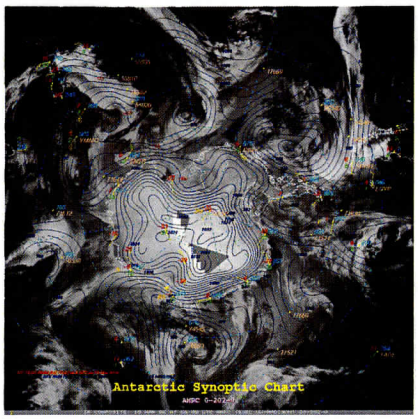
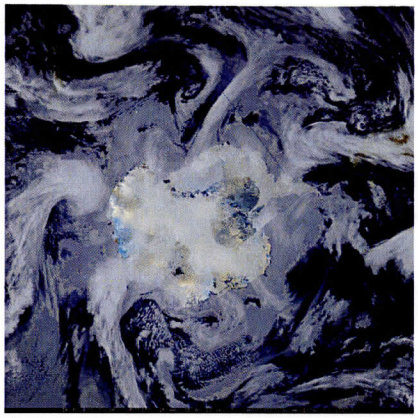
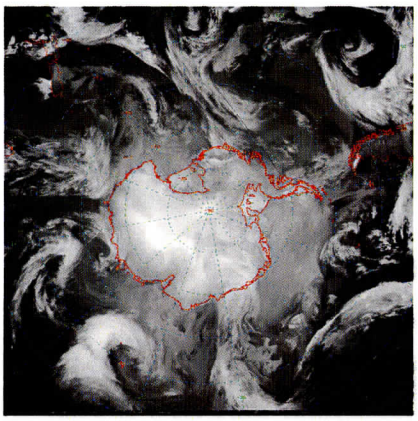
AMRC Final Project Report: NSF-OPP Grant #0126262, October 1, 2002 to September 30,2006

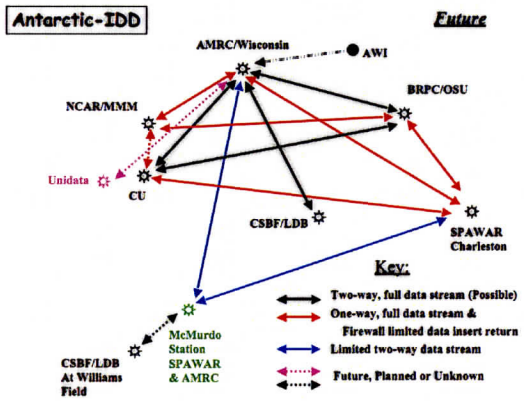
Antarctic Meteorological Research Center (AMRC) 2002-2005

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









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

Space Science and Engineering Center
University of Wisconsin-Madison

Submitted on November 21, 2006

Final Report for Period: 06/2006 - 10/2006
Submitted on: 11/21/2006
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 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 activites 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 an 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 Station, Antarctica 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

Throughout the project, the AMRC project increasingly kept in close contact with United States Antarctic Program (USAP) affiliated organizations including Raytheon Polar Services Company (RPSC), especially the South Pole Meteorology Office and RSPC Meteorology coordinator, and the Aviation Technical Services (ATS)/SPAWAR group, especially McMurdo Weather Office.

Efforts have expanded in the later years of the project to include other organizations, including the National Oceanic and Atmospheric Administration (NOAA)/National Climatic Data Center (NCDC), World Meteorological Organization (WMO), British Antarctic Survey (BAS), Microscale and Mesoscale Meteorology (MMM) division at the National Center for Atmospheric Research (NCAR), Byrd Polar Research Center at The Ohio State University, and University of Colorado-Boulder.

As in the past, the AMRC project continues to be a complement to AMRC's sister center, the Arctic and Antarctic Research Center at the Scripps Institute of Oceanography, University of California-San Diego.

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 reports (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
* Experimental development of Antarctic composite visible satellite imagery
* Initiation of case study collections of significant weather events
* Climatological analysis from the AWS, and other stations (complementing 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 water)
* 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.)

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 with this grant include:

* Continued meteorological data collection, archival and distribution
* The continued generation and improvement of the Antarctic composite satellite imagery
* Continued educational outreach activities
* Utilities developed to generate climatological analyses from AWS observations
* Identification and collection of case study data sets.
* Co-hosted 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.
* Established and fostered 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. 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 activites. 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
* WORT-FM Radio Interview (both in Madison, WI and live from McMurdo Station, Antarctica)
* Westside Optimists Club, Madison, WI
* Deerfield Public Library, Deerfield, WI
* 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
* 'Wednesday Night at the Lab', UW-Madison, Madison, WI
* UW Space Place, UW-Madison, Madison, WI
* Project ASPIRE, UW-Madison (A project aimed at encouraging and introducing higher education to disadvantage 10th grade students)
* CASPER homeless grade school project, 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
* Hopkinton High School, Hopkinton, MA
* King Philip Regional High School, Wrentham, MA
* Waunakee Middle School, Waunakee, WI
* Deerfield Middle School, Deerfield, WI

Elementary School:

* Madison Urban Adventures Program, Madison Public School System, Madison, WI
* Mendota Elementary School, Madison, WI
* 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

The project has worked to broaden the outreach audience. Some success has been achieved with more public venues reached.

Journal Publications

Lazzara, M.A., "McMurdo Station, Antarctica Fog Climatology: 1973-1998", 8th Conference on Polar Meteorology and Oceanography, American Meteorological Society,
San Diego, CA, p. P1.21, vol. , (2005). Published

Lazzara, M.A. P.K. Wang, and C.R. Stearns, "Observations of Antarctic Fog Particles", 7th Conference on Polar Meteorology and Oceanography, American Meteorological Society,
Hyannis, MA, p. P9.2, vol. , (2003). Published

Lazzara, M.A., C.R. Stearns, J.A. Staude, and S.L. Knuth, "10 Years of Antarctic Composite Images", 7th Conference on Polar Meteorology and Oceanography, American Meteorological Society,
Hyannis, MA, p. P9.4, vol. , (2003). Published

Books or Other One-time Publications

Knuth, S.L, M.A. Lazzara, A.M. Cayette,
and C.R. Stearns, "Antarctic Meteorological Data:
Availability, Applications, &
Considerations for Real-Time Data
Assimilation", (2003). Workshop, Published
Bibliography: Workshop on High Latitude Numerical Weather Prediction, Fairbanks, AK

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 Antar 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 & experimental Visible & "psuedo-colored"
* 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, Palmer Station real-time only)
  - GAC (Project FROST/by request)
  - LAC (iceberg monitoring)
* DMSP (real-time only for both McMurdo and Palmer Stations)
  - 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:

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 during this grant include:

* Amanda Adams, UW-Madison (now U. Calgary)
* Kelly Admunsen, BRPC/OSU
* Kathleen Allen (CPA)
* Jeremy Bassis, SIO/UCSD
* Bob Bundschuh
* Paul Dalrymple, Antarctican Society
* Ryan Fogt, BRPC/OSU
* Ralph Harvey, CWR
* Gonzolo Hernandez, U. Washington
* Roy Jenne, NCAR
* Dan Lubin, AARC/SIO/UCSD
* Doug MacAyeal, U. Chicago
* David McWilliams, EGS
* Andy Monaghan, BPRC/OSU
* Bill Neff, NOAA/ETL
* Kim Nielson, Utah State
* Thomas Nylen, Portland State
* Scott Polk, VIMS
* Jordan Powers, NCAR
* Mark Seefeldt, U. Colorado
* Bill Smith, 109th NYANG
* Meg Smith, U. Alaska
* Ken Taylor, DRI
* Esteban Vazquez, BPRC/OSU
* Jack Williams, USA Today/AMS
* Zhien Wang, NASA
* Jason Weale, CRREL
* Rebecca Wolf, US Naval Academy
* David Yu, AMANDA/UW-Madison

* SPAWAR
* RPSC

Italy:
* Marianna Nardino
* Iloria Fattori
* Stefano Di Battista
* Carlo Medaglia

Germany:

* Angelika Humbert
* Wolfgang Rack
* Andreas Will

New Zealand:
* Miranda Huston
* Christine Elliott
* Penny Clendon
* Narelle Baker
* Peter Barrett

Australia:
* Meraz Mostafa
* Hamish McGowan
* Clare Oatley
* Elizabeth Parer-Cook

Chile:
* Vivana Urbina

India:
* Raghavendra Babu
* Satyendra Bhandari

Malaysia:
* N.C. Sheeba
* Wayna Suparta

United Kingdom:
* Edward King
* James Brennan
* David Pedgley

Canada:
* Oascale Bilodeau

Spain:
* Irene Lopez Garrido

Brazil:
* Fabricio Pereira Harter

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 include 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). Some NSF-OPP grantees the AMRC has worked with during this grant in this role include but are not limited to:

U-Chicago: MacAyeal IO-190
Woods Hole: Beardsley OG-231-O
Portland State: Foutain BM-042-F
Svarney WO-220-O
NSBF: Stepp AB-145-O
NASA: Comberiate, T-927

Some non-NSF grantees include:

* NASA WFF, Bob Swift
* International Whaling Commission, Diederk van Liere, Netherlands

Contributions to Human Resource Development:

This grant's educational outreach efforts have contributed to human resource development, by raising awareness with student and public audiences of the critical role the Antarctic plays in the Earth system.

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 complements 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.)
* Providing comparative Antarctic weather data to a television weather reporter during a cold snap in the United States.

Categories for which nothing is reported:

Organizational Partners

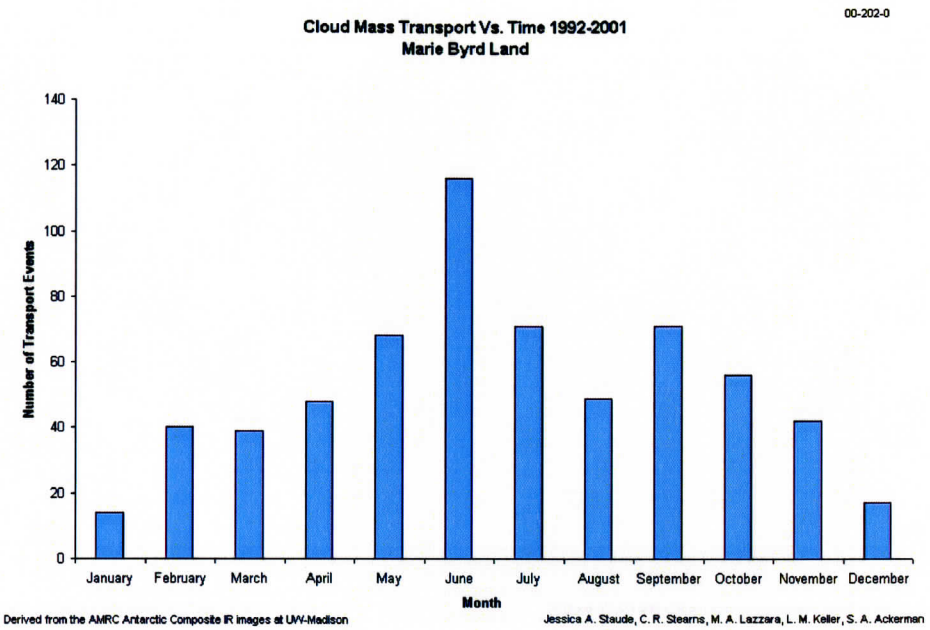


Figure 18. A histogram of cloud mass transport (CMT) events over the Marie Byrd Land coast on a monthly basis over the 9-year period from 1992 through 2001, derived from Antarctic composite satellite imagery animations. ***(Courtesy of Jessica Staude, UW-Madison)***

