APPENDIX D. NAVOCEANO PRODUCTS AND FILE FORMAT

This appendix presents the shared products and data file formats produced at the Naval Oceanographic Office.

D0 Data Product Format Originating from NAVOCEANO

NAVOCEANO produces and transmits Multi-channel Sea Surface Temperature (MCSST), Marine Wind Speed (MWS) and Sea Surface Height (SSH) data. A synopsis of these products, the data file formats used and corresponding data tables are presented in this appendix.

D1 Multi-channel Sea Surface Temperature

MCSST Initial Data Storage File contains derived sea surface temperature observations created on an orbit-by-orbit basis. GAC and HIRS data transmitted from NESDIS are used to produce the MCSST product. NAVOCEANO transmits the MCSST data files via SPP/ATM to provide global sea surface temperature to NESDIS and FNMOC.

D1.1 MCSST Data File Format

Figure˚D1.1-1 shows the data file format for the MCSST data. The file is formatted to contain DEF descriptors that describe and precede the data blocks. The descriptors included in the file are identified as the Product ID, Data Description Block Header, Data Description Block, and the MCSST Data Description Block. These descriptors occupy a total of 770 bytes and are present only once at the beginning of the file. Each MCSST data block occupies 1406 bytes and contains the global sea surface temperature data. The data blocks are contiguous and continue until all the sea surface temperature data is consumed within the file. A 6-byte End-of-Product block indicates the end of the data.

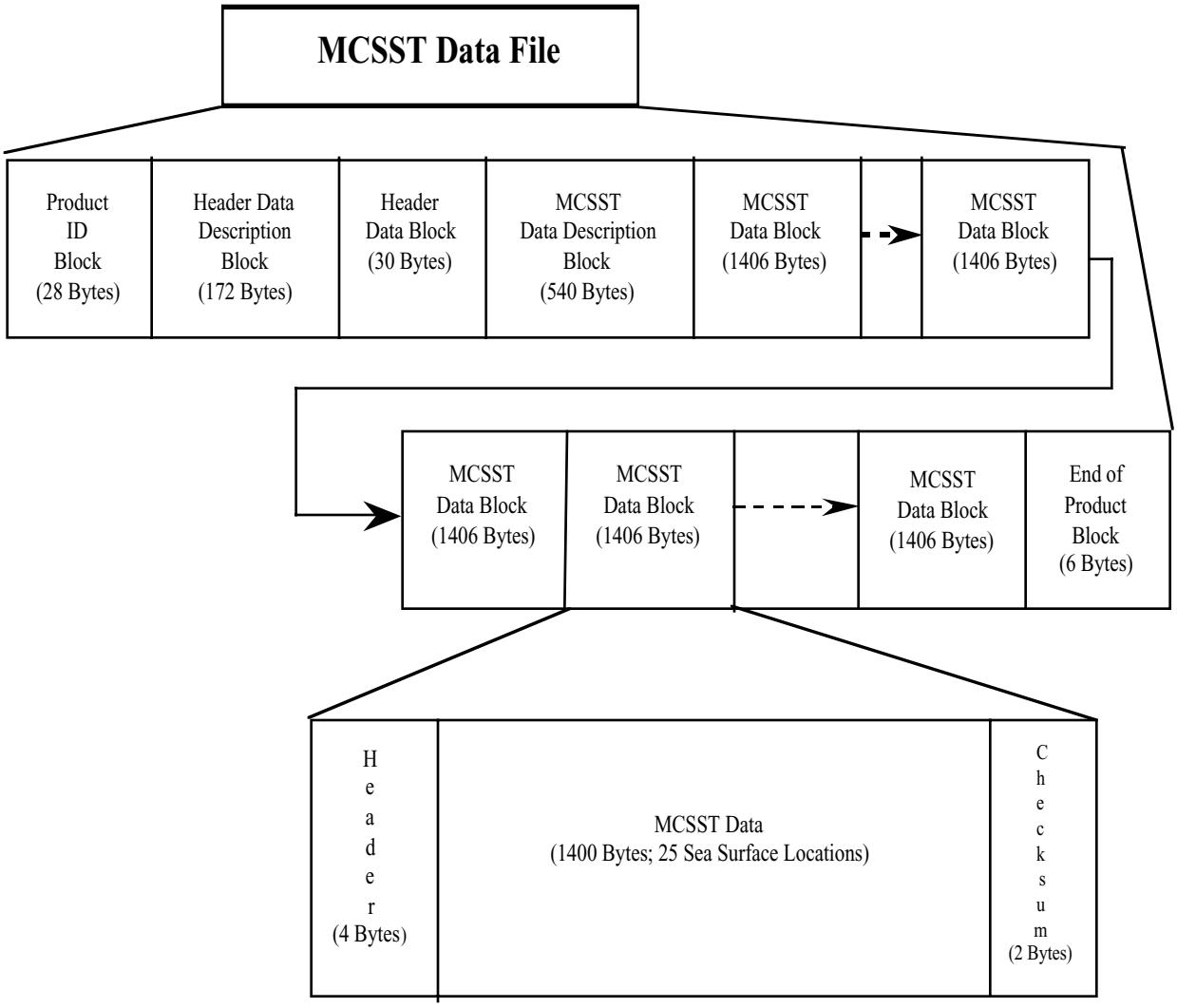


Figure D1.1-1 MCSST Data File Structure

D1.2 MCSST Descriptor Block Format

Within the MCSST product file, DEF descriptors are inserted into the first 12,798-byte text block. Figure D1.2-1 shows the arrangement of the MCSST data set and the size of each DEF descriptor and data blocks.

