NOAA Technical Report NOS CO-OPS 026

A NWS Guide to the Use of NWLON and PORTS® Computer-Based Products

Silver Spring, Maryland
September, 2001
Revised March 2002
Revised October 2004

noaa **National Oceanic and Atmospheric Administration**

U.S. DEPARTMENT OF COMMERCE
National Ocean Service
Center for Operational Oceanographic Products and Services

Center for Operational Oceanographic Products and Services
National Ocean Service
National Oceanic and Atmospheric Administration
U.S. Department of Commerce

The National Ocean Service (NOS) Center for Operational Oceanographic Products and Services (CO-OPS) collects and distributes observations and predictions of water levels and currents to ensure safe, efficient and environmentally sound maritime commerce. The Center provides the set of water level and coastal current products required to support NOS' Strategic Plan mission requirements, and to assist in providing operational oceanographic data/products required by NOAA's other Strategic Plan themes. The Center manages the National Water Level Observation Network (NWLON), and a national network of Physical Oceanographic Real-Time Systems (PORTS®) in major U.S. harbors. The Center: establishes standards for the collection and processing of water level and current data; collects and documents user requirements which serve as the foundation for all resulting program activities; designs new and/or improved oceanographic observing systems; designs software to improve CO-OPS' data processing capabilities; maintains and operates oceanographic observing systems; performs operational data analysis/quality control; and produces/disseminates oceanographic products.

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A NWS Guide to the Use of NWLON and PORTS® Computer-Based Products

Janet Burton
Information Systems Division

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TABLE OF CONTENTS

1.0 INTRODUCTION

The National Weather Service (NWS) is responsible for providing marine forecasts and warnings for the protection of life and property along the bays and coasts of the United States. The Center for Operational Oceanographic Products and Services (CO-OPS) within the National Ocean Service (NOS) contributes to the success of meeting these goals through the provision of real-time and near real-time water level, current, and meteorological information to NWS.

CO-OPS currently provides this information to NWS through:

- CREX (Character Form for the Representation and Exchange of Data) Bulletins

  1. Routine Water Level Data Bulletins
  2. Routine Ancillary Data Bulletins
  3. Storm Surge Water Level Data Bulletins
  4. Storm Surge Ancillary Data Bulletins

- SHEF (Standard Hydrometeorological Exchange Format) Bulletins

  1. Routine Water Level Data Bulletins
  2. Routine Ancillary Data Bulletins
  3. Predicted Water Level Data Bulletins

- Raw Data Transmissions for Tsunami Event Evaluation

- PORTS® (Physical Oceanographic Real-Time System) Voice System

- CO-OPS Web-Accessible Products
  1. Tides Online
  2. Station Status Report
  3. Retrieval of Historical Data
  4. PORTS® PICS (PORTS® Image Component System)
  5. PORTS® Text Screen

Each of these products is discussed in further detail later in this document.

The water level, current, and associated meteorological data are available to all NWS offices with marine and coastal responsibilities on a routine basis. The products allow NWS to compare observed water level data to the predicted astronomical tide heights as well as provide additional data quality information previously not available. Through these NOS products, increased sensitivity to routine marine changes is provided which allows the NWS field forecasters to make better use of the information in order to meet its short-term weather warning and forecasting responsibilities. The routine availability of this data leads to increased familiarity with changes in oceanographic conditions. This in turn should better alert surrounding offices of potential events as well as existing conditions. In addition, these products provide the NWS with an efficient means to access and utilize water level and current data during coastal storm events when the workload is higher than usual and timely data and information for decision-making is critical.

2.0 BACKGROUND

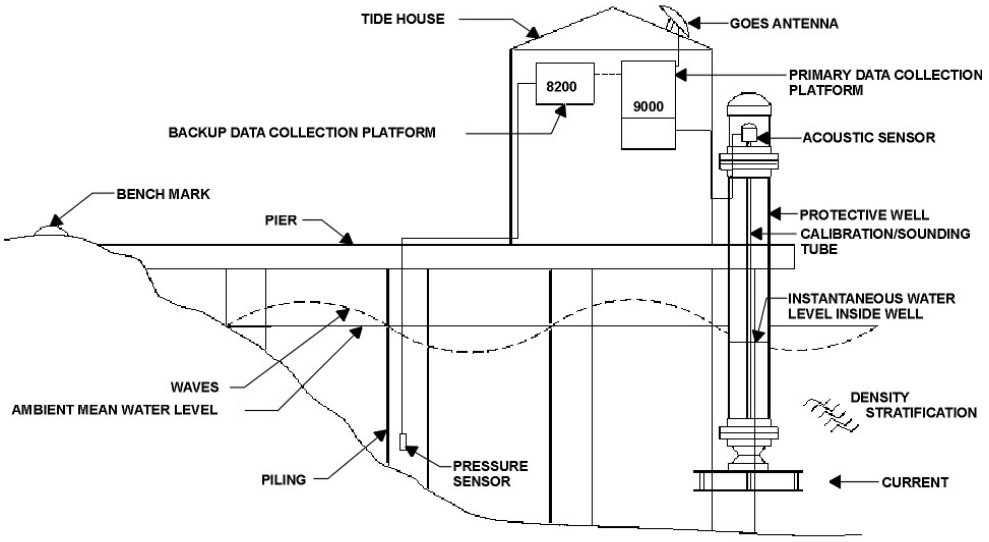
The National Ocean Service (NOS) is responsible for the management and operation of the National Water Level Observation Network (NWLON), a network of tide and water level gauges installed along U.S. coastlines, estuaries, and bays, and a national network of Physical Oceanographic Real-Time Systems (PORTS®) installed in major U.S. harbors. The National Water Level Measurement System (NGWLMS) is the computer-based data collection, processing, and dissemination system which supports the NWLON. The Information Dissemination System (IDS) is the computer-based data collection, processing, and dissemination system which supports PORTS®. The NOS established the NWLON and PORTS®, using state-of-the-art technology, to measure water levels, currents, and meteorological data and provide baseline data for activities such as navigation and marine forecasts.

There are 175 water level stations and 17 acoustic current profiler installations along the U.S. coasts, in major U.S. harbors, in the Great Lakes and connecting channels, and in the U.S. territories and possessions. The primary sensor used for measuring water levels is a self-calibrating, downward-looking acoustic device that reports 3-minute averages of 1-second measurements every six minutes. For the Great Lakes, the primary sensor is a shaft angle encoder. For measuring currents, the primary sensor is a acoustic doppler device that takes continuous samples and provides an average measurement on the hour and at succeeding six minute intervals. Some stations also have been equipped with meteorological sensors. See Figure 1 for a diagram of a typical NWLON installation.

For the NWLON network, gauges collect the data at each site and relay it via the Geostationary Operational Environmental Satellite (GOES) in near real-time to the National Environmental Satellite, Data, and Information Service (NESDIS) downlink at Wallops Island, Virginia. The data is then rebroadcast over the Domestic Communication Satellite System (DOMSAT). Using JAVA scripts, a CO-OPS UNIX-based workstation retrieves the data from DOMSAT.

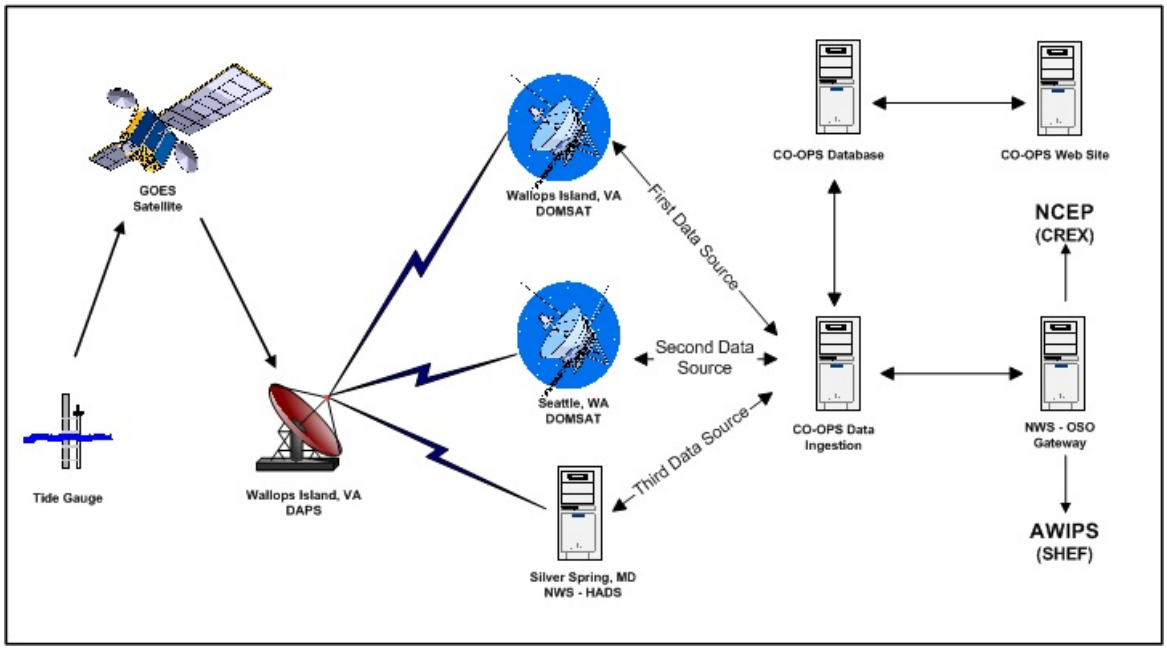
For the PORTS® network, a PC-based Data Acquisition System (DAS), running LINUX, installed at each of the local PORTS® sites, ingests all PORTS® data at that site. The DAS polls installed instruments every six minutes. The polling is achieved using land line telephone calls, line-of-site radio communications and/or dedicated leased lines. The instrument data is converted to engineering units, quality controlled and formatted. Using FTP, each DAS sends this formatted data to a central PC data collection platform located in SSMC II, Silver Spring, Maryland, over a commercial and dedicated MCI network. Again using FTP, all data is then sent via the local NOAA campus network to several CO-OPS special purpose workstations.

For both NWLON and PORTS®, once the data is received by CO-OPS, various products are generated to be used in satisfying NOAA mission requirements such as the NWS mission to provide marine forecasts and warnings for the protection of life and property along the bays and coasts of the United States. See Figure 2 for a diagram of the NGWLMS system topology.



NATIONAL WATER LEVEL OBSERVATION NETWORK INSTALLATION

Figure 1



NGWLMS System Topology

Figure 2

3.0 CREX BULLETINS

Upon receiving data, a CO-OPS workstation, running UNIX, performs outlier and rate-of-change quality checks on the data. Then, for a given list of stations provided by NWS, the data, along with the appropriate quality indicators, are formed into appropriate data bulletins for distribution to NWS. The data is arranged within a bulletin according to the NWS-defined CREX format definitions. Using FTP, the completed bulletins are transferred by NWS OSO from CO-OPS to the NWS Telecommunications Gateway for dispersal. See Appendix 1 (NWS Station List) for a list of stations for which CREX bulletins are currently being generated.

Currently, two types of CREX-formatted bulletins are distributed to NWS: routine and storm surge.

3.1 CREX Routine Data Bulletins

CO-OPS generates CREX routine data bulletins every hour at fifty-nine minutes past the hour. These routine bulletins contain data reported from stations while the stations are in their "routine" transmission mode. For some stations, "routine" transmission mode is every six minutes, for some it is every hour, for others it is every three hours. There are two types of CREX routine bulletins that can be created: water level and ancillary.

3.1.1 CREX Routine Water Level Data Bulletins

Each CREX routine water level bulletin contains the hourly and thirty-minute observed water level values reported in the most recent six-minute, one-hour, or three-hour transmission. Tidal residuals which are calculated by subtracting predicted astronomical water level values from the actual observed water level values are provided in the bulletin except for the Great Lakes stations. Great Lakes stations do not have predictions; therefore, no residual values can be calculated. Also included in the bulletin are two quality control flags which represent the overall quality of the water level values contained in the station transmission: an automatic flag which indicates if any water level tolerances such as rate-of-change have been exceeded; and a manual flag which indicates problems with the water level gauge itself, such as sensor problems or clogging. See Appendix 2 (CREX Bulletin Descriptions) for more detailed information on the format of the CREX routine water level bulletin and Appendix 5 (CREX Quality Control Identifiers) for more information about the water level quality control flags.