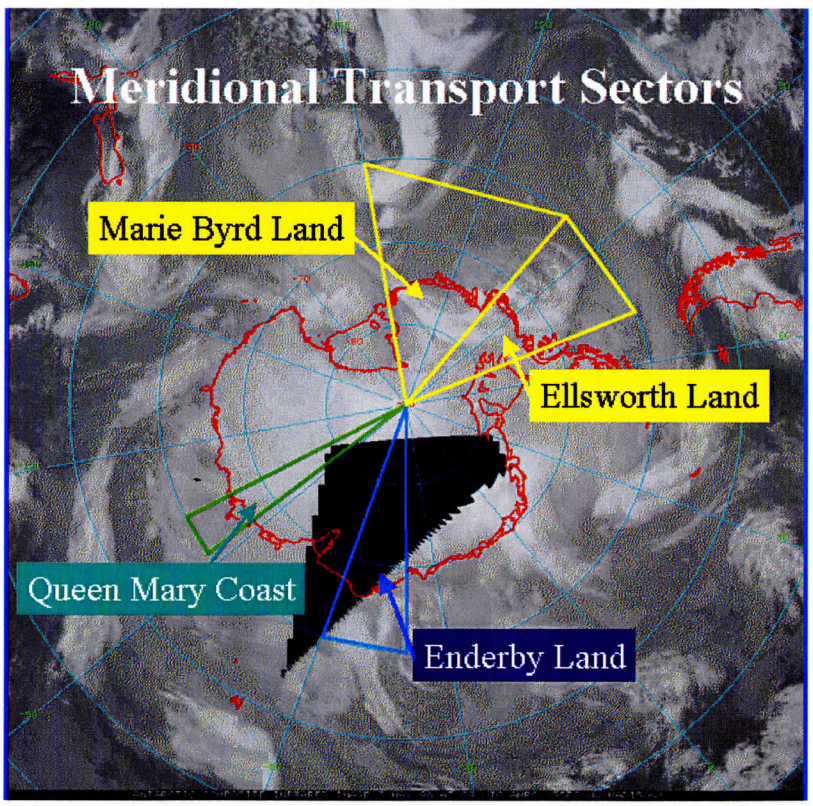


Figure 19. Areas of the Antarctic that have significant cloud mass transport (CMT) events. ***(Courtesy of Jessica Staude)***

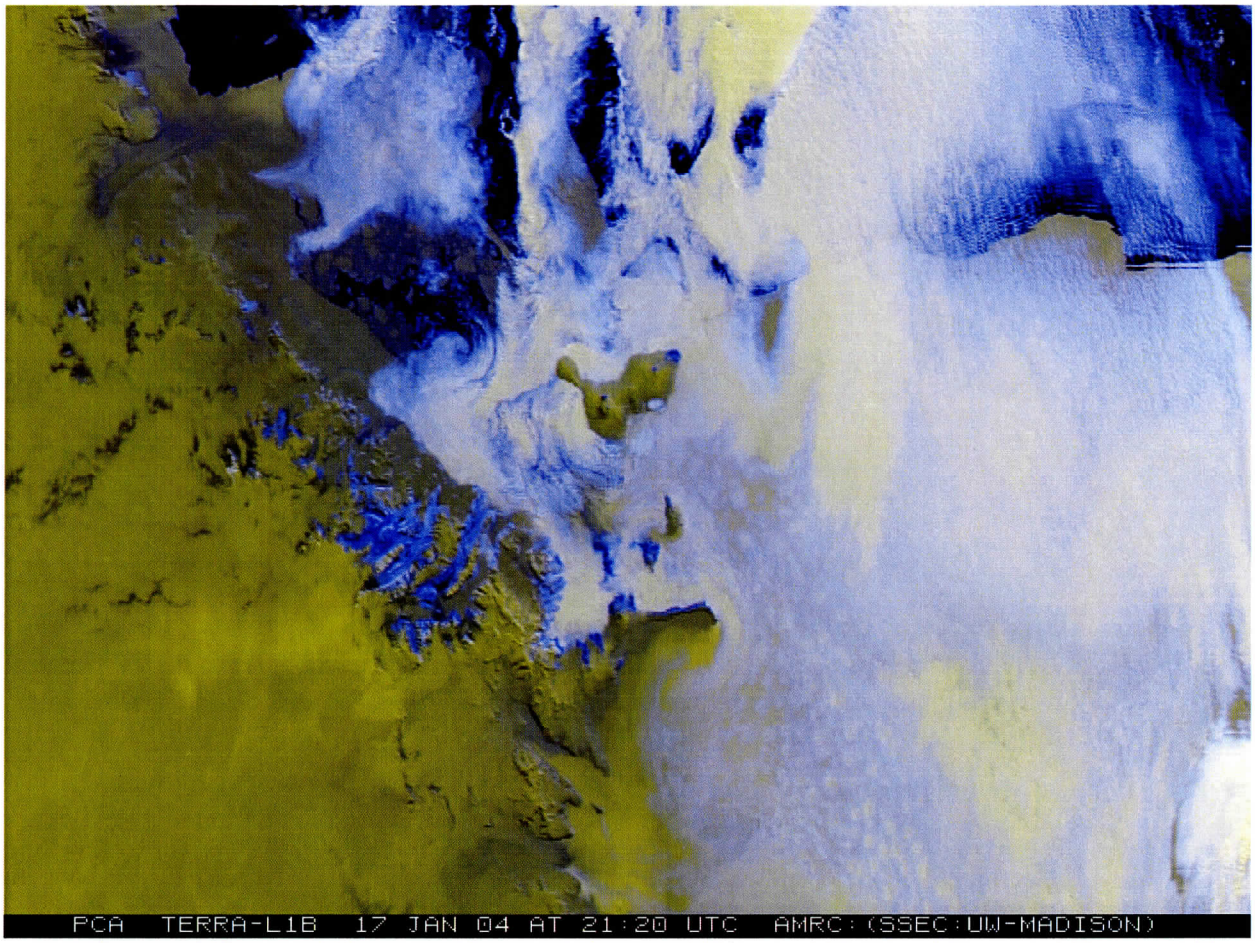


Figure 20. ***Fog Depiction over Ross Island, Antarctica:*** **A weighted first and second principal component analysis of Terra MODIS satellite imagery combined via red, green and blue with weighting on the second principal component. Note how with moderate clarity the fog and low stratus are depicted, with the thicker low clouds slightly color enhanced. (2006)**

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

Reply to Attn of: YS

February 12, 2003

Dr. Dennis Peacock
Head, Antarctic Sciences Section.
The National Science Foundation
Room 755 S
4201 Wilson Blvd.
Arlington, VA 22230

Dear Dr. ~~Peacock~~ Dennis,

This letter is to recognize and express our sincere appreciation to Matthew Lazzara, 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 and Thwaites Glaciers in West Antarctica. The purpose of the flights, staged out of Punta Arenas, Chile, was to acquire baseline measurements of ice surface elevation and thickness over these glaciers. These data will be made available to the scientific community to support investigations aimed at understanding the mechanisms that are driving the thinning and acceleration of these glaciers that has been observed in the past decade. As you are aware, this area was identified by Terry Hughes a number of years ago as the "weak underbelly of the West Antarctic Ice Sheet."

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 ~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 AVHRR Local Area Coverage (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. Several weeks prior to our deployment to Chile we apprised Matthew Lazzara of our project and our need for visible band imagery. Matthew was able to successfully convince NOAA to retain the LAC images of the area which were then downloaded at Wallops Island and routed to AMRC. Matthew and the staff were able to provide supporting processing of the images that enhanced their utility and he was even able to superimpose our intended flight tracks right on the images making them easier to interpret. A sample of this valuable product is enclosed.

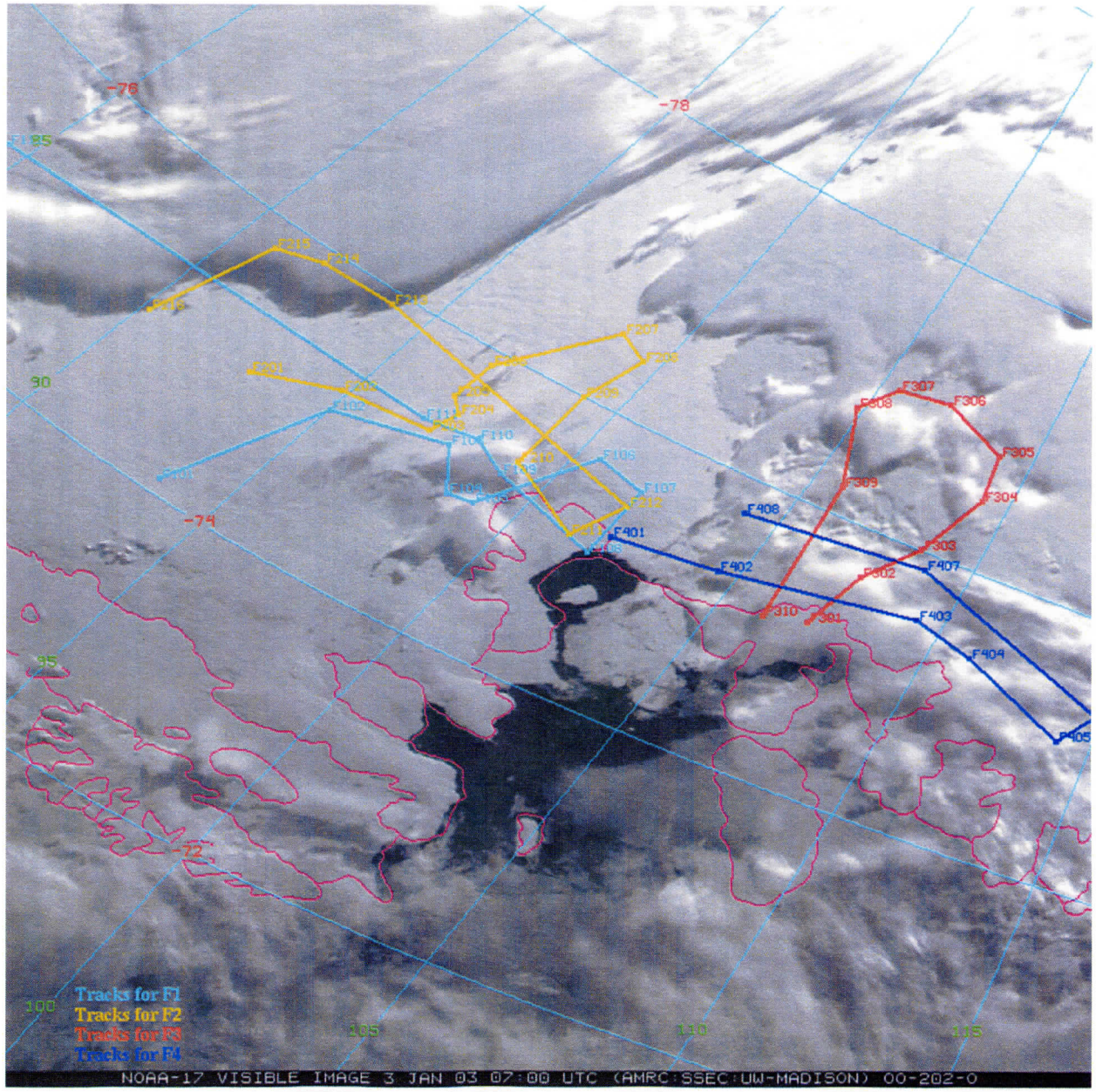
The staff at AMRC supported our project with the visible LAC imagery throughout our 3-week field campaign. These images formed an important component of our logistical

strategy, which resulted in the successful completion of all 4 of our planned missions over these glaciers. Considering that these missions require five hours of transit time each way for two hours of measurements on site, the data they provided was crucial to the success of our campaign.

