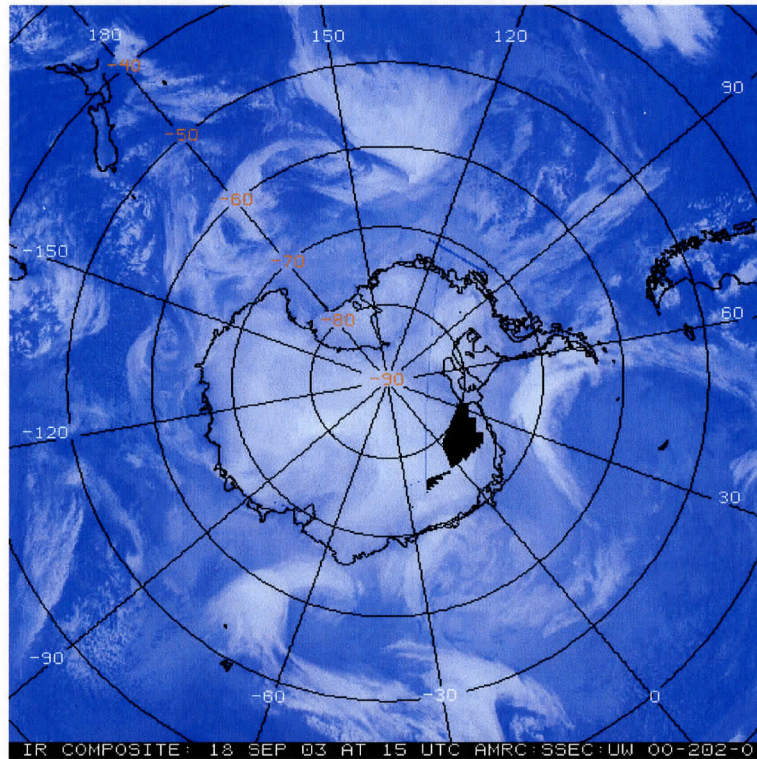


AMRC Annual Report: NSF-OPP Grant #0126262, June 30, 2003 to June 30, 2004

Antarctic Meteorological Research Center (AMRC) 2002-2005

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



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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 18, 2004



Annual Report for Period:06/2003 - 06/2004**Submitted on:** 06/18/2004**Principal Investigator:** Stearns, Charles R.**Award ID:** 0126262**Organization:** U of Wisconsin Madison**Title:**

Antarctic Meteorological Research Center (AMRC) 2002-2005

Project Participants**Senior Personnel****Name:** Stearns, Charles**Worked for more than 160 Hours:** No**Contribution to Project:**

During the first year of 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.

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.

Post-doc**Graduate Student****Undergraduate Student****Name:** Staude, Jessica**Worked for more than 160 Hours:** No**Contribution to Project:**

This student helped update the video tape of composite images. In conjunction with this work, areas of significant mass transport onto the continent were identified.

Name: Kudick, Karen**Worked for more than 160 Hours:** No**Contribution to 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.

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 past 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)
- * 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

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), and improved use of polar orbiting data including the initial use of Aqua and Terra MODIS satellite data in the water vapor composites (See Figure 1a and b). 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. It is hoped to overcome this as much as possible in the future. Work on the case study collections is continuing, as is the work on climatological analysis. Two case studies have been delivered to UNIDATA/COMET with more in progress. WMO data format investigation for Wisconsin AWS data has just begun.

