AWS Final Project Report: NSF-OPP Grant #6368730, August 1, 2009 to August 31, 2011

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 October 26, 2011

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, worked on the deployment of the Tall Tower AWS, 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, served as a consultant on the current effort. He unfortunately passed away in June of 2010 before end of this project.

Post-doc

Graduate Student

Name: Welhouse, Lee

Worked for more than 160 Hours: Yes

Contribution to Project:

Lee Welhouse project effort focused on studies related to the monitoring of El Nino Southern Oscillation via the automatic weather station network as compared to numerical model reanalyses. He has also assisted the AWS field team helping to repair and install AWS systems.

Undergraduate Student

Name: Asuma, Jonas

Worked for more than 160 Hours: No

Contribution to Project:

Jonas Asuma is an undergraduate student, worked on the web page and other data distribution efforts 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 has assisted the project with minor clerical work.

Name: Czeskleba, Julie

Worked for more than 160 Hours: No

Contribution to Project:

Julie has assisted the AWS project with miscellaneous clerical support.

Name: Oswalt, Jacqueline

Worked for more than 160 Hours: No

Contribution to Project:

Jacqueline has aided the AWS project with some accounting tasks.

Name: Mimier, Julia

Worked for more than 160 Hours: No

Contribution to Project:

Julia has assisted the AWS project with miscellaneous clerical support.

Name: Rasmussen, David

Worked for more than 160 Hours: Yes

Contribution to Project:

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

Name: Schroeder, Nicole

Worked for more than 160 Hours: Yes

Contribution to Project:

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

Name: Hau, Hoklan

Worked for more than 160 Hours: No

Contribution to Project:

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

Name: Uttech, Zach

Worked for more than 160 Hours: Yes

Contribution to Project:

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

Name: Ramaswamy, Pallavika

Worked for more than 160 Hours: No

Contribution to Project:

Pallavika worked on the web site for the AWS project.

chnician, Programmer

Name: Batzli, Samuel

Worked for more than 160 Hours: Yes

Contribution to Project:

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

Name: Bellon, Willard (Bill)

Worked for more than 160 Hours: No

Contribution to Project:

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

Name: Lalande, John

Worked for more than 160 Hours: No

Contribution to Project:

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

Name: Putman, Lee

Worked for more than 160 Hours: No

Contribution to Project:

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

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

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

Other Collaborators or Contacts

US Collaborators:

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

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

International Collaborators:

Institut polaire francais Paul Emile Victor (IPEV)

Programma Nazionale di Ricerche in Antarctide (PNRA)

Japanese Antarctic Research Expedition (JARE)

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

Latitudinal Gradient Project (LGP)/Antarctica New Zealand

British Antarctic Survey (BAS)

Mawson's Hut Foundation, Australia

Activities and Findings

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

Research Activities (September 2007 to August 2008):

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

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

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

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

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

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

Conferences 2007-2008:

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

'resentation on snow accumulation (Knuth)

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

'resentation on snow accumulation (Knuth)

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

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

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

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

Research Activities (September 2008 to July 2009):

I ld 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 t' field report in the Activities attached file as well as an overview in the ıched findings file.

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

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

Previous analysis of the ENSO interactions in the Antarctic used seasonal changes and trends in temperature and pressure fields to establish a correlation between SOI and these fields. Expanding on this work, we have begun to analyze the AWS observations to determine the spatial extent of these trends in temperature and pressure correlations, as well as analyze characteristics of the wind flow to determine how far inland these correlations extend. Our analysis will be two-pronged - analyzing temperature and pressure trends around a large portion of the Antarctic, with an emphasis on West Antarctica (known to be the center of the impact of ENSO in the Antarctic); and studying the flow pattern changes into the Ross Ice Shelf embayment as well as flow pattern changes around the whole Antarctic continent. We will also include the phase relationship between the Southern Annular Mode (SAM) and ENSO, as recent studies have shown SAM to modulate the effects of ENSO at higher latitudes.

Conferences for 2008-2009:

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

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

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

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

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

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

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

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

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

Matthew A. Lazzara, Antarctic Meteorological Research Center/ Univ. of Wisconsin, Madison, WI; and G. A. Weidner, J. J. Cassano, S. L. Knuth, J. E. Thom, L. M. Keller, and M.

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):

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.

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.

Research Activities (August 2009 to July 2010):

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

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

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

Climatology of 2009 was conducted for key AWS network sites, and the results published in the Bulletin of the American Meteorological Society's State of the Climate issue.

Conferences 2009-2010:

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

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

Polar Technology Conference, Boulder, CO.

- Presentation on the AWS program (M. Lazzara)

Research Activities (August 2010 to August 2011):

While the field season activities in the 2010-2011 field season overlapped with NSF grant #ANT-0944018, a piece proposed in this project was finally accomplished - the installation of the Tall Tower AWS 100 miles south of McMurdo Station. The field season and presentation reports for the 2010-2011 field season are found attached to this report however, further discussion of the 2010-2011 field season will be found in reports to NSF grant #ANT-0944018.

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

Research efforts on the studies of El Nino Southern Oscillation on the surface of the Antarctica as seen via temperature and pressure measurements from the AWS and extended by numerical model reanalysis was completed during this past year.

Climatology of 2010 was conducted on key AWS network sites, and the results published in the Bulletin of the American Meteorological Society's State of the Climate issue.

Conferences 2010-2011

SCAR Buenos Aires August 6-10 2010

-Poster on Composite Analysis of the Surface Effects of El Nino Southern Oscillation Teleconnections on Antarctica. (L. Welhouse)

Polar Technology Conference, Albuquerque, NM. March 24-25, 2011

- Presentation on 2010-11 Antarctic Automatic Weather Station field season and technical plans for the future (J. Thom)

6th Antarctic Meteorological Observation, Modeling and Forecasting Workshop in Hobart, Tasmania, Australia June 22-24, 2011

- Presentation on the 2010-2011 AWS field season (M. Lazzara)
- Presentation on 2011-2012 AWS field plans (M.Lazzara)
- Poster on Composite analysis of the surface effects of El Nino southern oscillation teleconnections on Antarctica (L. Welhouse, M. Lazzara, L. Keller, G. Tripoli)

(M. Lazzara was to give an additional talk at IUGG 2011 in Melbourne but was unable to due to an accident in Hobart)

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

Snow accumulation studies:

The project has 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.

Surface Effects of El Nino Southern Oscillation (ENSO):

Considerable effort has been put into analyzing signals found throughout Antarctica associated with El Nino Southern Oscillation events. Prior to delving directly into the signal analysis, the reanalysis data sets were analyzed to ensure a close match with Automatic Weather Stations (AWS) in varied regions. For this analysis, both the mean and anomalous near surface temperature and pressure values were evaluated. This analysis was performed on stations in the Ross Ice Shelf, Wilkes Land, and Marie Byrd Land. The European Centre for Medium-Range Weather Forecasting (ECMWF) ECMWF Reanalysis 40 (ERA-40) and Interim (ERA-Interim) were compared with these stations. The reanalysis data have been found to have a consistent warm bias when compared with AWS Temperature data. The findings of this initial analysis indicate a very strong correlation in both pressure and temperature anomalies, indicating the reanalysis is appropriate to utilize for our signal analysis.
The analysis of ENSO events is similar to prior analyses done, though with new methods which allow for analysis of the specific effects of each phase, El Nino and La Nina, of ENSO. To analyze each phase, composites were formed with the positive basis being El Nino or La Nina events, and the negative basis being the non event months during the same period. During austral spring both El Nino and La Nina were found to coincide with significant warming in the Amundsen Bellingshausen Sea region. Austral summer El Nino continued to coincide with effects in the Amundsen Bellingshausen Sea region, though they were reduced in both magnitude and the extent of the continent effected. La Nina showed a prominent feature of cooling in East Antarctica, but no effect in the Amundsen Bellingshausen Sea region. This East Antarctic feature is evident in all reanalysis products explored, and has not been discussed in prior literature regarding the effects of ENSO in Antarctica

AWS usage in Reanalyses:

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

2009 AWS State of the Climate Highlights:

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

2010 AWS State of the Climate Highlights:

In general, both the automatic and manned stations indicate well-below normal (and often record-setting) pressures during the austral winter. Stations in East Antarctica and over the Ross Ice Shelf recorded much lower temperatures throughout the year. Observations from automatic weather stations on the Polar Plateau, Ross Ice Shelf, and West Antarctica paint a very different picture for 2010 than was seen in 2009. Generally, above-average temperatures were found in the summer and fall, with below-average temperatures for the winter and spring. In addition, the stations reported lower pressures in the winter, with some low pressures breaking long-term records. On the Polar Plateau, Dome C II had a record-low monthly mean temperature (8?C below the mean), a record-low monthly mean pressure, (16 hPa below the mean), and a record-low monthly mean wind speed (1.5 m s-1 below the mean) for July. In addition, the minimum temperature during the winter was below -73.3?C for April through September at Dome C II. On the Ross Ice Shelf, Ferrell reported record-low pressures for July, August, and November (15 hPa, 9 hPa, and 7 hPa below the monthly mean, respectively), and Gill reported record-low pressures for June, July, and August (11 hPa, 15 hPa, and 9 hPa below the monthly mean, respectively; Fig. 6.3e). Closer to the Ross Sea, Marble Point also had a record-low pressure for July (14 hPa below the mean). In West Antarctica, record-low pressures for Byrd were below normal by 12 hPa for June and 17 hPa for July. Finally, at Possession Island near Cape Adare, record-low temperatures were 3?C below normal for both June and September and record low pressure was 11 hPa below the mean in July.

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:

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

2009-2011:

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* Continued working with the Wisconsin graduate student (Lee Welhouse) on the AWS platform - including wiring, plug assembly, enclosure and electronic mounting.

Outreach Activities:

2007-2008:

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* Participation in the PolarTrec Program during the 2007-2008 field season with Kirk Beckendorff, 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:
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* SSEC Public Tours, UW-Madison, Madison, WI (multiple tours, including University of Wisconsin Science Expeditions/Open House)
* E-mails answering questions, offering information or providing data to students and the general public including special reports to classrooms and the general public during field deployments.
* Mount Horeb Public Library, Mount Horeb, WI
* Wednesday Night at the Lab, UW-Madison, Madison, WI
* Mount Horeb Cub Scouts, Mount Horeb, WI
* West Madison Cub Scouts, Madison, WI
* MidWest Severe Storm Tracking and Response Center, Inc., Monona, WI
* Wisconsin State Fair, West Allis, WI
* Deerfield Cub Scouts, Deerfield, WI (2 visits)
* University of the Air, Wisconsin Public Radio, Madison, WI

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

2009-2010:

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

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

Efforts in 2010-2011 will be reported in grant #ANT-0944018 annual report to NSF.

Journal Publications

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

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

Colwell, S.; Keller, L. M. and Lazzara, M. A.., "Surface Manned and Automatic Weather Station Observations [in "State of the Climate in 2010"]", Bulletin of the American Meteorological Society, p. S163, vol. 92, (2011). Published,

Welhouse, L. J., M. A. Lazzara, G. J. Tripoli, and L.M. Keller, "Composite analysis of the effects of ENSO events on Antarctica during austral spring and summer", Journal of Climate, p. , vol. , (2011). Submitted,

Nigro, M.A., J.J. Cassano, M.A. Lazzara, and L.M. Keller, "Case study of a barrier wind tip jet off the coast of the Prince Olav Mountains, Antarctica", Monthly Weather Review, p. , vol. , (2011). Submitted,

Books or Other One-time Publications

Keller, L.M., G.A. Weidner, C.R. Stearns,
J.T. Thom, and M.A. Lazzara, "Antarctic Automatic Weather Station Data for the Calendar Year 2002", (2008). Book, Published
Bibliography: Space Science and Engineering Center,
University of Wisconsin-Madison

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

Web/Internet Site

RL(s):
http://amrc.ssec.wisc.edu ftp://amrc.ssec.wisc.edu
Description:
iese 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

roduct Type:
Data or databases
Product Description:
eteorological 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 cumulation, and temperature differences from the top to the bottom of the AWS tower. iese 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.
iaring Information:
Observations from the AWS sites are made available via the following avenues:

Real-time:

Web Site
'P Site
TS
McIDAS ADDE Server
Antarctic-IDD

. Archive:

Veb Site
TP Site
- Metadata via DIF with the Antarctic Master Directory at NSIDC and NASA Global Master Directory
)ata book covering an annual year of AWS summaries

Contributions

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

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

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

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

3157.

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

Steinhoff, D.F., Bromwich, D.H., Lambertson, M., Knuth, S.L., and Lazzara, M.A., 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., Bromwich, D.H., Chapman, W., and Comiso J.C., 2008: Recent variability and trends of Antarctic near-surface temperature. J. Geophys. Res., 113, D04105, doi:10.1029/2007JD009094.

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

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

Turnbull, I.A., 2010: Drift of large tabular icebergs in response to atmospheric surface pressure gradients, an observational study. Antarctic Science, 22, 199-208.

Galle, H., and Gorodetskaya, I.V., 2010: Validation of a limited area model over Dome C, Antarctic Plateau, during winter. Climate Dynamics,34, 61-72.

Nicolas, J.P., Bromwich, D.H., 2011: Climate of West Antarctica and Influence of Marine Air Intrusions, Journal of Climate, 24, 49-67.

Contributions to Other Disciplines:

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

Contributions to Human Resource Development:

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

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

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, mputational resources are available from this project to support the activities of project members.

zzara, M.A. and Hook. S., 2009: Bringing Antarctic atmospheric research into the middle 1ool classroom. In: Conference on Polar Meteorology and Oceanography, 10th, Madison, WI, 18-21 May. Boston, MA, American Meteorological Society.

ntributions Beyond Science and Engineering:

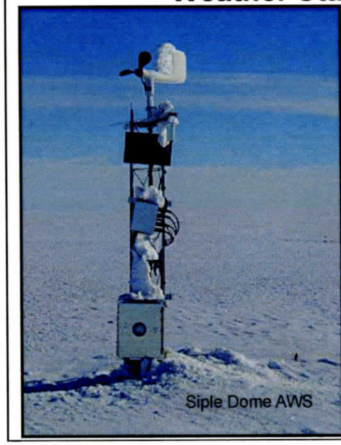
Conference Proceedings

Categories for which nothing is reported:

ntributions: To Any Beyond Science and Engineering

Any Conference

Overview of the Antarctic Automatic Weather Station Project



Siple Dome AWS

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

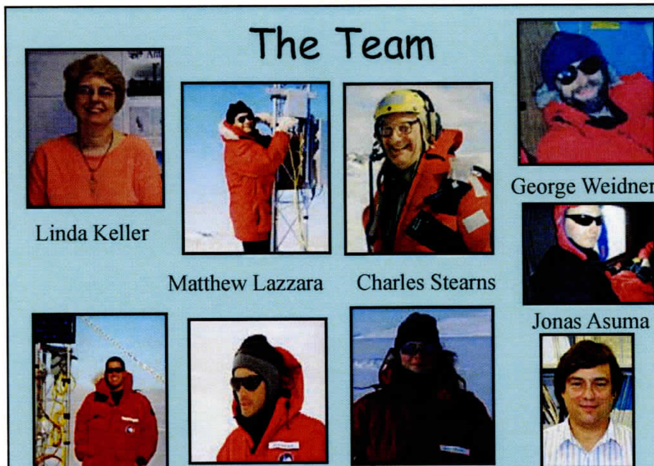
J.J. Cassano
University of Colorado-Boulder

Outline

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

South Pole - Clean Air AWS

The Team



Linda Keller, Matthew Lazzara, Charles Stearns, George Weidner, Jonas Asuma, John Cassano, Jonathan Thom, Shelley Knuth, Greg Tripoli

AWS History

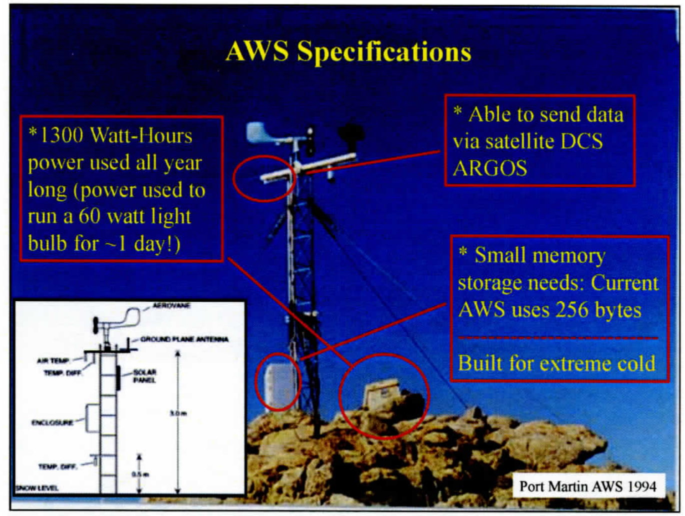
- Stanford University Radio Science Lab
  - Late 1970s
  - Key developments:
    - Low power electronics (Pioneer Spacecraft)
    - Satellite communications (Nimbus-7)
- University of Wisconsin-Madison
  - Assumed stewardship
  - Meteorological focus

AWS Versions

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

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

AWS Specifications



AWS Sensor Specifications

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

AWS Applications

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

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

Data Flow

Real time

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

Archival

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

The Data: Quality Control

Methodology

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

New Data Formats

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

CLIMAT Message Project

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

(As resources allow)

