



Climate Station Maintenance in the Central Alaska Inventory and Monitoring Network

2015 Summary

Natural Resource Data Series NPS/CAKN/NRDS—2015/991



ON THE COVER

Chicken Creek weather station, Wrangell-St. Elias National Park and Preserve.
Photograph by: Ken Hill

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Abstract

The mission of the Central Alaska Network Inventory and Monitoring Program (CAKN) is to collect, compile and synthesize scientific information about the central network of parks in order to manage park resources "unimpaired for the enjoyment of future generations". The Inventory and Monitoring (I&M) Program is a major component of the National Park Service's (NPS) strategy to improve park management through greater reliance on scientific information.

The objective of the climate monitoring program is to monitor and record weather conditions at representative locations in order to identify long and short-term trends, provide reliable climate data to other researchers, and to participate in larger scale climate monitoring and modeling efforts beyond park boundaries. Thirteen remote automated I&M weather stations (RAWS) have been installed in CAKN parks since 2003. There are additional weather and climate stations in the parks run by state and federal agencies with specific objectives and missions. It is in the best interest of the CAKN program to cooperate with these other entities on maintenance site visits. During the 2015 field season maintenance site visits were conducted at a total of twenty sites, including thirteen I&M RAWS, four Snotel (snow telemetry) stations in coordination with Natural Resource Conservation Service (NRCS) staff, and three fire RAWS station. A new U.S. Climate Reference Network (USCRN) station was installed in Denali near the Wonder Lake campground in cooperation with the National Oceanic and Atmospheric Administration (NOAA). This report summarizes all work for the 2015 field season and includes current sensor metadata.

Acknowledgments

A successful field season would not have been possible without support from staff in Fairbanks (Maggie MacCluskie, Jim Lawler, Doris Lenahan, Trey Simmons), McCarthy (Stephens Harper), Gulkana (Mary Odden), and Eagle. Additional support was provided by pilots (Andy Hermansky, Curtis Cebulski, Aaron Oberland, Lynn Ellis) and aviation staff (Denali Dispatch, Scott Sample, Susanna Nancarrow, Colin Milone).

List of Acronyms

Ah	Amp hour
AKDST	Alaska Daylight Savings Time
AKRO	Alaska Regional Office
AMD	Aviation Management Directorate
AS350	A-star 350 Helicopter
AT-RH	Air Temperature- Relative Humidity
C185	Cessna 185 airplane
C206	Cessna 206 airplane
CAKN	Central Alaska Network
CS	Campbell Scientific
DENA	Denali National Park and Preserve
DLP	Data Logger Program
FTS	Forest Technology Systems
GOES	Geostationary Operational Environmental Satellite
GPS	Global Positioning System
I&M	Inventory and Monitoring
LED	Light-Emitting Diode
NESDIS ID	National Environmental Satellite, Data, and Information Service Identifier
NIFC	National Interagency Fire Center
NRCS	Natural Resource Conservation Service
NPS	National Park Service
RAWS	Remote Automated Weather Station
RG-TB	Rain Gauge - Tipping Bucket
SD	Snow Depth
SDI	Serial Digital Interface
SR	Solar Radiation
ST	Soil Temperature
W	Watt
WFMI	Wildland Fire Management Information
WRCC	Western Regional Climate Center
WRST	Wrangell-St. Elias National Park and Preserve
WS-WD	Wind Speed - Wind Direction
YUCH	Yukon-Charley Rivers National Park and Preserve

Climate Station Locations

For the 2015 field season, the Central Alaska Network (CAKN) continued its climate monitoring program by visiting stations in Denali National Park and Preserve (DENA), Yukon-Charley Rivers National Preserve (YUCH), and Wrangell – St. Elias National Park and Preserve (WRST) (Figure 1). Thirteen CAKN climate stations were maintained (Table 1) along with NPS support at four NRCS snow and soil sites, and three fire RAWS stations. Annual maintenance includes downloading data, updating software and programming, replacing sensors, and troubleshooting problems. Maintenance is critical in order to provide continuous, high-quality meteorological data.

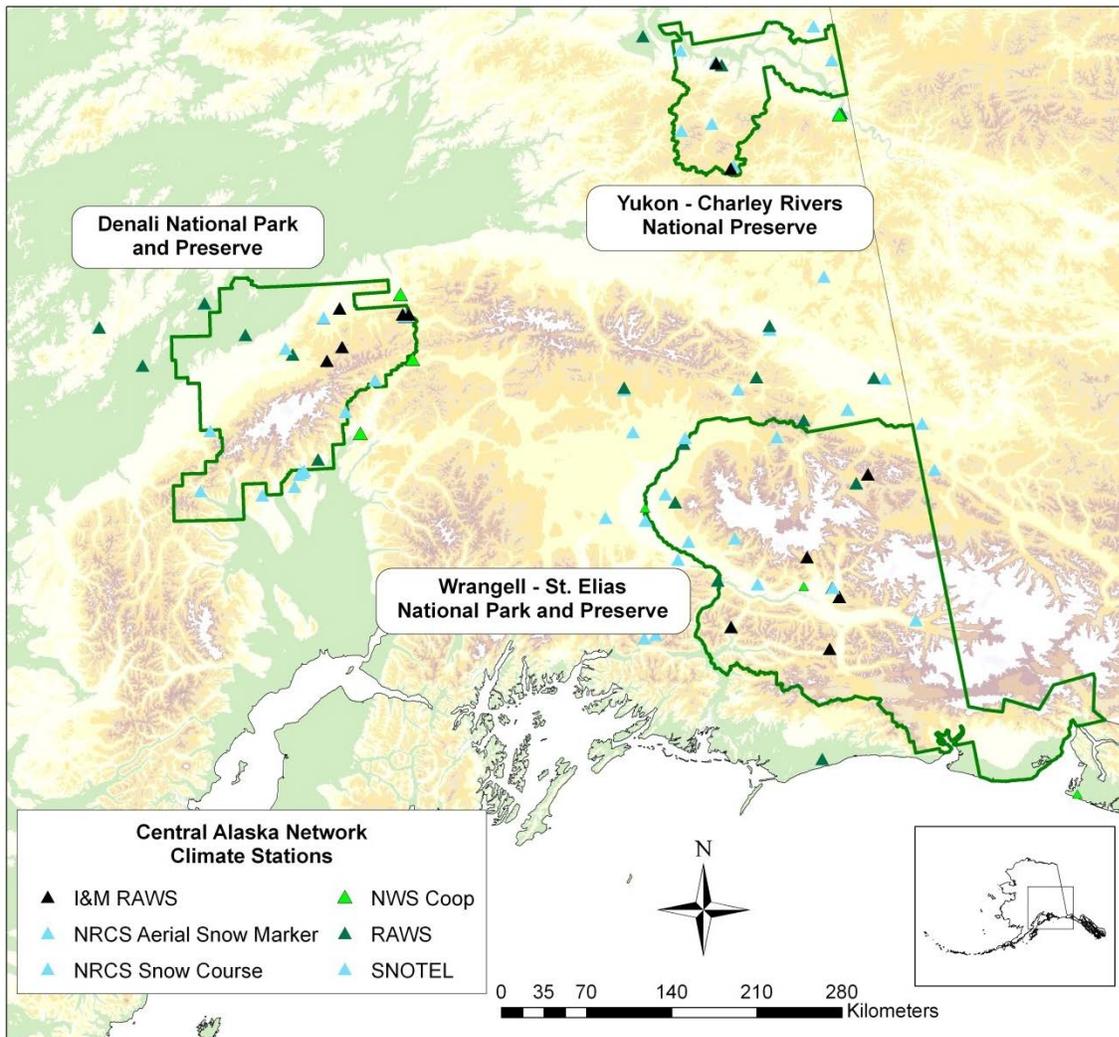


Figure 1. Map showing locations of CAKN climate stations.

