

Climate Station Maintenance in the Central Alaska Inventory and Monitoring Network

2022 Summary



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Photo

Upper Charley weather station, Yukon-Charley Rivers National Preserve.
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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 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 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 2022 field season maintenance site visits were conducted at a total of twenty-four sites, including eleven CAKN RAWS, four SNOTEL (snow telemetry) stations, eight fire RAWS stations, and one NOAA climate reference network site. We did not visit two of the CAKN RAWS sites this summer due to schedule conflicts.

This report summarizes all work for the 2022 field season and includes current sensor metadata. These annual operations reports are compiled each year along with other deliverables so that it is clear how the data were collected. For more information, including data access, weather summaries, and annual reports please visit the CAKN climate website at <https://www.nps.gov/im/cakn/climate.htm>.

List of Acronyms

Ah:	Amp hour
AT:	Air Temperature
AT-RH:	Air Temperature-Relative Humidity
CAKN:	Central Alaska Network
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
NESDIS ID:	National Environmental Satellite, Data, and Information Service Identifier
NPS:	National Park Service
NRCS:	Natural Resource Conservation Service
RAWS:	Remote Automated Weather Station
RG-TB:	Rain Gauge - Tipping Bucket
SD:	Snow Depth
SNOTEL:	Snow Telemetry
SR:	Solar Radiation
ST:	Soil Temperature
W:	Watt
WFMI:	Wildland Fire Management Information
WRST:	Wrangell-St. Elias National Park and Preserve
WS-WD:	Wind Speed - Wind Direction
YUCH:	Yukon-Charley Rivers National Preserve

Introduction

For the 2022 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). Eleven of the thirteen CAKN climate stations were maintained (Table 1) along with NPS support at four NRCS snow and soil sites, eight fire RAWS stations, and one NOAA Climate Reference Network station. Annual maintenance includes downloading data, updating software and programming, replacing sensors, and troubleshooting problems. Maintenance is critical to provide continuous, high-quality meteorological data.

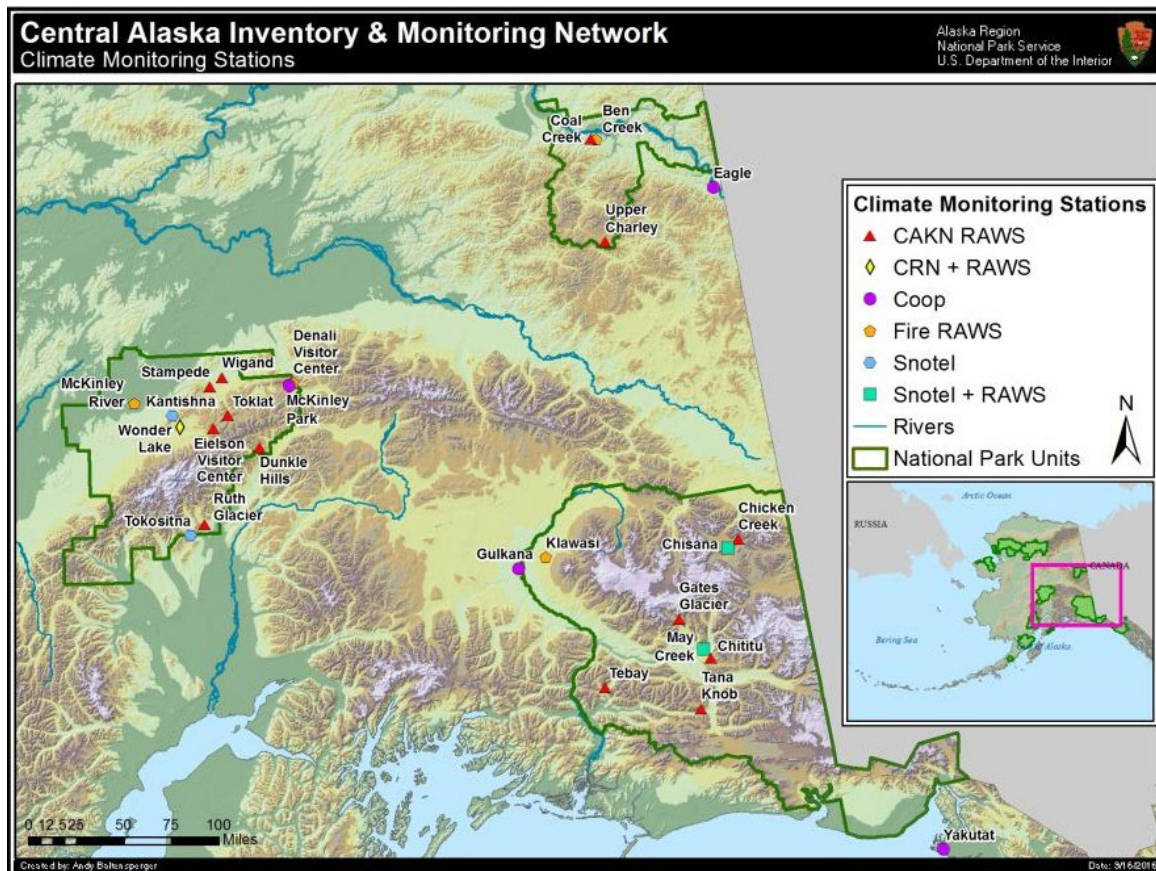


Figure 1. Locations of CAKN climate stations.

Table 1. Locations of CAKN climate stations maintained in 2022 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
Klawasi RAWS	62.217	-144.995	2513	WRST
Strelna/Chitina RAWS	61.521	-144.198	1232	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 CRN	63.452	-150.875	2163	DENA
Kantishna SNOTEL	63.540	-150.990	472	DENA
Tokositna SNOTEL	62.629	-150.775	259	DENA

*No site visits in 2022

Climate Station Maintenance Summaries

This section describes the maintenance details of twenty-five climate stations in CAKN organized by park unit. This work is being implemented based on Central Alaska Network (CAKN) climate vital sign protocols (Sousanes 2018) and standard operating procedures (Sousanes et al. 2017).

