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Marine Meteorology
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Metadata and Migration to BUFR

MONITORING AND DATA MANAGEMENT

METADATA AND CODING

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Metadata and Migration into BUFR Format

Introduction

Validation

Table Updates

Status Issues

◆ BATHY, TESAC, BUOY, TRACKOB

```
JJVV 26108 1310/ 70626 13838 22408 40230 88888 05205 02269 32267^M^M  
45256 64249 99238 99901 21223 28218 35215 40203 43199 48187 50184^M^M  
52177 56174 60163 63154 69147 80136 99902 03121 31117 73109 99904^M^M  
58091 99906 91066 99907 60061 66666 14710 30910 D5NZ=^M^M
```

BATHY

```
KKXX 24108 1547/ 70213 02536 88870 20003 32822 20008 32821 20014 ^M^M  
32821 20019 32821 20025 32821 20030 32820 20035 32820 20041 32814 ^M^M  
99999 13859=
```

```
ZZYY 44834 05038 1727/ 737010 034401 6111/^M^M  
444 20110 05038 1724/ 50101 80010 80071 9/015=^M^M
```

```
NNXX 04118 2300/ 50053 16151 41199 60257 83526 WTEU=  
TRACKOB
```

FM 62 VIII Ext. TRACKOB
FM 63-XI Ext. BATHY
Limited Metadata

ASCII Format
Human Readable



Metadata and Migration into BUFR Format

Introduction



- ◆ Low bandwidth legacy systems favoured the implementation of fixed ASCII formats (e.g. FM 62 VIII Ext. TRACKOB) and the usage of abbreviated coding.
- ◆ Nowadays: data volumes, accuracy needs, temporal and spatial resolutions are higher, there are new parameters. TACs cannot manage this.
- ◆ WMO-mandated decision to move to TDCFs by 2012.
- ◆ TDCFs support higher resolution and accuracy, provide higher performance and automation, flexibility, compression (BUFR, GRIB) and self description.
- ◆ TDCFs: BUFR, CREX, GRIB1, GRIB2.

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- ◆ **Binary Universal Format for the Representation of data**
- ◆ **WMO standard (binary) format for observational data for transmission on GTS/RMDCN.**
- ◆ **Often used for archiving and interface to NWP assimilation systems**
- ◆ **Self-defining data stream by use of common tables**
- ◆ **Dynamic replication**
- ◆ **Local descriptors**
- ◆ **JCOMM/SOT 4th session**  **AOML testbed for BUFR XBT&TSG**

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♦ A BUFR message consists of 6 sections:

- 1) Indicator: “BUFR” , Edition Number.
- 2) Header - IDs, Date/Time, table version number, ...
- 3) Optional data (not often used). e.g. Data using local descriptors, XML metadata, ...

4) List of descriptors

5) User data (bit stream)

6) “7777”

Self-description! Descriptors listed in predefined standard TABLES (units, scales, Ref. Value, data width-bits-, etc)

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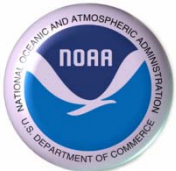


- ◆ **Specific BUFR templates and common sequences have been defined for different observation systems, improving data processing, preventing encoding errors and adding concision to the data description section.**
- ◆ **Operational community do care about the data origin, processing history and quality of the data. There are metadata requirements impossible to meet with TACs.**
- ◆ **Need to establish and define QC steps for the salinity measurements and associated metadata to be transmitted on the GTS.**
- ◆ **Urgent effort to include bio-chemical data, specially pCO2sw**

