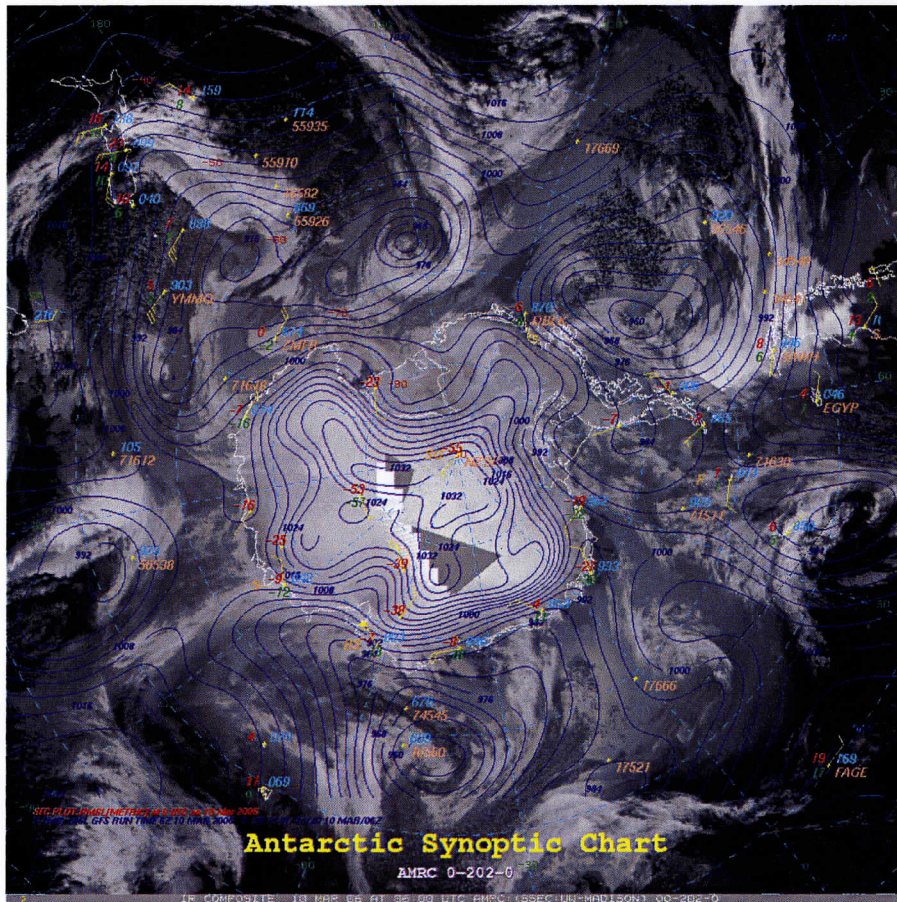


AMRC Annual Project Report: NSF-OPP Grant #0126262, June 30, 2005 to June 30, 2006

Antarctic Meteorological Research Center (AMRC) 2002-2005

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



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 22, 2006



Annual Report for Period:06/2005 - 06/2006**Submitted on:** 06/22/2006**Principal Investigator:** Stearns, Charles R.**Award ID:** 0126262**Organization:** U of Wisconsin Madison**Title:**

Antarctic Meteorological Research Center (AMRC) 2002-2005

Project Participants

The Schwerdtfeger Library
1225 W. Dayton Street
Madison, WI 53706

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 during the first year of the project. 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. Her role has expanded into helping with developing displays of weather information in the AMRC web site during the second year of the project.

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 during the first two years of the project.

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 second year of the project.

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.

Name: Kohrs, Richard

Worked for more than 160 Hours: No

Contribution to Project:

Rick Kohrs assisted the AMRC project with brief specialized programming assistance during the third year of the project.

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}
 - GOES satellite cloud drift and water vapor wind charts over the New Zealand/Ross Sea region (courtesy CIMSS)

- 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 a system to process Aqua and Terra direct broadcast data from the new X-band system at McMurdo Station for research applications, product generation, and specifically satellite cloud drift and water vapor feature winds using the MODIS sensor as well as other products (e.g. total precipitable weater)
- * Initial establishment of the Antarctic-Internet Data Distribution (Antarctic-IDD) system
- * Initial efforts in providing more robust station climatologies for USAP manned stations (e.g. McMurdo Station, etc.)

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 MTSAT-1R (See Figure 1).