Product Identification Block (28 Bytes)
Mcsst Header Data Description Block (172 Bytes)
Mcsst Header Data Block (30 Bytes)
Mcsst Data Description Block (540 Bytes)
Mcsst Data Blocks (n-Blocks times 1406 Bytes per block)
End Of Product Block (6 Bytes)

Figure D1.2- 1 MCSST Data File Forma

D1.2.1 MCSST Data Exchange Format Descriptors

The DEF descriptors describe the file structure by mapping the way sets of bytes are organized within each block and describing the data content. The required descriptors for the MCSST file are identified as the Product Identification, Header Data Description, Header Data Block, MCSST Data Description, and End-of-Product blocks. These descriptors are discussed in detail in the following subsections.

D1.2.1.1 MCSST Product ID Block

The Product Identification (Product-Id) is the first DEF descriptor block. Figure D1.2-2 shows the structure of the Product-Id block and the information contained within the block. Information included are the mode and submode, the data source, the name of the product in ASCII characters, and the date and time of transmission.

Word #	First Byte	Second Byte	
1	Ox0E		Hex Number of Two-byte Words
2	001	001	Octal
3	N	A	Originator s Identification
4	V	O	(ASCII Code)
5	U	255	Classification and Retention Time
6		M	
7	C	S	Product Identifier
8	S	T	(ASCII Code)
9		O	
10	B	S	
11	year		Two Digit Hex Value
12	month	day	
13	hour	min	
14	Checksum		

Figure D1.2-2 MCSST Product-ID Block: (Mode 1, Submode 1)

D1.2.1.2 MCSST Header Data Description Block

The single MCSST Header Data Description Block describes the format and content of the MCSST Header data. Figure D1.2-3 shows the structure of the 172-byte Header Data Description block. The data for elements 2 through 10 of the MCSST header are contained within the repeating sections of this block.

Word #	First Byte	Second Byte	
1	Ox56		Hex Number of Two-byte Words
2	003	022	Octal
3	10		
4	24		
5	1		
6	S	C	First Element Data Description Information
7	I	D	
8	4		
9	1		
10	1		
11	2	23	
12	1	0	
13	0		
14 –85	MCSST Header Data Repeating Sections Elements 2-10		
86	Checksum		

Figure D1.2-3 MCSST Header Data Description Block: (Mode 3, Submode 22)

Table D1.2-1 shows the header MCSST Header information. Each element is placed into 16 bytes of the repeated sections within the MCSST Header Data Description block.

Table D1.2-1 MCSST Header Information for the Header Data Description Block

Element #	Mnemonic 4 Chars	Start Byte	Byte/Sets	Byte /Elem	Data Rep.	Units	M Mant	M Char	Add Const.	Definition
1	'S"C"I"D'	4	1	1	2	23	1	0	0	Spacecraft ID
2	'T"Y"P"E'	5	1	1	2	23	1	0	0	Data Type
3	'B"Y"R"'	6	1	1	2	65	1	0	0	Year data begins
4	'B"J"L"D'	7	2	2	2	63	1	0	0	Julian date data begins
5	'B"S"E"C'	9	4	4	2	14	1	-3	0	GMT sec. data begins
6	'E"Y"R"'	13	1	1	2	65	1	0	0	Year data ends
7	'E"J"L"D'	14	2	2	2	63	1	0	0	Julian date data ends
8	'E"S"E"C'	16	4	4	2	14	1	-3	0	GMT seconds data ends
9	'P"B"I"D'	20	7	7	2	23	1	0	0	Processing Block ID
10	'X"T"R"A'	27	1	1	2	23	1	0	0	Spares

D1.2.1.3 MCSST Header Data Block

A single MCSST Header Data block contains the MCSST Header data bytes corresponding to the preceding MCSST Header Data Description Block. Figure D1.2-4 shows the structure of the MCSST Header Data block.

Word #	First Byte	Second Byte	
1	Ox0F		Hex Number of Two-byte Words
2	003	001	Octal
3 - 13	MCSST Header Data		
14	Checksum		

Figure D1.2-4 MCSST Header Data Block; (Mode 3, Submode 1)

The following definitions specify the data entered into the header data block for each element. The elements correspond to the element in Table D1.2-1 above.

Element 1 - Spacecraft ID Spacecraft is identified by an integer code established to represent the specific spacecraft.

7 = NOAA-9 NF
8 = NOAA-10 NG
1 = NOAA-11 NH
5 = NOAA-12 ND
2 = NOAA-13 NI
3 = NOAA-14 NJ
4 = NOAA-15 K
0 = SPARE

Element 2 - Data Type The data type of the data set is contained in a one-byte field. The bit and source code are identified in Table D1.2-2:

Table D1.2-2 Bit Codes for Data Types and TIP Sources for Element #2

BITS 1 - 4		BITS 5 - 8	
CODE	DATA TYPE	CODE	TIP SOURCE
1	LAC	1	EMBEDDED TIP
2	GAC	2	STORED TIP
3	HRPT	3	THIRD CDA TIP
4	TIP	4-15	SPARE
5	HIRS/2		
6	MSU		
7	SSU		
8	DCS		
9	SEM		
10-15	SPARE		

Elements 3-5 - Start Time: The start time is the spacecraft time code from the first frame of data processed for this data set. The 7-bit year is contained in the first byte, the 9-bit Julian day is right justified in the next two bytes and the 27-bit millisecond GMT time of day is right justified in the last four bytes. All other bits are zero.

Elements 6-8 - End Time: The end time is the spacecraft time code from the last frame of data processed for this data set. The formats are the same as described for the START TIME, elements 3-5.

Element 9 - Processing Block ID: The Processing Block ID is contained within a seven-byte field. Its value is generated from a five-digit starting orbit. The Processing Block ID s five leftmost bytes, contains the spacecraft s starting orbit at which recording of the data set began. The two rightmost bytes contain the least significant digits of the same orbit number. For example, data collection beginning at orbit 24836 generates a Processing Block ID value of 2483636.

Element 10 - Spare Element: A one-byte field reserved as a spare.

D1.2.1.4 MCSST Data Description Block

Figure D1.2-5 shows the structure of the MCSST Data Description block, which contains the information that describes the MCSST data.

