PART C

COMMON FEATURES TO BINARY AND ALPHANUMERIC CODES

d. Regulations for reporting traditional observations data in Table Driven Code Forms (TDCF): BUFR or CREX

B/C1 – Regulations for reporting SYNOP data in TDCF

ANNEX: Regional regulations for reporting SYNOP data in BUFR/CREX for RA I – RA II – RA III – RA IV – RA VI

B/C5 – Regulations for reporting SYNOP MOBIL data in TDCF

B/C10 – Regulations for reporting SHIP data in TDCF

B/C20 – Regulations for reporting PILOT, PILOT SHIP and PILOT MOBIL data in TDCF

B/C25 – Regulations for reporting TEMP, TEMP SHIP and TEMP MOBIL data in TDCF

ANNEX I: RA IV BUFR template for TEMP, TEMP SHIP and TEMP MOBIL data

ANNEX II: List of parameters for representation of additional information on sounding instrumentation

B/C26 – Regulations for reporting TEMP DROP data in TDCF

B/C35 – Regulations for reporting CLIMAT TEMP and CLIMAT TEMP SHIP data in TDCF

Regulations for reporting traditional observations data in TDCF

B/C1 – Regulations for reporting SYNOP data in TDCF
B/C5 – Regulations for reporting SYNOP MOBIL data in TDCF
B/C10 – Regulations for reporting SHIP data in TDCF
B/C20 – Regulations for reporting PILOT, PILOT SHIP and PILOT MOBIL data in TDCF
B/C25 – Regulations for reporting TEMP, TEMP SHIP and TEMP MOBIL data in TDCF
B/C26 – Regulations for reporting TEMP DROP data in TDCF
B/C35 – Regulations for reporting CLIMAT TEMP and CLIMAT TEMP SHIP data in TDCF

General

(i) The regulations for reporting data of traditional observations in BUFR or CREX are intended to provide a link between the Manual on Codes, Volume I.1 and Volume II, containing traditional alphanumeric codes (TAC) regulations with detailed description of reporting practices and the Volume I.2, where the code forms FM 94 BUFR and FM 95 CREX are defined.

(ii) A BUFR/CREX template has been developed for each traditional observation that is considered suitable for migration to table driven code forms (TDCF). Templates presented prior the regulations are BUFR templates; if used for CREX, relevant modifications have to be introduced.

(iii) The regulations for reporting data of each traditional observation in TDCF are numbered in the increasing order in compliance with a standard BUFR/CREX template recommended for the data type. For reference, the number of the corresponding TAC regulation is included at the end of the regulation, written in square brackets.

(iv) BUFR/CREX templates defined for traditional observation data contain not only the elements reported in the corresponding TAC, but also other important information. The regulations for reporting traditional observations data in BUFR/CREX address also these additional entries (e.g. horizontal and vertical coordinates of the observation site, position of sensors, significance qualifiers).

(v) With each element introduced within the regulations, the unit and the required precision are specified. If different units are used in BUFR and CREX, the unit in which the element value is reported in CREX is also mentioned. Scaling is expected to be executed by the encoding BUFR or CREX software; in case of manual encoding of a CREX message, however, the scaling shall be included in the reporting procedure.

(vi) If the unit of the element is defined as a flag table, the element values shall be reported in octal representation in CREX.

(vii) Reporting practices primarily refer to the procedures relevant for producing of the data in BUFR or CREX at the observing site. When data are collected in TAC and converted into BUFR or CREX in the centre, the differences in the reporting procedures, if any, are mentioned.

(viii) If regional or national reporting practices require inclusion of additional parameters, the regulations provide guidance for addition of the relevant descriptors.

(ix) A NIL report shall be represented by setting all values to “missing value” except for the identification of the station or observing site and delayed replication factors.

Note: Texts in italic within the regulations indicate that special attention should be given to this aspect of the regulation.

References:

[1] Manual on Codes, WMO-No. 306, Volume I.1 and I.2
[2] Manual on Codes, WMO-No. 306, Volume II
[3] Final Report, ET DR&C, Kuala Lumpur, 21 – 26 June 2004
[4] Final Report, ET DR&C, Muscat, 5 – 8 December 2005

B/C1 – Regulations for reporting SYNOP data in TDCF

TM 307080 - BUFR template for synoptic reports from fixed land stations suitable for SYNOP data

3 07 080		**Sequence for representation of synoptic reports from a fixed land station suitable for SYNOP data**
	3 01 090	Fixed surface station identification, time, horizontal and vertical coordinates
	3 02 031	Pressure data
	3 02 035	Basic synoptic “instantaneous” data
	3 02 036	Clouds with bases below station level
	3 02 047	Direction of cloud drift
	0 08 002	Vertical significance
	3 02 048	Direction and elevation of cloud
	3 02 037	State of ground, snow depth, ground minimum temperature
	3 02 043	Basic synoptic “period” data
	3 02 044	Evaporation data
	1 01 002	Replicate next descriptor 2 times
	3 02 045	Radiation data (from 1 hour and/or 24 hour period)
	3 02 046	Temperature change

This BUFR template for synoptic reports from fixed land stations further expands as follows:

3 01 090			**Fixed surface station identification, time, horizontal and vertical coordinates**	Unit, scale
	3 01 004	0 01 001	WMO block number **II**	Numeric, 0
		0 01 002	WMO station number **iii**	Numeric, 0
		0 01 015	Station or site name	CCITT IA5, 0
		0 02 001	Type of station ($\mathbf{i_x}$)	Code table, 0
	3 01 011	0 04 001	Year	Year, 0
		0 04 002	Month	Month, 0
		0 04 003	Day **YY**	Day, 0
	3 01 012	0 04 004	Hour **GG**	Hour, 0
		0 04 005	Minute **gg**	Minute, 0
	3 01 021	0 05 001	Latitude (high accuracy)	Degree, 5
		0 06 001	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
3 02 031			**Pressure data**	
	3 02 001	0 10 004	Pressure $\mathbf{P_0P_0P_0P_0}$	Pa, –1
		0 10 051	Pressure reduced to mean sea level **PPPP**	Pa, –1
		0 10 061	3-hour pressure change **ppp**	Pa, –1
		0 10 063	Characteristic of pressure tendency **a**	Code table, 0
	0 10 062		24-hour pressure change $\mathbf{p_{24}p_{24}p_{24}}$	Pa, –1
	0 07 004		Pressure (standard level) $\mathbf{a_3}$	Pa, –1
	0 10 009		Geopotential height of the standard level **hhh**	gpm, 0
3 02 035			**Basic synoptic “instantaneous” data**	
			Temperature and humidity data	
	3 02 032	0 07 032	Height of sensor above local ground (for temperature and humidity measurement)	m, 2
		0 12 101	Temperature/dry-bulb temperature(sc.2) $\mathbf{s_nTTT}$	K, 2
		0 12 103	Dew-point temperature (scale 2) $\mathbf{s_nT_dT_dT_d}$	K, 2
		0 13 003	Relative humidity	%, 0

			Visibility data	
	3 02 033	0 07 032	Height of sensor above local ground (for visibility measurement)	m, 2
		0 20 001	Horizontal visibility **VV**	m, –1
			Precipitation past 24 hours	
	3 02 034	0 07 032	Height of sensor above local ground (for precipitation measurement)	m, 2
		0 13 023	Total precipitation past 24 hours **$R_{24}R_{24}R_{24}R_{24}$**	kg m^{-2}, 1
	0 07 032		Height of sensor above local ground (set to missing to cancel the previous value)	m, 2
			Cloud data	
	3 02 004	0 20 010	Cloud cover (total) **N**	%, 0
		0 08 002	Vertical significance	Code table, 0
		0 20 011	Cloud amount (of low or middle clouds) **N_h**	Code table, 0
		0 20 013	Height of base of cloud **h**	m, –1
		0 20 012	Cloud type (low clouds C_L) **C_L**	Code table, 0
		0 20 012	Cloud type (middle clouds C_M) **C_M**	Code table, 0
		0 20 012	Cloud type (high clouds C_H) **C_H**	Code table, 0
			Individual cloud layers or masses	
	1 01 000		Delayed replication of 1 descriptor	
	0 31 001		Delayed descriptor replication factor	Numeric, 0
	3 02 005	0 08 002	Vertical significance	Code table, 0
		0 20 011	Cloud amount (N_s) **N_s**	Code table, 0
		0 20 012	Cloud type (C) **C**	Code table, 0
		0 20 013	Height of base of cloud (h_sh_s) **h_sh_s**	m, -1
			Clouds with bases below station level	
3 02 036	1 05 000		Delayed replication of 5 descriptors	
	0 31 001		Delayed descriptor replication factor	Numeric, 0
	0 08 002		Vertical significance	Code table, 0
	0 20 011		Cloud amount **N'**	Code table, 0
	0 20 012		Cloud type **C'**	Code table, 0
	0 20 014		Height of top of cloud **H'H'**	m, -1
	0 20 017		Cloud top description **C_t**	Code table, 0
			Direction of cloud drift gr. **$56D_LD_MD_H$**	
3 02 047	1 02 003		Replicate 2 descriptors 3 times	
	0 08 002		Vertical significance = 7 (low cloud) = 8 (middle cloud) = 9 (high cloud)	Code table, 0
	0 20 054		True direction from which clouds are moving **D_L, D_M, D_H**	Degree true, 0
0 08 002			Vertical significance (set to missing to cancel the previous value)	Code table, 0
			Direction and elevation of cloud gr. **$57CD_ae_C$**	
3 02 048	0 05 021		Bearing or azimuth **D_a**	Degree true, 2
	0 07 021		Elevation angle **e_C**	Degree, 2
	0 20 012		Cloud type **C**	Code table, 0
	0 05 021		Bearing or azimuth (set to missing to cancel the previous value)	Degree true, 2
	0 07 021		Elevation angle (set to missing to cancel the previous value)	Degree, 2
			State of ground, snow depth, ground minimum temperature	
3 02 037	0 20 062		State of ground (with or without snow) **E** or **E'**	Code table, 0
	0 13 013		Total snow depth **sss**	m, 2
	0 12 113		Ground minimum temperature (scale2), past 12	K, 2

			hours **$s_nT_gT_g$**	
3 02 043			**Basic synoptic "period" data**	
			Present and past weather	
	3 02 038	0 20 003	Present weather **ww**	Code table, 0
		0 04 024	Time period in hours	Hour, 0
		0 20 004	Past weather (1) **W_1**	Code table, 0
		0 20 005	Past weather (2) **W_2**	Code table, 0
			Sunshine data (from 1 hour and 24 hour period)	
	1 01 002		Replicate 1 descriptors 2 times	
	3 02 039	0 04 024	Time period in hours	Hour, 0
		0 14 031	Total sunshine **SS** and **SSS**	Minute, 0
			Precipitation measurement	
	3 02 040	0 07 032	Height of sensor above local ground (for precipitation measurement)	m, 2
		1 02 002	Replicate next 2 descriptors 2 times	
		0 04 024	Time period in hours **t_R**	Hour, 0
		0 13 011	Total precipitation / total water equivalent of snow **RRR**	kg m^{-2}, 1
			Extreme temperature data	
	3 02 041	0 07 032	Height of sensor above local ground (for temperature measurement)	m, 2
		0 04 024	Time period or displacement	Hour, 0
		0 04 024	Time period or displacement (see Notes 1 and 2)	Hour, 0
		0 12 111	Maximum temperature (scale 2) at height and over period specified **$s_nT_xT_xT_x$**	K, 2
		0 04 024	Time period or displacement	Hour, 0
		0 04 024	Time period or displacement (see Note 2)	Hour, 0
		0 12 112	Minimum temperature (scale 2) at height and over period specified **$s_nT_nT_nT_n$**	K, 2
			Wind data	
	3 02 042	0 07 032	Height of sensor above local ground (for wind measurement)	m, 2
		0 02 002	Type of instrumentation for wind measurement **i_w**	Flag table, 0
		0 08 021	Time significance (= 2 (time averaged))	Code table, 0
		0 04 025	Time period (= - 10 minutes, or number of minutes after a significant change of wind)	Minute, 0
		0 11 001	Wind direction **dd**	Degree true, 0
		0 11 002	Wind speed **ff**	m s^{-1}, 1
		0 08 021	Time significance (= missing value)	Code table, 0
		1 03 002	Replicate next 3 descriptors 2 times	
		0 04 025	Time period in minutes	Minute, 0
		0 11 043	Maximum wind gust direction	Degree true, 0
		0 11 041	Maximum wind gust speed 910**f_mf_m**, 911**f_xf_x**	m s^{-1}, 1
	0 07 032		Height of sensor above local ground (set to missing to cancel the previous value)	m, 2
			Evaporation data	
3 02 044	0 04 024		Time period in hours	Hour, 0
	0 02 004		Type of instrument for evaporation or crop type for evapotranspiration **i_E**	Code table, 0
	0 13 033		Evaporation /evapotranspiration **EEE**	kg m^{-2}, 1
			Radiation data (from 1 hour and 24 hour period)	
1 01 002			Replicate next descriptor 2 times	
3 02 045	0 04 024		Time period in hours	Hour, 0
	0 14 002		Long-wave radiation, integrated over period specified 553SS 4**FFFF** or 553SS 5**FFFF,**	J m^{-2}, -3

			55SSS 4$\mathbf{F_{24}F_{24}F_{24}F_{24}}$ or 55SSS 5$\mathbf{F_{24}F_{24}F_{24}F_{24}}$	
	0 14 004		Short-wave radiation, integrated over period specified 553SS 6**FFFF,** 55SSS 6$\mathbf{F_{24}F_{24}F_{24}F_{24}}$	J m^{-2}, -3
	0 14 016		Net radiation, integrated over period specified 553SS 0**FFFF** or 553SS 1**FFFF,** 55SSS 0$\mathbf{F_{24}F_{24}F_{24}F_{24}}$ or 55SSS 1$\mathbf{F_{24}F_{24}F_{24}F_{24}}$	J m^{-2}, -4
	0 14 028		Global solar radiation (high accuracy), integrated over period specified 553SS 2**FFFF,** 55SSS 2$\mathbf{F_{24}F_{24}F_{24}F_{24}}$	J m^{-2}, -2
	0 14 029		Diffuse solar radiation (high accuracy), integrated over period specified 553SS 3**FFFF,** 55SSS 3$\mathbf{F_{24}F_{24}F_{24}F_{24}}$	J m^{-2}, -2
	0 14 030		Direct solar radiation (high accuracy), integrated over period specified 55408 4**FFFF,** 55508 5$\mathbf{F_{24}F_{24}F_{24}F_{24}}$	J m^{-2}, -2
			Temperature change group **54$\mathbf{g_0s_nd_T}$**	
3 02 046	0 04 024		Time period or displacement	Hour, 0
	0 04 024		Time period or displacement (see Note 3)	Hour, 0
	0 12 049		Temperature change over period specified **$\mathbf{s_nd_T}$**	K, 0

Notes:

1) Within RA-IV, the maximum temperature at 1200 UTC is reported for the previous calendar day (i.e. the ending time of the period is not equal to the nominal time of the report). To construct the required time range, descriptor 004024 has to be included two times. If the period ends at the nominal time of the report, value of the second 004024 shall be set to 0.

2) Within RA-III, the maximum day-time temperature and the minimum night-time temperature is reported (i.e. the ending time of the period may not be equal to the nominal time of the report). To construct the required time range, descriptor 004024 has to be included two times. If the period ends at the nominal time of the report, value of the second 004024 shall be set to 0.

3) To construct the required time range, descriptor 004024 has to be included two times.

Regulations:

B/C 1.1 Section 1 of BUFR or CREX

B/C 1.1.1 Entries required in Section 1 of BUFR

The following entries shall be included in BUFR Section 1:

- BUFR master table,
- identification of originating/generating centre,
- identification of originating/generating sub-centre,
- update sequence number,
- identification of inclusion of optional section,
- data category (= 000 for SYNOP data),
- international data sub-category (1), (2),
- local data subcategory,
- version number of master table,
- version number of local tables,
- year (year of the century up to BUFR edition 3),
- month (standard time),
- day (standard time = YY in the abbreviated telecommunication header for SYNOP data),
- hour (standard time = GG in the abbreviated telecommunication header for SYNOP data),
- minute (standard time = 00 for SYNOP data).

Notes:
(1) Inclusion of this entry is required starting with BUFR edition 4.
(2) If required, the international data sub-category shall be included for SYNOP data as

= 002 at main synoptic times 00, 06, 12, 18 UTC,
= 001 at intermediate synoptic times 03, 09, 15, 21 UTC,
= 000 at observation times 01, 02, 04, 05, 07, 08, 10, 11, 13, 14, 16, 17, 19, 20, 22 and 23 UTC.

B/C 1.1.2 Entries required in Section 1 of CREX

The following entries shall be included in CREX Section 1:

- CREX master table,
- CREX edition number,
- CREX table version number,
- version number of BUFR master table (1),
- version number of local tables (1),
- data category (= 000 for SYNOP data),
- international data sub-category (1), (2),
- identification of originating/generating centre (1),
- identification of originating/generating sub-centre (1),
- update sequence number (1),
- number of subsets (1),
- year (standard time) (1),
- month (standard time) (1),
- day (standard time = YY in the abbreviated telecommunication header for SYNOP data) (1),
- hour (standard time = GG in the abbreviated telecommunication header for SYNOP data) (1),
- minute (standard time = 00 for SYNOP data) (1).

Notes:
(1) Inclusion of these entries is required starting with CREX edition 2.
(2) If inclusion of international data sub-category is required, Note (2) under B/C 1.1.1 applies.

B/C 1.2 Fixed station identification, time, horizontal and vertical coordinates <3 01 090>

B/C 1.2.1 Fixed station identification

WMO block number station (0 01 001) and WMO station number (0 01 002) shall be always reported as a non-missing value.

Station or site name (0 01 015) shall be reported as published in WMO-No. 306, Volume A, Observing Stations, provided that the station name does not exceed 20 characters. A shortened version of the name shall be reported otherwise.

Type of station (0 02 001) shall be reported to indicate the type of the station operation (manned, automatic or hybrid).
Note:
(1) If a station operates as a manned station for a part of the day and as an automatic station for the rest of the day, code figure 2 (Hybrid) may be used in all reports. It is preferable, however, to use code figure 1 (Manned) in reports produced under the supervision of an observer, and a code figure 0 (Automatic) in reports produced while the station operates in the automatic mode.

B/C 1.2.2 Time of observation

Year (0 04 001), month (0 04 002), day (0 04 003), hour (0 04 004) and minute (0 04 005) of the actual time of observation shall be reported.
Note:
(1) The actual time of observation shall be the time at which the barometer is read. [12.1.6]

B/C 1.2.2.1

If the actual time of observation differs by 10 minutes or less from the standard time reported in Section 1, the standard time may be reported instead of the actual time of observation. [12.2.8]

B/C 1.2.3 Horizontal and vertical coordinates

Latitude (0 05 001) and longitude (0 06 001) of the station shall be reported in degrees with precision in 10^{-5} of a degree.

Height of station ground above mean sea level (0 07 030) and height of barometer above mean sea level (0 07 031) shall be reported in meters with precision in tenths of a meter.

B/C 1.3 Pressure data <3 02 031>

B/C 1.3.1 Pressure at the station level

Pressure at the station level (0 10 004), i.e. at the level defined by 0 07 031 (height of barometer above mean sea level), shall be reported in pascals (with precision in tens of a pascal).

B/C 1.3.1.1

The station pressure shall be included in reports for global exchange from land stations, together with either the mean sea level pressure or, in accordance with Regulation B/C 1.3.5.1, with the geopotential height of a standard pressure level. [12.2.4]

Note:

(1) Inclusion of the station pressure at other times is left to the decision of individual Members.

B/C 1.3.2 Pressure reduced to mean sea level

Pressure reduced to mean sea level (0 10 051) shall be reported in pascals (with precision in tens of a pascal).

B/C 1.3.2.1

Whenever air pressure at mean sea level can be computed with reasonable accuracy, this pressure shall be reported. [12.2.3.4.1]

Notes:

(1) For a station situated in a region of normal synoptic network density, the pressure at mean sea level is considered not to be computed with reasonable accuracy when it introduces a deformation into the analysis of the horizontal pressure field, which is purely local and recurring.

(2) For a station lying in a data-sparse area of the synoptic network, reasonable accuracy will be obtained when using a reduction method, which has proved to be satisfactory in a region of normal network density and under similar geographic conditions.

B/C 1.3.3 Three-hour pressure change and characteristic of pressure tendency

Amount of pressure change at station level, during the three hours preceding the time of observation (0 10 061), either positive, zero *or negative*, shall be reported in pascals (with precision in tens of a pascal).

B/C 1.3.3.1

Unless specified otherwise by regional decision, pressure tendency shall be included whenever the three-hourly pressure tendency is available. [12.2.3.5.1]

B/C 1.3.3.2

The characteristic of pressure tendency (Code table 0 10 063) over the past three hours shall, whenever possible, be determined on the basis of pressure samples at equi-spaced intervals not exceeding one hour. [12.2.3.5.2]

Note:

(1) Algorithms for selecting the appropriate code figure are included in publication WMO–No.8, Guide to Meteorological Instruments and Methods of Observation.

B/C 1.3.3.3

Where it is not possible to apply the algorithms specified in Regulation B/C 1.3.3.2 in reports from automatic weather stations, the characteristic of pressure tendency shall be reported as 2 when the tendency is positive, as 7 when the tendency is negative, and as 4 when the atmospheric pressure is the same as three hours before. [12.2.3.5.3]

B/C 1.3.4 24-hour pressure change

If specified by regional decision, amount of surface pressure change at station level, during 24 hours preceding the time of observation (0 10 062), either positive, zero or negative, shall be reported in pascals (with precision in tens of a pascal). [12.4.7.1.2(k), (l)]

B/C 1.3.5 Geopotential height of the standard level

Geopotential height of the standard level (0 10 009) shall be reported in geopotential meters. The standard isobaric level is specified by the preceding entry Pressure (0 07 004).

B/C 1.3.5.1

By regional decision, a high-level station, which cannot give pressure at mean sea level to a satisfactory degree of accuracy, shall report both the station-level pressure and the geopotential height of an agreed standard isobaric surface. [12.2.3.4.2]

B/C 1.4 Basic synoptic "instantaneous" data <3 02 035>

B/C 1.4.1 Temperature and humidity data <3 02 032>

B/C 1.4.1.1 Height of sensor above local ground

Height of sensor above local ground (0 07 032) for temperature and humidity measurement shall be reported in meters (with precision in hundredths of a meter).
This datum represents the actual height of temperature and humidity sensors above ground at the point where the sensors are located.

B/C 1.4.1.2 Dry-bulb air temperature

Dry-bulb air temperature (0 12 101) shall be reported in degrees Kelvin (with precision in hundredths of a degree Kelvin); if produced in CREX, in degrees Celsius (with precision in hundredths of a degree Celsius)
Notes:
(1) Temperature data shall be reported with precision in hundredths of a degree even if they are measured with the accuracy in tenths of a degree. This requirement is based on the fact that conversion from the Kelvin to the Celsius scale has often resulted into distortion of the data values.
(2) Temperature t (in degrees Celsius) shall be converted into temperature T (in degrees Kelvin) using equation: T = t + 273.15.

B/C 1.4.1.2.1

When the data are not available as a result of a temporary instrument failure, this quality shall be included as a missing value. [12.2.3.2]

B/C 1.4.1.3 Dew-point temperature

Dew-point temperature (0 12 103) shall be reported in degrees Kelvin (with precision in hundredths of a degree Kelvin); if produced in CREX, in degrees Celsius (with precision in hundredths of a degree Celsius).
Note:
(1) Notes (1) and (2) under Regulation B/C 1.4.1.2 shall apply.

B/C 1.4.1.3.1

When the data are not available as a result of a temporary instrument failure, this quality shall be included as a missing value. [12.2.3.3.2]

B/C 1.4.1.4 Relative humidity

Relative humidity (0 13 003) shall be reported in units of a percent.

B/C 1.4.1.4.1

Both dew point temperature and relative humidity shall be reported when available.

B/C 1.4.2 Visibility data <3 02 033>

B/C 1.4.2.1 Height of sensor above local ground

Height of sensor above local ground (0 07 032) for visibility measurement shall be reported in meters (with precision in hundredths of a meter).
This datum represents the actual height of visibility sensors above ground at the point where the sensors are located. If visibility is estimated by a human observer, average height of observer's eyes above station ground shall be reported.

B/C 1.4.2.2 Horizontal visibility

Horizontal visibility (0 20 001) at surface shall be reported in meters (with precision in tens of a meter).

B/C 1.4.2.2.1
When the horizontal visibility is not the same in different directions, the shortest distance shall be given for visibility. [12.2.1.3.1]

B/C 1.4.3 Precipitation past 24 hours <3 02 034>

B/C 1.4.3.1 Height of sensor above local ground

Height of sensor above local ground (0 07 032) for precipitation measurement shall be reported in meters (with precision in hundredths of a meter).
This datum represents the actual height of the rain gauge rim above ground at the point where the rain gauge is located.

B/C 1.4.3.2 Total amount of precipitation during the 24-hour period

Total amount of precipitation during the 24-hour period ending at the time of observation (0 13 023) shall be reported in kilograms per square meter (with precision in tenths of a kilogram per square meter). [12.4.9]

B/C 1.4.3.2.1
The precipitation over the past 24 hours shall be included (not missing) at least once a day at one appropriate time of the main standard times (0000, 0600, 1200, 1800 UTC). [12.4.1]

B/C 1.4.3.2.2
Precipitation, when it can be and has to be reported, shall be reported as 0.0 kgm^{-2} if no precipitation were observed during the referenced period. [12.2.5.4]

B/C 1.4.3.2.3
Trace shall be reported as "- 0.1 kgm^{-2} ".

B/C 1.4.4 Cloud data <3 02 004>

B/C 1.4.4.1 Total cloud cover

Total cloud cover (0 20 010) shall embrace the total fraction of the celestial dome covered by clouds irrespective of their genus. It shall be reported in *units of a percent*.
Note:
(1) Total cloud cover shall be reported as 113 when sky is obscured by fog and/or other meteorological phenomena.

B/C 1.4.4.1.1
Total cloud cover shall be reported as actually seen by the observer during the observation. [12.2.2.2.1]

B/C 1.4.4.1.2
Altocumulus perlucidus or Stratocumulus perlucidus ("mackerel sky") shall be reported *as 99% or less* (unless overlying clouds appear to cover the whole sky) since breaks are always present in this cloud form even if it extends over the whole celestial dome. [12.2.2.2.2]

B/C 1.4.4.1.3

Total cloud cover shall be reported as zero when blue sky or stars are seen through existing fog or other analogous phenomena without any trace of cloud being seen. [12.2.2.2.3]

B/C 1.4.4.1.4

When clouds are observed through fog or analogous phenomena, their amount shall be evaluated and reported as if these phenomena were non-existent. [12.2.2.2.4]

B/C 1.4.4.1.5

Total cloud cover shall not include the amount resulting from rapidly dissipating condensation trails. [12.2.2.2.5]

B/C 1.4.4.1.6

Persistent condensation trails and cloud masses which have obviously developed from condensation trails shall be reported as cloud. [12.2.2.2.6]

B/C 1.4.4.2 Vertical significance – Code table 0 08 002

To specify vertical significance (0 08 002) within the sequence 3 02 004, a code figure shall be selected in the following way:

(a) If low clouds are observed, then code figure 7 (Low cloud) shall be used.
(b) If there are no low clouds but middle clouds are observed, then code figure 8 (Middle clouds) shall be used.
(c) If there are no low and there are no middle clouds but high clouds are observed, then code figure 0 shall be used.
(d) If sky is obscured by fog and/or other phenomena, then code figure 5 (Ceiling) shall be used.
(e) If there are no clouds (clear sky), then code figure 62 (Value not applicable) shall be used.
(f) If the cloud cover is not discernible for reasons other than (d) above or observation is not made, then code figure 63 (Missing value) shall be used.

B/C 1.4.4.3 Cloud amount (of low or middle clouds) – Code table 0 20 011

Amount of all the low clouds (clouds of the genera Stratocumulus, Stratus, Cumulus, and Cumulonimbus) present or, if no low clouds are present, the amount of all the middle clouds (clouds of the genera Altocumulus, Altostratus, and Nimbostratus) present.

B/C 1.4.4.3.1

Cloud amount shall be reported as follows:

(a) If there are low clouds, then the total amount of all low clouds, as actually seen by the observer during the observation shall be reported for the cloud amount.
(b) If there are no low clouds but there are middle clouds, then the total amount of the middle clouds shall be reported for the cloud amount.
(c) If there are no low clouds and there are no middle clouds but there are high clouds (clouds of the genera Cirrus, Cirrocumulus, and Cirrostratus), then the cloud amount shall be reported as zero. [12.2.7.2.1]

B/C 1.4.4.3.2

Amount of Altocumulus perlucidus or Stratocumulus perlucidus (“mackerel sky”) shall be reported using code figure 7 or less since breaks are always present in this cloud form even if it extends over the whole celestial dome. [12.2.7.2.2]

B/C 1.4.4.3.3

When the clouds reported for cloud amount are observed through fog or an analogous phenomenon, the cloud amount shall be reported as if these phenomena were not present. [12.2.7.2.3]

B/C 1.4.4.3.4

If the clouds reported for cloud amount include contrails, then the cloud amount shall include the amount of persistent contrails. Rapidly dissipating contrails shall not be included in the value for the cloud amount. [12.2.7.2.4]

B/C 1.4.4.4 Height of base of lowest cloud

Height above surface of the base (0 20 013) of the lowest cloud seen shall be reported in meters (with precision in tens of a meter).

Note:

(1) The term « height above surface » shall be considered as being the height above the official aerodrome elevation or above station elevation at a non-aerodrome station.

B/C 1.4.4.4.1

When the station is in fog, a sandstorm or in blowing snow but the sky is discernable, the base of the lowest cloud shall refer to the base of the lowest cloud observed, if any. When, under the above conditions, the sky is not discernible, the base of the lowest cloud shall be reported as missing. [12.2.1.2]

B/C 1.4.4.4.2

When no cloud are reported (Total cloud cover = 0) the base of the lowest cloud *shall be reported as a missing value.*

B/C 1.4.4.4.3

When, by national decision, clouds with bases below the station are reported from the station and clouds with bases below and tops above the station are observed, the base of the lowest cloud *shall be reported having a negative value if the base of cloud is discernible, or as a missing value.*

B/C 1.4.4.5 Cloud type of low, middle and high clouds - Code table 0 20 012

Clouds of the genera Stratocumulus, Stratus, Cumulus, and Cumulonimbus (low clouds) shall be reported for the first entry 0 20 012, clouds of the genera Altocumulus, Altostratus, and Nimbostratus (middle clouds) shall be reported for the second entry 0 20 012 and clouds of the genera Cirrus, Cirrocumulus, and Cirrostratus (high clouds) shall be reported for the third entry 0 20 012.

