 'mask' or detection product
- \* Assistance in the initial establishment of the Antarctic-Internet Data Distribution (Antarctic-IDD) system

At the time of this report, the AMRC is at different levels of accomplishment on these activities. The Antarctic composites have already had a significant improvement including higher resolution (now 5 kilometers rather than 10 kilometers nominally), larger size (2048 by 2048 rather than 1024 by 1024). Efforts have been made to include additional data sources, including Aqua, Terra, Meteosat-8 (See Figure 1). Attempts have been made to use FY2-C, and it will be operationally included in the near future with improved calibration. Other satellites will be used as they are available including Kalpana-1, MTSAT-1R, etc. The work with visible Antarctic composites has started, but there are some significant difficulties that have been encountered due to the way satellite operators calibrate visible satellite data differently across different satellites. This will continued to be worked on over the next year or so. Significant steps forward have been made for the USAP with the AMRC helping to establish and become a critical relay of the Antarctic-IDD system (See Figure 2).

Finally, the AMRC has rounded out its activities to include:

- \* Continued participating in Antarctica-RIME Science Planning discussions
- \* Participating in the annual AMRC meeting in conjunction with the AAWS and AMPS and held in Columbus, OH
- \* Conducting educational outreach activities

The AMRC personnel participated in the annual Automatic Weather Station meeting joint with the annual AMRC meeting and the Antarctic Mesoscale Prediction System Users' meeting. Of course, educational outreach activities have been conducted at several locations.

#### **Findings: (See PDF version submitted by PI at the end of the report)**

The results of the work accomplished to date with this grant include:

- \* Continued data collection, archival and distribution
- \* The continued generation and improvement of the Antarctic composite satellite imagery (as outlined in the above section)
- \* Continued educational outreach activities (as outlined in the above section and in the following outreach section)
- \* Utilities developed to generate climatological analyses
- \* Identification and processing of case studies.
- \* Attended annual AAWS/AMRC/AMPS joint meetings
- \* Initial setup of a system for the processing of Aqua and Terra X-band satellite observations at McMurdo Station, especially for the generation of satellite derived cloud drift and water vapor feature winds and cloud mask/detection (See Figure 3).
- \* Established the Antarctic-IDD data relay system.

As always, the AMRC aims to benefit a wide audience including operational, research and educational groups. Examples include the use of AMRC data for weather forecasting, use of AMRC Antarctic composites in the classroom for education and application of AMRC data holdings toward research projects by other scientists. Finally, as discussed in the Web/Internet site section, Figure 4 depicts AMRC's web and FTP site statistics.

#### **Training and Development:**

This project has concentrated on developing skills and expanding experiences in the areas of:

- \* Polar/Antarctic and Satellite Meteorology
- \* Computer Science
- \* Public Speaking

The members of the group continue to learn more about Antarctic meteorology. For example, the synoptic scale flow patterns in the AMRC composite satellite imagery animations are a constant source of learning and medium for understanding how the Antarctic atmosphere works.

Additionally, the group continues to learn more with regard to satellite meteorology, especially from polar orbiters, which is not always routinely a part of undergraduate education in the atmospheric sciences.

With regard to computer science, skills in using an interactive processing system (McIDAS), internet skills (such as HTML programming), and new methods of satellite data processing have been added to the abilities of the members of the project.

As a part of the public outreach efforts and the participation in scientific meetings, members of the group have worked on public speaking skills. This is critical to offering the best outreach effort as well as to conveying ideas in scientific meeting forums.

#### **Outreach Activities:**

The AMRC project continues to put significant effort into its outreach activities. The following lists AMRC's outreach efforts to date:

##### **General Public:**

- \* SSEC Public Tours, UW-Madison, Madison, WI
- \* E-mails answering questions or providing data or information to students and the general public
- \* Wisconsin State Fair, West Allis, WI

##### **University:**

- \* CIMSS/Wisconsin Space Grant Consortium Workshop on Earth, Atmospheric and Space Sciences, Madison, WI
- \* Grandparents University, UW-Madison, Madison, WI
- \* CASPER homeless grade school project, UW-Madison, Madison, WI

##### **Post High School:**

- \* Madison Area Technical College, Madison, WI

##### **Middle School**

- \* Deerfield Middle School, Deerfield, WI
- \* Lodi Area Middle School, Lodi, WI

##### **Elementary School:**

- \* Deerfield Elementary School, Deerfield, WI

**Pre-school:**

- \* Holland's Hearts & Hands Preschool Deerfield, WI

This past year, the project has worked to broaden the outreach audience.

