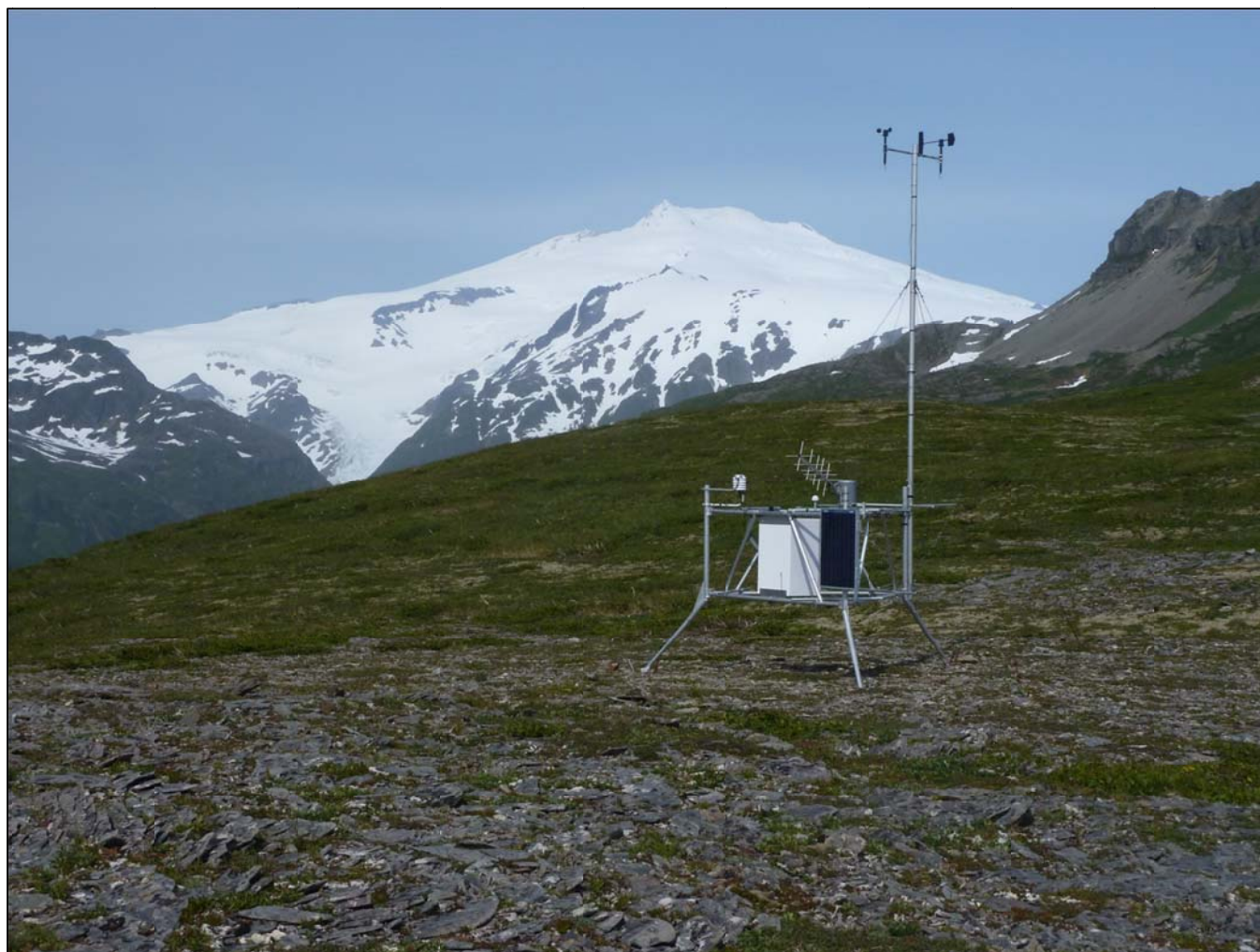




Weather Station Maintenance in Southwest Alaska Network Parks

Summary for the 2012 Hydrologic Year

Natural Resource Data Series NPS/SWAN/NRDS—2012/394



ON THE COVER

The Fourpeaked remote automated weather station, Katmai National Park and Preserve
Photograph by: Chuck Lindsay

Weather Station Maintenance in Southwest Alaska Network Parks

Summary for the 2012 Hydrologic Year

Natural Resource Data Series NPS/SWAN/NRDS—2012/394

Chuck Lindsay

National Park Service
Southwest Alaska Network Inventory and Monitoring Program
240 W 5th Avenue
Anchorage, Alaska 99501

October 2012

U.S. Department of the Interior
National Park Service
Natural Resource Stewardship and Science
Fort Collins, Colorado

The National Park Service, Natural Resource Stewardship and Science office in Fort Collins, Colorado, publishes a range of reports that address natural resource topics. These reports are of interest and applicability to a broad audience in the National Park Service and others in natural resource management, including scientists, conservation and environmental constituencies, and the public.

The Natural Resource Data Series is intended for the timely release of basic data sets and data summaries. Care has been taken to assure accuracy of raw data values, but a thorough analysis and interpretation of the data has not been completed. Consequently, the initial analyses of data in this report are provisional and subject to change.

All manuscripts in the series receive the appropriate level of peer review to ensure that the information is scientifically credible, technically accurate, appropriately written for the intended audience, and designed and published in a professional manner.

Data in this report were collected and analyzed using methods based on established, peer-reviewed protocols (Lindsay et al. 2012) and were analyzed and interpreted within the guidelines of the protocols.

Views, statements, findings, conclusions, recommendations, and data in this report do not necessarily reflect views and policies of the National Park Service, U.S. Department of the Interior. Mention of trade names or commercial products does not constitute endorsement or recommendation for use by the U.S. Government.

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Please cite this publication as:

Lindsay, C. 2012. Weather station maintenance in Southwest Alaska Network parks: Summary for the 2012 hydrologic year. Natural Resource Data Series NPS/SWAN/NRDS—2012/394. National Park Service, Fort Collins, Colorado.

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Abstract

Field maintenance of climate monitoring stations is necessary to provide for the continuous acquisition of quality meteorological data, retrieval of complete station data, and fulfilling the station standards issued by respective climate monitoring programs (e.g. NWCG 2012).

Currently, the Southwest Alaska Network (SWAN) maintains 10 Remote Automated Weather Stations (RAWS) in three network parks. This report summarizes all work (annual maintenance, unscheduled maintenance, and new installations) for the 2012 hydrologic year (October 1, 2011 to September 30, 2012) and includes up-to-date sensor metadata.

Acknowledgments

Successfully maintaining 10 weather stations in three park units wouldn't have been possible without the cooperation, field assistance, and air support from Alaska Wildland Adventures, Shosuke Akuzawa, Leon Alsworth, William Clark, Mellisa Elerick, Mike Fell, Bruce Giffen, Allen Gilliland, Vera Gilliland, Merlin Handley, Ginger Irvine, Mark Kansteiner, Deborah Kurtz, Jeff Nelson, Doug Peratrovich, Port Graham Corporation, Howard Reed, Rich Richotte, Michael Shephard, James Walton, and Jesse Wright.

