Standard Operating Procedure (SOP) 7: Satellite Transmitter Programming (GOES) and Data Ingest System (WFMI), Version 2.03

Weather and Climate Monitoring Protocol

Arctic (ARCN), Central Alaska (CAKN), and Southeast Alaska (SEAN) Inventory and Monitoring Networks

Change History

Prev. Version #	Revision Date	Revised By	Changes	Justification	New Version #
1.00 (SOP 7)	12/19/2006	P. Sousanes	Added reference to testing prior to field deployment	Incorporated peer reviewed comments	1.01
1.00 (SOP 8)	12/19/2006	P. Sousanes	Added new GOES ID #s acquired in 2005.	Acquired 13 new GOES IDs	1.01
1.01	March 2017	P. Sousanes K. Hill, B. Johnson, M. Bower	Instructions for communication set-up. Combined SOP 7 and 8. Added the WFMI access info.	Updated satellite transmitter technology and software for programming. Consolidated two SOPs to keep all GOES info and instructions in same location. The GOES and WFMI systems are linked.	2.0
2.0	May 2018	P.Sousanes, M. Bower	Added site IDs and locations to Table 3 in Appendix	Two new sites installed in SEAN in 2018	2.01
2.01	February 2019	B. Johnson	Revised lat/longs for certain SEAN stations.	More accurate coordinates became available.	2.02
2.02	March 2022	P. Sousanes	Revised WFMI access instructions.	WFMI has a new weather module WX-Weather to manage stations.	2.03

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Overview

This SOP outlines the process for setting up a remote weather station to transmit near real-time hourly weather data from the climate network. The network uses systems that are already in place and available to government agencies including the National Oceanic and Atmospheric (NOAA) National Environmental Satellite, Data, and Information System (NESDIS) and the National Interagency Fire Center (NIFC) Wildland Fire Management Information (WFMI) Weather Module. On site a Campbell Scientific, Inc. Geostationary Operational Environmental Satellites (GOES) satellite transmitter (TX-312/320/321/325) is used in conjunction with the weather station datalogger to transmit hourly data packets to GOES West. This SOP also includes instructions for accessing the NESDIS and WFMI systems.

Satellite Data Flow

The Campbell Scientific, Inc. GOES transmitter (TX 312/TX320/TX321/325) supports one-way communication, via satellite, from a Campbell Scientific datalogger to a ground receiving station (Figure SOP 7-1)The transmitter utilizes non-volatile memory to store configuration information, such as platform ID, transmission baud rate, channel number, scheduled transmission time, offset time, and message window length. The clock is maintained with a GPS receiver.

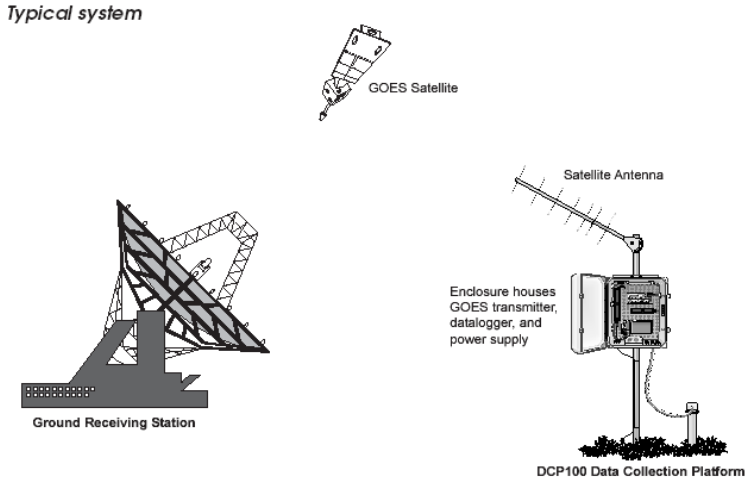


Figure SOP 7-1. Satellite data flow from weather station to receiving station.

GOES satellites have orbits that coincide with the Earth's rotation, allowing each satellite to remain above a specific region. The GOES system is administered by the National Environmental Satellite Data Information Service (NESDIS). NESDIS assigns addresses, uplink channels, and self-timed/random transmit time windows. Self-timed windows allow data transmission only during a predetermined time frame. Alaska is positioned to use the GOES West satellite.

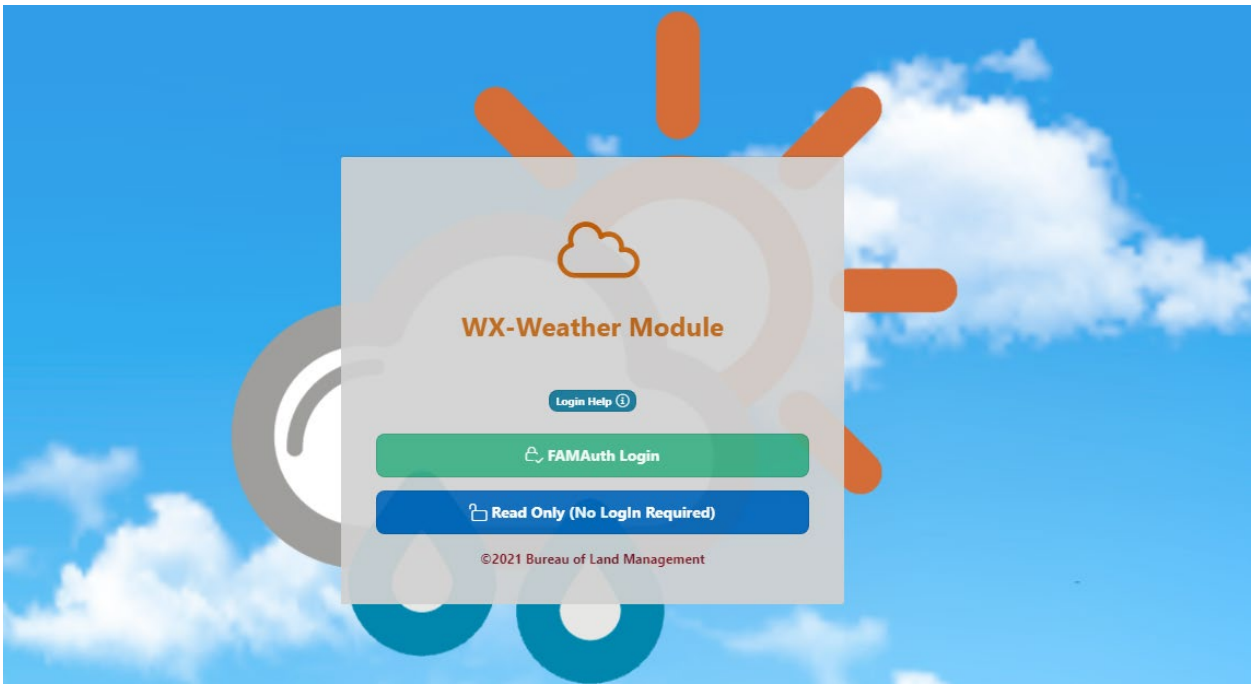
Process for Satellite Data Ingest

The satellite data system requires access to the two ground receiving stations that ingest the data from NESDIS and WFMI Weather Module. The process is outlined below followed by the instructions on how to access the two systems.

