Migration of XBT GTS data format from Traditional Alphanumeric Codes to BUFR: FRE-related metadata.

Joaquin Trinanes[1,2]

(1)Cooperative Institute for Marine and Atmospheric Studies, University of Miami, Miami, FL
(2) Technological Research Institute. University of Santiago de Compostela, Spain.

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Status and Issues

- **TAC: BATHY, TESAC, BUOY, TRACKOB**

BATHY

JJVV 22080 1107/ 304880 092823 88888 05271 04291 24291 53290 56289^M^M
63269 83253 90243 99901 08228 27187 42165 50163 68147 83146 99902^M^M
01138 26134 33130 57127 89119 95118 99903 20113 74107 99904 20103^M^M
72099 99905 16094 24094 99906 46086 74084 99082 99907 04081 18081^M^M
38078 99908 30072 62069 81067 A8UY4=^M^M

FM 63-XI Ext. BATHY. This format does not allow the distribution of metadata

ASCII Format
Human Readable
No-time –related info

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- **Low bandwidth legacy systems favoured the implementation of fixed ASCII formats (e.g. FM 63-XI Ext. BATHY) 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 flags to be transmitted on the GTS.**

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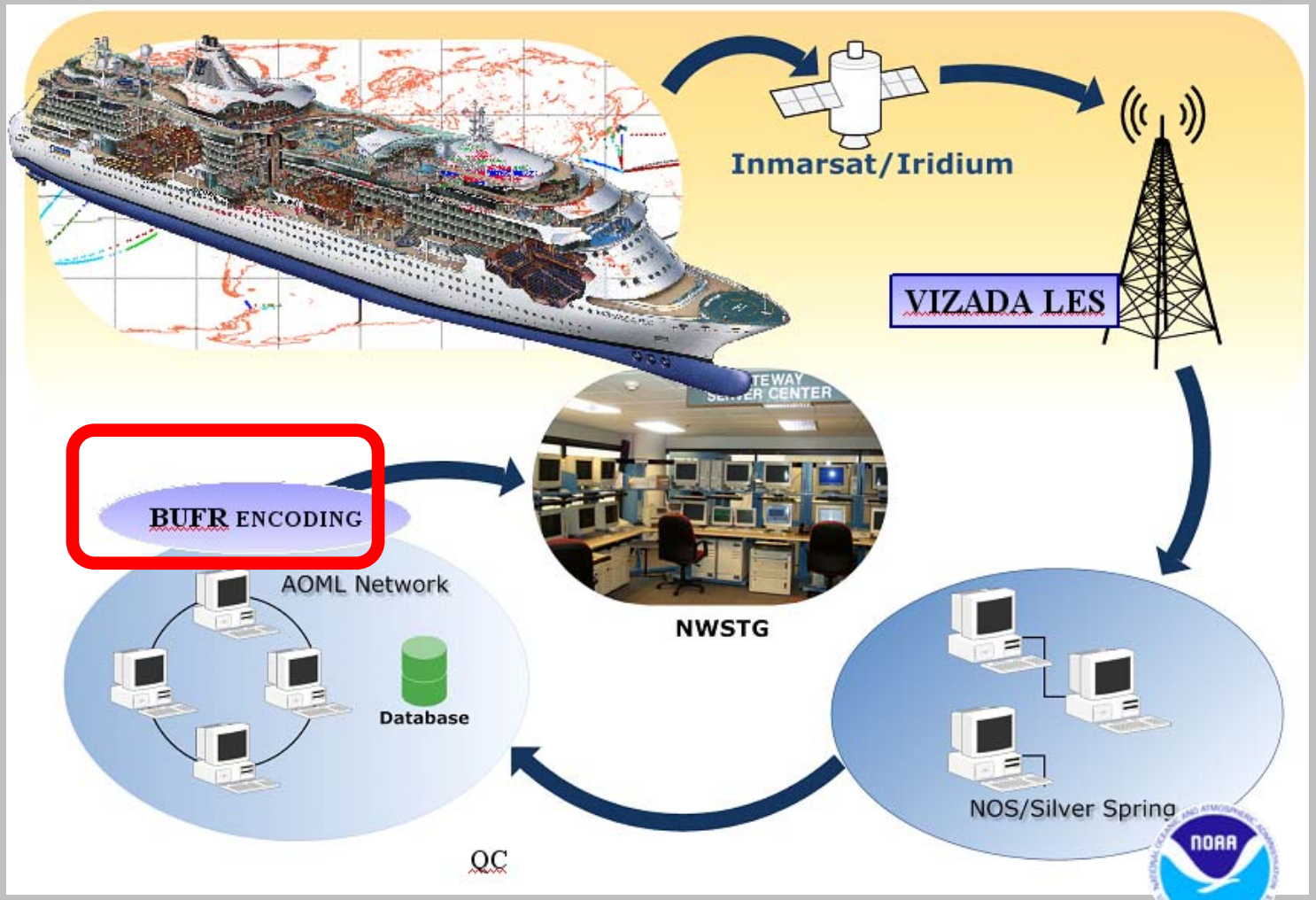
- **General Data Flow at NOAA/AOML**