List of Acronyms

Ah	Amp hour
AKDST	Alaska Daylight Savings Time
AKRO	Alaska Regional Office
AMD	Aviation Management Directorate
AT-RH	Air Temperature – Relative Humidity
B206	Bell 206 helicopter
CS	Campbell Scientific
C185	Cessna 185 airplane
C206	Cessna 206 airplane
DHC-2	de Havilland Beaver airplane
DLP	Data Logger Program
FTS	Forest Technology Systems
GOES	Geostationary Operational Environmental Satellite
GPS	Global Positioning System
I&M	Inventory and Monitoring
KATM	Katmai National Park and Preserve
KEFJ	Kenai Fjords National Park
LACL	Lake Clark National Park and Preserve
LED	Light-Emitting Diode
NESDIS ID	National Environmental Satellite, Data, and Information Service Identifier
NIFC	National Interagency Fire Center
NPS	National Park Service
RAWS	Remote Automated Weather Station

List of Acronyms (continued)

RG-TB	Rain Gauge – Tipping Bucket
SD	Snow Depth
SDI	Serial Digital Interface
SR	Solar Radiation
STEP	Single-skid, Toe-in, and hover Exit/entry procedure
SWAN	Southwest Alaska Network
W	Watt
WD	Wind Direction
WFMI	Wildland Fire Management Information
WRCC	Western Regional Climate Center
WS	Wind Speed

Weather Station Locations

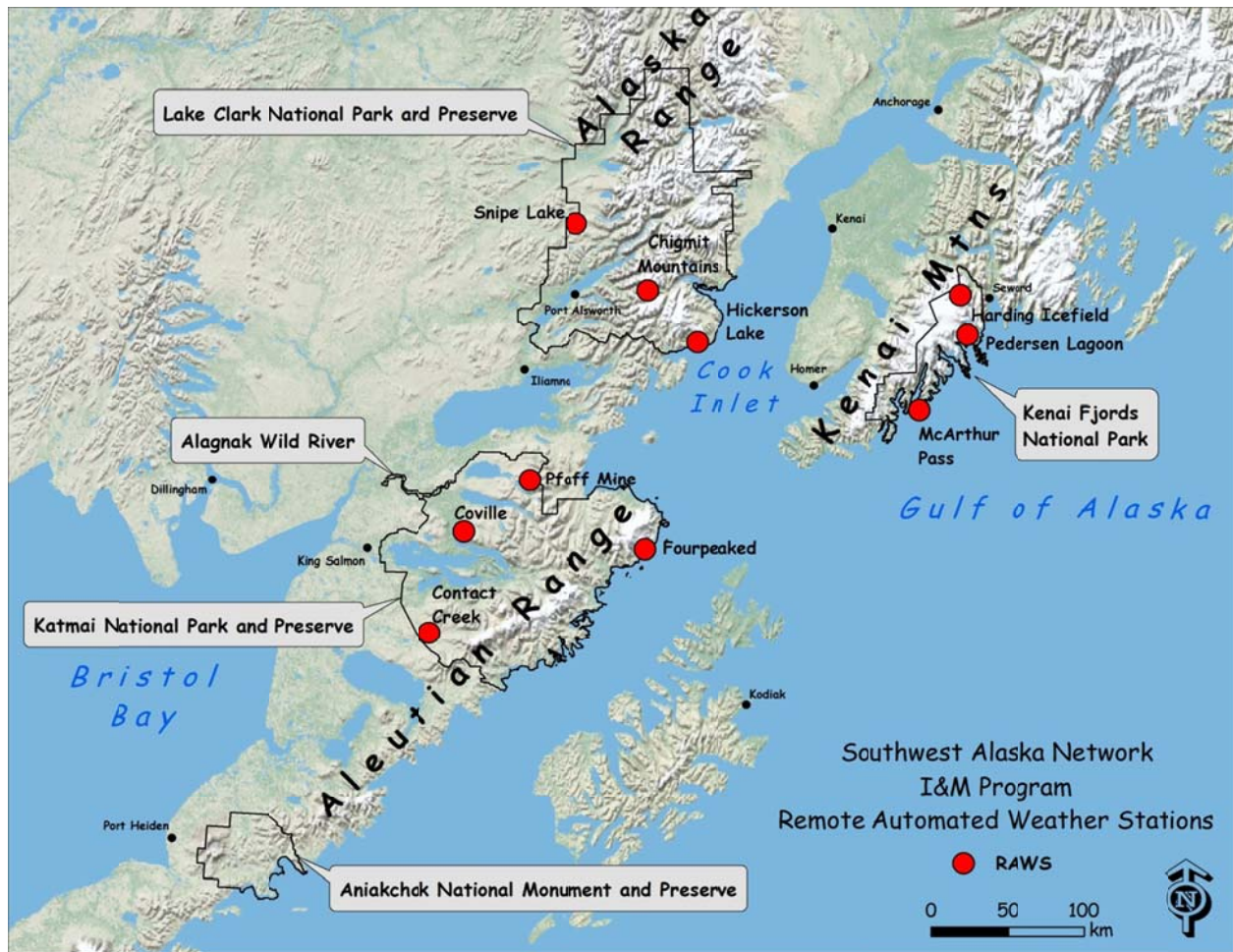


Figure 1. Map showing locations of weather stations operated and maintained by the SWAN.

Table 1. Metadata for weather stations operated and maintained by the SWAN.

Station name	Park	Station type	NESDIS ID no.	Lat. N	Lon. W	Elev ft.	Start date
Chignik Mountains	LACL	RAWS	FA6544FC	60.2249	153.4675	4658	7/2009
Contact Creek	KATM	RAWS	32803738	58.2076	155.9225	657	6/2008
Coville	KATM	RAWS	3280B12C	58.8025	155.5629	1567	6/2008
Fourpeaked	KATM	RAWS	328135C2	58.7057	153.5179	1074	6/2009
Harding Icefield	KEFJ	RAWS	FA656210	60.1325	149.7820	4335	7/2004
Hickerson Lake	LACL	RAWS	3280C7BC	59.9148	152.8925	1048	6/2008
McArthur Pass	KEFJ	RAWS	3280244E	59.4726	150.3337	1266	6/2008
Pedersen Lagoon	KEFJ	RAWS	326AD012	59.8944	149.7308	624	8/2011
Pfaff Mine	KATM	RAWS	FA65578A	59.1109	154.8367	2018	6/2008
Snipe Lake	LACL	RAWS	328041A8	60.6103	154.3199	2315	6/2008

Weather Station Maintenance Summaries

Chigmit Mountains Weather Station – Annual Maintenance – June 11, 2012

Date: June 11, 2012

Time of visit: 1100-1400

Personnel: Chuck Lindsay

Mode of transport: B206 helicopter from Homer (Pathfinder Aviation)

Purpose of trip: Annual maintenance

Weather: Mostly sunny, 42 F, winds NW 10 mph gusting 15 mph, 22 in snow on the ground

Sensors replaced:

Air temperature – relative humidity

Wind speed

Wind direction

Rain gauge tipping bucket

Snow depth

Narrative:

Access to the Chigmit Mountains weather station by park ski plane (from Port Alsworth) in March was prohibited because the ski plane got stuck in deep snow when landing near the weather station and the maintenance trip was aborted. Instead, a helicopter from Homer was used for access in June (Figure 2). The station was in good shape with no significant damage. The AT-RH sensor, WS sensor, and WD sensor were replaced. A WD sensor direction test was done. Both wind sensors on this station are replaced each year because of harsh conditions at site. The RG-TB was replaced, the rain count for the tipping bucket was zeroed, and a tipping bucket test was done. The SD sensor was replaced with a Campbell Scientific SR50 SD sensor, which was rehabbed with new transducer plates and desiccant. The data logger program CHMO_DLP_SR50_20120611.prg was loaded to support SR50 SD sensor. SD in the DLP was edited to zero the sensor. Snow depth was zeroed to an average reading of -0.5 inches to account for fluctuation without reporting misleading snow depth readings. Snow beneath sensor was replaced to approximate actual snow depth on ground, which was 22 inches at time of maintenance (Figure 3). All data in the data logger was down loaded to send to the WRCC in order to update the archive. Spare sensors that were ordered for this station were not used. The wind sensor support arm will need to be replaced during the next maintenance visit because the threads are stripped on the WS sensor mount. Two hose clamps were used to make up for the resulting missing bolt on this sensor. All bolts on the station were checked and tightened if loose and cables were zip-tied. Station observations and GOES transmission quality were checked before departure. Observations and transmissions were verified from the WFMI website by NIFC and relayed by satellite phone. Before departure the station was photographed from eight directions (every 45°) and the inside of the instrument enclosure (Figure 4) was also photographed.



