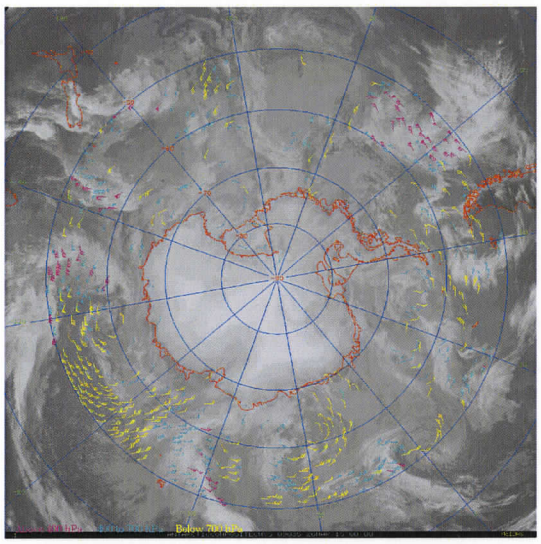
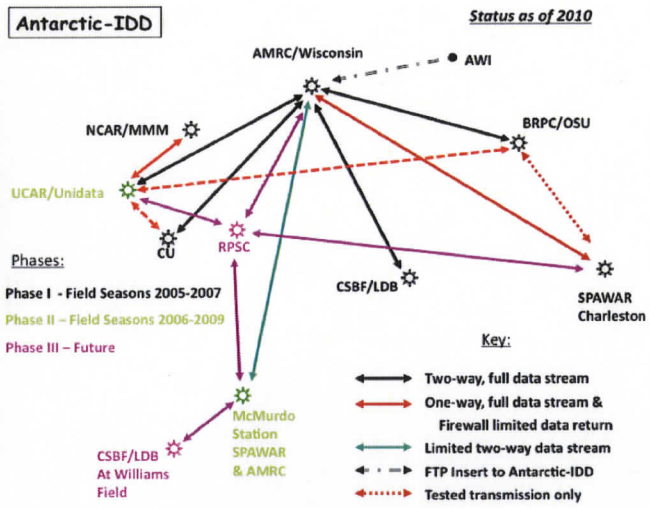
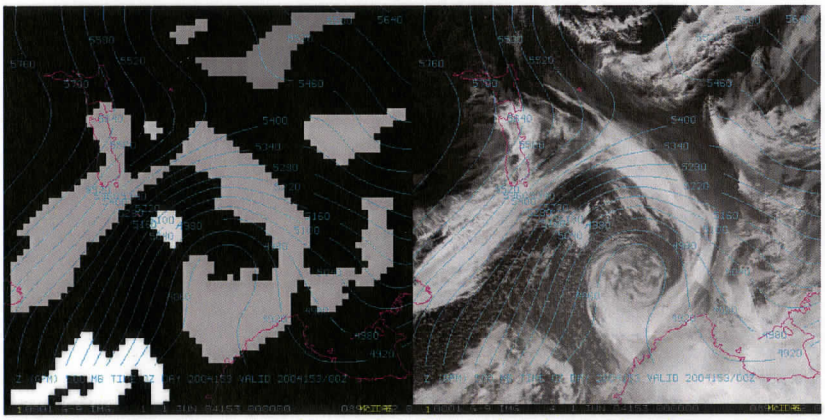
AMRC Final Project Report: NSF-OPP Grant #0537827, June 1, 2006 to May 31,2010

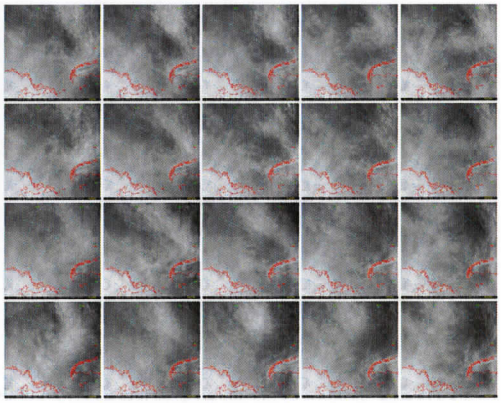
Collaborative Research:
Antarctic Meteorological Research Center (2006-2009)

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









Dr. Matthew A. Lazzara, Principal Investigator and Meteorologist
Dr. David B. Reusch, co-Principal Investigator
Professor Charles R. Stearns, Principal Investigator Emeritus

Space Science and Engineering Center
University of Wisconsin-Madison

Earth and Environmental Sciences Institute
The Pennsylvania State University

Submitted on June 17, 2010

Final Report for Period: 06/2009 - 05/2010
Submitted on: 06/17/2010
Principal Investigator: Lazzara, Matthew A.
Award ID: 0537827
Organization: U of Wisconsin Madison
Submitted By:
Lazzara, Matthew - Principal Investigator
Title:
Collaborative Research: Antarctic Meteorological Research Center (2006-2009)

Project Participants

Senior Personnel

Name: Lazzara, Matthew
Worked for more than 160 Hours: Yes
Contribution to Project:
Matthew Lazzara works on the day to day activities of the AMRC including program management, data management, data requests, consulting, product generation oversight and data flow. His role includes project lead, educational outreach and coordination with other associated communities. In addition, he has coordinated the modernization of AMRC's computing systems. This portion of the AMRC effort was completed by Spring 2008, as Matthew Lazzara moved into the role of Principal Investigator.

Name: Lazzara, Matthew
Worked for more than 160 Hours: Yes
Contribution to Project:
As of the summer of 2008, Dr. Matthew Lazzara assumed the role of Principal Investigator, in addition to his duties overseeing the day to day activities of the AMRC. Effort in the last year included development of hourly Antarctic composite generation, working with staff on atmospheric motion vector generation from the Antarctic composite, working with staff on storm tracking and South Pole climatology, working with collaborators on the composite satellite SOM, maintenance of AMRC processing and archiving systems. This undertaking has continued, and he has been working on draft papers for publication on the efforts accomplished as a part of this project.

Name: Knuth, Shelley
Worked for more than 160 Hours: Yes
Contribution to Project:
Shelley Knuth has worked on day to day activities of the AMRC, including data management, data requests, educational outreach activities and questions. In addition, she oversees the AMRC web and FTP sites, case study collection and is expanding into product generation and data flow management. As of the last year of this project, Shelley has left U. Wisconsin to pursue graduate studies at the University of Colorado-Boulder.

Name: Keller, Linda
Worked for more than 160 Hours: Yes
Contribution to Project:
Linda Keller has worked on applying storm track methods utilizing the Antarctic composite satellite imagery. She has also worked on analyzing the climatology of South Pole Station.

Post-doc

Graduate Student

Undergraduate Student

Name: Asuma, Jonas

Worked for more than 160 Hours: Yes

Contribution to Project:

Jonas Asuma's role has included the digitization of meteorological metadata records, assistance with web and ftp site management, data archival, and he also expanded into case study collections and satellite monitoring activities, as well as generation of Antarctic satellite composite displays over the full archive of imagery.

Name: Hodkiewicz, Jonathan

Worked for more than 160 Hours: No

Contribution to Project:

Jon Hodkiewicz has assisted the project with clerical needs for the AMRC project

Name: Mimier, Julia

Worked for more than 160 Hours: No

Contribution to Project:

Julia has assisted the AMRC effort with clerical assistance.

Name: Oswalt, Jacqueline

Worked for more than 160 Hours: No

Contribution to Project:

Jacqueline has assisted the AMRC effort with clerical assistance.

Name: Rowe, Shellie

Worked for more than 160 Hours: No

Contribution to Project:

Shellie has worked on maintenance of the AMRC web site and blog.

Name: Welhouse, Lee

Worked for more than 160 Hours: Yes

Contribution to Project:

Lee has worked with the AMRC during the summer of 2008 to assist with data archiving and data display/processing activities.

Name: Schroeder, Nicole

Worked for more than 160 Hours: Yes

Contribution to Project:

Nicole works on the routine management of AMRC datasets, and is working to document AMRC procedures. Additionally she handles occasional data requests and works on compiling corroborating information for USAP station climatology effort. She has also created a full collection of AMRC signature satellite composite imagery for the future new AMRC web portal.