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

- * Participating in RIME Science Planning discussions
- * Participating in the annual AMRC meeting in conjunction with the AAWS and AMPS and held in Charleston, SC
- * Organizing and co-hosting the MGS Workshop
- * Conducting educational outreach activities
- * Attending the National Highway Visibility Conference in Madison, WI

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. In addition, the MGS Workshop was organized to advise NSF of possible ground station configurations to receive the newer X-band satellite data. 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 (See Figure 2).
- * Attended annual AAWS/AMRC/AMPS joint meetings

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 3 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 regards 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 including Science Expeditions open house, UW-Madison
- * E-mails answering questions or providing data or information to students and the general public

University:

- * CIMSS/Wisconsin Space Grant Consortium Workshop on Earth, Atmospheric and Space Sciences, Madison, WI

Post High School:

- * Madison Area Technical College, Madison, WI

Middle School

- * Waunakee Middle School, Waunakee, WI

Elementary School:

- * Drought Elementary School, Franksville, WI
- * Glendale Elementary School, Madison, WI
- * Hawthorne Elementary School, Madison, WI
- * St. Ann's Elementary School, Stoughton, WI
- * Deerfield Elementary School, Deerfield, WI

During the past year, the AMRC continued to work on improving its grass-roots educational outreach activities. This initial effort is only the start of more effort planned for the remainder of the grant.

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. See Figure 3 in the activities and findings section for a graphic report on the traffic these sites have seen in the last calendar year.

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

- * 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
- * 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)

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
- * 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:

- * NCAR/NCEP Reanalysis Roy Jenne (AWS data, etc.)
- * NCAR/AMPS Jordan Powers (AWS data)
- * Meg Smith, U. Alaska (AVHRR imagery)
- * SPAWAR, (Variety of data)
- * Jack Williams (USA Today)(Imagery for books)
- * Ralph Harvey, CWR
- * OSU/BPRC, Andy Monaghan (variety of weather data)
- * Thomas Nysten, Portland State (McMurdo observations)
- * RPSC (Misc. weather data)
- * Jason Weale, CRREL
- * Dan Lubin, AARC, SIO, UCSD
- * David McWilliams, EGS
- * Ken Taylor, DRI
- * Lamont-Doherty Earth Observatory
- * Jeremy Bassis, SIO, UCSD
- * CAS, University of Cambridge, UK
- * Hamish McGowan, U. Queensland, Australia
- * Division Glaciologia Instituto Antartico, Argentina
- * Marsaryk University, Czech Republic
- * University of Canterbury, Christchurch, NZ
- * Peter Barrett, ARC Victoria U. of Wellington, New Zealand
- * Fabricio Pereira Harter National Institute for Space Research, Brazil
- * David Pedgley, UK
- * James Brennan, University of Reading, UK

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.

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)
- * NASA: Comberiate, T-927 (Test Composite Imagery/Iceberg data)

Other contributions are in discussion so there is no report yet.