Figure 2. Chigmit Mountain RAWS - Helispot adjacent to the weather station.

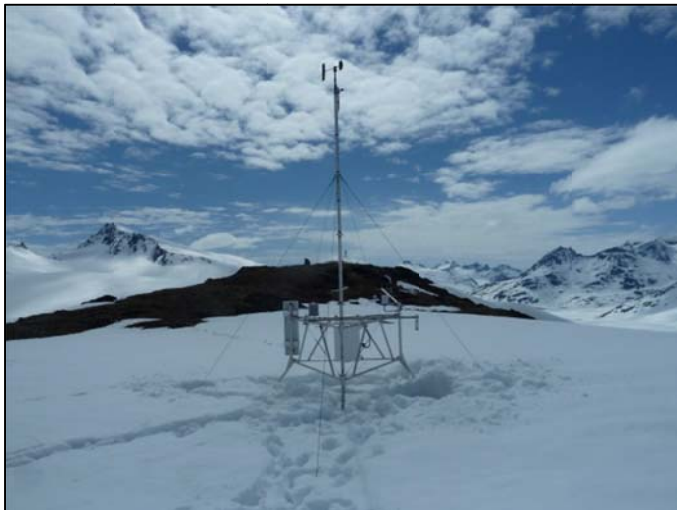


Figure 3. Chigmit Mountain RAWS - Snow was dug out below the SD sensor prior to zeroing the DLP. This snow was then replaced in order to approximate the 22 inches of snow that were still on the ground.



Figure 4. Chigmit Mountain RAWS - The inside of the instrument enclosure photographed just before departure.

Contact Creek Weather Station – Annual Maintenance – June 21, 2012

Date: June 21, 2012

Time of visit: 1600-2100

Personnel: Chuck Lindsay, Michael Shephard

Mode of transport: C185 (on wheels) from King Salmon (park aircraft)

Purpose of trip: Annual maintenance

Weather: Sunny, 60 F, winds W 12 mph gusting 20 mph

Sensors replaced:

Air temperature – relative humidity

Wind speed

Wind direction

Snow depth

Camera (added)

Narrative:

Access to the Contact Creek weather station was by park wheel plane. The station was in good shape. The AT-RH sensor, WS sensor, WS sensor cable (housing was cut), and WD sensor were all replaced. A WD sensor direction test was done. The rain count for the tipping bucket was zeroed and a tipping bucket test was done. The SD sensor was replaced with a Campbell Scientific SR50A SD sensor, which was rehabbed with new transducer plates and desiccant. The data logger program COCR_DLP_SR50A_20120621.prg was loaded in order to support the SR50A SD sensor. SD in the DLP was edited to zero the sensor. SD was zeroed to an average reading of -0.5 inches to account for fluctuation without reporting misleading snow depth readings. All data in the data logger was downloaded to send to WRCC in order to update the archive. Spare sensors that were ordered for this station were not used. Station observations and GOES transmission quality were checked before departure. Observations and transmissions were verified from the WFMI website by NIFC and relayed by satellite phone. All bolts on the station were checked and tightened if loose and cables were zip-tied. Before departure the station was photographed from eight directions (every 45°) and the inside of the instrument enclosure (Figure 5) was also photographed. An electric fence was set-up to mitigate damage from wildlife (Figure 6). An additional time-lapse camera (Campbell Scientific CC5MPX), 10 W solar panel, and 35 Ah battery were installed on the weather station (Figure 7).



Figure 5. Contact Creek RAWS - The inside of the instrument enclosure photographed just before departure. Additional 35 Ah battery for Campbell Scientific time-lapse camera is visible in the lower-right portion of the photograph.

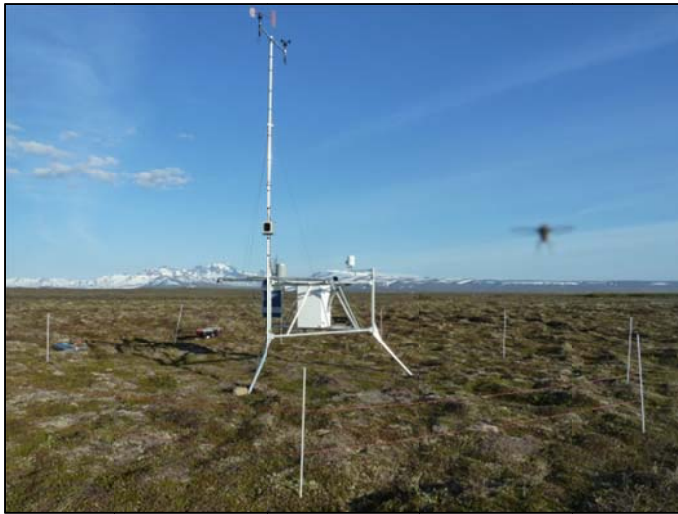


Figure 6. Contact Creek RAWS – An electric fence was setup to mitigate damage from wildlife.



Figure 7. Contact Creek RAWS – Campbell Scientific time-lapse camera set-up.

Coville Weather Station – Annual Maintenance – June 20, 2012

Date: June 20, 2012

Time of visit: 1300-1700

Personnel: Chuck Lindsay, Michael Shephard

Mode of transport: DHC-2 (on floats) from King Salmon (park aircraft)

Purpose of trip: Annual maintenance

Weather: Partly cloudy, 52 F, winds SW 6 mph gusting 14 mph

Sensors replaced:

Air temperature – relative humidity

Wind speed

Wind direction

Snow depth

Camera (added)

Narrative:

The station was in good shape except that the tail had fallen off the wind direction sensor (this probably occurred on November 13, 2011; Figure 8) and the mount on the AT-RH sensor was broken. WD observations were off by 180 degrees between November 13, 2011 and June 21, 2012. The erroneous WD observations (between December 21, 2011 and July 30, 2012) were intercepted using the WFMI system and were not passed on to client websites (e.g. WRCC). The AT-RH sensor, WS sensor, and WD sensor were all replaced. A wind direction sensor test was done. The rain count for the tipping bucket was zeroed. The SD sensor was replaced (with a Campbell Scientific SR50, which was rehabbed with new transducer plates and desiccant. The data logger program COVI_DLP_SR50_20120620.prg was loaded to support the SR50 SD sensor. SD in the DLP was edited to zero the sensor. SD was zeroed to an average reading of -0.5 inches to account for fluctuation without reporting misleading snow depth readings. All data in the data logger were downloaded to send to WRCC in order to update the archive. Spare sensors that were ordered for this station were not used. Station observations and GOES transmission quality were checked before departure. Observations and transmissions were verified from the WFMI website by SWAN staff in Anchorage and relayed by satellite phone. All bolts on the station were checked and tightened if loose and cables were zip-tied. Before departure the station was photographed from eight directions (every 45°) and the inside of the instrument enclosure (Figure 9) was also photographed. An additional time-lapse camera (Campbell Scientific CC5MPX), 10 W solar panel, and 35 Ah battery were installed on the weather station (Figure 10).



Figure 8. Coville RAWS – Wind direction sensor with no tail.



Figure 9. Coville RAWS - The inside of the instrument enclosure photographed just before departure. Additional 35 Ah battery for Campbell Scientific time-lapse camera is visible in the lower-right portion of the photograph.



Figure 10. Coville RAWS – Campbell Scientific time-lapse camera set-up.