The AMRC continues to be a focus for and a critical relay of the Antarctic-IDD system (See Figure 2a). Efforts are underway to evolve the system into a more topologically sound system (See Figure 2b).

Finally, the AMRC has rounded out its activities to include, but not limited to the following:

- * Participating in the annual AMRC meeting in conjunction with the AAWS and AMPS projects, now renamed the Antarctic Meteorological Observation, Modeling, and Forecasting Workshop
- * Participation in a recent DLESE meeting (part of the NSF funded National Digital Library System)
- * Conducting educational outreach activities

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 from AWS observations
- * Identification and collection of case study data sets.
- * Attended annual AAWS/AMRC/AMPS joint meetings (now named the Antarctic Meteorological Observation, Modeling, and Forecasting Workshop)
- * Initial setup and assistance with 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 and other products such as total precipitable water (See Figure 3).
- * Established and foster the Antarctic-IDD 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. As discussed in the Web/Internet site section, Figure 4 depicts AMRC's web and FTP site statistics. Finally, as depicted in figure 5, the project seeks data fusion between observational and analytic data sets.

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 a 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, IDL, IDV, etc.), 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
- * Westside Optimists Club, Madison, WI
- * Deerfield Public Library, Deerfield, WI

University:

- * CIMSS/Wisconsin Space Grant Consortium Workshop on Earth, Atmospheric and Space Sciences, Madison, WI
- * Grandparents University, UW-Madison, Madison, WI
- * 'Wednesday Night at the Lab', UW-Madison, Madison, WI
- * UW Space Place, UW-Madison, Madison, WI

Post High School:

- * Madison Area Technical College, Madison, WI

Middle School

- * Jefferson Middle School, Madison, WI
- * Lodi Area Middle School, Lodi, WI

Elementary School:

- * Madison Urban Adventures Program, Madison Public School System, Madison, WI

This past year, the project has worked to broaden the outreach audience. Some success has been achieved with more public venues reached.

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
- * MODIS Winds and other satellite generated products (Real time only)

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)
- * CIMSS Regional Assimilation System (CRAS) (Real-time only)

Satellite Imagery & Data

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

Observational Data (GTS/NOAAport)

- * METAR
- * PIREP/AIREP
- * Synoptic
- * ABoM Synoptic (ends March 2006)
- * Radiosonde
- * Ship & Buoy

Text Data

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

USAP Station Data

- * South Pole
- * Palmer
- * McMurdo
- * (+NCDC holdings)
- * USAP Field camps and McMurdo Area Wind Sensor (MAWS) network

Sharing Information:

AMRC Data Collection

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:

- * Amanda Adams, UW-Madison (now U. Calgary)
- * Kathleen Allen (CPA)
- * Gonzolo Hernandez, U. Washington
- * Kim Nielson, Utah State
- * Mark Seefeldt, U. Colorado
- * Bill Smith, 109th NYANG
- * Esteban Vazquez, BPRC/OSU
- * Rebecca Wolf, US Naval Academy
- * Zhien Wang, NASA
- * Clare Oatley, Australia
- * Meraz Mostafa, Australia
- * Vivana Urbina, Chile
- * Andreas Will, Germany
- * Raghavendra Babu, India
- * Stefano Di Battista, Italy
- * Carlo Medaglia, Italy
- * Penny Clendon, New Zealand
- * N.C. Sheeba, Malaysia
- * Wayna Suparta, Malaysia
- * Edward King, United Kingdom

Assisting with the annual joint AAWS/AMRC/AMPS (now named the Antarctic Meteorological Observational, Modeling, and Forecasting Workshop) 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, etc).