3.1.2 CREX Routine Ancillary Data Bulletins

If meteorological data exists for a station, the appropriate CREX routine ancillary bulletin is generated at the same time that the CREX routine water level bulletin is generated. Currently, the meteorological data values that can be included in the bulletin are air temperature, barometric pressure (sea level), wind speed, and wind direction. Not all stations have all sensors, so it is possible to have ancillary bulletins that do not contain information for all of the given data types. Should a new type of meteorological sensor be installed at a station, the data collected from that sensor for the given station would be added to the bulletin. Each ancillary bulletin includes the hourly meteorological data value(s) for each data type for the most recent six-minute, one-hour, or three-hour transmission. Also included in the bulletin are two quality control flags which represent the overall quality of the meteorological values contained in the station transmission: an automatic flag which indicates if any meteorological tolerances have been exceeded; and a manual flag which indicates problems with the meteorological gauge itself.

See Appendix 2 (CREX Bulletin Descriptions) for more detailed information on the format of the CREX routine ancillary bulletin and Appendix 5 (CREX Quality Control Identifiers) for more information about the meteorological quality control flags.

3.2 CREX Storm Surge Data Bulletins

CO-OPS generates CREX storm surge data bulletins every twenty minutes, at two minutes, twenty-two minutes, and forty-two minutes past the hour. These storm surge bulletins contain data reported from stations every eighteen minutes while in their "storm surge" transmission mode. If no station is in storm surge mode then no CREX storm surge data bulletins will be generated.

In order for a station to be placed in storm surge mode, the station must be capable of transmitting in storm surge mode and either: 1) a "storm event" must occur which will automatically cause the station to enter into its storm surge mode, based on station specific criteria, or; 2) CO-OPS personnel must manually place the station into storm surge mode.

- Automatic Activation

  For automatic activation, a "storm event" is defined as reaching a pre-determined critical water level height, typically a high or low value, or a pre-determined rate-of-change in the water level for east coast stations, or reaching a pre-determined critical water level height for west coast stations. If a west coast station exceeds a pre-determined rate-of-change in the water level, it is considered a "tsunami event" and the station is placed into "tsunami" reporting mode rather than "storm surge" reporting mode. Tsunami reporting is handled differently than storm surge reporting and is not addressed here. See Section 5.0 for information about tsunami reporting mode. The threshold values used to define a storm event are determined in conjunction with the individual NWS field offices in whose area of responsibility the station is located and their respective NWS Regional Headquarters. The NWS Office of Meteorology (OM) then provides these trigger values to NOS. When a storm event causes the station to switch to storm surge mode, 18-minute data transmissions continue until the values no longer exceed those limits coded into the station.

- Manual Activation

  A station may also be placed manually into storm surge reporting mode. To have a station turned on manually, the CO-OPS 24-hour Continuous Operational Realtime Monitoring System (CORMS) staff must be contacted at 301-713-2540. The person requesting the manual trigger will need to provide CORMS with their name, telephone number, the name of the office making the request, a list of the NOS Station IDs for which the storm surge mode should be set, and the length of time for which the station should remain in this state. When a station is turned on manually, the 18-minute data transmissions continue for the length of time requested. If no length of time is specified, the transmissions will continue for approximately 24 hours or until the storm surge mode is turned off manually, whichever occurs first.

There are two types of CREX storm surge bulletins that can be created: storm surge water level and storm surge ancillary.

3.2.1 CREX Storm Surge Water Level Data Bulletins

Each CREX storm surge water level bulletin contains the six-minute water level values reported from the most recent eighteen-minute station transmission. Tidal residuals which are calculated by subtracting predicted astronomical water level values from actual observed water level values are included in the bulletin except for the Great Lakes stations. Great Lakes stations do not have predictions; therefore, no residual values can be calculated. Also included in the bulletin are two quality control flags which represent the overall quality of the water level value(s) contained in the station transmission: an automatic flag which indicates if any water level tolerances have been exceeded; and a manual flag which indicates problems with the water level gauge itself, such as sensor problems or clogging. See Appendix 2 (CREX Bulletin Descriptions) for more detailed information on the format of the CREX storm surge water level bulletin and Appendix 5 (CREX Quality Control Identifiers) for more information about the water level quality control flags.

3.2.2 CREX Storm Surge Ancillary Data Bulletins

If meteorological data exists for a station, the appropriate CREX storm surge ancillary bulletin is generated at the same time that the CREX storm surge water level bulletin is generated. Currently, the meteorological data values that can be included in the bulletin are air temperature, barometric pressure (sea level), wind speed, and wind direction. Not all stations have all sensors, so it is possible to have ancillary bulletins that do not contain information for all of the given data types. Should a new type of meteorological sensor be installed at a station, the data collected from that sensor for the given station would be added to the bulletin. Each ancillary bulletin includes the first six-minute meteorological data value for each data type reported in the most recent eighteen-minute station transmission. Also included in the bulletin are two quality control flags which represent the overall quality of the meteorological value(s) contained in the station transmission: an automatic flag which indicates if any meteorological tolerances have been exceeded; and a manual flag which indicates problems with the meteorological gauge itself. See Appendix 2 (CREX Bulletin Descriptions) for more detailed information on the format of the CREX storm surge ancillary bulletin and Appendix 5 (CREX Quality Control Identifiers) for more information about the meteorological quality control flags.

4.0 SHEF BULLETINS

Upon receiving data, a CO-OPS workstation, running UNIX, performs outlier and rate-of-change quality checks on the data. Then, for a given list of stations provided by NWS, the data are formed into appropriate data bulletins for distribution to NWS. The data is arranged within bulletins according to the NWS-defined SHEF format definitions. Using FTP, the completed bulletins are transferred by NWS OSO from CO-OPS to the NWS Telecommunications Gateway for dispersal. See Appendix 1 (NWS Station List) for a list of stations for which SHEF bulletins are currently being generated.

Currently, two types of SHEF formatted bulletins are distributed to NWS: routine and predicted data.

4.1 SHEF Routine Data Bulletins

CO-OPS generates SHEF routine bulletins every ten minutes, at nine minutes, nineteen minutes, twenty-nine minutes, thirty-nine minutes, forty-nine minutes, and fifty-nine minutes past the hour. These routine bulletins contain data reported from stations while the stations are in their "routine" transmission mode. For some stations, "routine" transmission mode is every six minutes, for some it is every hour, for others it is every three hours. There are two types of SHEF routine bulletins that can be created: water level and ancillary.

4.1.1 SHEF Routine Water Level Data Bulletins

Each SHEF routine water level bulletin contains the six-minute observed water level values reported in a six-minute, one-hour, or three-hour station transmission. See Appendix 3 (SHEF Bulletin Descriptions) for more detailed information on the format of the SHEF routine water level bulletin.

4.1.2 SHEF Routine Ancillary Data Bulletins

If meteorological data exists for a station, the appropriate SHEF ancillary bulletin is generated at the same time that the SHEF routine water level bulletin is generated. Currently, the meteorological data values that can be included in the bulletin are air temperature, barometric pressure (sea level), wind speed, wind direction, wind gusts, water conductivity, and water temperature (sea surface). Not all stations have all sensors, so it is possible to have ancillary bulletins that do not contain information for all of the given data types. Should a new type of meteorological sensor be installed at a station, the data collected from that sensor for the given station would be added to the bulletin. Each ancillary bulletin includes the hourly meteorological data value for each data type from the most recent six-minute, one-hour, or three-hour station transmission. See Appendix 3 (SHEF Bulletin Descriptions) for more detailed information on the format of the SHEF routine ancillary bulletin.

4.2 SHEF Predicted Data Bulletins

CO-OPS generates SHEF predicted data bulletins once a day at twenty minutes after midnight (GMT). There is one type of SHEF predicted bulletin that can be created: water level.

4.2.1 SHEF Predicted Water Level Data Bulletins

A SHEF predicated water level data bulletin is generated for each NWS-defined region. See Appendix 4 for a list of these regions. Each bulletin contains ninety six hourly predicted water level values for each station within the given region, starting with the hourly value for midnight of the day the report is run and ending with the hourly value for 11:00 p.m, four days into the future from the day the report is run. Since Great Lakes stations do not have tides, no predicated water level values can be calculated for these stations. See Appendix 3 (SHEF Bulletin Descriptions) for more detailed information on the format of the SHEF predicted water level data bulletin.

5.0 SUPPORT TO THE TSUNAMI WARNING CENTERS

The NWS Tsunami Warning Program requires real-time access to water level data in the Pacific Ocean Basin. Currently, special arrangements have been made between CO-OPS and the Pacific Tsunami and Alaska Tsunami Warning Centers that allow the tsunami warning centers to directly download water level data for certain NWLON stations located in their areas of responsibility. In addition, the Pacific area stations are capable of being placed into "tsunami" reporting mode in order to track possible tsunami events.

Just as with storm surge, in order for a station to be placed in tsunami mode, the station must be capable of transmitting in tsunami mode and either: 1) a "tsunami event" must occur which will automatically cause the station to enter into its tsunami mode, based on station specific criteria, or; 2) CO-OPS personnel must manually place the station into tsunami mode.

- Automatic Activation

  For automatic activation, a "tsunami event" is defined as exceeding a pre-determined rate-of-change in the water level. When a tsunami event causes a station to switch to tsunami mode, 6-minute data transmissions continue until the values no longer exceed those limits coded into the station.

- Manual Activation

  A station may also be placed manually into tsunami reporting mode. To have a station turned on manually, the CO-OPS 24-hour Continuous Operational Realtime Monitoring System (CORMS) staff must be contacted at 301-713-2540. The person requesting the manual trigger will need to provide CORMS with their name, telephone number, the name of the office making the request, a list of the NOS Station IDs for which the tsunami mode should be set, and the length of time for which the station should remain in this state. When a station is set manually, the 6-minute data transmissions continue for the length of time requested. If no length of time is specified, the transmissions will continue for several hours or until the tsunami mode is turned off manually, whichever comes first.

The 6-minute tsunami transmissions are sent ***directly*** to the tsunami warning centers in a raw format for evaluation. The data is not processed by CO-OPS. **No CREX or SHEF bulletins are generated.**

6.0 PORTS® VOICE SYSTEM

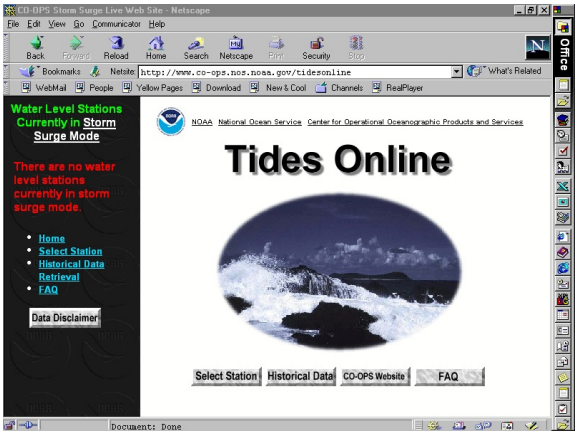
Each PORTS® system disseminates observations through a voice data product available via a dial-up touch tone phone which speaks the latest real-time observations. The voice system allows the user to choose what data to hear by providing a menu from which the user selects by pressing the appropriate touch tone keys on the phone. If the user wants to hear all the information, about three minutes expire while navigating through the entire menu. The voice quality is like that of a recorded magnetic tape. The voice system information is available 24 hours a day, seven days a week. Phone numbers associated with the voice system at each PORTS® site are available through the CO-OPS PORTS® Web Page by connecting to **ports.noaa.gov** and selecting the desired site.

7.0 CO-OPS WEB-ACCESSIBLE PRODUCTS

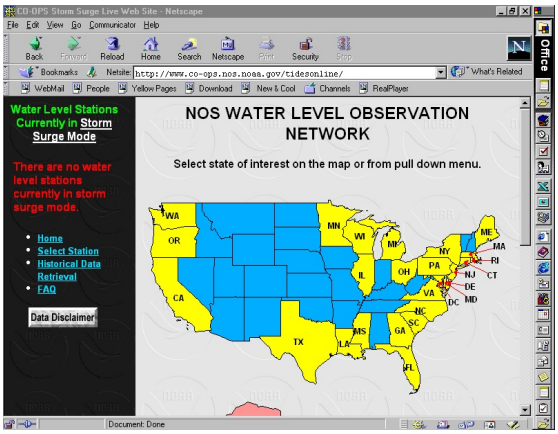
7.1 Tides Online

Tides Online is a CO-OPS Web-based product which provides users with the latest graphical and tabular water level and meteorological data for all NOS water level stations. For those stations activated, manually or automatically, for storm surge transmission rates, the Tides Online product isolates their selection for convenient interactive display. These activated stations are typically located along the projected path of severe storms such as hurricanes.