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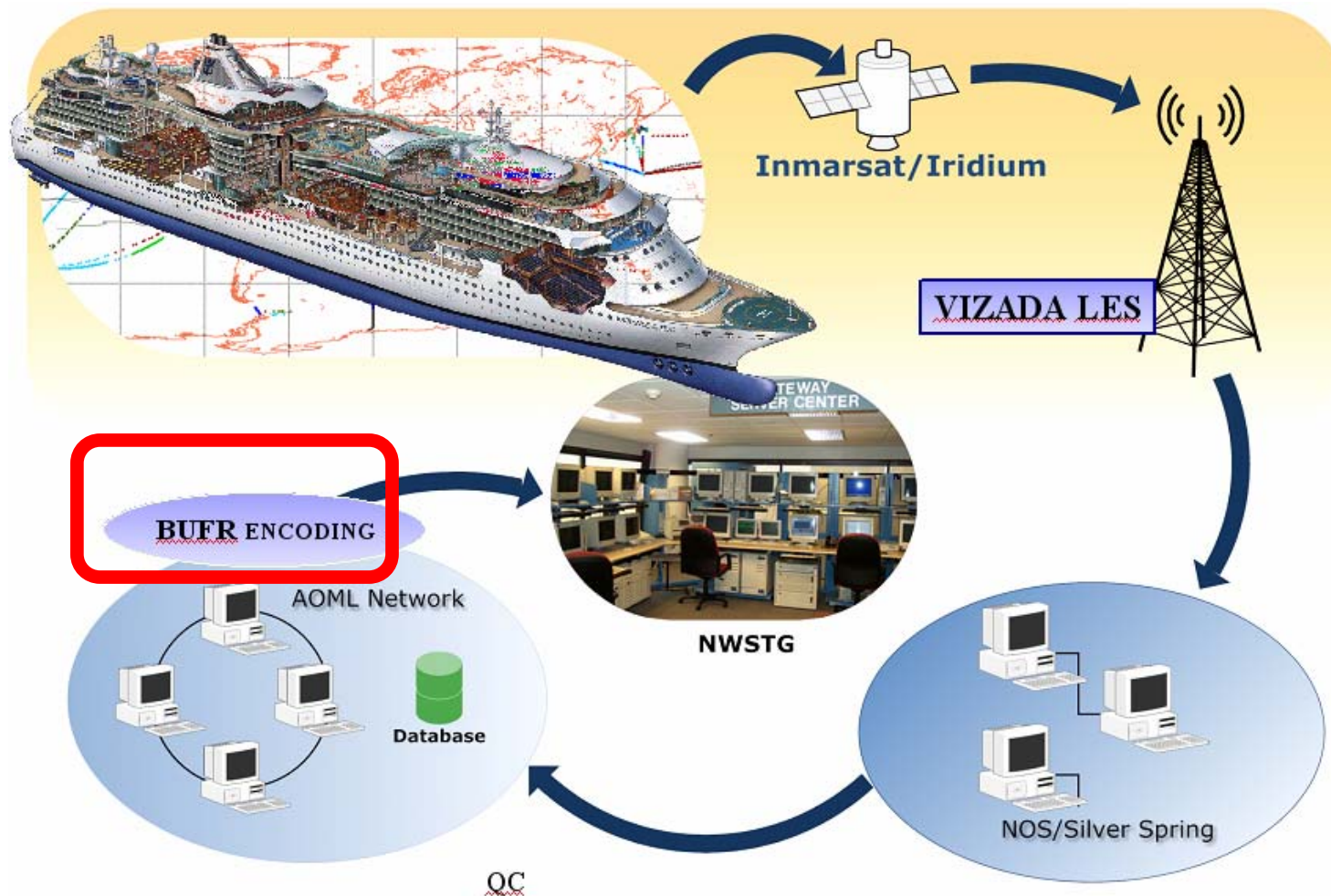
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General Data Flow





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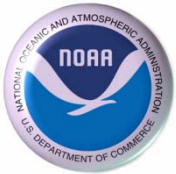
\$AOML:001
WMOID:WTEX
SHIPN:TEST
TSGTECM:test@noaa.gov
IMONO:IMONO Value
TSGMOD:Seabird 45
TSGSN:tsg-45-12345
IDP:4.5678
DCAL:1/1/2007
COTG:123
COTH:234
COTI:345,

COTJ:456
COTF0:567
COCG:678
COCH:789
COCI:890
COCJ:901
COCPR:111
COCTR:222
COA0:333
COA1:999
COA2:888
COA3:444

COSL:555
COTO:666
EXTMOD:SBE38 ext temp model
EXTSN:SBE38 S/N Value
EXTTD:777
EXTDCAL:2/2/2002
SSTMOD:SST Model
SSTSN:SST Ser Num
SSTD:11.1
SSTDICAL:3/3/2003

\$AOML:002, YMD:20070406, HMS:173544, LAT:56.46385, LON:-157.62350, SAL:31.184, COND:3.00, INT:5.437, SST:5.58

The flags generated during the QC process are:
possible datetime, possible location, at sea point, possible speed, global range (T,S), not spike (T,S), not gradient (T,S), climatology(T,S), buddy check (T,S), bottle_check



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Proposed descriptors

- ◆ Intake Depth
- ◆ Instrument type
- ◆ External ref SST
(with depth&instrument type)
- ◆ Date last biofouling removal
- ◆ Calibration date
- ◆ QC flags
- ◆ Bio-chemical parameters

BUFR TEMPLATE FOR TRACKOB DATA (Approved by CBS Ext. 6)

BUFR template

```

3 08 010 0 01 011 Ship or mobile land station identifier
1 13 000 Delayed replication of 13 descriptors
0 31 001 Delayed descriptor replication factor
3 01 011 Date
3 01 012 Time
3 01 021 Latitude/Longitude (high accuracy)
0 04 080 Averaging period for following value
0 22 049 Sea surface temperature
0 04 080 Averaging period for following value
0 22 059 Sea surface salinity
0 04 080 Averaging period for following value
0 22 005 Direction of sea surface current
0 02 042 Indicator for sea surface current speed
0 22 032 Speed of sea surface current
0 02 042 Indicator for sea surface current speed (cancel)
0 04 080 Averaging period for following value (cancel)