See Appendix A for detailed logistics for each of the base locations. Appendices B and C provide sensor specifications and metadata.

Denali National Park and Preserve

This section includes descriptions of all station maintenance in DENA in 2022. The sites include: Eielson Visitor Center, Stampede, Toklat, Wigand, Wonder Lake CRN, Tokositna SNOTEL, Kantishna SNOTEL, Denali Visitor Center Fire RAWS, McKinley River Fire RAWS, Wonder Lake Fire RAWS, and Lake Minchumina Fire RAWS. Dunkle Hills and Ruth Glacier were not visited in 2022.

Eielson Visitor Center

Date/Time: 8/16/2022 13:31

Personnel: Pam Sousanes

Logistics: A-star helicopter – Temsco – N970TH – Peter Howarth

Weather: 50s, breezy

Damage: tipping bucket just slightly off level

Sensors replaced:

1. AT-RH (EE181)
2. 2nd AT (ThermX to 109)

Other hardware replaced:

Additional Comments: Tipping bucket pole plumbed and leveled. Loaded new program for 109_2 sensor swap.

Potential Data Issues: none

To Do:

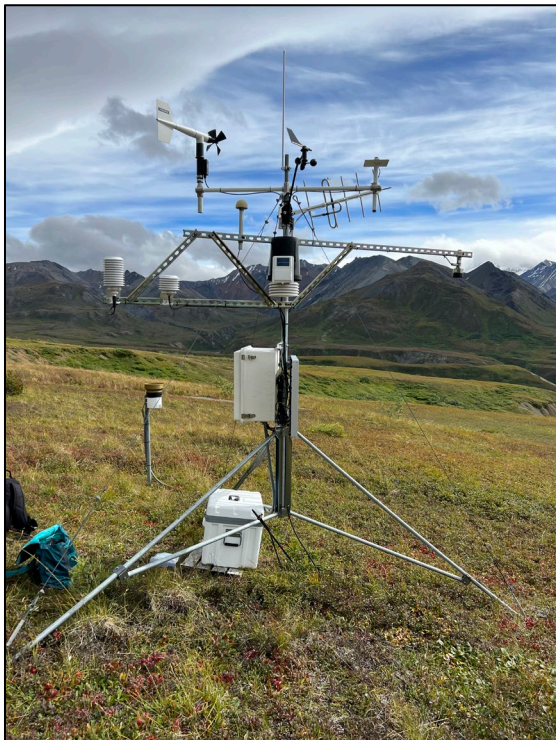


Figure 2. Eielson Visitor Center climate station, August 16, 2022.

Stampede

Date/Time: 6/23/2022 13:30

Personnel: Pam Sousanes, Ken Hill

Logistics: A-star helicopter – Temsco – N570AE – Christian Holden

Weather: low 60s, calm, buggy.

Damage: Failsafe tripped on transmitter. The P1 wiring on the tipping bucket was loose, noted some cable damage.

Sensors replaced:

1. AT-RH (EE181)
2. 2nd AT (ThermX to 109)
3. RG-TB (TE525)

Other hardware replaced:

Additional Comments: Loaded new program for 109_2 sensor swap. Site has 109 sensors for all soil temperature depths, needed to edit program.

The program start time was 5/14/2022, which is strange. Something also happened on 4/3/2022 that disrupted the rain and snow data records (see below). The data download record dates back to July 2020 with continuous records through the June site visit. Power issue? Wiring issue? There were low 12V counts, but battery seemed OK at the site visit.

Potential Data Issues:

1. 4/3/2022 – 6/23/2022. No rain measurements. Cumulative rain was reset to zero. After 4/3 there were no tips. May be related to the P1 loose wire connection?
2. 4/3/2022 – 6/23/2022. Snow was abruptly offset on 4/3/2022 from ~32 to ~54 inches? The offset persisted to the site visit in the hourly data files.

To Do:

1. Replace SR-50a
2. Monitor data through the winter for any more issues; problems could have been related to a bad SR50a sensor.



Figure 3. Stampede climate station, June 23, 2022. The tipping bucket was out of level on arrival (left) end of site visit photo (right).

Toklat

Date/Time: 6/23/2022 13:00

Personnel: Pam Sousanes, Ken Hill

Logistics: A-star helicopter – Temsco – N570AE – Christian Holden

Weather: mid 50's

Damage: none

Sensors replaced:

1. AT-RH (EE181)
2. SR (Li200X)
3. 2nd AT (ThermX to 109)

Other hardware replaced: Replaced coax cable.

Additional Comments: Once again the failsafe was tripped on the transmitter, everything else was fine. Reset by holding fault button for 10 seconds. Still don't know what is causing it to trip. Loaded new program for 109_2 sensor swap.

Potential Data Issues: None

To Do: Swapped coax this year so wait to see if transmissions continue through 2023, if not troubleshoot the satellite transmitter trip issue some more.



Figure 4. Toklat climate station, June 23, 2022.

Wigand

Date/Time: 6/23/2022 13:00

Personnel: Pam Sousanes, Ken Hill

Logistics: A-star helicopter – Temsco – N570AE – Christian Holden

Weather: high 50s, nice breeze.

Damage: none. But mast is leaning $<5^\circ$.

Sensors replaced:

1. AT-RH (EE181)
2. 2nd AT (ThermX to 109)

Other hardware replaced: Re-guy wired to fence corners to try to straighten station.

Additional Comments: Station looked good, but it's leaning. Did not try and lower the mast to swap the wind sensor this year for fear of irreparable damage. Sent new program for the addition of the 2nd 109 sensor. Verified wiring and depths of soil sensors. Plumbed and leveled the precip bucket and the snow sensor. Loaded new program for 109_2 sensor swap.