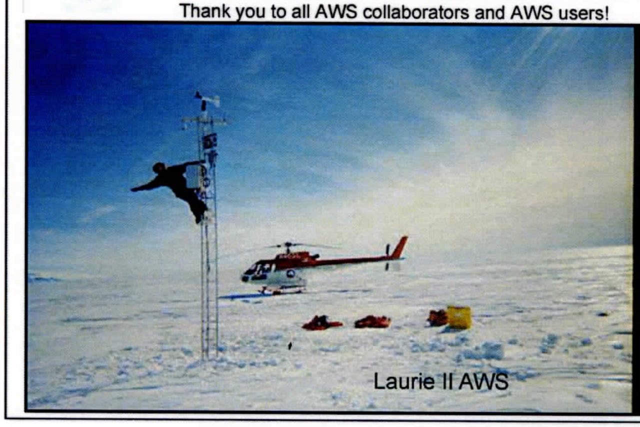
```
CSAA01 KWBC 171327                                  2007137 1432
CLIMAT 04007 89376
111 19813 31332060 412791386 8000000 9303030
333 23030 8070100
444 0123421 1144019 2117621 3147420 5120321 =
CSAA01 KWBC 171326                                  2007137 1432
CLIMAT 04007 89828
111 16431 31623036 415741661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

International Collaborations

- France
- United Kingdom
- Japan
- China

Acknowledgements

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



Laurie II AWS

Antarctic Automatic Weather Station Program: 2008-2009 Field Season Overview

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

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

Sabrina AWS

AWS Field Team

From Left to Right:

Ms. Melissa Richards
CU – ATOC

Dr. John Cassano
CU – ATOC

Dr. Matthew Lazzara
UW – AMRC/SSEC

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

Mr. Jonathan Thom
UW – AMRC/SSEC

AWS Field Work Summary

October-November Field Team

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

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

D-10 AWS
E-66 AWS
D-85 AWS

*** Mawson's Huts Foundation Support**

January-February Field Team

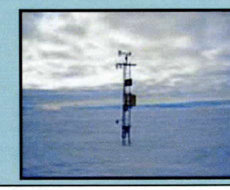
- Pegasus South AWS: Jan 7
- Pegasus North AWS: Jan 11, 24; Feb 5, 6
- Linda AWS: Jan 16, 21
- Ferrell AWS: Jan 16
- Marilyn AWS: Jan 23
- Carolyn AWS: Jan 23
- Vito AWS: Jan 24
- Emilia AWS: Jan 24
- Elaine AWS: Jan 28
- Kominko-Slade AWS: Jan 31
- Sabrina AWS: Feb 2
- Lettau AWS: Feb 2
- Williams Field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

Minna Bluff

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

Linda AWS

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



Williams Field AWS Test Facility

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

Lorne AWS

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

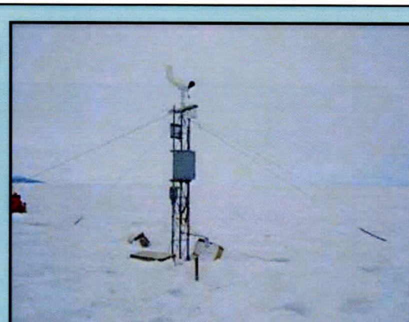
Ferrell AWS

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

Margaret AWS

- New AWS Install
- System Operational

Pegasus South AWS



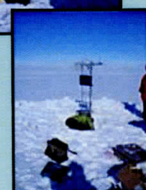
- Issues
  - Removed
  - Utilized for Redeployment
- Future:
  - Complete removal 2009-2010
  - (Limited utilization)
- System Non-operational

Pegasus North AWS

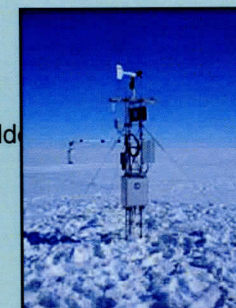
- Issues:
  - Stopped transmitting without cause in fall 2008
  - Check cables, restarted AWS, failed again, removed AWS electronics
    - Utilized for redeployment
  - Installed new electronics
  - Attempted to fix up electronics wiring for boom
- System Partially Operational
  - Wind speed and relative humidity not working…

Marilyn AWS

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



Carolyn AWS



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

Vito AWS

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

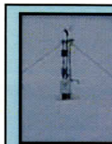
Emilia AWS

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

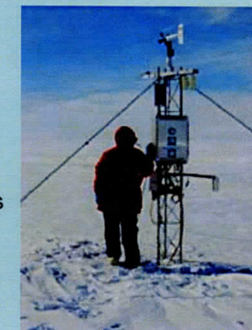
Elaine AWS

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

Kominko-Slade AWS



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

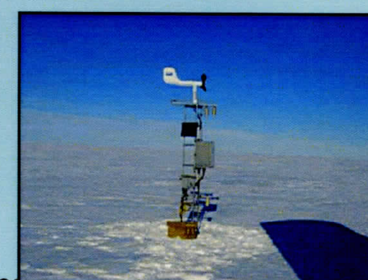


Sabrina AWS

- New AWS Install
- System Operational

Lettau AWS

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



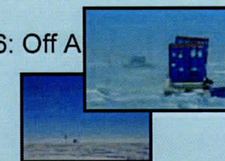
Maneula AWS

- Issues:
  - Aerovane Replacement
- System Operational

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

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

- E-66: Off A



- D-85: Operational

Thank you!

Summary:

* Visited over 21 sites

- 1/3 of the network!

* Most of the network operational

* Minor issues for next season:

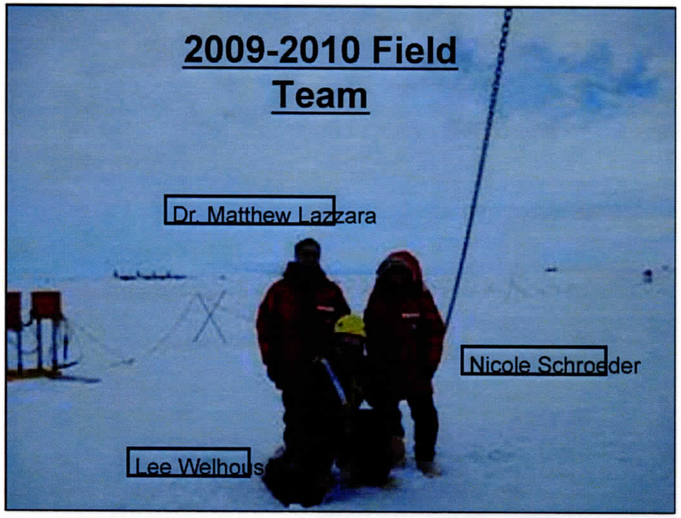
- Pegasus North to be replaced at WINFLY

- Williams Field to become

Williams Field AWS

A Review of the 2009-2010 Automatic Weather Station (AWS) Field Season

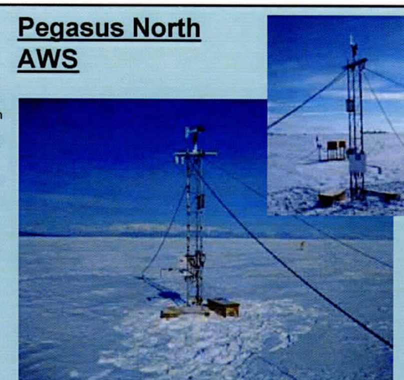
Matthew A. Lazzara[1], Nicole M. Schroeder[1,2], Lee J. Welhouse[2], George A. Weidner[2], and Jonathan E. Thom[1]
[1] Antarctic Meteorological Research Center
Space Science and Engineering Center
[2] Department of Atmospheric and Oceanic Sciences
University of Wisconsin-Madison
O-283-M/P/S



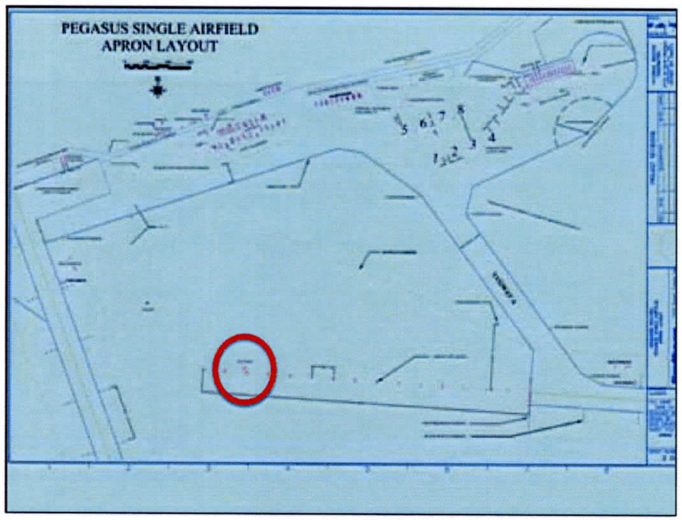
Pegasus North AWS

Visit #1:
- Date: 17/Jan/2010
- Time: 5:15 pm local McMurdo time
- Team members: Matthew Lazzara, Nicole Schroeder, and Lee Welhouse
- Measurements to the surface (bottom of the following):
  - Delta-T: 28.24 inches (0.72 meters)
  - Junction Box: 42.50 inches (1.1 meters)
  - Electronics Enclosure: 30.25 inches (0.77 meters)
  - Solar Panel: 86.25 inches (2.2 meters)
  - Boom: 131.25 inches (3.3 meters)
- Battery Voltages: Not measured
- AWS site assessment

Visit #2:
- Date: 24/Jan/2010
- Team members: Matthew Lazzara, Nicole Schroeder, Lee Welhouse
- Measurements: None measured
- Battery Voltages: None measured
- UNAVCO GPS: Yes, measure from 9:30 am until roughly 10:15 am local time.
- Repaired/tightened up mounting of wind sensor and re-taped loose cables.

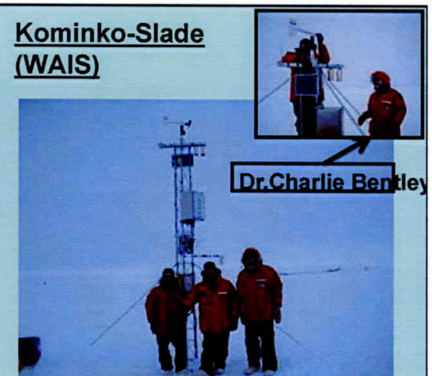


- Wind Sensor out of alignment (more in r
- Re-secured cables



Kominko-Slade (WAIS)

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



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

Ferrell AWS

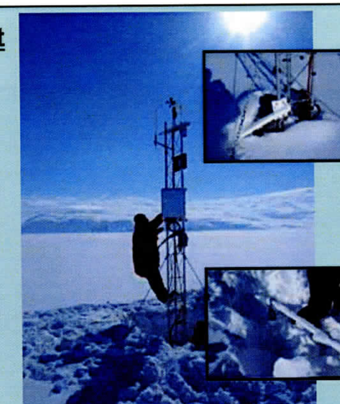
- Date: 29/Jan/2010
- Time: 11:00 am through 12:00 pm local time
- Team Members: Lee Welhouse, Markov Dimov (Helo Pilot)
- Took measurements and raised the ADG, lower temperature sensor, and lower enclosure. The measurements of the tower were as follows,
- Upon arrival (in inches):
  - Lower temperature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

- Raised lower components
- Swapped out ADG memory module

Windless Bight

Visit #1:
- Date: 25/Jan/2010
- Time: 9:50 am through 12:00 noonTeam members: Matthew Lazzara, Nicole Schroeder, Marko Dimov
- Measurements to the surface (bottom of the following):
- Before Tower Raise:
  - Solar Panel: 57.0 inches (1.45 meters)
  - Junction Box: 0 inches (0 meters) at surface
  - Electronics Box: Subsurface
  - Temp probe on boom: 58.0 inches (1.47 meters)
  - Antenna: N/A
  - Boom: N/A
  - ADG SubsurfaceAfter Tower Raise:
  - Solar Panel: 98.0 inches (2.49 meters)
  - Electronics box: 63.0 inches (1.60 meters
  - Antenna: 113.5 inches (2.88 meters)
  - Boom: 126.5 inches (3.21 meters)
  - Junction Box: 44.0 inches (1.12 meters)
- Battery Voltages:
  - Solar Panel: 20.7 volts
  - Battery: 12.87 volts
- UNAVCO GPS: Yes, measured from 9:50 am through 11:30 am
- Raised AWS with a 5 foot tower section, removed damaged ADG

Visit #2:
- Date: 29/Jan/2010
- Time: 9:00 am through 10:30 am
- Team Members: Lee Welhouse and Marko Dimov
- Attached new ADG bar at approximately 4 foot 6 inches.



- Raised tower
- Replaced damaged ADG arm m

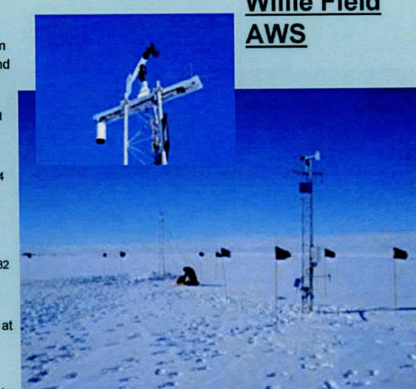
Elaine AWS

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

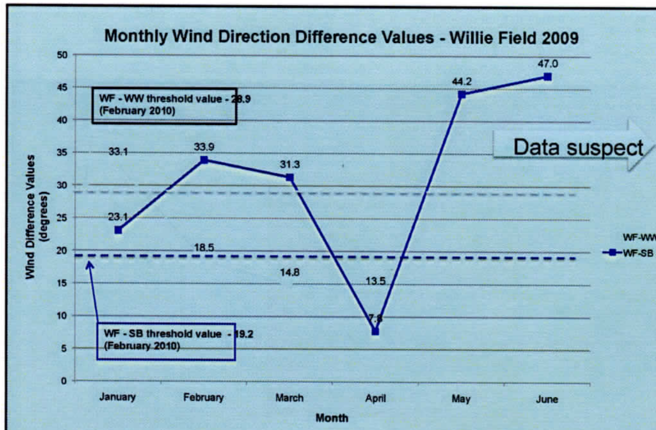
* Replaced AWS:
New Sensors: ADG & Insolat

Willie Field AWS

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



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



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

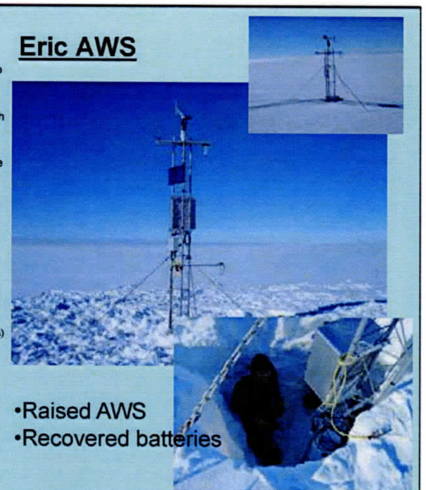
South Pole Radiation Shield Test Site

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

- New Install
- CR-1000 AWS

Eric AWS

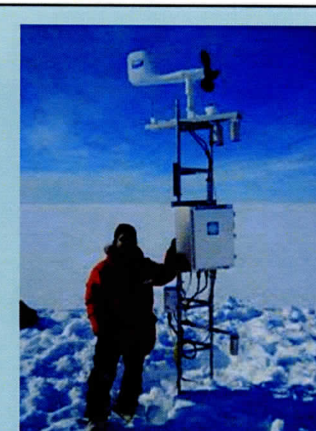
- Date: 2/Feb/2010
- Time: ~1:50 pm to ~4:30 pm local McMurdo time.
- Team Members: Matthew Lazzara, Lee Welhouse, Justin Dye (RPSC - FEMC), Zach Heid (RPSC - VMF), Lexy and Lee (Twin Otter Pilots)
- Measurements to the surface (bottom of the following):
- Before:
  - Solar Panel: 33 inches (0.84 meters)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



- Raised AWS
- Recovered batteries

Lettau AWS

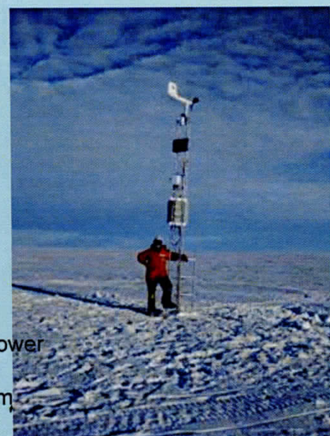
- Date: 30/Jan/2010
- Time: 1:30 pm local - Ground time of less than an hour
- Team Members: Matthew Lazzara, Lee Welhouse, Lexy and Lee (Twin Otter pilots)
- Measurements to the surface (bottom of the following):
  - Boom (to I-beam): 90.00 inches (2.29 meters)
  - Solar Panel: 66.25 inches (1.68 meters)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



* Replaced Battery Box

Byrd AWS

- •Date: January 26, 2010
- •Field Team Members: Dr. David Holland, Joe Petit, Susha Dore, Hayden (Kiwi mechanic)
- •AWS dug out and raised. Switched to a new tower type and installed new boom and new batteries.



- •Raised AWS
  - •Switched to "new" tower
- •Installed new batteries
- •Install new sensor boom

Collaboration with France/ IPEV

D-47

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

E-66

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

Nov 2009 / Jan 2010

Adelie Land AWS report

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

•D-10 AWS:
•Operating nominally

•D-47 AWS
•Removed 8947
•Installed 8916

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

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

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

4) D10: ID 30374

Type : RM Young mounted on Bendix base on sensor boom.
Electronic : Campbell CR10X
Current status: Working ok


D10 AWS (Feb 2010)


D10 AWS : Electronic box

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

5) D47 : ID8916

(installed in Feb 2010)
Type : RM Young mounted on Pipe all sensors independent mounts to tower
Electronic : AWSCR1000 with Telonics ST-20 PTT ID 8916
Current Status: Transmitting need to check data but would assume is OK

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

•E-66 AWS:
•Removed 8912 AWS
•Installed 8947 AWS

•D-85 AWS:
•Operating nominally

6) E66 : ID8947

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

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


E66-AWS (Feb 2010)

7) D85 : ID8986

Type : RM Young on Bendix base on sensor boom
Electronic : AWS2B Telonics ST-5 PTT
Current Status: Working OK

Collaboration with Japan/ JARE

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

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

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

listed by Takao Kameda

1. Data Logger Type

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

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

2. ARGOS Type

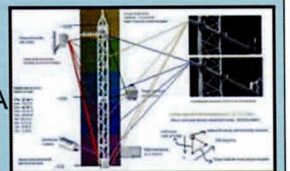
ARGOS-AWS units were set up at four sites as a cooperative program between Japanese Antarctic Research Expedition and University of Wisconsin, USA.

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

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

Sites Not Installed

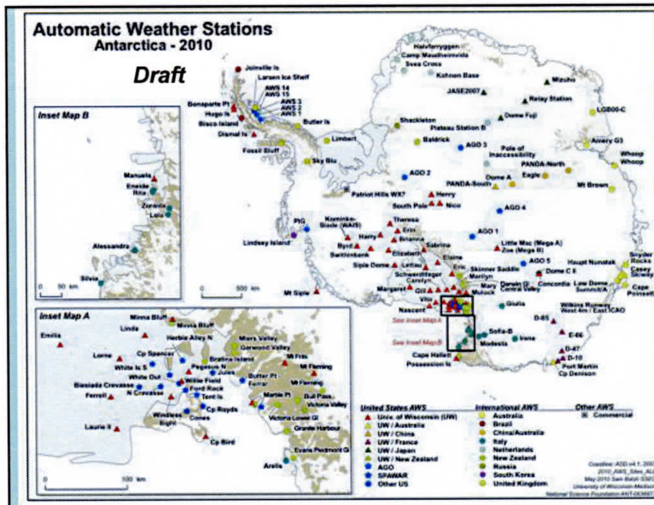
(Due to weather, scheduling, etc…)



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

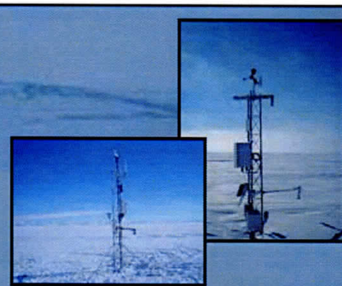
South Korea

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



AWS Issues

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



Thank you!

Acknowledgements:

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

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

2010-11 Antarctic Automatic Weather Station Field Season

Matthew Lazzara[1], Melissa Nigro[2], Jonathan Thom[1], Lee Welhouse[1]

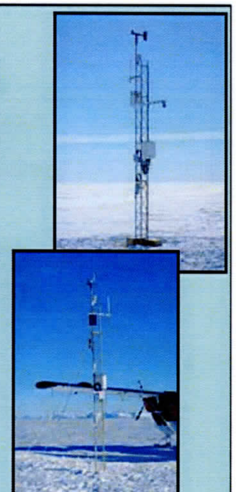
Antarctic Automatic Weather Station Program

[1] Antarctic Meteorological Research Center
Space Science and Engineering Center
University of Wisconsin-Madison

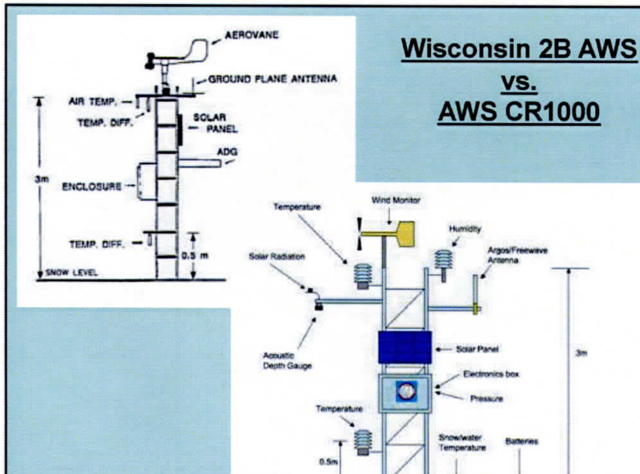
[2] University of Colorado at Boulder

2010-11 Field Work

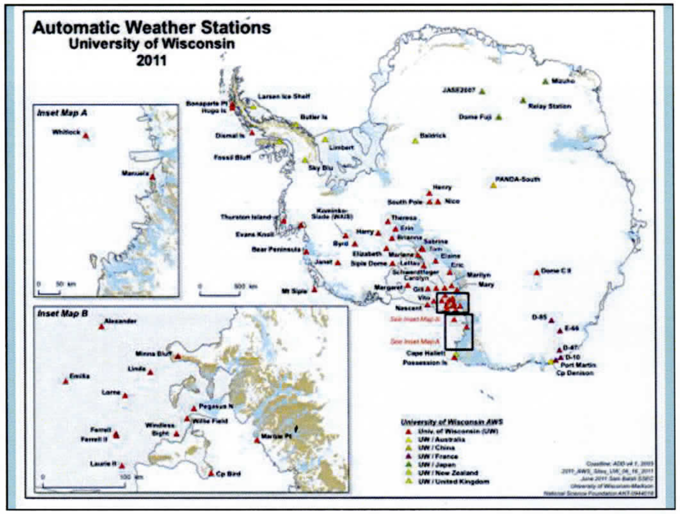
- *Shockingly* successful season
- 16+ stations visited
  - 6 additional by collaborators
- Utilized the Oden icebreaker to repair the AWS on Franklin Island.
- 6 new installations (2 on Ross Ice Shelf, 4 in West Antarctica).
- ~7 weather station removals:
  - "Mt. Friis", "Mt. Fleming", Mulock, Swithinbank, 3 AWS at Megadunes
- Still have > 60 Argos IDs, want to decrease to ~50.

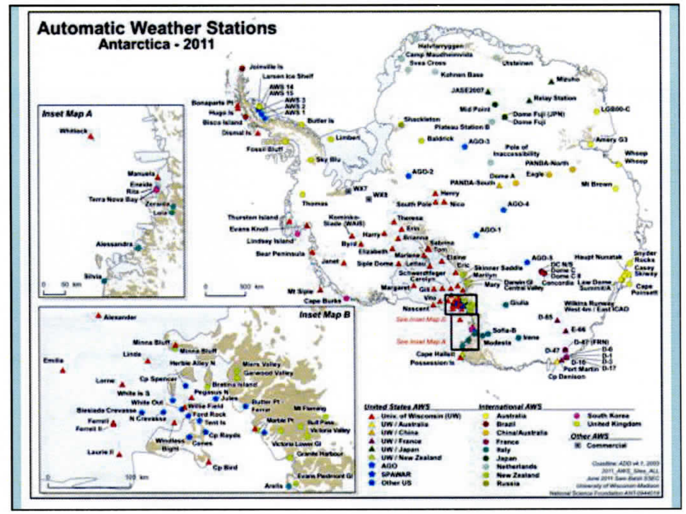


Wisconsin 2B AWS vs. AWS CR1000



Courtesy Joey Snarski



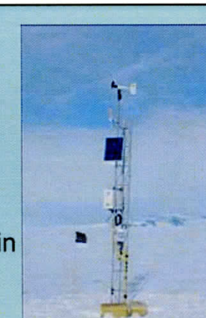


Cape Denison

- Collaboration with Mawson's Hut Foundation
- Brand new AWS installed
- Older AWS equipment removed
- Unfortunately failed
  - March ?
  - Cabling may be the cause

Willie Field

- Removed all older gear & towers
- Record-only AWS Installed (no Argos)
  - 10 Feb 2011
- Will be a freewave modem AWS in future seasons
- A test facility AWS
- Continuous record for Williams Field airfiel[d]



Lower temp	127 cm
Electronics box	204 cm
Pressure	239 cm
Junction box	142 cm
HMP	381 cm
Upper temp	394 cm
Aerovane	435 cm

Measurements After servicing

Sabrina AWS

- Full Station Replacement
  - 13 Jan 2011
  - Argos ID 8915
- Wind direction correctior
  - Affected entire record

ADG	29 cm
Wind	266 cm
Lower temp	90 cm
Upper temp	266 cm
Enclosure	110 cm
J-box	82 cm
Solar panel	168 cm

Measurements Before servicing

ADG	265 cm
Wind	521 cm
Lower temp	122 cm
Upper temp	480 cm
J-box	350 cm
Pyronometer	287 cm
HMP	216 cm

'Measurements After servicing

Marlene AWS

- New Installation
  - Near Sabrina AWS
  - 13 Jan 2011
  - Argos ID 8908
- Will be removed in approximately 2 years…
- Named for:
  - Marlene McCaffery/

Lower temp sensor	130 cm
J-box	213 cm
Enclosure	244 cm
HMP (humidity probe)	324 cm
Boom (ADG and pyronometer)	357 cm
Upper temp sensor	521 cm
Aerovane – RM Young 05103	560 cm

Measuremer After installat

Tom AWS

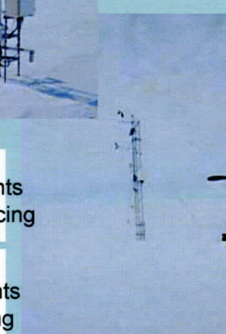
- New Installation
  - Near Sabrina AWS
  - 13 Jan 2011
  - Argos ID 8919
- Will be removed in approximately 2 years…
- Named for:
  - Tom Nigro (Melissa's

Lower temp	145 cm
J-box	217 cm
Enclosure	260 cm
HMP	307 cm
Boom (ADG and pyronometer)	372 cm
Upper temp	527 cm
Aerovane	560 cm

Measurements After installation

Lettau AWS

- Full Station Replacement
  - AWS CR1000
  - 14 Jan 2011
  - Argos ID 8928
- Last station still using old style Rohn Tower



Lower temp	21 cm
J-box	63 cm
Enclosure	102 cm
Solar Panel	162 cm
Upper temp	199 cm
Boom (old style for aerovane)	218 cm

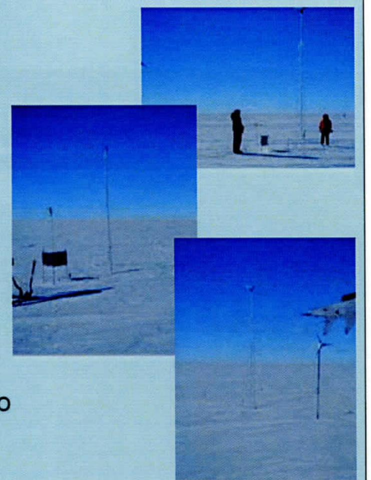
Measurements Before servicing

Lower temp	135 cm
J-box	220 cm
Enclosure	252 cm
HMP	310 cm
Boom (ADG and pyronometer)	380 cm
Upper temp	530 cm
Aerovane	555 cm

Measurements After servicing