Sincerely,

Waleed Abdalati
Manager, Cryospheric Sciences Program
Office of Earth Science

Cc: Dr. Bernhard Lettau/National Science Foundation
Mr. Al Sutherland/National Science Foundation
Dr. Hank Revercomb/University of Wisconsin
Dr. Charles Stearns/University of Wisconsin


-76
-78
-74
-72
30
95
100
105
110
115
Tracks for F1
Tracks for F2
Tracks for F3
Tracks for F4
NOAA-17 VISIBLE IMAGE 3 JAN 03 07:00 UTC (AMRC:SSEC:UW-MADISON) 00-202-0

Physical Science Laboratory

NATIONAL SCIENTIFIC BALLOON FACILITY
P.O. Box 319
Palestine, Texas 75802-0319
Area (903) 729-0271

NEW MEXICO STATE UNIVERSITY

19 March 2003

Mr. Hank Revercomb
1011 Atmospheric,Oceanic, and Space Sciences
Space Science and Engineering Center (SSEC)
University of Wisconsin
1225 West Dayton Street
Madison, WI 53706

Dear Mr. Revercomb:

I want to take this opportunity to express my sincere appreciation for the support that was provided to the National Scientific Balloon Facility (NSBF) by your meteorologist, Matthew Lazzara, during the NASA 2002-2003 Antarctic Long Duration Balloon Campaign. The support Matthew provided to us was outstanding in all respects.

The NSBF completed the campaign in late January with two successful launches from Williams Field. The first flight (ATIC/LSU) made a transit around the continent in 474 hours and was successfully terminated on the plateau west of Terra Nova Station, Antarctica. Our second flight remained aloft for 358 hours before being terminated south of Dome Fuji Automatic Weather Station (AWS) on the Valkyrie Plateau. The second flight was exceptionally successful with data being returned from detectors operating at unheard of sensitivity. When published, the results from both these flights are expected to gain worldwide scientific attention.

We are especially grateful for the timely satellite imagery and AWS reports that Matthew provided to us during the planning and execution of both of these payload termination and recovery evolutions. His data were extremely valuable and materially aided my staff in their decision-making. The real-time AWS data from Dome Fjui was a critical element in our decision to successfully terminate that flight in this very remote area of the Antarctic.

During the campaign there were some informal, and very preliminary discussions with Matthew regarding the possibility of establishing an "on-continent" WEB site. As envisioned, this site would contain data that could be very valuable to the NSBF meteorologist at Willliams Field. We would look forward to having this capability .

We expect to return to Antarctica later this year for another flight season and look forward to renewing our relationship with Matthew once again.

Sincerely,

DBall

Danny Ball, Site Manager
National Scientific Balloon Facility

cc: Dr. Karl Erb
Dr. Bernard Lettau
Mr. Al Sutherland
[redacted]
Ms. Terri Gregory

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,

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

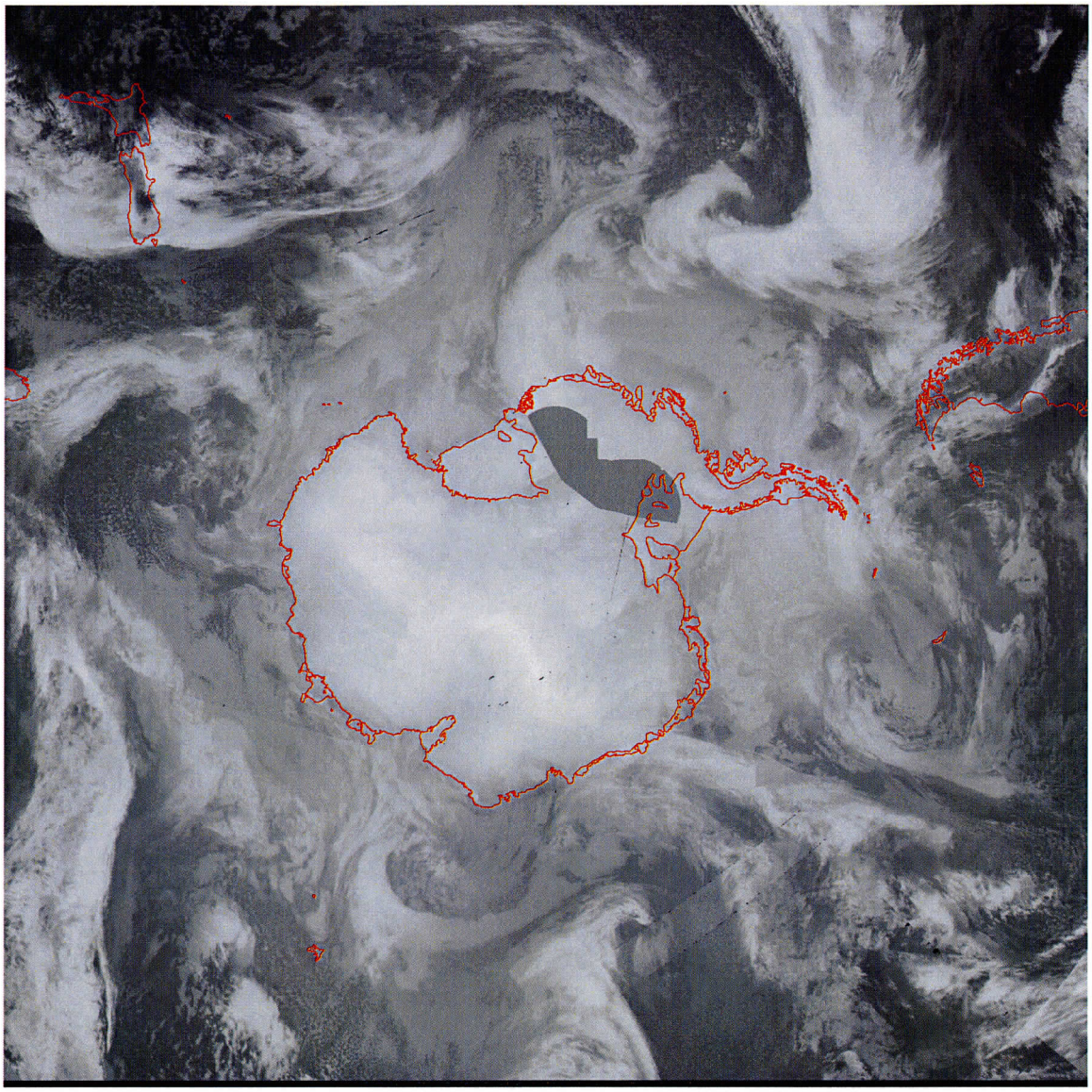


Figure 1. This is an example infrared Antarctic composite satellite image with the improvements of higher resolution and improved polar orbiter coverage over the Antarctic continent interior. The gray area in West Antarctica is missing data in this example. (2003)

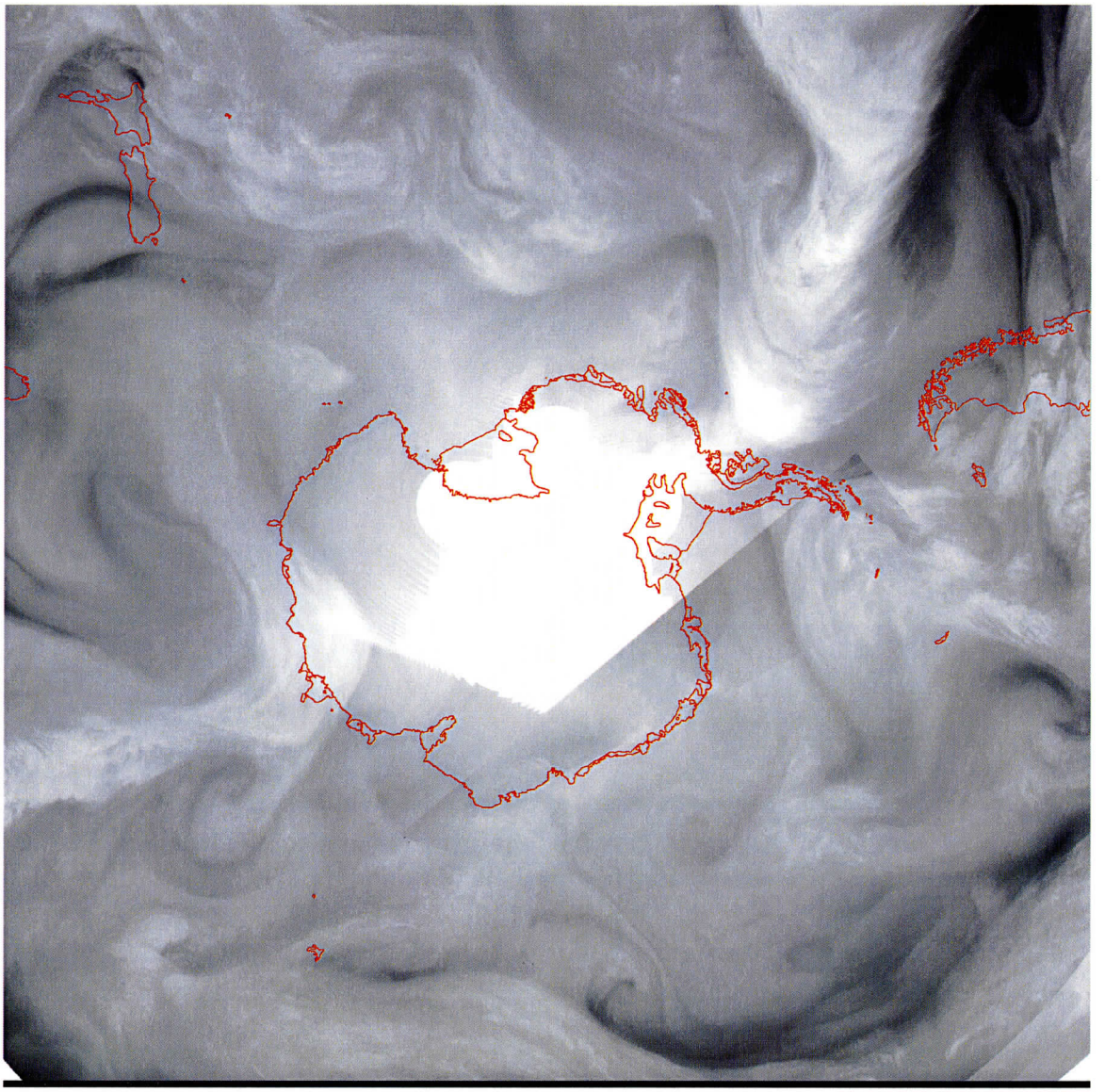


Figure 2. This is a sample Antarctic water vapor satellite composite image with MODIS data added over Queen Maud Land. (2003)

