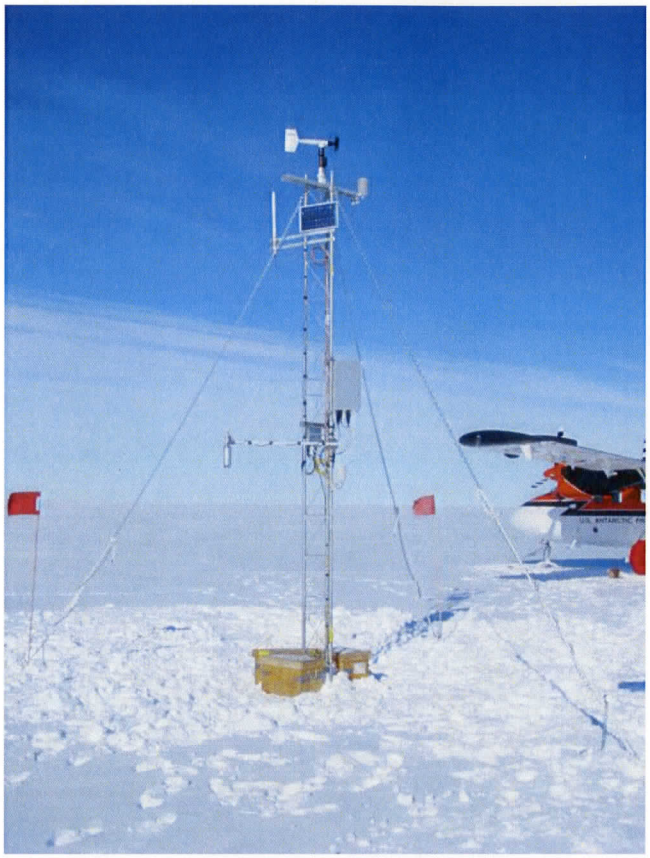
AWS 2nd Annual Project Report: NSF-OPP Grant #0, June 1, 2008 to July 31, 2009

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 July 24, 2009

Annual Report for Period: 09/2008 - 08/2009
Principal Investigator: Lazzara, Matthew A.
Organization: U of Wisconsin Madison
Submitted By:
Lazzara, Matthew - Principal Investigator
Title:
Collaborative Research: Antarctic Automatic Weather Station Program: 2007-2010

Submitted on: 07/24/2009
Award ID: 0636873

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: No
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: No

Contribution to Project:

Nicole has worked on AWS data distribution and preparations for assisting the AWS project for the 2009-2010 field season.

Technician, Programmer

Name: Batzli, Samuel

Worked for more than 160 Hours: No

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.

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.

Other 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.

Research Experience for Undergraduates

Organizational Partners

University of Colorado-Boulder

he University of Colorado-Boulder/John Cassano's polar meteorology group collaborate irectly 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 ctivity(s) together.

Other Collaborators or Contacts

US Collaborators:

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ohn 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)

rogramma 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)

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 attached field season activity presentation in findings 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)

esearch Activities (September 2008 to July 2009):
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ield 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 attached 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 olorado on AWS quality control efforts and other possible collaborators.

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

Previous analysis of the ENSO interactions in the Antarctic used seasonal changes, and ends, in temperature and pressure fields to establish a correlation between SOI and these elds. 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 ell as analyze characteristics of the wind flow to determine how far inland these orrelations extend. Our anaylsis 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 ıe flow pattern changes into the Ross Ice Shelf embayment as well as flow pattern hanges 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 o modulate the effects of ENSO at higher latitudes.

Conferences for 2008-2009:
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oster at the Argos Users Conference, Sept/Oct, 2008 (by George Weidner/Jonathan Thom):

Veidner, 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

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

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

resentation 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 AMOMFW meeting Charleston, SC.

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

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

Snow accumulation studies:

Efforts have studied the snow accumulation at seven AWS sites on the Ross Ice Shelf, Ross Island 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. Blowing 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.

Training and Development:

2007-2008:

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* 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.

Outreach Activities:

2007-2008:

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

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

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 2008)

2008-2009:

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

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

General Public:

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

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

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

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

Preschool:
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* UW Preschool Lab

McMurdo Station:

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

Journal Publications

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. , vol. , (2009). Submitted,

Books or Other One-time Publications

Web/Internet Site

URL(s):
http://amrc.ssec.wisc.edu ftp://amrc.ssec.wisc.edu
Description:
These web and FTP sites host real-time and archived AWS observations, related metadata, maps 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:
Data or databases
Product Description:
Meteorological observations from the Automatic Weather Stations (AWS) include measurements of temperature, wind speed, wind direction, atmospheric pressure, relative humidity and, in some cases, snow temperature profiles, water temperature, relative snow

ccumulation, 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 3 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
IcIDAS 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:

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

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

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

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

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

rdan 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.

aniel 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.

Contributions to Other Disciplines:

AWS observations are utilized by other disciplines glaciology (especially efforts by WAIS community), and oceanography.

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, performing Antarctic field work, as well as presenting and publishing the results in peer reviewed literature.

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

Contributions 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 assembly and fabrication of AWS equipment are a part of this effort. Additionally, computational resources are available from this project to support the activities of project members.

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 Book

Contributions: To Any Beyond Science and Engineering

Any Conference

nnual Report for Period: 09/2008 - 08/2009
Submitted on: 06/22/2009
Principal Investigator: Cassano, John J.
Award ID: 0636811
rganization: U of Colorado Boulder
ubmitted By:
Cassano, John - Principal Investigator
itle:
ollaborative Research: Antarctic Automatic Weather Station Program: 2007-2010

Project Participants

enior Personnel

Name: Cassano, John
Worked for more than 160 Hours: Yes
Contribution to Project:

ost-doc

Name: Seefeldt, Mark
Worked for more than 160 Hours: No
Contribution to Project:

Graduate Student

Name: Richards, Melissa
Worked for more than 160 Hours: Yes
Contribution to Project:

Undergraduate Student

echnician, Programmer

ther Participant

Research Experience for Undergraduates

Organizational Partners

University of Wisconsin-Madison

Other Collaborators or Contacts

latthew Lazarra - lead PI of project at University of Wisconsin

Activities and Findings

esearch and Education Activities:
esearch activities

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

3-21 2009, Madison, WI.

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

hom, 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.

/eidner, 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 rogram. 5th Annual Polar Technology Conference, April 16-17, 2009. Madison, WI.

ept 2007 to June 2008

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

evelopment of semi-automated automatic weather station quality control software

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

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

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

Conferences attended / presentations

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

assano, 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)

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

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

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

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

indings:

June 2008 - June 2009

he 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 dicated 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 cation. 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.

he AWS based evaluation of AMPS has indicated variable skill in the AMPS forecasts, dependent on the variable and location considered. urther, 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.

ept 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 Richards is a second 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. Richards' research will focus on an analysis of the mesoscale atmospheric features in the vicinity of Terra Nova Bay. A secondary research focus will be on evaluating Antarctic Mesoscale Prediction System (AMPS) forecasts. Ms. Richards gained Antarctic field experience from her participation in the 2008/09 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.

co-PI Cassano gave three invited talks during the period June 2008 - June 2009 which were based, in part, on Antarctic research funded by this award. 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, A.H. Lynch, K. Keay, and J.J. Cassano, "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. , vol. , (2009). Accepted,

Richards, M., Cassano, J.J., and M.W. Seefeldt, "Evaluation of Antarctic Mesoscale Prediction System (AMPS) forecasts using self-organizing maps: Part 2. Comparison to Automatic Weather Station", Weather and Forecasting, p. , vol. , (2009). in preparation,

Books or Other One-time Publications

John J. Cassano, "Climate of Extremes", (2009). Book, in preparation
Editor(s): David W. H. Walton
Collection: Antarctica - Global Science From a Frozen Continent
Bibliography: TBD

Web/Internet Site

Other Specific Products

Product Type:

oftware (or netware)

roduct Description:

Semi-automated AWS data quality control program

haring Information:

his 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:

he research activities of this project have contributed to an improved understanding of synoptic and mesoscale atmospheric processes in the ntarctic. 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.

ontributions to Other Disciplines:

ontributions to Human Resource Development:

unds from this project are being used to support a PhD student (Melissa Richards) in the Department of Atmospheric and Oceanic Sciences at the University of Colorado. Ms. Richards 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 terature.

Contributions to Resources for Research and Education:

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

Contributions Beyond Science and Engineering:

Conference Proceedings

Special Requirements

pecial reporting requirements: None

Change in Objectives or Scope: None

nimal, Human Subjects, Biohazards: None

Categories for which nothing is reported:

ny Web/Internet Site

ontributions: To Any Other Disciplines

Contributions: To Any Beyond Science and Engineering

ny Conference

Overview of the Antarctic Automatic Weather Station Project

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

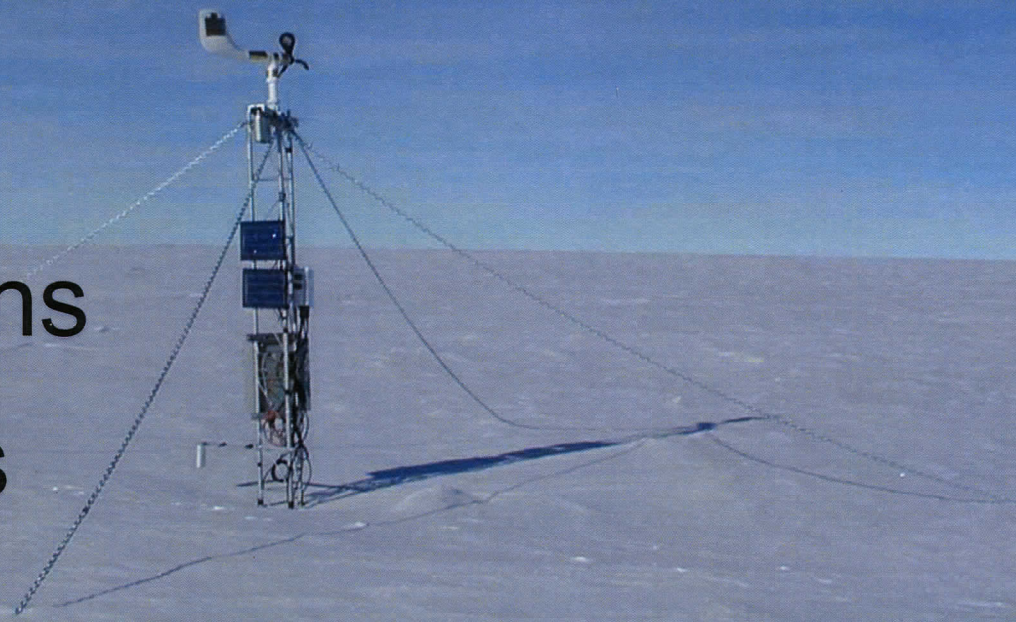
University of Wisconsin-Madison

J.J. Cassano

University of Colorado-Boulder

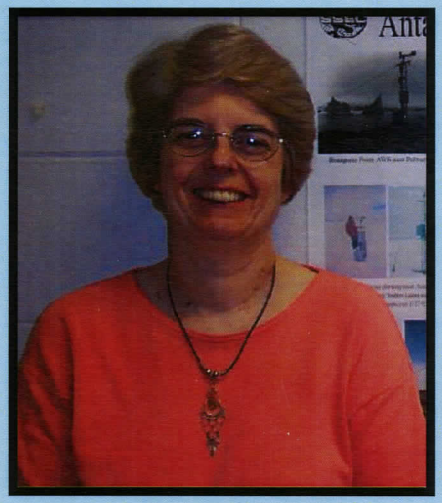
Outline

- The Team
- History
- Specifications
- Applications
- Data
- International Collaborations