1. Set up access to the Wildland Fire Management Information (WFMI) Weather Module
2. Obtain a unique NESDIS ID for a station
3. Program the satellite transmitter
4. Test the transmission at the office
5. Contact NIFC and give them details on the new station
6. Test the transmission in the field before you leave the site
7. Keep the System User Agreement with NOAA current
8. Keep the metadata current in the WFMI Weather Module.

Set Up WFMI Access

NIFC has set up a system to ingest data from remote automated weather stations (RAWS) across the country primarily for the purpose of fire weather management. The two main functions of the WFMI system are, 1) data conversion and distribution and 2) to process and store weather data. The four Inventory and Monitoring Networks in Alaska use the same system to process the satellite data from the climate monitoring stations. In 2021, the system was updated. The old version was retired on January 18, 2022. Please follow instructions on WX-Weather Module Application to login to the new system. There is also a LOGIN Help Page. It is important to "request user access" so that metadata can be changed and post season narratives can be added. The RAWS help desk can answer questions and provide more detailed information: RAWS help desk (208) 387-5475 8:00 to 4:30 (MT) or rawshelp@blm.gov.



Once an account has been set-up the website can be used to add a new station, view station data, satellite transmission quality, metadata for the station, and other information associated with either the station or the data. To add a new station, send the NESDIS ID (see next section for details) and the data stream order to the RAWS help desk website and follow-up with a phone call to verify they have the information they need. They will set up the new station in the system and it will be ready to activate once the station is transmitting data. If the transmitter is tested before field deployment the RAWS help desk staff can be used to verify a successful transmission.

Once a station is set-up in WFMI and the station has been activated the data will be ingested in the system and will go through preliminary data quality assurance; the values will not be changed, but if the data are outside expected thresholds or have not changed for a period of time, an event is logged. Each week a 'Station Event Report' is sent to the person assigned to the station that lists these events; some are informational and others may be an indication of a problem (Figure SOP 7-2 and 7-3).

Wildland Fire Management Information (WFMI)

RAWS Station Event Report

Created 03/14/2022 19:56:52 UTC

03/06/2022 - 03/13/2022

This message is automatically generated and mailed by WFMI Weather. You are receiving this message because your address is listed as the "Station Event Recipient" for each RAWS contained in this report. This report is distributed weekly for each RAWS defined in WFMI that has had at least one event in the past week. Some events are only informational and others may indicate a problem with the station. You are encouraged to log into the WFMI system for further details about these RAWS stations and/or to make changes necessary to correct any problems.

Figure SOP 7-2. Station event report e-mail generated each week

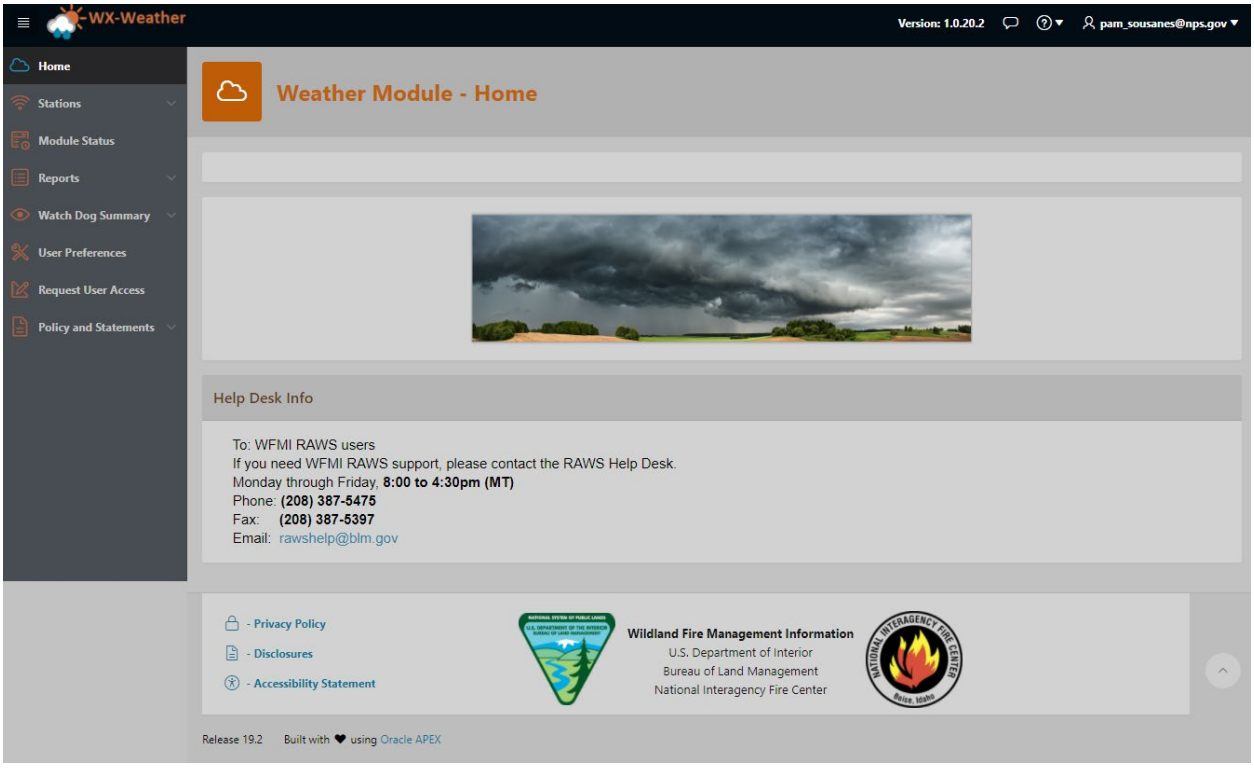
STATIONS with EVENTS

Station	Event Count
DEVIL MOUNTAIN, AK (3961221A)	1
IMELYAK, AK (3961316C)	39
SALMON RIVER, AK (3960F688)	29
TAHINICHOK, AK (396147FC)	9

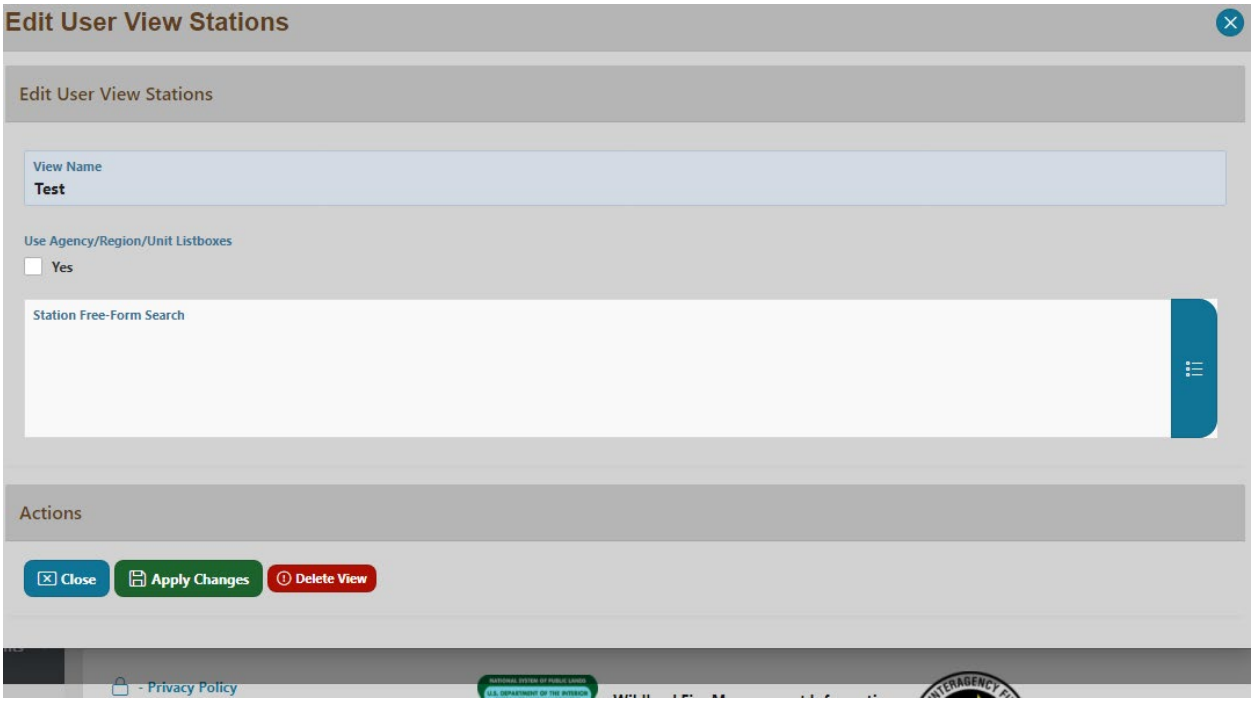
Figure SOP 7-3. Example of event notifications on a station event report.