Name: Rasmussen, David

Worked for more than 160 Hours: No

Contribution to Project:

DJ is undertaking the creation of long sequence Antarctic composite movies to made available on AMRC's new future web portal. He is also analyzing significant weather, specifically wind events, in the McMurdo area.

Name: Gebre, Embibel

Worked for more than 160 Hours: No

Contribution to Project:

Embibel assisted with the AMRC Web site.

Name: Uttech, Zach

Worked for more than 160 Hours: No

Contribution to Project:

Zach has participated in this project with the maintenance of the AMRC data streams and providing help with the storm tracking data transformations.

Name: Willmot, Kathleen

Worked for more than 160 Hours: No

Contribution to Project:

K. Elena Willmot has been overseeing the distribution and organization of AMRC data sets on a routine basis, as well as assisting with the AMRC Web site.

Technician, Programmer

Name: Bellon, Willard

Worked for more than 160 Hours: No

Contribution to Project:

Bill Bellon assisted with web site design and maintenance for the AMRC project.

Name: Nolin, Scott

Worked for more than 160 Hours: No

Contribution to Project:

Scott Nolin has assisted with the acquisition, setup, and maintenance of AMRC computing, especially meeting the NSF guidelines for USAP IT for AMRC's computing in Antarctica.

Name: Dworak, Richard

Worked for more than 160 Hours: Yes

Contribution to Project:

Rich Dworak has worked with the PI on implementing the atmospheric motion vector software and associated validation effort.

Name: Baggett, Kevin

Worked for more than 160 Hours: No

Contribution to Project:

Kevin has assisted with the AMRC project with McIDAS-X expertise.

Name: Heinzelman, Jay

Worked for more than 160 Hours: No

Contribution to Project:

Jay has provided training to AMRC students on the use of McIDAS.

Name: Kohrs, Richard

Worked for more than 160 Hours: No

Contribution to Project:

Rick has worked on some McIDAS software that will enable the AMRC signature composites to be interleaved as a single file, rather than be individual files for each type (infrared, water vapor, etc.) of composite. Rick has also been developing improved means for generating visible satellite composites.

Other Participant

Name: Tucker, Camillia

Worked for more than 160 Hours: No

Contribution to Project:

Camie Tucker supported this project with clerical support and assistance.

Research Experience for Undergraduates

Organizational Partners

The Pennsylvania State University

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

Other Collaborators or Contacts

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

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

The AMRC collaborates with Dr. Jeff Key of NOAA/NESDIS/CIMSS on the real-time generation of AMVs (Polar winds) from MODIS observations received at McMurdo Station for input to real-time numerical modeling efforts, including the Antarctic Mesoscale Prediction System (AMPS).

Special effort, as a part of AMRC's case study work, in the first two years of this project was assisting in the study of the May 2004 severe wind event with Daniel Steinhoff at BRPC/OSU.

Activities and Findings

Research and Education Activities:

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

The following activities have accented this grant:

1. The modernization of AMRC computing equipment. This effort has occurred in phases, with the past (2009) effort modernizing computing in Antarctic at McMurdo Station completed (Palmer Station was completed in 2008). These efforts have benefited the USAP by offering data and weather displays to those on-station and reducing bandwidth use to sites off station. These newer systems also require less care by on station staff, and are able to meet USAP IT and information security regulations.

2. The continuation of AMRC data collection, generation, archive and distribution efforts, including specialized data requests for Antarctic meteorological data, such as satellite imagery for research and education as well as for field programs. Efforts in the area of the Antarctic-IDD continue as well. Data distribution via the web and FTP services run between 60 to approximately 120 gigabytes per month. Antarctic-IDD offers approximately 7 gigabytes per day. On-line archives range on the order of 3.9 Tb to 4.3 Tb.

3. Engaged in active collaboration with Dr. David Reusch at Penn State University, including preprocessing and post-processing satellite composites for SOM research.

4. Generating and evaluating atmospheric motion vectors (AMVs) from the AMRC's Antarctic satellite composites. This project also had the mutual benefit of the increase in the temporal resolution of the satellite composites.

5. Efforts continue in gathering together complete climatology information for South Pole and McMurdo Station including historical climate summary information, metadata information, etc. South Pole efforts are closely worked on with South Pole Meteorology Office. McMurdo efforts are closely worked on with SPAWAR Office of Polar Programs.

6. Continued grassroots educational outreach efforts expanded beyond traditional K-12 students arenas to general public venues. An evaluation of the effectiveness of AMRC's outreach efforts was explored. Two methods were employed: gather post outreach evaluations from outreach hosts in the form of a questionnaire, and in one middle school investigated changes in students conceptions of Antarctic meteorology and Antarctic science after the outreach effort.

7. Continued to be a principal co-host for the Antarctic Meteorological Observation, Modeling and Forecasting Workshop (AMOMFW), held in Boulder, Colorado in 2006, Rome, Italy in 2007, Madison, Wisconsin in 2008; Charleston, South Carolina in 2009; and Columbus, Ohio in 2010.

8. The Antarctic composite satellite imagery has been used to test methods to track cyclones in the Southern Hemisphere.

9. The publications are in the process of preparation as the result of activities associated with this project.

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

The findings for each of the above activities are the following, respectively:

1. AMRC's computing hardware has been modernized as of the spring of 2009.

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

3. SOM efforts are summarized in Dr. David Reusch's annual reports.

4. The generation of atmospheric motion vectors (AMVs) from newly available hourly

Antarctic composites has been successfully demonstrated and is routinely generated. (See figure for additional description) This is a significant accomplishment, as the Antarctic composite derived AMVs will offer wind information over a portion of the earth presently not covered by geostationary or polar orbiting AMV data sets. They in turn may have application for numerical modeling and aiding directly in flight forecasting.

5. In conjunction with efforts with RPSC and South Pole Meteorology Office, corrected local climate data summaries are now available from AMRC's servers. Efforts to digitize corroborating historical climatological information for South Pole, McMurdo Station and other USAP stations is nearing completion, and will now allow a more complete analysis of McMurdo Station's climatology to proceed in the future. Time-order issues with South Pole's meteorological dataset have been recently been identified and are in the process of being analyzed and corrections will be forth coming.

6. AMRC's educational outreach horizons have continued to impact to both traditional K-12 students and the public. A more formal collection of feedback has had an initial response to AMRC outreach events being viewed as favorable. More feedback is need to gain a better handle on the effectiveness in the future. A focused investigation of AMRC's outreach efforts improving student's conception of Antarctic meteorology and Antarctic science shows that the effort does have an impact, but there is more to be done to more effective.

7. The AMOMFW continues to play key role in bringing together the broad Antarctic community - both research and operational interests participating.

8. Effort has been put into the use of satellite composite imagery to track cyclones in the Southern Hemisphere. Several techniques developed for studying cyclones in the Northern Hemisphere are used as a starting point. Degradation of the satellite image by averaging over blocks of pixels is being investigated as well as infrared thresholding at one brightness level. These techniques are being refined and in some cases rejected because of unacceptable results for the Southern Hemisphere. Threshold segmentation seems to be a better technique to isolate important cloud patterns using brightness thresholds between 150-170. Currently, the month of June, 2004 is being used to develop the method for identifying the cloud patterns and to test and refine thresholds and edge detection techniques to isolate and classify cyclone cloud patterns in the satellite imagery.

9. Publications as a result of all of AMRC's efforts are in preparation and will be submitted to peer reviewed journals as soon as practicably can be accomplished.

Training and Development:

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

* Two member's completion of a Bachelor's Degree
* One member's completion of a Master's Degree
* One member's completion of a PhD Degree
* First hand experience in computing, meteorological data and interactive processing for the project's five undergraduate student as well as the opportunity for two to deploy to McMurdo Station Antarctica.
* Computing, polar and satellite meteorology, public speaking & educational outreach opportunities for all project members

Outreach Activities:

One of the three pillars of the AMRC project is a grass roots educational outreach effort.

