8486451

AWS 3rd Annual Project Report: NSF-OPP Grant #6368730, August 1, 2009 to August 31, 2010

Collaborative Research:
Antarctic Automatic Weather Station Program (2007-2010)

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

Dr. Matthew A. Lazzara, Principal Investigator and Meteorologist
Mr. George Weidner, co-Principal Investigator
Dr. Greg Tripoli, co-Principal Investigator
Dr. John J. Cassano, co-Principal Investigator

Space Science and Engineering Center
Department of Atmospheric and Oceanic Sciences
University of Wisconsin-Madison

Department of Atmospheric and Oceanic Sciences
University of Colorado at Boulder

Submitted on August 25, 2010

Annual Report for Period: 09/2009 - 08/2010 **Submitted on:** 08/25/2010
Principal Investigator: Lazzara, Matthew A. **Award ID:** 0636873
Organization: U of Wisconsin Madison
Submitted By:
Lazzara, Matthew - Principal Investigator
Title:
Collaborative Research: Antarctic Automatic Weather Station Program: 2007-2010

Project Participants

Senior Personnel

Name: Lazzara, Matthew
Worked for more than 160 Hours: Yes
Contribution to Project:
Dr. Matthew Lazzara as the Principal Investigator oversees the Automatic Weather Station program, including the coordination of activities and projects within the research group as well as with domestic and international collaborators. Data distribution, data processing and station climatology are some of the efforts he is involved in. He is also active with educational outreach efforts associated with the project. In addition he is assisting in directly the research and logistic activities of the group, including graduate and undergraduate students.

Name: Tripoli, Gregory
Worked for more than 160 Hours: No
Contribution to Project:
Professor Greg Tripoli's effort in the project includes working with Shelley Knuth on snow accumulation studies as well as academic advisor for graduate student Lee Welhouse.

Name: Weidner, George
Worked for more than 160 Hours: Yes
Contribution to Project:
As co-Principal investigator, George Weidner's role includes assembly and fabrication of automatic weather station, repair and troubleshooting of electronic equipment, as well as design, installation and tower raise field work in Antarctica. In addition, he is working on the design, engineering, and fabrication of the tall tower AWS that is a part of this project. Diagnosing and analyzing AWS observations to confirm the quality of the observations considering electronic and meteorological factors is part of his activities on the project.

Name: Keller, Linda
Worked for more than 160 Hours: Yes
Contribution to Project:
The processing and quality control of observations from the automatic weather stations is a critical role executed by Linda Keller. She is also active in investigating Antarctic climatology using the AWS network.

Name: Knuth, Shelley
Worked for more than 160 Hours: Yes
Contribution to Project:
Shelley Knuth's primary activities include snow accumulation and precipitation studies at AWS sites as well as assisting with AWS installations and tower raise efforts in the field. She is also active in educational outreach efforts, as she was the primary contact and the lead for our participation in the PolarTrec project.

Name: Thom, Jonathan
Worked for more than 160 Hours: Yes

Contribution to Project:

Jonathan Thom's role in the project includes the fabrication, installation, repair and raising of automatic weather stations. He also develops and maintains the AWS decoding processing software as well as participates in educational outreach activities for the project. He is also overseeing the application, programming and development of the CR-1000 AWS systems for use in the Antarctic, and testing alternative communications systems for the AWS.

Name: Stearns, Charles

Worked for more than 160 Hours: No

Contribution to Project:

Dr. Charles Stearns, as the prior Principal Investigator of the automatic weather station project, serves as a consultant on the current effort.

Post-doc

Graduate Student

Name: Welhouse, Lee

Worked for more than 160 Hours: Yes

Contribution to Project:

Lee Welhouse joins the project as a graduate student. He is focusing on studies related to the monitoring of El Nino Southern Oscillation via the automatic weather station network.

Undergraduate Student

Name: Asuma, Jonas

Worked for more than 160 Hours: No

Contribution to Project:

Jonas Asuma is an undergraduate student, working on the web page and other data distribution effort that are a part of the project. He also conducted a historical review and literature survey of El Nino/Southern Oscillation connections to the Antarctic.

Name: Bushnell, Amanda

Worked for more than 160 Hours: No

Contribution to Project:

Amanda Bushnell, an undergraduate student, has assisted the project with minor clerical work.

Name: Czeskleba, Julie

Worked for more than 160 Hours: No

Contribution to Project:

Julie has assisted the AWS project with miscellaneous clerical support.

Name: Oswalt, Jacqueline

Worked for more than 160 Hours: No

Contribution to Project:

Jacqueline has aided the AWS project with some accounting tasks.

Name: Mimier, Julia

Worked for more than 160 Hours: No

Contribution to Project:

Julia has assisted the AWS project with miscellaneous clerical support.

Name: Rasmussen, David

Worked for more than 160 Hours: Yes

Contribution to Project:

DJ has worked on a variety of tasks working with the AWS web page, AWS meta data, and recovery and restoration of historical AWS observations.

Name: Schroeder, Nicole

Worked for more than 160 Hours: Yes

Contribution to Project:

Nicole has worked on AWS data distribution and preparations for assisting the AWS project for the 2009-2010 field season. She has also deployed to Antarctica for the 2009-2010 field season to assist with AWS servicing in the field.

Name: Hau, Hoklan

Worked for more than 160 Hours: No

Contribution to Project:

Hoklan has provided technical computing support to the AWS project, especially with computer maintenance, etc.

Name: Uttech, Zach

Worked for more than 160 Hours: No

Contribution to Project:

Zach contributed to the AWS project analyzing AWS observations to ascertain when some sensor observations (specifically wind direction) went out of specification at a few AWS sites impacted by faulting sensor mounting.

Technician, Programmer

Name: Batzli, Samuel

Worked for more than 160 Hours: Yes

Contribution to Project:

Samuel Batzli has aided the project with the generation of the maps that summarize the automatic weather station project utilizing GIS tools. He is also prototyping an GIS enable relational database system for improved organization of AWS data and metadata.

Name: Bellon, Willard (Bill)

Worked for more than 160 Hours: No

Contribution to Project:

Bill is overseeing the re-casting of the AWS web page to better provide AWS data and information to the community.

Name: Laland, John

Worked for more than 160 Hours: No

Contribution to Project:

John has provided technical computing support to the AWS project, especially with computer maintenance, etc.

Name: Putman, Lee

Worked for more than 160 Hours: No

Contribution to Project:

Lee has provided the AWS project hardware fabrication support - created components used on the AWS systems - mounting structures, sensor boom fixtures, etc.

ther Participant

Name: Tucker, Camillia

Worked for more than 160 Hours: No

Contribution to Project:

Camie Tucker has assisted with the AWS project with minor clerical work.

esearch Experience for Undergraduates

Organizational Partners

University of Colorado-Boulder

The University of Colorado-Boulder/John Cassano's polar meteorology group collaborate directly with the AWS project with help during field season activities, provided the quality control (QC) software used to QC the AWS observations, and will be/are working on research activity(s) together.

Other Collaborators or Contacts

US Collaborators:

John Cassano - co-PI of the project at the University of Colorado-Boulder

David Holland (New York University) and Robert Bindschadler (NASA/Goddard Space Flight Center) - Pine Island Glacier AWS

International Collaborators:

Institut polaire francais Paul Emile Victor (IPEV)

Programma Nazionale di Ricereche in Antarctide (PNRA)

Japanese Antarctic Research Expedition (JARE)

Chinese Academy of Meteorological Sciences/Chinese Meteorological Administration/Chinese Arctic and Antarctic Administration (CAAA)

Latitudinal Gradient Project (LGP)/Antarctica New Zealand

British Antarctic Survey (BAS)

Mawson's Hut Foundation, Australia

Activities and Findings

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

Research Activities (September 2007 to August 2008):

Field Season activities to repair, update and raise automatic weather stations (AWS). (Please see field season activity presentation in attached file).

Estimation of snow accumulation at AWS sites and snow pit verification.

Collaborated with University of Colorado-Boulder on the continued development and improvement of semi-automated automatic weather station quality control software.

Data processing, distribution, quality control and archive of AWS observations.

Long term climatology efforts started for a selection of elemental AWS sites, including routine CLIMAT message generation.

Historical review and literature survey of El Nino/Southern Oscillation and the Antarctic.

Conferences 2007-2008:

European Geophysical Union meeting, Vienna, Austria, April, 2008 (Knuth)

- Presentation on snow accumulation (Knuth)

Space Based Precipitation Measurements, Steamboat Springs, CO, April 2008 (Knuth)

- Presentation on snow accumulation (Knuth)

Antarctic Meteorological Observations, Modeling and Forecasting Workshop, Madison, WI June 2008 (Asuma, Keller, Knuth, Lazzara, Stearns, Thom, Weidner, Welhouse)

- Presentation on AWS Field season (Weidner)
- Presentation on Williams Field AWS test site (Thom)
- Presentation on overview of the AWS program (Lazzara)
- Presentation on AWS measurement sampling (Weidner)
- AWS Network Future (Weidner and Lazzara)

Biennial Scientific Committee on Antarctic Research (SCAR) Conference, St. Petersburg, Russia July 2008 (Knuth)

- Presentation on the AWS project (Knuth)
- Poster on snow accumulation (Knuth)

Research Activities (September 2008 to July 2009):

Field season activities this year included the installation of two new AWS sites, and repair & raise other AWS sites. Approximately one third of the network was visited. Please see the field report in the Activities attached file as well as an overview in the attached findings file.

Data processing, distribution, quality control and archive of AWS observations were an on-going activity through the year. Efforts included collaborating with the University of Colorado on AWS quality control efforts and other possible collaborators.

Studies of snow accumulation, precipitation and blowing snow using the AWS network sites equipped with Acoustic Depth Gauges (ADG) resulted in the submission of a paper for peer reviewed publication. Episodic snow accumulation events which are a combination of precipitation events, blowing, and drifting snow events were analyzed at seven sites. This effort more clearly defined the challenges with observing precipitation and blowing snow, but also defined some of the first short-term systematic climatology information of this kind for the Ross Ice Shelf, Ross Island and Ross Sea regions.

Previous analysis of the ENSO interactions in the Antarctic used seasonal changes, and trends, in temperature and pressure fields to establish a correlation between SOI and these fields. Expanding on this work, we have begun to analyze the AWS observations to determine the spatial extent of these trends in temperature, and pressure correlations, as well as analyze characteristics of the wind flow to determine how far inland these correlations extend. Our analysis will be two-pronged - analyzing temperature and pressure trends around a large portion of the Antarctic, with an emphasis on West

Antarctica (known to be the center of the impact of ENSO in the Antarctic); and studying the flow pattern changes into the Ross Ice Shelf embayment as well as flow pattern changes around the whole Antarctic continent. We will also include the phase relationship between the Southern Annular Mode (SAM) and ENSO, as recent studies have shown SAM to modulate the effects of ENSO at higher latitudes.

Conferences for 2008-2009:

Poster at the Argos Users Conference, Sept/Oct, 2008 (by George Weidner/Jonathan Thom):

Weidner, G.A., J.E. Thom, and S.L. Knuth, 2008: Antarctic automatic weather station program 1978-2008, Argos Users Conference, Annapolis, MD. Sept 30-Oct 2, 2008

Presentation at the EGU meeting, in Vienna, Austria, April, 2009 (by Jonathan Thom):

J.E. Thom, G.A. Weidner, M.A. Lazzara, S.L. Knuth, and J.J. Cassano, 2009: The Future of the United States Antarctic Program's Automatic Weather Station Program. EGU General Assembly, Vienna, Austria, 19-24 April 2009.

Presentation at the Polar Technology conference, in Madison, Wisconsin, April 2009 (by George Weidner):

Weidner, G.A. J.E. Thom, M.A. Lazzara, S.L. Knuth, and J.J. Cassano, 2009 The challenges of changing technologies for the USAP AWS program. Polar Technology Conference, Madison, WI.

Presentations/Poster at the AMS Polar Meteorology and Oceanography, in Madison, Wisconsin, May 2009 (by Matthew Lazzara and Shelley Knuth):

Shelley L. Knuth, Univ. of Wisconsin, Madison, WI; and G. J. Tripoli, J. E. Thom, and G. A. Weidner, 2009: The influence of blowing snow and precipitation on snow depth change across the Ross Ice Shelf and Ross Sea regions of Antarctica. The Antarctic automatic weather station network: a status report. Tenth Conference on Polar Meteorology and Oceanography, 18-21 May, Madison, WI

Matthew A. Lazzara, Antarctic Meteorological Research Center/ Univ. of Wisconsin, Madison, WI; and S. Hook, 2009: Bringing Antarctic atmospheric research into the middle school classroom. The Antarctic automatic weather station network: a status report. Tenth Conference on Polar Meteorology and Oceanography, 18-21 May, Madison, WI.

Matthew A. Lazzara, Antarctic Meteorological Research Center/ Univ. of Wisconsin, Madison, WI; and G. A. Weidner, J. J. Cassano, S. L. Knuth, J. E. Thom, L. M. Keller, and M. A. Richards, 2009: The Antarctic automatic weather station network: a status report. Tenth Conference on Polar Meteorology and Oceanography, 18-21 May, Madison, WI.

Presentations at the Antarctic Meteorological Observational, Modeling and Forecasting Workshop, in Charleston, South Carolina, July 2009 (by Matthew Lazzara):

M.A. Lazzara, G.A. Weidner, J.E. Thom, S.L. Knuth, J.J. Cassano, and M.A. Richards, 2009: Antarctic automatic weather station program: 2008-2009 Field season overview. 4th

MOMFW meeting Charleston, SC.

M.A. Lazzara, G.A. Weidner, J.E. Thom, L.M. Keller, and J.J. Cassano, 2009: Antarctic
ıtomatic weather station program: Future plans and discussions. 4th AMOMFW meeting,
ıarleston, SC.

ʀesearch Activities (August 2009 to July 2010):

WS field season activities continued this year, with the visit of 14 AWS sites between UW staff and collaborators. No new stations were installed; however, the installation of 3 new AWS in West Antarctica and the tall tower AWS 100 miles South of McMurdo were tempted, but did not succeed due to weather and other logistical constraints.

Data processing, distribution, quality control and archive of AWS observations persist as an ı-going activity through the year. Efforts included continued collaboration with the niversity of Colorado on AWS quality control efforts.

Research efforts focused on the studies of El Nino Southern Oscillation on the surface of e Antarctica as seen via temperature and pressure measurements from the AWS and xtended by numerical model reanalysis.

limatology of 2009 was conducted for the entire AWS network, and the results published the Bulletin of the American Meteorological Society's State of the Climate issue.

Conferences 2009-2010:

5th Antarctic Meteorological Observation, Modeling and Forecasting Workshop in
olumbus, OH

- Presentation on the 2009-2010 AWS field season (M. Lazzara)
- Presentation on 2010-2011 AWS field plans (J. Thom)
- Presentation on 30 years of AWS in Antarctica (G. Weidner)
- Tribute to Charles R. Stearns (M. Lazzara and G. Weidner)
- Presentation on high wind events in the McMurdo Area (D. Rasmussen)

ılar Technology Conference, Boulder, CO.

- Presentation on the AWS program (M. Lazzara)

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

ıow accumulation studies:

----

fforts have studied the snow accumulation at seven AWS sites on the Ross Ice Shelf, Ross land and Ross Sea region of Antarctica for a 22 month period, providing the first automated observations in this region and providing a look at the complex contributions precipitation, blowing snow and drifting snow make to snow accumulations at the sites. lowing snow and drifting snow made a near equal and majority contribution to accumulation while precipitation and unknown processes make up the remainder of the events. Limitations on making these measurements and understanding them do leave additional questions to be answered.

Surface Effects of El Nino Southern Oscillation (ENSO):

Studies on the impact of El Nino and La Nino events on the surface temperature and pressure
patterns over Antarctica have been conducted using reanalysis datasets, with comparisons to the AWS network. Though the values vary considerably, during the strongest ENSO periods, we note significant warming (cooling) over much of the continent primarily focused in the East Antarctic during El Nino (La Nina) events. Significant high pressure anomalies are found during El Nino events focused in the Amundsen-Bellingshausen Sea regions, and extending to the Ross Ice Shelf and the Antarctic Peninsula. During La Nina events low pressure anomalies are evident throughout the continent.

AWS usage in Reanalyses:

While researching the ENSO signals via reanalysis datasets, it has been discovered that several years of numerical model reanalysis did not use AWS observations, likely impacting the results of the reanalysis. This finding is still being explored and more fully characterized.

2009 AWS State of the Climate Highlights:

Record high mean temperatures for April 2009 were found at Gill AWS - 10 degrees C higher than the long term mean. Ferrell AWS also recorded a 6.3 degree C higher than the long term mean, with December seeing a record high value of -4.5 degrees C for a mean temperature. Byrd AWS was warmer than normal in July, August, November and December; while Dome C II AWS was 7.2 degrees C above the long term mean in July. Possession Island also had a record mean temperature of -17.0 degrees C for the month of July. Record high mean wind speeds were found at Gill AWS and Marble Point AWS - both in April. Higher than normal mean monthly pressure were observed at Byrd AWS in April, July, August and November, but no records set. Record high mean pressures were seen at Possession Island AWS for May and August - 7.5 hPa and 6.5 hPa respectively higher than normal.

Training and Development:

2007-2008:
----
* Working with new AWS platforms, and training for additional team members including collaborators at the University of Colorado-Boulder.

2008-2009:
----
* Working with Wisconsin graduate and undergraduate students on the AWS platforms as they will be a part of the 2009-2010 field team.

2009-2010:
----
* Continued working with the Wisconsin graduate student (Lee Welhouse) on the AWS

atform - including wiring, plug assembly, enclosure and electronic mounting.

utreach Activities:
07-2008:

Participation in the PolarTrec Program during the 2007-2008 field season with Kirk
ckendorff, middle school teacher from Blanco, Texas.

* Special outreach project with Pittsfield, Wisconsin Elementary school (Jelly Bear Outreach
oject).

* Additional outreach activities, joint with the Antarctic Meteorological Research Center:

Grandparents University, University of Wisconsin-Madison (July 2008)
- Atmospheric, Earth and Space Sciences Workshop for High School Students, University of Wisconsin-Madison (July 2008)
SSEC Building Tours (misc. dates)
Lodi Middle School, Lodi, Wisconsin (January 2008)
- MidWest Severe Storm Tracking and Response Center, Inc., Monona, Wisconsin (January 08)

2008-2009:

Special project with the Lodi Area Middle School (See reference to poster at the AMS
lar meteorology and oceanography meeting)

AWS outreach is cooperatively done with this effort's sister project, the Antarctic
eteorological Research Center:

General Public:
----

* SSEC Public Tours, UW-Madison, Madison, WI (multiple tours, including University of
isconsin 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

University/College:
----

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

iddle School:

Lodi Middle School, Lodi, WI (3 visits)

* Waunakee Intermediate School Family Science Night, Waunakee, WI

Elementary School:
----

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

Preschool:
----

* UW Preschool Lab

McMurdo Station:

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

2009-2010:

AWS outreach exclusively is in conjunction with AWS's sister project, Antarctic Meteorological Research Center:

* Madison West Rotary Club, Madison, WI
* SSEC Public Tours, UW-Madison, Madison, WI (over 2 dozen tour groups)
* Deerfield Middle School, Deerfield, WI
* E-mail contacts with the public and Antarctic community
* Deerfield Elementary School, Deerfield, WI
* CIMSS/WSGC workshop, UW-Madison, WI
* Presentation at Deerfield Lutheran Church, Deerfield, WI
* Interview - Channel 15 WMTV - Madison, WI
* Grandparents University, UW-Madison, Madison, WI

Journal Publications

Knuth, S.L. G.J. Tripoli, J.E. Thom, and G.A. Weidner, "The Influence of Blowing Snow and Precipitation on Snow Depth Change Across the Ross Ice Shelf and Ross Sea Regions of Antarctica", Journal of Applied Meteorology and Climatology, p. 1306, vol. 49, (2009). Published, 10.1175/2010JAMC2245.1

Colwell S., L.M. Keller and M.A. Lazzara, "Surface Manned and Automatic Weather Station Observations [in "State of the Climate in 2009"]", Bulletin of the American Meteorological Society, p. S128, vol. 91, (2010). Published,

Books or Other One-time Publications

Keller, L.M., G.A. Weidner, C.R. Stearns,
J.T. Thom, and M.A. Lazzara, "Antarctic Automatic Weather Station Data for the Calendar Year 2002", (2008). Book, Published

ibliography: Space Science and Engineering Center,
University of Wisconsin-Madison

eller, L.M., G.A. Weidner, C.R. Stearns,
T. Thom, M.A. Lazzara and S. Knuth, "Antarctic Automatic Weather Station Data for the Calendar Year 2009", (2010). Book, Published
Bibliography: Space Science and Engineering Center,
niversity of Wisconsin-Madison

Web/Internet Site

RL(s):

tp://amrc.ssec.wisc.edu ftp://amrc.ssec.wisc.edu

Description:

These web and FTP sites host real-time and archived AWS observations, related metadata, aps and other historical and background information. These sites are shared with AWS's sister project, the Antarctic Meteorological Research Center (AMRC).

Other Specific Products

Product Type:

ata or databases

Product Description:

Meteorological observations from the Automatic Weather Stations (AWS) include easurements of temperature, wind speed, wind direction, atmospheric pressure, relative humidity and, in some cases, snow temperature profiles, water temperature, relative snow accumulation, and temperature differences from the top to the bottom of the AWS tower. hese observations are made available in a 10 minute gross error checked format, as well as hourly fully quality controlled format. Additional quality controlled formats at 10 minutes, 1 hour and 3 hours have recently started to be made available.

haring Information:

bservations from the AWS sites are made available via the following avenues:

Real-time:

Web Site
FTP Site
TS
..cIDAS ADDE Server
Antarctic-IDD

Archive:

- Web Site
FTP Site
Metadata via DIF with the Antarctic Master Directory at NSIDC and NASA Global Master Directory
Data book covering an annual year of AWS summaries

Contributions

ontributions within Discipline:

The automatic weather station program offers a valuable resource of meteorological information for the meteorological and atmospheric sciences. These observations cover a significant portion of the Antarctic, and are utilized by the larger community (e.g. NCAR/NCEP reanalysis, verification of the Antarctic Mesoscale Prediction System (AMPS) modeling system). The availability of new formatted quality controlled 10 minute, 1 hourly and 3 hourly data sets will increase value to the community.

Here are a selected list of publications in the community that utilize AWS observations:

Petrelli, P; Bindoff, N L; Bergamasco, A., 2008: The sea ice dynamics of Terra Nova Bay and Ross Ice Shelf Polynyas during a spring and winter simulation. J. Geophys. Res. (C Oceans), 113, C09003, doi:10.1029/2006JC004048.

Seefeldt, MW; Cassano, JJ; Parish, TR, 2007: Dominant Regimes of the Ross Ice Shelf Surface Wind Field during Austral Autumn 2005. J. Appl. Meteorol. Climatol., 46, 1933-1955.

Chapman, WL; Walsh, JE, 2007: A Synthesis of Antarctic Temperatures. J. Clim., 20, 4096-4117.

Jordan G. Powers, 2007: Numerical Prediction of an Antarctic Severe Wind Event with the Weather Research and Forecasting (WRF) Model. Monthly Weather Review, 135, 3134?3157.

Daniel F. Steinhoff, David H. Bromwich, Michelle Lambertson, Shelley L. Knuth, and Matthew A. Lazzara, 2008: A Dynamical Investigation of the May 2004 McMurdo Antarctica Severe Wind Event Using AMPS. Monthly Weather Review, 136, 7?26.

Andrew J. Monaghan and David H. Bromwich, 2008: Advances in Describing Recent Antarctic Climate Variablity. Bulletin of the American Meteorological Society, 89, 1295?1306.

Monaghan, A. J., D. H. Bromwich, W. Chapman, and J. C. Comiso, 2008: Recent variability and trends of Antarctic near-surface temperature. J. Geophys. Res., 113, D04105, doi:10.1029/2007JD009094.

Uotila,? P.,? A.B.? Pezza,? A.H.? Lynch,? K.? Keay,? and? J.J.? Cassano,? 2009:? A? comparison? of? low? pressure? system? statistics? derived? from? a? high? resolution? NWP? output? and? three? re?analysis? products? over? the? Southern? Ocean.? J.? Geophys.? Res.,? 114,? D17105,?doi:10.1029/2008JD011583.

Contributions to Other Disciplines:

AWS observations are utilized by other disciplines including those in the glaciology community (especially efforts by investigators in the WAIS area), and the oceanography community.

Contributions to Human Resource Development:

Funds from this project are used to support an MS graduate student (Lee Welhouse) in the Department of Atmospheric and Oceanic Sciences at the University of Wisconsin-Madison. His efforts utilize the AWS observations for ENSO studies, analyzing them in conjunction with other data sets and performing Antarctic field work, as well as presenting at conferences and publishing the results in peer reviewed literature.

This project has also partially supported an undergraduate student (Jonas Asuma, Nicole Schroeder, DJ Rasmussen, Zach Uttech) in the Department of Atmospheric and Ocean Sciences at the University of Wisconsin-Madison in assisting with the AWS data collection, climatological summaries, etc.

ontributions to Resources for Research and Education:

The AWS project provides the opportunity for the AWS observations to be utilized in educational settings (Lazzara and Hook, 2009). Equipment and tools to maintain the sembly and fabrication of AWS equipment are a part of this effort. Additionally, mputational resources are available from this project to support the activities of project members.

ontributions Beyond Science and Engineering:

Conference Proceedings

Special Requirements

Special reporting requirements: None

hange in Objectives or Scope: None

Animal, Human Subjects, Biohazards: None

Categories for which nothing is reported:

Contributions: To Any Beyond Science and Engineering

ny Conference

Overview of the Antarctic Automatic Weather Station Project

Siple Dome AWS

M.A. Lazzara, G.A. Wiedner, J.T. Thom, L.M. Keller, S.L. Knuth, J.V. Asuma, G.J. Tripoli & C.R. Stearns

University of Wisconsin-Madison

J.J. Cassano

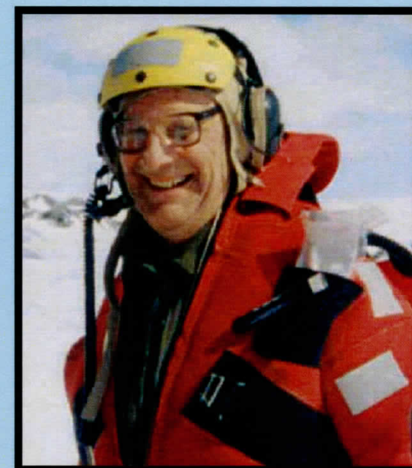
University of Colorado-Boulder


Outline
• The Team
• History
• Specifications
• Applications
• Data
• International Collaborations
South Pole - Clean Air AWS

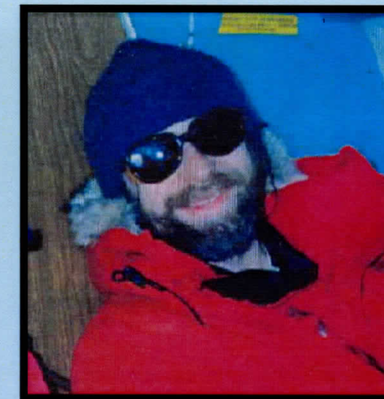
The Team

Linda Keller

Matthew Lazzara



Charles Stearns



George Weidner

Jonas Asuma

John Cassano

Jonathan Thom

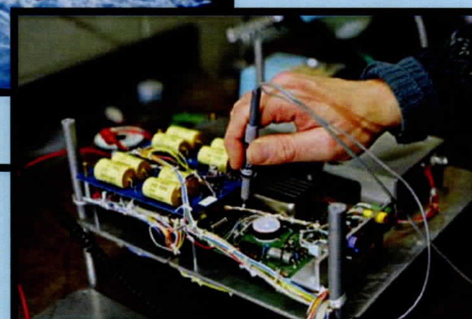
Shelley Knuth

Greg Tripoli

AWS History

- Stanford University Radio Science Lab
  - Late 1970s
  - Key developments:
    - Low power electronics (Pioneer Spacecraft)
    - Satellite communications (Nimbus-7)
- University of Wisconsin-Madison
  - Assumed stewardship
  - Meteorological focus

Laurie AWS 1981-1986



AWS Versions

❖AWS I (nimbus)

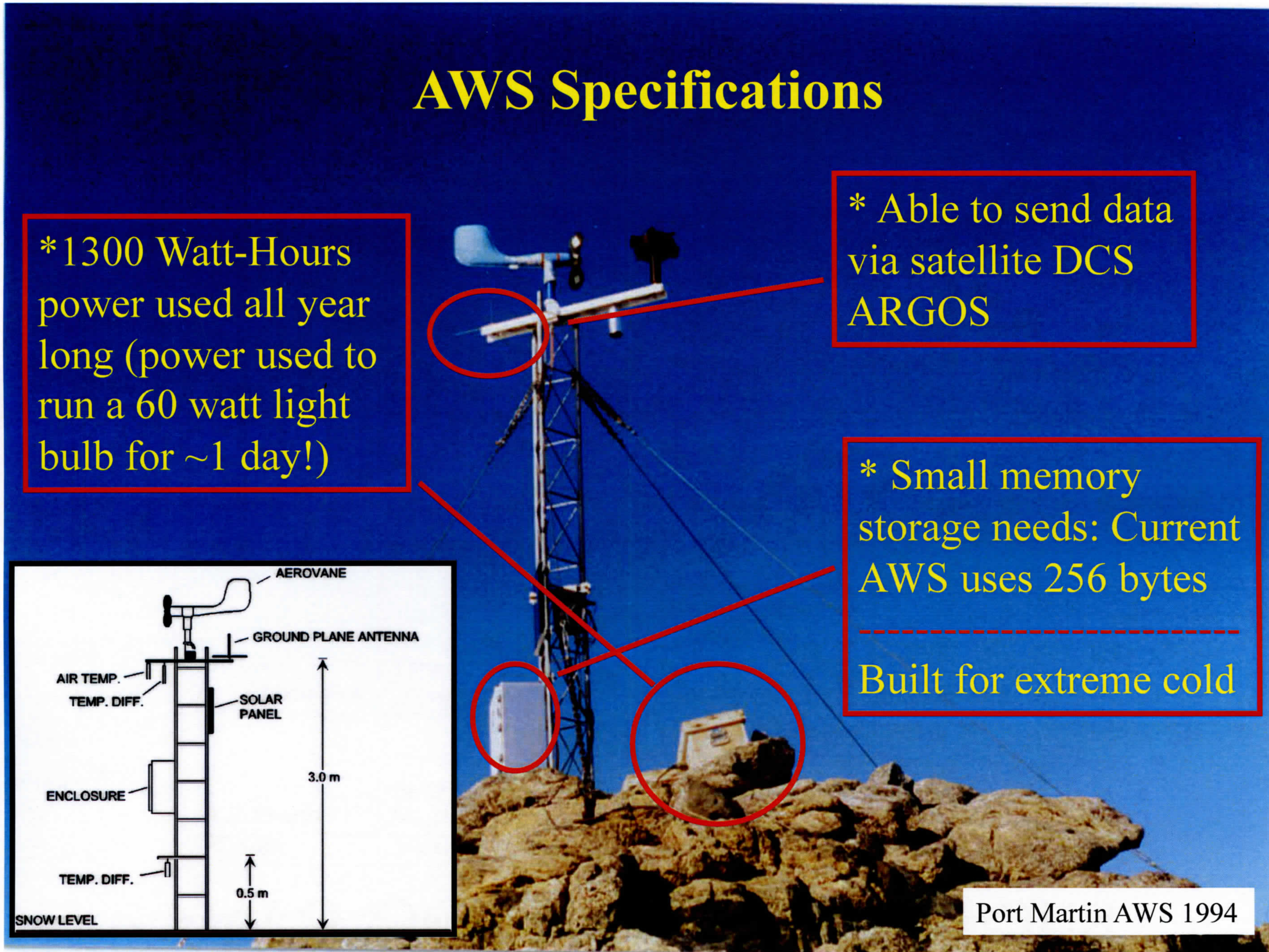
❖AWS II (RTG), IIB, IIC,etc.

❖AWS COTS:

–AWS-10x

–AWS-1000

Automatic Weather Stations (AWS): Circa 1966-1967
(Courtesy of Maurice Gibbs)



AWS Specifications
*1300 Watt-Hours power used all year long (power used to run a 60 watt light bulb for ~1 day!)
* Able to send data via satellite DCS ARGOS
* Small memory storage needs: Current AWS uses 256 bytes
Built for extreme cold
AEROVANE
GROUND PLANE ANTENNA
AIR TEMP.
TEMP. DIFF.
SOLAR PANEL
ENCLOSURE
3.0 m
TEMP. DIFF.
0.5 m
SNOW LEVEL
Port Martin AWS 1994

AWS Sensor Specifications

Variable	Sensor	Specifications
Air Pressure	Paroscientific Model 215 A	Range: 0 to 1100 hPa Resolution: 0.050 hPa Accuracy: +/- 0.2 hPa (0.2 hPa/year long term drift)
Air Temperature	Weed PRT Two-wire bridge	Range: to -100 C minimum Resolution: 0.125 C Accuracy: +/- 0.5 C * Lowest Recorded is -85.2 C at Dome Fuji 17 July 1996
Humidity	Vaisala HMP-35A (and other models)	Range: 0 to 100% Resolution: 1.0 % Accuracy: +/- 5.0 % down to -55 C Corrections possible for lower temperatures
Wind Direction	10 K Ohm pot.	Range: 0 to 355 Degrees Resolution: 1.5 Degrees Accuracy: +/- 3.0 Degrees
Wind Speed	Bendix/Belfort RM Young Hydro-Tech	Resolution/Accuracy: 0.25 +/- 0.5 m/s Resolution/Accuracy: 0.20 +/- 0.5 m/s Resolution/Accuracy: 0.33 +/- 2% * Maximum speed along Adelie Coast ~50 m/s
Temperature String	Thermocouple Two junction Copper-Cons.	Resolution: 0.06 C Accuracy: +/- 0.125 C

AWS Applications

Past:

- Barrier and Katabatic wind studies
- Mesoscale circulations
- Sensible and latent heat flux studies
- Southern Ocean GLOBEC
- Long Term Ecological Research
- Weather forecasting
- Research on Ocean-Atmosphere Variability and Ecosystem Response in the Ross Sea
- West Antarctic Ice Sheet Initiative and International Trans-Antarctic Scientific Expedition
- And more….

Current:

- Long term climatology
- Antarctic ENSO studies
- Precipitation/snow accumulation studies
- RAS near suface wind field
- Boundary Layer Studies
- Weather forecasting
- And more…

Data Flow

Real time

- Ground Stations:
  - HRPT
    - McMurdo Station
    - Palmer Station
  - GAC
    - Gilmore Creek, AK
    - Wallops Island, VA
- Two stage processing:
  - SSEC Desktop Ingestor
    - Signal to DCS hex
  - AWS DCS decoder
    - DCS Hex to ASCII science values
  - Only gross error checked
- Data distribution:
  - Antarctic-IDD
  - ADDE, FTP, Web
  - GTS
- All AWS (and AGO)

Archival

- CD CLS America (Argos) to Wisconsin
  - Last month available ~15th of this month
  - All AWS
    - Gross error checked only
    - .r format (ASCII)
  - CLIMAT AWS
    - Complete QC
    - .r, .dat, .q10, .q1h, .q3h (ASCII)
    - Future - netCDF
  - Wisconsin AWS only

The Data: Quality Control

Methodology

- Real time
  - Only gross error checked
- Archive
  - 10 minute (.r format) only gross error checked
  - 3 hourly (.dat format) full quality control
- Joint Machine-Manual QC mix:
  - Software M.W. Seefeldt
    - Lost time saving to increasing AWS to process

New Data Formats

- QC'ed (all ASCII)
  - 10 minute
  - 1 hourly
  - 3 hourly
    - New format!
- Recently available!
  - CLIMAT AWS station
  - Start April 2007 -
- All AWS sites:
  - Start Oct 2001 -
- Future formats
  - netCDF
  - BUFR ?