Table 1. Locations of CAKN sites operated and maintained in 2015 field season.

Station Name	Latitude	Longitude	Elevation (m)	Park
Chititu	61.274	-142.621	1385	WRST
Chicken Creek	62.124	-141.847	1597	WRST
Tana Knob	60.908	-142.901	1140	WRST
Gates Glacier	61.603	-143.013	1237	WRST
Tebay	61.181	-144.342	573	WRST
Chisana SNOTEL/RAWS	62.072	-142.065	1012	WRST
May Creek SNOTEL/RAWS	61.348	-142.694	503	WRST
Upper Charley	64.517	-143.202	1114	YUCH
Coal Creek	65.314	-143.132	292	YUCH
Toklat	63.524	-150.043	890	DENA
Eielson Visitor Center	63.431	-150.309	1202	DENA
Wigand	63.814	-150.109	1716	DENA
Ruth Glacier	62.710	-150.540	1006	DENA
Stampede	63.747	-150.328	549	DENA
Dunkle Hills	63.268	-149.539	808	DENA
Wonder Lake fire RAWS	63.490	-150.871	2038	DENA
Kantishna SNOTEL	63.540	-150.990	472	DENA
Tokositna SNOTEL	62.629	-150.775	259	DENA

Climate Station Maintenance Summaries

This section describes the maintenance details of twenty climate stations in the Central Alaska Network organized by park. See Appendix A for detailed logistics for each of the parks and Appendix B for detailed information on station metadata.

Denali National Park and Preserve

This section includes all of the stations that were maintained in DENA in 2015. The sites include: Dunkle Hills, Eielson Visitor Center, Wonder Lake fire RAWS, Ruth Glacier, Stampede, Toklat, Wigand, Tokositna Snetel, and Kantishna Snetel.

Dunkle Hills

Date: May 26, 2015

Time of visit: 1300-1500

Personnel: Pam Sousanes, Ken Hill

Mode of transport: A-star helicopter – Temsco (NPS Western Area Fire) – N-6015S

Purpose of trip: Annual Maintenance

Weather: 55°F

Sensors replaced:

AT-RH

CR1000 datalogger

Narrative: The site was accessed by helicopter from DENA park headquarters. The site appeared to be in good condition on arrival, but the station was transmitting intermittently and many sensors were not performing correctly. All data were downloaded from the datalogger. After troubleshooting the sensors, transmitter, and power system no problems were revealed. A failed attempt to send a new program to the datalogger read, “Warning: voltage calibration failure. Possible input to analog channel beyond +/- 8V”. An attempt to send a new operating system to the datalogger also failed. The datalogger was replaced as a final attempt at solving the station problems. All sensors worked as expected with the new logger. After returning from the field and discussing the problem with Campbell Scientific support, they advised that too much voltage was coming into the wiring panel. They suggested that the sensors with a 12 V power wire may have caused the error. Although the datalogger swap solved the problem *during the next site visit, the air temperature - relative humidity (AT-RH) and snow depth (SD) sensor cables should be inspected for damage and replaced if needed.*

A new program (*Dunkle2015.CR1*) was sent to the new datalogger. The new program transmits accumulated precipitation. The SD sensor height was measured and entered into the program as 104 inches. The AT-RH sensor was replaced for routine calibration. The 20 cm and 50 cm soil temperature (ST) sensors may be wired incorrectly and this issue should be investigated during data quality control. The desiccant packets were replaced in the enclosure. All bolts and guy wires were tightened.



Figure 2. Dunkle Hills station May 26, 2015

Eielson Visitor Center

Date: August 20, 2015

Time of visit: 1130-1230

Personnel: Ken Hill, Pam Sousanes, Mark Hall (NOAA)

Mode of transport: DENA Park Road

Purpose of trip: Annual Maintenance

Weather: Mostly sunny, 48°F

Sensors Replaced:

AT-RH

SR

Narrative: The site was accessed from the DENA park road by NPS vehicle. All data were downloaded from the CR1000 datalogger. The AT-RH and solar radiation (SR) sensors were replaced for routine calibration. A new program was sent to the datalogger (*Eielson2015.CRI*). All bolts were tightened on the station. Photos were taken from the eight cardinal directions both towards and away from the station.



Figure 3. Eielson visitor center station August 20, 2015.

Kantishna Snotel

Date: August 17, 2015

Time of visit: 5:00 -7:00 pm

Personnel: Daniel Fisher

Mode of transport: DENA Park Road

Purpose of trip: Maintenance

Weather: Rain showers

Sensors replaced: as needed by Snotel Network

Narrative: Daniel Fisher (NRCS) drove the Denali park road on August 17 and completed the maintenance at the Kantishna Snotel. The precipitation gauge was flushed and 10 gallons of fresh antifreeze liquid added for the winter. The sensors were tested and the site was working great on departure.

Wonder Lake Fire RAWS

Date: August 19, 2015

Time of visit: 1730-1900

Personnel: Ken Hill, Pam Sousanes

Mode of transport: DENA Park Road

Purpose of trip: Maintenance/Repair

Weather: 48°F, 5-15 mph, Scattered showers

Sensors replaced:

AT-RH

WS-WD

Narrative: The AT-RH and wind speed-wind direction (WS-WD) sensors were replaced for routine maintenance. The rain gage-tipping bucket (RG-TB) was tested and reset. Data was downloaded from the site. The SDI sensors were “mapped” as directed by the NPS radio shop staff. All bolts and guy wires were tightened.

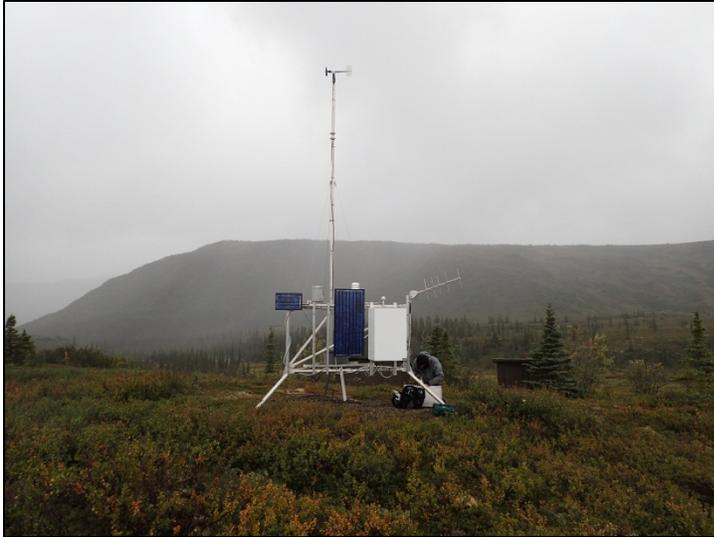


Figure 4. Wonder Lake RAWS August 19, 2015.