The following lists AMRC's outreach efforts in the last four years:

General Public:
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* SSEC Public Tours, UW-Madison, Madison, WI (multiple tours, including University of Wisconsin Science Expeditions/Open House)
* E-mails answering questions, offering information or providing data to students and the general public including special reports to classrooms and the general public during field deployments.
* Mount Horeb Public Library, Mount Horeb, WI
* Wednesday Night at the Lab, UW-Madison, Madison, WI
* Mount Horeb Cub Scouts, Mount Horeb, WI
* West Madison Cub Scouts, Madison, WI
* MidWest Severe Storm Tracking and Response Center, Inc., Monona, WI
* Wisconsin State Fair, West Allis, WI
* Deerfield Cub Scouts, Deerfield, WI (2 visits)
* University of the Air, Wisconsin Public Radio, Madison, WI
* West Madison Rotary Club, Madison, WI

University/College:
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* Madison Area Technical College, Madison, WI (multiple-visits)

Middle School:
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* Lodi Middle School, Lodi, WI (3 visits)
* Waunakee Intermediate School Family Science Night, Waunakee, WI

Elementary School:
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* Deerfield Elementary School, Deerfield, WI (3 visits)
* Sheboygan, WI (Elementary School)
* Pittsville, WI (Elementary School)
* Lincoln Elementary School, Madison, WI

Preschool:
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* UW Preschool Lab

McMurdo Station:

Wednesday Night Science Lecture (2 seasons)
Sunday Night Science Lecture

Journal Publications

Steinhoff, D.F., D.H. Bromwich, M. Lambertson, S.L. Knuth, and M.A. Lazzara, "A Dynamical Investigation of the May 2004 McMurdo Antarctica Severe Wind Event using", Monthly Weather Review, American Meteorological Society, p. 7, vol. 136, (2008). Published, 10.1175/2007mwr1999.1

Keller, L.M.;Baker, K.A.;Lazzara, M.A.;Gallagher, J., "A comparison of meteorological observations from South Pole Station before and after installation of a new instrument suite", Jounral of Atmospheric and Oceanic Technology, p. 1605, vol. 26, (2009). Published, 101175.2009JTECH1220.1

Lazzara, M.A., C.R. Stearns, S.L. Knuth, D.A. Santek, R.A. Kohrs, J. Robiadek, and N.A. Bearson, "Satellite composites: techniques in combining geostationary and polar orbiting observations", International Journal of Remote Sensing, p. , vol. , (2010). In preparation,

Lazzara, M.A. R. Dworak, D.A. Santek, J.R. Key, and J. Robaidek, "High Latitude Atmospheric Motion Vectors from Antarctic and Arctic Satellite Composite Imagery", Journal of Applied Meteorology and Climatology, p. , vol. , (2010). In preparation,

Keller, L.M., M.A. Lazzara, T. Markle, M. Carmody, and S. O'Reilly, "A 50 year climatology for Amundsen-Scott South Pole Station", International Journal of Climatology, p. , vol. , (2010). In preparation,

Rasmussen, D.J., L.M. Keller, and M. A. Lazzara, "An analysis of high wind events in the Ross Island region of Antarctica", Monthly Weather Review, p. , vol. , (2010). In preparation,

Keller, L.M., and M.A. Lazzara, "Tracking Southern Hemisphere Cyclones Using Composite Satellite Imagery", International Journal of Remote Sensing, p. , vol. , (2010). In preparation,

Books or Other One-time Publications

Matthew A. Lazzara, "A Diagnostic Study of Antarctic Fog", (2008). Thesis, Published
Bibliography: University of Wisconsin-Madison, Department of Atmospheric and Oceanic Sciences, Madison, WI, 2008, Call Number: UW MET Publication No.08.00.L1

Staude, Jessica A.; Stearns, Charles R.;
Lazzara, Matthew A.; Keller, Linda M., and
Ackerman, Steven A., "Poleward propagating weather systems in
Antarctica.", (2008). Conference Proceedings, Published
Bibliography: Antarctic Meteorological Observation,
Modeling, and Forecasting Workshop,
3rd, Madison, WI, 9-12 June 2008
(preprints). [Madison, WI]

Lazzara, Matthew A., Shelley Knuth,
Tim Retaino, Bob Vehorn, Dan
Steinhoff, Mark Seefeldt, Kevin
Manning and Robert Mullenax, "The Antarctic Internet Data Distribution
System 2008.", (2008). Conference Proceedings, Published
Bibliography: Antarctic Meteorological Observation,
Modeling, and Forecasting Workshop,
3rd, Madison, WI, 9-12 June 2008
(preprints).

Lazzara, Matthew A.; Ackerman, Steven
A., and Hillger, Donald W., "Antarctic fog depiction via satellite
analysis.", (2008). Conference Proceedings, Published
Bibliography: Antarctic Meteorological Observation,

Modeling, and Forecasting Workshop,
3rd, Madison, WI, 9-12 June 2008
(preprints).

Lazzara, Matthew A.; Knuth, Shelley L.;
Asuma, Jonas V.; Stearns, Charles R., and
Reusch, David B., "Status of the Antarctic Meteorological
Research Center.", (2008). Conference Proceedings, Published
Bibliography: Antarctic Meteorological Observation,
Modeling, and Forecasting Workshop,
3rd, Madison, WI, 9-12 June 2008
(preprints).

Lazzara, Matthew A., " A diagnostic study of Antarctic fog.", (2007). Conference Proceedings, Published
Bibliography: International Conference on Fog, Fog
Collection and Dew, 4th, La Serena,
Chile, 22-27 July 2007. Program and
abstracts. Santiago, Chile, Pontificia
Universidad Catolica

Lazzara, Matthew A.; Knuth, Shelley L.;
Stearns, Charles R., and Keller, Linda M., "Status of the Antarctic Meteorological
Research Center 2005-2006.", (2006). Conference Proceedings, Published
Bibliography: Antarctic Meteorological Observation,
Modeling, and Forecasting Workshop,
National Center for Atmospheric
Research (NCAR), Boulder, CO, 13-15
June 2006 (preprints)

Steinhoff, Daniel F.; Bromwich, David H.;
Lambertson, Michelle; Knuth, Shelley L.,
and Lazzara, Matthew A., "A dynamical investigation of the May
2004 McMurdo Antarctica severe wind
event.", (2006). Conference Proceedings, Published
Bibliography: Antarctic Meteorological Observation,
Modeling, and Forecasting Workshop,
National Center for Atmospheric
Research (NCAR), Boulder, CO, 13-15
June 2006 (preprints).

Straka, William III; Key, Jeff; Lazzara,
Matthew ; Santek, Dave; Gumley, Liam,
and Strabala, Kathy., "Satellite-derived wind, cloud, and surface
products at direct broadcast sites in the
Antarctic and Arctic.", (2006). Conference Proceedings, Published
Bibliography: Antarctic Meteorological Observation,
Modeling, and Forecasting Workshop,
National Center for Atmospheric
Research (NCAR), Boulder, CO, 13-15
June 2006 (preprints). Boulde

Lazzara, Matthew; Dworak, Richard;
Santek, David; Velden, Chris and Key,
Jeffrey, "High latitude atmospheric motion vectors:
Applications for Antarctic and Arctic

composite satellite imagery.", (2010). Conference Proceedings, Published
Bibliography: International Winds Workshop, 10th,
Tokyo, Japan, 22-28 February 2010.
University of Wisconsin-Madison,
Cooperative Institute for
Meteorological Satellite Studies
(CIMSS)

Keller, Linda M.; Lazzara, Matthew A.;
Baker, Kathie A. H. and Gallagher, John., "South Pole meteorological
modernization: A comparison before
and after installation of a new
instrumentation suite.", (2009). Conference Proceedings, Published
Bibliography: Antarctic Meteorological Observation,
Modeling, and Forecasting Workshop,
4th, Charleston, SC, 14-16 July 2009
(preprints).

Seefeldt, Mark W.; Yoksas, Tom and
Lazzara, Matthew A., "Real-time and archived Antarctic
meteorological data via a synergy of
interactive processing tools.", (2009). Conference Proceedings, Published
Bibliography: Antarctic Meteorological Observation,
Modeling, and Forecasting Workshop,
4th, Charleston, SC, 14-16 July 2009
(preprints).

