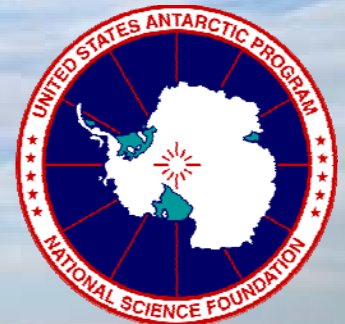
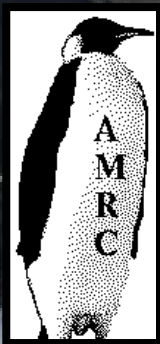


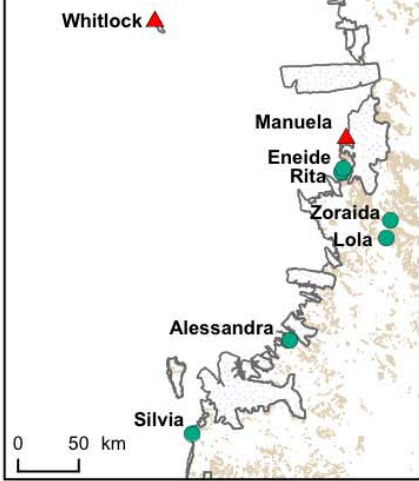
A Review of the 2009-2010 Automatic Weather Station (AWS) Field Season & *The Future...*

Dr. Matthew A. Lazzara
Antarctic Automatic Weather Station Program
Antarctic Meteorological Research Center
Space Science and Engineering Center
University of Wisconsin-Madison
O-283-M/P/S

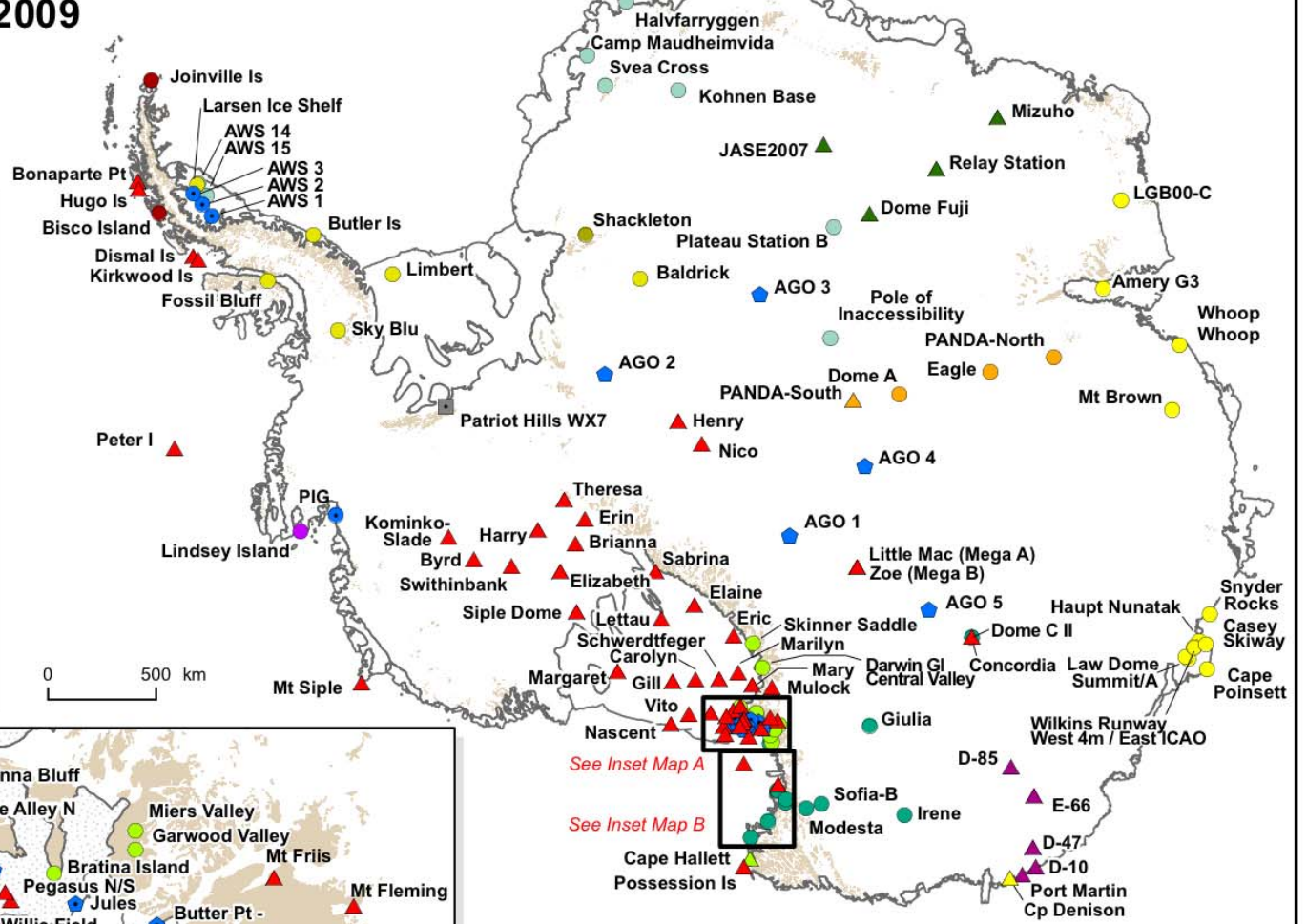
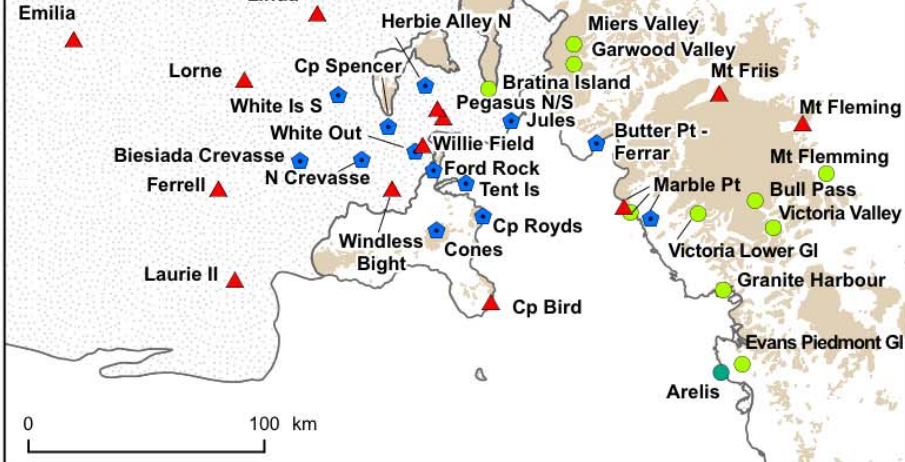


