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| WORLD METEOROLOGICAL ORGANIZATION  COMMISSION FOR BASIC SYSTEMS  -----------------------------  SECOND MEETING OF  INTER-PROGRAMME EXPERT TEAM ON DATA REPRESENTATION MAINTENANCE AND MONITORING  COLLEGE PARK, USA, 28 APRIL - 2 MAY 2014 |  | IPET-DRMM-II / Doc. 3.2 (7)  (16. 4. 2014)  -------------------------  ITEM 3.2  ENGLISH ONLY |

BUFR and CREX

**BUFR template for n-minute AWS data (3 07 092)**

*Submitted by Richard Weedon (UK Met Office)*

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**Summary and Purpose of Document**

This document contains additions to the template for n-minute AWS data originally proposed at the IPET-DRC 2012 (Exeter)

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**ACTION PROPOSED**

The meeting is requested to review the validation evidence and clear the template for pre-operational status

**ANNEXES:**

1. Code Tables (Proposed)

**Attachments**

1. Decode of BUFR test data from Mr Jeff Ator (NOAA)
2. Decode of BUFR test data from Mr Marian Majan (HEMI)
3. Decode of BUFR test data from Dr Enrico Fucile (ECMWF)

**DISCUSSIONS**

The third meeting of the Inter-Programme Expert Team on data representation and Codes (Melbourne 2010) agreed to modifications to the n-minute template (TM 307092) to allow the reporting of ground temperature measurements at more than one point (over a variety of surfaces, e.g. grass, concrete, road/runways). The meeting agreed to the further validation of the proposal.

The UK Met Office proposed further changes to the template at the first meeting of the Inter Programme Expert Team on Data Representation, Maintenance and Monitoring (IPET-DRMM - Tokyo 2013). The changes proposed being intended to allow for the identification and method of aspiration applied to humidity sensors. The meeting agreed to the changes and to an extension for the period of validation.

The following agreed to assist the UK Met office in the validation of the template and have contributed validation evidence as detailed below.

Mr Jeff Ator (NOAA)

Mr Marian Majan (HEMI)

Dr Enrico Fucile (ECMWF)

**PROPOSAL**

In the UK the replacement of psychrometers by capacitive sensors (mainly in 2008/09) seems to have replaced a dry bias with a wet bias (approximately -1%RH to +1.5-2%RH, but capacitive sensor bias is quite variable). This change in bias is potentially important for climate change studies, especially if it is found to apply to other countries as well. As observing has been automated, various other countries have also changed from psychrometers to capacitive sensors. However for many countries there is no direct evidence of which types of humidity instrument are used. The new WMO table driven code templates should be improved to indicate whether the system is aspirated or not; heated or not; and the type of humidity instrument used.

A new D descriptor 3 01 130 is proposed that would be placed in front of the current 3 02 072

|  |  |  |  |
| --- | --- | --- | --- |
| **3 01 130** |  | **Temperature and humidity instrumentation** |  |
|  | **0 03 002** | **Generic type of humidity instrument** | **Code table, 0** |
|  | **0 03 003** | **Configuration of sensors** | **Code table, 0** |
|  | **0 03 004** | **Type of Shield or Screen** | **Code table, 0** |
|  | **0 03 005** | **Horizontal Width of Screen or Shield (x)** | **m, 2** |
|  | **0 03 006** | **Horizontal Depth of Screen or Shield (y)** | **m, 2** |
|  | **0 03 007** | **Vertical Height of Screen or Shield (z)** | **m, 2** |
|  | **0 03 008** | **Artificially Ventilated Screen or Shield** | **Code table, 0** |
|  | **0 03 009** | **Degree of Forced Ventilation at time of reading** | **m-3 s-1, 1** |

In approving the new D sequence the meeting also agreed to the use of Class 03 “ to meet the growing need for observation and instrumentation metadata”.