Fourpeaked Weather Station – Annual Maintenance – June 7, 2012

Date: June 7, 2012

Time of visit: 1100-1600

Personnel: Chuck Lindsay

Mode of transport: B206 helicopter from Homer (Pathfinder Aviation)

Purpose of trip: Annual maintenance

Weather: Sunny, 50 F, winds SW 6 mph gusting 10 mph

Sensors replaced:

Air temperature – relative humidity

Wind speed

Wind direction

Batteries

Narrative:

Access to the Fourpeaked weather station was by helicopter from Homer. The station was in poor condition. There were breaks to the welds on two of the tri-leg tower panels (Figure 11). The AT-RH sensor had blown away (Figure 12). The GPS antenna cable had been pulled out of the antenna (Figure 13) probably because of the weight of ice buildup during winter storms. The tip had fallen off the WD sensor (Figure 14). The AT-RH sensor, WS sensor, WD sensor, and SR sensor were replaced. Both wind sensors on this station are replaced each year because of harsh conditions at the site. A WD sensor direction test was done. The Campbell Scientific SD sensor was removed and not replaced because ultrasonic distance ranging sensors don't work well at this location (moisture builds on the transducer plates) and most snow is blown away from this location. The SDI expansion port that was needed to run both the SD and SR sensors was also removed because it was no longer necessary. Both batteries were replaced with two new Sunlyte 100 Ah sealed batteries. The tri-leg tower frame was repaired using aircraft cable, turnbuckles, and shackles (Figure 15). The GPS antenna cable was replaced. The rain count for the tipping bucket was zeroed and a tipping bucket test was done. The current DLP running is DLP_FOUR_SR50A_20120607.prg. SD in the DLP was edited to force all SD observations to zero. This element will be deactivated in WFMI, so that a potentially false zero snow depth isn't passed on to client websites (e.g. WRCC) during winter months. All bolts on the station were checked and tightened if loose and cables were zip-tied. Station observations and GOES transmission quality were checked before departure. Observations and transmissions were verified from the WFMI website by NIFC and relayed by satellite phone. Before departure the station was photographed from eight directions (every 45°) and the inside of the instrument enclosure (Figure 16) was also photographed.



Figure 11. Fourpeaked RAWS – Broken weld on lower north corner of tri-leg tower frame.



Figure 12. Fourpeaked RAWS – AT-RH sensor was missing.



Figure 13. Fourpeaked RAWS – GPS antenna cable had been pulled out of the antenna.

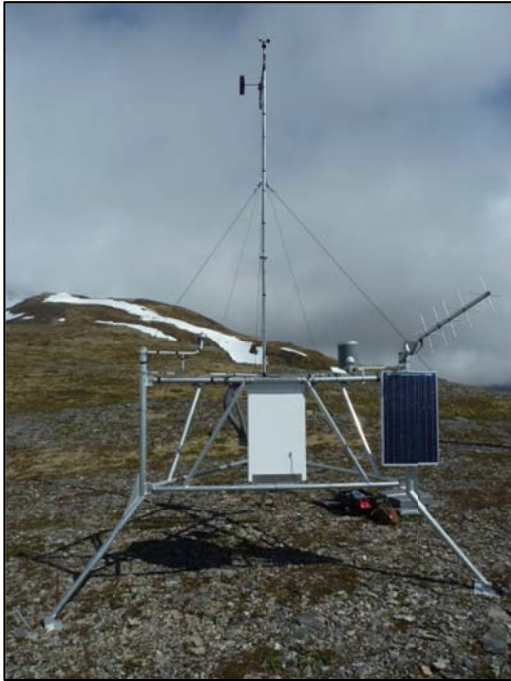


Figure 14. Fourpeaked RAWS – Wind direction sensor with no tip.



Figure 15. Fourpeaked RAWS – Field repair of broken weld in tri-leg tower frame.



Figure 16. Fourpeaked RAWS – Inside of instrument enclosure photographed just before departure.

Fourpeaked Weather Station – Unscheduled Maintenance – July 19, 2012

Date: July 19, 2012

Time of visit: 1000-1200

Personnel: Chuck Lindsay

Mode of transport: B206 helicopter from Homer (Pathfinder Aviation)

Purpose of trip: Unscheduled maintenance

Weather: Sunny, 49 F, winds S 5 mph gusting 12 mph

Sensors replaced:

Datalogger

GOES transmitter

GPS antenna

Narrative:

The station stopped transmitting on June 15, 2012, about a week after annual maintenance was done (June 7, 2012). Access to the Fourpeaked weather station was by helicopter from Homer. Station was not transmitting and the last few observations before the station stopped transmitting included parity errors in the message. There was no obvious damage to station. The LEDs on the GOES transmitter did not indicate any problems. All data in data logger was downloaded to send to WRCC in order to update the archive. The data logger, GOES transmitter, and the GPS antenna were replaced. The replacement data logger had been updated with firmware v. 6.7 (on June 12, 2012). The GOES antenna, GOES antenna cable, and GPS antenna cable were not replaced because there was no indication that anything was wrong with them. The GOES antenna orientation was verified (it was OK at 159 degrees and 21 degrees inclination). The NIFC RAWS Depot was contacted after repairs in order to verify that a transmission was received with good signal strength. The faulty data logger was returned to the RAWS Depot for repair. Aluminum pipe sections were attached to the tri-leg tower frame using U-bolts in order to help hold the broken frame welds together (Figure 17).



Figure 17. Fourpeaked RAWS – Aluminum pipe attached to help hold the broken tower frame welds together.

Harding Icefield Weather Station – Annual Maintenance – April 25, 2012

Date: April 25, 2012

Time of visit: 1100-1700

Personnel: Bruce Giffen (AKRO), William Clark (KEFJ)

Mode of transport: B206 helicopter from Seward (Maritime Helicopters)

Purpose of trip: Annual maintenance

Weather: Mostly Sunny, 32 F, winds NW 10 mph, 24" in snow on the ground

Sensors Replaced:

Temperature-Relative Humidity

Wind speed

Wind direction

Snow depth (Judd Communications sensor)

Data logger

SDI analog module (added)

Narrative:

Access was by helicopter from Seward. This work took place in conjunction with KEFJ glacier mass balance field work and helicopter expenses were split evenly between the park and I&M program. There was more snow around the station than observed in previous years (Figure 18). The station was in good shape. A few wind baffles on the precipitation gauge were upside down. These were repositioned. The AT-RH sensor, WD sensor, and the WS sensor were replaced. Both wind sensors on this station are replaced each year because of the harsh conditions at the site. AWD sensor direction test was done. All data was downloaded from the data logger to send to WRCC in order to update the archive. Some difficulty communicating with the data logger was experienced because laptop batteries quickly discharged due to the cold temperatures. The data logger was swapped out for one running newer firmware (v6.4). The new data logger was pre-programmed with a new data logger program (HAIC_DLP_judd_20120425.prg) designed for use with the Judd Communications snow depth sensor and configured for GOES telemetry. An analog-digital converter (SDI-AM module) was installed (wiring shown in Figure 19) so that the analog Judd SD sensor would communicate with the data logger using the SDI. The Campbell Scientific SR50A SD sensor was removed and replaced with a Judd Communications SD sensor (Figure 20). The all-weather precipitation gauge was serviced by draining the antifreeze/alcohol/water solution and replacing it with a fresh solution. There was a plug of ice blocking the outlet from the precipitation gauge. No precipitation will be logged until this ice melts. It is possible that this is a reoccurring problem in the spring. The rain count for the tipping bucket was zeroed and a tipping bucket test was done. Spare sensors that were ordered from RAWs Depot were not used. All bolts on the sensor arms and the tower and the guy lines were tightened. Station observations and GOES transmission quality were checked before departure. Observations and transmissions were verified from the WFMI website by satellite phone. Before departure the station was photographed from eight directions (every 45°) and the inside of the instrument enclosure (Figure 21) was also photographed.