Potential Data Issues:

1. Having the mast out of level could potentially affect the precip and solar radiation data for 2021-2022.

To Do: Remove 20' mast, replace with 3m mast (normal station). Add geogrid (like CRN) under the tripod legs. Should be able to use the mast sections on site to modify the station. Plan for extra time at this site next year.



Figure 5. Wigand climate station June 23, 2022.

Dunkle Hills

No site visit in 2022

Ruth Glacier

No Site visit in 2022

Denali Fire RAWS

DENA staff completed annual maintenance at all fire RAWS in summer 2022. More information is available through WFMI.

Denali Visitor Center: Annual maintenance performed 6/13/2022 by Joel Stewart and Peter Bengtson. Installed RH/AT 55112, replaced Wind with 54923. Rest tipping bucket. Update App Software to 3.14.09 and G6 firmware to ver. 11.12.

Lake Minchumina: Annual maintenance performed 6/15/2022 by Joel Stewart and Peter Bengtson. Replaced RH/AT (30465), rain (36550). All sensors scanned. Took pictures. Reset tipping bucket. Update App Software to 3.14.09 and G6 firmware to ver. 11.12.

McKinley River: Annual maintenance completed 7/20/2022 by Shannon Coykendall, Replaced RH/AT (23585), Rain (47791) rain gauge zeroed. Updated application software to 3.14.0.9.

Wonder Lake: Annual maintenance completed 6/4/2022. Replaced RH/AT Sensor (45714) and rain gauge (37045). F6 datalogger installed (56850).

Denali SNOTEL

Tokositna SNOTEL 6/28/2022: Daniel Fisher and Keegan Krantz from the Natural Resources Conservation Service completed the annual maintenance. The snow pillow had to be replaced and that involved slinging equipment and fluid from mile 131 gravel pit on the Parks Highway to the site. The Talkeetna Ranger staff helped with the slinging/helicopter managing for this trip. The precipitation gage was flushed, and 10 gallons of fresh antifreeze were added for the winter. Sensors were replaced as needed according to the SNOTEL network protocols (National Engineering Handbook 2015).

Kantishna SNOTEL 8/11/2022: Austin Hart and a volunteer did the annual maintenance. They flew to the site in the park plane with park pilot Justin Wiseman. The precipitation gage was flushed, and 10 gallons of fresh antifreeze were added for the winter. Sensors were replaced as needed according to the SNOTEL network protocols (National Engineering Handbook 2015).

Wonder Lake Climate Reference Network Station (AK Denali 27N)

8/16/2022. Mark Hall and Chuck Lindsay (NOAA) maintained the station according to CRN standards. The site was accessed by A-Star helicopter N97OTH. Staff stayed at the Admin Camp on the east end of the park and flew to the site for the day. This work was coordinated with site maintenance at Eielson.

Wrangell-St. Elias

Stations maintained in WRST include Chicken Creek, Chititu, Gates Glacier, Tana Knob and Tebay. The May Creek, Chisana, and Strelna/Chitina fire RAWS were also maintained. John Adam's airstrip was used for helicopter parking and fuel was obtained at the nearby McCarthy Airport. All staff stayed at the McCarthy B&B.

Chicken Creek

Date/Time: 7/29/2022 15:13

Personnel: Pam Sousanes

Logistics: A-star helicopter – Temsco – N6094E – Eric Steinbauer

Weather: low 60s, bluebird day.

Damage: none

Sensors replaced:

1. AT-RH (EE181)
2. SR (LI200X)
3. 2nd AT (ThermX to 109)

Other hardware replaced: none

Additional Comments: Loaded new program for 109_2 sensor swap. Needed to adjust it because three of the four soil sensors were 109s. Tipping bucket was full of mushrooms! Mushrooms were removed. Gutter screening seemed effective at protecting the soil sensors.

Potential Data Issues: Rain data is likely compromised because of the mushroom storage. It will be hard to pinpoint when it occurred.

To Do:

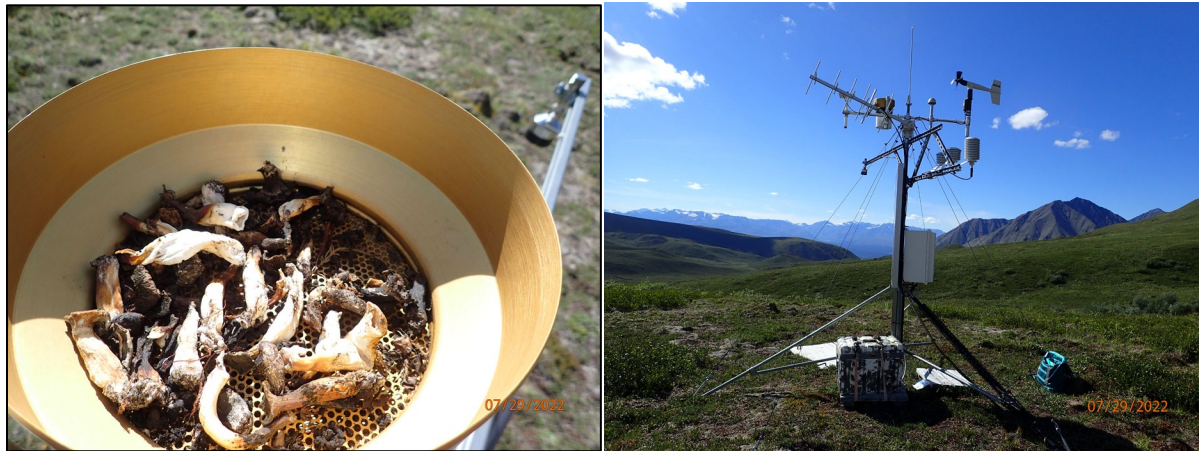


Figure 6. Chicken Creek climate station, July 29, 2022 (right). We found the tipping bucket full of mushrooms (left).

Chititu

Date/Time: 7/29/2022 1100

Personnel: Pam Sousanes

Logistics: A-star helicopter – Temsco – N6094E – Eric Steinbauer

Weather: mid 50's. Pleasant.