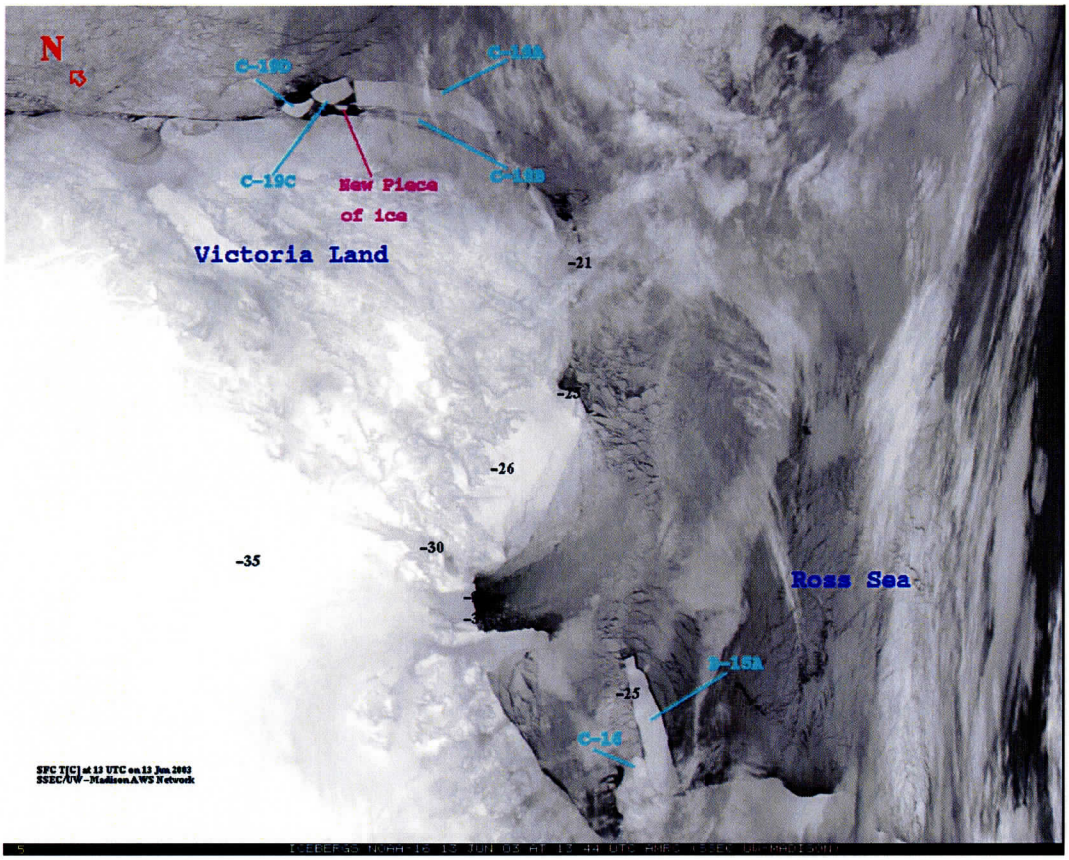
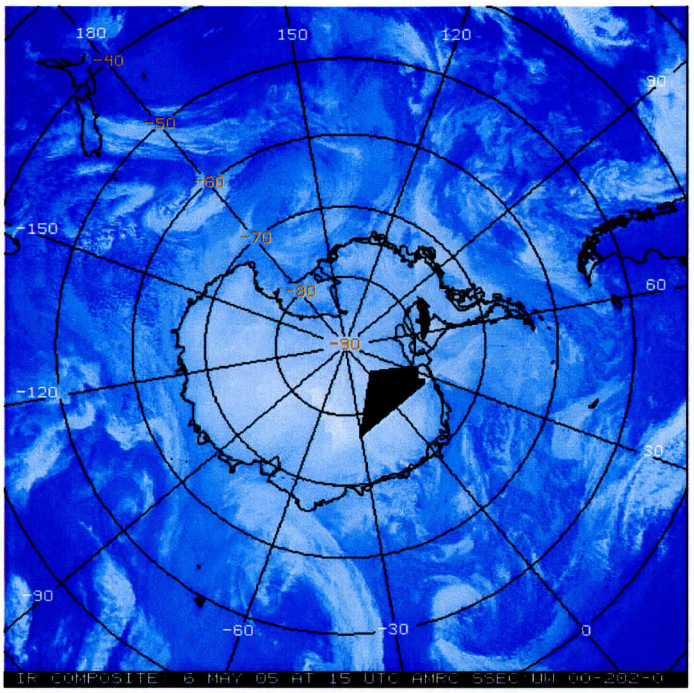
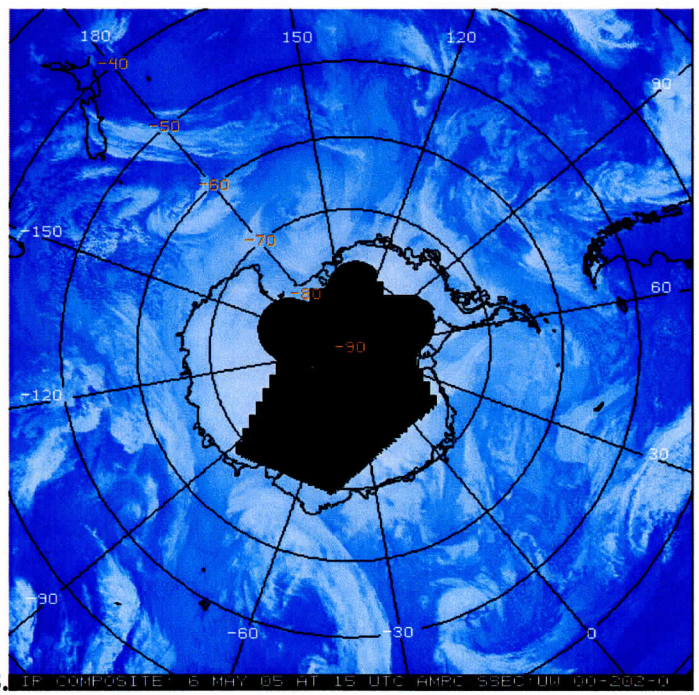


Figure 3. A sample NOAA-16 infrared image used to monitor and depict the location of tabular icebergs in the Ross Sea and Victoria Land region. (2003)



A.



B.

Figure 4. 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. (2005)

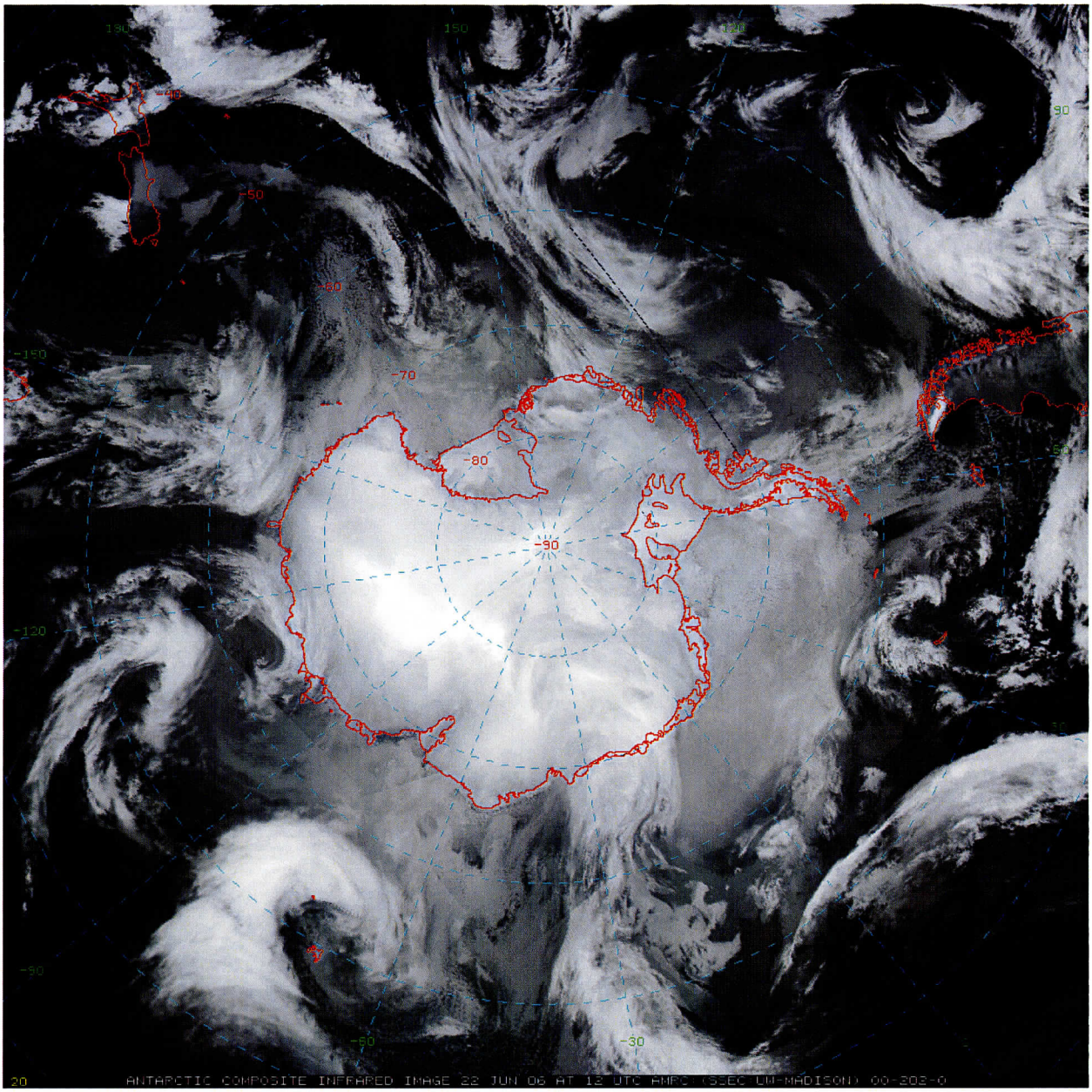


Figure 5. This sample Antarctic infrared composite satellite image is made from GOES-11, -12; Meteosat-5, and -8; FY2-C; Aqua and Terra; and NOAA-15, -17, and -18 satellites and with improvements from the additional satellites of MTSAT-1R. (2006)