B/C 1.4.4.5.1

The reporting of type of low, middle and high clouds shall be as specified in publication WMO-NO. 407 – International Cloud Atlas, Volume I. [12.2.7.3]

B/C 1.4.5 Individual cloud layers or masses

B/C 1.4.5.1 Number of individual cloud layers or masses

The number of individual cloud layers or masses shall be indicated by Delayed descriptor replication factor 0 31 001 in BUFR and by a four-digit number in the Data Section corresponding to the position of the replication descriptor in the Data Description Section of CREX.

Note:

(1) The number of cloud layers or masses shall never be set to missing value.

(2) The number of cloud layers or masses shall be set to a positive value in a NIL report.

B/C 1.4.5.1.1

The number of individual cloud layers or masses shall in the absence of Cumulonimbus clouds not exceed three. Cumulonimbus clouds, when observed, shall always be reported, so that the total number of individual cloud layers or masses can be four. The selection of layers (or masses) to be reported shall be made in accordance with the following criteria:

(a) The lowest individual layer (or mass) of any amount (cloud amount at least one octa or less, but not zero);

(b) The next higher individual layer (or mass) the amount of which is greater than two octas;

(c) The next higher individual layer (or mass) the amount of which is greater than four octas;

(d) Cumulonimbus clouds, whenever observed and not reported under (a), (b) and (c) above. [12.4.10.1]

B/C 1.4.5.1.2

When the sky is clear, the number of individual cloud layers or masses shall be set to zero.

B/C 1.4.5.1.3

The order of reporting the individual cloud layers or masses shall always be from lower to higher levels. [12.4.10.2]

B/C 1.4.5.2 Individual cloud layer or mass <3 02 005>

Each cloud layer or mass shall be represented by the following four parameters: Vertical significance (0 08 002), amount of individual cloud layer or mass (0 20 011), type of cloud layer or mass (0 20 012) and height of base of individual cloud layer or mass (0 20 013).

B/C 1.4.5.2.1 Vertical significance – Code table 0 08 002

To specify vertical significance (0 08 002) within the sequence 3 02 005, a code figure shall be selected in the following way:

(a) Code figure 1 shall be used in the first non-Cumulonimbus layer.
(b) Code figure 2 shall be used in the second non-Cumulonimbus layer.
(c) Code figure 3 shall be used in the third non-Cumulonimbus layer.
(d) Code figure 4 shall be used in any Cumulonimbus layer.
(e) If sky is obscured by fog and/or other phenomena, then code figure 5 (Ceiling) shall be used.
(f) If the cloud cover is not discernible for reasons other than (e) above or observation is not made, then code figure 63 (Missing value) shall be used.

B/C 1.4.5.2.2 Cloud amount, type and height of base

B/C 1.4.5.2.2.1

When the sky is clear, in accordance with Regulation B/C 1.4.5.1.2 cloud amount, genus, and height shall not be included. [12.4.10.4]

B/C 1.4.5.2.2.2

In determining cloud amounts (Code table 0 20 011) to be reported for individual layers or masses, the observer shall estimate, by taking into consideration the evolution of the sky, the cloud amounts of each individual layer or mass at the different levels, as if no other clouds existed. [12.4.10.3]

B/C 1.4.5.2.2.3

Type of a cloud layer or mass (Code table 0 20 012) shall be reported using code figures 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 59 and 63.

B/C 1.4.5.2.2.4

If, notwithstanding the existence of fog, sandstorm, duststorm, blowing snow or other obscuring phenomena, the sky is discernible, the partially obscuring phenomena shall be disregarded. If, under the above conditions, the sky is not discernible, the cloud type shall be reported using *code figure 59* and the cloud height shall be replaced by vertical visibility. [12.4.10.5]

Note:

(1) The vertical visibility is defined as the vertical visual range into an obscuring medium.

B/C 1.4.5.2.2.5

If two or more types of cloud occur with their bases at the same level and this level is one to be reported in accordance with Regulation B/C 1.4.5.1.1, the selection for cloud type and amount shall be made with the following criteria :

(a) If these types do not include Cumulonimbus then cloud genus shall refer to the cloud type that represents the greatest amount, or if there are two or more types of cloud all having the same amount, the highest applicable code figure for cloud genus shall be reported. Cloud amount shall refer to the total amount of cloud whose bases are all at the same level ;
(b) If these types do include Cumulonimbus then one layer shall be reported to describe only this type with cloud genus indicated as Cumulonimbus and the cloud amount as the amount of the Cumulonimbus. If the total amount of the remaining

type(s) of cloud (excluding Cumulonimbus) whose bases are all at the same level is greater than that required by Regulation B/C 1.4.5.1.1, then another layer shall be reported with type being selected in accordance with (a) and amount referring to the total amount of the remaining cloud (excluding Cumulonimbus). [12.4.10.6]

B/C 1.4.5.2.2.6

Regulations B/C1.4.4.1.3 to B/C1.4.4.1.6, inclusive, shall apply. [12.4.10.7]

B/C 1.4.5.2.2.7

Height above surface of the cloud base (0 20 013) shall be reported in meters (with precision in tens of a meter).

Note:

(1) The term « height above surface » shall be considered as being the height above the official aerodrome elevation or above station elevation at a non-aerodrome station.

B/C 1.5 Clouds with bases below station level <3 02 036>

B/C 1.5.1 Number of cloud layers with bases below station level

The number of cloud layers with bases below station level shall be indicated by Delayed descriptor replication factor 0 31 001 in BUFR and by a four-digit number in the Data Section corresponding to the position of the replication descriptor in the Data Description Section of CREX.

Note:

(1) The number of cloud layers with bases below station level shall never be set to a missing value.

(2) The number of cloud layers with bases below station level shall be set to a positive value in a NIL report.

B/C 1.5.1.1

Inclusion of these data shall be determined by national decision. The number of cloud layers with bases below station level shall be always set to zero in reports from a station at which observations of clouds with bases below station level are not executed.

B/C 1.5.1.2

When no cloud layers with bases below station are observed, the number of cloud layers with bases below station level shall be set to zero.

B/C 1.5.1.3

If the station is in continuous or almost continuous cloud, the number of cloud layers with bases below station level shall be set to one, with all parameters reported as missing except for vertical significance 0 08 002 that shall be set to 10 (cloud layer with a base below and tops above station level). [12.5.4]

B/C 1.5.1.4

If clouds with bases below station level are not discernible due to fog and/or other phenomena or observation is not made, then the number of cloud layers with bases below station level shall be set to one, with all parameters reported as missing except for vertical significance 0 08 002 that shall be set to 11.

B/C 1.5.1.5

When two or more cloud layers with their bases below station level occur at different levels, two or more cloud layers shall be reported. [12.5.5]

B/C 1.5.1.6

Clouds with bases below and tops above station level shall be reported as the first layer within the sequence 3 02 036, provided that the station is out of cloud sufficiently frequently to enable the various features to be recognized. Other low clouds present with tops below station level shall be reported as the following layers (one or more) within the sequence 3 02 036. [12.5.3]

Notes:

(1) Clouds with bases below and tops above station level shall be reported also in sequences 3 02 004 and 3 02 005. [12.5.3]

(2) Clouds with tops below station level shall be reported only in sequence 3 02 036, and any co-existent clouds with bases above station level shall be reported only in sequences 3 02 004 and 3 02 005. [12.5.2]

B/C 1.5.2 Individual cloud layer with base below station level

Each cloud layer with base below station level shall be represented by the following five parameters: Vertical significance (0 08 002), amount of clouds with base below station level (0 20 011), type of clouds with base below station level (0 20 012), altitude of the upper surface of clouds (0 20 014) and cloud top description (0 20 017).

B/C 1.5.2.1 Vertical significance - Code table 0 08 002

Code figure 10 shall be used for cloud layers with bases below and tops above station level; code figure 11 shall be used for cloud layers with bases and tops below station level.

B/C 1.5.2.2 Amount of clouds with base below station level - Code table 0 20 011

B/C 1.5.2.2.1

Regulations B/C1.4.4.1.1 to B/C1.4.4.1.6, inclusive, shall apply. [12.5.8]

B/C 1.5.2.2.2

Spaces occupied by mountains emerging from the cloud layers shall be counted as occupied by clouds. [12.5.9]

B/C 1.5.2.3 Type of clouds with base below station level - Code table 0 20 012

Type of clouds with bases below station level shall be reported using code figures 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 and 63.

B/C 1.5.2.4 Height of top of clouds above mean sea level

Height of top of clouds (0 20 014) shall be used to report the height above mean sea level of the upper surface of clouds, and shall be expressed in meters (with precision in tens of a meter).

B/C 1.5.2.4.1

Height of top of clouds with bases below and tops above station level shall be reported, provided that the upper surface of clouds can be observed. [12.5.3 (b)]

B/C 1.5.2.5 Cloud top description - Code table 0 20 017

B/C 1.5.2.5.1

Description of top of clouds with bases below and tops above station level shall be reported, provided that the station is out of cloud sufficiently frequently to enable the features to be recognized.

B/C 1.5.2.5.2

Rapidly dissipating condensation trails shall not be reported. However, the top of persistent condensation trails and cloud masses which have obviously developed from condensation trails (and whose bases are below station level) shall be reported in Sequence 3 02 036. [12.5.6], [12.5.7]

B/C 1.6 Direction of cloud drift <3 02 047>

This information is required from land stations mainly in the tropics. [12.4.7.5]

B/C 1.6.1 Vertical significance – Code table 0 08 002

To specify vertical significance (0 08 002) within the sequence 3 02 047, code figures shall be selected in the following way:

(a) Code figure 7 (Low cloud) shall be used in the first replication.
(b) Code figure 8 (Middle clouds) shall be used in the second replication.
(c) Code figure 9 (High cloud) shall be used in the third replication.

B/C 1.6.2 True direction from which clouds are moving

True direction from which low, middle, or high clouds are moving (0 20 054) shall be reported in degrees true as follows:

(a) True direction from which the low clouds are moving shall be included in the first replication.
(b) True direction from which the middle clouds are moving shall be included in the second replication.
(c) True direction from which the high clouds are moving shall be included in the third replication.

B/C 1.7 Direction and elevation of cloud <3 02 048>

This information is required from land stations mainly in the tropics. [12.4.7.5]

B/C 1.7.1 Direction of cloud

True direction (0 05 021), from which orographic clouds or clouds with vertical development are seen, shall be *reported in degrees true*. The cloud genus shall be specified by the third entry of the sequence 3 02 048, i.e. by Cloud type – Code table 0 20 012.

Note:

(1) It is considered sufficient to report direction of cloud in degrees true, although 0 05 021 (Bearing or azimuth) is defined with higher accuracy (hundredths of a degree true).

B/C 1.7.2 Elevation of cloud

Elevation angle (0 07 021) of the top of the cloud shall be reported in degrees. The cloud genus shall be specified by the following entry, i.e. by Cloud type – Code table 0 20 012.

Note:

(1) It is considered sufficient to report elevation of the top of cloud in degrees, although 0 07 021 (Elevation angle) is defined with higher accuracy (hundredths of a degree).

B/C 1.8 State of ground, snow depth, ground minimum temperature <3 02 037>

B/C 1.8.1 State of ground (with or without snow) - Code table 0 20 062.

State of ground without snow or with snow shall be reported using Code table 0 20 062. The synoptic hour at which this datum is reported shall be determined by regional decision.

B/C 1.8.2 Total snow depth

Total snow depth (0 13 013) shall be reported in meters (with precision in hundredths of a meter). The synoptic hour at which this datum is reported shall be determined by regional decision.

B/C 1.8.2.1

When total snow depth has to be reported, it is reported as 0.00 m if no snow, ice and other forms of solid precipitation on the ground are observed at the time of observation. A snow depth value of "– 0.01 m" shall indicate a little (less than 0.005 m) snow. A snow depth value of "– 0.02 m" shall indicate "snow cover not continuous".

B/C 1.8.2.2

The measurement shall include snow, ice and all other forms of solid precipitation on the ground at the time of observation. [12.4.6.1]

B/C 1.8.2.3

When the depth is not uniform, the average depth over a representative area shall be reported. [12.4.6.2]

B/C 1.8.3 Ground minimum temperature, past 12 hours

Ground minimum temperature from the previous 12 hours (0 12 113) shall be reported in degrees Kelvin (with precision in hundredths of a degree Kelvin); if produced in CREX, in degrees Celsius (with precision in hundredths of a degree Celsius).

Notes:

(1) Ground minimum temperature shall be reported with precision in hundredths of a degree even if they are measured with the accuracy in tenths of a degree. This requirement is based on the fact that conversion from the Kelvin to the Celsius scale has often resulted into distortion of the data values.

(2) Ground minimum temperature t (in degrees Celsius) shall be converted into ground minimum temperature T (in degrees Kelvin) using equation: T = t + 273.15.

(3) The period of time covered by ground minimum temperature and the synoptic hour at which this temperature is reported shall be determined by regional decision. If ground minimum temperature is to be reported from the period of previous night, then "ground minimum temperature, past 12 hours" (0 12 113) shall be reported as a missing value. In this case, ground minimum temperature of the previous night (0 12 122) shall be reported as shown in Common sequences 3 07 081, 3 07 082 and 3 07 083 suitable for SYNOP data in compliance with reporting practices in RA I, RA II and RA III, respectively.

B/C 1.9 "Instantaneous" data required by regional or national reporting practices

If regional or national reporting practices require inclusion of additional "instantaneous" parameters, the sequence descriptor 3 07 080 shall not be used. In this case BUFR/CREX template for SYNOP data shall be used in its first level expanded form and the descriptors, corresponding to the required "instantaneous" parameters, shall be inserted to precede 3 02 043 (Basic synoptic "period" data).

Note:

(1) "Instantaneous" parameter is a parameter that is not coupled to a time period descriptor, e.g. 0 04 024, 0 04 025.

B/C 1.9.1 "Instantaneous" data required by reporting practices in RA I

Regulations for reporting additional "instantaneous" parameters, required by regional reporting practices in RA I, are shown in the Annex.

B/C 1.9.2 "Instantaneous" data required by reporting practices in RA II

Regulations for reporting additional "instantaneous" parameters, required by regional reporting practices in RA II, are shown in the Annex.

B/C 1.9.3 "Instantaneous" data required by reporting practices in RA III

Regulations for reporting additional "instantaneous" parameters, required by regional reporting practices in RA III, are shown in the Annex.

B/C 1.9.4 "Instantaneous" data required by reporting practices in RA IV

Regulations for reporting additional "instantaneous" parameters, required by regional reporting practices in RA IV, are shown in the Annex.

B/C 1.9.5 "Instantaneous" data required by reporting practices in RA V

No regional requirements are indicated for reporting SYNOP data in RA V.

B/C 1.9.6 "Instantaneous" data required by reporting practices in RA VI

Regulations for reporting additional "instantaneous" parameters, required by regional reporting practices in RA VI, are shown in the Annex.

B/C 1.10 Basic synoptic "period" data <3 02 043>

B/C 1.10.1 Present and past weather <3 02 038>

B/C 1.10.1.1

Present weather (Code table 0 20 003) and past weather (1) (Code table 0 20 004) and past weather (2) (Code table 0 20 005) shall be reported as non-missing values if present and past conditions are known. In case of a report from a manually operated station after

a period of closure or at start up, when past weather conditions for the period applicable to the report are unknown, past weather (1) and past weather (2) reported as missing shall indicate that previous conditions are unknown. This regulation shall also apply to automatic reporting stations with the facility to report present and past weather. [12.2.6.1]

B/C 1.10.1.2

Code figures 0, 1, 2, 3, 100, 101, 102 and 103 for present weather and code figures 0, 1, 2 and 10 for past weather (1) and past weather (2) shall be considered to represent phenomena without significance. [12.2.6.2]

B/C 1.10.1.3

Present and past weather shall be *reported if observation was made (data available), regardless significance of the phenomena.*

Note:

(1) If data are produced and collected in traditional codes and present weather and past weather is omitted in a SYNOP report (no significant phenomena observed), code figure 508 shall be used for present weather and code figure 10 for past weather (1) and past weather (2) when converted into BUFR or CREX.

B/C 1.10.1.4

If no observation was made (data not available), code figure 509 shall be used for present weather and both past weather (1) and past weather (2) shall be reported as missing.

B/C 1.10.1.5 Present weather from a manned weather station

B/C 1.10.1.5.1

If more than one form of weather is observed, the highest applicable code figure from the range <00 to 99> shall be selected for present weather. Code figure 17 shall have precedence over code figures 20 – 49. Other weather may be reported using additional entries 0 20 003 or 0 20 021 to 0 20 026 applying Regulation B/C 1.9. [12.2.6.4.1]

B/C 1.10.1.5.2

In coding 01, 02, or 03, there is no limitation on the magnitude of the change of the cloud amount. Code figures 00, 01, and 02 can each be used when the sky is clear at the time of observation. In this case, the following interpretation of the specifications shall apply:

- 00 is used when the preceding conditions are not known,
- 01 is used when the clouds have dissolved during the past hour,
- 02 is used when the sky has been continuously clear during the past hour. [12.2.6.4.2]

B/C 1.10.1.5.3

When the phenomenon is not predominantly water droplets, the appropriate code figure shall be selected without regard to visibility. [12.2.6.4.3]

B/C 1.10.1.5.4

The code figure 05 shall be used when the obstruction to vision consists predominantly of lithometeors. [12.2.6.4.4]

B/C 1.10.1.5.5

National instructions shall be used to indicate the specifications for code figures 07 and 09. [12.2.6.4.5]

B/C 1.10.1.5.6

The visibility restrictions on code figure 10 shall be 1000 meters or more. The specification refers only to water droplets and ice crystals. [12.2.6.4.6]

B/C 1.10.1.5.7

For code figures 11 or 12 to be reported, the apparent visibility shall be less than 1000 meters. [12.2.6.4.7]

B/C 1.10.1.5.8

For code figure 18, the following criteria for reporting squalls shall be used:

(a) When wind speed is measured : A sudden increase of wind speed of at least eight meters per second, the speed rising to 11 meters per second or more and lasting for at least one minute;

(b) When the Beaufort scale is used for estimating wind speed: A sudden increase of wind speed by at least three stages of the Beaufort scale, the speed rising to force 6 or more and lasting for at least one minute. [12.2.6.4.8]

B/C 1.10.1.5.9

Code figures 20 – 29 shall never be used when precipitation is observed at the time of observation. [12.2.6.4.9]

B/C 1.10.1.5.10

For code figure 28, visibility shall have been less than 1000 meters.

Note:

(1) The specification refers only to visibility restrictions which occurred as a result of water droplets or ice crystals. [12.2.6.4.10]

B/C 1.10.1.5.11

For synoptic coding purposes, a thunderstorm shall be regarded as being at the station from the time thunder is first heard, whether or not lightning is seen or precipitation is occurring at the station. A thunderstorm shall be reported if thunder is heard within the normal observational period preceding the time of the report. A thunderstorm shall be regarded as having ceased at the time thunder is first heard and the cessation is confirmed if thunder is not heard for 10 – 15 minutes after this time. [12.2.6.4.11]

B/C 1.10.1.5.12

The necessary uniformity in reporting code figures 36, 37, 38, and 39, which may be desirable within certain regions, shall be obtained by means of national instructions. [12.2.6.4.12]

B/C 1.10.1.5.13

A visibility restriction « less than 1000 meters » shall be applied to code figures 42 – 49. In the case of code figures 40 or 41, the apparent visibility in the fog or ice fog patch or bank shall be less than 1000 meters. Code figures 40 – 47 shall be used when the obstructions to vision consist predominantly of water droplets or ice crystals, and 48 or 49 when the obstructions consist predominantly of water droplets. [12.2.6.4.13]

B/C 1.10.1.5.14

When referring to precipitation, the phrase « at the station » in the code table shall mean « at the point where the observation is normally taken ». [12.2.6.4.14]

B/C 1.10.1.5.15

The precipitation shall be encoded as intermittent if it has been discontinuous during the preceding hour, without presenting the character of a shower. [12.2.6.4.15]

B/C 1.10.1.5.16

The intensity of precipitation shall be determined by the intensity at the time of the observation. [12.2.6.4.16]

B/C 1.10.1.5.17

Code figures 80 – 89 shall be used only when the precipitation is of the shower type and takes place at the time of the observation.

Note:

(1) Showers are produced by convective clouds. They are characterized by their abrupt beginning and end and by the generally rapid and sometimes great variations in the intensity of the precipitation. Drops and solid particles falling in a shower are generally larger than those falling in non-showery precipitation. Between showers openings may be observed unless stratiform clouds fill the intervals between the cumuliform clouds. [12.2.6.4.17]

B/C 1.10.1.5.18

In reporting code figure 98, the observer shall be allowed considerable latitude in determining whether precipitation is or is not occurring, if it is not actually visible. [12.2.6.4.18]

B/C 1.10.1.6 Present weather from an automatic weather station

B/C 1.10.1.6.1

The highest applicable code figure shall be selected. [12.2.6.5.1]

B/C 1.10.1.6.2

In coding code figures 101, 102, and 103, there is no limitation on the magnitude of the change of the cloud amount. Code figures 100, 101, and 102 can each be used when the sky is clear at the time of observation. In this case, the following interpretation of the specifications shall apply:

- Code figure 100 is used when the preceding conditions are not known;
- Code figure 101 is used when the clouds have dissolved during the past hour;
- Code figure 102 is used when the sky has been continuously clear during the past hour. [12.2.6.5.2]

B/C 1.10.1.6.3

When the phenomenon is not predominantly water droplets, the appropriate code figure shall be selected without regard to the visibility. [12.2.6.5.3]

B/C 1.10.1.6.4

The code figures 104 and 105 shall be used when the obstruction to vision consists predominantly of lithometeors. [12.2.6.5.4]

B/C 1.10.1.6.5

The visibility restriction on code figure 110 shall be 1000 meters or more. The specification refers only to water droplets and ice crystals. [12.2.6.5.5]

B/C 1.10.1.6.6

For code figure 118, the following criteria for reporting squalls shall be used :
A sudden increase of wind speed of at least eight meters per second, the speed rising to 11 meters per second or more and lasting for at least one minute. [12.2.6.5.6]

B/C 1.10.1.6.7

Code figures 120 – 126 shall never be used when precipitation is observed at the time of observation. [12.2.6.5.7]

B/C 1.10.1.6.8

For code figure 120, visibility shall have been less than 1000 meters.
Note: The specification refers only to visibility restrictions which occurred as a result of water droplets or ice crystals. [12.2.6.5.8]

B/C 1.10.1.6.9

For synoptic coding purposes, a thunderstorm shall be regarded as being at the station from the time thunder is first detected, whether or not lightning is detected or precipitation is occurring at the station. A thunderstorm shall be reported in present weather if thunder is detected within the normal observational period preceding the time of the report. A thunderstorm shall be regarded as having ceased at the time thunder is last detected and the cessation is confirmed if thunder is not detected for 10 – 15 minutes after this time. [12.2.6.5.9]

B/C 1.10.1.6.10

A visibility restriction « less than 1000 meters » shall be applied to code figures 130 – 135. [12.2.6.5.10]

B/C 1.10.1.6.11

The precipitation shall be encoded as intermittent if it has been discontinuous during the preceding hour, without presenting the character of a shower. [12.2.6.5.11]

B/C 1.10.1.6.12

The intensity of precipitation shall be determined by the intensity at the time of observation. [12.2.6.5.12]

B/C 1.10.1.6.13

Code figures 180 – 189 shall be used only when the precipitation is intermittent or of the shower type and takes place at the time of observation.
Note:

(1) Showers are produced by convective clouds. They are characterized by their abrupt beginning and end and by the generally rapid and sometimes great variations in the intensity of the precipitation. Drops and solid particles falling in a shower are generally larger than those falling in non-showery precipitation. Between showers openings may be observed unless stratiform clouds fill the intervals between the cumuliform clouds. [12.2.6.5.13]

B/C 1.10.1.7 Past weather reported from a manned weather station

B/C 1.10.1.7.1 Time period

The time period (0 04 024) covered by past weather (1) and past weather (2) shall be expressed as *a negative value* in hours:

(a) Six hours, for observations at 0000, 0600, 1200, and 1800 UTC;
(b) Three hours for observations at 0300, 0900, 1500, and 2100 UTC;
(c) Two hours for intermediate observations if taken every two hours.
(d) *One hour* for intermediate observations if taken every hour. [12.2.6.6.1]

B/C 1.10.1.7.2

The code figures for past weather (1) and past weather (2) shall be selected in such a way that past and present weather together give as complete a description as possible of the weather in the time interval concerned. For example, if the type of weather undergoes a complete change during the time interval concerned, the code figures selected for past weather (1) and past weather (2) shall describe the weather prevailing before the type of weather indicated by present weather began. [12.2.6.6.2]

B/C 1.10.1.7.3

When the past weather (1) and past weather (2) are used in hourly reports, Regulation B/C 1.10.1.7.1 (d) shall apply. [12.2.6.6.3]

B/C 1.10.1.7.4

If, using Regulation B/C 1.10.1.7.2, more than one code figure may be given to past weather (1), the highest figure shall be reported for past weather (1) and the second highest code figure shall be reported for past weather (2). [12.2.6.6.4]

B/C 1.10.1.7.5

If the weather during the period has not changed so that only one code figure may be selected for past weather, then that code figure shall be reported for both past weather (1) and past weather (2). [12.2.6.6.5]

B/C 1.10.1.8 Past weather reported from an automatic weather station

B/C 1.10.1.8.1 Time period

The time period (0 04 024) covered by past weather (1) and past weather (2) shall be expressed as *a negative value* in hours:

(a) Six hours for observations at 0000, 0600, 1200, and 1800 UTC;
(b) Three hours for observations at 0300, 0900, 1500, and 2100 UTC;
(c) Two hours for intermediate observations if taken every two hours.
(d) *One hour* for intermediate observations if taken every hour. [12.2.6.7.1]

B/C 1.10.1.8.2

The code figures for past weather (1) and past weather (2) shall be selected so that the maximum capability of the automatic station to discern past weather is utilized, and so that past and present weather together give as complete a description as possible of the weather in the time interval concerned. [12.2.6.7.2]

B/C 1.10.1.8.3

In cases where the automatic station is capable only of discerning very basic weather conditions, the lower code figures representing basic and generic phenomena may be used. If the automatic station has higher discrimination capabilities, the higher code figures representing more detailed explanation of the phenomena shall be used. For each basic type of phenomenon, the highest code figure within the discrimination capability of the automatic station shall be reported. [12.2.6.7.3]

B/C 1.10.1.8.4

If the type of weather during the time interval concerned undergoes complete and discernible changes, the code figures selected for past weather (1) and past weather (2) shall describe the weather prevailing before the type of weather indicated by present weather began. The highest figure shall be reported for past weather (1) and the second highest code figure shall be reported for past weather (2). [12.2.6.7.4]

B/C 1.10.1.8.5

If a discernible change in weather has not occurred during the period, so that only one code figure may be selected for the past weather, then that code figure shall be reported for both past weather (1) and past weather (2). For example, rain during the entire period shall be reported as code figure 14 for both past weather (1) and past weather (2) in the case of an automatic station incapable of differentiating types of precipitation, or code figure 16 for both past weather (1) and past weather (2) in the case of a station with the higher discrimination capability. [12.2.6.7.5]

B/C 1.10.2 Sunshine data <1 01 002><3 02 039>

B/C 1.10.2.1 Period of reference for sunshine duration

Time period in hours (0 04 024) shall be included as follows:

(a) one hour in the first replication (reported as -1);
(b) 24 hours in the second replication (reported as -24).

B/C 1.10.2.2 Duration of sunshine

Duration of sunshine from the time period specified by the preceding parameter 0 07 024, shall be reported in minutes.

B/C 1.10.2.2.1

The duration of sunshine over the previous hour shall be reported by national decision. When reported, it shall be included in the first replication.

B/C 1.10.2.2.2

The duration of sunshine over the previous 24 hours shall, by regional decision, be reported at all stations capable of doing so and included at either 0000 UTC, 0600 UTC, 1200 UTC or 1800 UTC. When reported, it shall be included in the second replication. [12.4.7.4.2]

B/C 1.10.3 Precipitation measurement <3 02 040>

B/C 1.10.3.1 Height of sensor above local ground

Height of sensor above local ground (0 07 032) for precipitation measurement shall be reported in meters (with precision in hundredths of a meter).
This datum represents the actual height of the rain gauge rim above ground at the point where the rain gauge is located.

B/C 1.10.3.2 Period of reference for amount precipitation

Time period (0 04 024) for amount of precipitation shall be reported as *a negative value* in hours. It shall be determined

(a) by regional decision (e.g. -6, -12, -24) in the first replication,
(b) by national decision (e.g. -1, -3) in the second replication.

B/C 1.10.3.3 Total amount of precipitation

Total amount of precipitation, which has fallen during the period of reference for amount of precipitation, shall be reported in kilograms per square meter (with precision in tenths of a kilogram per square meter).

B/C 1.10.3.3.1

Precipitation, when it can be and has to be reported, shall be reported as 0.0 kgm^{-2} if no precipitation were observed during the referenced period. [12.2.5.4]

B/C 1.10.3.3.2

Trace shall be reported as "- 0.1 kgm^{-2} ".

B/C 1.10.4 Extreme temperature data <3 02 041>

B/C 1.10.4.1 Height of sensor above local ground

Height of sensor above local ground (0 07 032) for temperature measurement shall be reported in meters (with precision in hundredths of a meter).
This datum represents the actual height of temperature sensor(s) above ground at the point where the sensors are located.

B/C 1.10.4.2 Periods of reference for extreme temperatures

Time period for maximum temperature and time period for minimum temperature (0 04 024) shall be determined by regional decision and reported as *negative values* in hours. [12.4.4]
Notes:

(1) If the period for maximum temperature or the period for minimum temperature ends at the nominal time of report, the second value of 0 04 024 shall be reported as 0.