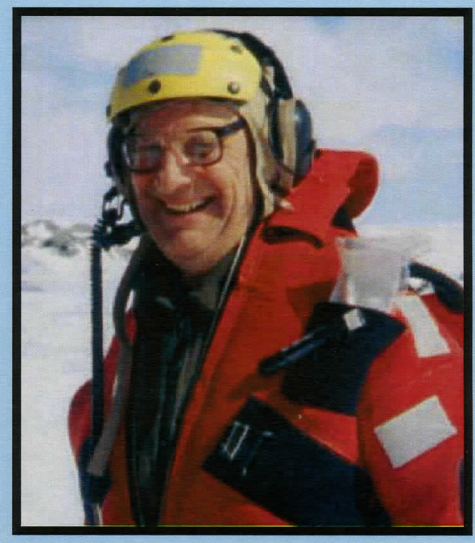
South Pole - Clean Air AWS

The Team



Linda Keller

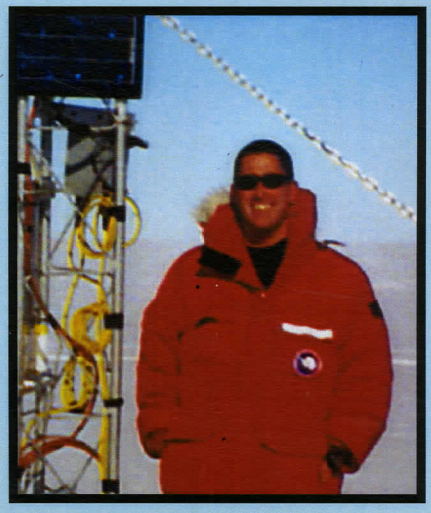
Matthew Lazzara



Charles Stearns

George Weidner

Jonas Asuma



John Cassano

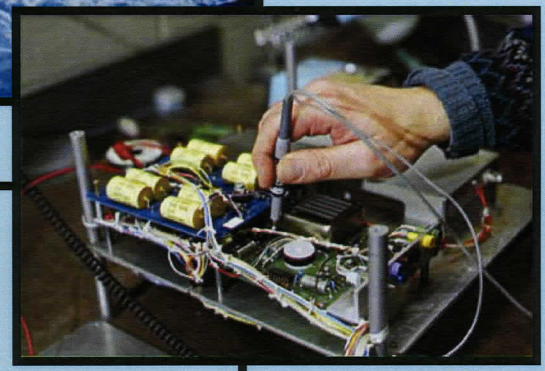
Jonathan Thom

Shelley Knuth

Greg Tripoli

AWS History


Laurie AWS 1981-1986



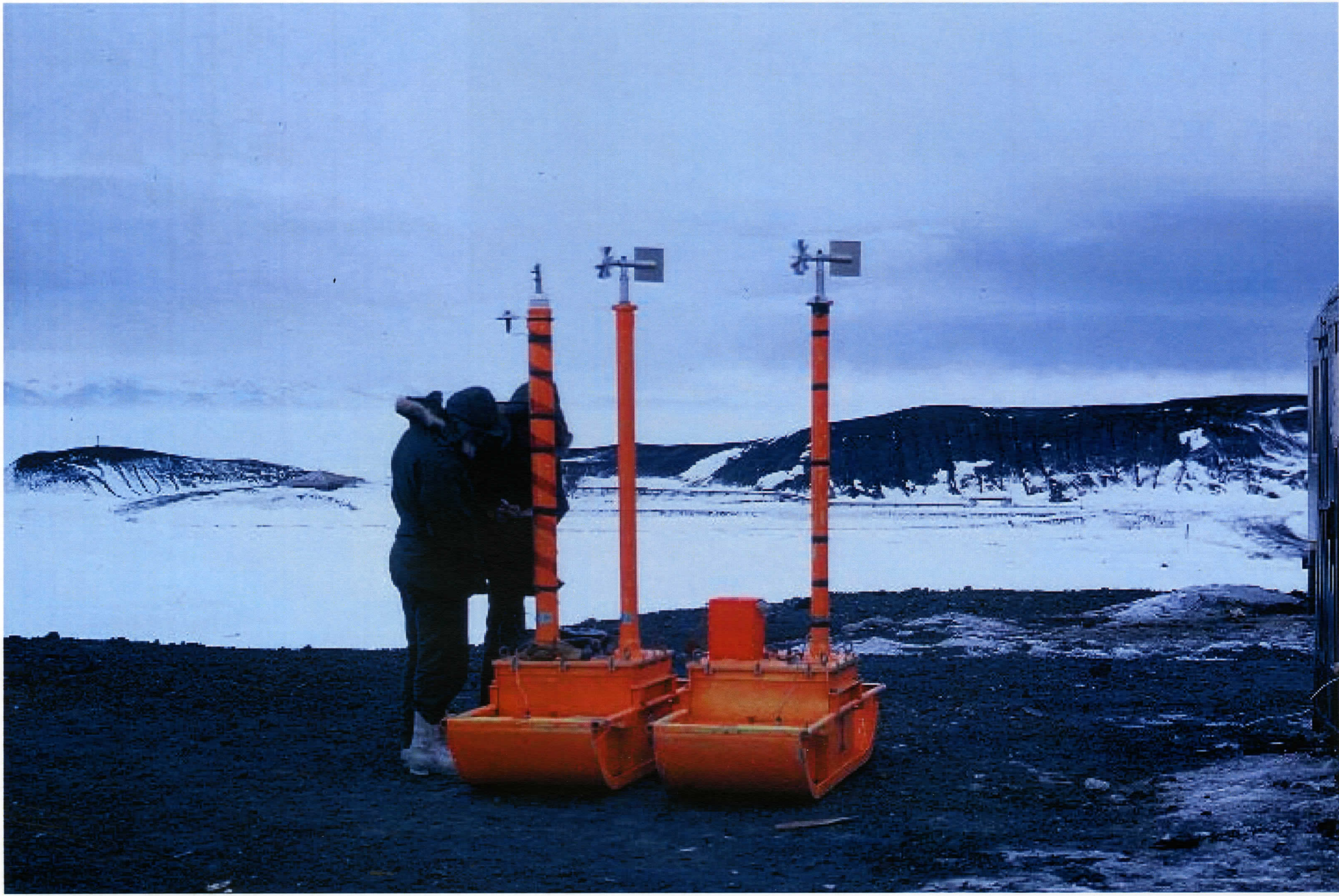
- Stanford University Radio Science Lab
  - Late 1970s
  - Key developments:
    - Low power electronics (Pioneer Spacecraft)
    - Satellite communications (Nimbus-7)

AWS Versions

- ❖AWS I (nimbus)
- ❖AWS II (RTG), IIB, IIC,etc.
- ❖AWS COTS:
  - –AWS-10x
  - –AWS-1000

- University of Wisconsin-Madison
  - Assumed stewardship
  - Meteorological focus