Word #	First Byte	Second Byte	
1	Ox10E		Hex Number of Two-byte Words
2	003	022	Octal
3	33		The Decimal Number of Elements
4	56		The Number of Data Bytes to contain one surface location
5	25		Number of surface locations in each Data Block
6	T	Y	
7	P	E	First Element form the Data Description Table
8	4		
9	1		
10	1		
11	2	23	
12	1	0	
13	0		
14 -269	MCSST Data Repeating Sections Elements 2-33		
270	Checksum		

Figure D1.2-5 MCSST Data Description Block (Mode 3, Submode 22)

Table D1.2-3 shows the descriptive information that is placed into the bytes of the Data Description block. The information from columns 1 through 9 for each element is placed into 16 bytes of the repeated sections within the MCSST Header Data Description block

Table D1.2- 3 MCSST Data Description Information for the Data Description Block

Element #	Mnemonic 4Chars	Start Byte	Bytes /Set	Bytes/ Elem	Data Rep.	Units (Octal)	M Mant	M. Char	Add Const	Definition
1	'T' 'Y' 'P''E'	4	1	1	2	23	1	0	0	Type of Observations
2	'S' 'R' 'C''E	5	1	1	2	23	1	0	0	Source of Observation
3	'Y' 'R' ' ' '	6	1	1	2	65	1	0	0	Year
4	'M' 'O' 'N' '	7	1	1	2	64	1	0	0	Month
5	'L' 'A' 'T' '	8	2	2	2	55	1	-2	0	Latitude
6	'L' 'O' 'N' '	10	2	2	2	55	1	-2	0	Longitude
7	'D' 'A''Y' '	12	1	1	2	63	1	0	0	Day
8	'H' 'R' ' ' '	13	1	1	2	62	1	0	0	Hour
9	'M' 'N' ' ' '	14	1	1	2	61	1	0	0	Minute
10	'S ' 'E' 'C' '	15	1	1	2	14	1	0	0	Second
11	'S ' 'S' 'T' '	16	2	2	2	2	1	-1	0	Sea Surface Temperature
12	'R' E' L' 'Y'	18	2	2	2	23	1	0	0	Reliability
13	'S''O' 'Z' 'A	20	2	2	2	37	1	-1	0	Solar Zenith Angle
14	'S''A' 'Z' 'A	22	2	2	2	37	1	0	0	Satellite Zenith Angle
15	'F' 'S' 'S ' T'	24	2	2	2	2	1	-1	0	Analyzed Field SST
16	'R''M' 'S' E'	26	2	2	2	2	1	-2	0	Internal Error
17	'S''O' 'A' A'	28	2	2	2	37	1	-1	0	Solar Azimuth Angle
18	'C' 'S' 'S' 'T	30	2	2	2	2	1	-1	0	Climatological SST
19	'B''R' 'U' A'	32	1	1	2	23	1	0	0	Begin row of unit array
20	'B''C' 'U' A'	33	1	1	2	23	1	0	0	Begin column of unit array
21	'A''V' 'C' '1	34	2	2	2	24	1	-2	0	AVHRRChannel1average
22	'A''V' 'C' '2	36	2	2	2	24	1	-2	0	AVHRRChannel2average
23	'A''V' 'C' '3	38	2	2	2	1	1	-2	0	AVHRRChannel3average
24	'A''V' 'C' '4	40	2	2	2	1	1	-2	0	AVHRRChannel4average
25	'A''V' 'C' '5	42	2	2	2	1	1	-2	0	AVHRRChannel5average
26	'S' 'S' 'D' '1	44	2	2	2	24	1	-2	0	SpaceviewSDEVChannel1
27	'S' 'S' 'D' '2	46	2	2	2	24	1	-2	0	SpaceviewSDEVChannel2
28	'S' 'S' 'D' '3	48	2	2	2	1	1	-2	0	SpaceviewSDEVChannel3
29	'S' 'S' 'D' '4	50	2	2	2	1	1	-2	0	SpaceviewSDEVChannel4
30	'S' 'S' 'D' '5	52	2	2	2	1	1	-2	0	SpaceviewSDEVChannel5
31	'A''L' 'G' 'N	54	2	2	2	23	1	0	0	Algorithm Number
32	'A''E' 'O' 'T	56	2	2	2	23	1	-3	0	Aerosol Optical Thickness
33	'X''T' 'R' 'A	58	2	1	2	23	1	0	0	Spares

D1.2.1.5 End-of-Product Block

The End-of-Product block is the final DEF descriptor in the MCSST file. Figure D1.2.1-6 shows the structure of the End-of-Product descriptor. This descriptor is found only in the last text block of the file and indicates the end of the MCSST data.

Word #	First Byte	Second Byte	
1	Ox03		Hex Number of two-byte Words
2	001	002	Octal
3	Checksum		

Figure D1.2- 6 End-of-Product Block: (Mode 1, Submode 3)

D1.3 MCSST Data Block

The MCSST Data Block structure is shown in Figure D1.3-1. Each MCSST Data Blocks contains 1406 data bytes for 25 sea surface locations. This MCSST data correspond to preceding information in the MCSST Data Description Block.

Word #	First Byte	Second Byte	
1	Ox2BF		Hex Number of Two-byte Words

2	003	001	Octal
3 - 702	MCSSTData		
703	Checksum		

Figure D1.3-1 MCSST Data Block: (Mode3, Submode 1)

The MCSST data occupies 1400 bytes of the Data Blocks. Each Data Block contains a 4-byte header and a 2-byte checksum. Each complete Data Block contains 1406 bytes of information.

The elements of data are described by the information found in the MCSST Data Description Block. Table D1.3-1 shows elements that are included in the Data Description block for a single sea surface location (4-character mnemonics not included). The element names in the Definitions column are explained in the following paragraphs.