Automatic Weather Stations Antarctica - 2009

Inset Map B



Inset Map A



United States AWS	International AWS	Other AWS
▲ Univ. of Wisconsin (UW)	● Australia	■ Commercial
▲ UW / Australia	● Brazil	
▲ UW / China	● China/Australia	
▲ UW / France	● Italy	
▲ UW / Japan	● Netherlands	
▲ UW / New Zealand	● New Zealand	
▲ AGO	● Russia	
▲ SPAWAR	● South Korea	
● Other US	● United Kingdom	

Coastline: ADD v4.1, 2003
2009_AWS_Sites_ALL

November 2009 Sam Batzli SSEC
University of Wisconsin-Madison

National Science Foundation ANT-0636873

2009-2010 Field Team



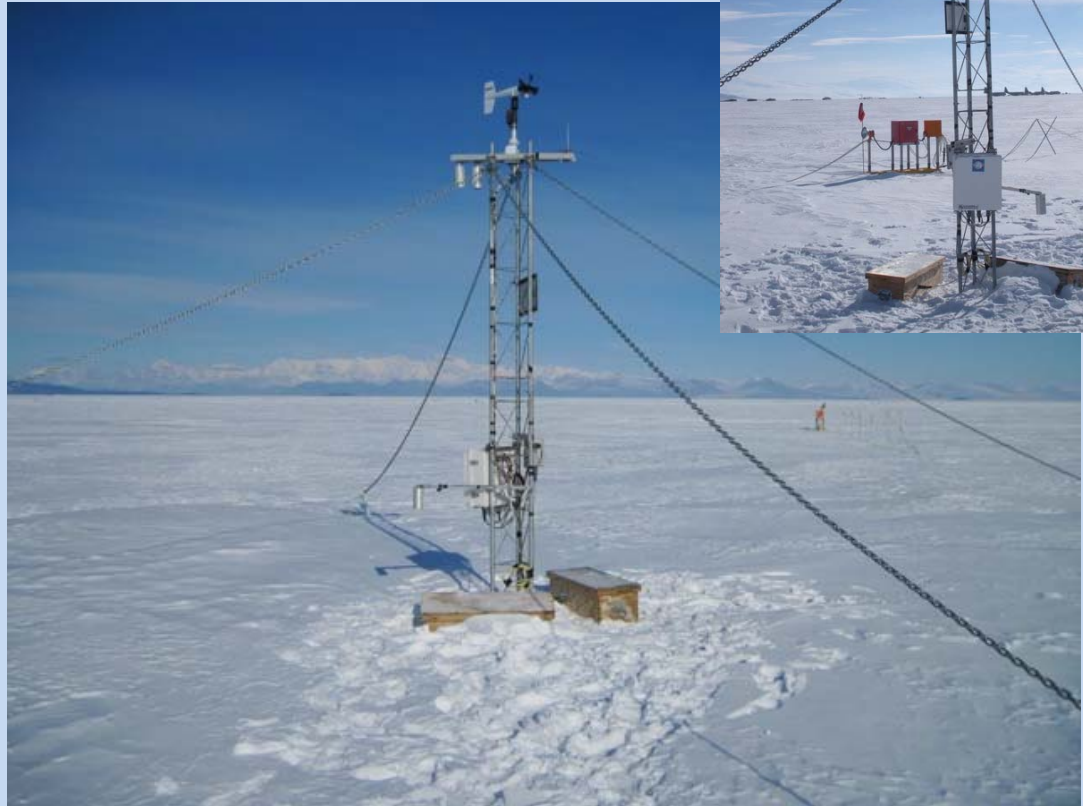
Pegasus North AWS

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.



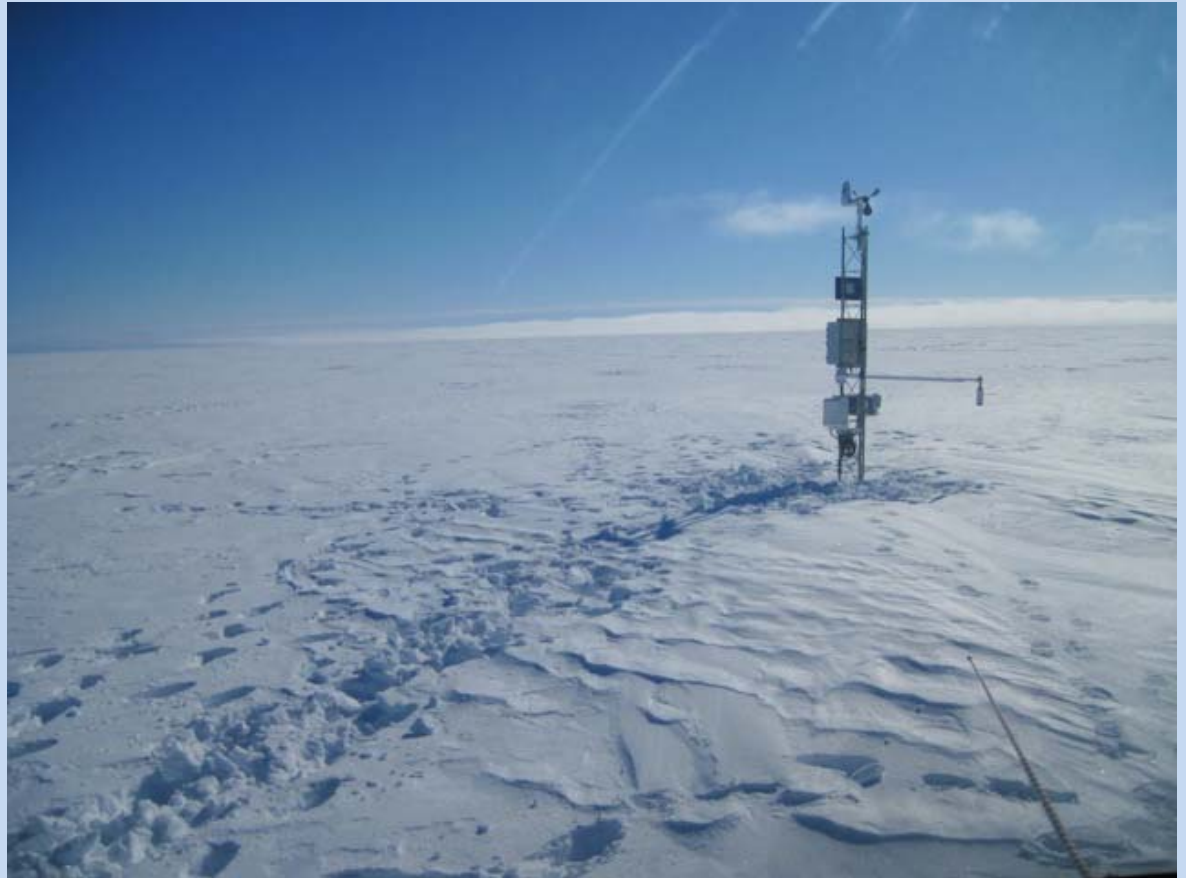
- Date: 20/Jan/2010
- Time: 9:30 am through 12 noon, 1:30 pm through 3:30 pm
- Team members: Matthew Lazzara, Charlie Bentley, Yvonne Gambini, Bradley Simon, Tony Wendricks
- Measurements to the surface (bottom of the following):
- Before Tower Raise:
 - Delta-T #1: 21.5 inches (0.55 meters)
 - Junction 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.

