



Climate Station Maintenance in the Arctic Network

2019 Summary

Natural Resource Data Series NPS/ARCN/NRDS—2021/1317



ON THE COVER

Pam Sousanes and Ken Hill at Pamichtuk Lake climate station, Gates of the Arctic National Park and Preserve.
NPS/Seth Adams

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Executive Summary

The mission of the Arctic Network Inventory and Monitoring Program (ARCN) is to collect, compile and synthesize scientific information about the Arctic 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.

In an attempt to better understand climate variation as well as long-term changes in park ecosystems, seventeen I&M climate stations have been installed in the five ARCN parks. The objective of the climate monitoring program is to monitor and record weather conditions at representative locations throughout ARCN in order to identify long and short-term trends, provide reliable climate data to other researchers, and to participate in large scale climate monitoring and modeling efforts beyond park boundaries. Seventeen I&M stations were maintained, five fire remote automated weather stations (RAWS) were maintained by the Alaska Fire Service in cooperation with NPS staff in Anchorage, and the Kelly snow telemetry (SNOTEL) station was maintained by the Natural Resources Conservation Service (NRCS) staff. This report summarizes the 2019 field season and includes current sensor metadata.

Acknowledgments

A successful field season would not have been possible without support from staff in Fairbanks, Nome, Kotzebue, and Bettles. Special thanks to all pilots for safely, efficiently, and happily delivering us to each climate station this season.

List of Acronyms

Ah	Amp hour
ARCN	Arctic Network
AS350	A-star 350 Helicopter
AT	Air Temperature
AT-RH	Air Temperature – Relative Humidity
BELA	Bering Land Bridge National Preserve
CAKR	Cape Krusenstern National Monument
DLP	Data Logger Program
GAAR	Gates of the Arctic National Park and Preserve
GOES	Geostationary Operational Environmental Satellite
GPS	Global Positioning System
I&M	Inventory and Monitoring
KOVA	Kobuk Valley National Park
LED	Light-Emitting Diode
NESDIS	National Environmental Satellite, Data, and Information Service
NOAT	Noatak National Park and Preserve
NPS	National Park Service
NRCS	Natural Resource Conservation Service
RAWS	Remote Automated Weather Station
RG-TB	Rain Gauge – Tipping Bucket
SD	Snow Depth
SDI	Serial Digital Interface
SNOTEL	Snow Telemetry
SR	Solar Radiation
ST	Soil Temperature
W	Watt
WEAR	Western Arctic National Parklands
WS-WD	Wind Speed – Wind Direction

Introduction

For the 2019 field season, the Arctic Network (ARCN) continued its climate monitoring program by maintaining seventeen stations in the network (Figure 1, Table 1). The park units include, Gates of the Arctic National Park and Preserve (GAAR), Bering Land Bridge National Preserve (BELA), Cape Krusenstern National Monument (CAKR), Kobuk Valley National Park (KOVA), and Noatak National Preserve (NOAT). Maintenance includes downloading data, updating software and datalogger programs, replacing sensors, and troubleshooting problems. Maintenance is necessary in order to provide continuous, high-quality meteorological data. There are additional weather and climate stations in the parks that are operated by other state and federal agencies with specific objectives. Remote automated weather stations (RAWS) deployed as part of the NPS fire program record real-time weather data for fire management. NRCS snow telemetry (SNOTEL) stations record weather and snow information. It is in the best interest of the ARCN program to cooperate with these and other entities by assisting in station maintenance; a total of 23 sites are maintained annually, including 17 ARCN RAWS, 5 fire RAWS and 1 SNOTEL station.

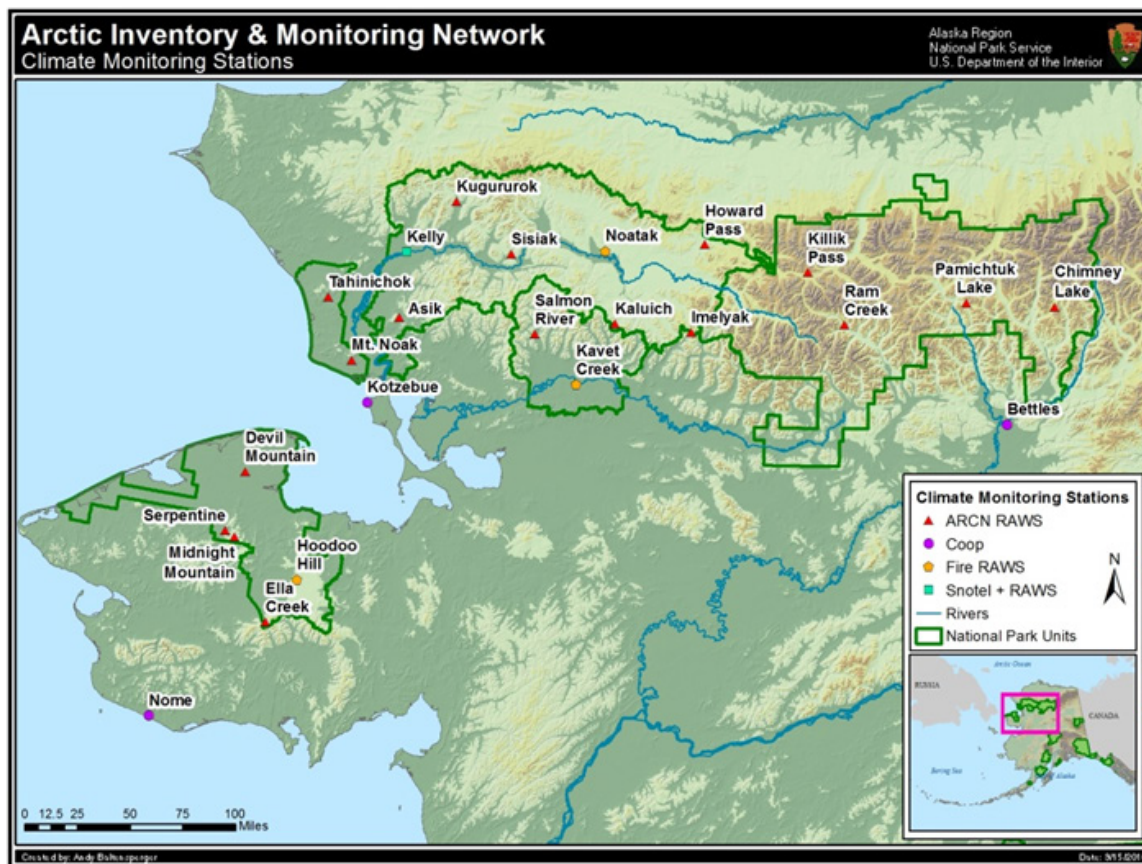


Figure 1. Locations of ARCN climate stations.

Table 1. Locations of ARCN climate stations maintained in 2018 field season.

Station Name	Station Type	Latitude (N)	Longitude (W)	Elevation (ft)	Park
Chimney Lake	ARCN RAWS	67° 42.853'	150° 35.100'	3780	GAAR
Killik Pass	ARCN RAWS	67° 59.007'	155° 00.782'	4355	GAAR
Pamichtuk Lake	ARCN RAWS	67° 45.977'	152° 09.854'	3294	GAAR
Ram Creek	ARCN RAWS	67° 37.458'	154° 20.678'	4110	GAAR
Asik	ARCN RAWS	67° 28.493'	162° 15.986'	1329	NOAT
Howard Pass	ARCN RAWS	68° 09.361'	156° 53.749'	2062	NOAT
Imelyak	ARCN RAWS	67° 32.689'	157° 04.646'	3620	NOAT
Kaluich	ARCN RAWS	67° 34.403'	158° 25.903'	2486	NOAT
Kavet Creek RAWS	Fire RAWS	67° 08.317'	159° 02.617'	235	KOVA
Kelly RAWS	Fire RAWS	67° 55.778'	162° 17.775'	412	NOAT
Kelly SNOTEL	SNOTEL	67° 55.780'	162° 17.410'	310	NOAT
Kugururok	ARCN RAWS	68° 19.003'	161° 29.518'	908	NOAT
Noatak RAWS	Fire RAWS	68° 04.222'	158° 42.224'	1040	NOAT
Salmon River	ARCN RAWS	67° 27.594'	159° 50.475'	1262	KOVA
Sisiak	ARCN RAWS	67° 59.702'	160° 23.739'	1823	NOAT
Tahinichok	ARCN RAWS	67° 33.009'	163° 34.031'	966	CAKR
Mt. Noak	ARCN RAWS	67° 08.486'	162° 59.672'	809	CAKR
Devil Mountain	ARCN RAWS	66° 16.553'	164° 31.851'	285	BELA
Ella Creek	ARCN RAWS	65° 16.289'	163° 48.681'	2258	BELA
Hoodoo Hills RAWS	Fire RAWS	65° 35.711'	163° 24.671'	1550	BELA
Midnight Mountain	ARCN RAWS	65° 49.220'	164° 32.565'	2267	BELA
Quartz Creek RAWS	Fire RAWS	65° 24.429'	164° 39.444'	276	BELA
Serpentine	ARCN RAWS	65° 51.138'	164° 42.469'	518	BELA

Climate Station Maintenance Summaries

This section describes the maintenance details of seventeen climate stations in ARCN organized by base locations. This work is being implemented based on the ARCN climate vital sign protocol implementation plan (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.