**Alterations to the original proposal**

The validation of the proposal uncovered an error in the proposed D sequence. The Quality Descriptor for the Temperature and humidity instrumentation section had been placed in error. As a consequence the descriptor in question (0 33 003 as below) was moved so as to be part of the new D sequence.

|  |  |  |
| --- | --- | --- |
| 0 33 003 | Quality of humidity measurement | Code table, 0 |

The revised template will now be as below –

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  | Unit, scale |
| 3 01 089 |  | National station identification |  |
|  | 0 01 101 | State identifier (1) | Code table, 0 |
|  | 0 01 102 | National station number (1) | Numeric, 0 |
| **3 01 090** |  | **Fixed surface station identification; time, horizontal and vertical co-ordinates** |  |
|  | 3 01 004 | Surface station identification |  |
|  |  | WMO block number | Numeric, 0 |
|  |  | WMO station number | Numeric, 0 |
|  |  | Station or site name | CCITT IA5, 0 |
|  |  | Type of station | Code table, 0 |
|  | 3 01 011 | Year(2) | Year, 0 |
|  |  | Month(2) | Month, 0 |
|  |  | Day(2) | Day, 0 |
|  | 3 01 012 | Hour(2) | Hour, 0 |
|  |  | Minute(2) | Minute, 0 |
|  | 3 01 021 | Latitude (high accuracy) | Degree, 5 |
|  |  | Longitude (high accuracy) | Degree, 5 |
|  | 0 07 030 | Height of station ground above mean sea level | m, 1 |
|  | 0 07 031 | Height of barometer above mean sea level | m, 1 |
| **0 03 001** |  | **Surface station type** | **Code table, 0** |
| 0 08 010 |  | Surface qualifier (for temperature data) | Code table, 0 |
| **3 01 091** |  | **Surface station instrumentation** |  |
|  | 0 02 180 | Main present weather detecting system | Code table, 0 |
|  | 0 02 181 | Supplementary present weather sensor | Flag table, 0 |
|  | 0 02 182 | Visibility measurement system | Code table, 0 |
|  | 0 02 183 | Cloud detection system | Code table, 0 |
|  | 0 02 184 | Type of lightning detection sensor | Code table, 0 |
|  | 0 02 179 | Type of sky condition algorithm | Code table, 0 |
|  | 0 02 186 | Capability to detect precipitation phenomena | Flag table, 0 |
|  | 0 02 187 | Capability to detect other weather phenomena | Flag table, 0 |
|  | 0 02 188 | Capability to detect obscuration | Flag table, 0 |
|  | 0 02 189 | Capability to discriminate lightning strikes | Flag table, 0 |
| 0 04 015 |  | Time increment (= - n minutes) | Minute, 0 |
| 0 04 065 |  | Short time increment ( = 1 minute) | Minute, 0 |
| **1 33 000** |  | **Delayed replication of 33 descriptors** |  |
| 0 31 001 |  | Delayed descriptor replication factor (= n) | Numeric, 0 |
| 0 10 004 |  | Pressure | Pa, –1 |
| **1 03 000** |  | **Delayed replication of 3 descriptors** |  |
| **0 31 001** |  | **Delayed descriptor replication factor** | **Numeric, 0** |
| **3 02 070** |  | **Wind data** |  |
|  | 0 07 032 | Height of sensor above local ground | m, 2 |
|  | 0 07 033 | Height of sensor above water surface | m, 1 |
|  | 0 11 001 | Wind direction | Degree true, 0 |
|  | 0 11 002 | Wind speed | m s-1, 1 |
|  | 0 11 043 | Maximum wind gust direction | Degree true, 0 |
|  | 0 11 041 | Maximum wind gust speed | m s-1, 1 |
|  | 0 11 016 | Extreme counterclockwise wind direction of a variable wind | Degree true, 0 |
|  | 0 11 017 | Extreme clockwise wind direction of a variable wind | Degree true, 0 |
| **3 01 130** |  | **Temperature and humidity instrumentation** |  |
|  | **0 03 002** | **Generic type of humidity instrument** | **Code table, 0** |
|  | **0 03 003** | **Configuration of sensors** | **Code table, 0** |
|  | **0 03 004** | **Type of Shield or Screen** | **Code table, 0** |
|  | **0 03 005** | **Horizontal Width of Screen or Shield (x)** | **m, 2** |
|  | **0 03 006** | **Horizontal Depth of Screen or Shield (y)** | **m, 2** |