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



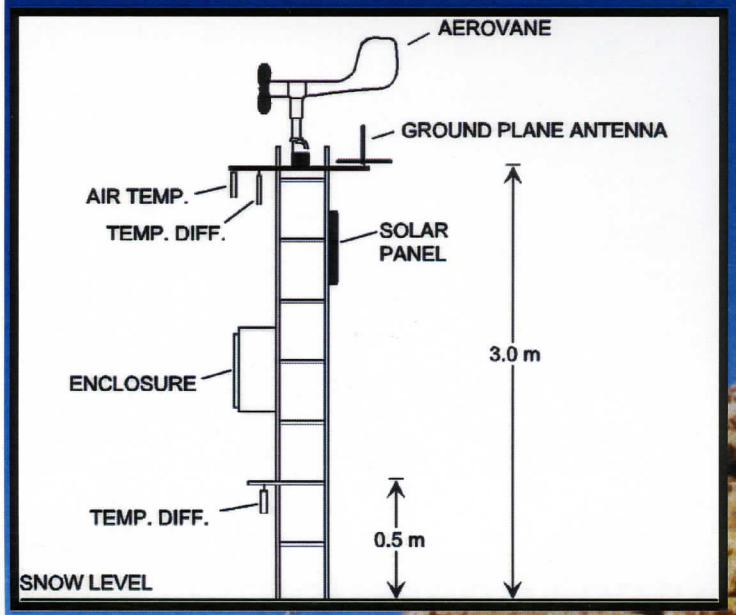
AWS Specifications

*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



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 =
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333 23030
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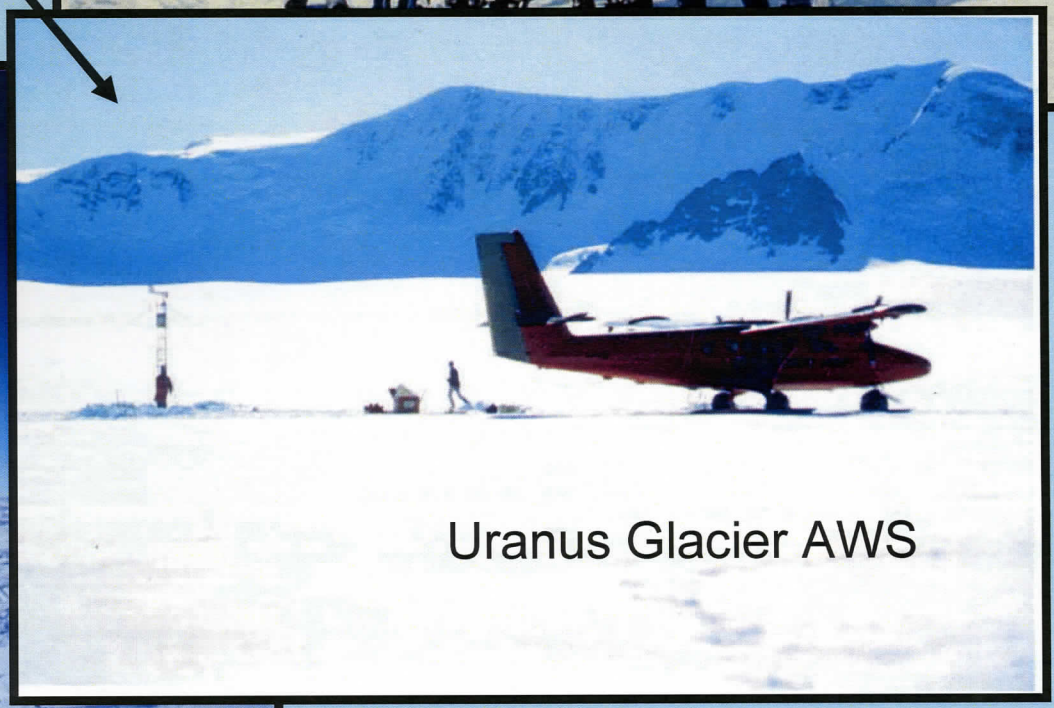
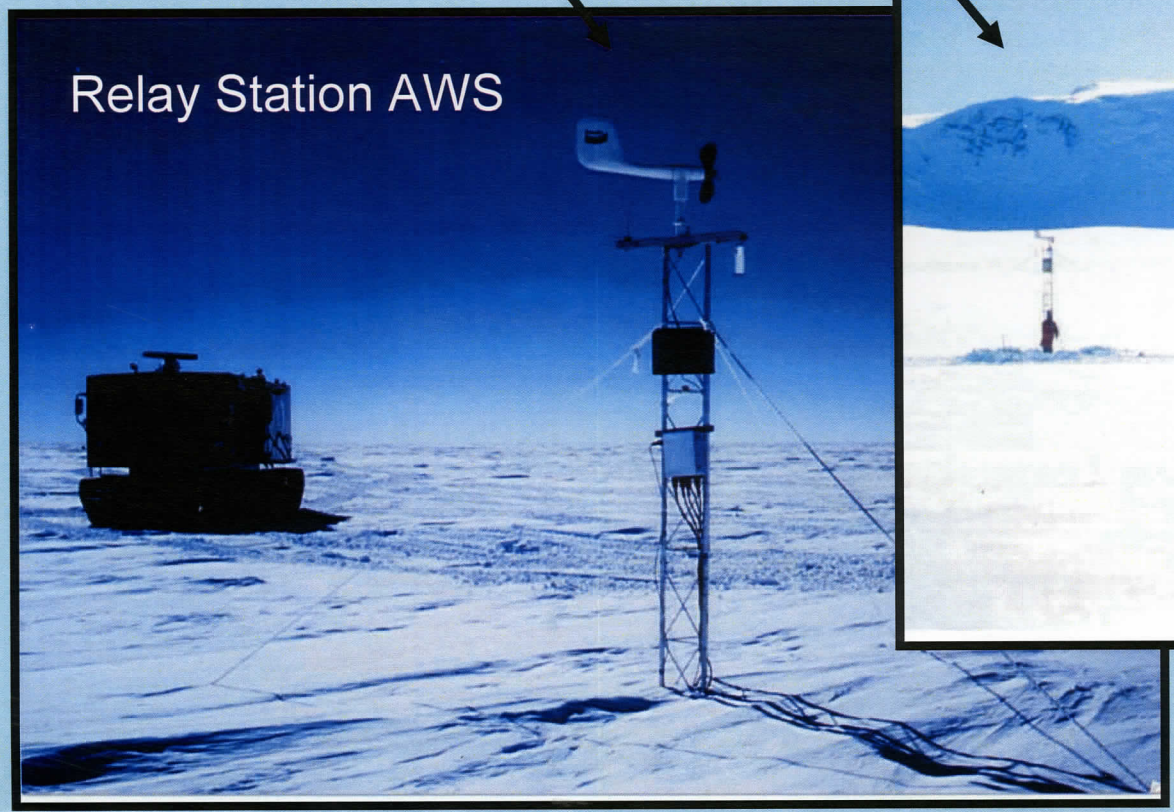
International Collaborations

- 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!

Laurie II AWS

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.

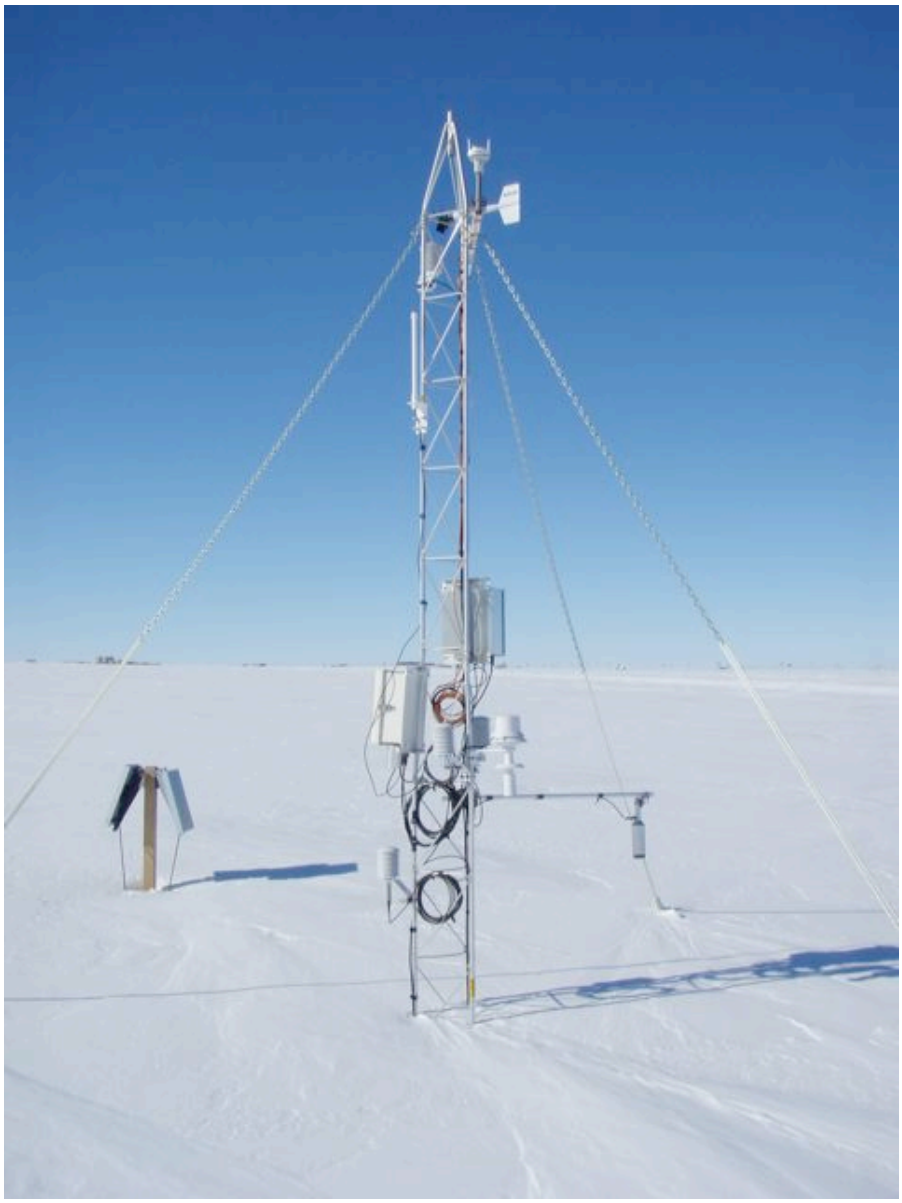


Figure 1. AWS test tower at Williams Field AWS site for 2008/2009.

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 / AWS _ type	Action 08/09	Lat.	Long.	Alt.(m)	Date STARTED	WMO#
	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.

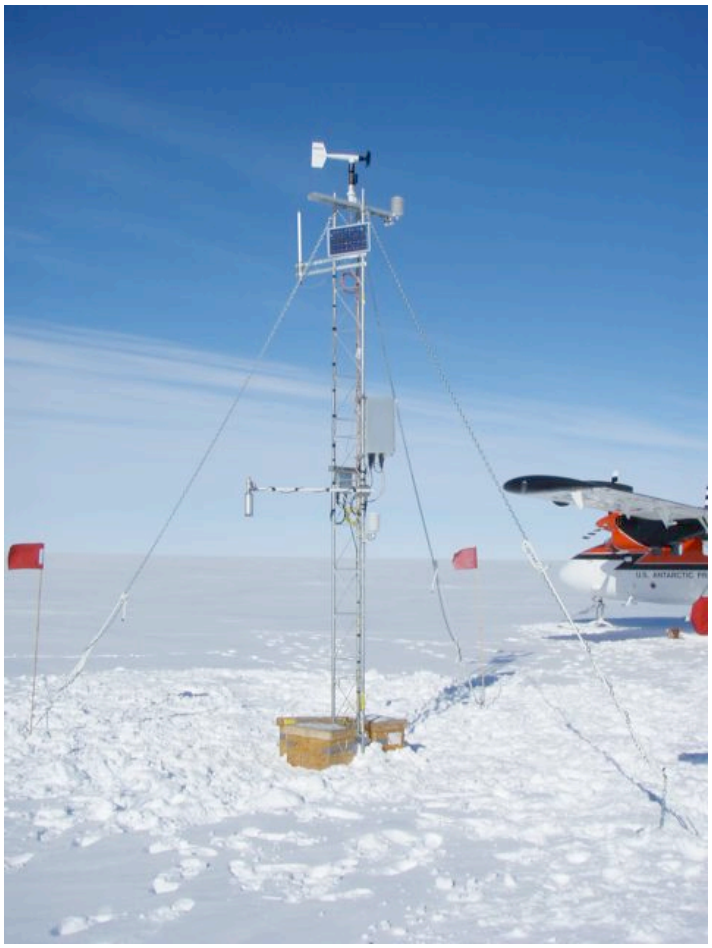


Figure 3. Margaret AWS - installed near Roosevelt Island on the eastern Ross Ice Shelf

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.