Bettles and Dahl Creek Base

ARCN climate stations maintained from Bettles include: Chimney Lake, Pamichtuk Lake, Ram Creek, Killik Pass, Howard Pass, Imelyak, Kaluich, Sisiak, and Salmon River. The Eastern Area Fire contract A-star helicopter (N6094E) was used to access the sites. Additional details are provided in Appendix A.

Chimney Lake

Date: June 10, 2019

Time of visit: 1415–1515

Personnel: Ken Hill, Pam Sousanes, Seth Adams

Mode of transport: A-star helicopter – Temsco – N6094E – Nick Siegal

Purpose of trip: Annual Maintenance

Weather: 48°F, 5 mph, showers

Sensors replaced:

AT-RH (HMP45)

The Chimney Lake station (Figure 2) was accessed by helicopter from Bettles. The station was in good condition. All data were downloaded from the datalogger. The AT-RH sensor was replaced for routine calibration. The electric fence was in good condition. Seth Adams took photos of the site visit (NPS contract photographer). Active thunderstorms were in the vicinity. The desiccant packets were replaced in the enclosure. Photos were taken from the four cardinal and four intercardinal directions both towards and away from the station.

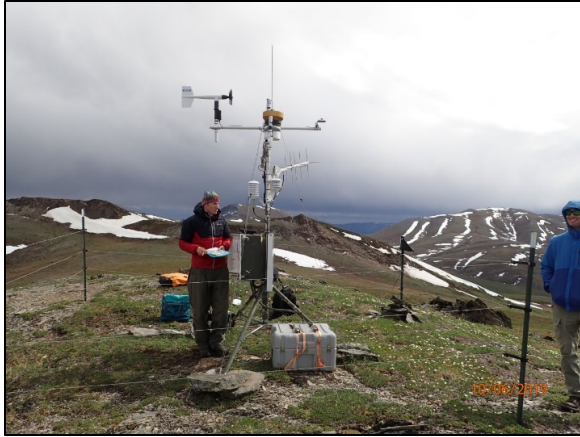


Figure 2. Chimney Lake climate station June 10, 2019.

Pamichtuk Lake

Date: June 10, 2019

Time of visit: 1530–1800

Personnel: Ken Hill, Pam Sousanes, Seth Adams

Mode of transport: A-star helicopter – Temsco – N6094E – Nick Siegal

Purpose of trip: Annual Maintenance

Weather: 46°F, 5–10 mph, heavy rain showers during site visit

Sensors replaced:

AT-RH (HMP45), SR (Li200x), WS-WD (05103)

The Pamichtuk Lake station (Figure 3) was accessed by helicopter from Bettles via Chimney Lake. The station was in good condition. All data were downloaded from the datalogger. The AT-RH, SR, and WS-WD sensors were replaced for routine calibration. The electric fence was maintained as needed. The soil temperature sensors were inspected and looked good. The images from the phenology camera were downloaded and the SD card was exchanged. The desiccant packets were replaced in the enclosure. High precision GPS coordinates were obtained with the Trimble unit. Photos were taken from the four cardinal and four intercardinal directions both towards and away from the station. *Note that the anemometer was incorrectly installed (180 degrees off) on June 10. Transmissions were turned off at WFMI on June 13. The transmissions will need to be turned back on and the data will need to be corrected after the next download. Additionally, the SR50a snow depth sensor is logging many errors. Consider replacing sensor and/or transducer at the next site visit.*



Figure 3. Pamichtuk climate station June 10, 2019.

Ram Creek

Date: June 11, 2019

Time of visit: 1130–1230

Personnel: Ken Hill, Pam Sousanes

Mode of transport: A-star helicopter – Temsco – N6094E – Nick Siegal

Purpose of trip: Annual Maintenance

Weather: 47°F, 5–10 mph, mostly clear

Sensors replaced:

AT-RH (HMP45)

Ram Creek climate station (Figure 4) was accessed by helicopter from Bettles. All data were downloaded from the datalogger. The station was in good condition. The AT-RH sensor was replaced for routine calibration. One connector on the electric fence was replaced and the polywire was tightened. The datalogger lithium battery was checked and deemed suitable (3.05 V). It should be replaced if it drops below 2.7 V. The desiccant packets were replaced in the enclosure. Photos were taken from the four cardinal and four intercardinal directions both towards and away from the station.

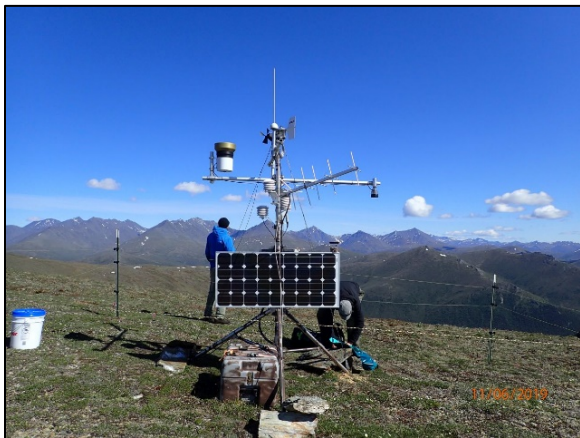


Figure 4. Ram Creek climate station June 11, 2019.

Killik Pass

Date: June 11, 2019

Time of visit: 1300–1400

Personnel: Ken Hill, Pam Sousanes

Mode of transport: A-star helicopter – Temsco – N6094E – Nick Siegal

Purpose of trip: Annual Maintenance

Weather: 45°F, 10–15 mph, partly cloudy

Sensors replaced:

AT-RH (HMP45), SR (Li200x)

Killik Pass climate station (Figure 5) was accessed by helicopter from Bettles via Ram Creek. The station was in good condition. All data were downloaded from the datalogger. The AT-RH and SR sensors were replaced for routine calibration. One YAGI antenna element was on the ground upon arrival and was reinstalled. The desiccant packets were replaced in the enclosure. Photos were taken from the four cardinal and four intercardinal directions both towards and away from the station. *The U-bolt mount for the lightning rod is missing. It should be replaced and reinstalled at the next field visit.*

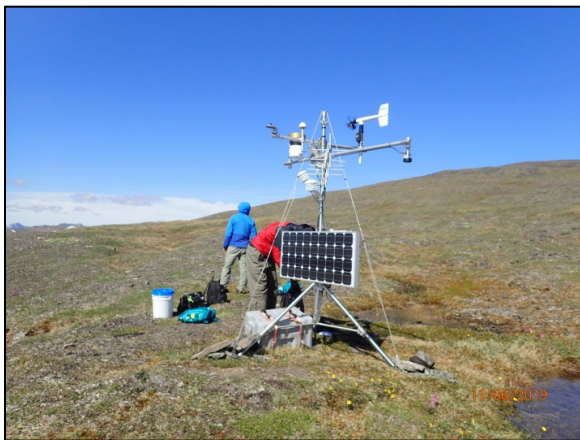


Figure 5. Killik Pass climate station June 11, 2019.

Howard Pass

Date: June 11, 2019

Time of visit: 1430–1630

Personnel: Ken Hill, Pam Sousanes

Mode of transport: A-star helicopter – Temsco – N6094E – Nick Siegal

Purpose of trip: Annual Maintenance

Weather: 57°F, 15–20 mph, sunny

Sensors replaced:

AT-RH (HMP45), YAGI Coax Cable

The Howard Pass climate station (Figure 6) was accessed from Bettles via Killik Pass. The station had been damaged in November 2018, possibly by high winds. The AT-RH HMP45 sensor was destroyed. The 05108 anemometer cable had been disconnected (ground only). The solar panel wire had been disconnected. The ST1 and ST2 soil temperature sensors were on the surface upon arrival; they were reinstalled at the appropriate depths. The damaged AT-RH sensor was replaced with a 7-wire model and a new program was sent to the datalogger to accommodate the change. The anemometer and solar panel cables were reconnected. The solar panel was replaced (the U-bolts had to be cut to fit on the frame). The coax cable for the YAGI antenna was damaged and replaced. All data were downloaded from the datalogger. The cumulative rainfall was reset to its observed value of 1.32 inches. The desiccant packets were replaced in the enclosure. Photos were taken from the four cardinal and four intercardinal directions both towards and away from the station.