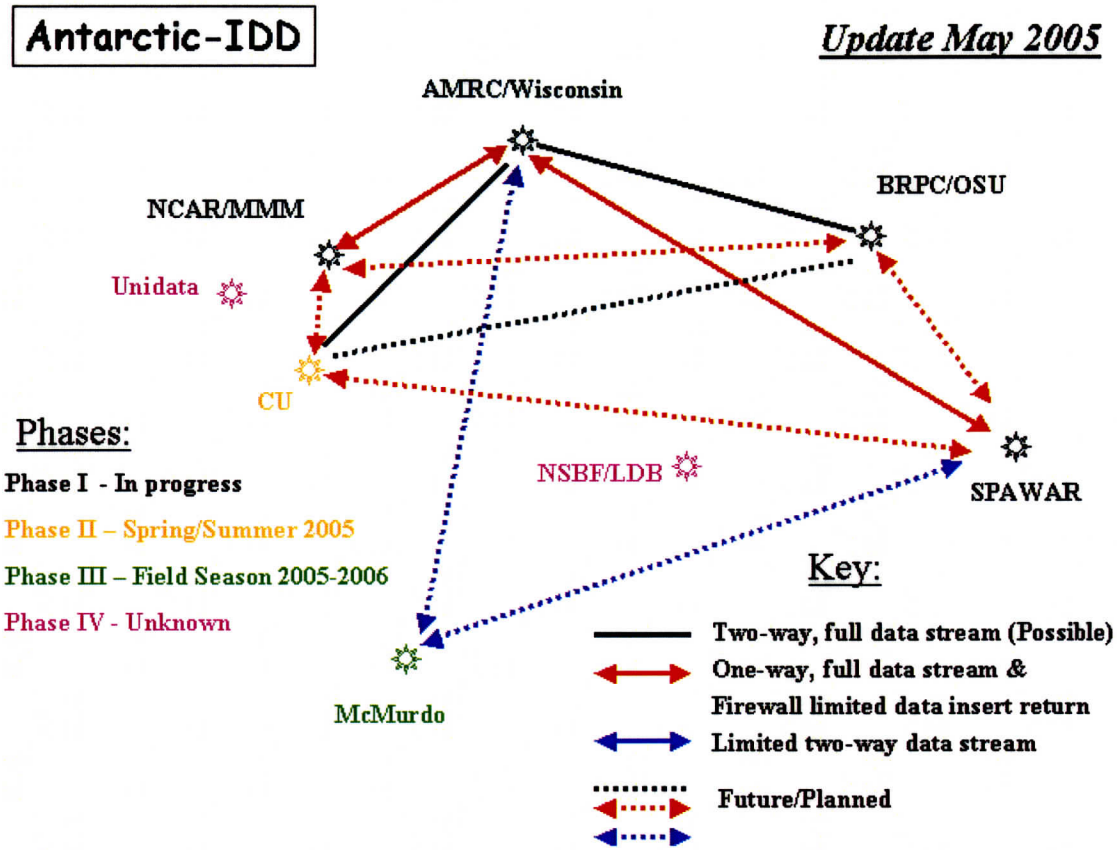


Figure 6. This diagram depicts the Antarctic-Internet Data Distribution (Antarctic-IDD) system depicting the initial formation of the network.

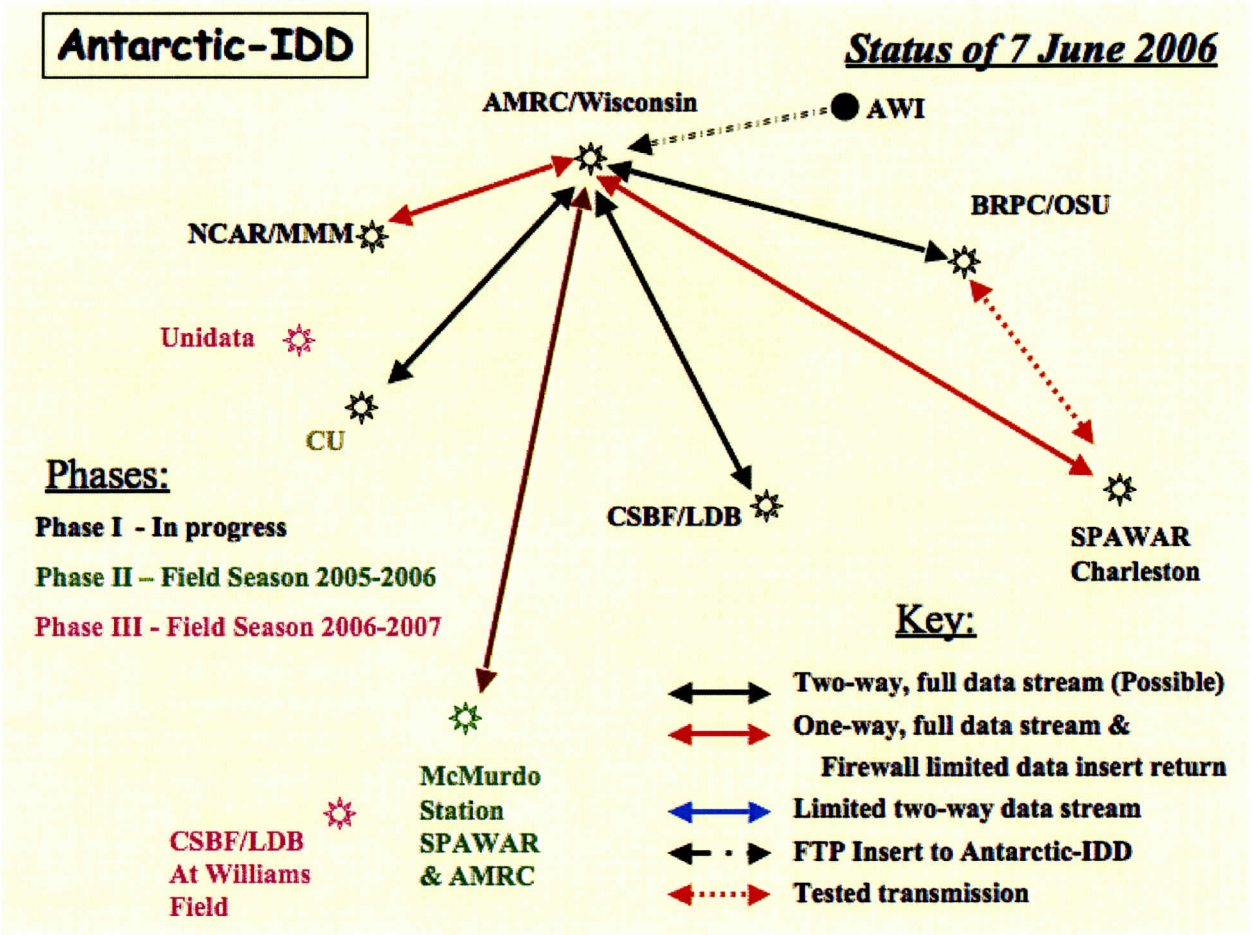


Figure 7. This diagram depicts the Antarctic-Internet Data Distribution (Antarctic-IDD) system as of 7 June 2006.

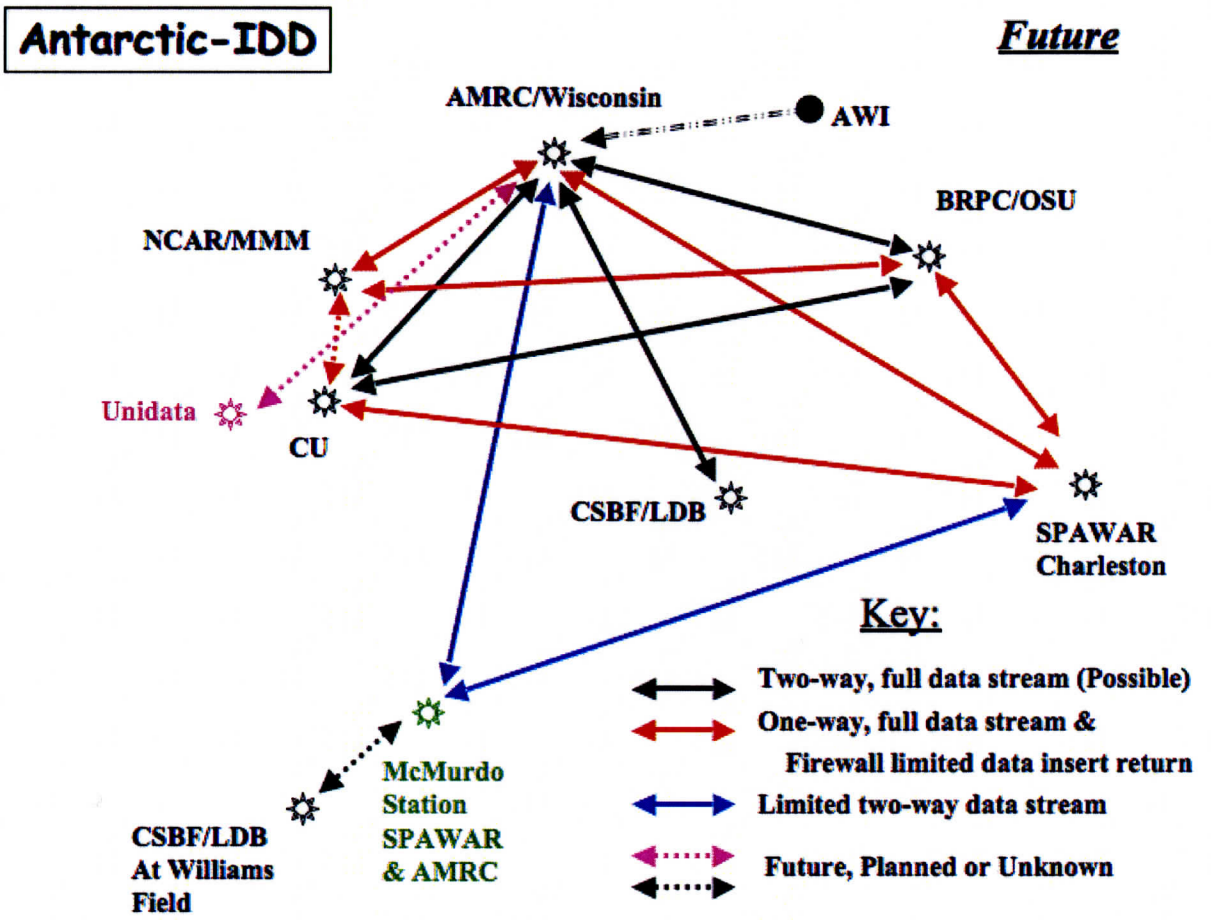


Figure 8. This diagram depicts the Antarctic-Internet Data Distribution (Antarctic-IDD) system as it is planned for the near future, including a more robust network topology. Work is underway today toward meeting this goal.