At the end of each field season the site visit date and a short narrative is logged on WFMI. The weather stations have an annual maintenance requirement; if a site has not been visited in the past year a message will be generated alerting the station owner that the station is overdue for maintenance. The following steps provide guidance on how to access the WFMI system and where to enter the annual metadata.

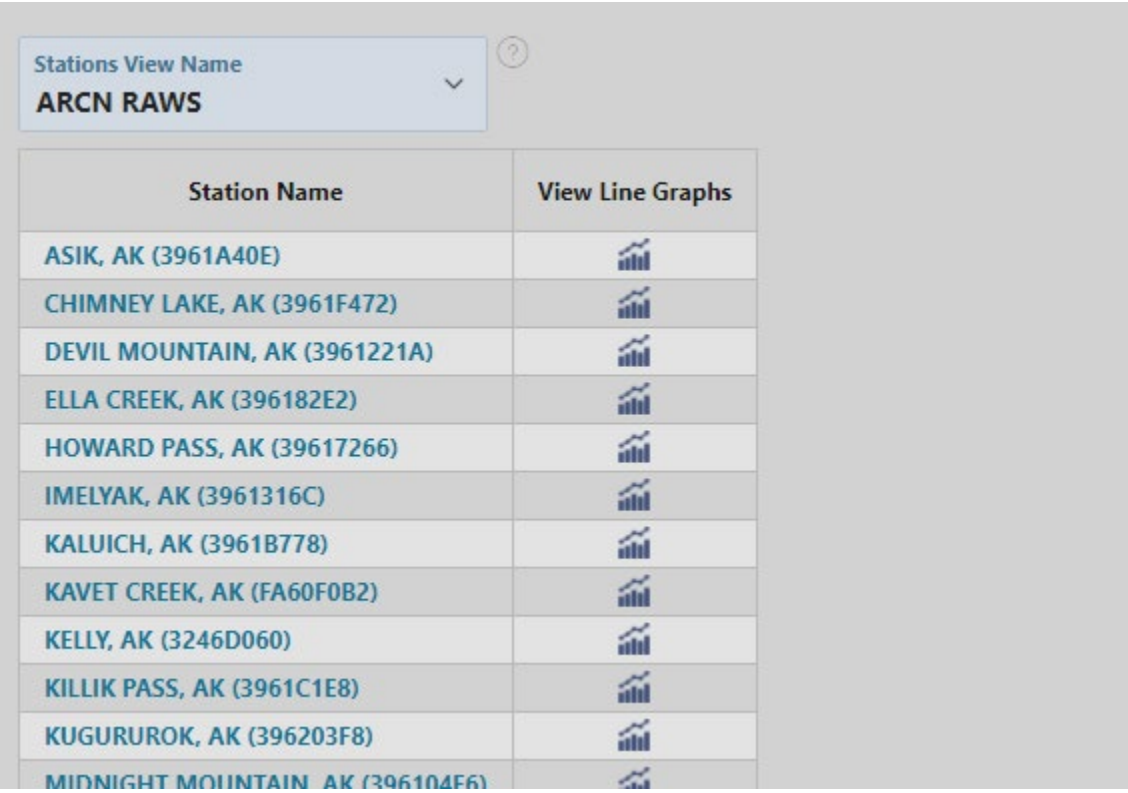
Navigate to the WFMI WX-Weather Module web page.



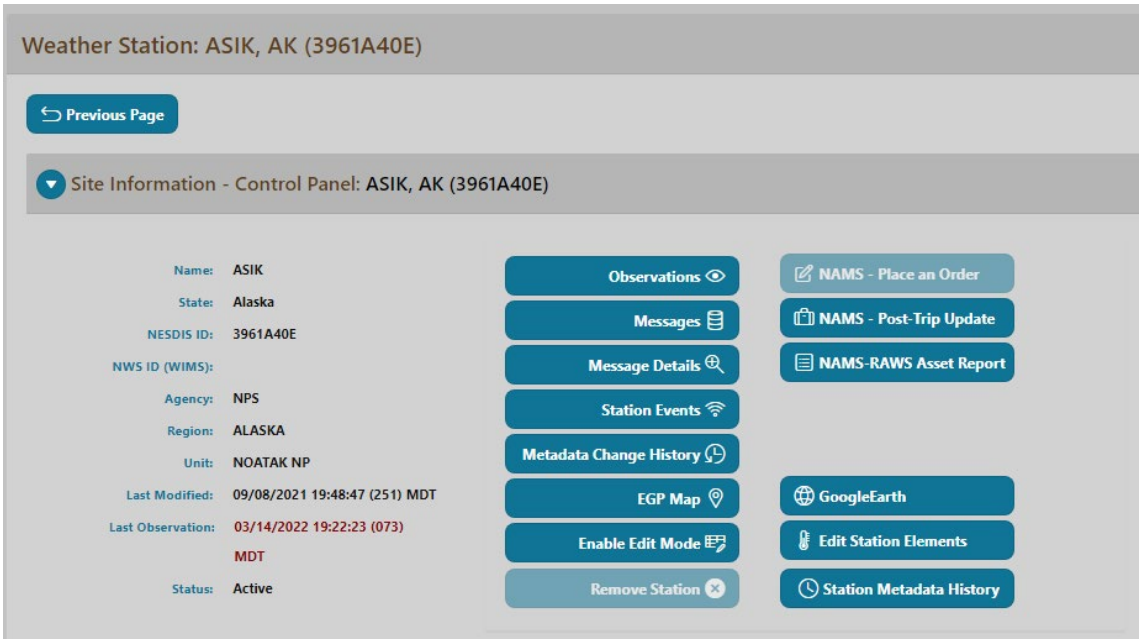
Click on **Stations** and either select a station by name or create a custom list of stations under **Select View List**. To make a custom list select **Edit/Create View** and then add stations; up to 20 stations can be added to one view.