Kominko-Slade (WAIS)



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



Windless Bight

Visit #1:

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

Visit #2:

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



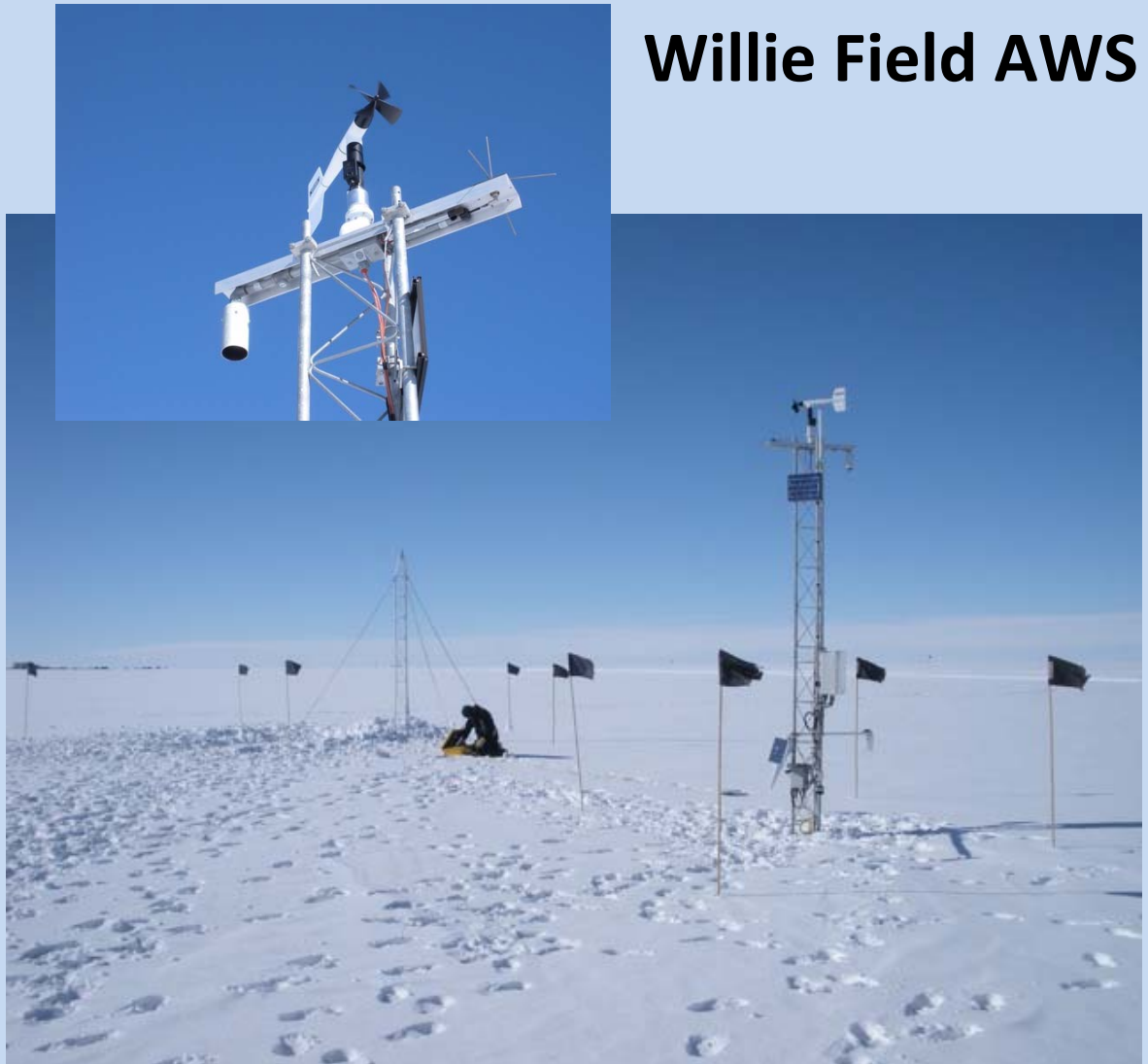
Elaine AWS

- 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.)