Damage: none

Sensors replaced:

1. AT-RH (EE181)
2. SR (Li200X)
3. 2nd AT (ThermX to 109)

Other hardware replaced: Added 2nd battery.

Additional Comments: Loaded new program for 109_2 sensor swap. Foam and bailing wire working as ground squirrel deterrent. Replaced screen in tipping bucket.

Potential Data Issues: Soil temperature sensors were reinstalled in 2021. Soil sensors 2013-2021 may have heaved and/or been in a different soil structure. Note added in Aquarius.

To Do:



Figure 7. Chititu climate station, July 29, 2022.

Gates Glacier

Date/Time: 7/29/2022 13:00

Personnel: Pam Sousanes

Logistics: A-star helicopter – Temsco – N6094E – Erik Steinbauer

Weather: upper 50's, calm, nice.

Damage: none

Sensors replaced:

1. AT-RH (EE181)
2. 2nd AT (ThermX to 109)

Other hardware replaced: SD memory card on CC5MPX phenology camera

Additional Comments: Replaced the EE181 cable because the black screw was not tightening.

Worked fine after the return to the office and put back in rotation. The YAGI antenna elevation was at 15° instead of 21°. The U-bolts on the mast had slipped out of level. Relevelled, realigned.

Checked focus on camera might have been able to tighten up a bit but decided not to mess with it.

Verified settings were at highest resolution. Solar panel mount looks good. Loaded new program for 109_2 sensor swap.

Potential Data Issues: AT-RH and AT sensors likely buried in snow from approximately 2/15/2022-4/20/2022. Soil sensors reinstalled in 2019 may be in new soil structure/slightly different depths.

Notes added in Aquarius.

To Do:

1. Continue to monitor solar panel mount.



Figure 8. Gates Glacier climate station, July 29, 2022. Antenna out of level on arrival (left) and station at end of site visit (right).

Tana Knob

Date/Time: 7/29/2022 9:30

Personnel: Pam Sousanes

Logistics: A-star helicopter – Temsco – N6094E – Erik Steinbauer

Weather: mid 50's, nice.

Damage: none

Sensors replaced:

1. AT-RH (EE181)
2. SR (li 200X)
3. WS-WD (05103)
4. 2nd AT (ThermX to 109)
5. SD (SR50a)

Other hardware replaced: Replaced one insulator on electric fence.

Additional Comments: Replaced SR50a because transducer film was shredded. Tightened electric fence wire. Loaded new program for 109_2 sensor swap.

Potential Data Issues: none

To Do:



Figure 9. Tana Knob climate station, July 29, 2022.

Tebay

Date/Time: 7/28/2022 16:30

Personnel: Pam Sousanes

Logistics: A-star helicopter – Temsco – N6094E – Erik Steinbauer

Weather: low 70s, bluebird day.

Damage: Station damaged. Bear and/or snow damage.

1. AT-RH (EE181) cable disconnected from sensor.
2. WS-WD – Cable pulled out
3. SDI (SR50a) - Cable pulled out
4. RNIN tipping bucket out of level.
5. YAGI antenna horizontal with poor azimuth

Sensors replaced:

1. AT-RH (EE181)
2. 2nd AT (ThermX to 109)

Other hardware replaced: Added 2nd battery and drilled new holes in battery case and enclosure.

Additional Comments: The sensor cables that were pulled out seemed OK so rewired them back into datalogger. Positive wire was pulled out of charging regulator for transmitter. Rewired it. Electric fence need several new insulators – the corners are not squared up so there are double insulators to keep the wire from touching the post and shorting out. Loaded new program for 109_2 sensor swap.

Potential Data Issues: AT-RH (EE181), SDI (SR50a), WS-WD (TE525)

Missing Logger data: 6/24/2021 – 6/13/2022.

The logger file downloaded on 7/28/2022 did not contain any data for 6/24/2021-6/13/2022.

Transmitted data were appended to Aquarius when available (6/24/2021-7/25/2021). It is unknown how/why the logger began recording again for the 6/13/2022-7/28/2022 time period. Nobody was in the field on 6/13/2022. The downloaded logger .dat file has some issues with blocked/repeated data. This logger was replaced in 2021 and the program was updated in 2022. The .dat file has data going back to 2019 (probably because Tebay site data had previously been downloaded on this field laptop). Interestingly, the cumulative precipitation value of 7.67 inches on 6/13/2022 suggests that the logger was recording prior to 6/13/2022. However, as of 12/2/2022, no data have been recovered from the logger for the 6/24/2021-6/13/2022 time period.

To Do: This site has had ongoing issues for ~3 years. Consider swapping out major components (logger and transmitter) and completely rebuilding the fence. Before sending a new program, search the logger for missing data 6/24/2021-6/13/2022. Repair electric fence and bring extra insulators.



Figure 10. Tebay climate station, July 28, 2022. Site had been damaged (left). Station after site maintenance was completed (right).

Wrangell-St. Elias Fire RAWS

Joel Stewart and Peter Bengston completed RAWS maintenance at May Creek (5/27/2022). Station down on arrival. Performed hard reset and update G6 firmware. Updated application software 3.14.09 and G6 firmware to 11.12 replaced AT/RH and RG. They also did the maintenance on the Chitina/Stelna site on 5/25/2022. Pam Sousanes did maintenance at Chisana (7/29/2022), swapped RH/AT, RG, and SR. Updated software application to 3.14.09, but could not get the G6 firmware updated. Pam did the Klawasi maintenance (7/30/2022). Swapped RH/AT and RG. Updated application software. Additional details are available in the Wildfire Management Information System (WFMI).