Table D1.3-1 Descriptive Information Included in the Data Description Block

Element #	Definition	Start Byte	Bytes /Set	Bytes /Elem	Data Rep	Units	M Mant	M Char	Add. Const
1	Type of Observations	4	1	1	2	23	1	0	0
2	Source of Observation	5	1	1	2	23	1	0	0
3	Year of Century	6	1	1	2	65	1	0	0
4	Month of Year	7	1	1	2	64	1	0	0
5	Latitude	8	2	2	2	55	1	-2	0
6	Longitude	10	2	2	2	55	1	-2	0
7	Day of Month	12	1	1	2	63	1	0	0
8	Hour of Day	13	1	1	2	62	1	0	0
9	Minute of Hour	14	1	1	2	61	1	0	0
10	Second of Minute	15	1	1	2	14	1	0	0
11	Sea Surface Temperature	16	2	2	2	2	1	-1	0
12	Reliability	18	2	2	2	23	1	0	0
13	Solar Zenith Angle	20	2	2	2	37	1	-1	0
14	Satellite Zenith Angle	22	2	2	2	37	1	0	0
15	Analyzed Field SST	24	2	2	2	2	1	-1	0
16	Internal Error	26	2	2	2	2	1	-2	0
17	Solar Azimuth Angle	28	2	2	2	37	1	-1	0
18	Climatological SST	30	2	2	2	2	1	-1	0
19	Begin row of unit array	32	1	1	2	23	1	0	0
20	Begin column of unit array	33	1	1	2	23	1	0	0
21	AVHRR Channel 1 average	34	2	2	2	24	1	-2	0
22	AVHRR Channel 2 average	36	2	2	2	24	1	-2	0
23	AVHRR Channel 3 average	38	2	2	2	1	1	-2	0
24	AVHRR Channel 4 average	40	2	2	2	1	1	-2	0
25	AVHRR Channel 5 average	42	2	2	2	1	1	-2	0
26	Space view SDEV Channel 1	44	2	2	2	24	1	-2	0
27	Space view SDEV Channel 2	46	2	2	2	24	1	-2	0
28	Space view SDEV Channel 3	48	2	2	2	1	1	-2	0
29	Space view SDEV Channel 4	50	2	2	2	1	1	-2	0
30	Space view SDEV Channel 5	52	2	2	2	1	1	-2	0
31	Algorithm Number	54	2	2	2	23	1	0	0
32	Aerosol Optical Thickness	56	2	2	2	23	1	-3	0
33	Spares	58	2	1	2	23	1	0	0

Element 1 - Type of Observation 1 To N One byte reserved for a Type Code value between 129 and 255, inclusive. All other values are illegal. Table D1.3-2 shows the Type codes:

Table D1.3-2 Observation Type and Associated Code Conversion

Code	Observation Type
0	No Type
1-128	Illegal Type Code
129	Nominal SST
130	AVHRR only SST
131	HIRS/2 only SST
132	Coastal Type
133	Reserved (Operational)
134	Reserved (Technique)
135	Reserved
136	Reserved
137	Reserved
138	Test Type
139-149	Reserved
150	Heat Budget Observation
151	AVHRR-only Day Opnl
152	AVHRR-only Night Opnl
153	HIRS-only Day Opnl (Multichannel)
154	HIRS-only Night Opnl (Technique)
155	AVHRR+HIRS Day Opnl
156	AVHRR+HIRS Night Opnl
157	Reserved
158	AVHRR-only Night Opnl (Aerosol Contaminated)
159	Reserved
160	Reserved
161	AVHRR-only Day Test
162	AVHRR-only Night Test
163	HIRS-only Day Test
164	HIRS-only Night Test
165	AVHRR+HIRS Day Test
166	AVHRR+HIRS Night Test
167-178	Reserved
179	ITOS SST
180-199	Reserved
200	Independent SST (Ship or Buoy)
201-254	Reserved
255	Erroneous Data - Do Not Use This Observation

Element 2 - Source of Observation One byte reserved for a numerical code value between 0 and 255 which identifies the source of the sea surface data. Table D1.3-3 the sources and source codes:

Table D1.3-3 Numerical Code Identifying the Source of the Sea Surface Data

Un-archived data Source Code	Archived data Source code	Source
0	128	No Source
1	129	AVHRR #1 TIROS-N
2	130	AVHRR #2 NOAA-6
3-20	131-148	AVHRR #3 - #20
21-50	149-178	Reserved
51	179	ITOS NOAA 1 Sensor #1
52	180	ITOS NOAA 1 Sensor #2
53	181	ITOS NOAA 2 Sensor #1
54	182	ITOS NOAA 2 Sensor #2
55-58	183-186	ITOS NOAA 3 and 4
59-62	187-190	ITOS NOAA 5 and 6
63-98	191-226	Reserved
99	227	Bogus data
100	228	Ship data
101	229	Buoy data from TIROS
102	230	Fixed Weather ship
103	231	Moving ship with name
104	232	Moving ship without name
105	233	Fixed Buoy
106	234	Drifting Buoy
107	235	XBT
108-127	236-255	Spare

Element 3 - Year of Century: One byte reserved for a value between 0 and 99 to indicate the year.

Element 4 - Month of Year: One byte reserved for a value between 1 and 12 to indicate the month.

Element 5 —Latitude: Two bytes reserved for value between -9000 and 9000. A positive value represents latitude North and a negative value represents latitude South. The true latitude is obtained by divided by 100.

Element 6 —Longitude: Two bytes reserved to hold a value in the range from -18000 to 17999. A positive value represents longitude east and a negative value represents longitude West. The true longitude is obtained by divided by 100.

Element 7 - Day of Month: One byte reserved for a value between 1 and 31 to indicate the day.

Element 8 - Hour of Day: One byte reserved for a value between 0 and 23 to indicate the hour.

Element 9 - Minute of Hour: One byte reserved for a value between 0 and 59 to indicate minutes.