**Journal Publications**

**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 FTP and web sites are the primary and secondary/backup AMRC sites offering real-time meteorological data over and near the Antarctic, links to AMRC's archived data, and other information. These sites are shared with AMRC's sister project, the Antarctic Automatic Weather Station Program.

**Other Specific Products**

**Product Type:**

**Data or databases**

**Product Description:**

AMRC Data Collection (Real-Time and Archive)

The AMRC has created, acquired and archived a significant collection of Antarctic meteorological data. The following summarizes the collection:

Generated Data/Products

- \* Antarctic Composites
  - Infrared & Water Vapor
- \* GMS/GOES Satellite Winds
  - IR & Water Vapor (CIMSS)
- \* UW & SPAWAR AWS Data

Model Analyses & Forecasts

- \* Global Forecast System (GFS) from NCEP (formerly MRF or AVN)
- \* Wind and Wave Forecast Model (WWFM) from NCEP
- \* UK Met. Office model
- \* European Centre for Medium Range Weather Forecasts model
- \* AMPS (real-time only)
- \* Soon to be available(CIMSS Regional Assimilation System (CRAS))

## Satellite Imagery & Data

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- \* NOAA
  - HRPT (McMurdo only)
  - GAC (Project FROST/by request)
  - LAC (iceberg monitoring)
- \* DMSP (real-time only)
  - OLS
  - SSM/I

## Observational Data (GTS/NOAAport)

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- \* METAR
- \* PIREP/AIREP
- \* Synoptic
- \* ABoM Synoptic
- \* Radiosonde
- \* Ship & Buoy

## Text Data

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- \* METAR (McMurdo Area/South Pole)
- \* TAF (McMurdo Area)
- \* USAP Ship
- \* AIREP (New Zealand Region)

## USAP Station Data

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- \* South Pole
- \* Palmer
- \* McMurdo
- \* (+NCDC holdings)

## Sharing Information:

This collection is shared with researchers, operational forecasters, educators and the general public via the following means:

- \* Via the Internet from AMRC's web, FTP and McIDAS ADDE servers
- \* Newly established Antarctic-IDD system
- \* Filing of AMRC data information using data interchange format (DIF) metadata with the Antarctic Master Directory at the National Snow and Ice Data Center/NASA Global Change Master Directory
- \* AMRC's infrared composite data distributed via NSF funded Unidata program's Internet Data Distribution (IDD) system
- \* AMRC to be a participant in the NSF funded Unidata THREDDS program
- \* "Advertised" via talks/presentations at meetings and lectures (such as American Meteorological Society meetings, Wednesday Science Lecture at McMurdo Station, etc.)
- \* Word of mouth

## Contributions

### Contributions within Discipline:

As noted in previous reports, the AMRC continues to contribute to the field of Antarctic meteorology with its unique products (e.g. Antarctic composite satellite data, AWS data, etc.), and archive of freely available data. Some NSF grantees and others the AMRC has worked with

recently include:

- \* Paul Dalrymple, Antarctic Society
- \* Kelly Admunsen, BPRC/OSU
- \* David Yu, AMANDA/UW-Madison
- \* Scott Polk, VIMS
- \* Mark Seefeldt, CU
- \* Amanda Adams, AOS/UW-Madison
- \* Rebecca Wolf, US Naval Academy
- \* Kathleen Allen
- \* Ryan Fogt, BRPC/OSU
- \* Gonzolo Hernandez, U. Washington
- \* SPAWAR
- \* RPSC
- \* Doug MacAyeal, U. Chicago
- \* Bob Bundschuh
- \* Stefano Di Battista, Italy
- \* Pascale Bilodeau, Canada
- \* Satyendra Bhandari, India
- \* Narelle Baker, New Zealand
- \* N.C. Sheeba, Malaysia
- \* Clare Oatley, Australia
- \* Irene Lopez Garrido, Spain
- \* Elizabeth Parer-Cook, Australia

Assisting with the annual joint AAWS/AMRC/AMPS meetings is becoming an important contribution to the field of Antarctic meteorology in gathering together the active participants for a partial working/scientific exchange meeting. This event provides a medium by which collaborations and future advances build from the foundations of prior work. Other specific contributions are in progress, such as the establishment of the Antarctic-IDD.