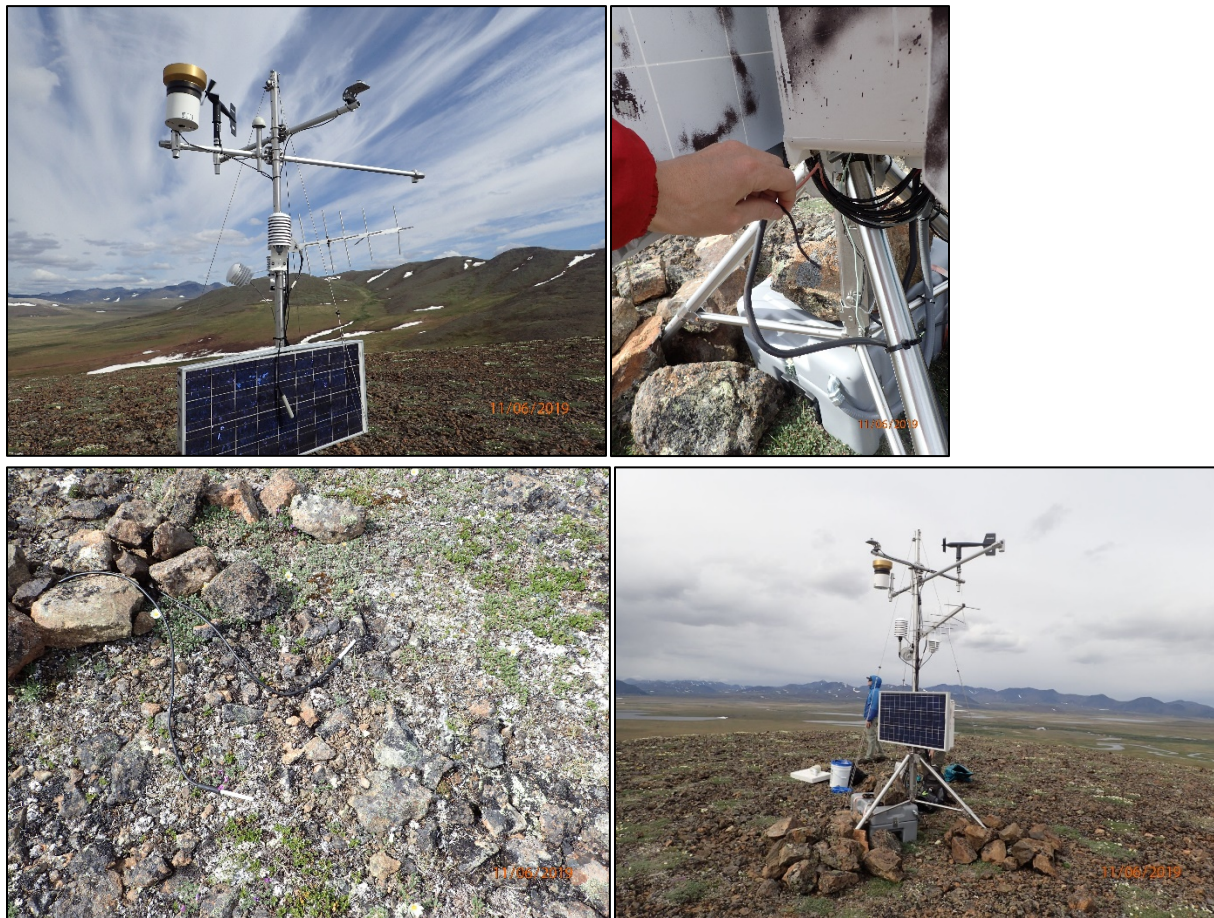


Figure 6. Howard Pass climate station, June 11, 2019. Clockwise from top left: damaged AT-RH sensor, disconnected solar panel cable, after repairs, soil temperature sensors on surface.

Imelyak

Date: June 11, 2019

Time of visit: 1700–1900

Personnel: Ken Hill, Pam Sousanes

Mode of transport: A-star helicopter – Temsco – N6094E – Nick Siegal

Purpose of trip: Annual maintenance

Weather: 47°F, 5–10 mph, cloudy

Sensors replaced:

AT-RH (HMP155), SR (Li200x), RG-TB, YAGI, SD (removed)

The Imelyak climate station site (Figure 7) was accessed by helicopter from Bettles via Ram Creek-Killik Pass-Howard Pass. All data were downloaded from the datalogger. The AT-RH and SR sensors were replaced for routine calibration. The RG-TB sensor was replaced (had not been working since previous field visit). The SD sensor was removed due to persistent erroneous data at this wind scoured location. The YAGI antenna was replaced (bent in 2018). *At the next field visit, the power cable should be replaced with terminal ends prepared and pre-housed in 2 to 3 feet of conduit (1/2" not 3/4").* The desiccant packets were replaced in the enclosure. Photos were taken from the four cardinal and four intercardinal directions both towards and away from the station.

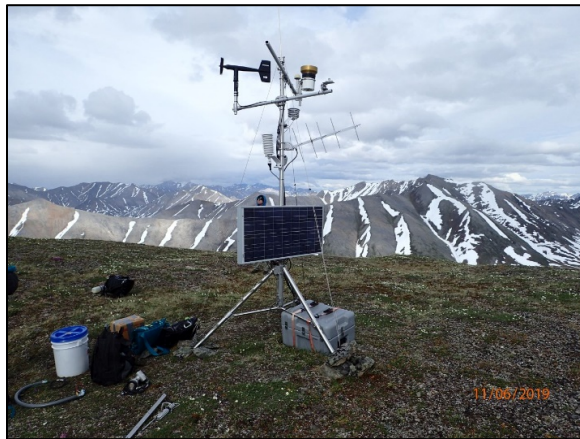


Figure 7. Imelyak climate station June 11, 2019.

Kaluich

Date: June 12, 2019

Time of visit: 1045–1330

Personnel: Ken Hill, Pam Sousanes

Mode of transport: A-star helicopter – Temsco – N6094E – Nick Siegal

Purpose of trip: Annual maintenance

Weather: 57°F, 5–10 mph, partly cloudy

Sensors replaced:

AT-RH (HMP155), SR, WS-WD (5108 Alpine HD), YAGI, Coax cable

The Kaluich climate station (Figure 8) was accessed by helicopter. The station had been damaged (bear?). The AT-RH (HMP155) sensor was damaged and the radiation shield was on the ground. Two driver elements on the YAGI antenna were on the ground. The crossarm with the RG-TB and SD sensors was out of level and bent. The other air temperature radiation shields were bent, but not damaged otherwise. The WS-WD (05108) bearings were somewhat noisy. The HMP155 sensor was replaced with a HMP45 AT-RH sensor. The coax cable was replaced (damaged/corroded 2018). The YAGI antenna was replaced, but not the mounting U-bolt assembly. All data were downloaded and a new program (Kaluich2019.CR1) was sent to the datalogger to account for the HMP45 7-wire sensor. The bent crossarm was moved down on the mast and the level part was used for the RG-TB and SD sensors. The new height of the snow depth sensor was entered into the program at 49.0 inches. The cumulative rainfall was reset to 2.50 inches. The desiccant packets were replaced in the enclosure. Photos were taken from the four cardinal and four intercardinal directions both towards and away from the station. *At the next field visit, the radiation shield for the ThermX sensor should be replaced. Consider adding an electric fence.*



Figure 8. Kaluich climate station June 12, 2019. Before (left, middle) and after (right) repairs.

Sisiak

Date: June 12, 2019

Time of visit: 1400–1530

Personnel: Ken Hill, Pam Sousanes

Mode of transport: A-star helicopter – Temsco – N6094E – Nick Siegal

Purpose of trip: Annual Maintenance

Weather: 61°F, 15–20 mph, cloudy

Sensors Replaced:

AT-RH (HMP45), SD (removed), ST3 (replaced)

The Sisiak station (Figure 9) was accessed from Dahl Creek via Kaluich. The station had been damaged, presumably by a bear. The station was out of level and the tripod was tipped up to the northwest. All sensors were out of level upon arrival. The ST3 sensor was damaged (had been spliced) and was replaced at 50 cm. An ST4 soil temperature sensor was added at 75 cm. The electric fence was badly damaged with wire strung out and most posts bent. The fence charger was okay. The AT-RH sensor (HMP45) was replaced for routine calibration. All data were downloaded from the

datalogger and a new program was sent to the datalogger. The snow depth sensor was removed due to persistent erroneous measurements at this wind scoured location. The cumulative rainfall was reset to 1.53 inches. The electric fence was repaired. The desiccant packets were replaced in the enclosure. Photos were taken from the four cardinal and four intercardinal directions both towards and away from the station.



