FILE NAME: Station Record AK 002.doc

LAST UPDATED: 09/23/22

**BARROW, ALASKA**

### SITE 2

### Station Record

**STATION:** AK002, BARROW2, KEN’S SITE (002)

|  |  |  |  |
| --- | --- | --- | --- |
| **PROJECT MANAGER:**  Phone:  FAX:  E-mail: | K. M. Hinkel  Department of Geography  University of Cincinnati  Cincinnati, Ohio 45221-0131  513-556-3430  513-556-3370  71042.2643@compuserve.com | C.A. Seybold  USDA NRCS  Federal Bldg., Rm. 152  Lincoln, NE 68508  (402) 437-4132  (402) 437-5336  cathy.seybold@lin.usda.gov |  |

**LOCATION:** North of Barrow, Alaska, on the research area.

GPS (06/26/96): 71° 18’ 27.82” N

156° 35’ 20.24” W

3 m elevation

GPS (08/15/97): 71° 18’ 27.64” N

156° 35’ 19.53” W

\_\_ ft elevation

GPS (08/11/98): 71° 18’ 28.2” N

156° 35’ 21.6” W

27 ft elevation

GPS (05/9/99): 71° 18’ 27.2” N

156° 35’ 18.5” W

421 ft elevation (clearly erroneous)

GPS (09/17/99): 71° 18’ 28.2” N

156° 35’ 21.4” W

97 ft elevation

GPS (04/25/00): 71° 18’ 27.4” N

156° 35’ 18.2” W

35 ft elevation

GPS (08/18/01): 71° 18’ 27.5” N

156° 35’ 19.8” W

7 ft elevation

GPS (06/26/02): 71° 18’ 27.7” N

156° 35’ 19.7” W

44 ft elevation

GPS (08/23/04): 71° 18’ 27.6” N

156° 35’ 19.7” W

8 ft elevation

GPS (08/19/07): 71° 18’ 27.6” N

156° 35’ 19.9” W

15 ft elevation

GPS (08/19/09): 71° 18’ 27.7” N

156° 35’ 19.7” W

5 ft elevation

GPS (08/16/10): 71° 18’ 27.7” N

156° 35’ 19.7” W

13 ft elevation

**INSTRUMENTATION:**

Summary

| Quantity | Description | Comments |
| --- | --- | --- |
| (1) | Campbell CR-10 datalogger SN: 26588 | Installed 1996; replaced 2000. |
| (1) | Campbell CR-10X-2M datalogger SN: X18065. Wiring panel SN: 6412 | Installed 2000. Recalled. Replaced 8/01 |
| 1 | Campbell CR-10X-2M datalogger SN: X16672. Wiring panel SN: 6412 | Installed 8/01 |
| 1 | Campbell AM416 multiplexer SN: 7656 | Installed 1996. |
| (1) | Campbell SM192 storage module.  (Campbell SM716 SN: 4292) | Installed 1996; upgraded by Nelson (date?) to SM716; removed 2000. |
| 1 | Campbell Storage module SM4M | Installed 2003. |
| 1 | Campbell PS12LA power supply. | Installed 1996 |
| 1 | 12 Ah battery | Installed 8/12 |
| (1) | 7 Ah battery | replaced 2003, replaced 2006, removed 8/12 |
| (1) | 7 Ah battery (added 2nd battery) | Installed 2006, removed 8/12 |
| 1 | Campbell Solar panel. | Installed 1996, replaced 2005 |
| 1 | Campbell ENC 16/18 enclosure. | Installed 1996. |
| 10 | Vitel dielectric constant soil moisture/temperature sensors. | Installed 1996. |
| 4 | Campbell 107B soil temperature sensors | Installed 1997. |

| MULTIPLEXER  POSITION | LOCATION | VITEL PROBE  SERIAL # | DEPTH  (cm) | COMMENTS |
| --- | --- | --- | --- | --- |
| 1 | Polygon | 361 | 15 | Horizontal orientation. |
| 2 | Polygon | 357 | 25 | Horizontal orientation. Just below zone with numerous roots. |
| 3 | Polygon | 309 | 34 | Horizontal orientation. Just above ice rich layer (ice lens). |
| 4 | Polygon | 307 | 46 | Vertical orientation. Ice rich zone (>50% ice). |
| 5 | Ken’s |  |  |  |
| 6 | Ken’s |  |  |  |
| 7 | Frost Boil | 394 | 10 | Horizontal orientation. |
| 8 | Frost Boil | 390 | 25 | Horizontal orientation. |
| 9 | Frost Boil | 388 | 40 | Horizontal orientation. |
| 10 | Frost Boil | 386 | 55 | Vertical orientation. |