(2) If the period for maximum temperature or the period for minimum temperature does not end at the nominal time of report, the first value of 0 04 024 shall indicate the beginning of the period of reference and the second value of 0 04 024 shall indicate the end of the period of reference. E.g. to report the maximum temperature for the previous calendar day from a station in RA IV, value of the first 0 04 024 shall be set to – 30 and value of the second 0 04 024 shall be set to – 6, provided that the nominal time of the report 12 UTC corresponds to 6 a.m. local time.

B/C 1.10.4.3 Maximum and minimum temperature

Maximum and minimum temperature shall be reported in degrees Kelvin (with precision in hundredths of a degree Kelvin); if produced in CREX, in degrees Celsius (with precision in hundredths of a degree Celsius). Extreme temperature data shall be reported with precision in hundredths of a degree even if they are measured with the accuracy in tenths of a degree.
Note:

(1) Notes (1) and (2) under Regulation B/C 1.4.1.2 shall apply.

B/C 1.10.5 Wind data <3 02 042>

B/C 1.10.5.1 Height of sensor above local ground

Height of sensor above local ground (0 07 032) for wind measurement shall be reported in meters (with precision in hundredths of a meter).
This datum represents the actual height of the sensors above ground at the point where the sensors are located.

B/C 1.10.5.2 Type of instrumentation for wind measurement - Flag table 0 02 002

This datum shall be used to specify whether the wind speed was measured by certified instruments (bit No. 1 set to 1) or estimated on the basis of the Beaufort wind scale (bit No. 1 set to 0), and to indicate the original units for wind speed measurement. Bit No. 2 set to 1 indicates that wind speed was originally measured in knots and bit No. 3 set to 1 indicates that wind speed was originally measured in kilometers per hour. Setting both bits No.2 and No.3 to 0 indicates that wind speed was originally measured in meters per second.

In CREX, type of instrumentation for wind measurement (0 02 002) shall be reported in octal representation. For example, if wind speed was measured by instruments in knots (bit No.1 and bit No.2 set to 1), then this datum shall be reported as 14.

B/C 1.10.5.3 Wind direction and speed

The mean direction and speed of the wind over the 10-minute period immediately preceding the observation shall be reported. The time period (0 04 025) shall be included as -10. However, when the 10-minute period includes a discontinuity in the wind

characteristics, only data obtained after the discontinuity shall be used for reporting the mean values, and hence the period (0 04 025) in these circumstances shall be correspondingly reduced. [12.2.2.3.1]

The time period is preceded by a time significance qualifier (0 08 021) that shall be set to 2 (Time averaged).

The wind direction (0 11 001) shall be reported in degrees true and the wind speed (0 11 002) shall be reported in meters per second (with precision in tenths of a meter per second).

B/C 1.10.5.3.1

In the absence of wind instruments, the wind speed shall be estimated on the basis of the Beaufort wind scale. The Beaufort number obtained by estimation is converted into meters per second by use of the relevant wind speed equivalent column on the Beaufort scale, and this speed is reported for wind speed. [12.2.2.3.2]

B/C 1.10.5.4 Maximum wind gust direction and speed

Time period for maximum wind gust direction and speed (0 04 025) shall be determined by regional or national decision and reported as a negative value in minutes.

Direction of the maximum wind gust (0 11 043) shall be reported in degrees true and speed of the maximum wind gust (0 11 041) shall be reported in meters per second (with precision in tenths of meters per second).

B/C 1.11 Evaporation data <3 02 044>

B/C 1.11.1 Period of reference for evaporation data

Evaporation or evapotranspiration during the previous 24 hours shall be reported. Time period in hours (0 04 024) shall be included as -24.

B/C 1.11.2 Indicator of type of instrument for evaporation measurement or the type of crops

– Code table 0 02 004

B/C 1.11.3 Evaporation or evapotranspiration

Amount of either evaporation or evapotranspiration (0 13 033) shall be reported in kilograms per square meter (with precision in tenths of a kilogram per square meter) at 0000 UTC, 0600 UTC or 1200 UTC. [12.4.7.2.2]

B/C 1.12 Radiation data <1 01 002><3 02 045>

B/C 1.12.1 Period of reference for radiation data

Radiation integrated over the previous hour and over the previous 24 hours may be reported. Time period in hours (0 04 024) shall be included as follows:

(a) one hour in the first replication (reported as -1);
(b) 24 hours in the second replication (reported as -24).

B/C 1.12.2 Amount of radiation

If included, amount of radiation integrated over the time period specified by the preceding parameter 0 07 024 shall be reported in joules per square meter (with precision in thousands of a joule per square meter for radiation type (1) and (2); with precision in ten-thousands of a joule per square meter for radiation type (3); with precision in hundreds of a joule per square meter for radiation types (4) to (6)).

B/C 1.12.2.1

The radiation data may take one or more of the following forms:

(1) Long-wave radiation (0 14 002); the positive sign shall be used to specify downward long-wave radiation and the negative sign to specify upward long-wave radiation;

(2) Short-wave radiation (0 14 004);
(3) Net radiation (0 14 016); the corresponding sign shall be used to specify positive and negative net radiation);
(4) Global solar radiation (0 14 028);
(5) Diffuse solar radiation (0 14 029);
(6) Direct solar radiation (0 14 030).
[12.4.7.4.3], [12.4.7.4.4]

B/C 1.13 Temperature change <3 02 046>

This information is required by regional or national decision from islands or other widely separated stations.

B/C 1.13.1 Period of reference for temperature change

The temperature change shall be reported for the period of time between the time of the observation and the time of the occurrence of temperature change. To construct the required period, time period 0 04 024 shall be included twice; the first one corresponding to period covered by past weather (1) and past weather (2), the second one specified by the time of the occurrence of temperature change. Both values of 0 04 024 shall be negative and expressed in hours.

Note:

(1) The period is the number of whole hours, disregarding the minutes. For example, if the time of occurrence is 45 minutes after the time of the observation, the time period is considered to be zero hours. If the time of occurrence is 1 hour or more, but less than 2 hours after the observation, the time period go shall be considered to be 1 hour, etc.

B/C 1.13.2 Temperature change over period specified

Temperature change (0 12 049) shall be reported in degrees Kelvin in BUFR, in degrees Celsius in CREX.

B/C 1.13.2.1

For a change of temperature to be reported, the change shall be equal to or more than 5^{o} C and occur in less than 30 minutes during the period covered by past weather (1) and past weather (2). [12.4.7.3]

B/C 1.14 "Period" data required by regional or national reporting practices

If regional reporting practices in a Region require inclusion of additional "period" parameters, the corresponding "regional" common sequence (see the Annex) shall be supplemented by relevant descriptors. If national reporting practices require inclusion of additional "period" parameters, either the common sequence 3 07 080 or any of the common sequences 3 07 081 to 3 07 086, whichever is the most convenient, shall be supplemented by relevant descriptors

Note:

(1) "Period" parameter is a parameter that is coupled to a time period descriptor, e.g. 0 04 024, 0 04 025.
(2) No additional "period" parameters are currently required by regional regulations for SYNOP data in Manual on Codes, WMO-No. 306, Volume II.

ANNEX to B/C1 – Regulations for reporting SYNOP data in TDCF

Regional regulations for reporting SYNOP data in BUFR/CREX

TM 307081 - BUFR template for synoptic reports from fixed land stations suitable for SYNOP data in compliance with reporting practices in RA I

3 07 081:

3 01 090	Fixed surface station identification, time, horizontal and vertical coordinates		Unit, scale
3 02 031	Pressure data		
3 02 035	Basic synoptic “instantaneous” data		
3 02 036	Clouds with bases below station level		
3 02 047	Direction of cloud drift		
0 08 002	Vertical significance (= missing to cancel the previous value)		Code table, 0
3 02 048	Direction and elevation of cloud		
3 02 037	State of ground, snow depth, ground minimum temperature (past 12 hours)		
0 12 122	Ground minimum temperature of the preceding night	$s_nT_gT_g$	K, 2
0 13 056	Character and intensity of precipitation	R_c	Code table, 0
0 13 057	Time of beginning or end of precipitation	R_t	Code table, 0
0 20 101	Locust (acridian) name	L_n	Code table, 0
0 20 102	Locust (maturity) color	L_c	Code table, 0
0 20 103	Stage of development of locusts	L_d	Code table, 0
0 20 104	Organization state of swarm or band of locusts	L_g	Code table, 0
0 20 105	Size of swarm or band of locusts and duration of passage of swarm	s_L	Code table, 0
0 20 106	Locust population density	d_L	Code table, 0
0 20 107	Direction of movements of locust swarm	D_L	Code table, 0
0 20 108	Extent of vegetation	v_e	Code table, 0
3 02 043	Basic synoptic “period” data		
3 02 044	Evaporation data		
1 01 002	Replicate next descriptor 2 times		
3 02 045	Radiation data (from 1 hour and/or 24 hour period)		
3 02 046	Temperature change		

Regulations:

General

(i) BUFR template TM 307081 shall not be mandatory for Member States in Region I. Either the template TM 307080 or any of the templates TM 307081 to TM 307086, whichever is the most convenient, may be used.

(ii) Regulations **B/C 1.1** to **B/C 1.9**, inclusive, shall apply.

(iii) Regulations **B/C 1.10** to **B/C 1.14**, inclusive, shall apply.

B/C 1.9.1 “Instantaneous” data required by reporting practices in RA I

B/C 1.9.1.1 Ground minimum temperature of the preceding night

Ground minimum temperature of the preceding night (0 12 122) shall be reported in degrees Kelvin (with precision in hundredths of a degree Kelvin); if produced in CREX, in degrees Celsius (with precision in hundredths of a degree Celsius).

Notes (1), (2) and (3) under Regulation B/C 1.8.3 shall apply.

This datum shall be reported by all Members at 0600 UTC. [1/12.6.1]

B/C 1.9.1.2 Character, intensity and time of beginning or end of precipitation

Character and intensity of precipitation (Code table 0 13 056) and Time of beginning or end of precipitation (Code table 0 13 057) shall be reported by all Members at 0600 UTC to meet requirements of agrometerological monitoring in the Region. [1/12.6.1] Inclusion of these data into reports at 0000 and 1200 UTC shall be left to national decision. [1/12.6.3]

B/C 1.9.1.3 Locust control-related observations

Following data shall be reported by all Members capable of doing so:

(a) Locust (acridian) name (Code table 0 20 101),
(b) Locust (maturity) color (Code table 0 20 102),
(c) Stage of development of locusts (Code table 0 20 103),
(d) Organization state of swarm or band of locusts (Code table 0 20 104),
(e) Size of swarm or band of locusts and duration of passage of swarm (Code table 0 20 105),
(f) Locust population density (Code table 0 20 106),
(g) Direction of movements of locust swarm (Code table 0 20 107),
(h) Extent of vegetation (Code table 0 20 108). [1/12.14.1]

TM 307082 - BUFR template for synoptic reports from fixed land stations suitable for SYNOP data in compliance with reporting practices in RA II

3 07 082:

3 01 090	Fixed surface station identification, time, horizontal and vertical coordinates	Unit, scale
3 02 031	Pressure data	
3 02 035	Basic synoptic “instantaneous” data	
3 02 036	Clouds with bases below station level	
3 02 047	Direction of cloud drift	
0 08 002	Vertical significance (= missing to cancel the previous value)	Code table, 0
3 02 048	Direction and elevation of cloud	
3 02 037	State of ground, snow depth, ground minimum temperature (past 12 hours)	
0 12 121	Ground minimum temperature (at the time of observation) **$s_nT'_gT'_g$**	K, 2
0 12 122	Ground minimum temperature of the preceding night **$s_nT_gT_g$**	K, 2
3 02 043	Basic synoptic “period” data	
3 02 044	Evaporation data	
1 01 002	Replicate next descriptor 2 times	
3 02 045	Radiation data (from 1 hour and/or 24 hour period)	
3 02 046	Temperature change	

Regulations:

General

(i) BUFR template TM 307082 shall not be mandatory for Member States in Region II. Either the template TM 307080 or any of the templates TM 307081 to TM 307086, whichever is the most convenient, may be used.

(ii) Regulations **B/C 1.1** to **B/C 1.9**, inclusive, shall apply.

(iii) Regulations **B/C 1.10** to **B/C 1.14**, inclusive, shall apply.

B/C 1.9.2 “Instantaneous” data required by reporting practices in RA II

B/C 1.9.2.1 Ground minimum temperature at the time of observation

Ground minimum temperature measured at the time of observation (0 12 121) shall be reported in degrees Kelvin (with precision in hundredths of a degree Kelvin); if produced in CREX, in degrees Celsius (with precision in hundredths of a degree Celsius).

Notes (1) and (2) under Regulation B/C 1.8.3 shall apply.

Inclusion of this datum into reports at least at 0000 and 1200 UTC shall be left to national decision. [2/12.6.1]

B/C 1.9.2.2 Ground minimum temperature of the preceding night

Ground minimum temperature of the preceding night (0 12 122) shall be reported in degrees Kelvin (with precision in hundredths of a degree Kelvin); if produced in CREX, in degrees Celsius (with precision in hundredths of a degree Celsius).

Notes (1), (2) and (3) under Regulation B/C 1.8.3 shall apply.

TM 307083 - BUFR template for synoptic reports from fixed land stations suitable for SYNOP data in compliance with reporting practices in RA III

3 07 083:

3 01 090	Fixed surface station identification, time, horizontal and vertical coordinates	Unit, scale
3 02 031	Pressure data	
3 02 035	Basic synoptic “instantaneous” data	
3 02 036	Clouds with bases below station level	
3 02 047	Direction of cloud drift	
0 08 002	Vertical significance (= missing to cancel the previous value)	Code table, 0
3 02 048	Direction and elevation of cloud	
3 02 037	State of ground, snow depth, ground minimum temperature (past 12 hours)	
0 12 122	Ground minimum temperature of the preceding night $s_nT_gT_g$	K, 2
3 02 043	Basic synoptic “period” data	
3 02 044	Evaporation data	
1 01 002	Replicate next descriptor 2 times	
3 02 045	Radiation data (from 1 hour and/or 24 hour period)	
3 02 046	Temperature change	

Regulations:

General

(i) BUFR template TM 307083 shall not be mandatory for Member States in Region III. Either the template TM 307080 or any of the templates TM 307081 to TM 307086, whichever is the most convenient, may be used.

(ii) Regulations **B/C 1.1** to **B/C 1.9**, inclusive, shall apply.

(iii) Regulations **B/C 1.10** to **B/C 1.14**, inclusive, shall apply.

B/C 1.9.3 “Instantaneous” data required by reporting practices in RA III

B/C 1.9.3.1 Ground minimum temperature of the preceding night

Ground minimum temperature of the preceding night (0 12 122) shall be reported in degrees Kelvin (with precision in hundredths of a degree Kelvin); if produced in CREX, in degrees Celsius (with precision in hundredths of a degree Celsius).

Notes (1), (2) and (3) under Regulation B/C 1.8.3 shall apply.

This datum shall be included into reports at 1200 UTC, if possible. [3/12.7.2]

TM 307084 - BUFR template for synoptic reports from fixed land stations suitable for SYNOP data in compliance with reporting practices in RA IV

3 07 084:

3 01 090	Fixed surface station identification, time, horizontal and vertical coordinates	Unit, scale
3 02 031	Pressure data	
3 02 035	Basic synoptic “instantaneous” data	
3 02 036	Clouds with bases below station level	
3 02 047	Direction of cloud drift	
0 08 002	Vertical significance (= missing to cancel the previous value)	Code table, 0
3 02 048	Direction and elevation of cloud	
3 02 037	State of ground, snow depth, ground minimum temperature (past 12 hours)	
0 20 055	State of sky in tropics **C_S**	Code table, 0
1 01 000	Delayed replication of 1 descriptor	
0 31 001	Delayed descriptor replication factor	Numeric, 0
2 05 001	Character field of 1 character	CCITT IA5, 0
3 02 043	Basic synoptic “period” data	
3 02 044	Evaporation data	
1 01 002	Replicate next descriptor 2 times	
3 02 045	Radiation data (from 1 hour and/or 24 hour period)	
3 02 046	Temperature change	

Regulations:

General

(i) BUFR template TM 307084 shall not be mandatory for Member States in Region IV. Either the template TM 307080 or any of the templates TM 307081 to TM 307086, whichever is the most convenient, may be used.

(ii) Regulations **B/C 1.1** to **B/C 1.9**, inclusive, shall apply.

(iii) Regulations **B/C 1.10** to **B/C 1.14**, inclusive, shall apply.

B/C 1.9.4 “Instantaneous” data required by reporting practices in RA IV

B/C 1.9.4.1 State of sky in tropics

State of sky in tropics (Code table 0 02 055) shall be reported only by stations in the southern part of Region IV, below 1000 m elevation and within 500 kilometers of the shore, and only during the part of the year in which tropical weather is observed. Direction of cloud drift shall be reported using sequence 3 02 047. [4/12.4.2]

B/C 1.9.4.2 Additional information in plain language

Information in plain language shall be reported as a character field, using delayed replication of the operator descriptor 2 05 001. The value of the delayed replication factor 0 31 001 shall correspond with the number of characters required for the reported information (space characters included). For example, if the word TORNADO is included in the report (tornado has been observed at, or within sight of, the station [4/12.14.1]), delayed replication factor 0 31 001 shall be set to 7.

TM 307086 - BUFR template for synoptic reports from fixed land stations suitable for SYNOP data in compliance with reporting practices in RA VI

3 07 086:

3 01 090		Fixed surface station identification, time, horizontal and vertical coordinates	Unit, scale
3 02 031		Pressure data	
3 02 035		Basic synoptic “instantaneous” data	
3 02 036		Clouds with bases below station level	
0 08 002		Vertical significance (= missing to cancel the previous value)	
3 02 037		State of ground, snow depth, ground minimum temperature	
3 02 066		**Dangerous weather phenomena**	
		Groups 919M_WD_a and 96119 in SYNOP	
	0 20 023	Other weather phenomena **M_W** (1= Dust/sand whirl, 9= Funnel clouds not touching surface, 10 = Funnel clouds touching surface, 12 = Water-spout)	Flag table, 0
	0 20 024	Intensity of phenomena (1= Light, 2 = Moderate, 3 = Heavy, 4 = Violent)	Code table, 0
	0 20 027	Phenomenon occurrence (1=At time of observation, 3=In time period for past weather)	Flag table, 0
	0 20 054	True direction from which a phenomenon or clouds are moving **D_a**	Degree true, 0
		Group 918s_qD_p in SYNOP	
	0 20 023	Other weather phenomena (2 = Squalls) **s_q**	Flag table, 0
	0 20 027	Phenomenon occurrence (1=At time of observation, 3=In time period for past weather)	Flag table, 0
	0 20 054	True direction from which a phenomenon or clouds are moving **D_p**	Degree true, 0
		Group 929$S_8S'_8$ in SYNOP	
	0 20 025	Obscuration (13 = Snow)	Flag table, 0
	0 20 026	Character of obscuration (5= Low drifting, 6= Blowing) **S_8**	Code table, 0
	0 20 027	Phenomenon occurrence (1=At time of observation, 3=In time period for past weather)	Flag table, 0
	0 20 040	Evolution of drift of snow **S'_8**	Code table, 0
		Group 932RR	
	0 20 066	Maximum diameter of hailstones **RR**	m, 3
	0 20 027	Phenomenon occurrence (1=At time of observation, 3=In time period for past weather)	Flag table, 0
		Groups 934RR- 937RR in SYNOP	
	0 20 021	Type of precipitation (15=Glaze, 16=Rime, 20=Wet snow)	Flag table, 0
	0 20 067	Diameter of deposit **RR**	m, 3
	0 20 027	Phenomenon occurrence (1=At time of observation, 3=In time period for past weather)	Flag table, 0
3 02 043		Basic synoptic “period” data	
3 02 044		Evaporation data	
1 01 002		Replicate next descriptor 2 times	
3 02 045		Radiation data (from 1 hour and/or 24 hour period)	

Note:
Groups 56$D_LD_MD_H$, 57CD_ae_C and 54$g_0s_nd_T$ are not used in RA VI and therefore the corresponding sequence descriptors 3 02 047, 3 02 048 and 3 02 046 are not included in the RA VI regional template for SYNOP data.

Regulations:

General

(i) BUFR template TM 307086 shall not be mandatory for Member States in Region VI. Either the template TM 307080 or any of the templates TM 307081 to TM 307086, whichever is the most convenient, may be used.
(ii) Regulations **B/C 1.1** to **B/C 1.9**, inclusive, shall apply.
(iii) Regulations **B/C 1.10** to **B/C 1.14**, inclusive, shall apply.

B/C 1.9.6 "Instantaneous" data required by reporting practices in RA VI

B/C 1.9.6.1 Dangerous weather phenomena

Sequence 3 02 066 should be used for regional exchange of data on dangerous phenomena. Reporting of other phenomena shall be left to national decision. [6/12.12.2]

B/C 1.9.6.1.1 Tornado, water spout, whirlwinds and dust devils

Tornadoes, water spouts, whirlwinds and dust devils between observation times shall be reported using two parameters: Other weather phenomena (Flag table 0 20 023) and Intensity of phenomena (Code table 0 20 024). Occurrence of the phenomenon (Flag table 0 20 027) shall be specified by setting bit No. 3 to 1 (In time period for past weather).

B/C 1.9.6.1.2 Squall

Squalls between observation times shall be reported using Flag table 0 20 023 (bit No.2 set to 1). Occurrence of the phenomenon (Flag table 0 20 027) shall be specified by setting bit No. 3 to 1 (In time period for past weather). True direction from which the squall approaches the station (0 20 054) shall be reported in degrees true.

B/C 1.9.6.1.3 Drifting and blowing snow

Drifting and blowing snow shall be reported using two parameters: Obscuration (Flag table 0 20 025) and Character of obscuration (Code table 0 26 026). Occurrence of the phenomenon (Flag table 0 20 027) shall be specified by setting to 1 either bit No. 1 (At time of observation) or bit No. 3 (In time period for past weather) or both. Evolution of drift of snow shall be reported using Code table 0 20 040.

B/C 1.9.6.1.4 Maximum diameter of hailstones

Maximum diameter of hailstones (0 20 066) shall be reported in meters (with precision in thousandths of a meter). Occurrence of the phenomenon (Flag table 0 20 027) shall be specified by setting to 1 either bit No. 1 (At time of observation) or bit No. 3 (In time period for past weather) or both.

B/C 1.9.6.1.5 Frozen deposit

Diameter of frozen deposit (0 20 067) shall be reported in meters (with precision in thousandths of a meter). The preceding entry Type of precipitation (Flag table 0 20 021) shall specify type of the frozen deposit, i.e. bit No. 15 set to 1 shall indicate deposit of glaze, bit No. 16 set to 1 shall indicate deposit of rime and bit No. 20 set to 1 shall indicate deposit of wet snow; compound deposit shall be indicated by at least two of the above mentioned bits set to 1. Occurrence of the phenomenon (Flag table 0 20 027) shall be specified by setting to 1 either bit No. 1 (At time of observation) or bit No. 3 (In time period for past weather) or both.

B/C5 – Regulations for reporting SYNOP MOBIL data in TDCF

TM 307090 - BUFR template for synoptic reports from mobile land stations suitable for SYNOP MOBIL data

3 07 090		**Sequence for representation of synoptic reports from a mobile land station suitable for SYNOP MOBIL data**
	3 01 092	Mobile surface station identification, time, horizontal and vertical coordinates
	3 02 031	Pressure data
	3 02 035	Basic synoptic “instantaneous” data
	3 02 036	Clouds with bases below station level
	3 02 047	Direction of cloud drift
	0 08 002	Vertical significance
	3 02 048	Direction and elevation of cloud
	3 02 037	State of ground, snow depth, ground minimum temperature
	3 02 043	Basic synoptic “period” data
	3 02 044	Evaporation data
	1 01 002	Replicate next descriptor 2 times
	3 02 045	Radiation data (from 1 hour and/or 24 hour period)
	3 02 046	Temperature change

This BUFR template for synoptic reports from mobile land stations further expands as follows:

3 01 092			**Mobile surface station identification, time, horizontal and vertical coordinates**	Unit, scale
	0 01 011		Mobile land station identifier **D….D**	CCITT IA5, 0
	0 01 003		WMO Region number **A_1**	Code table, 0
	0 02 001		Type of station **(i_x)**	Code table, 0
	3 01 011	0 04 001	Year	Year, 0
		0 04 002	Month	Month, 0
		0 04 003	Day **YY**	Day, 0
	3 01 012	0 04 004	Hour **GG**	Hour, 0
		0 04 005	Minute **gg**	Minute, 0
	3 01 021	0 05 001	Latitude (high accuracy) **$L_aL_aL_a$**	Degree, 5
		0 06 001	Longitude (high accuracy) **$L_oL_oL_oL_o$**	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 33 024		Station elevation quality mark **i_m**	Code table, 0
3 02 031			**Pressure data**	
	3 02 001	0 10 004	Pressure **$P_0P_0P_0P_0$**	Pa, –1
		0 10 051	Pressure reduced to mean sea level **PPPP**	Pa, –1
		0 10 061	3-hour pressure change **ppp**	Pa, –1
		0 10 063	Characteristic of pressure tendency **a**	Code table, 0
	0 10 062		24-hour pressure change **$p_{24}p_{24}p_{24}$**	Pa, –1
	0 07 004		Pressure (standard level) **a_3**	Pa, –1
	0 10 009		Geopotential height of the standard level **hhh**	gpm, 0
3 02 035			**Basic synoptic “instantaneous” data**	
			Temperature and humidity data	
	3 02 032	0 07 032	Height of sensor above local ground (for temperature and humidity measurement)	m, 2
		0 12 101	Temperature/dry-bulb temperature(sc.2) **s_nTTT**	K, 2
		0 12 103	Dew-point temperature (scale 2) **$s_nT_dT_dT_d$**	K, 2

		0 13 003	Relative humidity	%, 0
			Visibility data	
	3 02 033	0 07 032	Height of sensor above local ground (for visibility measurement)	m, 2
		0 20 001	Horizontal visibility **VV**	m, –1
			Precipitation past 24 hours	
	3 02 034	0 07 032	Height of sensor above local ground (for precipitation measurement)	m, 2
		0 13 023	Total precipitation past 24 hours $\mathbf{R_{24}R_{24}R_{24}R_{24}}$	kg m^{-2}, 1
	0 07 032		Height of sensor above local ground (set to missing to cancel the previous value)	m, 2
			Cloud data	
	3 02 004	0 20 010	Cloud cover (total) **N**	%, 0
		0 08 002	Vertical significance	Code table, 0
		0 20 011	Cloud amount (of low or middle clouds) $\mathbf{N_h}$	Code table, 0
		0 20 013	Height of base of cloud **h**	m, –1
		0 20 012	Cloud type (low clouds C_L) $\mathbf{C_L}$	Code table, 0
		0 20 012	Cloud type (middle clouds C_M) $\mathbf{C_M}$	Code table, 0
		0 20 012	Cloud type (high clouds C_H) $\mathbf{C_H}$	Code table, 0
			Individual cloud layers or masses	
	1 01 000		Delayed replication of 1 descriptor	
	0 31 001		Delayed descriptor replication factor	Numeric, 0
	3 02 005	0 08 002	Vertical significance	Code table, 0
		0 20 011	Cloud amount (N_s) $\mathbf{N_s}$	Code table, 0
		0 20 012	Cloud type (C) **C**	Code table, 0
		0 20 013	Height of base of cloud (h_sh_s) $\mathbf{h_sh_s}$	m, -1
			Clouds with bases below station level	
3 02 036	1 05 000		Delayed replication of 5 descriptors	
	0 31 001		Delayed descriptor replication factor	Numeric, 0
	0 08 002		Vertical significance	Code table, 0
	0 20 011		Cloud amount **N'**	Code table, 0
	0 20 012		Cloud type **C'**	Code table, 0
	0 20 014		Height of top of cloud **H'H'**	m, -1
	0 20 017		Cloud top description $\mathbf{C_t}$	Code table, 0
			Direction of cloud drift gr. $\mathbf{56D_LD_MD_H}$	
3 02 047	1 02 003		Replicate 2 descriptors 3 times	
	0 08 002		Vertical significance = 7 (low cloud) = 8 (middle cloud) = 9 (high cloud)	Code table, 0
	0 20 054		True direction from which clouds are moving $\mathbf{D_L, D_M, D_H}$	Degree true, 0
0 08 002			Vertical significance (set to missing to cancel the previous value)	Code table, 0
			Direction and elevation of cloud gr. $\mathbf{57CD_ae_C}$	
3 02 048	0 05 021		Bearing or azimuth $\mathbf{D_a}$	Degree true, 2
	0 07 021		Elevation angle $\mathbf{e_C}$	Degree, 2
	0 20 012		Cloud type **C**	Code table, 0
	0 05 021		Bearing or azimuth (set to missing to cancel the previous value)	Degree true, 2
	0 07 021		Elevation angle (set to missing to cancel the previous value)	Degree, 2
			State of ground, snow depth, ground minimum temperature	
3 02 037	0 20 062		State of ground (with or without snow) **E** or **E'**	Code table, 0
	0 13 013		Total snow depth **sss**	m, 2

	0 12 113		Ground minimum temperature (scale2), past 12 hours **$s_nT_gT_g$**	K, 2
3 02 043			**Basic synoptic "period" data**	
			Present and past weather	
	3 02 038	0 20 003	Present weather **ww**	Code table, 0
		0 04 024	Time period in hours	Hour, 0
		0 20 004	Past weather (1) **W_1**	Code table, 0
		0 20 005	Past weather (2) **W_2**	Code table, 0
			Sunshine data (from 1 hour and 24 hour period)	
	1 01 002		Replicate 1 descriptors 2 times	
	3 02 039	0 04 024	Time period in hours	Hour, 0
		0 14 031	Total sunshine **SS** and **SSS**	Minute, 0
			Precipitation measurement	
	3 02 040	0 07 032	Height of sensor above local ground (for precipitation measurement)	m, 2
		1 02 002	Replicate next 2 descriptors 2 times	
		0 04 024	Time period in hours **t_R**	Hour, 0
		0 13 011	Total precipitation / total water equivalent of snow **RRR**	kg m^{-2}, 1
			Extreme temperature data	
	3 02 041	0 07 032	Height of sensor above local ground (for temperature measurement)	m, 2
		0 04 024	Time period or displacement	Hour, 0
		0 04 024	Time period or displacement (see Notes 1 and 2)	Hour, 0
		0 12 111	Maximum temperature (scale 2) at height and over period specified **$s_nT_xT_xT_x$**	K, 2
		0 04 024	Time period or displacement	Hour, 0
		0 04 024	Time period or displacement (see Note 2)	Hour, 0
		0 12 112	Minimum temperature (scale 2) at height and over period specified **$s_nT_nT_nT_n$**	K, 2
			Wind data	
	3 02 042	0 07 032	Height of sensor above local ground (for wind measurement)	m, 2
		0 02 002	Type of instrumentation for wind measurement **i_w**	Flag table, 0
		0 08 021	Time significance (= 2 (time averaged))	Code table, 0
		0 04 025	Time period (= - 10 minutes, or number of minutes after a significant change of wind)	Minute, 0
		0 11 001	Wind direction **dd**	Degree true, 0
		0 11 002	Wind speed **ff**	m s^{-1}, 1
		0 08 021	Time significance (= missing value)	Code table, 0
		1 03 002	Replicate next 3 descriptors 2 times	
		0 04 025	Time period in minutes	Minute, 0
		0 11 043	Maximum wind gust direction	Degree true, 0
		0 11 041	Maximum wind gust speed 910**f_mf_m**, 911**f_xf_x**	m s^{-1}, 1
	0 07 032		Height of sensor above local ground (set to missing to cancel the previous value)	m, 2
			Evaporation data	
3 02 044	0 04 024		Time period in hours	Hour, 0
	0 02 004		Type of instrument for evaporation or crop type for evapotranspiration **i_E**	Code table, 0
	0 13 033		Evaporation /evapotranspiration **EEE**	kg m^{-2}, 1
			Radiation data (from 1 hour and 24 hour period)	
1 01 002			Replicate next descriptor 2 times	
3 02 045	0 04 024		Time period in hours	Hour, 0
	0 14 002		Long-wave radiation, integrated over period	J m^{-2}, -3

			specified 553SS 4**FFFF** or 553SS 5**FFFF,** 55SSS 4$\mathbf{F_{24}F_{24}F_{24}F_{24}}$ or 55SSS 5$\mathbf{F_{24}F_{24}F_{24}F_{24}}$	
	0 14 004		Short-wave radiation, integrated over period specified 553SS 6**FFFF,** 55SSS 6$\mathbf{F_{24}F_{24}F_{24}F_{24}}$	J m^{-2}, -3
	0 14 016		Net radiation, integrated over period specified 553SS 0**FFFF** or 553SS 1**FFFF,** 55SSS 0$\mathbf{F_{24}F_{24}F_{24}F_{24}}$ or 55SSS 1$\mathbf{F_{24}F_{24}F_{24}F_{24}}$	J m^{-2}, -4
	0 14 028		Global solar radiation (high accuracy), integrated over period specified 553SS 2**FFFF,** 55SSS 2$\mathbf{F_{24}F_{24}F_{24}F_{24}}$	J m^{-2}, -2
	0 14 029		Diffuse solar radiation (high accuracy), integrated over period specified 553SS 3**FFFF,** 55SSS 3$\mathbf{F_{24}F_{24}F_{24}F_{24}}$	J m^{-2}, -2
	0 14 030		Direct solar radiation (high accuracy), integrated over period specified 55408 4**FFFF,** 55508 5$\mathbf{F_{24}F_{24}F_{24}F_{24}}$	J m^{-2}, -2
3 02 046			**Temperature change** group **54**$\mathbf{g_0 s_n d_T}$	
	0 04 024		Time period or displacement	Hour, 0
	0 04 024		Time period or displacement (see Note 3)	Hour, 0
	0 12 049		Temperature change over period specified $\mathbf{s_n d_T}$	K, 0

Notes:

1) Within RA-IV, the maximum temperature at 1200 UTC is reported for the previous calendar day (i.e. the ending time of the period is not equal to the nominal time of the report). To construct the required time range, descriptor 004024 has to be included two times. If the period ends at the nominal time of the report, value of the second 004024 shall be set to 0.

