**Umiat Airfield RAWS**
**Data Measurement and Recording Standards**

Data-Collection Objectives: Weather station at Umiat Airfield with RAWS subset of data transmitted via GOES satellite. There are essentially two separate systems running on this datalogger. One system provides the RAWS data, the other has its data collected over a FreeWave radio network

Time Recording Standard: The datalogger clock will be set to and left on AK Standard Time with no adjustments for Daylight Savings Time.

Datalogger Scan Interval Standard: Five seconds.

Time Measurement Standards:
- For non-GOES outputs, hourly readings are recorded at the end of the hour, so hourly average air temperature for 14:00 with a 5-second scan interval is measured from 13:00:05 to 14:00:00, so for a 5-second scan interval, there would be [(60 sec/min)/(5 sec)]*60 min = 720 values to go into the hourly average. For the GOES transmitted data, see the RAWS output discussion below.
- Instantaneous readings are taken at the time specified.
- A day begins at midnight (00:00:05) and ends at midnight (00:00:00).

Data Retrieval Interval: All new data is retrieved every 60 minutes over the Freewave radio network. All GOES data are transmitted hourly at 23 minutes past the hour.

Data Post-Processing Interval: Hourly, any post-processing of data is done after retrieval.

Data Reporting Interval: Hourly, Daily, and 2-minute for wind.

GOES Radio Settings:
The GOES ID assigned to this station is 326B17F6. Data transmits on channel 158 to the GOES West satellite ever hour at 23 minutes and 50 seconds after the hour over a 10 second window. The transmission baud rate is 300bps.

The antenna azimuth is162 degrees true at an elevation of 11 degree above horizontal.


**Sensors and Measurements:**


**Air Temperature  (AirTempF, AirTempC)**
Sensor: HMP45C

Operating Range: -40 to 60C
Installation: in 10-plate gill radiation shield, non aspirated
Height: 2 meters
Output Units: deg C, deg F
Scan Interval: 5 second

Average Hourly Air Temperature: 720 readings from the beginning of the hour to the end of the hour, averaged and recorded at the end of the hour.
Hourly Maximum Air Temperature: the highest reading taken during the hour.
Hourly Minimum Air Temperature: the lowest reading taken during the hour.

Average Daily Air Temperature: 17280 readings from the beginning of the day to the end of the day, averaged and recorded at the end of the day.
Daily Maximum Air Temperature: the highest reading taken during the day
Daily Minimum Air Temperature: the lowest reading taken during the day.

**Dew Point (TdewC, TdewF)**
The equation used to calculate dew point is:
$$Td=(241.88*\ln(Vp/0.61078))/(17.558-\ln(Vp/0.61078))$$
Sensor:  A computed value from the HMP45C Air temperature and RH readings.
Operating Range: -40°C to +60°C
Installation:  In 12-gill radiation shield, non-aspirated.
Height: 2 meters
Output Units: deg C, deg F
Scan Interval: 5 second

**Air Temperature  (GWSAirTemp, GWSAirTempF, GWSAirTempR )**
Sensor: (2) YSI Series 44033 Thermistors
Operating Range: -80°C to +75°C
Installation:  In 6-gill radiation shield, non-aspirated.
Height: 2 meters
Output Units: deg C, deg F
Scan Interval: 5 second

Average Hourly Air Temperature: 720 readings from the beginning of the hour to the end of the hour, averaged and recorded at the end of the hour.
Hourly Maximum Air Temperature: the highest reading taken during the hour.
Hourly Minimum Air Temperature: the lowest reading taken during the hour.

Average Daily Air Temperature: 17280 readings from the beginning of the day to the end of the day, averaged and recorded at the end of the day.
Daily Maximum Air Temperature: the highest reading taken during the day
Daily Minimum Air Temperature: the lowest reading taken during the day.

**Soil  Temperature  (GWSSoilTemp, GWSSoilTempR)**
Sensor: (2) YSI Series 44033 Thermistors
Operating Range: -80°C to +75°C
Installation:  In 6-gill radiation shield, non-aspirated.
Height:  at the soil surfac
Output Units: deg C
Scan Interval: 5 second
Average Hourly Air Temperature: 720 readings from the beginning of the hour to the end of
the hour, averaged and recorded at the end of the hour.
Hourly Maximum Air Temperature: the highest reading taken during the hour.
Hourly Minimum Air Temperature: the lowest reading taken during the hour.


**Soil  6 inches Temperature  (GWSSoil6Temp, GWSSoil6TempR)**

Sensor: (2) YSI Series 44033 Thermistors
Operating Range: -80°C to +75°C
Height:  6 inches below the soil surface
Output Units: deg C
Scan Interval: 5 second
Average Hourly Soil 6  Temperature: 720 readings from the beginning of the hour to the end
of the hour, averaged and recorded at the end of the hour.
Hourly Maximum Soil 6 Temperature: the highest reading taken during the hour.
Hourly Minimum Soil 6 Temperature: the lowest reading taken during the hour.