**HISTORY:**  June 26, 1996: Our involvement began. Ken Hinkel had two Vitel sensors at this site that were being read manually. Four additional Vitel sensors were installed in the soil at the site. Sensor # 361 was installed horizontally at 15 cm, sensor #357 was installed horizontally at 25 cm, sensor #309 was installed horizontally at 35 cm, and sensor #307 was installed vertically in the bottom of the hole at 46 cm. The datalogger program is *ken1* and the order of sensor reading is: 15 cm, 25 cm, 35 cm, 46 cm, and then Ken’s two sensors. Ken’s sensors were not labeled and their depths are unknown. Datalogger was set to Alaska Savings Time. Measurements are made at 20-minute intervals and averaged and recorded every two hours. The enclosure was placed in a plastic garbage sack and wrapped with a plastic coated tarp, secured with duct tape. The wrapped enclosure was placed on two boards to raise it off the ground.

June 28, 1996: Added solar panel to the datalogger at this site.

August 11, 1996: Four Vitel sensors were added to a frost boil in an adjacent polygon. The soil in the frost boil at this time was thawed to a depth of about 58-60 cm. The frost boil is about five feet in diameter and is adjacent to a larger frost boil that looks disturbed. There is a third frost boil in this polygon. The soil in the frost boil is relatively dry and has desiccation cracks at the surface. It was necessary to extend the Vitel sensor leads between the frost boil and the datalogger. Enough wire was on hand only to extend two of the leads. The leads of the sensors at the 10-cm and 55-cm depths were spliced and connected to the datalogger. The other two leads were left to be connected at a future time. Downloaded data to ken1.dat. Reset datalogger clock. Revised datalogger program, *ken2*, to account for the extra sensors. Downloaded *ken2* to datalogger.

September 24, 1996: Spliced cable for the two middle frost boil Vitel sensors (#388 & #390). Connected them to the datalogger. About four inches of snow on the ground. Downloaded data to ken2.dat.

June 15, 1997: Downloaded revised datalogger program *barrow2a*. Added CR10TCR thermocouple reference for the enclosure thermocouple. Connected four Campbell 107B soil temperature sensors to datalogger, but did not install in ground because of snow cover. Datalogger program will read sensors in the order: 15, 25, 34, and 43 cm depth.

August 15, 1997: Repaired solar panel cable that was chewed in two. Downloaded data to Baro201.dat and Baro202.dat. Reset program to average and record data every two hours. Installed the four soil temperature sensors.

August 11, 1998: Serviced site. Everything seems OK. Downloaded data: Barw2001.dat, Barw2002.dat, Barw2003.dat, and Barw2004.dat.

May 9, 1999: Serviced site. Everything seems OK. Only top of blue tarp above snow. Dugout enclosure and solar panel. Evidently enough light gets through the snow to keep the battery charged because the voltage was higher than 13V. Downloaded data to AK002.001.dat. Downloaded modified CR10 program Barrow2a to eliminate Vitel sensor warm-up and read sensors every 15 minutes. Each reading is stored, not averaged. We want to get better spatial resolution during the spring thaw and will change back to hourly readings averaged every two hours when we return in the fall. Added desiccant to enclosure.

September 17, 1999: Changed *barrow2a* to read hourly and record every two hours. All sensors appear to be working Ok except Soil Temp #4, which reads –45deg. Downloaded to barrow2a.dat.

April 25, 2000: Solar panel about 2/3 under snow. Downloaded data to barrow2.dat. All sensors except two 107 temperature sensors appear to be working OK. Animal damage to the two 107 temperature sensor leads: labeled 43 and 34. Chewed in two. Tested continuity to establish correct sensor leads. Repaired sensor leads. Electrical tape does not work well in the cold. Replaced CR10 datalogger with CR10X-2M. Removed SM716 storage module. Downloaded *barrow2* v.2.00 program to read at 20-minute intervals and record hourly. Added desiccant.