CLIMAT Message Project

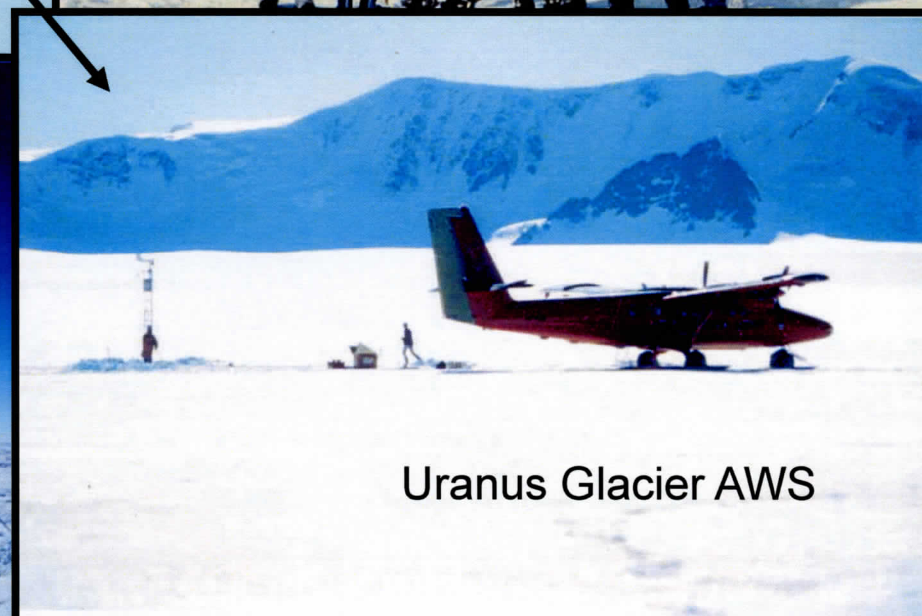
- World Meteorological Organization (WMO)
  - Monthly Climatology Summary
- AWS CLIMAT:
  - "Real-time" from Ferrell, Marble Point, Dome C II, Byrd, Siple Dome, Gill, Possession Island
    - This primarily list to be re-reviewed - NSF/NOAA-NCDC/WMO/UW
- Delivery:
  - NOAA TG
    - Via E-mail
  - Start date: 2006/7
  - AMRC FTP (soon)
- Future:
  - Will do more

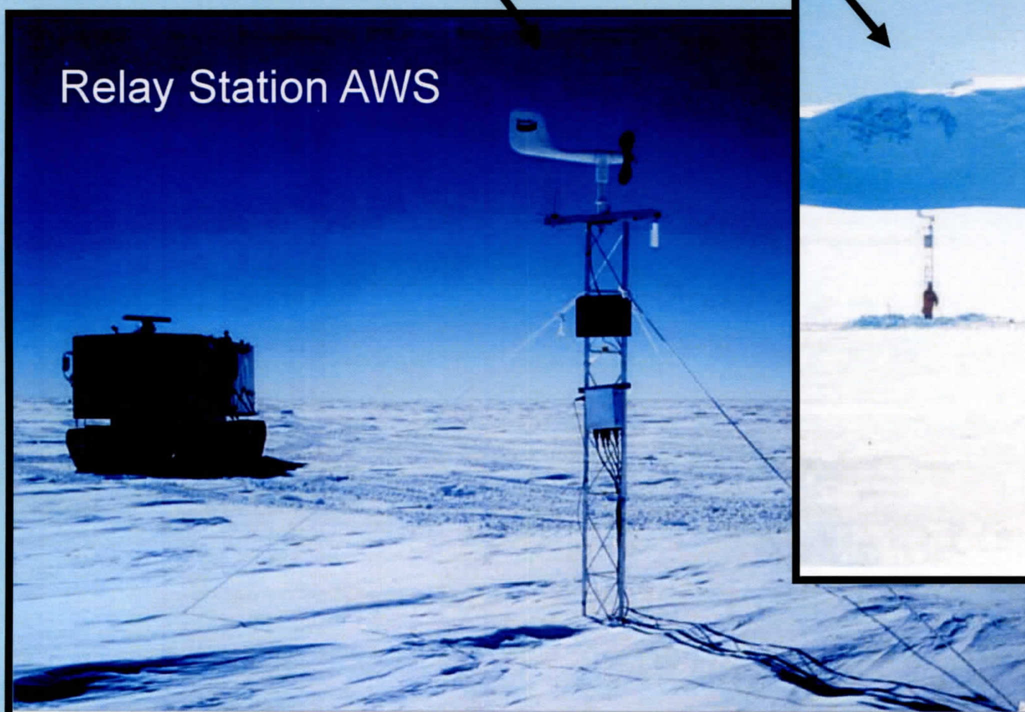
(As resources allow)

```
CSAA01 KWBC 171327                                    2007137 1432
CLIMAT 04007 89376
111 19813 31332060 412791386 8000000 9303030
333 23030 8070100
444 0123421 1144019 2117621 3147420 5120321 =
CSAA01 KWBC 171326                                    2007137 1432
CLIMAT 04007 89828
111 16431 31623036 415741661 8000000 9303030
333 23030 8010000
444 0156770 1168918 2148621 3173618 5111024 =
CSAA01 KWBC 171342                                    2007137 1432
CLIMAT 04007 89345
111 18851 411701269 8000800 9303030
333 23030
444 2106917 3141004 5106902 =
```

International Collaborations

- France
- United Kingdom
- Japan
- China





Acknowledgements

Thank you to Office of Polar Programs
National Science Foundation OPP-0338147 and ANT-0636873
Thank you to all AWS collaborators and AWS users!


Antarctic Automatic Weather Station Program:
2008-2009 Field Season Overview
Matthew A. Lazzara[1], George A. Weidner[2], Jonathan E. Thom[1], Shelley L. Knuth[1, 3], John J. Cassano[3], and Melissa A. Richards[3]
Sabrina AWS
[1]Antarctic Meteorological Research Center, Space Science and Engineering Center
[2]Department of Atmospheric and Oceanic Sciences
University of Wisconsin-Madison

AWS Field Team

From Left to Right:

Ms. Melissa Richards
CU – ATOC

Dr. John Cassano
CU – ATOC

Dr. Matthew Lazzara
UW – AMRC/SSEC

Ms. Shelley Knuth
UW – AMRC/SSEC & CU – ATOC

Mr. Jonathan Thom
UW – AMRC/SSEC

AWS Field Work Summary

October-November Field Team

- Minna Bluff AWS: Oct 31
- Linda AWS: Oct 31
- Ferrell AWS: Nov 3
- Lorne AWS: Nov 4
- Williams Field Test AWS: Nov 7
- Margaret AWS: Nov 12

* **Institut Polaire Francais – Paul Emile Victor (IPEV) Support**

D-10 AWS

E-66 AWS

D-85 AWS

* **Mawson's Huts Foundation Support**

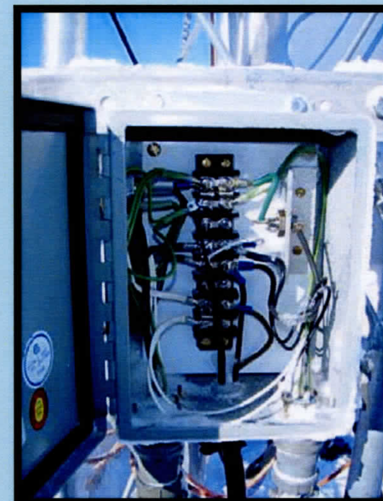
Cape Denison AWS

* **PNRA – Italian Antarctic**

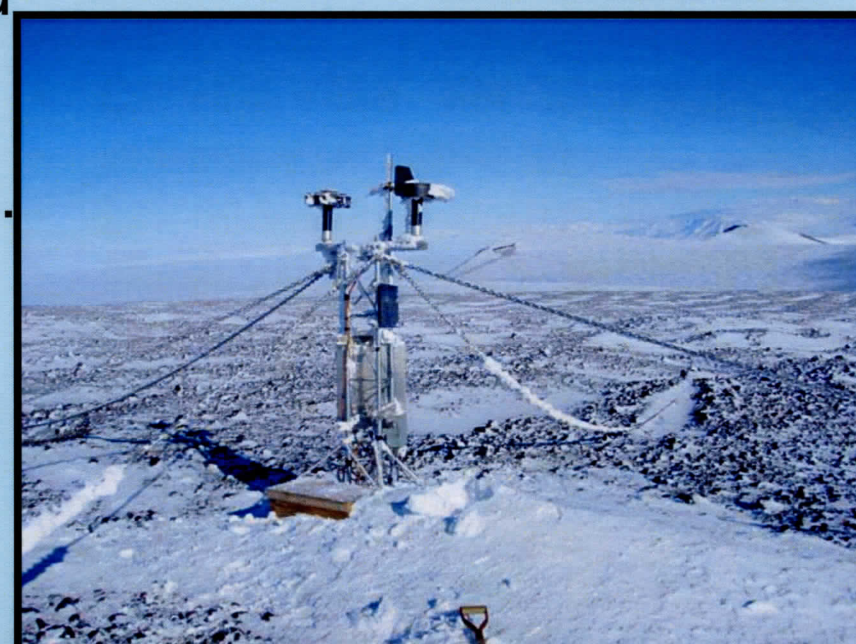
January-February Field Team

- Pegasus South AWS: Jan 7
- Pegasus North AWS: Jan 11, 24; Feb 5, 6
- Linda AWS: Jan 16, 21
- Ferrell AWS: Jan 16
- Marilyn AWS: Jan 23
- Carolyn AWS: Jan 23
- Vito AWS: Jan 24
- Emilia AWS: Jan 24
- Elaine AWS: Jan 28
- Kominko-Slade AWS: Jan 31
- Sabrina AWS: Feb 2
- Lettau AWS: Feb 2
- Williams Field Test AWS: Jan 8,12; Feb 5

Minna Bluff



- Issues:
  - Frosted
  - Based not supported
  - Mashed wire
  - Broken cross pieces.
- System Operational

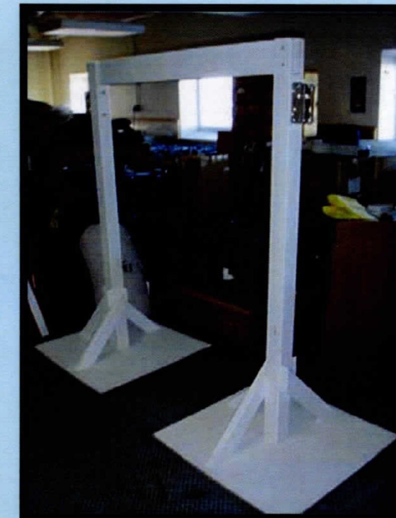


Linda AWS

- Issues:
  - Raising electronics, etc.
  - Unable to reboot system
  - Antenna broken, replaced
  - Snow pit dug
  - ADG data downloaded
  - New install (2 attempts)

- System Operational

Williams Field AWS Test Facility



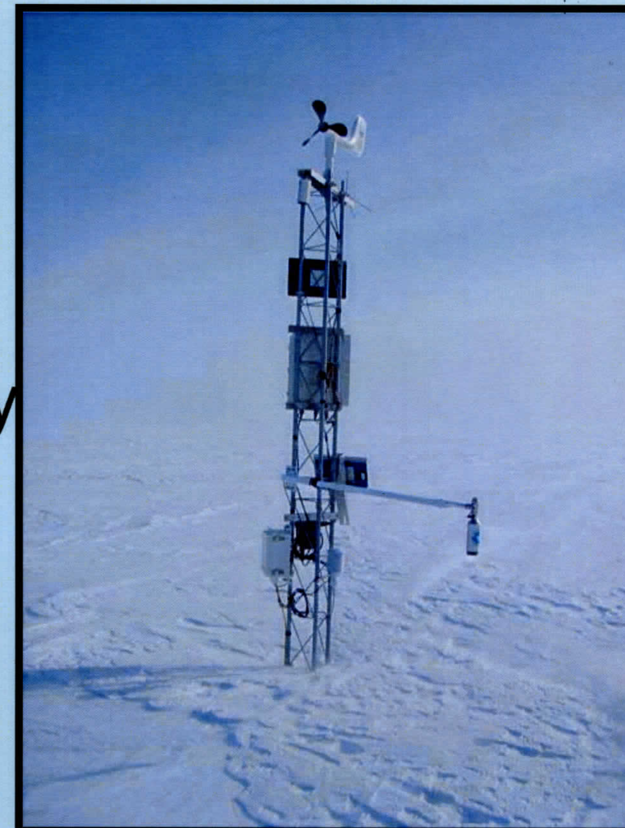
- Issues:
  - Removed iridium & radiation shield test AWS
  - Iridium modem failed
  - Installed new radiation shield test AWS
  - Removed original Wisconsin AWS IIB AWS
    - For redeployment
  - Replacement system installed….
- System Operational

Lorne AWS

- Issues
  - Raised AWS
  - Swapped out antenna
  - Teflon sheathing on wi
    - Broken on one spot
- System Operational

Ferrell AWS

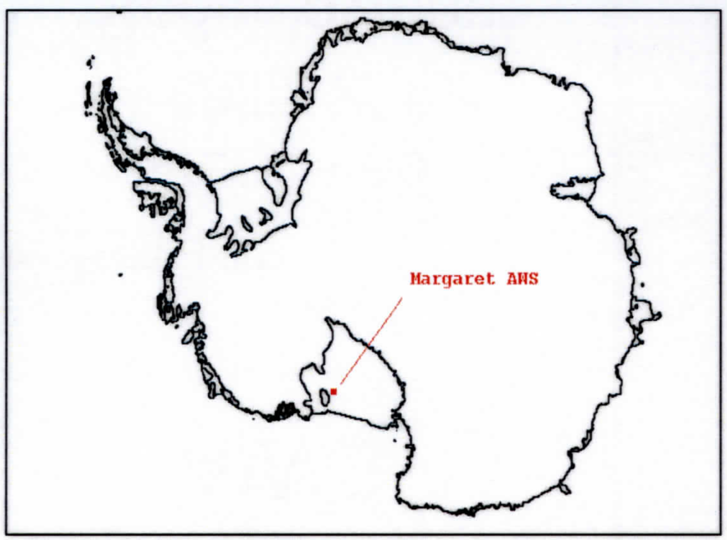
- Issues:
  - Swapped out ADG memory module
  - Visit for ADG replacement



- System Operational

Margaret AWS

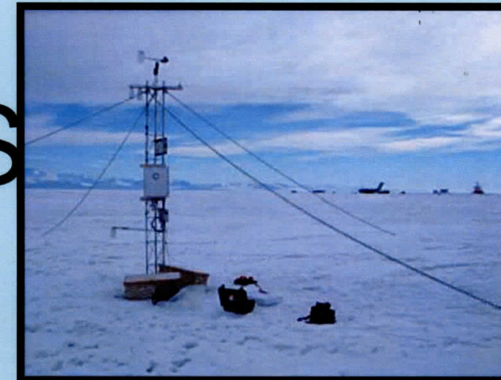
- New AWS Install
- System Operationa



Pegasus South AWS

- Issues
  - Removed
  - Utilized for Redeployment
- Future:
  - Complete removal 2009-2010
  - (Limited utilization)
- System Non-operational

Pegasus North AWS

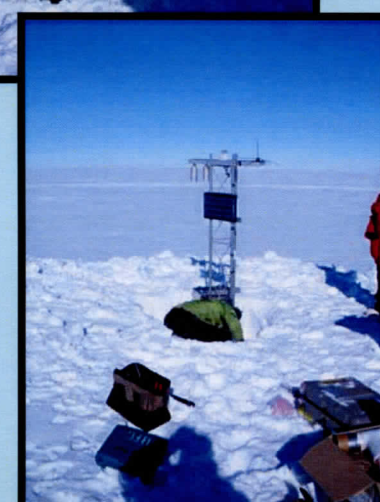


- Issues:
  - Stopped transmitting without cause in fall 2008
  - Check cables, restarted AWS, failed again, removed AWS electronics
    - Utilized for redeployment
  - Installed new electronics
  - Attempted to fix up electronics wiring for boom

- System Partially Operational
  - Wind speed and relative humidity not working…

Marilyn AWS

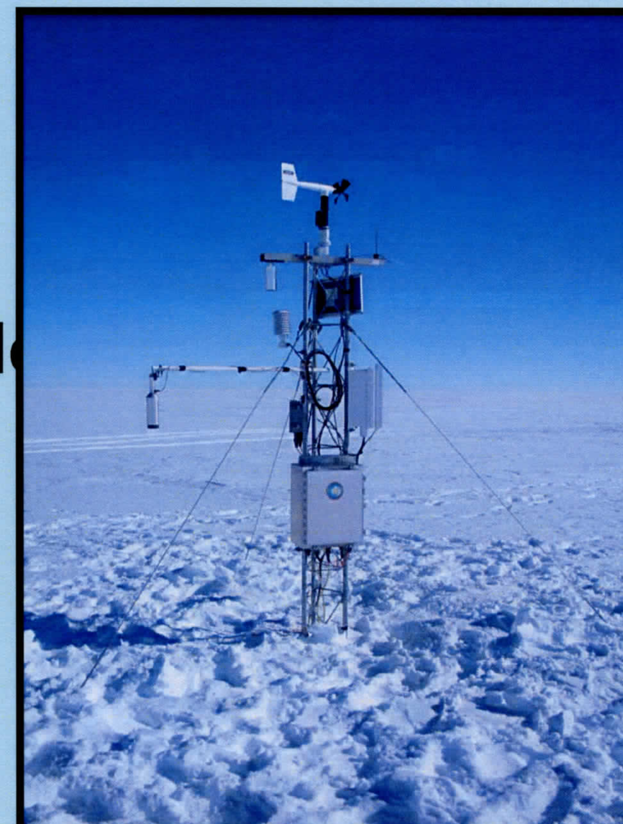
- Issues:
  - Raised AWS
  - 7 foot tower section adde
- System Operational



Carolyn AWS

- Issues:
  - Raised electronics
  - No new tower sections add

- System Operational



Vito AWS

- Issues
  - Raised AWS
  - Added 7 foot section
  - Rebooted AWS
- System Operational

Emilia AWS

- Issues:
  - Bolted on tower sections
  - Raised AWS
  - Added 7 foot section
  - Delta-T boom not found
    - (just cables – not hooked up)
- System Operational

Elaine AWS

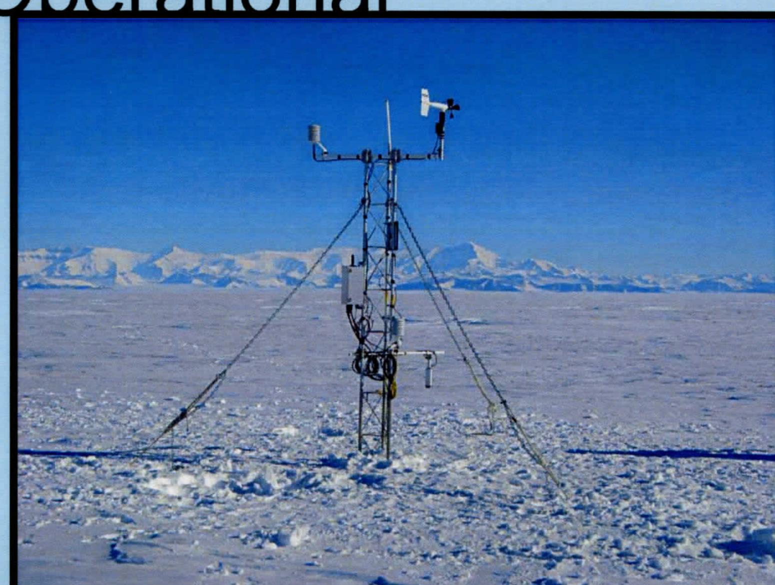
- Issues
  - Raised AWS
  - Added 7 foot tower section
- System Operationa

Kominko-Slade AWS

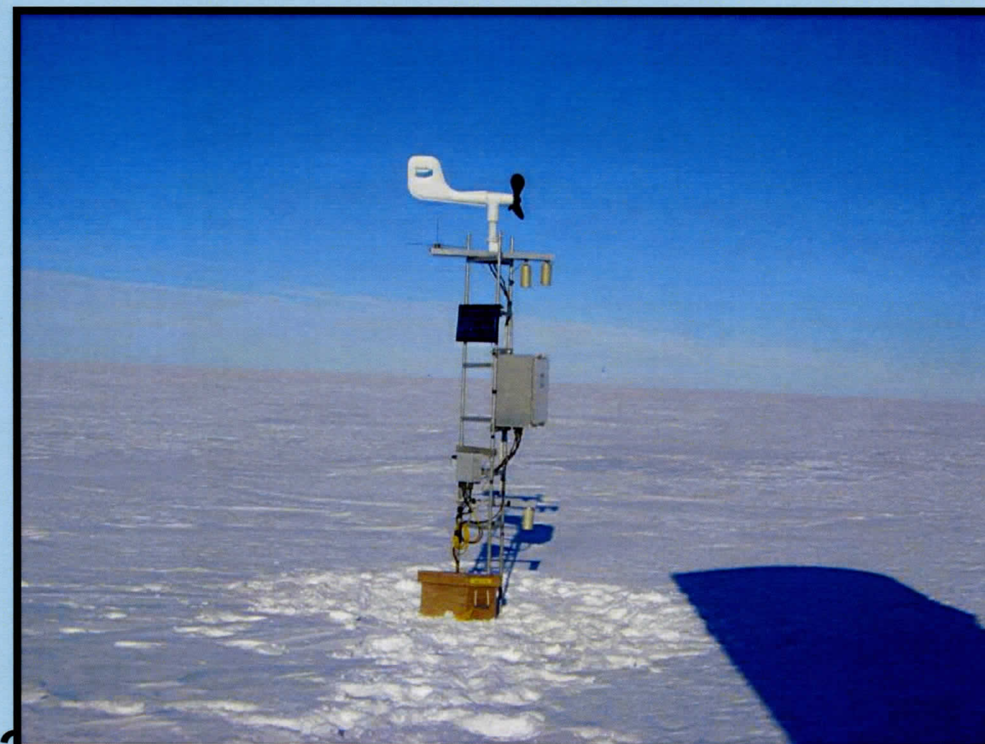
- Issues:
  - Not transmitting
  - Replaced electronics
    - Snow temperature sensors unable to be used with replaced electronics
- System Operational

Sabrina AWS

- New AWS Install
- System Operational



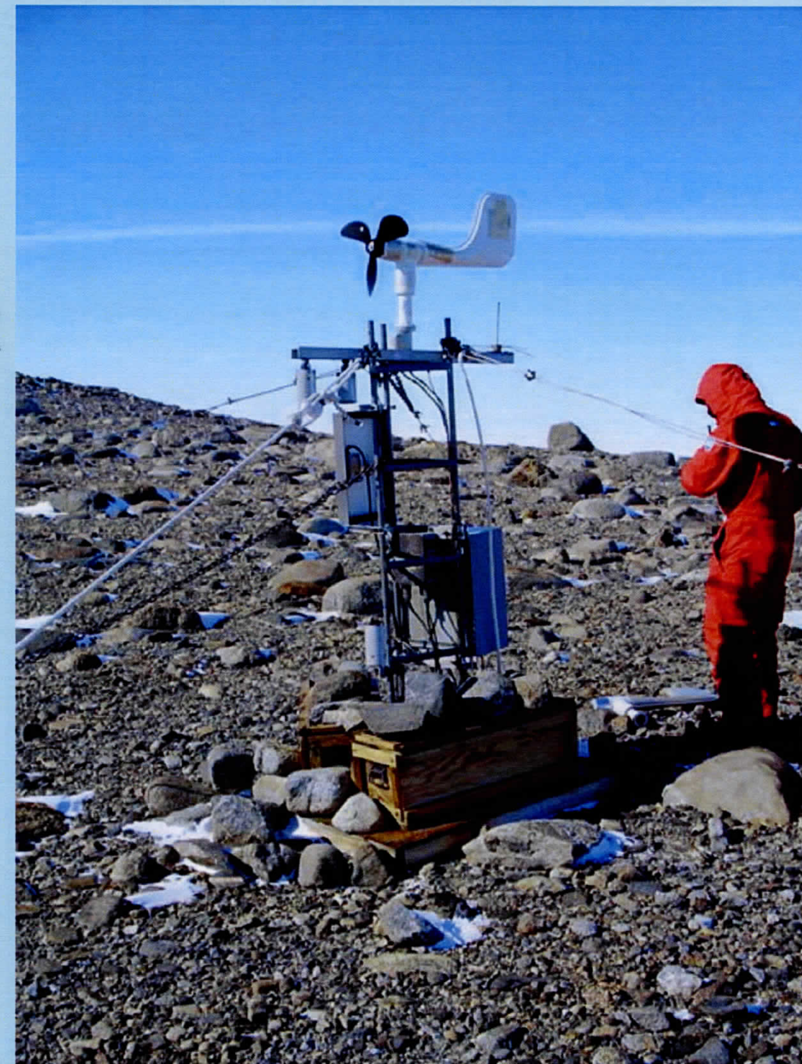
Lettau AWS



- Issues
  - Rebooted AWS
  - Raised AWS
  - Added batteries
- System Operational

Maneula AWS

- Issues:
  - Aerovane Replacement
- System Operational



D-10, D-47, D-66 and D-85

- D-10 – new Relative Humdity sensor installed & Operational
- D-47: Operational

- E-66: Off A

- D-85: Operational

Thank you!

Summary:

* Visited over 21 sites

    - 1/3 of the network!

* Most of the network operational

* Minor issues for next season:

    - Pegasus North to be replaced at WINFLY

    - Williams Field to become Argos III test site

Williams Field AWS


A Review of the 2009-2010 Automatic Weather Station (AWS) Field Season
Matthew A. Lazzara[1], Nicole M. Schroeder[1,2], Lee J. Welhouse[2], George A. Weidner[2], and Jonathan E. Thom[1]
[1] Antarctic Meteorological Research Center
Space Science and Engineering Center
[2] Department of Atmospheric and Oceanic Sciences
University of Wisconsin-Madison
O-283-M/P/S
AMRC
THE UNIVERSITY of WISCONSIN MADISON
SSEC
UNITED STATES ANTARCTIC PROGRAM
NATIONAL SCIENCE FOUNDATION


2009-2010 Field
Team
Dr. Matthew Lazzara
Nicole Schroeder
Lee Welhous

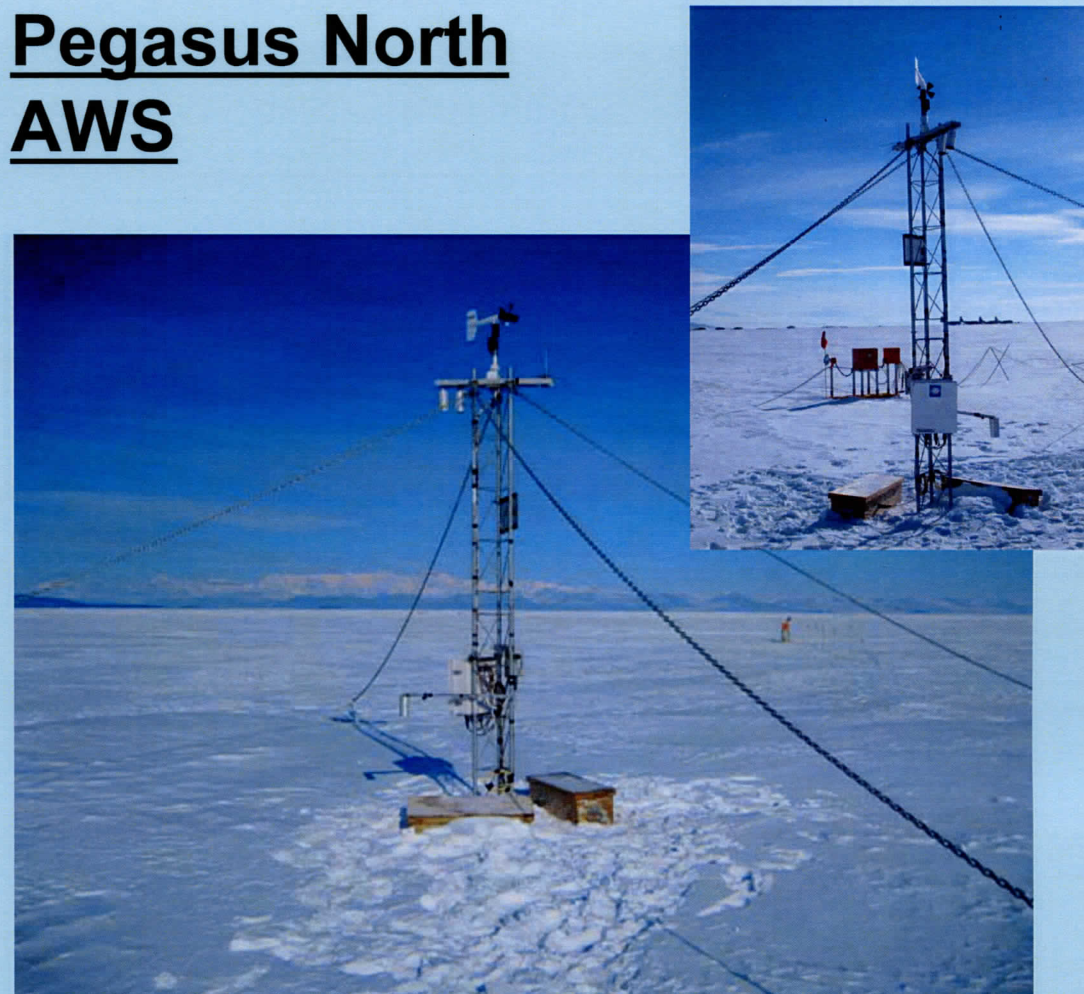
Pegasus North AWS

Visit #1:

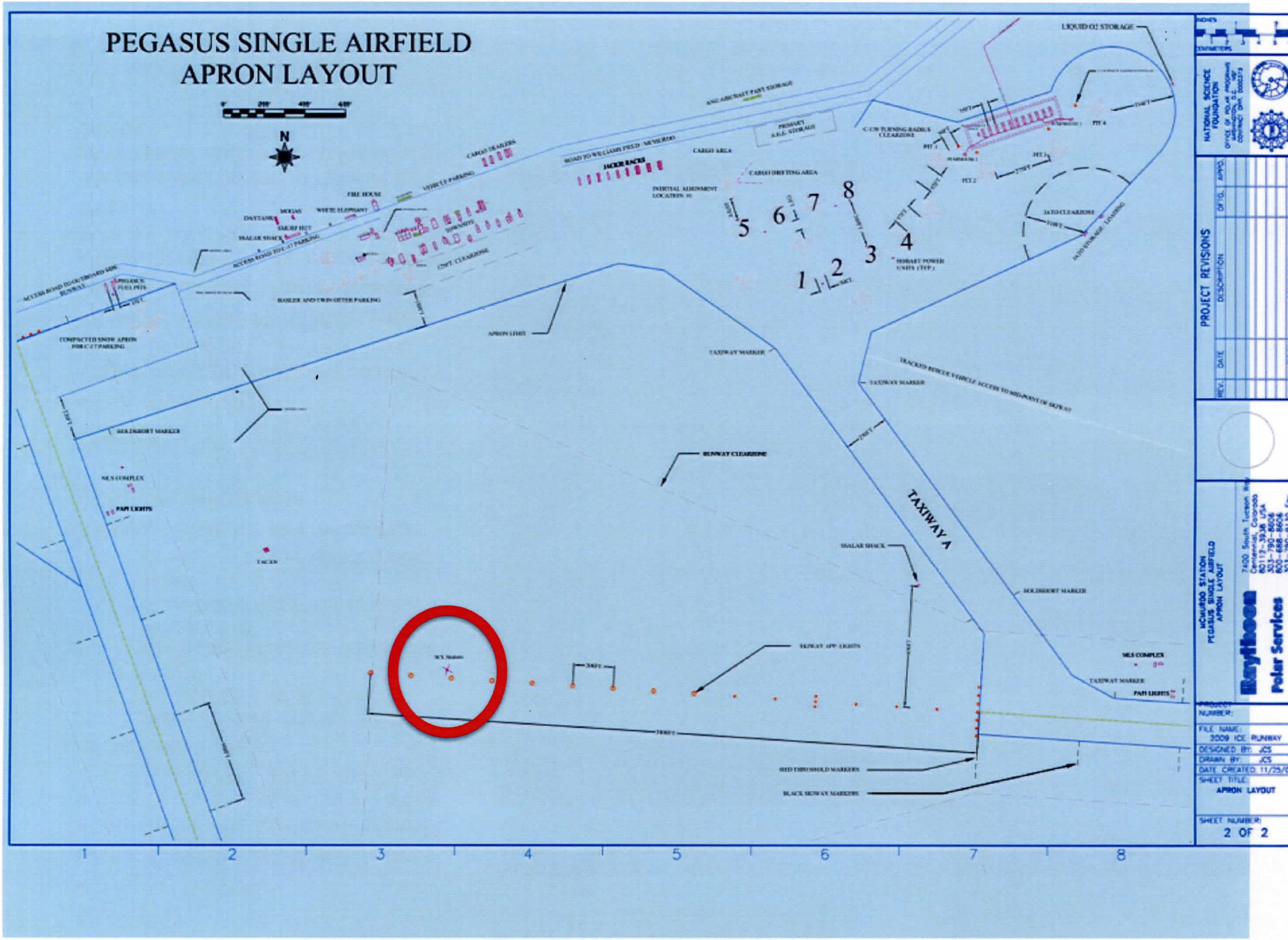
- Date: 17/Jan/2010
- Time: 5:15 pm local McMurdo time
- Team members: Matthew Lazzara, Nicole Schroeder, and Lee Welhouse
- Measurements to the surface (bottom of the following):
  - Delta-T: 28.24 inches (0.72 meters)
  - Junction Box: 42.50 inches (1.1 meters)
  - Electronics Enclosure: 30.25 inches (0.77 meters)
  - Solar Panel: 86.25 inches (2.2 meters)
  - Boom: 131.25 inches (3.3 meters)
- Battery Voltages: Not measured
- AWS site assessment

Visit #2:

- Date: 24/Jan/2010
- Team members: Matthew Lazzara, Nicole Schroeder, Lee Welhouse
- Measurements: None measured
- Battery Voltages: None measured
- UNAVCO GPS: Yes, measure from 9:30 am until roughly 10:15 am local time.
- Repaired/tightened up mounting of wind sensor and re-taped loose cables.



- Wind Sensor out of alignment (more in near
- Re-secured cables



PEGASUS SINGLE AIRFIELD
APRON LAYOUT
N
LIQUID O2 STORAGE
AND AIRCRAFT PARTS STORAGE
PRIMARY A.G.E. STORAGE
ROAD TO WILLIAMS FIELD / MCMURDO
CARGO AREA
CARGO DRIFTING AREA
JACKER RACKS
INERTIAL ALIGNMENT LOCATION
C-130 TURNING RADIUS CLEARZONE
PIT 1
PIT 2
PIT 3
PIT 4
JATO CLEARZONE
HOBART POWER UNITS (TYP.)
CARGO TRAILERS
VEHICLE PARKING
FIRE HOUSE
WHITE ELEPHANT
MOGAS
DAYTANK
SMURF HUT
SSALAR SHACK
ACCESS ROAD TO C-17 PARKING
BASLER AND TWIN OTTER PARKING
PEGASUS FUEL PITS
COMPACTED SNOW APRON FOR C-17 PARKING
APRON LIMIT
TAXIWAY MARKER
TRACKED RESCUE VEHICLE ACCESS TO MID-POINT OF SKIWAY
HOLDSHORT MARKER
RUNWAY CLEARZONE
TAXIWAY A
NLS COMPLEX
PAPI LIGHTS
TACAN
SSALAR SHACK
SKIWAY APP. LIGHTS
RED THRESHOLD MARKERS
BLACK SKIWAY MARKERS
MLS COMPLEX
PROJECT REVISIONS
REV. | DATE | DESCRIPTION | OF'D. | APPD.
X | MM/DD/YY | DESCRIPTION | XXX | XXX
NATIONAL SCIENCE FOUNDATION
OFFICE OF POLAR PROGRAMS WASHINGTON, D.C. NSF CONTRACT OPP. D000273
MCMURDO STATION
PEGASUS SINGLE AIRFIELD
APRON LAYOUT
7400 South Tucson Way
Centennial, Colorado 80112-3938 USA
303-790-8606
800-688-8606
303-790-9130 Fax
Raytheon
Polar Services
PROJECT NUMBER:
FILE NAME: 2009 ICE RUNWAY
DESIGNED BY: JCS
DRAWN BY: JCS
DATE CREATED: 11/25/09
SHEET TITLE: APRON LAYOUT
SHEET NUMBER: 2 OF 2

Kominko-Slade (WAIS)

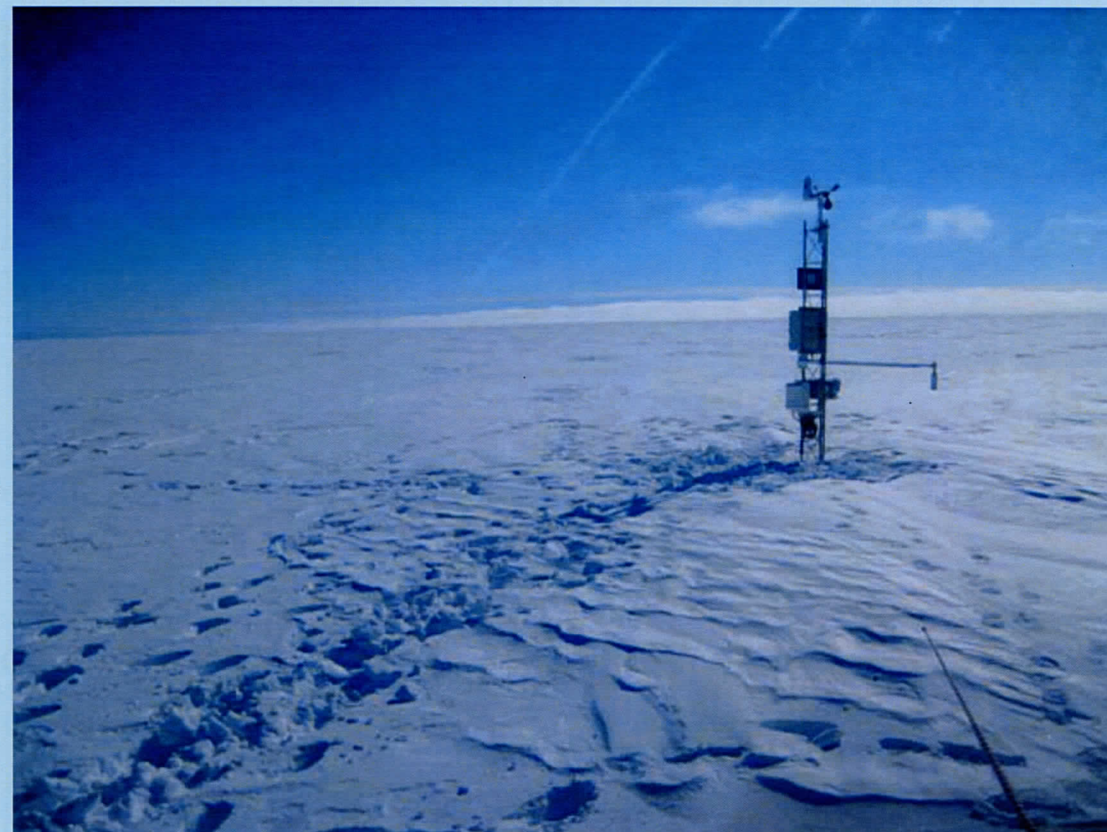
- Date: 20/Jan/2010
- Time: 9:30 am through 12 noon, 1:30 pm through 3:30 pm
- Team members: Matthew Lazzara, Charlie Bentley, Yvonne Gambini, Bradley Simon, Tony Wendricks
- Measurements to the surface (bottom of the following):
- Before Tower Raise:
  - Delta-T #1: 21.5 inches (0.55 meters)
  - Junction Box: 16.5 inches (0.42 meters)
  - Electronics Box: 34.0 inches (0.86 meters)
  - Solar Panel: 58.0 inches (1.47 meters)
  - Boom: 73.0 inches (1.85 meters)
  - Delta-T #2: 18.0 inches (0.46 meters)
- After Tower Raise:
  - Delta-T #1: 70.0 inches (1.78 meters)
  - Junction Box: 80.0 inches (2.03 meters)
  - Electronics Box: 102.0 inches (2.59 meters)
  - Solar Panel: 145.0 inches (3.68 meters)
  - Boom: 160.0 inches (4.06 meters)
  - Delta-T #2: 28.5 inches (0.72 meters)
- Snow temperature probe electronics
  - Enclosure: 48.5 inches (1.23 meters)
- Battery voltages:
  - Solar Panel: 12.78 volts
  - Battery #1: 12.82 volts
  - Battery #2: 12.83 volts
  - 100 Amp/hr battery for snow temp: 13.03 volts
- UNVACO GPS: Yes, measured from 9:30 am until 3:30 pm local time.
- Raised AWS with a 7 foot tower section and installed electronics/battery to record snow temperature string sensors.