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

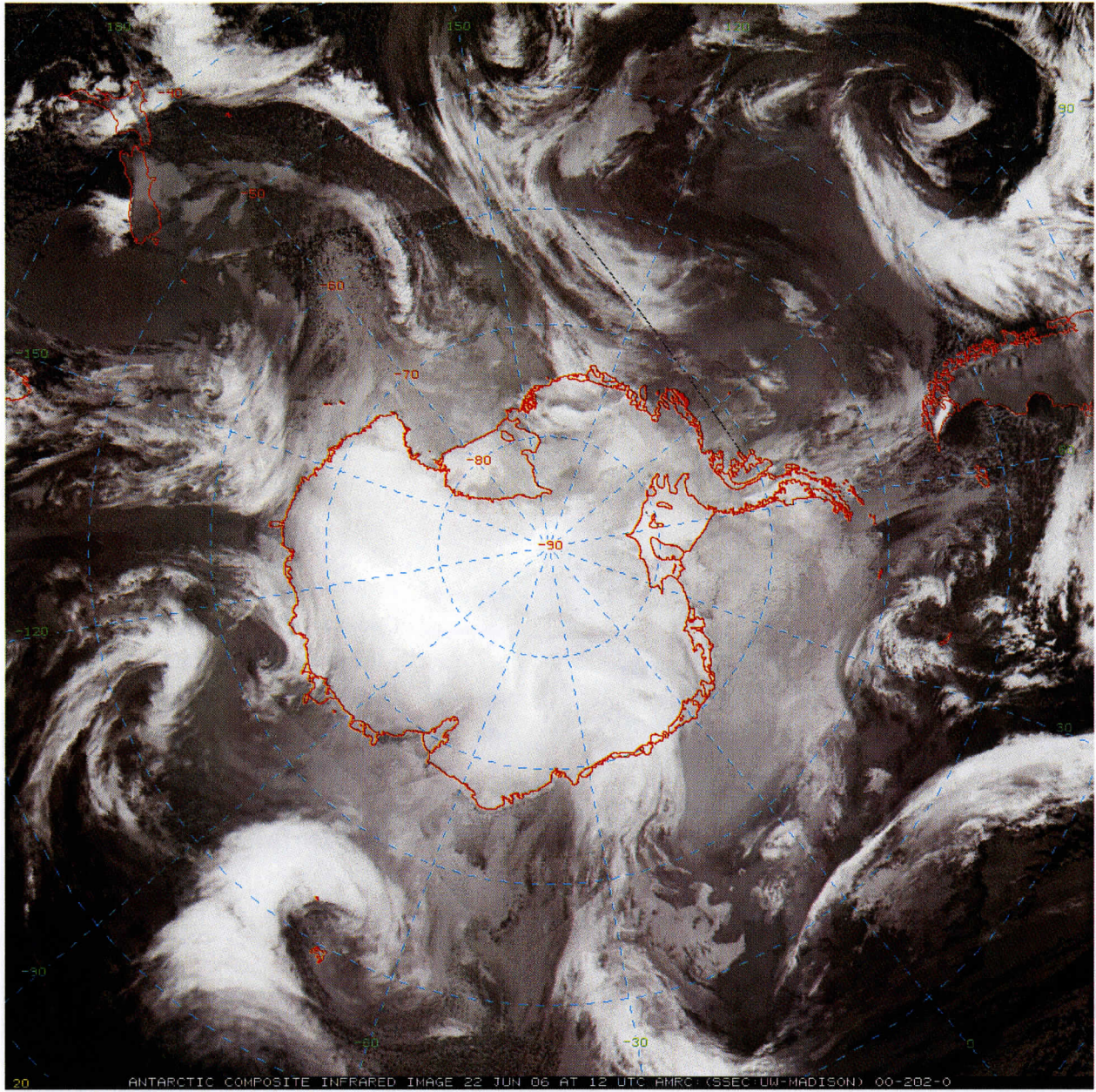


Figure 1. This sample Antarctic infrared composite satellite image is made from GOES-11, -12; Meteosat-5, and -8; FY2-C; Aqua and Terra; and NOAA-15, -17, and -18 satellites and with improvements from the additional satellites of MTSAT-1R.