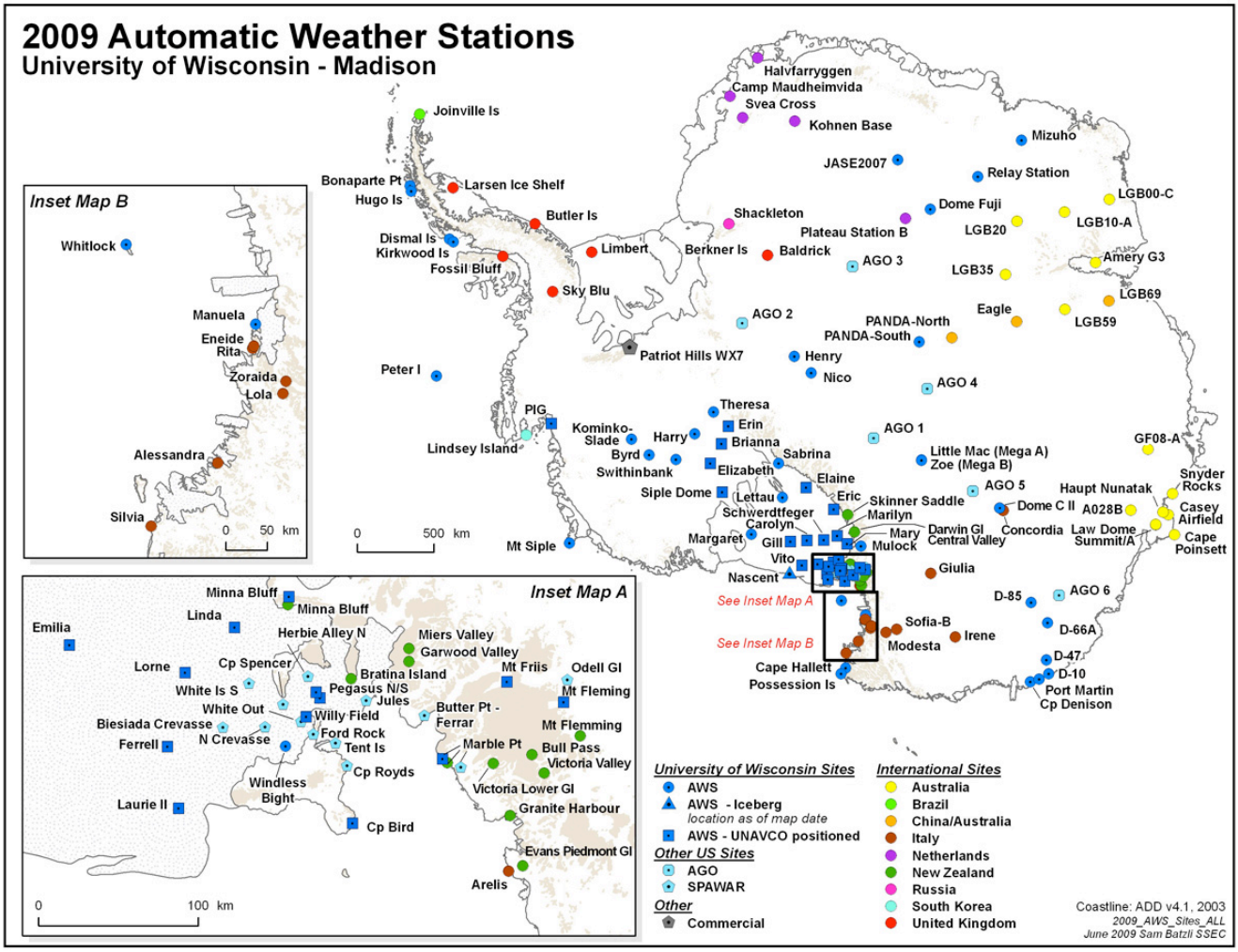


Figure 5. Map of Antarctic automatic weather stations (AWS) for 2009.

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

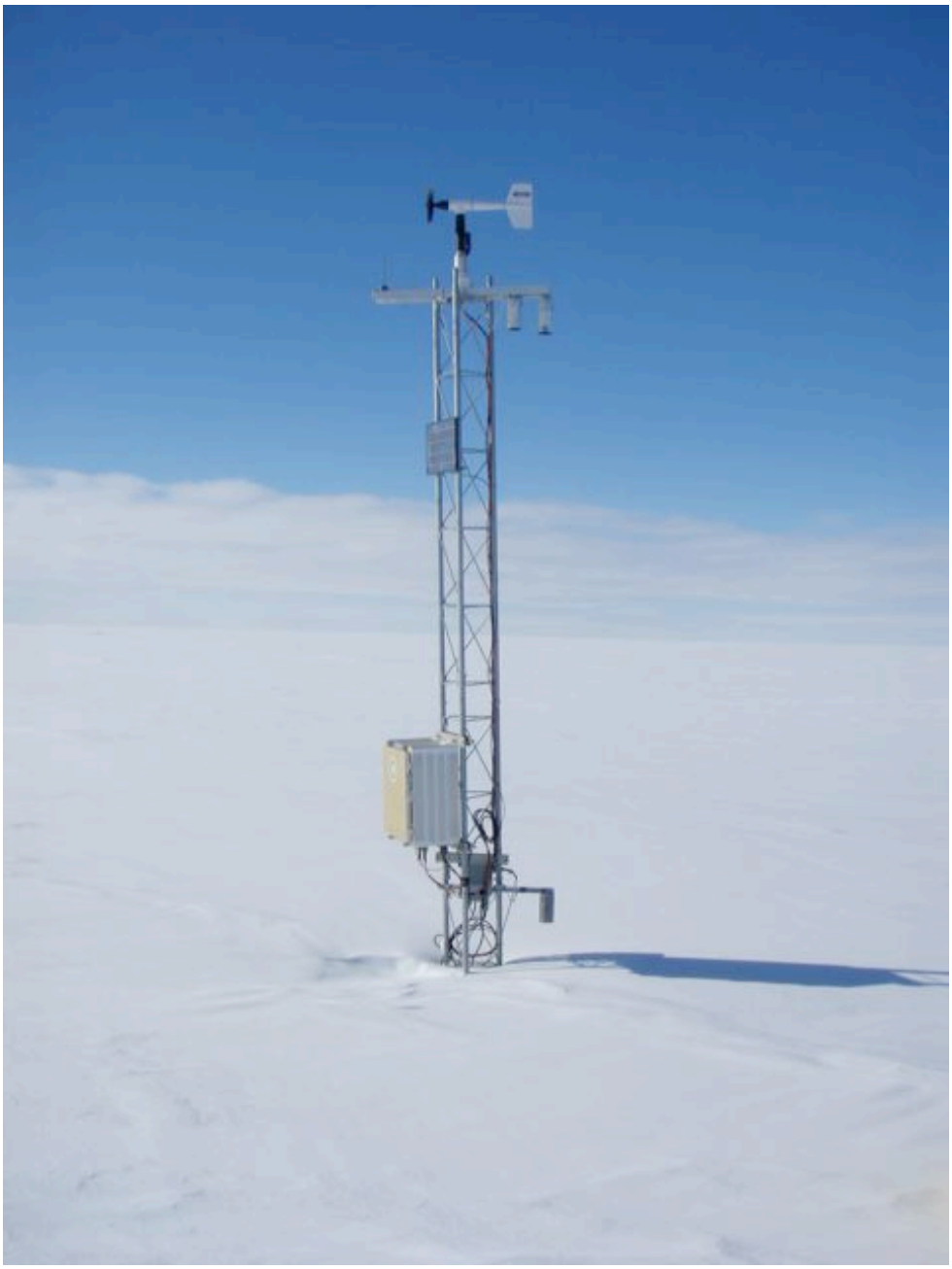


Image A3: Linda AWS before image

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

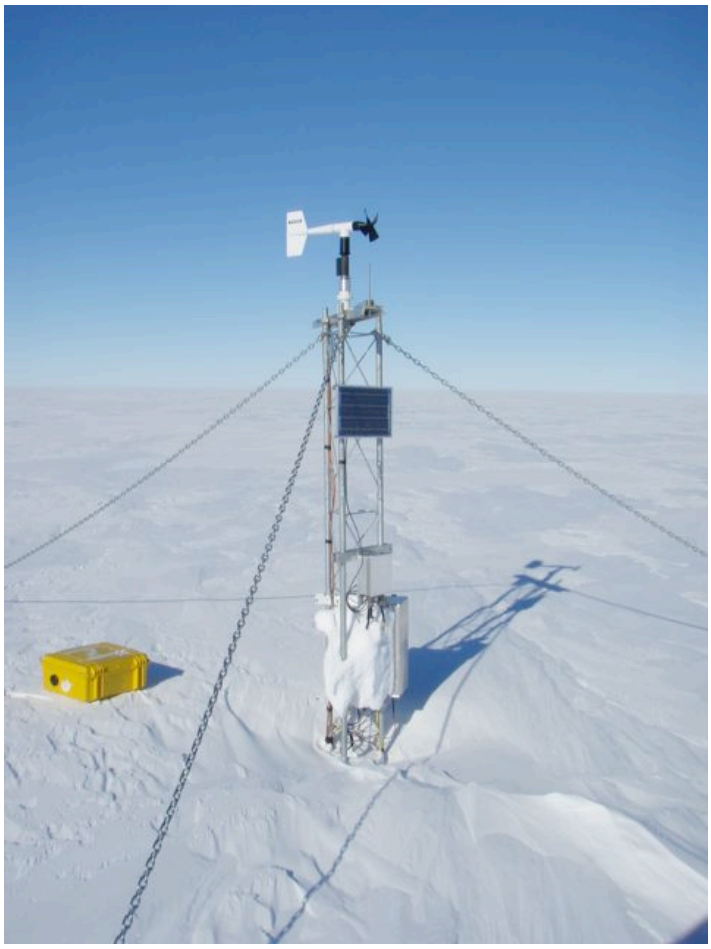


Image A7: Lorne AWS before servicing on November 4, 2008

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.