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- **General Data Tracking at NOAA/AOML**

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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

F	X	Y	Name	Unit	Scale	Ref value	Data Width (bits)	Notes
0	22	176	Unique identifier for the profile	Numeric	0	0	33	(1)
0	01	011	Ship or mobile land station identifier	CCITT IA5	0	0	72	(2)
0	01	103	IMO Number. Unique Lloyd's registry.	Numeric	0	0	24	(3)
0	01	087	WMO Marine observing platform extended identifier	Numeric	0	0	23	(4)
0	01	019	Long Station or site name	CCITT IA5	0	0	256	(5)
0	01	080	Ship line number according to SOOP	CCITT IA5	0	0	32	
0	05	036	Ship transect number according to SOOP	Numeric	0	0	7	(6)
0	01	013	Speed of motion of moving observing platform	m/s	0	0	10	
0	01	012	Direction of motion of moving observing platform	degree true	0	0	9	
3	01	011	Date					
3	01	012	Time					
3	01	021	Latitude and longitude (high accuracy)					
0	07	032	Height of sensor above local ground (or deck of marine platform)	m	2	0	16	

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0	07	033	Height of sensor above water surface	m	1	0	12	(7)
0	02	002	Type of instrumentation for wind measurement	Flag table	0	0	4	(8)
0	11	002	Wind speed	m/s	1	0	12	
0	11	001	Wind direction	degree true	0	0	9	
0	07	032	Height of sensor above local ground (or deck of marine platform)	m	2	0	16	(9)
0	07	033	Height of sensor above water surface	m	1	0	12	(9)
0	12	101	Temperature/Dry-bulb temperature	K	2	0	16	
0	12	103	Dew-point temperature	K	2	0	16	
0	07	032	Height of sensor above local ground (or deck of marine platform) (set to missing to cancel previous value)	m	2	0	16	
0	07	033	Height of sensor above water surface (set to missing to cancel previous value)	m	1	0	12	

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- **Template for Validation**

3	02	021	Waves					
0	02	171	Instrument serial number for water temperature measurement	CCITT IA5	0	0	64	(16)
3	02	056	Sea Surface Temperature					(10)
0	02	171	Instrument serial number for water temperature measurement (set to missing to cancel the previous value)	CCITT IA5	0	0	64	(16)
0	02	031	Duration and time of current measurement	code table	0	0	5	
0	02	030	Method of current measurement	code table	0	0	3	
0	22	005	Direction of sea surface current	degrees true	0	0	9	
0	22	032	Speed of sea surface current	m/s	0	0	13	
0	02	032	Indicator for digitization	code table	0	0	2	(11)
3	15	004	Water temperature profile (Temperature profile observed by XBT or Buoy)					(12)
0	22	063	Total depth of water	m	0	0	14	
0	08	080	Qualifier for GTSPP quality class	code table	0	0	6	(13)
0	33	050	Global GTSPP quality class	code table	0	0	4	
0	22	178	XBT/XCTD launcher Type	code table	0	0	8	(1

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- **Template for Validation**