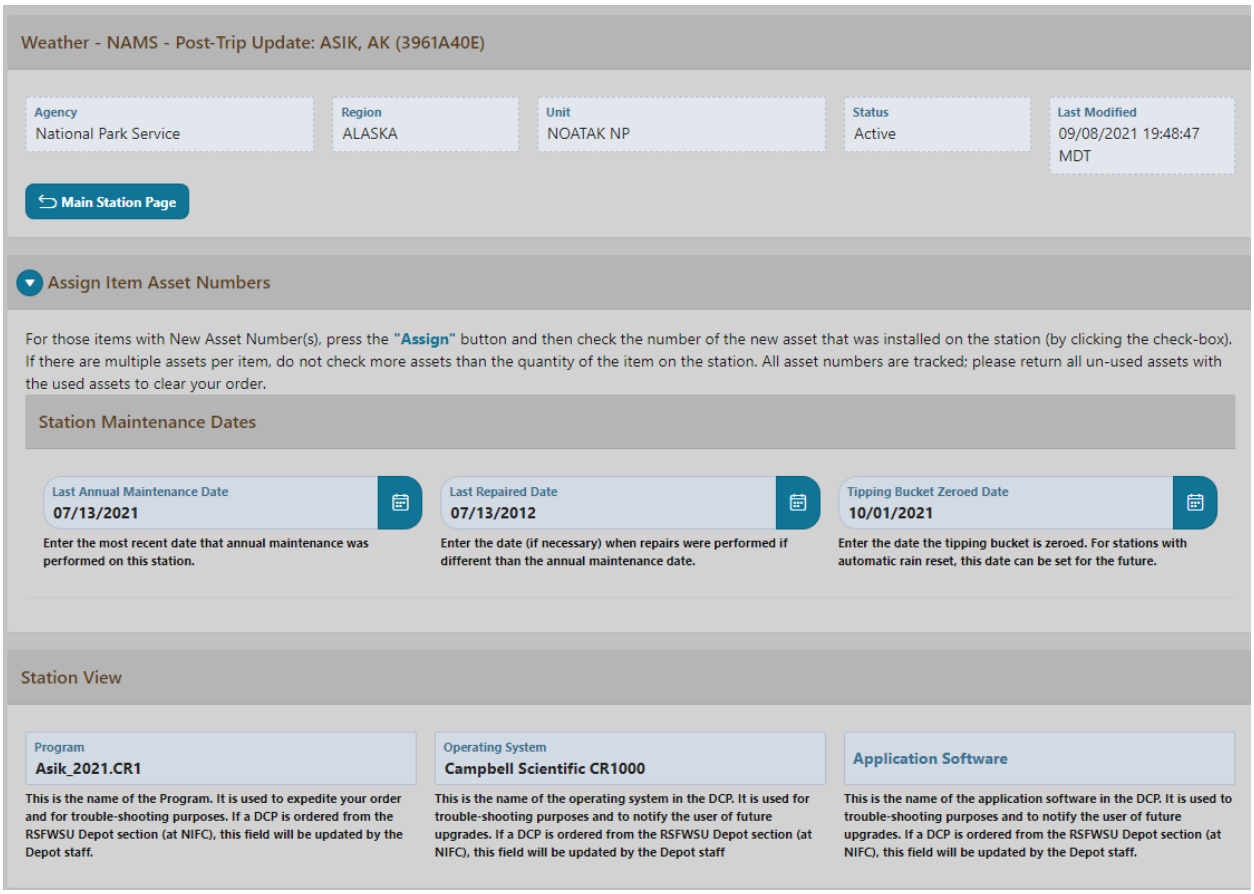
Click **Stations View List/Station View Name** and the stations under that 'Station View' will display.



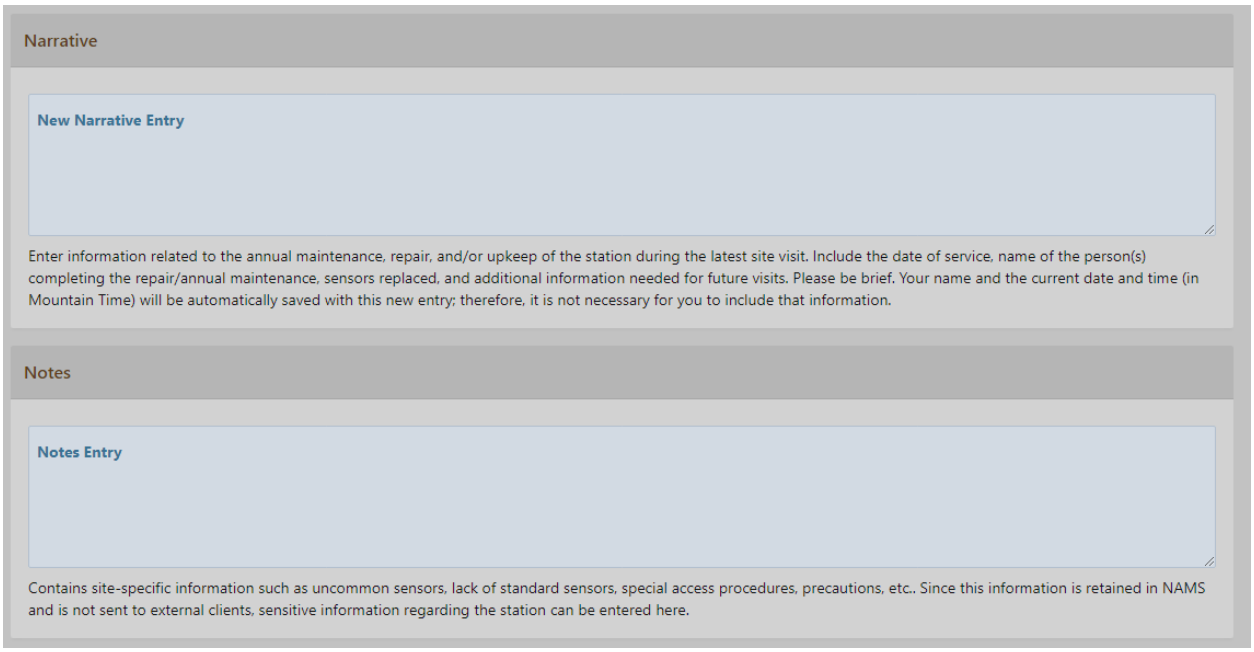
There are options for either viewing data or adding information to the blue colored boxes on the next page. Select the NAMS –Post-trip Update box to enter the information about the annual site maintenance trip.



Enter the date of the annual maintenance trip. If there was an unscheduled trip for repairs enter that date. Enter the date the tipping bucket was zeroed. The stations are programmed to reset on January 1, but this date may change in certain circumstances.



Enter a brief narrative of what work was done during the annual station visit and then click **Submit Post-trip Update**. If you want a copy of the report emailed to you, check the box.



The RAWS help desk staff are available to help with any questions regarding the WFMI system. Don't hesitate to call or e-mail them if there are any questions or issues but realize that they are providing a service that extends beyond their main mission of fire weather systems.