August 18, 2001: Replaced recalled datalogger with CR10X-2M-XT. Downloaded *barrow2* v.2.01 program (changed output to 4 soil temperature sensors from 6) and set datalogger time. All sensors appear to be working OK. Did not add desiccant. Downloaded data from recalled datalogger.

June 26, 2002: Downloaded data. Downloaded *barrow2* v.2.02 program (Added delay between Vitel sensor readings) and checked datalogger time. All sensors appear to be working OK. Did not add desiccant. Li battery = 3.1123 V. Datalogger ID set to 2.

August 17, 2003: Serviced site. Downloaded data. Added desiccant to enclosure. Replaced power supply (12V 7ah NP7-12). Added storage module. Everything seems to be working OK.

August 23, 2004: Downloaded data from storage module. Added storage module SN:3474. Added two desiccant packs to enclosure. Station clock was 1.5 min behind. Everything seems to be working OK. There were exposed wires on cable 390 (vital to frost boil)—re-enforced with black electrical tape.

August 20, 2005: Downloaded data from datalogger and swapped storage modules. Added four desiccant packs to enclosure. Station clock was 7 min behind. Replaced solar panel and put on T-post, one foot above ground. Everything seems to be working OK. There were several bite marks on several of the cables—re-enforced with black electrical tape. Replace battery next time.

August 24, 2006: Arrived at station at about 2:00 PM. Soil temp #2 was not reading correctly (i.e., 60.8°C). Tried to repair cable from an old chewed section of the cable, but still gave similar reading (i.e., 58.0°C). Need to replace for next time. Replace 7 Ah battery with two 7 Ah batties. Station clock was 9 min 30 sec behind; reset clock. Internal battery voltage was 3.17. Swapped storage modules. Added two desiccant packs to enclosure. Everything seems to be working OK.

August 19, 2007: Soil temp #1 and #2 were not reading correctly. Soil temp wire #1 was chewed in half. Replaced both soil temp sensors. Used a permafrost probe to make the hole and installed them at a slight angle from vertical (#1 at 15 cm depth and #2 at 25 cm depth). Station clock was nearly the same as the computer clock. Internal battery voltage was 3.1 volts. Swapped storage modules, and downloaded data from logger to computer. Added two desiccant packs to enclosure. Everything seems to be working OK. Distance from enclosure to frost boil is about 25 ft.

August 19, 2008: Arrived at site about 2:45 PM. Station was down. The solar panel cable had been chewed in half. Fixed the solar panel cable using butt-splices. There were two 7 Ahr batteries powering the station; one was removed. Both batteries were reading 7.5 volts. Solar panel began charging the one battery. Station clock was 52 min behind. Could not get a good reading on the lithium battery (e.i., 74.0, 2.99, 24.0). Soil temp #1 and #2 107 cables were also chewed in half; replaced both sensors. Used a permafrost probe to make the hole and installed them at a slight angle from vertical (#1 at 15 cm depth and #2 at 25 cm depth). Buried the cables. Swapped storage modules (did not connect the storage module). Was able to downloaded data from logger after letting the battery charge for about an hour (it was a cloudy/foggy day). Added three desiccant packs to enclosure. The station did not gain enough power to run the multiplexer and collect data. Download the program and set the clock. The battery was reading 10.0 volts when leaving the station. Left two 107s in the enclosure to install for next time. Removed the tarp. There were owl hair balls and feathers all around site.

August 21, 2008: The station was collecting data. Lithium batter was reading 3.01 volts. Batter was reading 13.1 volts. Replaced the 7 Ahr battery with an 8 Ahr battery. Removed the battery housing, but left the regulator. New battery was 12.49 volts. Connected up the storage module. Soil temp sensor #3 (34 cm depth) was reading -9999; the cable already had two repairs; replace next time. Everything else seemed to be working OK. For next time, measure depths of #3 and #4 soil temp sensors (or all temp sensors that were originally installed).