Dr.Charlie Bentley

- Raised tower
- Installed electronics –
  - recording snow temperature profiles!
- Finally operating over a full year!!

Ferrell AWS

- Date: 29/Jan/2010
- Time: 11:00 am through 12:00 pm local time
- Team Members: Lee Welhouse, Markov Dimov (Helo Pilot)
- Took measurements and raised the ADG, lower temperature sensor, and lower enclosure. The measurements of the tower were as follows,
- Upon arrival (in inches):
  - Lower temperature sensor: 6
  - Lower Enclosure: 8.5
  - Lower Solar: 31
  - ADG: 16.5
  - Upper Solar: 87
  - Boom: 115.5
  - Junction 17.5
  - Upper Enclosure: 56
- After leaving:
  - ADG: 33
  - Lower Enclosure: 27
  - Lower Temp: 25.5



- Raised lower components
- Swapped out ADG memory module

Windless Bight

Visit #1:

•Date: 25/Jan/2010

•Time: 9:50 am through 12:00 noonTeam members: Matthew Lazzara, Nicole Schroeder, Marko Dimov

•Measurements to the surface (bottom of the following):

•Before Tower Raise:

- •Solar Panel: 57.0 inches (1.45 meters)
- •Junction Box: 0 inches (0 meters) at surface
- •Electronics Box: Subsurface
- •Temp probe on boom: 58.0 inches (1.47 meters)
- •Antenna: N/A '
- •Boom: N/A
- •ADG Subsurface

After Tower Raise:

- •Solar Panel: 98.0 inches (2.49 meters)
- •Electronics box: 63.0 inches (1.60 meters
- •Antenna: 113.5 inches (2.88 meters)
- •Boom: 126.5 inches (3.21 meters)
- •Junction Box: 44.0 inches (1.12 meters)

•Battery Voltages:

- •Solar Panel: 20.7 volts
- •Battery: 12.87 volts

•UNAVCO GPS: Yes, measured from 9:50 am through 11:30 am

•Raised AWS with a 5 foot tower section, removed damaged ADG

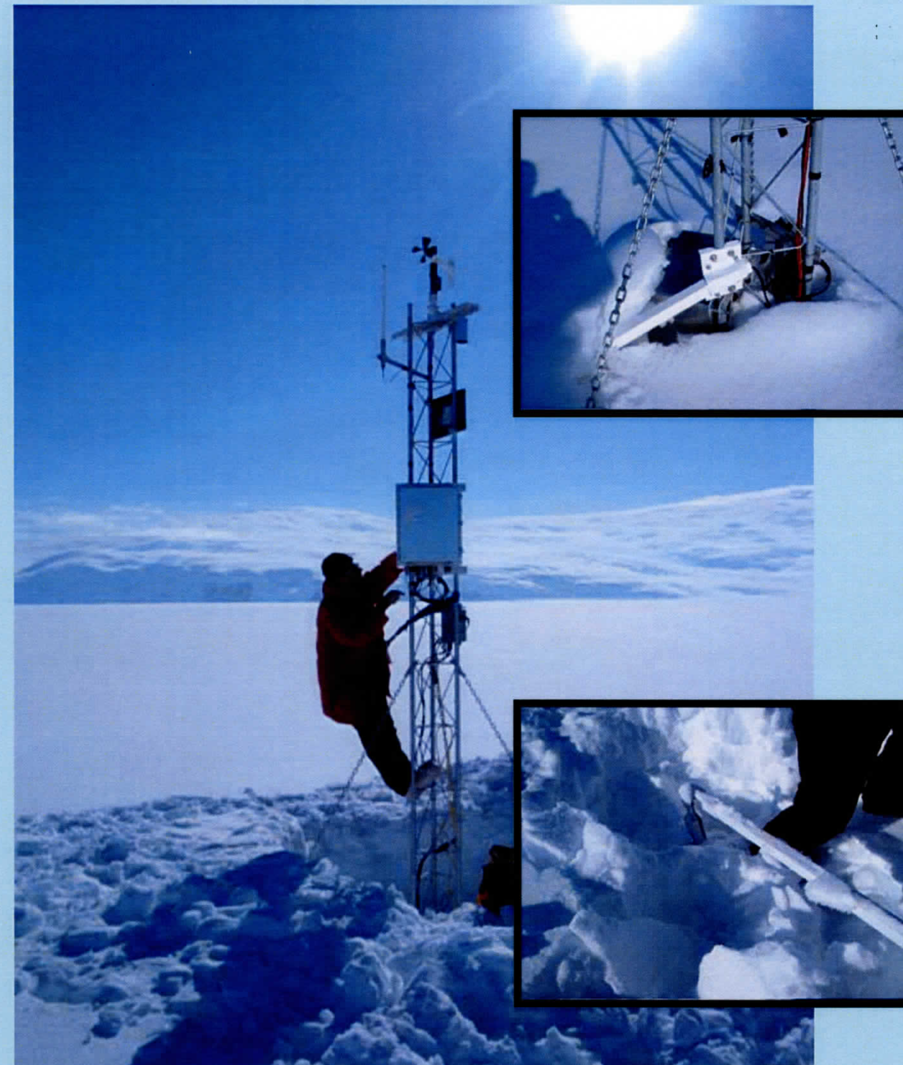
Visit #2:

•Date: 29/Jan/2010

•Time: 9:00 am through 10:30 am

•Team Members: Lee Welhouse and Marko Dimov

•Attached new ADG bar at approximately 4 foot 6 inches.



•Raised tower

•Replaced damaged ADG arm moun

Elaine AWS

- Date: 29/Jan/2010
- Time: Arrived at 11:35 am, departed at 4:35 pm
- Team members: Matthew Lazzara, Karl Frei (from RPSC Cargo), Twin Otter Pilots Brian and Phil.
- Measurements to the surface (bottom of the following (Made via a proxy measure):
  - Acoustic Depth Gauge: 48 inches (1.22 meters)
  - Depth of snow temp. probe: ~48 inches (~1.22 meters) (from below the snow surface)
- Battery voltages:
  - Batteries: ~13+ volts on both
  - Junction Box: ~14 volts
  - Solar Panel: 22 volts
- UNAVCO GPS: Yes
- Removed existing AWS system that was not working and installed new AWS system (electronics, sensors, etc.)

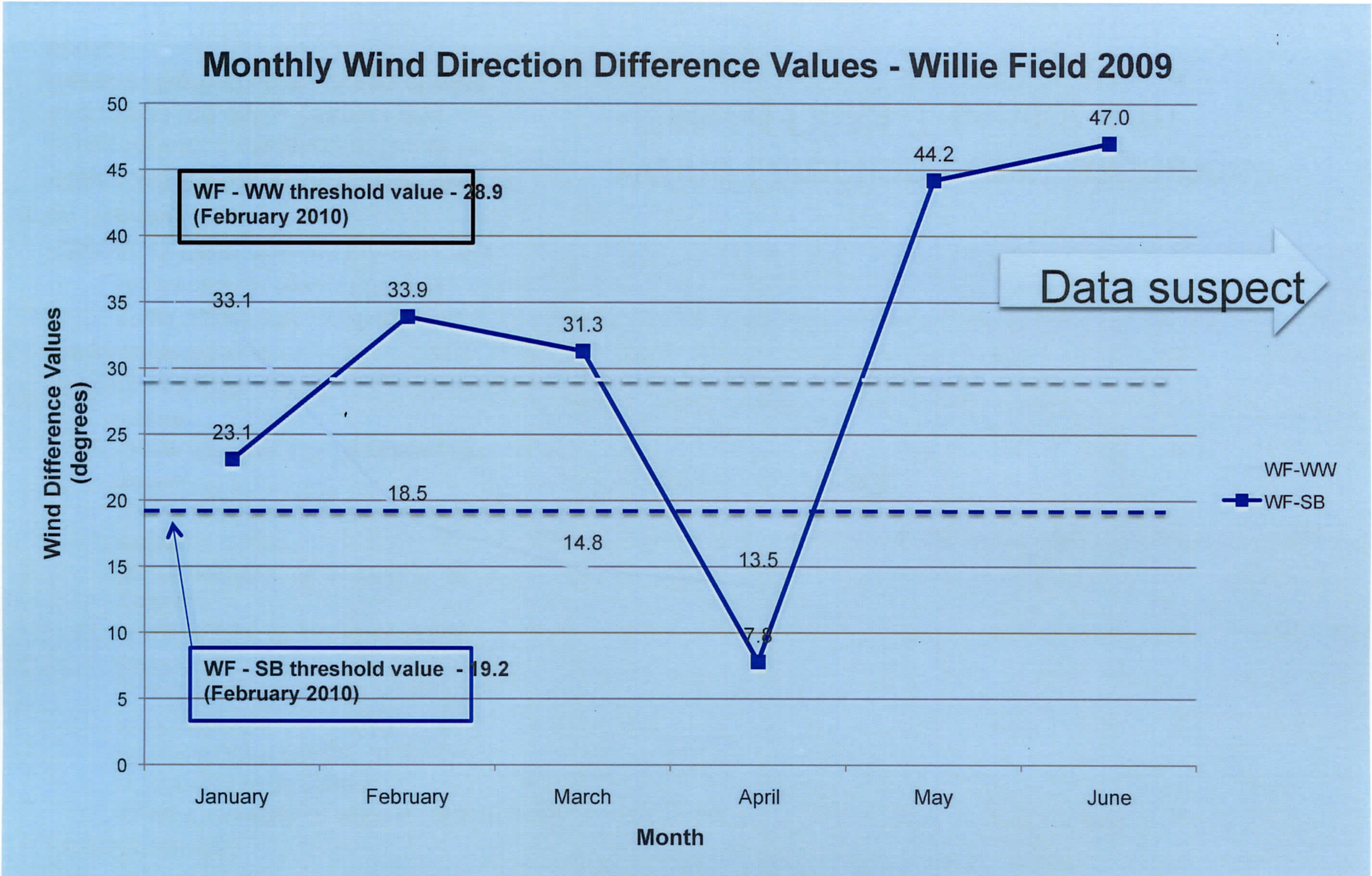
* Replaced AWS:

New Sensors: ADG & Insolation

Willie Field AWS

- Dates: 31/Jan/2010 1/Feb/2010
- Time: Sunday - ~1 pm to 3:30 pm
  Monday - ~10 am to 1 pm
- Team Members: Matthew Lazzara and Lee Welhouse
- Measurements:
  - Delta-T: 0 inches (0 meters) - raised to 33 inches (0.84 meters)
  - Acoustic Depth Gauge: 22.5 inches (0.57 meters)
  - Lower Solar Panel: 29.0 inches (0.74 meters)
  - Junction Box: 19.75 inches (0.50 meters)
  - Electronics Box: 55.0 inches (1.40 meters)
  - Upper solar Panel: 131.0 inches (3.32 meters)
  - Boom (I-beam): 153.75 inches (3.91 meters)
- Battery voltages: (AWS Only - taken at the junction box)
  - From Solar Panel - 12.6 volts
  - To Electronics Box - 11.89 volts
- UNVACO GPS: Yes on Monday (not on Sunday)
- Removed Radiation shield test site equipment for installation at South Pole and raised the delta-T sensor and Repaired/tighted up mounting of wind sensor

- Wind Direction out of alignment
- Raised Delta-T sensor arm



WF = Willie Field AWS SB = Scott Base WW = White Out AWS

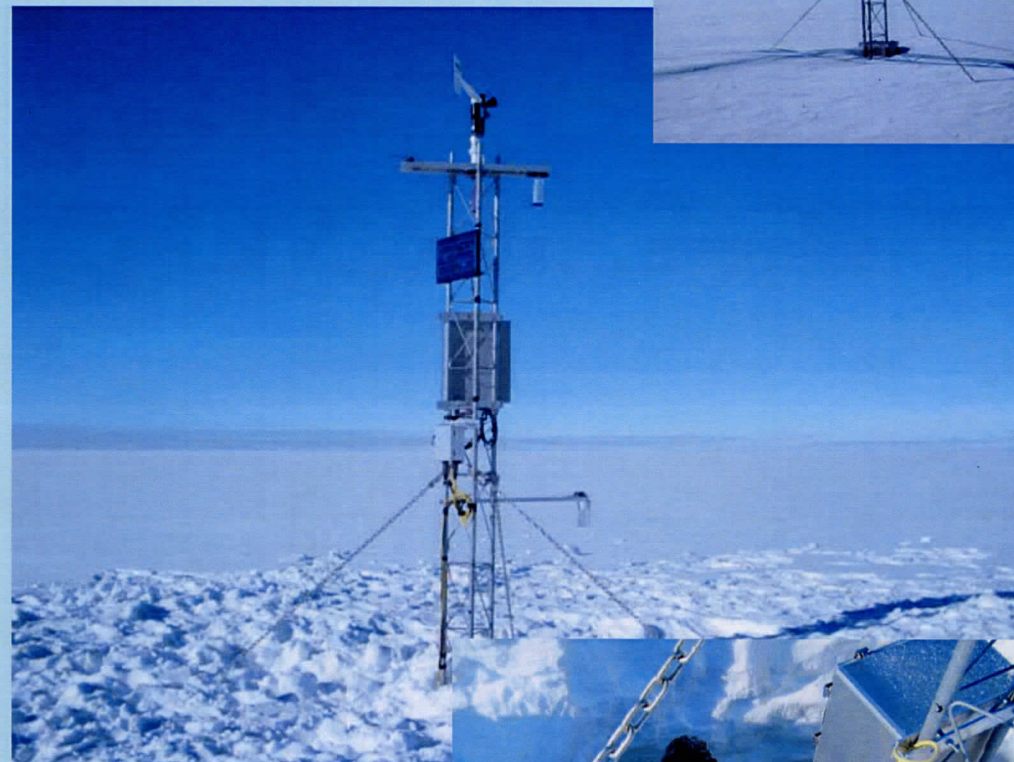
South Pole Radiation Shield Test Site

- Date: 4/Feb/2010
- Time: 2:00-3:00 pm and 8:30 pm to 111:45 pm
- Team members: Lee Welhouse and South Pole Meteorology Office
- Measurements:
  - 36 inches between the bottom of the sensor bar and snow surface.
- Installed radiation shield test AWS

- New Install
- CR-1000 AWS

Eric AWS

- Date: 2/Feb/2010
- Time: ~1:50 pm to ~4:30 pm local McMurdo time.
- Team Members: Matthew Lazzara, Lee Welhouse, Justin Dye (RPSC - FEMC), Zach Heid (RPSC - VMF), Lexy and Lee (Twin Otter Pilots)
- Measurements to the surface (bottom of the following):
- Before:
  - Solar Panel: 33 inches (0.84 meters)
  - Sensor Boom: 62 inches (1.57 meters)
  - All other components buried in the snow
- After:
  - Delta-T: Variable
  - Junction box: 52.50 inches (1.33 meters)
  - Electronics box: 62.25 inches (1.58 meters)
  - Solar Panel: 95.50 inches (2.43 meters)
  - Sensor Boom: 122.00 inches (3.10 meters)
- Battery Voltages: 12.75 volts at the power plug
- UNAVCO GPS: Yes
- Dug out AWS (half buried in snow), removed old batteries, installed new batteries, raised AWS with a 5 foot tower section.



- Raised AWS
- Recovered batteries

Lettau AWS

- Date: 30/Jan/2010
- Time: 1:30 pm local - Ground time of less than an hour
- Team Members: Matthew Lazzara, Lee Welhouse, Lexy and Lee (Twin Otter pilots)
- Measurements to the surface (bottom of the following):
  - Boom (to I-beam): 90.00 inches (2.29 meters)
  - Solar Panel: 66.25 inches (1.68 meters)
  - Junction Box: 27.00 inches (0.69 meters)
  - Electronics Box: 41.50 inches (1.05 meters)
  - Delta-T: 11.50 inches (0.29 meters)
- Battery Voltages:
  - Solar Panel: 14.0 volts
- UNAVCO GPS: Yes

* Replaced Battery Box

Byrd AWS

•Date: January 26, 2010

•Field Team Members: Dr. David Holland, Joe Petit, Susha Dore, Hayden (Kiwi mechanic)

•AWS dug out and raised. Switched to a new tower type and installed new boom and new batteries.

•Raised AWS

•Switched to “new” tower

•Installed new batteries

•Install new sensor boom

Collaboration with France/ IPEV

D-47

- Date: Jan 13, 2010 and Feb 1, 2010
- Field Team: IPEV field/ RAID team
- AWS 8947 removed
- AWS 8916 installed

E-66

- Date: Jan 24, 2010
- Field Team: IPEV field/ RAID team
- Existing poor-performing AWS 8912 removed
- AWS 8947 installed

Nov 2009 / Jan 2010

Adelie Land AWS report

Alain PIERRE
IPEV
Nov 2009 / Jan 2010

- Cargo Problems
  - No new AWS at:
    - Cape Denison
    - Port Martin
- New high speed wind systems
  - Available for these sites

2) Cape Denison : ID8988

Type : independent anemometer and wind direction sensor (Same as Port Martin)
Electronic : AWS2D
Current Status: HWS is not working
Location : 67°0'S / 142°39'E

This AWS is maintained by Mawson's Hut expeditionners.

NB : For Cape Denison AWS, boxes has to be received at Hobart before end of Nov.

3) Port Martin : ID8909

Type : High wind system anemometer and wind direction sensor (Taylor Scientific)
Electronic : AWS2D with Telonics ST-5
Current status: Not working, Has to be replaced as soon as possible. (scheduled for Nov 2010)

Location : 66°49'S / 141°23'E


AWS Port Martin (Wind anemometer has gone)

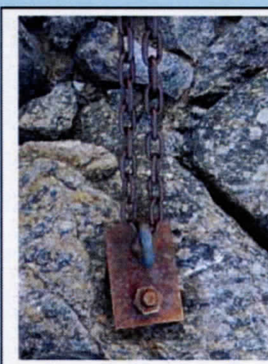
Actually Port Martin AWS can only be repaired during Nov, while Astrolabe vessel with 2 helicopters on board are not very far from Port Martin.

This year (Nov 2009) we went at Port Martin but unfortunately it was too windy to do any maintenance on it (80/km/h and higher wind with gusts).

The only parts which are in good conditions are :
- The mast
- Anchor points with steel chain and steel cable.

All others parts have to be replaced.


Steel cable tension (Good cond)


Anchor point (Good cond)


Junction box (Bad condition)

- D-10 AWS:
  - Operating nominally
- D-47 AWS
  - Removed 8947
  - Installed 8916

NB : Last summer season, AWS Port Martin box was not complete. One junction box was missing and terminations wire was not adapted at usual junction box plugs. However, replacement could still be done with some electrical adaptations and also because one spare junction box was available at Cap Prudhomme.

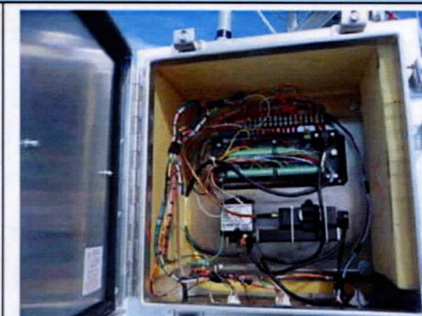
For others scientific reasons we have to go to Port Martin in Nov 2010 and we will try to install a new AWS station if AWS boxes are received at Hobart.

NB : Port Martin AWS boxes has to be received at Hobart before 10th of October.

4) D10: ID 30374

Type : RM Young mounted on Bendix base on sensor boom.
Electronic : Campbell CR10X
Current status: Working ok
Location : 66°42'S / 139°50'E

D10 AWS (Feb 2010)



D10 AWS : Electronic box

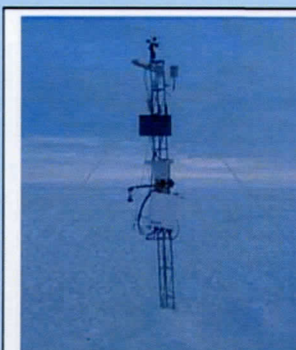
Maintenance schedule :

- Due to annual snow, we will probably add a section mast during 2010-2011 summer season.

5) D47 : ID8916

(installed in Feb 2010)
Type : RM Young mounted on Pipe all sensors independent mounts to tower
Electronic : AWSCR1000 with Telonics ST-20 PTT ID 8916
Current Status: Transmitting need to check data but would assume is OK
Location : 67°23'S 138°43,4'E

NB : Actual section mast used is smaller (IPEV mast) than AMRC section mast size. Keep in mind for next time when maintenance will be done.



D47. (Janv 2010)

- E-66 AWS:
  - Removed 8912 AWS
  - Installed 8947 AWS
- D-85 AWS:
  - Operating nominally

6) E66 : ID8947

installed in Jan 2005 at D47 and removed in Jan 2010 for E66
Type : Bendix on sensor boom
Electronic : AWS2B with Telonics ST-5 PTT
Current status: Working OK
Location :xxxxx / xxxxxx ?

Maintenance schedule :

- Due to annual snow, we will probably add a section mast during 2010-2011 summer season.


E66 AWS (Feb 2010)

7) D85 : ID8986

Type : RM Young on Bendix base on sensor boom
Electronic : AWS2B Telonics ST-5 PTT
Current Status: Working OK
Location : 70°25,6'S 134°08,8'E

Collaboration with Japan/ JARE

Dome Fuji

- Date: 12 January 2010
- Field Team: Dr. Motoyama & JARE
- Removed existing non-working AWS and installed a new AWS.

Relay Station

- Date: 31 January 2010
- Field Team: Dr. Motoyama & JARE
- Removed existing non-working AWS and installed a new AWS

AWS in Antarctica by Japanese Antarctic Research Expedition in June 2010.

listed by Takao Kameda

1. Data Logger Type

Parameters are T: temperature, WS: wind speed, WD: wind direction.

Site name	Latitude	Longitude	Elevation	Set up year	Parameters	Interval	Number	WMO No.	Instruments (Data logger)
Mid Point	76°47'37"S	31°54'01"E	3742m	2007	T, WS, WD	1hour	-	-	North One Co. Ltd, KADEC
Dome Fuji	77°19'00"S	39°42'11"E	3810m	1993	T, WS, WD	1hour	-	-	North One Co. Ltd, KADEC

2. ARGOS Type

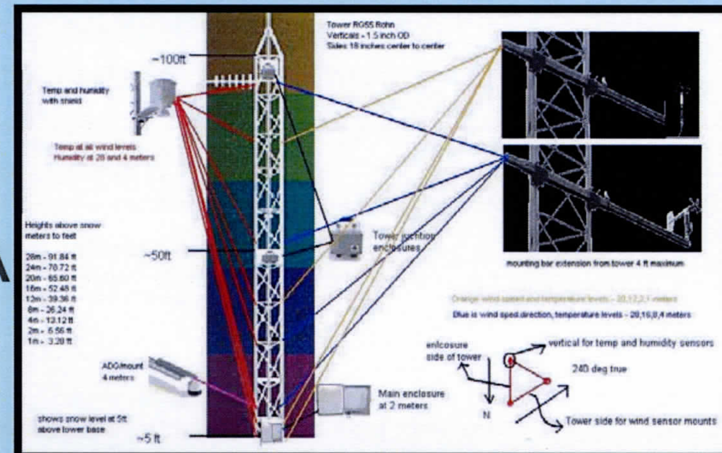
ARGOS-AWS units were set up at four sites as a cooperative program between Japanese Antarctic Research Expedition and University of Wisconsin, USA.

Parameters are T: temperature, WS: wind speed, WD: wind direction, P: atmospheric pressure

Site name	Latitude	Longitude	Elevation	Set up year	Parameters	Interval	Argos ID	WMO No.	Instruments
Mizuho	70° 42'00"S	44° 17'21"E	2250m	2001	T, WS, WD, P	10 min.	21359	-	Univ. of Wisconsin., ARGOS
Relay Station	74° 00'29"S	42° 59'48" E	3353m	1995	T, WS, WD, P	10 min.	8918	89744	Univ. of Wisconsin., ARGOS
Dome Fuji	77°19'00"S	39°42'11"E	3810m	1995	T, WS, WD, P	10 min.	8904, 8982	89734	Univ. of Wisconsin., ARGOS
JASE2007	75°53'17"S	25°50'01"E	3661m	2007	T, WS, WD, P	10 min.	30305	-	Univ. of Wisconsin., ARGOS

Sites Not Installed

(Due to weather, scheduling, etc…)

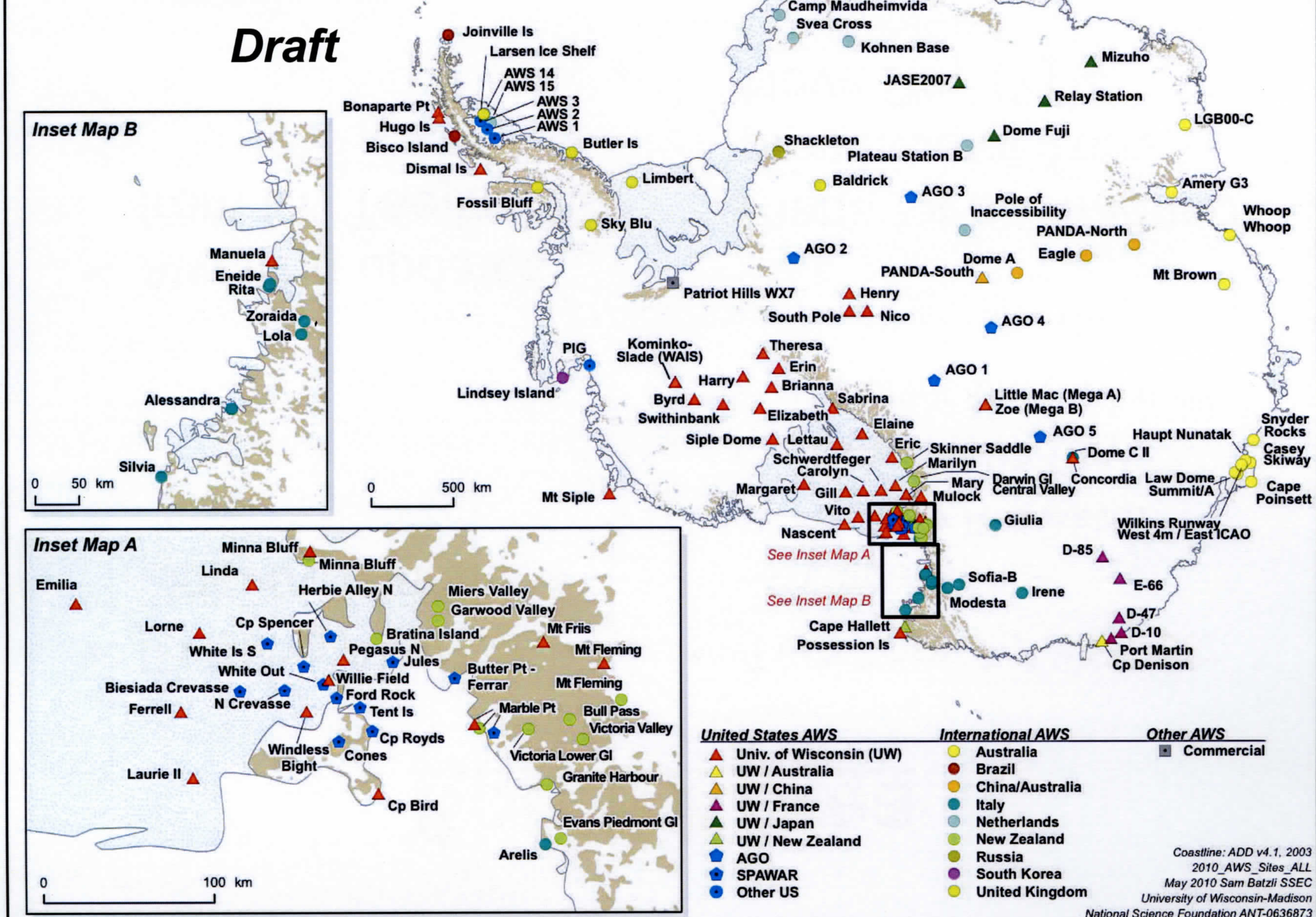


- South of McMurdo Station:
  - **Tall Tower AWS - new**
- In Pine Island Glacier (PIG) A
  - **Thurston Island - new**
  - **Bear Peninsula - new**
  - **Pig Helo Camp Site C - new**
    - Maybe installed at/near Meyers Nunatak?
  - *All of these are co-located at POLENET sites*
- **Siple Dome AWS** (in need of replacement electronics)
- **Minna Bluff** (in need of a new tower)

South Korea

- Existing AWS at Lindsey Island
- Awaiting updates from Dr. Taejin Choi
- Two *new* AWS at:
  - Cape Burks
    - (near Russkaya)
  - Terra Nova Bay
    - (near Mario Zuchelli)
- Plans for an manned presence at Terra Nova Bay (?)

Automatic Weather Stations
Antarctica - 2010



AWS Issues

- Larsen Ice, Carolyn, Panda South
  - Off the air
- Mizuho and Siple Dome
  - Bad data values
- Harry
  - Relative humidity not well
- Schwertfeger & E-66
  - Periodic pressure jumps
- JASE2007
  - Wind speed stuck at 1 m/s
- Cape Denison
  - Lost wind
  - Hence no pressure corrections
- Eric AWS
  - wind direction not reported between 347 and 360 degrees.
- Manuela
  - speed information gone, wind direction o.k.
- Mt. Siple & Possession Island
  - Fading off air (winter)
- Peter I and Whitlock
  - Installed & not working multiple years

Thank you!

Acknowledgements:

National Science Foundation, Office Polar Program Grant #ANT-06368783

Thanks to Raytheon Polar Services, PHI Helicopters, Ken Borek Air, IPEV, JARE, 109th NYANG, and Mawson's Huts Foundation.

Antarctic Automatic Weather Stations
Field Report for 2007-2008

George A. Weidner
Matthew A. Lazzara
Shelley L. Knuth
Jonathan E. Thom
Thomas Nylen[1]

Space Science and Engineering Center
University of Wisconsin - Madison
Madison, Wisconsin 53706

[1] UNAVCO
Boulder, CO 80301

The National Science Foundation's Office of Polar Programs funds the placement of automatic weather station (AWS) units in remote areas in Antarctica in support of meteorological research, applications and operations. The basic AWS units measure air temperature, wind speed and direction at a nominal height of 3 meters above the surface. Air pressure is measured at the height of the AWS electronic enclosure. Some units measure relative humidity at 3 meters above the surface and the air temperature difference between .5 and 3 meters above the surface at the time of installation. The data are collected by the ARGOS Data Collection System (DCS) on board the National Oceanic and Atmospheric Administration (NOAA) series of polar-orbiting satellites.

The AWS units are located in arrays for specific proposals and at other sites for operational purposes. Any one AWS may support several experiments and all support operational meteorological services - especially support for weather forecasts for aircraft flights.

Research areas supported include:

- Barrier wind flow along the Antarctic Peninsula and the Transantarctic Mountains
- Katabatic wind flow down the Reeves, Byrd and Beardmore Glaciers, the Siple and Adelie Coast
- Mesoscale circulation and sensible and latent heat fluxes on the Ross Ice Shelf
- The Ross Ice Shelf Air Stream.
- Climatology of Byrd and Dome C sites
- Meteorological support around the South Pole
- Meteorological support for the West Antarctic Ice Sheet Initiative and the International Trans-Antarctic Scientific Expedition
- Long Term Ecological Research (LTER) along the Antarctic Peninsula
- Southern Ocean Global Ocean Ecosystems Dynamics
- Meteorological support for United States Antarctic Program flight operations

The following are supported principal investigators funded by NSF-OPP.

- Dr. Douglas R. MacAyeal: Iceberg Drift in the Near-Shelf Environment, Ross Ice Shelf, Antarctica.
- Dr. Ray Smith, Long Term Ecological Research: Racer Rock, Bonaparte Point, and Santa Claus Island.
- Dr. Robert C. Beardsley, Southern Ocean GLOBEC: Marguerite Bay and the Islands in the area.
- West Antarctic Ice Sheet Initiative and International Trans Antarctic Scientific Expedition: Siple Dome and West Antarctic Divide drilling sites.
- Dr. Tom Parish and Dr. John Cassano: The Ross Ice Shelf Air Stream
- Aircraft Operation: All AWS sites in Antarctic.
- The Antarctic AWS units support many investigators outside of NSF-OPP.

AMRC/AWS collaboration:

- Climatological analysis from the AWS, and other stations (complimenting the activities in the SCAR READER project).
- Continued data collection, archival and distribution of AWS data.

- The continued generation and improvement of the Antarctic composite satellite imagery (as outlined in the above section).
- Continued educational outreach activities (as outlined in the above section and in the following outreach section).
- Utilities developed to generate climatological analyses from AWS observations.

Field work completed for 2007-2008

For the AS 2007-2008 field season, the field team consisted of George Weidner (O-283) and Jonathan Thom (O-283, I-190), and Mathew Lazzara O-202 and O-283), with assistance from Mr Thomas Nylen of UNAVCO during the month of January. Additional assistance from the personnel at the Crary Lab at Mcmurdo Station, Ken Borek Twin Otter pilots, and Dr. Gordon Hamilton and Ben Parten at WAIS divide field camp and West Antarctic Sites, and finally John Gallagher and the Met Office staff at South Pole. Also, a big thank you to Rob Easther, Coordinator, Mawson's Huts Conservation Expedition 2007, for replacing the wind sensor on the AWS at Cape Denison. Fieldwork was also done through cooperative programs with personnel from the Japanese Antarctic program (JARE), the French Antarctic program **Institut Polaire Français - Paul Emile Victor (IPEV)** and the **British Antarctic Survey (BAS).**

Summary of University of Wisconsin – Madison fieldwork follows:

A. McMurdo based operations (See full report of January Field team below)

Site	ARGOS ID	Service performed at site
Mullock	8907	New Site with High Wind System
Ferrell	8929	Retrieve ADG data
Willie Field	21364	Retrieve ADG data
Mary	8983	AWS software updated, ADG data
Mount Fleming	30393	New Site installation
Windless Bight	8982	AWS raised
Linda	21362	Replaced defective wind sensor
Lorne	21356	New installation near old Meeley site
Marilyn	8934	Replaced defective wind sensor
Lettau	8928	Raised Aws, replaced 8908 with 8928
Carolyn	8722	Replaced defective wind sensor
Emelia	8980	AWS 8919 replaced with CR10X ID 8980
Mt Friis	28339	AWS transferred from Andrew Fountain
Zoe	2769	Assumed AWS from Megadunes Prgram
Little Mac	2516	Assumed AWS from Megadunes Prgram

B. West Antarctic based operation

Site	ARGOS ID	Service performed at site
Swithinbank	21355	AWS 21355 installed by Gordon Hamilton (X)
Kominko-Slade (WAIS)	8936	AWS rebooted by Ben Parten

C. South Pole

Site	ARGOS ID	Service performed at site
Erin	21362	John Gallagher and field team weather out.

D. Field work in Adelie Land

- Three AWS shipped to Dumont D'Urville (arrived too late for deployment in 2006-2007).
- Cape Denison serviced by Australian Antarctic Historical Society.

E. Field work by the Japanese Antarctic Research Expedition

- Two AWS shipped to Syowa Base for deployment in 2007-2008.

F. Service performed on AWS located near Palmer Station

- New wind system installed on AWS 8923 at Bonaparte Point site.

G. AWS maintained cooperatively with the British Antarctic Survey

Summary of positions and height

Butler Island	S 72 12.38	W 060 10.18	205m
Sky Blu	S 74 47.53	W 071 29.31	1510m
Limbert	S 75 54.85	W 059 15.86	40m
Larsen Ice Shelf	S 67 00.70	W 061 32.97	17m
Uranus Glacier	S 71 21.67	W 068 47.83	753m

- AWS was removed and relocated to Fossil Bluff in 2006.

Current status

Name	Temperature	Pressure	Wind speed	Wind direction
Larsen*	OK	OK	OK	OK
Butler*	OK	OK	OK	OK
Sky Blu*	OK	OK	OK	OK
Limbert*	OK	OK	OK	OK
Fossil Bluff*	OK	OK	OK	OK

*Stations updated to CSI CR1000 based AWS units by BAS for 2007 to date.
•Data are sampled every 10 seconds then averaged every 10 minutes and transmitted.
•The data are downloaded from the ARGOS website every hour then decoded and error checked.