Figure 18. Harding Icefield RAWS – The weather station upon arrival with two feet of snow on the ground. The station is, in fact, level. The snow surface is sloping.

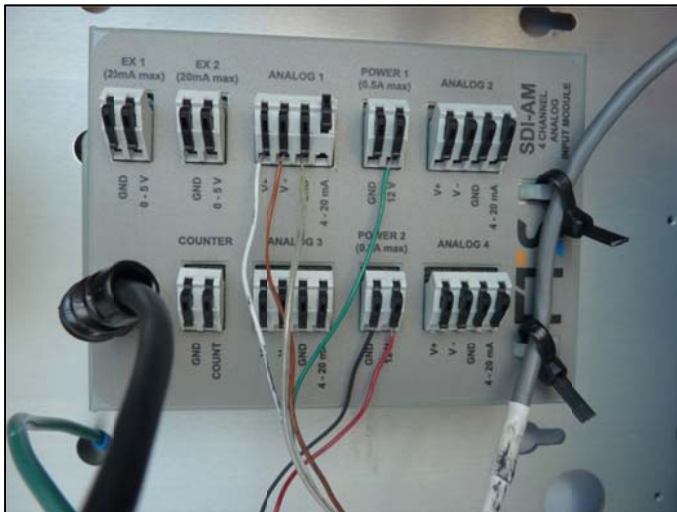


Figure 19. Harding Icefield RAWS – Wiring configuration for the Judd Communications snow depth sensor used on the SDI-AM module.



Figure 20. Harding Icefield RAWS – Judd Communications snow depth sensor.



Figure 21. Harding Icefield RAWS – Inside of instrument enclosure photographed just before departure.

Hickerson Lake Weather Station – Annual Maintenance – June 16, 2012

Date: June 16, 2012

Time of visit: 1100-1600

Personnel: Chuck Lindsay, Jeff Nelson (LACL)

Mode of transport: C185 (on floats) from Port Alsworth (park aircraft)

Purpose of trip: Annual maintenance

Weather: Sunny, 65 F, winds NW 6 mph

Sensors replaced:

Air temperature – relative humidity

Wind speed

Wind direction

Snow depth

GPS antenna

Narrative:

The station was significantly damaged by wildlife (black bear) on June 8, 2012. The GPS cable was cut. The GPS antenna was chewed-on (Figure 22). The RH/AT shielding (plastic louvers) was damaged (Figure 23), the wind speed cable was cut (Figure 24), and the GOES antenna cable was chewed-on (Figure 25). The AT-RH sensor, WS sensor, and WD sensor were all replaced. Both wind sensors on this station are replaced each year because of harsh conditions at the site. Both WS and WD sensor cables were replaced. A WD direction test was done. The GPS antenna and GPS antenna cable were replaced. The GOES antenna cable was replaced and the connection was sealed with mastic tape. The rain count for the tipping bucket was zeroed and a tipping bucket test was done. The SD sensor was replaced with a Campbell Scientific SR50 SD sensor, which was rehabbed with new transducer plates and desiccant. All data in the data logger was downloaded to send to the WRCC in order to update the archive. The data logger program HILA_DLP_SR50_20120616.prg was loaded to support the SR50 SD sensor. Snow depth was zeroed to an average reading of -0.5 inches to account for fluctuation without reporting misleading snow depth readings. All bolts on the station were checked and tightened if loose and cables were zip-tied. Station observations and GOES transmission quality were checked before departure. Observations and transmissions were verified from the WFMI website by NPS Radio Shop staff and relayed by satellite phone. Before departure the station was photographed from eight directions (every 45°) and the inside of the instrument enclosure (Figure 26) was also photographed.

Access to this station is challenging and potentially unsafe. The one mile hike from Hickerson Lake, where floatplanes land, crosses an unstable, lichen- and moss-covered boulder field with a 650 ft elevation gain. The hike is is challenging with heavy packs, potentially unsafe because of unstable boulders and definitely unsafe during wet conditions. Therefore, an attempt was made to try to identify a site where a helicopter could land adjacent to the weather station, but none was found. One small area of vegetation was found where a helicopter could make a STEP landing near the weather station (Figure 27). However, these procedures are prohibited except when approved in writing by the NPS regional director. Exceptions may be requested for a project or annually for a park program. It may be possible to construct a helipad using timbers and lumber, but a significant amount of materials would have to be brought in.



Figure 22. Hickerson Lake RAWS – GPS antenna with bear teeth marks.



Figure 23. Hickerson Lake RAWS – Damage to the plastic louvers on the AT-RH sensor.



Figure 24. Hickerson Lake RAWS – The wind speed cable was cut, likely because it was pulled.



Figure 25. Hickerson Lake RAWS – The GOES antenna cable was chewed on.



Figure 26. Hickerson Lake RAWS – Inside of instrument enclosure photographed just before departure.



Figure 27. Hickerson Lake RAWS – Possible STEP landing site (weather station circled in background).

McArthur Pass Weather Station – Annual Maintenance – June 5, 2012

Date: June 5, 2012

Time of visit: 1000-1630

Personnel: Chuck Lindsay, James Walton

Mode of transport: B206 helicopter from Homer (Pathfinder Aviation)

Purpose of trip: Annual maintenance

Weather: Sunny, 49 F, winds NW 8 mph

Sensors replaced:

Air temperature – relative humidity

Wind speed

Wind direction

Solar radiation

Rain gauge tipping bucket

GOES antenna

GPS antenna

20 ft mast, wind sensor support arm, guy lines

Batteries

Narrative:

A helicopter from Homer was used for access. The station was in poor condition (Figure 28). The 20-ft mast had broken (Figure 29) and wind sensors, support arm, and cables were destroyed. The AT-RH sensor had blown away and the GOES antenna was bent upwards. The 20 ft mast, guylines, spreader bars and additional guy lines were all replaced. The wind sensor support arm was replaced. The AT-RH sensor, WS sensor, and WD sensor were all replaced. Additionally, the WS and WD sensor cables were replaced. Both wind sensors on this station are typically replaced each year because of harsh conditions at this site. A WD sensor direction test was done. The GOES antenna and cable were replaced. The GPS antenna and cable were replaced. The SR sensor was replaced. The RG-TB was replaced, the rain count was zeroed, and a tipping bucket test was done. All data in the data logger was downloaded to send to the WRCC in order to update the archive. The SD sensor was removed and it will not be replaced because it doesn't work at this location - there's too much moisture. The SDI expansion port was also removed because it wasn't needed any more (only one SDI sensor is currently present). The current DLP running is DLP_MCPA_SR50A_20120605.prg. SD in the DLP was edited to force all SD observations to zero. This element will be deactivated in WFMI, so that a potentially false zero snow depth isn't passed on to client websites (e.g. WRCC) during winter months. Station observations and GOES transmission quality were checked before departure. Observations and transmissions were verified from the WFMI website by NIFC and relayed by satellite phone. Before departure the station was photographed from eight directions (every 45°; Figure 30) and the inside of the instrument enclosure (Figure 31) was also photographed.

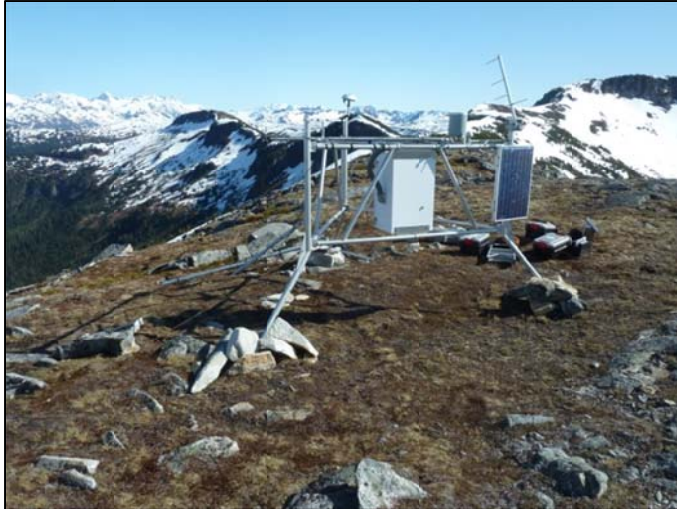


Figure 28. McArthur Pass RAWS – Damage to station from winter storms.



