



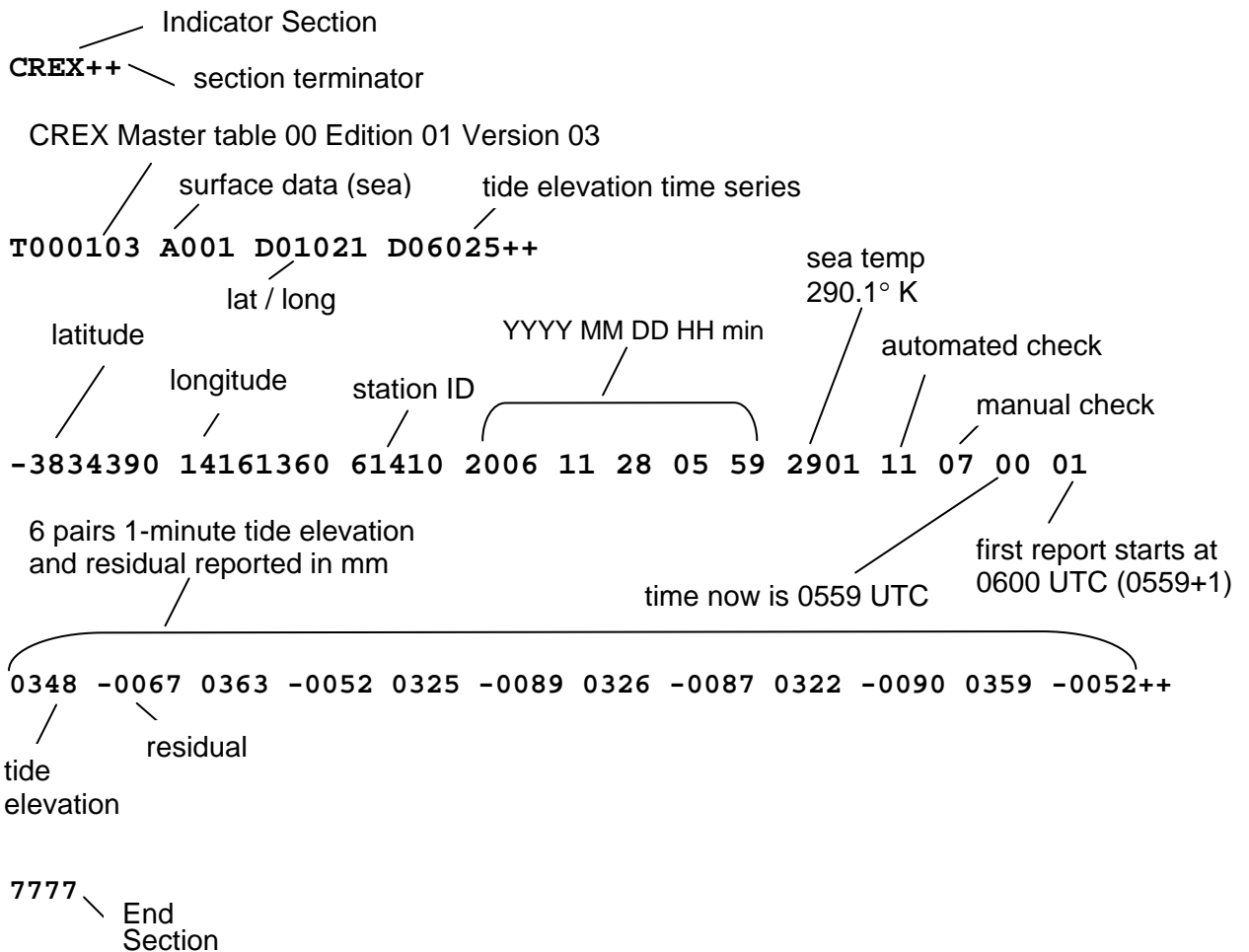
A brief description of the CREX sea level bulletins to be issued by the Australian Bureau of Meteorology on GTS with effect from 18 December 2006