```

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- ◆ WMO mandated migration from TAC→TDF by 2012
- ◆ Relevant conditions to be satisfied before experimental exchange may start:
 - Corresponding BUFR/CREX-tables and templates are available
 - Training of concerned testing parties has been completed
 - Required software of testing parties (encoding, decoding, viewing) is implemented
- ◆ Relevant conditions to be satisfied before operational exchange may start:
 - Corresponding BUFR/CREX-tables and templates are fully validated
 - Training of all concerned parties has been completed
 - All required software (encoding, decoding, viewing) is operational

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◆ Template for Validation

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NEW 0 22 0378	XBT/XCTD Launcher Type (scale 2)	NEW Code Table			
3 06 005	<i>Depth, Direction, Speed and Method of current</i>	(0 22 178)			0 02 031, 0 07 062, 0 22 004, 0 22
NEW 0 22 179	Software version of profile recorder	CCITT IA5 (Data			031 at depths
0 08 080	Qualifier for quality class	Width 256)			Value: 0=global water pressure
NEW 0 22 180	Autolauncher software version number	CCITT IA5 (Data			profile
0 33 050	Global GTSP quality class	Width 256)			For global water pressure profile
NEW 0 22 181	Instrument manufacturer's serial number	CCITT IA5 (Data			as qualified above
0 08 080	Qualifier for quality class	Width 32)			Value: 1=global water
0 08 041	Date Significance				Temperature profile
0 33 050	Buoy platform identifier				Manufacture Date
0 01 011	Manufacturing Date	Date			For global water temperature
NEW 0 03 03	Introduction number in Lloyd's registry. 0 to	Numeric (Data	-		Optional additional ship
3 01 011	999999999	Width 14)			description
0 01 042	Ship line number according to SOOP				
0 05 036	Ship name according to SOOP				10-5 precision
0 07 032	Agency in charge of operating the observing				Important field
0 11 001	Platform				
0 02 027	Winds				
0 02 038	Height of station above MSL				
0 02 038	Speed of motion of moving observing platform				[0 22 001],[0 22 011],[0 22 021]
NEW 3 15 004	Sea Surface Temperature				
0 22 049	Water temperature profile				NEW Sequence containing the
0 07 032	Method of removing platform direction and				profile itself
0 07 032	Height of thermometer above station platform				0 07 032 Here height of
NEW 0 22 177	Speed from current				from 5 m to
0 22 068	Height of XBT/XCTD Launcher	Numeric	m		thermometer (for a BUOY)
0 22 067	Water temperature profile recorder type				
0 22 067	Instrument type for water temperature profile				
0 22 067	measurement				



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◆ New Code Table

0 22 178

XBT/XCTD Launcher Type

Code figure	
0	Unknown
1	LM-2A Deck-mounted
2	LM-3A Hand-Held
3	LM-4A Thru-Hull
4-9	Reserved
10	AL-12 TSK Autolauncher (up to 12 Probes)
11-19	Reserved
20	SIO XBT Autolauncher (up to 6 probes)
21-29	Reserved
30	AOML XBT V6 Autolauncher (up to 6 Deep Blue probes)
31	AOML XBT V8.0 Autolauncher (up to 8 Deep Blue probes)
32	AOML XBT V8.1 Autolauncher (up to 8 Deep Blue&Fast Deep probes)
33-89	Reserved
90	CSIRO Devil Autolauncher
91-99	Reserved
100	MFSTEP Autolauncher (Mediterranean)
101-254	Reserved
255	Missing value

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◆ Modifications to Code Tables

0 08 041
Data Significance

8	XBT Manufacture Date
---	----------------------

0 08 080
Qualifier for GTSP quality flag

Code figure	
10	Water pressure/Depth at a level

0 33 050
Global GTSP quality flag

9	Good for operational use; Caution; check literature for other uses
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Metadata and Migration into BUFR Format

◆ Proposed New Sequences

3 15 004

Water Temperature Profile

(Temperature profile observed by XBT or Buoy)

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TABLE REFERENCE			TABLE REFERENCES			ELEMENT NAME
F	X	Y				
3	15	004	1	06	000	Delayed replication of 6 descriptors
			0	31	001	Replication factor
			0	07	063	Depth below sea surface
			0	08	080	Qualifier for quality class (qualifier = 10)
			0	33	050	GTSP quality class for depth
			0	22	045	Subsurface sea temperature
			0	08	080	Qualifier for quality class (qualifier = 11)
			0	33	050	GTSP quality class



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- ◆ **Status**
 - **Capability to encode BUFR bulletins (single and multiple)**
 - **Limited Testing with NCEP**
 - **XBT ad-hoc bulletins**
 - **Decoding successful**
 - **DIF HI Project**
 - **T/S Profiles**
 - **Very Simple Template. Decoding successful**
 - **Code Available**
 - **WMS/WCS/OPeNDAP/ERDDAP Servers**
- ◆ **Issues:**
 - **Limited Feedback, Legacy Systems, BUFR Size limitations, more NWPC (FNMOC, ECMWF?)**