Megadunes AWS

- Removal of
  - Zoe AWS
  - Little Mac AWS
  - Un-named AWS
  - 18 Jan 2011
- No new AWS left beind
  - Will be installed at AGO-1 or AGO-2
- AWS shipped back,to Mark Fahnstock…
- Recorded Data

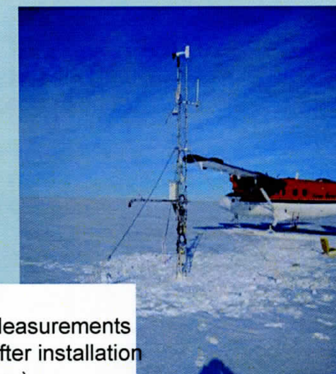


Janet AWS

- New Installation
  - 17 Jan 2011
  - Argos ID 8936
- Name for:
  - Janet Lazzara 1946-2002

Lower T	125
ADG	145
Pyronometer	173
Junction box(measured from bottom)	120
Enclosure	159
Upper T	379
HMP	378
Aerovane	437

Measurements After installation (cm)



Byrd AWS

- AWS 2B Removed
- Replaced with CR1000 AWS
  - 18 Jan 2011
  - Same Argos ID

Boom	162 in
Solar Panel	133 in
Junction	105 in
Enclosure	65 in

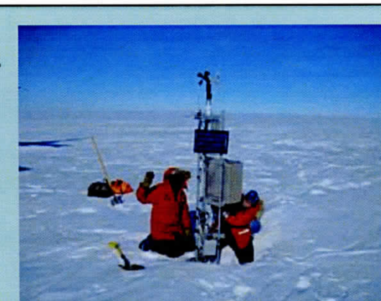
Measurements Before servicing

Aerovane	192 in
Upper temp	144 in
RH	144 in
Pyronometer	110 in
Lower Temp	106 in
ADG	104 in

Measurements After Servicing

Swithinbank AWS

- Removed AWS
  - 17 Jan 2011
  - 183 cm exposed…
- Removal part of reorganizing and spreading out of AWS in West Antarctica



Mulock Glacier AWS

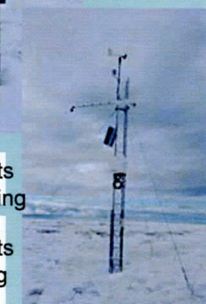
- Removed
  - 27 Jan 2011
- Formally used by Mark Seefeldt's PhD research
- (Not operating…)

Electronics box	140 cm
Junction box	267 cm
Boom Height	343 cm

Measurements Before removal

Whitlock AWS

- AKA Franklin Island
- Replaced AWS
  - 28 Jan 2011
  - (Former system not operating for some years)
- Requested by AMOMFW community



Boom	57"
Electronics Box	-12"
Solar panel	39.5"

Measurements Before servicing

Aerovane	219"
Upper temp	204"
ADG	172"
Electronics box	92"
Lower temp	53"
RH	102"

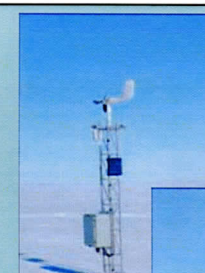
Measurements After servicing

South Pole Radiation Shield Test Facility

- Site visit
- Repair
  - 1-2 Feb 2011
- Will be removed next field season
- See Christophe's talk for more…

Gill AWS

- Raised Tower
- Replaced Instrumentation
  - 2 Feb 2011



Electronics box	24"
Solar panel	68"
Boom	99"
J-box	at the surface
Lower temp	below the surface

Measurements Before Servicing

Lower temp	60"
RH	85"
Electronics box	87"
ADG	138"
Upper temp	190"
Aerovane	204"

Measurements After Servicing

Marilyn AWS

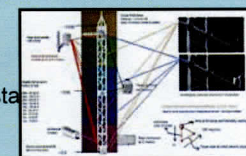
- Aerovane Replacement
  - 3 Feb 2011

J-box	57"
Electronics box	72"
Boom	133"

Measurements

Alexander Tall Tower! AWS

- Finally installed after 3 years.
- 100 ft tower located on the Ross Ice Shelf (~160 km from McMurdo)
- Installed for surface wind and energy balance studies
- Instrumentation
  - 30 m: wind, temperature, humidity, net radiation
  - 15 m: wind, temperature
  - 8 m: wind, temperature, humidity
  - 4 m: wind, temperature
  - ~3 m: acoustic depth gauge is insta
  - 2 m: wind speed, temperature
  - 1 m: wind speed, temperature



Big Al's Tall Tower!

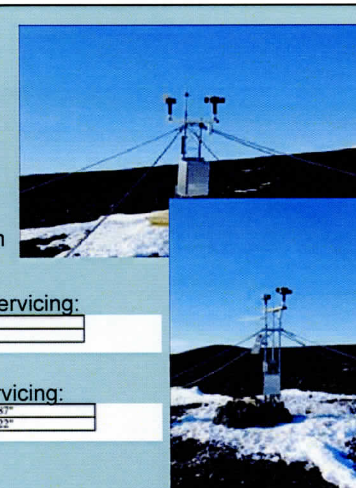
- Groups are welcome to propose to install instrumentation at this site.
- Tower installed and maintained by USAP contractor.
- Power provided by a UNAVCO 5 W power system

Cup anemometer level 1	52"
Temp level 1	43"
Cup anemometer level 2	93"
Temp level 2	83"
Electronics box	100"
ADG and antennae	136"

Measurements of Non-boom sesnors

Minna Bluff

- Replaced AWS
  - 4 Feb 2011
  - Freewave Modem
  - No Argos ID



Measurements Before Servicing:

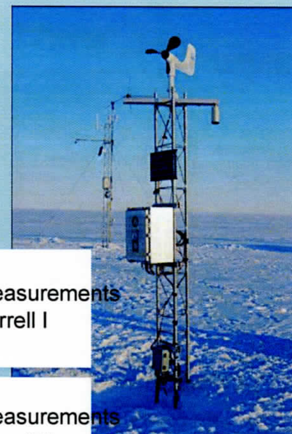
Boom	60"
Electronics box	27"

Measurements After Servicing:

Boom	87"
Electronics box	22"

Ferrell AWS & Ferrell II AWS

- Raised existing AWS
- Installed new



Lower temp	62 cm
ADG	60 cm
Electronics box	127 cm
ADG electronics box	53 cm
ADG solar panel	57 cm
Junction box	27 cm
Solar panel	201 cm
Boom	277 cm

Measurements Ferrell I

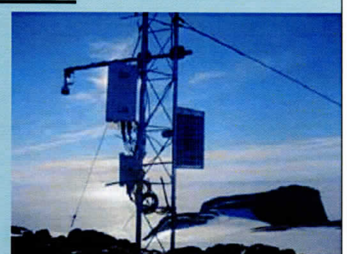
Lower temp	102 cm
J-box	207 cm
Electronics box	240 cm
ADG and pyronometer	432 cm
Solar panel	365 cm
Upper temp and HMP	524 cm
Aerovane	568 cm

Measurements Ferrell II

Evans Knoll AWS

- New AWS Installation
  - By David Holland
  - Dual purpose
    - In support of Pine Island Glacier activities
  - Possible long term climatology studies ?

Bear Peninsula AWS



- New AWS Installation
  - By David Holland
  - Dual purpose
    - In support of Pine Island Glacier activities
  - Possible long term climatology studies
- Historically requested AWS site by the

Thurston Island AWS

- New AWS Installation
  - By David Holland
  - Dual purpose
    - In support of Pine Island Glacier activities
  - Possible long term climatology studies
- Long desired by the AMOMFW community

D-10 AWS

- Tower Straightened
  - 18 Feb 2011

File photo: 2004 Christophe Gentl

E-66 AWS

- Replaced electronics
  - 7 December 2010

D-85 AWS

- Replaced electronics
  - 22 January 2011

Thank you!

http://amrc.ssec.wisc.edu

Acknowledgements:
National Science Foundation, Office Polar Pro gram grant #ANT-0944018

AWS Photos by Melissa Nigro, Jonathan Thom, and Lee Welhouse

Antarctic Automatic Weather Stations
Field Report for 2007-2008

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

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

[1] UNAVCO
Boulder, CO 80301

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

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

Research areas supported include:

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

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

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

AMRC/AWS collaboration:

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

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

Field work completed for 2007-2008

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

Summary of University of Wisconsin – Madison fieldwork follows:

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

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

B. West Antarctic based operation

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

C. South Pole

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

D. Field work in Adelie Land

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

E. Field work by the Japanese Antarctic Research Expedition

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

F. Service performed on AWS located near Palmer Station

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

G. AWS maintained cooperatively with the British Antarctic Survey

Summary of positions and height

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

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

Current status

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

*Stations updated to CSI CR1000 based AWS units by BAS for 2007 to date.

•Data are sampled every 10 seconds then averaged every 10 minutes and transmitted.

•The data are downloaded from the ARGOS website every hour then decoded and error checked.

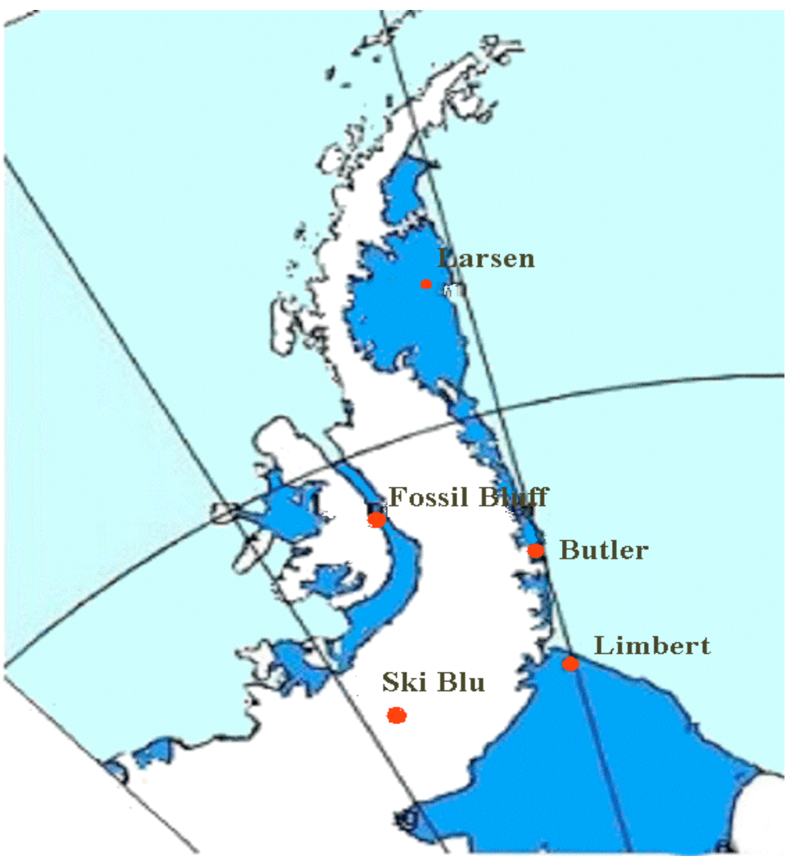


Figure 1. AWS sites maintained by the British Antarctic Survey (BAS)

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

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

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

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

Table 2. AWS unit not deployed for 2007

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

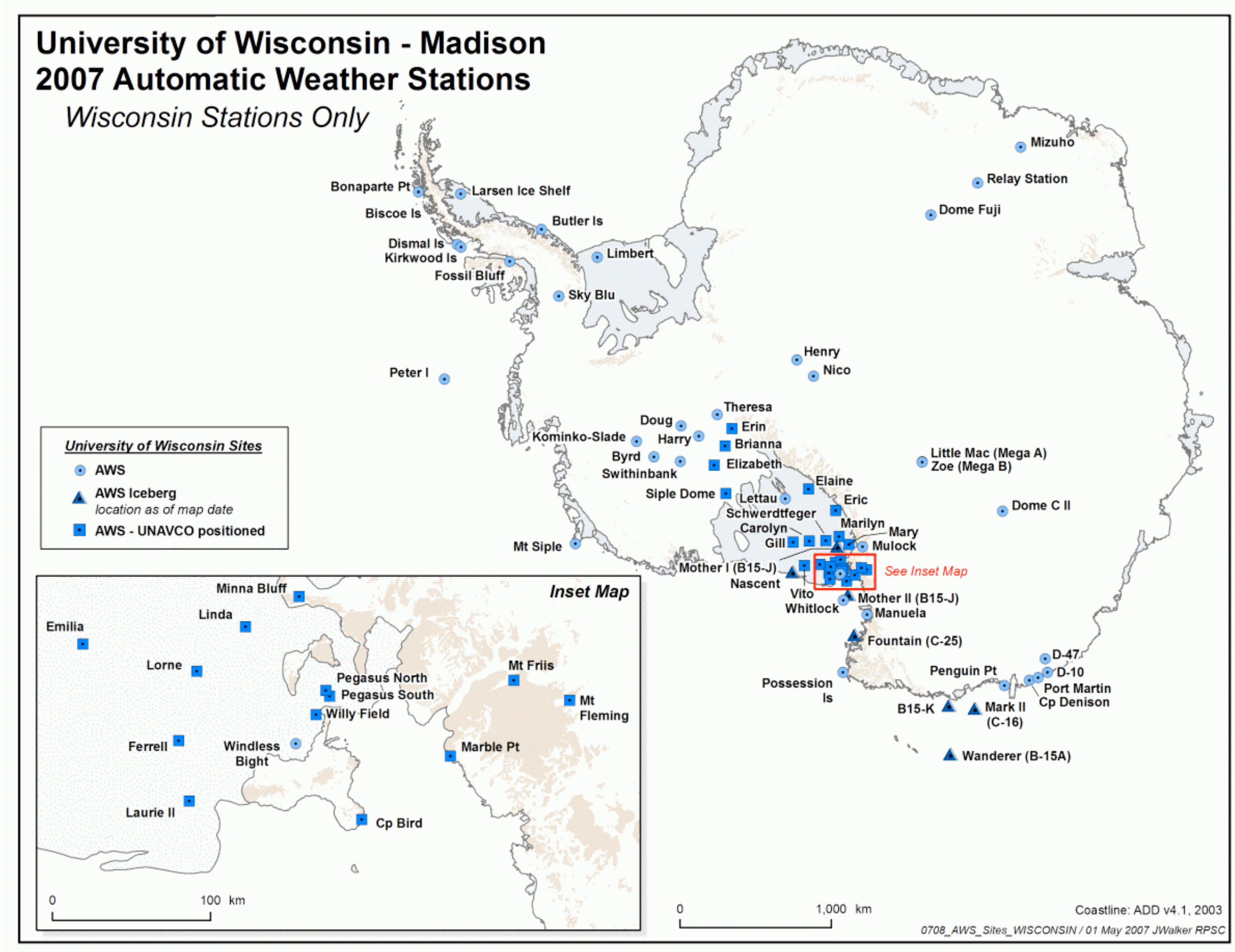


Figure 8. A map of Antarctica showing the locations of the University of Wisconsin's automatic weather stations for 2007. Identification of the sites is by the site name

Tentative AWS Field Work
2008/2009 Austral Summer

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

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

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

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

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

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

C. AWS operations in West Antarctica

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

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

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

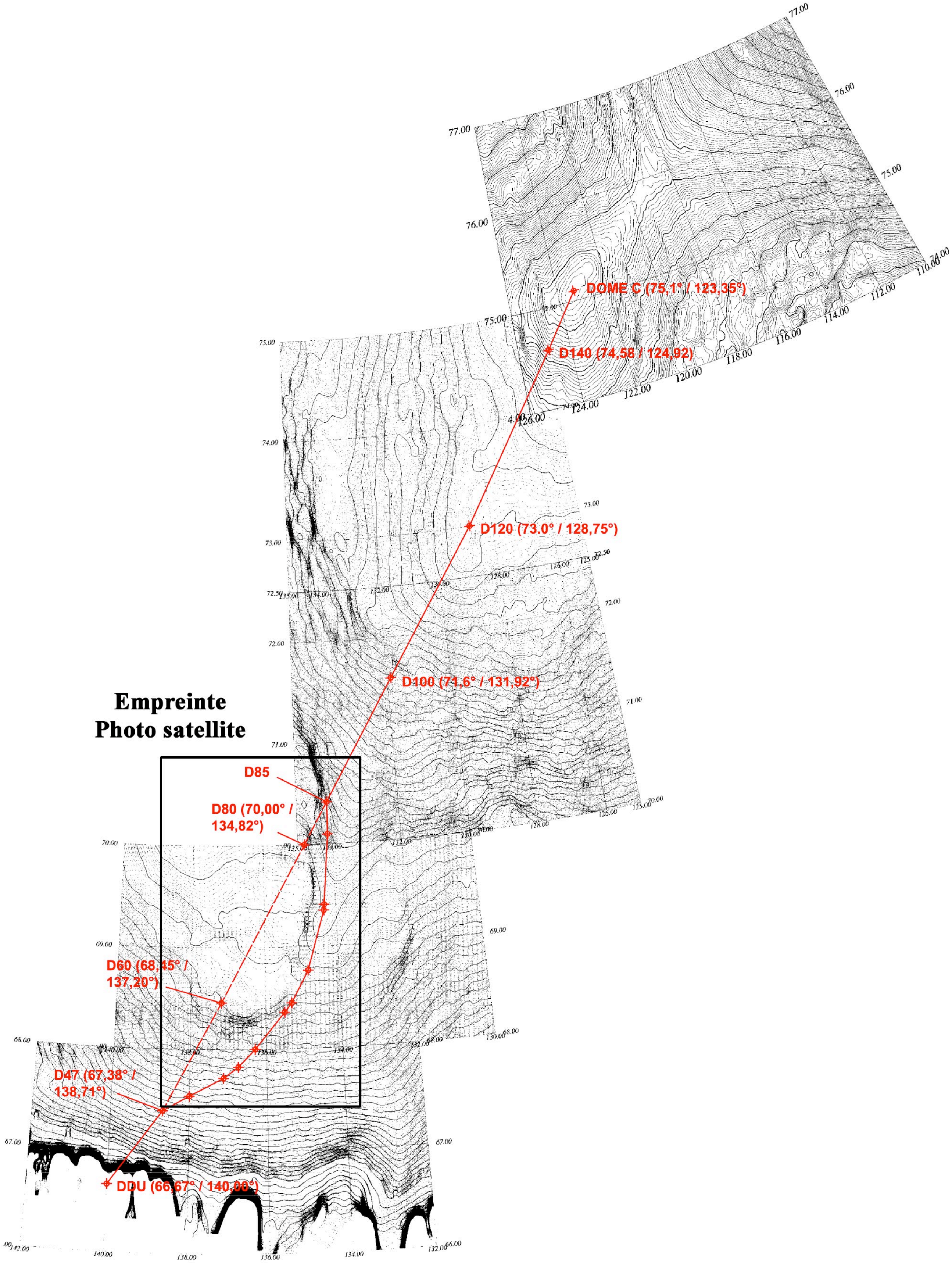
* May be serviced from South Pole

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

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

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

* Need to be replaced


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

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

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

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


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

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

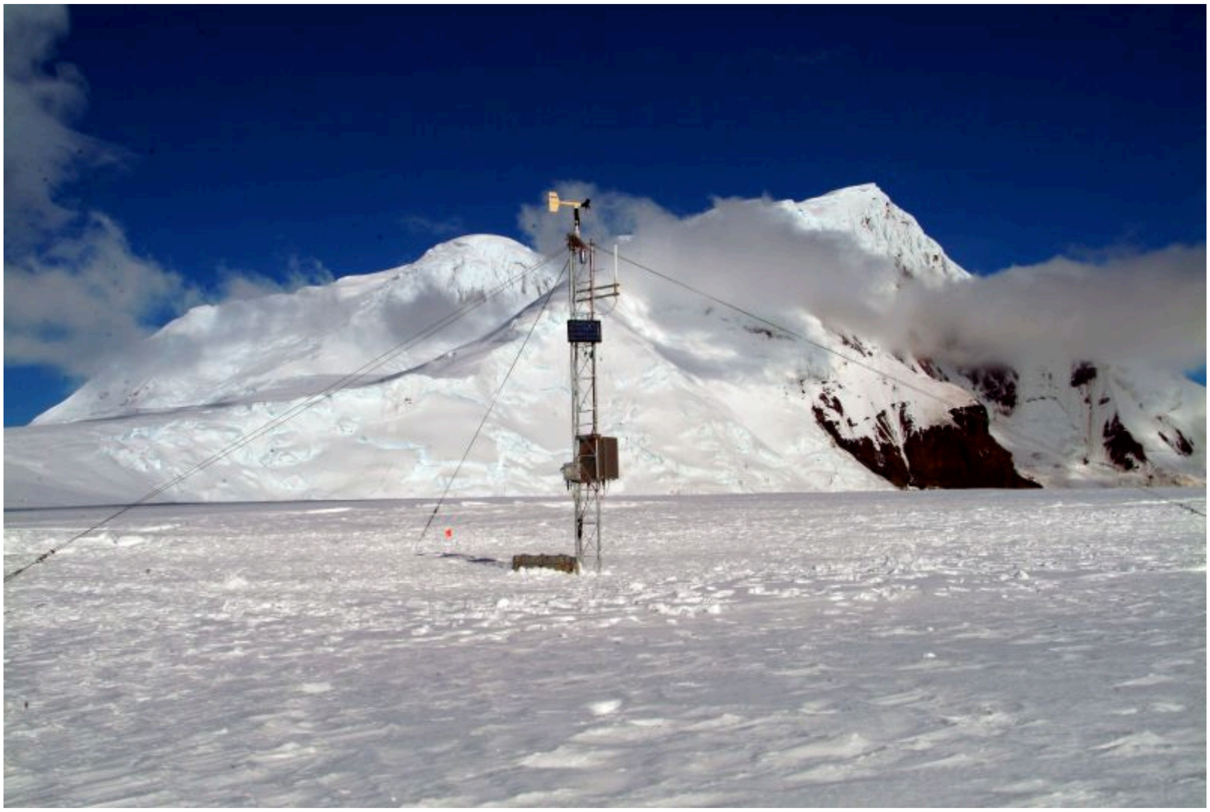
Larsen Ice	8926	Upgrade software	66.949oS	60.897oW	17
Butler Island	8902	Upgrade software	72.207oS	60.160oW	91
Fossil Bluff	8920	Upgrade software	71.33oS	68.283oW	63
Limbert	8925	Upgrade software	75.422oS	59.851oW	40
Ski-Hi	8917	Upgrade software	74.792oS	70.488oW	1395

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

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

H. AWS servicing of Peter I Island AWS

Peter I	8933 Service /New	68.769oS	90.670oE	90



I. WS Fieldwork in support of GLOBEC AWS.

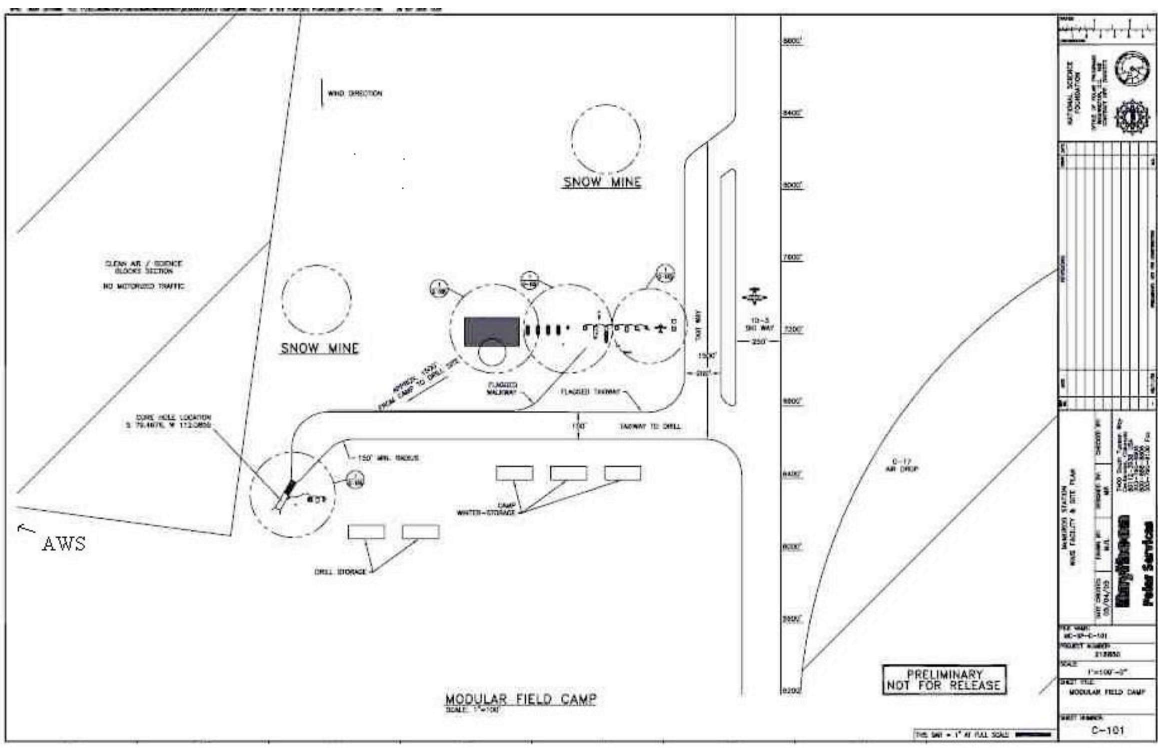
Kirkwood Isand*	8930 replace	68.340oS	69.007oW	30
Dismal Island*	8932 replace	68.087oS	68.825oW	10

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

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

*** Not received as of June 15**

Appendix A. Images of AWS at WAIS Divide camp



Figur

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

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

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

Automatic Weather Station Program
2010-2011 Field Season Report

Field Season Report Author: George A. Weidner[1,2]
Field Team members: Jonathan E. Thom[1], Melissa Nigro[3], Lee J. Welhouse[1]
Principal Investigator: Matthew A. Lazzara[1]

[1] Space Science and Engineering Center
University of Wisconsin-Madison
[2] Department of Atmospheric and Oceanic Science
University of Wisconsin - Madison
[3] Department of Atmospheric and Oceanic Science
University of Colorado – Boulder

The National Science Foundation's Office of Polar Programs funds the University of Wisconsin's Automatic Weather Station Program to design, fabricate, deploy, and maintain an array of automatic weather stations (AWS) 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 and/or solar radiation. 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 are 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 at approved sites around the Antarctic continent. This was the 31st field season for project O-283 (formerly S-283) under the direction of Principal Investigators (PI) from the University of Wisconsin – Madison. Emeritus Professor Charles R. Stearns, the PI of the AWS Program from 1980 to 2004, passed away on June 22, 2010. (see Dr. Charles Stearns).

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:

One of the unique aspects of maintaining the AWS observational network is the necessary fieldwork. A full time job in and of itself, keeping a network of 50 to 70 AWS systems operating, even with international partners, requires a devoted effort of AWS fabrication and repair team members doubling as field personnel. Flying to remote places around the Antarctic and dealing with polar weather conditions makes maintenance a challenge. The success of the AWS network would not be possible without the support of all those who help, directly or indirectly. Thanks go to Ken Borek Air, the 109th New York Air National Guard, PHI Helicopters, Raytheon Polar Services, our international partners in France, Australia, United Kingdom, Japan, New Zealand and China, and especially the Office of Polar Programs at the National Science Foundation in the USA.

1. INTRODUCTION

Automatic weather station (AWS) units are deployed to collect Antarctic surface weather observations in support of specific meteorological research projects as well as operational activities in Antarctica. The 2009 network consisted of 55 installed AWS units providing observations on the Ross Ice Shelf, east of the Transantarctic Mountains and north of McMurdo to the Adelie Coast, along the Antarctic Peninsula, West Antarctica, East Antarctic, and climatological locations such as the South Pole. Each unit measures air temperature, wind speed, and wind direction at the top of the unit's tower at a nominal height of three meters and air pressure at the electronics enclosure (Figure 1). Some AWS units also measure the relative humidity at three meters, vertical air temperature difference between 0.5 and 3 meters, snow accumulation, and solar radiation. Measurement heights relative to the actual surface at the site are nominal due to snow accumulation around the AWS unit.

2. DATA TRANSMISSION

Most transmitted AWS data are received and stored by the Data Collection System (DCS) on the NOAA series and MetOp series of polar orbiting satellites. The DCS data are retransmitted by the satellite for use in the High Resolution Picture Transmission (HRPT) broadcast at McMurdo and Palmer Station, Antarctica. The DCS data is also included in the Global Area Coverage (GAC) data, recorded on board the NOAA satellites and downloaded to Gilmore Creek, AK and Wallops Island, VA. These data are rebroadcast to a domestic satellite (DOMSAT) and this broadcast is received here at the University of Wisconsin-Madison. The data are processed into scientific units and are available for local use. CLS America (Service ARGOS), Largo, Maryland, receives the complete DCS data set and sends it to the University of Wisconsin-Madison where it is processed and distributed to the users.

This season saw the first deployment of non-Argos transmitting AWS. A prototype AWS using a Freewave modem was deployed at the Minna Bluff AWS site. The data is transmitted to a receiving system in McMurdo where it is stored and forwarded to users. A relay has been setup to provide this data over the Antarctic-Internet Data Distribution system using the Local Data Manager (LDM), making it available to both science and operational user communities.

3. AWS IDENTIFICATION AND LOCATION