Figure 9. Sisiak climate station June 12, 2019 before (left) and after (right) repairs.

Salmon River

Date: June 12, 2019

Time of visit: 1615–1800

Personnel: Ken Hill, Pam Sousanes

Mode of transport: A-star helicopter – Temsco – N6094E – Nick Siegal

Purpose of trip: Annual maintenance

Weather: 67°F, 5–10 mph, partly sunny

Sensors replaced:

AT-RH (HMP155), SR (Li200x)

The Salmon River station (Figure 10) was accessed by helicopter. The HMP155 shield and sensor had been damaged, presumably by a bear in May. The tip of the sensor was broken. The bent shield had partially blocked the CC5MPX camera image. Field notes indicate that the RG-TB sensor was under the SD sensor upon arrival. All data were downloaded from the datalogger. The AT-RH radiation shield was replaced. The coax recoiled and secured to the solar panel. The CC5MPX camera image was refocused. The conduit for the camera power cable was re-taped at the enclosure. The SD card in the phenology camera was exchanged. One YAGI antenna element was missing. The electric fence wire was down along with many connectors, but the charger was not damaged. The fence was repaired. The AT-RH and SR sensors were replaced for routine calibration. The desiccant packets were replaced in the enclosure. Photos were taken from the four cardinal and four intercardinal directions both towards and away from the station.



Figure 10. Salmon River climate station June 12, 2019 before (left) and after (right) repairs.

Nome and Kotzebue Base

ARCN climate stations maintained from Nome include: Devil Mountain, Ella Creek, Midnight Mountain, and Serpentine Hot Springs. Stations maintained from Kotzebue include Tahinichok, Mt. Noak, Kugururok, and Asik. The Kelly Station SNOTEL site was also maintained. All sites were accessed by helicopter (Bering Air – R44 -N644CH – pilot Patrik Toerdal). Additional details are available in Appendix A.

Ella Creek

Date: August 1, 2019

Time of visit: 1550–1750

Personnel: Pam Sousanes

Mode of transport: R44 helicopter – Bering Air – N644CH – Patrik Toerdal

Purpose of trip: Annual Maintenance

Weather: 45°F, 2–10 mph winds

Sensors replaced:

AT-RH (HMP45), ST1, RG-TB (funnel), TX312 replaced with TX321, YAGI Antenna

The Ella Creek station (Figure 11) was accessed by helicopter from Nome. The station had been damaged, presumably by icing and/or wind in March 2019. The AT-RH (HMP45) sensor was replaced for routine calibration. The YAGI antenna was replaced—many elements were broken and/or missing. The tipping bucket funnel was missing and replaced. The ST1 cable had been severed and it was replaced. The small radiation shield was cracked and therefore replaced. The south guy wire was tightened. All data were downloaded from the datalogger. The desiccant packets were replaced in the enclosure. Photos were taken from the four cardinal and four intercardinal directions both towards and away from the station.

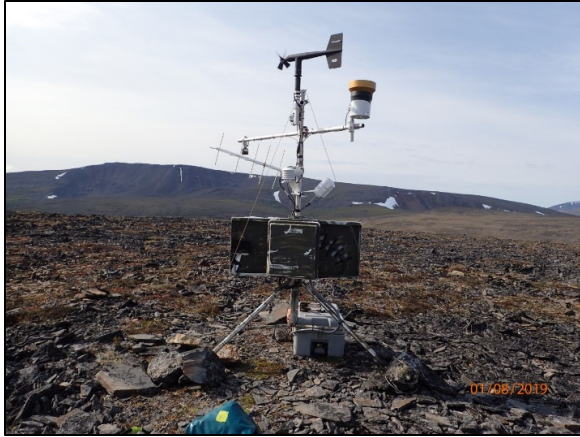


Figure 11. Ella Creek climate station August 1, 2019.

Midnight Mountain

Date: August 1, 2019

Time of visit: 1200–1300

Personnel: Pam Sousanes

Mode of transport: R44 helicopter – Bering Air – N644CH – Patrik Toerdal

Purpose of trip: Annual Maintenance

Weather: 42°F

Sensors replaced/repared:

Solar Panel

Midnight Mountain (Figure 12) was accessed by helicopter. Because of heavy rime ice buildup in winter months, only air temperature is measured at this site and data are not transmitted. The station was in good condition. All data were downloaded from the datalogger. The large 75 W solar panel was replaced with a 20 W panel. The new panel was mounted with hose clamps. The mechanism is bulky and its survival in the harsh conditions is questionable. *The large solar panel was left on site because it could not fit in the R44.* It should be retrieved at the next site visit. Photos were taken from the four cardinal and four intercardinal directions both towards and away from the station.



Figure 12. Midnight Mountain climate station August 1, 2019.

Devil Mountain

Date: August 1, 2019

Time of visit: 1430–1630

Personnel: Pam Sousanes

Mode of transport: R44 helicopter – Bering Air – N644CH – Patrik Toerdal

Weather: 62°F, 10–15 mph winds

Sensors replaced:

AT-RH, SR (Li200x), TX312 replaced with TX321

The Devil Mountain station (Figure 13) was accessed by helicopter. The station had some damage: the RG-TB sensor was 90 degrees out of level and one fence post and all polywire were missing. The AT-RH (HMP45) and SR (Li200x) sensors were replaced for routine calibration. The RG-TB sensor was righted and leveled. The fence was removed. The solar panel power cables were replaced (looked corroded). All data were downloaded from the datalogger. The desiccant packets were replaced in the enclosure. Photos were taken from the four cardinal and four intercardinal directions both towards and away from the station.



Figure 13. Devil Mountain climate station after maintenance August 1, 2019.

Serpentine Hot Springs

Date: August 1, 2019 and September 22, 2019

Time of visit: 1645–1845

Personnel: Pam Sousanes

Mode of transport: R44 helicopter – Bering Air – N644CH – Patrik Toerdal

Purpose of trip: Annual Maintenance

Weather: 56°F, 10–15 mph winds

Sensors replaced:

AT-RH (HMP155), CC5MPX, TX312 replaced with TX321 (both 8/1 and 9/22)

The Serpentine station (Figure 14) was accessed by helicopter. The station was in good condition except for the CC5MPX phenology camera. Camera images ceased on 7/13/2019, presumably due to power supply issues. The battery voltage was checked and okay, but the camera would not power on. The camera was replaced and configured appropriately.

The AT-RH sensor (HMP155) was replaced for routine calibration. All data were downloaded from the datalogger. The desiccant packets were replaced in the enclosure. Photos were taken from the four cardinal and four intercardinal directions both towards and away from the station. *Note: Pam Sousanes revisited the station on 9/22/2019 because the station was not transmitting. The transmitter failsafe had tripped. The TX321 was replaced with a new TX321. All data were downloaded. The camera was checked and had been functioning properly since the last visit. The power supply for both the camera and station should be checked extensively during the next field visit.*



Figure 14. Serpentine climate station August 1, 2019.

Tahinichok

Date: August 4, 2019

Time of visit: 1415–1530

Personnel: Sousanes, Dan Kenny (NRCS)

Mode of transport: R44 helicopter – Bering Air – N644CH – Patrik Toerdal

Purpose of trip: Annual Maintenance

Weather: 53°F, 10–15 mph

Sensors Replaced:

AT-RH (HMP45)

The Tahinichok station (Figure 15) was accessed from Kotzebue by helicopter. The station had minor damage. The long crossarm was out of level on arrival. The polywire on the electric fence was down. All data were downloaded from the datalogger. The electric fence was repaired. A guy wire was replaced. The height of the snow depth sensor height was adjusted –1.0 inches to 48.5 inches. The desiccant packets were replaced in the enclosure. Photos were taken from the four cardinal and four intercardinal directions both towards and away from the station. *The SR sensor was not replaced because the small set screw on the mount was stripped and could not be removed. A new sensor and leveling base should be installed at the next site visit. Also, the small radiation shield for the ThermX sensor is damaged and should be replaced at the next visit.*

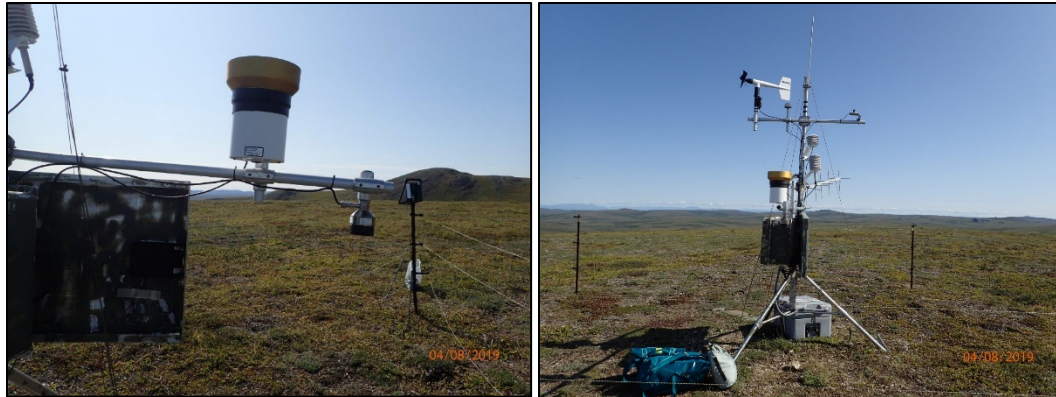


Figure 15. Tahinichok climate station August 4, 2019 shown before (left) and after (right) repairs.