Wonder Lake USCRN (AK Denali 27N)

Date: August 17-20, 2015

Time of visit:

Personnel: Ken Hill, Pam Sousanes, Mark Hall + 2 NOAA staff

Mode of transport: DENA Park Road (3 trucks)

Purpose of trip: Installation

Weather: Mostly rainy

Sensors installed:

Air Temperature (x3, aspirated)

Precipitation (weighing gage + tipping bucket + wetness detector)

Solar radiation

Surface Temperature

Relative Humidity

Wind Speed-Wind Direction

Soil Temperature and Soil Moisture (5, 10, 20, 50, 100 cm)

Narrative: A new station was installed west of the Wonder Lake Campground along the service road. The station is part of the NOAA Climate Reference Station Network (USCRN). The vision of the USCRN program is to maintain a sustainable high-quality climate observation network that 50 years from now can with the highest degree of confidence answer the question: How has the climate of the Nation changed over the past 50 years? Three NOAA staff and two NPS staff completed the installation from August 17-20.



Figure 5. Wonder Lake CRN, August 20, 2015.

Ruth Glacier

Date: July 3, 2015

Time of visit: 0930-1030

Personnel: Pam Sousanes, Trey Simmons

Mode of transport: A-star helicopter – Temsco – 570AE – Andy Hermansky

Purpose of trip: Annual Maintenance

Weather: Partly cloudy, light winds

Sensors replaced:

AT-RH

SR

Narrative: The DENA mountain rescue A-star helicopter from Talkeetna was used to access the site. The site looked good upon arrival. The AT-RH and SR sensors were replaced for routine maintenance. A new program (*Ruth2015.CR1*) was sent to the datalogger. The new program transmits cumulative rainfall. The measured snow depth sensor height was 68.5 inches. The configuration file for the transmitter was re-sent. The electric fence was repaired as needed. All bolts and guy wires were tightened. Photos were taken from the eight cardinal directions both towards and away from the station.



Figure 6. Ruth Glacier station July 3, 2015

Ruth Glacier

Date: August 12, 2015

Time of visit: 0930-1030

Personnel: Ken Hill, Pam Sousanes

Mode of transport: A-star helicopter – Temsco – 570AE – Andy Hermansky

Purpose of trip: Repair and Troubleshooting

Weather: Cloudy

Sensors replaced:

AT-RH

Narrative: The DENA mountain rescue A-star helicopter from Talkeetna was used to access the site. The site looked good upon arrival, but it was transmitting many bad values. After troubleshooting the sensors, it was discovered that the AT-RH sensor was corroded, likely causing a short in the datalogger. The sensor and sensor cable were replaced. The transmission time for the satellite transmission was off by 30 seconds and not transmitting correctly; to correct this, the transmission time was changed from 32:10 to 32:40 after the hour. The snow depth sensor cable was also damaged upon inspection and replaced. The sensor was moved closer to the enclosure to accommodate a shorter cable length. All bolts and guy wires were tightened.

Stampede

Date: August 13, 2015

Time of visit: 1400-1600

Personnel: Ken Hill, Pam Sousanes

Mode of transport: A-star helicopter – Temsco (NPS Western Area Fire) – N-6015S

Purpose of trip: Annual Maintenance

Weather: 55° F, calm

Sensors replaced:

AT-RH

WS-WD
SR

Narrative: An A-star helicopter was used to access the site from DENA park headquarters after maintenance at the Wigand station. The site was in good condition upon arrival. All data were downloaded from the CR1000 datalogger to the field laptop. The AT-RH, WS-WD, and SR sensors were replaced for routine calibration. All bolts were tightened on the station. Loppers were used to remove some brush near the site. A 360° panorama of photos was taken of the station along with a photo of the inside of the enclosure box before departure.



Figure 7. Stampede station August 13, 2015.

Toklat

Date: August 20, 2015

Time of visit: 1300-1500

Personnel: Ken Hill, Pam Sousanes, Mark Hall (NOAA)

Mode of transport: DENA Park Road

Purpose of trip: Annual Maintenance

Weather: 50°F, 5-10 mph, mostly sunny

Sensors Replaced:

None

Narrative: The site was accessed from the DENA park road by NPS vehicle. All data were downloaded from the CR1000 datalogger. The CR1000 was configured with a new program (*Toklat2015.CRI*) which transmits cumulative precipitation. The RG-TB was cleaned. There was some dust in the bucket, but the funnel was not plugged. The 10-cm soil temperature sensor was just below the surface (3-5 cm) and reinserted to the appropriate depth. The 2015 inventory of calibrated sensors had been exhausted, and therefore no sensors were replaced. The AT-RH and SR sensors were scheduled to be calibrated this season. All bolts were tightened on the station. A

360° panorama of photos was taken of the station along with a photo of the inside of the enclosure box before departure.



Figure 8. Toklat station August 20, 2015.

Tokositna Snotel

Date: July 3, 2015

Time of visit: 0930-1130

Personnel: Daniel Fisher and Tony DiMarco (NRCS)

Mode of transport: A-star helicopter – Temsco – 570AE – Andy Hermansky

Purpose of trip: Annual Maintenance

Weather: Mostly cloudy

Narrative: Daniel Fisher and Tony DeMarco from the Natural Resources Conservation Service did the annual maintenance on the Tokositna Snotel site. The precipitation gauge was flushed and 10 gallons of fresh antifreeze liquid was added for the winter. The electric fence was repaired. The sensors were tested and the site was working great on departure. The helicopter landing zone was cleared of vegetation that had grown in over the past 5 years.



Figure 9. Tokositna Snotel station. Photo from June 24, 2014.

Wigand

Date: August 13, 2015

Time of visit: 1100-1300

Personnel: Ken Hill, Pam Sousanes

Mode of transport: A-star helicopter – Temsco (NPS Western Area Fire) – N-6015S

Purpose of trip: Maintenance

Weather: 60 F, 10-15 mph, scattered showers

Sensors replaced:

AT-RH

SR

Narrative: The site was accessed by helicopter from DENA park headquarters. The station looked good upon arrival. Data were downloaded from the CR1000 datalogger to the field laptop. The AT-RH and SR sensors were replaced for routine calibration. The CR1000 program was updated (*Wigand2015.CRI*). The new program transmits cumulative precipitation. The electric fence had been affected by snow and the charger was face down in the tundra upon arrival. The fence was repaired, but the charger was not working on departure (it may not have been charged). A new fence charger should be installed during the next field visit. The enclosure desiccant packets were replaced. All bolts and guy wires were tightened. One guy wire is damaged and should be replaced during the next field visit. There are three guy wire anchors that were not used for the USCRN site installation that can be used at this site next year. A 360° panorama of photos was taken of the station along with a photo of inside the enclosure box before departure.

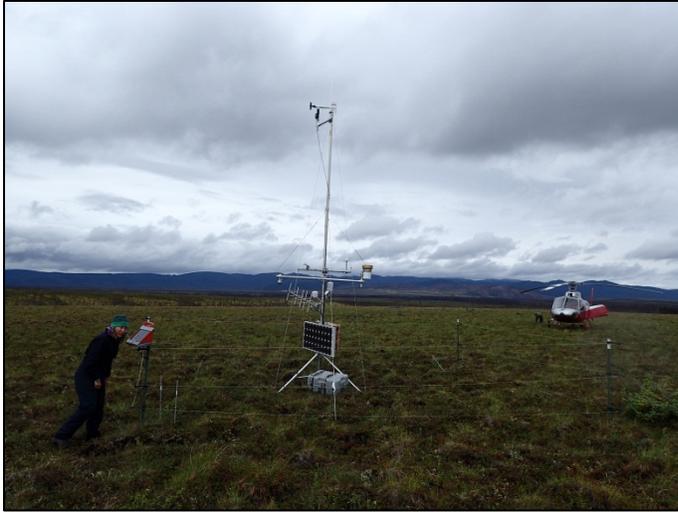


Figure 10. Wigand station August 13, 2015.