0	22	177	Height of XBT/XCTD Launcher above sea level	m	0	0	6	(15)
0	22	067	Instrument type for water temperature profile measurement	code table	0	0	10	
0	02	171	Instrument serial number for water temperature profile measurement	CCITT IA5	0	0	64	(16)
0	08	041	Date significance	Code table	0	0	5	(17)
0	26	021	Year	year	0	0	12	
0	26	022	Month	month	0	0	4	
0	26	023	Day	day	0	0	6	
0	22	068	Water temperature profile recorder type	code table	0	0	7	
0	25	061	Data acquisition software type (or name) and version number	CCITT IA5	0	0	96	(18)
0	01	036	Agency in charge of operating the observing platform	code table	0	0	20	

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- **Template for Validation**

Notes:

(1) Currently some countries are using a 32 bit CRC calculation to generate a unique identifier for the individual BATHY messages. Since missing values in a template have all bits set to 1 and since this may be a legitimate CRC result, we have set the bit width to be 33. If using the CRC to generate the unique ID, use all fields of the BUFR template starting with the "Ship or mobile land station identifier (0-01-011).

(2) Place the ship call sign here.

(3) Values are restricted to be between 0 and 9999999.

(4) If field 0-01-011 is used, this field will be left missing and vice versa.

(5) Place the ship name here.

3

(12) Proposed new sequence as follows. Note that temperatures are stored in K.

3-15-004: Water Temperature Profile

1-06-000	Delayed replication of 6 descriptors
0-31-002	Extended delayed descriptor replication factor
0-07-063	Depth below sea surface
0-08-080	Qualifier for quality class. Note: set to qualifier = 13
0-33-050	GTSPP quality class
0-22-043	Subsurface sea temperature
0-08-080	Qualifier for quality class. Note: set to qualifier = 11
0-33-050	GTSPP quality class

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- **New Code Table**

(14) Propose new code table 0-22-178 as follows:

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

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Modifications to Code Tables

(17) Set the value for this descriptor to be 8 and we require a new code figure in table 0-08-041:

Code	Meaning
0	Parent site
1	Observation site
2	Balloon manufacture date
3	Balloon launch point
4	Surface observation
5	Surface observation displacement from launch point
6	Flight level observation
7	Flight level termination point
8	Instrument manufacture date
9-30	Reserved
31	Missing value

The subsequent date fields then record year, month and day of the manufacturing date of the instrument.

0 33 050 Global GTSPP quality flag

Code figure	Meaning
0	Unqualified
1	Correct value (all checks passed)
2	Probably good but value inconsistent with statistics (differ from climatology)
3	Probably bad (spike, gradient, ... if other tests passed)
4	Bad value, Impossible value (out of scale, vertical instability, constant profile)
5	Value modified during quality control
6-7	Reserved
8	Interpolated value
9	Good for operational use; Caution; check literature for other uses
10-14	Reserved
15	Missing value

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- **Proposed New Sequences**

(12) Proposed new sequence as follows. Note that temperatures are stored in K.

3-15-004: Water Temperature Profile

1-06-000	Delayed replication of 6 descriptors
0-31-002	Extended delayed descriptor replication factor
0-07-063	Depth below sea surface
0-08-080	Qualifier for quality class. Note: set to qualifier = 13
0-33-050	GTSPP quality class
0-22-043	Subsurface sea temperature
0-08-080	Qualifier for quality class. Note: set to qualifier = 11
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- **Category 2 Metadata**
  - **Available through META-T Servers (NDBC & NMDIS)**

- **Telecommunication system used**
- **Recorder version number**
- **Telecommunication ID number**
- **Fall rate equation coefficients**

- **Would it be possible to use customized FRE coefficients for GTS profiles?**
  - **We should commit to the good practices and request a new entry into code table 1770.**
  - **Provide metadata to META-T servers.**
  - **Local section could serve to test new encoding schemes.**
  - **Template allows to provide the full profile and implicitily, the coefficients.**

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- **Status**
  - **BUFR Ed. 4 (Recommended by WMO)**

  Are users ready for this?
  - **Map RT QC Flags to BUFR Flag Convention**
  - **Headers:**

  IOSX01 KWBC

- **Routing**
- **Encoding**
- **Decoding**
- **Source binary format should accommodate additional metadata.**

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- **Status**
  - **Capability to work with BUFR bulletins (single and multiple)**
  - **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 NWPCs involved (FNMOC, ECMWF), fill metadata fields, BUFR-ASCII routing, …**