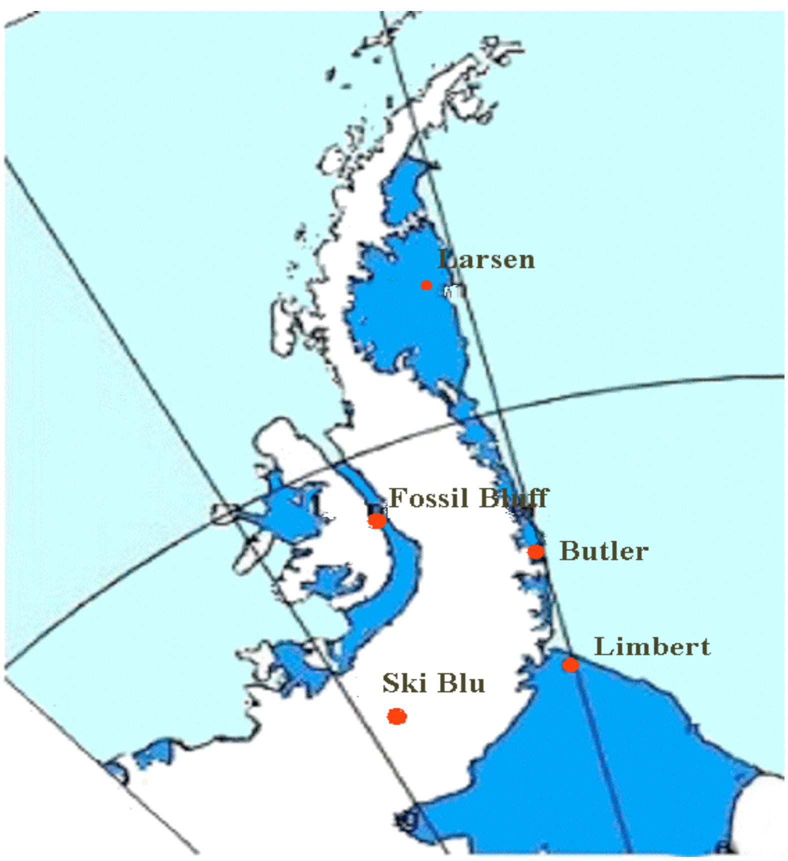


Figure 1. AWS sites maintained by the British Antarctic Survey (BAS)

Table 1: AWS for 2008X. An '@' in the 'Altitude' column indicates a location obtained from UNAVCO GPS. Red print indicates a site was serviced and a red@' is a new value. Blue print indicates 2007 changes or additions/deletions for a site.

SITE	ARGOS ID	Action for	Lat.	Long.	Alt.(m)	Date	WMO#
	2007	2007/2008				STARTED	
	Adelie Coast						
D-10	8986 replaced	30374 (CR10X)	66.71oS	139.83oE	243	Jan-80	89832
D-47	8947		67.397oS	138.726oE	1560	Nov-82	89834
D-66		8912 Installed				Jan-96	
D-85		8916 Installed				Jan-83	89836
Dome C II	8989		75.121oS	123.374oE	3250	Dec-95	89828
Port Martin	8909	8914(?)	66.82oS	141.40oE	39	Jan-90	
Cape Denison	8988	Serviced	67.009oS	142.664oE	31	Jan-90	
Penguin Point	8910	Removed	67.617oS	146.180oE	30	Dec-93	89847
	West Antarctica						
Byrd Station	8903	Visited	80.007oS	119.404oW	1530	Feb-80	89324
Brianna	8931	Serviced	83.889oS	134.154oW	@525	Nov-94	
Elizabeth	21361		82.607oS	137.078oW	@519	Nov-94	89332
J.C.	No AWS	Not active	85.070oS	135.516oW	549	Nov-94	
Erin	21363		84.904oS	128.828oW	@990	Nov-94	
Harry	8900		83.003oS	121.393oW	945	Nov-94	
Theresa	21358	Serviced	84.599oS	115.811oW	1463	Nov-94	89314
Doug	No AWS	Not active	82.315oS	113.240oW	1433	Nov-94	
Mount Siple	8981		73.198oS	127.052oW	230	Feb-92	89327
Siple Dome	8938		81.656oS	148.773oW	@668	Jan-97	89345
Swithinbank	21355	8927 installed	81.201oS	126.177oW	@959	Jan-97	
WAIS K-S	8936	Serviced	79.468oS	112.086oW	@1833	Jan-06	
	Ross Island Region						
Marble Point	8906		77.439oS	163.754oE	@108	Feb-80	89866
Ferrell	8929	ADG data	77.865oS	170.819oE	@45	Dec-80	89872
Pegasus North	21357	Serviced	77.952oS	166.500oE	@8	Jan-90	89667
Pegasus South	8937	Serviced	77.990oS	166.568oE	@5	Jan-91	
Minna Bluff	8939		78.555oS	166.691oE	@47	Jan-91	89769
Mullock	8907		79.018	170.819	@378	Oct-06	
Willie Field	21364	Serviced	77.866oS	166.983oE	@14	Jan-92	
Willie Field	Iridium AWS	Installed	77.866oS	166.983oE	@14	Jan-92	
Willie Field	CR1000 AWS	Serviced	77.866oS	166.983oE	@14	Jan-92	
Windless Bight	8982	Serviced	77.728oS	167.703oE	61	Nov-98	
Cape Bird	8901	Serviced	77.224oS	166.440oE	@42	Jan-99	
Laurie II	21360	Serviced	77.509oS	170.797oE	@37	Jan-00	
Linda	21362		78.439oS	168.406oE	@43	Jan-91	89769
Lorne	21356		78.250oS	170.000oE	@45	Jan-07	
Mt Friis	28339	Updated	77.747oS	161.516 E	@1581	Jan-07	

Mt Fleming	30393	Serviced	77.533oS	160.276 E	@1868	Nov-06	
Cape Hallet	28338	Added Argos	72.190 S	170.160 E	@14	Nov-07	
	Ocean Islands						
Whitlock	8935	Not serviced	76.144oS	168.392oE	(275)@206	Jan-82	89865
Scott Island	No AWS		67.37oS	179.97oW	30	Dec-87	89371
Young Island	No AWS		66.229oS	162.275oE	30	Jan-91	89660
Possession Is.	8984		71.891oS	171.210oE	30	Dec-92	89879
Manuela	8905		74.946oS	163.687oE	80	Feb-84	89864
Peter I	8933		68.769oS	90.670oE	90	Feb-06	
	Ross Ice Shelf						
Marilyn	8934	Serviced	79.954oS	165.130oE	(72)@64	Jan-84	89869
Schwerdtfeger	8913	Serviced	79.875oS	170.105oE	@54	Jan-85	89868
Gill	8911		79.985oS	178.611oW	@54	Jan-85	89376
Elaine	8987		83.134oS	174.169oE	@59	Jan-86	89873
Lettau	8908		82.518oS	174.452oW	55	Jan-86	89377
Vito	8695		78.509oS	177.746oE	@+52	4-Feb	
Emilia	8980(new ID)		78.509oS	173.114oE	@+50	4-Feb	
Carolyn	8722	Serviced	79.964oS	175.842oE	@+52		
Mary	8983	Serviced	79.303oS	162.968oE	@+58		
Nascent	28336		78.127oS	178.497oE	30		
Eric	8697		81.504oS	163.940oE	@+45		
Roosevelt Island		Not installed					
	Antarctic Peninsula						
Larsen Ice	8926	Data download	66.949oS	60.897oW	17	Oct-85	89262
Butler Island	8902	Data download	72.207oS	60.160oW	91	Mar-86	89266
Fossil Bluff	8920	Data download	71.33oS	68.283oW	63	Dec-01	89065
Limbert	8925	Data download	75.422oS	59.851oW	40	Dec-95	89257
Ski-Hi	8917	Data download	74.792oS	70.488oW	1395	Feb-94	89272
Bonaparte Point	8923	8921 CR10X	64.778oS	64.067oW	8	Jan-92	89269
Santa Claus I		8922 CR10X	64.964oS	65.670oW	25	Dec-94	
Racer Rock		Not active	64.067oS	61.613oW	17	Nov-89	89261
Kirkwood Island	8930	Off	68.340oS	69.007oW	30	May-01	
Dismal Island	8932	Working	68.087oS	68.825oW	10	May-01	
	High Polar Plateau						
Henry	8985	Serviced	89.011oS	1.025oW	2755	Jan-93	89108
Nico	8924	Serviced	89.000oS	89.669oE	2935	Jan-93	89799
Relay Station	8918	8918 new AWS	74.017oS	43.062oE	3353	Feb-95	89744
Dome Fuji	8904	Retrieved	77.31oS	39.70oE	3810	Feb-95	89734
Mizuho	21359		70.70oS	44.29oE	2260	Oct-00	
JARE 2008	30305	Installed	77.000 S	20.000 E	3400	Dec-07	
Megadunes	2769		80.775oS	124.526oE	2881	Jan-04	
Panda South	30416	Installed	82.246 S	75.989 E	4027	Jan-08	

M83 (BAS)	9116	Installed	82.774 S	13.054 W	1968	Jan-08	
	Iceberg AWS stations						
B15J Mother 1	30504						
B15J Mother 2	30580						
B15K	9116	Lost, ID to BAS AWS					
B15A Wanderer	30477						
C16	15930						
Drygalski Fountain	30416	Off Jan 2007					
		ID to Chinese					

Table 2. AWS unit not deployed for 2007

AWS item	AWS ID	AWS TYPE/TX'er	Current status	2008 use ?
Madison-BAS	8902	AWS2B/PRL	Upgrade/TEL	New ID/Byrd
Madison-BAS	8917	AWS2B/PRL	Upgrade/TEL	New ID
Madison-BAS	8920	AWS2B/PRL	Upgrade/TEL	New ID
Madison-BAS	8925	AWS2B/TEL	Upgrade	Chinese/New ID
Madison-BAS	8926	AWS2B/PRL	Upgrade/TEL	New ID
Madison-Lettau	8908	AWS2B/PRL	Upgrade/TEL	ITASE
Madison-Emelia	8919	AWS2B/PRL	Upgrade/TEL	ITASE
Madison	8927	AWS2B/PRL	Upgrade/TEL	UNAVCO/Harvey
Madison-CR10X	8921	CSI CR10X/Seimac	Test	
Madison-CR10X	8922	CSI CR10X/Seimac	Test	
Madison-CR1000	*8909	CSI CR1000/ST-20	Assemble	IPEV
Madison-CR1000	*8910	CSI CR1000/ST-20	Assemble	IPEV
Madison-CR1000	*8915	CSI CR1000/ST-20	Assemble	Roosevelt Is.
Madison-CR1000	*8935	CSI CR1000/ST-20	Assemble	Franklin Is
Madison-CR1000	*8937	CSI CR1000/ST-20	Assemble	Pegasus South
Madison-CR1000*	*8934	CSI CR1000/ST-20		Marilyn
Madison-CR1000*	*8913	CSI CR1000/ST-20		Schwerdtfeger
Madison-CR1000*	*8911	CSI CR1000/ST-20		Gill
Madison-CR1000*	TBD	CSI CR1000/ST-20		
Madison-CR1000*	TBD	CSI CR1000/ST-20		
Available ID's				
Megadunes	2516	CR10X/Seimac	Megadunes	Reuse
LTER – Bonaparte Point	8923	AWS2W	LTER	Reuse
GLOBEC – Dismal Island	8930	CR10X/ST-13	GLOBEC	Reuse
GLOBEC – Kirkwood Island	8932	CR10X/ST-13	GLOBEC	Reuse
B15 K	9116	CR10X/Seimac	Iceberg	Reuse
Swithinbank	21355	AWS2B/TEL	WA	Repalcement
Not deployed	28338	CR10X/Seimac		Cape Hallett
Not deployed	30374	CR10X/Seimac		TBD
C25 Fountain AWS (gone)	30416	CR10X/Seimac	Iceberg	Reuse

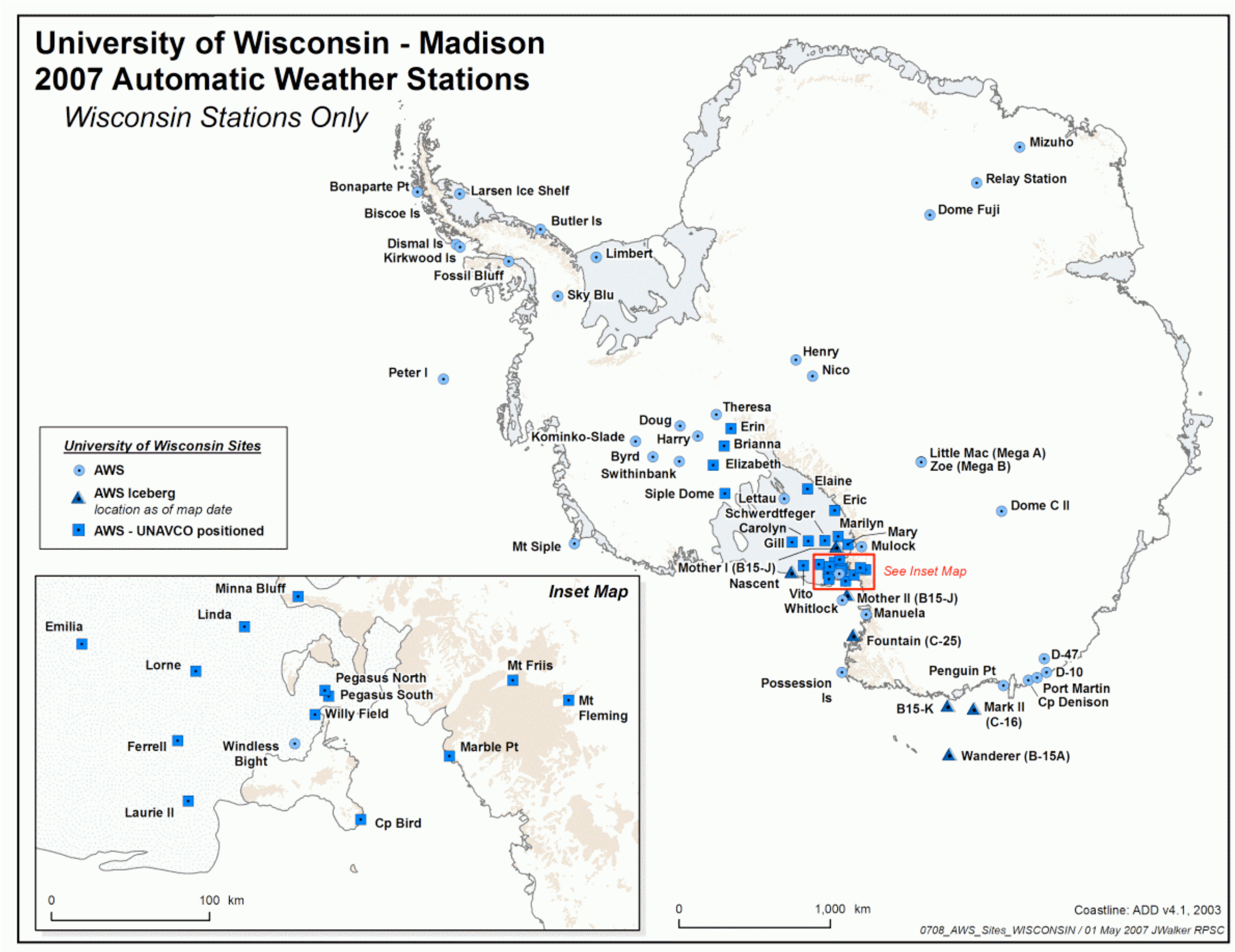


Figure 8. A map of Antarctica showing the locations of the University of Wisconsin's automatic weather stations for 2007. Identification of the sites is by the site name

Tentative AWS Field Work
2008/2009 Austral Summer

A. AWS servicing based from Mcmurdo as of June 2007.

Ross Island Region				
Ferrell	8929	Down load ADG data	77.865oS	170.819oE
Pegasus South	8937	Replace AWS	77.990oS	166.568oE
Minna Bluff	8939	Check HWS	78.555oS	166.691oE
Mt Fleming	30393	Wind Senor upgrade	77.533 S	160.276E
Mount Friis	28339	Check wind system	77.747 S	161.516 E

Ross Ice Shelf				
Marilyn	8934	Replace Belfort,Raise AWS	79.954oS	165.130oE
Schwerdtfeger	8913	Replace Belfort	79.875oS	170.105oE
Gill	8911	Replace Belfort	79.985oS	178.611oW
Elaine	8987	Service	83.134oS	174.169oE
Lettau	8928	Replace Belfort	82.518oS	174.452oW
Carolyn	8722	Replace Belfort	79.964oS	175.842oE
Mary	8983	Raise AWS	79.303oS	162.968oE
Nascent	28336	Temp string install	78.127oS	178.497oE
Roosevelt Island	TBD	Install new AWS	TBD	TBD

B. **AWS operations from the icebreaker (as a wish list)**.

1. The following AWS sites would be visited for installing a minimal (dog house AWS on an opportunity baisis from a ship, preferably an icebreaker).

Scott Island	TBD	67.37oS	179.97oW	Deploy new AWS
Young Island	TBD	66.229oS	162.275oE	Deploy new AWS
Whitlock	8935	76.144oS	168.392oE	Deploy new AWS

C. AWS operations in West Antarctica

1. Service West Antarctic Sites – replacing old Bendix/Belfort wind systems and Servicing as many AWS as needed from WAIS Divide camp/ Siple Dome or ?

Byrd Station	Upgrade 8903	80.007oS	119.404oW	1530
Brianna	8931	83.889oS	134.154oW	@525
Elizabeth	21361	82.607oS	137.078oW	@519
Erin*	21363	84.904oS	128.828oW	@990
Harry	8900	83.003oS	121.393oW	945
Theresa	21358	84.599oS	115.811oW	1463
Mount Siple	8981	73.198oS	127.052oW	230
Siple Dome	8938	81.656oS	148.773oW	@668

Swithinbank	Install new AWS	81.201oS	126.177oW	@959
WAIS Divide (K-S)	8936	79.334oS	111.077oW	@1833

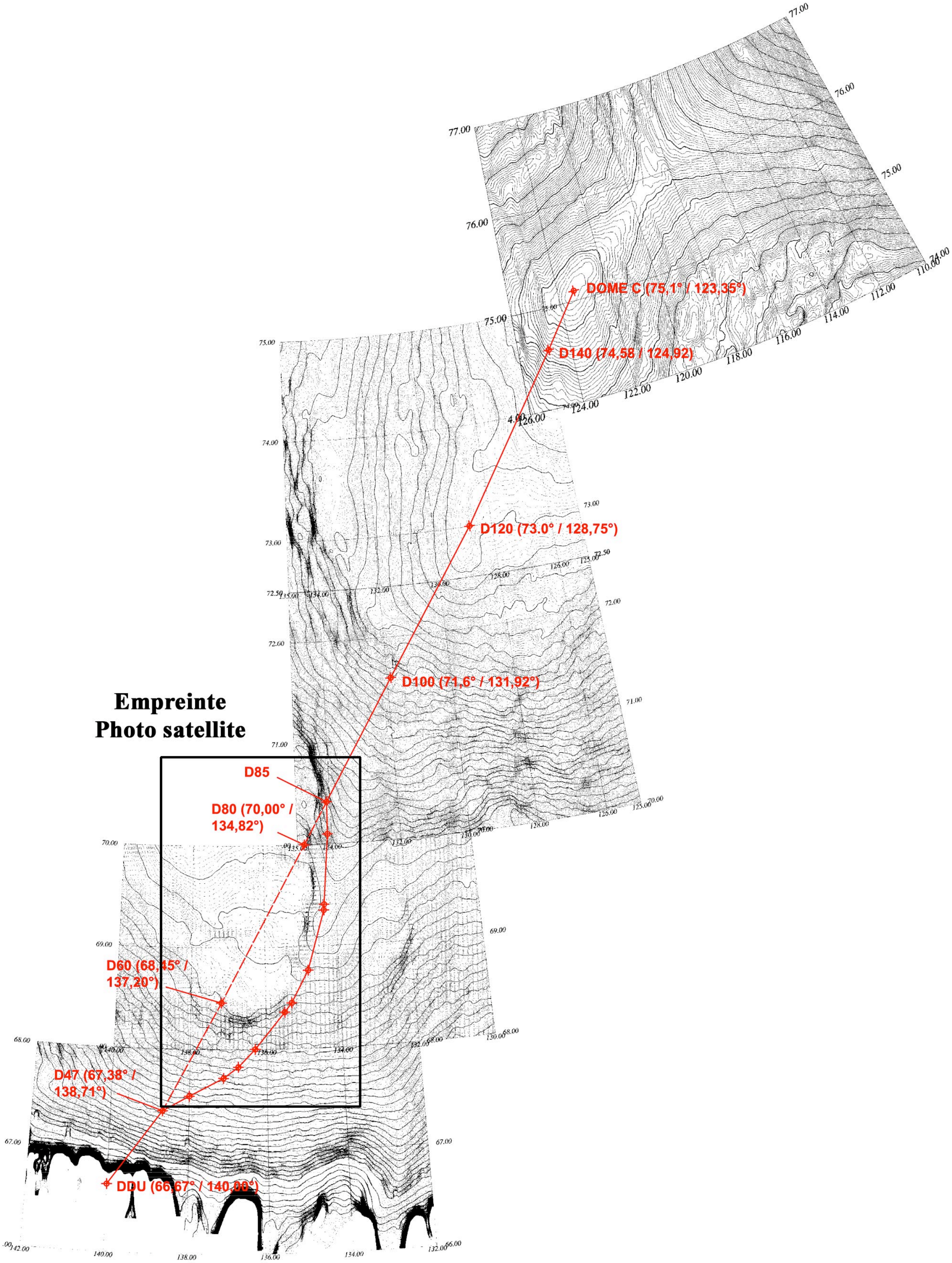
* May be serviced from South Pole

D. **Tentative field work supported by the Institut Francais Pour la Recherche et la Technologie Polaires (IFRTP) at Dumont D'Urville.**

1. Two installations are planned with other sites to be serviced as necessary.

D-10*	8986	66.71oS	139.83oE	243
D-47	8947	67.397oS	138.726oE	1560
D-57 reinstall	TBD	68.199oS	137.538oE	2105
D-80 reinstall	TBD	70.040oS	134.878oE	2500
Dome C II	8989	75.121oS	123.374oE	3250
Port Martin*	8909	66.82oS	141.40oE	39
Cape Denison	8988	67.009oS	142.664oE	31
Penguin Point*	8910	67.617oS	146.180oE	30

* Need to be replaced


DOME C (75,1° / 123,35°)
D140 (74,58 / 124,92)
D120 (73.0° / 128,75°)
D100 (71,6° / 131,92°)
Empreinte
Photo satellite
D85
D80 (70,00° /
134,82°)
D60 (68,45° /
137,20°)
D47 (67,38° /
138,71°)
DDU (66,67° / 140,00°)

E. Tentative Field work by the Japanese Antarctic Expedition from Dome Fuji.

- One new installation is planned at the midpoint between the Japanese Dome Fuji Station and the German Kohnen Station.
- At this time Relay Station is not transmitting and an updated AWS will be sent to replace the current AWS.

Relay Station	8918	74.017oS	43.062oE	3353
Dome Fuji	8904	77.31oS	39.70oE	3810
Mizuho	21359	70.70oS	44.29oE	2260
New installation	30305	70.00oS	20.00oE	3400


YOUNG
Antenna new
mount just below
R M YOUMG
AWS 30305 works with
R M YOUNG
8918 replacement
Does NOT

F. AWS Fieldwork to be done by the British Antarctic Survey based at Rothera Station.

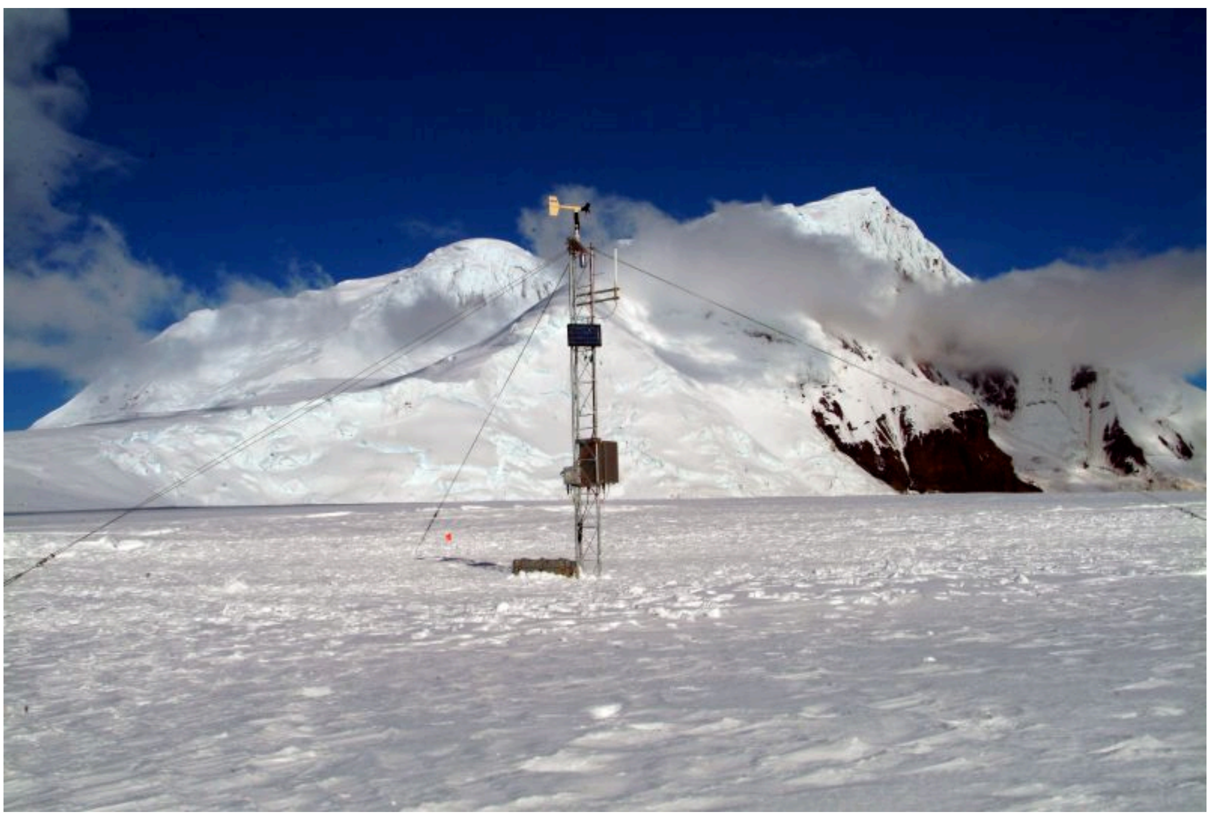
Larsen Ice	8926	Upgrade software	66.949oS	60.897oW	17
Butler Island	8902	Upgrade software	72.207oS	60.160oW	91
Fossil Bluff	8920	Upgrade software	71.33oS	68.283oW	63
Limbert	8925	Upgrade software	75.422oS	59.851oW	40
Ski-Hi	8917	Upgrade software	74.792oS	70.488oW	1395

G. AWS Fieldwork to be done for LTER/Operations based from Palmer Station.

Bonaparte Point	8921 New AWS	64.778oS	64.067oW	8
Santa Claus I	8922 New AWS	64.964oS	65.670oW	25

H. AWS servicing of Peter I Island AWS

Peter I	8933 Service /New	68.769oS	90.670oE	90



I. WS Fieldwork in support of GLOBEC AWS.

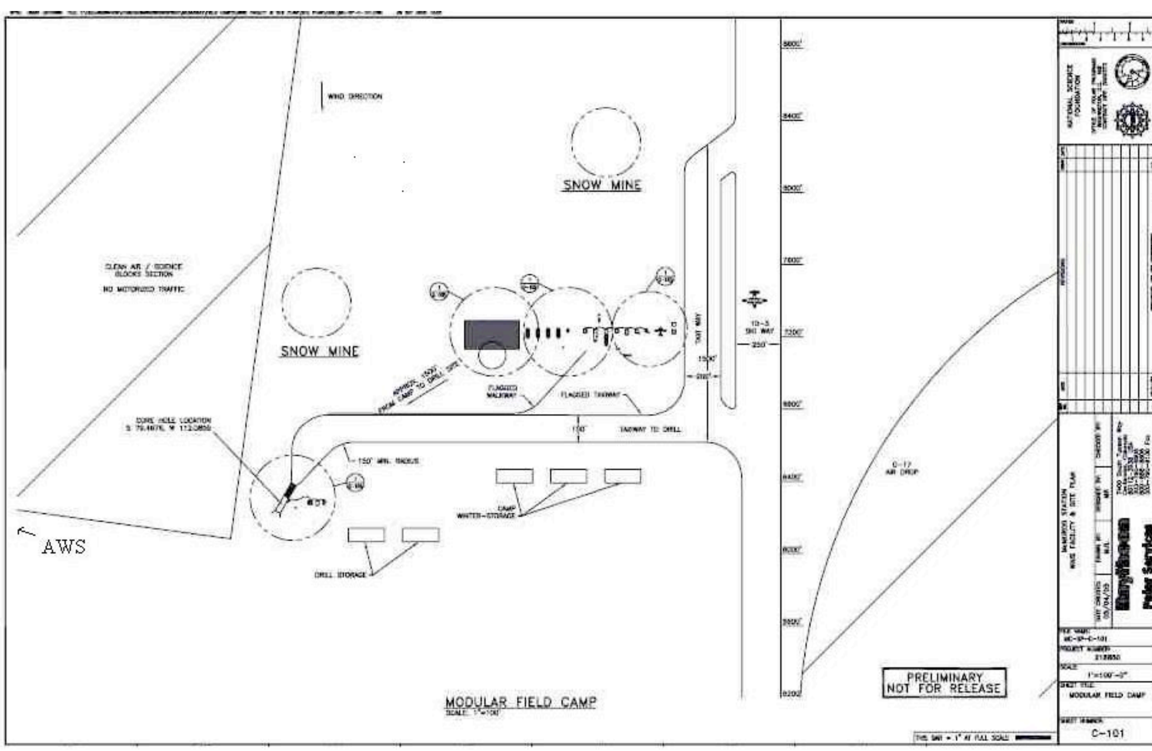
Kirkwood Isand*	8930 replace	68.340oS	69.007oW	30
Dismal Island*	8932 replace	68.087oS	68.825oW	10

J. AWS servicing in support of Iceberg Research (IO-190-O)

B15J Mother 1	30504			
B15J Mother 2	30580			
B15K*	9116			
B15A Wnderer	30477			
C16	15930			

*** Not received as of June 15**

Appendix A. Images of AWS at WAIS Divide camp



Figur

Figuree A1. Layout of WAIS Divide Camp and location of AWS Kominko-Slade.

Figure A2. View towards WAIS AWS Kominko Slade (small arrow is near top of tower).

Figure A3. AWS Kominko-Slade at WAIS Divide camp January 2006 including the snow profile sensors.

Antarctic Automatic Weather Stations
Field Report for 2008-2009

George A. Weidner[1,2]
Jonathan Thom[1]
Matthew Lazzara[1]
Shelley Knuth[1]
John Cassano[3]
Melissa Richards[3]

[1]Space Science and Engineering Center
[2]Department of Atmospheric and Oceanic Sciences
University of Wisconsin - Madison

[3] Department of Atmospheric Science
University of Colorado - Boulder

The National Science Foundation's Office of Polar Programs funds the placement of automatic weather station (AWS) units in remote areas in Antarctica in support of meteorological research, applications and operations. The basic AWS units measure air temperature, wind speed and direction at a nominal height of 3 meters above the surface. Air pressure is measured at the height of the AWS electronic enclosure. Some units measure relative humidity at 3 meters above the surface and the air temperature difference between .5 and 3 meters above the surface at the time of installation. A small, but increasing number of AWS sites measure snow accumulation. The data are collected by the ARGOS Data Collection System (DCS) on board the National Oceanic and Atmospheric Administration (NOAA) and MetOp (EUMETSAT) series of polar-orbiting satellites.

The AWS units are located in arrays for specific research activities and also used for operational purposes. Any one AWS may support several experiments and all support operational meteorological services - especially support for weather forecasts for aircraft flights.

Research areas supported over the years include:

- Barrier wind flow along the Antarctic Peninsula and the Transantarctic Mountains
- Katabatic wind flow down the Byrd and Beardmore Glaciers, the Siple and Adelie Coast
- Mesoscale circulation and sensible and latent heat fluxes on the Ross Ice Shelf
- The Ross Ice Shelf Air Stream.
- Climatology of long operating AWS sites in particular, Byrd and Dome C sites.
- Meteorological support for the West Antarctic Ice Sheet Initiative
- Long Term Ecological Research (LTER) along the Antarctic Peninsula
- Meteorological support for United States Antarctic Program flight operations

The following are a sampling of historically supported principal investigators funded by NSF-OPP.

- Dr. Douglas R. MacAyeal: Iceberg Drift in the Near-Shelf Environment, Ross Ice Shelf, Antarctica.
- Dr. Ray Smith, Long Term Ecological Research: Racer Rock, Bonaparte Point, and Santa Claus Island.

- West Antarctic Ice Sheet Initiative: Siple Dome and West Antarctic Divide drilling sites.
- Dr. John Cassano: The Ross Ice Shelf Air Stream
- Aircraft Operation: All AWS sites in Antarctic.
- The Antarctic AWS units support many investigators outside of NSF-OPP.

AMRC collaboration:
- Climatological analysis from the AWS, and other stations (complimenting the activities in the SCAR READER project).
- Continued data collection, archival and distribution of AWS data.
- Continued educational outreach activities (as outlined in the above section and in the following outreach section).
- Utilities developed to generate climatological analyses from AWS observations.

Field work completed for 2008-2009

For the AS 2008-2009 field season, the field team consisted of Matthew Lazzara (O-283, O-202) and Jonathan Thom (O-283), and Shelley Knuth (O-283) all from the University of Wisconsin – Madison and John Cassano (O-283) and Melissa Richards (O-283) from the University of Colorado - Boulder, with assistance from the personnel at McMurdo Station, Ken Borek Twin Otter pilots, and station personnel at WAIS divide field camp. Fieldwork was also done through cooperative programs with personnel from the the French Antarctic program, **Institut Polaire Français - Paul Emile Victor (IPEV)** and the **British Antarctic Survey (BAS).** Additional assistance was received from **the Mawson's Huts Foundation's** field personnel of Chris Henderson and Pete McCabe.

Mr. Jonathan Thom arrived in Mcmurdo on October 19, 2008 as the only member of O-283 to deploy for the early season part of the 2008/2009 field season. He departed McMurdo on 17 November for return to Madison. George Weidner did not deploy as planned due to a back problem and remotely assisted field personnel in McMurdo from Madison. The remaining field team members deployed at the end December with varied departure dates from late January to early February 2009.

In addition to the normal servicing of AWS sites, we retrieved two AWS set up for testing at the Williams Field AWS site. The first test AWS use an Iridium modem rather than n Argos transmitter for data telemetry. The second test AWS was recording data from various temperature sensors to determine the effect of differing radiation shields and sampling protocols that are being introduced with the new AWS based on Campbell Scientific Inc.'s, (CSI) CR1000 data logger. Jonathan Thom serviced the two test AWS in late October 2008.

For the Iridium test AWS we are using a NAL Research A3LA-D modem to send SBD binary messages from a Campbell-Scientific CR1000 datalogger. The messages were sent to an email address provided by Jonathan Thom to the Iridium network. Anecdotal evidence from other attempts at using Iridium modems in cold climates indicated they did not function a very cold temperatures. We experienced similar results. When the ambient temperature at Williams Field AWS site went below –20C, SBD messages became sporadic. Finally all messages ceased near the start of the Austral Winter in April. Data was successfully stored on the compact flash cards installed with the CR1000 datalogger.

The AWS us to test the radiation shields was also a CR1000 based AWS using a Telonics ST-20A transmitter for data telemetry. There was also a compact flash card installed with the CR1000. The data was complete on the flash card. We tested our traditional temperature sensor (a PRT fabricated with a WEED Inc. 1000 ohm platinum element) with both our own radiation shield and with a RM Young radiation shield that is now standard with CSI temperature sensors. In addition a RM Young RTD temperature sensors were installed with one sensor ventilated and another not ventilated.

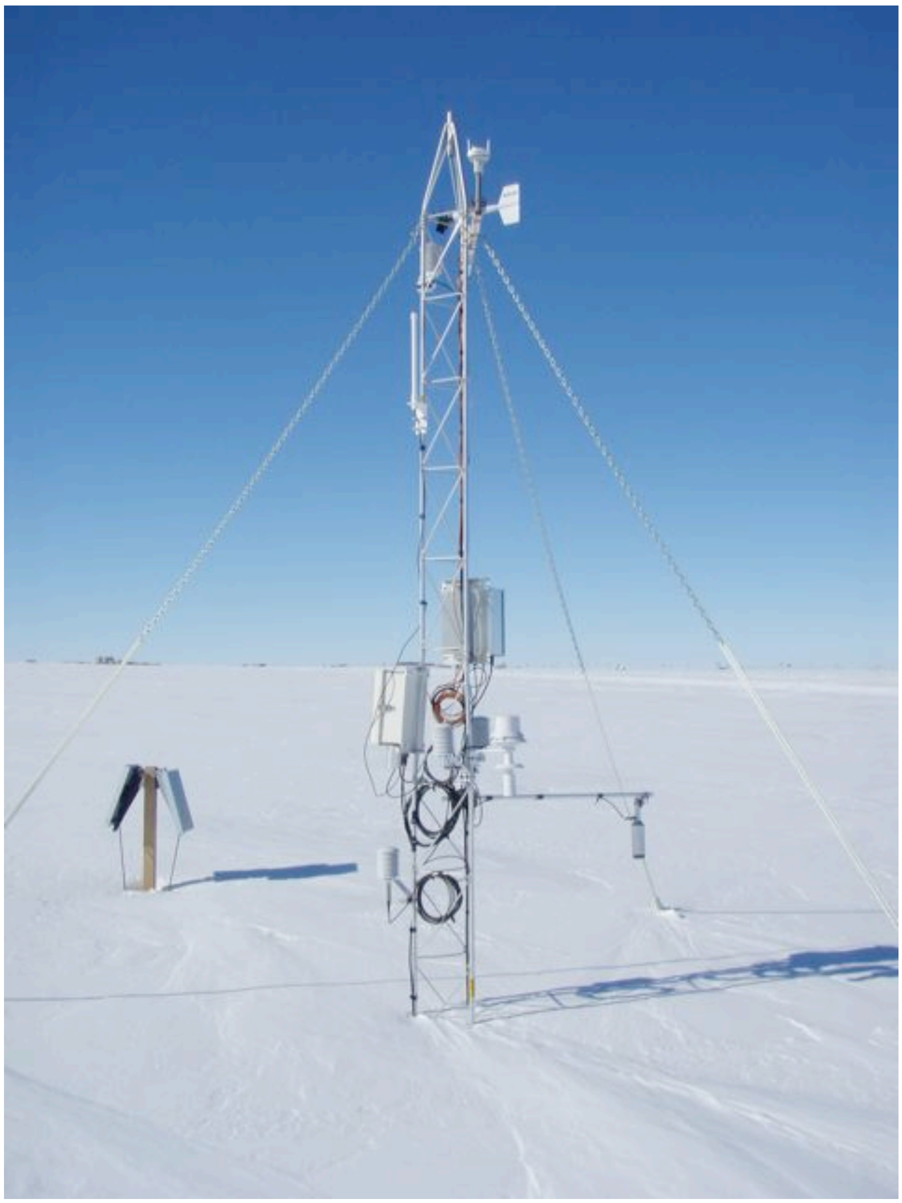


Figure 1. AWS test tower at Williams Field AWS site for 2008/2009.