1. Introduction

CREX (Character form for the **R**epresentation and **E**Xchange of meteorological data) and BUFR (**B**inary **U**niversal **F**orm for the **R**epresentation of meteorological data) are table driven code forms (TDCF) approved by the WMO for the representation and exchange of observational data and are recommended for all present and future WMO applications. They offer advantages of flexibility and expandability compared with traditional alphanumeric code forms. TDCF are self descriptive which means that the form and content of the data contained in the message are described within the message itself. While BUFR conserves storage in a highly compressed binary form CREX provides human readability.

The following is only a brief description of the CREX sea level bulletins to be issued by the Australian Bureau of Meteorology. Readers should refer to the WMO Manual on Codes ^[1] and other guidance material available from WMO ^[2]. Relevant documents are described in the Reference section.

2. CREX sea level report explained



Decoded values of the observation time stamp, tide elevation and residual for the six pairs of 1-minute time series are as follows:

| Time | Tide Elevation (mm) | Residual (mm) |
|-------------|--------------------------------|--------------------------|
| 0600 | 348 | -67 |
| 0601 | 363 | -52 |
| 0602 | 325 | -89 |
| 0603 | 326 | -87 |
| 0604 | 322 | -90 |
| 0605 | 359 | -52 |

3. CREX templates for sea level data

A full description of the following CREX templates for sea level data and their expanded sequences are available in the WMO Manual on Codes ^[1] and the updates approved for implementation with effect from 2 November 2005 ^[2]. Users should refer to the respective BUFR/CREX table entries for details of the table element name, unit, scale and data width for each item of the element descriptors (Table B entries).

The template D06025 offers the reports of tidal elevation and residual to be repeated six times whereas D06019 when used on its own can choose to report variable replications, examples as follows:

(i) Tidal elevation and residual are replicated 6 times

```
CREX++
T000103 A001 D01021 D06025++
```

(ii) Variable replications for single to unlimited observations

```
CREX++
T000103 A001 D01021 D06019 R02000 B22038 B22039++
```

Replication of tidal elevation and residual is not specified in the Data Description Section. This is called delayed replication. The number of replications is specified in the Data Section by a 4-digit number corresponding to the position of the replication descriptor in the Data Description Section.

The fully expanded sequence of the two CREX templates consist of the following:

| D06019 | D06025 |
|---------------|---------------|
| ----- | ----- |
| B01075 | B01075 |
| B04001 | B04001 |
| B04002 | B04002 |
| B04003 | B04003 |
| B04004 | B04004 |
| B04005 | B04005 |
| B22042 | B22042 |
| B22120 | B22120 |
| B22121 | B22121 |
| C01002 | C01002 |
| B04015 | B04015 |
| B04065 | B04065 |
| | R02006 |
| | B22038 |
| | B22039 |

4. Station location D01021

B05001 7-character latitude in 0.00001 degrees, e.g. 1234567
 B06001 8-character longitude in 0.00001 degrees, e.g. -12345678

South latitude shall be assigned negative values
 West longitude shall be assigned negative values

5. Tide station identification B01075

The Australian National Tide Table number (ANTT) will be used because all sea level stations or tide gauges operated in Australia are given an ANTT number by the Australian Hydrographic Service as a station identification.

WMO numbers have been used for the Sea Level Fine Resolution Acoustic Measuring Equipment (SEAFRAME) stations operated in the South Pacific Sea Level and Climate Monitoring Project and hourly reports of sea level data transmitted in the plain language section in SYNOP bulletins are being switched to PTWC. However, not all sea level stations will have WMO number or Bureau identification number. In addition to the stations operated by the Bureau's National Tidal Centre (NTC), the Bureau also has access to stations operated by other state agencies such as the Victorian Channels Authority, the Australian Antarctic Division, Manly Hydraulics Laboratory, etc. and they have no WMO numbers or Bureau site numbers.