|  | **0 03 007** | **Vertical Height of Screen or Shield (z)** | **m, 2** |
|  | **0 03 008** | **Artificially Ventilated Screen or Shield** | **Code table, 0** |
|  | **0 03 009** | **Degree of Forced Ventilation at time of reading** | **m-3 s-1, 1** |
|  | **0 33 003** | **Quality of humidity measurement** | **Code table, 0** |
| **3 02 072** |  | **Temperature and humidity data** |  |
|  | 0 07 032 | Height of sensor above local ground | m, 2 |
|  | 0 07 033 | Height of sensor above water surface | m, 1 |
|  | 0 12 101 | Temperature/Air-temperature (scale 2) | K, 2 |
|  | 0 12 103 | Dew-point temperature (scale 2) | K, 2 |
|  | 0 13 003 | Relative humidity | %, 0 |
|  | 0 33 003 | Quality of humidity measurement | Code table, 0 |
| 1 03 000 |  | Delayed replication of 3 descriptors |  |
| 0 31 001 |  | Delayed descriptor replication factor | Numeric, 0 |
| 0 07 032 |  | Height of sensor above local ground **(6)** | m, 2 |
| 0 08 010 |  | Surface qualifier | Code table, 0 |
| 0 12 120 |  | Ground temperature | K, 2 |
| 0 07 032 |  | Height of sensor above local ground  (set to missing to cancel the previous value) | m, 2 |
| 0 08 010 |  | Surface qualifier  (set to missing to cancel the previous value) | Code table, 0 |
| 1 03 000 |  | Delayed replication of 3 descriptors |  |
| 0 31 000 |  | Short delayed descriptor replication factor | Numeric, 0 |
| 1 01 005 |  | Replicate 1 descriptor five times |  |
| 3 07 063 | 0 07 061 | Depth below land surface | m, 2 |
|  | 0 12 130 | Soil temperature (scale 2) | K, 2 |
| 0 07 061 |  | Depth below land surface  (set to missing to cancel the previous value) | m, 2 |
| 1 01 000 |  | Delayed replication of 1 descriptor |  |
| 0 31 000 |  | Short delayed descriptor replication factor | Numeric, 0 |
| **3 02 069** |  | **Visibility data** |  |
|  | 0 07 032 | Height of sensor above local ground | m, 2 |
|  | 0 07 033 | Height of sensor above water surface | m, 1 |
|  | 0 33 041 | Attribute of following value | Code table, 0 |
|  | 0 20 001 | Horizontal visibility | m, –1 |
| 0 07 032 |  | Height of sensor above local ground  (set to missing to cancel the previous value) | m, 2 |
| 0 07 033 |  | Height of sensor above water surface  (set to missing to cancel the previous value) | m, 1 |
| 1 01 000 |  | Delayed replication of 1 descriptor |  |
| 0 31 000 |  | Short delayed descriptor replication factor | Numeric, 0 |
| **3 02 073** |  | **Cloud data** |  |
|  | 0 20 010 | Cloud cover (total) | %, 0 |
|  | 1 05 004 | Replicate 5 descriptors four times |  |
|  | 0 08 002 | Vertical significance | Code table, 0 |
|  | 0 20 011 | Cloud amount | Code table, 0 |
|  | 0 20 012 | Cloud type | Code table, 0 |
|  | 0 33 041 | Attribute of following value | Code table, 0 |
|  | 0 20 013 | Height of base of cloud | m, –1 |
| 1 01 000 |  | Delayed replication of 1 descriptor |  |
| 0 31 000 |  | Short delayed descriptor replication factor | Numeric, 0 |
| **3 02 076** |  | **Precipitation, obscuration and other phenomena** |  |
|  | 0 20 021 | Type of precipitation | Flag table, 0 |
|  | 0 20 022 | Character of precipitation | Code table, 0 |
|  | 0 26 020 | Duration of precipitation(3) | Minute, 0 |
|  | 0 20 023 | Other weather phenomena | Flag table, 0 |
|  | 0 20 024 | Intensity of phenomena | Code table, 0 |
|  | 0 20 025 | Obscuration | Flag table, 0 |
|  | 0 20 026 | Character of obscuration | Code table, 0 |
| 1 02 000 |  | Delayed replication of 2 descriptors |  |
| 0 31 000 |  | Short delayed descriptor replication factor | Numeric, 0 |
| 0 13 155 |  | Intensity of precipitation | kgm-2s-1, 4 |
| 0 13 058 |  | Size of precipitation element | m, 4 |
|  |  | ***(end of the replicated sequence)*** |  |
| 1 02 000 |  | Delayed replication of 2 descriptors |  |
| 0 31 000 |  | Short delayed descriptor replication factor | Numeric, 0 |