**Wind Speed (WSpd_knots, WSpd_mph, WSpd_ms, WDir_mph)**
Sensor: RM Young 05103 Anemometer
Operating Range:  0 to 60 m/s (0 to 134 mph)
Starting Threshold:  1 m/s (2.2 mph)
Installation:  30 m from nearest obstruction.
Height:  15 meters
Output Units:  knots, miles per hour, and meters per second.
Scan Interval: 5 seconds
Recording Interval: 2-minute data and hourly data are recorded; data saved in 2 different
storage areas.
Instantaneous Wind Speed: the 5-second wind speed sampled at the top of each hour.
Average Wind Speed:  the average of all 5-second wind speeds during the reporting intervals
of 2 minutes and 60 minutes.
Peak Wind Speed: the highest recorded 5-second wind observation from the reporting interval
of the past 2 minutes or past hour (max wind).
Hourly Average Wind Speed:  the hourly average of all 5-second wind speeds.
Hourly Peak Wind Speed:  the highest recorded 5-sec wind speed for the hour.
Daily Average Wind Speed:  the daily average of all 5-second wind speeds.

Daily Peak Wind Speed:  the highest recorded 5-sec wind speed for the day.


**Wind Direction (WDir)**
Sensor: RM Young 05103 Anemometer
Operating Range:  0 to 360 deg (mechanical) True North (0 to 355 electrical, 5 deg open)
Starting Threshold:  1.1 m/s (2.2 mph) 10 deg displacement
Installation:  Align true north.
Height:  15 meters
Output Units:  degrees true north
Scan Interval: 5 seconds
Recording Interval: 2-minute data and hourly data are recorded
Vector Mean Wind Direction: the unit vector mean of all 5-second wind directions for the recording period.  For example during a 2-minute recording period this will be the vector mean of 24 five-second wind directions.
Hourly Wind Direction: Vector mean of all wind direction readings for the hour
Daily Wind Direction: Vector mean of all wind direction readings for the day


**Snow Depth (Snowdepth)**
**With Air Temperature  (GWS YSI AirTemp(1) to correct for speed of sound in air)**
Sensor: CSI SR50A
This measurement is reference to the GWS YSI air temperature to correct for the speed of sound in air.
Operating Range: -45°C to +50°C
Installation:  at approximately 2 meters above the ground.
Output Units: cm
Scan Interval: 1 minute
Average Hourly Snow Depth: 60 readings from the beginning of the hour to the end of the hour, any value <-25 or >100 is not used, the rest are averaged and recorded at the end of the hour.
Hourly Maximum Snow Depth: the highest reading taken during the hour.
Hourly Minimum Snow Depth: the lowest reading taken during the hour.
Sample Snow Depth: the instantaneous measurement at the top of the hour.
SR50_quality: a unitless number from 0 to 600.  Values between 160 and 210 are good measurements.  0 means not able to make a measurement.  210 to 300 are not as good.  300 to 600 means there is a high level of uncertainty.
Average Daily Snow Depth: 1440 readings from the beginning of the day to the end of the day, any value <-25 or >100 is not used, the rest are averaged and recorded at the end of the day.


**Barometric Pressure (BP_inHg_C, BP_mBar_NC)**
Sensor:  CSI CS105 which is the Vaisala PTB101
Operating Range: 600 to 1060 mBar

Installation: in the enclosure with the datalogger
Height: in enclosure
Output Units: mBar, inHG
Scan Interval: hourly, 2 minutes before the GOES transmission
Sample Barometric Pressure: the instantaneous measurement at the top of the hour.
The BP_inHg_C is corrected for altitude using the GPS elevation output.
The BP_mBar_NC is Not Corrected for altitude.


**Precipitation (Rain_in, Raintot)**
Sensor:  CSI TE525WS
Operating Range: 0-20in/hour
Resolution: 0.01 "/tip
Installation: on a pole near the weather station.
Height: approximately 1 meter above the ground surface.
Output Units: inches
Scan Interval:  5 seconds
Total Precipitation:   Total number of tips or inches of rain during the hour.
Daily Total Precipitation:  Total number of inches of rain during the day.

Raintot is an accumulated value of precipitation since the last program was sent.  Ideally, this would be set to zero annually.

**CR1000 Battery Voltage (Batt_Volt)**
Sensor: CR1000
Output Units:  V.
Scan Interval: 5 seconds
Recording Interval: Hourly average

**Datalogger (CR1000) Panel Temperature (Panel_TempF)**
Sensor: CR1000 Internal thermistor
Output Units:  °C.
Scan Interval: 5 seconds
Recording Interval: Hourly average.

**Solar Panel Voltage (SolarPnlV)**
Sensor: voltage divider across 1K and 10K resistors.
Output Units:  V
Scan Interval: 5 seconds
Recording Interval: Hourly average.


**Resulting Final Storage Data Tables:**

RAWS Resulting Final Storage Hourly Data Table transmitted via GOES satellite

1. Total precipitation (in) as XX.XX. This is the total accumulated precipitation since the last datalogger program was sent.
2. 10 minute average wind speed from the 10 minutes before the transmission (mph) as XXX.
3. 10 minute average wind direction from the 10 minutes before the transmission (deg) as XXX.
4. Sample GWS YSI Air Temperature from 2 minutes before the transmission (°F) as XXX.
5. Fuel Temperature sample. Since this sensor is not on this station, it is set to 0 as XXX.
6. 10 minute average Relative Humidity from the 10 minutes before the transmission (%) as XXX.
7. Sample Battery Volts (V) as XX.X.