2) Within RA-III, the maximum day-time temperature and the minimum night-time temperature is reported (i.e. the ending time of the period may not be equal to the nominal time of the report). To construct the required time range, descriptor 004024 has to be included two times. If the period ends at the nominal time of the report, value of the second 004024 shall be set to 0.

3) To construct the required time range, descriptor 004024 has to be included two times.

Regulations:

B/C 5.1 Section 1 of BUFR or CREX

B/C 5.1.1 Entries required in Section 1 of BUFR

The following entries shall be included in BUFR Section 1:

- BUFR master table,
- identification of originating/generating centre,
- identification of originating/generating sub-centre,
- update sequence number,
- identification of inclusion of optional section,
- data category (= 000 for SYNOP MOBIL data),
- international data sub-category (1), (2),
- local data subcategory,
- version number of master table,
- version number of local tables,
- year (year of the century up to BUFR edition 3),
- month (standard time),
- day (standard time = YY in the abbreviated telecommunication header for SYNOP MOBIL data),
- hour (standard time = GG in the abbreviated telecommunication header for SYNOP MOBIL data),
- minute (standard time = 00 for SYNOP MOBIL data).

Notes:
(1) Inclusion of this entry is required starting with BUFR edition 4.

(2) If required, the international data sub-category shall be included for SYNOP MOBIL data as
= 005 at main synoptic times 00, 06, 12, 18 UTC,
= 004 at intermediate synoptic times 03, 09, 15, 21 UTC,
= 003 at observation times 01, 02, 04, 05, 07, 08, 10, 11, 13, 14, 16, 17, 19, 20, 22 and 23 UTC.

B/C 5.1.2 Entries required in Section 1 of CREX

The following entries shall be included in CREX Section 1:

- CREX master table,
- CREX edition number,
- CREX table version number,
- version number of BUFR master table (1),
- version number of local tables (1),
- data category (= 000 for SYNOP MOBIL data),
- international data sub-category (1), (2),
- identification of originating/generating centre (1),
- identification of originating/generating sub-centre (1),
- update sequence number (1),
- number of subsets (1),
- year (standard time) (1),
- month (standard time) (1),
- day (standard time = YY in the abbreviated telecommunication header for SYNOP MOBIL data) (1),
- hour (standard time = GG in the abbreviated telecommunication header for SYNOP MOBIL data) (1),
- minute (standard time = 00 for SYNOP MOBIL data) (1).

Notes:
(1) Inclusion of these entries is required starting with CREX edition 2.
(2) If inclusion of international data sub-category is required, Note (2) under B/C 5.1.1 applies.

B/C 5.2 Mobile station identification, time, horizontal and vertical coordinates <3 01 092>

B/C 5.2.1 Mobile station identification

Mobile land station identifier (0 01 011) shall be always reported as a non-missing value. In the absence of a suitable call sign, the word MOBIL shall be used for mobile land station identifier. [12.1.7(c)]

WMO regional number (0 01 003) shall be reported to indicate the geographical area in which the mobile station has been deployed.

Type of station (Code table 0 02 001) shall be reported to indicate the type of the station operation (manned, automatic or hybrid).
Note:
(1) If a station operates as a manned station for a part of the day and as an automatic station for the rest of the day, code figure 2 (Hybrid) may be used in all reports. It is preferable, however, to use code figure 1 (Manned) in reports produced under the supervision of an observer, and a code figure 0 (Automatic) in reports produced while the station operates in the automatic mode.

B/C 5.2.2 Time of observation

Year (0 04 001), month (0 04 002), day (0 04 003), hour (0 04 004) and minute (0 04 005) of the actual time of observation shall be reported.
Note:
(1) The actual time of observation shall be the time at which the barometer is read. [12.1.6]

B/C 5.2.2.1

If the actual time of observation differs by 10 minutes or less from the standard time reported in Section 1, the standard time may be reported instead of the actual time of observation. [12.2.8]

B/C 5.2.3 Horizontal and vertical coordinates

Latitude (0 05 001) and longitude (0 06 001) of the station shall be reported in degrees with precision in 10^{-5} of a degree.

Height of station ground above mean sea level (0 07 030) and height of barometer above mean sea level (0 07 031) shall be reported in meters with precision in tenths of a meter.

B/C 5.2.4 Station elevation quality mark – Code table 0 33 024

Station elevation quality mark shall be reported to indicate the accuracy of the vertical coordinates of the mobile station.

B/C 5.3 Pressure data <3 02 031>

B/C 5.3.1 Pressure at the station level

Pressure at the station level (0 10 004), i.e. at the level defined by 0 07 031 (height of barometer above mean sea level), shall be reported in pascals (with precision in tens of a pascal).

B/C 5.3.1.1

The station pressure shall be included in reports for global exchange from land stations, together with either the mean sea level pressure or, in accordance with Regulation B/C 5.3.5.1, with the geopotential height of a standard pressure level. [12.2.4]

Note:

(1) Inclusion of the station pressure at other times is left to the decision of individual Members.

B/C 5.3.2 Pressure reduced to mean sea level

Pressure reduced to mean sea level (0 10 051) shall be reported in pascals (with precision in tens of a pascal).

B/C 5.3.2.1

Whenever air pressure at mean sea level can be computed with reasonable accuracy, this pressure shall be reported. [12.2.3.4.1]

Notes:

(1) For a station situated in a region of normal synoptic network density, the pressure at mean sea level is considered not to be computed with reasonable accuracy when it introduces a deformation into the analysis of the horizontal pressure field, which is purely local and recurring.

(2) For a station lying in a data-sparse area of the synoptic network, reasonable accuracy will be obtained when using a reduction method,which has proved to be satisfactory in a region of normal network density and under similar geographic conditions.

B/C 5.3.3 Three-hour pressure change and characteristic of pressure tendency

Amount of pressure change at station level, during the three hours preceding the time of observation (0 10 061), either positive, zero *or negative*, shall be reported in pascals (with precision in tens of a pascal).

B/C 5.3.3.1

Unless specified otherwise by regional decision, pressure tendency shall be included whenever the three-hourly pressure tendency is available. [12.2.3.5.1]

B/C 5.3.3.2

The characteristic of pressure tendency (Code table 0 10 063) over the past three hours shall, whenever possible, be determined on the basis of pressure samples at equi-spaced intervals not exceeding one hour. [12.2.3.5.2]

Note:

(1) Algorithms for selecting the appropriate code figure are included in publication WMO–No.8, Guide to Meteorological Instruments and Methods of Observation.

B/C 5.3.3.3

Where it is not possible to apply the algorithms specified in Regulation B/C 5.3.3.2 in reports from automatic weather stations, the characteristic of pressure tendency shall be reported as 2 when the tendency is positive, as 7 when the tendency is negative, and as 4 when the atmospheric pressure is the same as three hours before. [12.2.3.5.3]

B/C 5.3.4 24-hour pressure change

If specified by regional decision, amount of surface pressure change at station level, during 24 hours preceding the time of observation (0 10 062), either positive, zero or negative, shall be reported in pascals (with precision in tens of a pascal). [12.4.7.1.2(k), (l)]

B/C 5.3.5 Geopotential height of the standard level

Geopotential height of the standard level (0 10 009) shall be reported in geopotential meters. The standard isobaric level is specified by the preceding entry Pressure (0 07 004).

B/C 5.3.5.1

By regional decision, a high-level station which cannot give pressure at mean sea level to a satisfactory degree of accuracy shall report both the station-level pressure and the geopotential height of an agreed standard isobaric surface. [12.2.3.4.2]

B/C 5.4 Basic synoptic “instantaneous” data <3 02 035>

B/C 5.4.1 Temperature and humidity data <3 02 032>

B/C 5.4.1.1 Height of sensor above local ground

Height of sensor above local ground (0 07 032) for temperature and humidity measurement shall be reported in meters (with precision in hundredths of a meter).
This datum represents the actual height of temperature and humidity sensors above ground at the point where the sensors are located.

B/C 5.4.1.2 Dry-bulb air temperature

Dry-bulb air temperature (0 12 101) shall be reported in degrees Kelvin (with precision in hundredths of a degree Kelvin); if produced in CREX, in degrees Celsius (with precision in hundredths of a degree Celsius)
Notes:
(1) Temperature data shall be reported with precision in hundredths of a degree even if they are measured with the accuracy in tenths of a degree. This requirement is based on the fact that conversion from the Kelvin to the Celsius scale has often resulted into distortion of the data values.
(2) Temperature t (in degrees Celsius) shall be converted into temperature T (in degrees Kelvin) using equation: T = t + 273.15.

B/C 5.4.1.2.1

When the data are not available as a result of a temporary instrument failure, this quality shall be included as a missing value. [12.2.3.2]

B/C 5.4.1.3 Dew-point temperature

Dew-point temperature (0 12 103) shall be reported in degrees Kelvin (with precision in hundredths of a degree Kelvin); if produced in CREX, in degrees Celsius (with precision in hundredths of a degree Celsius).
Note:
(1) Notes (1) and (2) under Regulation B/C 5.4.1.2 shall apply.

B/C 5.4.1.3.1

When the data are not available as a result of a temporary instrument failure, this quality shall be included as a missing value. [12.2.3.3.2]

B/C 5.4.1.4 Relative humidity

Relative humidity (0 13 003) shall be reported in units of a percent.

B/C 5.4.1.4.1

Both dew point temperature and relative humidity shall be reported when available.

B/C 5.4.2 Visibility data <3 02 033>

B/C 5.4.2.1 Height of sensor above local ground

Height of sensor above local ground (0 07 032) for visibility measurement shall be reported in meters (with precision in hundredths of a meter).
This datum represents the actual height of visibility sensors above ground at the point where the sensors are located. If visibility is estimated by a human observer, average height of observer's eyes above station ground shall be reported.

B/C 5.4.2.2 Horizontal visibility

Horizontal visibility (0 20 001) at surface shall be reported in meters (with precision in tens of a meter).

B/C 5.4.2.2.1

When the horizontal visibility is not the same in different directions, the shortest distance shall be given for visibility. [12.2.1.3.1]

B/C 5.4.3 Precipitation past 24 hours <3 02 034>

B/C 5.4.3.1 Height of sensor above local ground

Height of sensor above local ground (0 07 032) for precipitation measurement shall be reported in meters (with precision in hundredths of a meter).
This datum represents the actual height of the rain gauge rim above ground at the point where the rain gauge is located.

B/C 5.4.3.2 Total amount of precipitation during the 24-hour period

Total amount of precipitation during the 24-hour period ending at the time of observation (0 13 023) shall be reported in kilograms per square meter (with precision in tenths of a kilogram per square meter). [12.4.9]

B/C 5.4.3.2.1

The precipitation over the past 24 hours shall be included (not missing) at least once a day at one appropriate time of the main standard times (0000, 0600, 1200, 1800 UTC). [12.4.1]

B/C 5.4.3.2.2

Precipitation, when it can be and has to be reported, shall be reported as 0.0 kgm^{-2} if no precipitation were observed during the referenced period. [12.2.5.4]

B/C 5.4.3.2.3

Trace shall be reported as "- 0.1 kgm^{-2} ".

B/C 5.4.4 Cloud data <3 02 004>

B/C 5.4.4.1 Total cloud cover

Total cloud cover (0 20 010) shall embrace the total fraction of the celestial dome covered by clouds irrespective of their genus. It shall be reported in *units of a percent*.

Note:

(1) Total cloud cover shall be reported as 113 when sky is obscured by fog and/or other meteorological phenomena.

B/C 5.4.4.1.1

Total cloud cover shall be reported as actually seen by the observer during the observation. [12.2.2.2.1]

B/C 5.4.4.1.2

Altocumulus perlucidus or Stratocumulus perlucidus (“mackerel sky”) shall be reported *as 99% or less* (unless overlying clouds appear to cover the whole sky) since breaks are always present in this cloud form even if it extends over the whole celestial dome. [12.2.2.2.2]

B/C 5.4.4.1.3

Total cloud cover shall be reported as zero when blue sky or stars are seen through existing fog or other analogous phenomena without any trace of cloud being seen. [12.2.2.2.3]

B/C 5.4.4.1.4

When clouds are observed through fog or analogous phenomena, their amount shall be evaluated and reported as if these phenomena were non-existent. [12.2.2.2.4]

B/C 5.4.4.1.5

Total cloud cover shall not include the amount resulting from rapidly dissipating condensation trails. [12.2.2.2.5]

B/C 5.4.4.1.6

Persistent condensation trails and cloud masses which have obviously developed from condensation trails shall be reported as cloud. [12.2.2.2.6]

B/C 5.4.4.2 Vertical significance – Code table 0 08 002

To specify vertical significance (0 08 002) within the sequence 3 02 004, a code figure shall be selected in the following way:

(a) If low clouds are observed, then code figure 7 (Low cloud) shall be used.

(b) If there are no low clouds but middle clouds are observed, then code figure 8 (Middle clouds) shall be used.

(c) If there are no low and there are no middle clouds but high clouds are observed, then code figure 0 shall be used.

(d) If sky is obscured by fog and/or other phenomena, then code figure 5 (Ceiling) shall be used.

(e) If there are no clouds (clear sky), then code figure 62 (Value not applicable) shall be used.

(f) If the cloud cover is not discernible for reasons other than (d) above or observation is not made, then code figure 63 (Missing value) shall be used.

B/C 5.4.4.3 Cloud amount (of low or middle clouds) – Code table 0 20 011

Amount of all the low clouds (clouds of the genera Stratocumulus, Stratus, Cumulus, and Cumulonimbus) present or, if no low clouds are present, the amount of all the middle clouds (clouds of the genera Altocumulus, Altostratus, and Nimbostratus) present.

B/C 5.4.4.3.1

Cloud amount shall be reported as follows:

(a) If there are low clouds, then the total amount of all low clouds, as actually seen by the observer during the observation shall be reported for the cloud amount.

(b) If there are no low clouds but there are middle clouds, then the total amount of the middle clouds shall be reported for the cloud amount.

(c) If there are no low clouds and there are no middle clouds but there are high clouds (clouds of the genera Cirrus, Cirrocumulus, and Cirrostratus), then the cloud amount shall be reported as zero. [12.2.7.2.1]

B/C 5.4.4.3.2

Amount of Altocumulus perlucidus or Stratocumulus perlucidus (“mackerel sky”) shall be reported using code figure 7 or less since breaks are always present in this cloud form even if it extends over the whole celestial dome. [12.2.7.2.2]

B/C 5.4.4.3.3

When the clouds reported for cloud amount are observed through fog or an analogous phenomenon, the cloud amount shall be reported as if these phenomena were not present. [12.2.7.2.3]

B/C 5.4.4.3.4

If the clouds reported for cloud amount include contrails, then the cloud amount shall include the amount of persistent contrails. Rapidly dissipating contrails shall not be included in the value for the cloud amount. [12.2.7.2.4]

B/C 5.4.4.4 Height of base of lowest cloud

Height above surface of the base (0 20 013) of the lowest cloud seen shall be reported in meters (with precision in tens of a meter).

Note:

(1) The term « height above surface » shall be considered as being the height above the official aerodrome elevation or above station elevation at a non-aerodrome station.

B/C 5.4.4.4.1

When the station is in fog, a sandstorm or in blowing snow but the sky is discernable, the base of the lowest cloud shall refer to the base of the lowest cloud observed, if any. When, under the above conditions, the sky is not discernible, the base of the lowest cloud shall be reported as missing. [12.2.1.2]

B/C 5.4.4.4.2

When no cloud are reported (Total cloud cover = 0) the base of the lowest cloud *shall be reported as a missing value.*

B/C 5.4.4.4.3

When, by national decision, clouds with bases below the station are reported from the station and clouds with bases below and tops above the station are observed, the base of the lowest cloud *shall be reported having a negative value if the base of cloud is discernible, or as a missing value.*

B/C 5.4.4.5 Cloud type of low, middle and high clouds - Code table 0 20 012

Clouds of the genera Stratocumulus, Stratus, Cumulus, and Cumulonimbus (low clouds) shall be reported for the first entry 0 20 012, clouds of the genera Altocumulus, Altostratus, and Nimbostratus (middle clouds) shall be reported for the second entry 0 20 012 and clouds of the genera Cirrus, Cirrocumulus, and Cirrostratus (high clouds) shall be reported for the third entry 0 20 012.

B/C 5.4.4.5.1

The reporting of type of low, middle and high clouds shall be as specified in publication WMO-NO. 407 – International Cloud Atlas, Volume I. [12.2.7.3]

B/C 5.4.5 Individual cloud layers or masses

B/C 5.4.5.1 Number of individual cloud layers or masses

The number of individual cloud layers or masses shall be indicated by Delayed descriptor replication factor 0 31 001 in BUFR and by a four-digit number in the Data Section corresponding to the position of the replication descriptor in the Data Description Section of CREX.

Notes:

(1) The number of cloud layers or masses shall never be set to a missing value.

(2) The number of cloud layers or masses shall be set to a positive value in a NIL report.

B/C 5.4.5.1.1

The number of individual cloud layers or masses shall in the absence of Cumulonimbus clouds not exceed three. Cumulonimbus clouds, when observed, shall always be

reported, so that the total number of individual cloud layers or masses can be four. The selection of layers (or masses) to be reported shall be made in accordance with the following criteria:

(a) The lowest individual layer (or mass) of any amount (cloud amount at least one octa or less, but not zero);

(b) The next higher individual layer (or mass) the amount of which is greater than two octas;

(c) The next higher individual layer (or mass) the amount of which is greater than four octas;

(d) Cumulonimbus clouds, whenever observed and not reported under (a), (b) and (c) above. [12.4.10.1]

B/C 5.4.5.1.2

When the sky is clear, the number of individual cloud layers or masses shall be set to zero.

B/C 5.4.5.1.3

The order of reporting the individual cloud layers or masses shall always be from lower to higher levels. [12.4.10.2]

B/C 5.4.5.2 Individual cloud layer or mass <3 02 005>

Each cloud layer or mass shall be represented by the following four parameters: Vertical significance (0 08 002), amount of individual cloud layer or mass (0 20 011), type of cloud layer or mass (0 20 012) and height of base of individual cloud layer or mass (0 20 013).

B/C 5.4.5.2.1 Vertical significance – Code table 0 08 002

To specify vertical significance (0 08 002) within the sequence 3 02 005, a code figure shall be selected in the following way:

(a) Code figure 1 shall be used in the first non-Cumulonimbus layer.

(b) Code figure 2 shall be used in the second non-Cumulonimbus layer.

(c) Code figure 3 shall be used in the third non-Cumulonimbus layer.

(d) Code figure 4 shall be used in any Cumulonimbus layer.

(e) If sky is obscured by fog and/or other phenomena, then code figure 5 (Ceiling) shall be used.

(f) If the cloud cover is not discernible for reasons other than (e) above or observation is not made, then code figure 63 (Missing value) shall be used.

B/C 5.4.5.2.2 Cloud amount, type and height of base

B/C 5.4.5.2.2.1

When the sky is clear, in accordance with Regulation B/C 5.4.5.1.2 cloud amount, genus, and height shall not be included. [12.4.10.4]

B/C 5.4.5.2.2.2

In determining cloud amounts (Code table 0 20 011) to be reported for individual layers or masses, the observer shall estimate, by taking into consideration the evolution of the sky, the cloud amounts of each individual layer or mass at the different levels, as if no other clouds existed. [12.4.10.3]

B/C 5.4.5.2.2.3

Type of a cloud layer or mass (Code table 0 20 012) shall be reported using code figures 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 59 and 63.

B/C 5.4.5.2.2.4

If, notwithstanding the existence of fog, sandstorm, duststorm, blowing snow or other obscuring phenomena, the sky is discernible, the partially obscuring phenomena shall be disregarded. If, under the above conditions, the sky is not discernible, the cloud type shall be reported using *code figure 59* and the cloud height shall be replaced by vertical visibility. [12.4.10.5]

Note:

(1) The vertical visibility is defined as the vertical visual range into an obscuring medium.

B/C 5.4.5.2.2.5

If two or more types of cloud occur with their bases at the same level and this level is one to be reported in accordance with Regulation B/C 5.4.5.1.1, the selection for cloud type and amount shall be made with the following criteria:

(a) If these types do not include Cumulonimbus then cloud genus shall refer to the cloud type that represents the greatest amount, or if there are two or more types of cloud all having the same amount, the highest applicable code figure for cloud genus shall be reported. Cloud amount shall refer to the total amount of cloud whose bases are all at the same level ;

(b) If these types do include Cumulonimbus then one layer shall be reported to describe only this type with cloud genus indicated as Cumulonimbus and the cloud amount as the amount of the Cumulonimbus. If the total amount of the remaining type(s) of cloud (excluding Cumulonimbus) whose bases are all at the same level is greater than that required by Regulation B/C 5.4.5.1.1, then another layer shall be reported with type being selected in accordance with (a) and amount referring to the total amount of the remaining cloud (excluding Cumulonimbus). [12.4.10.6]

B/C 5.4.5.2.2.6

Regulations B/C5.4.4.1.3 to B/C5.4.4.1.6, inclusive, shall apply. [12.4.10.7]

B/C 5.4.5.2.2.7

Height above surface of the cloud base (0 20 013) shall be reported in meters (with precision in tens of a meter).

Note:

(1) The term « height above surface » shall be considered as being the height above the official aerodrome elevation or above station elevation at a non-aerodrome station.

B/C 5.5 Clouds with bases below station level <3 02 036>

B/C 5.5.1 Number of cloud layers with bases below station level

The number of cloud layers with bases below station level shall be indicated by Delayed descriptor replication factor 0 31 001 in BUFR and by a four-digit number in the Data Section corresponding to the position of the replication descriptor in the Data Description Section of CREX.

Notes:

(1) The number of cloud layers with bases below station level shall never be set to a missing value.

(2) The number of cloud layers with bases below station level shall be set to a positive value in a NIL report.

B/C 5.5.1.1

Inclusion of these data shall be determined by national decision. The number of cloud layers with bases below station level shall be always set to zero in reports from a station at which observations of clouds with bases below station level are not executed.

B/C 5.5.1.2

When no cloud layers with bases below station are observed, the number of cloud layers with bases below station level shall be set to zero.

B/C 5.5.1.3

If the station is in continuous or almost continuous cloud, the number of cloud layers with bases below station level shall be set to one, with all parameters reported as missing except for vertical significance 0 08 002 that shall be set to 10 (cloud layer with a base below and tops above station level). [12.5.4]

B/C 5.5.1.4

If clouds with bases below station level are not discernible due to fog and/or other phenomena or observation is not made, then the number of cloud layers with bases below station level shall be set to one, with all parameters reported as missing except for vertical significance 0 08 002 that shall be set to 11.

B/C 5.5.1.5

When two or more cloud layers with their bases below station level occur at different levels, two or more cloud layers shall be reported. [12.5.5]

B/C 5.5.1.6

Clouds with bases below and tops above station level shall be reported as the first layer within the sequence 3 02 036, provided that the station is out of cloud sufficiently frequently to enable the various features to be recognized. Other low clouds present with tops below station level shall be reported as the following layers (one or more) within the sequence 3 02 036. [12.5.3]

Notes:

(1) Clouds with bases below and tops above station level shall be reported also in sequences 3 02 004 and 3 02 005. [12.5.3]

(2) Clouds with tops below station level shall be reported only in sequence 3 02 036, and any co-existent clouds with bases above station level shall be reported only in sequences 3 02 004 and 3 02 005. [12.5.2]

B/C 5.5.2 Individual cloud layer with base below station level

Each cloud layer with base below station level shall be represented by the following five parameters: Vertical significance (0 08 002), amount of clouds with base below station level (0 20 011), type of clouds with base below station level (0 20 012), altitude of the upper surface of clouds (0 20 014) and cloud top description (0 20 017).

B/C 5.5.2.1 Vertical significance - Code table 0 08 002

Code figure 10 shall be used for cloud layers with bases below and tops above station level; code figure 11 shall be used for cloud layers with bases and tops below station level.

B/C 5.5.2.2 Amount of clouds with base below station level - Code table 0 20 011

B/C 5.5.2.2.1

Regulations B/C 5.4.4.1.1 to B/C 5.4.4.1.6, inclusive, shall apply. [12.5.8]

B/C 5.5.2.2.2

Spaces occupied by mountains emerging from the cloud layers shall be counted as occupied by clouds. [12.5.9]

B/C 5.5.2.3 Type of clouds with base below station level - Code table 0 20 012

Type of clouds with bases below station level shall be reported using code figures 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 and 63.

B/C 5.5.2.4 Height of top of clouds above mean sea level

Height of top of clouds above mean sea level (0 20 014) shall be reported in meters (with precision in tens of a meter).

B/C 5.5.2.4.1

Height of top of clouds with bases below and tops above station level shall be reported, provided that the upper surface of clouds can be observed. [12.5.3 (b)]

B/C 5.5.2.5 Cloud top description - Code table 0 20 017

B/C 5.5.2.5.1

Description of top of clouds with bases below and tops above station level shall be reported, provided that the station is out of cloud sufficiently frequently to enable the features to be recognized.

B/C 5.5.2.5.2

Rapidly dissipating condensation trails shall not be reported. However, the top of persistent condensation trails and cloud masses which have obviously developed from condensation trails (and whose bases are below station level) shall be reported in Sequence 3 02 036. [12.5.6], [12.5.7]

B/C 5.6 Direction of cloud drift <3 02 047>

This information is required from land stations mainly in the tropics. [12.4.7.5]

B/C 5.6.1 Vertical significance – Code table 0 08 002

To specify vertical significance (0 08 002) within the sequence 3 02 047, code figures shall be selected in the following way:

(a) Code figure 7 (Low cloud) shall be used in the first replication.
(b) Code figure 8 (Middle clouds) shall be used in the second replication.
(c) Code figure 9 (High cloud) shall be used in the third replication.

B/C 5.6.2 True direction from which clouds are moving

True direction from which low, middle, or high clouds are moving (0 20 054) shall be reported in degrees true as follows:

(a) True direction from which the low clouds are moving shall be included in the first replication.
(b) True direction from which the middle clouds are moving shall be included in the second replication.
(c) True direction from which the high clouds are moving shall be included in the third replication.

B/C 5.7 Direction and elevation of cloud <3 02 048>

This information is required from land stations mainly in the tropics. [12.4.7.5]

B/C 5.7.1 Direction of cloud

True direction (0 05 021), from which orographic clouds or clouds with vertical development are seen, shall be *reported in degrees true*. The cloud genus shall be specified by the third entry of the sequence 3 02 048, i.e. by Cloud type – Code table 0 20 012.

Note:

(1) It is considered sufficient to report direction of cloud in degrees true, although 0 05 021 (Bearing or azimuth) is defined with higher accuracy (hundredths of a degree true).