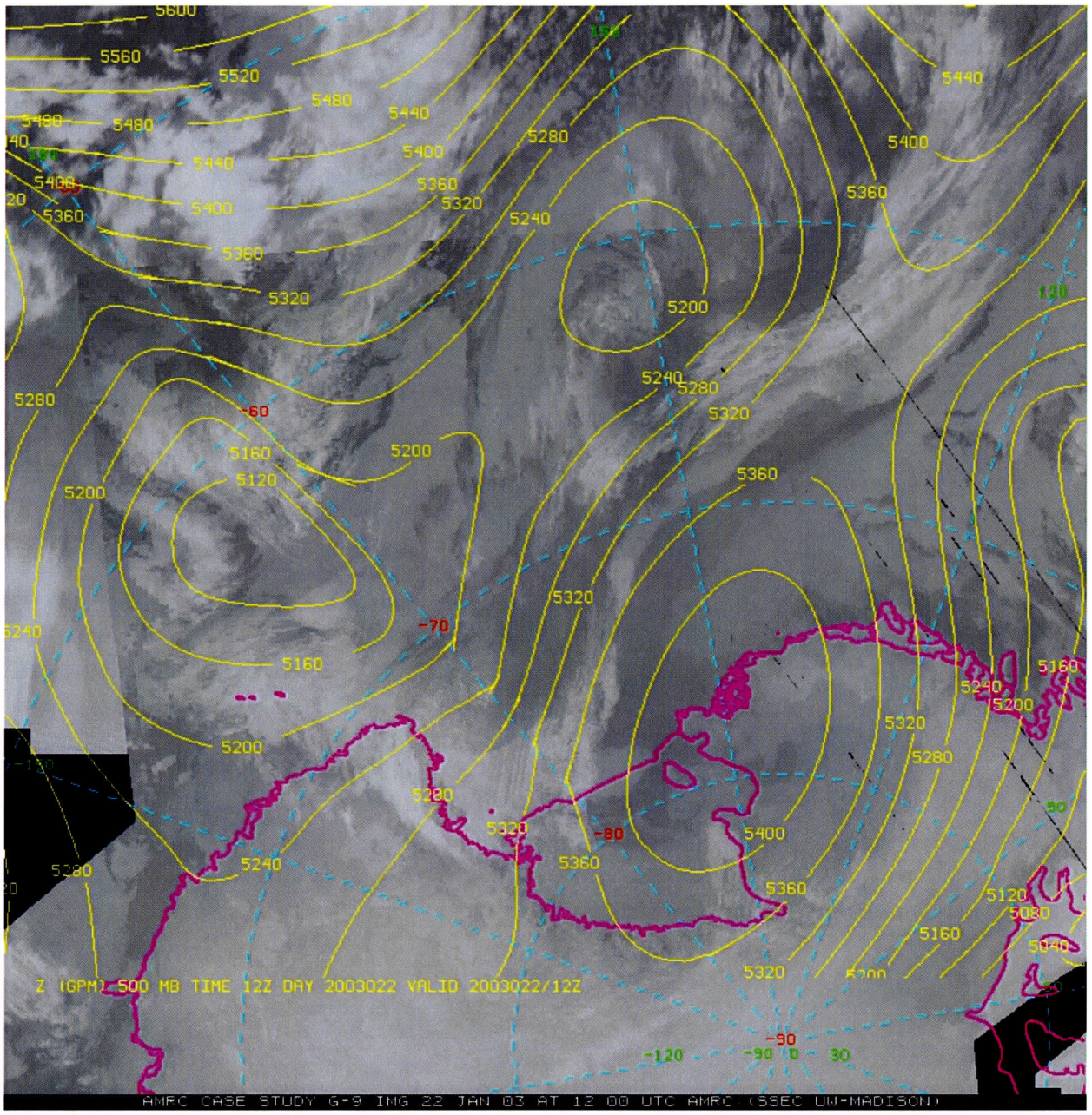


Figure 9. An Antarctic infrared composite satellite image with matching 500 hPa ECMWF model analysis heights from 12 UTC on 22 January 2003. This view shows a significant storm impacting McMurdo Station, Antarctica on Ross Island. (2003)

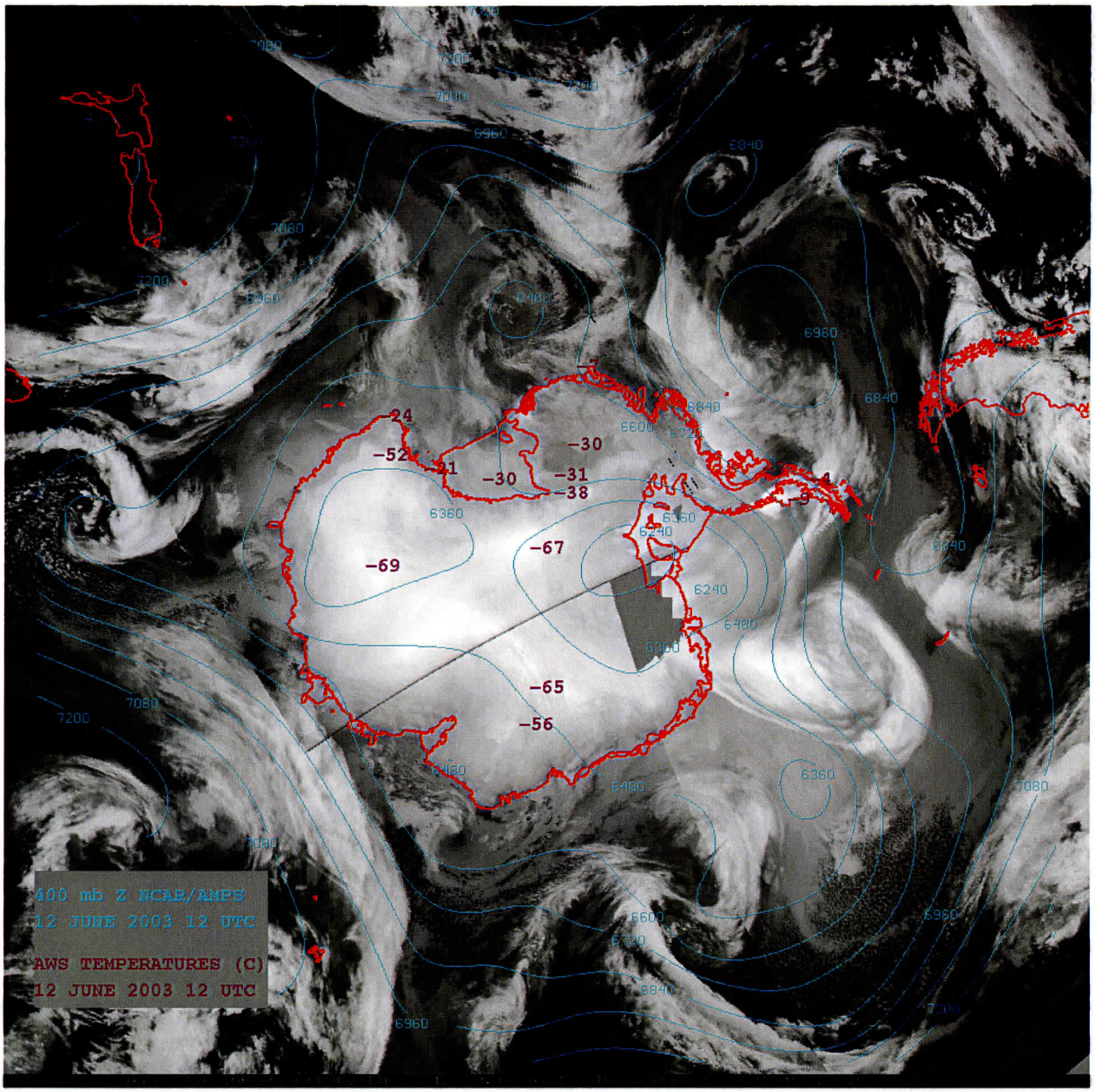


Figure 10. This display shows an example of data fusion by contouring Antarctic Mesoscale Prediction System 400 hPa heights and plotting temperatures from Automatic Weather Stations on top of an infrared Antarctic composite satellite image from 12 June 2003 at 12 UTC. (2003)

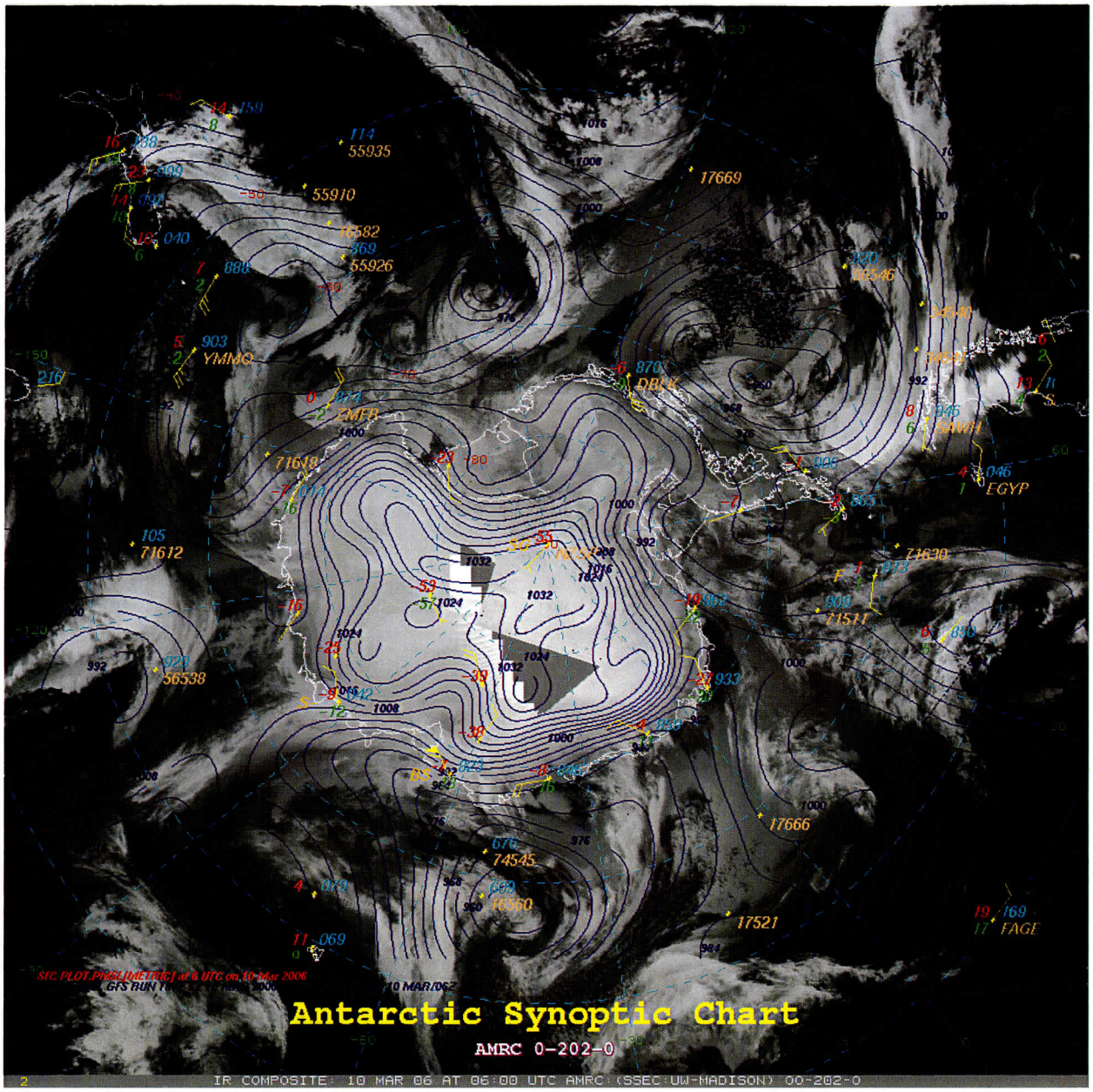


Figure 11. A sample Antarctic synoptic chart using the AMRC signature Antarctic composite infrared satellite image, overlain with synoptic and ship/buoy observations combined with NCEP's Global Forecast System model isobaric analysis. (2006)