#### **Contributions to Other Disciplines:**

As in the past, AMRC's data and expertise are used to benefit other non-meteorological disciplines (such as Antarctic glaciology). Some NSF-OPP grantees the AMRC has worked with recently in this role include:

- \* U-Chicago: MacAyeal IO-190 (Iceberg/AWS data)
- \* NSBF: Stepp AB-145-O (Imagery/AWS data)
- \* Portland State: Fountain BM-042-F (McMurdo weather)
- \* Svarney WO-220-O (Misc. Data/Information)
- \* NASA WFF, Bob Swift (NOAA LAC data)

#### **Contributions to Human Resource Development:**

##### **Contributions to Resources for Research and Education:**

The AMRC continues to be the polar meteorology center within the University of Wisconsin-Madison/Space Science and Engineering Center (SSEC). This compliments other projects within SSEC, especially bringing a polar meteorology point of view to the significant satellite meteorological studies taking place at SSEC. The AMRC continues to be an educational resource to the students and the university community hosting materials, information, expertise and data about the Antarctic.

##### **Contributions Beyond Science and Engineering:**

This project offers to the general public its Antarctic meteorological data collection, along with its expertise, free of charge. The following are examples of how the public can and does benefit from this project work:

- \* Monitoring of tabular icebergs with a continued public interest
- \* Unique and one of kind displays of meteorological data looked at routinely by interested citizens



\* An open-door resource to answering questions and clarifying concepts to the general public as well as other communities (e.g Public tours at SSEC, E-mail questions from the public, etc.)

Work in progress in this grant will improve this role.

**Special Requirements**

**Special reporting requirements:** None

**Change in Objectives or Scope:** None

**Unobligated funds:** less than 20 percent of current funds

**Animal, Human Subjects, Biohazards:** None

**Categories for which nothing is reported:**

Organizational Partners

Any Journal

Any Book

Contributions: To Any Human Resource Development

National Aeronautics and  
Space Administration  
**Headquarters**  
Washington, DC 20546-0001



March 9, 2005

Reply to Attn of:

SMD

Dr. Scott G. Borg  
Office of Polar Programs  
The National Science Foundation  
4201 Wilson Boulevard  
Arlington, Virginia 22230, USA

Dear Dr. Borg,

This letter is to recognize and express our sincere appreciation to Matthew Lazarra, Shelley Knight, and the rest of the staff at the Antarctic Meteorological Research Center for weather imagery support during our recent missions flown over Pine Island Glacier, Thurston Island Glaciers in West Antarctica, and glaciers along the Antarctic Peninsula. The purpose of the flights staged out of Punta Arenas, Chile was to acquire measurements of ice surface elevation and thickness over these glaciers, which were previously occupied in 2002. As you are well aware, these areas are changing dramatically and observations such as these greatly improve our understanding of the mechanisms that drive these changes.

These missions were logistically difficult, owing to the long distance of the glaciers from Punta Arenas and the lack of good weather support required for making these measurements from an altitude of approximately 600 meters above the ice surface. This low altitude operation is a particular challenge because it is so difficult to recognize low clouds and ground fog from infrared LAC images that are routinely available from the AMRC real-time web site. Visible band LAC imagery provides the type of tool required to make "go/nogo" decisions. Matthew, Shelley, and the staff were able to provide supporting processing of the images that enhanced their utility. Additionally, they were able to superimpose our intended flight tracks right on the images, making them easier to interpret.

The staff at AMRC supported our project with the visible LAC imagery throughout our 3-week field campaign. These images formed an important component of our logistical strategy, which resulted in the successful completion of all four of our planned missions over these glaciers.

Cordially,

A handwritten signature in black ink, appearing to read "Waleed Abdalati".

Waleed Abdalati  
Manager, Cryospheric Sciences Program  
Science Mission Directorate.