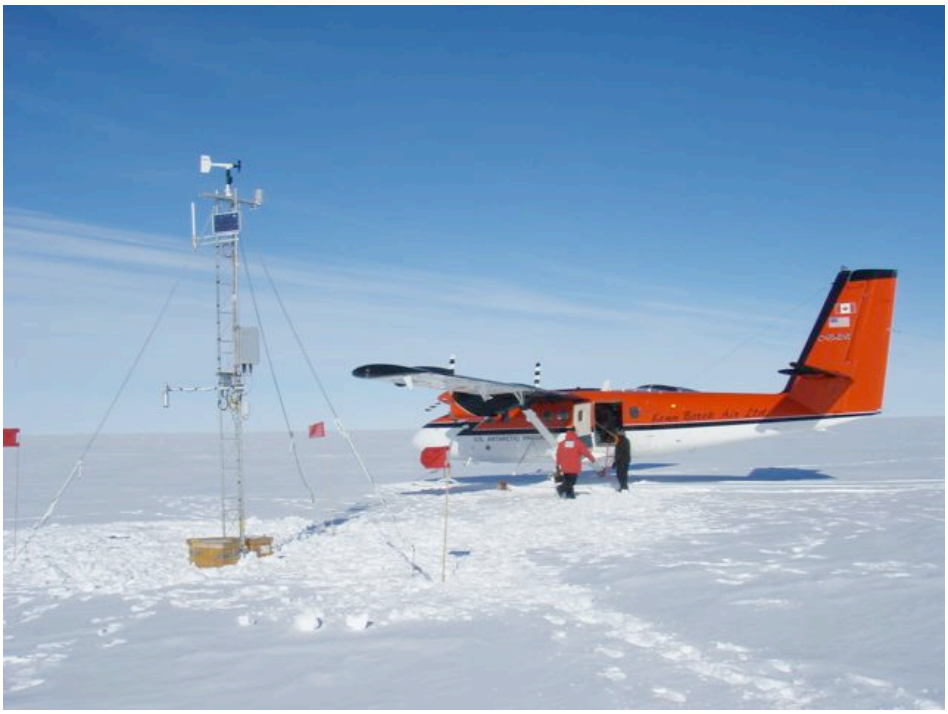


Image A9: Margaret AWS near Roosevelt Island after installation.

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

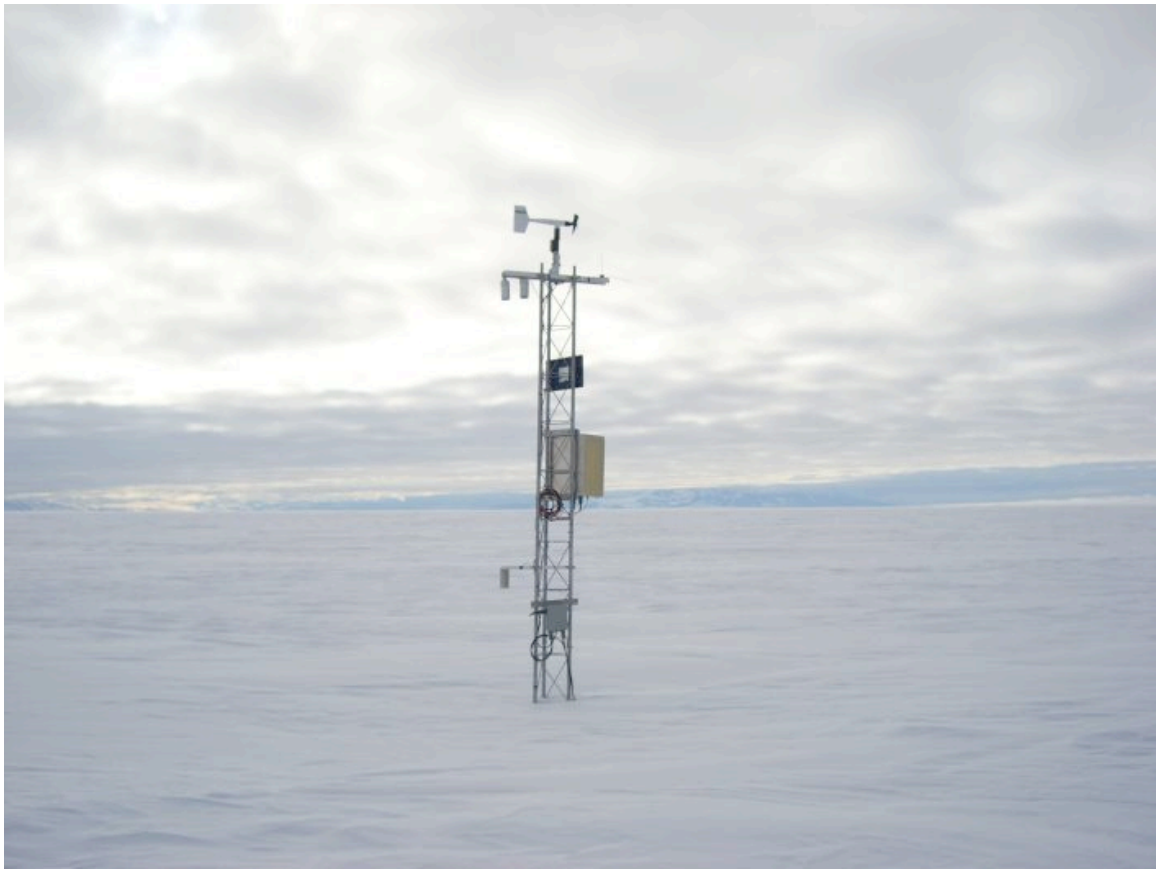


Image A12: Linda AWS after servicing on January 16, 2009

Image A13: Image of damaged antenna at Linda AWS

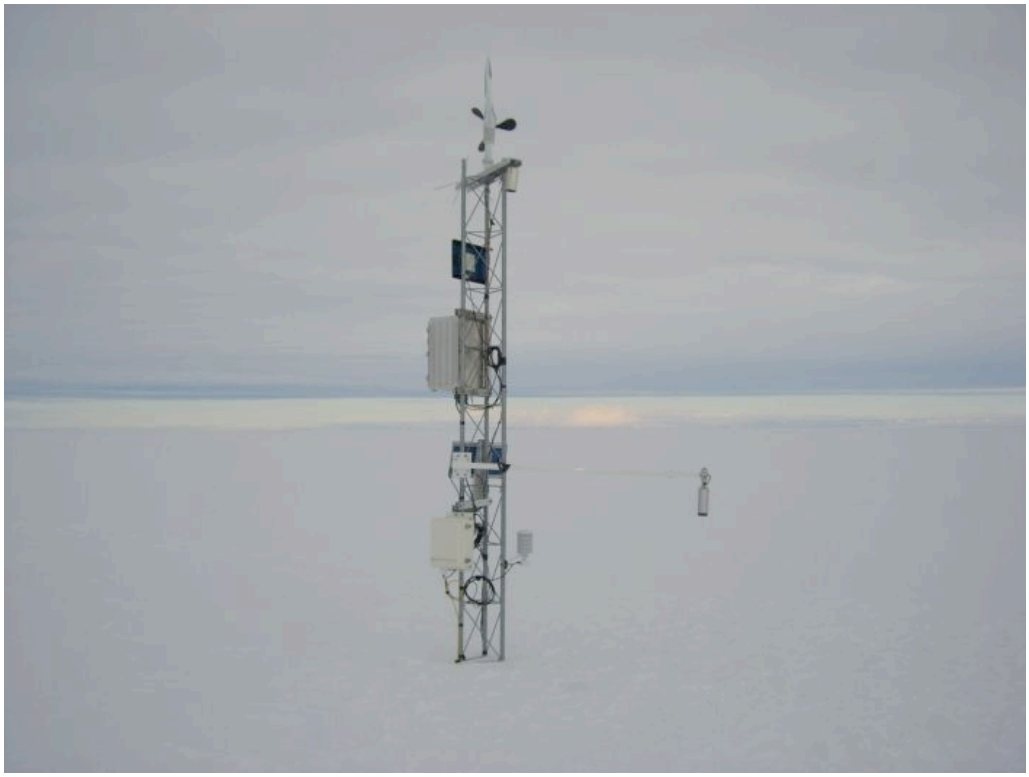


Image A14: Ferrell AWS on January 16, 2009 after servicing ADG

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.