Lazzara, Matthew A.; Dworak, Richard;
Santek, David A.; Velden, Chris S. and
Key, Jeffrey R., "Antarctic atmospheric motion vectors:
Application of Antarctic composite
satellite meteorology.", (2009). Conference Proceedings, Published
Bibliography: Antarctic Meteorological Observation,
Modeling, and Forecasting Workshop,
4th, Charleston, SC, 14-16 July 2009
(preprints).

Lazzara, M. A.; Ackerman, S. and Hilger,
D. W., "Diagnosing Antarctic fog from satellite.", (2009). Conference, Published
Bibliography: MOCA-09, Our Warming Planet,
Montreal, Canada, 19-29 July 2009.
Abstracts. IAMAS, IAPSO, IACS Joint
Assembly, Montreal, 2009

Lazzara, Matthew A. and Hook. S.., "Bringing Antarctic atmospheric research
into the middle school classroom.", (2009). Conference, Published
Bibliography: Conference on Polar Meteorology and
Oceanography, 10th, Madison, WI, 18-
21 May 2009 (preprints). American
Meteorological Society, Boston, MA,
2009

Seefeldt, Mark W.; Yoksas, T. and
Lazzara, M. A., "The distribution, retrieval, and
visualization of real-time Antarctic

numerical weather prediction, satellite, and observational data.", (2009). Conference, Published Bibliography: Conference on Polar Meteorology and Oceanography, 10th, Madison, WI, 18-21 May 2009 (preprints).

Lazzara, Matthew A.; Ackerman, S. and Hillger, D. W., "A satellite diagnostic study of Antarctic fog", (2009). Conference Proceedings, Published Bibliography: Conference on Polar Meteorology and Oceanography, 10th, Madison, WI, 18-21 May 2009 (preprints). American Meteorological Society, Boston, MA, 2009

Matthew A. Lazzara, "Satellite Monitoring of Antarctic Fog", ( ). Conferences, Accepted Bibliography: International Conference on Fog, Fog Collection and Dew, 5th, Munster, Germany, 25-30 July 2010.

Web/Internet Site

URL(s):

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

Description:

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

Other Specific Products

Product Type:

Data or databases

Product Description:

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

Sharing Information:

This data collection is increasingly available via the following means:

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

Contributions

Contributions within Discipline:

The AMRC contributes to the field of meteorology with its unique products and archive of freely available datasets. Over the course of this grant, the following have been specifically provided data sets from the AMRC:

USA:
* Gonzalo Hernandez, U. Washington
* Dan Steinhoff, BPRC/OSU
* Mark Seefeldt, CU
* Gary Hufford, NWS-AK
* Doug MacAyeal, UC
* Michael Carmody, RPSC
* Santiago Gasso, NASA
* Larry Saranthus, Devon Gas
* Shelley Knuth, CU
* Valerie Loeb, Moss Landing Marine Lab
* Annalisa Schilla, CU
* Mike Willis, BPRC/OSU
* Mark Twickler, NICL/UNH
* Laurie Padman, ERSC
* Ana Camila Benitez-Martinez, AMNH

Australia:
* Steve Pendlebury
* Meraz Mostafa
* Clare Oatley
* Gabrielle Kelly
* Adrian Cooper
* Alex Pezza

Austria:
* C. Riedl
* Elisabeth Schlosser

China:
* Yan Hao

France:
* Christophe Genthon

Germany:
* Wolfgang Rack

Italy:
* Cpt. Roberto Bove

Malaysia:
* N.C. Sheeba

New Zealand
* Bill Trompetter

UK:
* Rebecca Jansen

* Gareth Marshall
* Tom Lachlan-Cope

Other:
* Jorge Giammateo
* Serg Zarin

Contributions to Other Disciplines:

Historically, the AMRC has been a contributor to other disciplines, such as glaciology, oceanography, artists and writers, etc. This project continues this, as opportunities and interest arose during the project. Via known and anonymous data requests, AMRC datasets have been used outside our discipline. Examples include:

Oceanography:
http://coseenow.net/podcast/tag/antarctic-circumpolar-current/

Glaciology:
http://www.waisdivide.unh.edu/about/weather.html

Contributions to Human Resource Development:

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

Within the project team, human resource development can be exemplified via the graduation of one team member with a PhD, another with a Master's Degree and the on-going development of computing and meteorology skills for several undergraduate student team members (some who have graduated with undergraduate degrees during this project) .

Contributions to Resources for Research and Education:

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

Contributions Beyond Science and Engineering:

The datasets the AMRC has invested time and effort into collecting are becoming increasingly critical for research projects exploring a wide range of topics from glaciology to climate in the Antarctic, and logistical decision making within the USAP.

Conference Proceedings

Categories for which nothing is reported:

Any Conference

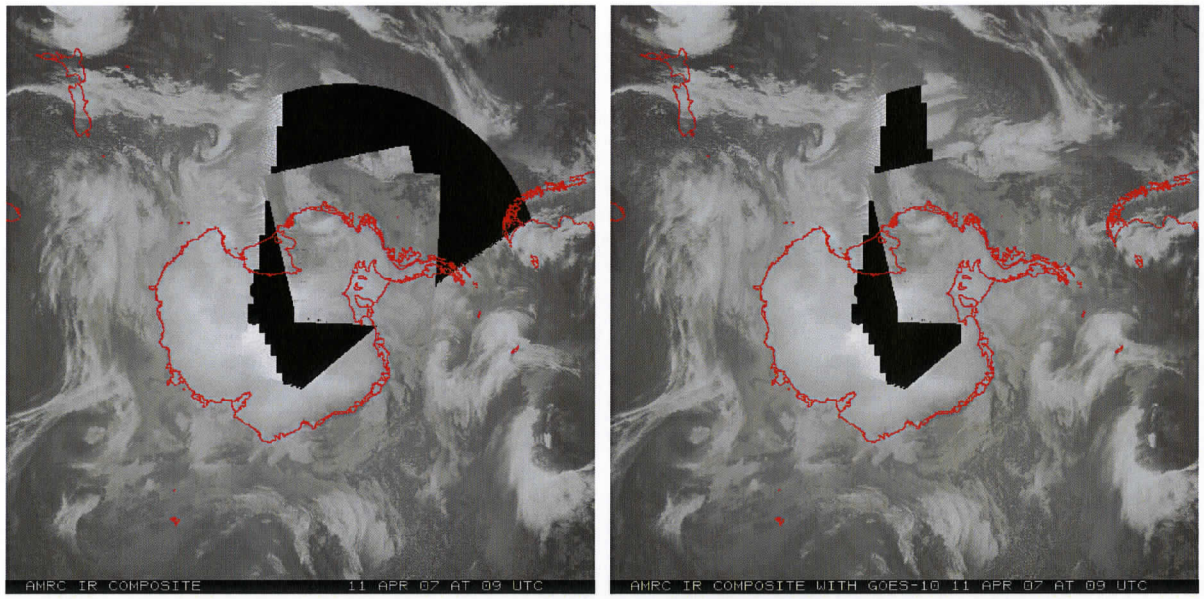


Figure 1. A sample composite made without GOES-10 (left) and with GOES-10 (right), which demonstrates the value of the GOES-10/GOES for South America imagery. GOES-10 imagery, which is available on a more frequent basis, is enabling composites to be made on an hourly basis. GOES-10 was recently replaced by GOES-12.