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

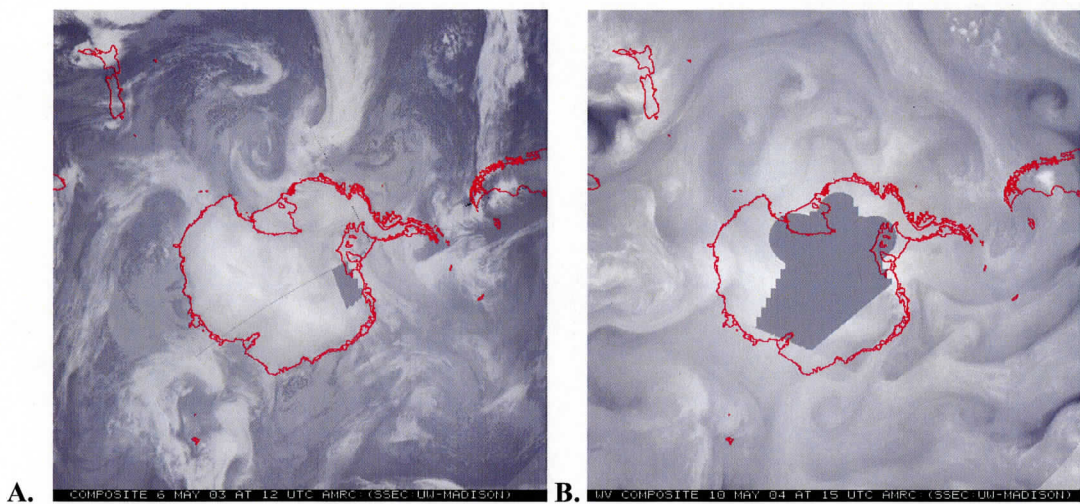


Figure 1. A) A sample Antarctic infrared composite satellite image made from GOES-9, GOES-10, GOES-12, Meteosat-3, Meteosat-7, DMSP and NOAA satellites. B) A sample Antarctic water vapor composite satellite image made from the same satellites as the infrared as well as Aqua and Terra in Queen Maud Land in East Antarctica. The images are from different days.

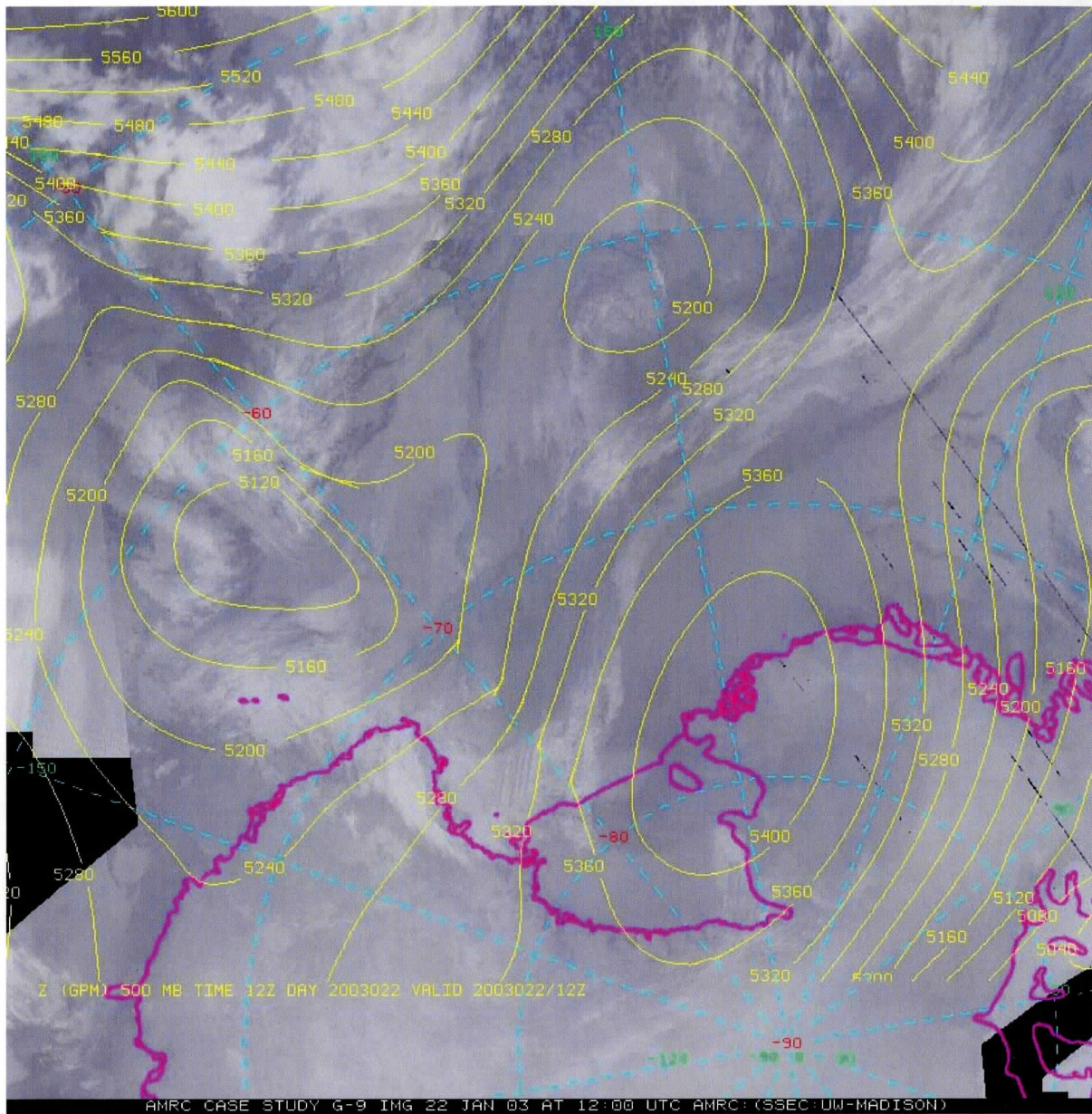
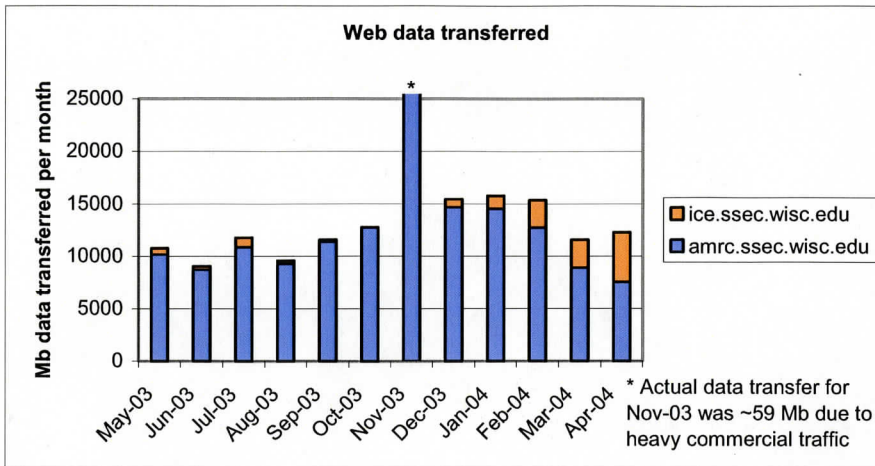