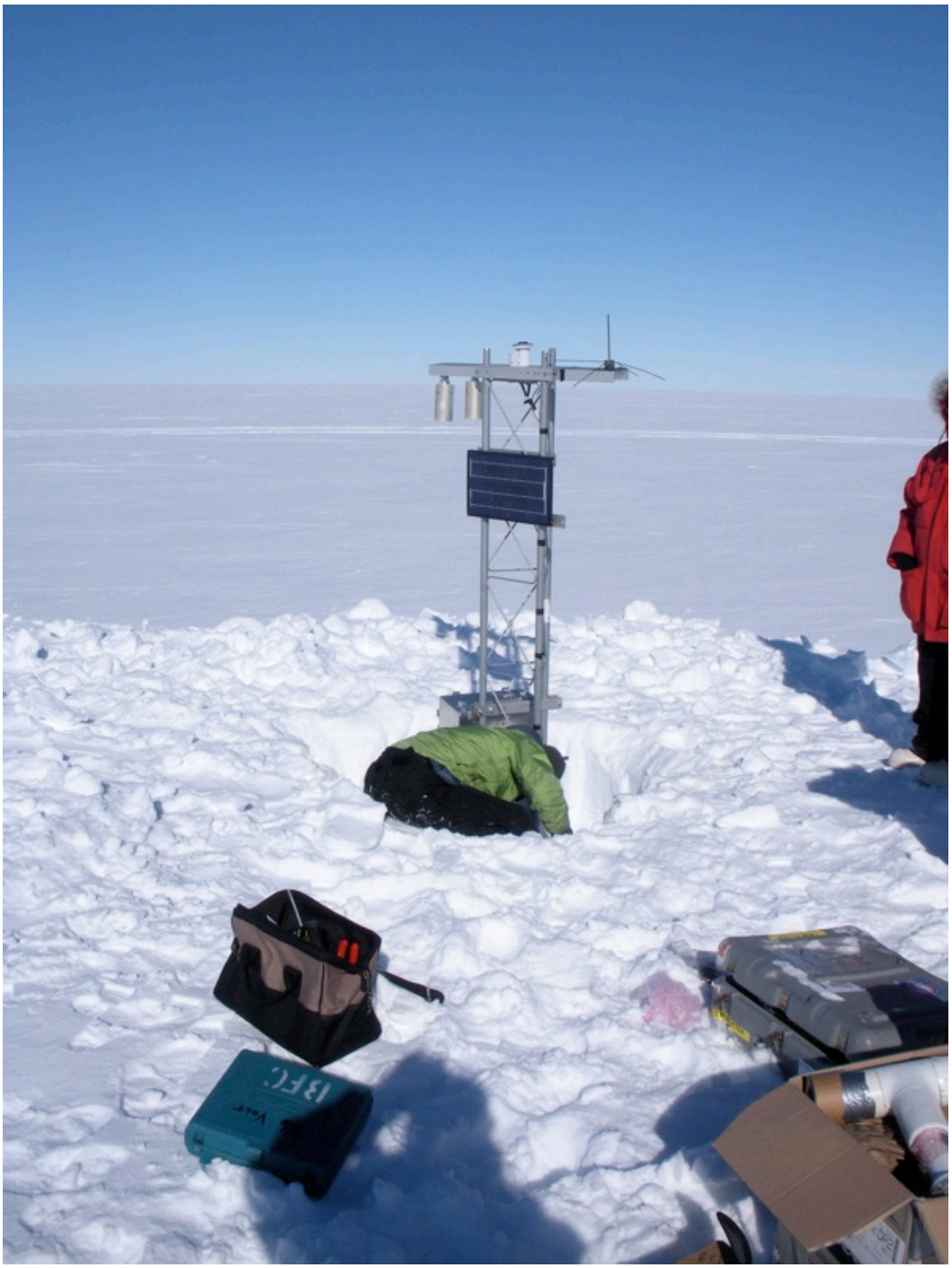


Image A18: Marilyn AWS January 2009 (before raising the tower)

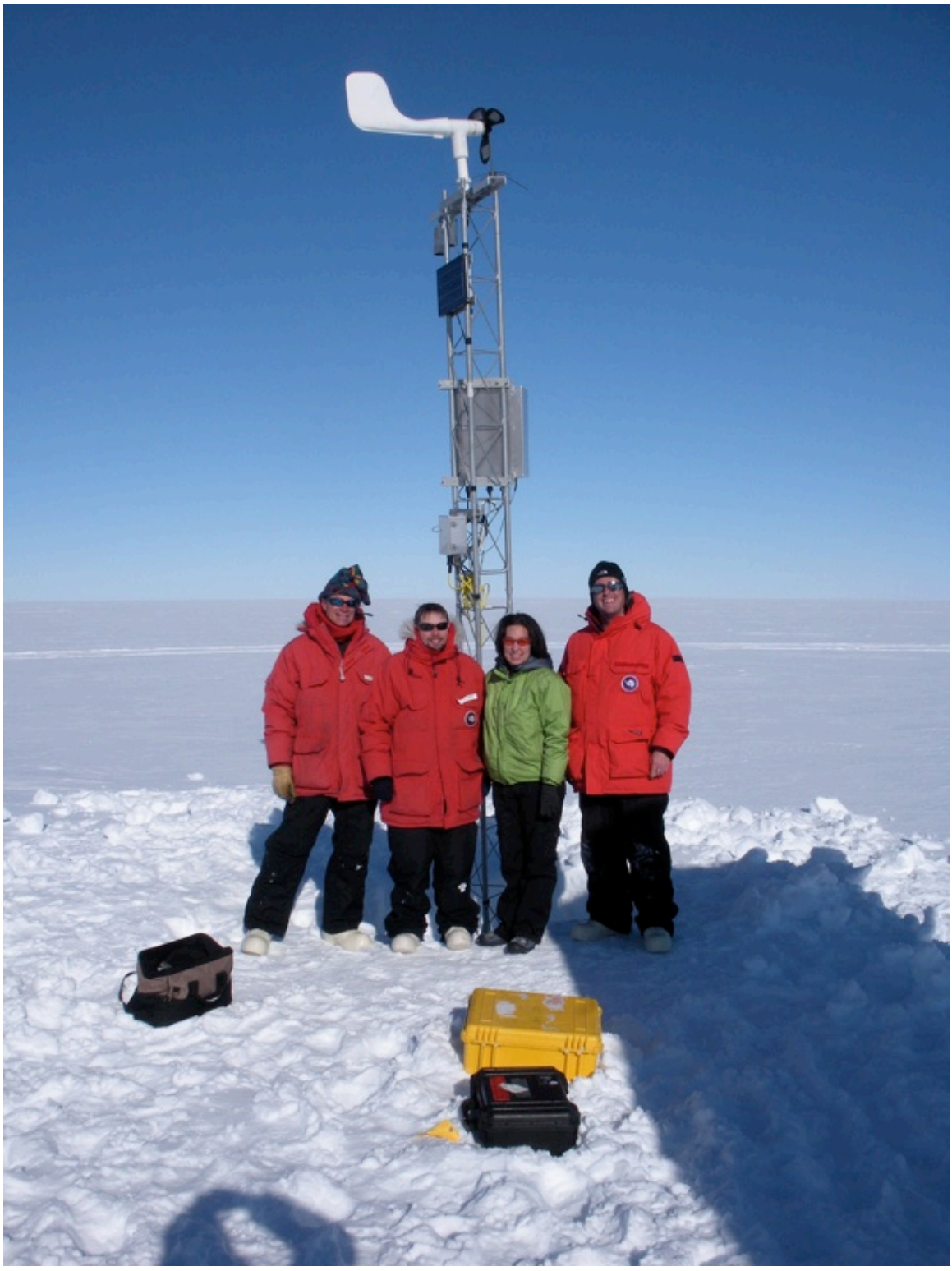


Image A19: Marilyn AWS January 2009 after raising the tower

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.