Element 10 - Second of Minute: One byte reserved for a value between 0 and 59 to indicate seconds.

Element 11 - Sea Surface Temperature SST: Two bytes reserved for a value between -20 and 350. The true SST value is obtained by dividing by 10. A value of -3000 means the data is missing.

Element 12 —Reliability: Two bytes reserved for a value between 0 and 32767 to indicate reliability.

Element 13 - Solar Zenith Angle: Two bytes reserved for a value between 0 and 1800. The true zenith angle is obtained by dividing by 10.
Element 14 - Satellite Zenith Angle: Two bytes reserved for a value between -600 and 600. The true zenith

angle is obtained by dividing by 100.

Element 15 - Analyzed Field SST: Two bytes reserved for a value between -20 and 350. This value is divided by 10 to obtain the true sea surface temperature. A value of -3000 indicates that data is missing.

Element 16 - Internal Error: Two bytes reserved for a value between 0 and 1000. To obtain the true internal error divide the value is by 100.

Element 17 - Solar Azimuth Angle: Two bytes reserved for a value between 0 and 1800. To obtain the true azimuth angle divide the value is by 10.

Element 18 - Climatological SST: Two bytes reserved for a value between -20 and 350. To obtain the true SST value divide the value is by 10. A value of -3000 means the data is missing.

Element 19 - Beginning Row of Unit Array: One byte reserved for a value between 1 and 11.

Element 20 - Beginning Column of Unit Array: One byte reserved for a value between 1 and 11.

Element 21 - AVHRR Channel 1 Average: Two bytes reserved for a value between 0 and 10000. To obtain the true channel 1 average divide the value is by 100.

Element 22 - AVHRR Channel 2 Average: Two bytes reserved for a value between 0 and 10000. To obtain the true channel 1average divide the value is by 100.

Element 23 - AVHRR Channel 3 Average: Two bytes reserved for a value between 0 and 32767. To obtain the true channel 1 average divide the value is by 100.

Element 24 - AVHRR Channel 4 Average: Two bytes reserved for a value between 0 and 32767. To obtain the true channel 1 average divide the value is by 100.

Element 25 - AVHRR Channel 5 Average: Two bytes reserved for a value between 0 and 32767. The true channel 1 average value is obtained by dividing the value by 100.

Element 26 - Space View SDEV Channel 1: Two bytes reserved for a value between 0 and 10000. The true SDEV channel 1 average is obtained by divided the number by 100.

Element 27 - Space View SDEV Channel 2: Two bytes reserved for a number between 0 and 10000. The true value is obtained by dividing the number by 100.

Element 28 - Space View SDEV Channel 3: Two bytes reserved for a number between 0 and 32767. To get the true value divide this value is by 100.

Element 29 - Space view SDEV Channel 4: Two bytes reserved for a number between 0 and 32767. To get the true value divide this value is by 100.

Element 30 - Space View SDEV Channel 5: Two bytes reserved for a number between 0 and 32767. To get the true value, divide this value by 100.

Element 31 - Algorithm Number: Two bytes reserved for a value between 1 and 12.

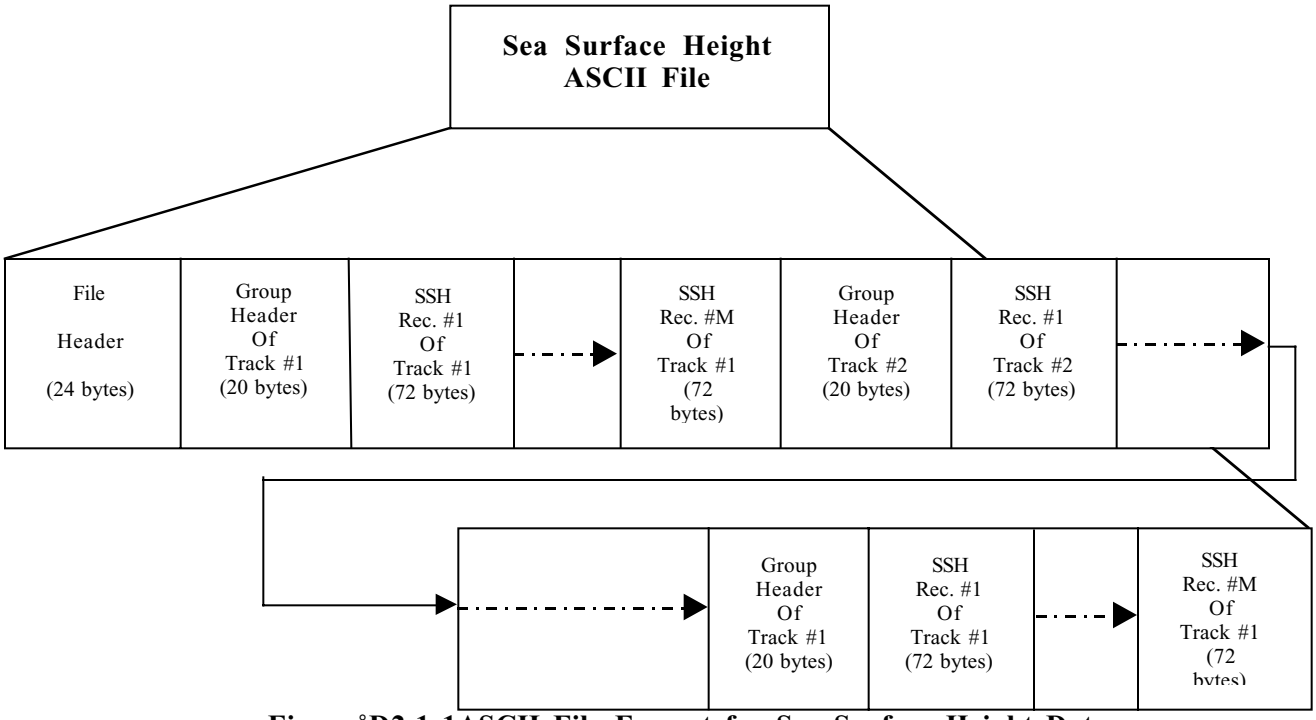
Element 32 - Aerosol Optical Thickness: Two bytes reserved for aerosol optical depth (or thickness). The valid range for this value is from 0 to 2440. Divide this value by 1000 to get the true value. A value of –1 indicates that no current data exists for the given area.
Element 33 —Spare: Two bytes reserved are spares.