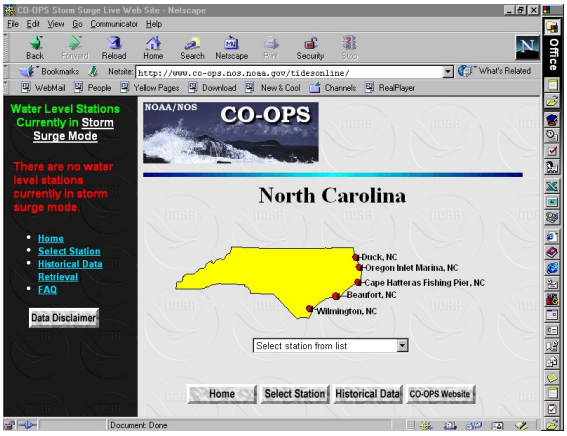
Tides Online can be accessed through the CO-OPS's Tides OnlineWeb Page by connecting to **tidesonline.nos.noaa.gov**. Some example screens for navigating from the Tides Online main page to data for Wilmington, North Carolina are shown in Figure 3.



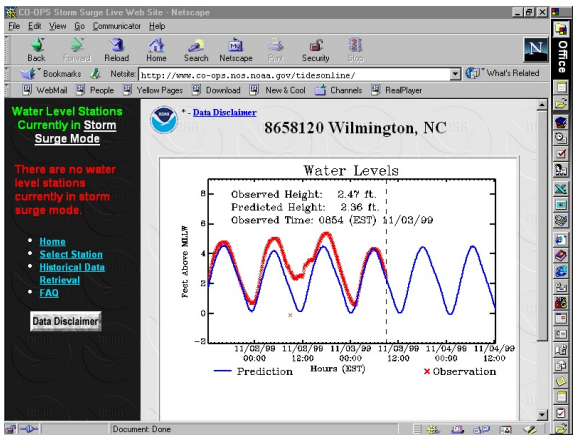
3a.



3b.



3c.



3d.

TIDES ONLINE

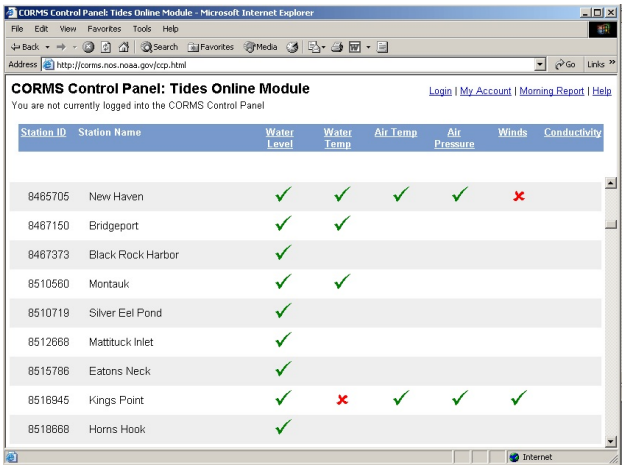
FIGURE 3

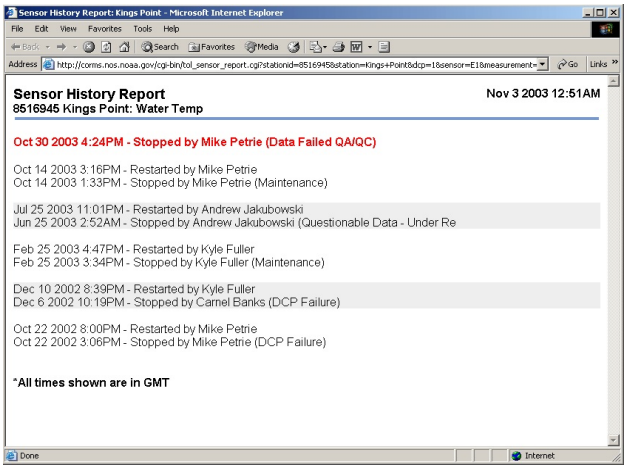
7.2 Station Status Report

CO-OPS generates a report which provides a convenient way to check on the status of the sensors configured at each of the NWLON stations. The purpose of this report is to provide information on stations that are not, for some reason, transmitting data via GOES; that are experiencing sensor problems and have had data dissemination to external users discontinued; that are scheduled for maintenance; or other events that temporarily or permanently have an impact on the operation of the station.

The report is periodically updated by the CORMS operator on duty. If a user suspects that the report does not reflect present situations or conditions, they can call (301) 713-2540, twenty-four hours a day, to get the most up-to-date information.

The report can be accessed through the CO-OPS's CORMS Web Page by connecting to **corms.nos.noaa.gov/ccp.html.** Upon being presented with the list of stations, a green check mark means there is a sensor of the given type attached to the specified station, and it is currently providing data. A red cross mark means there is a sensor of the given type attached to the specified station, but it is not currently providing data. If there is neither a green check mark nor a red cross mark for a given sensor at a given station, it means there is no sensor of that type installed at that particular station. In Figure 4a, the screen indicates that the station at Kings Point has sensors which measure water level, water temperature, air temperature, air pressure, and wind; there is no conductivity sensor installed at Kings Point; and all but the water temperature sensor are currently providing data. To see detailed information about the operation of a given sensor, simply right-click your mouse over the green or red mark for that sensor and you will receive a report in a separate window. Figure 4b is an example of such a report for the water temperature sensor at Kings Point.





4a 4b

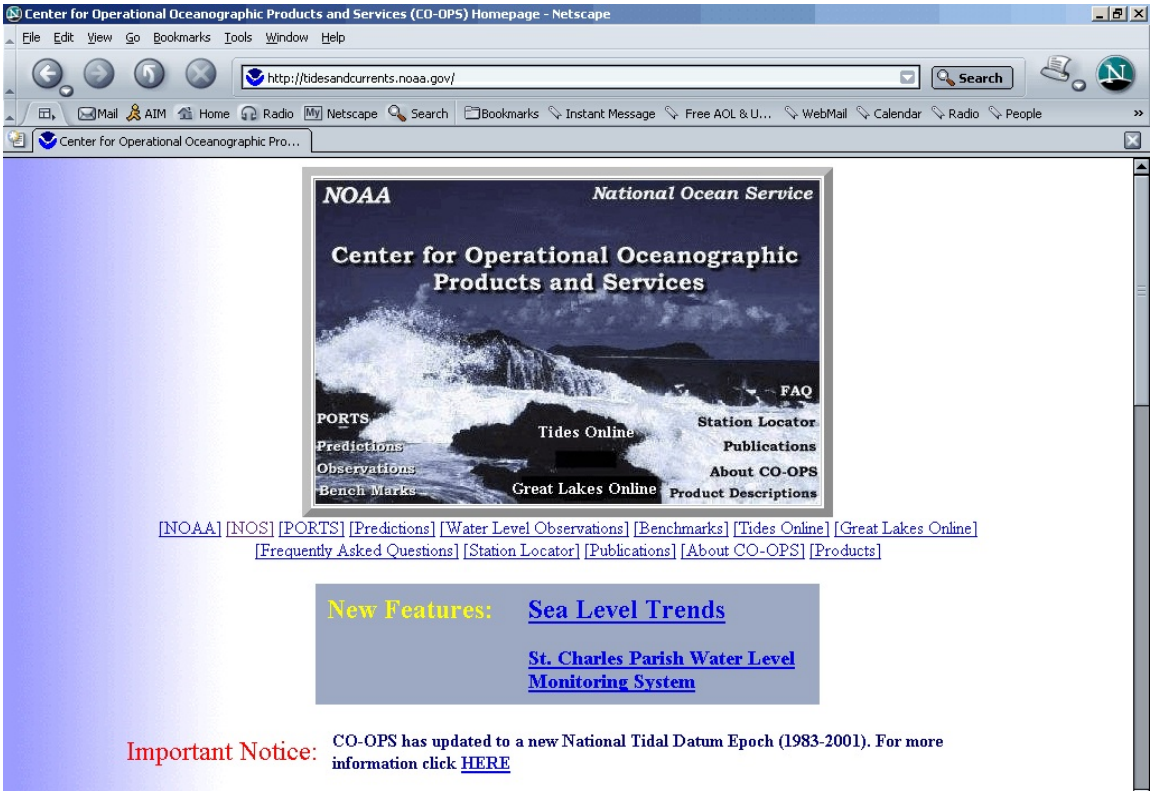
Station Status Report

FIGURE 4

7.3 Retrieval of Historical Data

CO-OPS maintains a web site that provides users with direct access to the database which stores all data collected through the NWLON. Through an interface to this database, users can access real-time and near-real time water level and ancillary meteorological and oceanographic data from the various stations. In addition, users have access to historic 6-minute, hourly, monthly, and annual water level data, six months of tide predictions, and tidal datum information. Users can access and download bench mark descriptions and elevations. The site provides inventory lists of stations for which different types of data are available, as well.

The CO-OPS web site can be accessed by connecting to **tidesandcurrents.noaa.gov**. The home page for CO-OPS is shown in Figure 5.

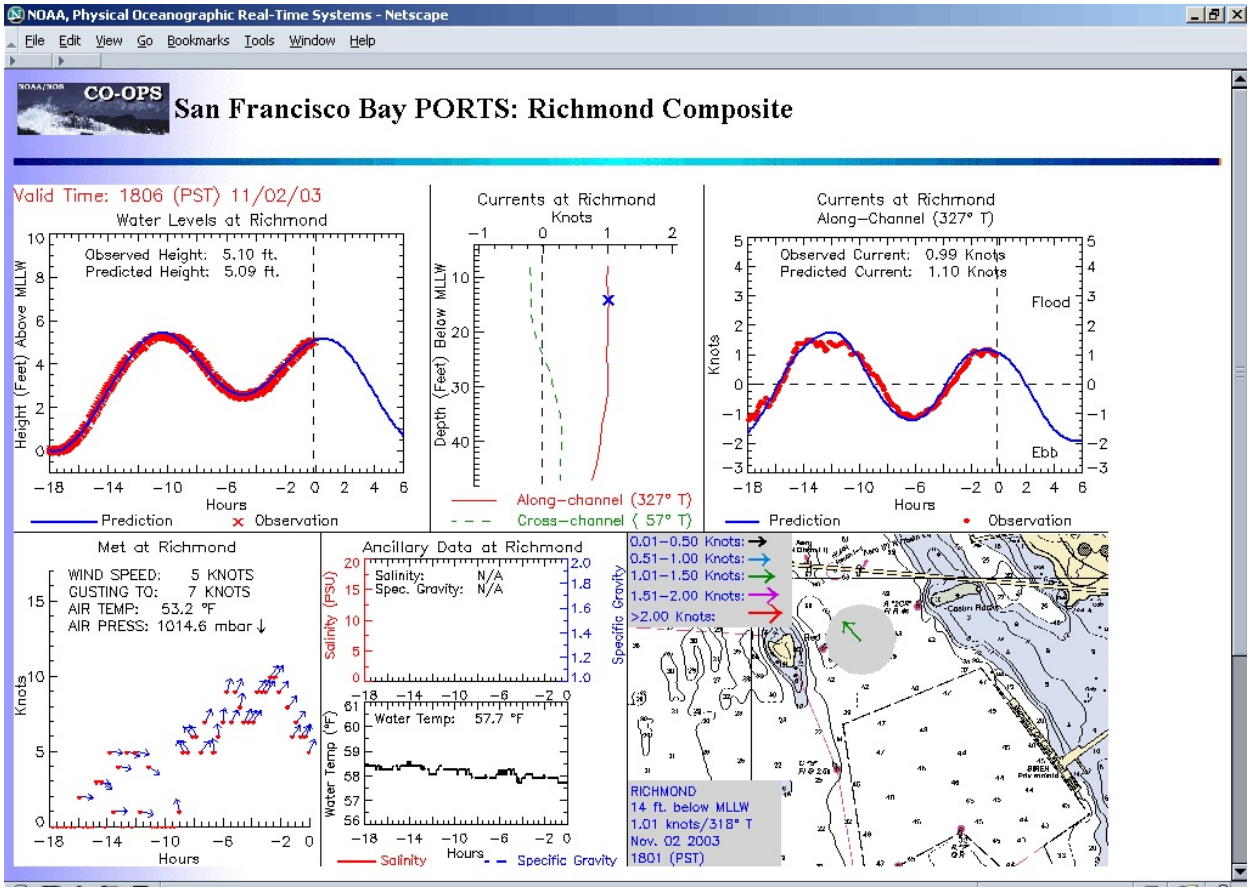


CO-OPS Home Page

Figure 5

7.4 PORTS® PICS

PORTS® provides real time currents, water levels, and meteorological data every six minutes. The PORTS® PICS provides a graphical representation of all these real-time PORTS® observations as well as predictions. Displays that are offered include time series plots for water level data, current data, wind speed and direction, salinity, water temperature, and specific gravity. The time series for water level and current data includes observed and predicted data for 18 hours in the past and predicted data for 6 hours in the future from the given time stamp for the most recent 6-minute sampling. The remaining time series include observed data for 18 hours in the past. Other displays provide a vertical profile for current data and a vector plot for current data with a cartographic background. A user can gain access to a PICS display through the web by connecting to **ports.noaa.gov**, selecting the desired site, and selecting to view PORTS® data products. A sample of a composite of these various displays for Richmond in San Francisco Bay is shown in Figure 6.