Wrangell – St. Elias

Stations maintained in WRST include Chicken Creek, Chititu, Gates Glacier, Tana Knob, Tebay, Chisana RAWS and Snotel, and May Creek RAWS and Snotel. CAKN staff used McCarthy as a base for helicopter operations and stayed at the McCarthy B&B.

Chicken Creek

Date: July 9, 2015

Time of visit: 1200-1330

Personnel: Ken Hill, Pam Sousanes

Mode of transport: A-star helicopter – Temsco (NPS Mountain Rescue) – N570AE – Hermansky

Purpose of trip: Maintenance

Weather: 55°F, light winds, partly cloudy

Sensors replaced:

AT-RH

Narrative: The station was accessed by helicopter from McCarthy. Upon arrival the station was in good condition. Data were downloaded from the CR1000 datalogger to the field laptop. The CR1000 program was updated (*Chicken2015.CRI*). The new program transmits cumulative precipitation. The AT-RH sensor was replaced for routine calibration. The height of the snow depth sensor was configured in the new program and set at 85.5 inches. The screen on the RG-TB was re-taped. It appeared as if the GPS cable had been pulled on by wildlife, but there was not damage. The enclosure desiccant packets were replaced. A 360° panorama of photos was taken of the station along with a photo of inside the enclosure box before departure.



Figure 11. Chicken Creek station July 9, 2015.

Chititu

Date: July 10, 2015

Time of visit: 1330-1445

Personnel: Ken Hill, Pam Sousanes

Mode of transport: A-star helicopter – Temsco (NPS Mountain Rescue) – N570AE – Hermansky

Purpose of trip: Maintenance

Weather: Scattered showers, 48 F, 0-5 mph

Sensors replaced:

AT-RH

WS-WD

Narrative: Access to Chititu was from McCarthy – Tebay – Tana Knob by helicopter. The station was in good condition upon arrival. All data were downloaded from the CR1000 datalogger to the field laptop. The AT-RH and WS-WD sensors were replaced for routine calibration. The CR1000 program was updated to *Chititu2015.CRI* and sent to the datalogger with a snow depth sensor height of 96.4 inches. The 2013 repair of the battery box was holding up well. Guy wires were tightened. A 360° panorama of photos was taken of the station along with a photo of inside the enclosure box before departure.



Figure 12. Chititu station July 10, 2015.

Gates Glacier

Date: July 9, 2015

Time of visit: 1600-1900

Personnel: Ken Hill, Pam Sousanes, Trey Simmons

Mode of transport: A-star helicopter – Temsco (NPS Mountain Rescue) – N570AE – Hermansky

Purpose of trip: Annual maintenance

Weather: Partly cloudy, calm

Sensors replaced:

AT-RH

SR

WS-WD

AT-RH cable

GPS cable

Antenna (coax) cable

CC5MPX cable

Narrative: The station had been damaged by a bear. All data were downloaded from the CR1000 datalogger to the field laptop. The CR1000 program was updated (*GatesGl2015.CR1*) with a snow depth sensor height of 107.5 inches. The AT-RH, SR, and WS-WD sensors were replaced for routine calibration. The cables for the AT-RH, CC5MPX camera, GPS, and Yagi antenna had all been damaged and were replaced. The battery enclosure had teeth marks and was pulled away from the station. The enclosure was realigned under the tripod legs and fixed to the legs with cam straps. The loose mast was re-tightened. The long cross arm was readjusted and aligned. The SD and RG-TB sensors were tested. A new battery was installed to power the CC5MPX camera. The 100 aH battery has its own enclosure and is independent of the station power supply. The SD memory card from the camera was swapped and all photos were uploaded to the field laptop. The camera settings were reviewed to make appropriate updates and confirm that five images are taken each day centered near solar noon. A 360° panorama of photos was taken of the station along with a photo of inside the enclosure box before departure.



Figure 13. Gates Glacier station July 10, 2015 before (left) and after (right) repairs.

May Creek and Chisana Snotel

Date: July 8, 2015

Personnel: Tony DeMarco (NRCS), Lynn Ellis (NPS Pilot)

Mode of transport: NPS plane and pilot from Gulkana

Purpose of trip: Annual maintenance

Sensors replaced: as needed by NRCS

Narrative: Tony DeMarco from the Natural Resources Conservation Service completed the annual maintenance at May Creek and Chisana Snotel sites on July 8. The precipitation gauges were flushed and 10 gallons of fresh antifreeze liquid added for the winter. The electric fences were repaired. The sensors were tested and the sites were working great on departure.

Chisana Fire RAWS

Date: July 9, 2015

Time of visit: 1200-1300

Personnel: Ken Hill, Pam Sousanes

Mode of transport: A-star helicopter – Temsco (NPS Mountain Rescue) – N570AE – Hermansky

Purpose of trip: Maintenance

Weather: 72°F, 3 mph, mostly sunny

Sensors replaced:

AT-RH

WS-WD

SR

Narrative: The AT-RH, SR, and wind speed-wind direction (WS-WD) sensors were replaced for routine maintenance. The solar radiation mounting arm was out of level and not mounted well; the arm was moved and secured with cable ties. The rain gage-tipping bucket (RG-TB) was tested and reset. Data was downloaded from the site. The SDI sensors were “mapped” as directed by the NPS radio shop staff. All bolts and guy wires were tightened. There is a spruce tree on the NW side of the station that should be removed in the next few years.



May Creek Fire RAWS

Date: July 10, 2015

Time of visit: 1300-1400

Personnel: Ken Hill, Pam Sousanes

Mode of transport: A-star helicopter – Temsco (NPS Mountain Rescue) – N570AE – Hermansky

Purpose of trip: Maintenance

Weather: 60°F, 5 mph, partly cloudy, rain showers

Sensors replaced:

AT-RH

WS-WD

SR

Narrative: The AT-RH, SR, and WS-WD sensors were replaced for routine maintenance. The rain gage-tipping bucket (RG-TB) was tested and reset. Data was downloaded from the site. The SDI sensors were “mapped” as directed by the NPS radio shop staff. All bolts and guy wires were tightened. Some brush was cleared around the station.



Tana Knob

Date: July 10, 2015

Time of visit: 1300-1430

Personnel: Ken Hill, Pam Sousanes

Mode of transport: A-star helicopter – Temsco (NPS Mountain Rescue) – N570AE – Hermansky

Purpose of trip: Annual Maintenance

Weather: 50 °F, partly cloudy, light winds

Sensors replaced:

AT-RH

Narrative: Access to Tana Knob was from McCarthy – Tebay via helicopter. All data were downloaded from the CR1000 datalogger to the field laptop. The CR1000 program was updated (*Tana2015.CRI*) with a snow depth sensor height of 102.5 inches. The AT-RH sensor was replaced for routine calibration. The electric fence was in decent condition and repaired as needed. The enclosure desiccant packets were replaced. A 360° panorama of photos was taken of

the station along with a photo of inside the enclosure box before departure. There was a hummingbird at the site during the station maintenance.

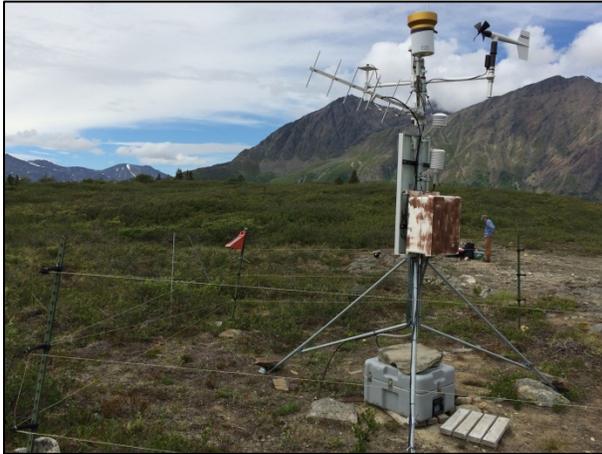


Figure 14. Tana Knob station July 10, 2015.