D2 Sea Surface Height Product

The NAVOCEANO Altimetry Data Fusion Center (ADFC) ASCII Sea Surface Height (SSH) file contains SSH observations derived from multiple satellite altimeters on a daily basis. The ADFC receives TOPEX/POSEIDON data from the Jet Propulsion Laboratory via ftp, ERS-2 data from NOAA/NESDIS via SPP/ATM, and GFO data from the Naval Satellite Operations Center Remote Sites in Laguna Peak, CA and Prospect Harbor, ME. NAVOCEANO transmits these ASCII SSH files via SPP/ATM to provide global sea surface height data to FNMOC for operational oceanographic models.

D2.1 SSH Data File Format

Figure˚D2.1-1 shows the ASCII data file format for the SSH data. The file is formatted to contain a file header and data records group together by tracks.



Figure˚D2.1-1 ASCII File Format for Sea Surface Height Data

D2.3 SSH File Header

The file header occupies 21 bytes containing information that indicates the altimeter type by satellite type and identification. This header is present only once at the beginning of the file. The data type and values are shown in Table D2.1-1 as follows:

Table D2.1-1 Data Type and Values contained within the Header

Data Type	Code Value
SatType	8 = TOPEX 15 = ERS-2 7 = GFO
sat_id	1 = (TOPEX) 2 = (ERS-2) 3 = (GFO)

D2.4 SSH Group Header and Records

The remaining bytes of the file consist of sea surface height records grouped by track number. Each group consists or a group (or track) header record corresponding to a track and a record for each sea surface height within that group.

Each group header record consists of elements containing information about cycle number, track number, number of points in track and sat_id value.

The record for each sea surface height point contains the following elements:

Point number
Latitude in degrees
Longitude in degrees
Time in days past 1 January 1985
Sea surface height in meters

The following example presents a partial data file of SSH data to illustrate the arrangement of information within the file.

```
SatType = 8
sat_id = 1
253  2  2752  1
1924    63.896458    179.145615    5321.012852
0.068198
1926    63.854412    179.358871    5321.012875
0.001400
1927   63.833260   179.465240   5321.012887   -
0.072598
1928   63.812027   179.571472   5321.012898   -
0.108139
1929   63.790710   179.677536   5321.012910   -
0.122344
1930   63.769306   179.783417   5321.012921   -
0.201981
1931   63.747822   179.889130   5321.012933   -
0.246596
...
```

D3 Marine Wind Speed and Significant Wave Height

The NAVOCEANO Altimetry Data Fusion Center (ADFC) Marine Wind Speed and Significant Wave Height (MWS/SWH) file contains wind speed and wave height observations derived from multiple satellite altimeters on a routine basis. The ADFC receives three TOPEX/POSEIDON data files per day from the Jet Propulsion Laboratory via ftp. Also, approximately 30 ERS-2 data files are received from NOAA/NESDIS via SPP/ATM, and 4 -5 GFO data files from the Naval Satellite Operations Center Remote Sites in Laguna Peak, CA and Prospect Harbor, ME per day. NAVOCEANO transmits the files via SPP/ATM to provide global wind speed and wave height data to FNMOC on an operational basis.

D3.1 MWS/SWH Data Format

The MWS/SWH Data product is transmitted in binary BUFR Format. The data set is encoded in accordance with Version 1.1 of the BUFR Encoder. All versions of the BUFR Encoder standards are provided by the European Space Agency (ESA). The format of the data set is shown in Figure D3.1-1.