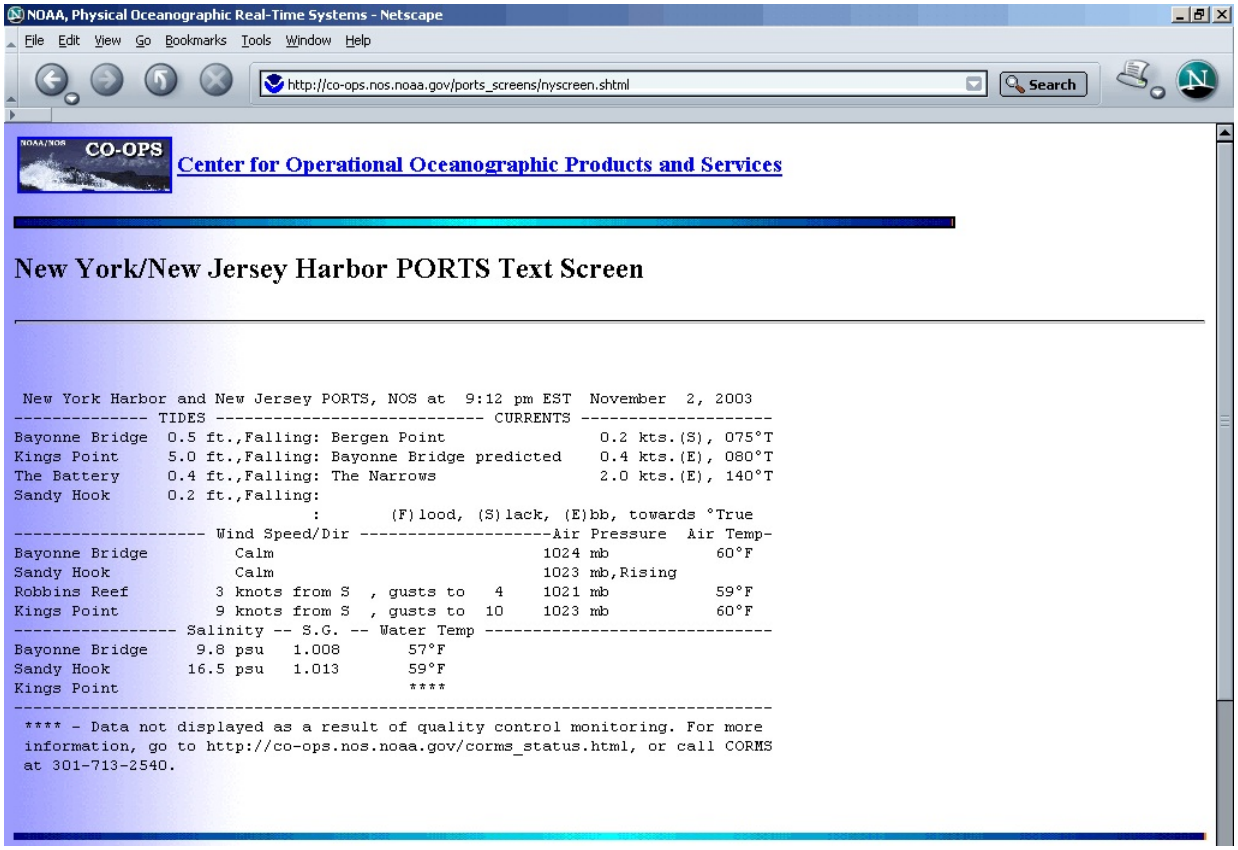


PICS Display for Richmond at San Francisco Bay PORTS®

Figure 6

7.5 PORTS® Text Screen

Another product provided by PORTS® is a text-based real-time data display which shows the latest instrument measurements from the most recent 6-minute sampling for all sensor locations at a single PORTS® site. It is a single screen, 22 line message. Access to this screen is provided through the web by connecting to **ports.noaa.gov**, selecting the desired site, and selecting to view the text-based PORTS® screen. A sample of this screen for New York Harbor is shown in Figure 7.



Text Screen for New York PORTS®

Figure 7

8.0 REPORTING PROBLEMS AND REQUESTING CHANGES TO NOS PRODUCTS

It is expected that from time to time there may be questions regarding the operation of these various products or suggestions for improvement. There may also be questions concerning data quality that may not be sufficiently addressed through the NOS Station Status Report. Field offices should work through their Regional Marine Focal Points with these questions or suggestions. The Regional offices will contact the Office of Meteorology (OM).

Similarly, there may be sites where the trigger levels for the storm surge/tsunami data need to be adjusted. Proposed changes should also filter through the Regional Marine Focal Points as described above. This will ensure that all changes are fully considered and coordinated prior to their implementation.

The OM Focal Point for these NOS products is Richard May. He will determine if the problem or suggestion is best addressed within the NWS or the NOS and make appropriate contacts or assignments. He can be reached by telephone at (301) 713-1677, extension 127, by fax at (301) 713-1598, or by e-mail at Richard.May@noaa.gov.

APPENDIX 1

NWS STATION LIST

Below is a listing of the stations for which data is currently being reported to NWS. Both the NOS and NWS station identification numbers are given, along with the common station name, and its latitude and longitude. NOS station identifiers have been assigned by NOS, using a two-digit number for each state followed by five digits for the number assigned to that station in that state. NWS CREX station identifiers have been assigned by NWS, using the two-letter abbreviation for each state followed by three digits for the number assigned to that station in that state. The NWS CREX IDs are generally in increments of ten from north to south, or east to west as appropriate, allowing for additional stations to be added in the future and using the intermediary numbers. The NWS SHEF station identifiers are assigned by NWS and are a unique identifier that can be three through eight alphanumeric characters in length.

Latitudes and longitudes are presented in degrees, minutes, and tenths of minutes.

If the station is equipped to report meteorological data, the data type(s) it is able to report are annotated as follows: "AT" for air temperature; "BP" for barometric pressure; and "W" for wind speed and direction; "WT" for water temperature; and "WC" for water conductivity.

To see any changes made to this listing between revision releases of this document, connect to **co-ops.nos.noaa.gov/nwsproducts.html**.

NOS ID	CREX ID	SHEF ID	LAT	LON	LOCATION	MET DATA
1611400	HI010		21 57.4 N	159 21.6 W	Nawiliwili, HI	WT
1612340	HI020	OOUH1	21 18.4 N	157 52.0 W	Honolulu, HI	AT,BP, WT
1612480	HI030		21 26.2 N	157 47.6 W	Mokuoloe, HI	WT
1615680	HI040	KLIH1	20 53.9 N	156 28.3 W	Kahului, HI	WT
1617433		KWHH1	20 2.4 N	155 49.9 W	Kawaihae, HI	AT,BP,W,WT
1617760	HI050		19 43.8 N	155 3.4 W	Hilo, HI	WT
1619910	HI070		27 12.7 N	177 21.6 W	Sand Islands, Midway Islands	BP,WT
1630000	HI080		13 26.5 N	144 39.2 E	Guam	AT,BP,W,WT
1820000	HI090		8 44.2 N	167 44.3 E	Kwajalein, Marshall Islands	AT,BP,W,WT
1890000	HI100		19 17.4 N	166 37.1 E	Wake Island	BP,WT
8311030	NY034		44 42.2 N	75 29.7 W	Ogdensburg, NY	WT
8311062	NY036		44 19.9 N	75 56.1 W	Alexandria Bay, NY	

NOS ID	CREX ID	SHEF ID	LAT	LON	LOCATION	MET DATA
8410140	ME010	PSBM1	44 54.2 N	66 59.1 W	Eastport, ME	AT,BP,W,WT
8411250	ME012		44 38.5 N	67 17.8 W	Cutler Naval Base, ME	WT
8413320	ME014		44 23.5 N	68 12.3 W	Bar Harbor, ME	WT
8418150	ME020	CASM1	43 39.4 N	70 14.8 W	Portland, ME	WT
8443970	MA010	BHBM3	42 21.3 N	71 3.1 W	Boston, MA	WT
8447386	MA012	FRVM3	41 42.3 N	71 9.8 W	Fall River, MA	AT,BP,WT,WC
8447387	MA013	BLTM3	41 42.3 N	71 10.4 W	Borden Flats Light at Fall River, MA	W
8447930	MA015	BZBM3	41 31.4 N	70 40.3 W	Woods Hole, MA	WT
8449130	MA020	NTKM3	41 17.1 N	70 5.8 W	Nantucket Island, MA	WT
8452660	RI010	NWPR1	41 30.3 N	71 19.6 W	Newport, RI	AT,BP,W,WT, WC
8452944	RI012	CPTR1	41 43.0 N	71 20.6 W	Conimicut Light, RI	AT,BP,W,WT
8452951	RI013	PTCR1	41 38.1 N	71 20.4 W	Potter Cove, Prudence Island, RI	AT,BP,W
8454000	RI015	FOXR1	41 48.4 N	71 24.1 W	Providence, RI	AT,BP,W,WT, WC
8454049	RI016	QPTR1	41 35.1 N	71 24.5 W	Quonset Point, RI	AT,BP,W,WT, WC
8461490	CT010	NLNC3	41 21.3 N	72 5.2 W	New London, CT	WT
8465705	CT015	NWHC3	41 17.0 N	72 54.5 W	New Haven, CT	AT,BP,W,WT
8467150	CT020	BRHC3	41 10.4 N	73 10.9 W	Bridgeport, CT	WT
8510560	NY010	MTKN6	41 2.9 N	71 57.6 W	Montauk, NY	WT
8516945	NY015	KPTN6	40 48.6 N	73 45.9 W	Kings Point, NY	AT,BP,W,WT
8518750	NY030	BATN6	40 42.0 N	74 0.9 W	The Battery, NY	WT
8519483	NY033	BGNN4	40 38.4 N	74 8.8 W	Bergen Point West Reach, NY	AT,BP,W,WT, WC
8531680	NJ010	SDHN4	40 28.0 N	74 0.6 W	Sandy Hook, NJ	BP,W,WT,WC
8534720	NJ015	ACYN4	39 21.3 N	74 25.1 W	Atlantic City, NJ	WT
8536110	NJ020	CMAN4	38 58.1 N	74 57.6 W	Cape May, NY	AT,BP,W,WT
8545240	PA010	PHBP1	39 56.0 N	75 8.5 W	Philadelphia, Pa	AT,BP,W,WT
8548989	NBLP1		40 8.2 N	74 45.1 W	Newbold, PA	AT,W,WT
8551762	DELD1		39 34.9 N	75 35.4 W	Delaware City, DE	AT,BP,W,WT