Cc: Dr. Bernhard Lettau, NSF  
Mr. Alexander Sutherland, NSF  
Dr. Hank Revercomb, Univ. Wisconsin-Madison  
Dr. Charles Stearns Univ. Wisconsin-Madison  
Mr. William Krabill, NASA

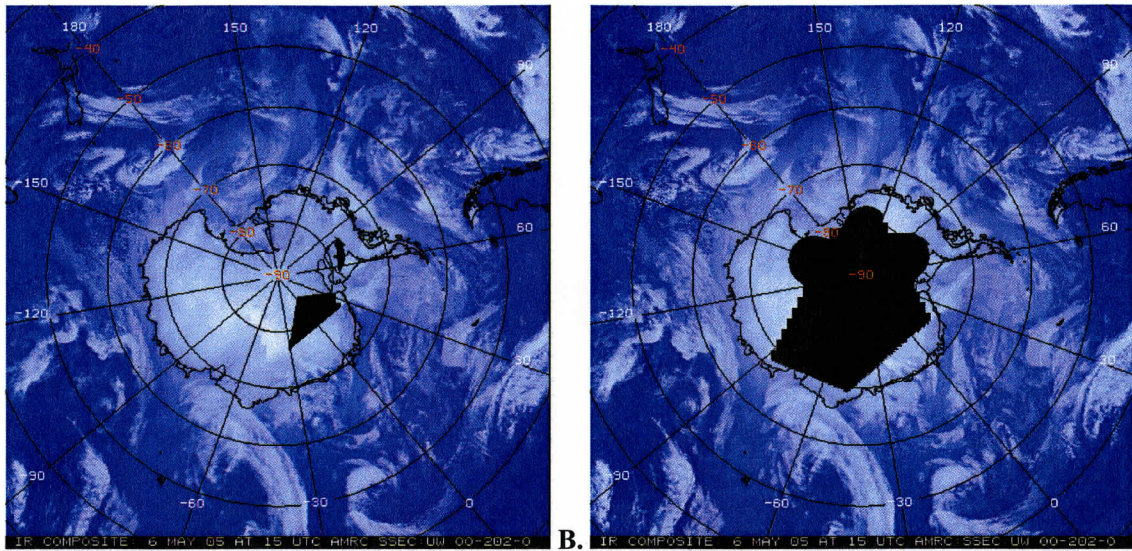


Figure 1. A. A sample Antarctic infrared composite satellite image made from GOES-9, -10, -12; Meteosat-3, -7, -8; FY2-C; Aqua and Terra; and NOAA satellites. B. The same composite made prior to the improvements from the additional satellites of Aqua, Terra, FY2-C, and Meteosat-8.