B/C 5.7.2 Elevation of cloud

Elevation angle (0 07 021) of the top of the cloud shall be reported in degrees. The cloud genus shall be specified by the following entry, i.e. by Cloud type – Code table 0 20 012.

Note:

(1) It is considered sufficient to report elevation of the top of cloud in degrees, although 0 07 021 (Elevation angle) is defined with higher accuracy (hundredths of a degree).

B/C 5.8 State of ground, snow depth, ground minimum temperature <3 02 037>

B/C 5.8.1 State of ground (with or without snow) - Code table 0 20 062.

State of ground without snow or with snow shall be reported using Code table 0 20 062. The synoptic hour at which this datum is reported shall be determined by regional decision.

B/C 5.8.2 Total snow depth

Total snow depth (0 13 013) shall be reported in meters (with precision in hundredths of a meter). The synoptic hour at which this datum is reported shall be determined by regional decision.

B/C 5.8.2.1

When total snow depth has to be reported, it is reported as 0.00 m if no snow, ice and other forms of solid precipitation on the ground are observed at the time of observation. A snow depth value of "– 0.01 m" shall indicate a little (less than 0.005 m) snow. A snow depth value of "– 0.02 m" shall indicate "snow cover not continuous".

B/C 5.8.2.2

The measurement shall include snow, ice and all other forms of solid precipitation on the ground at the time of observation. [12.4.6.1]

B/C 5.8.2.3

When the depth is not uniform, the average depth over a representative area shall be reported. [12.4.6.2]

B/C 5.8.3 Ground minimum temperature, past 12 hours

Ground minimum temperature from the previous 12 hours (0 12 113) shall be reported in degrees Kelvin (with precision in hundredths of a degree Kelvin); if produced in CREX, in degrees Celsius (with precision in hundredths of a degree Celsius).

Notes:

(1) Ground minimum temperature data shall be reported with precision in hundredths of a degree even if they are measured with the accuracy in tenths of a degree. Notes (1) and (2) under Regulation B/C 5.4.1.2 shall apply.

(2) The period of time covered by ground minimum temperature and the synoptic hour at which this temperature is reported shall be determined by regional decision. If ground minimum temperature is to be reported from the period of previous night, then "ground minimum temperature, past 12 hours" (0 12 113) shall be reported as a missing value. In this case, ground minimum temperature of the previous night (0 12 122) shall be reported in compliance with Regulation B/C 5.9.

B/C 5.9 "Instantaneous" data required by regional or national reporting practices

If regional or national reporting practices require inclusion of additional "instantaneous" parameters, the sequence descriptor 3 07 090 shall not be used. In this case BUFR/CREX template for SYNOP MOBIL data shall be used in its first level expanded form and the descriptors, corresponding to the required "instantaneous" parameters, shall be inserted to precede 3 02 043 (Basic synoptic "period" data).

Notes:

(1) "Instantaneous" parameter is a parameter that is not coupled to a time period descriptor, e.g. 0 04 024, 0 04 025.

(2) No regional requirements are currently indicated for reporting SYNOP MOBIL data in Manual on Codes, WMO-No. 306, Volume II.

B/C 5.10 Basic synoptic "period" data <3 02 043>

B/C 5.10.1 Present and past weather <3 02 038>

B/C 5.10.1.1

Present weather (Code table 0 20 003) and past weather (1) (Code table 0 20 004) and past weather (2) (Code table 0 20 005) shall be reported as non-missing values if present and past conditions are known. In case of a report from a manually operated station after a period of closure or at start up, when past weather conditions for the period applicable to the report are unknown, past weather (1) and past weather (2) reported as missing shall indicate that previous conditions are unknown. This regulation shall also apply to automatic reporting stations with the facility to report present and past weather. [12.2.6.1]

B/C 5.10.1.2

Code figures 0, 1, 2, 3, 100, 101, 102 and 103 for present weather and code figures 0, 1, 2 and 10 for past weather (1) and past weather (2) shall be considered to represent phenomena without significance. [12.2.6.2]

B/C 5.10.1.3

Present and past weather shall be *reported if observation was made (data available), regardless significance of the phenomena.*

Note:

(1) If data are produced and collected in traditional codes and present weather and past weather is omitted in a SYNOP report (no significant phenomena observed), code figure 508 shall be used for present weather and code figure 10 for past weather (1) and past weather (2) when converted into BUFR or CREX.

B/C 5.10.1.4

If no observation was made (data not available), code figure 509 shall be used for present weather and both past weather (1) and past weather (2) shall be reported as missing.

B/C 5.10.1.5 Present weather from a manned weather station

B/C 5.10.1.5.1

If more than one form of weather is observed, the highest applicable code figure from the range <00 to 99> shall be selected for present weather. Code figure 17 shall have precedence over code figures 20 – 49. Other weather may be reported using additional entries 0 20 003 or 0 20 021 to 0 20 026 applying Regulation B/C 5.9. [12.2.6.4.1]

B/C 5.10.1.5.2

In coding 01, 02, or 03, there is no limitation on the magnitude of the change of the cloud amount. Code figures 00, 01, and 02 can each be used when the sky is clear at the time of observation. In this case, the following interpretation of the specifications shall apply:

- 00 is used when the preceding conditions are not known,
- 01 is used when the clouds have dissolved during the past hour,
- 02 is used when the sky has been continuously clear during the past hour. [12.2.6.4.2]

B/C 5.10.1.5.3

When the phenomenon is not predominantly water droplets, the appropriate code figure shall be selected without regard to visibility. [12.2.6.4.3]

B/C 5.10.1.5.4

The code figure 05 shall be used when the obstruction to vision consists predominantly of lithometeors. [12.2.6.4.4]

B/C 5.10.1.5.5

National instructions shall be used to indicate the specifications for code figures 07 and 09. [12.2.6.4.5]

B/C 5.10.1.5.6

The visibility restrictions on code figure 10 shall be 1000 meters or more. The specification refers only to water droplets and ice crystals. [12.2.6.4.6]

B/C 5.10.1.5.7

For code figures 11 or 12 to be reported, the apparent visibility shall be less than 1000 meters. [12.2.6.4.7]

B/C 5.10.1.5.8

For code figure 18, the following criteria for reporting squalls shall be used:

(a) When wind speed is measured : A sudden increase of wind speed of at least eight meters per second, the speed rising to 11 meters per second or more and lasting for at least one minute;

(b) When the Beaufort scale is used for estimating wind speed: A sudden increase of wind speed by at least three stages of the Beaufort scale, the speed rising to force 6 or more and lasting for at least one minute. [12.2.6.4.8]

B/C 5.10.1.5.9

Code figures 20 – 29 shall never be used when precipitation is observed at the time of observation. [12.2.6.4.9]

B/C 5.10.1.5.10

For code figure 28, visibility shall have been less than 1000 meters.

Note:

(1) The specification refers only to visibility restrictions which occurred as a result of water droplets or ice crystals. [12.2.6.4.10]

B/C 5.10.1.5.11

For synoptic coding purposes, a thunderstorm shall be regarded as being at the station from the time thunder is first heard, whether or not lightning is seen or precipitation is occurring at the station. A thunderstorm shall be reported if thunder is heard within the normal observational period preceding the time of the report. A thunderstorm shall be

regarded as having ceased at the time thunder is first heard and the cessation is confirmed if thunder is not heard for 10 – 15 minutes after this time. [12.2.6.4.11]

B/C 5.10.1.5.12

The necessary uniformity in reporting code figures 36, 37, 38, and 39, which may be desirable within certain regions, shall be obtained by means of national instructions. [12.2.6.4.12]

B/C 5.10.1.5.13

A visibility restriction « less than 1000 meters » shall be applied to code figures 42 – 49. In the case of code figures 40 or 41, the apparent visibility in the fog or ice fog patch or bank shall be less than 1000 meters. Code figures 40 – 47 shall be used when the obstructions to vision consist predominantly of water droplets or ice crystals, and 48 or 49 when the obstructions consist predominantly of water droplets. [12.2.6.4.13]

B/C 5.10.1.5.14

When referring to precipitation, the phrase « at the station » in the code table shall mean « at the point where the observation is normally taken ». [12.2.6.4.14]

B/C 5.10.1.5.15

The precipitation shall be encoded as intermittent if it has been discontinuous during the preceding hour, without presenting the character of a shower. [12.2.6.4.15]

B/C 5.10.1.5.16

The intensity of precipitation shall be determined by the intensity at the time of the observation. [12.2.6.4.16]

B/C 5.10.1.5.17

Code figures 80 – 89 shall be used only when the precipitation is of the shower type and takes place at the time of the observation.

Note:

(1) Showers are produced by convective clouds. They are characterized by their abrupt beginning and end and by the generally rapid and sometimes great variations in the intensity of the precipitation. Drops and solid particles falling in a shower are generally larger than those falling in non-showery precipitation. Between showers openings may be observed unless stratiform clouds fill the intervals between the cumuliform clouds. [12.2.6.4.17]

B/C 5.10.1.5.18

In reporting code figure 98, the observer shall be allowed considerable latitude in determining whether precipitation is or is not occurring, if it is not actually visible. [12.2.6.4.18]

B/C 5.10.1.6 Present weather from an automatic weather station

B/C 5.10.1.6.1

The highest applicable code figure shall be selected. [12.2.6.5.1]

B/C 5.10.1.6.2

In coding code figures 101, 102, and 103, there is no limitation on the magnitude of the change of the cloud amount. Code figures 100, 101, and 102 can each be used when the sky is clear at the time of observation. In this case, the following interpretation of the specifications shall apply:

- Code figure 100 is used when the preceding conditions are not known;
- Code figure 101 is used when the clouds have dissolved during the past hour;
- Code figure 102 is used when the sky has been continuously clear during the past hour. [12.2.6.5.2]

B/C 5.10.1.6.3

When the phenomenon is not predominantly water droplets, the appropriate code figure shall be selected without regard to the visibility. [12.2.6.5.3]

B/C 5.10.1.6.4

The code figures 104 and 105 shall be used when the obstruction to vision consists predominantly of lithometeors. [12.2.6.5.4]

B/C 5.10.1.6.5

The visibility restriction on code figure 110 shall be 1000 meters or more. The specification refers only to water droplets and ice crystals. [12.2.6.5.5]

B/C 5.10.1.6.6

For code figure 118, the following criteria for reporting squalls shall be used :
A sudden increase of wind speed of at least eight meters per second, the speed rising to 11 meters per second or more and lasting for at least one minute. [12.2.6.5.6]

B/C 5.10.1.6.7

Code figures 120 – 126 shall never be used when precipitation is observed at the time of observation. [12.2.6.5.7]

B/C 5.10.1.6.8

For code figure 120, visibility shall have been less than 1000 meters.
Note:
(1) The specification refers only to visibility restrictions, which occurred as a result of water droplets or ice crystals. [12.2.6.5.8]

B/C 5.10.1.6.9

For synoptic coding purposes, a thunderstorm shall be regarded as being at the station from the time thunder is first detected, whether or not lightning is detected or precipitation is occurring at the station. A thunderstorm shall be reported in present weather if thunder is detected within the normal observational period preceding the time of the report. A thunderstorm shall be regarded as having ceased at the time thunder is last detected and the cessation is confirmed if thunder is not detected for 10 – 15 minutes after this time. [12.2.6.5.9]

B/C 5.10.1.6.10

A visibility restriction « less than 1000 meters » shall be applied to code figures 130 – 135. [12.2.6.5.10]

B/C 5.10.1.6.11

The precipitation shall be encoded as intermittent if it has been discontinuous during the preceding hour, without presenting the character of a shower. [12.2.6.5.11]

B/C 5.10.1.6.12

The intensity of precipitation shall be determined by the intensity at the time of observation. [12.2.6.5.12]

B/C 5.10.1.6.13

Code figures 180 – 189 shall be used only when the precipitation is intermittent or of the shower type and takes place at the time of observation.
Note:
(1) Showers are produced by convective clouds. They are characterized by their abrupt beginning and end and by the generally rapid and sometimes great variations in the intensity of the precipitation. Drops and solid particles falling in a shower are generally larger than those falling in non-showery precipitation. Between showers openings may be observed unless stratiform clouds fill the intervals between the cumuliform clouds. [12.2.6.5.13]

B/C 5.10.1.7 Past weather reported from a manned weather station

B/C 5.10.1.7.1 Time period

The time period (0 04 024) covered by past weather (1) and past weather (2) shall be expressed as *a negative value* in hours:
(a) Six hours, for observations at 0000, 0600, 1200, and 1800 UTC;
(b) Three hours for observations at 0300, 0900, 1500, and 2100 UTC;
(c) Two hours for intermediate observations if taken every two hours.
(d) *One hour* for intermediate observations if taken every hour. [12.2.6.6.1]

B/C 5.10.1.7.2

The code figures for past weather (1) and past weather (2) shall be selected in such a way that past and present weather together give as complete a description as possible of the weather in the time interval concerned. For example, if the type of weather undergoes a complete change during the time interval concerned, the code figures selected for past

weather (1) and past weather (2) shall describe the weather prevailing before the type of weather indicated by present weather began. [12.2.6.6.2]

B/C 5.10.1.7.3

When the past weather (1) and past weather (2) are used in hourly reports, Regulation B/C 5.10.1.7.1 (d) shall apply. [12.2.6.6.3]

B/C 5.10.1.7.4

If, using Regulation B/C 5.10.1.7.2, more than one code figure may be given to past weather (1), the highest figure shall be reported for past weather (1) and the second highest code figure shall be reported for past weather (2). [12.2.6.6.4]

B/C 5.10.1.7.5

If the weather during the period has not changed so that only one code figure may be selected for past weather, then that code figure shall be reported for both past weather (1) and past weather (2). [12.2.6.6.5]

B/C 5.10.1.8 Past weather reported from an automatic weather station

B/C 5.10.1.8.1 Time period

The time period (0 04 024) covered by past weather (1) and past weather (2) shall be expressed as *a negative value* in hours:

(a) Six hours for observations at 0000, 0600, 1200, and 1800 UTC;
(b) Three hours for observations at 0300, 0900, 1500, and 2100 UTC;
(c) Two hours for intermediate observations if taken every two hours.
(d) *One hour* for intermediate observations if taken every hour. [12.2.6.7.1]

B/C 5.10.1.8.2

The code figures for past weather (1) and past weather (2) shall be selected so that the maximum capability of the automatic station to discern past weather is utilized, and so that past and present weather together give as complete a description as possible of the weather in the time interval concerned. [12.2.6.7.2]

B/C 5.10.1.8.3

In cases where the automatic station is capable only of discerning very basic weather conditions, the lower code figures representing basic and generic phenomena may be used. If the automatic station has higher discrimination capabilities, the higher code figures representing more detailed explanation of the phenomena shall be used. For each basic type of phenomenon, the highest code figure within the discrimination capability of the automatic station shall be reported. [12.2.6.7.3]

B/C 5.10.1.8.4

If the type of weather during the time interval concerned undergoes complete and discernible changes, the code figures selected for past weather (1) and past weather (2) shall describe the weather prevailing before the type of weather indicated by present weather began. The highest figure shall be reported for past weather (1) and the second highest code figure shall be reported for past weather (2). [12.2.6.7.4]

B/C 5.10.1.8.5

If a discernible change in weather has not occurred during the period, so that only one code figure may be selected for the past weather, then that code figure shall be reported for both past weather (1) and past weather (2). For example, rain during the entire period shall be reported as code figure 14 for both past weather (1) and past weather (2) in the case of an automatic station incapable of differentiating types of precipitation, or code figure 16 for both past weather (1) and past weather (2) in the case of a station with the higher discrimination capability. [12.2.6.7.5]

B/C 5.10.2 Sunshine data <1 01 002><3 02 039>

B/C 5.10.2.1 Period of reference for sunshine duration

Time period in hours (0 04 024) shall be included as follows:

(a) one hour in the first replication (reported as -1);
(b) 24 hours in the second replication (reported as -24).

B/C 5.10.2.2 Duration of sunshine

Duration of sunshine from the time period specified by the preceding parameter 0 07 024, shall be reported in minutes.

B/C 5.10.2.2.1

The duration of sunshine over the previous hour shall be reported by national decision. When reported, it shall be included in the first replication.

B/C 5.10.2.2.2

The duration of sunshine over the previous 24 hours shall, by regional decision, be reported at all stations capable of doing so and included at either 0000 UTC, 0600 UTC, 1200 UTC or 1800 UTC. When reported, it shall be included in the second replication. [12.4.7.4.2]

B/C 5.10.3 Precipitation measurement <3 02 040>

B/C 5.10.3.1 Height of sensor above local ground

Height of sensor above local ground (0 07 032) for precipitation measurement shall be reported in meters (with precision in hundredths of a meter).
This datum represents the actual height of the rain gauge rim above ground at the point where the rain gauge is located.

B/C 5.10.3.2 Period of reference for amount precipitation

Time period (0 04 024) for amount of precipitation shall be reported as *a negative value* in hours. It shall be determined

(a) by regional decision (e.g. -6, -12, -24) in the first replication,
(b) by national decision (e.g. -1, -3) in the second replication.

B/C 5.10.3.3 Total amount of precipitation

Total amount of precipitation, which has fallen during the period of reference for amount of precipitation, shall be reported in kilograms per square meter (with precision in tenths of a kilogram per square meter).

B/C 5.10.3.3.1

Precipitation, when it can be and has to be reported, shall be reported as 0.0 kgm^{-2} if no precipitation were observed during the referenced period. [12.2.5.4]

B/C 5.10.3.3.2

Trace shall be reported as "- 0.1 kgm^{-2} ".

B/C 5.10.4 Extreme temperature data <3 02 041>

B/C 5.10.4.1 Height of sensor above local ground

Height of sensor above local ground (0 07 032) for temperature measurement shall be reported in meters (with precision in hundredths of a meter).
This datum represents the actual height of temperature sensor(s) above ground at the point where the sensors are located.

B/C 5.10.4.2 Periods of reference for extreme temperatures

Time period for maximum temperature and time period for minimum temperature (0 04 024) shall be determined by regional decision and reported as *negative values* in hours. [12.4.4]

Notes:

(1) If the period for maximum temperature or the period for minimum temperature ends at the nominal time of report, the second value of 0 04 024 shall be reported as 0.
(2) If the period for maximum temperature or the period for minimum temperature does not end at the nominal time of report, the first value of 0 04 024 shall indicate the beginning of the period of reference and the second value of 0 04 024 shall indicate the end of the period of reference. E.g. to report the maximum temperature for the previous calendar day from a station in RA IV,

value of the first 0 04 024 shall be set to – 30 and value of the second 0 04 024 shall be set to – 6, provided that the nominal time of the report 12 UTC corresponds to 6 a.m. local time.

B/C 5.10.4.3 Maximum and minimum temperature

Maximum and minimum temperature shall be reported in degrees Kelvin (with precision in hundredths of a degree Kelvin); if produced in CREX, in degrees Celsius (with precision in hundredths of a degree Celsius).

Note:

(1) Notes (1) and (2) under Regulation B/C 5.4.1.2 shall apply.

B/C 5.10.5 Wind data <3 02 042>

B/C 5.10.5.1 Height of sensor above local ground

Height of sensor above local ground (0 07 032) for wind measurement shall be reported in meters (with precision in hundredths of a meter).

This datum represents the actual height of the sensors above ground at the point where the sensors are located.

B/C 5.10.5.2 Type of instrumentation for wind measurement - Flag table 0 02 002

This datum shall be used to specify whether the wind speed was measured by certified instruments (bit No. 1 set to 1) or estimated on the basis of the Beaufort wind scale (bit No. 1 set to 0), and to indicate the original units for wind speed measurement. Bit No. 2 set to 1 indicates that wind speed was originally measured in knots and bit No. 3 set to 1 indicates that wind speed was originally measured in kilometers per hour. Setting both bits No.2 and No.3 to 0 indicates that wind speed was originally measured in meters per second.

B/C 5.10.5.3 Wind direction and speed

The mean direction and speed of the wind over the 10-minute period immediately preceding the observation shall be reported. The time period (0 04 025) shall be included as -10. However, when the 10-minute period includes a discontinuity in the wind characteristics, only data obtained after the discontinuity shall be used for reporting the mean values, and hence the period (0 04 025) in these circumstances shall be correspondingly reduced. [12.2.2.3.1]

The time period is preceded by a time significance qualifier (0 08 021) that shall be set to 2 (Time averaged).

The wind direction (0 11 001) shall be reported in degrees true and the wind speed (0 11 002) shall be reported in meters per second (with precision in tenths of a meter per second).

B/C 5.10.5.3.1

In the absence of wind instruments, the wind speed shall be estimated on the basis of the Beaufort wind scale. The Beaufort number obtained by estimation is converted into meters per second by use of the relevant wind speed equivalent column on the Beaufort scale, and this speed is reported for wind speed. [12.2.2.3.2]

B/C 5.10.5.4 Maximum wind gust direction and speed

Time period for maximum wind gust direction and speed (0 04 025) shall be determined by regional or national decision and reported as a negative value in minutes.

Direction of the maximum wind gust (0 11 043) shall be reported in degrees true and speed of the maximum wind gust (0 11 041) shall be reported in meters per second (with precision in tenths of meters per second).

B/C 5.11 Evaporation data <3 02 044>

B/C 5.11.1 Period of reference for evaporation data

Evaporation or evapotranspiration during the previous 24 hours shall be reported. Time period in hours (0 04 024) shall be included as -24.

B/C 5.11.2 Indicator of type of instrument for evaporation measurement or the type of crops – Code table 0 02 004

B/C 5.11.3 Evaporation or evapotranspiration

Amount of either evaporation or evapotranspiration (0 13 033) shall be reported in kilograms per square meter (with precision in tenths of a kilogram per square meter) at 0000 UTC, 0600 UTC or 1200 UTC. [12.4.7.2.2]

B/C 5.12 Radiation data <1 01 002><3 02 045>

B/C 5.12.1 Period of reference for radiation data

Radiation integrated over the previous hour and over the previous 24 hours may be reported. Time period in hours (0 04 024) shall be included as follows:

(a) one hour in the first replication (reported as -1);
(b) 24 hours in the second replication (reported as -24).

B/C 5.12.2 Amount of radiation

If included, amount of radiation integrated over the time period specified by the preceding parameter 0 07 024 shall be reported in joules per square meter (with precision in thousands of a joule per square meter for radiation type (1) and (2); with precision in ten-thousands of a joule per square meter for radiation type (3); with precision in hundreds of a joule per square meter for radiation types (4) to (6)).

B/C 5.12.2.1

The radiation data may take one or more of the following forms:

(1) Long-wave radiation (0 14 002); the positive sign shall be used to specify downward long-wave radiation and the negative sign to specify upward long-wave radiation;
(2) Short-wave radiation (0 14 004);
(3) Net radiation (0 14 016); the corresponding sign shall be used to specify positive and negative net radiation);
(4) Global solar radiation (0 14 028);
(5) Diffuse solar radiation (0 14 029);
(6) Direct solar radiation (0 14 030).

[12.4.7.4.3], [12.4.7.4.4]

B/C 5.13 Temperature change <3 02 046>

This information is required by regional or national decision from islands or other widely separated stations.

B/C 5.13.1 Period of reference for temperature change

The temperature change shall be reported for the period of time between the time of the observation and the time of the occurrence of temperature change. To construct the required period, time period 0 04 024 shall be included twice; the first one corresponding to period covered by past weather (1) and past weather (2), the second one specified by the time of the occurrence of temperature change. Both values of 0 04 024 shall be negative and expressed in hours.

Note:

(1) The period is the number of whole hours, disregarding the minutes. For example, if the time of occurrence is 45 minutes after the time of the observation, the time period is considered to be

zero hours. If the time of occurrence is 1 hour or more, but less than 2 hours after the observation, the time period go shall be considered to be 1 hour, etc.

B/C 5.13.2 Temperature change over period specified

Temperature change (0 12 049) shall be reported in degrees Kelvin in BUFR, in degrees Celsius in CREX.

B/C 5.13.2.1

For a change of temperature to be reported, the change shall be equal to or more than 5^{o} C and occur in less than 30 minutes during the period covered by past weather (1) and past weather (2). [12.4.7.3]

B/C 5.14 "Period" data required by regional or national reporting practices

If regional or national reporting practices require inclusion of additional "period" parameters, the common sequence 3 07 090 shall be supplemented by relevant descriptors.

Notes:

(1) "Period" parameter is a parameter that is coupled to a time period descriptor, e.g. 0 04 024, 0 04 025.

(2) No regional requirements are currently indicated for reporting SYNOP MOBIL data in Manual on Codes, WMO-No. 306, Volume II.

B/C10 – Regulations for reporting SHIP data in TDCF

TM 308009 - BUFR template for synoptic reports from sea stations suitable for SHIP data

3 08 009		**Sequence for representation of synoptic reports from a sea station suitable for SHIP data**
	3 01 093	Ship identification, movement, date/time, horizontal and vertical coordinates
	3 02 001	Pressure data
	3 02 054	SHIP “instantaneous” data
	0 08 002	Vertical significance
	3 02 055	Icing and ice
	3 02 057	SHIP marine data
	3 02 060	SHIP “period” data

This BUFR template for synoptic reports from sea stations further expands as follows:

3 01 093			**Ship identification, movement, date/time, horizontal and vertical coordinates**	Unit, scale
	3 01 036	0 01 011	Ship or mobile land station identifier **D….D**	CCITT IA5, 0
		0 01 012	Direction of motion of moving observing platform(3) **D_s**	Degree true, 0
		0 01 013	Speed of motion of moving observing platform(4) **v_s**	m s^{-1}, 0
		0 02 001	Type of station **(i_x)**	Code table, 0
		0 04 001	Year	Year, 0
		0 04 002	Month	Month, 0
		0 04 003	Day **YY**	Day, 0
		0 04 004	Hour **GG**	Hour, 0
		0 04 005	Minute **gg**	Minute, 0
		0 05 002	Latitude (coarse accuracy) **$L_aL_aL_a$**	Degree, 2
		0 06 002	Longitude (coarse accuracy) **$L_oL_oL_oL_o$**	Degree, 2
	0 07 030		Height of station platform above mean sea level	m, 1
	0 07 031		Height of barometer above mean sea level	m, 1
			Pressure data	
3 02 001	0 10 004		Pressure **$P_0P_0P_0P_0$**	Pa, –1
	0 10 051		Pressure reduced to mean sea level **PPPP**	Pa, –1
	0 10 061		3-hour pressure change **ppp**	Pa, –1
	0 10 063		Characteristic of pressure tendency **a**	Code table, 0
3 02 054			**SHIP “instantaneous” data**	
			Temperature and humidity data	
	3 02 052	0 07 032	Height of sensor above marine deck platform (for temperature and humidity measurement)	m, 2
		0 07 033	Height of sensor above water surface (for temperature and humidity measurement)	m, 1
		0 12 101	Temperature/dry-bulb temperature(sc.2) **s_nTTT**	K, 2
		0 02 039	Method of wet-bulb temperature measurement	Code table, 0
		0 12 102	Wet-bulb temperature (scale 2) **$s_wT_bT_bT_b$**	K, 2
		0 12 103	Dew-point temperature (scale 2) **$s_nT_dT_dT_d$**	K, 2
		0 13 003	Relative humidity	%, 0

			Visibility data	
	3 02 053	0 07 032	Height of sensor above marine deck platform (for visibility measurement)	m, 2
		0 07 033	Height of sensor above water surface (for visibility measurement)	m, 1
		0 20 001	Horizontal visibility **VV**	m, –1
	0 07 033		Height of sensor above water surface (set to missing to cancel the previous value)	m, 1
			Precipitation past 24 hours	
	3 02 034	0 07 032	Height of sensor above marine deck platform (for precipitation measurement)	m, 2
		0 13 023	Total precipitation past 24 hours **$R_{24}R_{24}R_{24}R_{24}$**	kg m^{-2}, 1
	0 07 032		Height of sensor above marine deck platform (set to missing to cancel the previous value)	m, 2
			Cloud data	
	3 02 004	0 20 010	Cloud cover (total) **N**	%, 0
		0 08 002	Vertical significance	Code table, 0
		0 20 011	Cloud amount (of low or middle clouds) **N_h**	Code table, 0
		0 20 013	Height of base of cloud **h**	m, –1
		0 20 012	Cloud type (low clouds) **C_L**	Code table, 0
		0 20 012	Cloud type (middle clouds) **C_M**	Code table, 0
		0 20 012	Cloud type (high clouds) **C_H**	Code table, 0
	1 01 000		Delayed replication of 1 descriptor	
	0 31 001		Delayed descriptor replication factor	Numeric, 0
	3 02 005	0 08 002	Vertical significance	Code table, 0
		0 20 011	Cloud amount **N_s**	Code table, 0
		0 20 012	Cloud type **C**	Code table, 0
		0 20 013	Height of base of cloud **h_sh_s**	m, -1
0 08 002			Vertical significance (set to missing to cancel the previous value)	Code table, 0
			Icing and ice	
3 02 055	0 20 031		Ice deposit (thickness) **E_sE_s**	m, 2
	0 20 032		Rate of ice accretion **R_s**	Code table, 0
	0 20 033		Cause of ice accretion **I_s**	Flag table, 0
	0 20 034		Sea ice concentration **c_i**	Code table, 0
	0 20 035		Amount and type of ice **b_i**	Code table, 0
	0 20 036		Ice situation **z_i**	Code table, 0
	0 20 037		Ice development **S_i**	Code table, 0
	0 20 038		Bearing of ice edge **D_i**	Degree true, 0
3 02 057			**SHIP marine data**	
	3 02 056		Sea surface temperature, method of measurement, and depth below sea surface	
		0 02 038	Method of sea/water temperature measurement	Code table, 0
		0 07 063	Depth below sea/water surface (for sea surface temperature measurement)	m, 2
		0 22 043	Sea/water temperature **$s_sT_wT_wT_w$**	K, 2
		0 07 063	Depth below sea/water surface (set to missing to cancel the previous value)	m, 2
			Waves	
	3 02 021	0 22 001	Direction of waves	Degree true
		0 22 011	Period of waves **$P_{wa}P_{wa}$**	s, 0
		0 22 021	Height of waves **$H_{wa}H_{wa}$**	m, 1
	3 02 024	0 22 002	Direction of wind waves	Degree true, 0
		0 22 012	Period of wind waves **P_wP_w**	s, 0

		0 22 022	Height of wind waves **H_wH_w**	m, 1
		1 01 002	Replicate 1 descriptor 2 times	
		3 02 023	Swell waves (2 systems of swell) **$d_{w1}d_{w1}$, $P_{w1}P_{w1}$, $H_{w1}H_{w1}$ $d_{w2}d_{w2}$, $P_{w2}P_{w2}$, $H_{w2}H_{w2}$**	
3 02 060			**SHIP"period" data**	
			Present and past weather	
	3 02 038	0 20 003	Present weather **ww**	Code table, 0
		0 04 024	Time period in hours	Hour, 0
		0 20 004	Past weather (1) **W_1**	Code table, 0
		0 20 005	Past weather (2) **W_2**	Code table, 0
			Precipitation measurement	
	3 02 040	0 07 032	Height of sensor above marine deck platform (for precipitation measurement)	m, 2
		1 02 002	Replicate next 2 descriptors 2 times	
		0 04 024	Time period in hours **t_R**	Hour, 0
		0 13 011	Total precipitation / total water equivalent of snow **RRR**	kg m^{-2}, 1
			Extreme temperature data	
	3 02 058	0 07 032	Height of sensor above marine deck platform (for temperature measurement)	m, 2
		0 07 033	Height of sensor above water surface (for temperature measurement)	m, 1
		0 04 024	Time period or displacement	Hour, 0
		0 04 024	Time period or displacement (see Notes 1 and 2)	Hour, 0
		0 12 111	Maximum temperature (scale 2) at height and over period specified **$s_nT_xT_xT_x$**	K, 2
		0 04 024	Time period or displacement	Hour, 0
		0 04 024	Time period or displacement (see Note 2)	Hour, 0
		0 12 112	Minimum temperature (scale 2) at height and over period specified **$s_nT_nT_nT_n$**	K, 2
			Wind data	
	3 02 059	0 07 032	Height of sensor above marine deck platform (for wind measurement)	m, 2
		0 07 033	Height of sensor above water surface (for wind measurement)	m, 1
		0 02 002	Type of instrumentation for wind measurement **i_w**	Flag table, 0
		0 08 021	Time significance (= 2 (time averaged))	Code table, 0
		0 04 025	Time period (= - 10 minutes, or number of minutes after a significant change of wind)	Minute, 0
		0 11 001	Wind direction **dd**	Degree true, 0
		0 11 002	Wind speed **ff**	m s^{-1}, 1
		0 08 021	Time significance (= missing value)	Code table, 0
		1 03 002	Replicate next 3 descriptors 2 times	
		0 04 025	Time period in minutes	Minute, 0
		0 11 043	Maximum wind gust direction	Degree true, 0
		0 11 041	Maximum wind gust speed 910**f_mf_m**, 911**f_xf_x**	m s^{-1}, 1

Notes:

1) Within RA-IV, the maximum temperature at 1200 UTC is reported for the previous calendar day (i.e. the ending time of the period is not equal to the nominal time of the report). To construct the required time range, descriptor 004024 has to be included two times. If the period ends at the nominal time of the report, value of the second 004024 shall be set to 0.