We had intended to move this test AWS platform to the South Pole for use in comparing data with the South Pole temperature sensors, bet we significantly modified the test platform and decided to operate the system at Williams Field for one more year. The new temperature sensor mounting system is shown below in Figure 2. We anticipate that the radiation shields/temperature sensors will have a more uniform exposure to the sun and wind with this platform.

Figure 2. Mounting platform for radiation shield/temperature sensor testing.

With the introduction of the new AWS based on the CR1000, the measurement protocols available compared with the traditional AWS2 version of our automatic weather station will be quite different. The AWS2 model essentially took instantaneous temperature readings every 10 minutes. The CR1000 based AWS can record temperature data for almost varying lengths of time for whatever sampling interval one chooses. As more of our traditional AWS are retired, we wish to document any differences in temperature statistic due to the new radiation shields and various sampling schemes. Many analyses of long-term temperature records imply temperature trends on the order of 0.1C per decade are important. We wish to insure that the temperature data between the various AWS is rigorously compared and checked for consistency. Final analyses of the temperature data from the test AWS site will be available before the next field season.

The remainder of this report documents the fieldwork accomplished during the 2008/2009 season. The deploy members of the January field team deserve recognition for completing much of the planned work despite limited electronics knowledge due George Weidner's absence. This work could not have been done without the Internet and digital photography. We have come a long way in 30 years of Antarctic AWS.

George Weidner (May , 2009)

Table 1: AWS for 2009. An '@' in the 'Altitude' column indicates a location obtained from UNAVCO GPS. Red print is site service in 2008/2009. Blue print is new site established.

SITE	ARGOS ID /	Action 08/09	Lat.	Long.	Alt.(m)	Date	WMO#
	AWS _ type					STARTED	
	Adelie Coast						
D-10	30374 CR10X	Repair wiring	66.71°S	139.83°E	243	Jan-80	89832
D-47	8947 2B		67.397°S	138.726°E	1560	Nov-82	89834
E-66 NEW	8912 2B	Service	68.912°S	134.655°E		Dec 07	
D-85 NEW	8986 2B	Installed	70,426°S	134.146°E		Dec 07	
Dome C II	8989 2B		75.121°S	123.374°E	3250	Dec-95	89828
Port Martin	8909 2HWS		66.82°S	141.40°E	39	Jan-90	
Cape Denison	8988 2HWS	Serviced	67.009°S	142.664°E	31	Jan-90	
Penguin Point	Not active		67.617°S	146.180°E	30	Dec-93	89847
Not active	8914	Spare at DDU					
	West Antarctica						
Byrd Station	8903 2B		80.007°S	119.404°W	1530	Feb-80	89324
Brianna	8931 2B		83.889°S	134.154°W	@525	Nov-94	
Elizabeth	21361 2B		82.607°S	137.078°W	@519	Nov-94	89332
J.C.	Not active		85.070°S	135.516°W	549	Nov-94	
Erin	21363 2B		84.904°S	128.828°W	@990	Nov-94	
Harry	8900 2B		83.003°S	121.393°W	945	Nov-94	
Theresa	21358 2B		84.599°S	115.811°W	1463	Nov-94	89314
Doug	Not active		82.315°S	113.240°W	1433	Nov-94	
Mount Siple	8981 2B		73.198°S	127.052°W	230	Feb-92	89327
Siple Dome	8938 2C		81.656°S	148.773°W	@668	Jan-97	89345
Swithinbank	8927 2B		81.201°S	126.177°W	@959	Jan-97	
WAIS K-S	21364 2B	Installed	79.468°S	112.086°W	@1833	Jan-06	
	Ross Island Region						
Marble Point	8906 2B		77.439°S	163.754°E	@108	Feb-80	89866
Ferrell	8929 2B	Serviced	77.865°S	170.819°E	@45	Dec-80	89872
Pegasus North	8923 2B	Installed	77.952°S	166.500°E	@8	Jan-90	89667
Pegasus South	Not active	AWS removed	77.990°S	166.568°E	@5	Jan-91	
Minna Bluff	8939 2B	Serviced	78.555°S	166.691°E	@47	Jan-91	89769
Mullock	8907 2HWS		79.018°S	170.819°E	@378	Oct-06	
Willie Field	30477 CR1000	Installed	77.866°S	166.983°E	@14	Jan-92	
Willie Field	Iridium AWS	Removed	77.866°S	166.983°E	@14	Jan-92	
Willie Field	Test	Serviced	77.866°S	166.983°E	@14	Jan-92	

Windless Bight	8982 CR10X	Serviced	77.728°S	167.703°E	61	Nov-98	
Cape Bird	8901 2B		77.224oS	166.440oE	@42	Jan-99	
Laurie II	21360 2B		77.509oS	170.797oE	@37	Jan-00	
Linda	21362 2B	Serviced	78.439oS	168.406oE	@43	Jan-91	89769
Lorne	21356 2B	Serviced	78.250oS	170.000oE	@45	Jan-07	
Mt Friis	28339 CR10X		77.747oS	161.516 E	@1581	Jan-07	
Mt Fleming	30393 CR10X		77.533oS	160.276 E	@1868	Nov-06	
Cape Hallet	28338 CR10X		72.190 S	170.160 E	@14	Nov-07	
	Ocean Islands						
Whitlock	8935 2HWS		76.144°S	168.392°E	(275)@206	Jan-82	89865
Scott Island	No AWS		67.37°S	179.97°W	30	Dec-87	89371
Young Island	No AWS		66.229°S	162.275°E	30	Jan-91	89660
Possession Is.	8984 2DH		71.891°S	171.210°E	30	Dec-92	89879
Manuela	8905 2B		74.946°S	163.687°E	80	Feb-84	89864
Peter I	8933 2B		68.769°S	90.670°E	90	Feb-06	
	Ross Ice Shelf						
Marilyn	8934 2B	Serviced	79.954°S	165.130°E	(72)@64	Jan-84	89869
Schwerdtfeger	8913 2B		79.875°S	170.105°E	@54	Jan-85	89868
Gill	8911 2B		79.985°S	178.611°W	@54	Jan-85	89376
Elaine	21357 2B	Installed	83.134°S	174.169°E	@59	Jan-86	89873
Lettau	8928 2B	Serviced	82.518°S	174.452°W	55	Jan-86	89377
Vito	8695 2B	Serviced	78.509°S	177.746°E	@+52	4-Feb	
Emilia	8980 CR10X	Serviced	78.509°S	173.114°E	@+50	4-Feb	
Carolyn	8722 2B	Serviced	79.964°S	175.842°E	@+52		
Mary	8983 CR10X		79.303°S	162.968°E	@+58		
Nascent	28336 CR10X		78.127°S	178.497°E	30		
Eric	8697 2B		81.504°S	163.940°E	@+45		
Roosevelt Island	8910 CR1000	Installed	80.00°S	165.00°W		Jan 09	
South Ross Ice Shelf	8915 CR1000	Installed	84.25°S	170.00°W		Nov 08	
	Antarctic Peninsula						
Larsen Ice	8926 CR1000	BAS	66.949°S	60.897°W	17	Oct-85	89262
Butler Island	8902 CR1000	BAS	72.207°S	60.160°W	91	Mar-86	89266
Fossil Bluff	8920 CR1000	BAS	71.33°S	68.283°W	63	Dec-01	89065
Limbert	8925 CR1000	BAS	75.422°S	59.851°W	40	Dec-95	89257
Ski-Hi	8917 CR1000	BAS	74.792°S	70.488°W	1395	Feb-94	89272
Bonaparte Point	8921 CR10X	Serviced	64.778°S	64.067°W	8	Jan-92	89269
Hugo Is	8935 CR1000	Installed	64.964°S	65.670°W	25	Dec-94	
Racer Rock	Not active		64.067°S	61.613°W	17	Nov-89	89261
Kirkwood Island	8930 CR10X	Off	68.340°S	69.007°W	30	May-01	
Dismal Island	8932 CR10X	Works summer	68.087°S	68.825°W	10	May-01	
	High Polar Plateau						

Henry	8985 2B		89.011°S	1.025°W	2755	Jan-93	89108
Nico	8924 2B		89.000°S	89.669°E	2935	Jan-93	89799
Relay Station	8918 2B		74.017°S	43.062°E	3353	Feb-95	89744
Dome Fuji	8904 2B		77.31°S	39.70°E	3810	Feb-95	89734
Mizuho	21359 2B		70.70°S	44.29°E	2260	Oct-00	
JARE 2008	30305 2B		77.000°S	20.000°E	3400	Dec-07	
Megadunes	2769 (CR10X)		80.775°S	124.526°E	2881	Jan-04	
Panda South	30416 2B		82.246°S	75.989°E	4027	Jan-08	
Baldrick (BAS)	9116 (CR1000)	BAS	82.774°S	13.054°W	1968	Jan-08	
	Iceberg AWS stations						
B15J Mother 1	30504 (CR10X)	Transmitting					
B15J Mother 2	30580 (CR10X)	Transmitting					
B15K	9116 (CR10X)	Off ID reused					
B15A Wanderer	30477 (CR10X)	Off ID reused					
C16	15930 (CR10X)	Transmitting					
Drygalski Fountain	30416 (CR10X)	Off ID reused					

Table 2. AWS unit not deployed for 2009

AWS not deployed		**AWS type**
Madison	8908	AWS2B
Madison	8916	AWS2B
Madison	8919	AWS2B
Madison	8936	AWS2D
Madison	21355	AWS2D
Madison-CR10X	8922	CSI /Seimac
Madison-CR10X	30423	CSI /Seimac
Madison-CR1000	*8901	CSI/ST-20
Madison-CR1000	*8903	CSI/ST-20
Madison-CR1000	*8927	CSI/ST-20
Madison-CR1000	*8937	CSI/ST-20
Madison-CR1000	*8987	CSI/ST-20
* Replacement AWS ID's for 2009		
For Telonics ST-20's with CR1000		

Table 3. GPS data for 2008/2009. Horizontal accuracy is +/- 10 cm and vertical accuracy +/- 20 cm. The horizontal position does not refer to the exact AWS location, but rather a position approximately 10 (~meters) paces north of the AWS.

GPS data	For 2008/2009			
Name	**Latitude**	**Longitude**	**Elevation**	**Start Time (UTC)**
Pegaus S	77.9903768°S	166.5600761°E	4.839	1/7/2009 2:49
Willy Field	77.8669724°S	166.9565529°E	12.581	1/12/2009 0:43
Linda	78.4262044°S	168.4178687°E	42.484	1/16/2009 6:50
Ferrell	77.8459259°S	170.8190210°E	45.06	1/16/2009 8:21
Carolyn	79.9391445°S	175.88395625°E	52.017	1/22/2009 21:58
Marilyn	79.9258367°S	165.49386925°E	62.899	1/23/2009 1:29
Vito	78.4661465°S	177.78168453°E	49.55	1/23/2009 21:48
Emelia	78.4736640°S	173.14581275°E	51.494	1/24/2009 0:31
K-S WAIS	79.4656911°S	112.10623369°W	1801.095	1/26/2009 21:31
Elaine	83.0972223°S	174.2912160°E	61.587	1/28/2009 1:35
Sabrina	84.2503706°S	169.98718025°W	88.072	2/2/2009 0:43
Lettau	82.4805819°S	174.57042869°W	38.804	2/2/2009 4:01
Minna Bluff	78.5546910°S	166.69081022°E	894.872	10/31/2008 23:32
Linda	78.4271355°S	168.41696764°E	42.277	11/1/2008 0:09
Linda	78.4271357°S	168.41696232°E	42.253	11/1/2008 0:09
Ferrell	77.8473396°S	170.81911836°E	45.536	11/3/2008 21:29
Ferrell	77.8473389°S	170.81913969°E	45.693	11/3/2008 21:29
Lorne	78.2394977°S	170.00577011°E	45.262	11/4/2008 22:15
Margaret (RI)	79.9999052°S	165.00039361°W	67.419	11/12/2008 23:05
Margaret(RI)	79.9999039°S	165.00040228°W	67.554	11/13/2008 0:00
Bases				
DEVI	81.47672111°S	161.9770776°E	114.353	1/21/2009 23:59
MCMD	77.838349719°S	166.669330152°E	151.452	1/6/2009 23:59
MIN0	78.6503084°S	167.163793652°E	729.568	1/15/2009 23:59
RAMG	84.338425444°S	178.047113444°E	1103.681	1/27/2009 23:59
WAIS	79.467499966°S	112.053987572°W	1802.972	1/25/2009 23:59

New Installation Site: Margaret AWS site near Roosevelt Island

Jonathan Thom with assistance from Ken Borek Twin Otter pilots, and Bill Vandiver (SPAWAR Office of Polar Programs), installed a new AWS site near Roosevelt Island on November 12, 20008.

Installation information:

Sensor Boom height: 514 cm
Top of enclosure: 325 cm
Lower Temperature: 210 cm
ADG height: 215 cm

The boom is about 8 degrees west of North.
Note: this requires a correction for the wind direction of negative 8 degrees (-8 deg)
The station is installed at 80 S and 165 W.
The snow surface there was nice, no sastrugi at all.

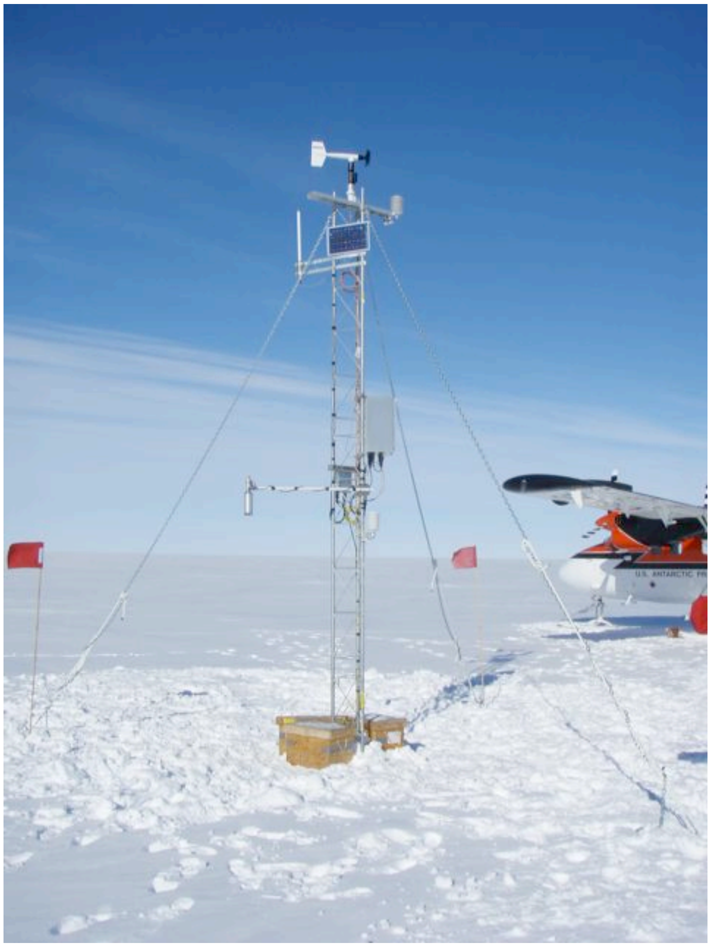


Figure 3. Margaret AWS - installed near Roosevelt Island on the eastern Ross Ice Shelf

New Installation Site: Sabrina site at southern end of the Ross Ice Shelf

Sabrina AWS installed on 2/2/2009 1:30 pm (approximate ground time was 2.5 hours).
Field Team: Shelley Knuth, Melissa Richards, Kevin Emery (FSTP)
Pilots: Lexi and Rory (Ken Borek):

The UNAVCO GPS was up from 1:30-4 pm.

Heights to surface:

ADG:	066 cm
Junction box:	112 cm
ADG Temp:	116 cm
Electronics box:	146 cm
Solar Panel:	201 cm
Sensor Boom:	288 cm

Field notes: Beautiful day on the field, and a beautiful location with the mountains in the background. Temperature was fairly warm and there was no wind. The area is crevasse free so it's pretty safe. The South Pole traverse was very nearby - we could see their tracks and flags. We stopped at Moody Glacier on the way out and back to refuel. Took about 4.5 hours to get out to Sabrina from McMurdo.

Site was a new install. Put one 5' base and one 7' tower section on top. Then we added a solar panel, temperature/RH sensor, RM Young, junction box, CR1000, ADG, and lower temperature sensor for ADG. Also added white wand antenna. Added two battery boxes measured at 12.7 volts each.

Once the tower was up, we could not get a transmission for about 20 minutes. We began troubleshooting by rebooting the system, unplugging and re-plugging the antenna in, but nothing happened. We had just pulled out the toughbook laptop computer and an extra antenna and suddenly got a transmission. We verified three transmissions before we left.

We did not have a handheld gps with us. The one we had was packed in our WAIS cargo, and we could not retrieve another one before we left in the morning despite various attempts. While we talked to the pilots and know where true north was so that the boom is facing that direction, the RM Young could easily be off by several degrees, and we had no way of verifying how far off it was.

Figure 4. Sabrina AWS after installation in January 2009.

Table 4. AWS Activities planned this season (2009-2010) by U. Wisconsin field team[1]

AWS Site	Latitude	Longitude	Elevation	Status	Field Season Activity	Comments
Tall Tower	78.82° S	173.33°E	Unknown	Not installed – new AWS site	First installation	Site to be renamed, Put-in by traverse and twin otter
Elaine	83.097°S	174.29°E	62 m	Installed Off air	Servicing	Twin Otter
Carolyn	79.939°S	175.884°E	52 m	Installed Off air	Servicing	Twin Otter
Lettau	82.481°S	174.57°E	39 m	Installed	Servicing	Twin Otter
Gill	79.922°S	178.586°W	54 m	Installed	Servicing	Twin Otter
Byrd	80.007°S	119.404°W	1530 m	Installed	Servicing	Twin Otter or LC130 to camp
Siple Dome	81.656°S	148.773°W	668 m	Installed	Servicing	Twin Otter or LC130 to camp
Kominko-Slade (WAIS Divide)	79.466°S	112.106°W	1801 m	Installed	Servicing	Twin Otter or LC130 to camp
Elizabeth	82.607°S	137.078°W	519 m	Installed	Servicing	Twin Otter
Harry	83.003°S	121.393°W	945 m	Installed	Servicing	Twin Otter
Erin	84.904°S	128.828°W	990 m	Installed	Servicing	Twin Otter
South Pole	-90°S		Unknown	Not installed	Install of test AWS (non-transmitting)	LC130 day trip. One year test - only
Cape Bird	77.21°S	166.439°E	38 m	Installed	Servicing	Helicopter
Ferrell	77.846°S	170.819°E	45 m	Installed	Servicing	Helicopter
Laurie II	77.517°S	170.801°E	37 m	Installed	Servicing	Helicopter
Linda	78.426°S	168.418°E	43 m	Installed	Servicing	Helicopter
Marble Point	77.439°S	163.754°E	108 m	Installed	Servicing	Helicopter
Minna Bluff	78.554°S	166.69°E	895 m	Installed	Servicing	Helicopter

[1] This list is subject to modification based on any AWS failures that may occur before the start of the field season. Some sites may not be visited due to limited logistics or weather. This list is not in priority order.

Table 5. AWS Activities planned this season (2009-2010) by U. Wisconsin collaborators [2]

AWS Site	Latitude	Longitude	Elevation	Status	Collaborator	Comments
Pegasus North	77.952oS	166.5oE	10 m	Installed – needs servicing	John Cassano	USAP - O-400-M
PIG Helo Camp (Site C)	75.6°S	99.917°W	Unknown	Not installed – new AWS site	David Holland field team (includes UNAVCO)	USAP - WAP
Thurston Island	72.53°S	97.56°W	Unknown	Not installed – new AWS site	David Holland field team (includes UNAVCO)	USAP - WAP - POLENET
Bear Peninsula	74.546°S	111.88°W	Unknown	Not installed – new AWS site	David Holland field team (includes UNAVCO)	USAP - WAP - POLENET
E-66	68.912°S	134.655°E	2485 m	Installed – needs repair	Christophe Genthon	France - IPEV
Port Martin	66.82°S	141.39°E	39 m	Installed – needs repair	Christophe Genthon	France - IPEV
Dome Fuji	77.31oS	39.7°E	3810 m	Installed – needs repair	Takao Kameda	Japan - JARE
Relay Station	74.017°S	43.062°E	3353 m	Installed – needs repair	Takao Kameda	Japan - JARE
Cape Denison	67.009°S	142.664°E	31 m	Installed – needs servicing	Rob Easther	Mawson's Huts Foundation
Panda South	82.325°S	75.989°E	4027 m	Installed – needs repair	Bian Ligen, Cunde Xiao	China - CHINARE

[2]This list is not in priority order and is subject modification.

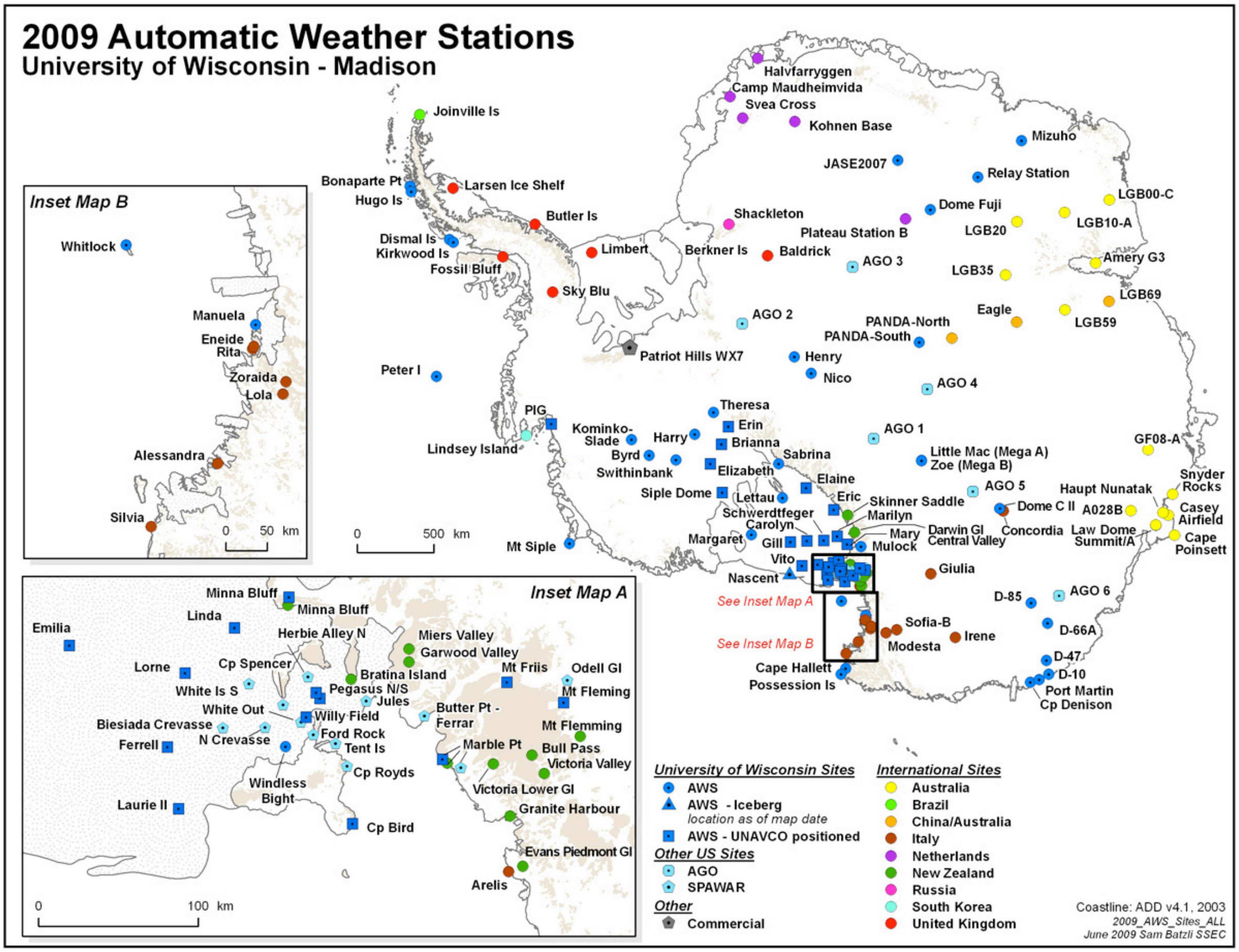


Figure 5. Map of Antarctic automatic weather stations (AWS) for 2009.

Appendix A
Summary of site visits for 2008/2009

Event 1: Minna Bluff and Linda AWS site visits by Jonathan Thom
10/31/2008 9:28 PM
Made it to Minna Bluff and Linda today. Minna bluff had one battery cable that was busted and one that was still good. It was pretty well covered in hoar frost. I have a feeling that this station is going to need to be completely reinstalled next year. It was pretty well stabilized by the chains, but tower base is not being held by anything. I think it will probably last for another year, but next year we should probably install a Rohn base. The tower section had at least one broken cross piece. Other than that it seemed that it was in OK shape.

Linda was another issue. I ended up raising the box, delta T and junction box. I tried multiple attempts to get it rebooted, but I did not have any success. I checked the antenna and power and they were both good. I ended up leaving the box there because were were a bit short on time to take everything down. I also forgot to bring caps for the cables. So, it is still there, but everything is raised up so you will just need to replace the box. The boom is a thermocouple delta-T. We can reprogram to read the thermocouple on the CR1000, if we choose to replace it with a CR1000.

Image A1: Minna Bluff AWS October 31 2008.

Image A2: Damaged battery cables from Minna Bluff AWS

Here are the before and after photos of Linda AWS. We raised the box, delta T and junction box. The junction box didn't have much extra battery cable so, we got it up as far as we could. Unfortunately, I couldn't get the station to boot up again. It should be an easy swap when you are down in January. It shouldn't be too difficult to make this a CSI station.

Top of the boom was 350 cm
top of the box was 224 cm
top of the delta-T 108 cm

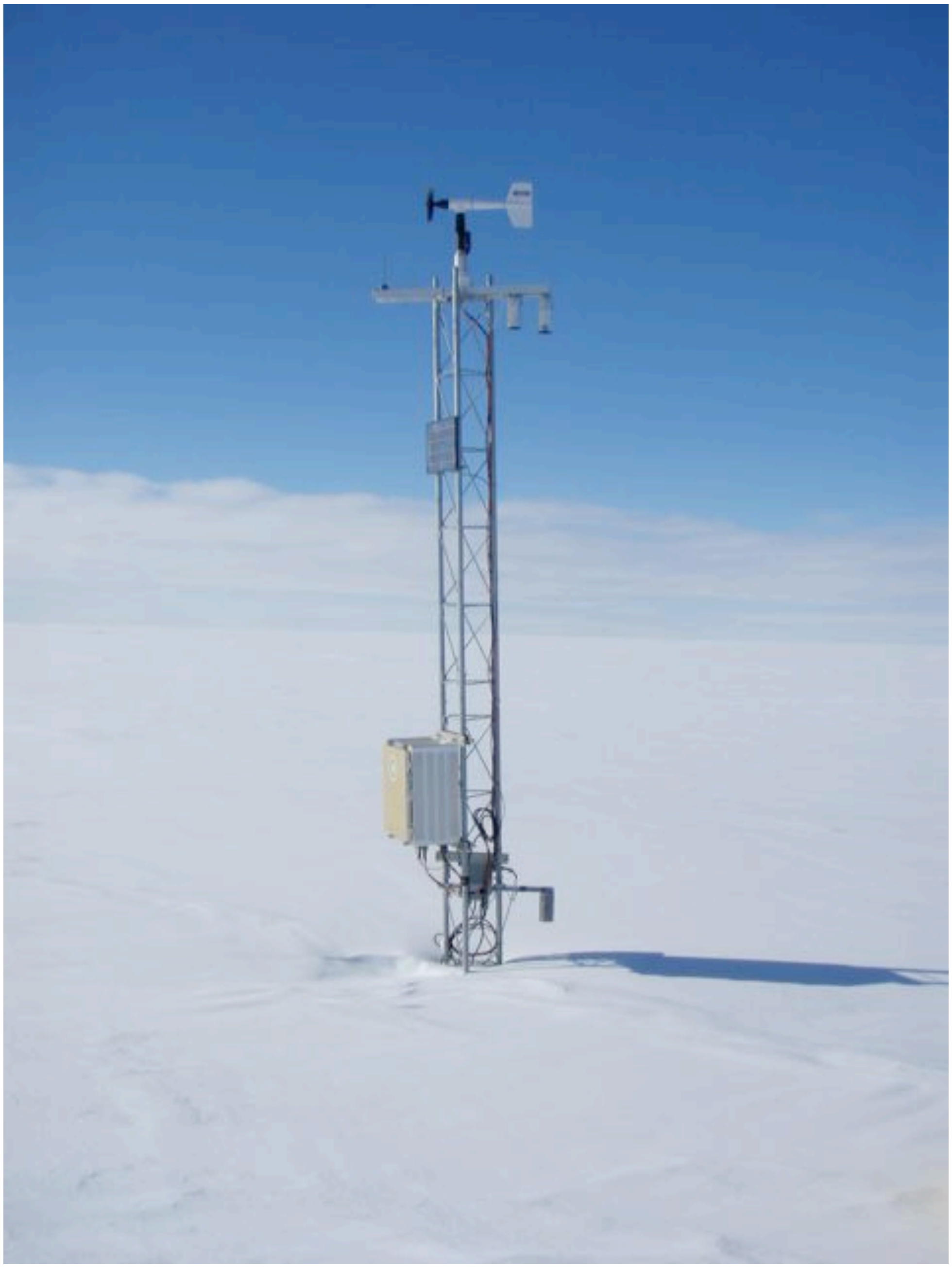


Image A3: Linda AWS before image

Image A4: Linda AWS after field work

Event 2: Ferrell site visit by Jonathan Thom
11/3/2008 4:54 PM
Didn't make it to Lorne today. Conditions were a bit sketchy, with 25 knot winds and -24C. It would have been difficult to get the tower raised. We did stop at Ferrell. I swapped out the memory module and will download the data this afternoon. It looked all right and should be all right for another year. It may need a raise next year. The ADG will definitely need to be raised next year. I'll send the tower measurements with the photos in the next email. I got about 15 minutes of GPS data at Ferrell. Picture from Ferrell AWS. I think I mentioned in the last email, I got about 15 minutes of GPS data. I still need to download the data from the memory module.

Here are the measurements from the site:

Top of boom: 338 cm
top of box: 234 cm
T for ADG: 075 cm
Base of ADG: 090.5 cm

Image A5: Ferrell AWS November 3, 2008 (before)

Image A6: Ferrell AWS on November 3, 2008 (after ADG raise).

Event 3: Visit of Lorne AWS by Jonathan Thom

11/4/2008 7:11 PM

Just got back from Lorne. It was a much, much (dare I say much three times) better day. No wind and temps around -20 or so. We got the station raised and I did get one reception at least on the telonics uplink receiver. I ended up swapping out the antenna for an antennex antenna. There teflon sheathing was broken in a spot. We'll see if it keeps transmitting. It would be an easy swap out, like Linda if it does turn off.

Here are the heights:

Before raise:

Boom	2.38 m
top of box:	0.72 m

After raise:

boom	4.3 m
top of box	2.9 m
top of jnc box was	2.4 m

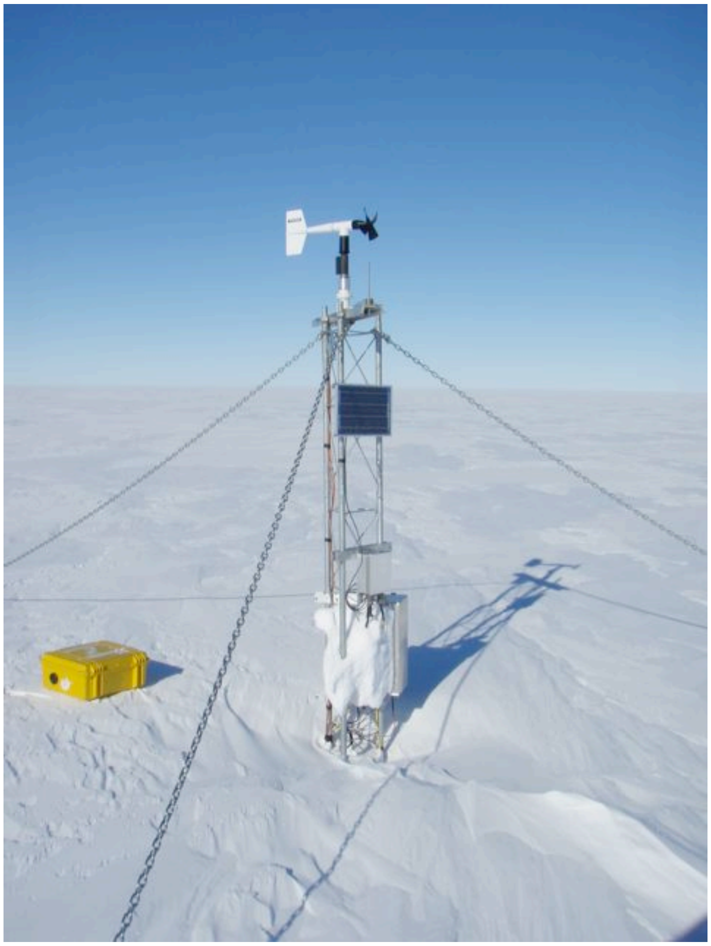


Image A7: Lorne AWS before servicing on November 4, 2008

Image A8: Lorne AWS on November 4, 2008 after servicing

Event 4: Iridium AWS servicing at Williams Field AWS sit by Jonathan Thom.
11/7/2008 12:10 PM
I pulled the radiation shield test and the box with the iridium modem yesterday. I downloaded the data from the radiation shield test compact flash card. The data was perfect. There were none of the crazy points I was seeing in the Argos transmission. I'm a little bit concerned about sending this set up to pole as it is. I would kind of like to get it setup on the rack and run in McM at least until January to try and find out if the Argos TX issue can be resolved. If anyone has any other ideas let me know. The iridium station was completely dead. I haven't tried to fire it up in the lab yet, but I'll do that today. I'll let you know what I find out. That's all for now.
Jonathan

Event 5: Installation of Margaret AWS near Roosevelt Island by Jonathan Thom
11/12/2008 11:48 PM
(See more at the beginning of this report)

Boom height:	514 cm
top of box:	325 cm
lower T:	210 cm
ADG height	215 cm

The boom is about 8 degrees west of North.
I'll update the cal file tomorrow with all of the info.
The station is installed at 80 S and 165 W, I think the TO pilot actually tried to get as close to that location as possible.
The snow surface there was nice, no sastrugi at all.

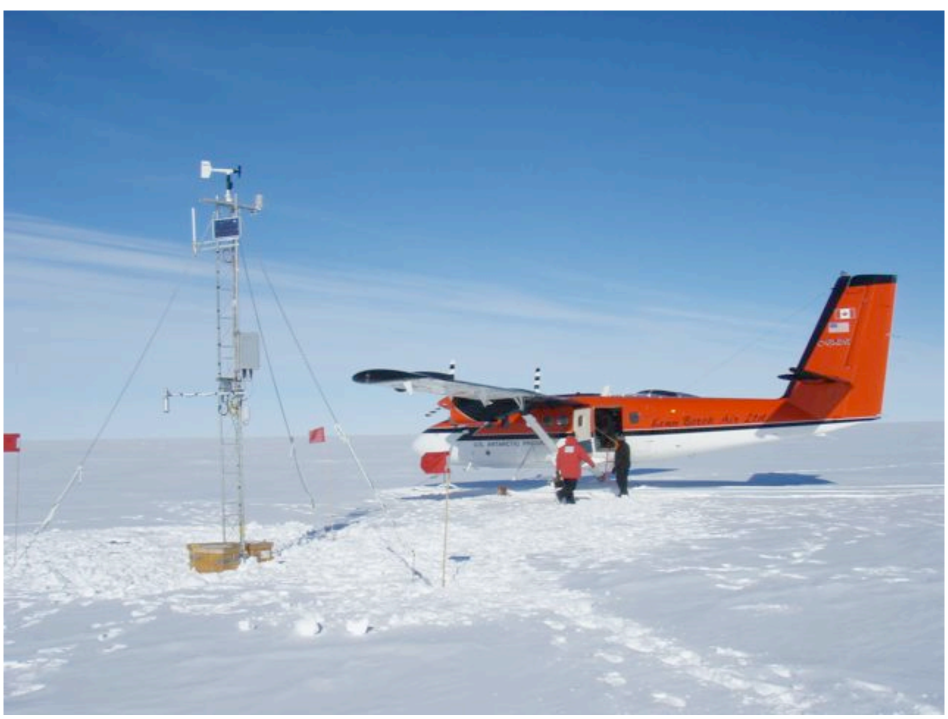


Image A9: Margaret AWS near Roosevelt Island after installation.