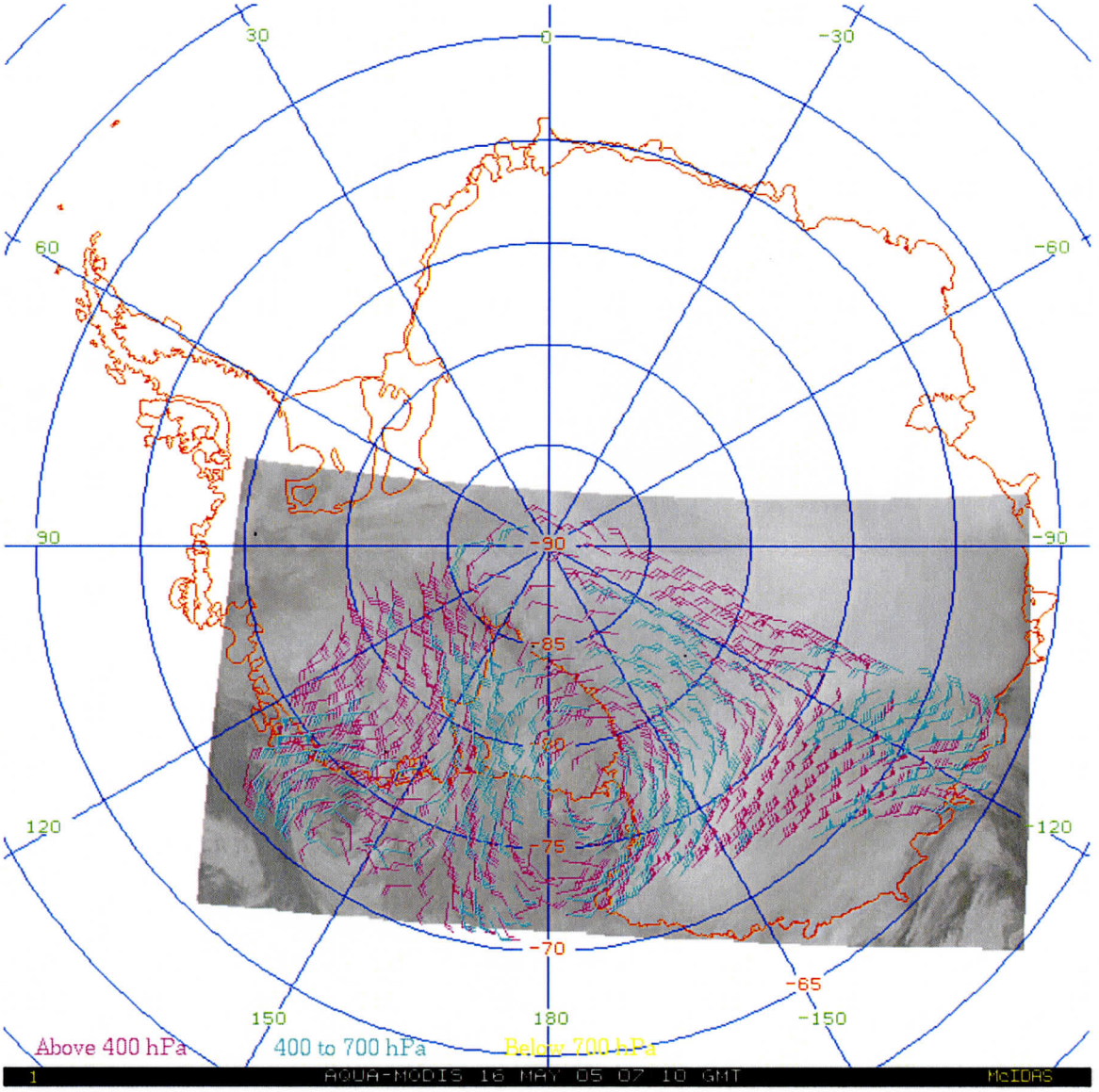


Figure 12. A sample infrared satellite image from the MODIS sensor on the Aqua satellite is overlain with satellite-derived winds, computed from the prior three Aqua passes. (*Image Courtesy of Jeff Key, NOAA/NESDIS/CIMSS*) (2005)

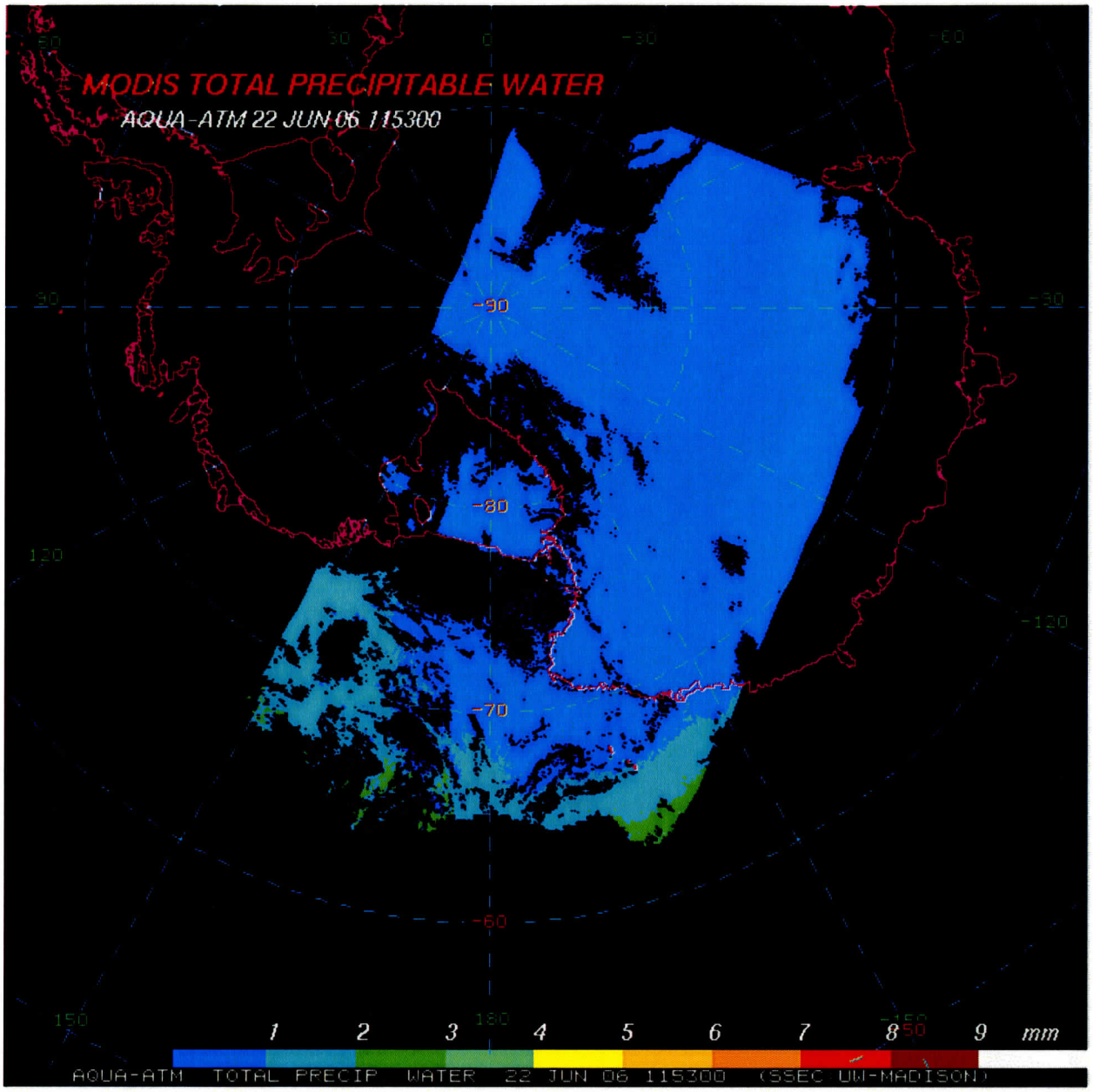


Figure 13. A sample total precipitable water product image from the MODIS sensor on the Aqua satellite, received and processed with the new X-band direct broadcast readout system at McMurdo Station. (2006)

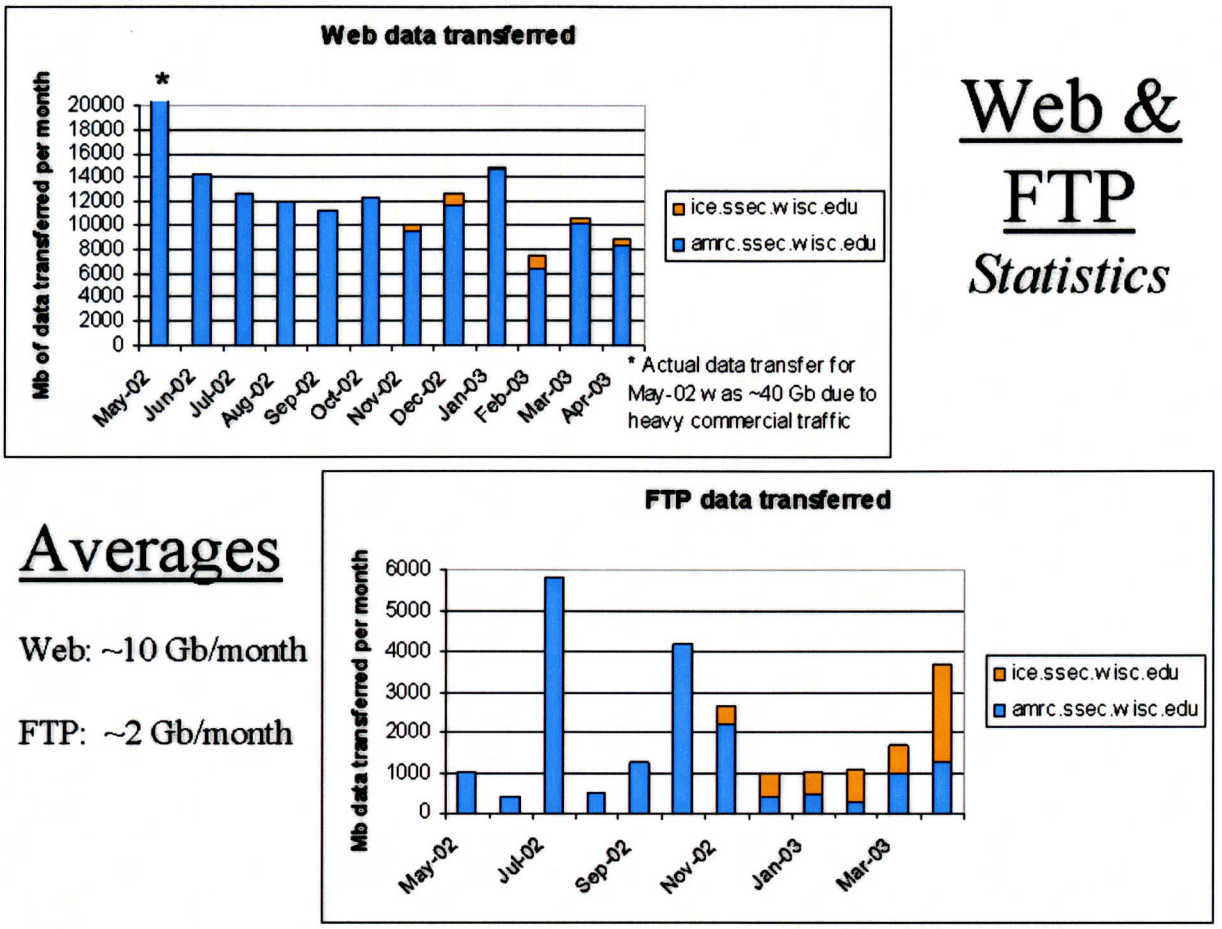


Figure 14. This display of AMRC Web and FTP Internet site statistics depicts the activity of these sites. The variable usage of the FTP is due to variable sized data requests posted to this site at the request of interested users. (2002-2003)