Wrangell-St. Elias SNOTEL

The SNOTEL sites at May Creek and Chisana were maintained by NRCS staff on July 7, 2022. Keegan Krantz accessed the site via NPS fleet aircraft with NPS pilot Don Welty from Gulkana. Sensors were replaced as needed according to the SNOTEL network protocols (National Engineering Handbook 2015). The precipitation gages were flushed, and 10 gallons of fresh antifreeze liquid added for the winter. The electric fences were repaired.

Yukon-Charley Rivers National Preserve

CAKN stations maintained in YUCH include Coal Creek, Upper Charley, and Andrew Creek Fire. Sousanes and Hill flew via Temsco A-Star helicopter N970TH (Denali fire helicopter) with Erik Steinbauer from Fairbanks.

Coal Creek

Date/Time: 8/8/2022 14:00

Personnel: Pam Sousanes, Ken Hill

Logistics: A-Star helicopter – N970TH - Erik Steinbauer

Weather: mid 50s, cloudy, light rain

Damage: none

Sensors replaced:

1. AT-RH (EE181)
2. 2nd AT (ThermX to 109)

Other hardware replaced:

Additional Comments: Added a replicate set of soil sensors off the south leg of the tripod: STF1-2 @ 10cm, SE13/EX3; STF2-2 @ 50 cm, SE14/EX3; STF-3 @ 90 cm, SE15/EX3. Sent new program for the changes to the 2nd AT and the 2nd soil sensor array. Tightened SR50a crossarm.

Potential Data Issues: first array of soil temperature sensors have known sensor drift (corrected in Aquarius).

To Do:



Figure 11. Coal Creek climate station, August 8, 2022.

Upper Charley

Date/Time: 8/8/2022 10:50

Personnel: Pam Sousanes, Ken Hill

Logistics: A-star helicopter – Temsco – N970TH – Erik Steinbauer

Weather: mid 40s, light rain

Damage: none

Sensors replaced:

1. AT-RH (EE181)
2. SR (Li 200X)
3. 2nd AT (ThermX to 109)
4. AT (109)

Other hardware replaced:

1. Replaced screen on tipping bucket
2. Swapped SD memory card in CC5MPX camera
3. Straightened AT/RH shield, but did not replace

Additional Comments: Replaced primary AT sensor (there were outliers in AT1H). Loaded new program for 109_2 sensor swap.

Potential Data Issues: AT-RH (EE181) Spikes started in 2020 and are obvious from 2/2022 through 5/2022 and maybe more. AT1L and AT Avg data file does not show same pattern.

To Do:

1. Bring replacement radiation shield for EE181 sensor.

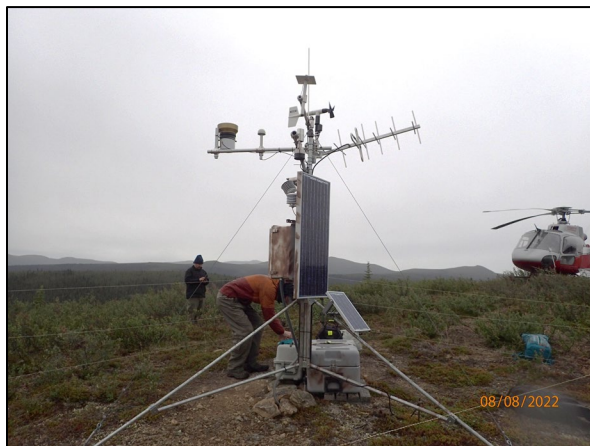


Figure 12. Upper Charley station August 8, 2022.

Andrew Creek Fire

Date/Time: 8/8/2022 13:15

Personnel: Pam Sousanes, Ken Hill, Tim Nolan (fire heli manager)

Logistics: A-star helicopter – Temsco – N970TH – Erik Steinbauer

Weather: mid 50s, light rain

Damage: Damage to tipping bucket, camera, snow depth sensor, AT/RH shield. Soil sensors were pulled out of ground slightly, may be OK data wise.

Sensors replaced: None. Removed station.

Other hardware replaced:

Additional Comments: The site was removed due to the extensive damage and data loss. It was only planned for one more year and not worth the equipment loss. There is no evidence that the station was ever there. Everything was removed.

Potential Data Issues:

Air and soil temperatures missing 11/16/2019-3/13/2020 and 7/9/2020-7/31/2020.

RNIN missing 11/16/2019-3/13/2020 and 5/31/2020-7/27/2021 and 7/25/2022-8/8/2022.

SDI missing 11/16/2019-3/13/2020 and 7/9/2020-7/27/2021. SDI suspect 3/13/2020-7/9/2020 (shift correction).

To Do:



Figure 13. Andrew Creek Fire station on August 8, 2022, with damage from bear (left, middle) and after station was removed (right).

Literature Cited

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Appendix A. Logistics Summary 2022

DENA Logistics

June 23, 2022: Toklat, and Wigand were completed by Pam Sousanes and Ken Hill. Site accessed via DENA rescue A-star helicopter N570AE with pilot Christian Holden.

June 28, 2022: Tokositna SNOTEL. Talkeetna Ranger staff supported this mission and helped with the sling loads from mile 131 Parks Hwy. Used the DENA rescue A-star helicopter N570AE.

August 11, 2022: Kantishna SNOTEL accessed by park plane (N709M) with NPS pilot Justin Wiseman from the park airstrip. Austin Hart (NRCS) and a volunteer did the maintenance.

Aug 16, 2022: Eielson and Wonder Lake CRN. Pam Sousanes, Mark Hall, and Chuck Lindsay accessed these stations by helicopter from Denali Park headquarters with the Temsco A-star western area fire helicopter N970TH with pilot Peter Howarth.

WRST Logistics

July 28-29, 2022

Personnel: Pam Sousanes, Chad Leshuk (helicopter manager), and Erik Steinbauer (Temsco pilot).

Aircraft: N6094E. Temsco A-star on exclusive use contract with NPS eastern area fire program.

Helicopter staged at John Adam's Airstrip.

Fuel: McCarthy Airport. Account and PIN arranged prior to project. Contact Lori Rowland in McCarthy.