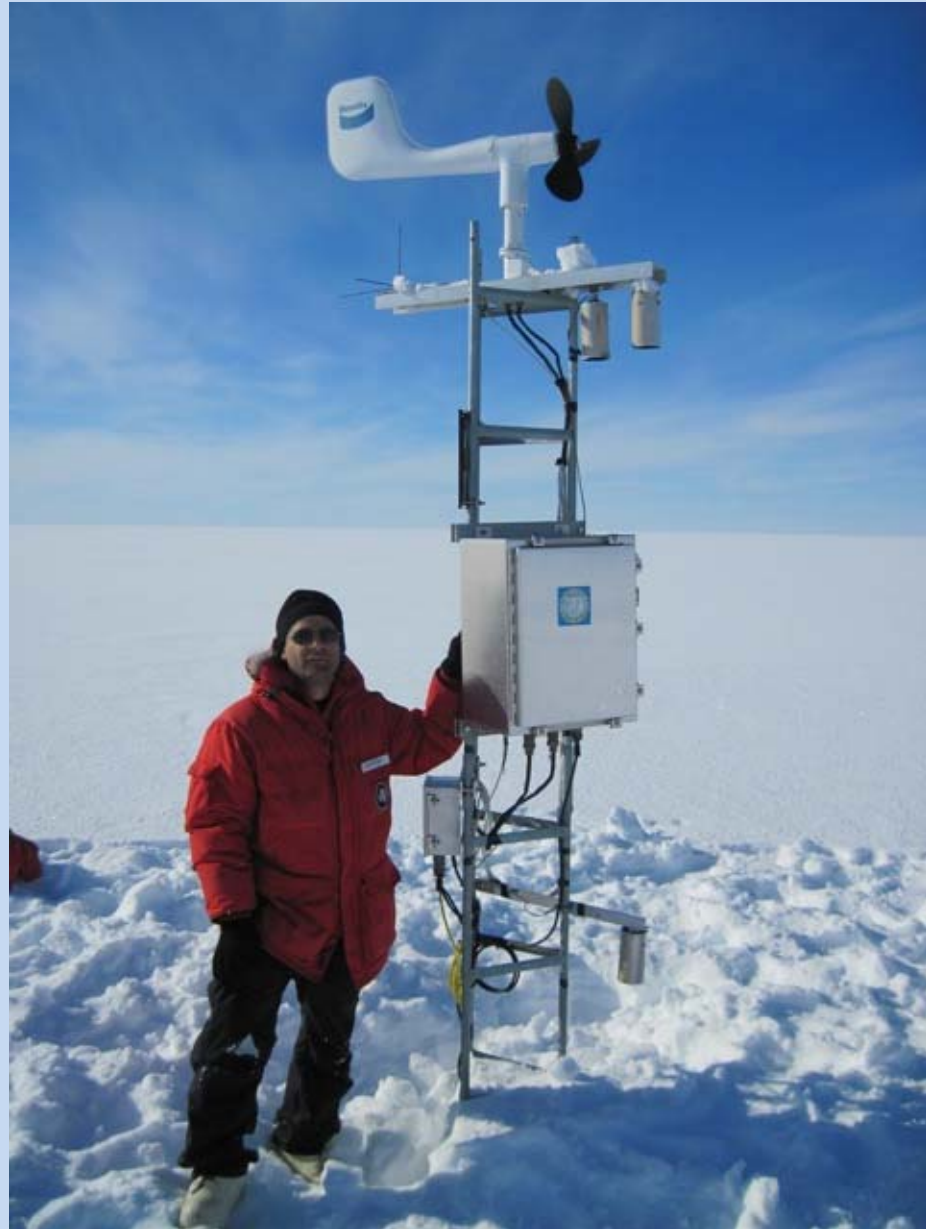
Willie Field AWS

- 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: (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/tightened up mounting of wind sensor



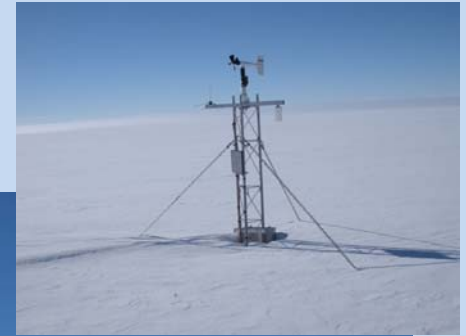
Lettau AWS

- 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: 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
 - Battery (yellow cord): 12.7 volts.
 - Battery (black cord): 13.3 volts
 - Junction Box: 12.9 volts
- UNAVCO GPS: Yes
- Replaced old/exposed battery box with new battery box.
- Corrected installation of solar panel.