Obtaining a NESDIS ID and accessing the DCS

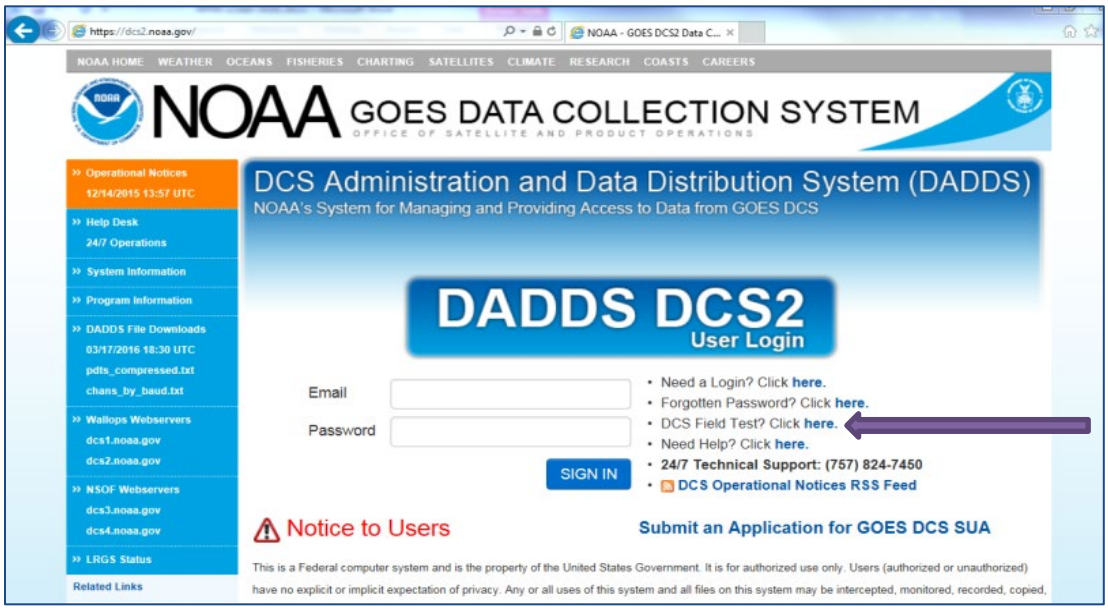
Each weather station has a unique National Oceanic and Atmospheric (NOAA) National Environmental Satellite, Data, and Information System (NESDIS) identification (ID) number. This ID is necessary to transmit messages over the GOES Data Collection System (DCS). The system is regulated, by law, to the collection of environmental data by the U.S. federal, state, and local government agencies, and by international government agencies and research organizations with a U.S. government sponsor.

The NPS Alaska climate monitoring program has a current System Users Agreement (SUA) in place that is renewable every five years. The current principle investigator (PI) is the lead; if that changes the contact info on the SUA must be updated. The GOES NESDIS IDs, the channel number, and the transmission times (10 second window) have been assigned to all of the weather stations in the

network and are listed, along with their locations, in Appendix A. There are currently 40 NESDIS IDs assigned to the Alaska Climate Protocol (CAKN, ARCN, and SEAN) through this SUA. Additional IDs can be requested if more stations are added. The group name ALKDNP has been assigned to the Climate Monitoring Protocol for Alaska. The current NOAA contact is listed below:

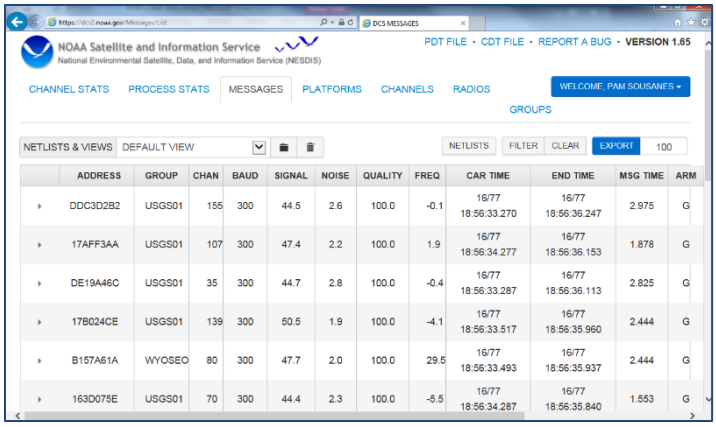
GOES DCS SUA Processing Unit NOAA,
Satellite Services Division
4231 Suitland Road, Rm 1646
Suitland Federal Center Suitland, MD 20746
Tel: 301-817-4563
Fax: 301-817-4569
Email: Letecia.Reeves@noaa.gov

NOAA maintains a system for managing and providing access to data from GOES. The website for the Data Collection System (DCS) Administrative and Data Distribution System (DADDS) provides another mechanism for checking on the status of the satellite transmissions. A Login is required for this system and can be obtained through the website.

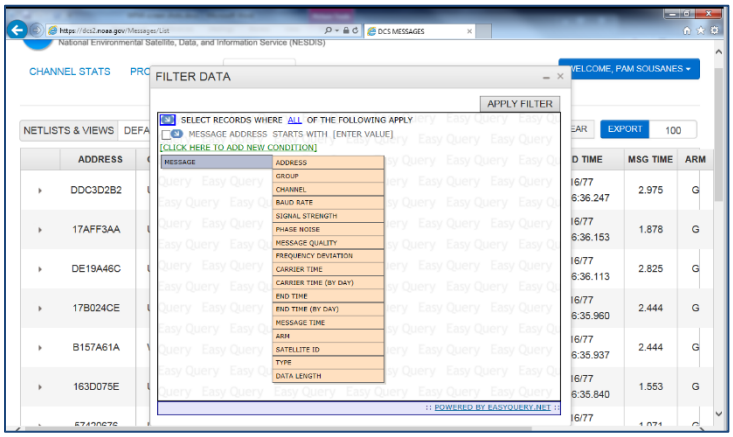


On the home page there is an option for a **DCS Field Test**. You can select this and enter a station ID and get the status without logging on to the system. You can only look at a single station using this method. If you want to see all of the stations or look at more detail you'll need to log in.

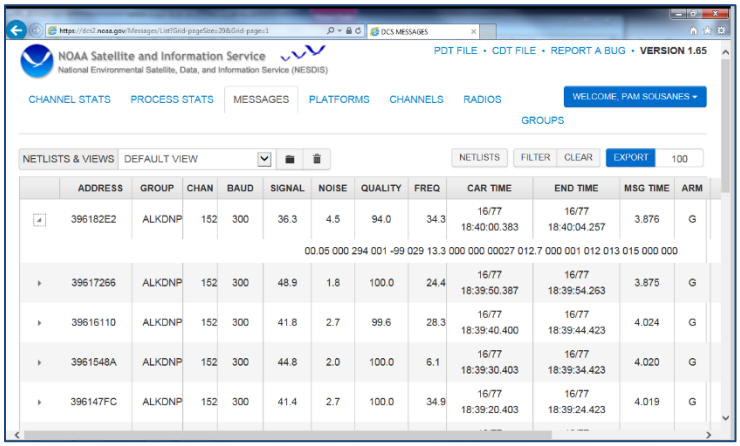
Once logged in, navigate to the **Messages** tab and select **Filter**.



Select ‘Click here to add new condition’ and filter by selecting an individual address (IDs) or the entire group (ALKDNP).



The latest messages will be displayed without any headings or formatting. This is the raw data package from the weather station. The data flows from this system directly to the WFMI system in Boise, ID.