| 0 20 031 |  | Ice deposit (thickness) | m, 2 |
| 0 20 032 |  | Rate of ice accretion | Code table, 0 |
| 1 01 000 |  | Delayed replication of 1 descriptor |  |
| 0 31 000 |  | Short delayed descriptor replication factor | Numeric, 0 |
| **3 02 078** |  | **State of ground and snow depth measurement** |  |
|  | 0 02 176 | Method of state of ground measurement | Code table, 0 |
|  | 0 20 062 | State of ground (with or without snow) | Code table, 0 |
|  | 0 02 177 | Method of snow depth measurement | Code table, 0 |
|  | 0 13 013 | Total snow depth | m, 2 |
| 1 02 000 |  | Delayed replication of 2 descriptors |  |
| 0 31 000 |  | Short delayed descriptor replication factor | Numeric, 0 |
| **3 02 079** |  | **Precipitation measurement** |  |
|  | 0 07 032 | Height of sensor above local ground | m, 2 |
|  | 0 02 175 | Method of precipitation measurement | Code table, 0 |
|  | 0 02 178 | Method of liquid water content measurement of  Precipitation | Code table, 0 |
|  | 0 04 025 | Time period (= - n minutes) | Minute, 0 |
|  | 0 13 011 | Total precipitation / total water equivalent of snow | kg m-2, 1 |
| 0 07 032 |  | Height of sensor above local ground  (set to missing to cancel the previous value) | m, 2 |
| 1 01 000 |  | Delayed replication of 1 descriptor |  |
| 0 31 000 |  | Short delayed descriptor replication factor | Numeric, 0 |
| **3 02 080** |  | **Evaporation measurement** |  |
|  | 0 02 185 | Method of evaporation measurement | Code table, 0 |
|  | 0 04 025 | Time period or displacement ( = - n minutes) | Minute, 0 |
|  | 0 13 033 | Evaporation /evapotranspiration | kg m-2, 1 |
| 1 01 000 |  | Delayed replication of 1 descriptor |  |
| 0 31 000 |  | Short delayed descriptor replication factor | Numeric, 0 |
| **3 02 081** |  | **Total sunshine data** |  |
|  | 0 04 025 | Time period (= - n minutes) | Minute, 0 |
|  | 0 14 031 | Total sunshine | Minute, 0 |
| 1 01 000 |  | Delayed replication of 1 descriptor |  |
| 0 31 000 |  | Short delayed descriptor replication factor | Numeric, 0 |
| **3 02 082** |  | **Radiation data** |  |
|  | 0 04 025 | Time period (= - n minutes) | Minute, 0 |
|  | 0 14 002 | Long-wave radiation, integrated over period specified | J m-2, -3 |
|  | 0 14 004 | Short-wave radiation, integrated over period specified | J m-2, -3 |
|  | 0 14 016 | Net radiation, integrated over period specified | J m-2, -4 |
|  | 0 14 028 | Global solar radiation (high accuracy),  integrated over period specified | J m-2, -2 |
|  | 0 14 029 | Diffuse solar radiation (high accuracy),  integrated over period specified | J m-2, -2 |
|  | 0 14 030 | Direct solar radiation (high accuracy),  integrated over period specified | J m-2, -2 |
| 1 02 000 |  | Delayed replication of 2 descriptors |  |
| 0 31 000 |  | Short delayed descriptor replication factor | Numeric, 0 |
| 0 04 025 |  | Time period (= - n minutes) | Minute |
| 0 13 059 |  | Number of flashes | Numeric |
| 1 01 000 |  | Delayed replication of 1 descriptor |  |
| 0 31 000 |  | Short delayed descriptor replication factor | Numeric, 0 |
| **3 02 083** |  | **First order statistics of P, W, T, U data** |  |
|  | 0 04 025 | Time period (= - n minutes) | Minute, 0 |
|  | 0 08 023 | First order statistics  (= 9; best estimate of standard deviation) (4) | Code table, 0 |
|  | 0 10 004 | Pressure | Pa, –1 |
|  | 0 11 001 | Wind direction | Degree true, 0 |
|  | 0 11 002 | Wind speed | m s-1, 1 |
|  | 0 12 101 | Temperature/dry-bulb temperature (scale 2) | K, 2 |
|  | 0 13 003 | Relative humidity | %, 0 |
|  | 0 08 023 | First order statistics (= missing value) | Code table, 0 |
| 0 33 005 |  | Quality information (AWS data) | Flag table, 0 |
| 0 33 006 |  | Internal measurement status information (AWS) | Code table, 0 |
|  |  |  |  |