It should be noted that sea level stations in other networks also use different identification systems, e.g. GLOSS (Global Sea Level Observing System), WOCE (World Ocean Circulation Experiment), ANT (Admiralty Tide Table), etc. A cross reference of the different station identifications for some of the Bureau's sea level stations are listed below.

| | |
|-------|--|
| ANTT | Australian National Tide Table number |
| ATT | Admiralty Tide Table number |
| BOM | Bureau's 6-digit station identification number |
| GLOSS | Global Sea Level Observing System |
| WOCE | World Ocean Circulation Experiment |
| WMO | WMO number |

| ANTT | ATT | BOM | GLOSS | WOCE | WMO | Station Name |
|-------|------|--------|-------|------|-------|-------------------------------|
| 46280 | | 200865 | 046 | 171 | 96997 | COCOS ISLAND NTC AWS |
| 56130 | 5613 | 200862 | 400 | 400 | 92036 | PNG NTC AWS |
| 56670 | 5667 | 200859 | 066 | 009 | 91519 | SOLOMON IS. NTC AWS |
| 57320 | 5732 | 200857 | | 046 | 91559 | VANUATU NTC AWS |
| 59260 | | 032182 | | | 94297 | CAPE FERGUSON NTC AWS |
| 59670 | | 033208 | | | 95298 | ROSSLYN BAY NTC AWS |
| 60420 | | 068253 | | | 95745 | PORT KEMBLA NTC AWS |
| 60910 | | 091344 | | | 95963 | BURNIE NTC AWS |
| 61170 | | 092133 | 056 | 335 | 95987 | SPRING BAY NTC AWS |
| 61410 | | 090192 | 055 | | 95826 | PORTLAND NTC AWS |
| 61583 | | 023899 | | | 94800 | PORT STANVAC NTC AWS |
| 62000 | | 018207 | 308 | | 95652 | THEVENARD NTC AWS |
| 62080 | | 109504 | 054 | 176 | 95648 | ESPERANCE NTC AWS |
| 62237 | | 009265 | | | 95605 | HILLARYS BOAT HARBOUR NTC AWS |
| 62650 | | 003102 | 040 | 166 | 95202 | BROOME NTC AWS |
| 63230 | | 014072 | 062 | 168 | 95122 | DARWIN NTC AWS |
| 63511 | | 014406 | | | 94154 | GROOTE EYLANDT NTC AWS |
| 65180 | 6518 | 200866 | 403 | 403 | 93713 | JACKSON BAY NTC AWS |
| 65980 | 6598 | 200855 | 139 | 023 | 91844 | COOK ISLANDS NTC AWS |
| 66600 | 6660 | 200861 | | 038 | 91789 | TONGA NTC AWS |
| 66840 | 6684 | 200814 | | 401 | 91756 | SAMOA NTC AWS |
| 67050 | 6705 | 200863 | 122 | 118 | 91689 | SUVA NTC AWS |
| 67070 | 6707 | 200856 | 402 | 402 | 91679 | LAUTOKA NTC AWS |
| 67440 | 6744 | 200860 | 121 | 025 | 91642 | TUVALU NTC AWS |
| 67590 | 6759 | 200299 | 113 | 002 | 91611 | KIRIBATI NTC AWS |
| 67640 | 6764 | 200858 | 114 | 004 | 91531 | NAURU NTC AWS |
| 67680 | 6768 | 200832 | 112 | 005 | 91375 | MARSHALL ISLANDS NTC AWS |

6. Initial time stamp (Year-Month-Day-Hour-Minute) and time increment

B04001 4- character Year, e.g. 2006

B04002 2-character Month 01, 02, ... 11, 12
 B04003 2-character Day 01, 02, ... 29, 30, 31
 B04004 2-character Hour, e.g. 00, 01, 02, ... 23
 B04005 2-character Minute, e.g. 00, 01, 02, ... 59

This is the initial time stamp that is used to calculate the measurement time stamp for the six 1-minute water level values contained in the bulletin for the station.