Mt. Noak

Date: August 4, 2019

Time of visit: 1615–1815

Personnel: Pam Sousanes, Dan Kenney (NRCS)

Mode of transport: R44 helicopter – Bering Air – N644CH – Patrik Toerdal

Purpose of trip: Annual Maintenance

Weather: 57°F, 10–15 mph

Sensors Replaced:

AT-RH (HMP45), SR

The Mt. Noak station (Figure 16) was accessed from Kotzebue by helicopter. The station had some damage: the RG-TB and SD sensors were out of level and the bracket on the RG-TB mount was broken. The SD and AT (109) sensors were damaged. The lower crossarm (RG-TB, SD) was moved back up on the mast because one U-bolt was missing and it was stressing the solar panel. The AT-RH and SR sensors were replaced for routine calibration. All data were downloaded from the datalogger. The SD and AT109 sensors were replaced. The solar panel box was re-taped. The guy wires were tightened. The height of the snow depth sensor was re-entered into the program at 66.7 inches. The cumulative rainfall was left at its value of 1.15 inches. The desiccant packets were replaced in the enclosure. The camera SD memory card was swapped and the camera was tested. The electric fence was repaired. Photos were taken from the four cardinal and four intercardinal directions both towards and away from the station.

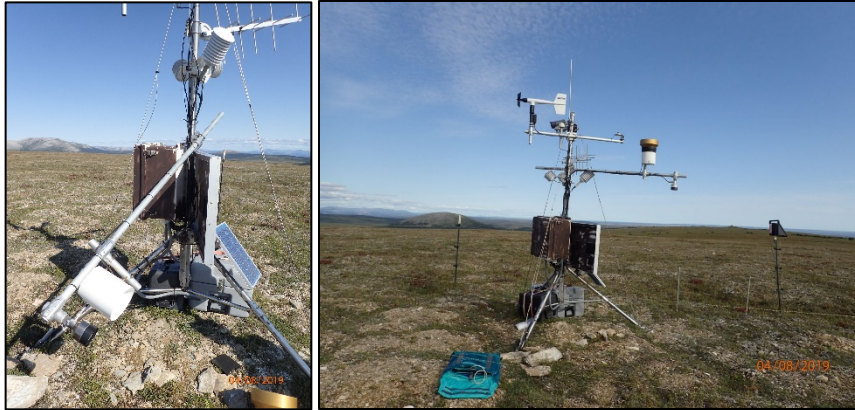


Figure 16. Mt. Noak climate station August 4, 2019 before (left) and after (right) repairs.

Kugururok

Date: August 5, 2019

Time of visit: 1000–1145

Personnel: Pam Sousanes

Mode of transport: R44 helicopter – Bering Air – N644CH – Patirk Toerdal

Purpose of trip: Annual Maintenance

Weather: 53°F, 5–10 mph

Sensors Replaced:

AT-RH (HMP45), SR, WS-WD

The Kugururok station (Figure 17) was accessed by helicopter from Kotzebue. The station had minor damage and it is suspected that something may have snuck in through the fence (porcupine?). Based on tipping bucket data, it appears the damage occurred on July 30, 2019. There were chew marks on the camera battery box. The RG-TB cable had been severed. The GPS cable was pulled out slightly from the enclosure. The inside of the enclosure was a bit wet and one of the desiccant packets was saturated. It is unknown how liquid entered the enclosure. The AT-RH (HMP45) sensor was replaced for routine calibration. All data were downloaded from the datalogger. The RG-TB cable was repaired by splicing and tested. The solar panel cables were taped to the back of the panel. The enclosure was wiped out and dried and putty was added to the small holes in the door of the enclosure. The desiccant packets were replaced in the enclosure. The SD card in the CC5MPX digital camera was exchanged. Photos were taken from the four cardinal and four intercardinal directions both towards and away from the station.



Figure 17. Kugururok climate station August 5, 2019 before (left) and after (right) maintenance. Porcupine damage suspected.

Asik

Date: August 5, 2019

Time of visit: 1215–1415

Personnel: Pam Sousanes

Mode of transport: R44 helicopter – Bering Air – N644CH – Patrik Toerdal

Purpose of trip: Annual maintenance

Weather: 56°F, 10–15 mph

Sensors replaced:

AT-RH (HMP45), WS-WD (05103), ST2

The Asik station (Figure 18) was accessed from Kotzebue by helicopter. The station looked good. The AT-RH and WS-WD sensors were replaced for routine calibration. All data were downloaded from the datalogger. The ST2 sensor was replaced (previously repaired by splicing). The AT 109 sensor was placed in the better radiation shield (swapped with ThermX). The RG-TB sensor was inspected and looked good. The electric fence was repaired. The desiccant packets were replaced in the enclosure. Photos were taken from the four cardinal and four intercardinal directions both towards and away from the station.



Figure 18. Asik climate station August 5, 2019.

Kelly SNOTEL

Date: August 4, 2019

Personnel: Dan Kenny (NRCS) and Pam Sousanes

Mode of transport: R44 helicopter – Bering Air – N644CH – Patrik Toerdal Purpose of trip: Annual maintenance

Sensors replaced: as needed by NRCS

Dan Kenny completed the annual maintenance at the Kelly SNOTEL site on August 4, 2019 with Pam Sousanes. The precipitation gauge was flushed and 10 gallons of fresh antifreeze liquid added for the winter. The electric fence was repaired. The sensors were replaced as needed according to the SNOTEL network protocols (National Engineering Handbook 2015). The sensors were tested and the site was working on departure. Extra five-gallon containers of fluid are stored in the locked shelter on site for future visits.

Fire RAWS stations

All Fire RAWS stations were maintained by the Alaska Fire Service in May 2019. Details are available via WFMI narratives. Stations include: Kavet Creek (5/16 and 6/4), Quartz Creek (5/18), Kelly (5/15), Noatak (5/16), and Hoodoo Hills (5/18). Notably, the Kavet Creek station had major bear damage and required two visits in 2019. *NPS climate staff should check for any potentially damaged soil temperature sensors before the next site visits. If AFS staff are visiting the sites, NPS staff should make prior arrangements as to whether these sensors can be replaced by AFS.*

Literature Cited

National Engineering Handbook. 2015. United States Department of Agriculture Natural Resources Conservation Service. Part 622, Snow Survey and Water Supply Forecasting. Chapter 5, Maintenance and Calibration.

Sousanes PJ and Others. 2017. Protocol implementation plan for monitoring weather and climate in the Arctic Network. Natural Resource Report. NPS/ARC/NRR—2017/1537. National Park Service. Fort Collins, Colorado

Appendix A. Base Logistics Summary 2019

Bettles and Dahl Creek Logistics June 10–13, 2019

Ken Hill and Pam Sousanes met helicopter N6094E (Temco/Eastern area fire helicopter contract) and pilot Nick Siegal at the Alaska Fire Service landing area on Fort Wainwright in Fairbanks. A government vehicle was parked on site. Helicopter fueled in Bettles (Brooks Range Aviation) and Dahl Creek (NPS Jet-A). All staff stayed in the NPS bunkhouse at Bettles (6/10) and Dahl Creek (6/11–6/12). The Chimney Lake and Pamichtuk Lake sites were maintained on 6/10. Seth Adams (NPS contract photographer) joined for these two stations. Ram Creek, Killik Pass, Howard Pass, and Imelyak stations were visited on 6/11. Sousanes, Hill, and Siegal cooked, slept (tents) and fueled at the NPS Dahl Creek facilities. Kaluich, Sisiak, and Salmon River were maintained on 6/12. The helicopter and all passengers ferried back to Fairbanks on 6/13.