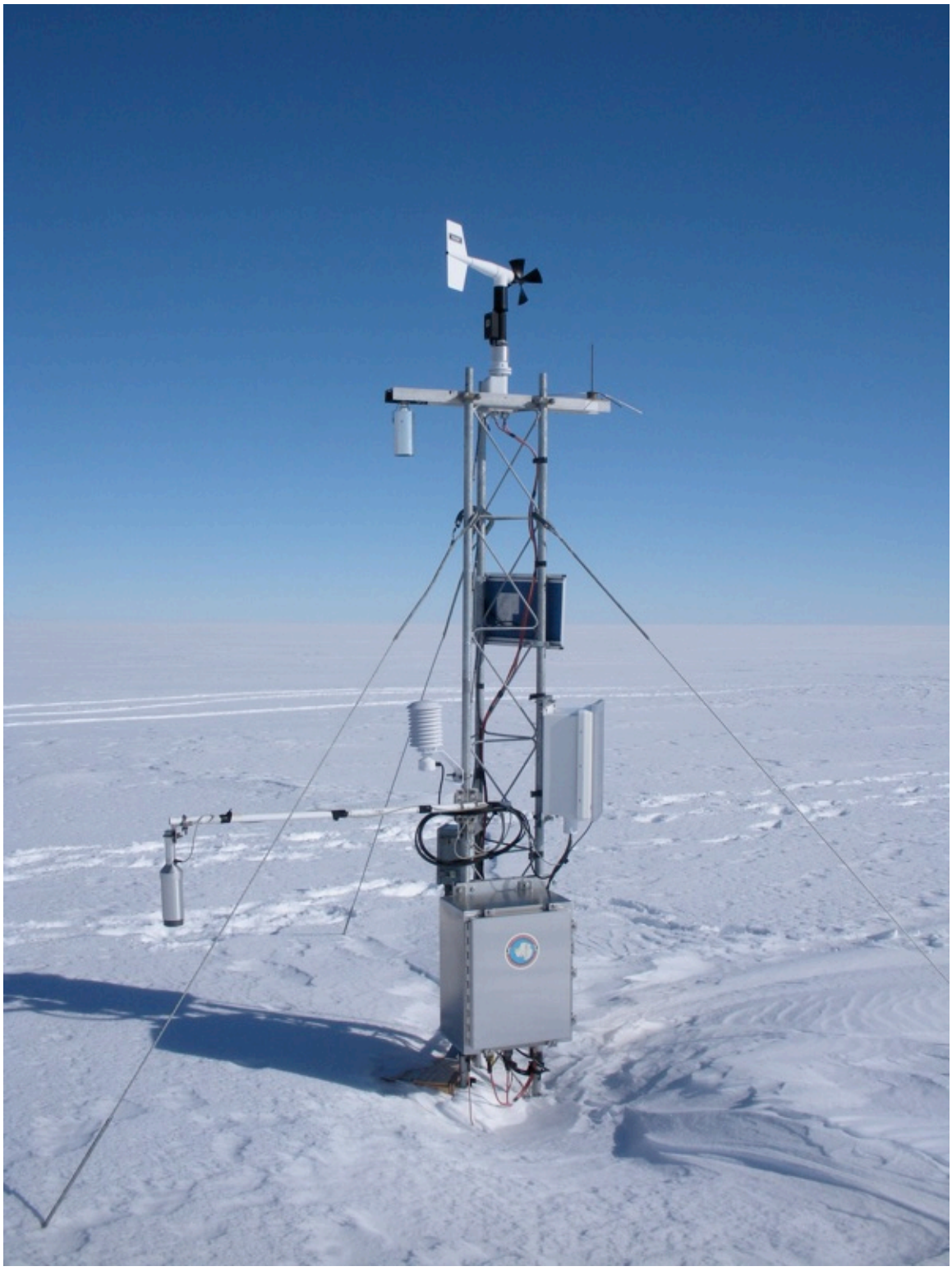


Image A20: Carolyn AWS site before servicing in January 2009

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

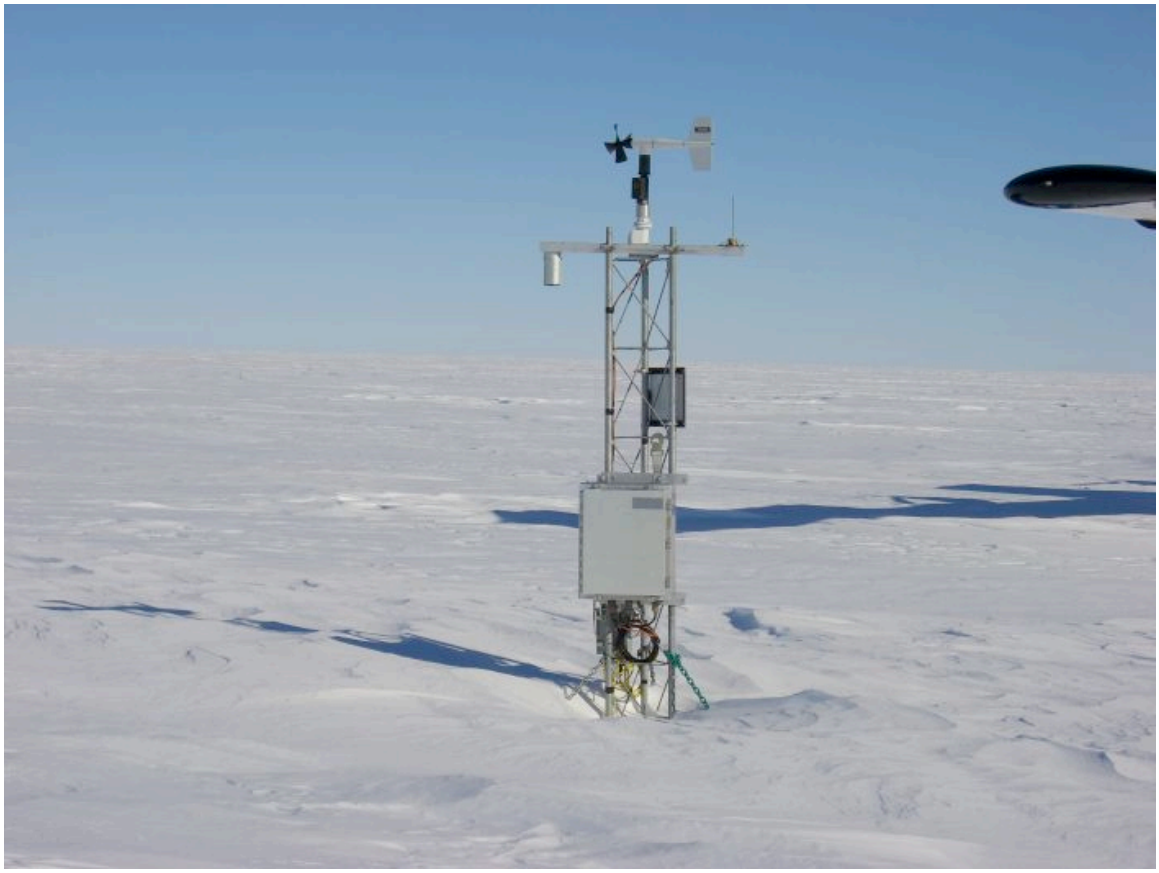


Image A22: Vito AWs before raising the tower in January 2009

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

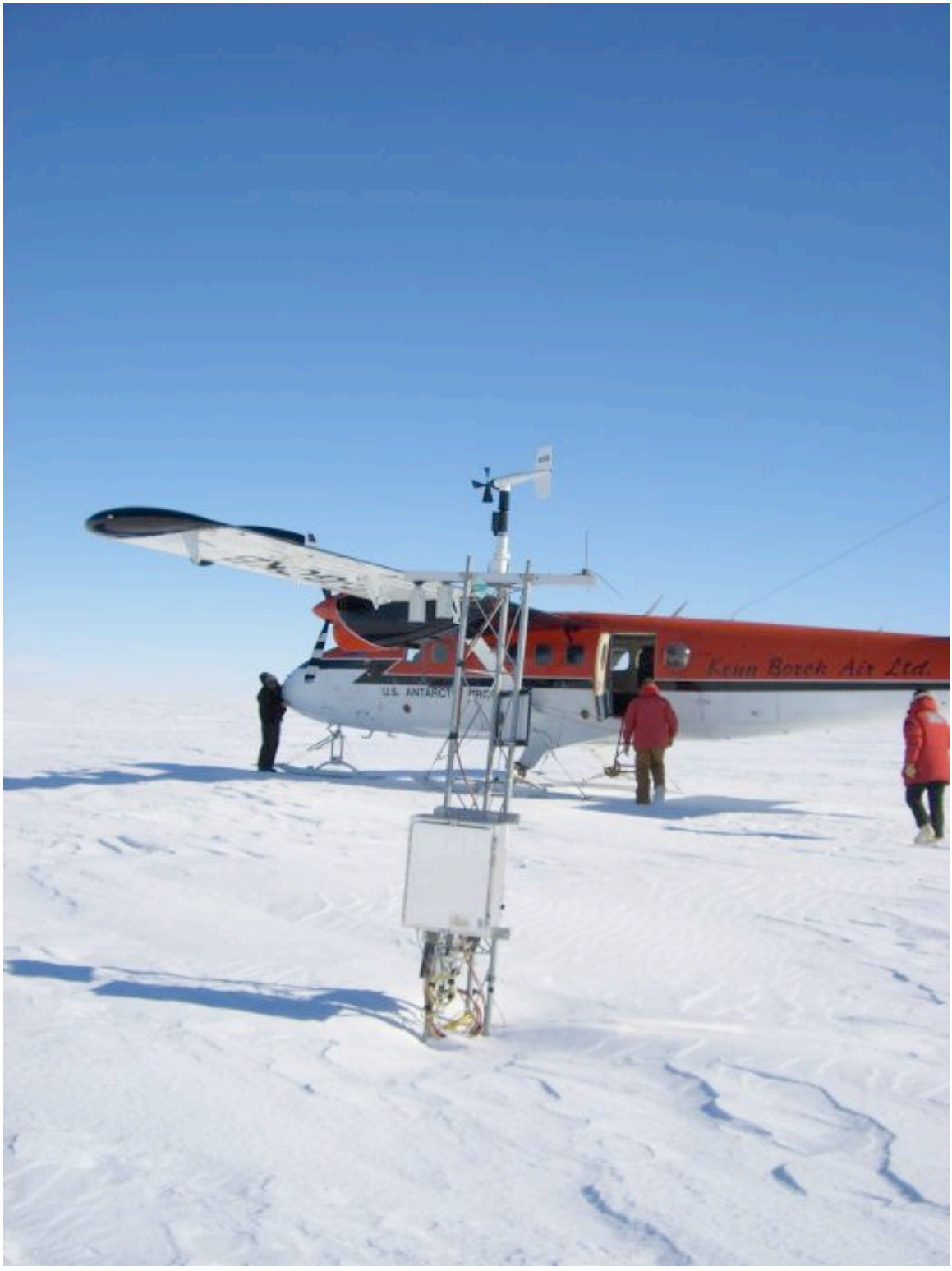


Image A24: Emilia AWs before raising the tower in January 2009

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

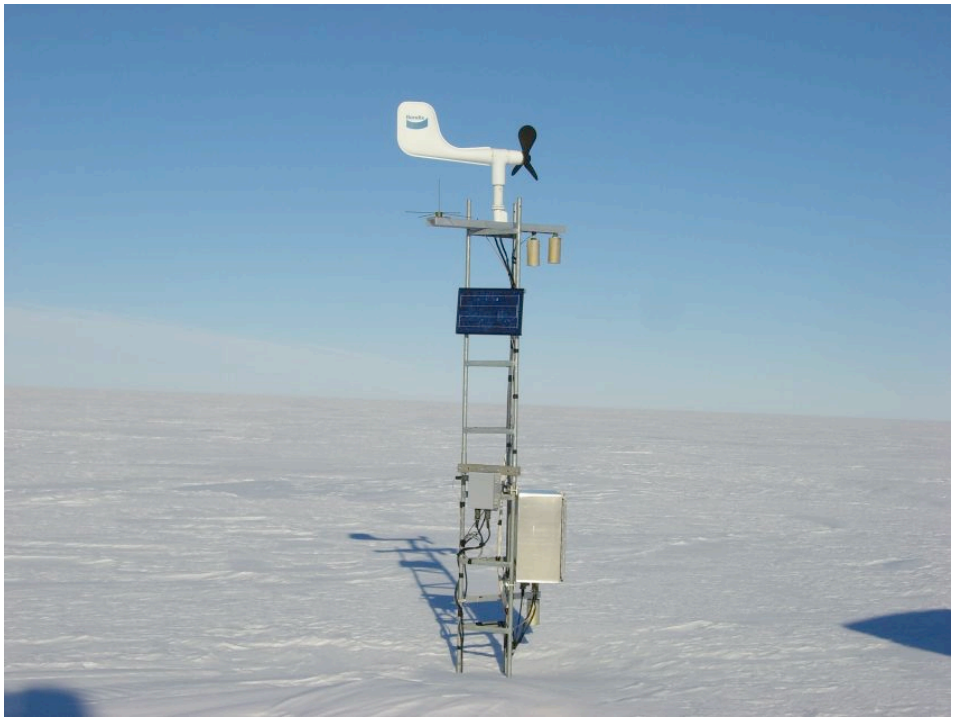


Image A28: Lettau AWS before servicing in February 2009

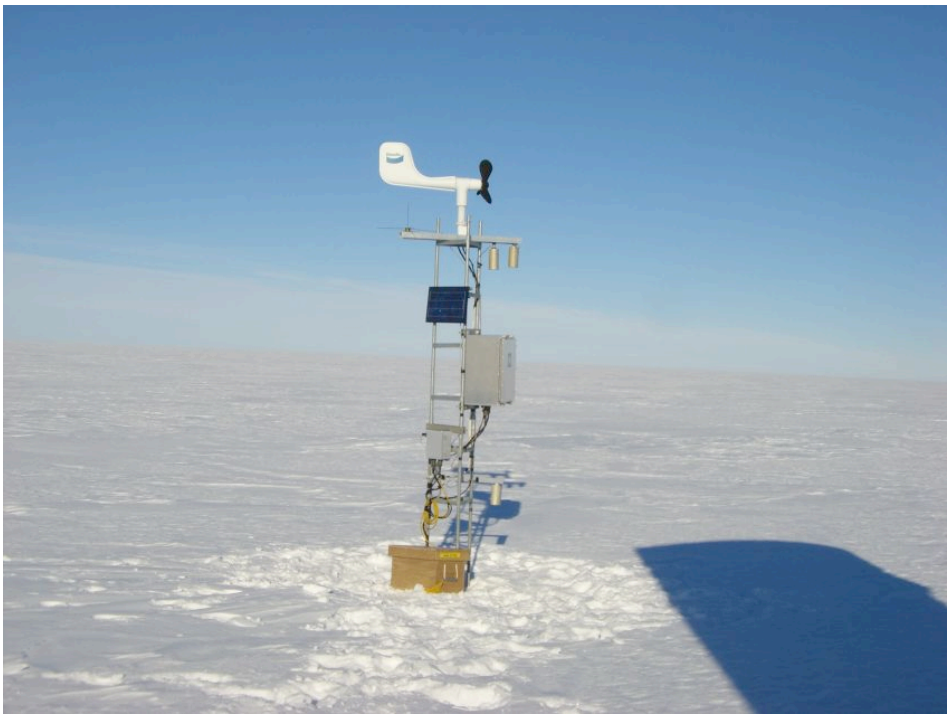


Image A29: Lettau AWS after servicing in February 2009

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

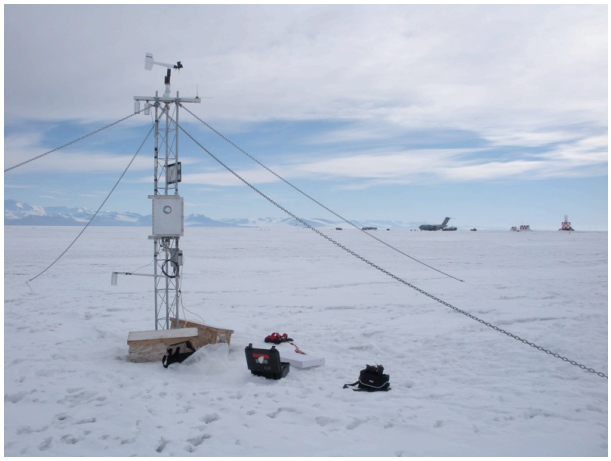