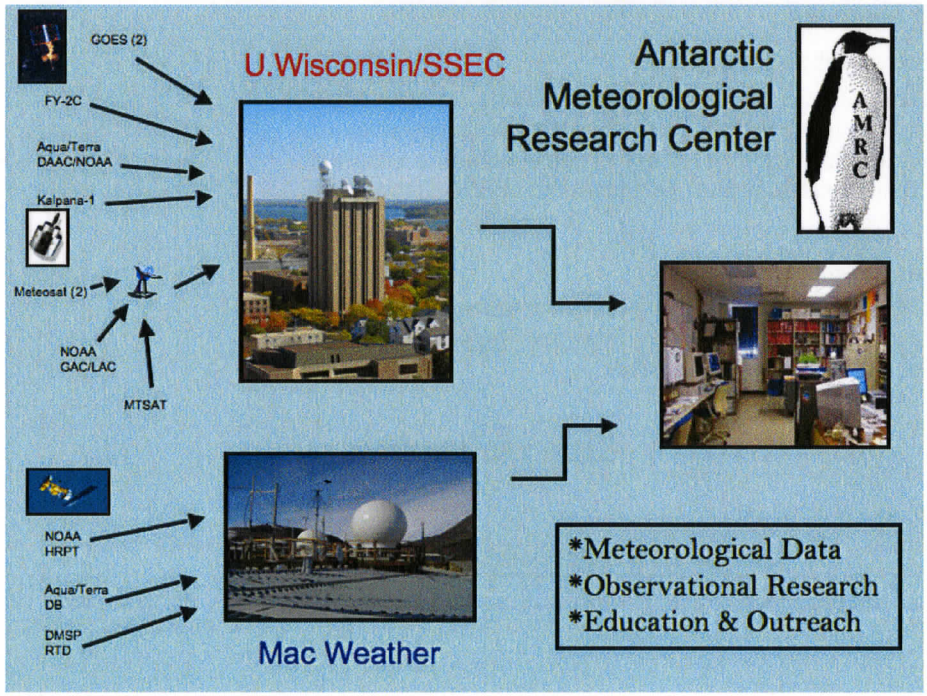


Figure 2. A graphical depiction of the partial data flow shows the Antarctic satellite composite input data sources (missing from the figure are input from Palmer Station, Antarctica).

Figure 3. Educational outreaches to public groups, such as this Mt. Horeb Public Library book club (top) and University of Wisconsin Science Expeditions (bottom) are a focus of the AMRC grassroots educational outreach program (*Top photo Courtesy of the Mt. Horeb Public Library*).

Figure 4. The 2nd annual Antarctic Meteorological Observation, Modeling, and Forecasting Workshop in Rome, Italy.

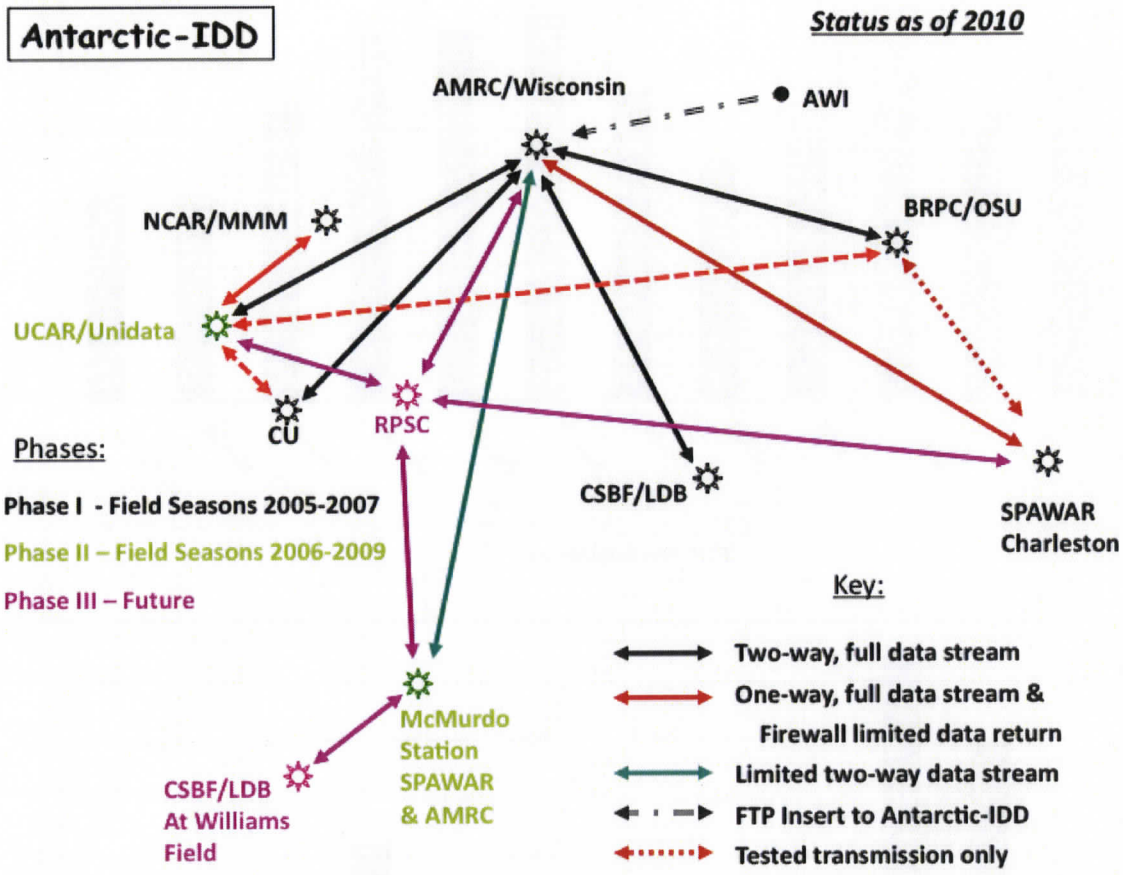


Figure 5. The network configuration of the Antarctic-IDD updated as of January 2010.

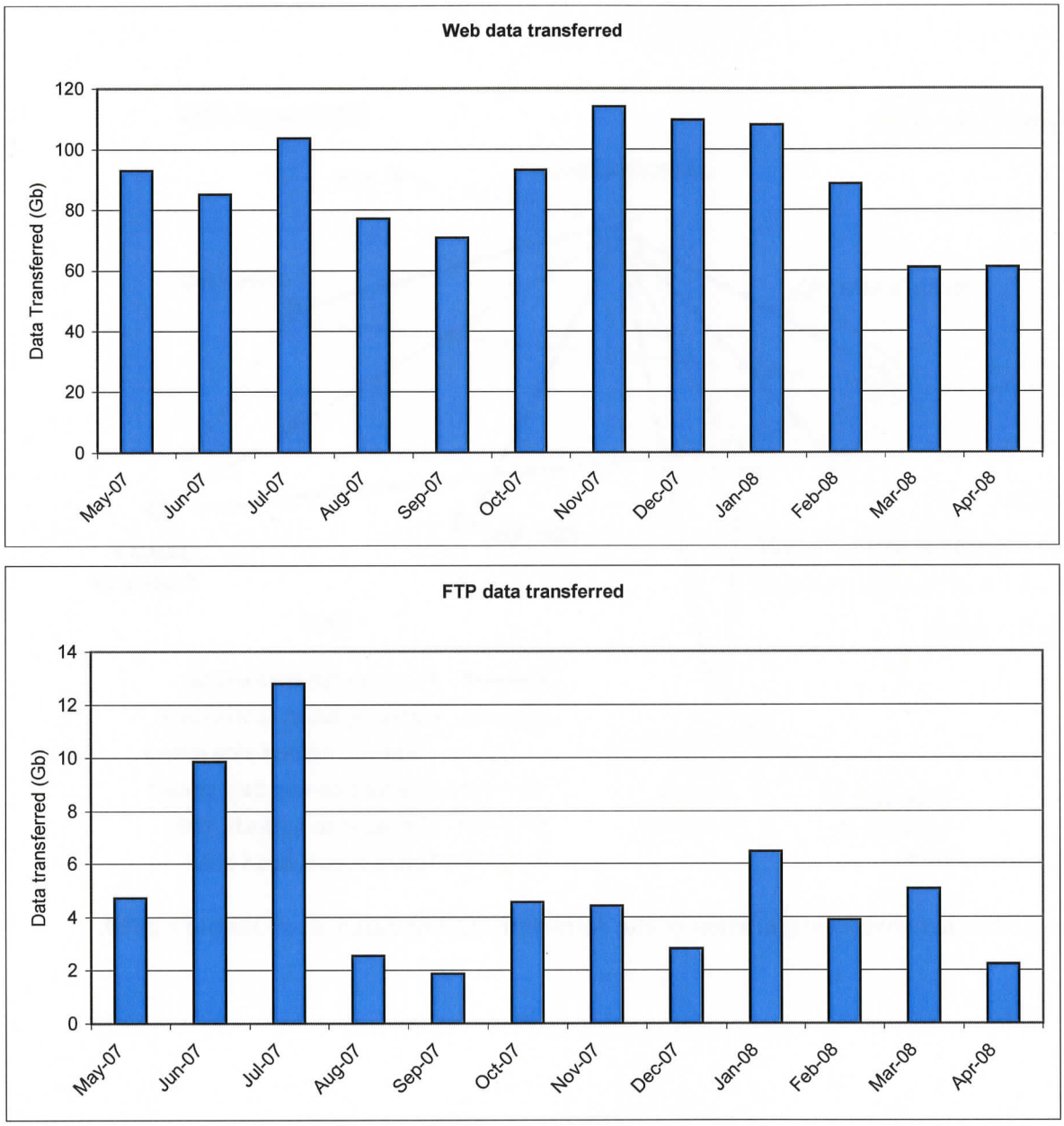


Figure 6. The web and FTP data transfer amounts on a monthly basis from May 2007 through April 2008. FTP data transfers are highly variable, depending on requested data volumes by end users.