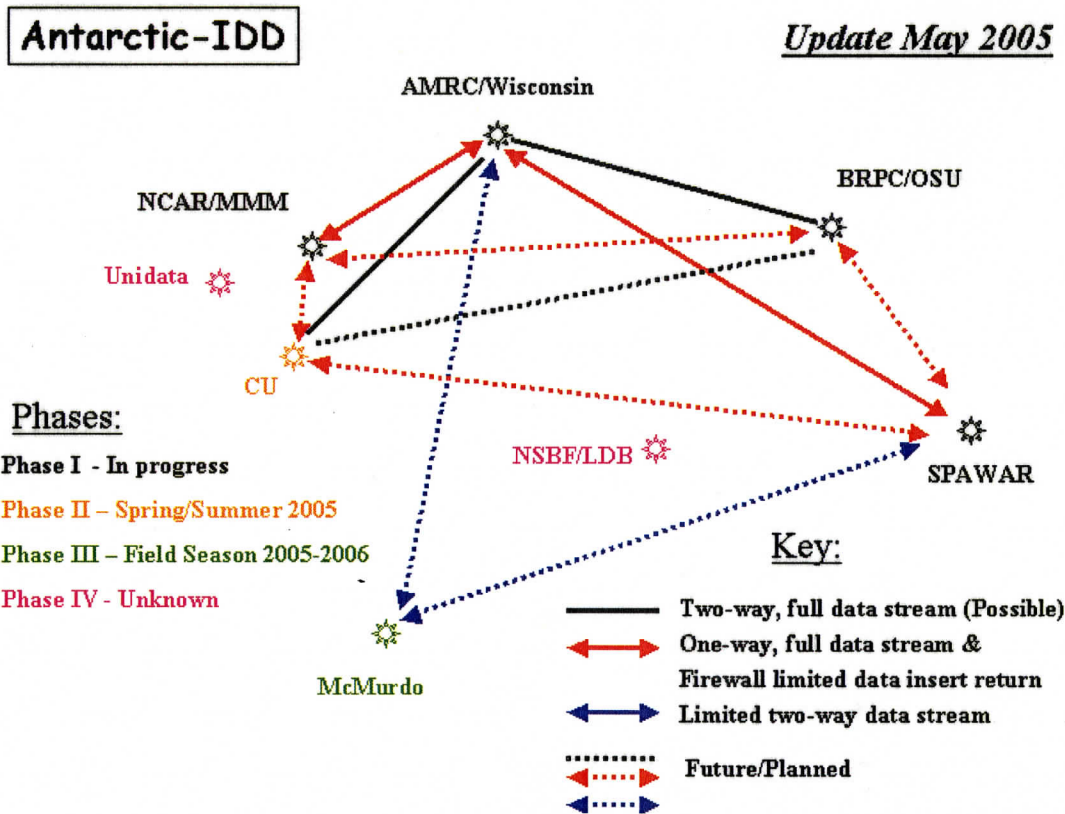
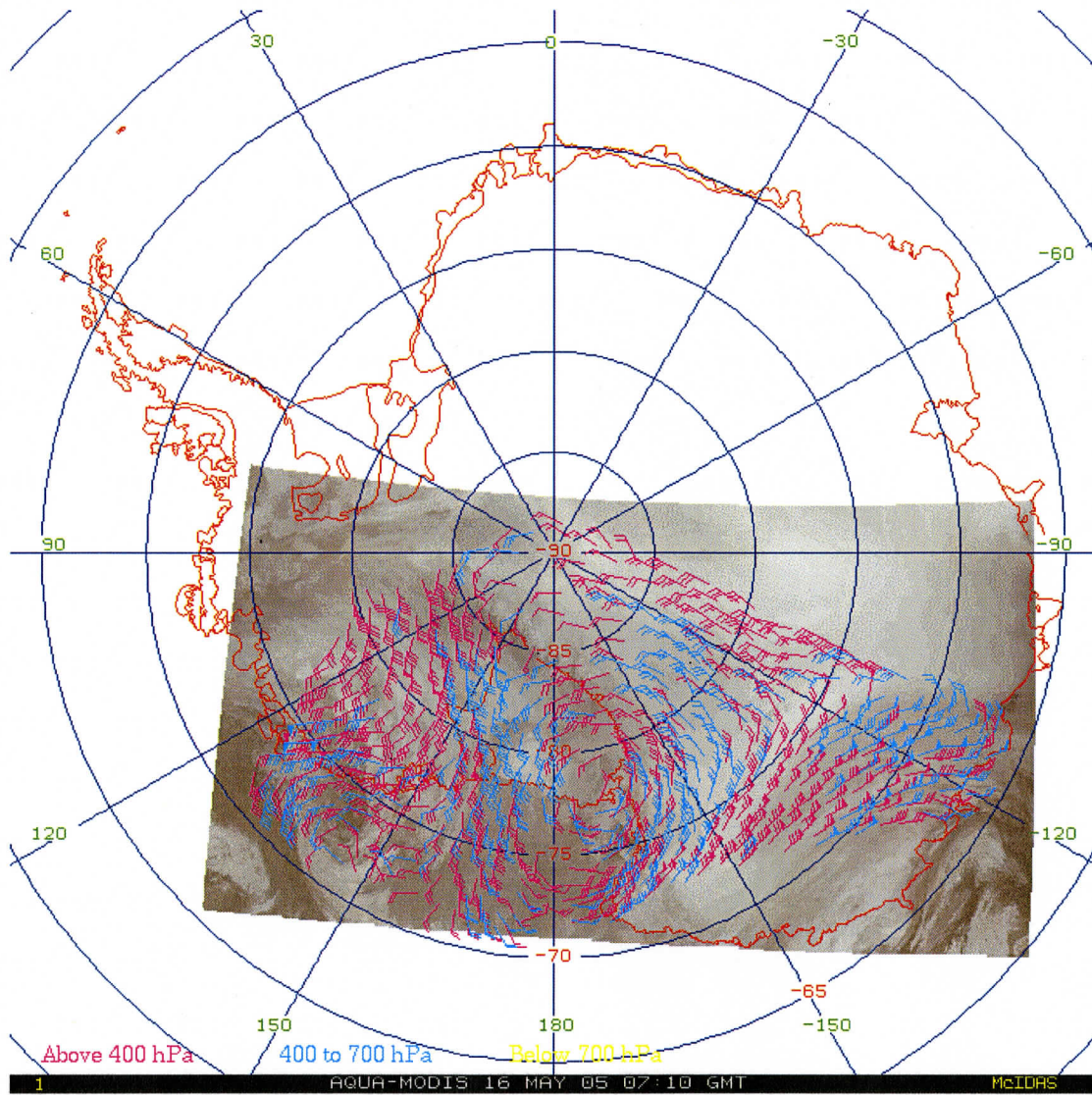
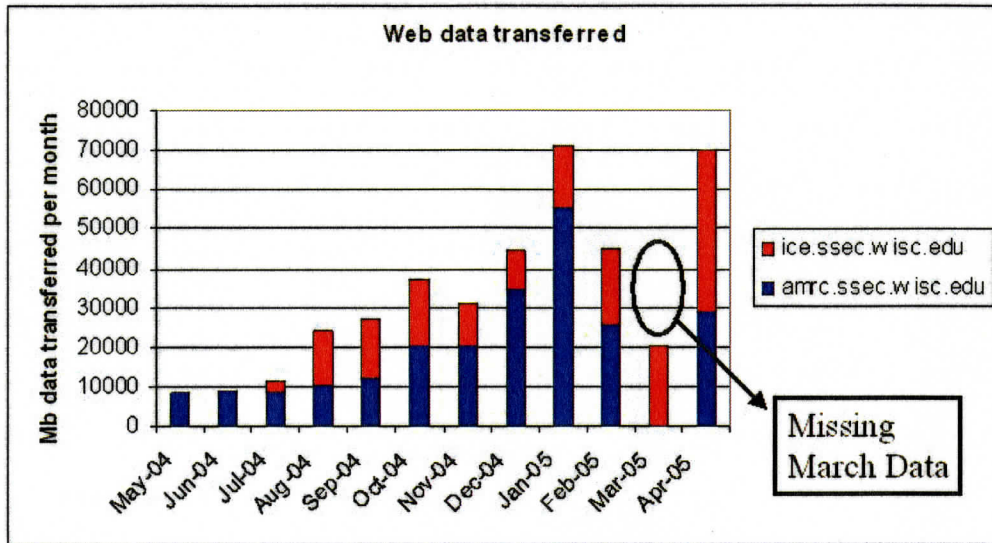