Figure 29. McArthur Pass RAWS – Broken 20-ft wind sensor mast.



Figure 30. McArthur Pass RAWs – Station after maintenance.



Figure 31. McArthur Pass RAWs - Inside of instrument enclosure photographed just before departure.

Pedersen Lagoon Weather Station – Annual Maintenance – July 25, 2012

Date: July 25, 2012

Time of visit: 1400-1800

Personnel: Chuck Lindsay, Deborah Kurtz, William Clark

Mode of transport: Skiff (23 ft SAFE Boat)

Purpose of trip: Annual maintenance

Weather: Mostly sunny, 62 F, calm winds

Sensors replaced:

Air temperature – relative humidity

Wind speed

Wind direction

Snow depth (Judd Communications sensor)

SDI analog module (added)

Narrative:

Access to the Pedersen Lagoon weather station was by skiff (park boat from Seward) and foot (from Alaska Wildland Adventure's Kenai Fjords Glacier Lodge). The weather station was in good shape with no significant damage. The AT-RH sensor, WS sensor, and WD sensors were all replaced. AWD sensor direction test was done. Both wind sensors on this station are replaced each year because of harsh conditions at this site. The rain count for the tipping bucket was zeroed and a tipping bucket test was done. All data from the data logger was downloaded to send to the WRCC in order to update the data archive. An analog/digital converter was installed to support an analog SD sensor using SDI (Figure 32). The existing SD sensor was replaced with a Judd Communications SD sensor. The data logger configuration file PELA_F6config_Judd_20120725.xml was installed in order to support the Judd Communications SD sensor. The target for the SD sensor was rebuilt out of rock and soil because the target needed to be moved a little to accommodate the new sensor (Figure 33). SD in the DLP was zeroed to an average reading of -0.5 inches to account for fluctuation without reporting misleading snow depth readings. All bolts on the station were checked and tightened if loose and cables were zip-tied. Station observations and GOES transmission quality were checked before departure. Observations and transmissions were verified from the WFMI website by NIFC staff and relayed by satellite phone. Before departure, the station was photographed from eight directions (every 45°; Figure 34) and the inside of the instrument enclosure (Figure 35) was also photographed. Vegetation beneath and around station was trimmed and some additional barbed wire was added to help mitigate damage from black bears.

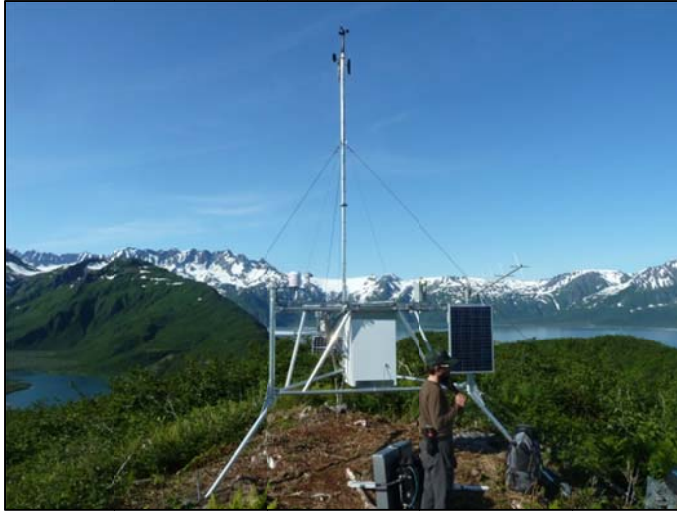


Figure 34. Pedersen Lagoon RAWS – Station after maintenance, recent plant growth was trimmed.



Figure 35. Pedersen Lagoon RAWS - Inside of instrument enclosure photographed just before departure.

Pfaff Mine Weather Station – Annual Maintenance – June 21, 2012

Date: June 21, 2012

Time of visit: 1130-1500

Personnel: Chuck Lindsay, Michael Shephard

Mode of transport: C185 (on wheels) from King Salmon (park aircraft)

Purpose of trip: Annual maintenance

Weather: Sunny, 55 F, winds W 10 mph gusting 18 mph

Sensors replaced:

Air temperature – relative humidity

Wind speed

Wind direction

Rain gauge tipping bucket

Snow depth

Data logger

Soil temperature probes (added)

SDI analog module (added)

Narrative:

Access to the Pfaff Mine weather station was by park wheel plane. The station was in good shape except the rain gauge tipping bucket was upside down (Figure 36). The AT-RH sensor, WS sensor, and WD sensor were all replaced (Figure 37). A WD sensor direction test was done. The WS and WD sensor cables should be replaced during the next maintenance trip because the cable sheaths are showing signs of wear. The RG-TB was replaced, the rain count was zeroed, and a tipping bucket test was done. Unfortunately, no precipitation was recorded since the last maintenance visit on June 15, 2011. The horizontal axis adjustment bolt on the sensor mounting arm wasn't tight and this is why the RG-TB was upside down. The SD sensor was replaced with a Campbell Scientific SR50A SD sensor, which had been rehabbed with new transducer plates and desiccant. The data logger was replaced with another FTS 12S data logger running firmware version 6.6. Dual soil temperature probes, custom made by FTS, were installed at depths of 10 and 50 cm (Figure 38). Soil temperature sensors were installed in-line with the SW tower footing, 1 m away from the footing (Figure 39). The datalogger firmware and program had to be updated to incorporate this sensor. The data logger program

PFMI_DLP_SR50A_SoilTemp_20120621.prg was installed. The transmitted element No. 17 corresponds to Temp1 in the data logger program and this is the soil temperature at 10 cm depth. Transmitted element No. 18 corresponds to Temp2 in the data logger program and this is the soil temperature at 50 cm depth. This data logger program matches the format used by the custom DLP at Snipe Lake, Alaska RAWS. An analog/digital converter was also installed to support the analog SD sensor through SDI (Figure 40). The SD in the DLP was edited to zero the sensor. SD was zeroed to an average reading of -0.5 inches to account for fluctuation without reporting misleading snow depth readings. All data in the previous data logger was downloaded to send to WRCC in order to update the archive. Station observations and GOES transmission quality were checked before departure. Observations and transmissions were verified from the WFMI website by NIFC and relayed by satellite phone. All bolts on the station were checked and tightened if loose and cables were zip-tied. Before departure the station was photographed from eight

directions (every 45°) and the inside of the instrument enclosure (Figure 41) was also photographed.



Figure 36. Pfaff Mine RAWS – The rain gauge tipping bucket was upside down and wasn't recording precipitation.

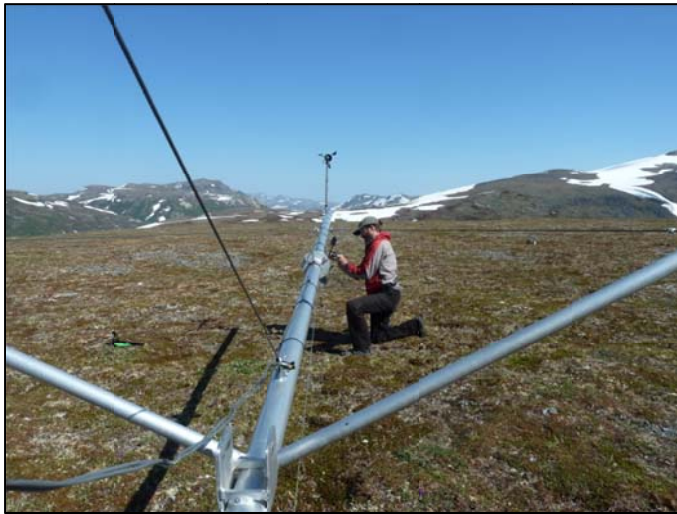


Figure 37. Pfaff Mine RAWS – Michael Shephard replaces the wind direction sensor.