B04015 is the time increment of minutes that are to be added to the initial time stamp to determine a base time stamp from which the six water level time stamps are to be calculated. This is a 2-character number in minutes after the Data Descriptor Operator C01002 has been applied to its original value which is a 4-character number. C01002 is a data width replacement operator for replacing B04015 with the specified data width of 2.

To determine the time of each measurement as in the following sample CREX sea level message:

```
CREX++
T000103 A001 D01021 D06025++
-3834390 14161360 61410 2006 11 28 05 59 2901 11 07 00 01
0348 -0067 0363 -0052 0325 -0089 0326 -0087 0322 -0090 0359 -0052++
7777
```

B04015 is the time increment to be applied to the base time stamp to determine the first and earliest water level value time stamp. The same value continues to be applied to determine each succeeding time stamp. This means:

```
0348 was measured at 2006 11 28 06:00 UTC
0363 was measured at 2006 11 28 06:01 UTC
0325 was measured at 2006 11 28 06:02 UTC
0326 was measured at 2006 11 28 06:03 UTC
0322 was measured at 2006 11 28 06:04 UTC
0359 was measured at 2006 11 28 06:05 UTC
```

7. Tidal elevation (B22038), tidal prediction and residual (B22039)

The SEAFRAME network of the Australian Baseline sea level stations has been upgraded to report one-minute average water level observations. The corresponding tidal predictions are also made available for the calculation of residuals, i.e. Observed value – Predicted value. Sample one-minute observations and predictions are as follows:

| Portland Sea Levels (1 minute) | | | | |
|--------------------------------|-------|------------|-------------|------------|
| Date | UTC | Obs (m) | Pred (m) | Res (m) |
| 28/11/2006 | 06:00 | 0.348 | 0.415 | -0.067 |
| 28/11/2006 | 06:01 | 0.363 | 0.415 | -0.052 |
| 28/11/2006 | 06:02 | 0.325 | 0.414 | -0.089 |
| 28/11/2006 | 06:03 | 0.326 | 0.413 | -0.087 |
| 28/11/2006 | 06:04 | 0.322 | 0.412 | -0.090 |
| 28/11/2006 | 06:05 | 0.359 | 0.411 | -0.052 |
| 28/11/2006 | 06:06 | 0.358 | 0.411 | -0.053 |
| 28/11/2006 | 06:07 | 0.372 | 0.410 | -0.038 |
| 28/11/2006 | 06:08 | 0.338 | 0.409 | -0.071 |
| 28/11/2006 | 06:09 | 0.363 | 0.408 | -0.045 |
| 28/11/2006 | 06:10 | 0.336 | 0.408 | -0.072 |
| 28/11/2006 | 06:11 | 0.362 | 0.406 | -0.044 |
| 28/11/2006 | 06:12 | 0.313 | 0.406 | -0.093 |

8. Sea / Water temperature B22042

The water temperature is given in degree K (Kelvin) in the CREX message

$$tK = tC + 273.15$$

9. Tide station automated/manual water level checks

B22120
B22121

Refer to the listed Code Tables and Flag Tables associated with the BUFR/CREX Table B in the WMO Manual on Codes ^[1]. B22120 is automated water level check and B22121 is manual water level check. They are encoded as 11 and 07 respectively if no automated and manual water level checks are performed, or 00 and 00 to indicate good data.

10. Bulletin preparation and GTS headers (TTAAii CCCC)

Bulletins transmitted on the GTS will comprise an abbreviated heading (TTAAii CCCC) for routing purpose on the Global Telecommunication System. The TTAAii is the data designator and CCCC is the international four-letter location indicator of the station or centre originating the bulletin. The WMO standard designators are given in Attachment II-5, Manual on the Global Telecommunication System, Volume I, Part II ^[3].