Site location is defined by the latitude and longitude, which is determined by various methods: sun shots, angles to geographical features, aircraft data, ice breaker data, the platform location system of CLS America (Service ARGOS), and the Global Positioning System. AWS elevation is obtained by barometry and Global Positioning System (GPS) and should be correct to within +/- 5 meters. Site names were introduced for convenience. Table 3.1 lists the site name, ARGOS identification number, latitude, longitude, elevation, start date for the site, and the World Meteorological Organization (WMO) number for the site. Figures 2, and 3 show the locations of the AWS units in the Antarctic for 2009.

The ARGOS identification number (ID) is used to identify the data sets distributed to the users. AWS units are sometimes moved from one location to another, and as a result, the ID at a given site may change from year to year. The site name does not change. Table 3.2 lists the site name with the ARGOS ID, the site start date, and the ID start and stop dates.

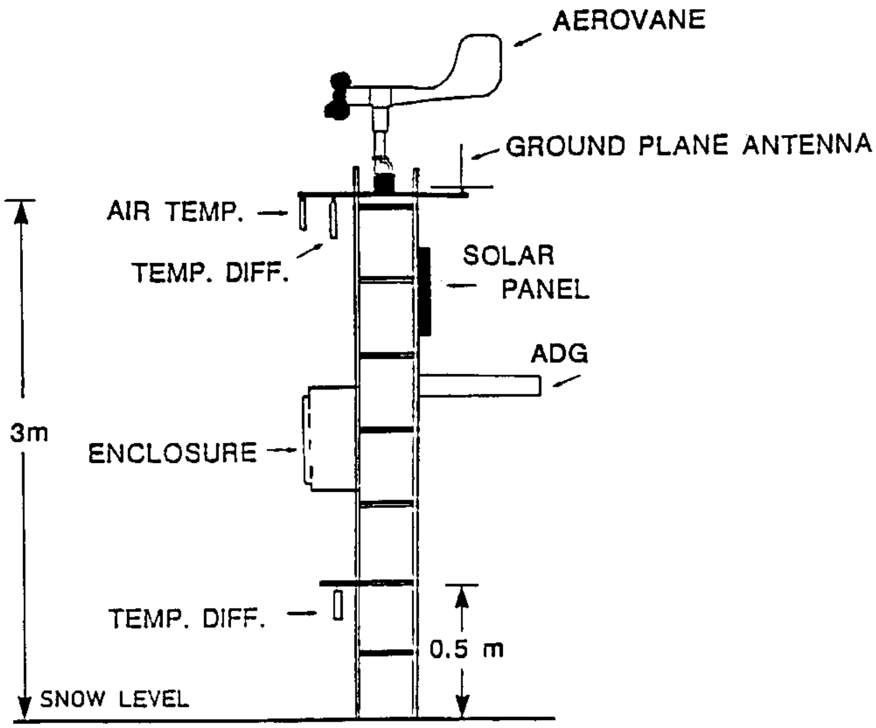


Figure 1. Layout of the AWS unit used in the Antarctic. The installed AWS unit has a 3-meter tower with a horizontal boom supporting the antenna, aerovane for measuring wind speed and direction, air temperature resistance thermometer, upper thermopile for measuring vertical air temperature difference, and the relative humidity sensor. The electronics enclosure is mounted at the midpoint of the tower. The gel cell batteries are placed at the tower base. The solar panel, located near the tower top, faces north. The Acoustic Depth Gauge (ADG) is installed on some of the AWS units to measure snow accumulation.

Chronological summary of 2010/2011 field season for O-283.

Willie Field extra equipment removed on 1-10-11

Sabrina full station replacement on 1-13-11

Marlene AWS site installed on 1-13-11

Tom AWS installed on 1-13-11

Lettau AWS full station replacement on 1-14-11

Janet AWS installed on 1-17-11

Swithinbank removal on 1-17-2011

Byrd old AWS removed, new AWS installed 1-18-2011

Megadunes AWS removal of 3 stations on 1-18-11

Station Removal from Mulock glacier 1-27-11

Franklin Island AWS (Whitlock) replaced with new AWS on 1-28-11

South Pole test site February 1 - 2 2011

Gill tower raise and full new set of instruments on 2-2-11

Marilyn Aerovane (Belfort) replacement on 2-3-11

Tall tower installation of instrumentation and power system on 2-3-11

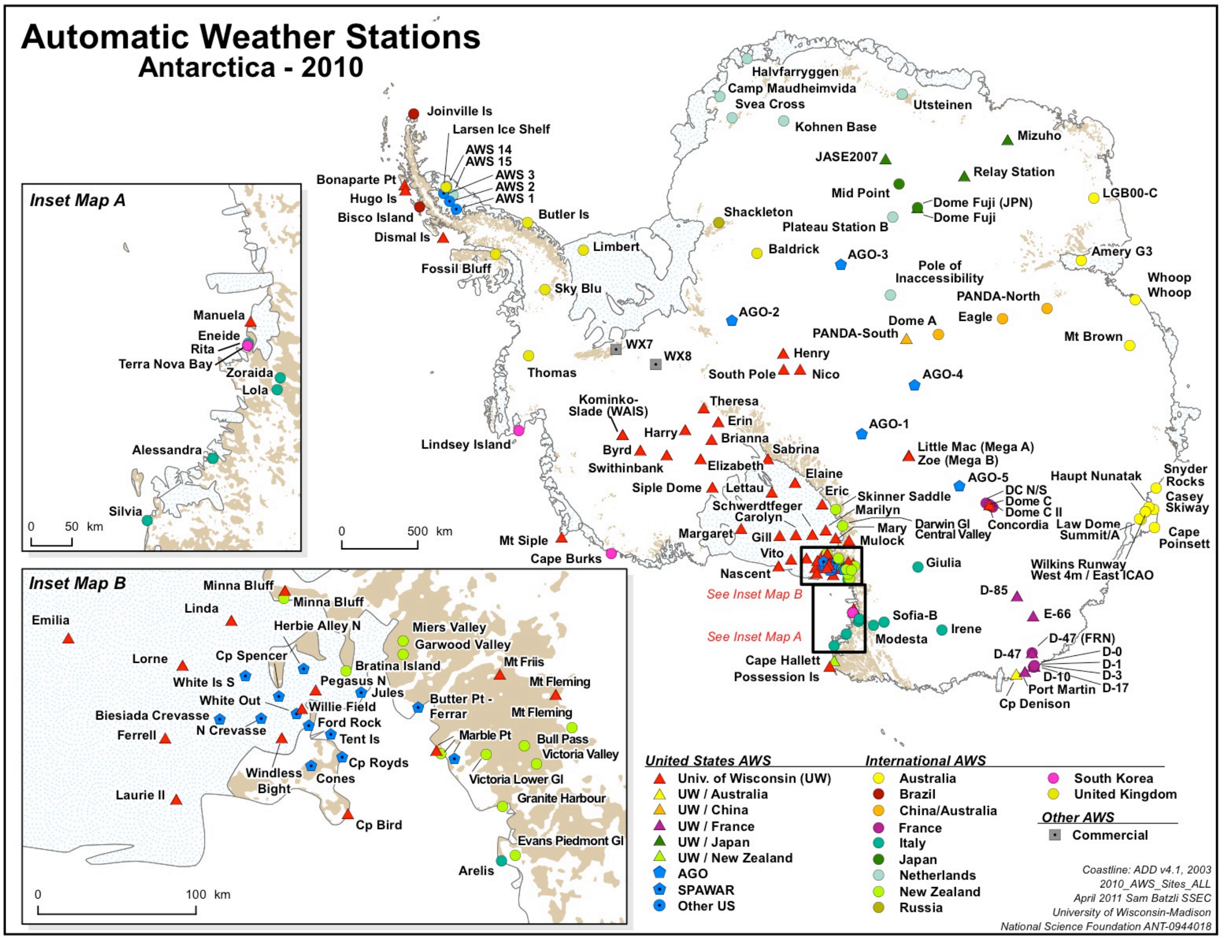
Minna Bluff replacement of Argos transmitter with Freewave transmitter on 2-4-11

Installation of a duplicate tower at Ferrell on 2-10-11

Willy VHF Station installation on 2-10-11

New names for AWS sites by Argos ID

8936	Janet
8987	Alexander (Tall Tower!)
8923	Evans Knoll
8922	Bear Peninsula
8930	Thurston Island
8908	Marlene
8919	Tom
8947	Ferrell II



AWS status table as of 1 June 2011

2516	Megadunes	AWSCR10X					Removed, PTT ID returned Argos
2769	Megadunes	AWSCR10X	80.775oS	124.526oE	2881		Removed, PTT ID returned Argos
8695	Vito	AWS2S	78.509oS	177.746oE	@+52		TX OK
8697	Eric	AWS2S	81.504oS	163.940oE	@+45		TX OK
8722	Carolyn	AWS2S	79.964oS	175.842oE	@+52		Now OFF Day 351
8900	Harry	AWS2B	83.003oS	121.393oW	945		Bat Low, Belfort WS now working
8901	Cape Bird	AWS2B	77.224oS	166.440oE	@42		TX OK, Temp issue?
8902	Butler Island	AWSCR1000	72.207oS	60.160oW	91	89266	TX OK
New 8903	Byrd	AWSCR1000	80.007oS	119.404oW	1530	89324	Installed Byrd Jan 18, 2011
8903	Byrd Station	AWS2B	80.007oS	119.404oW	1530	89324	Removed, return Madison
8904	Dome Fuji	AWSCR1000	77.31oS	39.70oE	3810	89734	New Batteries / Software installed
8905	Manuela	AWS2B	74.946oS	163.687oE	80	89864	Wind out - Belfort
8906	Marble Point	AWS2B	77.439oS	163.754oE	@108	89866	TX OK
8907	Mullock	AWS2HWS	79.018oS	170.819	@378		Removed Jan 30, 2011
New 8908	Marlene	AWSCR1000	83.65oS	167.40E	@82		RIS South #1 Jan 13, 2011
8909	Port Martin	AWS2HWS	66.82oS	141.40oE	39		OFF
New 8909	New AWS HWS	AWSCR1000	66.82oS	141.40oE	39		Installed Jan 6, 2011 by MHS
8910	Roosevelt Island	AWSCR1000	80.00°S	165.00°W	@67		TX OK

8911	Gill	AWS2B	79.985oS	178.611oW	@54	89376	Removed Feb 2, 2011, return MSN
New 8911	Gill	AWSCR1000	79.879oS	178.565oW	@53	89376	Installed Feb 2, 2011
8912	D85	AWS2B	68.912oS	134.655oE			Installed D85 Jan 22, 2011
8913	Schwerdtfeger	AWS2B	79.875oS	170.105oE	@54	89868	TX OK
8914	E-66	AWS2B	68.912oS	134.655oE			Installed Dec 8, 2010
8915	Sabrina	AWSCR1000	84.25 S	169.98 W	@88		Replaced with new AWSCR1000
New 8915	Sabrina	AWSCR1000	84.25 S	170.0W	@88		new AWS installed Jan 13,2011
8916	D-47	AWSCR1000	70,426oS	134.146oE			TX OK
8917	Ski-Hi	AWSCR1000	74.792oS	70.488oW	1395	89272	TX OK
8918	Relay Station	AWSCR1000	74.017oS	43.062oE	3353	89744	TX OK
New 8919	Tom	AWSCR1000	84.43 S	171.46 W	@80		Installed South #2 Jan 13, 2011
8920	Fossil Bluff	AWSCR1000	71.33oS	68.283oW	63	89065	TX OK
8921	Bonaparte Point	AWSCR10X	64.778oS	64.067oW	8	89269	TX OK
New 8922	Bear Peninsula	AWSCR1000	74.55oS	111.89oW	312		Holland, Installed Jan 14, 2011
8923	Madison	AWS2W					Spare Madison ID reused
New 8923	Evans Knoll	AWSCR1000	74.85oS	100.40oW	188		Holland, Installed Jan 12, 2011
8924	Nico	AWS2B	89.000oS	89.669oE	2935	89799	TX OK
8925	Limbert	AWSCR1000	75.422oS	59.851oW	40	89257	TX OK
8926	Larsen Ice	AWSCR1000	66.949oS	60.897oW	17	89262	TX OK
8927	Swithinbank	AWS2B	81.201oS	126.177oW	@959		Removed, Jan 21, 2011 return MSN
8928	Lettau	AWS2B	82.518oS	174.452oW	55	89377	Removed Jan 11, 2011 return MSN
New 8928	Lettau	AWSCR1000	82.475oS	174.587oW	@37.9	89377	Installed at Lettau Site Jan 14,2011
8929	Ferrell	AWS2B	77.865oS	170.819oE	@45	89872	TX OK
8930	Kirkwood Island	AWSCR10X	68.340oS	69.007oW	30		OFF
New 8930	Byrd - Holland	AWSCR1000	80.00oS	199.40oW	1530		Holland AWS/Rock Site 1
8931	Brianna	AWS2B	83.889oS	134.154oW	@525		Wind out - Belfort ws out
8932	Dismal Island	AWSCR10X	68.087oS	68.825oW	10		TX OK
8933	Peter I	AWS2B	68.769oS	90.670oE	90		OFF ID reused
New 8933	New AWS - HWS	AWSCR1000					Hobart to be returned
8934	Marilyn	AWS2B	79.921oS	165.550oE	@62	89869	Belfort replaced Feb 3, 2011
8935	Whitlock	AWS2B	76.142oS	168.394oE	@262	89865	OFF Removed Jan 28, 2011
8935	Santa Claus I	AWSCR1000	64.964oS	65.670oW	25		Data issues
8936	Madison	AWS2C					Spare ID reused
New 8936	Janet	AWSCR1000	77.17oS	123.39oW	@2085		Installed I-189 Jan 13, 2011
8937	Pegasus North	AWSCR1000	77.990oS	166.568oE	@5		TX OK
8938	Siple Dome	AWS2C	81.656oS	148.773oW	@668	89345	TX OK
8939	Minna Bluff	AWS2HWS	78.555oS	166.691oE	@47	89769	Removed Feb 4, 2011 return MSN
8947	French for return	AWS2B	67.397oS	138.726oE	1560	89834	To be returned to Madison
New 8947	Ferrell II	AWSCR1000	77.833oS	170.819oE	@45	89872	Installed Feb 10, 2011
8980	Emilia	AWSCR10X	78.509oS	173.114oE	@+50		TX OK
8981	Mount Siple	AWS2DH	73.198oS	127.052oW	230	89327	Low batteries/Pressure ??
8982	Windless Bight	AWSCR10X	77.728oS	167.703oE	61		TX OK
8983	Mary	AWSCR10X	79.303oS	162.968oE	@+58		TX OK
8984	Possession Is.	AWSDH	71.891oS	171.210oE	30	89879	TX OK
8985	Henry	AWS2B	89.011oS	1.025oW	2755	89108	TX OK
8986	D-85	AWS2B					Removed Jan 26, 2011 return MSN
New 8987	Alexander (Tall Tower!)	AWSCR3000	79.045oS	170.651oE	@55		Installed at Tall Tower Site

8988	Cape Denison	AWS2HWS	67.009oS	142.664oE	31		Removed Jan 6, 2011 return MSN
New 8988	Whitlock	AWSCR1000	76.142oS	168.392oE	@262	89865	Installed Jan 28, 2011
8989	Dome C II	AWS2B	75.121oS	123.374oE	3250	89828	TX OK
9116	Baldrick (BAS)	AWSCR1000	82.774 S	13.054 W	1968		TX OK
21355	Spare - Madison	AWS2B					Spare RMY/Telonics/No PG
21356	Lorne	AWS2B	78.250oS	170.000oE	@45		TX OK
21357	Madison	AWS2B					Spare RMY/Telonics/has PG
21357	Elaine	AWSCR1000	77.952oS	166.500oE	@8	89667	TX OK
21358	Theresa	AWS2B	84.599oS	115.811oW	1463	89314	TX OK
21359	Mizuho	AWS2B	70.70oS	44.29oE	2260		TX OK
21360	Laurie II	AWS2B	77.509oS	170.797oE	@37		TX OK
21361	Elizabeth	AWS2B	82.607oS	137.078oW	@519	89332	TX OK
21362	Linda	AWS2B	78.439oS	168.406oE	@43	89769	TX OK
21363	Erin	AWS2B	84.904oS	128.828oW	@990		TX OK
21364	WAIS K-S	AWS2S	79.468oS	112.086oW	@1833		TX OK
NO TX	WAIS K-S	AWSCR1000	79.468oS	112.086oW	@1833		Snow temp, New batteries installed
28336	Nascent	AWSCR10X	78.127oS	178.497oE	30		TX OK
28338	Cape Hallet	AWSCR10X	72.190 S	170.160 E	@14		TX OK
28339	Mt Friis	AWSCR10X	77.747oS	161.516 E	@1581		Converted to logging, 12/20,2010
30305	JARE 2008	AWS2B	77.000 S	20.000 E	3400		TX OK
30374	D-10	AWSCR10X	66.71oS	139.83oE	243	89832	TX OK
30393	Mt Fleming	AWSCR10X	77.533oS	160.276 E	@1868		Converted to logging, 12/20,2010
30416	Panda South	AWS2B	82.246 S	75.989 E	4027		
30423	Nascent temp string	AWSCR10X	78.127oS	178.497oE	30		Snow temperature data
30477	Willy Field	AWSCR1000					Removed 1/10/11 ID returned to Argos
New VHF AWS	Willie Field test	AWSCR1000	77.867oS	166.947oE	@12		Installed Feb 10, 2011 (NO VHF)
New VHF AWS	McMurdo/Minna Bluff	AWSCR1000					Installed Feb 4, 2011
ICEBERG AWS							
15930 (CR10X)	C16	Transmitting					OFF day 349 (was tx default only)
30504 (CR10X)	B15J Mother 1	Transmitting					OFF
30580 (CR10X)	B15J Mother 2	Transmitting					TX OK
Argos 3 AWS	Madison	AWSCR1000					Test AWS
CR10X AWS							
	8922 (Seimac TX)	AWSCR10X					Madison
	28339 (Seimac TX)	AWSCR10X					Madison
	30393 (Seimac TX	AWSCR10X					Madison (No CR10X)
Inactive Sites							
	J.C.	Not active	85.070oS	135.516oW	549		
	Doug	Not active	82.315oS	113.240oW	1433		
	Scott Island	Not active	67.37oS	179.97oW	30	89371	
	Young Island	Not active	66.229oS	162.275oE	30	89660	
	Penguin Point	Not active	67.617oS	146.180oE	30	89847	
	Pegasus South	Not active	77.990oS	166.568oE	@5		
	Racer Rock	Not active	64.067oS	61.613oW	17	89261	

Cape Denison Servicing
January 6 Mawson Hut Society field team replaces Cape Denison.

On 1/6/11 6:38 AM, David Tingay wrote:

Dear Matthew and George,
I removed the old AWS and replaced it with the new unit (or some thereof) today, thanks to your excellent instructions, which displayed beautifully on the iPad on site!

To summarise:
Items of old AWS removed and replaced with new components intended for Port Martin:
1. Sensor Boom
2. High wind speed system
3. Spoke Antenna
4. AWS enclosure

All cable were disconnected during dismantling and reconnected in the order specified.

I have left the original batteries (all look good when tested), solar panel (photo attached) and junction box (when I checked power cable as per your instructions was producing a nice 12.6V). If you want I can put on the new junction box and panels but it looks fine to me.

Please see attached a photo of the spoke antenna - when we unpacked the box the antenna arms are bent down wards. I assume they should be perpendicular.
The old antenna looked fine but I had basically taken it off so thought I would put the new one on. Do you want me to bend the antenna spokes or leave then?
Out of interest, once I connected the little 12V connector within the enclosure the unit should auto-power up - I saw no lights etc so I hope it has happened.
Enclose a photo of the AWS enclosure box (D52552) in case you need to confirm with records. Interested to know if it is up and going?
If not please advise ASAP. If it is up and running how do we access the data?

We expect blizzard conditions from tomorrow evening our time.

Cheers
David
Dr David Tingay
2010 - 2011 Mawson's Huts Foundation Expedition

Please visit our blog:
www.mawsons-huts.org.au\cms\blog\

Automatic weather station operational once more at Cape Denison

January 8th, 2011

Accurate and detailed recording of the meteorological conditions were a feature of Mawson's 1911 – 1914 Australasian Antarctic Expedition. Back then all measurements were manually recorded, quite a task as it often involved going outside in horrendous conditions.

Now days accurate meteorological data is just as important in Antarctica but the process has been automated. The use of Automatic Weather Stations (AWS) means that meteorological data can be recorded in remote and uninhabited parts of the continent.

One such AWS exists at Cape Denison and is managed by the Antarctic Meteorological Research Center in the University of Wisconsin-Madison as part of the US Antarctic Program.

Unfortunately the Cape Denison AWS has had a broken wind direction indicator for a couple of seasons meaning this all important data, used by forecasters as part of the World Weather Watch program, has been incomplete.

This season we were sent an entirely new AWS system to install. The AWS sits on a tower on a high ridge behind Mawson's Huts. The system consists of a series of atmospheric, wind and temperature sensors with an Argos transmitter that sends the data back to the University of Wisconsin. The base of the tower houses the control box enclosure, solar panels and battery bank to power the unit through the long dark winter.

Yesterday we had a calm and clear day which was ideal to scale the tower and remove the old system and replace with the new one. The whole process took about 6 hours as caution was needed hoisting and fixing the delicate instruments. In addition, the proximity to the coast means that fixing bolts quickly become corroded. Not that there was any complaining with a spectacular view across Boat Harbor and beyond.

Overnight we received confirmation that the system was operational and recorded wind speeds of close to 40 knots whilst we were tucked up in our sleeping bags. Today, a marginal but far from awful day, wind speeds of 30 knots were recorded with lulls of 15 knots. Not hard to see why this place is the windiest place on Earth.

It is a great pleasure to be able to help the on going, and essential, collaborative science that occurs down here.

Dr David Tingay

Ed note: once the University AWS website has been re-jigged to show the data for all to see, we will put the link on the blog.

Willie Field servicing on 1/10/2011.

Team: Melissa Nigro and Lee Welhouse

A picture of the station upon arrival is shown below. We removed the instrumentation from the Willie Field AWS, except for the solar panel and the batteries. The solar panel is mounted to the tower with the cable coiled and taped to the tower. The battery cables have been taped to prevent moisture from getting into the plug, and the cables have been secured to the tower with electrical tape.

The experimental tower at Willie Field (pictured below Figure Willy Experimental) has been removed. We dug down about 6 ft to reach the bottom of the tower. All of the tower sections and the base have been recovered. Additionally, the power cable that had previously been strung to the battery bank of the radiation test site was removed.