Figure 38. Pfaff Mine RAWS – Soil pit profile where the soil temperature sensors were installed.

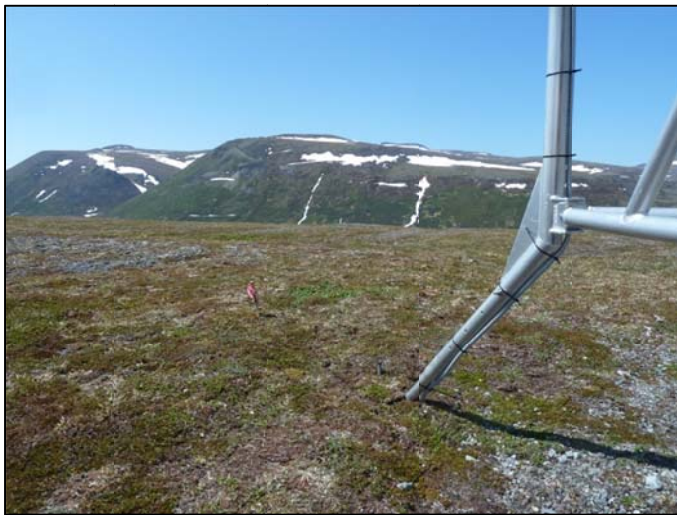


Figure 39. Pfaff Mine RAWS – Soil temperature sensors were installed 10 and 50 cm below surface (and the survey tape).



Figure 40. Pfaff Mine RAWS – Wiring configuration used on the analog/digital convertor to accommodate the dual soil temperature sensors.



Figure 41. Pfaff Mine RAWS – Inside of instrument enclosure photographed just before departure.

Snipe Lake Weather Station – Annual Maintenance – June 14, 2012

Date: June 14, 2012

Time of visit: 1100-1700

Personnel: Chuck Lindsay, Jesse Wright

Mode of transport: C185 (on floats) from Port Alsworth (park aircraft)

Purpose of trip: Annual maintenance

Weather: Partly sunny, 54 F, winds SE 10 mph gusting 20 mph

Sensors replaced:

Air temperature – relative humidity

Wind speed

Wind direction

Snow depth

Camera (added)

Narrative:

Access to the Snipe Lake weather station was by park float plane. The station was in good shape. The AT-RH sensor, WS sensor, and the WD sensor were replaced. A WD sensor direction test was done. The rain count for the tipping bucket was zeroed and a tipping bucket test was done. The SD sensor was replaced with a Campbell Scientific SR50A SD sensor, which had been rehabbed with new transducer plates and desiccant. All data in the data logger was downloaded to send to the WRCC in order to update the archive. The data logger program SNLA_DLP_SR50A_20120614.prg was installed to support the SR50A SD sensor. SD in the DLP was edited to zero the sensor. SD was zeroed to an average reading of -0.5 inches to account for fluctuation without reporting misleading snow depth readings. Spare sensors that were ordered for this station were not used. Station observations and GOES transmission quality were checked before departure. Observations and transmissions were verified from the WFMI website by NPS staff and relayed by satellite phone. All bolts on the station were checked and tightened if loose and cables were zip-tied. Before departure the station was photographed from eight directions (every 45°; Figure 42) and the inside of the instrument enclosure (Figure 43) was also photographed. An additional time-lapse camera (Campbell Scientific CC5MPX), 10 W solar panel, and 35 Ah battery were installed on the weather station (Figure 44).

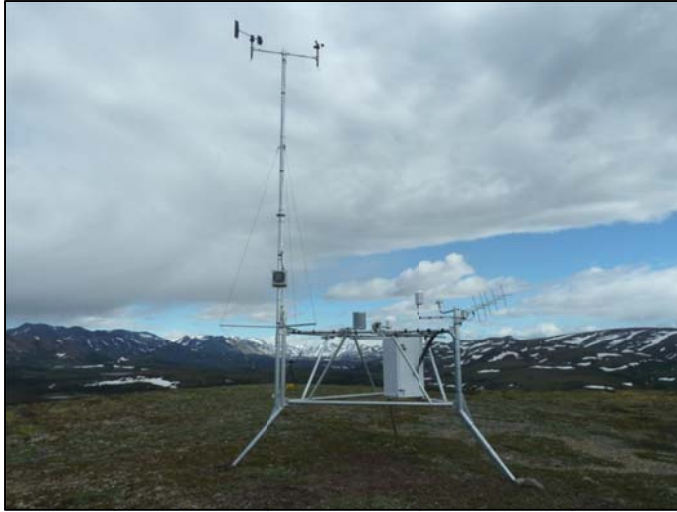


Figure 42. Snipe Lake RAWS – Station after maintenance.



Figure 43. Snipe Lake RAWS – The inside of the instrument enclosure photographed just before departure. Additional 35 Ah battery for Campbell Scientific time-lapse camera is visible in the center of the photograph.



Figure 44. Snipe Lake RAWS – Campbell Scientific time-lapse camera set-up.

Weather Station Sensor Metadata

Table 2. Sensor metadata for weather stations operated and maintained by the SWAN.

Station name	Sensor	Model	Height M	Serial no	Asset no	Start date	Stop date
Chigmit Mountains	AT-RH	FTS THS-3	2.34	31670	22267	6/30/11	6/11/12
	AT-RH	FTS THS-3	2.34	49794	39340	6/11/12	active
	WD	FTS 023-30	6.10	26473	127459	6/30/11	6/11/12
	WD	FTS 023-30	6.10	K4017	104913	6/11/12	active
	WS	FTS 013-30	6.10	X1891	15799	6/30/11	6/11/12
	WS	FTS 013-30	6.10	36907	30587	6/11/12	active
	RG-TB	FTS RG-T	2.18	7676	n/a	6/30/09	6/11/12
	RG-TB	FTS RG-T	2.18	2754	121530	6/11/12	active
	SR	FTS SDI-SR-PYR	2.29	14519	7029	6/30/11	active
	SD	CS SR50A	1.87	41916	n/a	6/30/11	6/11/12
	SD	CS SR50	1.87	88116	n/a	6/11/12	active
Contact Creek	AT-RH	FTS THS-3	2.21	30875	22213	6/14/11	6/21/12
	AT-RH	FTS THS-3	2.21	32359	22126	6/21/12	active
	WD	FTS 023-30	2.34	J7035	30308	6/17/10	6/21/12
	WD	FTS 023-30	2.34	J7032	30305	6/21/12	active
	WS	FTS 013-30	6.10	26458	127550	6/17/10	6/21/12
	WS	FTS 013-30	6.10	K1530	125507	6/21/12	active
	RG-TB	FTS RG-T	2.26	93217	19574	6/14/11	active
	SR	FTS SDI-SR-PYR	2.29	18427	7734	6/14/11	active
	SD	CS SR50A	1.80	41913	n/a	6/14/11	6/21/12
	SD	CS SR50A	1.80	28268	n/a	6/21/12	active
Coville	AT-RH	FTS THS-3	2.06	30040	21276	6/14/11	6/20/12
	AT-RH	FTS THS-3	2.06	27667	127814	6/20/12	active
	WD	FTS 023-30	6.10	28981	125651	6/15/10	6/20/12
	WD	FTS 023-30	6.10	37246	39665	6/20/12	active
	WS	FTS 013-30	6.10	7081	16676	6/15/10	active
	WS	FTS 013-30	6.10	37241	107508	6/20/12	active
	RG-TB	FTS RG-T	2.21	1596	6808	6/14/11	active
	SR	FTS SDI-SR-PYR	2.21	26378	127804	6/14/11	active
	SD	CS SR50A	1.52	41911	n/a	6/14/11	active
	SD	CS SR50	1.52	18259	n/a	6/20/12	active

Table 2 continued. Sensor metadata for weather stations operated and maintained by the SWAN.