2) Within RA-III, the maximum day-time temperature and the minimum night-time temperature is reported (i.e. the ending time of the period may not be equal to the nominal time of the report). To construct

the required time range, descriptor 004024 has to be included two times. If the period ends at the nominal time of the report, value of the second 004024 shall be set to 0.

3) 0 01 012: Means course made good (average course over the ground) during the three hours preceding the time of observation.

4) 0 01 013: Means speed made good (average speed over the ground) during the three hours preceding the time of observation.

5) If “plain language” text is reported within Section 2, this information can be conveyed in BUFR via the use of an appropriate 205YYY field as an extra descriptor following the above basic template.

Regulations:

B/C 10.1 Section 1 of BUFR or CREX

B/C 10.1.1 Entries required in Section 1 of BUFR

The following entries shall be included in BUFR Section 1:

- BUFR master table,
- identification of originating/generating centre,
- identification of originating/generating sub-centre,
- update sequence number,
- identification of inclusion of optional section,
- data category (= 001 for SHIP data),
- international data sub-category (1), (2),
- local data subcategory,
- version number of master table,
- version number of local tables,
- year (year of the century up to BUFR edition 3),
- month (standard time),
- day (standard time = YY in the abbreviated telecommunication header for SHIP data),
- hour (standard time = GG in the abbreviated telecommunication header for SHIP data),
- minute (standard time = 00 for SHIP data).

Notes:
(1) Inclusion of this entry is required starting with BUFR edition 4.
(2) If required, the international data sub-category shall be included for SHIP data as 000 at all observation times 00, 01, 02, ..., 23 UTC.

B/C 10.1.2 Entries required in Section 1 of CREX

The following entries shall be included in CREX Section 1:

- CREX master table,
- CREX edition number,

- CREX table version number,
- version number of BUFR master table (1),
- version number of local tables (1),
- data category (= 001 for SHIP data),
- international data sub-category (1), (2),
- identification of originating/generating centre (1),
- identification of originating/generating sub-centre (1),
- update sequence number (1),
- number of subsets (1),
- year (standard time) (1),
- month (standard time) (1),
- day (standard time = YY in the abbreviated telecommunication header for SHIP data) (1),
- hour (standard time = GG in the abbreviated telecommunication header for SHIP data) (1),
- minute (standard time = 00 for SHIP data) (1).

Notes:
(1) Inclusion of these entries is required starting with CREX edition 2.
(2) If inclusion of international data sub-category is required, Note (2) under B/C 10.1.1 applies.

B/C 10.2 Ship identification, movement, date/time, horizontal and vertical coordinates <3 01 093>

B/C 10.2.1 Ship identification, movement, type of station

Ship identifier (0 01 011) shall be always reported as a non-missing value. In the absence of a suitable call sign, the word SHIP shall be used for ship identifier in reports of sea stations other then buoys, drilling rigs and oil- and gas-production platforms. [12.1.7(b)]

B/C 10.2.2 Ship movement

Direction of motion of moving observing platform (0 01 012) shall be reported in degrees true to indicate course made good (average course over the ground) during the three hours preceding the time of observation.

Speed of motion of moving observing platform (0 01 013) shall be reported in meters per second to indicate speed made good (average speed over the ground) during the three hours preceding the time of observation.

B/C 10.2.2.1

Direction and speed of motion of moving observing platform shall always be included in reports from stations, which have observed maritime conditions, and in reports from ships being requested to include this information as a routine procedure. [12.3.1.1]

B/C 10.2.2.2

Direction and speed of motion of moving observing platform may be included as missing values in reports from a supplementary or auxiliary ship, except when reporting from an area for which the ship report collecting centre, in order to meet a requirement of a search and rescue centre, has requested inclusion of direction and speed of ship motion as a routine procedure. [12.3.1.2(b)]

B/C 10.2.3 Type of station

Type of station (0 02 001) shall be reported to indicate the type of the station operation (manned, automatic or hybrid).

Note:
(1) If a station operates as a manned station for a part of the day and as an automatic station for the rest of the day, code figure 2 (Hybrid) may be used in all reports. It is preferable, however, to use code figure 1 (Manned) in reports produced under the supervision of an observer, and a code figure 0 (Automatic) in reports produced while the station operates in the automatic mode.

B/C 10.2.4 Time of observation

Year (0 04 001), month (0 04 002), day (0 04 003), hour (0 04 004) and minute (0 04 005) of the actual time of observation shall be reported.

Note:

(1) The actual time of observation shall be the time at which the barometer is read. [12.1.8]

B/C 10.2.4.1

If the actual time of observation differs by 10 minutes or less from the standard time reported in Section 1, the standard time may be reported instead of the actual time of observation. [12.2.6]

B/C 10.2.5 Horizontal and vertical coordinates

Latitude (0 05 002) and longitude (0 06 002) of the station shall be reported in degrees with precision in hundredths of a degree.

Height of station ground above mean sea level (0 07 030) and height of barometer above mean sea level (0 07 031) shall be reported in meters with precision in tenths of a meter.

B/C 10.3 Pressure data <3 02 001>

B/C 10.3.1 Pressure at the station level

Pressure at the station level (0 10 004), i.e. at the level defined by 0 07 031 (height of barometer above mean sea level), shall be reported in pascals (with precision in tens of a pascal).

Note:

(1) Inclusion of the station pressure in reports from sea stations is left to the decision of individual Members.

B/C 10.3.2 Pressure reduced to mean sea level

Pressure reduced to mean sea level (0 10 051) shall be reported in pascals (with precision in tens of a pascal).

B/C 10.3.2.1

In reports from ships, air pressure at mean sea level shall be reported. [12.1.3.6], [12.1.3.7]

B/C 10.3.3 Three-hour pressure change and characteristic of pressure tendency

Amount of pressure change at station level, during the three hours preceding the time of observation (0 10 061), either positive, zero *or negative*, shall be reported in pascals (with precision in tens of a pascal).

B/C 10.3.3.1

Unless specified otherwise by regional decision, pressure tendency shall be included whenever the three-hourly pressure tendency is available. [12.2.3.5.1]

B/C 10.3.3.2

The characteristic of pressure tendency (Code table 0 10 063) over the past three hours shall, whenever possible, be determined on the basis of pressure samples at equi-spaced intervals not exceeding one hour. [12.2.3.5.2]

Note:

(1) Algorithms for selecting the appropriate code figure are included in publication WMO–No.8, Guide to Meteorological Instruments and Methods of Observation.

B/C 10.3.3.3

Where it is not possible to apply the algorithms specified in Regulation B/C 10.3.3.2 in reports from automatic weather stations, the characteristic of pressure tendency shall be reported as 2 when the tendency is positive, as 7 when the tendency is negative, and as 4 when the atmospheric pressure is the same as three hours before. [12.2.3.5.3]

B/C 10.4 SHIP “instantaneous” data <3 02 054>

B/C 10.4.1 Temperature and humidity data <3 02 052>

B/C 10.4.1.1 Height of sensor above marine deck platform and height of sensor above water surface

Height of sensor above marine deck platform (0 07 032) for temperature and humidity measurement shall be reported in meters (with precision in hundredths of a meter).
This datum represents the actual height of temperature and humidity sensors above marine deck platform at the point where the sensors are located.

Height of sensor above water surface (0 07 033) for temperature and humidity measurement shall be reported in meters (with precision in hundredths of a meter).
This datum represents the actual height of temperature and humidity sensors above marine water surface of sea or lake.

B/C 10.4.1.2 Dry-bulb air temperature

Dry-bulb air temperature (0 12 101) shall be reported in degrees Kelvin (with precision in hundredths of a degree Kelvin); if produced in CREX, in degrees Celsius (with precision in hundredths of a degree Celsius). Temperature data shall be reported with precision in hundredths of a degree even if they are measured with the accuracy in tenths of a degree.
Notes:
(1) This requirement is based on the fact that conversion from the Kelvin to the Celsius scale has often resulted into distortion of the data values.
(2) Temperature t (in degrees Celsius) shall be converted into temperature T (in degrees Kelvin) using equation: T = t + 273.15.

B/C 10.4.1.2.1

When the data are not available as a result of a temporary instrument failure, this quality shall be included as a missing value. [12.2.3.2]

B/C 10.4.1.3 Wet-bulb temperature and method of its measurement

Wet-bulb temperature (0 12 102) shall be reported in degrees Kelvin (with precision in hundredths of a degree Kelvin); if produced in CREX, in degrees Celsius (with precision in hundredths of a degree Celsius). Method of wet-bulb temperature measurement shall be reported by the preceding entry (Code table 0 02 039). Wet-bulb temperature data shall be reported with precision in hundredths of a degree even if they are available with the accuracy in tenths of a degree.
Note:
(1) Notes (1) and (2) under Regulation B/C 10.4.1.2 shall apply.

B/C 10.4.1.3.1

When wet-bulb temperature is used to derive dew-point value in a ship report, 0 12 102 shall be included to report the wet-bulb temperature measurement. [12.3.6]

B/C 10.4.1.4 Dew-point temperature

When available, dew-point temperature (0 12 103) shall be reported in degrees Kelvin (with precision in hundredths of a degree Kelvin); if produced in CREX, in degrees Celsius (with precision in hundredths of a degree Celsius).
Note:
(1) Notes (1) and (2) under Regulation B/C 10.4.1.2 shall apply.

B/C 10.4.1.5 Relative humidity

Relative humidity (0 13 003) shall be reported in units of a percent.

B/C 10.4.1.5.1

Both dew point temperature and relative humidity shall be reported when available.

B/C 10.4.2 Visibility data <3 02 053>

B/C 10.4.2.1 Height of sensor above marine deck platform and height of sensor above water surface

Height of sensor above marine deck platform (0 07 032) for visibility measurement shall be reported in meters (with precision in hundredths of a meter).
This datum represents the actual height of visibility sensors above marine deck platform at the point where the sensors are located. If visibility is estimated by a human observer, the average height of observer's eyes above marine deck platform shall be reported.

Height of sensor above water surface (0 07 033) for visibility measurement shall be reported in meters (with precision in hundredths of a meter).
This datum represents the actual height of visibility sensors above the level of water surface of sea or lake. If visibility is estimated by a human observer, the average height of observer's eyes above the level of water surface of sea or lake at the time of observation shall be reported.

B/C 10.4.2.2 Horizontal visibility

Horizontal visibility (0 20 001) at surface shall be reported in meters (with precision in tens of a meter).

B/C 10.4.2.2.1

When the horizontal visibility is not the same in different directions, the shortest distance shall be given for visibility. [12.2.1.3.1]

B/C 10.4.3 Precipitation past 24 hours <3 02 034>

B/C 10.4.3.1 Height of sensor above marine deck platform

Height of sensor above marine deck platform (0 07 032) for precipitation measurement shall be reported in meters (with precision in hundredths of a meter).
This datum represents the actual height of the rain gauge rim above marine deck platform at the point where the rain gauge is located.
Note:
(1) Height of sensor above water surface (0 07 033) is not required for precipitation measurement. Therefore, there is an entry 0 07 033, directly preceding the sequence 3 02 034, that is set to a missing value to cancel the previous value.

B/C 10.4.3.2 Total amount of precipitation during the 24-hour period

Total amount of precipitation during the 24-hour period ending at the time of observation (0 13 023) shall be reported in kilograms per square meter (with precision in tenths of a kilogram per square meter). [12.4.9]

B/C 10.4.3.2.1

The precipitation over the past 24 hours shall be included (not missing) at least once a day at one appropriate time of the main standard times (0000, 0600, 1200, 1800 UTC). [12.4.1]

B/C 10.4.3.2.2

Precipitation, when it can be and has to be reported, shall be reported as 0.0 kgm^{-2} if no precipitation were observed during the referenced period. [12.2.5.4]

B/C 10.4.3.2.3

Trace shall be reported as "- 0.1 kgm^{-2} ".

B/C 10.4.4 Cloud data <3 02 004>

B/C 10.4.4.1 Total cloud cover

Total cloud cover (0 20 010) shall embrace the total fraction of the celestial dome covered by clouds irrespective of their genus. It shall be reported in *units of a percent*.

Note:

(1) Total cloud cover shall be reported as 113 when sky is obscured by fog and/or other meteorological phenomena.

B/C 10.4.4.1.1

Total cloud cover shall be reported as actually seen by the observer during the observation. [12.2.2.2.1]

B/C 10.4.4.1.2

Altocumulus perlucidus or Stratocumulus perlucidus ("mackerel sky") shall be reported *as 99% or less* (unless overlying clouds appear to cover the whole sky) since breaks are always present in this cloud form even if it extends over the whole celestial dome. [12.2.2.2.2]

B/C 10.4.4.1.3

Total cloud cover shall be reported as zero when blue sky or stars are seen through existing fog or other analogous phenomena without any trace of cloud being seen. [12.2.2.2.3]

B/C 10.4.4.1.4

When clouds are observed through fog or analogous phenomena, their amount shall be evaluated and reported as if these phenomena were non-existent. [12.2.2.2.4]

B/C 10.4.4.1.5

Total cloud cover shall not include the amount resulting from rapidly dissipating condensation trails. [12.2.2.2.5]

B/C 10.4.4.1.6

Persistent condensation trails and cloud masses, which have obviously developed from condensation trails, shall be reported as cloud. [12.2.2.2.6]

B/C 10.4.4.2 Vertical significance – Code table 0 08 002

To specify vertical significance (0 08 002) within the sequence 3 02 004, a code figure shall be selected in the following way:

(a) If low clouds are observed, then code figure 7 (Low cloud) shall be used.
(b) If there are no low clouds but middle clouds are observed, then code figure 8 (Middle clouds) shall be used.
(c) If there are no low and there are no middle clouds but high clouds are observed, then code figure 0 shall be used.
(d) If sky is obscured by fog and/or other phenomena, then code figure 5 (Ceiling) shall be used.
(e) If there are no clouds (clear sky), then code figure 62 (Value not applicable) shall be used.
(f) If the cloud cover is not discernible for reasons other than (d) above or observation is not made, then code figure 63 (Missing value) shall be used.

B/C 10.4.4.3 Cloud amount (of low or middle clouds) – Code table 0 20 011

Amount of all the low clouds (clouds of the genera Stratocumulus, Stratus, Cumulus, and Cumulonimbus) present or, if no low clouds are present, the amount of all the middle clouds (clouds of the genera Altocumulus, Altostratus, and Nimbostratus) present.

B/C 10.4.4.3.1

Cloud amount shall be reported as follows:

(a) If there are low clouds, then the total amount of all low clouds, as actually seen by the observer during the observation shall be reported for the cloud amount.
(b) If there are no low clouds but there are middle clouds, then the total amount of the middle clouds shall be reported for the cloud amount.

(c) If there are no low clouds and there are no middle clouds but there are high clouds (clouds of the genera Cirrus, Cirrocumulus, and Cirrostratus), then the cloud amount shall be reported as zero. [12.2.7.2.1]

B/C 10.4.4.3.2

Amount of Altocumulus perlucidus or Stratocumulus perlucidus ("mackerel sky") shall be reported using code figure 7 or less since breaks are always present in this cloud form even if it extends over the whole celestial dome. [12.2.7.2.2]

B/C 10.4.4.3.3

When the clouds reported for cloud amount are observed through fog or an analogous phenomenon, the cloud amount shall be reported as if these phenomena were not present. [12.2.7.2.3]

B/C 10.4.4.3.4

If the clouds reported for cloud amount include contrails, then the cloud amount shall include the amount of persistent contrails. Rapidly dissipating contrails shall not be included in the value for the cloud amount. [12.2.7.2.4]

B/C 10.4.4.4 Height of base of lowest cloud

Height above surface of the base (0 20 013) of the lowest cloud seen shall be reported in meters (with precision in tens of a meter).

Note:

(1) The term « height above surface » shall be considered as being the height above water surface of sea or lake.

B/C 10.4.4.4.1

When clouds are observed through fog or analogous phenomena but the sky is discernable, the base of the lowest cloud shall refer to the base of the lowest cloud observed, if any. When, under the above conditions, the sky is not discernible, the base of the lowest cloud shall be reported as missing. [12.2.1.2]

B/C 10.4.4.4.2

When no cloud are reported (Total cloud cover = 0) the base of the lowest cloud *shall be reported as a missing value.*

B/C 10.4.4.5 Cloud type of low, middle and high clouds - Code table 0 20 012

Clouds of the genera Stratocumulus, Stratus, Cumulus, and Cumulonimbus (low clouds) shall be reported for the first entry 0 20 012, clouds of the genera Altocumulus, Altostratus, and Nimbostratus (middle clouds) shall be reported for the second entry 0 20 012 and clouds of the genera Cirrus, Cirrocumulus, and Cirrostratus (high clouds) shall be reported for the third entry 0 20 012.

B/C 10.4.4.5.1

The reporting of type of low, middle and high clouds shall be as specified in publication WMO-NO. 407 – International Cloud Atlas, Volume I. [12.2.7.3]

B/C 10.4.5 Individual cloud layers or masses

B/C 10.4.5.1 Number of individual cloud layers or masses

The number of individual cloud layers or masses shall be indicated by Delayed descriptor replication factor 0 31 001 in BUFR and by a four-digit number in the Data Section corresponding to the position of the replication descriptor in the Data Description Section of CREX.

Note:

(1) The number of cloud layers or masses shall never be set to missing value.

(2) The number of cloud layers or masses shall be set to a positive value in a NIL report.

B/C 10.4.5.1.1

The number of individual cloud layers or masses shall in the absence of Cumulonimbus clouds not exceed three. Cumulonimbus clouds, when observed, shall always be reported, so that the total number of individual cloud layers or masses can be four. The

selection of layers (or masses) to be reported shall be made in accordance with the following criteria:

(a) The lowest individual layer (or mass) of any amount (cloud amount at least one octa or less, but not zero);

(a) The next higher individual layer (or mass) the amount of which is greater than two octas;

(b) The next higher individual layer (or mass) the amount of which is greater than four octas;

(c) Cumulonimbus clouds, whenever observed and not reported under (a), (b) and (c) above. [12.4.10.1]

B/C 10.4.5.1.2

When the sky is clear, the number of individual cloud layers or masses shall be set to zero.

B/C 10.4.5.1.3

The order of reporting the individual cloud layers or masses shall always be from lower to higher levels. [12.4.10.2]

B/C 10.4.5.2 Individual cloud layer or mass <3 02 005>

Each cloud layer or mass shall be represented by the following four parameters: Vertical significance (0 08 002), amount of individual cloud layer or mass (0 20 011), type of cloud layer or mass (0 20 012) and height of base of individual cloud layer or mass (0 20 013).

B/C 10.4.5.2.1 Vertical significance – Code table 0 08 002

To specify vertical significance (0 08 002) within the sequence 3 02 005, a code figure shall be selected in the following way:

(a) Code figure 1 shall be used in the first non-Cumulonimbus layer.

(b) Code figure 2 shall be used in the second non-Cumulonimbus layer.

(c) Code figure 3 shall be used in the third non-Cumulonimbus layer.

(d) Code figure 4 shall be used in any Cumulonimbus layer.

(e) If sky is obscured by fog and/or other phenomena, then code figure 5 (Ceiling) shall be used.

(f) If the cloud cover is not discernible for reasons other than (e) above or observation is not made, then code figure 63 (Missing value) shall be used.

B/C 10.4.5.2.2 Cloud amount, type and height of base

B/C 10.4.5.2.2.1

When the sky is clear, in accordance with Regulation B/C 10.4.5.1.2 cloud amount, genus, and height shall not be included. [12.4.10.4]

B/C 10.4.5.2.2.2

In determining cloud amounts (Code table 0 20 011) to be reported for individual layers or masses, the observer shall estimate, by taking into consideration the evolution of the sky, the cloud amounts of each individual layer or mass at the different levels, as if no other clouds existed. [12.4.10.3]

B/C 10.4.5.2.2.3

Type of a cloud layer or mass (Code table 0 20 012) shall be reported using code figures 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 59 and 63.

B/C 10.4.5.2.2.4

If, notwithstanding the existence of fog or other obscuring phenomena, the sky is discernible, the partially obscuring phenomena shall be disregarded. If, under the above conditions, the sky is not discernible, the cloud type shall be reported using *code figure 59* and the cloud height shall be replaced by vertical visibility. [12.4.10.5]

Note:

(1) The vertical visibility is defined as the vertical visual range into an obscuring medium.

B/C 10.4.5.2.2.5

If two or more types of cloud occur with their bases at the same level and this level is one to be reported in accordance with Regulation B/C 10.4.5.1.1, the selection for cloud type and amount shall be made with the following criteria :

(a) If these types do not include Cumulonimbus then cloud genus shall refer to the cloud type that represents the greatest amount, or if there are two or more types of cloud all having the same amount, the highest applicable code figure for cloud genus shall be reported. Cloud amount shall refer to the total amount of cloud whose bases are all at the same level ;

(b) If these types do include Cumulonimbus then one layer shall be reported to describe only this type with cloud genus indicated as Cumulonimbus and the cloud amount as the amount of the Cumulonimbus. If the total amount of the remaining type(s) of cloud (excluding Cumulonimbus) whose bases are all at the same level is greater than that required by Regulation B/C 10.4.5.1.1, then another layer shall be reported with type being selected in accordance with (a) and amount referring to the total amount of the remaining cloud (excluding Cumulonimbus). [12.4.10.6]

B/C 10.4.5.2.2.6

Regulations B/C 10.4.4.1.3 to B/C 10.4.4.1.6, inclusive, shall apply. [12.4.10.7]

B/C 10.4.5.2.2.7

Height above surface of the cloud base (0 20 013) shall be reported in meters (with precision in tens of a meter).

Note:

(1) The term « height above surface » shall be considered as being the height above water surface of sea or lake.

B/C 10.5 Icing and ice <3 02 055>

B/C 10.5.1 Icing

Thickness of ice deposit (0 20 031) shall be reported in meters (with precision in hundredths of a meter).

Rate of ice accretion (0 20 032) shall be reported using corresponding Code table.

Cause of ice accretion (0 20 033) shall be reported using corresponding Flag table.

B/C 10.5.1.1

When the ice accretion on ships is reported in plain language, this information shall be conveyed in BUFR/CREX via the use of an appropriate 205YYY field as an extra descriptor following the basic template.

B/C 10.5.1.2

When the ice accretion on ships is reported in plain language, it shall be preceded by the word ICING. [12.3.5]

B/C 10.5.2 Ice

Sea ice concentration (0 20 034) shall be reported using corresponding Code table.

Amount and type of ice (0 20 035) shall be reported using corresponding Code table.

Ice situation (0 20 036) shall be reported using corresponding Code table.

Ice development (0 20 037) shall be reported using corresponding Code table.

Bearing of ice edge (0 20 038) shall be reported in degrees true.

B/C 10.5.2.1

The reporting of sea ice and ice of land origin using the sequence <0 20 034, 0 20 035, 0 20 036, 0 20 037, 0 20 038> shall not supersede the reporting of sea ice and icebergs in accordance with the International Convention for the Safety of Life at Sea. [12.3.7.1]

B/C 10.5.2.2

The sequence <0 20 034, 0 20 035, 0 20 036, 0 20 037, 0 20 038> shall be reported whenever sea ice and/or ice of land origin are observed from the ship's position at the

time of observation, unless the ship is required to report ice conditions by means of a special sea-ice code. [12.3.7.2]

B/C 10.5.2.3

When an ice edge is crossed or sighted between observational hours, it shall be reported as a plain-language addition in the form “ice edge lat. long.” (with position in degrees and minutes). This information shall be conveyed in BUFR/CREX via the use of an appropriate 205YYY field as an extra descriptor following the basic template. [12.3.7.3]

B/C 10.5.2.4

If the ship is in the open sea reporting an ice edge, the sea ice concentration (0 20 034) and ice development (0 20 037) shall be reported only if the ship is close to the ice (i.e. within 0.5 nautical mile). [12.3.7.4]

B/C 10.5.2.5

If the ship is in an open lead more than 1.0 nautical mile wide, sea ice concentration (0 20 034) shall be set to 1 and bearing of ice edge (0 20 038) to 0. If the ship is in fast ice with ice boundary beyond limit of visibility, sea ice concentration (0 20 034) shall be set to 1 and bearing of ice edge (0 20 038) to missing. [12.3.7.5]

B/C 10.5.2.6

If no sea ice is visible and the sequence <0 20 034, 0 20 035, 0 20 036, 0 20 037, 0 20 038> is used to report ice of land origin only, 0 20 035 shall be used to report the amount of ice of land origin, and 0 20 034 and 0 20 036 shall be set to 0, and 0 20 037 and 0 20 038 shall be set to missing; e.g. <0,2,0, missing, missing> would mean 6-10 icebergs in sight, but no sea ice. [12.3.7.6]

B/C 10.5.2.7

In coding concentration or arrangement of sea ice (0 20 034) that condition shall be reported which is of the most navigational significance. [12.3.7.7]

B/C 10.5.2.8

The bearing of the principal ice edge reported shall be to the closest part of that edge. [12.3.7.8]

B/C 10.5.2.9

The requirements for sea-ice reporting are covered in the following way by the associated parameters:

Sea ice concentration - Code table 0 20 034

(a) The purpose of the code figure 0 in code table 0 20 034 is to establish in relation to code figure 0 in code table 0 20 036 and code table 0 20 035 whether the floating ice that is visible is only ice of land origin;

(b) The possible variation in sea-ice concentration and arrangement within an area of observation are almost infinite. However, the field of reasonably accurate observation from a ship’s bridge is limited. For this reason, and also because minor variations are of temporary significance, the choice of concentrations and arrangements has been restricted for reporting purposes to those representing significantly different conditions from a navigational point of view. The code figures 2-9 have been divided into two sections depending on:

(i) Whether sea-ice concentration within the area of observation is more or less uniform (code figures 2-5); or

(ii) Whether there are marked contrasts in concentration or arrangement (code figures 6-9).

Amount and type of ice - Code table 0 20 035

(1) This code provides a scale of increasing navigational hazard;

(2) Growlers and bergy bits, being much smaller and lower in the water than icebergs, are more difficult to see either by eye or radar. This is especially so if there is heavy sea running. For this reason, code figures 4 and 5 represent more hazardous conditions than code figures 1 to 3.

Ice situation - Code table 0 20 036

(a) The purpose of this parameter is to establish:

(i) Whether the ship is in pack ice or is viewing floating ice (i.e. sea ice and/or ice of land origin) from the open sea; and
(ii) A qualitative estimate, dependent on the sea-ice navigation capabilities of the reporting ship, of the penetrability of the sea ice and of the recent trend in conditions;

(b) The reporting of the conditions represented by code figures 1-9 in Code table 0 20 036 can be used to help in the interpretation of reports from the two code tables (ice concentration 0 20 034 and ice development 0 20 037).

Ice development - Code table 0 20 037

(a) This code table represents a series of increasing navigational difficulties for any given concentration; i.e. if the concentration is, for example, 8/10ths, then new ice would hardly have any effect on navigation while predominantly old ice would provide difficult conditions requiring reductions in speed and frequent course alternations;
(b) The correlation between the stage of development of sea ice and its thickness is explained in publication WMO-No.8 – Guide to Meteorological Instruments and Methods of Observation.

Bearing of ice edge – 0 20 038

There is no provision in this code for the reporting of distance from the ice edge. It will be assumed by those receiving the report that the bearing has been given to the closest part of the ice edge. From the reported code figures for ice concentration 0 20 034 and ice development 0 20 037, it will be clear whether the ship is in ice or within 0.5 nautical mile of the ice edge. If the ship is in open water and more than 0.5 nautical mile from the ice edge, the ice edge will be assumed to be aligned at right angles to the bearing which is reported.