**Annexe A Code Tables**

**0 03 001 Surface station type**

0 Land station (synoptic network)

1 Shallow water station (fixed to sea/lake floor)

2 Ship

3 Rig/Platform

4 Moored buoy

5 Drifting buoy (or drifter)

6 Ice buoy

7 Land station (local network)

8 Land vehicle

9 Autonomous marine vehicle

10-14 Reserved

15 Missing value

Notes

1. This table (and 0 02 233) have also been proposed to JCOMM (Etienne Charpentier) for use with ship BUFR data

2. The last three categories are for possible future use.

3. "Land station (local network)" distinguishes "non-synoptic" stations these aren't currently distributed on the GTS but might be stored in BUFR in the future.

4. There could be separate tables for marine and land stations but there are marginal cases (shallow water fixed stations in the southern North Sea and some rigs reporting in SYNOP code).

**0 03 002 Generic type of humidity instrument**

1. Psychrometer
2. Capacitive sensor (unheated)
3. Capacitive sensor (heated)
4. Resistive sensor
5. Ordinary human hair
6. Rolled hair
7. Goldbeater’s skin
8. Chilled mirror hygrometer
9. Dew Cell
10. Optical absorption sensor
    1. Reserved

15 Missing value

**0 03 003 Configuration of Sensors**

0 Solar Radiation Shield or Screen (Double V Section Louvers)

1 No Solar Radiation Shield or Screen

2 Solar Radiation Shield or Screen (Single V section Louvers)

3 Solar Radiation Shield or Screen (overlapping Louvers)

4 Solar Radiation Shield or Screen (non-overlapping louvers)

5 Solar Radiation Shield or Screen (not Louvered)

6 Integrated e.g. Chilled Mirror

7 Missing value

**0 03 004 Type of Shield or Screen**

0 within Stevenson screen (Wooden)

1 within Stevenson Screen (Plastic)

2 within Marine Stevenson Screen (wooden)

3 within Marine Stevenson Screen (Plastic)

4 within Cylindrical Section Plate Shield (metal)

5 within Cylindrical Section Plate Shield (wooden)

6 within Cylindrical Section Plate Shield (Plastic)

7 within Concentric tube (metal)

8 within Concentric tube (wooden)

9 within Concentric tube (plastic)

10 within Rectangular section Shield (metal)

11 within Rectangular section Shield (wooden)

12 within Rectangular section Shield (plastic)

13 within Rectangular section Shield (metal)

14 within Square section Shield (wooden)

15 within Square section Shield (plastic)

16 within Square section Shield (metal)

18 within Triangular section Shield (wooden)

19 within Triangular section Shield (plastic)

20 within Triangular section Shield (metal)

21 within open covered lean-to (reed/grass/leaf)

22 within open covered inverted v roof (reed/grass/leaf)

23-29 Reserved

30 Not Applicable e.g. Chilled mirror manufacturers enclosure

31 Missing Value

**0 03 008 Artificially Ventilated Screen or Shield**

0 Natural ventilation in use

1 Artificial aspiration in use: constant flow at time of reading

2 Artificial aspiration in use: variable flow at time of reading

3 -6 Reserved

7 Missing value