Housing: McCarthy B&B. Contact John Adams in McCarthy.

Vehicles: Government vehicle from Fairbanks

Stations maintained: Klawasi and Tebay (7/28); Tana Knob, Gates Glacier, Chititu, Chicken Creek, and Chisana on 7/29.

Equipment: All equipment transported via government vehicle.

Narrative: This flight was delayed/condensed due to COVID – the relief pilot was not available, so the helicopter was not available. Pam Sousanes drove from Fairbanks on 7/28. Pilot Erik Steinbauer and manager Chad Leshuk also drove down from Fairbanks since the pilot was coming from days off. The A-star helicopter N-6094E was in Gulkana. Both vehicles were left in Gulkana, and the mission was done via helicopter. We spent one night at the McCarthy B&B. Fuel was purchased at the McCarthy Airport this year since there were some issues with space and aircraft at the Fireweed airstrip earlier in the season. This seems like a much better option and the fueling is the same. This was an expedited trip since the helicopter was going off contract at 9 pm on 7/29 in Fairbanks.

July 7, 2022: The SNOTEL sites at May Creek and Chisana were accessed from Gulkana with NPS fleet pilot. Keegan Krantz (NRCS) completed the maintenance.

YUCH Logistics

8/8/2022

Personnel: Pam Sousanes, Ken Hill, Tim Nolan (helicopter manager), and Erik Steinbauer (pilot).

Aircraft: N970TH. Temsco A-star on exclusive use contract with NPS western area fire program.

Fuel: JetA tanks at Coal Creek and Fort Wainwright. Check on fuel levels and keys prior to travel.

Vehicles: Government vehicle to Fort Wainwright/AFS heli base

Stations maintained: Coal Creek, Upper Charley, and Andrew Creek

Equipment: All equipment transported via government vehicle and aircraft.

Narrative: Crew flew from Fort Wainwright to Upper Charley, Andrew Creek, and Coal Creek. Refueled at Coal Creek and returned to Fairbanks the same day.

Appendix B. CAKN I&M Station Specifications

Tables B1 through B6 provide details on the climate station specifications.

Table B1. Sensor specifications.

Measurements	Model/Manufacturer/Item#	Purchased from:
Air Temperature 1/Relative Humidity	HMP-45C/HMP155a/EE181 Temperature and Relative Humidity Probe	Campbell Scientific
Air Temperature 2	109 Temperature Probe (primary beginning summer 2016)	Campbell Scientific
Air Temperature 3	109 Temperature Probe (secondary, replacing ThermX in 2022)	Campbell Scientific
Wind Speed and direction	RM Young 05103/05103-45 (alpine version); or 05108 HD Alpine version	Campbell Scientific
Precipitation (summer rainfall)	Texas Electronics TE525WS Rain Gage	Campbell Scientific
Solar Radiation (incoming)	LI-COR LI200X, LI200RX, CS320	Campbell Scientific
Snow Depth	SR50A sonic ranging sensor	Campbell Scientific
Soil Temperature	107 Temperature Probe (3)	Campbell Scientific

Table B2. Datalogger specifications.

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

Table B3. Satellite communication specifications.

Satellite Communication	Model/Item #	Purchased From:
GOES Satellite transmitter	TX312/TX320/TX321 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 B4. Power specifications.

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

Table B5. Hardware specifications.

Station Hardware - Item	Type/Model	Purchased from:
Tripod	CM110 10 ft. stainless-steel tripod w/grounding kit	Campbell Scientific
Guyline 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 B6. 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	Various local vendors
Poly wire	200 ft. Poly-wire	Various local vendors
Solar fence charger	10 mile low impedance fence charger – various models	Various local vendors

Appendix C. CAKN RAWS Components by Climate Station

Tables C1 through C 13 provide metadata on each climate station.

Table C1. Metadata for Chicken Creek climate station.

Station Name	Item	Model	Start Date
Chicken Creek	Antenna	25316 YAGI	8/21/2004
Chicken Creek	AT	109	7/6/2016
Chicken Creek	AT (2)	109 (2)	7/29/2022
Chicken Creek	AT-RH	EE181	7/29/2022
Chicken Creek	Battery	100 AH (x2)	8/21/2004
Chicken Creek	Cross arm	CM204	8/21/2004
Chicken Creek	Datalogger	CR1000	6/19/2013
Chicken Creek	DLP	Chicken2022	7/29/2022
Chicken Creek	GPS	17992 GPS	7/3/2014
Chicken Creek	RG-TB	TE525	7/12/2017
Chicken Creek	SD	SR50a	6/19/2013
Chicken Creek	Solar Panel	75 W	8/21/2004
Chicken Creek	SR	Li200x	7/29/2022
Chicken Creek	ST -10 cm	107	7/7/2020
Chicken Creek	ST -20 cm	107	7/7/2020
Chicken Creek	ST -50 cm	107	7/7/2020
Chicken Creek	ST -100 cm	107	7/7/2020
Chicken Creek	Tripod	CM106	8/21/2004
Chicken Creek	TX321	NESDIS ID 39603396	7/12/2018
Chicken Creek	WS/WD	5103	7/7/2020

Table C2. Metadata for Chititu climate station.

Station Name	Item	Model	Start Date
Chititu	Antenna	25316 YAGI	8/20/2004
Chititu	AT	109	6/30/2016
Chititu	AT (2)	109 (2)	7/29/2022
Chititu	AT-RH	EE181	7/29/2022
Chititu	Battery	100 AH (x1)	7/8/2020
Chititu	Cross arm	CM204	8/20/2004
Chititu	Cross arm	CM206	8/20/2004
Chititu	Datalogger	CR1000	6/26/2012
Chititu	DLP	Chititu2022	7/29/2022
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	Out 2021
Chititu	Solar Panel	75 W	8/20/2004
Chititu	SR	Li200x	7/29/2022
Chititu	ST -10 cm	107	6/23/2021
Chititu	ST -20 cm	107	6/23/2021
Chititu	ST -50 cm	107	6/23/2021
Chititu	ST -100 cm	107	6/23/2021
Chititu	Tripod	CM106	8/20/2004
Chititu	TX321	NESDIS ID 396020E0	7/8/2020
Chititu	WS/WD	5103	6/23/201

Table C3. Metadata for Coal Creek climate station.