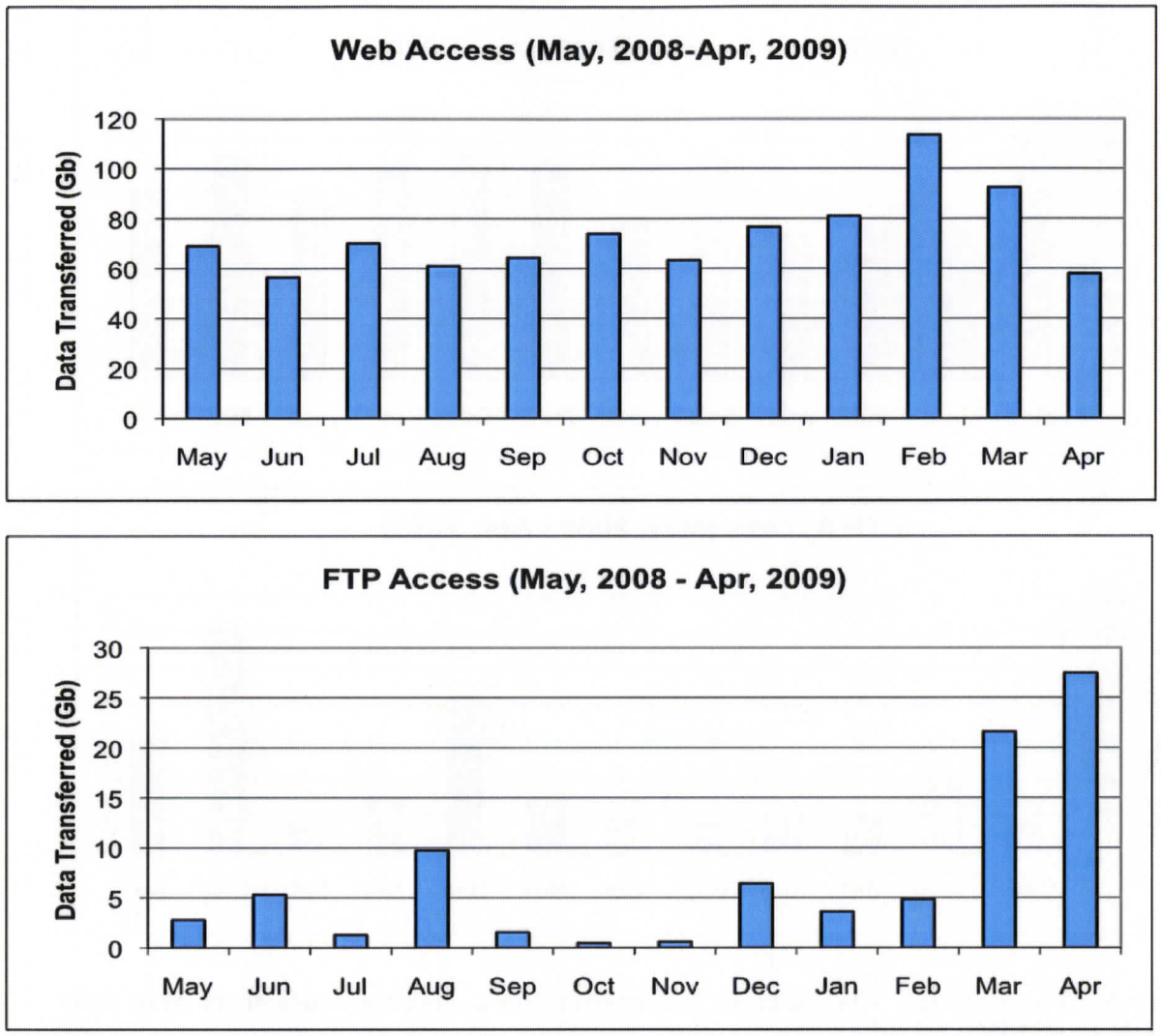


Figure 7. The web and FTP data access amounts on a monthly basis from May 2008 through April 2009.