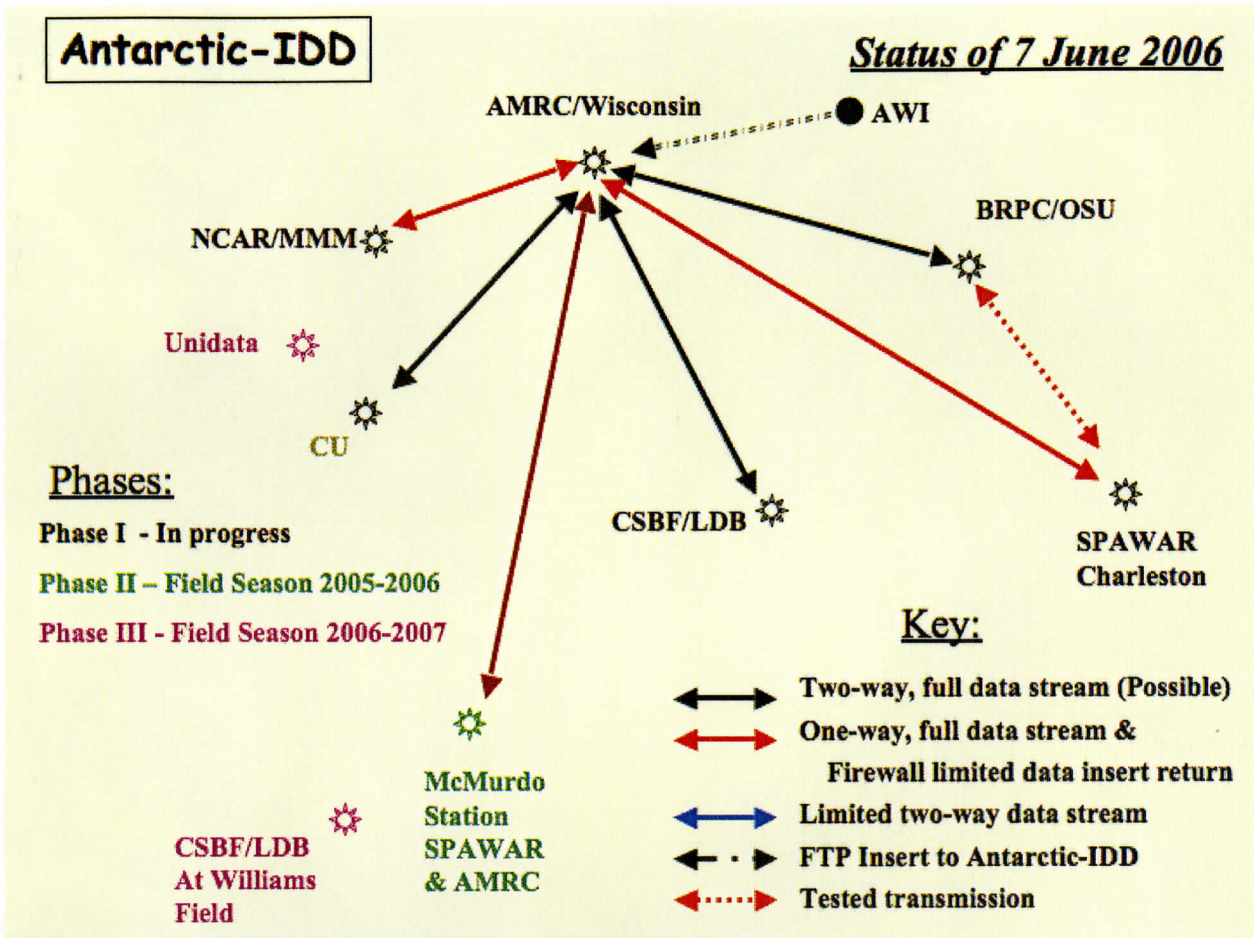


Figure 2a. This diagram depicts the Antarctic-Internet Data Distribution (Antarctic-IDD) system as of 7 June 2006.