CBS-Ext.(06) has agreed on the allocation of a specific abbreviated heading TTAAii to be included in the WMO Manual on the GTS ^[3] for the collection and distribution of sea level data and deep-ocean tsunami detection data. A single T₁T₂, complemented with the A₁A₂ designator relevant to the country/ocean/sea area or basin concerned, for all sea level data for all alphanumerical code formats including CREX is recommended to facilitate routing.

According to the latest amendments adopted in CBS-Ext.(06) T₁T₂ = SZ will be used for all sea level data for all alphanumerical code formats including CREX. Depending on the location of the sea level station the following A₁A₂ designator will be implemented for bulletins compiled at RTH Melbourne:

AU for Australian coastal stations
PA for Australian stations in the Pacific Ocean area
PS for Australian stations in the South Pacific area
IO for Australian stations in the Indian Ocean area

CREX bulletins are able to report multiple stations as subsets of reports in the same bulletin. This will avoid using different ii indicator for each station.

CREX bulletins of six 1-minute observations/residuals transmitted every three minutes, 3 of which appeared in an earlier bulletin are repeated. The stations will be grouped in two bulletins:

SZIO01 AMMC (currently only Cocos Island is available)
SZAU01 AMMC (12 stations are now available from the Australian Baseline network)

11. Examples of reporting replications in CREX reports in succeeding bulletins

The CREX templates D06025 will be implemented with effect from 18 December 2006 for reporting the time series of 1-minute sea level observations. Six 1-minute observations will be transmitted every 3 minutes. Three 1-minute observations reported in the earlier message bulletin are repeated. Examples are as follows:

First CREX message bulletin
SZAU01 AMMC 280606
CREX++

T000103 A001 D01021 D06025++
-3834390 14161360 61410 2006 11 28 05 59 2901 11 07 00 01
0348 -0067 0363 -0052 0325 -0089 0326 -0087 0322 -0090 0359 -0052++
7777

Second CREX message bulletin

SZAU01 AMMC 280609
CREX++
T000103 A001 D01021 D06025++
-3834390 14161360 61410 2006 11 28 06 02 2901 11 07 00 01
0326 -0087 0322 -0090 0359 -0052 0358 -0053 0372 -0038 0338 -0071++
7777

Third CREX message bulletin

SZAU01 AMMC 280612
CREX++
T000103 A001 D01021 D06025++
-3834390 14161360 61410 2006 11 28 06 05 2901 11 07 00 01
0358 -0053 0372 -0038 0338 -0071 0363 -0045 0336 -0072 0362 -0044++
7777

It is also possible to transmit single 1-minute observation every minute but this will not be implemented at this stage.

SZAU44 AMMC 280600
CREX++
T000103 A001 D01021 D06019 R02000 B22038 B22039++
-3834390 14161360 61410 2006 11 28 06 00 2901 11 07 00 00 0001
0348 -0067++
7777

Sample bulletins to be implemented with effect from 18 December 2006 are as follows:

SZIO01 AMMC 130530
CREX++
T000103 A001 D01021 D06025++
-1211670 09689190 46280 2006 12 13 05 23 3008 11 07 00 01
1129 0094 1122 0087 1117 0082 1112 0078 1113 0079 1114 0080++
7777