Image A30: Pegasus North after servicing in February 2009

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 ..

George

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

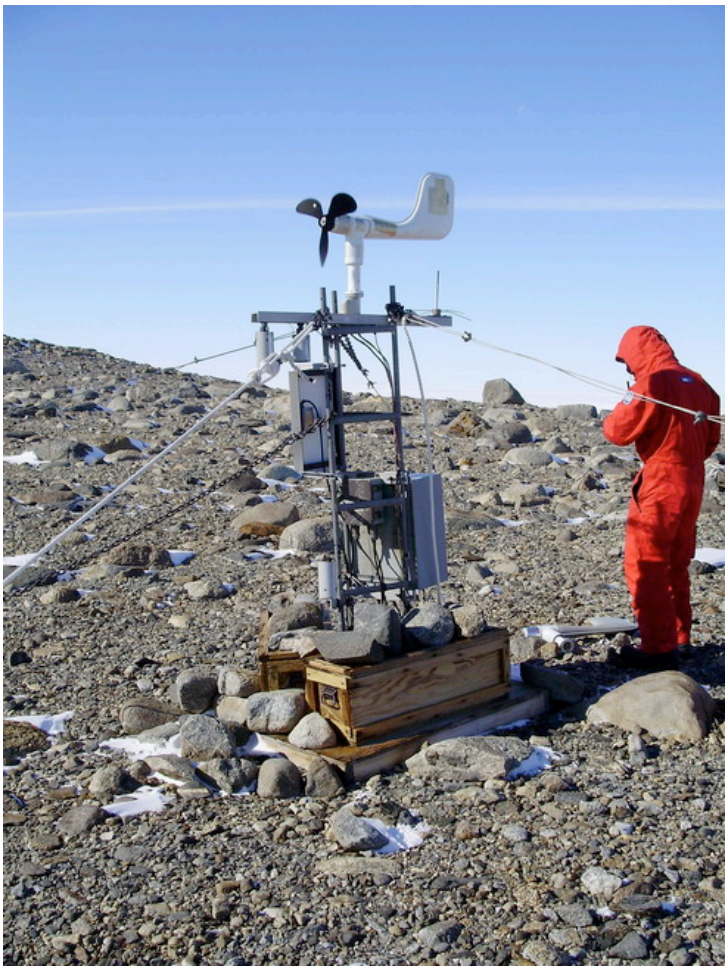


Image B1: Manuela AWS with Bendix Aerovane 2008/2009

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
```

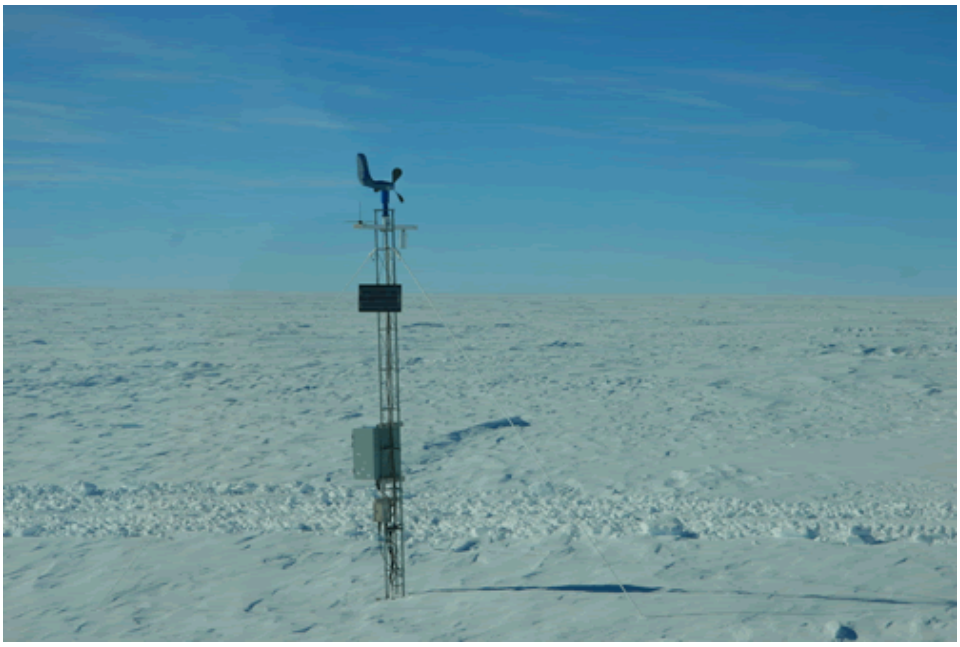


Image B3: D-47 AWS, 2009 (Courtesy of Bruno Jourdain)

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

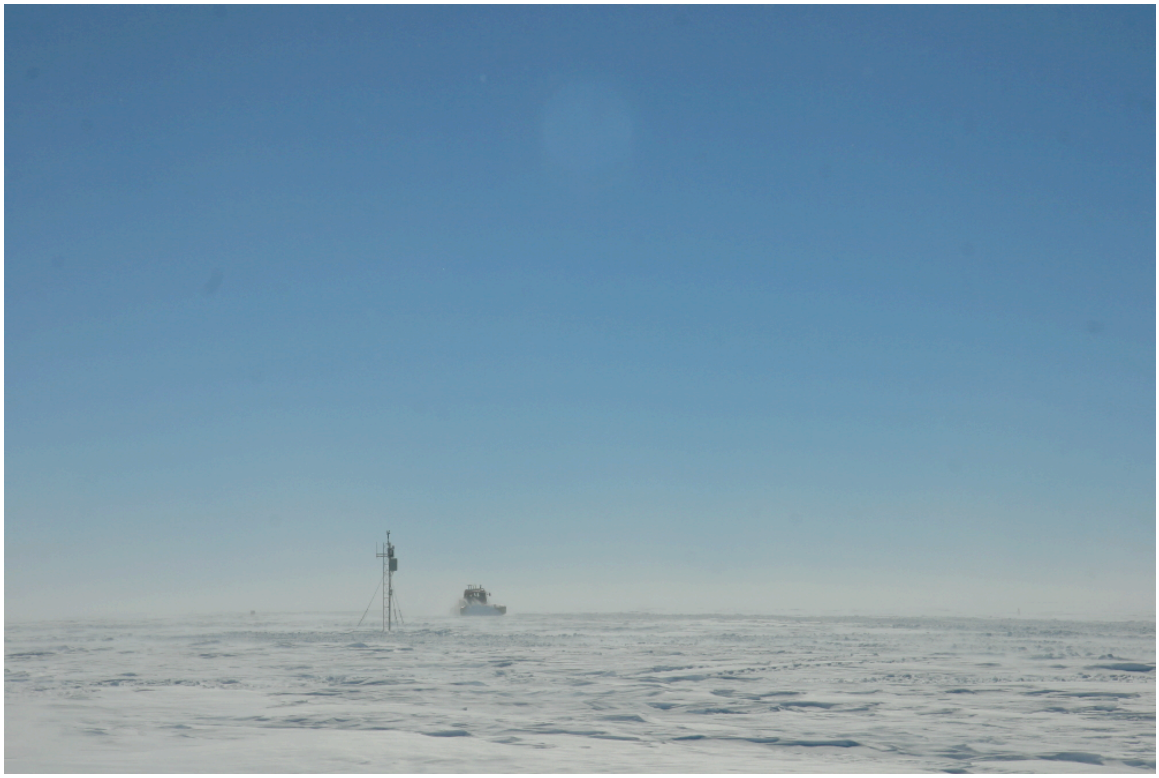


Image B5: D-85 AWS, 2009 (Courtesy of Bruno Jourdain)

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"

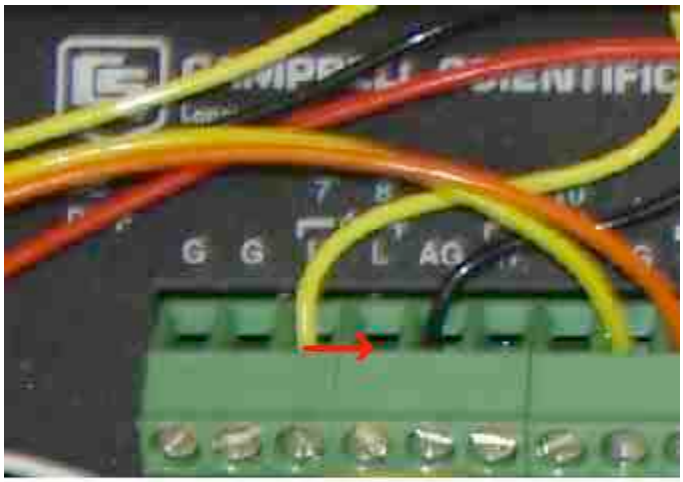


Image B4: Visual instruction for moving the humidity wire to correct input location on CR100

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