NOS ID	CREX ID	SHEF ID	LAT	LON	LOCATION	MET DATA
8551910	DE010	RDYD1	39 33.5 N	75 34.4 W	Reedy Point, DE	WT
8557380	DE020	LWSD1	38 46.9 N	75 7.2 W	Lewes, DE	AT,BP,W,WT
8571892	MD025	CAMM2	38 34.4 N	76 4.1 W	Cambridge, MD	AT,BP,W,WT
8573364	MD015	TCBM2	39 12.8 N	76 14.7 W	Tolchester Beach, MD	AT,BP,W,WT
8574680	MD010	BLTM2	39 16.0 N	76 34.7 W	Baltimore, MD	WT,WC
8575512	MD020	APAM2	38 59.0 N	76 28.8 W	Annapolis, Md	
8577330	MD030	SLIM2	38 19.0 N	76 27.1 W	Solomons Island, MD	AT,BP,W,WT
8594900	DC010	WASD2	38 52.4 N	77 1.3 W	Washington, DC	WT
8631044	VA010	WAHV2	37 36.4 N	75 41.2 W	Wachapreague, VA	BP,WT
8632200	VA020	KPTV2	37 10.0 N	75 59.3 W	Kiptopeke, VA	W,WT
8632837	VA025	RPLV2	37 32.3 N	76 0.9 W	Rappahannock Light, VA	BP,W
8635750	VA040	LWTV2	37 59.7 N	76 27.9 W	Lewisetta, VA	AT,BP,W,WT
8636580	VA0456	WNDV2	37 36.9 N	76 17.6 W	Windmill Point, VA	WT
8638610	VA070	SWPV2	36 57.3 N	76 19.9 W	Sewells Point, VA	AT,BP,W,WT, WC
8638863	VA060	CBBV2	36 58.0 N	76 6.8 W	Chesapeake Bay Bridge Tunnel, VA	AT,BP,W,WT, WC
8638979	VA061	CHLV2	36 54.3 N	75 41.8 W	Chesapeake Light, VA	W
8639348	VA062	MNPV2	36 46.7 N	76 18.1 W	Money Point, VA	AT,W,WT,WC
8651370	NC010	DUKN7	36 11.0 N	75 44.8 W	Duck, NC	AT,BP,W,WT
8652587	NC015	ORIN7	35 47.8 N	75 33.0 W	Oregon Inlet Marina, NC	WT
8654400	NC020	CFPN7	35 13.4 N	75 38.1 W	Cape Hatteras Fishing Pier, NC	AT,BP,W,WT
8656483	NC030	BFTN7	34 43.2 N	76 40.2 W	Beaufort, NC	WT
8658120	NC040		34 13.6 N	77 57.2 W	Wilmington, NC	WT
8661070	SC010	MROS1	33 39.3 N	78 55.1 W	Springmaid Pier, SC	AT,BP,W,WT
8665530	SC020		32 46.9 N	79 55.5 W	Charleston, SC	WT,WC
8670870		FPKG1	32 02.0 N	80.54.1 W	Fort Pulaski, GA	W,AT,WT
8677344	GA020		31 7.9 N	81 23.8 W	St. Simons Lighthouse, GA	
8720030	FL005	FRDF1	30 40.3 N	81 27.9 W	Fernandina Beach, FL	AT,BP,W,WT

NOS ID	CREX ID	SHEF ID	LAT	LON	LOCATION	MET DATA
8720218	FL010	MYPF1	30 23.8 N	81 25.8 W	Mayport (Bar Pilots Dock), FL	AT,BP,W,WT, WC
8720587	FL020		29 51.4 N	81 15.8 W	St. Augustine Beach, FL	AT,BP,W,WT
8721604	FL025	TRDF1	28 24.9 N	80 35.6 W	Trident Pier, FL	AT,BP,W,WT
8723214	FL040	VAKF1	24 43.9 N	80 9.7 W	Virginia Key, FL	AT,BP,W,WT, WC
8723970	FL050	VCAF1	24 42.7 N	81 63. W	Vaca Key, FL	AT,BP,W,WT
8724580	FL060	KYWF1	24 33.2 N	81 48.5 W	Key West, FL	AT,BP,W,WT
8725110	FL070	NPSF1	26 7.8 N	81 48.4 W	Naples, FL	AT,BP,W,WT
8725520	FL065	FMRF1	26 38.8 N	81 52.3 W	Fort Myers, FL	AT,BP,W,WT
8726520	FL080	SAPF1	27 45.6 N	82 37.6 W	St. Petersburg, FL	AT,BP,W,WT
8726724	FL085	CWBF1	27 58.6 N	82 49.9 W	Clearwater Beach, FL	AT,BP,W,WT
8727520	FL087	CKYF1	29 8.1 N	83 1.9 W	Cedar Key, FL	AT,BP,W,WT
8728690	FL090	APCF1	29 43.6 N	84 58.9 W	Apalachicola, FL	AT,BP,W,WT
8729108	FL097		30 9.1 N	85 40.0 W	Panama City, FL	WT
8729210	FL100	PCBF1	30 12.8 N	85 52.8 W	Panama City Beach, FL	AT,BP,W,WT
8729840	FL110	PCLF1	30 24.2 N	87 12.7 W	Pensacola, FL	AT,BP,W,WT
8735180	AL020		30 15.0 N	88 4.5 W	Dauphin Island, AL	AT,BP,W,WT
8747766	MS100	WAVM6	30 16.9 N	89 22.0 W	Waveland, MS	AT,BP,W,WT
8761724	LA020	GISL1	29 15.8 N	89 57.4 W	Grand Isle, LA	AT,BP,W,WT
8770570	TX010	SBPT2	29 43.8 N	93 52.2 W	Sabine Pass North, TX	AT,BP,WT
8770613	TX036	MGPT2	29 40.6 N	94 59.1 W	Morgans Point, TX	AT,BP,W,WT, WC
8770777	TX035		29 43.1 N	95.15.1 W	Manchester,TX	WT
8771013	TX033	EPTT2	29 28.8 N	94 55.1 W	Eagle Point, TX	AT,BP,W,WT
8771450	TX020	GTOT2	29 18.8 N	94 47.6 W	Galveston Pier 21, TX	AT,BP,WT
8771510	TX030	GPST2	29 17.1 N	94 47.3 W	Galveston Pleasure Pier, TX	AT,BP,W,WT
8772440	TX040		28 56.9 N	95 18.5 W	Freeport, TX	W,WT
8774770	TX050		28 1.3 N	97 2.8 W	Rockport, TX	WT
8775870	TX060	MQTT2	27 34.8 N	97 13.0 W	Corpus Christi, TX	AT,W,WT
8779770	TX080	PTIT2	26 3.7 N	97 12.8 W	Port Isabel, TX	AT,BP,W,WT

NOS ID	CREX ID	SHEF ID	LAT	LON	LOCATION	MET DATA
9014070	MI240		42 37.2 N	82 31.6 W	Algonac, MI	
9014080	MI250		42 48.8 N	82 29.2 W	St. Clair State Police, MI	
9014087	MI260		42 56.7 N	82 26.6 W	Dry Dock, MI	
9014090	MI255		42 58.4 N	82 25.2 W	Mouth of the Black River, MI	
9014096	MI256		43 0.2 N	82 25.3 W	Dunn Paper, MI	
9014098	MI245	FTGM4	43 0.4 N	82 25.5 W	Fort Gratiot, MI	BP
9034052	MI230		42 28.4 N	82 52.8 W	St. Clair Shores, MI	
9044020	MI200		42 5.5 N	83 11.2 W	Gibraltar, MI	
9044030	MI210		42 12.2 N	83 8.8 W	Wyandotte, MI	
9044036	MI220		42 17.9 N	83 5.6 W	Fort Wayne, MI	
9044049	MI221		42 21.5 N	82 55.8 W	Windmill Point, MI	
9052000	NY038		44 7.8 N	76 20.2 W	Cape Vincent, NY	
9052030	NY040	OSGN6	43 27.8 N	76 30.7 W	Oswego, NY	AT,W,WT
9052058	NY041		43 16.2 N	77 37.6 W	Rochester, NY	
9052076	NY042		43 20.3 N	78 43.6 W	Olcott, NY	
9063007	NY043		43 6.0 N	79 3.6 W	Ashland Ave., NY	
9063009	NY046		43 4.9 N	79 3.7 W	American Falls, NY	
9063020	NY050	BUFN6	42 52.6 N	78 53.4 W	Buffalo, NY	AT,BP,W,WT
9063028	NY060		42 41.4 N	79 2.9 W	Sturgeon Point, NY	
9063038	PA012		42 9.2 N	80 4.5 W	Erie, PA	
9063053	OH010		41 45.0 N	81 17.0 W	Fairport, OH	
9063063	OH020		41 32.4 N	81 38.1 W	Cleveland, OH	
9063079	OH025		41 32.7 N	82 43.9 W	Marblehead, OH	
9063085	OH030		41 41.6 N	83 28.3 W	Toledo, OH	
9063090	MI010		41 57.6 N	83 15.5 W	Fermi Power Plant, MI	
9075002	MI257		43 8.5 N	82 29.6 W	Lakeport, MI	
9075014	MI013	HRBM4	43 50.8 N	82 38.6 W	Harbor Beach, MI	AT,BP,W,WT
9075035	MI016		43 38.5 N	83 50.8 W	Essexville, MI	
975059	MI270		44 39.6 N	83 17.2 W	Harrisville, MI	

NOS ID	CREX ID	SHEF ID	LAT	LON	LOCATION	MET DATA
9075080	MI019		45 46.7 N	84 43.2 W	Mackinaw City, MI	
9075099	MI100	DTLM4	45 59.5 N	83 53.8 W	De Tour Village, MI	AT,BP,W,WT
9076024		RCKM4	46 15.9 N	84 11.5 W	Rock Cut, MI	AT,BP,W,WT
9076060	MI110		46 30.0 N	84 20.4 W	U.S. Slip, MI	
9076070	MI120	SWPM4	46 30.1 N	84 22.4 W	S.W. Pier, MI	AT,BP,W,WT
9087023	MI025	LDTM4	43 56.8 N	86 26.5 W	Ludington, MI	AT,BP,W,WT
9087031	MI290		42 46.1 N	86 12.1 W	Holland, MI	
9087044	IL010	CMTI2	41 43.8 N	87 32.3 W	Calumet Harbor, IL	AT,BP,W,WT
9087057	WI010		43 0.1 N	87 53.2 W	Milwaukee, WI	
9087068	WIO15		44 27.8 N	87 30.0 W	Kewaunee, WI	
9087072	WI020		44 47.7 N	87 18.8 W	Sturgeon Bay Canal, WI	
9087079	WI040		44 32.4 N	88 0.5 W	Green Bay, WI	
9087096	MI020		45 58.3 N	85 52.3 W	Port Inland, MI	
9099004	MI130	PTIM4	46 29.1 N	84 37.9 W	Point Iroquois, MI	AT,BP,W,WT
9099018	MI140	MCGM4	46 32.7 N	87 22.7 W	Marquette C.G., MI	AT,BP,W,WT
9099044	MI145		46 52.7 N	89 19.3 W	Onotonagon, MI	
9099064	MN100	DULM5	46 46.5 N	92 5.6 W	Duluth, MN	AT,BP,W,WT
9099090	MN110	GDMM5	47 44.9 N	90 20.5 W	Grand Marais, MN	AT,BP,WT
9410170	CA010	SDBC1	32 42.8 N	117 10.4 W	San Diego, CA	WT
9410230	CA020	LJAC1	32 52.0 N	117 15.5 W	La Jolla, CA	WT
9410660	CA030	OHBC1	33 43.2 N	118 16.3 W	Los Angeles, CA	BP,WT
9410840	CA040	SMOC1	34 0.5 N	118 30.0 W	Santa Monica, CA	WT
9412110	CA060	PSLC1	35 10.6 N	120 45.6 W	Port San Luis, CA	WT
9413450	CA070	MTYC1	36 36.3 N	121 53.3 W	Monterey, CA	WT
9414290	CA080	FTPC1	37 48.4 N	122 27.9 W	San Francisco, CA	AT,BP,W,WT
9414523	CA075	RTYC1	37 30.4 N	122 12.6 W	Redwood City, CA	AT,BP,W,WT
9414750	CA085	AAMC1	37 46.3 N	122 17.9 W	Alameda, CA	AT,BP,W,WT, WC
9414863	CA087	RCMC1	37 55.7 N	122 24.0 W	Richmond, CA	AT,BP,W,WT, WC
9415020	CA090	PRYC1	37 59.8 N	122 58.5 W	Point Reyes, CA	WT