Antarctic-IDD

Future

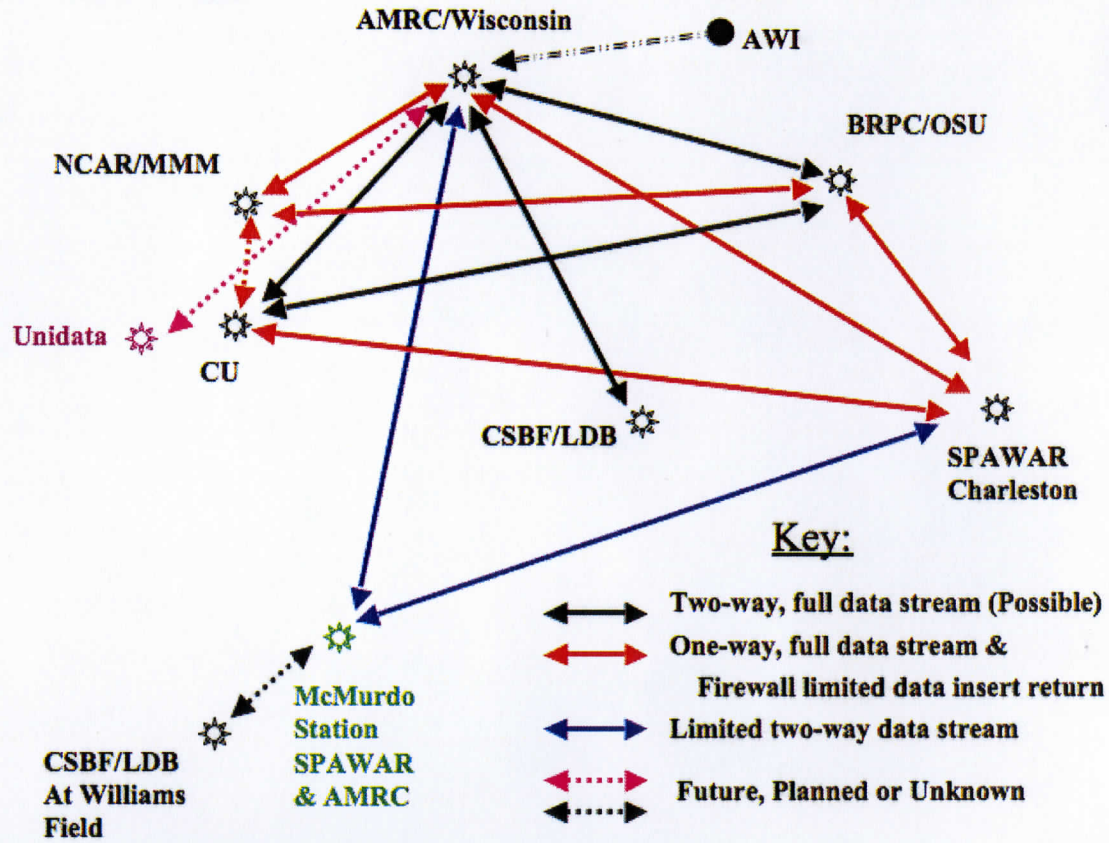


Figure 2b. This diagram depicts the Antarctic-Internet Data Distribution (Antarctic-IDD) system as it is planned for the near future, including a more robust network topology.