Tebay

Date: July 10, 2015

Time of visit: 0930-1130

Personnel: Ken Hill, Pam Sousanes

Mode of transport: A-star helicopter – Temsco (NPS Mountain Rescue) – N570AE – Hermansky

Purpose of trip: Annual Maintenance

Weather: Rain, 50° F, 0-5 mph

Sensors replaced:

AT-RH

SR

WS-WD

Narrative: The station was accessed by helicopter from McCarthy. The station looked good upon arrival. Data were downloaded from the CR1000 datalogger to the field laptop. The AT-RH, SR, and WS-WD sensors were replaced for routine calibration. The CR1000 program was updated (*Tebay2015.CR1*). The height of the snow depth sensor was configured in the new program and set at 105.2 inches. The electric fence had been affected by snow and was repaired. The charger was placed on the ground inside the fence. The enclosure desiccant packets were replaced. A 360° panorama of photos was taken of the station along with a photo of inside the enclosure box before departure. The aerial snow marker near the site was repainted.

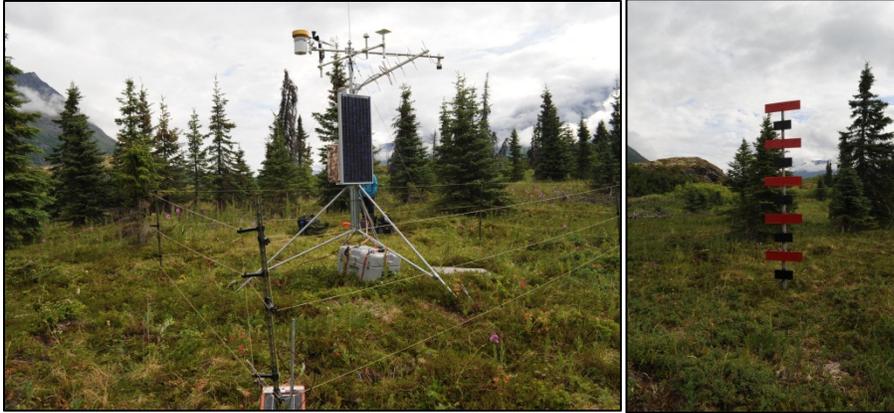


Figure 15. Tebay station July 10, 2015 (left). The aerial snow marker was repainted (right).

Yukon-Charley Rivers

This next section includes maintenance done on sites in YUCH, which includes the Upper Charley and Coal Creek stations.

Coal Creek

Date: August 7, 2015

Time of visit: 1630-1730

Personnel: Pam Sousanes

Mode of transport: Cessna 206 from Fairbanks – NPS Fleet N473YC\Pilot – Curtis Cebulski

Purpose of trip: Maintenance at station and snow course

Weather: 66°F, light wind

Sensors replaced:

AT-RH

SR

Narrative: The station was in good condition upon arrival. All data were downloaded from the CR1000 datalogger to the field laptop. The CR1000 program was updated (*CoalCreek2015.CRI*) and the snow depth sensor height set at 72 inches. The AT-RH and SR sensors were replaced for routine calibration. All bolts and guy wires were tightened on the station. A 360° panorama of photos was taken of the station. After maintenance at the weather station, the snow course near Coal Creek Camp was brushed. The Coal Creek Camp manager had cleared the trail to the snow course.



Figure 16. Coal Creek station August 7, 2015.

YUCH Snow Markers

Date: August 7, 2015

Personnel: Pam Sousanes, Trey Simmons

Mode of transport: R44 from Coal Creek – Inflight Helicopters – N522CC – Quintin Slade

Purpose of trip: Maintenance

Sites maintained: Cathedral Creek, Step Mountain, Crescent Creek

Cathedral Creek: Plumbed the snow marker. Re-oriented the cross bars to run parallel with the creek to make it easier to see when flying by in winter. The distance from the ground surface to the middle of the first black cross bar is 20.5 inches. Only two of the red cross bars need to be repainted.

Step Mountain: Marker was leaning ~ 20° to the N upon arrival. The marker was plumbed by moving the guy wires. Currently the guy wires are attached to black spruce trees; bring tundra anchors for next site visit. There are two bolts missing – one on the 1st red crossbar and one on the 3rd red crossbar; cable ties were used to secure them. The marker is sinking into the tundra and the distance from the ground surface to the middle of the first black cross bar is now 8.0 inches. The vegetation that had grown back in the landing zone was cleared by the pilot; he also placed logs across the landing zone so the skids would have a solid landing area. The paint on the crossbars was in good shape, but a fresh coat was applied anyway.

Crescent Creek: This marker was leaning towards the creek on arrival. It was plumbed with spruce branches and supported by large boulders near the base. The bottom red and black crossbars were repainted; all others looked good. The distance from the ground to the middle of the black crossbar is 12 inches.

Copper Creek and Three Fingers snow markers were not maintained this year.

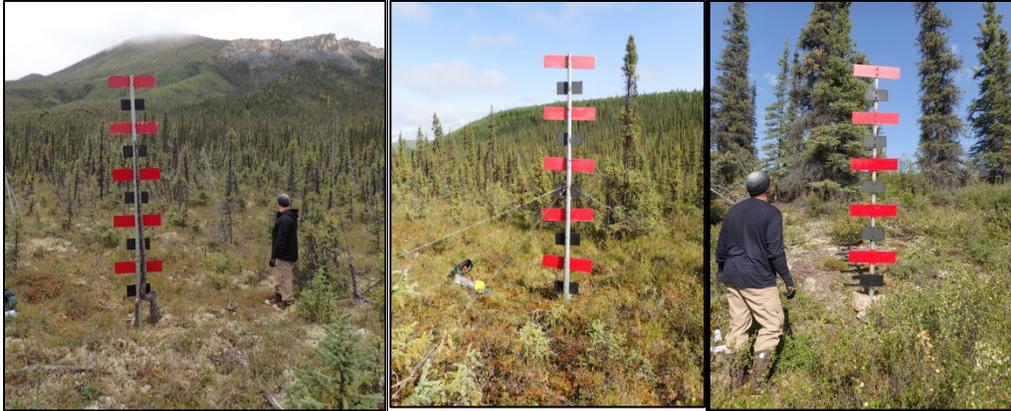


Figure 17. Cathedral Creek (left), Step Mountain (middle), and Crescent Creek (right) August 7, 2015

Upper Charley

Date: August 6 & 7, 2015

Time of visit: 1700-1900

Personnel: Pam Sousanes, Trey Simmons

Mode of transport: R44 from Coal Creek – Inflight Helicopters – N522CC – Quintin Slade

Purpose of trip: Maintenance

Weather: 55°F, partly cloudy, light winds

Sensors replaced:

AT-RH

Narrative: Access to Upper Charley was by helicopter from Coal Creek Camp. The station was in good condition upon arrival. All data were downloaded from the CR1000 datalogger to the field laptop. The AT-RH sensor was replaced for routine calibration. The electric fence was repaired as needed. The SD card on the CC5MPX camera was swapped. There was some trouble connecting to the camera with the field laptop and Sousanes returned on August 7 with Hill's pre-configured laptop. The settings on the camera were configured to "Deep Sleep" power mode and capture times were set for five images daily. All bolts and guy wires were tightened on the station. A 360° panorama of photos was taken of the station along with a photo of inside the enclosure box before departure.