Station Name	Item	Model	Start Date
Coal Creek	Antenna	25316 YAGI	9/16/2004
Coal Creek	AT	109	7/6/2016
Coal Creek	AT (2)	109 (2)	8/8/2022
Coal Creek	AT-RH	EE181	8/8/2022
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	CoalCreek2022	8/8/2022
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	7/28/2021
Coal Creek	ST1	107	9/16/2004
Coal Creek	ST2	107	9/16/2004
Coal Creek	ST3	107	9/16/2004
Coal Creek	STF1_2	107	8/8/2022
Coal Creek	STF2_2	107	8//2022
Coal Creek	STF3_2	107	8/8/2022
Coal Creek	Tripod	CM106	9/16/2004
Coal Creek	TX321	NESDIS ID 39605670	6/14/2018
Coal Creek	WS/WD	5103	7/10/2020

Table C4. Metadata for Dunkle Hills climate station.

Station Name	Item	Model	Start Date
Dunkle Hills	Antenna	25316 YAGI	8/1/2002
Dunkle Hills	AT	109	8/11/2016
Dunkle Hills	AT (2)	Therm-X	8/1/2002
Dunkle Hills	AT-RH	EE181	6/14/2021
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	Dunkle2020	7/29/2020
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	6/14/2021
Dunkle Hills	ST1	107	8/8/2017
Dunkle Hills	ST2	107	8/14/2013
Dunkle Hills	ST3	107	8/14/2013
Dunkle Hills	ST4 – 90 cm	107	6/14/2021
Dunkle Hills	Tripod	CM106	8/1/2002
Dunkle Hills	TX321	NESDIS ID 3960B582	7/29/2020
Dunkle Hills	WS/WD	5103	7/29/2020

Table C5. Metadata for Eielson Visitor Center climate station.

Station Name	Item	Model	Start Date
Eielson	Antenna	25316 YAGI	6/4/2005
Eielson	AT	109	9/8/2016
Eielson	AT (2)	109 (2)	8/16/2022
Eielson	AT-RH	EE181	8/16/2022
Eielson	Battery	100 AH (x2)	6/4/2005
Eielson	Crossarm	3/4"	6/4/2005
Eielson	Datalogger	CR1000	5/28/2014
Eielson	DLP	Eielson2022	8/16/2022
Eielson	Enclosure	ENC 16/18	6/4/2005
Eielson	GPS	17992 GPS	6/4/2005
Eielson	RG-TB	TE525	6/5/2019
Eielson	SD	SR50a	5/28/2014
Eielson	Solar Panel	75 W	6/4/2005
Eielson	SR	Li200x	8/24/2021
Eielson	Tripod	CM106	6/4/2005
Eielson	TX321	NESDIS ID 39604506	8/21/2018
Eielson	WS/WD	5103	5/21/2020

Table C6. Metadata for Gates Glacier climate station.

Station Name	Item	Model	Start Date
Gates Glacier	Antenna	25316 YAGI	7/6/2005
Gates Glacier	AT	109	6/29/2016
Gates Glacier	AT (2)	109 (2)	7/29/2022
Gates Glacier	AT-RH	EE181	7/29/2022
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	GatesGI2022	7/29/2022
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	7/7/2020
Gates Glacier	Solar Panel	75 W	7/7/2020
Gates Glacier	SR	Li200x	7/7/2020
Gates Glacier	ST1	107	6/27/2019
Gates Glacier	ST2	107	6/27/2019
Gates Glacier	ST3	107	6/27/2019
Gates Glacier	Tripod	CM106	6/21/2013
Gates Glacier	TX321	NESDIS ID 39608018	7/11/2018
Gates Glacier	WS/WD	5103	6/24/2021

Table C7. Metadata for Ruth Glacier climate station.

Station Name	Item	Model	Start Date
Ruth Glacier	Antenna	25316 YAGI	9/6/2008
Ruth Glacier	AT	109	6/21/2017
Ruth Glacier	AT (2)	Therm-X	9/6/2008
Ruth Glacier	AT-RH	EE181	8/3/2021
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	8/3/2021
Ruth Glacier	DLP	Ruth2019	6/26/2019
Ruth Glacier	Enclosure	ENC 16/18	6/26/2019
Ruth Glacier	GPS	17992 GPS	9/6/2008
Ruth Glacier	RG-TB	TE525	9/6/2008
Ruth Glacier	SD	SR50a	6/21/2017
Ruth Glacier	Solar Panel	75 W	9/6/2008
Ruth Glacier	SR	Li200x	8/11/2020
Ruth Glacier	ST1	107	9/6/2008
Ruth Glacier	ST2	107	9/6/2008
Ruth Glacier	ST3	107	6/24/2014
Ruth Glacier	ST4 – 90 cm	107	6/26/2019
Ruth Glacier	Tripod	FTS RAWS Lunar Lander	9/6/2008
Ruth Glacier	TX321	NESDIS ID 396063EA	6/26/2019
Ruth Glacier	TX321 Cable	Coaxial Cable	8/11/2020
Ruth Glacier	WS/WD	5103 (30')	8/11/2020

Table C8. Metadata for Stampede climate station.