Station name	Sensor	Model	Height m	Serial no	Asset no	Start date	Stop date
Fourpeaked	AT-RH	FTS THS-3	2.34	29470	123356	6/30/11	6/7/12
	AT-RH	FTS THS-3	2.34	51288	39788	6/7/12	active
	WD	FTS THS-3	6.10	17907	37232	6/30/11	6/7/12
	WD	FTS THS-3	6.10	30181	13517	6/7/12	active
	WS	FTS 023-30	6.10	7667	127669	6/30/11	6/7/12
	WS	FTS 013-30	6.10	Y4728	15990	6/7/12	active
	RG-TB	FTS RG-T	2.18	97206	121220	6/30/11	active
	SR	FTS SDI-SR-PYR	2.29	32222	n/a	6/9/09	6/7/12
	SR	FTS SDI-SR-PYR	2.29	13797	114743	6/7/12	active
	SD	CS SR50A	1.77	41917	n/a	6/30/11	6/7/12
	SD	removed	n/a	n/a	n/a	6/7/12	n/a
Harding Icefield	AT-RH	FTS THS-3		30622	22085	5/2/11	4/25/12
	AT-RH	FTS THS-3		4791	39337	4/25/12	active
	WD	FTS 013-30	6.10	K4022	110651	5/2/11	4/25/12
	WD	FTS 013-30	6.10	43702	13664	4/25/12	active
	WS	FTS 023-30	6.10	R1548	123031	5/2/11	4/25/12
	WS	FTS 023-30	6.10	32004	39198	4/25/12	active
	RG-TB	FTS RG-T		20173	122373	5/2/11	active
	SR	FTS SDI-SR-PYR		36485	30140	4/24/10	active
	SD	CS SR50	1.74	42006	n/a	5/2/11	4/25/12
	SD	Judd	1.74	3690	n/a	4/25/12	active
Hickerson Lake	AT-RH	FTS THS-3	2.49	31673	22270	7/7/11	6/16/12
	AT-RH	FTS THS-3	2.49	51283	39783	6/16/12	active
	WD	FTS 013-30	6.10	33192	124122	6/21/10	6/16/12
	WD	FTS 013-30	6.10	7145	125325	6/16/12	active
	WS	FTS 023-30	6.10	U1323	1353	6/21/10	6/16/12
	WS	FTS 023-30	6.10	N1501	105962	6/16/12	active
	RG-TB	FTS RG-T	2.46	1686	117213	7/7/11	active
	SR	FTS SDI-SR-PYR	2.54	22383	126817	7/7/11	active
	SD	CS SR50A	1.65	41910	n/a	7/7/11	6/16/12
	SD	CS SR50	1.65	15070	n/a	6/16/12	active

Table 2 continued. Sensor metadata for weather stations operated and maintained by the SWAN.

Station name	Sensor	Model	Height m	Serial no	Asset no	Start date	Stop date
McArthur Pass	AT-RH	FTS THS-3	2.24	30636	16586	7/5/11	6/5/12
	AT-RH	FTS THS-3	2.24	49963	39760	6/5/12	active
	WD	FTS THS-3	6.10	18390	37233	7/5/11	6/5/12
	WD	FTS THS-3	6.10	22940	35935	6/5/12	active
	WS	FTS 023-30	6.10	30754	116184	7/5/11	6/5/12
	WS	FTS 013-30	6.10	Y4726	39218	6/5/12	active
	RG-TB	FTS RG-T	2.39	7978	119177	7/5/11	6/5/12
	RG-TB	FTS RG-T	2.39	41334	36331	6/5/12	active
	SR	FTS SDI-SR-PYR	2.39	1191	110129	11/18/10	6/5/12
	SR	FTS SDI-SR-PYR	2.39	50530	39525	6/5/12	active
	SD	CS SR50A	1.96	41915	n/a	7/5/11	6/5/12
	SD	removed	n/a	n/a	n/a	6/5/12	n/a
Pedersen Lagoon	AT-RH	FTS THS-3	2.14	38207	33220	9/27/11	7/25/12
	AT-RH	FTS THS-3	2.14	22737	39093	7/25/12	active
	WD	FTS 013-30	6.03	40923	n/a	8/10/11	7/25/12
	WD	FTS 013-30	6.03	J7089	30318	7/25/12	active
	WS	FTS 023-30	6.03	40636	n/a	8/10/11	7/25/12
	WS	FTS 023-30	6.03	22737	39093	7/25/12	active
	RG-TB	FTS RG-T	1.91	40718	n/a	8/10/11	active
	SR	FTS SDI-SR-PYR	2.21	39327	n/a	8/10/11	active
	SD	CS SR50A	1.71	41908	n/a	8/10/11	7/25/12
	SD	Judd	1.71	04015	n/a	7/25/12	active
Pfaff Mine	AT-RH	FTS THS-3	2.03	30303	21110	6/15/11	6/21/12
	AT-RH	FTS THS-3	2.03	51274	39775	6/21/12	active
	WD	FTS 013-30	6.10	26322	29151	6/6/10	6/21/12
	WD	FTS 013-30	6.10	39942	39532	6/21/12	active
	WS	FTS 023-30	6.10	6775	111880	6/6/10	6/21/12
	WS	FTS 023-30	6.10	34209	39551	6/21/12	active
	RG-TB	FTS RG-T	2.21	14322	127660	6/15/11	6/21/12
	RG-TB	FTS RG-T	2.21	unknown	37579	6/21/12	active
	SR	FTS SDI-SR-PYR	2.21	19009	102143	6/15/11	active
	SD	CS SR50A	1.51	41909	n/a	6/15/11	6/21/12
	SD	CS SR50A	1.51	42006	n/a	6/21/12	active

Table 2 continued. Sensor metadata for weather stations operated and maintained by the SWAN.

Station name	Sensor	Model	Height m	Serial no	Asset no	Start date	Stop date
Snipe Lake	AT-RH	FTS THS-3	2.16	31553	30462	6/17/11	6/14/12
	AT-RH	FTS THS-3	2.16	51287	39787	6/14/12	active
	WD	FTS 013-30	6.10	A1582	1350	4/9/10	active
	WD	FTS 013-30	6.10	7147	125837	6/14/12	active
	WS	FTS 023-30	6.10	31553	30462	4/9/10	6/14/12
	WS	FTS 023-30	6.10	36480	124605	6/14/12	active
	RG-TB	FTS RG-T	2.26	26640	127456	6/17/11	active
	SR	FTS SDI-SR-PYR	2.21	15340	122043	6/17/11	active
	SD	CS SR50A	2.11	41914	n/a	6/17/11	6/14/12
	SD	CS SR50A	2.11	28267	n/a	6/14/12	active

References

- Lindsay, C., B. Giffen, and N. Wilson. 2012. Methods for monitoring climate in southwest Alaska network parks: Version 1.0. Natural Resource Report NPS/SWAN/NRR—2012/582. National Park Service, Fort Collins, Colorado.
- National Wildfire Coordinating Group. 2012. Interagency Wildland Fire Weather Station Standards & Guidelines. Available from <http://www.nwcg.gov/pms/pubs/PMS426-3.pdf> (accessed 18 September 2012).