Figure 18. Upper Charley station May 23, 2014

Appendix A: Logistics Summary 2015

DENA Logistics

May 26, 2015: Dunkle Hills. Pam Sousanes and Ken Hill accessed Dunkle Hills station by helicopter from Denali Headquarters. It was the first day of the Temsco contract for the A-star fire helicopter N6015S.

July 3, 2015: Tokositna Snotel and Ruth Glacier. Pam Sousanes met Daniel Fisher and Tony DeMarco (NRCS) along with Trey Simmons (CAKN aquatic ecologist) in Talkeetna. Sites were accessed with the DENA rescue A-star helicopter N570AE under pilot Andy Hermansky. The helicopter was on contract from Temsco for mountain operations in Denali. The NPS bunkhouse was full, so staff stayed at the Latitude 62 hotel on July 2.

August 12, 2015: Ruth Glacier. Sousanes and Hill accessed the Ruth Glacier station from Talkeetna with DENA rescue helicopter N570AE. Sousanes and Hill stayed at NPS housing in Talkeetna

August 13, 2015: Wigand and Stampede. Sousanes and Hill accessed the sites from DENA park headquarters. Helicopter N6015S (Temsco contract for Western Area Fire) was used to access the sites.

August 17-20, 2015: DENA park road. Sousanes, Hill, and three NOAA staff (Mark Hall + 2 technicians) completed the installation of the Wonder Lake CRN site. The equipment was shipped in crates in advance to DENA and unloaded into three trucks for transport to the site. The Wonder Lake Fire RAWs, Eielson Visitor Center, and Toklat site maintenance was carried out after the CRN installation. All staff stayed at the Friday Creek camp for three nights.

WRST Logistics

July 8-10, 2015: Pam Sousanes and Ken Hill drove from Fairbanks to McCarthy on July 8. The A-star helicopter N570AE with pilot Andy Hermansky arrived July 9. Fuel was purchased at the Fireweed airstrip on the west side of the Kennicott River (contact: Lori Rowland). The helicopter was also staged at the Fireweed airstrip. Chicken Creek, Chititu, Gates Glacier, Tana Knob, and Tebay were accessed by helicopter 7/9-7/10. The helicopter was shared with Trey Simmons (CAKN aquatic ecologist). All staff stayed at the McCarthy B&B (contact: John Adams).

July 8, 2015: The Snotel sites at May Creek and Chisana were accessed from Gulkana with NPS pilot Lynn Ellis. Tony DeMarco (NRCS Palmer) completed the maintenance at the Snotel sites.

YUCH Logistics

August 6-7, 2015: Pam Sousanes and Trey Simmons flew to Coal Creek with NPS fleet aircraft (N473YC, pilot Curtis Cebulski) on August 6, 2015. Maintenance at the Coal Creek station and snow course was completed on 8/7. On 8/6, an R44 helicopter (Inflight Helicopters, pilot Quintin Slade) arrived at Coal Creek. Sousanes flew to the Upper Charley site via helicopter to complete the maintenance. On 8/7 Sousanes and Simmons used the R44 helicopter to access three snow courses and three stream sites. Fuel was available at the NPS tank at Coal Creek. All staff stayed at park housing in Coal Creek.

Appendix B: ARCN I&M Station Specifications

Table 2. Sensor Specifications.

Measurements	Model/Manufacturer/Item#	Purchased from:
Air Temperature 1/Relative Humidity	HMP-45C Temperature and Relative Humidity Probe	Campbell Scientific
Air Temperature 2	Resistance Temperature Detector (RTD) Thermistor. Custom build.	Therm-X
Wind Speed and direction	RM Young 05103	Campbell Scientific
Precipitation (summer rainfall)	Texas Electronics TE525WS Rain Gage	Campbell Scientific
Solar Radiation (incoming)	LI-COR LI200X	Campbell Scientific
Snow Depth	SR50A sonic ranging sensor	Campbell Scientific
Soil Temperature	107 Temperature Probe (3)	Campbell Scientific

Table 3. Datalogger Specifications.

Datalogger	Purchased from:
CR1000-XT Measurement and Control System	Campbell Scientific

Table 4. Satellite Communication Specifications

Satellite Communication	Model/Item #	Purchased From:
GOES Satellite transmitter	TX312/TX320 High Data rate GOES Transmitter	Campbell Scientific
GPS Antenna	GPS Antenna 3.3 V 17992	Campbell Scientific
GPS Cable	Antenna Cable 18017	Campbell Scientific
GOES Antenna	GOES 11 dBi YAGI RHCP Antenna 25316	Campbell Scientific
Coaxial Cable	Antenna Cable RG8 COAXNTN	Campbell Scientific

Table 5. Power Specifications

Power	Model	Purchased form:
Batteries	Concorde Sun Extender PV 1040 T 12 Volt 100 Amp hour (2)	ABS Alaskan
Solar Panel	60-75 watt	Varies depending on prices
Battery Box	Pelican Hardigg Single Lid Case	AllCases
Charging Regulator	CH100 12V Charging Regulator	Campbell Scientific

Table 6. Hardware Specifications

Station Hardware - Item	Type/Model	Purchased from:
Tripod	CM110 10 ft. stainless-steel tripod w/grounding kit	Campbell Scientific
Guy Kit	Guy Kit for Tripod 19239	Campbell Scientific
Crossarm – 4 ft.	CM204 Sensor crossarm with mounting hardware – 4ft	Campbell Scientific
Crossarm – 6 ft.	CM206 Sensor crossarm with mounting hardware – 6ft	Campbell Scientific
Enclosure with (2) 1.5” diameter holes and mounting hardware for tripod	Weather Resistant 16” x 18” enclosure ENC 16/18 – DC - MM	Campbell Scientific

Table 7. Electric Fence Specifications

Electric Fence Parts	Type/Model	Purchased from:
Metal fence posts	6 ft. T-Posts	Various local vendors
T-Post Insulators	5-inch extender insulators	
Poly wire	200 ft. Polywire	Various local vendors
Solar fence charger	10 mile low impedance fence charger – various models	Various local vendors

Appendix C: ARCN I&M Components by Station

Chicken Creek

Station Name	Item	Model	Start Date
Chicken Creek	Antenna	25316 YAGI	8/21/2004
Chicken Creek	AT	ThermX	8/21/2004
Chicken Creek	AT-RH	HMP45	7/9/2015
Chicken Creek	Battery	100 AH (x2)	8/21/2004
Chicken Creek	Crossarm	3/4"	8/21/2004
Chicken Creek	Datalogger	CR1000	6/19/2013
Chicken Creek	DLP	Chicken2015	7/9/2015
Chicken Creek	Enclosure	ENC 16/18	8/21/2004
Chicken Creek	GPS	17992 GPS	7/3/2014
Chicken Creek	RG-TB	TE525	8/21/2004
Chicken Creek	SD	SR50a	6/19/2013
Chicken Creek	Solar Panel	75 W	8/21/2004
Chicken Creek	SR	Li200x	7/3/2014
Chicken Creek	ST1	107	7/2/2010
Chicken Creek	ST2	107	7/2/2010
Chicken Creek	ST3	107	7/2/2010
Chicken Creek	Tripod	CM106	8/21/2004
Chicken Creek	TX312	NESDIS ID 39603396	5/25/2006
Chicken Creek	WSWD	5103	6/19/2013