This is a useful tool for looking at the raw data and the technicians that support this system are available 24 hours a day, 7 days a week. You can contact them from the field to check on the status

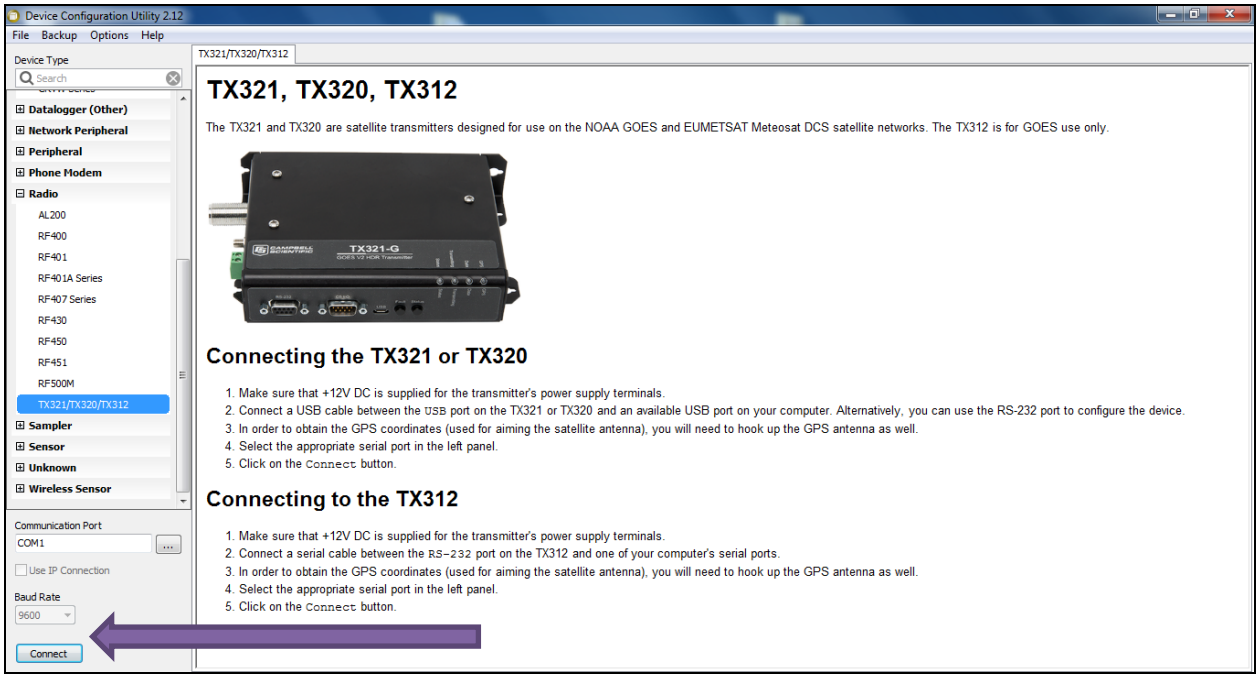
of a transmission by simply providing the NESDIS ID. They can give you the transmission signal quality and read the data string for you; they will not however know what the values are since they manage many different types of data. The 24/7 technical support phone number is: (757) 824-7450

Procedures for programming the transmitter

The Campbell Scientific, Inc. instruction manuals for the TX312/TX320/TX321GOES transmitter(s) outline, in detail, the GOES system, transmitter functions, software instructions, programming, and installation instructions. The TX312 and TX320 models are now retired, but are still being supported.

It is wise to do the transmitter programming in the office and test it prior to field deployment. A transmitter in the field can be upgraded or reprogrammed by bringing a laptop with the proper software and cable connection. Campbell Scientific, Inc. Device Configuration Utility software has recently replaced their Sat Commander software for all transmitter setup and programming.

1. Download and install Device Configuration Utility software from the Campbell Scientific, Inc. website.
2. Install any drivers necessary to utilize connection cables. The transmitter configuration port is an RS232 port utilizing a DB9 female connector. The Device Configuration Utility communicates with the transmitter through this RS232 configuration port. You must have an appropriate cable for your laptop or PC. A male-to-female serial cable can be used if the laptop has a serial port. If the laptop does not have a serial port, a serial-to-USB converter cable is used. Serial-USB cables often require installation of a software driver. Converter cables can be ordered from Campbell Scientific or purchased at electronic stores. Connect one end to the USB or Serial port on your PC and one end to the RS232 Configuration Port on the transmitter. If using a TX321 unit (which is built with a USB port), a straight USB cable may be used to connect to a laptop.
3. Open Device Configuration Utility software and select the TX321/TX320/TX312 under radio devices. Choose the appropriate communications port used by the PC's connection cable and then click **Connect**.



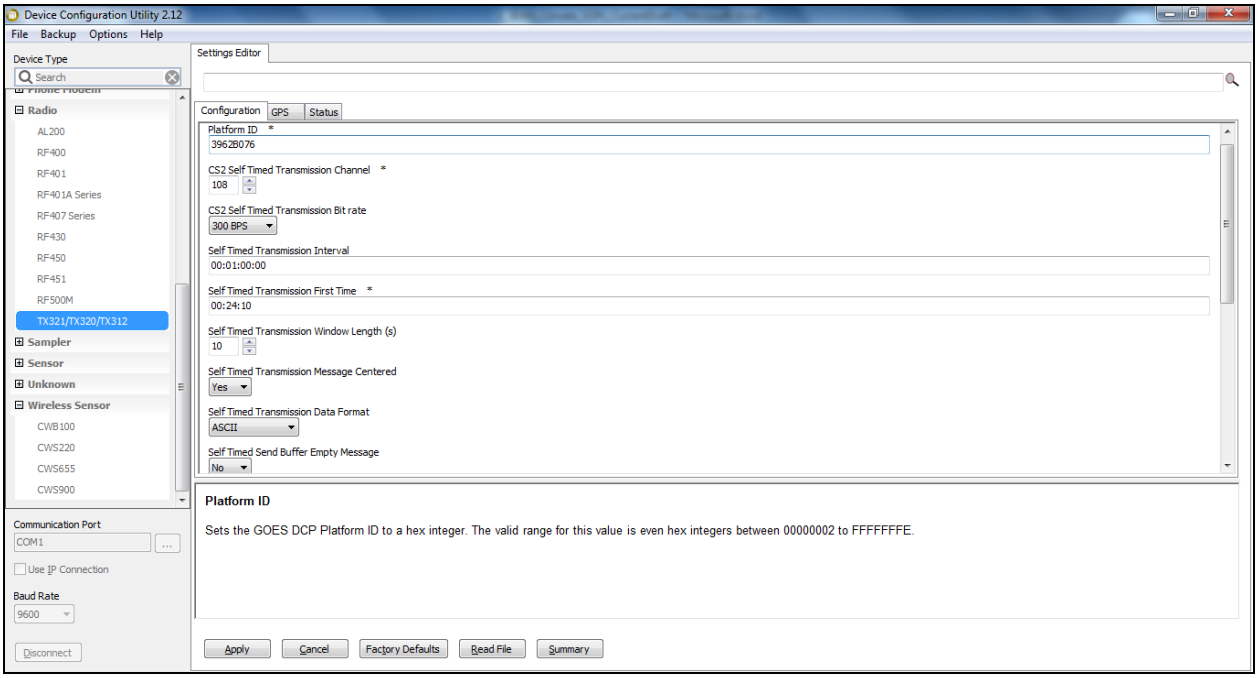
4. On the **Settings Editor** and **Configuration** tabs, the **Platform ID, CS2 Self Timed Transmission Channel,** and **Self Timed Transmission First Time** fields will need to be changed to correspond to each station. The factory defaults should be correct for other fields, but it is good practice to review values for accuracy.