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.



Byrd AWS

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



Collaboration with France/IPEV

D-47 AWS

- Date: Jan 13, 2010 and Feb 1, 2010
- Field Team: IPEV field/RAID team
- AWS 8947 removed for installation at E-66.
- Installed AWS 8916.

E-66 AWS

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

Collaboration with Japan/JARE

Dome Fuji AWS

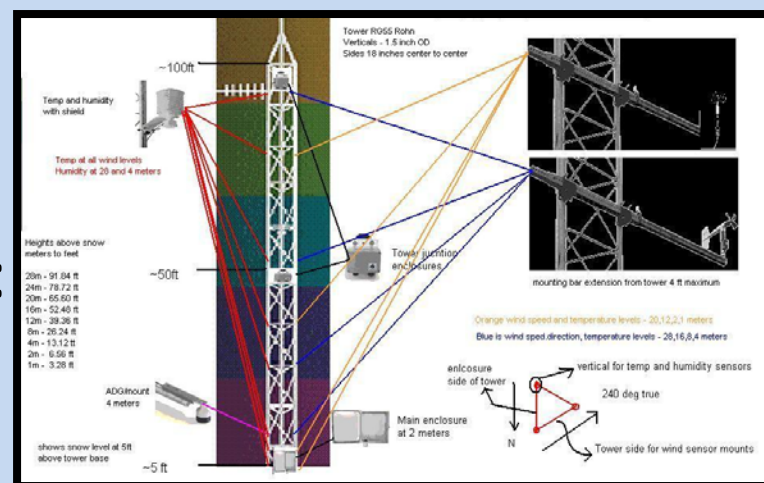
- Date: 12 January 2010
- Field Team: Dr. Motoyama & JARE field team
- Removed existing non-working AWS and installed a new AWS (Argos ID 8904)