Willy Field AWS tower

Willy Field Experimental Station Tower

Sabrina AWS servicing

Coordinates: -83.65, -167.40 (83.65 S , 167.40 W)
Full station replacement on 1-13-11 (approximate ground time 2.5 hours)
Team: Melissa and Jonathan
Pilots: Randy and Travis

We had good weather. About a 1.5-hour flight from CTAM.

Upon arriving at the station, the snow line was about a foot down from the top of the 5' tower section (from looking at the installation pictures of Sabrina, my guess is that there has been approximately a foot of accumulation since Feb 2009). A before picture is shown below. We found north with the handheld GPS. The original install was pointed at approximately 320 deg (therefore a -40 deg correction should be applied to the previous wind direction measurements).
UNAVCO GPS was set out. Approximate times were 11:15-1:45 (very rough estimate).
We removed all of the instruments from the station. The original heights were as follows:

ADG	29 cm
Wind	266 cm
Lower temp	90 cm
Upper temp	266 cm
Enclosure	110 cm
J-box	82 cm
Solar panel	168 cm

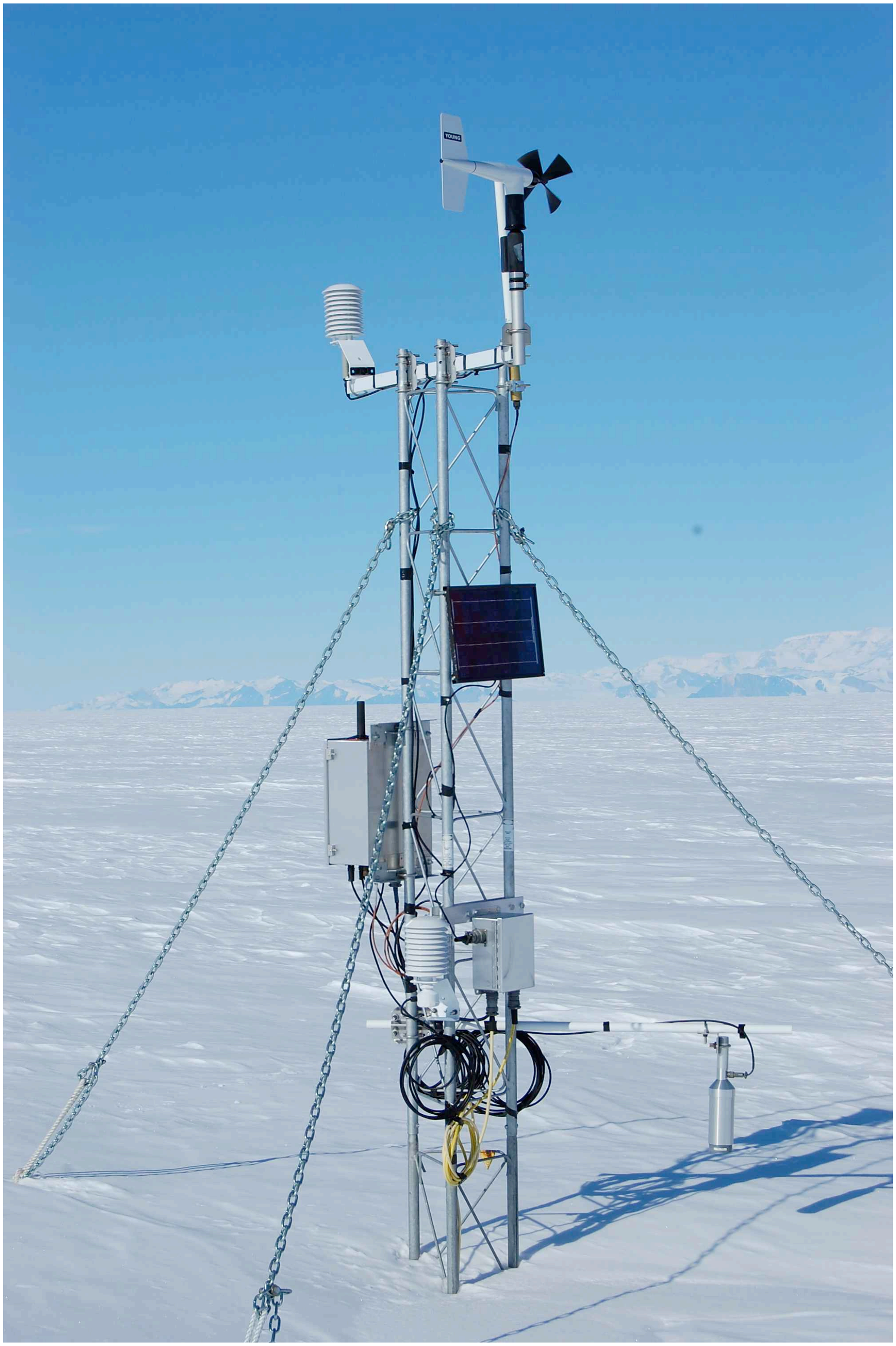
We added a 7' tower section and installed all new instruments (see list of heights below). Two additional batteries were added to the site. The enclosure number is 14635 and the Argos ID is 8915. The computer was plugged in and we received good data.

Final instrument heights:

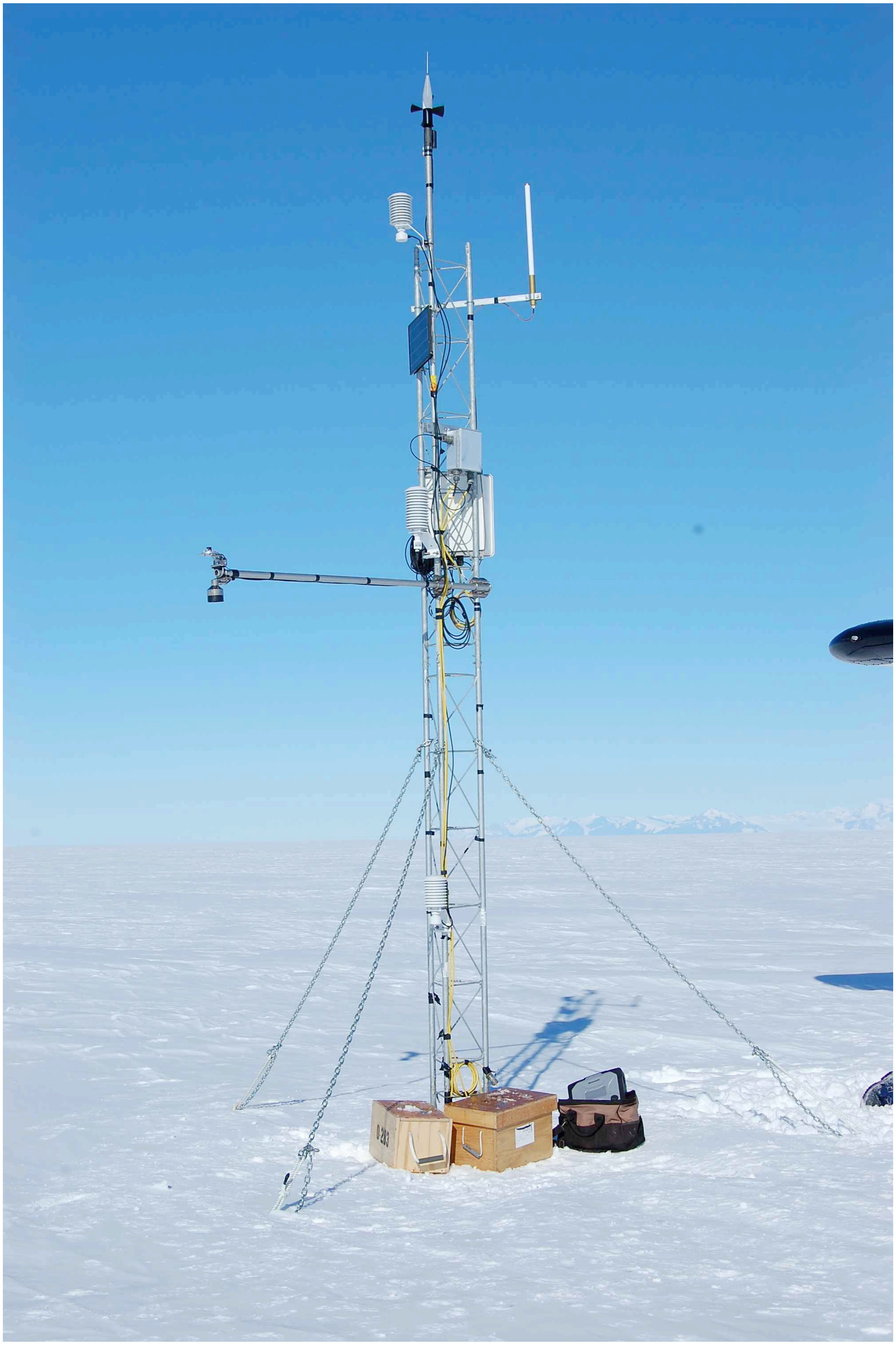
ADG	265 cm
Wind	521 cm
Lower temp	122 cm
Upper temp	480 cm
J-box	350 cm
Pyronometer	287 cm
HMP	216 cm

I've attached before and after photos below. I have full resolution pictures if anyone wants them when I return to the States. A few other notes that are quite important...

We re-used the junction box and solar panel. So, the panel plugs and battery plugs will be the old style. We also replaced the power plug in the junction box (to fit with the new enclosure). This may need to be upgraded on a subsequent visit. Installed on 1-13-11 (approximate ground time 2 hours).



Sabrina AWS before servicing on January 13th 2011



Sabrina AWS after servicing on January 13th, 2011

Priority 1 site south Ross Ice Shelf - Name Marlene AWS site
Team: Melissa and Jonathan
Pilots: Randy and Travis

This was about a 10-15 minute flight from Sabrina. The ground is smooth and crevasse free. The snow is a bit softer here.

UNAVCO GPS was set out. Approximate times were 2:15-4:15 (very rough estimate).

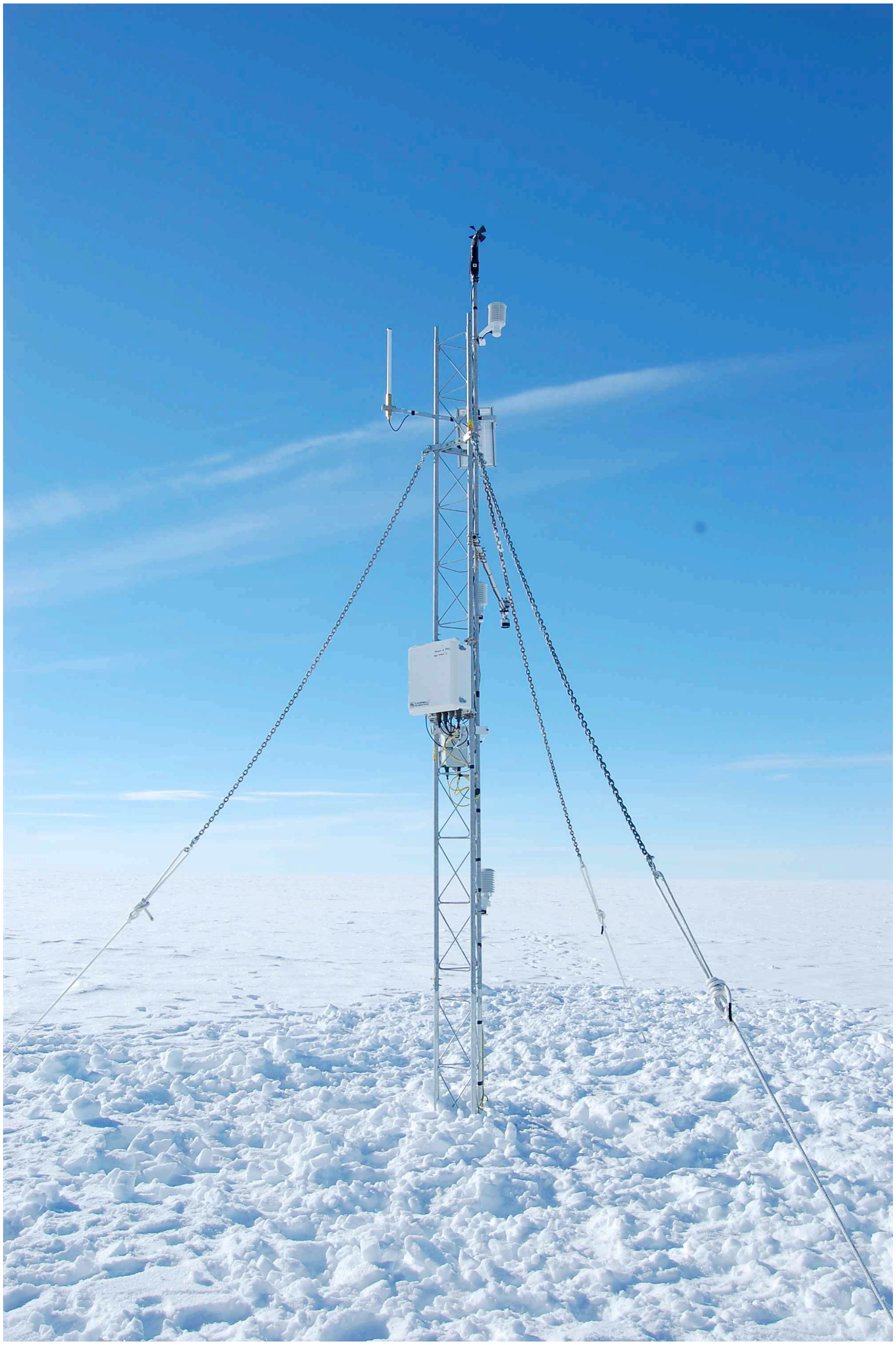
A new station was installed with a 5' base and two 7' tower sections. The tower and guides have been installed approximately 2' into the snow. 2 sets of battery boxes were installed at this site. All instruments are the new style AWS. The enclosure number is 14632 and the Argos ID is 8908.

The final instrument heights are:

Lower temp sensor	130 cm
J-box	213 cm
Enclosure	244 cm
HMP (humidity probe)	324 cm
Boom (ADG and pyronometer)	357 cm
Upper temp sensor	521 cm
Aerovane – RM Young 05103	560 cm

Final picture of the station shown below. Again, I have these in full resolution (and other pics) if anyone wants them.

Melissa



Marlene AWS site after installation on January 13th, 2011

Priority 2 Site south Ross Ice Shelf – Named Tom AWS site
Installed on 1-13-11 (approximate ground time 1.5 hours)
Coordinates: **-84.43, -171.46**

Team: Melissa and Jonathan
Pilots: Randy and Travis

This was about a 20-30 minute flight from Priority #1. The ground is smooth. No crevasses in the immediate area (satellite imagery shows a crevasse area approximately 8.5 km to the south, southwest). The snow is more wind blown, with a crust layer in this area.

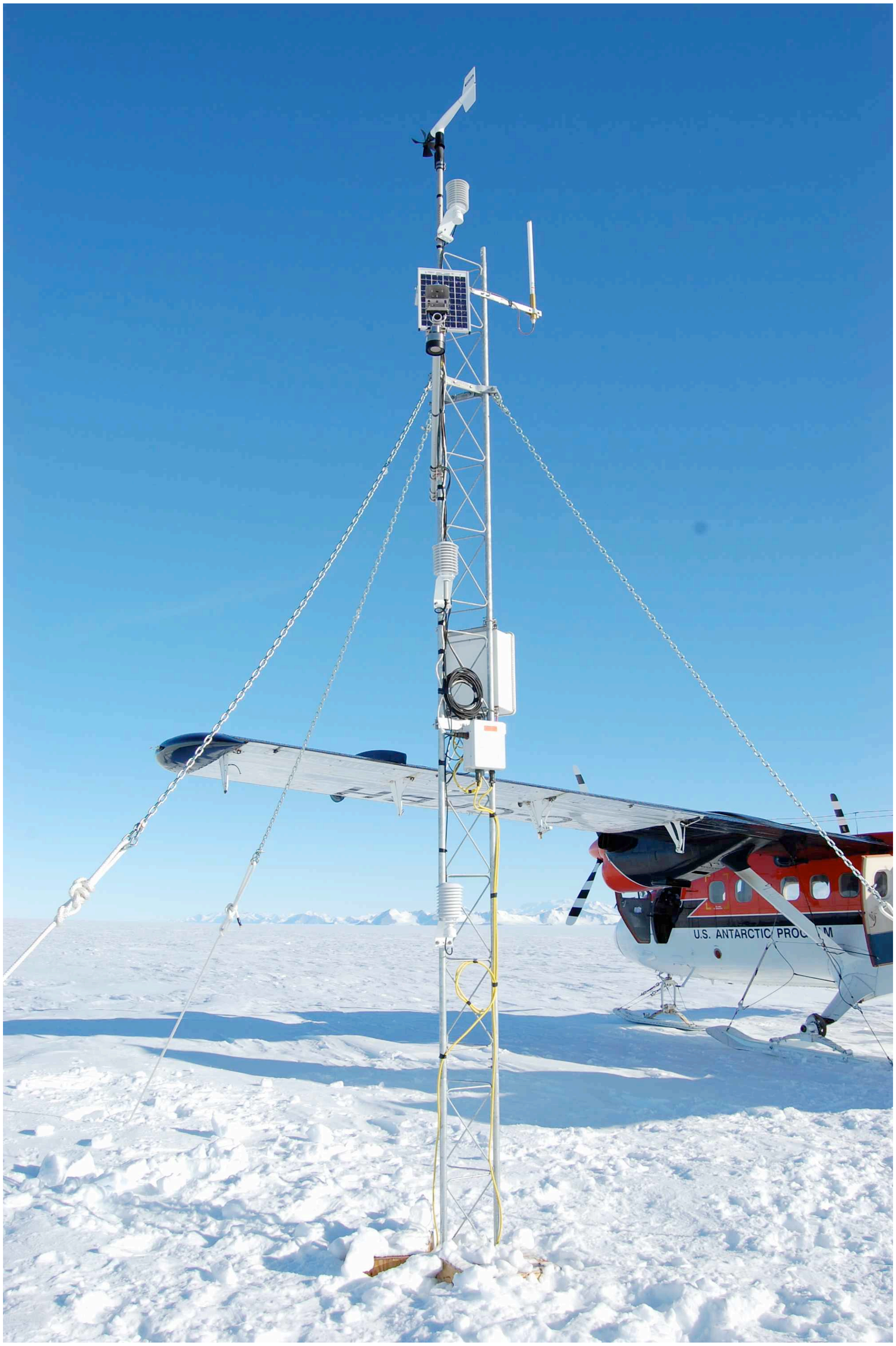
UNAVCO GPS was set out. Approximate times were 4:30-6:30 (very rough estimate).

A new station was installed with a 5' base and two 7' tower sections. The tower and guides have been installed approximately 2' into the snow. 2 sets of battery boxes were installed at this site. All instruments are the new style AWS. The enclosure number is 14633 and the Argos ID is 8919.

The final instrument heights are:

Lower temp	145 cm
J-box	217 cm
Enclosure	260 cm
HMP	307 cm
Boom (ADG and pyronometer)	372 cm
Upper temp	527 cm
Aerovane	560 cm

Picture of the newly installed station shown below. Again, I have these in full resolution (and other pictures) if anyone wants them.



Tom AWS after installation on January 13th, 2011

<u>Lettau AWS</u>
Full station replacement on 1-14-11 (approximate ground time 3 hours)

Team: Melissa and Jonathan
Pilots: Randy and Travis

The weather started out good, but the clouds moved in on us quickly. About a 1.75 hour flight from CTAM.

UNAVCO GPS was set out. Approximate times were 10:45-1:45 (rough estimate).

We removed all of the instruments from the station (a before picture is shown below). The original heights were as follows:

Lower temp	21 cm
J-box	63 cm
Enclosure	102 cm
Solar Panel	162 cm
Upper temp	199 cm
Boom (old style for aerovane)	218 cm

The station had the old style tower sections. Therefore, we bolted a 5' base and two 7' tower sections to the old tower. The new tower was installed about 2' in the snow supported by a plywood base and new guidelines. The 5' tower section was secured to the old tower using 2 sets of metal plates (this can be seen in the second "after" picture). Two additional batteries were added to the site. A full set of new style AWS instruments were installed at the site. The enclosure number is 14414 and the Argos ID is 8928. The computer was plugged in and we received good data.

Note, the new style vertical aerovane boom was misplaced. Therefore, the white boom (that was removed from Sabrina) was used to install the aerovane. The next time the site is visited a new style vertical aerovane boom should be installed.

Final instrument heights:

Lower temp	135 cm
J-box	220 cm
Enclosure	252 cm
HMP	310 cm
Boom (ADG and pyronometer)	380 cm
Upper temp	530 cm
Aerovane	555 cm

Lettau AWS site before servicing January 14th , 2011

Lettau AWS after servicing on January 14^{th}, 2011

<u>Megadunes AWS removal</u>
Removed 3 stations on 1-18-11

Team: Melissa and Jonathan
Pilots: Randy and Travis

Megadues was about a 2.5 hour flight from CTAM.

We visited the most northern site first (approximate ground time 1.5 hours).
Upon arriving at the station, the wind generator was no longer working. The station instruments were fully above the snow surface.

UNAVCO GPS was set out. Approximate times were 1:45-3:15 (very rough estimate).

We removed the AWS plywood box (this houses both the batteries and the AWS), which was about 1' below the snow level. This box has been marked with a "#1" in black marker. The full tower and instruments were removed (again, about 1' below the snow level). The antennae and mounting pole were removed. The wind generator and mounting pole were removed. The solar panel was removed.

We visited the middle site next (approximate ground time 0.5 hours). This was about a 5 min taxi from the first site.

UNAVCO GPS was set out. Approximate times were 3:15-3:45 (very rough estimate).

This station did not have a tower. A cup anemometer and temperature sensor were installed on a single pole. The AWS plywood box for this station was removed. Again, it was about 1' below the snow level. The pole, cup anemometer and temperature sensor were removed. The antennae and mounting pole were removed. The solar panel was removed.

We visited the most southerly site late (approximate ground time 1 hour). This was about a 10 min taxi from the second site. The snow was more rough and wind blown in this area.

UNAVCO GPS was set out. Approximate times were 3:45-4:45 (very rough estimate).

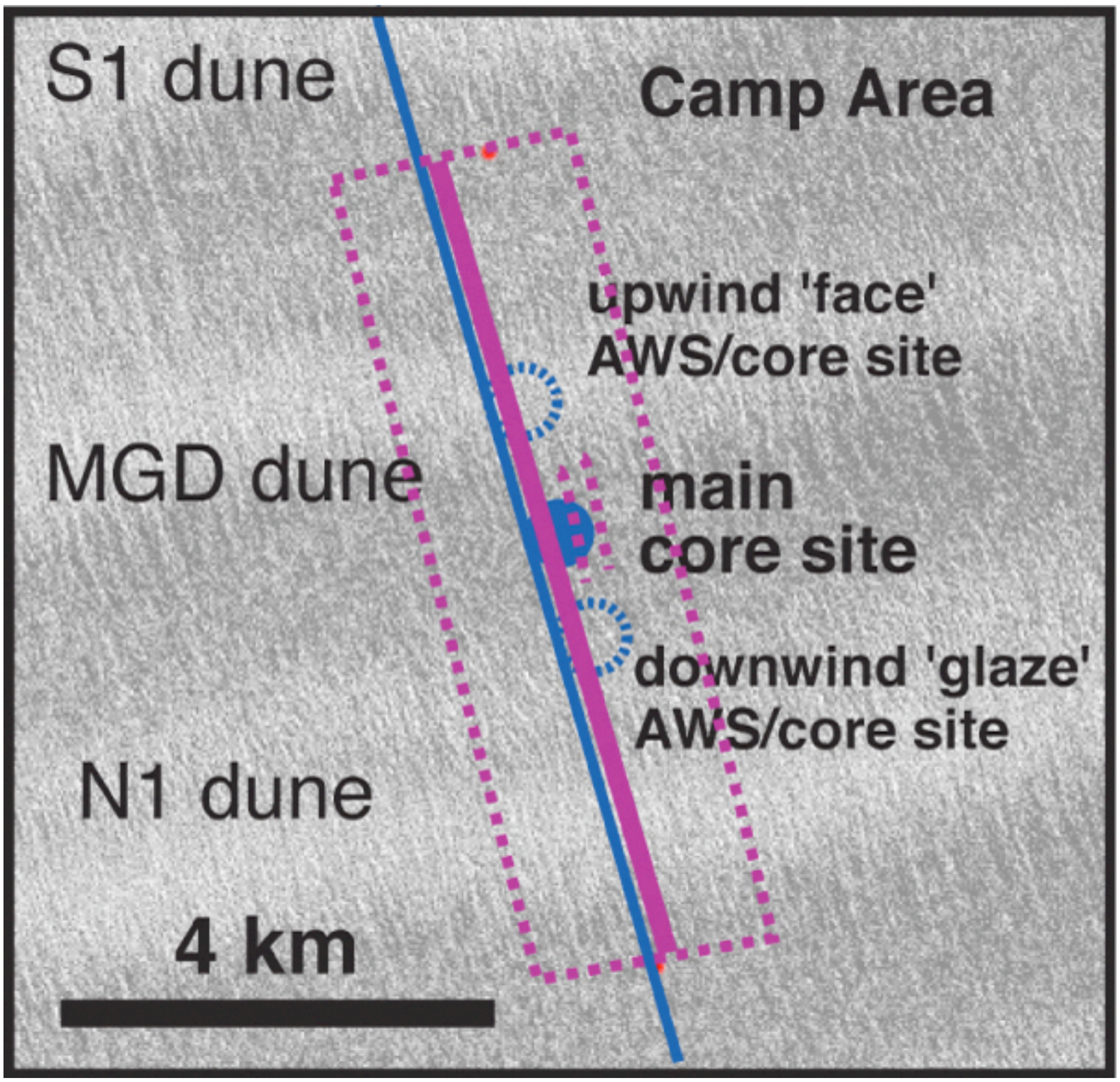
Upon arriving at the station, the wind generator was no longer working, the solar panel was buried by snow and the cup anemometer was buried by snow and no longer working. This site had significantly more accumulation than either of the other sites.

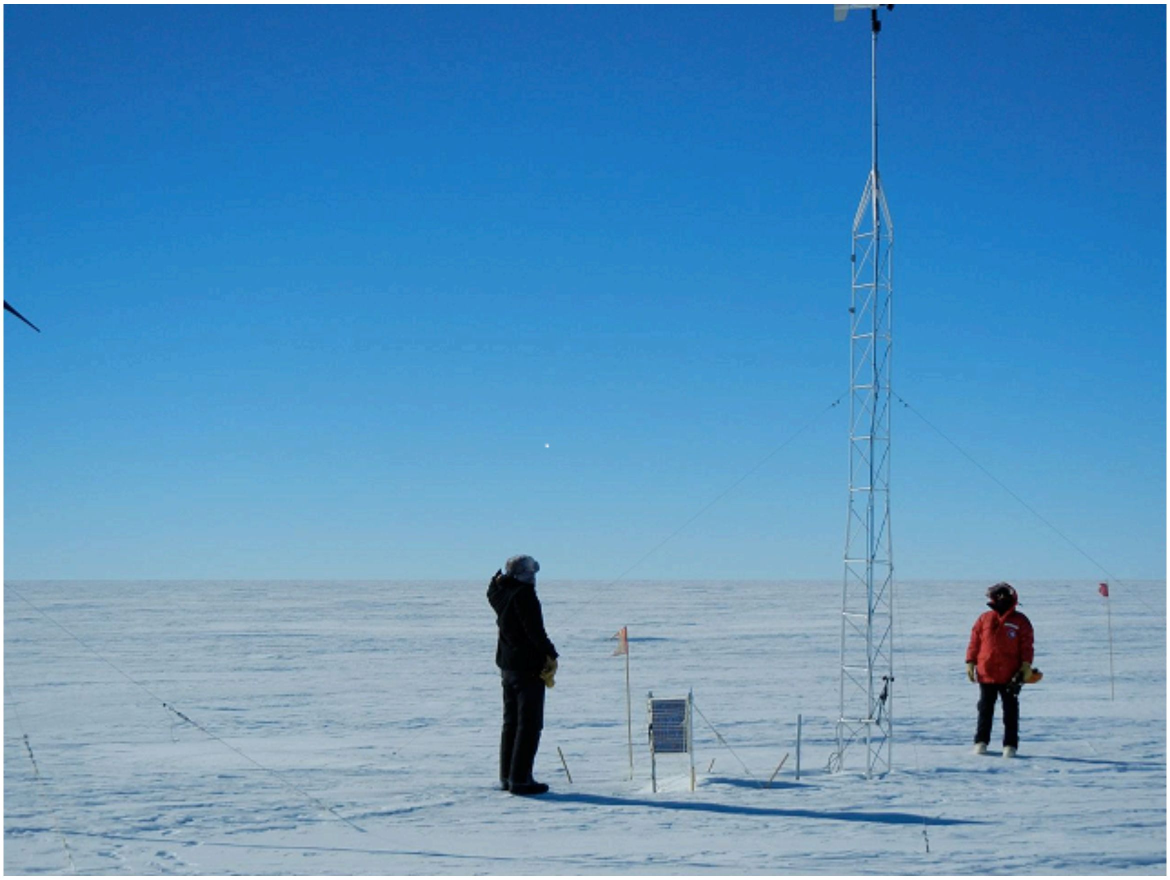
We removed the AWS plywood box, which was about 4-4.5' below the snow surface. The towers and all instruments were removed (again the bottom of the tour was about 4-4.5' below the snow surface). The antennae and mounting pole were removed (although, we were unable to remove the very bottom of this mounting pole and it had to be cut). The wind generator and mounting pole were removed. The solar panel was removed.

Melissa

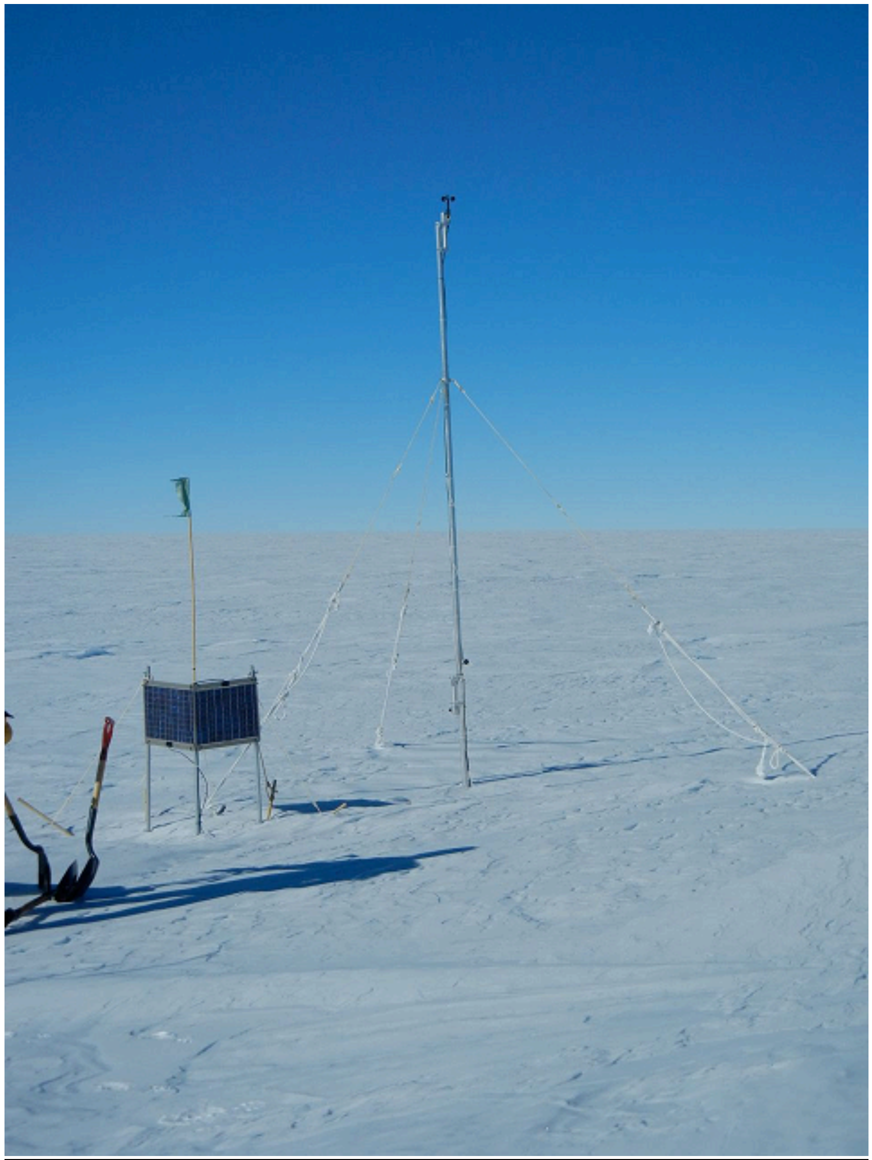
Mac site (MGD 160 AWS, ARGOS ID 2516):
Latitude: 80.79008° S
Longitude: 124.43450° E
Elevation: 2884 meters above WGS84 ellipsoid

Zoe site (N1 360 AWS, ARGOS ID 2769):
Latitude: 80.77546° S
Longitude: 124.52668° E
Elevation: 2881 meters above WGS84 ellipsoid

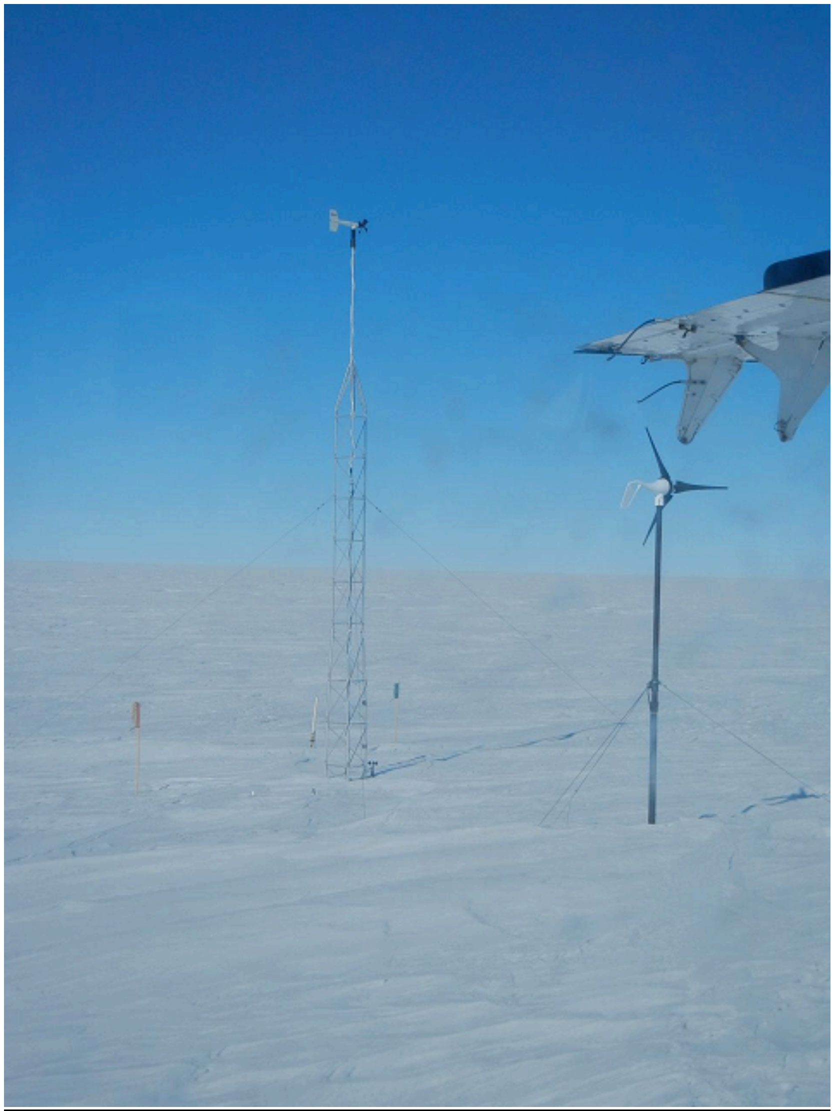




North Megadunes



Middle Megadunes



South Meagdunes

Janet AWS Installation
I-189 Fuel Cache, New Station install. Ground time approximately 5 hours.

Team: Lee, Todd, and Cecelia
Pilots: Lexy, and Claire

Flying out of Byrd with the assistance of two camp members we were able to install a station at I-189. Instruments heights and notes follow:

Enclosure # 14413
Argos ID # 8936

Final Component Heights (cm):

Lower T	125
ADG	145
Pyronometer	173
Junction box(measured from bottom)	120
Enclosure	159
Upper T	379
HMP	378
Aerovane	437

Janet AWS after installation on January 17^{th}, 2011

Janet AWS after installation on January 17th, 2011

Byrd AWS conversion

Field Team: Lee Welhouse, Galit Sorokin, Andrew Lloyd, Katie Koster

Final conversion from AWS2B type AWS to CR1000 type AWS completed on 1-18-2011.

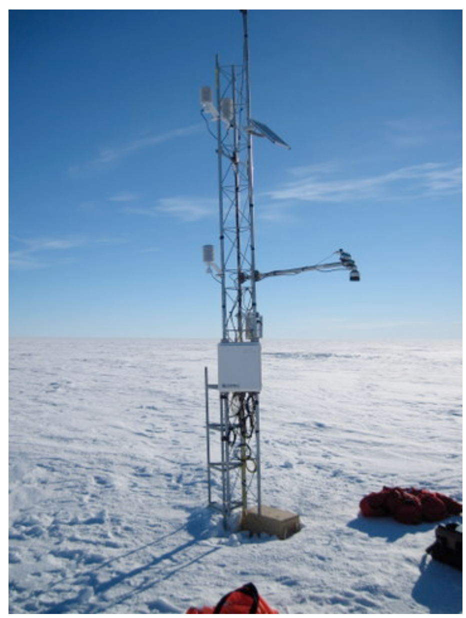
Multiple trips were taken to the station to ensure correct installation.
On 1-14 a new prop was installed. Then the station was replaced with a new enclosure and instrumentation. Two boxes of batteries, the boom, the solar panel, enclosure, and junction box were recovered. One of the plugs was locked in place so the cable was cut. The old Boom height was at approximately 162 in. The new station was installed on 1-16, and an adjustment to the direction of the aerovane was performed on 1-19 to ensure prevailing wind did not occur in a dead spot in the potentiometer. Site was turned 180 degrees normal southern alignment.

Old heights:

Boom	162 in
Solar Panel	133 in
Junction	105 in
Enclosure	65 in

New instrument measurements.

Aerovane	192 in
Upper temp	144 in
RH	144 in
Pyronometer	110 in
Lower Temp	106 in
ADG	104 in



New AWS installed at Byrd AWS site on January 18th, 2011

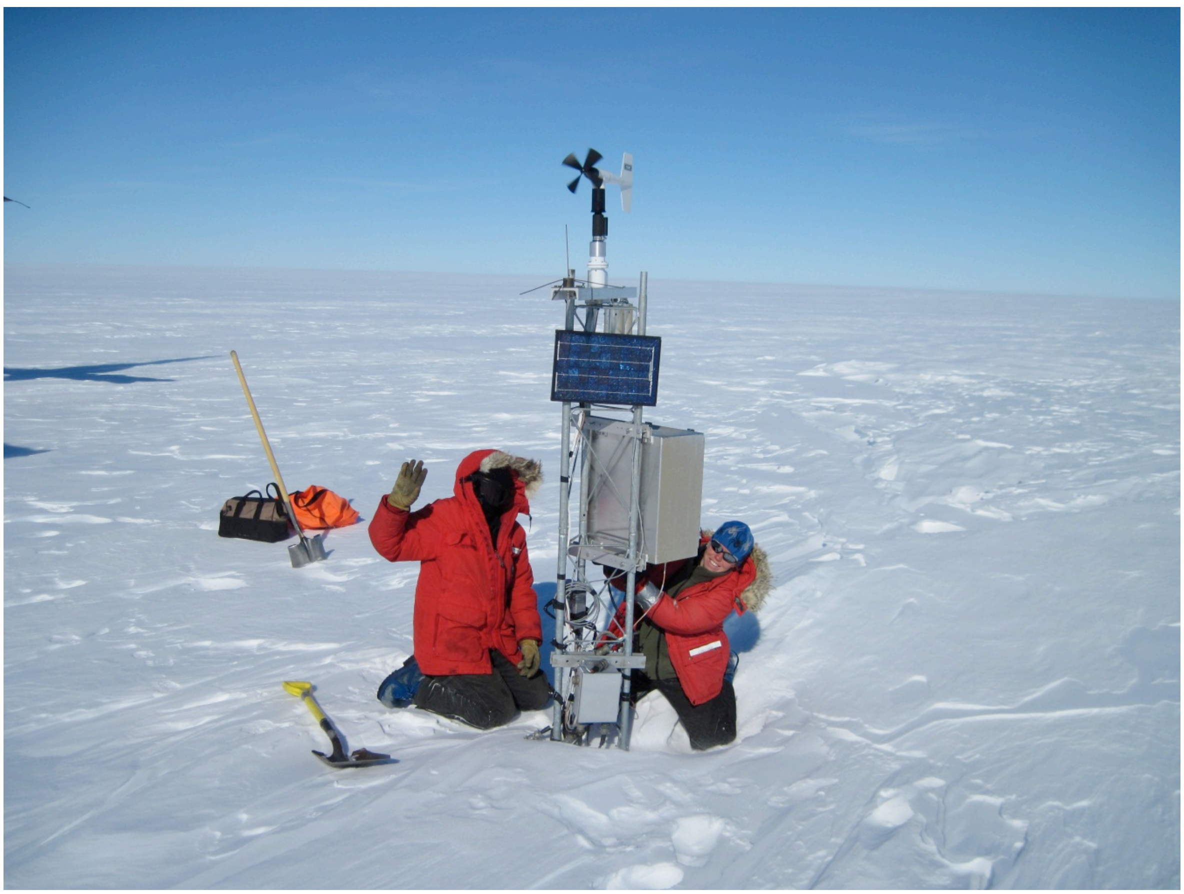
Swithinbank AWS removal
On 1/21/2011 10:17 AM, Lee Welhouse wrote:
Removed 1 station on 1-17-2011

Team: Lee, Galit, Marsha
Pilots: Lexy, Claire

Flight from Byrd station took approximately 40 minutes, and the ground time was approximately an hour.

Station was found with approximately 183 cm exposed. The boom, junction box, solar panel, and enclosure were removed. Solar panel looked to be damaged. Digging down we discovered the top 2 tower sections were short 3 foot sections. We dug to a depth of approximately 5 feet and found 1 battery box and 3 capped, disconnected wires. The Battery was at approximately 2 feet below the surface. The plugs were removed and the exposed wire covered. There is still tower section, and presumably batteries at this station. Unavco GPS was not deployed at this station as it was at the exact location the 2008 coordinates indicated.

Lee



Swithinbank AWS before removal on January 21st, 2011

Mulock AWS removal

2009-10 Location
-79.0256, 160.1937
S 79° 01.48', E 160° 11.624'
1.075 km downstream from 2005 coords

Estimated 2010-11 Location
-79.025, 160.194
S 79° 01.418' , E 160° 11.623'
1.369 km downstream from 2005 coords

Claire was able to obtain the coordinates from 2008-09 and 2009-10, b/c we were able to locate the site in satellite imagery. Claire estimated that the station has moved about 1.3 km since installation. From what we can tell, it has stayed between the same two crevasses since it was installed.

Helo Pilot: Dustin, Helo tech:
Team Members: Lee Welhouse, Kris Young, Jen Erxleben

Approximate helo flight time was an hour, ground time was approximately 2 hours.

The tower base was approximately 18 inches below surface level, with the deadmen anchors approximately 30 inches below surface level.

Electronics box	140 cm
Junction box	267 cm
Boom Height	343 cm

Notes: Upon arrival one of the battery cables was found loose. One of the attached pictures illustrates this. All portions of the station was recovered successfully.

Mulock AWS before removal on January 21st, 2011

<u>Whitlock AWS (Franklin Island)</u>
Full station replacement on 1-28-11 (approximate ground time 3.5 hours)

Team: Jonathan Thom and Melissa Nigro
Pilot: Sven

UNAVCO GPS was set out. Approximate times were 11:45-3:15.

It was about a 5 minute helo flight from the Oden. Sven dropped the passengers off first and then sling loaded the equipment.

A portion of the electronics box was buried in snow. We removed all of the instruments from the station. The original heights were as follows:

Boom	57"
Electronics Box	-12"
Solar panel	39.5"

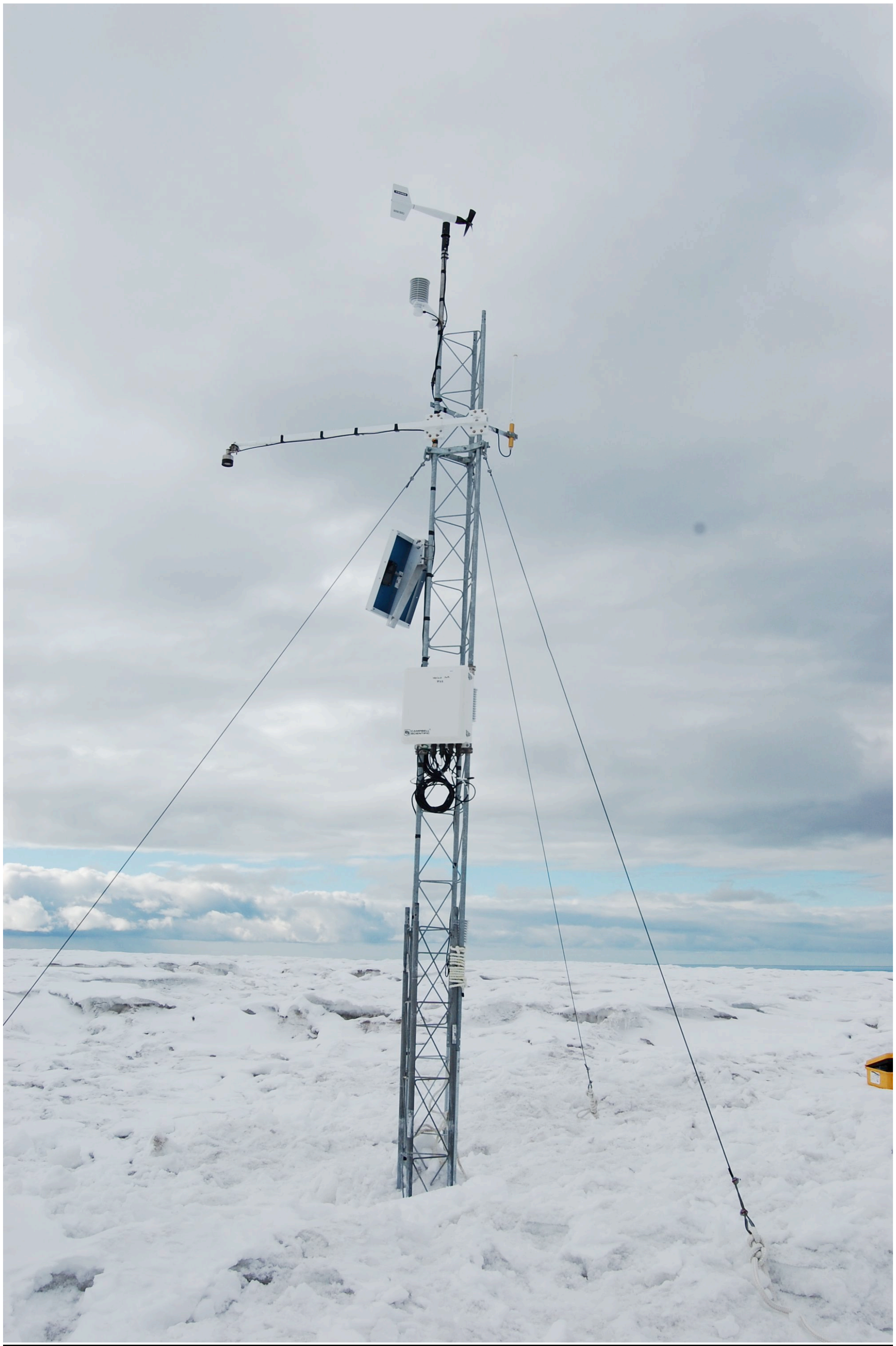
The old station had a 5' new style tower section roped to the old style tower sections. These tower sections were leaning and we could not straighten them out. Therefore, we installed a 5' and two 7' tower sections next to the existing site. The new tower sections are on a wooden base and were guided. The new tower has also been tied to the old tower using rope. Three 100 amp hour batteries were installed at the site. These were wired up in a medium sized harding case. The charge controller is wired inside the harding case and therefore this station does not have a junction box. A new set of instruments were installed on the tower.

Final instrument heights:

Aerovane	219"
Upper temp	204"
ADG	172"
Electronics box	92"
Lower temp	53"
RH	102"

-Melissa

Whitlock AWS2HWS AWS before replacement on Januray 28th , 2011



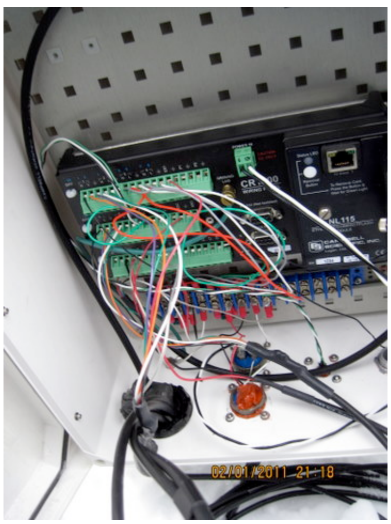
Whitlock AWS (Franklin Island) after conversion to new CR1000 AWS on January 28th, 2011

South Pole

Field Team: Lee Welhouse

February 1 - 2 2011