Figure 2. An Antarctic infrared composite satellite image with matching 500 hPa ECMWF model analysis heights from 12 UTC on 22 January 2003. This view shows a significant storm impacting McMurdo Station, Antarctica on Röss Island.

Web & FTP *Statistics*



Averages

Web: ~12 Gb/month

FTP: ~3 Gb/month

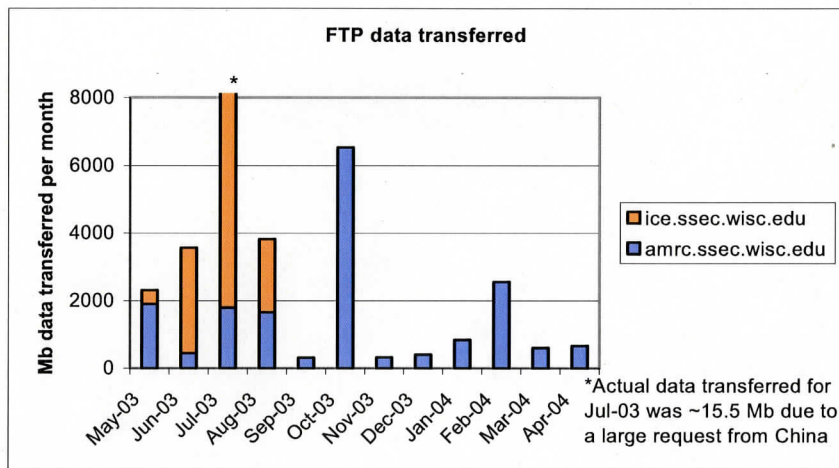


Figure 3. The AMRC Web and FTP Internet site statistics depicts the activity of these sites for the past year. The variable usage of the FTP is due to variable sized data requests posted to this site at the request of interested users.