NOS ID	CREX ID	SHEF ID	LAT	LON	LOCATION	MET DATA
9415144	CA100	PCOC1	38 3.4 N	122 2.3 W	Port Chicago, CA	AT,BP,W,WT
9416841	CA110	ANVC1	38 54.8 N	123 42.5 W	Arena Cove, CA	AT,BP,W,WT
9418767	CA120	HBYC1	40 46.0 N	124 13.0 W	North Spit, CA	WT
9419750	CA130	CECC1	41 44.7 N	124 11.0 W	Crescent City, CA	WT
9431647	OR010	PORO3	42 44.4 N	124 29.8 W	Port Orford, OR	AT,BP,W,WT
9432780	OR020	CHAO3	43 20.7 N	124 19.3 W	Charleston, OR	WT
9435380	OR030	SBEO3	44 37.5 N	124 2.6 W	South Beach, OR	AT,BP,W,WT
9439040	OR040	ASTO3	46 12.5 N	123 46.0 W	Astoria, OR	WT
9440910	WA010	TOKW1	46 42.5 N	123 57.9 W	Toke Point, WA	AT,BP,W,WT
9443090	WA020	NEAW1	48 22.1 N	124 37.0 W	Neah Bay, WA	WT
9444090	WA030	PTAW1	48 7.5 N	123 26.4 W	Port Angeles, WA	WT
9444900	WA040	PTWW1	48 6.9 N	122 45.5 W	Port Townsend, WA	WT
9446484	WWA045	TCNW1	47 16.0 N	122 24.8 W	Tacoma, WA	BP,W,WT
9447130	WA050	EBSW1	47 36.3 N	122 20.3 W	Seattle, WA	AT.BP,W,WT
9449424	WA060	CHYW1	48 51.8 N	122 45.5 W	Cherry Point, WA	WT
9449880	WA070	FRDW1	48 32.8 N	123 0.6 W	Friday Harbor, WA	WT
9450460	AK010		55 20.0 N	131 37.5 W	Ketchikan, AK	WT
9451600	AK020		57 3.1 N	135 20.5 W	Sitka, AK	WT
9452210	AK030		58 17.9 N	134 24.7 W	Juneau, AK	WT
9452400	AK035	SKTA2	59 27.0 N	135 19.5 W	Skagway, AK	
9453220	AK040		59 32.9 N	139 44.0 W	Yakutat, AK	WT
9454050	AK050		60 33.5 N	145 45.2 W	Cordova, AK	WT
9454240	AK060		61 7.5 N	146 21.7 W	Valdez, AK	WT
9455090	AK070		60 7.2 N	149 25.6 W	Seward, AK	WT
9455500	AK080		59 26.4 N	151 43.2 W	Seldovia, AK	WT
9455760	AK084	NKTA2	60 41.0 N	151 23.8 W	Nikiski, AK	AT,BP,W,WT
9455920	AK085	ANTA2	61 14.3 N	149 53.4 W	Anchorage, AK	AT,BP,W,WT
9457292	AK090		57 43.9 N	152.30.7 W	Kodiak Island, AK	WT
9459450	AK100		55 20.0 N	160 30.1 W	Sand Point, AK	WT
9461380	AK110	ADKA2	51 51.8 N	176 37.9 W	Adak Island, AK	AT,BP,W,WT

NOS ID	CREX ID	SHEF ID	LAT	LON	LOCATION	MET DATA
9462620	AK120		53 52.8 N	166 32.2 W	Unalaska, AK	WT
9468756	AK150	NMTA2	64 30.0 N	165 25.8 W	Nome, Norton Sound, AK	AT,BP,W,WT
9497645	AK130	PRDA2	70 23.3 N	148 30.6 W	Prudhoe Bay, AK	AT,BP,W,WT
9751401	PR040	LBTV3	17 41.8 N	64 45.2 W	Lime Tree Bay, VI	AT,BP,W,WT
9751639	PR030	CHAV3	18 20.2 N	64 55.2 W	Charlotte Amalie, VI	AT,BP,W,WT
9755371	PR010	SJNP4	18 27.7 N	66 7.0 W	San Juan, PR	AT,BP,W,WT
9759110	PR020	MGIP4	17 58.3 N	67 2.8 W	Magueyes Island, PR	AT,BP,W,WT

APPENDIX 2

CREX BULLETIN DESCRIPTIONS

One of the formats used for the relay of NOS data to NWS is called CREX (Character Form for the Representation and EXchange of data). A formal description of CREX code is available from NWS. The following descriptions apply only to the formats being used by CO-OPS for providing data to NWS.

Routine Water Level Bulletin

The following is a detailed explanation of a routine water level CREX bulletin. Throughout the bulletin one or more slashes (///) indicate that a value was not available, each subset (a report) ends with the terminator (+) and two plus signs (++) indicate the end of a section. A routine water level bulletin contains 30-minute water level values.

```
SOUS52 KWBC 021659
CREX++
T000101 A001 D06022++
MA015 2003 11 02 16 00 5222 00 00 0030 -30
00159 0045 00118 0035 00109 0057 ///// //// ///// ////+
RI015 2003 11 02 16 00 4632 00 00 0030 -30
00199 0063 00248 0085 00240 0043 00315 0084 00340 0078++
7777
```

The first line of each bulletin is a WMO header. **SOUS52 KWBC** identifies the WMO region in which the data was collected. The region specified here is the Atlantic Coast. See Appendix 4 (CREX and SHEF Geographic Identifiers) for a list of all the region identifiers. **021659** specifies, in GMT, the day, hour, and minute the bulletin was created. In this case, the bulletin was created on day 02, at hour 16, and minute 59.

The second line of each bulletin indicates the bulletin is of type **CREX**. On the third line of each bulletin, **T000101** indicates that it is from the CREX master table number 00, using edition 01 and version 01 of that edition. **A001** indicates the bulletin contains sea surface information. **D06022** indicates the bulletin contains water level data.

The fourth and fifth lines of this bulletin are specific to the station for which data is being reported. One line is station header information and the other line contains the actual data. These two lines will be repeated for each station for which data exists.

In the station header record, the NWS Station Identifier is given which in this case is **MA015**, the identifier for Woods Hole, Massachusetts. **2003 11 02 16 00** (year/month/day/hour/minute) is the initial time that is to be used to calculate the measurement times for the 30-minute water level values contained in the bulletin for the given station. If the data is from a Great Lakes station, this time is local standard time. For all other stations, the time is GMT. **5222** is the sea surface temperature in degrees kelvin to tenths. **00 00** are the two numeric flags which indicate the overall quality of the data. The first set of numbers is the automatic flag and indicates the

quality of the data. The second set of numbers is the manual flag and indicates the quality of the water level gauge. In this example, the first **00** indicates that the quality of the data is good and the second **00** indicates that the gauge is operational. See Appendix 5 (CREX Quality Control Identifiers) for a list of all flags. **0030** indicates the number of minutes that are to be added to the initial time, referred to earlier, to calculate the measurement time for the first and most recent 30-minute water level value for the given station. **-30** indicates the time increment between measurements. How to use this information to determine the time of each measurement is discussed in the next paragraph.

In a routine water level bulletin, a data record contains six water level values along with an associated residual value for each. The values are reported in millimeters. In this example, **00159, 00118**, and **00109** are the water level values. **0045, 0035**, and **0057** are the associated residual values. To determine the time of each measurement, start with the time provided in the station header record which in this case is **2003 11 02 16 00**. The station header record indicates **30** minutes need to be added to **2003 11 02 16 00** to calculate the measurement time for the first and most recent water level value. Then **-30** minutes are to be applied to determine each succeeding measurement time. This means, in keeping with the given example:

00159	was measured at	**2003 11 02 16:30 GMT**
00118	was measured at	**2003 11 02 16:00 GMT**
00109	was measured at	**2003 11 02 15:30 GMT**

The last line of each bulletin will be **7777** to indicate the end of the bulletin.

Routine Ancillary Data Bulletin

The following is a detailed explanation of the routine meteorological CREX bulletin. Throughout the bulletin, one or more slashes (///) indicate that a value was not available, each subset (a report) ends with the terminator (+) and two plus signs (++) indicate the end of a section. A routine meteorological bulletin contains hourly meteorological values.

```
SOUS54 KWBC 021459
CREX++
T000101 A001 D06021++
TX030 2003 11 02 13 00 00 00 014 10166 351 0009+
TX040 2003 11 02 13 00 00 00 102 10215 /// ////++
7777
```

The first line of each bulletin is a WMO header. **SOUS54 KWBC** identifies the WMO region in which the data was collected. The region specified here is the Gulf of Mexico Coast. See Appendix 4 (CREX and SHEF Geographic Identifiers) for a list of all the region identifiers. **021459** specifies the GMT day, hour, and minute the bulletin was created. In this case, the bulletin was created on day 02, at hour 14, and minute 59.

The second line of each bulletin indicates the bulletin is of type **CREX**. On the third line of each bulletin, **T000101** indicates that it is from the CREX master table number 00, using edition 01

and version 01 of that edition. **A001** indicates the bulletin contains sea surface information. **D06021** indicates the bulletin contains meteorological data.

The fourth line of this bulletin is specific to the station for which data is being reported. It contains both the header information and the actual data. This line will be repeated for each station for which a set of hourly meteorological values exists. In this record, the NWS Station Identifier is **TX030** and is the identifier for Galveston Pleasure Pier, Texas. **2003 11 02 13 00** (year/month/day/hour/minute) is the measurement time that is to be assigned to the set of hourly meteorological values contained in the bulletin for the given station. If the data is from a Great Lakes station, this time is local standard time. For all other stations, the time is GMT. **00 00** are the two numeric flags which indicate the overall quality of the data. The first set of numbers is the automatic flag and indicates the quality of the data. The second set of numbers is the manual flag and indicates the quality of the meteorological gauge. In this example, the first set of **00** indicates that the quality of the data is good and the second set of **00** indicates that the gauge is operational. See Appendix 5 (CREX Quality Control Identifiers) for a list of all flags. The remaining values in the record are the actual data values. In a set, the first value is Air Temperature in degrees Celsius (to tenths), the second value is Sea Level Pressure in hPa (to tenths), the next value is Wind Direction in tens of degrees and the final value is Wind Speed in m/sec. So for Galveston Pleasure Pier, Texas, the following is being reported:

Air Temperature	**014**	was measured at **2003 11 02 13:00 GMT**
Sea Level Pressure	**10166**	was measured at **2003 11 02 13:00 GMT**
Wind Direction	**351**	was measured at **2003 11 02 13:00 GMT**
Wind Speed	**0009**	was measured at **2003 11 02 13:00 GMT**

The last line of each bulletin will be **7777** to indicate the end of the bulletin.

Storm Surge Water Level Bulletin

The following is a detailed explanation of a storm surge water level CREX bulletin. Throughout the bulletin one or more slashes (///) indicate that a value was not available, each subset (a report) ends with the terminator (+) and two plus signs (++) indicate the end of a section. A storm surge water level bulletin contains 6-minute water level values.

```
SOUS52 KWBC 021542
CREX++
T000101 A001 D06022+
NC040 2003 11 02 15 24 /// 10 00 0006 -06
00075 0043 00076 0041 00078 0041 00080 0040 00082 0040 00083 0039++
7777
```

The first line of each bulletin is a WMO header. **SOUS52 KWBC** identifies the WMO region in which the data was collected. The region specified here is the Atlantic Coast. See Appendix 4 (CREX and SHEF Geographic Identifiers) for a list of all the region identifiers. **021542** specifies the GMT day, hour, and minute the bulletin was created. In this case, the bulletin was created on day 02, at hour 15, and minute 42.

The second line of each bulletin indicates the bulletin is of type **CREX**. On the third line of each bulletin, **T000101** indicates that it is from the CREX master table number 00, using edition 01 and version 01 of that edition. **A001** indicates the bulletin contains seas surface information. **D06022** indicates the bulletin contains water level data.

The fourth and fifth lines of this bulletin are specific to the station for which data is being reported. One line is station header information and the other line contains the actual data. These two lines will be repeated for each station for which data exists.

In this station header record, the NWS Station Identifier is **NC040** and is the identifier for Wilmington, North Carolina. **2003 11 02 15 24** (year/month/day/hour/minute) is the initial time that is to be used to calculate the measurement times for the 6-minute water level values contained in the bulletin for the given station. If the data is from a Great Lakes station, this time is local standard time. For all other stations, the time is GMT. //// is the sea surface temperature in degrees kelvin to tenths, which in this example is not available. **10 00** are the two numeric flags which indicate the overall quality of the data. The first set of numbers is the automatic flag and indicates the quality of the data. The second set of numbers is the manual flag and indicates the quality of the water level gauge. In this example, the **10** indicates that multiple quality control checks failed for this collection of data and **00** indicates that the gauge is operational. See Appendix 5 (CREX Quality Control Identifiers) for a list of all flags. **0006** indicates the number of minutes that are to be added to the initial time, referred to earlier, to calculate the measurement time for the first and most recent 6-minute water level value for the given station. **-06** indicates the time increment between measurements. How to use this information to determine the time of each measurement is discussed in the next paragraph.

In a storm surge water level bulletin, a data record contains six water level values along with an associated residual value for each. The values are reported in millimeters. In this example, **00075, 00076**, and **00078, 00080, 00082 and 00083** are the water level values. **00043, 00041**, **00040**, **00040**, and **00039** are the associated residual values. To determine the time of each measurement, start with the time provided in the station header record which in this case is **2003 11 02 15 24**. The header record indicates **6** minutes need to be added to **2003 11 02 15 24** to calculate the measurement time for the first and most recent water level value. Then **-6** minutes are to be applied to determine each succeeding measurement time. This means, in keeping with the given example:

00075	was measured at	**2003 11 02 15:30 GMT**
00076	was measured at	**2003 11 02 15:24 GMT**
00078	was measured at	**2003 11 02 15:18 GMT**
00080	was measured at	**2003 11 02 15:12 GMT**
00082	was measured at	**2003 11 02 15:06 GMT**
00083	was measured at	**2003 11 02 15:00 GMT**

The last line of each bulletin will be **7777** to indicate the end of the bulletin.