Event 6: Removal of AWS at Pegasus South by Shelley Knuth and John Cassano
1/7/2009 1:02 AM
Here are our notes from our trip to Pegasus South:
Shelley and I flew out to Pegasus South AWS this afternoon to remove this site. We retrieved:
AWS electronics
Belfort aerovane
Upper boom attached to lower boom with delta T
solar panel
junction box
3 battery boxes (2 with 3 batteries and 1 with 2 batteries)
2 anchor chains
2 anchor boards
1 AWS base board
2 5' tower sections

We left the following items at the site (as they were encased in ice):
2 anchor boards and chains
1 battery box (at least we assume one was buried as we
had to cut the cables)
4 4"x4" wood posts used for anchoring the station

The Unavco GPS was left running at the site from approximately
3:30 to 5:20 PM (Unavco GPS unit 16414)

John

Image A10: Pegasus South AWS before removal on January 7, 2009

Event 7: Removal of Williams Field Iridium test AWS by Shelley Knuth and Melissa Richards

1/8/2009 2:50 AM

Shelley and Melissa visited Willie Field and pulled out the Iridium test AWS only. The radiation shield test AWS is still there, as well as the batteries/tower from the Iridium test AWS.

Event 8: Servicing of Pegasus North AWS by Shelley Knuth and John Cassano

1/11/2009 8:29 PM

Shelley and I visited Pegasus North yesterday. We checked all of the cables, and they appeared to be fine. We unplugged the AWS electronics and then plugged the power back in. The station then began transmitting (we received two transmissions with the Teloniks before removing the power again). We removed the following from this site for redeployment:

AWS electronics
Junction box
Lower delta T boom
Instrument boom
RM Young aerovane

We left the following at the site:
Tower
2 battery boxes
solar panel

John

Event 9: Removal of the AWS2B version of our AWS from Williams Field site by Matthew Lazzara and Melissa Richards

As of 00:30 UTC today, 12 Jan 2009, Wisconsin's Williams Field AWS has been taken off the air. As a note, the Argos ID 21364 will be redeployed to another field location later in this field season. You may want to change processing on the MetApps system so that data will not be mis-filed as Williams Field data, when it may indeed be installed at a new location soon.

Here is the information from Melissa and my visit to Willie Field AWS:
Removed 21364 at 00:30 UTC
Height to the boom from the snow surface: 174.5 inches or 443.25 centimeters
Height to bottom of the electronics box from the snow surface: 78.25 inches or 198.75 centimeters
Height to the bottom of the delta-T from the snow surface: 18 inches or 45.75 centimeters
We removed the aerovane (in case that is needed at all) - and capped the based on the boom.
We removed the electronics enclosure.
All loose plugs capped, etc.
We did take UNAVCO GPS measurements.

Image A11 Williams Field Test Site before removal of the Wisconsin AWS IIB. (radiation test site still installed on right).

Event 10: Servicing of Linda AWS and Ferrell AWS by John Cassano
1/16/2009 2:43 PM

- First attempt to get to Linda (new electronics) and Ferrell (ADG fix) didn't work out due to fog. They are flying now - night shift - to try again today....they ***just*** took off as I write this.

Here is my field report from our visit to Linda and Ferrell, to add

Linda
Field team: Shelley, Melissa, John
Replaced AWS electronics with AWS 21355
Unable to confirm transmission with Telonics
One horizontal prong on the antenna is broken off
Dug snow pit (3 years)
Placed UNAVCO GPS at site for approx. 1h (GPS 16414)

Height to bottom of:
Junction box: 23"
Lower delta T boom: 42"
AWS enclosure: 65"
Solar panel: 99"
Upper boom: 137"

Ferrell
Field team: Shelley, Melissa, John
Replaced ADG and confirmed correct operation
Dug snow pit (2 years)
Placed UNAVCO GPS at site for approx. 40 min (GPS 16414)

Height to bottom of:
Junction box: 35"
ADG: 37.5"
AWS enclosure: 74"
Solar panel: 104"
Upper boom: 131"
ADG solar panel: 51"
Campbell enclosure: 28"

GPS coordinates from helo:
77 deg 50.77 min
170 deg 49.15 min

John

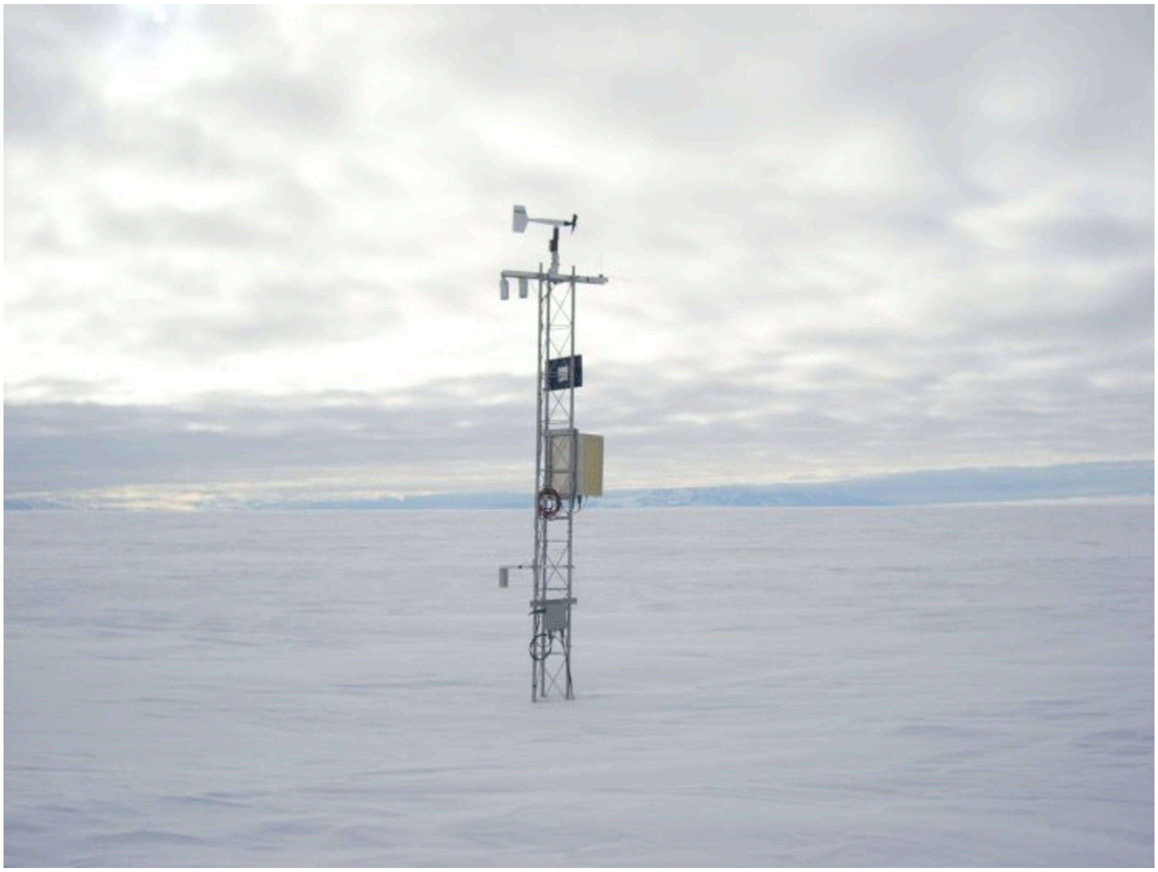


Image A12: Linda AWS after servicing on January 16, 2009

Image A13: Image of damaged antenna at Linda AWS

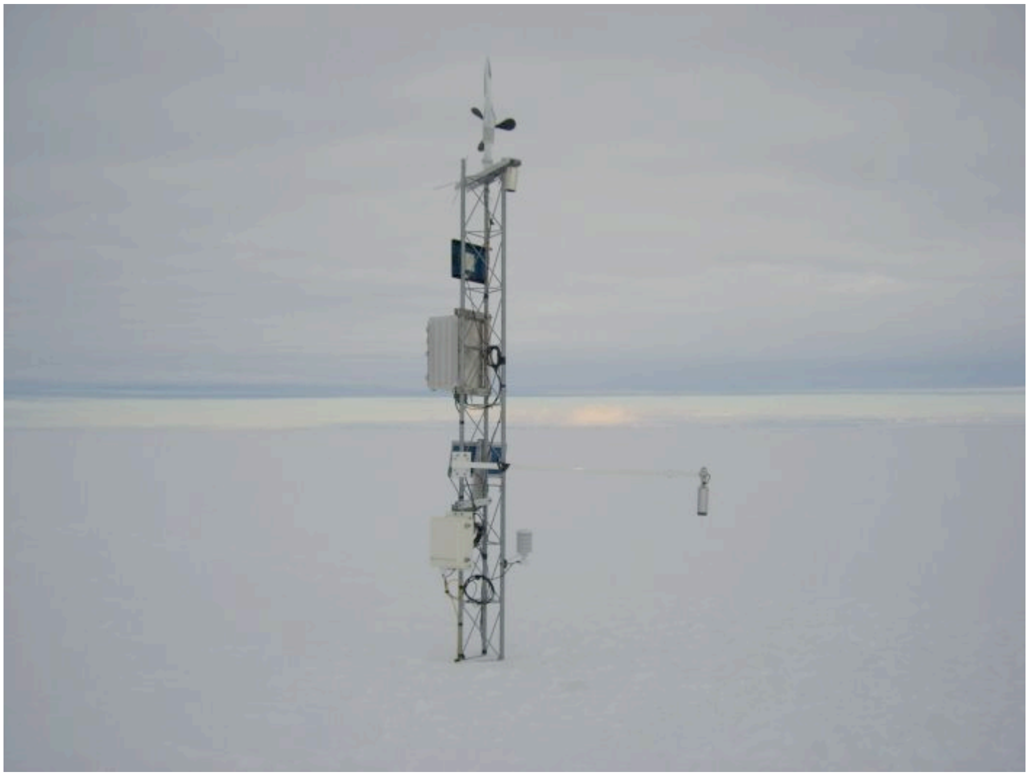


Image A14: Ferrell AWS on January 16, 2009 after servicing ADG

Event 11: Servicing of Linda AWS by John Cassano and Shelley Knuth
1/21/2009 10:50 PM
Shelley and I visited Linda AWS today and all appears to be working.
Here are my notes for the trip:
Field team: Shelley and John
Reboot existing AWS (21355) at Linda site: No transmission
Check voltage at junction box plug going into AWS: 13.4V
Disconnect solar panel
Note: all of the following voltage measurements were made with power connected to the AWS
Check voltage at jct box: 13.4 V
Disconnect 1 battery box check voltage in jct box from green to black: 0.008 V
Reconnect battery box and disconnect second battery box, check voltage in jct box from green to black: 0.034 V
Check voltage of battery boxes at plugs going into jct box:
Battery box 1: 13.2 V
Battery box 2: 13.3 V
Replace antenna and cable
Replace AWS 21355 with AWS 21362 (original Linda AWS)
Confirmed transmission with Telonics in field
We also see current data on local computer (http://herbie.usap.gov/~amrc/21362.txt)
The GPS coordinates from the helo were:
78 deg 25.57 min S
168 deg 25.03 min E
and differ from those we had for the site (78 deg 27.06 min S, 168 deg 23.64 min E)

Shelley and I cannot remember if 21355 transmitted with the new
antenna and cable (actually we do remember, but not the same thing).
John

Event 12: Kominko – Slade AWS (WAIS Divide) by Shelley Knuth and Melissa Richards
1/25/2009 7:22 PM
Shelley's report from WAIS.

So as you know we serviced K-S site on Tuesday, and revisited on Wednesday to check to make sure everything was working ok.

Event 13: Servicing Marilyn AWS by John Cassano
1/23/2009 4:30 PM
Marilyn site was visited on 1/23/09 by John Cassano and 3 RPSC personnel on a morale trip (Kris, Marty, and Joel).

The Twin Otter had difficulty locating this site. After circling for approximately 15 minutes we landed at the given lat/long and scanned the horizon for the AWS. We were unable to spot the AWS and then taxied approximately due east until we spotted the AWS. The Twin Otter GPS coordinates at the site were 79 deg 55.551 min S and 165 deg 29.511 min E.

UNAVCO GPS (#16414) deployed at site from 2:30 to 5:00PM

Upon arrival the height to bottom of:

Lower T boom: buried
Junction box: buried
Solar panel: 38"
AWS enclosure: mostly buried (top 7" exposed)
Upper boom: 58"

A new 7' tower section was added to this site. New height to bottom of:

Lower T boom: Not retrieved (had not been connected when we arrived)
Junction box: 76"
Solar panel: 128"
AWS enclosure: 92"
Upper boom: 150"

After reinstalling all equipment transmission from the station was confirmed with Telonics. I've attached a before and after photo.

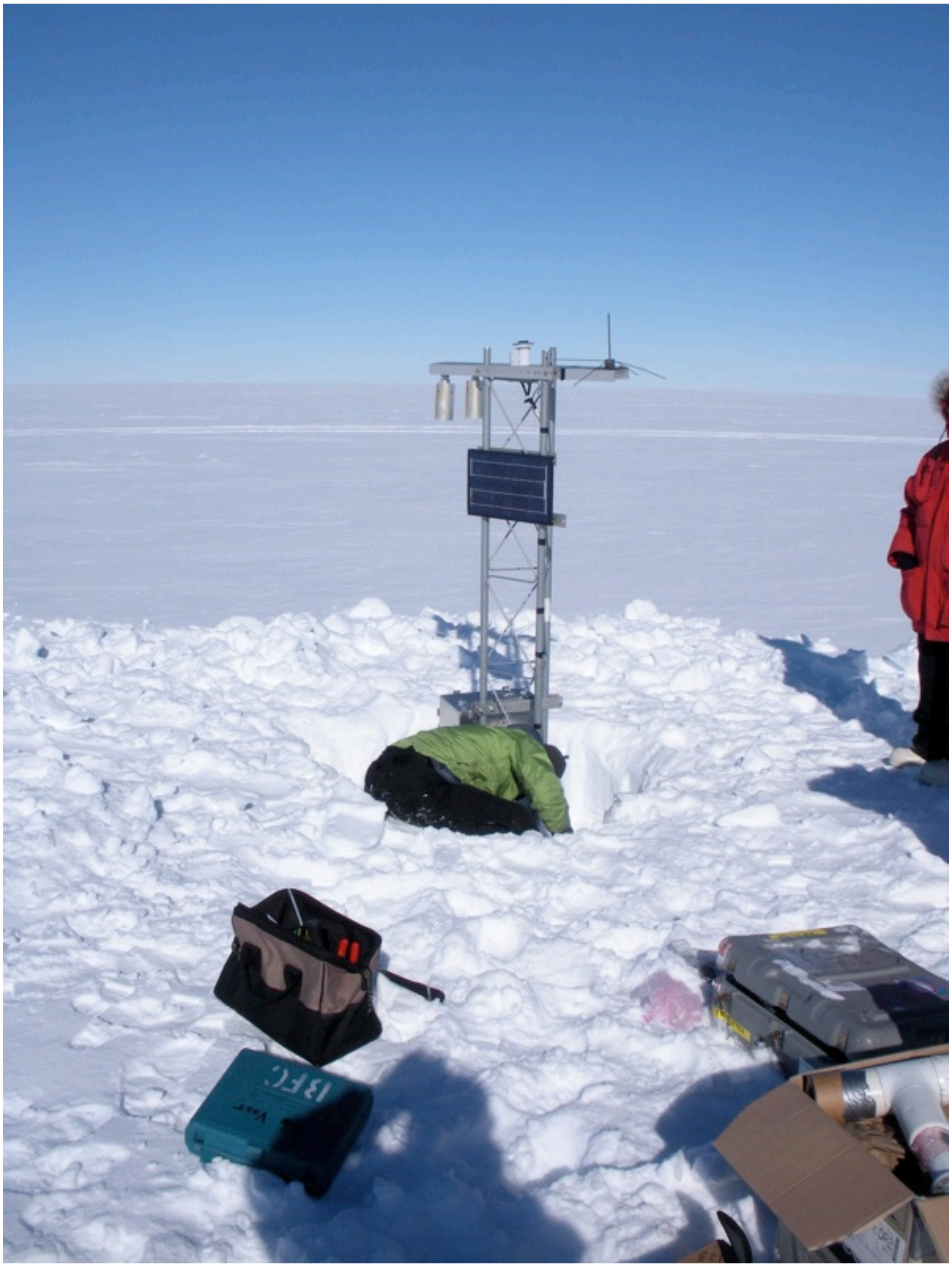


Image A18: Marilyn AWS January 2009 (before raising the tower)

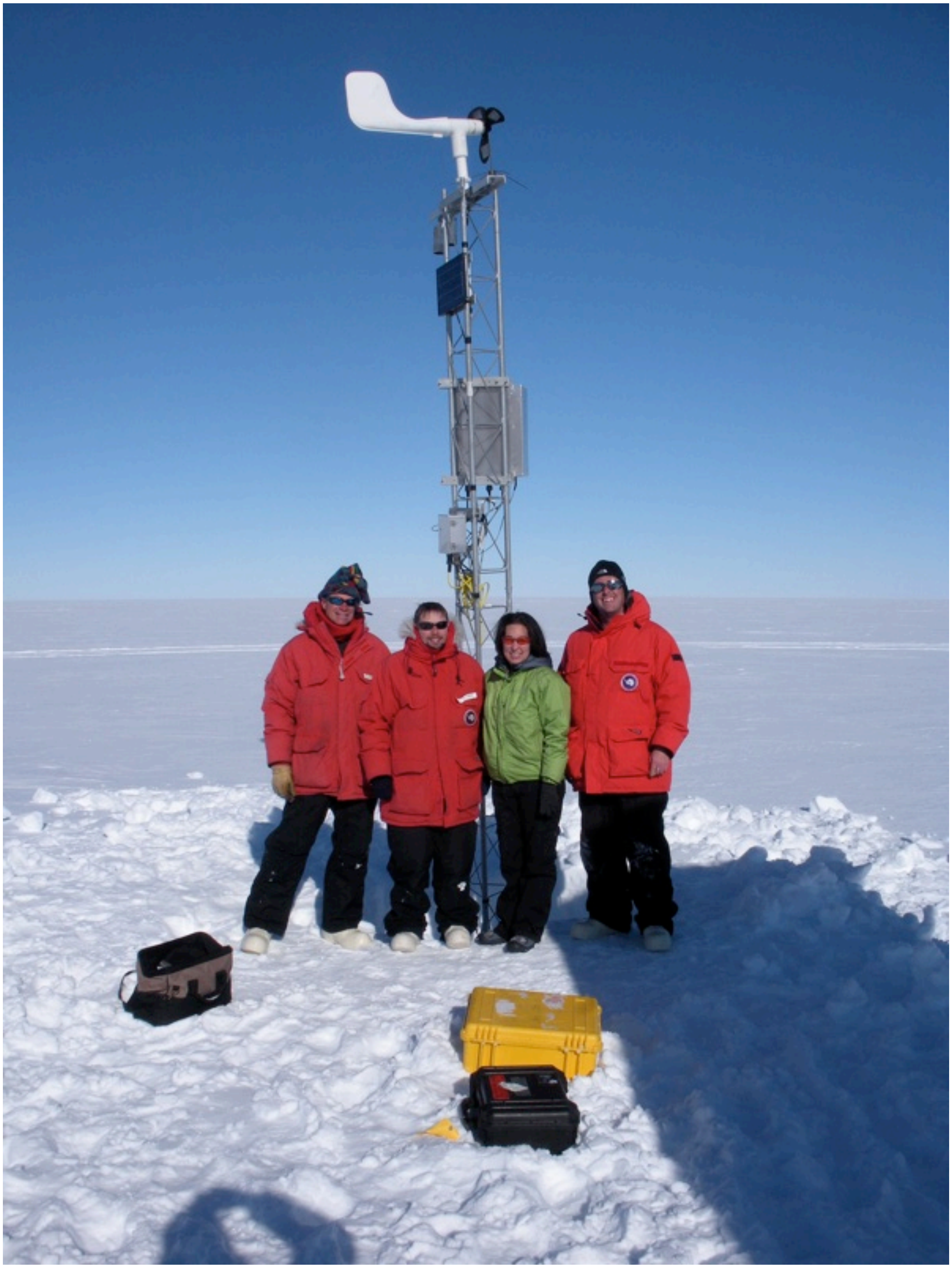


Image A19: Marilyn AWS January 2009 after raising the tower

Event 14: Servicing Carolyn AWS site by John Cassano
Carolyn site was visited on 1/23/09 by John Cassano and 3 RPSC personnel on a morale trip (Kris, Marty, and Joel).

The Twin Otter had difficulty locating this site, and the Twin Otter GPS coordinates at the site were 79 deg 56.368 min S and 175 deg 53.049 min E.

UNAVCO GPS (#16414) deployed at site from 11AM to 12:15PM

ADG data downloaded to Toughbook laptop computer, but data from late 2008 through present was retrieved.

Height to bottom of:

Lower T boom: at snow surface
Junction box: 28"
Solar panel: 65"
AWS enclosure: 12"
Upper boom: 99"
ADG: 25"
ADG temperature: 47"
CR10 enclosure: 40"

Decision was made to not add an additional tower section, but all equipment was repositioned on the tower.

New height to bottom of:

Lower T boom: 25"
Junction box: 53"
Solar panel: 84"
AWS enclosure: 28"
Upper boom: 99"
ADG: 56"
ADG temperature: 74"
CR10 enclosure: 54"

After reinstalling all equipment transmission from the station was confirmed with Telonics.

I've attached a before and after photo.

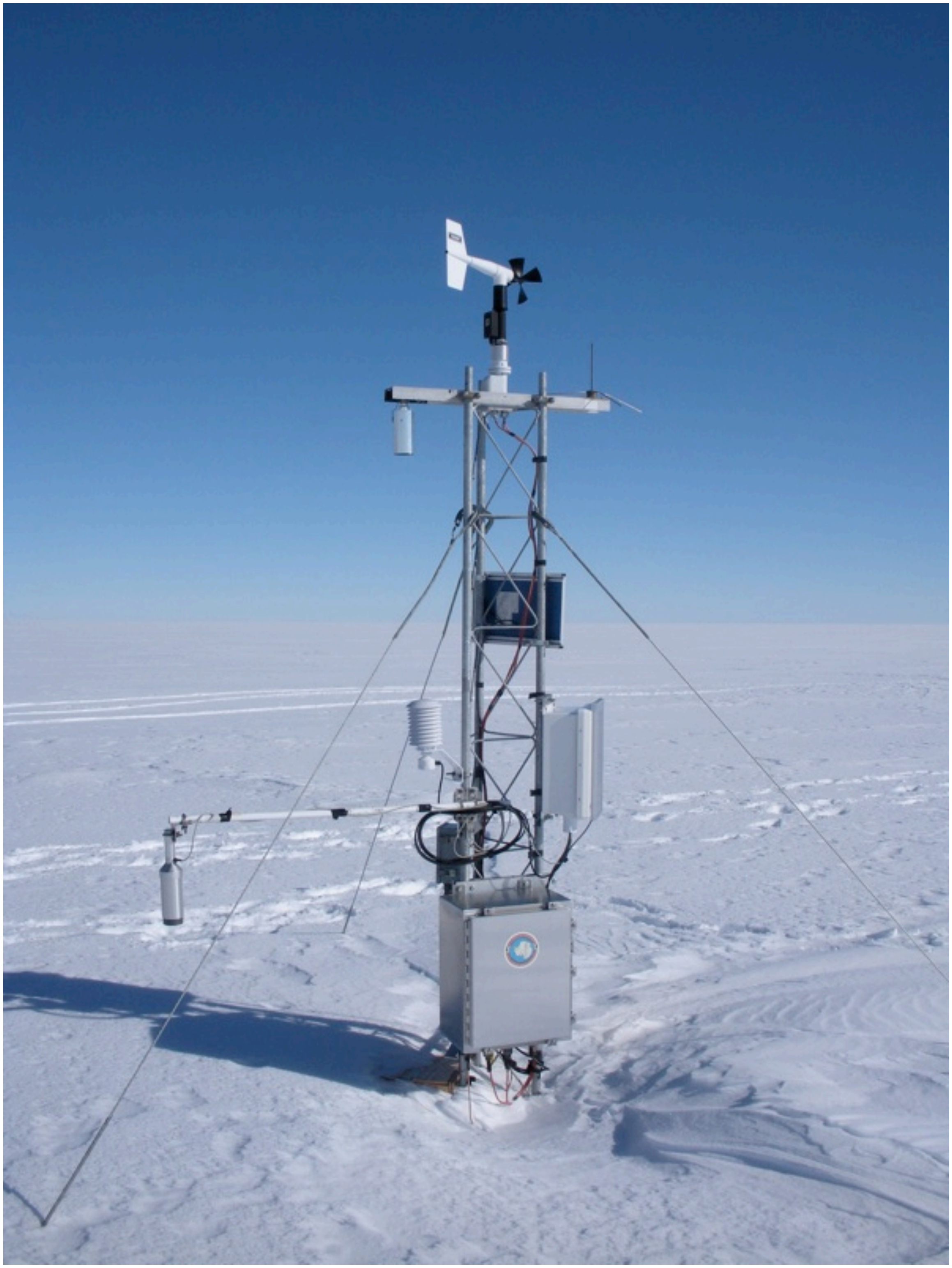


Image A20: Carolyn AWS site before servicing in January 2009


Image A21: Carolyn AWS site after servicing in January 2009

Event 15: Servicing Vito AWS site by Shelley Knuth and Melissa Richards
Visited Vito AWS on 1/24/2009 at 10:30 am (approximate ground time was 2 hours)

Team: Shelley, Melissa, Jason (RPSC), and LaVonne (RPSC)
Pilots: Josh and Randy

Had a bit of trouble spotting Vito. Site had moved about a half a mile since last visited. Upon arrival, all instruments including junction box were above snow. Measurements to surface were as follows:

Junction box: 13 cm
Electronics box: 22 cm
Solar panel: 34 cm
Boom: 2.3 m

Unfortunately we forgot to get new heights before we left so this is the only information we have.

Noted that tower put on from previous year was simply held on by a cargo strap and was not bolted on (was a base section). Did not rectify because tower seemed solid and cargo strap would soon be buried in snow. Could still see guy lines above surface.

RM Young shaft was loose (ie, it would turn). Was tightened.

Removed all instruments, added a 7 foot tower section on top, then re-mounted all instruments. Station did not come back online at first. Had to reboot, and then was fine. Got two, possibly three transmissions. A battery was not added as it was determined that there was more than enough battery power. Next time visited will definitely need battery extension cables.

Battery voltages were as follows:

Battery #1: 13.14
Battery #2: 13.15

UNAVCO GPS was put out from approximately 10:30 am - 12:30 pm.

New GPS coordinates from pilots:
78 27.973'S 177 46.854'E

Shelley

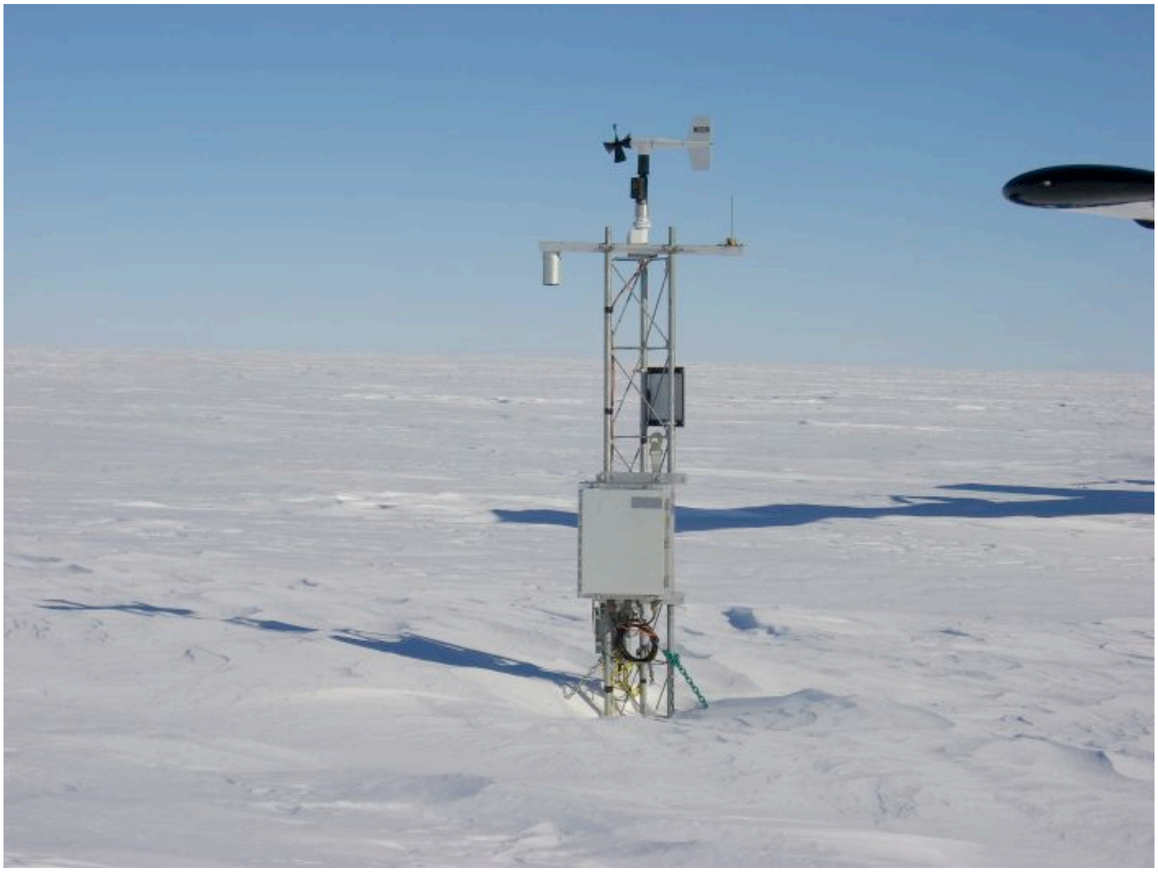


Image A22: Vito AWs before raising the tower in January 2009


Image A23: Vito AWS after raising the tower in January 2009

Event 16: Servicing Emilia AWS by Shelley Knuth and Melissa Richards
Visited Emilia AWS on 1/24/2009 at 1:30 pm (approximate ground time was 1.5 hours)

Team: Shelley, Melissa, Jason (RPSC), and LaVonne (RPSC)
Pilots: Josh and Randy

Actually had no trouble spotting Emilia, even though the pilots said it was nearly 2.5 miles from last known coordinates. Upon arrival, all instruments including junction box were above snow. Measurements to surface were as follows:

Junction box: 21 cm
Electronics box: 53 cm
Solar panel: 1.32 m
Boom: 2.05 m

New measurements after raise:
Junction box: 97 cm
Electronics box: 240 cm
Solar panel: 320 cm
Boom: 430 cm

The tower on this station was also not bolted on, even though there were holes in the section to bolt it with. Added bolts in the section to secure.

Removed all instruments, added a 7 foot tower section on top, then re-mounted all instruments. Station came back online right away. Next time visited will definitely need battery extension cables.

We cut the delta T cable which was taped to the tower but wasn't plugged into the electronics box so didn't think was hooked up. Dug down 3 feet but never saw the lower boom.

Battery voltages were as follows:

Battery #1: 12.8
Battery #2: 12.9

UNAVCO GPS was put out from approximately 1:30 pm - 3:00 pm.

New GPS coordinates from pilots:
78 28.37'S 173 08.81'E

Shelley

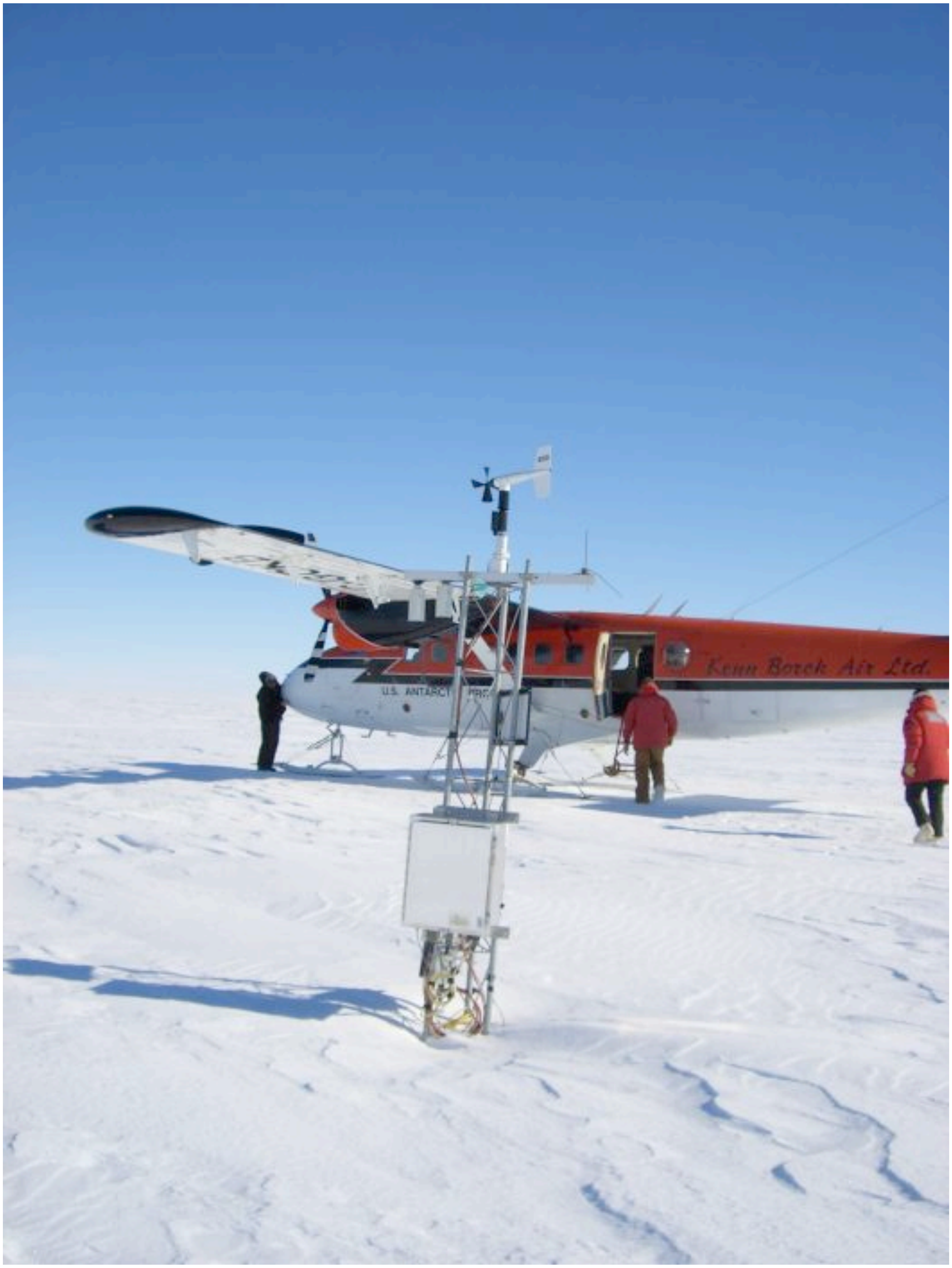


Image A24: Emilia AWs before raising the tower in January 2009

Image A25: Emilia AWS after raising the tower in January 2009

Event 17: Servicing Elaine AWS site by John Cassano
Elaine site was visited on 1/28/09 by John Cassano, 3 RPSC personnel on a morale trip (Scott, Tanya, and Kat), and 2 Twin Otter pilots (Josh and Randy).

The Twin Otter had difficulty locating this site.

The Twin Otter GPS coordinates at the site were 83 deg 05.84 min S and 174 deg 17.38 min E.

UNAVCO GPS (#16414) deployed at site from 14:35 to 16:50 local time

Upon arrival the height to bottom of:

Lower delta T boom: buried
Junction box: buried
Solar panel: 28"
AWS enclosure: buried to top of enclosure
Upper boom: 61"

Work completed:
A new 7' tower section was added to this site
AWS 8987 was replaced with AWS 21357
Belfort aerovane was replaced with RM Young aerovane

New height to bottom of:

Lower delta T boom: 34"
Junction box: 55"
Solar panel: 117"
AWS enclosure: 89"
Upper boom: 148"

Voltage at AWS power plug: 14.0V (without solar panel)

The next time this site is raised we will need two battery extension cables as there is no more slack left in the existing battery cables.

After reinstalling all equipment transmission from the station was confirmed with Telonics.

I did not remember to take a before photo, but have attached two after photos.

Image A26: Elaine AWS after servicing in January 2009

Event 18: Installation of Sabrina AWS site in southern area of Ross Ice Shelf by Shelley Knuth and Melissa Richards
Installed Sabrina on 2/2/2009 1:30 pm (approximate ground time was 2.5 hours).

Team: Shelley, Melissa, Kevin Emery (FSTP)
Pilots: Lexi and Rory

Beautiful day on the field, and a beautiful location with the mountains in the background. Temperature was fairly warm and there was no wind. The area is crevasse free so it's pretty safe. The South Pole traverse was very nearby - we could see their tracks and flags. We stopped at Moody Glacier on the way out and back to refuel. Took about 4.5 hours to get out to Sabrina from McMurdo.