Relay Station AWS

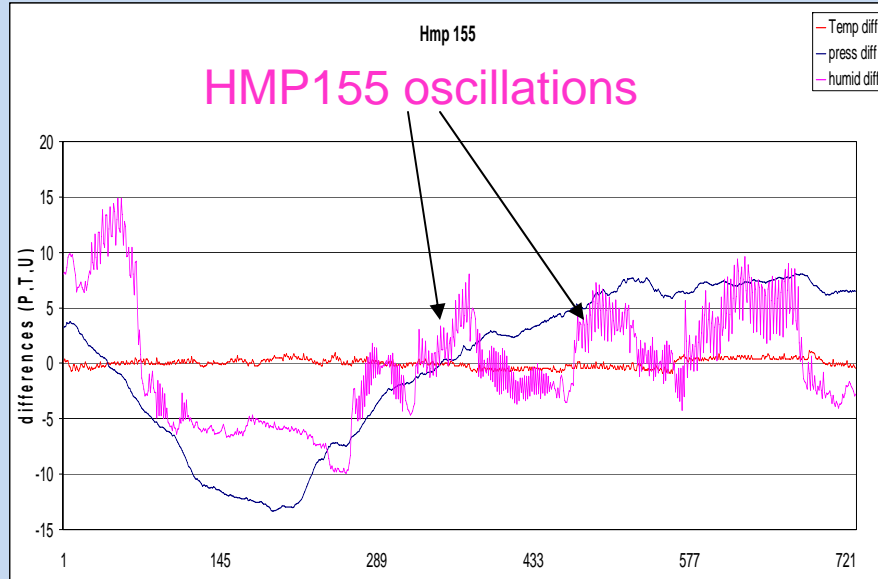
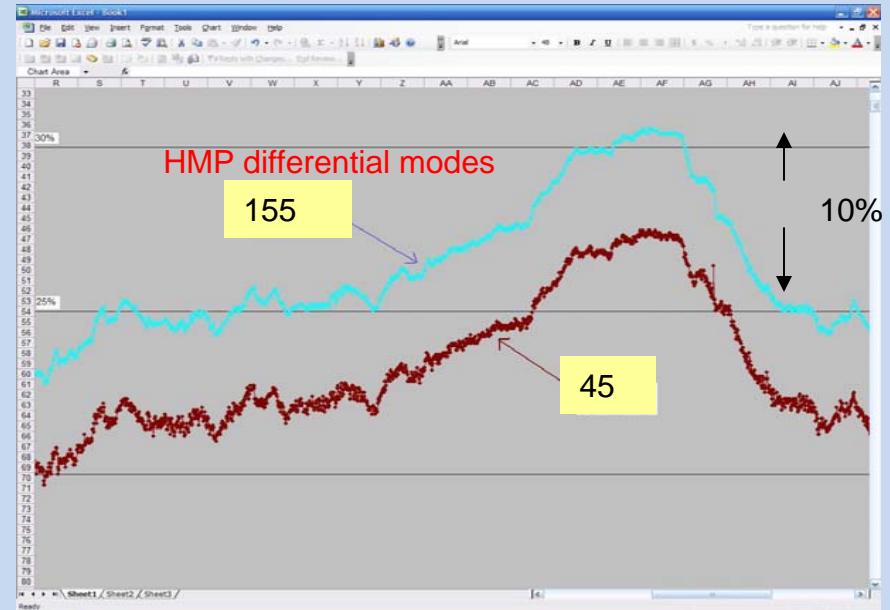
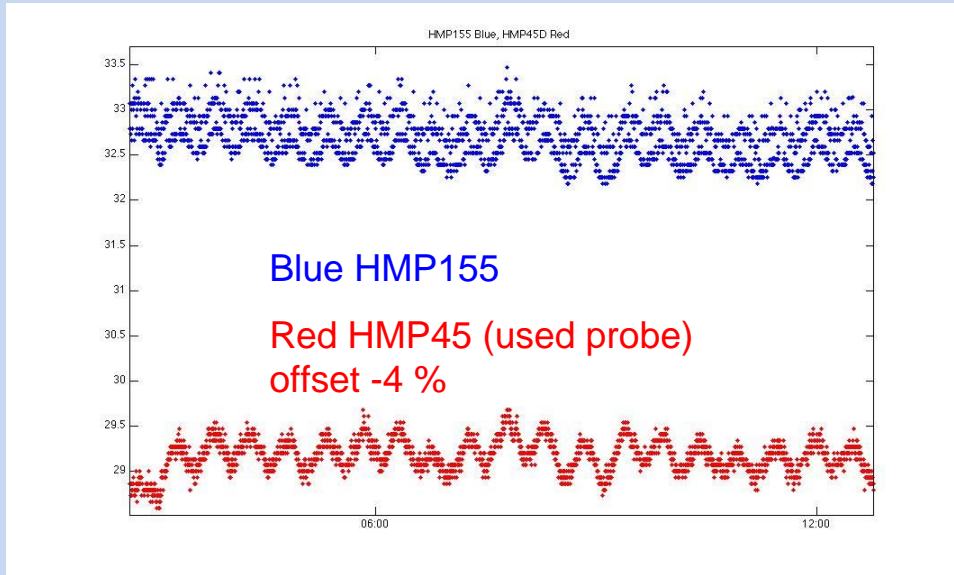
- Date: 31 January 2010
- Field Team: Dr. Motoyama & JARE field team
- Removed existing non-working AWS and installed a new AWS (Argos ID 8918)

Sites Not Installed (Due to weather...)

- South of McMurdo Station:
 - **Tall Tower AWS**
- In Pine Island Glacier (PIG) Area:
 - **Thurston Island AWS**
 - **Bear Peninsula AWS**
 - **Pig Helo Camp Site C AWS**
 - Maybe installed at/near Meyers Nunatak?
 - *All of these are co-located at POLENET sites*
 - *Other sites not visited (e.g. Siple Dome) due to limits on logistics/time/etc.*



Issues: Humidity probe replacement HMP155 for the HMP45 (in single-ended mode not a simple replacement!)



- In single-ended mode we observed high frequency oscillations (upper left)
- Wired into a CR1000 we observed episodic oscillations (left)
- From Vaisala: **In older products there is PTC-resistor connected in GND line for current protection and now if you are measuring RHout against GND (we weren't) instead of Agnd you can see ripple in measurements because of the variable current of digital electronics. HMP45 is fully analog.** In current products this PTC-resistor is removed and is less noisy if the probe is in 3-wire connection but still the 4-wire is preferred
- Solution: we wired the 155 into the CR1000 in differential mode as above. Results much improved! (above plot)
- Our solution for single-ended configuration: What we found was that by placing a load resistor on the output (RHout to Agnd) we could significantly reduce the "oscillations" in RHout.
- If the value of this resistor was 1Kohm we also observed a shift of -0.02 VDC on the output. e.g. 48% to 46% in humidity units(%)
- As we increased the resistor to 10Kohm and finally to 1Mohm this output shift was reduced so that at 1 Mohm we no longer saw the output voltage changing and we still observed reduced oscillations in the output.
- This is discussed on the CSI forum page at the link below.

<http://www.campbellsci.com/forum/messages.cfm?threadid=E5BAA333-E407-75BD-F9D9B0DCA02CA7CE>

Changes...