Nome and Kotzebue Logistics July 31–August 6, 2019

Pam Sousanes flew via Alaska Airlines to Nome on 7/31. Bering Air R44 helicopter N644CH was piloted by Patrik Toerdal to access all sites. Sousanes visited Ella Creek, Midnight Mountain, Devil Mountain, and Serpentine Hot Springs on 8/1. A record rain event occurred in Nome starting the night of 8/1 ([link](#)), the two day storm delayed the shift of operations to Kotzebue until 8/4. On 8/4, Sousanes maintained the Kelly SNOTEL station with Dan Kenny, and completed maintenance at Tahinichok and Mt. Noak. On 8/5, Sousanes visited Kugururok and Asik. Sousanes returned to Fairbanks via commercial airline service on 8/6. Housing and vehicle needs were arranged in advance at the NPS bunkhouses in Nome and Kotzebue. Field equipment was shipped to and from Nome via Alaska Air cargo and on 8/6 the remaining field gear was shipped back to Fairbanks, also via Alaska Air cargo.

Nome Logistics September 22–23, 2019

Pam Sousanes returned to Nome via Alaska Airlines on 9/22 to repair the Serpentine and Ella Creek stations. Serpentine was not transmitting data and the August storms had damaged the wind sensor at Ella Creek. This trip was combined with a seabird die-off survey conducted along the northern coast of BELA. Sousanes visited the Serpentine site on 9/22 with a Bering Air R44 piloted by Patrik Toerdal. Ella Creek was not accessed due to freezing rain/low clouds at the site. Sousanes stayed at the NPS bunkhouse in Nome and returned to Fairbanks on September 24. All equipment for this trip was checked in on the Alaska Airlines flight.

From 2018: A spare electric fence charger and a spare station mast are stored at the Kotzebue warehouse. Two spare fence chargers and one 100 aH 12-volt battery are stored at the Nome warehouse.

Appendix B. ARCN RAWS Station Specifications

Table B1. Sensor specifications.

Measurements	Model/Manufacturer/Item#	Purchased from:
Air Temperature 1/Relative Humidity	HMP-45C/HMP155/EE181 Temperature and Relative Humidity Probe	Campbell Scientific
Air Temperature 2	Resistance Temperature Detector (RTD) Thermistor. Custom build.	Therm-X
Air Temperature 3	109 Temperature Probe (primary beginning summer 2016)	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	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 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
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. ARCN RAWS Components by Climate Station

Table C1. Metadata for Asik climate station.

Station Name	Item	Model	Start Date
Asik	Antenna	25316 YAGI	7/13/2012
Asik	AT	109	7/12/2016
Asik	AT	ThermX	7/13/2012
Asik	AT-RH	HMP45	8/5/2019
Asik	Battery	100 AH (x2)	7/13/2012
Asik	Cross arm	CM204	7/13/2012
Asik	Cross arm	CM206	7/13/2012
Asik	Datalogger	CR1000	7/13/2012
Asik	DLP	Asik2017	7/27/2017
Asik	GPS	17992 GPS	7/13/2012
Asik	RG-TB	TE525	7/13/2012
Asik	SD	SR50a	7/13/2012
Asik	Solar Panel	75 W	7/13/2012
Asik	SR	Li200x	7/22/2018
Asik	ST -10 cm	107	7/13/2012
Asik	ST -20 cm	107	8/5/2019
Asik	ST -50 cm	107	7/13/2012
Asik	Tripod	CM106	7/13/2012
Asik	TX312	NESDIS ID 3961A40E	7/13/2012
Asik	WS/WD	5103	8/5/2019

Table C2. Metadata for Chimney Lake climate station.

Station Name	Item	Model	Start Date
Chimney Lake	Antenna	25316 YAGI	8/7/2012
Chimney Lake	AT	109	7/25/2016
Chimney Lake	AT	ThermX	5/27/2013
Chimney Lake	AT-RH	HMP45	6/10/2019
Chimney Lake	Battery	100 AH (x2)	8/7/2012
Chimney Lake	Cross arm	CM204	8/7/2012
Chimney Lake	Cross arm	CM206	8/7/2012
Chimney Lake	Datalogger	CR1000	8/7/2012
Chimney Lake	DLP	Chimney2017	6/27/2017
Chimney Lake	Electric Fence	T-post, poly-wire solar charger	5/27/2013
Chimney Lake	GPS	17992 GPS	8/7/2012
Chimney Lake	RG-TB	TE525	8/7/2012
Chimney Lake	SD	SR50a	6/26/2018
Chimney Lake	Solar Panel	75 W	8/7/2012
Chimney Lake	SR	Li200x	6/26/2018
Chimney Lake	ST -10 cm	107	8/7/2012
Chimney Lake	ST -20 cm	107	8/7/2012
Chimney Lake	ST -50 cm	107	8/7/2012
Chimney Lake	ST -75 cm	107	5/27/2013
Chimney Lake	Tripod	CM106	8/7/2012
Chimney Lake	TX312	NESDIS ID 3961F472	8/7/2012
Chimney Lake	WS/WD	5103	6/26/2018

Table C3. Metadata for Devil Mountain climate station.

Station Name	Item	Model	Start Date
Devil Mountain	Antenna	25316 YAGI	8/23/2012
Devil Mountain	AT	109	6/1/2016
Devil Mountain	AT	ThermX	8/18/2011
Devil Mountain	AT-RH	HMP45	8/1/2019
Devil Mountain	Battery	100 AH (x2)	8/18/2011
Devil Mountain	Cross arm	CM204	8/18/2011
Devil Mountain	Cross arm	CM206	8/6/2013
Devil Mountain	Datalogger	CR1000	8/18/2011
Devil Mountain	DLP	Devil2017	8/10/2017
Devil Mountain	Electric Fence	T-post, poly-wire solar charger	Out 2019
Devil Mountain	Enclosure	ENC 16/18	8/18/2011
Devil Mountain	GPS	17992 GPS	8/18/2011
Devil Mountain	RG-TB	TE525	6/1/2016
Devil Mountain	SD	SR50a	8/10/2017
Devil Mountain	Solar Panel	75 W	8/18/2011
Devil Mountain	SR	Li200x	8/1/2019
Devil Mountain	ST -10 cm	107	8/18/2011
Devil Mountain	ST -20 cm	107	8/18/2011
Devil Mountain	ST -50 cm	107	8/18/2011
Devil Mountain	Tripod	CM106	8/18/2011
Devil Mountain	TX321	NESDIS ID 3961221A	8/1/2019
Devil Mountain	WS/WD	5103	7/25/2018

Table C4. Metadata for Ella Creek climate station.

Station Name	Item	Model	Start Date
Ella Creek	Antenna	25316 YAGI	8/1/2019
Ella Creek	AT	109	6/2/2016
Ella Creek	AT	ThermX	9/18/2012
Ella Creek	AT-RH	HMP45	8/1/2019
Ella Creek	Battery	100 AH (x2)	9/18/2012
Ella Creek	Cross arm	CM204	9/18/2012
Ella Creek	Cross arm	CM206	9/18/2012
Ella Creek	Datalogger	CR1000	9/18/2012
Ella Creek	DLP	Ella2017	8/9/2017
Ella Creek	Enclosure	ENC 16/18	9/18/2012
Ella Creek	GPS	17992 GPS	9/18/2012
Ella Creek	RG-TB	TE525	8/9/2017
Ella Creek	SD	SR50a	7/24/2018
Ella Creek	Solar Panel	75 W	9/18/2012
Ella Creek	SR	Li200x	7/24/2018
Ella Creek	ST -10 cm	107	8/1/2019
Ella Creek	ST -20 cm	107	9/18/2012
Ella Creek	ST -50 cm	107	9/18/2012
Ella Creek	Tripod	CM106	9/18/2012
Ella Creek	TX321	396182E2	8/1/2019
Ella Creek	WS/WD	5108-Alpine-HD	6/2/2016

Table C5. Metadata for Howard Pass climate station.

Station Name	Item	Model	Start Date
Howard Pass	Antenna	25316 YAGI	7/23/2018
Howard Pass	AT	109	7/23/2018
Howard Pass	AT	ThermX	7/7/2011
Howard Pass	AT-RH	HMP45	6/11/2019
Howard Pass	Battery	100 AH (x2)	7/7/2011
Howard Pass	Cross arm	CM204	7/7/2011
Howard Pass	Cross arm	CM206	7/7/2011
Howard Pass	Datalogger	CR1000	7/23/2018
Howard Pass	DLP	Howard2017	6/28/2017
Howard Pass	Enclosure	ENC 16/18	7/7/2011
Howard Pass	GPS	17992 GPS	7/7/2011
Howard Pass	RG-TB	TE525	7/7/2011
Howard Pass	SD	SR50a	Removed
Howard Pass	Solar Panel	75 W	7/7/2011
Howard Pass	SR	Li200x	7/23/2018
Howard Pass	ST -10 cm	107	7/7/2011
Howard Pass	ST -20 cm	107	7/7/2011
Howard Pass	ST -50 cm	107	7/26/2016
Howard Pass	Tripod	CM106	7/7/2011
Howard Pass	TX312	NESDIS ID 39617266	7/7/2011
Howard Pass	WS/WD	5108-Alpine-HD	6/11/2018

Table C6. Metadata for Imelyak climate station.