B/C 10.6 SHIP marine data <3 02 057>

B/C 10.6.1 Sea surface temperature, method of its measurement and depth below sea/water surface <3 02 056>

Method of sea/water temperature measurement shall be reported by Code table 0 02 038; depth bellow sea/water surface (0 07 063) shall be reported in meters (with precision in hundredths of a meter). Sea/water temperature (0 22 043) shall be reported in degrees Kelvin (with precision in hundredths of a degree Kelvin); if produced in CREX, in degrees Celsius (with precision in hundredths of a degree Celsius). Sea/water temperature data shall be reported with precision in hundredths of a degree even if they are available with the accuracy in tenths of a degree.

Note:
(1) Notes (1) and (2) under Regulation B/C 10.4.1.2 shall apply.

B/C 10.6.1.1

Sea/water temperature shall always be included in reports from ocean weather stations, when data are available. [12.3.2]

B/C 10.6.2 Instrumental wave data <3 02 021>

Direction of waves (0 22 001) shall be used to reported true direction (direction from which the waves are coming) in degrees true.

Period of waves (0 22 011) shall be reported in seconds.

Height of waves (0 22 021) shall be reported in meters with precision in tenths of a meter.

Note:
(1) Height of waves shall be reported with precision in tenths of a meter even if the data are available with lower accuracy and reported in TAC in units of 0.5 meter. [12.3.3.2]

B/C 10.6.2.1

These data shall always be included in reports from ocean weather stations, when data are available. [12.3.3.1]

B /C 10.6.2.2

The sequence 3 02 021 shall be used to report instrumental wave data. [12.3.3.2]

B/C 10.6.2.3

When the sea is calm (no waves and no swell) direction of waves, period of waves and height of waves shall be reported as 0. [12.3.3.4(a)] [12.3.3.5(a)]

B/C 10.6.2.4

If instrumental wave data are not available for direction, period or height of waves, as the case may be, 0 22 001, 0 22 011 or 0 22 021shall be set to missing. [12.3.3.4(c)]

B/C 10.6.3 Wind waves and swell waves <3 02 024>

Direction of wind waves (0 22 002) shall be used to reported true direction (direction from which the waves are coming) in degrees true.

Period of wind waves (0 22 012) shall be reported in seconds.

Height of wind waves (0 22 022) shall be reported in meters with precision in tenths of a meter.

Direction of swell waves (0 22 003) shall be used to reported true direction (direction from which the waves are coming) in degrees true.

Period of swell waves (0 22 013) shall be reported in seconds.

Height of swell waves (0 22 023) shall be reported in meters with precision in tenths of a meter.

B/C 10.6.3.1

Wind wave data and swell wave data shall always be included in reports from ocean weather stations, when data are available. [12.3.3.1] [12.3.4.4]

B /C 10.6.3.2

The sequence <0 22 002, 0 22 012, 0 22 022> shall be used to report wind waves, when instrumental wave data are not available. [12.3.3.3]

B/C 10.6.3.3

When the sea is calm (no waves and no swell) direction, period and height of wind waves shall be reported as 0. [12.3.3.4(a)]

B/C 10.6.3.4

If wind wave data are not available (owing to confused sea or for any other reason) for direction, period or height of wind waves, as the case may be, 0 22 002, 0 22 012 or 0 22 022 shall be set to missing. [12.3.3.4(b), (d)]

B/C 10.6.3.5

Swell wave data shall be reported only when swell waves can be distinguished from wind waves. [12.3.4.1]

B/C 10.6.3.6

When the sea is calm (no waves and no swell) direction, period and height of swell waves shall be reported as 0.

B/C 10.6.3.7

If swell waves cannot be distinguished from wind waves, direction 0 22 003, period 0 22 013 and height 0 22 023 of swell waves shall be set to missing.

B/C 10.6.3.8

If only one system of swell is observed, direction, period and height of swell waves shall be reported in the first replication of <3 02 023> = <0 22 003, 0 22 013, 0 22 023>. All elements in the second replication of <3 02 023> shall be set to missing. [12.3.4.2]

B/C 10.6.3.9

If a second system of swell is observed, its direction, period and height shall be reported in the second replication of <3 02 023> = <0 22 003, 0 22 013, 0 22 023>. The corresponding data for the first system of swell shall be reported as prescribed by Regulation B/C 10.6.3.8. [12.3.4.3]

B/C 10.7 "Instantaneous" data required by regional or national reporting practices

If regional or national reporting practices require inclusion of additional "instantaneous" parameters, the sequence descriptor 3 08 009 shall not be used. In this case BUFR/CREX template for SHIP data shall be used in its first level expanded form and the descriptors, corresponding to the required "instantaneous" parameters, shall be inserted to precede 3 02 060 (SHIP "period" data).

Notes:

(1) "Instantaneous" parameter is a parameter that is not coupled to a time period descriptor, e.g. 0 04 024, 0 04 025.

(2) No regional requirements are currently indicated for reporting SHIP data from sea stations in Manual on Codes, WMO-No. 306, Volume II.

B/C 10.8 SHIP "period" data <3 02 060>

B/C 10.8.1 Present and past weather <3 02 038>

B/C 10.8.1.1

Present weather (Code table 0 20 003) and past weather (1) (Code table 0 20 004) and past weather (2) (Code table 0 20 005) shall be reported as non-missing values if present and past conditions are known. In case of a report from a manually operated station after a period of closure or at start up, when past weather conditions for the period applicable to the report are unknown, past weather (1) and past weather (2) reported as missing shall indicate that previous conditions are unknown. This regulation shall also apply to automatic reporting stations with the facility to report present and past weather. [12.2.6.1]

B/C 10.8.1.2

Code figures 0, 1, 2, 3, 100, 101, 102 and 103 for present weather and code figures 0, 1, 2 and 10 for past weather (1) and past weather (2) shall be considered to represent phenomena without significance. [12.2.6.2]

B/C 10.8.1.3

Present and past weather shall be *reported if observation was made (data available), regardless significance of the phenomena.*

Note:

(1) If data are produced and collected in traditional codes and present weather and past weather is omitted in a SHIP report (no significant phenomena observed), code figure 508 shall be used for present weather and code figure 10 for past weather (1) and past weather (2) when converted into BUFR or CREX.

B/C 10.8.1.4

If no observation was made (data not available), code figure 509 shall be used for present weather and both past weather (1) and past weather (2) shall be reported as missing.

B/C 10.8.1.5 Present weather from a manned weather station

B/C 10.8.1.5.1

If more than one form of weather is observed, the highest applicable code figure from the range <00 to 99> shall be selected for present weather. Code figure 17 shall have precedence over code figures 20 – 49. Other weather may be reported using additional entries 0 20 003 or 0 20 021 to 0 20 026 applying Regulation B/C 10.7. [12.2.6.4.1]

B/C 10.8.1.5.2

In coding 01, 02, or 03, there is no limitation on the magnitude of the change of the cloud amount. Code figures 00, 01, and 02 can each be used when the sky is clear at the time of observation. In this case, the following interpretation of the specifications shall apply:

- 00 is used when the preceding conditions are not known,
- 01 is used when the clouds have dissolved during the past hour,
- 02 is used when the sky has been continuously clear during the past hour. [12.2.6.4.2]

B/C 10.8.1.5.3

When the phenomenon is not predominantly water droplets, the appropriate code figure shall be selected without regard to visibility. [12.2.6.4.3]

B/C 10.8.1.5.4

The code figure 05 shall be used when the obstruction to vision consists predominantly of lithometeors. [12.2.6.4.4]

B/C 10.8.1.5.5

National instructions shall be used to indicate the specifications for code figures 07 and 09. [12.2.6.4.5]

B/C 10.8.1.5.6

The visibility restrictions on code figure 10 shall be 1000 meters or more. The specification refers only to water droplets and ice crystals. [12.2.6.4.6]

B/C 10.8.1.5.7

For code figures 11 or 12 to be reported, the apparent visibility shall be less than 1000 meters. [12.2.6.4.7]

B/C 10.8.1.5.8

For code figure 18, the following criteria for reporting squalls shall be used:

(a) When wind speed is measured : A sudden increase of wind speed of at least eight meters per second, the speed rising to 11 meters per second or more and lasting for at least one minute;

(b) When the Beaufort scale is used for estimating wind speed: A sudden increase of wind speed by at least three stages of the Beaufort scale, the speed rising to force 6 or more and lasting for at least one minute. [12.2.6.4.8]

B/C 10.8.1.5.9

Code figures 20 – 29 shall never be used when precipitation is observed at the time of observation. [12.2.6.4.9]

B/C 10.8.1.5.10

For code figure 28, visibility shall have been less than 1000 meters.

Note:

(1) The specification refers only to visibility restrictions which occurred as a result of water droplets or ice crystals. [12.2.6.4.10]

B/C 10.8.1.5.11

For synoptic coding purposes, a thunderstorm shall be regarded as being at the station from the time thunder is first heard, whether or not lightning is seen or precipitation is occurring at the station. A thunderstorm shall be reported if thunder is heard within the normal observational period preceding the time of the report. A thunderstorm shall be regarded as having ceased at the time thunder is first heard and the cessation is confirmed if thunder is not heard for 10 – 15 minutes after this time. [12.2.6.4.11]

B/C 10.8.1.5.12

The necessary uniformity in reporting code figures 36, 37, 38, and 39, which may be desirable within certain regions, shall be obtained by means of national instructions. [12.2.6.4.12]

B/C 10.8.1.5.13

A visibility restriction « less than 1000 meters » shall be applied to code figures 42 – 49. In the case of code figures 40 or 41, the apparent visibility in the fog or ice fog patch or bank shall be less than 1000 meters. Code figures 40 – 47 shall be used when the obstructions to vision consist predominantly of water droplets or ice crystals, and 48 or 49 when the obstructions consist predominantly of water droplets. [12.2.6.4.13]

B/C 10.8.1.5.14

When referring to precipitation, the phrase « at the station » in the code table shall mean « at the point where the observation is normally taken ». [12.2.6.4.14]

B/C 10.8.1.5.15

The precipitation shall be encoded as intermittent if it has been discontinuous during the preceding hour, without presenting the character of a shower. [12.2.6.4.15]

B/C 10.8.1.5.16

The intensity of precipitation shall be determined by the intensity at the time of the observation. [12.2.6.4.16]

B/C 10.8.1.5.17

Code figures 80 – 89 shall be used only when the precipitation is of the shower type and takes place at the time of the observation.

Note:

(1) Showers are produced by convective clouds. They are characterized by their abrupt beginning and end and by the generally rapid and sometimes great variations in the intensity of the precipitation. Drops and solid particles falling in a shower are generally larger than those falling in non-showery precipitation. Between showers openings may be observed unless stratiform clouds fill the intervals between the cumuliform clouds. [12.2.6.4.17]

B/C 10.8.1.5.18

In reporting code figure 98, the observer shall be allowed considerable latitude in determining whether precipitation is or is not occurring, if it is not actually visible. [12.2.6.4.18]

B/C 10.8.1.6 Present weather from an automatic weather station

B/C 10.8.1.6.1

The highest applicable code figure shall be selected. [12.2.6.5.1]

B/C 10.8.1.6.2

In coding code figures 101, 102, and 103, there is no limitation on the magnitude of the change of the cloud amount. Code figures 100, 101, and 102 can each be used when the sky is clear at the time of observation. In this case, the following interpretation of the specifications shall apply:

- Code figure 100 is used when the preceding conditions are not known;
- Code figure 101 is used when the clouds have dissolved during the past hour;
- Code figure 102 is used when the sky has been continuously clear during the past hour. [12.2.6.5.2]

B/C 10.8.1.6.3

When the phenomenon is not predominantly water droplets, the appropriate code figure shall be selected without regard to the visibility. [12.2.6.5.3]

B/C 10.8.1.6.4

The code figures 104 and 105 shall be used when the obstruction to vision consists predominantly of lithometeors. [12.2.6.5.4]

B/C 10.8.1.6.5

The visibility restriction on code figure 110 shall be 1000 meters or more. The specification refers only to water droplets and ice crystals. [12.2.6.5.5]

B/C 10.8.1.6.6

For code figure 118, the following criteria for reporting squalls shall be used :

A sudden increase of wind speed of at least eight meters per second, the speed rising to 11 meters per second or more and lasting for at least one minute. [12.2.6.5.6]

B/C 10.8.1.6.7

Code figures 120 – 126 shall never be used when precipitation is observed at the time of observation. [12.2.6.5.7]

B/C 10.8.1.6.8

For code figure 120, visibility shall have been less than 1000 meters.

Note: The specification refers only to visibility restrictions, which occurred as a result of water droplets or ice crystals. [12.2.6.5.8]

B/C 10.8.1.6.9

For synoptic coding purposes, a thunderstorm shall be regarded as being at the station from the time thunder is first detected, whether or not lightning is detected or precipitation is occurring at the station. A thunderstorm shall be reported in present weather if thunder is detected within the normal observational period preceding the time of the report. A

thunderstorm shall be regarded as having ceased at the time thunder is last detected and the cessation is confirmed if thunder is not detected for 10 – 15 minutes after this time. [12.2.6.5.9]

B/C 10.8.1.6.10

A visibility restriction « less than 1000 meters » shall be applied to code figures 130 – 135. [12.2.6.5.10]

B/C 10.8.1.6.11

The precipitation shall be encoded as intermittent if it has been discontinuous during the preceding hour, without presenting the character of a shower. [12.2.6.5.11]

B/C 10.8.1.6.12

The intensity of precipitation shall be determined by the intensity at the time of observation. [12.2.6.5.12]

B/C 10.8.1.6.13

Code figures 180 – 189 shall be used only when the precipitation is intermittent or of the shower type and takes place at the time of observation.

Note:

(1) Showers are produced by convective clouds. They are characterized by their abrupt beginning and end and by the generally rapid and sometimes great variations in the intensity of the precipitation. Drops and solid particles falling in a shower are generally larger than those falling in non-showery precipitation. Between showers openings may be observed unless stratiform clouds fill the intervals between the cumuliform clouds. [12.2.6.5.13]

B/C 10.8.1.7 Past weather reported from a manned weather station

B/C 10.8.1.7.1 Time period

The time period (0 04 024) covered by past weather (1) and past weather (2) shall be expressed as *a negative value* in hours:

(a) Six hours, for observations at 0000, 0600, 1200, and 1800 UTC;
(b) Three hours for observations at 0300, 0900, 1500, and 2100 UTC;
(c) Two hours for intermediate observations if taken every two hours.
(d) *One hour* for intermediate observations if taken every hour. [12.2.6.6.1]

B/C 10.8.1.7.2

The code figures for past weather (1) and past weather (2) shall be selected in such a way that past and present weather together give as complete a description as possible of the weather in the time interval concerned. For example, if the type of weather undergoes a complete change during the time interval concerned, the code figures selected for past weather (1) and past weather (2) shall describe the weather prevailing before the type of weather indicated by present weather began. [12.2.6.6.2]

B/C 10.8.1.7.3

When the past weather (1) and past weather (2) are used in hourly reports, Regulation B/C 10.8.1.7.1 (d) shall apply. [12.2.6.6.3]

B/C 10.8.1.7.4

If, using Regulation B/C 10.8.1.7.2, more than one code figure may be given to past weather (1), the highest figure shall be reported for past weather (1) and the second highest code figure shall be reported for past weather (2). [12.2.6.6.4]

B/C 10.8.1.7.5

If the weather during the period has not changed so that only one code figure may be selected for past weather, then that code figure shall be reported for both past weather (1) and past weather (2). [12.2.6.6.5]

B/C 10.8.1.8 Past weather reported from an automatic weather station

B/C 10.8.1.8.1 Time period

The time period (0 04 024) covered by past weather (1) and past weather (2) shall be expressed as *a negative value* in hours:

(a) Six hours for observations at 0000, 0600, 1200, and 1800 UTC;

(b) Three hours for observations at 0300, 0900, 1500, and 2100 UTC;
(c) Two hours for intermediate observations if taken every two hours.
(d) *One hour* for intermediate observations if taken every hour. [12.2.6.7.1]

B/C 10.8.1.8.2

The code figures for past weather (1) and past weather (2) shall be selected so that the maximum capability of the automatic station to discern past weather is utilized, and so that past and present weather together give as complete a description as possible of the weather in the time interval concerned. [12.2.6.7.2]

B/C 10.8.1.8.3

In cases where the automatic station is capable only of discerning very basic weather conditions, the lower code figures representing basic and generic phenomena may be used. If the automatic station has higher discrimination capabilities, the higher code figures representing more detailed explanation of the phenomena shall be used. For each basic type of phenomenon, the highest code figure within the discrimination capability of the automatic station shall be reported. [12.2.6.7.3]

B/C 10.8.1.8.4

If the type of weather during the time interval concerned undergoes complete and discernible changes, the code figures selected for past weather (1) and past weather (2) shall describe the weather prevailing before the type of weather indicated by present weather began. The highest figure shall be reported for past weather (1) and the second highest code figure shall be reported for past weather (2). [12.2.6.7.4]

B/C 10.8.1.8.5

If a discernible change in weather has not occurred during the period, so that only one code figure may be selected for the past weather, then that code figure shall be reported for both past weather (1) and past weather (2). For example, rain during the entire period shall be reported as code figure 14 for both past weather (1) and past weather (2) in the case of an automatic station incapable of differentiating types of precipitation, or code figure 16 for both past weather (1) and past weather (2) in the case of a station with the higher discrimination capability. [12.2.6.7.5]

B/C 10.8.2 Precipitation measurement <3 02 040>

B/C 10.8.2.1 Height of sensor above marine deck platform

Height of sensor above marine deck platform (0 07 032) for precipitation measurement shall be reported in meters (with precision in hundredths of a meter).
This datum represents the actual height of the rain gauge rim above marine deck platform at the point where the rain gauge is located.

B/C 10.8.2.2 Period of reference for amount precipitation

Time period (0 04 024) for amount of precipitation shall be reported as *a negative value* in hours. It shall be determined
(a) by regional decision (e.g. -6, -12, -24) in the first replication,
(b) by national decision (e.g. -1, -3) in the second replication.

B/C 10.8.2.3 Total amount of precipitation

Total amount of precipitation, which has fallen during the period of reference for amount of precipitation, shall be reported in kilograms per square meter (with precision in tenths of a kilogram per square meter).

B/C 10.8.2.3.1

Precipitation, when it can be and has to be reported, shall be reported as 0.0 kgm^{-2} if no precipitation were observed during the referenced period. [12.2.5.4]

B/C 10.8.2.3.2

Trace shall be reported as "- 0.1 kgm^{-2} ".

B/C 10.8.3 Extreme temperature data <3 02 058>

B/C 10.8.3.1 Height of sensor above marine deck platform and height of sensor above water surface

Height of sensor above marine deck platform (0 07 032) for temperature measurement shall be reported in meters (with precision in hundredths of a meter).
This datum represents the actual height of temperature sensors above marine deck platform at the point where the sensors are located.

Height of sensor above water surface (0 07 033) for temperature measurement shall be reported in meters (with precision in hundredths of a meter).
This datum represents the actual height of temperature sensors above marine water surface of sea or lake.

B/C 10.8.3.2 Periods of reference for extreme temperatures

Time period for maximum temperature and time period for minimum temperature (0 04 024) shall be determined by regional decision and reported as *negative values* in hours. [12.4.4]
Notes:

(1) If the period for maximum temperature or the period for minimum temperature ends at the nominal time of report, the second value of 0 04 024 shall be reported as 0.

(2) If the period for maximum temperature or the period for minimum temperature does not end at the nominal time of report, the first value of 0 04 024 shall indicate the beginning of the period of reference and the second value of 0 04 024 shall indicate the end of the period of reference. E.g. to report the maximum temperature for the previous calendar day from a station in RA IV, value of the first 0 04 024 shall be set to – 30 and value of the second 0 04 024 shall be set to – 6, provided that the nominal time of the report 12 UTC corresponds to 6 a.m. local time.

B/C 10.8.3.3 Maximum and minimum temperature

Maximum and minimum temperature shall be reported in degrees Kelvin (with precision in hundredths of a degree Kelvin); if produced in CREX, in degrees Celsius (with precision in hundredths of a degree Celsius).
Note:

(1) Notes (1) and (2) under Regulation B/C 10.4.1.2 shall apply.

B/C 10.8.4 Wind data <3 02 059>

B/C 10.8.4.1 Height of sensor above marine deck platform and height of sensor above water surface

Height of sensor above marine deck platform (0 07 032) for wind measurement shall be reported in meters (with precision in hundredths of a meter).
This datum represents the actual height of wind sensors above marine deck platform at the point where the sensors are located.

Height of sensor above water surface (0 07 033) for wind measurement shall be reported in meters (with precision in hundredths of a meter).
This datum represents the actual height of wind sensors above marine water surface of sea or lake.

B/C 10.8.4.2 Type of instrumentation for wind measurement - Flag table 0 02 002

This datum shall be used to specify whether the wind speed was measured by certified instruments (bit No. 1 set to 1) or estimated on the basis of the Beaufort wind scale (bit No. 1 set to 0), and to indicate the original units for wind speed measurement. Bit No. 2 set to 1 indicates that wind speed was originally measured in knots and bit No. 3 set to 1 indicates that wind speed was originally measured in kilometers per hour. Setting both bits No.2 and No.3 to 0 indicates that wind speed was originally measured in meters per second.

B/C 10.8.4.3 Wind direction and speed

The mean direction and speed of the wind over the 10-minute period immediately preceding the observation shall be reported. The time period (0 04 025) shall be included as -10. However, when the 10-minute period includes a discontinuity in the wind characteristics, only data obtained after the discontinuity shall be used for reporting the mean values, and hence the period (0 04 025) in these circumstances shall be correspondingly reduced. [12.2.2.3.1]

The time period is preceded by a time significance qualifier (0 08 021) that shall be set to 2 (Time averaged).

The wind direction (0 11 001) shall be reported in degrees true and the wind speed (0 11 002) shall be reported in meters per second (with precision in tenths of a meter per second).

B/C 10.8.4.3.1

In the absence of wind instruments, the wind speed shall be estimated on the basis of the Beaufort wind scale. The Beaufort number obtained by estimation is converted into meters per second by use of the relevant wind speed equivalent column on the Beaufort scale, and this speed is reported for wind speed. [12.2.2.3.2]

B/C 10.8.4.4 Maximum wind gust direction and speed

Time period for maximum wind gust direction and speed (0 04 025) shall be determined by regional or national decision and reported as a negative value in minutes.

Direction of the maximum wind gust (0 11 043) shall be reported in degrees true and speed of the maximum wind gust (0 11 041) shall be reported in meters per second (with precision in tenths of meters per second).

B/C 10.9 "Period" data required by regional or national reporting practices

If regional reporting practices in a Region require inclusion of additional "period" parameters, the corresponding "regional" common sequence (see the Annex) shall be supplemented by relevant descriptors. If national reporting practices require inclusion of additional "period" parameters, the common sequence 3 08 009 shall be supplemented by relevant descriptors.

Note:

(1) "Period" parameter is a parameter that is coupled to a time period descriptor, e.g. 0 04 024, 0 04 025.

(2) No additional "period" parameters are currently required by regional regulations for SHIP data in Manual on Codes, WMO-No. 306, Volume II.

B/C20 – Regulations for reporting PILOT, PILOT SHIP and PILOT MOBIL data in TDCF

General

A BUFR (or CREX) message should be sent when level the 100 hPa is reached. In any case, a BUFR (or CREX) message shall be produced when the sounding is completed containing data from the entire sounding.

BUFR templates for wind vertical profiles suitable for PILOT, PILOT SHIP and PILOT MOBIL observation data:

TM 309050 - BUFR template for wind vertical profiles with pressure as the vertical coordinate

3 09 050		**Sequence for representation PILOT, PILOT SHIP and PILOT MOBIL observation type data with pressure as the vertical coordinate**
	3 01 110	Identification of launch site and instrumentation for wind measurement
	3 01 113	Date/time of launch
	3 01 114	Horizontal and vertical coordinates of launch site
	1 01 000	Delayed replication of 1 descriptor
	0 31 002	Extended delayed descriptor replication factor
	3 03 050	Wind data at a pressure level
	1 01 000	Delayed replication of 1 descriptor
	0 31 001	Delayed descriptor replication factor
	3 03 051	Wind shear data at a pressure level

TM 309051 - BUFR template for wind vertical profiles with height as the vertical coordinate

3 09 051		**Sequence for representation PILOT, PILOT SHIP and PILOT MOBIL observation type data with height as the vertical coordinate**
	3 01 110	Identification of launch site and instrumentation for wind measurement
	3 01 113	Date/time of launch
	3 01 114	Horizontal and vertical coordinates of launch site
	1 01 000	Delayed replication of 1 descriptor
	0 31 002	Extended delayed descriptor replication factor
	3 03 052	Wind data at a height level
	1 01 000	Delayed replication of 1 descriptor
	0 31 001	Delayed descriptor replication factor
	3 03 053	Wind shear data at a height level

BUFR template TM 309050 for wind vertical profiles *(with pressure as the vertical coordinate)* is further expanded as follows:

3 01 110		**Identification of launch site and instrumentation**	
	3 01 001	WMO block number	Numeric
		WMO station number	Numeric
	0 01 011	Ship or mobile land station identifier	CCITT IA5
	0 02 011	Radiosonde type	Code table
	0 02 014	Tracking technique/status of system used	Code table
	0 02 003	Type of measuring equipment used	Code table
3 01 113		**Date/time of launch**	
	0 08 021	Time significance (= 18 (launch time))	Code table
	3 01 011	Year	Year

		Month	Month
		Day	Day
	3 01 013	Hour	Hour
		Minute	Minute
		Second	Second
3 01 114		**Horizontal and vertical coordinates of launch site**	
	3 01 021	Latitude (high accuracy)	Degree, scale 5
		Longitude (high accuracy)	Degree, scale 5
	0 07 030	Height of station ground above mean sea level	m, scale 1
	0 07 031	Height of barometer above mean sea level	m, scale 1
	0 07 007	Height of release of sonde above mean sea level	m
	0 33 024	Station elevation quality mark (for mobile stations)	Code table
		Wind data at pressure levels	
1 01 000		Delayed replication of 1 descriptor	
0 31 002		Extended delayed descriptor replication factor	Numeric
3 03 050		**Wind data at a pressure level**	
	0 04 086	Long time period or displacement (since launch time)	Second
	0 08 042	Extended vertical sounding significance	Flag table
	0 07 004	Pressure	Pa, scale –1
	0 05 015	Latitude displacement since launch site (high accuracy)	Degree, scale 5
	0 06 015	Longitude displacement since launch site (high accuracy)	Degree, scale 5
	0 11 001	Wind direction	Degree true
	0 11 002	Wind speed	m s^{-1}, scale 1
		Wind shear data	
1 01 000		Delayed replication of 1 descriptor	
0 31 001		Delayed descriptor replication factor	Numeric
3 03 051		**Wind shear data at a pressure level**	
	0 04 086	Long time period or displacement (since launch time)	Second
	0 08 042	Extended vertical sounding significance	Flag table
	0 07 004	Pressure	Pa, scale –1
	0 05 015	Latitude displacement since launch site (high accuracy)	Degree, scale 5
	0 06 015	Longitude displacement since launch site (high accuracy)	Degree, scale 5
	0 11 061	Absolute wind shear in 1 km layer below	m s^{-1}, scale 1
	0 11 062	Absolute wind shear in 1 km layer above	m s^{-1}, scale 1

Notes:

(1) Time of launch 3 01 013 shall be reported with the highest possible accuracy available. If the launch time is not available with second accuracy, the entry for seconds shall be put to zero.

(2) Long time displacement 0 04 086 represents the time offset from the launch time 3 01 013 (in seconds).

(3) Latitude displacement 0 05 015 represents the latitude offset from the latitude of the launch site. Longitude displacement 0 06 015 represents the longitude offset from the longitude of the launch site.

(4) If maximum wind data and/or wind shear data are reported with height as the vertical coordinate in Parts A or C of Pilot report, while the whole vertical wind profile is reported with pressure as the vertical coordinate, the data may be converted into BUFR using sequence 3 09 050 because the maximum wind data are as significant levels also included in Parts B or D (being identified by pressure as the vertical coordinate), provided that Part B and D are available when the entire wind profile is produced in BUFR or CREX.

BUFR template 3 09 051 for wind vertical profiles *(with height as the vertical coordinate)* is further expanded as follows:

3 01 110		**Identification of launch site and instrumentation for wind measurements**	
	3 01 001	WMO block number	Numeric
		WMO station number	Numeric
	0 01 011	Ship or mobile land station identifier	CCITT IA5
	0 02 011	Radiosonde type	Code table
	0 02 014	Tracking technique/status of system used	Code table
	0 02 003	Type of measuring equipment used	Code table
3 01 113		**Date/time of launch**	
	0 08 021	Time significance (= 18 (launch time))	Code table
	3 01 011	Year	Year
		Month	Month
		Day	Day
	3 01 013	Hour	Hour
		Minute	Minute
		Second	Second
3 01 114		**Horizontal and vertical coordinates of launch site**	
	3 01 021	Latitude (high accuracy)	Degree, scale 5
		Longitude (high accuracy)	Degree, scale 5
	0 07 030	Height of station ground above mean sea level	m, scale 1
	0 07 031	Height of barometer above mean sea level	m, scale 1
	0 07 007	Height of release of sonde above mean sea level	m
	0 33 024	Station elevation quality mark (for mobile stations)	Code table
		Wind data at heights	
1 01 000		Delayed replication of 1 descriptor	
0 31 002		Extended delayed descriptor replication factor	Numeric
3 03 052		**Wind data at a height level**	
	0 04 086	Long time period or displacement (since launch time)	Second
	0 08 042	Extended vertical sounding significance	Flag table
	0 07 009	Geopotential height	gpm
	0 05 015	Latitude displacement since launch site (high accuracy)	Degree, scale 5
	0 06 015	Longitude displacement since launch site (high accuracy)	Degree, scale 5
	0 11 001	Wind direction	Degree true
	0 11 002	Wind speed	m s^{-1}, scale 1
		Wind shear data at heights	
1 01 000		Delayed replication of 1 descriptor	
0 31 001		Delayed descriptor replication factor	Numeric
3 03 053		**Wind shear data at a height level**	
	0 04 086	Long time period or displacement (since launch time)	Second
	0 08 042	Extended vertical sounding significance	Flag table
	0 07 009	Geopotential height	gpm
	0 05 015	Latitude displacement since launch site (high accuracy)	Degree, scale 5
	0 06 015	Longitude displacement since launch site (high accuracy)	Degree, scale 5
	0 11 061	Absolute wind shear in 1 km layer below	m s^{-1}, scale 1
	0 11 062	Absolute wind shear in 1 km layer above	m s^{-1}, scale 1

Notes:

(1) Time of launch 3 01 013 shall be reported with the highest possible accuracy available. If the launch time is not available with second accuracy, the entry for seconds shall be put to zero.