SZAU01 AMMC 130530
CREX++
T000103 A001 D06025++
-1927750 14705860 59260 2006 12 13 05 23 3014 11 07 00 01
2175 -0070 2181 -0066 2183 -0067 2186 -0067 2189 -0067 2192 -0066+
-2316110 15079000 59670 2006 12 13 05 23 2993 11 07 00 01
3377 -0035 3373 -0040 3370 -0045 3372 -0044 3371 -0046 3374 -0044+
-3447390 15091190 60420 2006 12 13 05 23 2921 11 07 00 01
1172 0000 1163 -0008 1165 -0004 1157 -0010 1156 -0010 1158 -0007+
-4105000 14591470 60910 2006 12 13 05 23 2880 11 07 00 01
2258 0030 2271 0035 2277 0034 2279 0029 2279 0020 2287 0022+
-4254640 14793080 61170 2006 12 13 05 23 2885 11 07 00 01
1194 -0033 1186 -0040 1187 -0038 1177 -0047 1175 -0048 1177 -0045+
-3834390 14161360 61410 2006 12 13 05 23 2908 11 07 00 01
0413 -0039 0448 -0004 0421 -0032 0427 -0026 0446 -0007 0455 0002+
-3510860 13846720 61583 2006 12 13 05 23 2946 11 07 00 01
0452 -0059 0451 -0061 0452 -0060 0448 -0064 0450 -0062 0446 -0067+
-3214890 13364170 62000 2006 12 13 05 23 2952 11 07 00 01
0668 -0119 0668 -0121 0668 -0122 0670 -0122 0670 -0123 0671 -0124+
-3387330 12189500 62080 2006 12 13 05 23 2930 11 07 00 01
0630 0031 0630 0031 0638 0039 0645 0045 0638 0038 0639 0038+
-3182560 11573860 62237 2006 12 13 05 23 2960 11 07 00 01

```

0568 0003 0573 0007 0575 0009 0571 0005 0574 0007 0569 0001+
-1247190 13084580 63230 2006 12 13 05 23 3046 11 07 00 01
3632 -0058 3626 -0059 3621 -0057 3616 -0058 3611 -0059 3606 -0057+
-1386000 13641580 63511 2006 12 13 05 23 3036 11 07 00 01
0731 -0159 0729 -0161 0730 -0161 0733 -0158 0732 -0158 0732 -0159++
7777

```

The station details and GTS bulletin abbreviated headings to be implemented are as follows:

| ANNT | Station Name | TTAAii | Lat | Long |
|-------|----------------------------------|--------|-----------|-----------|
| 46280 | COCOS ISLAND NTC AWS | SZIO01 | -12.11670 | 96.89190 |
| 59260 | CAPE FERGUSON NTC AWS | SZAU01 | -19.27750 | 147.05860 |
| 59670 | ROSSLYN BAY NTC AWS | SZAU01 | -23.16110 | 150.79000 |
| 60420 | PORT KEMBLA NTC AWS | SZAU01 | -34.47390 | 150.91190 |
| 60910 | BURNIE NTC AWS | SZAU01 | -41.05000 | 145.91470 |
| 61170 | SPRING BAY NTC AWS | SZAU01 | -42.54640 | 147.93080 |
| 61410 | PORTLAND NTC AWS | SZAU01 | -38.34390 | 141.61360 |
| 61583 | PORT STANVAC NTC AWS | SZAU01 | -35.10860 | 138.46720 |
| 62000 | THEVENARD NTC AWS | SZAU01 | -32.14890 | 133.64170 |
| 62080 | ESPERANCE NTC AWS | SZAU01 | -33.87330 | 121.89500 |
| 62237 | HILLARYS BOAT HARBOUR NTC AWS | SZAU01 | -31.82560 | 115.73860 |
| 62650 | BROOME NTC AWS | SZAU01 | -18.00080 | 122.21830 |
| 63230 | DARWIN NTC AWS | SZAU01 | -12.47190 | 130.84580 |
| 63511 | GROOTE EYLANDT NTC AWS | SZAU01 | -13.86000 | 136.41580 |

12. References

[1] WMO Number 306 – Manual on Codes, Volume I, Part B (Binary Codes) and Part C (Common Features)

http://www.wmo.ch/web/www/DPS/Manual_Codes.html

[2] Guidance material on Table Driven Code Forms operational since 2 November 2005

<http://www.wmo.ch/web/www/WMOCodes.html>

[3] WMO Number 386 – Manual on the Global Telecommunication System (GTS), Volume I, Part II

http://www.wmo.int/web/www/ois/Operational_Information/WMO386/ManOnGTS.html

Prepared by: Kelvin Wong
RTH Melbourne
Bureau of Meteorology
Contact: k.wong@bom.gov.au
Last updated: 15 December 2006