Approximately 6 inches of drift/accumulation was found near the site, leaving the sensor bar still above surface height though frost was found on the radiation shields so raising the station may be necessary soon. Solar panel mounts, and the antenna have been removed, and the cup anemometer was successfully added to the station. Cable for a tachometer on the aspirated shield was unable to be installed as the aspirated shield lacked the necessary connection. Data was retrieved, and the system had stopped recording mid-June and failed to come back on until after a new OS and program had been installed on the station. WEEDgill2 sensor reported anomalous data when the system was running again, reporting 70-100C temperatures or reporting NaN. Faulty connections could not be found to explain this.



-Lee

Gill AWS Servicing

Last two locations from last visit to Gill AWS site were
79.985S/ 178.611W 55 m 08/02/94 Twin otter GPS
79.922S/ 178.586W 54 m UNAVCO GPS in 2005

Neglecting the change in longitude of .611 -.586 (slight eastward change) of .025 degrees this would be 19.27 km (one degree longitude at 80 deg latitude) * .025 is about .5 km or 500 meters. OR less than 50 meters per year movement to the east.

The distance northward (latitude) is .063 deg latitude or about 0.063 * 111km or 7 km north from 1994 position or about 635 meters to the north per year.

Note that we have tracked Ferrell site moving north on average of about 1 km per year so this seems reasonable.

Hence since 2005 expect Gill to have moved north about --- 3.82 km and slightly to the east by about 275 meters. If not spotted, would suggest Mark's solution to go to last location and fly north.
From Mark's report in January 2005
The Twin Otter went airborne a second time, started heading directly north, and the AWS site was found. Gill AWS had moved 3.8 nm from the previous GPS position. Upon arriving at the site, the sensor boom was 1.57 m above the surface and the lower delta-T was buried 0.63 m below the snow surface. The site was determined to be in good working condition and a 2.1 m Rohn tower section was added. The junction box was raised to the extent of the battery cables. A transmission was verified and the sensor boom was measured to be 3.84 m above the surface.

Gill AWS after 2005 visit

Gill AWS servicing 2011
Tower raise and full new set of instruments on 2-2-11 (approximate ground time 2.25 hours)

Team: Jonathan and Melissa
Moral: Matthew and Jeffrey
Pilots: Brian and Jason

UNAVCO GPS was set out. Approximate times were 11:00-2:15.

It was about a 1.5 hour Twin Otter flight from Pegasus.

The lower temperature sensor and junction box were below the snow level. We removed all of the instruments from the station. The original heights were as follows:

Electronics box	24"
Solar panel	68"
Boom	99"
J-box	at the surface
Lower temp	below the surface

We added a 7' tower section and installed all new instruments. Two additional batteries were placed at the site. The telonics received a good transmission.

Final instrument heights:

Lower temp	60"
RH	85"
Electronics box	87"
ADG	138"
Upper temp	190"
Aerovane	204"

I've attached before and after pictures below.

Gill AWS before servicing on February 2nd, 2011

Gill AWS after servicing on February 2nd, 2011

Marilyn AWS Servicing

Aerovane (Belfort) replacement on 2-3-11 (approximate ground time 25 minutes)

Team: Jonathan and Melissa
UNAVCO: Marianne
Rigger: Erin and Dan
Pilots: Brian and Jason

UNAVCO GPS was set out. Approximate times were 11:40-12:00.

We flew by the Tall Tower site on the way out of McMurdo (about 35 minutes flight). The site was covered by fog. Erin was able to see the very top of the tower through the fog, but we were not able to land. We flew on to the Marilyn AWS site (about a 30 minute flight from Tall Tower).

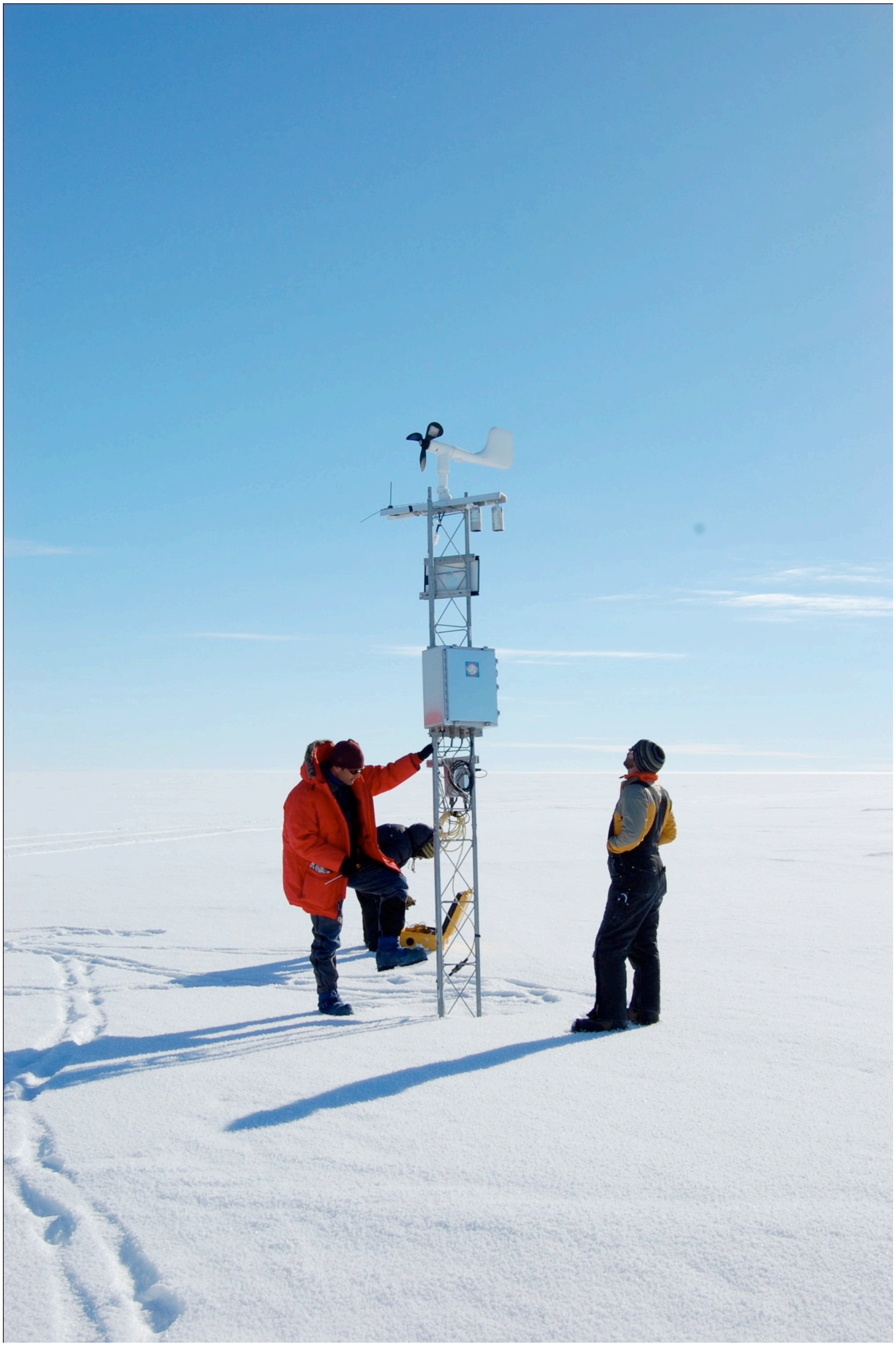
The Belfort aerovane was replaced.

Instrument heights are:

J-box	57"
Electronics box	72"
Boom	133"

The boom is oriented facing 316 deg.

Note: the tower is leaning quite a bit. A new tower should probably be installed at the next visit.



Marilyn AWS during replacement of Aerovane on February 3rd, 2011

Tall tower installation

Installation of instrumentation and power system on 2-3-11 (approximate ground time 6 hours)

Team: Jonathan and Melissa
UNAVCO: Marianne
Rigger: Erin and Dan
Pilots: Brian and Jason

UNAVCO GPS was set out. Approximate times were 1:00-6:30.

It was about a 30 minute flight from the Marilyn AWS and about a 35 minute flight from Pegasus. Upon arrival there was still quite a bit of fog in the area. The tower and the South Pole Traverse road were visible, which enabled us to land.
The riggers worked on re-tensioning the guidelines (the tower has settled since it was originally installed) before climbing the tower. All of the instruments were installed on the levels as planned:

Level 6 (top level)	radiation sensor, aerovane, RH, temp
Level 5	aerovane, temp
Level 4	aerovane, temp, RH
Level 3	aerovane, temp (ADG and antennae were installed on a second boom just underneath the boom for level 3)
Level 2	cup anemometer, temp
Level 1	cup anemometer, temp

The heights of the top four levels are the boom installation heights given to the riggers when the tower was installed.
For the rest of the instruments:

Cup anemometer level 1	52"
Temp level 1	43"
Cup anemometer level 2	93"
Temp level 2	83"
Electronics box	100"
ADG and antennae	136"

Boom was oriented at 346 deg.
The power supply was installed about 21' to the north of the tower. All voltages were checked. The red/green LED light for the cycling of the solar panels was blinking red and off instead of red and green. We believe that the green light bulb may be out. The solar panels were charging the batteries while we were there.

-Melissa

Tall Tower tower before installation of sensors on February 3th, 2011

Tall tower after instruments installed on February 3[th], 2011

<u>Minna Bluff AWS conversion</u>

Replacement of AWS2B version AWS with Argos transmitter with CR1000 based AWS using Freewave transmitter on 2-4-11 (approximate ground time 2.75 hours)

Team: Jonathan, Lee and Melissa
Pilot: Paul + Helo Tech

UNAVCO GPS was not set out. The coordinates for this station should not have changed.

It was about a 0.5 hour 212 helo flight from McMurdo.

The original instrument heights were:

Boom	60"
Electronics box	27"

And the boom was oriented at 328 deg.

We removed all of the instruments from the existing tower. We removed the existing batteries, tower and base.

The station is on dirt (actually, very hard permafrost). We chiseled out a hole large enough to fit a metal base. We leveled the base and installed a 7' tower section. We used the existing guide lines to secure the tower. We also covered the metal base with rocks from the surrounding area. The existing boom was re-installed on the station. A new solar panel, antennae (Freewave), electronics box, junction box and 2 battery boxes were installed. The battery boxes were placed with the cables facing each other in order to protect the cables. A rock wall was then built around the battery boxes and the remaining tower in order to help with stability and protection.

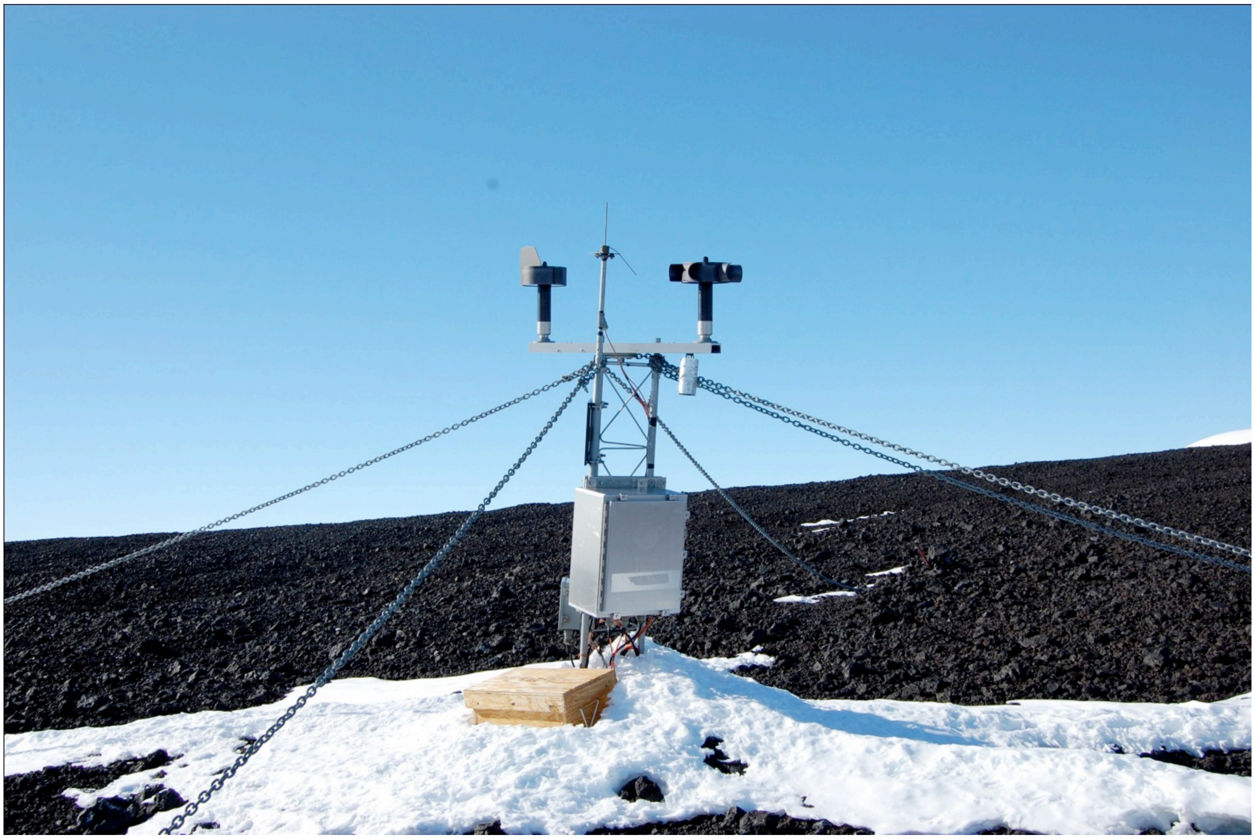
We received good readings on the computer. We will be able to test the effectiveness of the Freewave transmitter after the antennae installation at McMurdo on Tuesday.

The final instrument heights are:

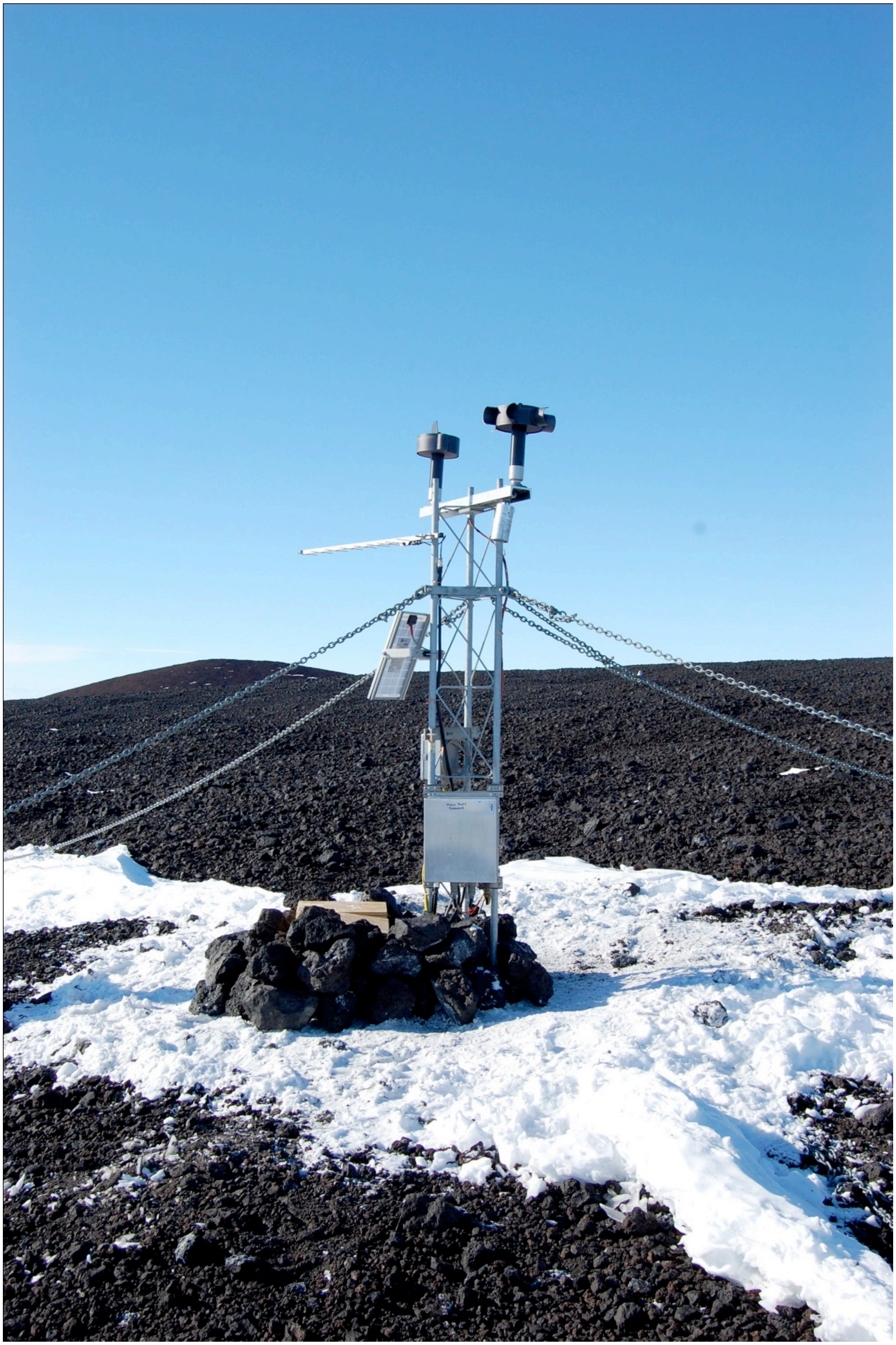
Boom	87"
Electronics box	22"

Boom is oriented at 359 deg.

Before and after pictures follow below:



Minna Bluff AWS2B version AWS prior to changeover to new AWS on February 4th, 2011



Minna Bluff CR1000 based AWS using Freewave 900MHz transmitter on February 4th, 2011

Whitlock AWS (Franklin Island)
Full station replacement on 1-28-11 (approximate ground time 3.5 hours)

Team: Jonathan Thom and Melissa Nigro
Pilot: Sven

UNAVCO GPS was set out. Approximate times were 11:45-3:15.

It was about a 5 minute helo flight from the Oden. Sven dropped the passengers off first and then sling loaded the equipment.

A portion of the electronics box was buried in snow. We removed all of the instruments from the station. The original heights were as follows:

Boom	57"
Electronics Box	-12"
Solar panel	39.5"

The old station had a 5' new style tower section roped to the old style tower sections. These tower sections were leaning and we could not straighten them out. Therefore, we installed a 5' and two 7' tower sections next to the existing site. The new tower sections are on a wooden base and were guided. The new tower has also been tied to the old tower using rope. Three 100 amp hour batteries were installed at the site. These were wired up in a medium sized harding case. The charge controller is wired inside the harding case and therefore this station does not have a junction box. A new set of instruments were installed on the tower.

Final instrument heights:

Aerovane	219"
Upper temp	204"
ADG	172"
Electronics box	92"
Lower temp	53"
RH	102"

-Melissa

Ferrell I servicing and II AWS installation

Installation of a duplicate tower at Ferrell on 2-10-11 (approximate ground time 2.5 hours)

Team: Jonathan, Lee and Melissa
Pilot: Dean
Helo Tech: Roger

UNAVCO GPS was set out. Approximate times were 8:00 pm - 10:30 pm.

It was about a 45 minute 212 helo flight from McMurdo.

The instrument heights on the original tower are as follows:

Lower temp	62 cm
ADG	60 cm
Electronics box	127 cm
ADG electronics box	53 cm
ADG solar panel	57 cm
Junction box	27 cm
Solar panel	201 cm
Boom	277 cm

Boom oriented at 6 deg

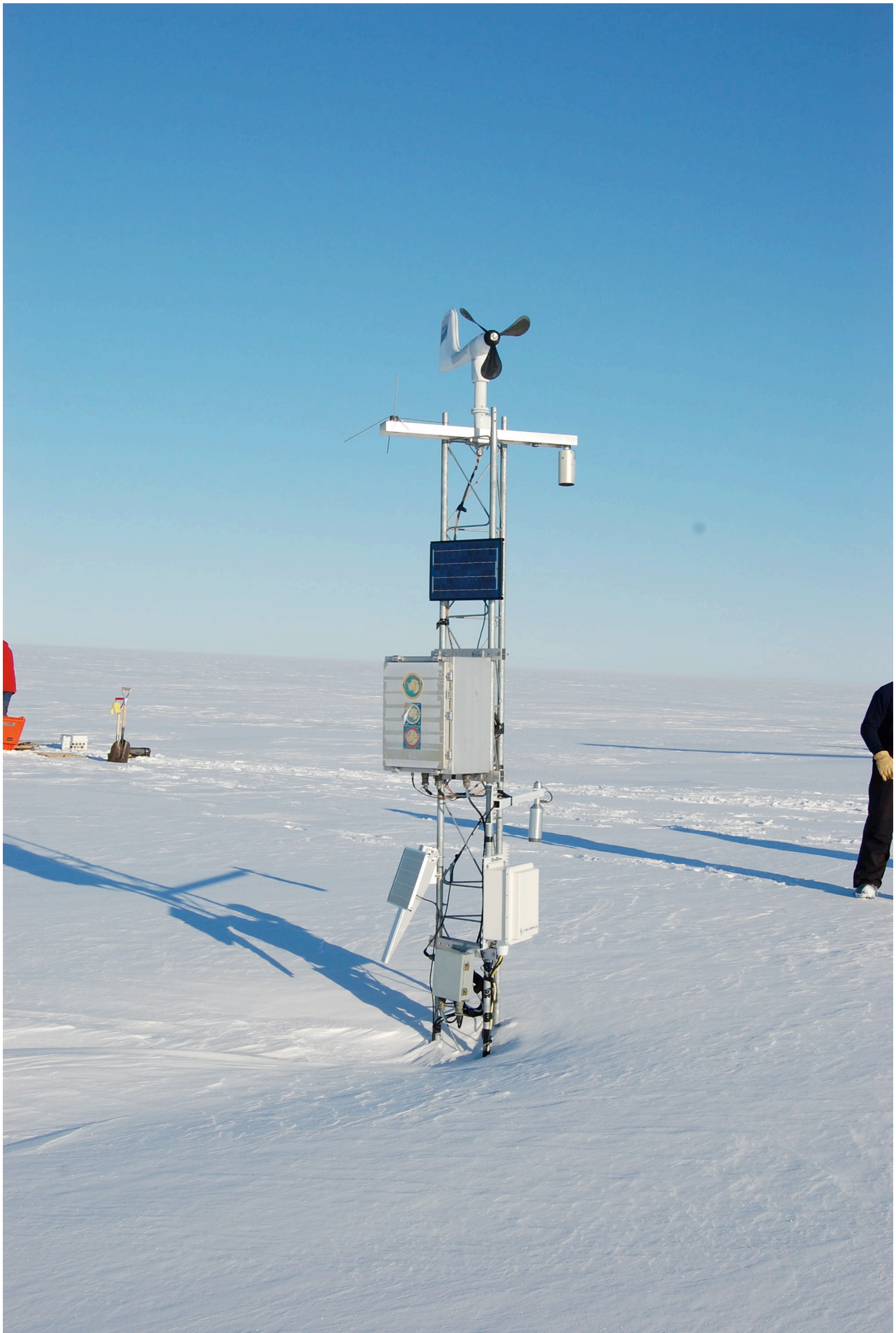
The ADG, ADG electronics box, lower temperature and ADG solar panel were removed from this station. Otherwise this station remains as is.

We installed a full new station about "21 Jonathan paces" to the east of the original station. This station will be used to test the difference in measurements between the old style AWS station and the new style AWS station. A 5' and two 7' tower sections were installed. The tower and guides have been installed approximately 2-3 feet into the snow. Two sets of batteries and a full set of instruments were installed at this site.

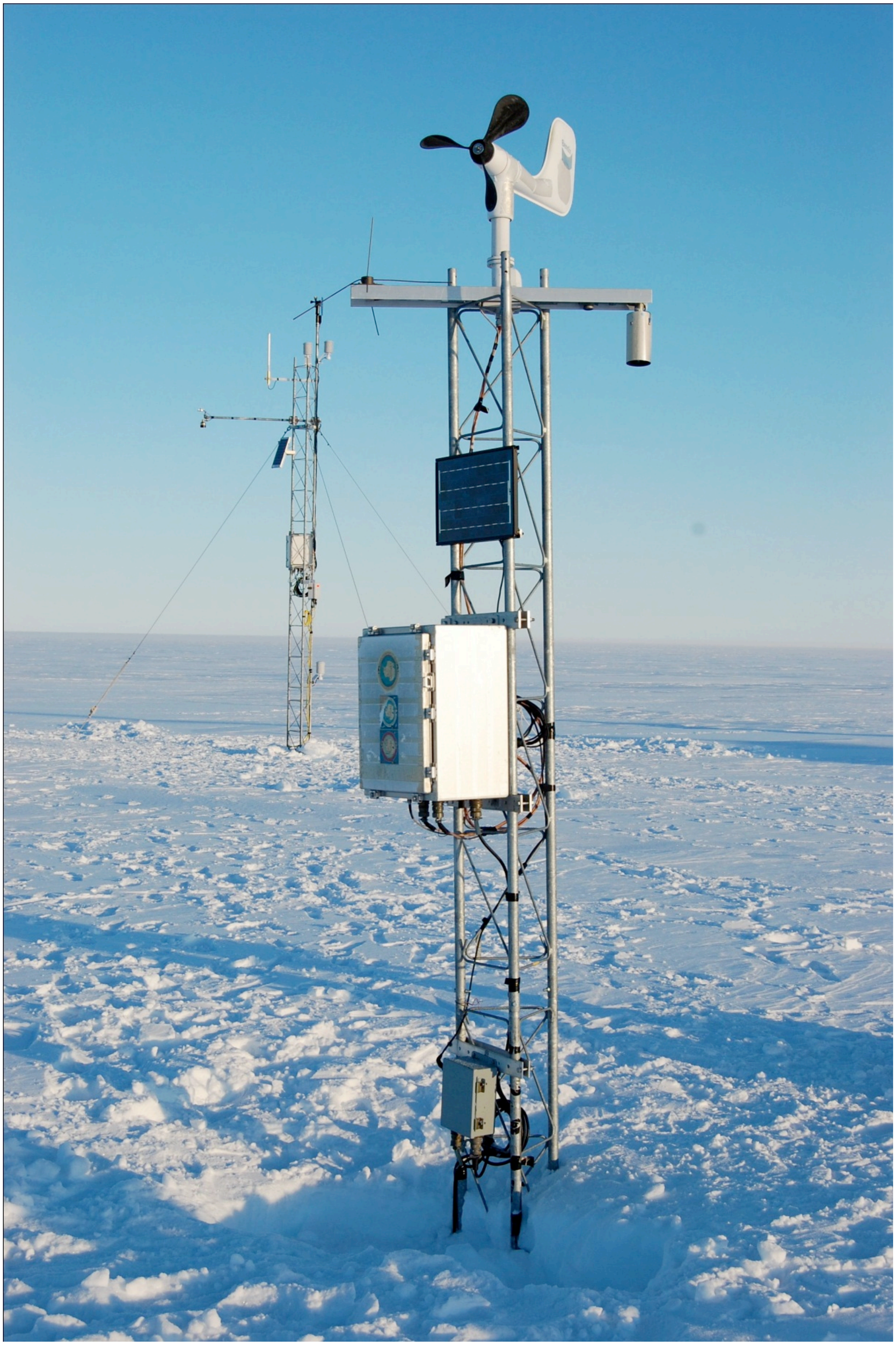
The final instrument heights were:

Lower temp	102 cm
J-box	207 cm
Electronics box	240 cm
ADG and pyronometer	432 cm
Solar panel	365 cm
Upper temp and HMP	524 cm
Aerovane	568 cm

Before and After pictures are attached below.



Ferrell AWS2B AWS before servicing on February 10th, 2011



Ferrell AWS2B AWS after servicing and Ferrell II new AWS in background on February 10th, 2011

<u>Willy VHF Station installation</u>
Installation on 2-10-11 (approximate ground time 1.75 hours)

Team: Jonathan, Lee, Melissa and Julien Nicholas

UNAVCO GPS was set out. Approximate times are 2:00-3:30pm.

It was about a 0.5 hour pickup truck ride out to the site from McMurdo.

The station was initially empty, except for a solar panel that we removed (all of the remaining instruments were removed at an earlier visit this season). One battery box was also removed.

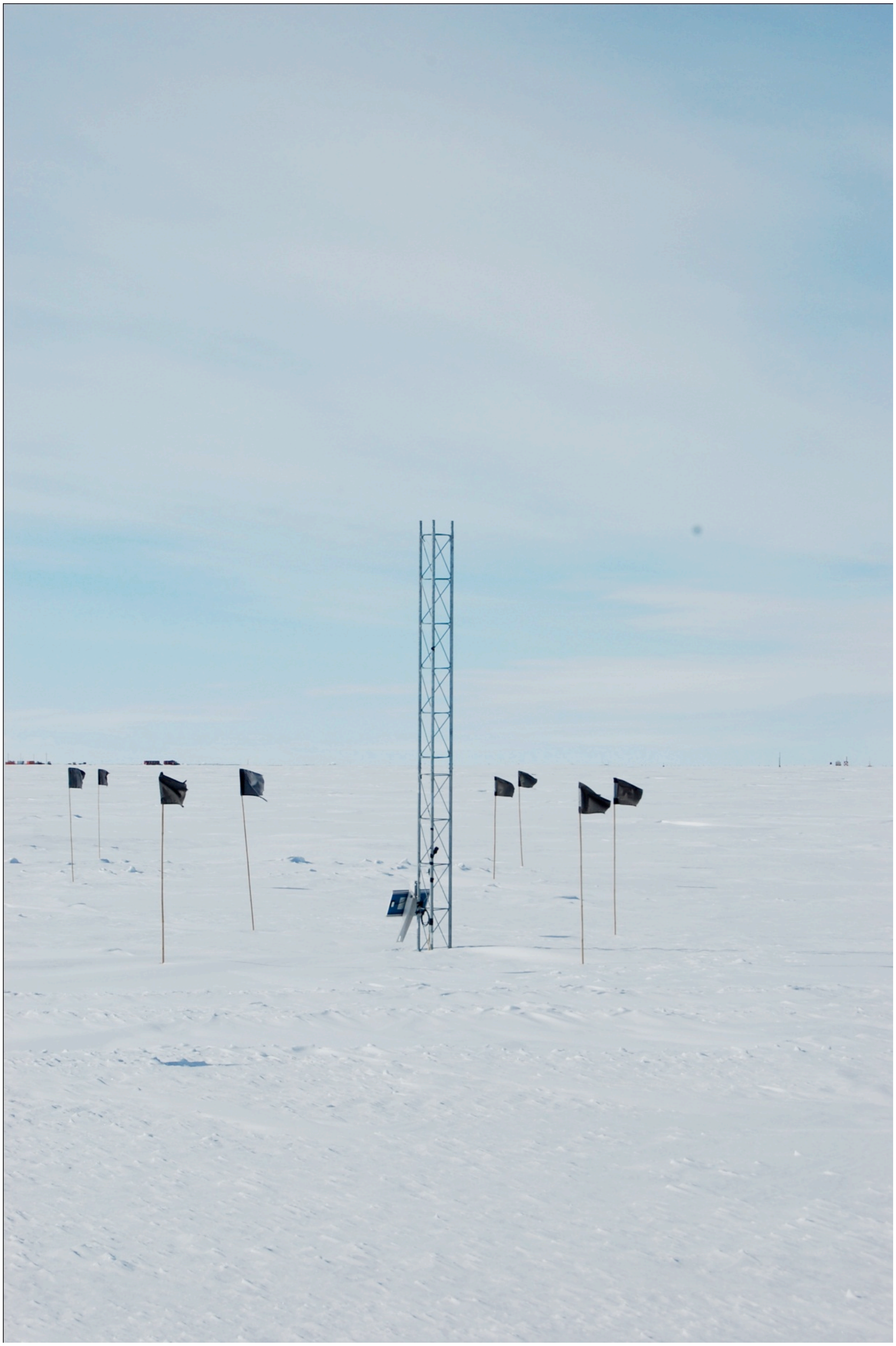
We installed an aerovane, upper temp, lower temp, HMP, solar panel, electronics box and junction box. We put out 2 sets of batteries at the site. Note: the junction box is an old style box. Therefore the solar panel has been hardwired into the junction box and the battery cables are the old style. Also, we removed the freewave transmitter from the site, due to the fact that the freewave receiving antennae on top of Crary will not pick up the signal from this site. Therefore, a data card will collect the data and will need to be retrieved next season. The computer was connected to the station and the data collection looked good.

The final instrument heights are as follows:

Lower temp	127 cm
Electronics box	204 cm
Pressure	239 cm
Junction box	142 cm
HMP	381 cm
Upper temp	394 cm
Aerovane	435 cm

Before and after pictures are attached.

- Melissa



Willy Field Site before installation of new CR1000 based AWS with Freewave transmitter

Willy Field CR1000 based AWS for testing Freewave transmitter

Freewave data

The new AWS using Freewave transmitters (900MHz line of site) rather than the standard Argos (satellite) transmitters require a receiving station in the McMurdo area. Matt Lazzara has put together a system for the proper movement of the Minna Bluff real-time observations being sent via Freewave radio-modem from the Minna Bluff AWS to the Crary Lab computer (flounder.usap.gov ?), and then to the site **herbie.usap.gov** and then on to here:

ftp://amrc.ssec.wisc.edu/pub/aws/freewave/

This is just the first step. We will have to get this filed much more logically (broken up by year and month), else we'll have very large unwieldy files. We need to:

1. Handle inserting this to McIDAS based systems for real-time display
2. Handle how we'll work on QC
3. Get the data to Mac Weather for operational use

We will update everyone when we have a better organization for this on the FTP site. We will also have it automatically go on both amrc.ssec.wisc.edu and aws.ssec.wisc.edu

Collaborative AWS Servicing and Installations

David Holland West Antarctic AWS

Three UW CR1000 AWS were unable to be deployed during the 2009-2010 field season and were stored at Byrd Surface Camp by David Holland's field team. This season the three AWS were successfully deployed by David Holland's field team. They were deployed on Evans Knoll, Bear Peninsula and Thurston Island.

Installation of CR1000 AWS at Evans Knoll on January 12th, 2011

Installation of CR1000 AWS at Bear Peninsula on January 14th, 2011 by David Holland's field team

Installation of CR1000 AWS on Thurston Island on January 19th, 2011 by David Holland's field team

AWS servicing in Adelie Land by IPEV

D10
Just to inform you that D10 AWS mast station has been realigned vertically.
So, no electric disconnection was required.
This has been done Friday 18 Feb during one hour between 06H00 UTC and 07H00 UTC.
(16h00 and 17h00 DDU time)

Precise height of snow accumulation sensor will be done soon/later by Alexander Trouviller.
(Person which work with C. Genthon)

NB : Due to mast snow accumulation, next year a new mast section will be added on existing D10 AWS mast section/station.

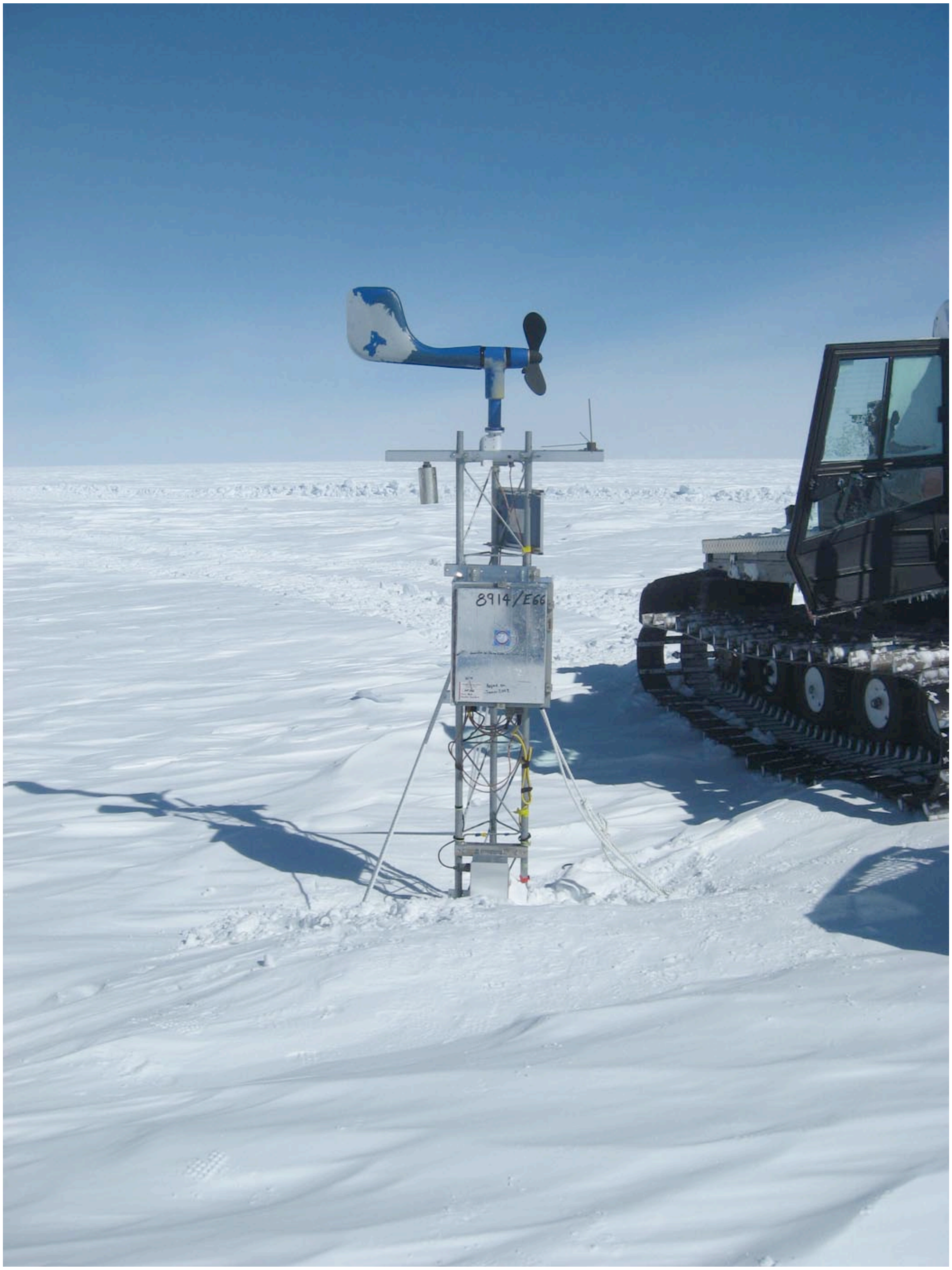
Best regards
IPEV
Scientific coordination
Alain PIERRE

E66
AWS 8914 has been installed December 7th, 2010 0045 UTC.