August 19, 2009: Downloaded data from data logger and swapped storage modules. The first three soil temp sensors were chewed and not working. Replace all four soil temp sensors—new depths are 5, 15, 25, and 20 cm depths in that order (reset the depths for next time).The solar panel cable had been chewed (outer sheath) where is was fixed last time, but was still charging—placed silicone sealant around wires. Station clock was 26.5 min behind—reset clock. V3 vitel had a bad reading. Swapped batteries—put in the battery that was taken out of Westdock7. Added two desiccant packs to enclosure.

August 16, 2010: Downloaded data from data logger (with RECON) and swapped storage modules. Lithium battery was 3.1 volts; battery 13.6 volts. Everything seemed to be working OK. Station clock was 4 min behind; reset clock. Added two desiccant packs to enclosure.

August 15, 2012: Solar panel was chewed in half. Fixed cable and added a new 12 Ah battery. Removed the two 7 Ah batteries. Downloaded data from data logger (with RECON) and swapped storage modules. Lithium battery was 3.1 volts; battery 12.54 volts. Station clock was about an hour behind; reset clock. Everything seemed to be working OK. There was light rain. Bring new solar panel for next time.

August 20, 2014: Swapped storage modules at 4:15 PM. For next time replace battery.

August 27, 2015: Opened box at 1430 ADT. No light on. The cable to the solar panel is chewed through. The battery was replaced. Swapped storage modules. Need to replace solar panel for next time.

August 24, 2016: Box opened at 0905. Clean and dry inside. Replaced solar panel without incident (old one is in the mail). Regulator light came on when new solar panel was connected. Removed SM #2798 and installed SM #3466. Neither light on the storage module came on when it was connected. I checked the connectors and toggled the switch on the regulator, but no light appeared on the storage module. I gave it 10 minutes and tried again by disconnecting and reconnecting the module. Same result, no lights other than on regulator. Logger closed at 0920 ADT. (next time replace battery and datalogger)

August 21, 2017: Swapped storage modules. Replaced battery and datalogger. There was a full year of data on the storage module.

August 19, 2018: Swapped storage modules. There was a loose wire that was secured. Station is up and running. There was no data on the storage module.

August 20, 2019: Swapped storage modules at 2:45 pm. The storage module did not contain any data for the soil temperature and moisture sensors. The multiplexer could be down or have loose connection wire to datalogger; check for next time.

August 17, 2022: Swapped storage modules. The storage module did not contain any data for the soil temperature and moisture sensors. The datalogger went down on 12/21/2019 (low power). This climate station will no longer be continued. The end.

**DATA:**

DATALOGGER OUTPUT:

| COL | OUTPUT | UNITS | LOCATION | SENSOR | COMMENTS |
| --- | --- | --- | --- | --- | --- |
| 1 | Station ID | N/A | N/A | Campbell CR10 | 002 |
| 2 | Year | N/A | N/A | Campbell CR10 |  |
| 3 | Day | N/A | N/A | Campbell CR10 |  |
| 4 | Time | N/A | N/A | Campbell CR10 | AK savings time |
| 5 | Battery | Volts | Enclosure | Campbell CR10 |  |
| 6 | Int Temp | °C | Datalogger | Campbell CR10 |  |
| 7 | Ref Temp | °C | Enclosure | Campbell CR10TCR |  |
| 8 | Enc Temp | °C | Enclosure | Thermocouple |  |
| 9 | 1V1 | Volts | Soil 15 cm | Vitel Soil Moisture/Temp |  |
| 10 | 2V1 | Volts | Soil 25 cm | Vitel Soil Moisture/Temp |  |
| 11 | 3V1 | Volts | Soil 34 cm | Vitel Soil Moisture/Temp |  |
| 12 | 4V1 | Volts | Soil 46 cm | Vitel Soil Moisture/Temp |  |
| 13 | 5V1 | Volts | Soil ? cm | Vitel Soil Moisture/Temp |  |
| 14 | 6V1 | Volts | Soil ? cm | Vitel Soil Moisture/Temp |  |
| 15 | 7V1 | Volts | Soil 10 cm | Vitel Soil Moisture/Temp | Frost Boil |
| 16 | 8V1 | Volts | Soil 25 cm | Vitel Soil Moisture/Temp | Frost Boil |
| 17 | 9V1 | Volts | Soil 40 cm | Vitel Soil Moisture/Temp | Frost Boil |
| 18 | 10V1 | Volts | Soil 55 cm | Vitel Soil Moisture/Temp | Frost Boil |
| 19 | 1V2 | Volts | Soil 15 cm | Vitel Soil Moisture/Temp |  |
| 20 | 2V2 | Volts | Soil 25 cm | Vitel Soil Moisture/Temp |  |
| 21 | 3V2 | Volts | Soil 34 cm | Vitel Soil Moisture/Temp |  |
| 22 | 4V2 | Volts | Soil 46 cm | Vitel Soil Moisture/Temp |  |
| 23 | 5V2 | Volts | Soil ? cm | Vitel Soil Moisture/Temp |  |
| 24 | 6V2 | Volts | Soil ? cm | Vitel Soil Moisture/Temp |  |
| 25 | 7V2 | Volts | Soil 10 cm | Vitel Soil Moisture/Temp | Frost Boil |
| 26 | 8V2 | Volts | Soil 25 cm | Vitel Soil Moisture/Temp | Frost Boil |
| 27 | 9V2 | Volts | Soil 40 cm | Vitel Soil Moisture/Temp | Frost Boil |
| 29 | 10V2 | Volts | Soil 55 cm | Vitel Soil Moisture/Temp | Frost Boil |
| 29 | 1V3 | Volts | Soil 15 cm | Vitel Soil Moisture/Temp |  |
| 30 | 2V3 | Volts | Soil 25 cm | Vitel Soil Moisture/Temp |  |
| 31 | 3V3 | Volts | Soil 34 cm | Vitel Soil Moisture/Temp |  |
| 32 | 4V3 | Volts | Soil 46 cm | Vitel Soil Moisture/Temp |  |
| 33 | 5V3 | Volts | Soil ? cm | Vitel Soil Moisture/Temp |  |
| 34 | 6V3 | Volts | Soil ? cm | Vitel Soil Moisture/Temp |  |
| 35 | 7V3 | Volts | Soil 10 cm | Vitel Soil Moisture/Temp | Frost Boil |
| 36 | 8V3 | Volts | Soil 25 cm | Vitel Soil Moisture/Temp | Frost Boil |
| 37 | 9V3 | Volts | Soil 40 cm | Vitel Soil Moisture/Temp | Frost Boil |
| 38 | 10V3 | Volts | Soil 55 cm | Vitel Soil Moisture/Temp | Frost Boil |
| 39 | 1V4 | Volts | Soil 15 cm | Vitel Soil Moisture/Temp |  |
| 40 | 2V4 | Volts | Soil 25 cm | Vitel Soil Moisture/Temp |  |
| 41 | 3V4 | Volts | Soil 34 cm | Vitel Soil Moisture/Temp |  |
| 42 | 4V4 | Volts | Soil 46 cm | Vitel Soil Moisture/Temp |  |
| 43 | 5V4 | Volts | Soil ? cm | Vitel Soil Moisture/Temp |  |
| 44 | 6V4 | Volts | Soil ? cm | Vitel Soil Moisture/Temp |  |
| 45 | 7V4 | Volts | Soil 10 cm | Vitel Soil Moisture/Temp | Frost Boil |
| 46 | 8V4 | Volts | Soil 25 cm | Vitel Soil Moisture/Temp | Frost Boil |
| 47 | 9V4 | Volts | Soil 40 cm | Vitel Soil Moisture/Temp | Frost Boil |
| 48 | 10V4 | Volts | Soil 55 cm | Vitel Soil Moisture/Temp | Frost Boil |
| 49 | Soil Temp | °C | Soil 15 cm | Campbell 107B |  |
| 50 | Soil Temp | °C | Soil 25 cm | Campbell 107B |  |
| 51 | Soil Temp | °C | Soil 34 cm | Campbell 107B |  |
| 52 | Soil Temp | °C | Soil 43 cm | Campbell 107B |  |
| 53 | 0 |  |  |  | Eliminated 08/18/01 |
| 54 | 0 |  |  |  | Eliminated 08/18/01 |

DATA PROCESSING ALGORITHMS:

Vitel Hydra Probe soil moisture, temperature, complex dielectric constant, electrical conductivity, and salinity are determined from the raw data (four voltages), and a calibration option (1, 2, or 3), depending on the soil texture, with a program supplied by Vitel, Inc. Option 2 (silt) is used here.