Station Name	Item	Model	Start Date
Imelyak	Antenna	25316 YAGI	6/11/2019
Imelyak	AT	109	7/26/2016
Imelyak	AT	ThermX	7/6/2011
Imelyak	AT-RH	HMP155	6/11/2019
Imelyak	Battery	100 AH (x2)	7/6/2011
Imelyak	Cross arm	CM204	7/6/2011
Imelyak	Cross arm	CM206	7/6/2011
Imelyak	Datalogger	CR1000	7/20/2012
Imelyak	DLP	Imelyak2017	6/27/2017
Imelyak	Enclosure	ENC 16/18	7/6/2011
Imelyak	GPS	17992 GPS	7/6/2011
Imelyak	RG-TB	TE525	6/11/2019
Imelyak	SD	SR50a	Removed
Imelyak	Solar Panel	75 W	7/6/2011
Imelyak	SR	Li200x	6/11/2019
Imelyak	ST -10 cm	107	7/6/2011
Imelyak	ST -20 cm	107	7/6/2011
Imelyak	ST -50 cm	107	7/6/2011
Imelyak	Tripod	CM106	7/6/2011
Imelyak	TX312	NESDIS ID 3961316C	7/20/2012
Imelyak	WS/WD	5108 Alpine HD	6/12/2018

Table C7. Metadata for Kaluich climate station.

Station Name	Item	Model	Start Date
Kaluich	Antenna	25316 YAGI	6/12/2019
Kaluich	AT	109	7/27/2016
Kaluich	AT	ThermX	7/20/2012
Kaluich	AT-RH	HMP45	6/12/2019
Kaluich	Battery	100 AH (x2)	7/20/2012
Kaluich	Cross arm	CM204	7/20/2012
Kaluich	Cross arm	CM206	7/20/2012
Kaluich	Datalogger	CR1000	7/20/2012
Kaluich	DLP	Kaluich2017	6/28/2017
Kaluich	Enclosure	ENC 16/18	7/20/2012
Kaluich	GPS	17992 GPS	7/20/2012
Kaluich	RG-TB	TE525	7/20/2012
Kaluich	SD	SR50a	7/20/2012
Kaluich	Solar Panel	75 W	7/20/2012
Kaluich	SR	Li200x	6/12/2019
Kaluich	ST -10 cm	107	7/20/2012
Kaluich	ST -20 cm	107	7/20/2012
Kaluich	ST -50 cm	107	7/20/2012
Kaluich	Tripod	CM106	7/20/2012
Kaluich	TX312	NESDIS ID 39617266	7/20/2012
Kaluich	WS/WD	5108 Alpine HD	6/12/2019

Table C8. Metadata for Killik Pass climate station.

Station Name	Item	Model	Start Date
Killik Pass	Antenna	25316 YAGI	8/8/2012
Killik Pass	AT	109	7/26/2016
Killik Pass	AT	ThermX	5/29/2013
Killik Pass	AT-RH	HMP45	6/11/2019
Killik Pass	Battery	100 AH (x2)	8/8/2012
Killik Pass	Cross arm	CM204	8/8/2012
Killik Pass	Cross arm	CM206	8/8/2012
Killik Pass	Datalogger	CR1000	8/8/2012
Killik Pass	DLP	Killik2017	6/27/2017
Killik Pass	Enclosure	ENC 16/18	8/8/2012
Killik Pass	GPS	17992 GPS	8/8/2012
Killik Pass	RG-TB	TE525	6/24/2015
Killik Pass	SD	SR50a	6/27/2018
Killik Pass	Solar Panel	75 W	8/8/2012
Killik Pass	SR	Li200x	6/11/2019
Killik Pass	ST -10 cm	107	8/8/2012
Killik Pass	ST -20 cm	107	8/8/2012
Killik Pass	ST -50 cm	107	8/8/2012
Killik Pass	Tripod	CM106	8/8/2012
Killik Pass	TX312	NESDIS ID 3961C1E8	8/8/2012
Killik Pass	WS/WD	5103	6/27/2018

Table C9. Metadata for Kugururok climate station.

Station Name	Item	Model	Start Date
Kugururok	Antenna	25316 YAGI	7/18/2014
Kugururok	AT	109	7/12/2016
Kugururok	AT	ThermX	7/18/2014
Kugururok	AT-RH	HMP45	8/5/2019
Kugururok	Battery	100 AH (x2)	7/18/2014
Kugururok	Camera	CC5MPX	6/5/2015
Kugururok	Camera battery/solar panel	12 V – 100 AH/10 W solar panel	6/5/2015
Kugururok	Cross arm	CM204	7/18/2014
Kugururok	Cross arm	CM206	7/18/2014
Kugururok	Datalogger	CR1000	7/18/2014
Kugururok	DLP	Kugururok2017	7/26/2017
Kugururok	Electric Fence	T-post, poly-wire solar charger	7/21/2018
Kugururok	GPS	17992 GPS	7/18/2014
Kugururok	RG-TB	TE525	7/18/2014
Kugururok	SD	SR50a	7/18/2014
Kugururok	Solar Panel	75 W	7/18/2014
Kugururok	SR	Li200x	8/5/2019
Kugururok	ST -10 cm	107	7/18/2014
Kugururok	ST -20 cm	107	7/18/2014
Kugururok	ST -50 cm	107	7/18/2014
Kugururok	Tripod	CM106	7/18/2014
Kugururok	TX312	NESDIS ID 396203F8	7/18/2014
Kugururok	WS/WD	5103	8/5/2019

Table C10. Metadata for Midnight Mountain climate station.

Station Name	Item	Model	Start Date
Midnight Mountain	AT_1	ThermX	8/6/2013
Midnight Mountain	AT_2	ThermX	8/6/2013
Midnight Mountain	AT_3	ThermX	8/6/2013
Midnight Mountain	Battery	12 V	9/3/2014
Midnight Mountain	Datalogger	CR1000	8/6/2013
Midnight Mountain	DLP	Midnight_2017_ThermX_Air	8/6/2013
Midnight Mountain	Enclosure	Small	7/8/2011
Midnight Mountain	Solar Panel	20 W	8/1/2019
Midnight Mountain	Tripod	CM106	7/8/2011

Table C11. Metadata for Mt. Noak climate station.

Station Name	Item	Model	Start Date
Mt. Noak	Antenna	25316 YAGI	7/22/2018
Mt. Noak	AT	109	7/14/2016
Mt. Noak	AT	ThermX	7/11/2011
Mt. Noak	AT-RH	HMP45	8/4/2019
Mt. Noak	Battery	100 AH (x2)	7/11/2011
Mt. Noak	Camera	CC5MPX	7/27/2017
Mt. Noak	Camera battery/solar panel	12 V – 100 AH/10 W solar panel	Out 2017
Mt. Noak	Cross arm	CM204	7/11/2011
Mt. Noak	Cross arm	CM206	7/11/2011
Mt. Noak	Datalogger	CR1000	7/11/2011
Mt. Noak	DLP	Noak2017	7/27/2017
Mt. Noak	Electric Fence	T-post, poly-wire solar charger	7/22/2018
Mt. Noak	GPS	17992 GPS	7/11/2011
Mt. Noak	RG-TB	TE525	7/11/2011
Mt. Noak	SD	SR50a	8/4/2019
Mt. Noak	Solar Panel	75 W	7/11/2011
Mt. Noak	SR	Li200x	8/4/2019
Mt. Noak	ST -10 cm	107	7/11/2011
Mt. Noak	ST -20 cm	107	7/11/2011
Mt. Noak	ST -50 cm	107	6/29/2013
Mt. Noak	ST -75 cm	107	6/29/2013
Mt. Noak	Tripod	CM106	7/11/2011
Mt. Noak	TX312	NESDIS ID 39616110	7/15/2014
Mt. Noak	WS/WD	5103	7/27/2017

Table C12. Metadata for Pamichtuk climate station.