Station is pretty snowed in, we repositioned solar panel and 8914, we will have to think about adding to the mast. I will send you pictures of all stations on the way to Dome C once I get back to Dumont d'Urville. I will let you know parts required in order to proceed.
I hope station is received okay.
Cheers
Philippe Dordhain

D85

Hi George,
E85 AWS has been replaced on Januray 22nd, 2011 with AWS 8912.
regards - Philippe

Following images of AWS line from Dumont D'Urville to Dome C II taken on the early traverse from Dumont D'Urville to Dome Concordia.



E66 AWS after replacement of AWS 8986 with 8914 (both AWS2B AWS)

D85 AWS 8986 before being replaced with AWS 8912 (both AWS2B type AWS)

Here's the summary of our AWS 2011-2012 field season meeting

We've identified the following new CR1000 AWS requirements for next year:
----

* AGO collaboration - New install
* POLENET collaboration - New install
* Cape Hallett - removal of two AWS, new install CR1000 AWS
* I-157 (which will be renamed...fyi) , new install of CR1000 AWS
* Kominko-Slade/WAIS, removal of Wisconsin AWS 2B, new install of CR1000 AWS
* Dome C II, new install of CR1000 AWS (removal of old AWS 2B?)
* Manuela, removal of old non-high speed wind Wisconsin AWS 2B, new install of CR1000 AWS - (unit is coming back from Port Martin)

We've identified the following replacement AWS2B needed:
----

* Carolyn - Off the air replacement with a standard RM Young AWS2B AWS
* Eric - replacement with a standard RM Young AWS2B AWS
* Vito - replacement with a standard RM Young AWS2B AWS

We'll plan on removing the following:
----

* Brianna - No longer needed.
* South Pole Radiation Test Facility - No longer needed.
* Erin and/or Elizabeth are low on the priority list and may be removed if time/transportation available.

We'll visit/service:
----

* Janet - Reverse tower and see how the accumulation is going...
* Harry needs batteries and conversion to RM Young AWS2B AWS
* Tall Tower - Check on settling and several other items, TBD
* Margaret - Reprogram CR1000, and check on a raise?
* Hugo Island - Not working well - may need a host of servicing?? (marine issues?)
* Siple Dome needs new electronics/possible move/temperature string???

Lower priority for servicing:

* Converting CR10X based AWS to CR1000 based AWS

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

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

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

1. Introduction

Significant work has been done on identifying and understanding upper level height anomalies associated with El Nino Southern Oscillation (ENSO) events in the Amundsen and Bellingshausen Sea regions. (Turner, 2004) This work focuses on the effect these teleconnections have on the Antarctic continent and adjacent Southern Ocean. Composites of ERA-40 (European Centre for Medium-Range Weather Forecasting Re-analysis), ERA-Interim, and Climate Forecast System Reanalysis (CFSR) illustrate how these events affect the surface (e.g. pressure, temperature) and upper level (500 hPa heights, and 200 hPa velocity potential) variables. These composites consist of monthly averaged data compiled into three month seasons, with emphasis on September through February. To ensure the accuracy of these findings regions with values exceeding the confidence intervals are compared with ground based Automatic Weather Stations (AWS) from the University of Wisconsin-Madison that have not been used in the reanalysis. Significant high pressure anomalies are found during El Nino events focused in the Amundsen-Bellingshausen Sea (ABS) regions, and extending to the Ross Ice Shelf and the Antarctic Peninsula. These have the effect of generally warming the ABS region. During La Nina events low pressure anomalies are evident throughout the continent. Early in the season these anomalies are associated with warming in the ABS region, while late in the season they are associated with cooling in East Antarctica.

2. Data

Throughout this study we have used the ERA-40, ERA-Interim, and CFSR data for surface temperature and pressure values due to it having higher correlations with observations (Bromwich 2004) during the post satellite era (1980-present). 500 hPa heights and 200 hPa velocity potential were utilized to examine upper levels. We have also used the AWS dataset as a means to check the accuracy of the reanalysis during times when AWS stations weren't assimilated.

a. Reanalysis Data sets

For our composite analyses we have created two different sets of composites, for both El Nino and La Nina events. This analysis has been performed on the ERA The composites consist of three-month seasonal time sets from September through February. The timeframe of three months was chosen as it matches with the time frame used to calculate the ENSO indices, SOI and ONI, used. These composites allow us to observe differences in the anomaly patterns between El Nino and La Nina during times when there is spatial correlation between ENSO indices and regions of Antarctica (Turner, 2004, Fogt and Bromwich, 2006) In all composites the events are compared against the average values of non events.

b. AWS Network

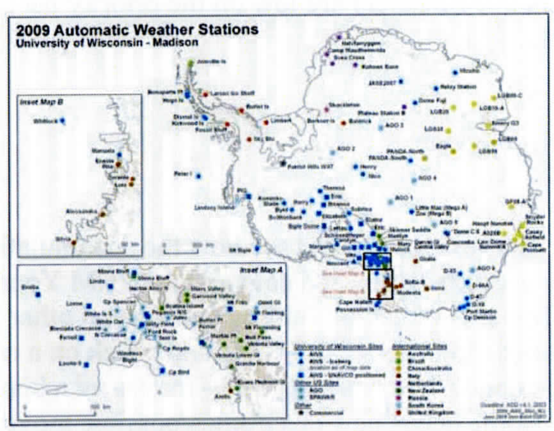


Figure 1: A map of the current AWS Network

Throughout this process the reanalysis data sets are compared with the observational network (Figure 1). To compare between the grid points of the reanalysis and observation network the weighted average of the nearest four points in the reanalysis was used. Initial

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

findings indicate there is a strong correlation, on the order of .95, between the AWS and ERA-40, while stronger correlation exists for newer reanalyses, ERA-Interim and CFSR.

c. ENSO Indices

In this study we have chosen to use the Southern Oscillation index and Oceanic Nino Index as our metrics for determining ENSO events. Both indices account for similar effects seen on the continent of Antarctica, with differences primarily being a shift in timing of approximately one season. As such the Southern Oscillation Index will be used for Figures throughout.

3. Analysis

This section will focus on understanding the effects ENSO has on Antarctic near surface temperature anomalies, and upper level features. In general the surface pressure field matches well with the 500 hPa heights, as such only upper levels have been shown as this variable is commonly used in past literature (Turner, 2004).

a. El Nino

El Niño events generally account for approximately 31% of the equatorial sea surface temperature conditions, and there have been approximately ten events from 1979-2010. Prior work indicates an expected reduction of the ABS low pressure area (Turner, 2004). There is good agreement from similar composites of CFSR, ERA-40, and ERA-Interim so only CFSR composites will be shown in this work. While specific differences exist in how far the signal extends onto the continent, all have a general agreement of the location of the teleconnection existing along the West Antarctic coast. They also agree on the general timing and strength of the anomaly associated with El Niño events. More specifically, the timing is that of strong signal existing in the September, October, November (SON) period (Fig. 1a), the signal remaining strong and moving closer to the coast or on land in the October, November, December (OND) period (Fig. 1b), before weakening in the November, December, January (NDJ) period (Figs. 1c), and moving away and weakening further in the December, January, February (DJF) period (Fig. 1d). Newer reanalyses, ERA-Interim and CFSR, indicate a more robust effect extending over the continent at upper levels throughout the period.

Analysis of mean sea level pressure closely matches that of upper level features, indicating the features can be considered relatively deep. Winds associated with these changes in pressure act, through advection, to change temperatures throughout the ABS region (Fig. 2). Specifically, increased temperatures are noted in the Ross Ice Shelf region, associated with warm moist air being transported southward, while cooler temperatures are noted throughout the Antarctic Peninsula, associated with cooler air being drawn north. An interesting, though not statistically significant, cool surface temperature feature is found in the southern Ross Ice Shelf region during the DJF period (Fig. 2d).

The CFSR model results provide a useful diagnostic for analyzing ENSO events in the velocity potential field (Fig. 3). Again, the characteristic pattern of a robust signal being evident in the early months of the austral summer followed by a diminished signal in the later months is present. Of particular interest is that the location of the 500 hPa anomalies fall directly along the path of the gradient between the regions of anomalously high and anomalously low velocity potential. This robust signal in the velocity potential exists throughout all austral spring and summer months and could provide an explanation for why the teleconnection in the ABS region is so consistent. It is the predominant signal associated with ENSO in the region.

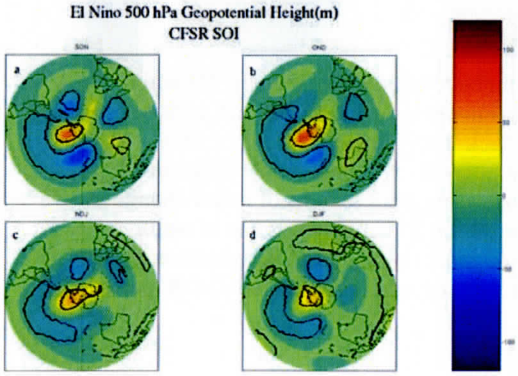


Fig. 1: Composite of 500 hPa heights during El Niño events using CFSR and a basis based on SOI. The expected pattern of teleconnection is found in the ABS region throughout all seasons. Black lines indicate regions of 95% confidence interval. a) SON period b) OND period c) NDJ period d) DJF period.

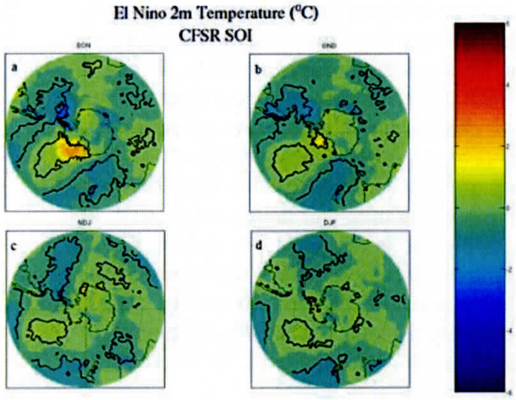


Fig. 2: Composite of two meter temperatures during El Niño events using CFSR and a basis based on SOI. Black lines indicate regions of 95% confidence interval. Significant temperature anomalies are found on the continent prior to El Niño index peak. a) SON period b) OND period c) NDJ period d) DJF period.

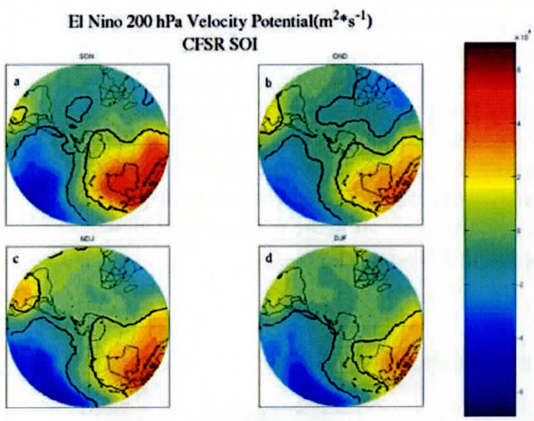


Fig. 3: Composite of 200 hPa Velocity Potential during El Niño events using CFSR and a basis based on SOI. Black lines indicate regions of 95% confidence interval. A robust dipole exists in all seasons, extending from regions of major change in the tropics, during El Niño, to regions of major change throughout the Southern Hemisphere. a) SON period b) OND period c) NDJ period d) DJF period.

b. La Nina

La Niña events account for approximately 23% of the equatorial sea surface conditions experienced, or approximately 8 events from 1979 through 2010. While analysis of El Niño events provided about the expected result associated with ENSO events, a distinct signal in the ABS region (Turner, 2004), analysis of La Niña events provide a relatively large divergence from the expected signal during the NDJ and DJF time periods. Again, different reanalysis products depict this signal effecting greater or lesser extents of the continent. In the interest of space the similarities have been the primary focus of this work. The ONI, CFSR depicts many of the similarities with few unique characteristics as such it has been used throughout this analysis.

The general pattern found during La Niña events is that of a positive height anomaly found in the ABS region in the beginning of the analyzed period, followed by a negative height anomaly found over the East Antarctic Plateau during the later analyzed months. The CFSR depicts this pattern in 500 hPa heights relatively accurately with the DJF feature being a single anomaly which is centered on the Transantarctic Mountains between East Antarctica and the Ross Ice Shelf (Fig. 4d). The composites indicate the early ABS features bring warm air into West Antarctica and the Ross Ice Shelf (Fig. 5a). As these features weaken and the East Antarctic signals strengthen, cool air is seen throughout much of East Antarctica (Fig. 5d). The statistically significant signal seen at the surface is often more extensive than the statistically significant signal seen in the upper air fields.

Analyzing the velocity potential field provides interesting insight into the differences seen between La Niña and El Niño seen at upper levels. As discussed earlier, the signal in velocity potential of El Niño events remained robust throughout the analyzed period. The same can not be said of the signal seen in the velocity potential field during La Niña events. The initial gradient of velocity potential is weaker during La Niña events than during El Niño events (Figs. 6a, 6b), which could account for the signal in the 500 hPa height field being weaker during La Niña. The composites of later time periods, NDJ and DJF, show little or no robust velocity potential signal extending toward high southern latitudes (Figs. 6c, 6d). This breakdown in the pattern could explain the high variability in the location of the 500 hPa height signal, as there is no distinct path to follow.

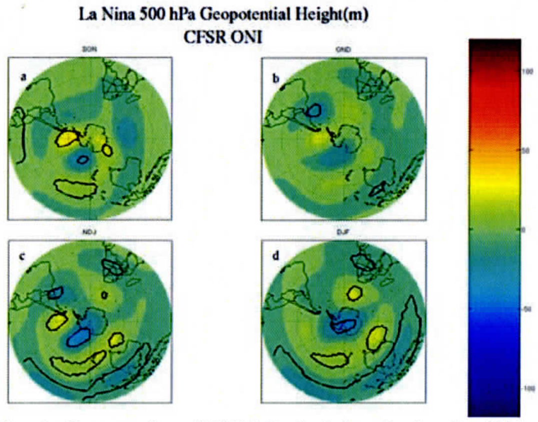


Fig. 4: Composite of 500 hPa heights during La Niña events using CFSR with a basis based on ONI. Black lines indicate regions of 95% confidence interval. The ABS region signal is seen, though in some cases not reaching the criteria for significance, during the first three time periods. DJF shows a negative anomaly over both West Antarctica and East Antarctica. a) SON period b) OND period c) NDJ period d) DJF period.

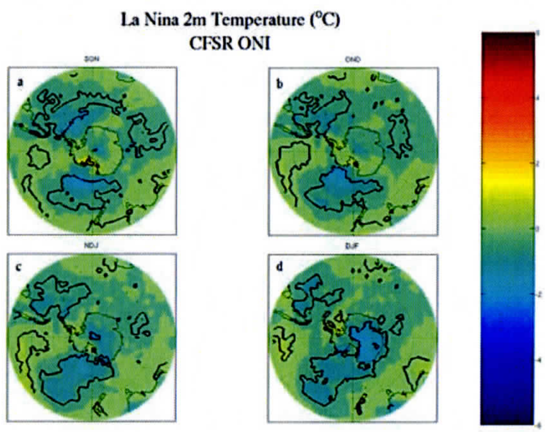


Fig. 5: As in Fig. 4 but depicting two meter temperatures. Large scale temperature change is not seen until DJF, where East Antarctic cooling becomes evident.

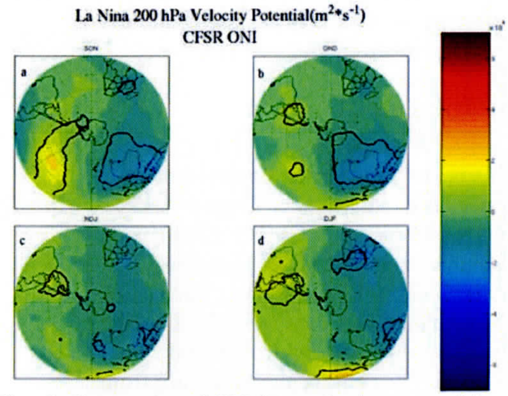


Fig. 6: Composite of 200 hPa velocity potential during La Niña events using ERA-40 with a basis based on ONI. Black lines indicate regions of 95% confidence interval. A generally weak dipole of velocity potential is seen in earlier seasons, and is absent in later seasons. a) SON period b) OND period c) NDJ period d) DJF period.

4. Conclusions