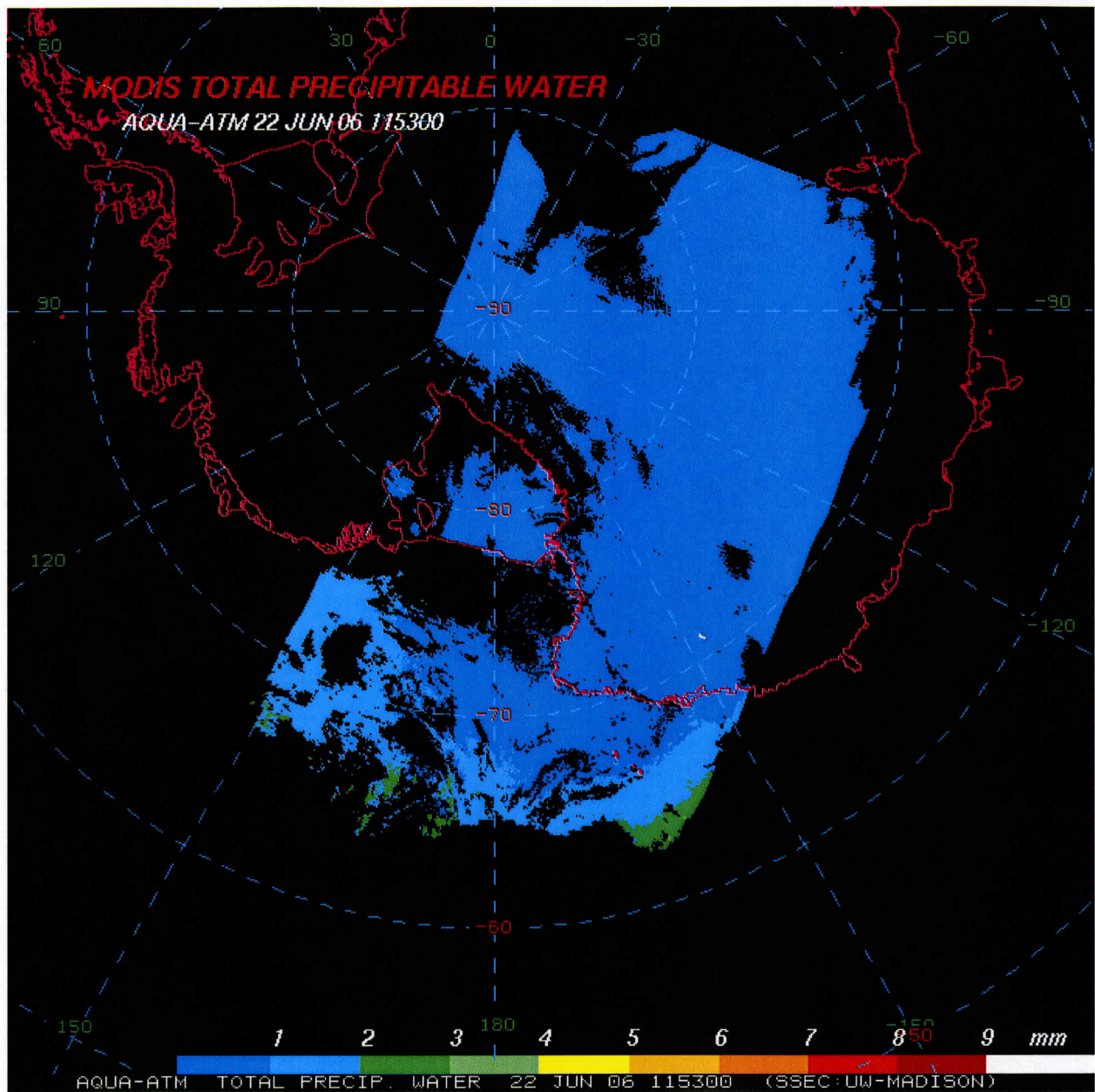
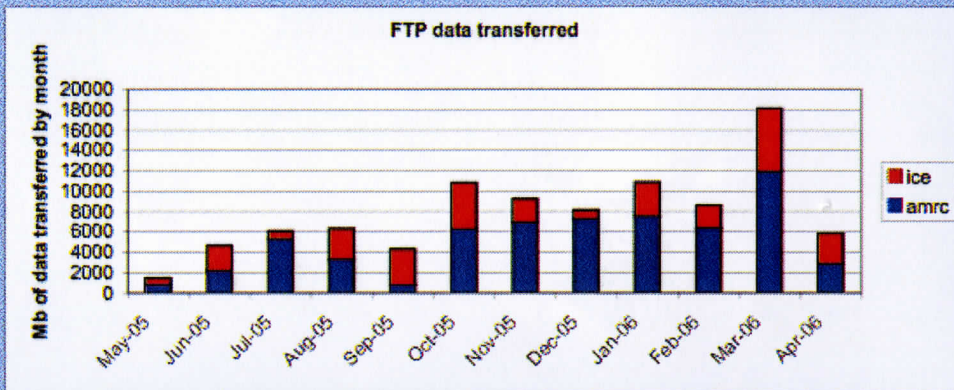
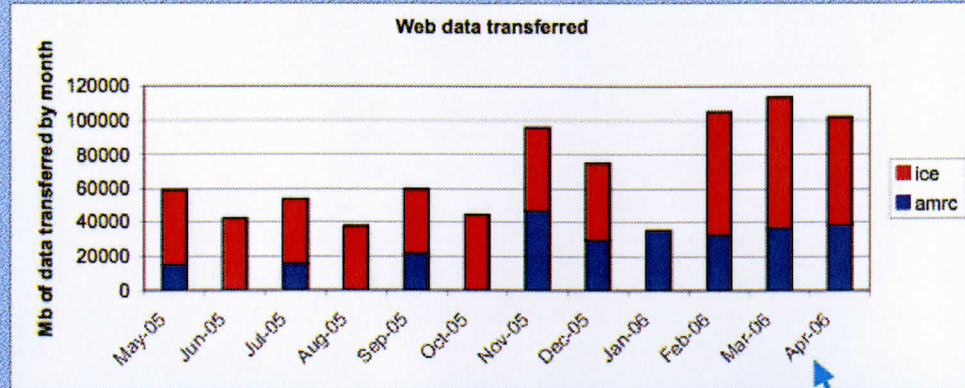


Figure 3. A sample total precipitable water product image from the MODIS sensor on the Aqua satellite, received and processed with the new X-band direct broadcast readout system at McMurdo Station.

Web & FTP Stats



Reached
100 Gb
Mark!!!!

