BUFR TEMPLATE FOR ROAD WEATHER DATA

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ABSTRACT

Although RWIS-BUFR code has already been used in some countries, new version was developed in co-operation between Czech and German national meteorological services during winter season 2004–2005. This code is supposed for future cross-border exchange of road weather data via Global Telecommunication System of the World Meteorological Organization (WMO). The template and local descriptors were developed by Eva Cervena (CHMI) and Sibylle Krebber (DWD) – members of Expert Team for Data Representation and Codes (WMO) in collaboration with authors of this paper. Local descriptors enable for example description of road sensor position (fast/slow lane, between/in the wheel tracks), type of road construction, and information about surrounding of the station. In RWIS it will make it possible to distinguish stations according to different parameters, for example name of road sensor manufacturers if necessary. In accord with national plans for migration from traditional meteorological codes to BUFR, the new road weather BUFR template should be used operationally in the Central Europe during winter season 2006/2007.

Keywords: Meteorological Codes, Cross-border Exchange of Data, World Meteorological Organization

1. INTRODUCTION

Cooperation in road meteorology between DWD and CHMI was initiated in connection with „Sumava Project“ (2001) concerning installation of common road weather stations near the border between Germany and the Czech Republic in the region of Sumava Mountains (Black Forest). The experts from CHMI and DWD developed SH70 code as a successor of SH10 code used in Germany in 90-ties, with aim of internal usage of data in presentation systems of DWD and CHMI. During 2004 the collection of data in SH70 in the Czech Republic has been realised and experimental cross-border exchange started in the end of winter season 2004/2005 with transmission of data via Global Telecommunication System of WMO.

The form of the SH10/SH70-code was chosen to look like the SYNOP-code, which is used internationally to exchange weather data. The data is grouped into blocks of 5 digits, certain numbers identify sections of data and groups of data containing the measured values of atmospheric parameters and road parameters. In accord with migration policy of WMO [1] to replace traditional alphanumeric codes by the table driven code BUFR (Binary Universal Form for the Representation of meteorological data), the work started with target to develop suitable template for road weather data. The second reason for choosing BUFR for representation of the road information is its ability to transmit more parameters and details about road weather station.

2. TEMPLATE

Important benefit of the proposed BUFR template is the ability to describe position of road weather station and individual sensors in detail. It is known that some manufacturers put temperature and humidity sensors into 2 m above local ground while another into 4 m. Height of wind sensors can also differentiate from case to case. In one country there can be trend to place road sensors between the wheel tracks whereas in neighbour country the sensors tend to be situated in the wheel tracks. If we intend to present road weather data from several countries in one information system [2], [3], it is important to have quality metadata with such details and to know what we can see in outputs from RWIS. This is also important in that the new European RWIS Norm probably will not standardise all details.

The template is presented in this paper without the corresponding BUFR descriptors.

Identification	
Short station or site name (for identification of the road weather monitoring site)	CCITT IA5 (up to 5 characters)
Station or site name	CCITT IA5 (up to 20 characters)
State / federal state identifier	CCITT IA5 (up to 4 characters)
Highway designator	CCITT IA5 (up to 5 characters)
Routes kilometer of highway	m, scale -2
Extended type of station	Flag table
Type of road	Code table
Type of construction	Code table
Year	Year
Month	Month
Day	Day
Hour	Hour
Minute	Minute
Latitude (high accuracy)	Degree, scale 5
Longitude (high accuracy)	Degree, scale 5
Height of station ground above mean sea level	m, scale 1
Temperature, humidity and visibility data	
Height of sensor above local ground	m, scale 2
Temperature/dry-bulb temperature	K, scale 2
Dew-point temperature	K, scale 2
Relative humidity	%
Height of sensor above local ground (= missing value)	m, scale 2
Horizontal visibility	m, scale –1
Road temperature and other data	
Replicate nine descriptors	
Delayed descriptor replication factor	numeric
Position of road sensors	Code table
Road surface temperature	K, scale 2
Replicate two descriptors	
Delayed descriptor replication factor	numeric
Depth below land surface = 0.30 m in the first replication, = e.g. 0.15 or 0.07 m in the second replication	m, scale 2
Road sub-surface temperature	K, scale 2
Depth below land surface (= missing value)	m, scale 2
Water film thickness	m, scale 3
Road surface condition	Code table
Precipitation data	
Time period in minutes	Minute
Intensity of phenomena (for intensity of precipitation)	Code table
Intensity of precipitation	kg m^{-2} s^{-1}, scale 4
Type of precipitation	Flag table
Total precipitation / total water equivalent of snow	kg m^{-2}, scale 1
Wind data	
Height of sensor above local ground	m, scale 2
Time significance (= 2 (time averaged))	Code table
Time period (= - 10 minutes)	Minute
Wind direction	Degree true