Composite analysis has been shown to be an effective means of analyzing ENSO effects at high latitudes, and the new method of using non-events as one portion of the comparison allows for differences between different phases of ENSO, El Niño and La Niña, to be distinguished. It is must still be acknowledged that a relatively few number of events have been analyzed due to the quality of reanalysis data for the Southern Hemisphere prior to 1979 being in question (Bromwich and Fogt, 2004). Despite the small number of events, a number of conclusions can be drawn from the composite analysis performed. As expected, the ABS region remains the primary location of strong teleconnection. The seasonality of El Niño and La Niña events seems to indicate that El Niño plays a larger role within this region than La Niña, though both seem to play a role in this region more strongly in spring than in summer. There also seems to be greater seasonal variance in the signal during La Niña events than El Niño events. This is indicated by the consistent late austral summer effect seen in East Antarctica through multiple indices and reanalysis time periods. While differences are evident in the upper air data, the surface data is in general agreement that East Antarctica experiences significant cooling in association with La Niña events, usually in association with significant upper air features. This East Antarctica cooling signal warrants further exploration for mechanisms of changes in the location of teleconnections. The seasonality of both phases of ENSO, particularly the breakdown of the signal during peak ENSO months also warrants further exploration.

5. Acknowledgements

This material is based upon work supported by the National Science Foundation under Grant # ANT-0636873 and ANT-0944018. ECMWF ERA-40 and ERA-Interim data used in this study have been obtained from the ECMWF data server. The CFSR and NCEP/NCAR reanalysis data were developed by NOAA's National Centers for Environmental Prediction (NCEP). The data for this study are from the Research Data Archive (RDA) which is maintained by the Computational and Information Systems Laboratory (CISL) at the National Center for Atmospheric Research (NCAR). NCAR is sponsored by the National Science Foundation (NSF). The original data are available from the RDA (http://dss.ucar.edu) in dataset number ds093.2.

6. References

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

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

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

.nal Report for Period: 09/2010 - 08/2011
Submitted on: 10/21/2011
Principal Investigator: Cassano, John J.
Award ID: 0636811
ganization: U of Colorado Boulder
ubmitted By:
Cassano, John - Principal Investigator
tle:
Collaborative Research: Antarctic Automatic Weather Station Program: 2007-2010

Project Participants

Senior Personnel

Name: Cassano, John
Worked for more than 160 Hours: Yes
Contribution to Project:
Cassano is the University of Colorado co-PI on the automatic weather station project. He has supervised graduate student Nigro's and graduate student / post-doc Seefeldt's work related to this project. Cassano has taken part in AWS field work as part of this project.

st-doc

Name: Seefeldt, Mark
Worked for more than 160 Hours: No
Contribution to Project:
Seefeldt's work on this project focused on analysis of the low-level wind field over the Ross Ice Shelf using a combination of automatic weather station data and numerical model output.

Graduate Student

Name: Nigro, Melissa
Worked for more than 160 Hours: Yes
Contribution to Project:
Melissa Nigro (maiden name: Richards) has worked on this project as a graduate research assistant since fall 2009. Her research is focused on the dynamics of high wind events over the Ross Ice Shelf.

ndergraduate Student

chnician, Programmer

Other Participant

esearch Experience for Undergraduates

Organizational Partners

University of Wisconsin-Madison

Other Collaborators or Contacts

Matthew Lazarra - lead PI of project at University of Wisconsin

Activities and Findings

Research and Education Activities:
Research activities

September 2010 to August 2011

The manuscript detailing a synoptic climatology based method for evaluation of numerical weather prediction forecasts using AWS observations has been published in Weather and Forecasting (Nigro et al. 2011a).

A case study of a high wind event over the southern Ross Ice Shelf has been completed by University of Colorado graduate student Melissa Nigro. The manuscript describing this case study (Nigro et al. 2011b) has been submitted to Monthly Weather Review.

An evaluation of Antarctic Mesoscale Prediction System (AMPS) forecasts of cyclones in the western Ross Sea was completed with partial salary support for University of Colorado graduate student Melissa Nigro from this award. Results from this evaluation are in press in Antarctic Science (Nigro et al. 2011c).

Nigro spent January and part of February 2011 in Antarctica taking part in the 2010-2011 Antarctic Automatic Weather Station field season.

Cassano and Nigro attended several national and international workshops and conferences. Cassano gave 3 invited presentations that were based in part on work completed as part of this project.

Conferences attended / presentations

Cassano attended the Autonomous Polar Observing Systems Workshop in Washington D.C. (Sept. 2010).

Cassano, J.J., 2010: Observational needs for polar atmospheric science. Autonomous Polar Observing Systems Workshop, Washington D.C. Invited presentation.

Cassano attended the WWRP ? THORPEX ? WCRP Polar Prediction Workshop in Oslo, Norway (October 2010).

Cassano, J.J., 2010: Autonomous polar atmospheric observations. WWRP ? THORPEX ? WCRP Polar Prediction Workshop, Oslo, Norway. Invited presentation.

Nigro, M. and J. Cassano, 2010: Case study of a high wind event over the Ross Ice Shelf, Antarctica. Department of Atmospheric and Oceanic Sciences poster conference. Poster presentation.

Cassano and Nigro attended the American Meteorological Society 11th Conference on Polar Meteorology and Oceanography in Boston, MA (May 2011).

Nigro, M.A. and J.J. Cassano, 2011: Case study of a high wind event off the coast of the Prince Olav Mountains, Antarctica. American Meteorological Society 11th Conference on Polar Meteorology and Oceanography, Boston, MA. Oral presentation.

Lazzara, M.A., J.E. Thom, G.A. Weidner, L.M. Keller, M.A. Nigro, and J.J. Cassano, 2011: The Antarctic automatic weather station program. American Meteorological Society 11th Conference on Polar Meteorology and Oceanography, Boston, MA. Poster presentation.

Cassano attended the Antarctic Meteorological Observation, Modeling, and Forecasting workshop in Hobart, Australia (June 2011).

Cassano, J.J. and M.A. Nigro, 2011: Case study of a high wind event off the coast of the Prince Olav Mountains, Antarctica. Antarctic Meteorological Observation, Modeling, and Forecasting workshop, Hobart, Australia. Oral presentation.

Cassano attended the International Union of Geodesy and Geophysics General Assembly in Melbourne, Australia (July 2011).

Cassano, J., S. Knuth, and M. Nigro, 2011: Use of autonomous observing platforms to study polar mesoscale features. International Union of Geodesy and Geophysics General Assembly, Melbourne, Australia. Invited presentation.

July 2009 to August 2010

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

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

Conferences attended / presentations

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

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

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

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

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

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

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

June 2008 to June 2009

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

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

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

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

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

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

Conferences attended / presentations

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

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

Seefeldt, M.W. and J.J. Cassano, 2008: A description of the Ross Ice Shelf air stream (RAS) through the use of self-organizing maps. Scientific

Committee on Antarctic Research Open Science Meeting, July 2008, St. Petersburg, Russia.

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

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

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

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

McMurdo Station, January 2009

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

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

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

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

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

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

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

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

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

Sept 2007 to June 2008

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

Development of semi-automated automatic weather station quality control software

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

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

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

Conferences attended / presentations

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

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

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

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

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

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

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

Findings:

ptember 2010 to August 2011

The case study of the high wind event at Sabrina AWS (Nigro et al. 2011b) identified the multiple processes responsible for the development of this event. These processes spanned the mesoscale and synoptic space scales and included forcing from synoptic and mesoscale cyclones, esoscale katabatic and barrier winds, and mesoscale flow interactions with the topography of the Transantarctic Mountains. A conceptual odel for the development of this high wind event was presented and has been defined as being a barrier wind tip jet. Forcing for this barrier wind tip jet was strongest near Sabrina AWS (near the Prince Olav Mountains) two weaker barrier wind tip jets formed downwind of the Queen Alexander and Churchill Mountains.

The primary results from the AMPS cyclone evaluation (Nigro et al. 2011c) were:

AMPS accurately predicts 40% of satellite observed cyclones in the western Ross Sea region

- AMPS accurately predicts the absence of cyclones 70% of the time

he majority of cyclones in the analysis region are mesoscale cyclones

- AMPS forecasts of cyclones are more accurate in the eastern portion of the domain, away from the complex topography of the Transantarctic ountains

- a large number of small cyclones north of Ross Island were identified in both the satellite images and in the AMPS forecasts, although the details of these cyclones was not well represented in AMPS forecasts

July 2009 - August 2010

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

June 2008 - June 2009

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

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

Sept 2007 - June 2008

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

Training and Development:

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

Outreach Activities:

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

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

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, "A description of the Ross Ice Shelf air stream (RAS) through the use of self-organizing maps (SOMs)", Journal of Geophysical Research, p. , vol. , (2011). Submitted,

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

Nigro, M.A., Cassano, J.J., and M.W. Seefeldt, "A weather pattern-based approach to evaluate the Antarctic Mesoscale Prediction System (AMPS) forecasts: Comparison to automatic weather station observations", Weather and Forecasting, p. 184, vol. 26, (2011). Published, 10.1175/2010WAF2222444.1

Nigro, M.A., J.J. Cassano, M.A. Lazzara, and L.M. Keller, "Case study of a barrier wind tip jet off the coast of the Prince Olav Mountains, Antarctica", Monthly Weather Review, p. , vol. , (2011). Submitted,

Nigro, M.A., J.J. Cassano, and S.L. Knuth, "Evaluation of Antarctic Mesoscale Prediction System (AMPS) cyclone forecasts using infrared satellite imagery", Antarctic Science, p. , vol. , (2011). Published, 10.1017/S0954102011000745

Books or Other One-time Publications

John J. Cassano, "Climate of Extremes", (2010). Book, in preparation

litor(s): David W. H. Walton
ollection: Antarctica - Global Science From a Frozen Continent
Bibliography: Cambridge University Press

Web/Internet Site

Other Specific Products

roduct Type:

Software (or netware)

oduct Description:

Semi-automated AWS data quality control program

Sharing Information:

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

Contributions

ontributions within Discipline:

The 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 published and in press that describe the climatology and dynamics of the low level wind field er the Ross Ice Shelf, describe the synoptic climatology of cyclones over the Southern Ocean, and evaluate the accuracy of Antarctic Mesoscale Prediction System (AMPS) forecasts.

ntributions to Other Disciplines:

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

ntributions to Human Resource Development:

Funds from this project have been used to support a PhD student (Melissa Nigro, maiden name Richards) in the Department of Atmospheric d Oceanic Sciences at the University of Colorado. Ms. Nigro has gained experience in analyzing observational and model based data, rforming Antarctic field work, presenting results of her research at national and international conferences, and publishing her research results in the peer reviewed literature. Ms. Nigro will complete her Ph.D. in 2012.

ntributions to Resources for Research and Education:

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

ntributions Beyond Science and Engineering:

Conference Proceedings

Categories for which nothing is reported:

Any Web/Internet Site

ntributions: To Any Beyond Science and Engineering

y Conference