8. Sample Barometric Pressure corrected to altitude (inHg) as XX.XX
9. Direction of Hourly Maximum Wind Speed from the hour before transmission (deg) as XXX.
10. Hourly Maximum Wind Speed from the hour before the transmission (mph) as XXX.

11. Average Snow Depth with values <-25 cm and >100cm not used in the average. The hourly intervals are from the previous whole hour starting at midnight.
12. Sample HMP45C Air Temperature in °F from 2 minutes before the transmission as XXX.
13. Hourly Average GWS Soil surface Temperature in °C from the hour preceding the GOES transmission as XXX.X.
14. Hourly Average GWS Soil Temperature 6 inches below the surface in °C fron the hour preceding the GOES transmission as XXX.X.

RAWS Resulting Final Storage Hourly Data Tables can be collected via FreeWave radio network.

RAWS
Total accumulated precipitation (in)
10 minute average wind speed from the 10 minutes before the transmission (mph)
10 minute average wind direction from the 10 minutes before the transmission (deg)
Sample GWS YSI air temperature from 2 minutes before the transmission (°F)
Fuel Temperature sample. Since this sensor is not on this station, it is set to 0.
10 minute average Relative Humidity from the 10 minutes before the transmission (%)
Sample Battery Volts (V)

Two Minute Wind Table (TwoMinWind)
        Sample Station ID (3150)
        WindVector

Mean Wind Speed (knots)
Mean Wind Vector Direction (deg)
Standard Deviation Wind Direction (unitless)
Maximum 5-sec Wind Speed (knots)


Hourly Measurements Table (Hourly_Data)
Sample Station ID (3150)
WindVector
Average Wind Speed (knots)
Mean Wind Vector Direction (deg)
Standard Deviation Wind Direction (No Units)
Maximum 5-sec Wind Speed (knots)
Average HMP45C Air Temperature  (deg C)
Average Computed Dew Point Temperature (deg C)
Minimum HMP45C Air Temperature  (deg C)
Sample Barometric Pressure not corrected for altitude (mBar)
Total Precipitation (in)


Hourly Atmospheric Measurements Table (HrlyAtms)
Sample Station ID (3150)
Average HMP45C Air Temperature Thermistors (deg C)
Maximum HMP45C Air Temperature Thermistors (deg C)
Minimum HMP45C Air Temperature Thermistors (deg C)
Sample Relative Humidity (%)
Maximum Relative Humidity (%)
Minimum Relative Humidity (%)
Average 2 YSI Air Temperature Thermistors (deg C)
Average Snow Depth with values  <-25cm and >100cm not used (cm)
Maximum Snow Depth (cm)
Minimum Snow Depth (cm)
Sample Snow Depth (cm)
Sample SR50A quality (unitless)
WindVector
Average Wind Speed (m/s)
Mean Wind Vector Direction (deg)
Standard Deviation Wind Direction (No Units)


Hourly Sub Surface Table (HourlySubSurface)
Sample Station ID (3150)
Average 2 YSI Soil Temperature Thermistors (deg C)
Average 2 YSI Soil Temperature Thermistors -6 inches below the surface (deg C)

Hourly Raw Data Table (HourlyRaw)
  Sample Station ID (3150)
  Average 2 YSI Air Temperature Thermistors (kohm)
  Average 2 YSI Soil Temperature Thermistors (kohm)
  Average 2 YSI Soil Temperature Thermistors -6 inches below the surface (kohm)


Hourly Diagnostics Table (HourlyDiag)
  Sample Station ID (3150)
  Average Battery Voltage (V)
  Average Panel Temperature (deg C)
  Average Solar Panel Voltage (V)


Daily
  Sample StationID
  Average AirTempC (C)
  Maximum AirTempC (C)
  Minimum AirTempC (C)
  Average 2 GWSAirTemp() (C)
  Maximum 2 GWSAirTemp()(C)
  Minimum 2 GWSAirTemp()(C)
  Average 2 GWSSoilTemp()(C)
  Maximum 2 GWSSoilTemp()(C)
  Minimum 2 GWSSoilTemp()(C)
  Average 2 GWSSoil6Temp()(C)
  Maximum 2 GWSSoil6Temp()(C)
  Minimum 2 GWSSoil6Temp()(C)
  Maximum RH (%)
  Minimum RH (%)
  WindVector
      Average Wind Speed (m/s)
      Mean Wind Vector Direction (deg)
      Standard Deviation Wind Direction (No Units)
  Maximum WSpd_ms (m/s)
  Totalize Rain_in (in)
  Average snowdepth with values  <-25cm and >100cm not used (cm)


Definitions:
Scan interval = sampling duration = scan rate
Times of maximum or minimum values are not recorded
Sample reading = instantaneous reading
Beginning of the hour = top of the hour