    a. **Platform ID:** Enter the assigned NESDIS platform ID (see Appendix A or Site Visit Datasheet for current list). This ID is unique; it should be assigned to one station and not moved to another station or duplicated.
    b. **CS2 Self Timed Transmission Channel:** The timed channel is also assigned with the NESDIS platform ID.
    c. CS2 Self Timed Transmission Bit Rate: Enter the assigned channel bit rate (baud rate) as 300 BPS. The bit rate is assigned by NESDIS and is tied to the channel number. The bit rate for all the network stations is currently 300 BPS.
    d. Self Timed Transmission Interval: The timed interval refers to how often the data are transmitted. The NPS network stations are transmitted hourly (00:01:00:00).
    e. **Self Timed Transmission First Time**: The first timed transmission is the transmission time unique to each NESDIS ID. The TX312 will transmit on the next Timed Interval after the clock has been set. In the example below, transmission will occur at 33 minutes and 00 seconds past the hour (00:33:00).
    f. Self Timed Transmission Window Length (s): This is the length of the assigned self-time transmit window in seconds. The network stations have a transmission window of 10 seconds.
    g. Self Timed Transmission Message Centered: Determined when the transmission will occur within the indicated window. Set this as Yes.

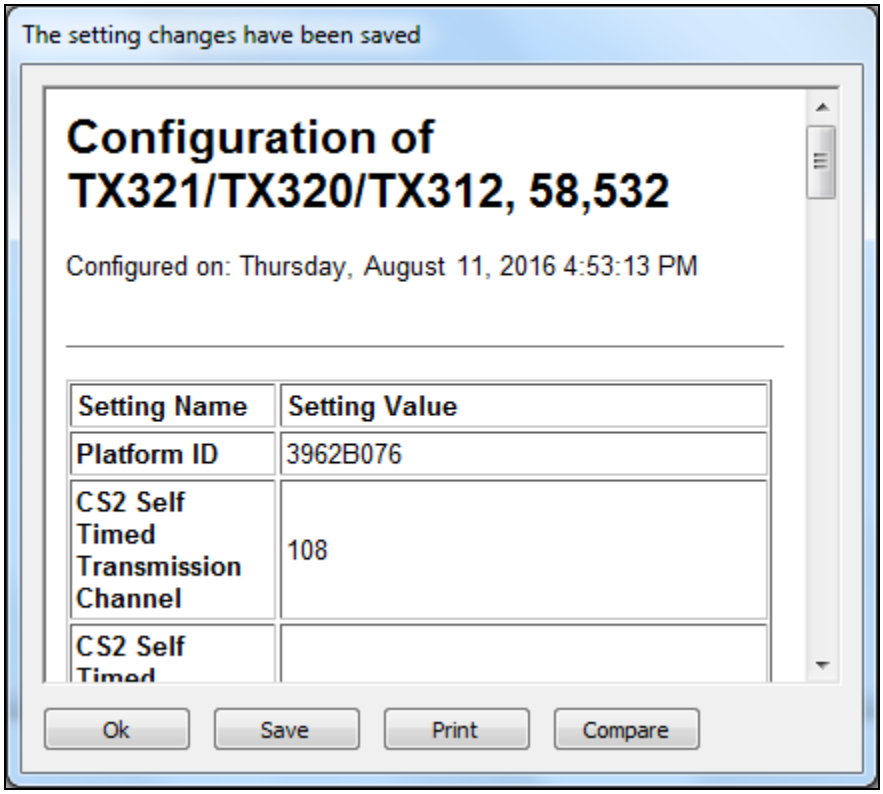
h. Self Timed Transmission Data Format: This field determines how the flag word is written and which characters are legal. Select A for the ASCII data format for all the network weather stations.

i. Self Timed Send Buffer Empty Message: Specifies whether the transmitter should send a BUFFER EMPTY message if the timed buffer is empty at the time of transmission. Set this as No.

j. Leave the Random Channel fields with the default values; the network climate sites do not use the random channels.



5. Once all of the information has been populated in the fields and double checked for accuracy, select **Apply**. Choose **Yes** on the pop-up screen to confirm your changes. On the next screen, click the **Save** button to save a configuration file. Use the station name and save in an appropriate folder. After saving the configuration file, click **Ok**, to send the settings to the transmitter.

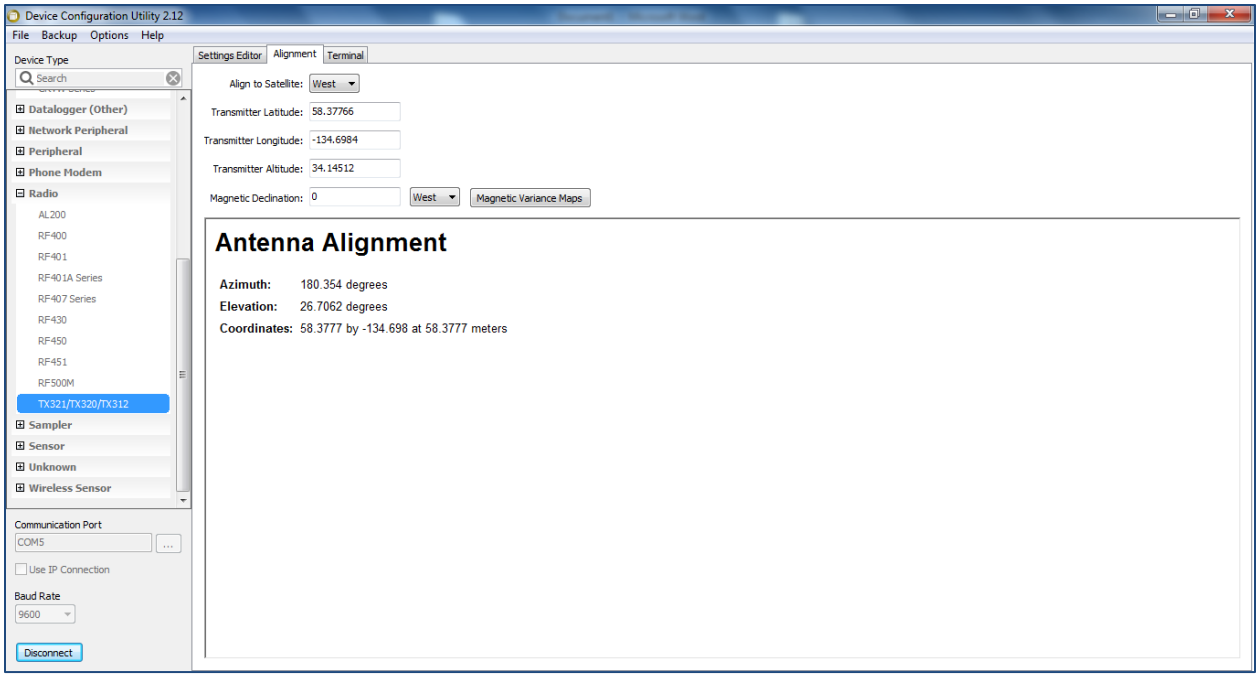


6. To keep track of what was loaded onto the transmitter, use a printed sticker or label tape displaying the NESDIS ID, channel number, and transmission time.