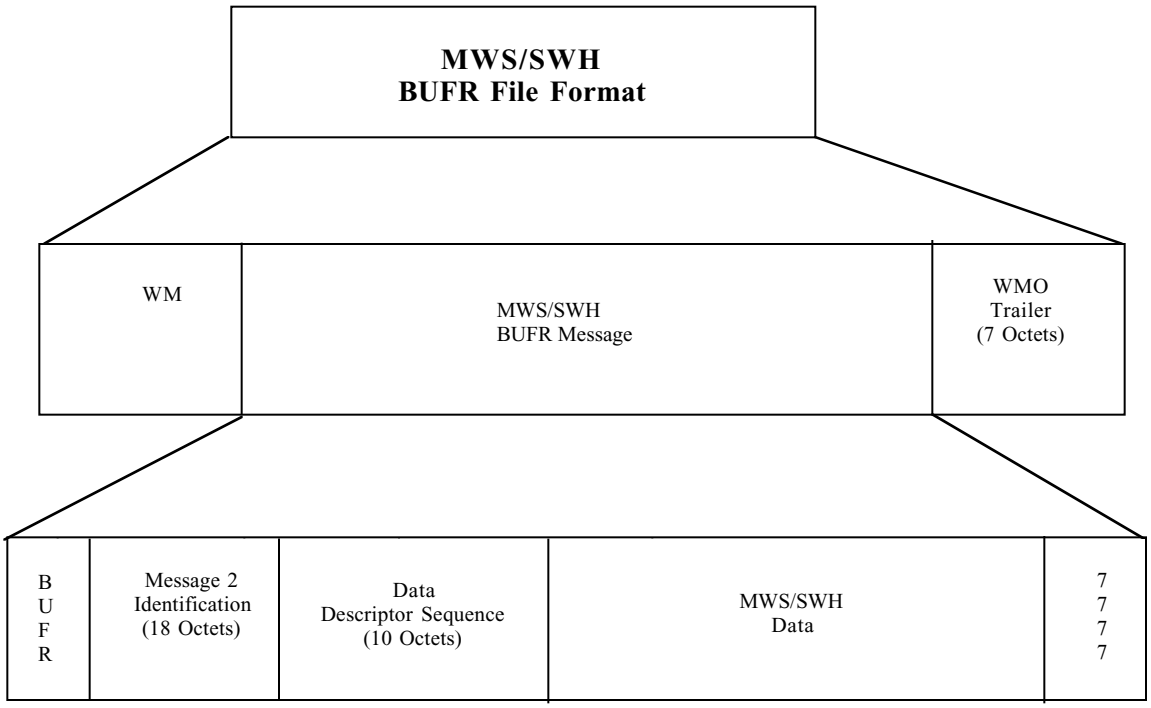


Figure D3.1-1 Marine Wind Speed and Significant Wave Height Data File Format

Each WMO FM94 BUFR encoded FDP file is transmitted as a continuous binary data stream. The file consists of three parts: a 31-Octet (Byte) WMO Header containing WMO GTS routing information; the FM94 BUFR encoded BUFR message; and a 7-Octet WMO Trailer to indicate the end of the FDP file.

D3.2 WMO Header

The **WMO Header** is a 31-byte (octet) block that contains information, which enables the file to be routed to customers over the WMO GTS. Table D3.2-1 shows the format and content of the header.

Table D3.2-1 Format and Content of the WMO Header for the MWS/SWH Data Set

Field #	# Bytes	Data Type	Byte Position	Description
1	1	ASCII	1	Start of Header Character = 1 decimal
2	3	ASCII	2-4	<CR><CR><LF>
3	3	ASCII	5-7	Message Sequence Number
4	3	ASCII	8-10	<CR><CR><LF>
5	6	ASCII	11-16	$T_1T_2A_1A_2$ii T_1 Defines Data Exchange Format T_2 Defines the Data Type A_1 Defines the Data Sub Type A_2 Defines the Area Code ii = Product Type
6	1	ASCII	17	<SP>
7	4	ASCII	18-21	Source of File
8	1	ASCII	22	<SP>
9	6	ASCII	23-28	Date/time DDHHMM
10	3	ASCII	19-31	<CR>CR>LF>

Field 1 is a 1-byte field containing a character used to indicate the start of the WMO header block.

Field 3 is a 3-byte field containing the Message Sequence Number (range 001 to 999), which is generated by the encoding or routing center.

Field 5 is a 6-byte field containing the Product Definition code. This code defines the data exchange format, data type, WMO area code, and product type.

Field 7 is a 4-byte field used to indicate the source or originator of the file.

Field 9 is a 6-byte field containing the date and time of observation.

D3.3 MWS/SWH BUFR Message

The BUFR message contains the FM94 BUFR encoded data. Table D3.3-1 shows the general format of a BUFR message, which includes the optional section 2. The MWS/SWH BUFR message does not use section 2 of the message.

Table D3.3-1 General BUFR Encoded Data

Section	Description
0	BUFR Code Description
1	Data Identification
2	Optional — For Local Use Only
3	Data Description
4	Data
5	End of BUFR

Table D3.3-2 shows the format and content for Section 0 of the MWS/SWH BUFR message. The information within the BUFR message is arranged in accordance with Version 1.1 of the WMO FM94 BUFR standards. The beginning of the message is indicated in section 0 by the 4-byte character BUFR . This indicator starts in the 32nd byte of the data set.

Table D3.3-2 Start of the MWS/SWH BUFR Message (Section 0)

Field #	# Bytes	Data Type	Byte Position	Description
1	4	ASC*II	32-35	BUFR

Table D3.3-3 shows the format and content for Section 1 of the MWS/SWH BUFR message. This section 1 contains information that identifies the data stored in Section 4 and starts in the 36th byte of the data set.

Table D3.3-3 MWS/SWH Product Identification (Section 1)

Field #	# Bytes	Data Type	Byte Position	Description
1	3	Integer*	36-38	Length of Section = 18
2	1	Integer*	39	BUFR Specification and Tables Used = 1
3	2	Integer*	40-41	Code for originating Center = 253
4	1	Integer*	42	Type of BUFR Message
5	1	Integer*	43	Indicator for Section 2 = 0 if no Section 2
6	1	Integer*	44	Type of data = 12 for satellite data
7	1	Integer*	45	Code for Product = 8 UWI
8	2	Integer*	46-47	Version of BUFR Tables
9	1	Integer*	48	Year of Century (0-99)
10	1	Integer*	49	Month (1 — 12)
11	1	Integer*	50	Day (1-31)
12	1	Integer*	51	Hour (0 — 23)
13	1	Integer*	52	Minute (0-59)
14	1	Integer*	53	0 (Pad Byte)

*Unsigned Integer

The first 3 bytes contains the value that indicates the length of section 1. The vaue indicated for section 1 is 18 bytes. Within the 8th byte, bit number 1 set to zero indicates that section 2 is omitted. Bytes 9 and 10 contains the Data Category Code, which indicates the BUFR message type as determined from BUFR Table A. In accordance with BUFR Table A, the value set in byte 9 indicates that the MWS/SWH information is satellite data. The information within bytes 11 and 12 indicates that the standard WMO FM 94 BUFR tables are used. The year, date, and time of the data are indicated in bytes 13 through 17.

Table D3.3-4 shows the format and content for Section 3 of the MWS/SWH BUFR message. This section 3 contains information that describes the data stored in Section 4 and starts in the 54th byte of the data set.