- Limited resources for a lot of science groups
 - More groups using Twin Otter and Helicopters
 - Lab space limitations
 - No longer have access to some stations because of discontinued ship support (e.g. no over water helo support)
- Changes in cost accounting
 - More logistic costs being paid for through science
 - Argos/CLS America
- Changes in policy
 - Focus on Science
 - Collaborations must be explicit/formal
 - Initial “informal” collaboration with POLENET ?
 - AGO ?

The AWS Future....

- ✦ Repairs
- ✦ Replacements
- ✦ Removals
- ✦ Returns/Transfers
- ✦ Sites to not be visited again
- ✦ New Installs
- ✦ “Reduce” Argos AWS sites to ~50 in 3 years
- ✦ On-board storage recording
- ✦ Proposed UHF/VHF relay in the McMurdo area (~8 sites)
- ✦ Continually re-evaluate other communication options
 - ✦ Iridium
 - ✦ Argos III (testing 2010)
 - ✦ Other?

Overall: Focus on research activities

Collaborations...

Policy

Optimize capabilities – Mutual benefit

Table 3. AWS Activities proposed in future years (pending funding and is subject change).

AWS Site	Latitude	Longitude	Elevation	Plan	Comments
I-157 Fuel cache	78.0°S	96.03°W	Unknown	New AWS install	Proposal pending with NSF. Install proposed 2010-2011
I-189 Fuel Cache	77.17°S	123.4°W	Unknown	New AWS install	Proposal pending with NSF. Install proposed 2010-2011
Swithinbank	81.201°S	126.177°W	959 m	AWS removal	Proposal pending with NSF. Removal proposed 2010-2011 or 2011-2012
Brianna	83.889°S	134.154°W	525m	AWS removal	Proposal pending with NSF. Removal proposed 2010-2011 or 2011-2012
Theresa or Harry	Theresa: 84.599°S	Theresa: 115.811°W	Theresa: 1463 m	AWS removal	Proposal pending with NSF. Removal proposed 2010-2011 or 2011-2012 – exact site to be removed to be determined.
	Harry: 83.003°S	Harry: 121.393°W	Harry: 945 m		
Larsen Ice Shelf, Bulter Island, Sky Blu, Limbert, Baldrick	Various	Various	Various	AWS communications hand over to British Antarctic Survey	United Kingdom takes over AWS completely in 2010-2011 or 2011-2012 field seasons.
Minna Bluff, Linda, Lorne, Ferrell, Laurie II, Windless Bight, Willie Field, Pegasus North	Various	Various	Various	AWS communications switch from Argos DCS to UHF/VHF modem	Proposal pending with NSF. Switch to take place over 2 field seasons 2010-2011 and 2011-2012. Exact sites pending communications tests.
Mt. Friis, Mt. Fleming	77.533°S	160.271°E	1950 m	Removal of Argos DCS communications	AWS returned to original PIs or removed.
	77.747°S	161.516°E	1580 m		
Megadunes AWS (Little Mac, Zoe, etc.)	~80.7°S	~124.45°E	~2884 m	Removal of older AWS, and leave one working AWS	Proposal Pending with NSF for 2010-2011 field season

AWS Site	Latitude	Longitude	Elevation	Plan	Comments
Mt. Siple, Possession Island, Kirkwood Island	Various	Various	Various	AWS sites with no logistics plans to visit for repair	As sites fail, they will not be replaced or repaired
Dismal Island	68.087°S	68.825°W	10 m	AWS may be adopted by BAS	Future unknown, under discussion
Ross Ice Shelf site 1, Ross Ice Shelf site 2	Near Sabrina AWS - TBD	Near Sabrina AWS - TBD	Near Sabrina AWS - TBD	New AWS install – temporary for 2 years	Proposal pending with NSF. Installation in 2010-2011 and removal in 2012-2013
Henry	89.011°S	1.025°W	2755 m	AWS Removal	Proposal pending with NSF. Removal proposed 2010-2011 or 2011-2012. Recommend AWS site to be taken over by McMurdo Weather
Nico	89.00°S	89669°E	2935 m	AWS Removal	Proposal pending with NSF. Removal proposed 2010-2011 or 2011-2012. Recommend AWS site to be taken over by McMurdo Weather
Whitlock	76.144°S	168.392°E	206 m	AWS repair	Proposal pending with NSF. Repair pending availability of over-water helicopters.
Peter I Island	68.769°S	90.67°W	90 m	AWS replacement	AWS installed, but not working. Proposal pending with NSF. AWS replacement proposed 2010-2011, and depends on availability of helicopters on the Oden.



Thank you!

Acknowledgements:
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