Once the transmitter is deployed at the site, follow the next steps:

7. Click the **Alignment** tab for information on how to align the antenna. Be sure to select the **West** (as in GOES West) satellite from the drop-down menu. If the GPS is functioning, the latitude, longitude, and altitude will be displayed. It is possible to enter the magnetic declination of the site and calculate the azimuth to correctly position the antenna if your compass does not compensate for declination.

8. On the **Settings Editor** tab, click the **GPS** tab to verify that a successful GPS connection has been achieved and that the coordinates align with expectations. The GPS Status field provides useful information on the strength of the GPS signal and condition of the GPS antenna for troubleshooting any connection problems.
9. On the **Setting Editor** tab, click the **Status** tab to confirm the Next Timed TX (corresponding to the NESDIS ID for a particular station), Next Timed TX, and the Fail Safe Status, and the Last Transmit Status.



10. Confirm a successful transmission by employing one or more of the following methods.
    a. Monitor the diagnostic lights on the transmitter. The program is designed to send data to the transmitter at 5 minutes past the hour (see SOP 6 Programming the Datalogger). The Data in Buffer indicator light on the transmitter should display a green light from 5 minutes past the hour until the assigned First Transmission Window of the associated NESDIS ID. At the time of the Transmission Window (00:33:00 on the example above), the Data in Buffer indicator light will disappear and the Transmitting light should flash green. This indicates a successful transmission. No indicator lights should be lit from the transmission window through 5 minutes past the hour. The Fault LED will only light after the Diagnostics button has been depressed. For troubleshooting, press and hold the Diagnostics button for about 2 seconds. The Fault LED will flash once to indicate the Failsafe has not been tripped. If the LED flashes twice, the Failsafe has tripped. To clear the Failsafe, press and hold the diagnostic button for about 10 seconds. If the failsafe has tripped, the transmitter probably needs to be returned for service.
    b. Call the GOES DCS/DADDS system support technicians, available 24 hours a day, 7, days a week including holidays. They will need the NESDIS ID and they can confirm/deny a successful transmission. Phone: 757.824.7450
    c. Call the RAWS Helpdesk Monday through Friday 7:30 am to 4:30 pm Mountain Time. Phone: 208-387-5475.
    d. Check the NESDIS DCS/DADDS website (described above). Use the 'DCS Field Test' button on the home page or login to access more sites.

Appendix SOP 7 – A. Arctic, Central Alaska, and Southeast Alaska Network NESDIS IDs.

Table SOP 7-A1. ARCN NESDIS station IDS

Station Name	GOES NESDIS ID	Channel	TX Time	Lat DM WGS84	Long DM WGS84	Elev ft.	Park acronym
Chimney Lake	3961F472	108	0:23:10	67 45.345	-150 29.602	3,700	GAAR
Pamichtuk Lake	3961E704	108	0:23:00	67 46.316	-152 11.700	3,135	GAAR
Ram Creek	3961D29E	108	0:22:50	67 41.111	-154 28.387	4,100	GAAR
Killik Pass	3961C1E8	108	0:22:40	67 58.221	-154 55.450	4,360	GAAR
Howard Pass	39617266	152	0:39:50	68 09.361	-156 53.749	2,062	NOAT
Imelyak	3961316C	152	0:39:10	67 32.689	-157 04.646	3,620	NOAT
Kaluich	3961B778	108	0:22:30	67 34.403	-158 25.903	2,411	NOAT
Salmon River	3960F688	152	0:38:30	67 27.594	-159 50.475	1,262	NOAT
Sisiak	3961548A	152	0:39:30	67 59.702	-160 23.739	1,823	NOAT
Asik	3961A40E	108	0:22:20	67 28.493	-162 15.986	1,329	NOAT
Kugururok	396203F8	108	0:23:20	68 19.003	-161 29.518	1,020	NOAT
Tahinichok	396147FC	152	0:39:20	67 33.009	-163 34.031	966	CAKR
Mt. Noak	39616110	152	0:39:40	67° 08.486	-162 59.672	809	CAKR
Devil Mountain	3961221A	152	0:39:00	66 16.553	-164 31.851	285	BELA
Ella Creek	396182E2	152	0:40:00	65 16.511	-163 49.208	2,318	BELA
Midnight Mountain	396104F6	152	0:38:40	65 49.220	-164 32.564	2,267	BELA
Serpentine HS	39611780	152	0:38:50	65 51.138	-164 42.469	518	BELA

Table SOP 7-A2. CAKN NESDIS station IDs

Station Name	GOES NESDIS ID	Channel	TX Time	Lat DM WGS84	Long DM WGS84	Elev ft.	Park acronym
Chititu	396020E0	172	0:32:50	61 16.416	-142 37.254	4,544	WRST
Chicken Creek	39603396	172	0:33:00	62 07.441	-141 50.840	5,240	WRST
Tana Knob	3960709C	172	0:33:40	60 54.480	-142 54.078	3,739	WRST
Gates Glacier	39608018	172	0:33:50	61 36.173	-143 00.793	4,060	WRST
Tebay	3960936E	172	0:34:00	61 10.860	-144 20.532	1,880	WRST
Upper Charley	3960D064	152	0:38:10	64 31.015	-143 12.143	3,655	YUCH
Coal Creek	39605670	172	0:33:20	65 18.248	-143 09.421	958	YUCH
Toklat	396063EA	172	0:33:30	63 31.530	-150 02.789	2,920	DENA
Eielson Visitor Center	39604506	172	0:33:10	63 25.854	-150 18.646	3,944	DENA
Stampede	3960A6F4	172	0:34:10	63 44.867	-150 19.683	1,800	DENA
Dunkle Hills	3960B582	172	0:34:20	63 16.019	-149 32.492	2,651	DENA
Ruth Glacier	3960157A	172	0:32:40	62 42.598	-150 19.683	3,300	DENA
Wigand	3960060C	172	0:32:30	63 48.853	-150 06.565	1,717	DENA

Table SOP 7-A3. SEAN NESDIS station IDs

Station Name	GOES NESDIS ID	Channel	TX Time	Latitude WGS84	Longitude WGS84	Elev ft.	Park acronym
Deception Hills	3962A300	108	0:25:00	59.090630	-138.214629	2,190	GLBA
Dry Bay	39622514	108	0:23:40	59.167948	-138.484093	29	GLBA
Glacier Bay Fuel Dock	3962D590	108	0:25:30	58.455151	-135.888519	30	GLBA
Lituya Bay	39623662	108	0:23:50	58.626560	-137.657944	4	GLBA
Lone Island	396008DE	108	0:27:40	58.721868	-136.295032	85	GLBA
Nunatak Lower	3962B076	108	0:25:10	58.977761	-136.100986	20	GLBA
Nunatak Upper	3962C6E6	108	0:25:20	58.983758	-136.100385	941	GLBA
Queen Inlet	3962969A	108	0:24:50	58.917260	-136.584659	1,045	GLBA
Chilkoot Pass	3962661E	108	0:24:20	59.695300	-135.259200	4,200	KLGO
Dyea	39627568	108	0:24:30	59.511889	-135.346851	50	KLGO
Goat Lake[1]	396285EC	108	0:24:40	59.526280	-135.187270	2,925	KLGO
Sheep Camp	39625384	108	0:24:10	59.656832	-135.267867	920	KLGO
Brady Icefield[2]	39601BA8	108	0:27:50	-	-	-	GLBA

[1]Goat Lake station was decommissioned as of 9/13/2017.

[2]Brady Icefield station has not yet been deployed.