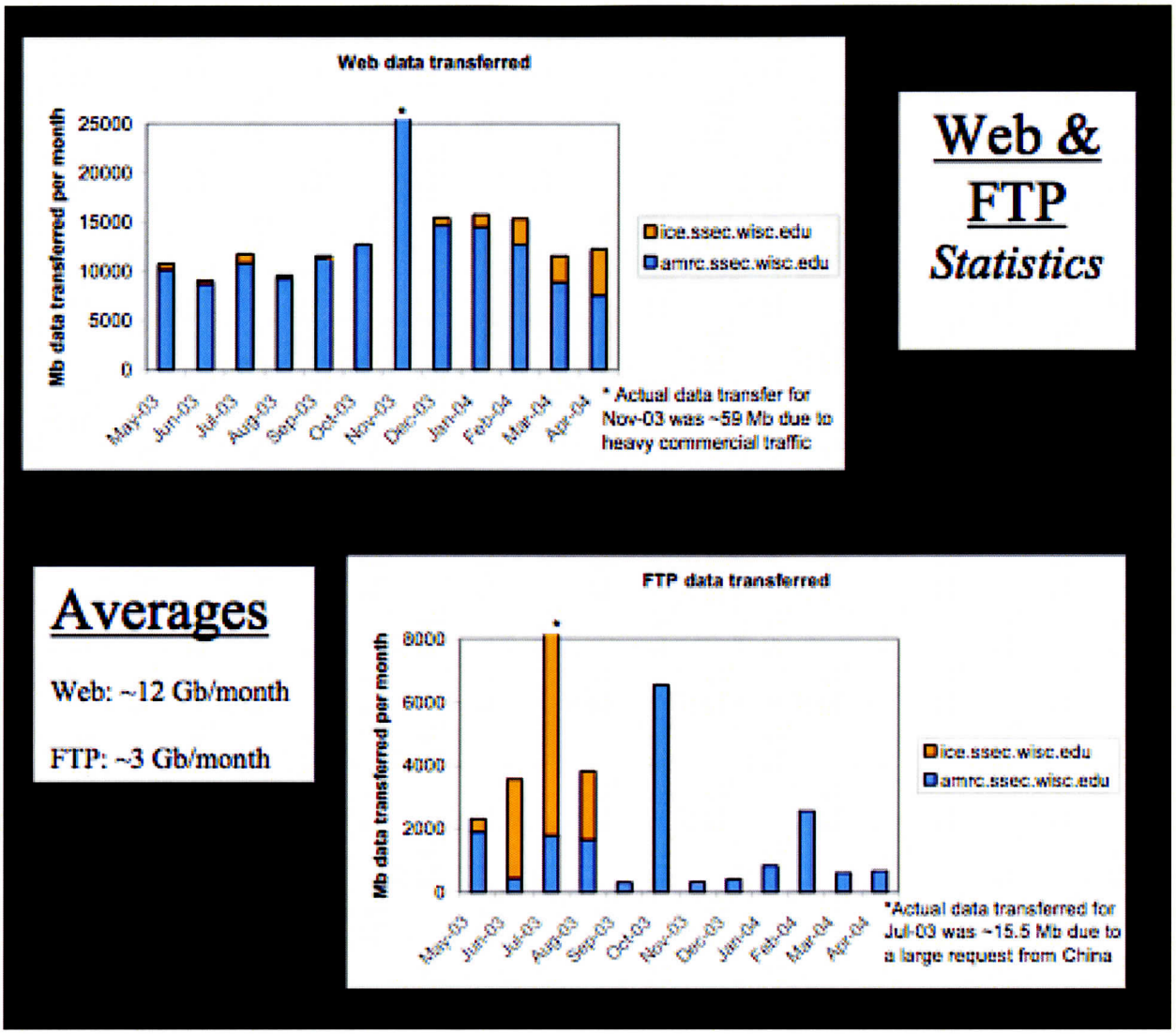
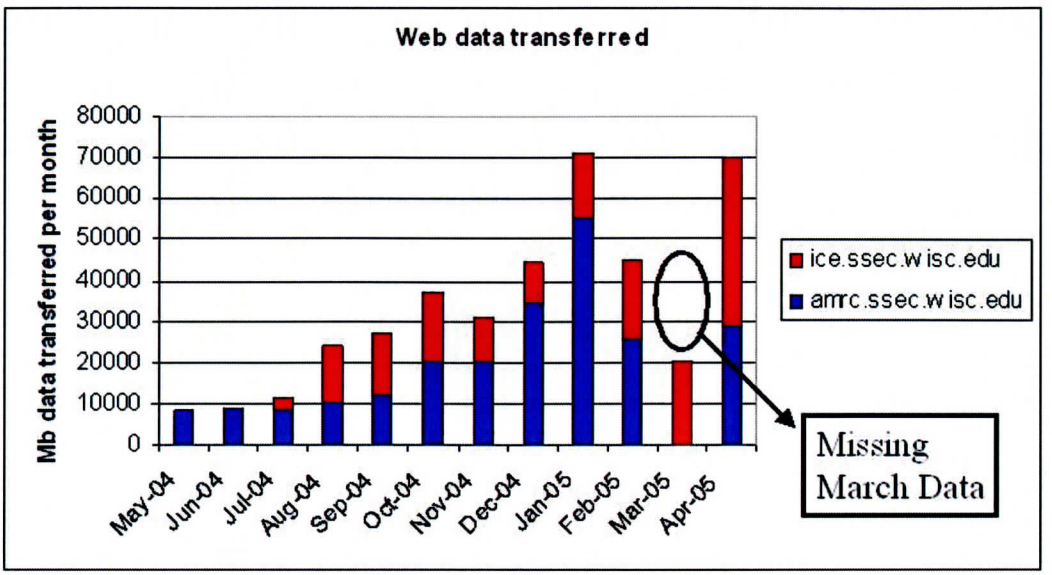


Figure 15. The AMRC Web and FTP Internet site statistics depicts the activity of these sites for the 2003-2004 year. The variable usage of the FTP site is due to variable sized data requests posted to this site at the request of interested users. (2003-2004)

Web Site Statistics



FTP Site Statistics

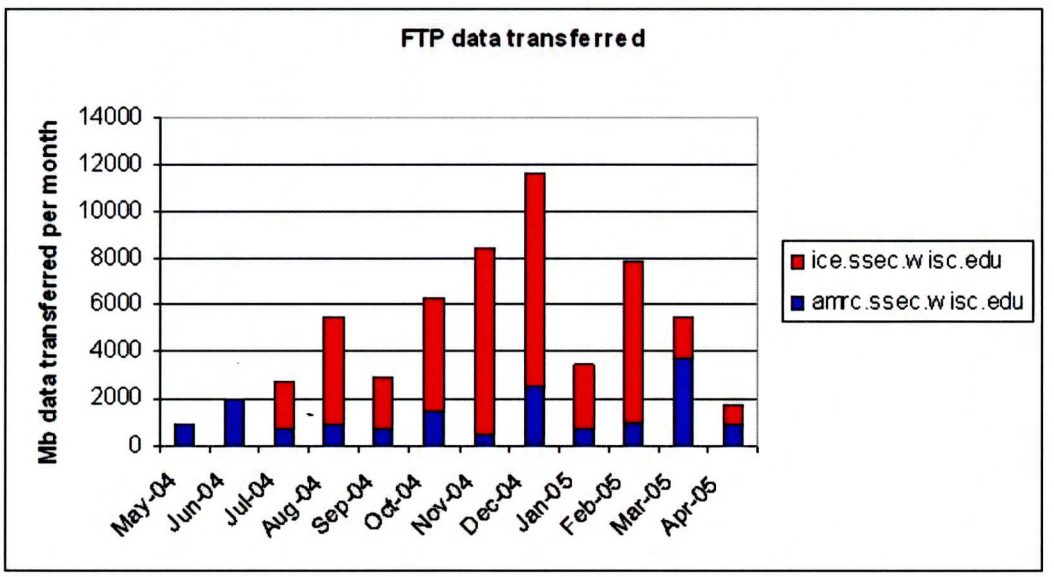


Figure 16. This figure depicts the Web and FTP server statistics for AMRC's two server systems for 2004-2005. (2004-2005)

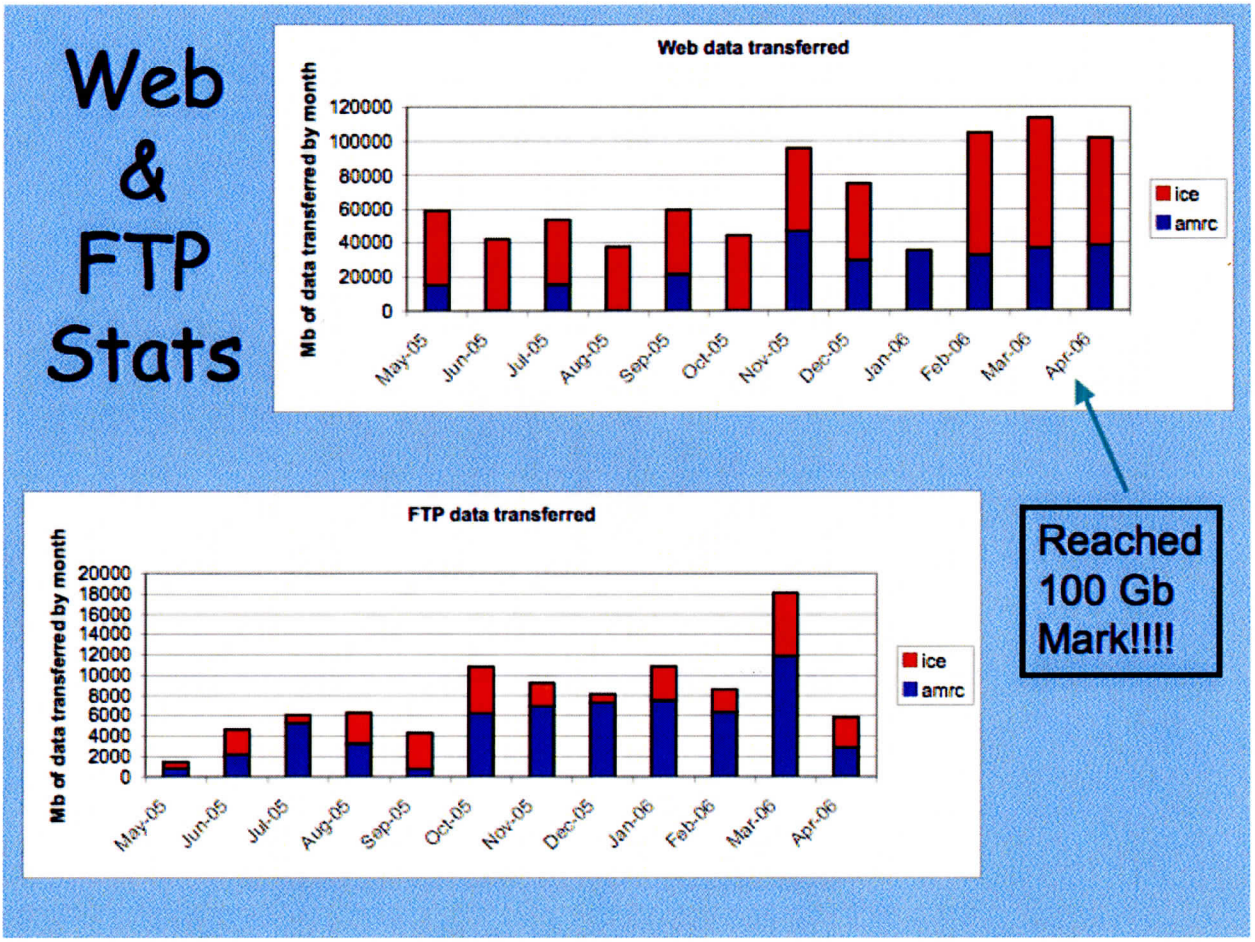


Figure 17. This figure depicts the Web and FTP server statistics for AMRC's two server systems for the 2005-2006 year. Note that the amount of data served per month has exceed the 100 Gb mark. (2005-2006)