DATA STORAGE AND ACCESS:

Processed data are available on the USDA NRCS NSSC Internet home page at [http://www.wcc.nrcs.usda.gov](http://www.wcc.nrcs.usda.gov/). Data are in Excel files organized by calendar year. Each file consists of a page containing all downloaded data for that year and 10 pages of processed Vitel sensor data (one page for each sensor) with the following column headings: SENSOR, SOIL (calibration option), ER (real part of the soil dielectric constant), EI (imaginary part of the soil dielectric constant), TEMP (soil temperature °C), ER-COR (temperature corrected ER), EI\_COR (temperature corrected EI), WATER (volume fraction soil water content), SALINITY (soil salinity in g/l NaCl), SOIL\_COND (soil electrical conductivity in S/m or mhos/m), SOIL\_COND\_COR (temperature corrected SOIL\_COND in S/m or mhos/m), WATER\_CON\_COR (temperature corrected soil water electrical conductivity in S/m or mhos/m). The column headings for the annual data are: ID (site), YEAR, DAY OF YEAR, HOUR, TIME, DATE, BATT VOLT (battery voltage), INT TEMP deg C (datalogger temperature), REF TEMP °C, TC °C (enclosure temperature), 1V1 15-cm depth (Vitel), 1V2 15-cm depth (Vitel), 1V3 15-cm depth (Vitel), 1V4 15-cm depth (Vitel), 2V1 25-cm depth (Vitel), 2V2 25-cm depth (Vitel), 2V3 25-cm depth (Vitel), 2V4 25-cm depth (Vitel), 3V1 34-cm depth (Vitel), 3V2 34-cm depth (Vitel), 3V3 34-cm depth (Vitel), 3V4 34-cm depth (Vitel), 4V1 46-cm depth (Vitel), 4V2 46-cm depth (Vitel), 4V3 46-cm depth (Vitel), 4V4 46-cm depth (Vitel), 5V1 Ken1 -cm depth (Vitel), 5V2 Ken1 -cm depth (Vitel), 5V3 Ken1 -cm depth (Vitel), 5V4 Ken1 -cm depth (Vitel), 6V1 Ken2 -cm depth (Vitel), 6V2 Ken2 -cm depth (Vitel), 6V3 Ken2 -cm depth (Vitel), 6V4 Ken2 -cm depth (Vitel), 7V1 10-cm depth Frost Boil (Vitel), 7V2 10-cm depth Frost Boil (Vitel), 7V3 10-cm depth Frost Boil (Vitel), 7V4 10-cm depth Frost Boil (Vitel), 8V1 25-cm depth Frost Boil (Vitel), 8V2 25-cm depth Frost Boil (Vitel), 8V3 25-cm depth Frost Boil (Vitel), 8V4 25-cm depth Frost Boil (Vitel), 9V1 40-cm depth Frost Boil (Vitel), 9V2 40-cm depth Frost Boil (Vitel), 9V3 40-cm depth Frost Boil (Vitel), 9V4 40-cm depth Frost Boil (Vitel), 10V1 55-cm depth Frost Boil (Vitel), 10V2 55-cm depth Frost Boil (Vitel), 10V3 55-cm depth Frost Boil (Vitel), 10V4 55-cm depth Frost Boil (Vitel), SOIL T 15 cm °C, SOIL T 25 cm °C, SOIL T 34 cm °C, SOIL T 43 cm °C.

**SOILS:**

CLASSIFICATION:

**LANDSCAPE:** Polygons

SLOPE:

ASPECT:

ELEVATION:

**VEGETATION:** Moss, grass, and small annual flowers.

GROUND COVER:

CANOPY COVER:

**COMMENTS:**

**NOTES FOR NEXT STATION VISIT:** Routine maintenance. Add soil temperature sensors to frost boil.