Wind speed	m s^{-1}, scale 1
Time significance (= missing value)	Code table
Maximum wind gust	
Time period in minutes	Minute
Maximum wind gust direction	Degree true
Maximum wind gust speed	m s^{-1}, scale 1
State of functionality	
Quality information (AWS data)	Flag table

3. CODE AND FLAG TABLES

List of manufacturers, the standard of time period 15 minutes the same as other basic table inputs were adopted from Germany being gradually adjusted.

Code figure	**Name of road sensor manufacturer**
0	Reserved
1	ANT/Bosch
2	Boschung
3	SSI/Scan (MicKS)
4	Vaisala
5	Vibrometer
6	Malling
7 -14	Reserved
15	Missing value

Bit No.	**Extended type of station**
1	Automatic
2	Manned
3	Event triggered
4	Longer time period than the standard
5	Reserved
All 6	Missing value

Code figure	**Position of road sensors**
0	Fast lane between the wheel tracks
1	Fast lane between the wheel tracks in the opposite direction
2	Fast lane in the wheel tracks
3	Fast lane in the wheel tracks in the opposite direction
4	Slow lane between the wheel tracks
5	Slow lane between the wheel tracks in the opposite direction
6	Slow lane in the wheel tracks
7	Slow lane in the wheel tracks in the opposite direction
8 – 14	Reserved
15	Missing value

Code figure	**Type of construction**
0	Asphalt
1	Concrete
2	Concrete construction
3	Steel-girder construction
4	Box girder bridge
5	Orthotrope slab
6	Drain asphalt
7-14	Reserved
15	Missing value

Code figure	**Road surface condition**
0	Dry
1	Moist
2	Wet
3	Rime
4	Snow
5	Ice
6	Glaze
7	Not dry
8-14	Reserved
15	Missing value

Code figure	**Type of road**
0	Free track without further information
1	Free track, embankment
2	Free track, flat relative to surroundings
3	Free track, water basin(s) in vicinity
4	Free track, forest
5	Free track, cleft
6	Free track, on hilltop
7	Free track, on hilltop, forest
8	Free track, in valley
9	Free track, in valley, forest
10	Free track, north inclination
11	Free track, north inclination, forest
12	Free track, south inclination
13	Free track, south inclination, forest
14-19	Reserved
20	Bridge without further information
21	Bridge across a valley in a urban area
22	Bridge across a valley with forest/meadows/fields
23	Bridge across street/track
24	Bridge across big river/canal
25	Bridge across river/canal of medium size
26	Bridge across a small stream/loading canal
27-30	Reserved
31	Missing value

Bit No.	**Type of precipitation**	Bit No.	**Type of precipitation**
1	Precipitation-unknown type	13	Small hail
2	Liquid precipitation not freezing	14	Hail
3	Liquid freezing precipitation	15	Glaze
4	Drizzle	16	Rime
5	Rain	17	Soft rime
6	Solid precipitation	18	Hard rime
7	Snow	19	Clear ice
8	Snow grains	20	Wet snow
9	Snow pellets	21	Hoar frost
10	Ice pellets	22	Dew
11	Ice crystals	23	White dew
12	Diamond dust	24-29	Reserved
		All 30	Missing value

The template is flexible and open for further development, for example addition of chemical aspects (freezing temperature, salt concentration, etc). Any comment is welcome. The current version of template was tested in two lands of Germany: Mecklenburg-Vorpommern and Hessen during winter 2005/2006.

4. CONCLUSIONS

New BUFR template for road weather data was developed by experts from CHMI and DWD in accord with migration policy of WMO [1] to replace traditional alphanumeric meteorological codes by the table driven code. Application of this template is supposed for Central European Road Weather Information System [2], [3] during winter season 2006/2007.

5. REFERENCES

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