Storm Surge Ancillary Data Bulletin

The following is a detailed explanation of the storm surge meteorological CREX bulletin. Throughout the bulletin, one or more slashes (///) indicate that a value was not available, each subset (a report) ends with the terminator (+) and two plus signs (++) indicate the end of a section. A storm surge meteorological bulletin contains the first set of 6-minute meteorological data values reported in the given 18-minute transmission.

```
SOUS52 KWBC 021622
CREX++
T000101 A001 D06021++
VA020 2003 11 02 16 06 00 00 025 10200 006 ///++
7777
```

The first line of each bulletin is a WMO header. **SOUS52 KWBC** identifies the WMO region in which the data was collected. The region specified here is the Atlantic Coast. See Appendix 4 (CREX and SHEF Geographic Identifiers) for a list of all the region identifiers. **021622** specifies the GMT day, hour, and minute the bulletin was created. In this case, the bulletin was created on day 02, at hour 16, and minute 22.

The second line of each bulletin indicates the bulletin is of type **CREX**. On the third line of each bulletin, **T000101** indicates that it is from the CREX master table number 00, using edition 01 and version 01 of that edition. **A001** indicates the bulletin contains seas surface information. **D06021** indicates the bulletin contains meteorological data.

The fourth line of this bulletin is specific to the station for which data is being reported. It contains both the header information and the actual data. This line will be repeated for each station for which a set of hourly meteorological values exists. In this record, the NWS Station Identifier is **VA020** and is the identifier for Kiptopeke Beach, Virginia. **2003 11 02 16 06** (year/month/day/hour/minute) is the measurement time that is to be assigned to the set of meteorological values contained in the bulletin for the given station. If the data is from a Great Lakes station, this time is local standard time. For all other stations, the time is GMT. **00 00** are the two numeric flags which indicate the overall quality of the data. The first set of numbers is the automatic flag and indicates the quality of the data. The second set of numbers is the manual flag and indicates the quality of the meteorological gauge. In this example, the first set of **00** indicates that the quality of the data is good and the second set of **00** indicates that the gauge is operational. See Appendix 5 (CREX Quality Control Identifiers) for a list of all flags. The remaining values in the record are the actual data values. In a set, the first value is Air Temperature in degrees Celsius (to tenths), the second value is Sea Level Pressure in hPa (to tenths), the next value is Wind Direction in tens of degrees and the final value is Wind Speed in m/sec. So for Kiptopeke Beach, Virginia, the following is being reported:

Air Temperature	**025**	was measured at **2003 11 02 16:06 GMT**
Sea Level Pressure	**10200**	was measured at **2003 11 02 16:06 GMT**
Wind Direction	**006**	was measured at **2003 11 02 16:06 GMT**
Wind Speed	**Not Reported**	was measured at **2003 11 02 16:06 GMT**

The last line of each bulletin will be **7777** to indicate the end of the bulletin.

APPENDIX 3

SHEF BULLETIN DESCRIPTIONS

Another format used for the relay of NOS data to NWS is called SHEF (Standard Hydrometeorological Exchange Format). A formal description of SHEF code is available from NWS. The following descriptions apply only to the formats being used by CO-OPS for providing data to NWS.

Routine Water Level Bulletin

The following is a detailed explanation of a routine water level SHEF bulletin. Throughout the bulletin, a colon (:) indicates a comment line, .E indicates the beginning of a data line for a station; .E1, .E2, .E3, etc. indicate continuation data lines; and a slash (/) is used to separate information. A routine water level bulletin contains 6-minute water level values.

```
SOUS41 KWBC 160809
TIDNT
:SHEF ENCODED 6 MINUTE NOS WATER LEVEL DATA
:NATIONAL WATER LEVEL OBSERVATION NETWORK (NWLON)
:WATER LEVEL VALUES REFERENCED TO MLLW IN FEET
:PROVIDED BY DOC/NOAA/NOS/CO-OPS, (301)713-2806
:Joyce.G.Kinnard@noaa.gov (ext. 146)
.E BHBM3 20040416 Z DH0442/HMIRG/DIN06/  5.31 /  5.09 /  4.87 /  4.65F /  4.42
.E1   4.19 /  3.94 /  3.69 /  -9999 /  3.23
.E NTKM3 20040416 Z DH0436/HMIRG/DIN06/  2.57 /  2.51 /  2.44 /  2.36 /  2.30
.E1   2.25 /  2.19 /  2.13 /  2.07 /  2.00
.E NWPR1 20040416 Z DH0400/HMIRG/DIN06/  0.19 /  0.13 /  0.21 /  0.22 /  0.16
.E1   0.20 /  0.23 /  0.25 /  0.24 /  0.28
.E MYPF1 20040416 Z DH0442/HHIRG/DIN06/ -2.90 / -2.90 / -2.90 / -2.89 / -2.86
.E1  -2.82 / -2.78 / -2.74 / -2.69 / -2.63
```

The first line of each bulletin is a WMO header. **SOUS41 KWBC** identifies the WMO region in which the data was collected. The region specified here is the North Atlantic. See Appendix 4 (CREX and SHEF Geographic Identifiers) for a list of all the WMO region identifiers. **160809** specifies the GMT day, hour, and minute the bulletin was created. In this case, the bulletin was created on day 16, at hour 08, and minute 09.

The second line of each bulletin contains the AWIPS ID used by NWS to indicate the geographic area in which the data was collected. The AWIPS ID (**TIDNT**) indicates the North Atlantic. See Appendix 4 (CREX and SHEF Geographic Identifiers) for a list of all the AWIPS region identifiers.

The lines that begin with a colon (:) are comment lines which explain that the data is water level data provided by the National Ocean Service.

The lines following the comment lines are specific to each station for which data is being reported. The .E line contains the station header information followed by the beginning of the data. The continuation lines (.E1 - .E3) contain the remainder of the data. These sets of lines will be repeated for each station for which data exists.

On the first .E line in the above example, **BHBM3** is the NWS Station Identifier for Boston, Massachusetts. Therefore, Boston is the first station within this bulletin for which data is being provided. **20040416** (year/month/day) is the observation date that is to be associated with the initial water level value that follows the header information. **Z** specifies that the data is being reported in GMT. If the data is from a Great Lakes station, this time is local standard time (**CS** for Central Standard or **ES** for Eastern Standard). For all other stations, the time zone is **Z**. **DH0442** supplies the required information to determine the observation time that is to be associated with the initial water level value that follows the header information. The first two characters (**DH)** indicate that the time is provided in the hour/minute format. In this case, **04** is the hour and **42** is the minute and translates to 4:42 a.m.

The next set of characters, **HMIRG**, explains information about the data and how it is transmitted. **HM** designates the transmission of water level data that has been corrected to MLLW (Mean Lower Low Water). An **HH** in this position would designate water level data that has been corrected to MSL (Mean Sea Level). The next character indicates whether the data is instantaneous or not. Currently, the only value used for observed water levels is **I** which indicates the data is instantaneous. The fourth and fifth characters represent whether the data is as received directly from the gauge or has been computed. All observed water level values will have either **RG** to indicate the value is as received from the gauge via GOES or **RP** to indicate the value is as received from the gauge via PORTS.

The final set of characters in the header, **DIN06,** provides the information needed to calculate the time interval between data measurements. **DIN** designates a time increment unit of minutes and **06** indicates a time increment of 6. Therefore, in this bulletin, there is a time increment of 6 minutes between each data measurement.

This is the end of the header information for Boston. The remaining values in the .E and .E1 records associated with the given station are the actual water level data values reported in feet. An **F** after a water level value means that a parity error occurred during the transmission of that value and that the value should be considered suspect. A water level value of **-9999** indicates either the value was never received or the received value was flagged during the quality control process and is not to be reported.

To determine the date and time of each measurement, start with the date and time provided in the station header record which in this case is **2004 04 16 04 42**. This is the date and time for the first measurement. Since the header record indicates there is a **6**-minute increment between each data measurement, 6 minutes are to be added to **2004 04 16 04 42** to determine the next measurement time. Then 6 minutes are to be applied to determine each succeeding measurement time. So, for Boston, the following water level values are being reported for Boston:

5.31	was measured at	**2004 04 16 04:42 GMT**
5.09	was measured at	**2004 04 16 04:48 GMT**
4.87	was measured at	**2004 04 16 04:54 GMT**
4.65	was measured at	**2004 04 16 05:00 GMT** (suspect due to parity error)

4.42	was measured at	**2004 04 16 05:06 GMT**
4.19	was measured at	**2004 04 16 05:12 GMT**
3.94	was measured at	**2004 04 16 05:18 GMT**
3.69	was measured at	**2004 04 16 05:24 GMT**
Not Reported	at	**2004 04 16 05:30 GMT**
3.23	was measured at	**2004 04 16 05:36 GMT**

Routine Meteorological Data Bulletin

The following is a detailed explanation of the routine meteorological SHEF bulletin. Throughout the bulletin, a colon (:) indicates a comment line and a slash (/) is used to separate information. The bulletin will contain a .A and/or .E records for each station for which data is being reported. For .E records, there may be continuation lines (.E1 - .E2) if necessary. A routine meteorological bulletin can contain hourly or 6-minute meteorological values.

```
SXUS51 KWBC 201359
OSONT
:SHEF ENCODED 6-MINUTE NOS MET DATA
:NATIONAL WATER LEVEL OBSERVATION NETWORK (NWLON)
:TA(AIR TEMP DEG F)  SLP(SEA LEVEL PRESSURE INCHES)
:UD(WIND DIRECTION WHOLE DEGREES) US (WIND SPEED MPH)
:TW(WATER TEMP DEG F) UG(WIND GUSTS MPH) WC(CONDUCTIVITY uMHOS/CM)
:-9999 (MISSING VALUES)
:PROVIDED BY DOC/NOAA/NOS/CO-OPS, (301)713-2806
:Joyce.G.Kinnard@noaa.gov (ext.146)
.A FRVM3 20040420 Z DH1348/TAIRP    62/UGIRP -9999/PLIRP 29.96/UDIRP -9999/USIRP
-9999/TWIRP    48/WCIRP 25300
.E SC020 20040420 Z DH1348/TWIRP/DIN06/   67/   68/
```

The first line of each bulletin is a WMO header. **SXUS51 KWBC** identifies the WMO region in which the data was collected. The region specified here is the North Atlantic. See Appendix 4 (CREX and SHEF Geographic Identifiers) for a list of the WMO region identifiers. **201359** specifies the GMT day, hour, and minute the bulletin was created. In this case, the bulletin was created on day 20, at hour 13, and minute 59.

The second line of each bulletin contains the AWIPS ID used by NWS to indicate the geographic area in which the data was collected. The AWIPS ID (**OSONT**) indicates the North Atlantic. See Appendix 4 (CREX and SHEF Geographic Identifiers) for a list of all the AWIPS region identifiers.

The lines that begin with a colon (:) are comment lines which explain that the data is meteorological data provided by the National Ocean Service.

The lines following the comment lines are specific to each station for which data is being reported. A .A record is generated for a given station when the station has one or more data

types on which to report and there is only one data value associated with each data type. A .E record is generated for a given station whenever a given data type for that station is reporting more than one value. There can be both .A and .E records for a given station within a single bulletin. The .A and .E records contain header information and actual data.

On the first data line in the above example, the meteorological data for the given station is reported using the .A format. Since the .A format is being used, one or more data types may be provided within this record; however, there is only one data value associated with each data type. The NWS Station Identifier is **FRVM3** which represents Fall River, Massachusetts. **20040420** (year/month/day) is the observation date that is to be associated with the meteorological value(s) that follow the header information. **Z** specifies that the data is being reported in GMT. If the data is from a Great Lakes station, this time is local standard time (**CS** for Central Standard or **ES** for Eastern Standard). For all other stations, the time zone is **Z**. **DH1348** supplies the required information to determine the observation time that is to be associated with the meteorological value(s) that follow the header information. The first two characters (**DH)** indicate that the time is provided in the hour/minute format. In this case, **13** is the hour and **48** is the minute and translates to 1:42 p.m. This is the end of the header information for Fall River.