Table D3.3-4 MWS/SWH Data Description (Section 3)

Field #	# Bytes	Data Type	Byte Position	Description
1	3	Integer*	54-56	Length of Section
2	1	Integer*	57	Reserved Byte
3	2	Integer*	58-59	Number of Encoded Observations 361 for UWI
4	1	Byte	60	Data Description Flags
5	1	Byte	61	Bits 1 - 2 = 3 Bits 3 — 8 = 12
6	1	Byte	62	Bits 1 — 8 = 201 for UWI products
7	1	Integer*	63	Pad Character = 0

*Unsigned Integer

The first 3 bytes contains the value that indicates the length of section 3. The vaue indicated for section 3 is 10 bytes. The number of data subsets (or reports) contained within the data section (Section 4) is indicated by the value 361 in bytes 5 and 6. There are 361 locations, all reports having the same data format. Bytes 8 and 9 contains the FXY coded descriptor (3 12 201) that describes the data in section 4. This FXY descriptor describes the format of the MWS/SWH data in subset for one of the 361 location

and is repeated to contain all of the data for the 361 locations.

Table D3.3-5 shows the format and content of the MWS/SWH data. Bytes 1 through 3 contains the value that indicates the length of section 4 and starts in the 64th byte of the data set. The vaue indicated varies according to the data that is reported.

Table D3.3-5 MWS/SWH Data Fields (Section 4)

Field #	# Bytes	Data Type	Byte Position	Description
1	3	Integer*	64-66	Length of Section
2	1	Integer*	67	Reserved Byte = 0
3	Variable	Binary Data	68 -	Binary Data

*Unsigned Integer

The data starts in byte 5 of this section (or byte 68 within the message). Table D3.3-6 shows the format and content of one subset of the MWS/SWH data. Each subset corresponds to one data location and all data for that point location is reported as indicated. The first 342 bits of the data reports the common information that applies to all 361 locations. This data is compressed to zero bits for all except the first location to reduce redundancy.

Each subset consists of a cell wherein the data for the particular location is stored. The cell size for each location is a maximum of 224 bits or minimum of 140 bits. There are as many cells as there are location (361 points). Thus 361 cells are required to contain the data. Each cell that storing a maximum or minimum number of bits (depending upon the presence or absence of data). The minimum number of bits for a cell is required for transmission.

The heavier line that separates fields 41 and 42 is there to delimit the Significant Wave Height Data from the Marine Wind Speed and Product Confidence Code data. However, each location contains all of this information within the cell.

Table D3.3-6 MWS/SWH Binary Data

Field #	# Bits **		Data Type	Byte Position	Description	Units
	D	C				
1	10	0	I*	68	Satellite Identifier	
2	14	0	I*		Software Identifier	
3	8	0	Bit		Originating Center Code	
4	8	0	Bit		Ground Station Code	
5	9	0	I*		Satellite Track	Degrees
6	12	0	I*		Year	
7	4	0	I*		Month	
8	6	0	I*		Day	
9	5	0	I*		Hour	
10	6	0	I*		Minute	
11	16	0	I*		Seconds	sec * 10^{-3}
12	31	0	I*		State Vector : X location	m * 10^{-2}
13	31	0	I*		State Vector : Y location	m * 10^{-2}
14	31	0	I*		State Vector : Z location	m * 10^{-2}
15	31	0	I*		State Vector: X location	$ms^{-1}*10^{-5}$
16	31	0	I*		State Vector : Y location	$ms^{-1}*10^{-5}$
17	31	0	I*		State Vector: Z location	$ms^{-1}*10^{-5}$
18	9	0	Bit		Satellite Instrument	
19	12	0	I*		Year	
20	4	0	I*		Month	
21	6	0	I*		Day	
22	5	0	I*		Hour	
23	6	0	I*		Minute	
24	16	0	I*		Second	sec * 10^{-3}
Fields 25-44 are repeated 361 times						
25	15	9	I*		Latitude	Deg * 10^{-2}
26	16	10	I*		Longitude	Deg * 10^{-2}
Fore beam data						
27	10	9	I*		Radar Incident Angle	Deg * 10^{-4}
28	12	8	I*		Radar Look Angle	Deg * 10^{-4}
29	13	11	I*		Backscatter	DB * 10^{-2}
30	10	4	I*		Noise Figure	Percent*10^{-1}
31	8	3	I*		Missing Packet Counter	Number
Mid beam data						
32	10	9	I*		Radar Incident Angle	Deg * 10^{-4}
33	12	8	I*		Radar Look Angle	Deg * 10^{-4}
34	13	11	I*		Backscatter	DB * 10^{-2}
35	10	4	I*		Noise Figure	Percent
36	8	3	I*		Missing Packet Counter	Number
Aft beam data						
37	10	9	I*		Radar Incident Angle	Deg * 10^{-4}
38	12	8	I*		Radar Look Angle	Deg * 10^{-4}
39	13	11	I*		Backscatter	DB * 10^{-2}
40	10	4	I*		Noise Figure	Percent
41	8	3	I*		Missing Packet Counter	Number
42	12	6	I*		Wind Speed at 10m	$Ms^{-1}*10^{-1}$
43	9	6	I*		Wind Direction at 10m	Degrees
44	13	4	Bit		UWI Product Confidence Code	

*Unsigned Integer
** D Column = maximum number of bits; C Column = number of bits required for transmission

Section 5 of the BUFR message contains the coded characters 7777 and indicates the ending of the

BUFR message stream. Table D3.3-6 shows the format and content for the 4 bytes of section 5. The end of the data set varies according to the combined number of cells with and without data.

Table D3.3-6 End of BUFR Message (Section 5)

Field #	# Bytes	Data Type	Description
1	4	ASCII	End of BUFR Message = 7777

D3.4 MWS/SWH WMO Trailer

The WMO Trailer is a 7-byte data block, which indicates the end of the data set. The position of the trailer within the data set will vary according to the data.

Table D3.4-1 WMO Trailer Fields

Field #	# Bytes	Data Type	Byte Position	Description
1	3	ASCII		<CR><CR><LF>
2	3	ASCII		<CR><CR><LF>
3	1	ASCII		End of Transmission character = 3 decimal