Station Name	Item	Model	Start Date
Stampede	Antenna	YAGI	6/14/2021
Stampede	AT	109	8/11/2016
Stampede	AT (2)	109 (2)	6/23/2022
Stampede	AT-RH	EE181	6/23/2022
Stampede	Battery	100 AH (x2)	2003
Stampede	Crossarm	3/4"	8/1/2002
Stampede	Datalogger	CR1000	9/16/2014
Stampede	DLP	Stampede2022	6/23/2022
Stampede	Enclosure	ENC 16/18	5/18/2011
Stampede	GPS	17992 GPS	8/1/2002
Stampede	RG-TB	TE525	6/23/2022
Stampede	SD	SR50a	9/16/2014
Stampede	Solar Panel	75 W	8/1/2002
Stampede	SR	Li200x	6/14/2021
Stampede	ST1	109	8/8/2019
Stampede	ST2	109	8/8/2019
Stampede	ST3	109	8/8/2019
Stampede	ST4 – 90 cm	109	8/8/2019
Stampede	Tripod	CM106	6/14/2021
Stampede	TX321	NESDIS ID 3960A6F4	8/8/2019
Stampede	WS/WD	5103	6/14/2021

Table C9. Metadata for Tana Knob climate station.

Station Name	Item	Model	Start Date
Tana Knob	Antenna	25316 YAGI	7/5/2005
Tana Knob	AT	109	6/28/2016
Tana Knob	AT (2)	109 (2)	7/29/2022
Tana Knob	AT-RH	EE181	7/29/2022
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	Tana2022	7/29/2022
Tana Knob	Enclosure	ENC 16/18	7/5/2005
Tana Knob	GPS	17992 GPS	7/5/2005
Tana Knob	RG-TB	TE525	6/28/2016
Tana Knob	SD	SR50	7/29/2022
Tana Knob	Solar Panel	75 W	7/5/2005
Tana Knob	SR	Li200x	7/29/2022
Tana Knob	ST1	107	6/24/2021
Tana Knob	ST2	107	7/10/2018
Tana Knob	ST3	107	7/5/2005
Tana Knob	Tripod	CM106	6/27/2012
Tana Knob	TX321	NESDIS ID 3960709C	7/10/2018
Tana Knob	WS/WD	5103	7/29/2022

Table C10. Metadata for Tebay climate station.

Station Name	Item	Model	Start Date
Tebay	Antenna	25316 YAGI	7/6/2020
Tebay	AT	109	6/28/2016
Tebay	AT (2)	109 (2)	7/28/2022
Tebay	AT-RH	EE181	7/28/2022
Tebay	Battery	100 AH (x1)	7/6/2020
Tebay	Crossarm	CM204	7/8/2005
Tebay	Crossarm	CM206	7/8/2005
Tebay	Datalogger	CR1000	6/24/2021
Tebay	DLP	Tebay2022	7/28/2022
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	7/6/2020
Tebay	Solar Panel	75 W	7/8/2005
Tebay	SR	Li200x	7/6/2020
Tebay	ST1	107	7/6/2020
Tebay	ST2	107	6/30/2010
Tebay	ST3	107	6/30/2010
Tebay	Tripod	CM106	7/3/2014
Tebay	TX321	NESDIS ID 3960936E	7/10/2018
Tebay	WS/WD	5103	6/24/2021

Table C11. Metadata for Toklat climate station.

Station Name	Item	Model	Start Date
Toklat	Antenna	25316 YAGI	6/16/2005
Toklat	AT	109	9/9/2016
Toklat	AT (2)	109 (2)	6/23/2022
Toklat	AT-RH	EE181	6/23/2022
Toklat	Battery	100 AH (x2)	6/5/2019
Toklat	Crossarm	3/4"	6/16/2005
Toklat	Datalogger	CR1000	9/9/2016
Toklat	DLP	Toklat2022	6/23/2022
Toklat	Enclosure	ENC 16/18	6/16/2005
Toklat	GPS	17992 GPS	5/28/2014
Toklat	RG-TB	TE525	9/9/2016
Toklat	SD	SR50a	8/24/2021
Toklat	Solar Panel	75 W	6/16/2005
Toklat	SR	Li200x	6/23/2022
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	TX321	NESDIS ID 396063EA	5/21/2020
Toklat	WS/WD	5103	5/21/2020

Table C12. Metadata for Upper Charley climate station.

Station Name	Item	Model	Start Date
Upper Charley	Antenna	25316 YAGI	8/3/2005
Upper Charley	AT	109	8/8/2022
Upper Charley	AT (2)	109 (2)	8/8/2022
Upper Charley	AT-RH	EE181	8/8/2022
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	9/7/2012
Upper Charley	DLP	UCharley2022	8/8/2022
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	6/13/2017
Upper Charley	Solar Panel	75 W	8/3/2005
Upper Charley	SR	Li200x	8/8/2022
Upper Charley	ST1	107	7/23/2013
Upper Charley	ST2	107	7/23/2013
Upper Charley	ST3	107	7/23/2013
Upper Charley	ST4 – 75 cm	107	5/14/2019
Upper Charley	Tripod	CM206	8/3/2005
Upper Charley	TX321	NESDIS ID 3960D064	6/13/2018
Upper Charley	WS/WD	5103	7/10/2020

Table C13. Metadata for Wigand climate station.

Station Name	Item	Model	Start Date
Wigand	Antenna	25316 YAGI	8/3/2005
Wigand	AT	109	8/11/2016
Wigand	AT (2)	109 (2)	6/23/2022
Wigand	AT-RH	EE181	6/23/2022
Wigand	Battery	100 AH (x2)	8/13/2013
Wigand	Crossarm	3/4"	8/13/2013
Wigand	Crossarm	CM206	8/13/2013
Wigand	Datalogger	CR1000	8/13/2013
Wigand	DLP	Wigand2022	6/23/2022
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	6/23/2022
Wigand	ST1	107	8/13/2013
Wigand	ST2	107	8/13/2013
Wigand	ST3	107	8/13/2013
Wigand	ST4	107	7/29/2020
Wigand	ST5	107	6/14/2021
Wigand	Tripod	CM206	8/13/2013
Wigand	TX321	NESDIS ID 39600060C	8/8/2019
Wigand	WS/WD	5103 (30" cable)	8/8/2019