The remaining information is related to the actual meteorological data values being reported for Fall River. Each data value is preceded by a 5-character set of codes which identifies the data and specifies data transmission information. The first two characters identify the data. Currently, the identifiers that can be included in the bulletin are **TA** for air temperature (in degrees Fahrenheit), **UG** for wind gusts (in miles per hour), **PL** for barometric pressure (sea level in inches), **UD** for wind direction (in whole degrees), **US** for wind speed (in miles per hour), **TW** for water temperature (sea surface in degrees Fahrenheit), and **WC** for water conductivity (in uMHOS/CM). The last three characters specify data transmission information. The first of these three characters indicates whether the data is instantaneous or not. Currently, the only value used for observed meteorological data is **I** which indicates the data is instantaneous. The fourth and fifth characters represent whether the data is as received directly from the gauge or has been computed. All observed meteorological data values will have either **RG** to indicate the value is as received from the gauge via GOES or **RP** to indicate the value is as received from the gauge via PORTS. Therefore, in keeping with the example, the data being reported for Fall River is as follows:

Air Temperature	**62**	was measured at **2004 04 20 13:48 GMT**
Wind Gusts	**Not Reported**	was measured at **2004 04 20 13:48 GMT**
Sea Level Pressure	**29.96**	was measured at **2004 04 20 13:48 GMT**
Wind Direction	**Not Reported**	was measured at **2004 04 20 13:48 GMT**
Wind Speed	**Not Reported**	was measured at **2004 04 20 13:48 GMT**
Sea Surface Temp	**48**	was measured at **2004 04 20 13:48 GMT**
Water Conductivity	**25300**	was measured at **2004 04 20 13:48 GMT**

The meteorological data for the next station is reported using the .E format. Since the .E format is being used, only one type of data is being provided by this record with several values being reported for the given data type. The NWS Station Identifier is **SC020** for Charleston, South Carolina. **20040420** (year/month/day) is the observation date that is to be associated with the initial meteorological value that follows the header information. **Z** specifies that the data is

being reported in GMT. **DH1348** supplies the required information to determine the observation time that is to be associated with the initial meteorological value that follows the header information. The first two characters (**DH)** indicate that the time is provided in the hour/minute format. In this case, **13** is the hour and **48** is the minute and translates to 1:42 p.m. This is the end of the header information for Charleston.

The remaining information is related to the actual meteorological data values being reported for Charleston. The data is preceded by a 5-character set of codes (**TWIRP**) which identifies the type of data that is being provided along with data transmission information about that data. This set of codes is interpreted in the same manner as described previously for the .A-formatted records. Therefore, **TW** indicates that the data values that are to follow represent water temperature (sea surface in degrees Fahrenheit); **I** indicates the data values are instantaneous; and **RP** indicates the data values are as received directly from the gauge via PORTS. The data is also preceded by a 5-character set of codes (**DIN06**) that are needed to calculate the time interval between the data measurements. **DIN** is the time interval specifier for minutes and **06** indicates a time increment of 6. Therefore, in this record, there is a time increment of 6 minutes between each data measurement. So for Charleston, the data being reported is as follows:

Sea Surface Temp	**67**	was measured at **2004 04 20 13:48 GMT**
Sea Surface Temp	**68**	was measured at **2004 04 20 13:54 GMT**

SHEF Predicted Water Level Data Bulletins

The following is a detailed explanation of a predicated water level SHEF bulletin. Throughout the bulletin, a colon (:) indicates a comment line, .E indicates the beginning of a data line for a station; .E1, .E2, .E3, etc. indicate continuation data lines; and a slash (/) is used to separate information. A predicated water level bulletin contains 96 hourly water level values for each station being reported.

```
SOUS64 KWBC 050120
TIDAK
:SHEF ENCODED 1 HOUR NOS WATER LEVEL PREDICTED DATA
:NATIONAL WATER LEVEL OBSERVATION NETWORK (NWLON)
:WATER LEVEL VALUES REFERENCED TO MLLW IN FEET (HMIFZ)
:AND MSL IN FEET (HHIFZ) PROVIDED BY DOC/NOAA/NOS/CO-OPS
.E AK010 20040305 Z DH0000/DC03050000/HMIFZ/DIH1/ 11.58/ 13.85/ 14.80/ 14.20
.E1  12.19/  9.24/  6.05/  3.39/  1.84/  1.70/  2.88/  5.00/  7.49/  9.72
.E1  11.18/ 11.52/ 10.68/  8.88/  6.61/  4.49/  3.16/  3.02/  4.19/  6.41
.E1   9.18/ 11.85/ 13.79/ 14.55/ 13.92/ 12.01/  9.23/  6.19/  3.56/  1.88
.E1   1.45/  2.27/  4.04/  6.28/  8.46/ 10.07/ 10.78/ 10.45/  9.21/  7.42
.E1   5.62/  4.37/  4.11/  4.99/  6.86/  9.30/ 11.73/ 13.59/ 14.40/ 13.94
.E1  12.23/  9.59/  6.55/  3.73/  1.72/  0.89/  1.34/  2.86/  5.06/  7.41
.E1   9.40/ 10.60/ 10.79/  9.98/  8.43/  6.65/  5.21/  4.63/  5.16/  6.75
.E1   9.03/ 11.47/ 13.47/ 14.53/ 14.31/ 12.77/ 10.12/  6.87/  3.70/  1.26
.E1   0.05/  0.25/  1.74/  4.12/  6.84/  9.32/ 11.02/ 11.58/ 10.94/  9.33
.E1   7.28/  5.47
```

The first line of each bulletin is a WMO header. **SOUS64 KWBC** identifies the WMO region for which water level data is being predicated. The region specified here is the Alaska. See Appendix 4 (CREX and SHEF Geographic Identifiers) for a list of all the WMO region identifiers. **050120** specifies the GMT day, hour, and minute the bulletin was created. In this case, the bulletin was created on day 05, at hour 01, and minute 20.

The second line of each bulletin contains the AWIPS ID used by NWS to indicate the geographic area for which water level data is being predicted. The AWIPS ID (**TIDAK**) indicates the Alaska. See Appendix 4 (CREX and SHEF Geographic Identifiers) for a list of all the AWIPS region identifiers.

The lines that begin with a colon (:) are comment lines which explain that the data is predicated water level data provided by the National Ocean Service.

The lines following the comment lines are specific to each station for which data is being reported. The .E line contains the header information followed by the beginning of the data. The continuation lines (.E1 - .E3) contain the remainder of the data. These sets of lines will be repeated for each station for which data exists.

On the first .E line in the above example, **AK010** is the NWS Station Identifier for Ketchikan, Alaska. Therefore, Ketchikan is the first station within this bulletin for which data is being provided. **20040305** (year/month/day) is the date that is to be associated with the initial predicted water level value that follows the header information. **Z** specifies that the data is being reported in GMT. If the data is from a Great Lakes station, this time is local standard time (**CS** for Central Standard or **ES** for Eastern Standard). For all other stations, the time zone is **Z**. **DH0000** supplies the required information to determine the time that is to be associated with the initial predicted water level value that follows the header information. The first two characters (**DH)** indicate that the time is provided in the hour/minute format. In this case, **00** is the hour and **00** is the minute and translates to 00:00 midnight.

The next set of codes (**DC03050000**) are optional but will generate a nonfatal SHEF error if omitted. Therefore, NOS has chosen to include this **DC** field with the same month/day/hour/minute information contained in **20040305** and **DH0000**. This information can be ignored.

The set of characters that follow, **HMIFZ**, explains information about the data and how it is transmitted. **HM** designates the generation of predicted water level data that has been corrected to MLLW (Mean Lower Low Water). An **HH** in this position would designate water level data that has been corrected to MSL (Mean Sea Level). The next character indicates whether the data is instantaneous or not. Currently, the only value used for predicted water levels is **I** which indicates the data is instantaneous. The fourth and fifth characters represent whether the data is as received directly from the gauge or has been computed. The only value used for predicted water levels is **FZ** to indicate the value is computed forecast data.

The final set of characters in the header, **DIH1,** provides the information needed to calculate the time interval between data measurements. **DIH** designates a time increment unit of hours and **1** indicates a time increment of 1. Therefore, in this bulletin, there is a time increment of 1 hour between each data measurement.

This is the end of the header information for Ketchikan. The remaining values in the .E and .E1 records associated with the given station are the actual water level data values reported in feet. To determine the date and time of each measurement, start with the date and time provided in the station header record which in this case is **2004 03 05 00 00**. This is the date and time for the first measurement. The header record indicates **1** hour is to be added to **2004 03 05 00 00** to determine the next measurement time with 1 hour to be added to determine each succeeding measurement time as well. So, for the given example, the following predicated water level values are being reported for Ketchikan:

11.58	was measured at	**2004 03 05 00:00 GMT**
13.85	was measured at	**2004 03 05 01:00 GMT**
14.80	was measured at	**2004 03 05 02:00 GMT**
14.20	was measured at	**2004 03 05 03:00 GMT**
12.19	was measured at	**2004 03 05 04:00 GMT**
	.	
	.	
	.	
11.58	was measured at	**2004 03 08 19:00 GMT**
10.94	was measured at	**2004 03 08 20:00 GMT**
9.33	was measured at	**2004 03 08 21:00 GMT**
7.28	was measured at	**2004 03 08 22:00 GMT**
5.47	was measured at	**2004 03 08 23:00 GMT**

APPENDIX 4

CREX AND SHEF GEOGRAPHIC IDENTIFIERS

CREX Water Level and Meteorological Geographic Identifiers

AFOS Header	WMO Header	Geographic Area
NMCTIDATL	SOUS52 KWBC	Atlantic Coast and Bays
NMCTIDMEX	SOUS54 KWBC	Gulf of Mexico Coast and Bays, Puerto Rico, and the Virgin Islands
NMCTIDPAC	SOPA56 KWBC	Pacific Coast and Bays
NMCTIDGTL	SOUS53 KWBC	Great Lakes
NMCTIDAK	SOAK58 KWBC	Alaskan Coast and Bays
NMCTIDHI	SOUS50 KWBC	Hawaii and Pacific Basin

SHEF Water Level Geographic Identifiers

AWIPS Header	WMO Header	Geographic Area
TIDNT	SOUS41 KWBC	North Atlantic
TIDGX	SOUS42 KWBC	Gulf of Mexico
TIDGT	SOUS44 KWBC	Great Lakes
TIDPZ	SOUS43 KWBC	Pacific
TIDAK	SOUS45 KWBC	Alaska
TIDHW	SOPA46 KWBC	Hawaii

SHEF Meteorological Geographic Identifiers

AWIPS Header	WMO Header	Geographic Area
OSONT	SXUS51 KWBC	North Atlantic
OSOGX	SXUS52 KWBC	Gulf of Mexico
OSOGT	SXUS54 KWBC	Great Lakes
OSOPZ	SXUS53 KWBC	Pacific
OSOAK	SXAK55 KWBC	Alaska
OSOHW	SXPA56 KWBC	Hawaii

SHEF Predicted Water Level Geographic Identifiers

AWIPS Header	WMO Header	Geographic Area
TIDNT	SOUS61 KWBC	North Atlantic
TIDGX	SOUS62 KWBC	Gulf of Mexico
TIDPZ	SOUS63 KWBC	Pacific
TIDAK	SOUS64 KWBC	Alaska
TIDHI	SOUS65 KWBC	Hawaii

APPENDIX 5

CREX QUALITY CONTROL IDENTIFIERS

CREX Automated Water Level Quality Control Flags

ALPHA CODE	NUMERIC CODE	MEANING
G	00	Good data
H	01	Maximum (high) water level limit exceeded
L	02	Minimum (low) water level limit exceeded
R	03	Rate-of-change limit for water level exceeded
F	04	Flat limit for water level exceeded
P	05	Observed water level minus predicted water level value limit exceeded
B	06	Observed primary water level value minus backup water level value limit exceeded
E	07	
Q	08	Water level QA parameter (sigmas and/or outliers) limits exceeded
S	09	Sea temperature outside of expected range
M	10	Multiple QC checks listed above failed

CREX Manual Water Level Quality Control Flags

ALPHA CODE	NUMERIC CODE	MEANING
O	00	Operational
C	01	Possible clogging problem or otherwise degraded water level data
D	02	Possible datum shift
U	03	Unknown status of water level sensor
S	04	Suspected or known sea temperature sensor problem
M	05	Multiple possible problem listed above
X	06	Bad data - DO NOT DISSEMINATE!

CREX Automated Meteorological Quality Control Flags

ALPHA CODE	NUMERIC CODE	MEANING
G	00	Good data from all sensors
D	01	Wind direction outside of allowable range
S	02	Wind speed outside of expected range
P	03	Barometric pressure outside of expected range
A	04	
M	05	Multiple sensors failed QC checks

CREX Manual Meteorological Quality Control Flags

ALPHA CODE	NUMERIC CODE	MEANING
O	00	Operational
W	01	Suspected or known problem with wind sensor
P	02	Suspected or known problem with barometric pressure sensor
A	03	Suspected or known problem with air temperature sensor
U	04	Unknown status of all sensors
M	05	Suspected or known problems with multiple sensors
X	06	Bad data - DO NOT DISSEMINATE!