Chititu

Station Name	Item	Model	Start Date
Chititu	Antenna	25316 YAGI	8/20/2004
Chititu	AT	ThermX	6/21/2013
Chititu	AT-RH	HMP45	7/10/2015
Chititu	Battery	100 AH (x2)	8/20/2004
Chititu	Crossarm	3/4"	8/20/2004
Chititu	Crossarm	3/4"	8/20/2004
Chititu	Datalogger	CR1000	6/26/2012
Chititu	DLP	Chititu2015	7/10/2015
Chititu	Enclosure	ENC 16/18	8/20/2004
Chititu	GPS	17992 GPS	6/21/2013
Chititu	RG-TB	TE525	8/20/2004
Chititu	SD	SR50a	6/21/2013
Chititu	Solar Panel	75 W	8/20/2004
Chititu	SR	Li200x	6/21/2013
Chititu	ST1	107	8/20/2004
Chititu	ST2	107	8/20/2004
Chititu	ST3	107	6/25/2011
Chititu	Tripod	CM106	8/20/2004
Chititu	TX312	NESDIS ID 396020E0	6/21/2013
Chititu	WSWD	5103	7/10/2015

Coal Creek

Station Name	Item	Model	Start Date
Coal Creek	Antenna	25316 YAGI	9/16/2004
Coal Creek	AT	ThermX	
Coal Creek	AT-RH	HMP45	8/7/2015
Coal Creek	Battery	100 AH (x2)	9/16/2004
Coal Creek	Crossarm	3/4"	9/16/2004
Coal Creek	Crossarm	3/4"	9/16/2004
Coal Creek	Datalogger	CR1000	7/24/2013
Coal Creek	DLP	CoalCreek2015	8/7/2015
Coal Creek	Enclosure	ENC 16/18	9/16/2004
Coal Creek	GPS	17992 GPS	9/8/2012
Coal Creek	RG-TB	TE525	9/16/2004
Coal Creek	SD	SR50a	7/24/2013
Coal Creek	Solar Panel	75 W	9/16/2004
Coal Creek	SR	Li200x	8/7/2015
Coal Creek	ST1	107	9/16/2004
Coal Creek	ST2	107	9/16/2004
Coal Creek	ST3	107	9/16/2004
Coal Creek	Tripod	CM106	9/16/2004
Coal Creek	TX312	NESDIS ID 39605670	9/8/2012
Coal Creek	WSWD	5103	5/22/2014

Dunkle Hills

Station Name	Item	Model	Start Date
Dunkle Hills	Antenna	25316 YAGI	8/1/2002
Dunkle Hills	AT	ThermX	8/1/2002
Dunkle Hills	AT-RH	HMP-45	5/26/2015
Dunkle Hills	Battery	100 AH (x2)	8/1/2002
Dunkle Hills	3/4"	CM204	8/1/2002
Dunkle Hills	3/4"	CM206	8/1/2002
Dunkle Hills	Datalogger	CR1000	5/26/2015
Dunkle Hills	DLP	Dunkle2015	5/26/2015
Dunkle Hills	Enclosure	ENC 16/18	9/19/2011
Dunkle Hills	GPS	17992 GPS	8/1/2002
Dunkle Hills	RG-TB	TE525	8/1/2002
Dunkle Hills	SD	SR50a	8/22/2014
Dunkle Hills	Solar Panel	75 W	8/1/2002
Dunkle Hills	SR	Li200x	8/14/2013
Dunkle Hills	ST1	107	8/14/2013
Dunkle Hills	ST2	107	8/14/2013
Dunkle Hills	ST3	107	8/14/2013
Dunkle Hills	Tripod	CM106	8/1/2002
Dunkle Hills	TX312	NESDIS ID 3960B582	9/17/2009
Dunkle Hills	WSWD	5103	8/22/2014

Eielson Visitor Center

Station Name	Item	Model	Start Date
Eielson	Antenna	25316 YAGI	6/4/2005
Eielson	AT	ThermX	6/4/2005
Eielson	AT-RH	HMP45	8/20/2015
Eielson	Battery	100 AH (x2)	6/4/2005
Eielson	Crossarm	3/4"	6/4/2005
Eielson	Datalogger	CR1000	5/28/2014
Eielson	DLP	Eielson2015	8/20/2015
Eielson	Enclosure	ENC 16/18	6/4/2005
Eielson	GPS	17992 GPS	6/4/2005
Eielson	RG-TB	TE525	6/4/2005
Eielson	SD	SR50a	5/28/2014
Eielson	Solar Panel	75 W	6/4/2005
Eielson	SR	Li200x	8/20/2015
Eielson	Tripod	CM106	6/4/2005
Eielson	TX312	NESDIS ID 39604506	9/17/2009
Eielson	WSWD	5103	5/28/2014

Gates Glacier

Station Name	Item	Model	Start Date
Gates Glacier	Antenna	25316 YAGI	7/6/2005
Gates Glacier	AT	ThermX	7/6/2005
Gates Glacier	AT-RH	HMP45	7/9/2015
Gates Glacier	Battery	100 AH (x2)	7/6/2005
Gates Glacier	Camera	CC5MPX	6/21/2013
Gates Glacier	Camera Battery/Solar Panel	12 Volt – 100 AH / 10 W panel	7/9/2015
Gates Glacier	Crossarm	3/4"	7/6/2005
Gates Glacier	Crossarm	CM206	7/6/2005
Gates Glacier	Datalogger	CR1000	6/21/2013
Gates Glacier	DLP	GatesGI2015	7/9/2015
Gates Glacier	Enclosure	ENC 16/18	7/6/2005
Gates Glacier	GPS	17992 GPS	7/6/2005
Gates Glacier	RG-TB	TE525	7/6/2005
Gates Glacier	SD	SR50	6/21/2013
Gates Glacier	Solar Panel	75 W	7/6/2005
Gates Glacier	SR	Li200x	6/21/2013
Gates Glacier	ST1	107	7/6/2005
Gates Glacier	ST2	107	7/6/2005
Gates Glacier	ST3	107	7/6/2005
Gates Glacier	Tripod	CM106	6/21/2013
Gates Glacier	TX312	NESDIS ID 39608018	6/30/2010
Gates Glacier	WS/WD	5103	7/9/2015

Ruth Glacier

Station Name	Item	Model	Start Date
Ruth Glacier	Antenna	25316 YAGI	9/6/2008
Ruth Glacier	AT	ThermX	9/6/2008
Ruth Glacier	AT-RH	HMP45	8/12/2015
Ruth Glacier	Battery	100 AH (x2)	9/6/2008
Ruth Glacier	Battery Cable	Power Cable	6/13/2012
Ruth Glacier	Charging Regulator	CH-100	6/13/2012
Ruth Glacier	Datalogger	CR1000	6/24/2014
Ruth Glacier	DLP	Ruth2015	8/12/2015
Ruth Glacier	Enclosure	ENC 16/18	9/6/2008
Ruth Glacier	GPS	17992 GPS	9/6/2008
Ruth Glacier	RG-TB	TE525	9/6/2008
Ruth Glacier	SD	SR50a	6/24/2014
Ruth Glacier	Solar Panel	75 W	9/6/2008
Ruth Glacier	SR	Li200x	7/3/2015
Ruth Glacier	ST1	107	9/6/2008
Ruth Glacier	ST2	107	9/6/2008
Ruth Glacier	ST3	107	6/24/2014
Ruth Glacier	Tripod	FTS RAWS Lunar Lander	9/6/2008
Ruth Glacier	TX312	NESDIS ID 396063EA	6/13/2012
Ruth Glacier	TX312 Cable	Coaxial Cable	6/13/2012
Ruth Glacier	WSWD	5103	6/24/2014