Station Name	Item	Model	Start Date
Pamichtuk	Antenna	25316 YAGI	8/6/2012
Pamichtuk	AT	109	7/25/2016
Pamichtuk	AT	ThermX	5/29/2013
Pamichtuk	AT-RH	HMP45	6/10/2019
Pamichtuk	Battery	100 AH (x2)	8/6/2012
Pamichtuk	Camera	CC5MPX	5/28/2013
Pamichtuk	Camera battery/solar panel	12V-100 AH/10 W solar panel	6/22/2015
Pamichtuk	Cross arm	CM204	8/6/2012
Pamichtuk	Cross arm	CM206	8/6/2012
Pamichtuk	Datalogger	CR1000	8/6/2012
Pamichtuk	DLP	Pamichtuk2017	6/27/2017
Pamichtuk	Electric Fence	T-post, poly-wire solar charger	5/28/2013
Pamichtuk	Enclosure	ENC 16/18	8/6/2012
Pamichtuk	GPS	17992 GPS	8/6/2012
Pamichtuk	RG-TB	TE525	8/6/2012
Pamichtuk	SD	SR50a	8/6/2012
Pamichtuk	Solar Panel	75 W	8/6/2012
Pamichtuk	SR	Li200x	6/10/2019
Pamichtuk	ST -10 cm	107	8/6/2012
Pamichtuk	ST -20 cm	107	8/6/2012
Pamichtuk	ST -50 cm	107	8/6/2012
Pamichtuk	Tripod	CM106	8/6/2012
Pamichtuk	TX312	NESDIS ID 3961E704	8/6/2012
Pamichtuk	WS/WD	5103	6/10/2019

Table C13. Metadata for Ram Creek climate station.

Station Name	Item	Model	Start Date
Ram Creek	Antenna	25316 YAGI	8/7/2012
Ram Creek	AT	109	6/27/2018
Ram Creek	AT	ThermX	5/28/2013
Ram Creek	AT-RH	HMP45	6/11/2019
Ram Creek	Battery	100 AH (x2)	8/7/2012
Ram Creek	Cross arm	CM204	8/7/2012
Ram Creek	Cross arm	CM206	8/7/2012
Ram Creek	Datalogger	CR1000	8/7/2012
Ram Creek	DLP	Ram2017	6/27/2017
Ram Creek	Electric Fence	T-post, poly-wire solar charger	6/10/2014
Ram Creek	Enclosure	ENC 16/18	8/7/2012
Ram Creek	GPS	17992 GPS	8/7/2012
Ram Creek	RG-TB	TE525	6/27/2018
Ram Creek	SD	SR50a	8/7/2012
Ram Creek	Solar Panel	75 W	8/7/2012
Ram Creek	SR	Li200x	6/27/2018
Ram Creek	ST -10 cm	107	6/27/2018
Ram Creek	ST -20 cm	107	6/27/2018
Ram Creek	ST -50 cm	107	6/27/2018
Ram Creek	Tripod	CM106	8/7/2012
Ram Creek	TX312	NESDIS ID 3961D29E	6/10/2014
Ram Creek	WS/WD	5103	6/27/2017

Table C14. Metadata for Salmon River climate station.

Station Name	Item	Model	Start Date
Salmon River	Antenna	25316 YAGI	7/17/2013
Salmon River	AT	109	7/27/2016
Salmon River	AT-RH	HMP155	6/12/2019
Salmon River	Battery	100 AH (x2)	7/8/2011
Salmon River	Camera	CC5MPX	7/17/2013
Salmon River	Camera battery/solar panel	12 V – 100 AH/10 W solar panel	7/21/2015
Salmon River	Cross arm	CM204	7/8/2011
Salmon River	Cross arm	CM206	7/8/2011
Salmon River	Datalogger	CR1000	7/17/2013
Salmon River	DLP	Salmon2017	6/28/2017
Salmon River	Electric Fence	T-post, poly-wire solar charger	7/17/2013
Salmon River	Enclosure	ENC 16/18	7/8/2011
Salmon River	GPS	17992 GPS	7/17/2013
Salmon River	RG-TB	TE525	7/17/2013
Salmon River	SD	SR50a	7/17/2013
Salmon River	SR	Li200x	6/12/2019
Salmon River	ST -10 cm	107	7/17/2013
Salmon River	ST -20 cm	107	7/17/2013
Salmon River	ST -50 cm	107	7/17/2013
Salmon River	Tripod	CM106	7/17/2013
Salmon River	TX312	NESDIS ID 3960F688	7/24/2014
Salmon River	WS/WD	5103	6/28/2017

Table C15. Metadata for Serpentine climate station.

Station Name	Item	Model	Start Date
Serpentine	Antenna	25316 YAGI	7/25/2018
Serpentine	AT	109	6/1/2016
Serpentine	AT	ThermX	8/18/2011
Serpentine	AT-RH	HMP155	8/1/2019
Serpentine	Battery	100 AH (x2)	8/18/2011
Serpentine	Camera	CC5MPX	8/1/2019
Serpentine	Camera battery/solar panel	12 V – 100 AH/10 W solar panel	6/2/2015
Serpentine	Cross arm	CM204	8/18/2011
Serpentine	Cross arm	CM206	8/18/2011
Serpentine	Datalogger	CR1000	8/18/2011
Serpentine	DLP	Serpentine2017	8/10/2017
Serpentine	Enclosure	ENC 16/18	8/18/2011
Serpentine	GPS	17992 GPS	8/18/2011
Serpentine	RG-TB	TE525	8/18/2011
Serpentine	SD	SR50a	8/8/2018
Serpentine	Solar Panel	75 W	8/18/2011
Serpentine	SR	Li200x	8/10/2017
Serpentine	ST -10 cm	107	8/10/2017
Serpentine	ST -20 cm	107	8/18/2011
Serpentine	ST -50 cm	107	8/10/2017
Serpentine	Tripod	CM106	8/18/2011
Serpentine	TX321	NESDIS ID 3961C1E8	9/22/2019
Serpentine	WS/WD	5103	8/10/2017

Table C16. Metadata for Sisiak climate station.

Station Name	Item	Model	Start Date
Sisiak	Antenna	25316 YAGI	7/26/2017
Sisiak	AT	109	7/13/2016
Sisiak	AT	ThermX	7/13/2011
Sisiak	AT-RH	HMP45	6/12/2019
Sisiak	Battery	100 AH (x2)	7/13/2011
Sisiak	Cross arm	CM204	7/13/2011
Sisiak	Cross arm	CM206	7/13/2011
Sisiak	Datalogger	CR1000	7/13/2011
Sisiak	DLP	Sisiak2017	7/26/2017
Sisiak	Enclosure	ENC 16/18	7/13/2011
Sisiak	GPS	17992 GPS	7/13/2011
Sisiak	RG-TB	TE525	7/13/2016
Sisiak	SD	SR50a	Removed
Sisiak	Solar Panel	75 W	7/13/2016
Sisiak	SR	Li200x	7/21/2018
Sisiak	ST -10 cm	107	7/26/2017
Sisiak	ST -20 cm	107	7/13/2011
Sisiak	ST -50 cm	107	6/12/2019
Sisiak	ST -75 cm	107	6/12/2019
Sisiak	Tripod	CM106	7/13/2011
Sisiak	TX312	NESDIS ID 3961548A	7/13/2011
Sisiak	WS/WD	5103	7/26/2017

Table C17. Metadata for Tahinichok climate station.

Station Name	Item	Model	Start Date
Tahinichok	Antenna	25316 YAGI	7/27/2017
Tahinichok	AT	109	7/13/2016
Tahinichok	AT	ThermX	7/27/2017
Tahinichok	AT-RH	HMP45	8/4/2019
Tahinichok	Battery	100 AH (x2)	7/10/2011
Tahinichok	Cross arm	CM204	7/10/2011
Tahinichok	Cross arm	CM206	7/10/2011
Tahinichok	Datalogger	CR1000	7/10/2011
Tahinichok	DLP	Tahinichok2017	7/27/2017
Tahinichok	Electric Fence	T-post, poly-wire solar charger	7/18/2015
Tahinichok	Enclosure	ENC 16/18	7/10/2011
Tahinichok	GPS	17992 GPS	7/10/2011
Tahinichok	RG-TB	TE525	7/10/2011
Tahinichok	SD	SR50a	6/6/2015
Tahinichok	Solar Panel	75 W	7/10/2011
Tahinichok	SR	Li200x	7/27/2017
Tahinichok	ST -10 cm	107	7/10/2011
Tahinichok	ST -20 cm	107	7/10/2011
Tahinichok	ST -50 cm	107	7/10/2011
Tahinichok	ST -75 cm	107	6/30/2013
Tahinichok	Tripod	CM106	7/10/2011
Tahinichok	TX312	NESDIS ID 3961548A	7/10/2011
Tahinichok	WS/WD	5103	7/27/2017

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.

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