Figure 2. This diagram depicts the Antarctic-Internet Data Distribution (Antarctic-IDD) system depicting the initial formation of the network.



**Figure 3. A sample infrared satellite image from the MODIS sensor on the Aqua satellite is overlain with satellite-derived winds, computed from the prior three Aqua passes. (Image Courtesy of Jeff Key, NOAA/NESDIS/CIMSS)**

# Web Site Statistics



# FTP Site Statistics

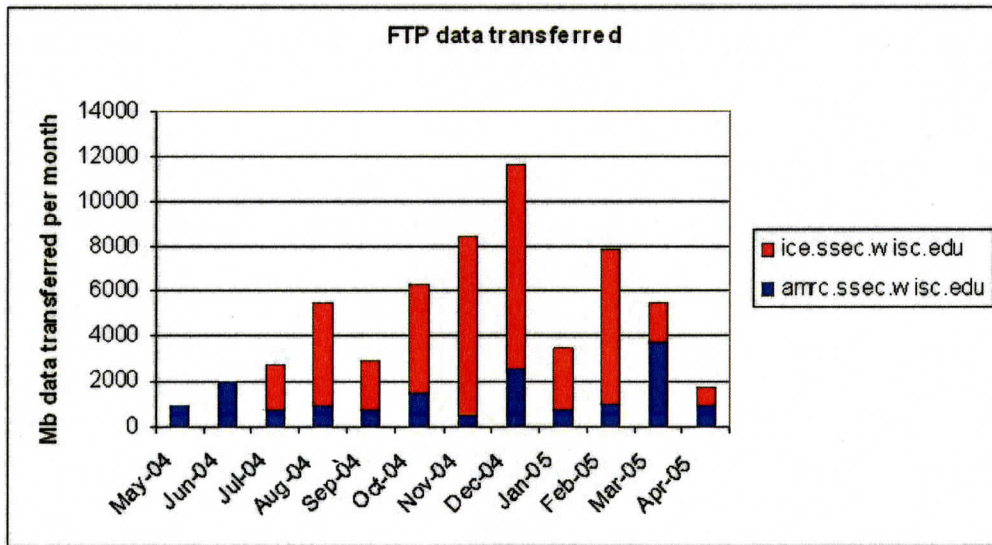


Figure 4. This figure depicts the Web and FTP server statistics for AMRC's two server systems for the past year.