Figure 4. This figure depicts the Web and FTP server statistics for AMRC's two server systems for the past year. Note that the amount of data served per month has exceeded the 100 Gb mark.

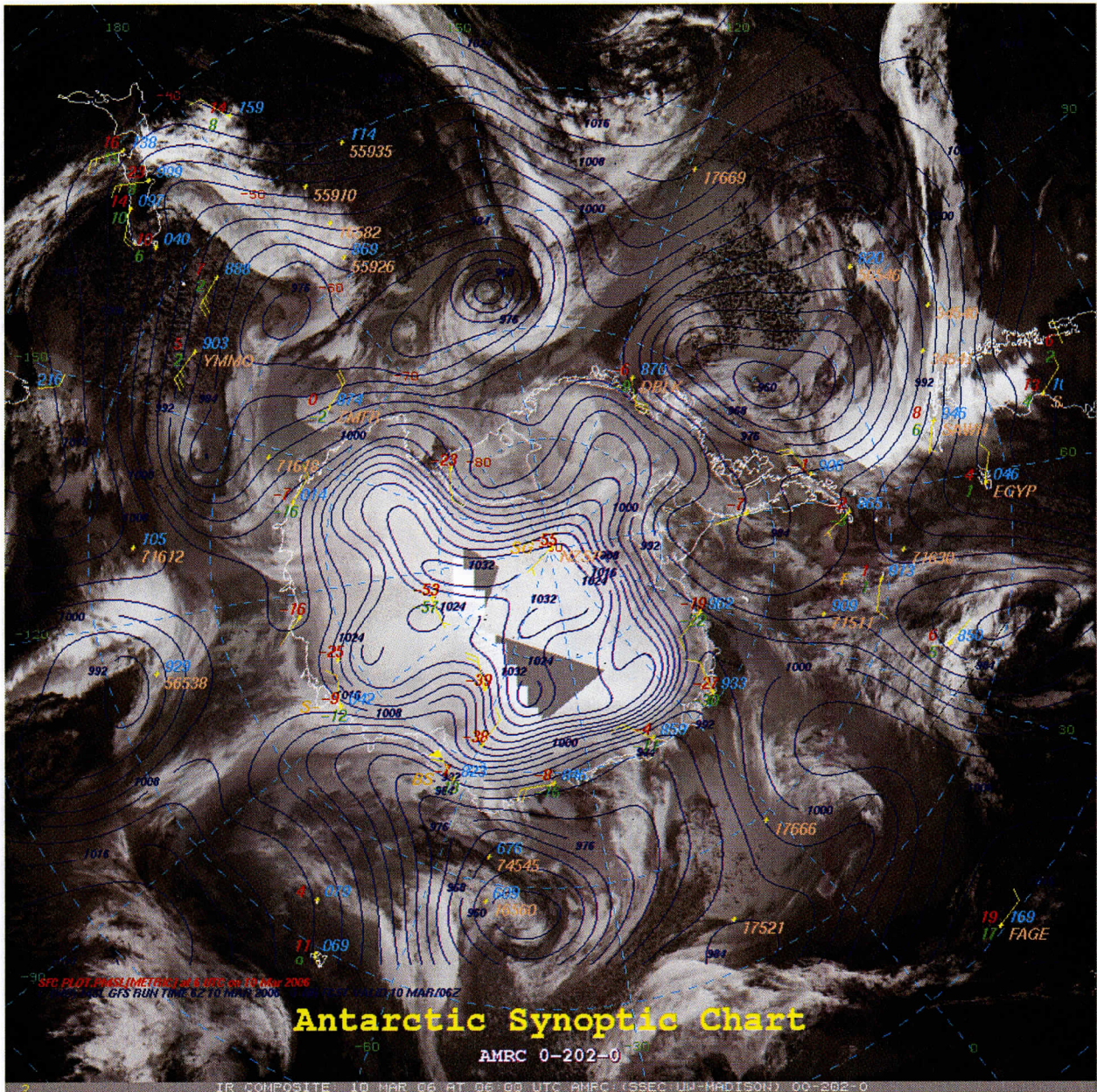


Figure 5. A sample Antarctic synoptic chart using the AMRC signature Antarctic composite infrared satellite image, overlain with synoptic and ship/buoy observations combined with NCEP's Global Forecast System model isobaric analysis.

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