Stampede

Station Name	Item	Model	Start Date
Stampede	Antenna	25316 YAGI	8/1/2002
Stampede	AT	ThermX	8/1/2002
Stampede	AT-RH	HMP-45	8/13/2015
Stampede	Battery	100 AH (x2)	2003
Stampede	Crossarm	3/4"	8/1/2002
Stampede	Datalogger	CR1000	9/16/2014
Stampede	DLP	Stampede2015	8/13/2015
Stampede	Enclosure	ENC 16/18	5/18/2011
Stampede	GPS	17992 GPS	8/1/2002
Stampede	RG-TB	TE525	8/1/2002
Stampede	SD	SR50a	9/16/2014
Stampede	Solar Panel	75 W	8/1/2002
Stampede	SR	Li200x	8/13/2015
Stampede	ST1	107	8/1/2002
Stampede	ST2	107	8/1/2002
Stampede	ST3	107	8/1/2002
Stampede	Tripod	CM106	9/1/2002
Stampede	TX312	NESDIS ID 3960A6F4	9/17/2009
Stampede	WSWD	5103	8/13/2015

Tana Knob

Station Name	Item	Model	Start Date
Tana Knob	Antenna	25316 YAGI	7/5/2005
Tana Knob	AT	ThermX	7/5/2005
Tana Knob	AT-RH	HMP45	7/10/2015
Tana Knob	Battery	100 AH (x2)	7/5/2005
Tana Knob	Crossarm	CM204	7/5/2005
Tana Knob	Crossarm	CM206	7/5/2005
Tana Knob	Datalogger	CR1000	7/2/2014
Tana Knob	DLP	Tana2015	7/10/2015
Tana Knob	Enclosure	ENC 16/18	7/5/2005
Tana Knob	GPS	17992 GPS	7/5/2005
Tana Knob	RG-TB	TE525	7/5/2005
Tana Knob	SD	SR50	6/20/2013
Tana Knob	Solar Panel	75 W	7/5/2005
Tana Knob	SR	Li200x	7/2/2014
Tana Knob	ST1	107	7/5/2005
Tana Knob	ST2	107	7/5/2005
Tana Knob	ST3	107	7/5/2005
Tana Knob	Tripod	CM106	6/27/2012
Tana Knob	TX312	NESDIS ID 3960709C	7/1/2010
Tana Knob	WSWD	5103	6/20/2013

Tebay

Station Name	Item	Model	Start Date
Tebay	Antenna	25316 YAGI	7/8/2005
Tebay	AT	ThermX	7/8/2005
Tebay	AT-RH	HMP45	7/10/2015
Tebay	Battery	100 AH (x2)	7/8/2005
Tebay	Crossarm	CM204	7/8/2005
Tebay	Crossarm	CM206	7/8/2005
Tebay	Datalogger	CR1000	6/20/2013
Tebay	DLP	Tebay2015	7/10/2015
Tebay	Enclosure	ENC 16/18	7/8/2005
Tebay	GPS	17992 GPS	7/8/2005
Tebay	RG-TB	TE525	7/8/2005
Tebay	SD	SR50a	6/20/2013
Tebay	Solar Panel	75 W	7/8/2005
Tebay	SR	Li200x	7/10/2015
Tebay	ST1	107	6/30/2010
Tebay	ST2	107	6/30/2010
Tebay	ST3	107	6/30/2010
Tebay	Tripod	CM106	7/3/2014
Tebay	TX312	NESDIS ID 3960936E	9/17/2008
Tebay	WSWD	5103	7/10/2015

Toklat

Station Name	Item	Model	Start Date
Toklat	Antenna	25316 YAGI	6/16/2005
Toklat	AT	ThermX	6/16/2005
Toklat	AT-RH	HMP45	5/28/2014
Toklat	Battery	100 AH (x2)	6/16/2005
Toklat	Crossarm	3/4"	6/16/2005
Toklat	Datalogger	CR1000	5/28/2014
Toklat	DLP	Toklat2014	5/28/2014
Toklat	Enclosure	ENC 16/18	6/16/2005
Toklat	GPS	17992 GPS	5/28/2014
Toklat	RG-TB	TE525	6/16/2005
Toklat	SD	SR50a	5/28/2014
Toklat	Solar Panel	75 W	6/16/2005
Toklat	SR	Li200x	8/19/2012
Toklat	ST1	107	6/16/2005
Toklat	ST2	107	6/16/2005
Toklat	ST3	107	6/16/2005
Toklat	Tripod	CM106	6/16/2005
Toklat	TX312	NESDIS ID 396063EA	5/28/2014
Toklat	WSWD	5103	5/28/2014

Upper Charley

Station Name	Item	Model	Start Date
Upper Charley	Antenna	25316 YAGI	8/3/2005
Upper Charley	AT	ThermX	8/3/2005
Upper Charley	AT-RH	HMP45	8/6/2015
Upper Charley	Battery	100 AH (x2)	8/3/2005
Upper Charley	Camera	CC5MPX	7/23/2013
Upper Charley	Camera Battery/Solar Panel	12 Volt – 100 AH / 10 W panel	8/6/2015
Upper Charley	Crossarm	3/4"	8/3/2005
Upper Charley	Crossarm	CM206	8/3/2005
Upper Charley	Datalogger	CR1000	8/3/2005
Upper Charley	DLP	UpperCharley2015	7/23/2013
Upper Charley	Enclosure	ENC 16/18	8/3/2005
Upper Charley	GPS	17992 GPS	9/8/2012
Upper Charley	RG-TB	TE525	8/3/2005
Upper Charley	SD	SR50a	9/7/2012
Upper Charley	Solar Panel	75 W	8/3/2005
Upper Charley	SR	Li200x	7/23/2013
Upper Charley	ST1	107	7/23/2013
Upper Charley	ST2	107	7/23/2013
Upper Charley	ST3	107	7/23/2013
Upper Charley	Tripod	CM206	8/3/2005
Upper Charley	TX312	NESDIS ID 3960D064	9/8/2012
Upper Charley	WSWD	5103	5/23/2014

Wigand

Station Name	Item	Model	Start Date
Wigand	Antenna	25316 YAGI	8/3/2005
Wigand	AT	ThermX	8/13/2013
Wigand	AT-RH	HMP45	8/13/2015
Wigand	Battery	100 AH (x2)	8/13/2013
Wigand	Camera	CC5MPX	7/23/2013
Wigand	Crossarm	3/4"	8/13/2013
Wigand	Crossarm	CM206	8/13/2013
Wigand	Datalogger	CR1000	8/13/2013
Wigand	DLP	UpperCharley2015	8/13/2015
Wigand	Enclosure	ENC 16/18	8/13/2013
Wigand	GPS	17992 GPS	8/13/2013
Wigand	RG-TB	TE525	8/13/2013
Wigand	SD	SR50a	8/13/2013
Wigand	Solar Panel	75 W	8/13/2013
Wigand	SR	Li200x	8/13/2015
Wigand	ST	107	8/13/2013
Wigand	ST	107	8/13/2013
Wigand	ST	107	8/13/2013
Wigand	Tripod	CM206	8/13/2013
Wigand	TX312	NESDIS ID 3960D064	8/13/2013
Wigand	WS/WD	5103	8/13/2013

The Department of the Interior protects and manages the nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities.

NPS 953/130695, November 2015

National Park Service
U.S. Department of the Interior



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