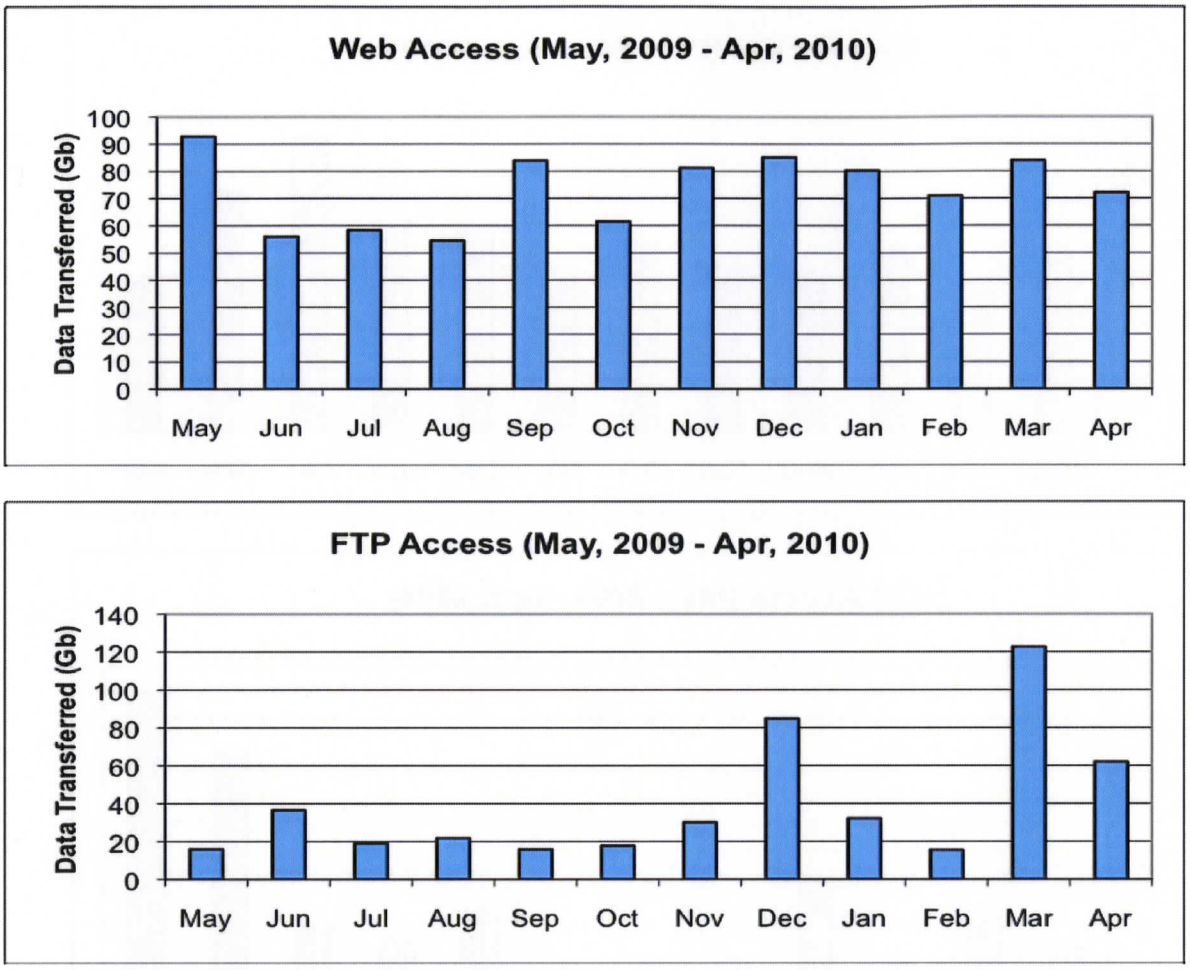
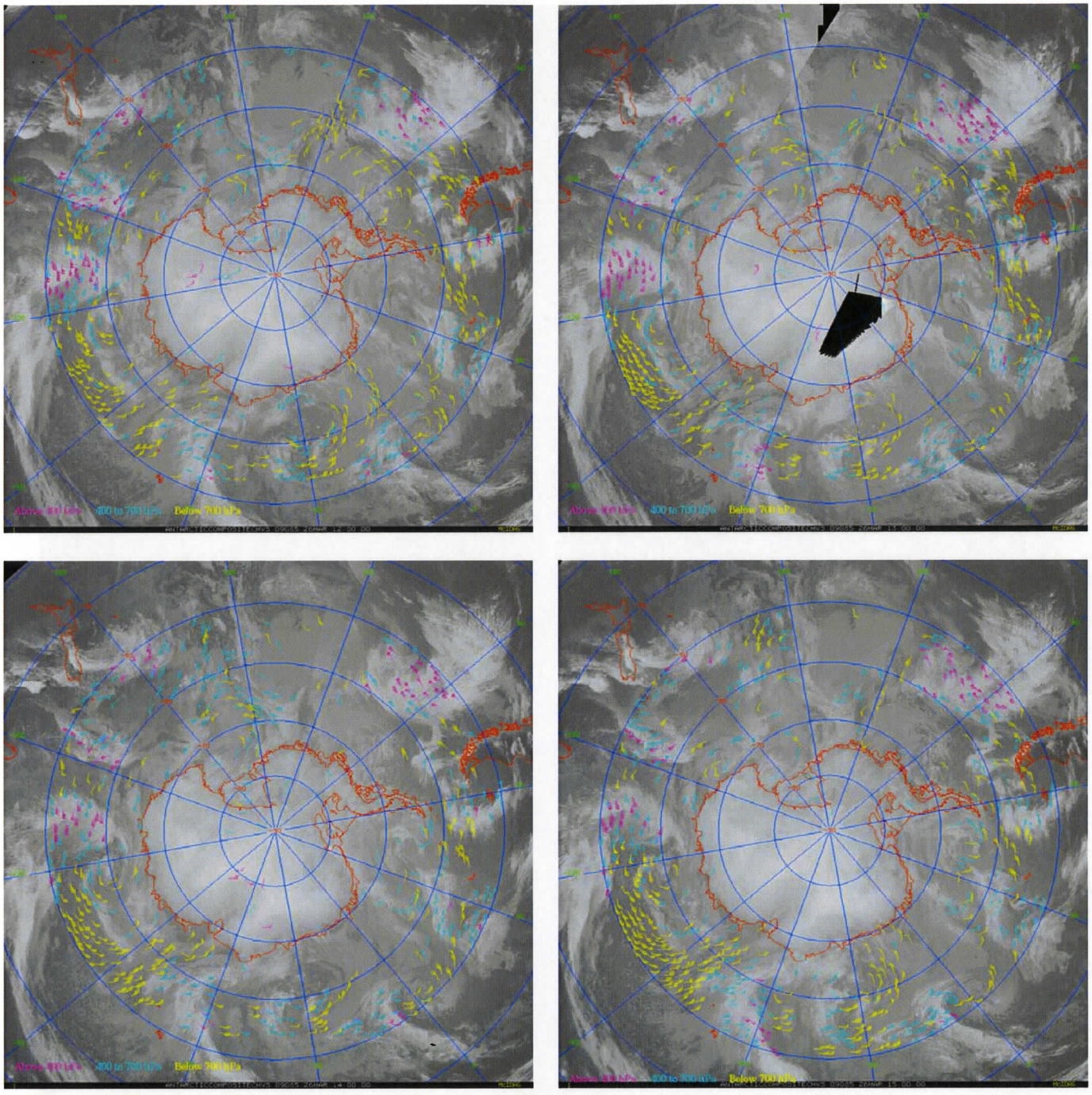
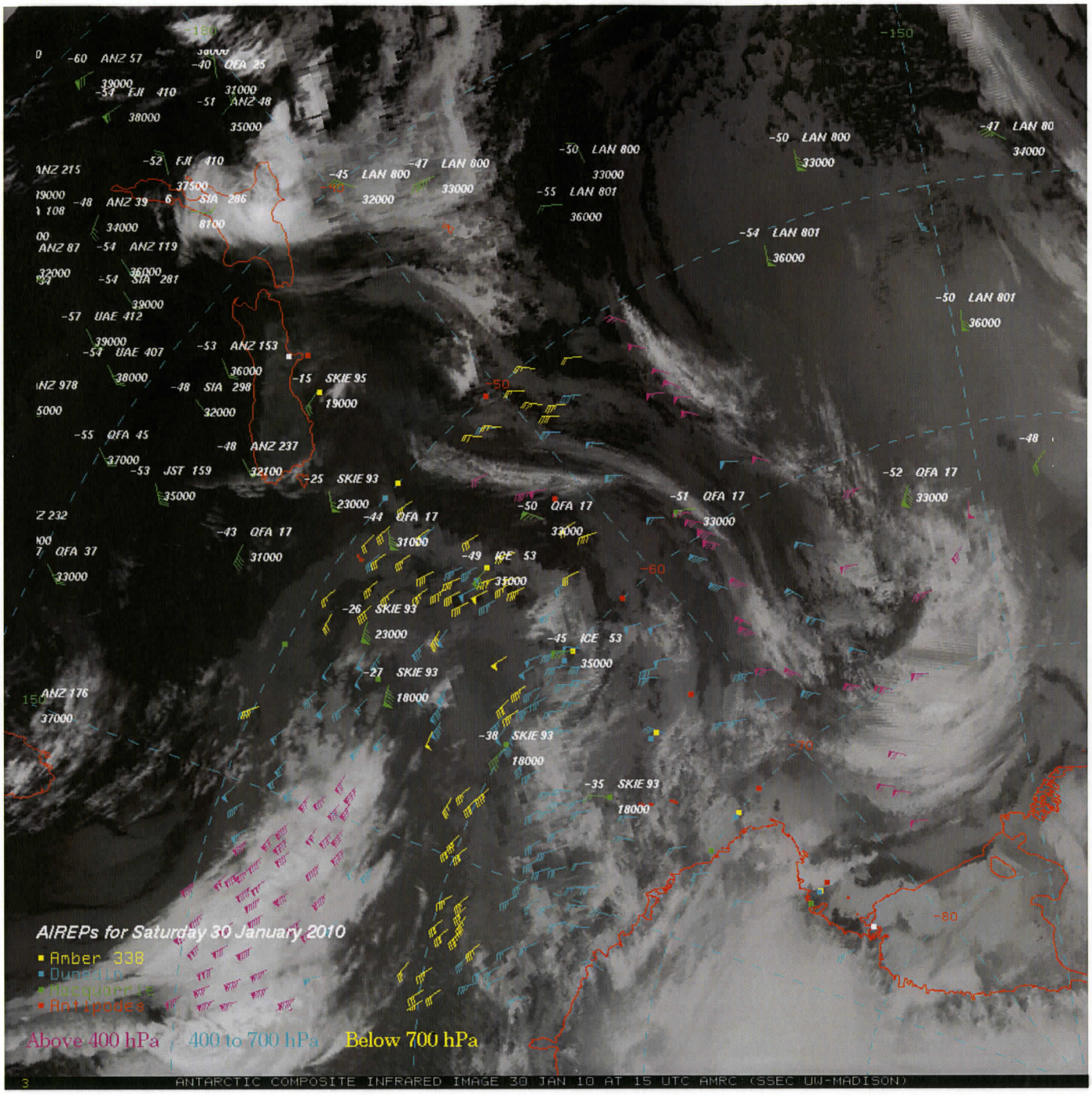