Site was a new install. Put one 5' base and 1 7' tower section on top. Added solar panel, temperature/RH sensor, RM Young, junction box, CR1000, ADG, and lower temperature sensor for ADG. Also added white wand antenna. Added 2 battery boxes measured at 12.7 volts each.

Once the tower was up, we could not get a transmission for about 20 minutes. We began troubleshooting by rebooting the system, unplugging and re-plugging the antenna in, but nothing happened. We had just pulled out the toughbook and an extra antenna and suddenly got a transmission. We verified 3 transmissions before we left.

One very important note.

We did not have a handheld gps with us. The one we had was packed in our WAIS cargo, and we could not retrieve another one before we left in the morning despite various attempts. While we talked to the pilots and know where true north was so that the boom is facing that direction, the RM Young could easily be off by several degrees, and we had no way of verifying how far off it was.

The UNAVCO GPS was up from 1:30-4 pm.

Heights to surface:

ADG: 66 cm
Junction box: 112 cm
ADG Temp: 116 cm
Electronics box: 146 cm
Solar Panel: 201 cm
Boom: 288 cm

I've attached photos.

Shelley

P.S. The before picture is just us being funny...the pilots were circling several times and we didn't know what they were doing (they didn't give us a headset) and finally they yelled that they couldn't find the site. So we informed them it wasn't there. Also, the pilots were a HUGE help with installing the site too, as was Kevin.

Image A27: Area before installation of Sabrina AWS

Image A28: Sabrina AWS after installation in January 2009

Event 19: Servicing of Lettau AWS by Shelley Knuth and Melissa Richards
Visited Lettau on 2/2/2009 at 5 pm. Approximate ground time was 45 minutes.
Team: Shelley, Melissa, Kevin Emery (FSTP)
Pilots: Lexi and Rory

Upon arrival all sensors were above the surface, including the delta T (although barely). Site was off air so we rebooted the electronics box, and it came back online right away. We checked the antenna and antenna cable and everything appeared fine. We moved the electronics box and delta T further up the tower to avoid being buried. We also replaced a battery at the site, although the 2 batteries on site appeared ok (we replaced the battery registering the smallest voltage). We cut off the plug from the battery that was left there. After moving the instruments up the tower we plugged everything back in and got a transmission immediately. Verified with three transmissions.

Heights to surface upon arrival:
Delta T: 22 cm
Electronics box: 55 cm
Junction box: 94 cm
Solar panel: 198 cm
Boom: 258 cm
Heights after raising instruments:

Delta T: 57 cm
Electronics box: 137 cm

Voltages of batteries on site: 13.08 and 12.79
Voltage of power cable coming out of junction box: 13.23

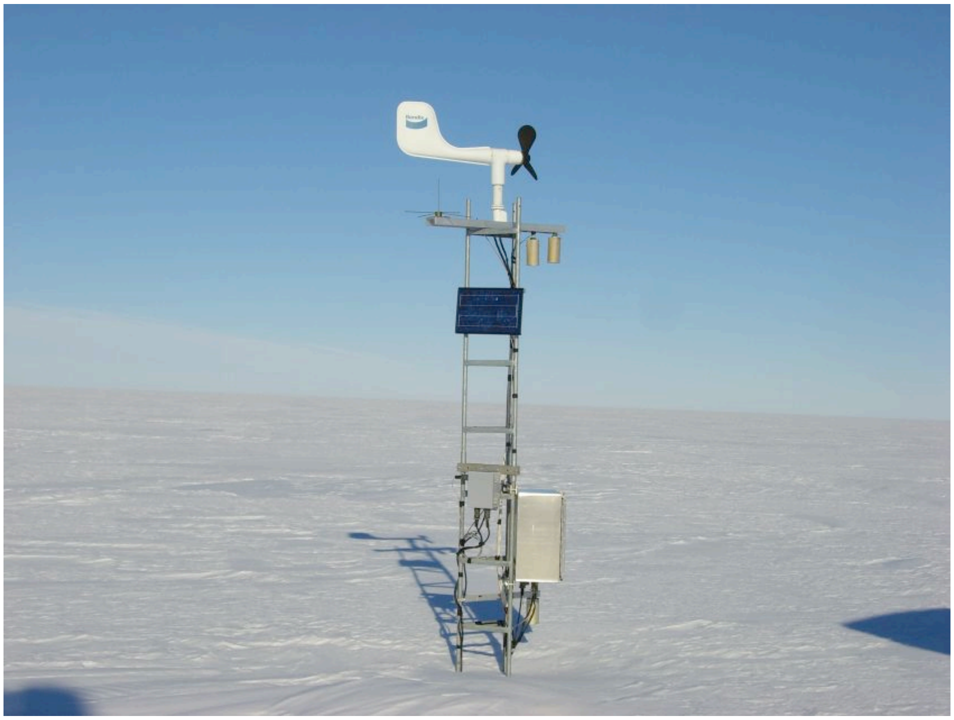


Image A28: Lettau AWS before servicing in February 2009

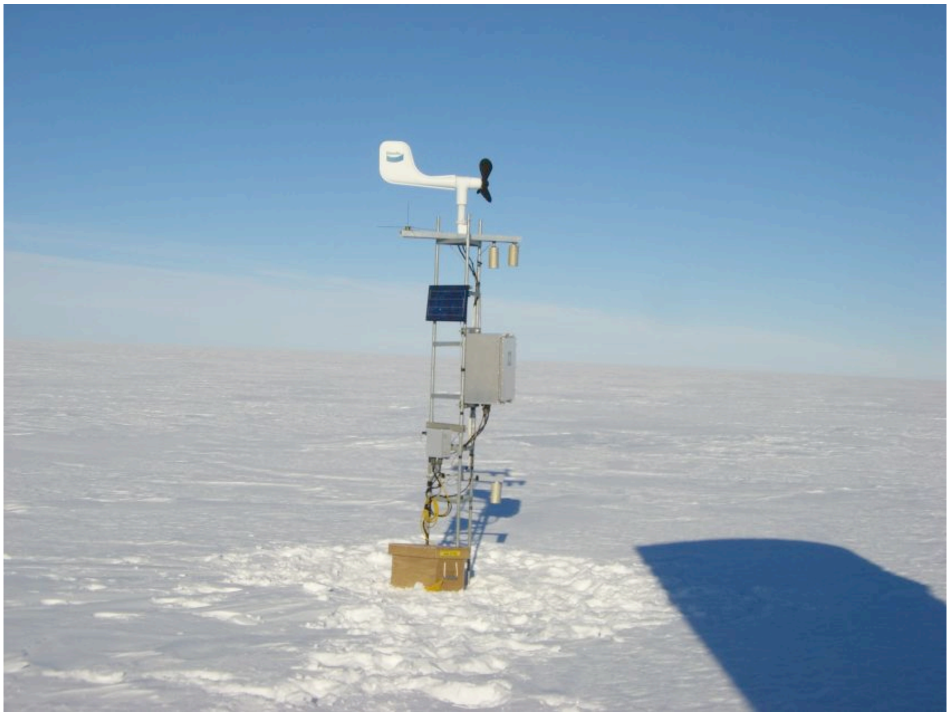


Image A29: Lettau AWS after servicing in February 2009

Event 20a,b,c: Servicing of Pegasus North AWS by John Cassano and Melissa Richards
Here are my field notes for the re-deployment of Pegasus North:

Field team: Melissa and John
Install:
AWS 21355
Junction box
Boom and lower delta T boom

Height to bottom of:
Lower delta T boom: 33"
Junction box: 44"
Solar panel: 86"
AWS enclosure: 61"
Upper boom: 130"

Voltage at:
Battery box 1: 12.8V
Battery box 2: 12.9V
AWS power plug: 12.9V

Confirmed transmission with Telonics. I've attached a photo of the station.
John

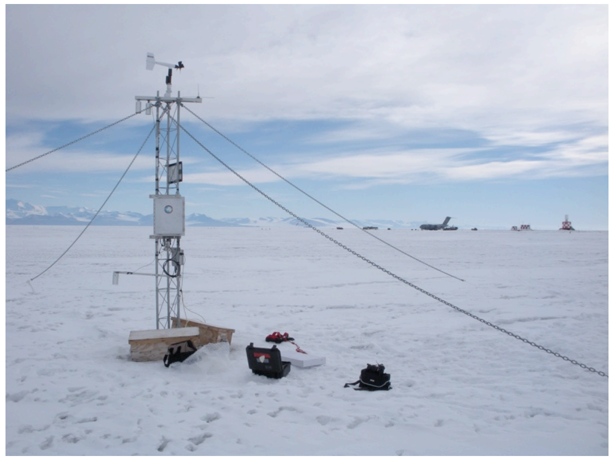


Image A30: Pegasus North after servicing in February 2009

Pegasus North site was visited agian on 2/5/09 by Melissa Richards and Dan Steinhoff
Work completed:
Removed electronics box 21355
Installed electronics box 8923
Installed lower temperature sensor below the current lower delta-T

Height to lower temperature sensor: 20"
Height to the remaining instruments are the same as the last field report

Received 3 successful transmissions.
Melissa

Event 21: Installation of new AWS at Williams Field AWS site by Melissa Richards

Willie site was visited on 2/5/09 by Melissa Richards and Dan Steinhoff

Work completed:
Installed electronics box 30477
Installed RMY aerovane with Belfort base
Installed Antennax antennae
Removed ADG, ADG radiation shield and ADG enclosure
Installed new ADG to attach to the 30477 electronics box

New height to bottom of:

Lower temperature sensor: 20"
Junction box: 41"
ADG: 43"
Solar panel: 49"

Electronics box: 77"
Solar panel: 154"
Antennae: 164"
Boom: 175"

Received 3 successful transmissions.

A few notes:
* The old style antennae was left on the boom with the electronics box end of the cable taped off
* The Antennax antennae was attached directly to the tower as done at Sabrina. This caused close clearance with the aerovane, but it was verified multiple times that there is sufficient clearance.
* The old ADG enclosure had a battery cable hard wired inside. In order to remove the enclosure, this cable needed to be cut. Dan and I did not have a shovel to try to dig up the battery box. The cut end of the battery cable has been covered with tape and taped to the tower.
* The cable to the lower solar panel followed the tower down into the snow. Does this go to the battery box that powered the ADG enclosure? If so, is there a problem that this is still connected and the battery box cable has been cut?

I think that is it. Dan, do you have anything to add?
Melissa

The following pictures are of the completed site, the cut battery cable taped to the tower and of the close clearance of the antennae and aerovane.

On Feb 5, 2009, at 9:14 PM, George Weidner wrote:
Melissa,

The Experiment wins one. Evidently my supposition that the problem was with the 10V line to the WS interface and Humidity probe proved incorrect. After you fine work, we still have no WS or Humidity... it is a harsh continent.
Thanks to you and Dan for attempting to correct the problem as assumed..
We will provide a new AWS for John when he is there early next season...
either the RM Young board itself is the issue or there are subtle issues with the A to D circuit...

Thanks again to you and Dan for your efforts and for your work in the field ..

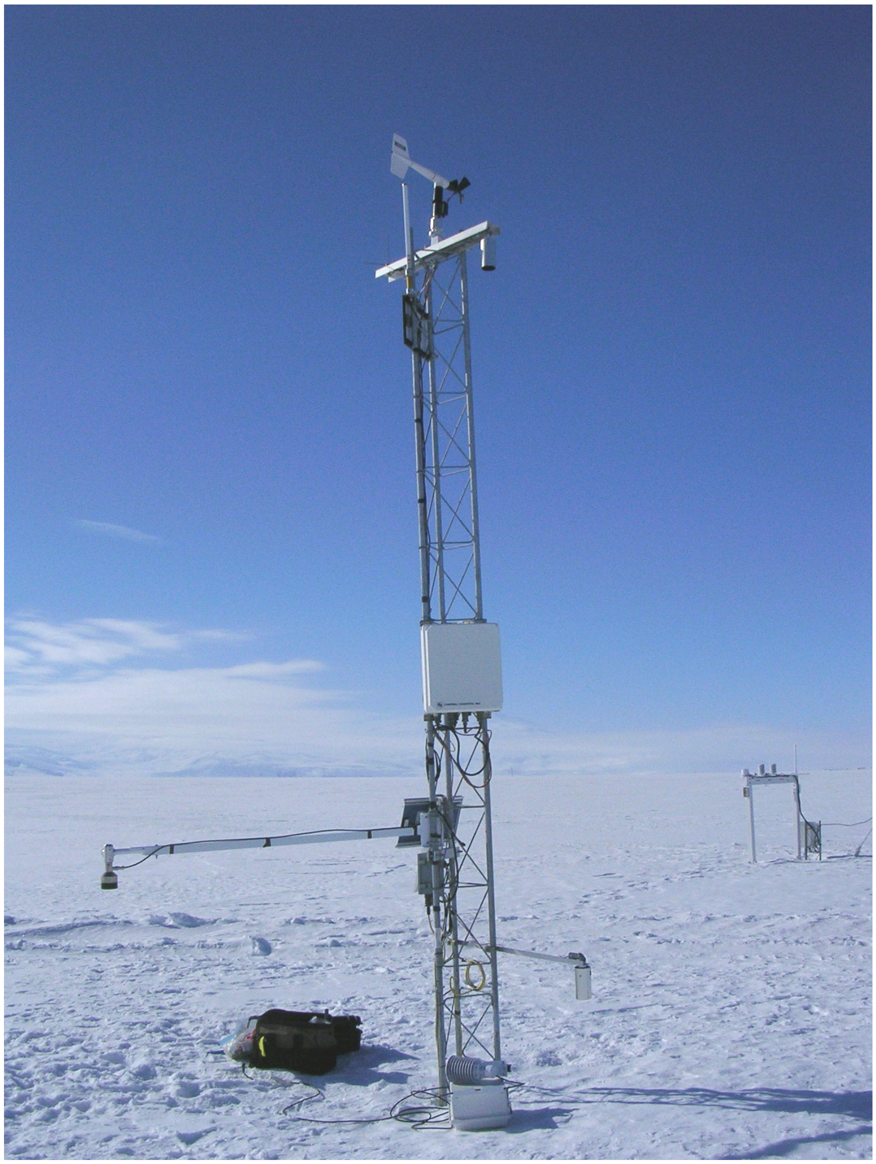


Image A31: New AWS 30477 after installation at Williams Field site in February 2009

Event 22: Installation of new AWS on Hugo Island
Field team headed by
W. Kevin Pedigo
Sr. Marine Computer and Instrument Specialist
ARSV Laurence M. Gould
United States Antarctic Program

Image A32: AWS for Hugo Island under test in Punta Arenas

ARSV LAURENCE M. GOULD DAILY SITUATION REPORT

GMT DATE: 2 April 2009

REMARKS: Done and done as they say. Today we installed the second GPS station for C-515-L and the AWS (automatic weather station) for the University of Wisconsin. None of this could have happened in weather other than what we experienced today. Nor could any of this have happened without the very spirited help of all who went ashore including three personnel from Palmer Station who logged a very physical day hauling gear up and down some very rocky inclines. We also hauled out the old AWS, including all rigging and batteries and loaded them aboard the ship. Some feisty fur seals stood guard as well as colonies of gentoo and chinstrap penguins to whom we gave a wide berth. Despite the ideal weather conditions, Zodiac landing sites require a great deal of caution due to the breakers on the rocks with even a minimal swell.

Once again we very much appreciate the incredibly accurate weather forecasts that we are receiving and the help of ECO working the back deck and holding station with the ship. We are now enroute to the final GPS site at Duthier's Point near Paradise Harbor, ETA tomorrow morning early.

I have a lat/lon for Hugo Island, from Kevin on the LMG:

64 57.70 S, 64 40.12 W

Image A33: W. Kevin Pedigo
(Sr. Marine Computer and Instrument Specialist)
on the ARSV Laurence M. Gould
installing AWS at Hugo Island

Appendix B
Summary of collaborative site visits for 2008/2009

Event 1: Aerovane servicing at Manuela AWS on Inexpressible Island by PNRA personnel.
November 27, 2008 3:23:02 AM CST
I would like to inform you that we have replaced the Aerovane on the Manuela AWS, as you asked us. Now the AWS is working properly. I would excuse me for the delay of this message, but in the last two weeks we have been very busy. I would appreciate if you can write me the name and the address of the person to whom we can send back the old sensor. In attachment you will find a picture of the repaired Manuela AWS.
Best regards
Lorenzo De Silvestri
Meteo-Climatological Observatory
ITALIAN ANTARCTIC RESEARCH PROGRAMME
Mario Zucchelli Station
E-MAIL: lorenzo.desilvestri_s@mzs.it

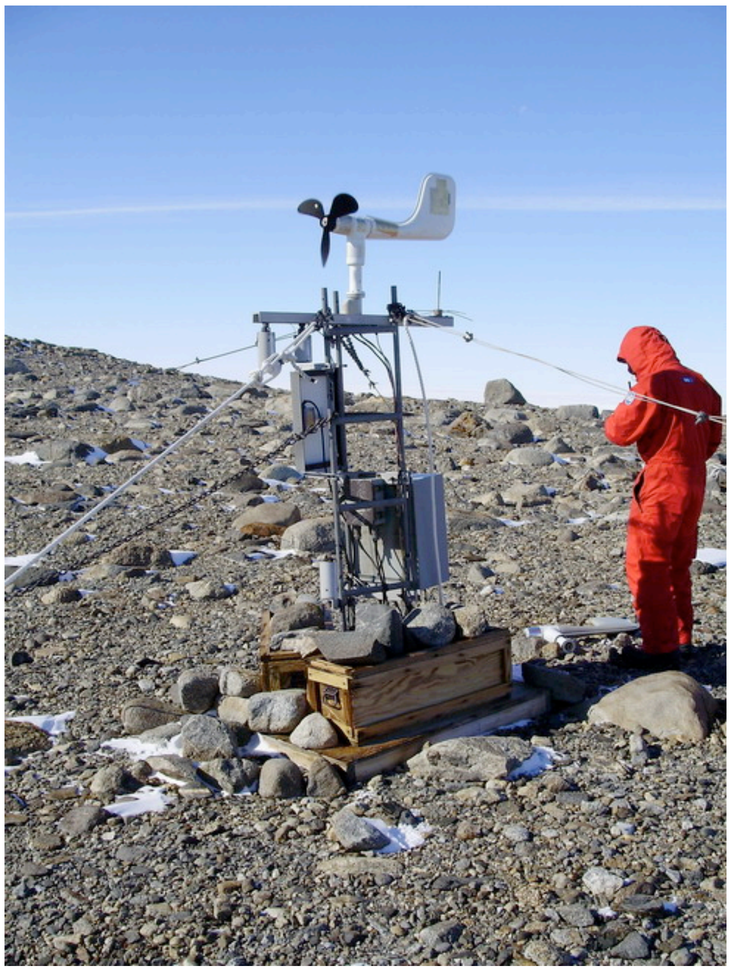


Image B1: Manuela AWS with Bendix Aerovane 2008/2009

Event 2: Servicing of AWS at Cape Denison by Mawson's Hut Foundation personnel
1/11/2009 11:44 PM
I replaced the anemometer today without any problem. The cables all looked in good condition, but the rubber sleeves on the 3 data cables' entry into the small metal box were perishing so I taped them up. I will sent you pictures when I get back.
Regards

Chris Henderson
chris.henderson@mhf.aq
Mawson's Huts Foundation
Read our blogs at http://www.mawsons-huts.org.aq
Find us on the web at http://www.mhf.aq

B2: AWS at Cape Denison

Event 3: Servicing AWS D-47, E-66, & D-85 along traverse line from Dumont D'Urville to Dome Concordia by IPEV collaborators
Collaborators: Christophe Genthon, Patrice Gordon, Alain Pierre, Bruno Jourdain of the Institut Polaire Français Paul Emile Victor – IPEV

D47 and D85 working; E66 no longer received as of January 19, 2009.

```
08912  E66                          343/0915Z-
 ( 1)        28          D2          A8          00
             AB          4F          FF          B5
             3C          62          35          65
             00          00          00          03
             3D          63          2F          65
             01          FF          00          B5
             3E          5F          49          B1
             FF          FF          E2          C5

08914  NO LOCATION   Not deployed (spare unit)
```

```
08916  removed from D85 (return to US) 336/1211Z-
 ( 1)        B5           12           EA           FE
             ED           7D           B1           00
             00           00           00           00
             00           01           FF           00
             00           00           00           00
             E5           35           A6           00
             00           00           24           00
             FB           00           C6           DB

08947  D47                             019/0639Z-
 ( 1)        27           69           30           88
             CD           A8           89           18
             20           54           E7           C6
             4C           64           E3           45
             63           8A           74           03
             42           8C           55           8D
             0F           BC           11           1B
             C1           3D           D1           3F

08986  D85                             019/1234Z-          ( 1)
26          52           93           00
             A6           22           01           35
             2D           55           30           59
             01           00           03           00
             28           5C           2B           59
             00           00           02           36
             34           59           92           35
             00           00           D3           52
```

Update on IPEC traverse AWS sites as of 2300 UTC 04 February 2009

```
                  E66 and D85 working ok.
        08912  E66                             035/2255Z-
   ( 1)        25           42           5E           00
               AA           21           FF           94
               30           69           31           67
               FD           00           FE           FF
               37           67           36           64
               00           02           01           A2
               34           67           24           A3
               00           FF           DF           7B

        08986  D85                             035/2251Z-
   ( 1)        23           22           5E           00
               A5           51           FF           38
               1F           6E           20           6E
               FE           FE           FE           FF
               1A           6D           1E           71
               00           01           00           37
               1B           6E           92           37
               00           00           DE           28
```

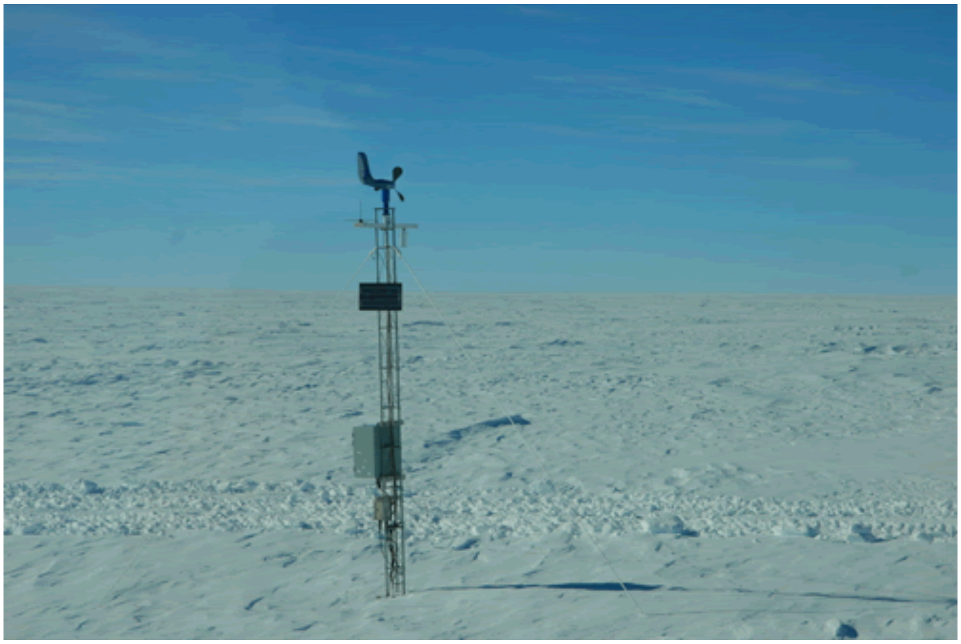


Image B3: D-47 AWS, 2009 (Courtesy of Bruno Jourdain)


Image B4: E-66 AWS, 2009 (Courtesy of Bruno Jourdain)

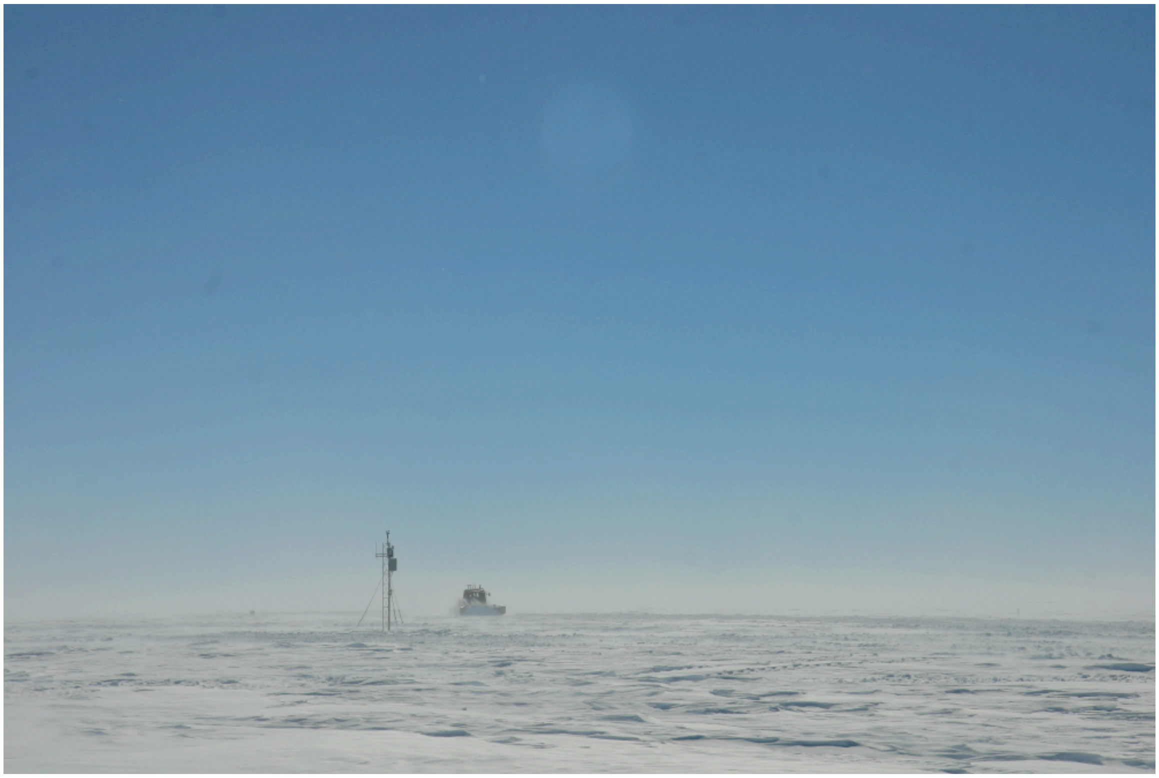


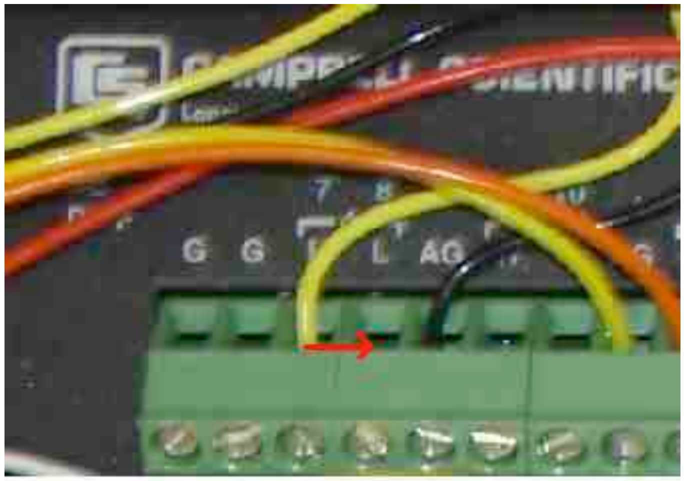
Image B5: D-85 AWS, 2009 (Courtesy of Bruno Jourdain)

Event 4: Servicing and correcting wiring error for humidity of AWS at D10.
Collaborators: Christophe Genthon, Phillippe Dorhain, and Vincent Favier
January 8-10, 2009

From Christophe:
We did raise D10 one mast length today. Philippe Dordhain had an essential contribtution here. Vincent Favier also helped. Operation was done at ~15:00 local time. The SR50 height above surface was 96 cm before, is 310 cm after.

From George Weidner:
We have found the source of the error with the humidity data with D10. The input channel on the CR10X for humidity should be 8 and NOT 7. Channel 7 was the temperature sensor in the HMP45 rather than the humidity sensor. The yellow wire should be moved to channel 8 (fourth from the left). Other AWS that use this CR10X program used the temperature data from the HMP45.... The good news is that the data is stored as temperature data in the storage module and can be recomputed as humidity when we get the storage module back after this year. There is enough memory for two years of data and will not need to be replaced until next season. After the wire is moved, the humidity will be stored in its correct field in the storage module, and this should solve the humidity issue for the transmitted data ...

Added sentence in instructions:
"only requires a small slot screwdriver to change the yellow wire channel connection"



Move yellow wire from 7 to 8....

Image B4: Visual instruction for moving the humidity wire to correct input location on CR100

Event 5: Servicing AWS on Dismal Island by the British Antarctic Survey

Subject:
RE: Parts for Dismal Island AWS
From:
"Colwell, Steven R" <src@bas.ac.uk>
Date:
Tue, 17 Mar 2009 16:06:52 +0000
To:
George Weidner <george.weidner@ssec.wisc.edu>

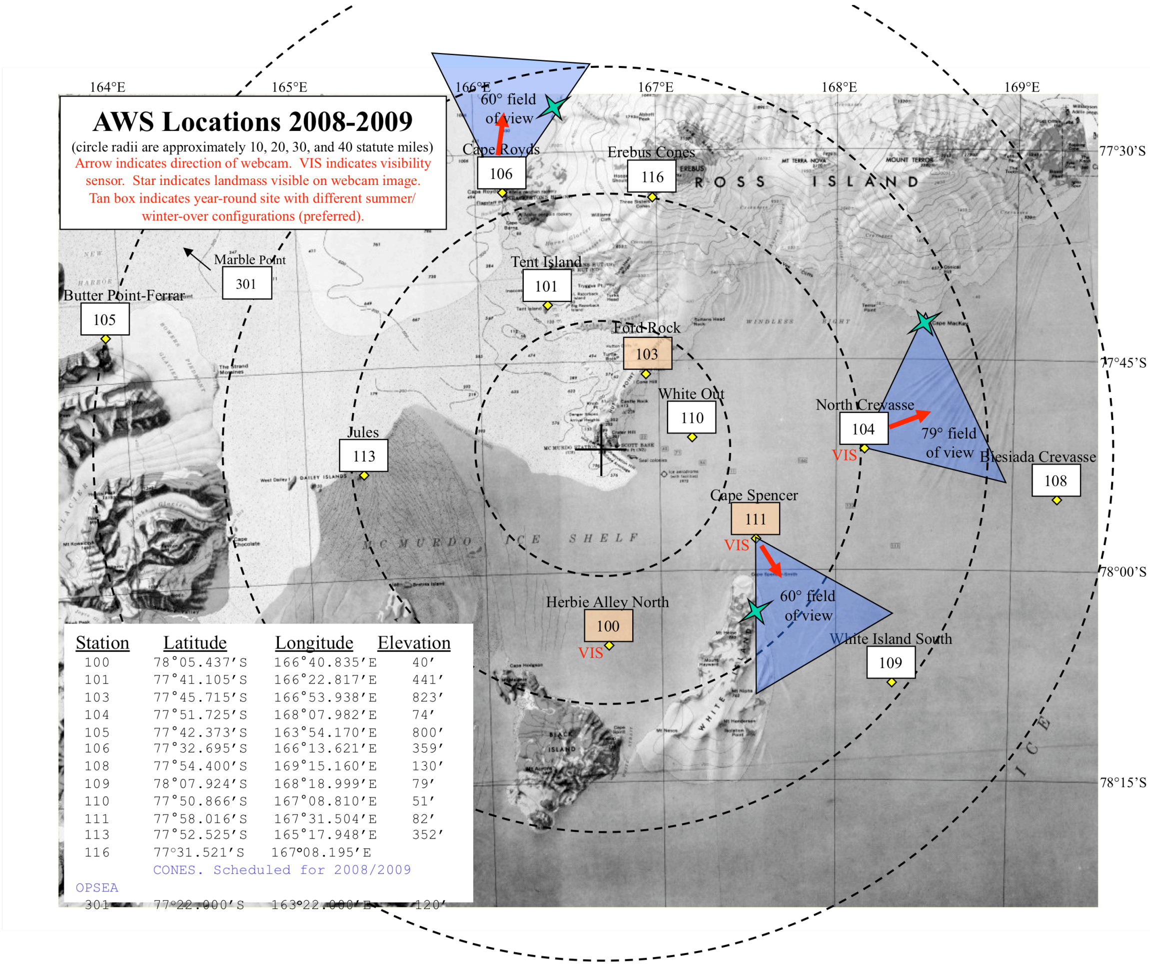
Hi George,

Hope you are well, just to let you know that we will not be able to service the Dismal Island AWS this season, we had planned to do it from the Endurance but it nearly sank in December see http://www.visitandlearn.co.uk/TrackHMSEndurance/CaptainsBlog/tabid/64/EntryID/21/Default.aspx

The next plan was to do if from one of our own ships on its way into Rothera but it has not been possible to do that due to bad weather and changes in the ships itinerary. We plan to leave the equipment at Rothera for the winter and then it has been added to the task list for next season so fingers crossed for more success then.

Bye
Steve

Appendix C
SPAWAR Office Of Polar Programs
Automatic Weather Station Locations for 2008/2009



Antarctic Automatic Weather Stations
Abbreviated Field Report for 2009-2010

Matthew A. Lazzara
George A. Weidner
Jonathan E. Thom
Lee J. Welhouse
Nicole M. Schroeder

Space Science and Engineering Center
University of Wisconsin - Madison
Madison, Wisconsin 53706

The National Science Foundation's Office of Polar Programs funds the placement of automatic weather station (AWS) units in remote areas in Antarctica in support of meteorological research, applications and operations. The basic AWS units measure air temperature, wind speed and direction at a nominal height of 3 meters above the surface. Air pressure is measured at the height of the AWS electronic enclosure. Some units measure relative humidity at 3 meters above the surface and the air temperature difference between .5 and 3 meters above the surface at the time of installation. A small, but increasing number of AWS sites measure snow accumulation. The data are collected by the ARGOS Data Collection System (DCS) on board the National Oceanic and Atmospheric Administration (NOAA) and MetOp (EUMETSAT) series of polar-orbiting satellites. The AWS units are located in arrays for specific research activities and also used for operational purposes. Any one AWS may support several experiments and all support operational meteorological services - especially support for weather forecasts for aircraft flights.

Research areas supported in the past include:

- Barrier wind flow along the Antarctic Peninsula and the Transantarctic Mountains
- Katabatic wind flow down the Byrd and Beardmore Glaciers, the Siple and Adelie Coast
- Mesoscale circulation and sensible and latent heat fluxes on the Ross Ice Shelf
- The Ross Ice Shelf Air Stream.
- Climatology of long operating AWS sites in particular, Byrd and Dome C sites.
- Meteorological support for the West Antarctic Ice Sheet Initiative
- Long Term Ecological Research (LTER) along the Antarctic Peninsula
- Meteorological support for United States Antarctic Program flight operations

A sampling of historically supported principal investigators funded by NSF-OPP:

- Dr. Douglas R. MacAyeal: Iceberg Drift in the Near-Shelf Environment, Ross Ice Shelf, Antarctica
- Drs. Tom Parish and John Cassano: The Ross Ice Shelf Air Stream
- Dr. Ray Smith, Long Term Ecological Research: Racer Rock, Bonaparte Point, and Santa Claus Island.
- West Antarctic Ice Sheet Initiative: Siple Dome and West Antarctic Divide drilling sites
- Aircraft Operation: All AWS sites in Antarctic.
- The Antarctic AWS units support many investigators outside of NSF-OPP.

AMRC collaboration:

- Climatological analysis from the AWS, and other stations (complimenting the activities in the SCAR READER project).
- Continued data collection, archival and distribution of AWS data.
- Continued educational outreach activities (as outlined in the above section and in the following outreach section).
- Utilities developed to generate climatological analyses from AWS observations.

Current research efforts include:

- Composite analysis of the surface effects of El Nino/Southern Oscillation and La Nina teleconnections on Antarctica
- Ross Ice Shelf wind flow studies (with collaborator, Dr. John Cassano)
- Snow accumulation studies
- State of the Antarctic climate

Fieldwork completed for 2009-2010

The 2009-2010 field team included Matthew Lazzara (O-283), Lee Welhouse (O-283), and Nicole Schroeder (O-283). Ms. Nicole Schroeder arrived in McMurdo 31 December 2009 and redeployed on 26 January 2010. Mr. Lee Welhouse and Dr. Matthew Lazzara deployed to McMurdo Station on 9 January 2010, and redeployed on 8 February 2010. Fieldwork was also done through cooperative programs with personnel from the Japanese Antarctic program (JARE), the French Antarctic program Institut Polaire Français - Paul Emile Victor (IPEV), the Mawson's Hut Foundation, and the British Antarctic Survey (BAS). A total of 15 AWS were visited this field season.

Several AWS sites were not able to be serviced due to the reduced field deployment and the weather. Sites that had been expected to visit included Siple Dome and Minna Bluff AWS. New sites that did not get installed included the Tall Tower AWS site and three new AWS in the Pine Island Glacier area of West Antarctica: Thurston Island, Bear Peninsula and Pig Helo Camp Site C/Meyers Nunatak – to be installed by Dr. David Holland. These will be attempted again in the 2010-2011 field season.