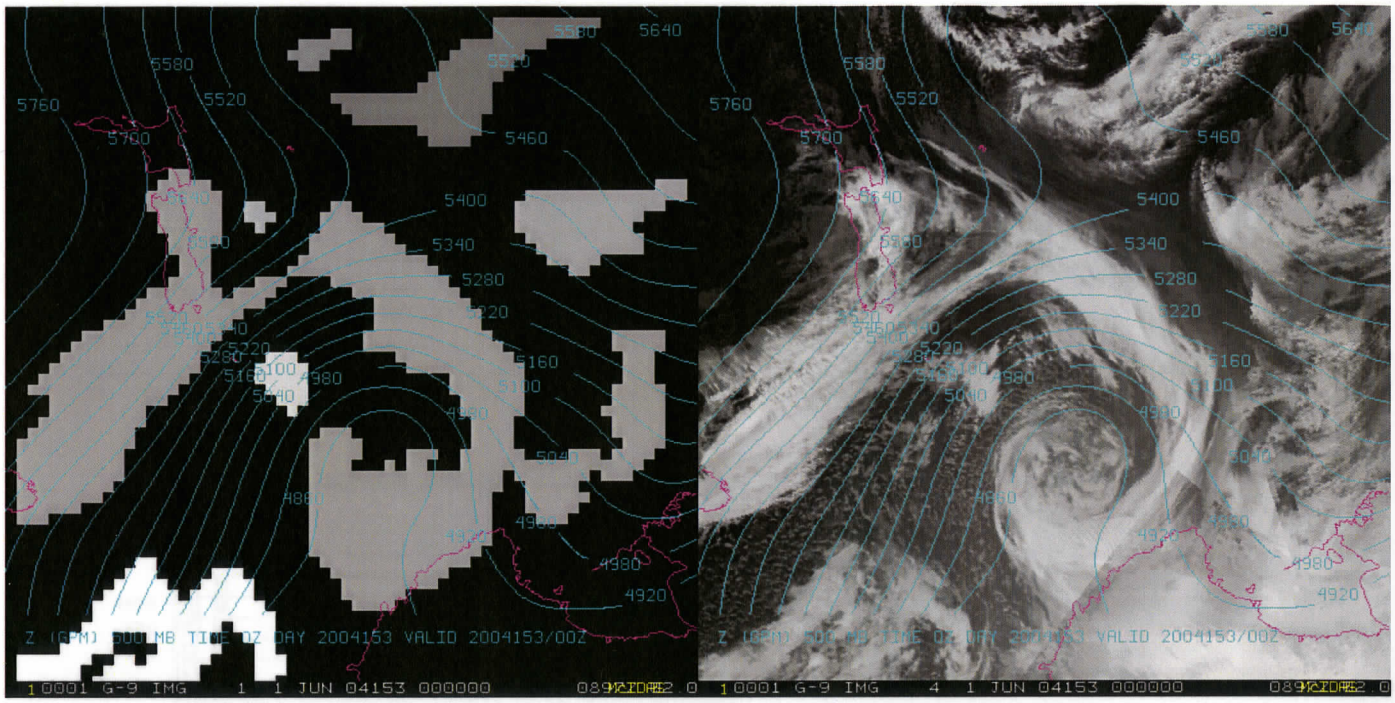
Figure 8. The web and FTP data access amounts on a monthly basis from May 2008 through April 2009.



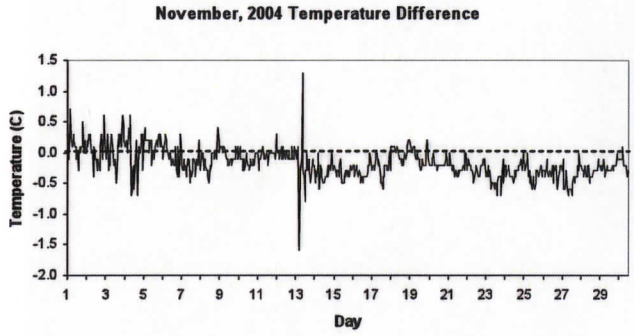
Hourly Antarctic infrared composite imagery with atmospheric motion vectors (AMVs) plotted for the period 12 through 15 UTC on 26 March 2009. These AMVs, also known as cloud drift winds, fill a gap between geostationary satellite AMVs generated to the North and polar orbiting satellite AMVs generated to the South. This project is a collaboration between the Cooperative Institute for Meteorological Satellite Studies (CIMSS) and the Antarctic Meteorological Research Center (AMRC), both housed at the Space Science and Engineering Center, with assistance from the Data Center within SSEC.

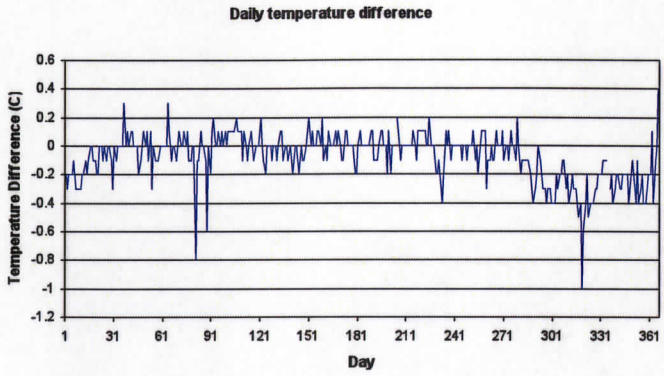


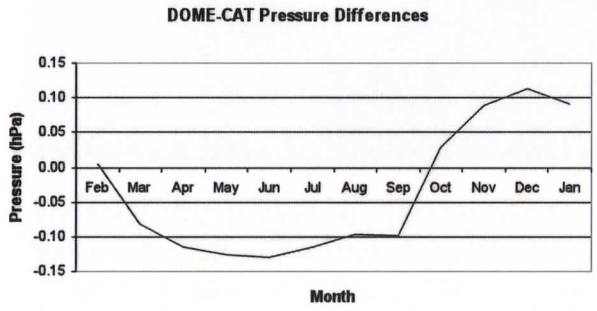
One important aspect to validating the AMV is the lack of radiosonde observations around the Southern Ocean basin. Hence, the use of aircraft observation to meet this need is a new and novel method used in this project. This image from 30 January 2010 at 15 UTC shows the aircraft reports during the local day along with the AMV valid for 15 UTC.

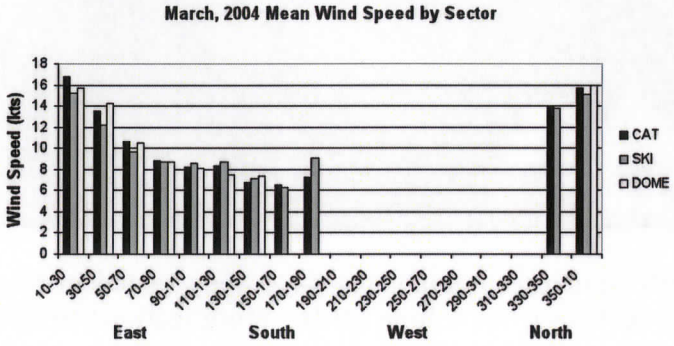


The AMRC signature composites have been tested in tracking storm systems, as seen in this textbook example cyclone from 4 June 2004. Modifications to existing satellite cyclone-tracking schemes were required.









A comparison of the current and prior South Pole Station weather station instrumentation for February 2004 through February 2005 reveals that overall; the new system does perform well, however some differences do exist. The spikes seen in the data are due to observations (two top figures). Differences in the later portion of the study, November through January are greater than instrument accuracy (+/-0.2 ^{o}C). Differences are indeed significant in February, May, July, September, November, December and January. The new instrumentation inserted a bias and statistically significant differences for all months except February, due to a change in elevation of the measurement. There is a switch in the bias in November 2004 (lower left figure). Wind speeds at the Clean Air Tower are higher in the 350 to 70 degree quadrant, while the speeds are higher at the Skiway Tower in the 170 to 190 degree quadrant. Due to the increase profile of the station, official METAR observations from the Skiway Tower may have blowing snow (manually reported) at low wind speeds (e.g. 10 knots at the Skiway and 17 knots at the Clean Air Tower). It is recommended that researchers use observations made at the Clean Air Tower for research activities to avoid this bias.