Summary fieldwork follows:

A. McMurdo based operations (USAP/Wisconsin)

Site	ARGOS ID	Service performed at site
Ferrell	8929	Retrieve ADG data, Replaced memory module, raised lower sensors
Willie Field	21364	Raised lower temperature probe Fixed wind sensor mounting
Windless Bight	8982	AWS raised; replaced ADG arm
Lettau	8928	Replaced Batteries
Pegasus North	8937	Fixed wind sensor mounting
Elaine	21375	Replaced AWS: new ADG and solar radiation sensors
Eric	8697	Raised AWS; recovered/replaced batteries

B. West Antarctic based operation (USAP/Wisconsin)

Site	ARGOS ID	Service performed at site
Kominko-Slade (WAIS)	8936	AWS raised; electronics added to snow temperature string; Added battery
Byrd	8903	AWS raised – new tower and sensor boom -by Dr David Holland, Joe Petit, Susha Dore

C. South Pole (USAP/Wisconsin)

Site	ARGOS ID	Service performed at site
South Pole	n/a	Test radiation shield AWS installed.

D. Palmer Station/Peninsula (USAP/Wisconsin)

No AWS serviced in the Palmer Station/Peninsula region

E. Field work in Adelie Land (France –IPEV)

Site	ARGOS ID	Service performed at site
D-47	8916	Replaced AWS 8947 with AWS 8916
E-66	8947	Removed AWS 8912 with AWS 8947

See appendix for excerpts from report from IPEV

F. Field work in Adelie Land (Mawson's Hut Foundation)

No AWS servicing due to cargo problems

G. Field work in Enderby Land (Japan – JARE)

Site	ARGOS ID	Service performed at site
Dome Fuji	8904	Replaced AWS with a new AWS
Relay Station	8918	Replaced AWS with a new AWS

H. Field work in Peninsula (United Kingdom – BAS) & AWS maintained cooperatively with the British Antarctic Survey

Site	ARGOS ID	Service performed at site
Dismal Island	8932	Replaced AWS with a new AWS

See appendix for photos from BAS

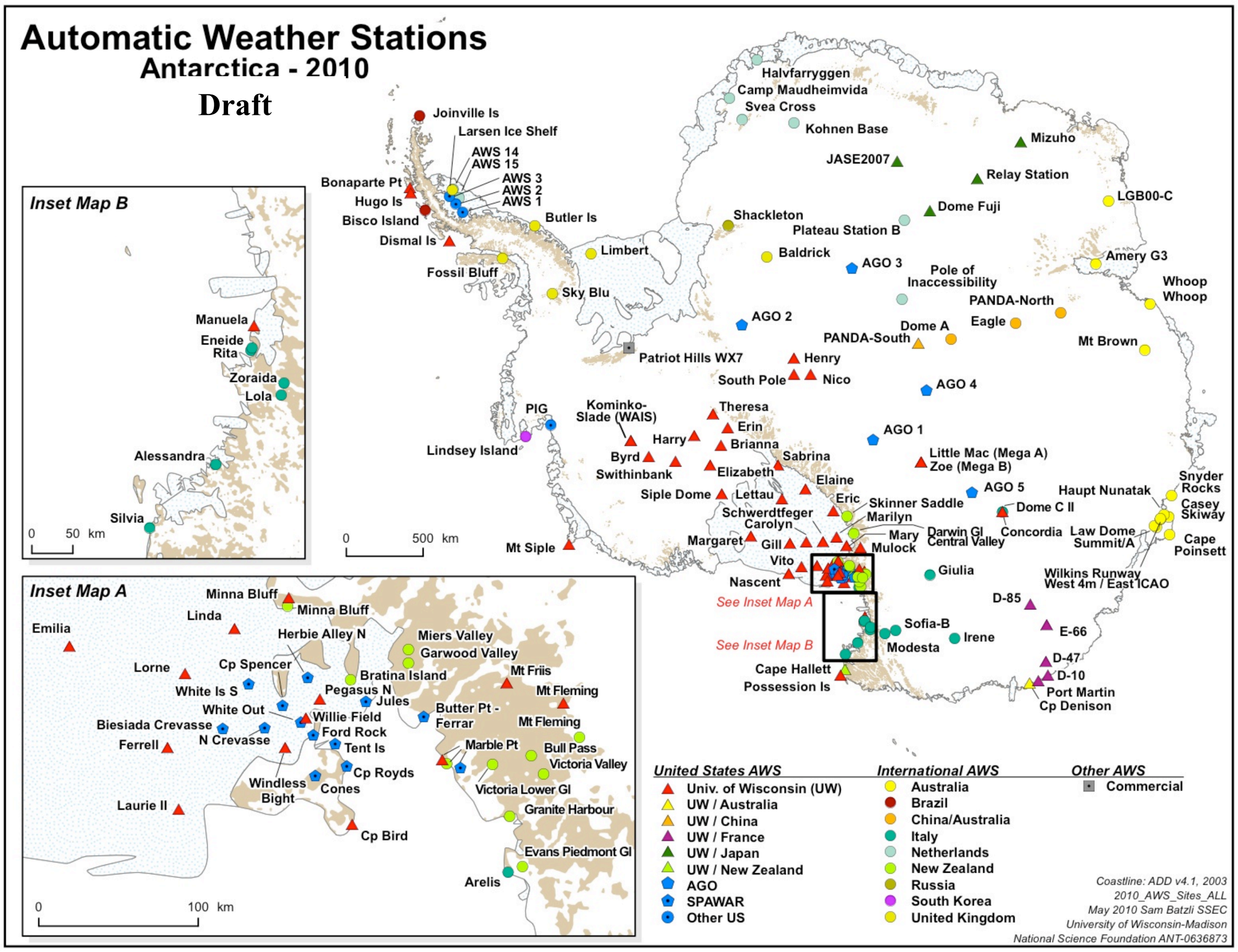


Figure 1. A draft map of Antarctica showing the locations of the University of Wisconsin's automatic weather stations (and other nations) for 2010. Identification of the sites is by the site name

Servicing of Dismal Island AWS by British Antarctic Survey
(Photos Courtesy of Tasmin Gray, BAS)

Nov 2009 / Jan 2010

Adelie Land AWS report

Alain PIERRE

IPEV

Nov 2009 / Jan 2010

2) Cape Denison : ID8988

Type : independent anemometer and wind direction sensor (Same as Port Martin)
Electronic : AWS2D
Current Status: HWS is not working
Location : 67°0'S / 142°39'E

This AWS is maintained by Mawson's Hut expeditionners.

NB : For Cape Denison AWS, boxes has to be received at Hobart before end of Nov.

3) Port Martin : ID8909

Type : High wind system anemometer and wind direction sensor (Taylor Scientific)
Electronic : AWS2D with Telonics ST-5
Current status: Not working, Has to be replaced as soon as possible. (scheduled for Nov 2010)

Location : 66°49'S / 141°23'E


AWS Port Martin (Wind anemometer has gone)

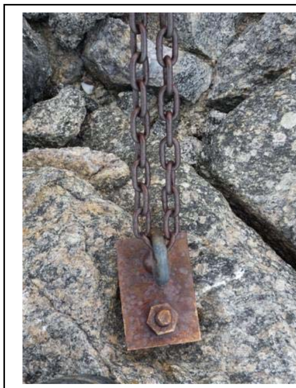
Actually Port Martin AWS can only be repaired during Nov, while Astrolabe vessel with 2 helicopters on board are not very far from Port Martin.

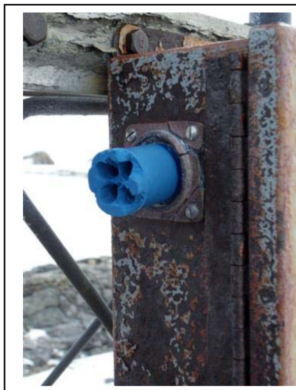
This year (Nov 2009) we went at Port Martin but unfortunately it was too windy to do any maintenance on it (80/km/h and higher wind with gusts).

The only parts which are in good conditions are :
- The mast
- Anchor points with steel chain and steel cable.

All others parts have to be replaced.


Steel cable tension (Good cond)


Anchor point (Good cond)


Junction box (Bad condition)

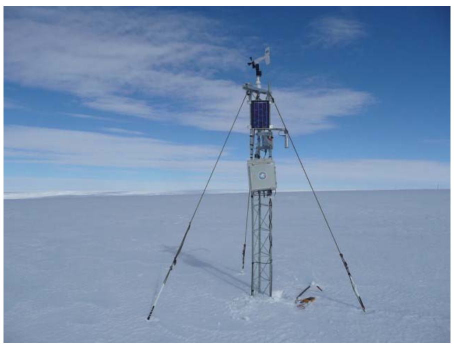
NB : Last summer season, AWS Port Martin box was not complete. One junction box was missing and terminations wire was not adapted at usual junction box plugs. However, replacement could still be done with some electrical adaptations and also because one spare junction box was available at Cap Prudhomme.

For others scientific reasons we have to go to Port Martin in Nov 2010 and we will try to install a new AWS station if AWS boxes are received at Hobart.

NB : Port Martin AWS boxes has to be received at Hobart before 10th of October.

4) D10: ID 30374

Type : RM Young mounted on Bendix base on sensor boom.
Electronic : Campbell CR10X
Current status: Working ok
Location : 66°42'S / 139°50'E



D10 AWS (Feb 2010)

D10 AWS : Electronic box

Maintenance schedule :

- Due to annual snow, we will probably add a section mast during 2010-2011 summer season.

5) D47 : ID8916

(installed in Feb 2010)
Type : RM Young mounted on Pipe all sensors independent mounts to tower
Electronic : AWSCR1000 with Telonics ST-20 PTT ID 8916
Current Status: Transmitting need to check data but would assume is OK
Location : 67°23'S 138°43,4'E

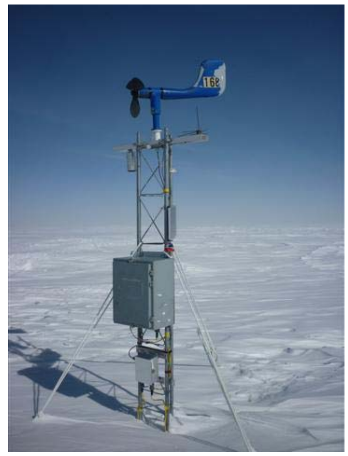
NB : Actual section mast used is smaller (IPEV mast) than AMRC section mast size. Keep in mind for next time when maintenance will be done.

D47. (Janv 2010)

5

6) E66 : ID8947

installed in Jan 2005 at D47 and removed in Jan 2010 for E66
Type : Bendix on sensor boom
Electronic : AWS2B with Telonics ST-5 PTT
Current status: Working OK
Location :xxxxx / xxxxxx ?


E66 AWS (Feb 2010)

Maintenance schedule :

- Due to annual snow, we will probably add a section mast during 2010-2011 summer season.

7) D85 : ID8986

Type : RM Young on Bendix base on sensor boom
Electronic : AWS2B Telonics ST-5 PTT
Current Status: Working OK
Location : 70°25,6'S 134°08,8'E

Photos ?

COMPOSITE ANALYSIS OF THE SURFACE EFFECTS OF EL NINO SOUTHERN OSCILLATION TELECONNECTIONS ON ANTARCTICA

Welhouse, L.J.[1*], Lazzara, M.A.[2], Tripoli, G.J.[1], Keller, L.M.[1]

[1]Department of Atmospheric and Oceanic Sciences, University of Wisconsin-Madison
[2]Antarctic Meteorological Research Center, Space Science and Engineering, University of Wisconsin-Madison

1. Introduction

Significant work has been done on identifying and understanding upper level height anomalies associated with El Nino Southern Oscillation (ENSO) events in the Amundsen and Bellingshausen Sea regions. (Turner 2004) This work focuses on the effect these teleconnections have on the Antarctic continent and adjacent Southern Ocean. Composites of ERA-40 (European Centre for Medium-Range Weather Forecasting Re-analysis) data from 1979-2002 of ENSO events, as determined by the Multivariate ENSO Index(MEI), illustrate how these events affect the surface variables (e.g. pressure, temperature, etc.). These composites consist of monthly averaged data compiled into three month seasons, with emphasis on December, January, and February as this is generally the period of maximum ENSO intensity. To ensure the accuracy of these findings regions with values exceeding the confidence intervals are compared with ground based Automatic Weather Stations (AWS) from the University of Wisconsin-Madison that have not been used in the reanalysis. Though the values vary considerably, during the strongest ENSO periods, we note significant warming (cooling) over much of the continent primarily focused in the East Antarctic during El Nino (La Nina) events. Significant high pressure anomalies are found during El Nino events focused in the Amundsen-Bellingshausen Sea regions, and extending to the Ross Ice Shelf and the Antarctic Peninsula. During La Nina events low pressure anomalies are evident throughout the continent.

2. Data

Throughout this study we have used the ERA-40 data set for surface temperature, pressure, wind, and humidity values due to it having higher correlations with observations (Bromwich 2004) during the post satellite era (1980-2002). We have also used the AWS dataset as a means to check the accuracy of the reanalysis during times when AWS stations weren't assimilated.

* Corresponding Author: Lee J. Welhouse
947 Atmospheric, Oceanic, And Space Science Building,
1225 West Dayton Street, Madison, Wisconsin 53706
Phone: 608-262-0436
Email: lee.welhouse@ssec.wisc.edu

a. ERA-40

For our composite analyses we have created two different sets of composites, for both El Nino and La Nina events. The first of these composites consist of using all months during all events, as determined by the MEI, to determine the overall affect these events have on the Antarctic continent. The second set of composites involves using three-month seasonal time sets. The timeframe of three months was chosen as it matches with the time frame used to calculate the ENSO indices used. These composites allow us to observe differences in the anomaly patterns between typically weaker seasons (April, May, June) and typically stronger seasons (December, January, February). In all composites the events are compared against the average values.

b. AWS Network

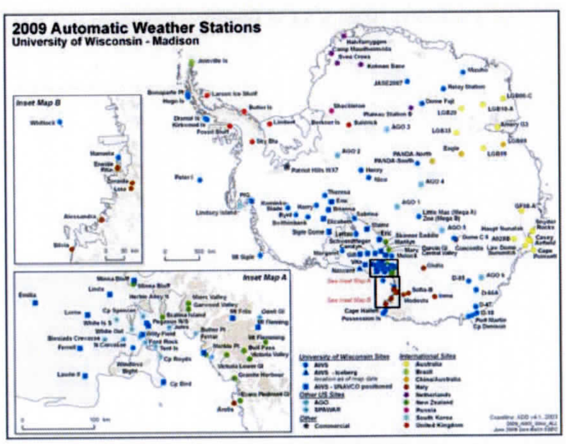


Figure 1: A map of the current AWS Network

Throughout this process the reanalysis is compared with the observational network (Figure 1) during times we are certain the weather station data has not been assimilated. As the reanalysis discontinued using AWS station data in 1998, a period of 44 months remains available in the ERA-40 dataset that we are able to compare with. We have also checked prior to this time for stations that have gone unused to ensure consistency between the Re-analysis and the observations. To compare between the grid points of the reanalysis and observation network the weighted average of the nearest four points in the reanalysis was used. Initial findings indicate there is a strong correlation, on the order of .95, between the two datasets.

c. MEI

In this study we have chosen to use the Multivariate ENSO Index as our metric for determining ENSO events. This index utilizes the first principal component of the weighted average of sea surface temperatures, sea level pressures, surface wind speeds, cloudiness, and precipitation. (Wolter, K. 1993) It seems to be a more accurate representation of ENSO events than the more commonly used Southern Oscillation index. Similar compositing techniques were used with SOI as a metric, and while they showed similar results they showed a less robust signal in general.

3. Analysis

This section will focus on understanding the effects ENSO has on Antarctic near surface temperature anomalies. Though our analysis extends to pressure, and will extend to wind speed and direction as well as relative humidity for this section we are focusing on temperature as seen in the yearly and seasonal composites.

a. Full Year

1. El Nino

This composite shows a general effect that remains consistent with prior understanding of the teleconnection in the Amundsen-Bellingshausen Sea with a few new, potentially important additions. In the case of the El Nino (Figure 2) event we note a relatively strong warming in the Amundsen-Bellingshausen sea region with the statistically significant warming extending somewhat into the Ross Ice Shelf. We also note a cooling just off the Antarctic Peninsula near the Weddell Sea. These two features make physical sense when you consider the teleconnection is generally expressed as an upper level height anomaly, and the associated flow can account for these temperature changes. Analysis of the pressure field indicates this as a likely cause. On the other hand the region of cooling in the Amery Ice Shelf seems disconnected from the upper level height anomalies, and because it is statistically significant it warrants further exploration.

2. La Nina

This composite is also consistent with prior work on the subject, with weaker warming being centered more closely to the Antarctic Peninsula and a region of cooling located north of the Ross Sea. These features seem to be linked to the upper level teleconnection in the same general area. We also see that much of East Antarctica has moderate cooling occurring. Much like the Amery Ice Shelf cooling this region warrants more study as to why this is occurring.

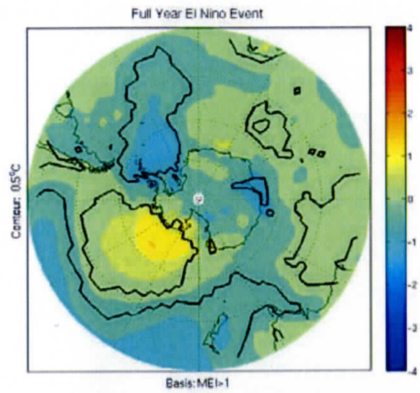


Figure 2: A composite of Full Year temperature anomalies during El Nino events with black lines indicating the 95% confidence interval.

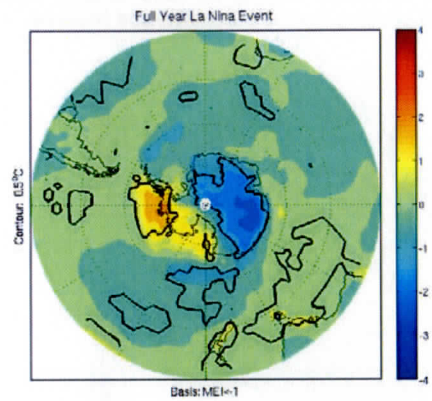


Figure 3: A composite of Full Year temperature anomalies during La Nina events with black lines indicating the 95% confidence interval.

b. Seasonal

1. El Nino

Throughout this section we will focus on two particular seasons, July-September and November-January. These two seasons are quite different. First we note July- September (Figure 4) is generally a season where the event is still growing in intensity. In this composite we note the expected features associated with the teleconnection, but also a region of weak warming on the Queen Maud Land coast that isn't associated with the upper level flow. This seems to be associated with a strong negative surface pressure anomaly. November-January (Figure 5) is moving toward months where we see the strongest ENSO activity. During this period we note relatively strong, significant, warming throughout much of the continent, with the only regions lacking this warming being the Ross Ice Shelf and the Antarctic Peninsula. Much of this seems to be disconnected from the Amundsen Bellingshausen Sea teleconnection, which shows up quite strongly in the surface pressure composites.

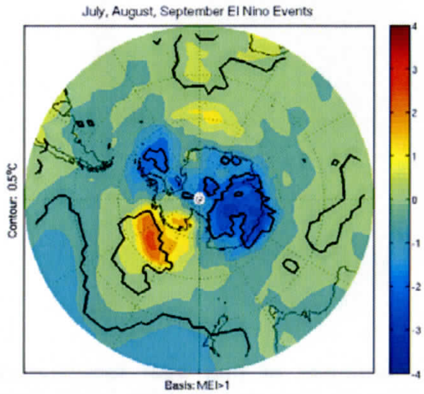


Figure 4: A composite of the July-September temperature anomalies during El Nino events with black lines indicating the 95% confidence interval.

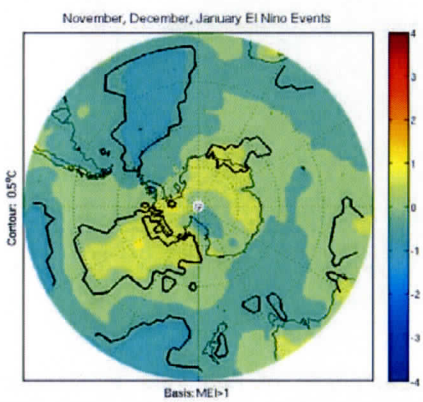


Figure 5: A composite of the November-January temperature anomalies during El Nino events with black lines indicating the 95% confidence interval.

2. La Nina

Again we focus on the July-September and November-January time periods. In July-September (Figure 6) we note two areas of interest, the first being strong warming throughout much of the West Antarctic, specifically focused in Marie Byrd Land and Ellsworth Land. This feature seems connected with the teleconnection. On the other hand there is a region of cooling in Wilkes Land that requires more study. Moving on to the November-January (Figure 7) season much has changed. There is little to no signal in the regions associated with the teleconnection in the West Antarctic, but the cooling in East Antarctic remains strong but has grown to cover most of the East Antarctic generally running along the Transantarctic Mountains

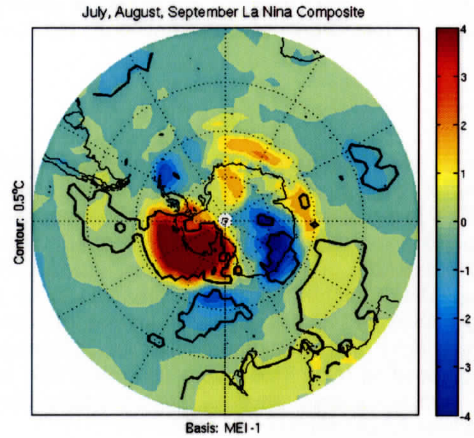


Figure 6: A composite of the July-September temperature anomalies during La Nina events with black lines indicating the 95% confidence interval.

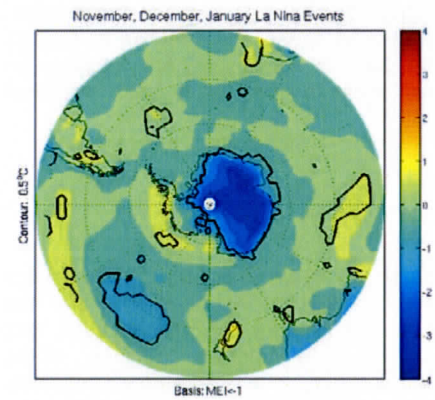


Figure 7: A composite of the November-January temperature anomalies during La Nina events with black lines indicating the 95% confidence interval.

4. Future Work

With the recent release of newer long-term Re-analysis products that extend through 2009 we hope to expand this study to capture more events. Also expanding the analysis to view humidity as well as wind speed an direction is a necessary step toward understanding the full effects these events have. Also, recent research has shown that the Southern Annular Mode has a strong effect on the variability of the high latitude teleconnections associated with ENSO events. (Fogt R.L. 2006) As such we hope to determine the effect including SAM events has on our findings.

5. Acknowledgements

The National Science Foundation Office of Polar Programs Grant # ANT-0636873 supported this research

6. References

Bromwich, D. H., and R. L. Fogt, 2004: Strong trends in the skill of the ERA-40 and NCEP/NCAR Reanalyses in the high and middle latitudes of the Southern Hemisphere, 1958-2001. J. Climate, 17, 4603-4619.

Fogt, R. L., and D. H. Bromwich, 2006: Decadal variability of the ENSO teleconnection to the high latitude South Pacific governed by coupling with the Southern Annular Mode. J. Climate, 19, 979-997.

Turner, J 2004: The El Nino-Southern Oscillation and Antarctica. Int. J. Climatol. 24: 1–31.

Wolter, K., and M.S. Timlin, 1993: Monitoring ENSO in COADS with a seasonally adjusted principal component index. Proc. Of the 17th Climate Diagnostics Workshop, Norman, OK, NOAA/NMC/CAC, NSSL, Oklahoma Clim. Survey, CIMMS and the School of Meteor., Univ. of Oklahoma, 52-57

Annual Report for Period: 09/2009 - 08/2010

Principal Investigator: Cassano, John J.

Organization: U of Colorado Boulder

Submitted By:

Cassano, John - Principal Investigator

Title:

Collaborative Research: Antarctic Automatic Weather Station Program: 2007-2010

Submitted on: 08/30/2010

Award ID: 0636811

Project Participants

Senior Personnel

Name: Cassano, John

Worked for more than 160 Hours: Yes

Contribution to Project:

Post-doc

Name: Seefeldt, Mark

Worked for more than 160 Hours: No

Contribution to Project:

Graduate Student

Name: Nigro, Melissa

Worked for more than 160 Hours: Yes

Contribution to Project:

Melissa Nigro (maiden name: Richards) has worked on this project as a graduate research assistant since fall 2009. Her research is focused on the dynamics of high wind events over the Ross Ice Shelf.

Undergraduate Student

Technician, Programmer

Other Participant

Research Experience for Undergraduates

Organizational Partners

University of Wisconsin-Madison

Other Collaborators or Contacts

Matthew Lazarra - lead PI of project at University of Wisconsin

Activities and Findings

Research and Education Activities:

Research activities

July 2009 to August 2010

The primary research activity at the University of Colorado during the past year has been an analysis of high wind events over the southern Ross Ice Shelf using data from the recently installed Sabrina AWS (installed Feb 2009). CU grad student Nigro (formerly Richards) has identified several high wind events at Sabrina AWS and is using a combination of AWS observations and output from AMPS to analyze the dynamics of these high wind events.

A manuscript detailing a synoptic climatology based method for evaluation of numerical weather prediction forecasts using in-situ observational data has been submitted for publication in Weather and Forecasting. This manuscript uses AWS data to evaluate AMPS forecasts in the Ross Sea sector under a variety of different synoptic weather regimes. CU grad student Nigro is the lead author on this manuscript. This manuscript also served as the basis for Nigro's comprehensive exam for her Ph.D.

Conferences attended / presentations

Cassano attended the Antarctic Meteorological Observation, Modeling, and Forecasting workshop in Charleston, SC (July 2009).

Lazzara, M.A., Thom, J., Weidner, G. J.J. Cassano , 2009: Antarctic automatic weather station program: 2008-2009 field season overview. 4th Antarctic Meteorological Observation, Modeling, and Forecasting workshop, Charleston, SC (oral)

Nigro attended the Polar Technology meeting in Boulder, CO (March 2010)

Nigro attended the Antarctic Meteorological Observation, Modeling, and Forecasting workshop in Columbus, OH (July 2010).

Richards (Nigro), M.A. and J.J. Cassano, 2010: An analysis of the low-level wind field over the Ross Ice Shelf, Antarctica. Antarctic Meteorological Observation, Modeling, and Forecasting workshop, Columbus, OH. July 2010 (oral).

Thom, J., M. Lazzara, G. Weidner, L. Keller, and J. Cassano, 2010: Antarctic Automatic Weather Station Program 2010-11 field plans. Antarctic Meteorological Observation, Modeling, and Forecasting workshop, Columbus, OH. July 2010 (oral).

Cassano attended the Scientific Committee on Antarctic Research Open Science Conference, Buenos Aires, Argentina (August 2010).

June 2008 to June 2009

co-PI Cassano and grad student Richards took part in the 08/09 AWS field season at McMurdo station, servicing stations on the Ross Ice Shelf and in West Antarctica.

A new station (Sabrina AWS) was installed at 84.25S, 170W to observe the low-level wind field over the southern Ross Ice Shelf, adjacent to the Transantarctic Mountains.

Grad student Richards continues to assist with QCing AWS data from sites on and near the Ross Ice Shelf.

Grad student Richards is continuing an AWS based evaluation of Antarctic Mesoscale Prediction System forecasts. A manuscript describing this work is currently in preparation and this work will serve as a significant portion of Richards oral Ph.D. comprehensive exam.

Richards is also contributing to an observational and model based synoptic and mesoscale cyclone climatology in the Ross Sea sector.

A climatology of Southern Ocean cyclones (Uotila et al., 2009) is currently in press in JGR. co-PI Cassano was a co-author on this paper.

Conferences attended / presentations

Scientific Committee on Antarctic Research (SCAR) Open Science Conference, St. Petersburg, Russia, July 2008

Cassano, J.J., 2008: Applications of a synoptic pattern classification scheme to evaluate Antarctic Mesoscale Prediction System Forecasts, Scientific Committee on Antarctic Research Open Science Meeting, July 2008, St. Petersburg, Russia.

Seefeldt, M.W. and J.J. Cassano, 2008: A description of the Ross Ice Shelf air stream (RAS) through the use of self-organizing maps. Scientific Committee on Antarctic Research Open Science Meeting, July 2008, St. Petersburg, Russia.

Iowa State University, Department of Geologic and Atmospheric Sciences, September 2008

Cassano, J.J. and M.W. Seefeldt, 2008: Antarctic Weather Forecasting: Evaluation of Antarctic Mesoscale Prediction System (AMPS) forecasts, Department of Geological and Atmospheric Sciences seminar, Iowa State University, September 2008, Ames, IA (invited presentation).

American Geophysical Union Fall Meeting, San Francisco, CA, Dec 2008

Uotila, P., A. Lynch, M. D?Amico, R. Abramson, A. Egan, A. Pezza, K. Keay, and J. Cassano, 2008: A high-resolution Southern Ocean cyclone climatology. American Geophysical Union Fall Meeting, December 2008, San Francisco, CA.

McMurdo Station, January 2009

Cassano, J.J. and M.W. Seefeldt, 2009: A weather pattern based approach to evaluate Antarctic Mesoscale Prediction System (AMPS) forecasts, Wednesday Science lecture, January 2009, McMurdo, Antarctica.

4th Malaysian International Seminar on Antarctica, Kuala Lumpur, Malaysia, April 2009

Cassano, J.J., P. Uotila, and A.H. Lynch, 2009: Predicted changes in Antarctic net precipitation over the 21st century. 4th Malaysian International Seminar on Antarctica, April 2009, Kuala Lumpur, Malaysia (invited presentation).

Cassano, J.J., M. Richards, and M.W. Seefeldt, 2009: Application of a synoptic pattern classification scheme to evaluate Antarctic Mesoscale Predcition System (AMPS) weather forecasts. 4th Malaysian International Seminar on Antarctica. April 2009, Kuala Lumpur, Malaysia (invited presentation).

10th Conference on Polar Meteorology and Oceanography, Madison, WI, May 2009

Richards, M., J. Cassano, and M. Seefeldt, 2009: A weather pattern based approach to evaluate Antarctic Mesoscale Prediction System (AMPS) forecasts: Part 2. Comparison to automatic weather station observations. 10th Conference on Polar Meteorology and Oceanography, May 18-21 2009, Madison, WI.

Other presentations given at conferences not attend by University of Colorado project participants:

Thom, J.E., G.A. Weidner, M.A. Lazzara, S.L. Knuth, and J.J. Cassano, 2009: The future of the United States Antarctic Program?s Automatic Weather Station program. EGU General Assembly, April 19-24, 2009, Vienna, Austria.

Weidner, G.A., J.E. Thom, M.A. Lazzara, S.L. Knuth, and J.J. Cassano, 2009: The challenges of changing technology for the USAP AWS program. 5th Annual Polar Technology Conference, April 16-17, 2009. Madison, WI.

Sept 2007 to June 2008

Purchase and setup of new Linux workstation to serve as University of Colorado node on Antarctic LDM network

Development of semi-automated automatic weather station quality control software

Contribute chapter on Antarctic climate and weather to 'Antarctica - Global Science from a Frozen Continent'

Analysis of low-level wind field over the Ross Ice Shelf based on Antarctic Mesoscale Prediction System and AWS data

Comparison of global reanalysis cyclone climatologies for the Southern Ocean with a cyclone climatology derived from a high-resolution regional atmospheric model (Antarctic Mesoscale Prediction System)

Conferences attended / presentations

Antarctic Meteorology, Observations, Modeling, and Forecasting Workshop, Madison, WI, June 2008 (Cassano, Richards, Seefeldt)

Cassano, J.J. and M.W. Seefeldt: Comparison of AMPS MM5 and AMPS WRF Forecasts Using Self-Organizing Maps (oral presentation)

Cassano, J.J. and M.W. Seefeldt: Development and Evaluation of Polar WRF (oral presentation)

Seefeldt, M.W. and J.J. Cassano: A Description of the Ross Ice Shelf Air Stream (RAS) Through the Use of Self-Organizing Maps (oral presentation)

Atmospheric Observation Panel for Climate (AOPC-XIV), Geneva, Switzerland, April 2008

Cassano, J.J.: Atmospheric Observations in Polar Regions (invited oral presentation)

Oden Southern Ocean Workshop, Lejondals Slott, Sweden, Feb 2008 (Cassano)

Findings:

July 2009 - August 2010

Two extreme high wind events were identified at Sabrina AWS during August and September 2009. The wind speed during these events exceeded 15 m/s for more than 48 h. The peak wind speed observed was 24 m/s.

June 2008 - June 2009

The location of the newly installed Sabrina AWS site was selected based on simulations from the Antarctic Mesoscale Prediction System (AMPS). This location has the strongest simulated winds over the Ross Ice Shelf in the Antarctic Mesoscale Prediction System (AMPS). Observations from Sabrina AWS from February through April indicate a mean wind speed of 5.4 m/s, which is substantially slower than that indicated by AMPS (12.5 m/s). Work is on-going to understand the source of this discrepancy between the observed and modeled winds at this location. The dynamics of the strong winds in AMPS is still in debate in the literature (Seefeldt et al. suggested this is a tip jet while Steinhoff et al. suggest that this feature is a knob jet), and we are hoping that the new observations from Sabrina AWS will help resolve this issue.

The AWS based evaluation of AMPS has indicated variable skill in the AMPS forecasts, dependent on the variable and location considered. Further, some simulated variables show variable skill as a function of varying synoptic weather patterns, while other variables show little change in skill as synoptic weather patterns vary.

Sept 2007 - June 2008

The analysis of the low-level wind field over the Ross Ice Shelf identified three low level jets in this area. Two of these jets are located in well known katabatic prone regions (near Byrd Glacier and at Terra Nova Bay) while the third low-level jet is located over the southern portion of the Ross Ice shelf adjacent to the Transantarctic Mountains. These low-level jets were identified based on Antarctic Mesoscale Prediction System output and the details of these jets still require observational validation.

Training and Development:

Melissa Nigro (maiden name Richards) is a fourth year graduate student in the Department of Atmospheric and Oceanic Sciences at the University of Colorado, and has been supported as a graduate research assistant on this project since fall 2009. Ms. Nigro's research will focus on the dynamics of high wind events over the Ross Ice Shelf. A secondary research focus has been on evaluating Antarctic Mesoscale Prediction System (AMPS) forecasts. Ms. Nigro gained Antarctic field experience from her participation in the 2008/09 AWS field season and will participate in the 2010/11 AWS field season.

Outreach Activities:

The University of Colorado PI (John Cassano) has contributed a chapter on Antarctic weather and climate to the book 'Antarctica - Science From a Frozen Continent' (in preparation). This book is aimed at a general audience, with the goal of bringing Antarctic science to the public. This book is being prepared as part of the International Polar Year.

Grad student Richards gave a presentation at a Saratoga, NY K12 school prior to her Antarctic deployment (Dec 2008) to discuss Antarctic science and field work.

o-PI Cassano gave three invited talks during the period June 2008 - June 2009 which were based, in part, on Antarctic research funded by this ward. One of the invited talks was given as part of an undergraduate seminar series in the Department of Geologic and Atmospheric Sciences at Iowa State University. The other two invited talks were given at the 4th Malaysian International Seminar on Antarctica.

Journal Publications

Seefeldt, M.W. and J.J. Cassano, "An analysis of low-level jets in the greater Ross Ice Shelf region based on numerical simulations", Monthly Weather Review, p. 4188, vol. 136, (2008). Published, 10.1175/2008MWR2455.1

Seefeldt, M.W. and J.J. Cassano, "An examination of the Antarctic low-level wind field using self-organizing maps", Monthly Weather Review, p. , vol. , (2009). in preparation,

Uotila, P., A.B. Pezza, J.J. Cassano, K. Keay, and, A.H. Lynch,, "A comparison of low pressure system statistics derived from high resolution NWP output and three re-analysis products over the Southern Ocean", Journal of Geophysical Research, p. D17105, vol. 114, (2009). Published, 10.1029/2008JD011583

Nigro, M.A., Cassano, J.J., and M.W. Seefeldt, "A weather pattern based approach to evaluate the Antarctic Mesoscale Prediction System (AMPS) forecasts: Comparison to automatic weather station observations", Weather and Forecasting, p. , vol. , (2010). Submitted,

Books or Other One-time Publications

John J. Cassano, "Climate of Extremes", (2010). Book, in preparation
Editor(s): David W. H. Walton
Collection: Antarctica - Global Science From a Frozen Continent
Bibliography: Cambridge University Press

Web/Internet Site

Other Specific Products

Product Type:

Software (or netware)

Product Description:

Semi-automated AWS data quality control program

Sharing Information:

This software has been provided to our collaborators at the University of Wisconsin and has been implemented as part of their AWS quality control procedure.

Contributions

Contributions within Discipline:

The research activities of this project have contributed to an improved understanding of synoptic and mesoscale atmospheric processes in the Antarctic. Specifically we have several papers in press and in preparation that describe the details of the low level wind field over the Ross Ice Shelf and describe the synoptic climatology of cyclones over the Southern Ocean.

Contributions to Other Disciplines:

Our analysis of Antarctic cyclones and high wind events and evaluation of Antarctic numerical weather prediction models will allow for improved operational weather forecasting in the Antarctic, which benefits all Antarctic field related activities.

Contributions to Human Resource Development:

Funds from this project are being used to support a PhD student (Melissa Nigro, maiden name Richards) in the Department of Atmospheric and Oceanic Sciences at the University of Colorado. Ms. Nigro will gain experience in analyzing observational and model based data, performing Antarctic field work, presenting results of her research at national and international conferences, and publishing her research results in the peer reviewed literature.

Contributions to Resources for Research and Education:

A new Linux workstation was purchased using funds from this project. This workstation serves as the University of Colorado node on the Antarctic LDM network and also provides computational resources for project participants at the University of Colorado.

Contributions Beyond Science and Engineering:

Conference Proceedings

Special Requirements

Special reporting requirements: None

Change in Objectives or Scope: None

Animal, Human Subjects, Biohazards: None

Categories for which nothing is reported:

Any Web/Internet Site

Contributions: To Any Beyond Science and Engineering

Any Conference