(2) Long time displacement 0 04 086 represents the time offset from the launch time 3 01 013 (in seconds)

(3) Latitude displacement 0 05 015 represents the latitude offset from the latitude of the launch site. Longitude displacement 0 06 015 represents the longitude offset from the longitude of the launch site.

Regulations:

B/C 20.1 Section 1 of BUFR or CREX

B/C 20.1.1 Entries required in Section 1 of BUFR

The following entries shall be included in BUFR Section 1:

- BUFR master table,
- identification of originating/generating centre,
- identification of originating/generating sub-centre,
- update sequence number,
- identification of inclusion of optional section,
- data category (= 002 for all PILOT type data),
- international data sub-category (1), (2),
- local data subcategory,
- version number of master table,
- version number of local tables,
- year (year of the century up to BUFR edition 3),
- month (standard time),
- day (standard time = YY in the abbreviated telecommunication header for all PILOT type data),
- hour (standard time = GG in the abbreviated telecommunication header for all PILOT type data),
- minute (standard time = 00 for all PILOT type data).

- Notes:

(1) Inclusion of this entry is required starting with BUFR edition 4.

(2) If required, the international data sub-category shall be included at all observation times as follows:
= 001 for PILOT data,
= 002 for PILOT SHIP data,
= 003 for PILOT MOBIL data.

B/C 20.1.2 Entries required in Section 1 of CREX

The following entries shall be included in CREX Section 1:

- CREX master table,
- CREX edition number,
- CREX table version number,
- version number of BUFR master table (1),
- version number of local tables (1),
- data category (= 002 for all PILOT type data),
- international data sub-category (1), (2),

- identification of originating/generating centre (1),
- identification of originating/generating sub-centre (1),
- update sequence number (1),
- number of subsets (1),
- year (standard time) (1),
- month (standard time) (1),
- day (standard time = YY in the abbreviated telecommunication header for all PILOT type data) (1),
- hour (standard time = GG in the abbreviated telecommunication header for all PILOT type data) (1),
- minute (standard time = 00 for all PILOT type data) (1).

Notes:
(1) Inclusion of these entries is required starting with CREX edition 2.
(2) If inclusion of international data sub-category is required, Note (2) under B/C 20.1.1 applies.

B/C 20.2 Identification of launch site and instrumentation <3 01 110>

B/C 20.2.1 Identification of launch site

WMO block number station (0 01 001) and WMO station number (0 01 002) shall be always reported as a non-missing value in reports from a fixed land station.

Ship or mobile land station identifier (0 01 011) shall be always reported not exceeding 9 characters in reports from ships or mobile stations. [32.2.1]

B/C 20.2.1 Instrumentation for wind measurement

Radiosonde type (Code table 0 02 011), tracking techniques/status of system used (Code table 0 02 014) and type of measuring equipment used (Code table 0 02 003) shall be reported.

B/C 20.3 Date/time of launch <3 01 113>

Time significance (0 08 021) shall be always set to 18 to indicate that the following entries specify the date and time of launching the radiosonde.

Date of launch <3 01 011> and time of launch <3 01 013> shall be reported, i.e. year (0 04 001), month (0 04 002), day (0 04 003)> and hour (0 04 004), minute (0 04 005) and second (0 04 006) of the actual time of launch shall be reported.
Note:
(1) Time of launch <3 01 013> shall be reported with the highest possible accuracy available. If the launch time is not available with second accuracy, the entry 0 04 006 for seconds shall be set to zero.

B/C 20.4 Horizontal and vertical coordinates of launch site <3 01 114>

Latitude (0 05 001) and longitude (0 06 001) of the launch site shall be reported in degrees with precision in 10^{-5} of a degree.

Height of station ground above mean sea level (0 07 030) and height of barometer above mean sea level (0 07 031) shall be reported in meters with precision in tenths of a meter.

Height of release of sonde above mean sea level (0 07 007) shall be reported in meters.

Station elevation quality mark (Code table 0 33 024) shall be reported to indicate the accuracy of the vertical coordinates of the mobile land station. Fixed land stations and sea stations shall report this datum as a missing value. [32.2.1]

B/C 20.5 Wind data at pressure levels

Wind data at pressure levels shall be always reported using *template TM 309050* and shall be included in descending order with respect to pressure. Data at each pressure

level shall be included only once. For example, if a significant level with respect to wind and a standard level coincide, data for that level shall be included only once, the multiple attributes being indicated by Extended vertical sounding significance (Flag table 0 08 042) as specified in Regulation B/C 20.5.2.2.

Note:

(1) If data are produced and collected in traditional PILOT codes, the order of pressure levels may correspond to the order of levels in Parts A, B, C and D, when converted into BUFR or CREX. In this case, data at a level may be included more than once.

B/C 20.5.1 Number of reported pressure levels

The number of reported pressure levels shall be indicated by Extended delayed descriptor replication factor 0 31 002 in BUFR and by a four-digit number in the Data Section corresponding to the position of the replication descriptor in the Data Description Section of CREX.

Notes:

(1) The number of pressure levels shall never be set to a missing value.

(2) The number of pressure levels shall be set to a positive value in a NIL report.

B/C 20.5.1.1

All required data from the entire ascent shall be reported in a BUFR (or CREX) message that shall be produced when the sounding is completed. In interest of timely data delivery, however, a BUFR (or CREX) message should be sent when level 100 hPa is reached.

B/C 20.5.2 Wind data at a pressure level <3 03 050>

B/C 20.5.2.1 Long time displacement (since launch time)

Long time displacement (0 04 086) represents the time offset from the launch time specified in Regulation 20.3, and shall be reported in seconds if available.

B/C 20.5.2.2 Extended vertical sounding significance – Flag table 0 08 042

This datum shall be used to specify vertical sounding significance in the following way:

(a) Bit No. 1 set to 1 indicates surface (see Regulation B/C 20.7.1).

(b) Bit No. 2 set to 1 indicates a standard level (see Regulation B/C 20.7.2).

(c) Bit No. 4 set to 1 indicates a maximum wind level (see Regulation B/C 20.7.3).

(d) Bit No. 7 set to 1 indicates a level significant with respect to wind (see Regulation B/C 20.7.4).

(e) Bit No. 12 set to 1 indicates beginning of missing wind data bit No. 13 set to 1 indicates end of missing wind data (see Regulation B/C 20.7.5).

(f) Bit No. 14 set to 1 indicates the top of wind sounding.

(g) Bit No. 15 set to 1 indicates a level determined by regional decision.

(h) Bit No. 17 set to 1 indicates a pressure level originally identified by height as the vertical coordinate.

(i) All bits set to 0 indicate a level determined by national decision.

(j) All bits set to 1 indicate a missing value.

B/C 20.5.2.3 Pressure

Pressure (0 07 004) shall be reported in pascals (with precision in tens of a pascal).

Notes:

(1) Pressure as the vertical coordinate shall be used when template TM 309050 is applied.

(2) Pressure as the only vertical coordinate shall be used in a report. [32.3.1.4]

B/C 20.5.2.4 Latitude and longitude displacements

Latitude displacement (0 05 015) represents the latitude offset from the latitude of the launch site specified in Regulation 20.4, and shall be reported in degrees with precision in 10^{-5} of a degree if available. Longitude displacement 0 06 015 represents the

longitude offset from the longitude of the launch site specified in Regulation 20.4, and shall be reported in degrees with precision in 10^{-5} of a degree if available.

B/C 20.5.2.5 Wind direction and speed

The wind direction (0 11 001) shall be reported in degrees true and the wind speed (0 11 002) shall be reported in meters per second (with precision in tenths of a meter per second).

B/C 20.6 Wind data at height levels

Wind data at height levels shall be always reported using *template TM 309051* and shall be included in ascending order with respect to altitude. Data at each height level shall be included only once. For example, if a significant level with respect to wind and a standard level coincide, data for that level shall be included only once, the multiple attributes being indicated by Extended vertical sounding significance (Flag table 0 08 042) as specified in Regulation B/C 20.5.2.2.

Note:

(1) If data are produced and collected in traditional PILOT codes, the order of height levels may correspond to the order of levels in Parts A, B, C and D, when converted into BUFR or CREX. In this case, data at a level may be included more than once.

B/C 20.6.1 Number of reported height levels

The number of reported height levels shall be indicated by Extended delayed descriptor replication factor 0 31 002 in BUFR and by a four-digit number in the Data Section corresponding to the position of the replication descriptor in the Data Description Section of CREX.

Notes:

(1) The number of height levels shall never be set to a missing value.

(2) The number of height levels shall be set to a positive value in a NIL report.

B/C 20.6.1.1

Regulation B/C 20.5.1.1 shall apply.

B/C 20.6.2 Wind data at a height level <3 03 052>

B/C 20.6.2.1 Long time displacement (since launch time)

Long time displacement (0 04 086) represents the time offset from the launch time specified in Regulation 20.3, and shall be reported in seconds if available.

B/C 20.6.2.2 Extended vertical sounding significance – Flag table 0 08 042

Regulation B/C 20.5.2.2 shall apply.

B/C 20.6.2.3 Geopotential height

Geopotential height of the level (0 07 009) shall be reported in geopotential meters.

Notes:

(1) Geopotential height as the vertical coordinate shall be used when template TM 309051 is applied.

(2) Geopotential height as the only vertical coordinate shall be used in a report. [32.3.1.4]

B/C 20.6.2.4 Latitude and longitude displacements

Regulation B/C 20.5.2.4 shall apply.

B/C 20.6.2.5 Wind direction and speed

Regulation B/C 20.5.2.5 shall apply.

B/C 20.7 Criteria for reporting standard and significant levels

B/C 20.7.1 Surface

The surface level shall be always reported.

Note:

(1) The value of Extended vertical sounding significance 0 08 042 at the surface level shall indicate that this level is also a level significant with respect to wind, i.e. bit No.1 and also bit No. 7 shall be set to 1.

B/C 20.7.2 Standard levels

B/C 20.7.2.1

The standard levels of 850, 700, 500, 400, 300, 250, 200, 150, 100, 70, 50, 30, 20 and 10 hPa shall be reported in descending order with respect to pressure (in ascending order with respect to altitude). [32.2.2.1]

B/C 20.7.2.2

When pressure measurements are not available, wind data shall be reported using geopotential approximations to the standard isobaric surfaces. [32.2.2.2]

B/C 20.7.2.3

When wind data at a standard level are not available, the corresponding entries for that level shall be reported as missing values. [32.2.2.3]

B/C 20.7.2.4

When the standard levels are located by means of pressure equipment and if the pressure element failed during the ascent, the remaining standard levels to be reported shall be indicated by 0 08 042 - bit No. 2 set to 1 (standard level) and by bit No. 17 set to 1 (a pressure level originally identified by height as the vertical coordinate) [32.2.2.4]

B/C 20.7.3 Maximum wind level(s)

B/C 20.7.3.1

When a maximum wind level (one or more) is reported, the corresponding number of levels shall be included in the report indicated by 0 08 042 - bit No. 4 set to 1. [32.2.3.3]

Notes:

(1) Criteria for determining maximum wind levels are given in Regulations B/C 20.7.3.3 and B/C 20.7.3.4 below.

(2) As a maximum wind level is also a level significant with respect to wind, bit No. 7 as well as bit No. 4 shall be set to 1 in the Extended vertical sounding significance 0 08 042.

B/C 20.7.3.2

When no maximum wind level is observed, no level shall be indicated by bit No. 4 of 0 08 042 set to 1. [32.2.3.4.5]

B/C 20.7.3.3

A maximum wind level:

(a) Shall be determined by consideration of the list of significant levels for wind speed, as obtained by means of the relevant recommended or equivalent national method (see Note under Regulation B/C 20.7.4.2) and *not* by consideration of the original wind-speed curve;

(b) Shall be located above the 500-hPa isobaric surface and shall correspond to a speed of more than 30 meters per second.

Note:

(1) A maximum wind level is defined as a level at which the wind speed is greater than that observed immediately above and below that level. [32.2.3.1]

B/C 20.7.3.4

Whenever more than one maximum wind level exists, these levels shall be reported as follows:

(a) The level of greatest maximum wind speed shall be always included;

(b) The other levels shall be included in the report only if their speed exceeds those of the two adjacent minima by at least 10 meters per second;

(c) Furthermore, the highest level attained by the sounding shall be indicated as a maximum wind level, provided:

(i) It satisfies the criteria set forth in Regulation B/C 20.7.3.3 above;
(ii) It constitutes the level of the greatest speed of the whole sounding. [32.2.3.2]

B/C 20.7.3.5

When the greatest wind speed observed throughout the sounding occurred at the top of the sounding, this level shall be indicated by 0 08 042 - bit No. 4 set to 1 (maximum wind level), bit No. 7 set to 1 (level significant with respect to wind) and bit No. 14 set to 1 (top of wind sounding). [32.2.3.4.3], [32.2.3.4.4]

B/C 20.7.3.6

In compliance with Regulation B/C 20.5.2.3 or B/C 20.6.2.3, maximum wind level data shall be reported with the same vertical coordinate as the other data in the profile, using template TM 309050 or template TM 309051 for the entire sounding.

Note:

(1) If data are produced and collected in traditional PILOT codes, maximum wind data may be reported with height as the vertical coordinate in Parts A or C of Pilot report, while the whole vertical wind profile is reported with pressure as the vertical coordinate. Even in this case, the maximum wind data may be converted into BUFR using sequence 3 09 050 because the maximum wind data were selected from the list of significant levels with respect to wind. And these significant levels are included in Parts B or D of Pilot report, identified by pressure as the vertical coordinate. [32.3.1.4]

B/C 20.7.4 Levels significant with respect to wind

B/C 20.7.4.1

Significant wind levels shall be chosen so that the data from them *alone* shall make it possible to reconstruct the wind profile with sufficient accuracy for practical use. [32.3.1.1]

B/C 20.7.4.2

Criteria for determining significant levels with respect to changes in wind speed and direction:

(a) The direction of speed curves (in function of the log of pressure or altitude) can be reproduced with their prominent characteristics;
(b) These curves can be reproduced with the accuracy of at least 10 for direction and five meters per second for speed;

Note:

To satisfy these criteria, the following method of successive approximations is recommended, but other methods of attaining equivalent results may suit some national practices better and may be used:

(i) The surface level and highest level for which wind data are available constitute the first and the last significant levels.
The deviation from the linearly interpolated values between these two levels is then considered. If no direction deviates by more than 10 and no speed by more than five meters per second, no other significant level need be reported. Whenever one parameter deviates by more than the limit specified in paragraph (b) above the level of greatest deviation becomes a supplementary significant level for both parameters.
(ii) The additional significant levels so introduced divide the sounding into two layers. In each separate layer, the deviation from the linearly interpolated values between the base and the top are then considered. The process used in paragraph (i) above is repeated and yields other significant levels. These additional levels in turn modify the layer distribution, and the method is applied again until any level is approximated to the above-mentioned specified values. [32.3.1.1]

B/C 20.7.5 Beginning and end of missing wind data

B/C 20.7.5.1

If wind profile data are reported with pressure as the vertical coordinate, a layer for which wind data are missing shall be indicated by reporting the boundary levels of the layer, provided that the layer is at least 50 hPa thick. The boundary levels are the levels closest to the bottom and the top of the layer for which the observed data are available. The boundary levels are not required to meet “significant wind level” criteria. [32.3.1.5.2]

B/C 20.7.5.2

If wind profile data are reported with height as the vertical coordinate, a layer for which wind data are missing shall be indicated by reporting the boundary levels of the layer, provided that the layer is at least 1 500 geopotential meters thick. The boundary levels are the levels closest to the bottom and the top of the layer for which the observed data are available. The boundary levels are not required to meet "significant wind level" criteria. [32.3.1.5.1]

B/C 20.8 Wind shear data at pressure levels

B/C 20.8.1 Number and order of levels for which wind shear is reported

B/C 20.8.1.1

The number of levels with wind shear data shall be indicated by Delayed descriptor replication factor 0 31 001 in BUFR and by a four-digit number in the Data Section corresponding to the position of the replication descriptor in the Data Description Section of CREX.

Notes:

(1) The number of levels with wind shear data shall never be set to a missing value.

(2) The number of levels with wind shear data shall be set to a positive value in a NIL report.

(3) The number of levels with wind shear data shall be set to zero if data for vertical wind shear are not computed and required. [32.2.3.5]

B/C 20.8.1.2

Whenever wind shear data are reported for more than one level, these maximum wind levels shall be included in the same order as in the sequence <3 03 050>, i.e. in descending order with respect to pressure.

B/C 20.8.2 Wind shear data at a pressure level <3 03 051>

B/C 20.8.2.1 Long time displacement (since launch time)

Long time displacement (0 04 086) represents the time offset from the launch time specified in Regulation 20.3, and shall be reported in seconds if available.

B/C 20.8.2.2 Extended vertical sounding significance – Flag table 0 08 042

A level, for which wind shear data are reported, shall be indicated by vertical sounding significance 0 08 042 - bit No. 4 set to 1 (maximum wind level) and by bit No. 7 set to 1 (level significant with respect to wind). Moreover, if the top of the wind sounding corresponds to the highest wind speed observed throughout the ascent, this level shall be indicated also by bit No. 14 set to 1 (top of wind sounding).

B/C 20.8.2.3 Pressure

Pressure (0 07 004) shall be reported in pascals with precision in tens of a pascal.

B/C 20.8.2.4 Latitude and longitude displacements

Latitude displacement (0 05 015) represents the latitude offset from the latitude of the launch site specified in Regulation 20.4, and shall be reported in degrees with precision in 10^{-5} of a degree if available. Longitude displacement 0 06 015 represents the longitude offset from the longitude of the launch site specified in Regulation 20.4, and shall be reported in degrees with precision in 10^{-5} of a degree if available.

B/C 20.8.2.5 Wind shear data

Absolute wind shear in 1 km layer below (0 11 061) and absolute wind shear in 1 km layer above (0 11 062) shall be reported in meters per second (with precision in tenths of a meter per second), if data for vertical wind shear are computed and required. [32.2.3.5]

B/C 20.9 Wind shear data at heights

B/C 20.9.1 Number and order of levels for which wind shear is reported

B/C 20.9.1.1

Regulation B/C 20.8.1.1 shall apply.

B/C 20.9.1.2

Whenever wind shear data are reported for more than one level, these maximum wind levels shall be included in the same order as in the sequence <3 03 052>, i.e. in ascending order with respect to altitude.

B/C 20.9.2 Wind shear data at a height level <3 03 053>

B/C 20.9.2.1 Long time displacement (since launch time)

Long time displacement (0 04 086) represents the time offset from the launch time specified in Regulation 20.3, and shall be reported in seconds if available.

B/C 20.9.2.2 Extended vertical sounding significance – Flag table 0 08 042

Regulation B/C 20.8.2.2 shall apply.

B/C 20.9.2.3 Geopotential height

Geopotential height of the level (0 07 009) shall be reported in geopotential meters.

B/C 20.9.2.4 Latitude and longitude displacements

Regulation B/C 20.8.2.4 shall apply.

B/C 20.9.2.5 Wind shear data

Regulation B/C 20.8.2.5 shall apply.

B/C 20.10 Data required by regional or national reporting practices

If regional or national reporting practices require inclusion of wind data at additional levels, these data shall be reported using sequence <3 03 050> for wind data at a pressure level or sequence <3 03 052> for wind data at a height level. Regulation B/C 20.5 or Regulation B/C 20.6 shall apply.

Notes:

(1) A level determined by regional decision shall be indicated by Extended vertical sounding significance 0 08 042 - bit No. 15 set to 1.

(2) A level determined by national decision shall be indicated by Extended vertical sounding significance 0 08 042 – all bits set to 0.

B/C 20.10.1 Additional data required by reporting practices in RA I

Wind data at additional levels 600, 900, 2 100, 3 900, 4 500, 5 100, 21 000, and all successive levels at 3 000 m intervals, shall be reported in compliance with Regulation B/C 20.10 and Note (1) under this regulation. [1/32.2] [1/32.4.1]

B/C 20.10.2 Additional data required by reporting practices in RA II

B/C 20.10.2.1

Wind data at additional levels 300, 600, 900, 2 100, 3 600, 4 500, 6 000 m shall be reported in compliance with Regulation B/C 20.10 and Note (1) under this regulation. [2/32.3]

B/C 20.10.2.2

The inclusion of wind shear data shall be left to national decision. Members are recommended to include these data as often as possible. [2/32.2]

B/C 20.10.3 Additional data required by reporting practices in RA III

Wind data at additional levels 300, 600, 900, 2 100, 2 400, 4 200, 6 000, 8 100, 33 000 m, and all successive levels at 3 000 m intervals, shall be reported in compliance with Regulation B/C 20.10 and Note (1) under this regulation. [3/32.2] [3/32.4.1]

B/C 20.10.4 Additional data required by reporting practices in RA IV

Wind data at additional levels 300, 600, 900, 1 200, 1 800, 2 100, 2 400, 2 700, 3 600, 4200, 4 800, 6 000, 7 500, 9 000, 15 000 m, and all successive levels at 3 000 m intervals, shall be reported in compliance with Regulation B/C 20.10 and Note (1) under this regulation. [4/32.2] [4/32.4.1]

B/C 20.10.5 Additional data required by reporting practices in RA V

Wind data at additional levels 900, 2 100, 4 200 m shall be reported in compliance with Regulation B/C 20.10 and Note (1) under this regulation. [5/32.3]

B/C 20.10.6 Additional data required by reporting practices in RA VI

B/C 20.10.6.1

Wind data at additional levels 900, 800, 600 hPa (with pressure as the vertical coordinate) and at levels 1 000, 2 000, 4 000 m or 900, 2 100, 4 200 m (with height as the vertical coordinate), shall be reported in compliance with Regulation B/C 20.10 and Note (1) under this regulation. [6/32.3.1]

B/C 20.10.6.2

The inclusion of wind shear data shall be left to national decision. Members are recommended to include these data as often as possible. [6/32.2] [6/32.5]

B/C25 – Regulations for reporting TEMP, TEMP SHIP and TEMP MOBIL data in TDCF

General

A BUFR (or CREX) message should be sent when level the 100 hPa is reached. In any case, a BUFR (or CREX) message shall be produced when the sounding is completed containing data from the entire sounding.

TM 309052 - BUFR template for P, T, U and wind vertical profiles suitable for TEMP, TEMP SHIP and TEMP MOBIL observation data

3 09 052		**Sequence for representation TEMP, TEMP SHIP and TEMP MOBIL observation type data**
	3 01 111	Identification of launch site and instrumentation
	3 01 113	Date/time of launch
	3 01 114	Horizontal and vertical coordinates of launch site
	3 02 049	Cloud information reported with vertical soundings
	0 22 043	Sea/water temperature (for ship stations)
	1 01 000	Delayed replication of 1 descriptor
	0 31 002	Extended delayed descriptor replication factor
	3 03 054	Temperature, dew-point and wind data at a pressure level
	1 01 000	Delayed replication of 1 descriptor
	0 31 001	Delayed descriptor replication factor
	3 03 051	Wind shear data at a pressure level

This BUFR template for P, T, U and wind profiles further expands as follows:

3 01 111		**Identification of launch site and instrumentation**	
	3 01 001	WMO block number	Numeric
		WMO station number	Numeric
	0 01 011	Ship or mobile land station identifier	CCITT IA5
	0 02 011	Radiosonde type	Code table
	0 02 013	Solar and infrared radiation correction	Code table
	0 02 014	Tracking technique/status of system used	Code table
	0 02 003	Type of measuring equipment used	Code table
3 01 113		**Date/time of launch**	
	0 08 021	Time significance (= 18 (launch time))	Code table
	3 01 011	Year	Year
		Month	Month
		Day	Day
	3 01 013	Hour	Hour
		Minute	Minute
		Second	Second
3 01 114		**Horizontal and vertical coordinates of launch site**	
	3 01 021	Latitude (high accuracy)	Degree, scale 5
		Longitude (high accuracy)	Degree, scale 5
	0 07 030	Height of station ground above mean sea level	m, scale 1
	0 07 031	Height of barometer above mean sea level	m, scale 1
	0 07 007	Height of release of sonde above mean sea level	m
	0 33 024	Station elevation quality mark (for mobile stations)	Code table

3 02 049		**Cloud information reported with vertical soundings**	
	0 08 002	Vertical significance	Code table
	0 20 011	Cloud amount (of low or middle clouds N_h)	Code table
	0 20 013	Height of base of cloud (h)	m, scale –1
	0 20 012	Cloud type (low clouds C_L)	Code table
	0 20 012	Cloud type (middle clouds C_M)	Code table
	0 20 012	Cloud type (high clouds C_H)	Code table
	0 08 002	Vertical significance (= missing value)	Code table
0 22 043		Sea/water temperature (for ship stations)	K, scale 2
		Temperature, dew-point and wind data at pressure levels	
1 01 000		Delayed replication of 1 descriptor	
0 31 002		Extended delayed descriptor replication factor	Numeric
3 03 054		**Temperature, dew-point and wind data at a pressure level with radiosonde position**	
	0 04 086	Long time period or displacement (since launch time)	Second
	0 08 042	Extended vertical sounding significance	Flag table
	0 07 004	Pressure	Pa, scale –1
	0 10 009	Geopotential height	gpm
	0 05 015	Latitude displacement since launch site (high accuracy)	Degree, scale 5
	0 06 015	Longitude displacement since launch site (high accuracy)	Degree, scale 5
	0 12 101	Temperature/dry-bulb temperature (scale 2)	K, scale 2
	0 12 103	Dew-point temperature (scale 2)	K, scale 2
	0 11 001	Wind direction	Degree true
	0 11 002	Wind speed	m s^{-1}, scale 1
		Wind shear data	
1 01 000		Delayed replication of 1 descriptor	
0 31 001		Delayed descriptor replication factor	Numeric
3 03 051		**Wind shear data at a pressure level**	
	0 04 086	Long time period or displacement (since launch time)	Second
	0 08 042	Extended vertical sounding significance	Flag table
	0 07 004	Pressure	Pa, scale –1
	0 05 015	Latitude displacement since launch site (high accuracy)	Degree, scale 5
	0 06 015	Longitude displacement since launch site (high accuracy)	Degree, scale 5
	0 11 061	Absolute wind shear in 1 km layer below	m s^{-1}, scale 1
	0 11 062	Absolute wind shear in 1 km layer above	m s^{-1}, scale 1

Notes:
(1) Time of launch 3 01 013 shall be reported with the highest possible accuracy available. If the launch time is not available with second accuracy, the entry for seconds shall be put to zero.
(2) Long time displacement 0 04 086 represents the time offset from the launch time 3 01 013 (in seconds)
(3) Latitude displacement 0 05 015 represents the latitude offset from the latitude of the launch site. Longitude displacement 0 06 015 represents the longitude offset from the longitude of the launch site.
(4) If additional information on sounding instrumentation is required, the sequence <3 09 052> may be supplemented by one or more additional parameters to allow data representation of this information, e.g. Radiosonde serial number (0 01 081).

Regulations:

B/C 25.1 Section 1 of BUFR or CREX

B/C 25.1.1 Entries required in Section 1 of BUFR

The following entries shall be included in BUFR Section 1:

- BUFR master table,
- identification of originating/generating centre,
- identification of originating/generating sub-centre,
- update sequence number,
- identification of inclusion of optional section,
- data category (= 002 for all TEMP type data),
- international data sub-category (1), (2),
- local data subcategory,
- version number of master table,
- version number of local tables,
- year (year of the century up to BUFR edition 3),
- month (standard time),
- day (standard time = YY in the abbreviated telecommunication header for TEMP, TEMP SHIP and TEMP MOBIL type data),
- hour (standard time = GG in the abbreviated telecommunication header for TEMP, TEMP SHIP and TEMP MOBIL type data),
- minute (standard time = 00 for TEMP, TEMP SHIP and TEMP MOBIL type data).

Notes:

(1) Inclusion of this entry is required starting with BUFR edition 4.

(2) If required, the international data sub-category shall be included at all observation times as follows:

= 004 for TEMP data,
= 005 for TEMP SHIP data,
= 006 for TEMP MOBIL data.

B/C 25.1.2 Entries required in Section 1 of CREX

The following entries shall be included in CREX Section 1:

- CREX master table,
- CREX edition number,
- CREX table version number,
- version number of BUFR master table (1),
- version number of local tables (1),
- data category (= 002 for all TEMP type data),

- international data sub-category (1), (2),
- identification of originating/generating centre (1),
- identification of originating/generating sub-centre (1),
- update sequence number (1),
- number of subsets (1),
- year (standard time) (1),
- month (standard time) (1),
- day (standard time = YY in the abbreviated telecommunication header for TEMP, TEMP SHIP and TEMP MOBIL type data) (1),
- hour (standard time = GG in the abbreviated telecommunication header for TEMP, TEMP SHIP and TEMP MOBIL type data) (1),
- minute (standard time = 00 for TEMP, TEMP SHIP and TEMP MOBIL type data) (1).

Notes:
(1) Inclusion of these entries is required starting with CREX edition 2.
(2) If inclusion of international data sub-category is required, Note (2) under B/C 25.1.1 applies.

B/C 25.2 Identification of launch site and instrumentation <3 01 111>

B/C 25.2.1 Identification of launch site

WMO block number station (0 01 001) and WMO station number (0 01 002) shall be always reported as a non-missing value in reports from a fixed land station.

Ship or mobile land station identifier (0 01 011) shall be always reported not exceeding 9 characters in reports from ships or mobile land stations. [35.2.1]

B/C 25.2.1 Instrumentation for P, T, U and wind measurement

Radiosonde type (Code table 0 02 011), solar and infrared radiation correction (Code table 0 02 013), tracking techniques/status of system used (Code table 0 02 014) and type of measuring equipment used (Code table 0 02 003) shall be reported. [35.2.5]

B/C 25.3 Date/time of launch <3 01 113>

Time significance (0 08 021) shall be always set to 18 to indicate that the following entries specify the date and time of launching the radiosonde.

Date of launch <3 01 011> and time of launch <3 01 013> shall be reported, i.e. year (0 04 001), month (0 04 002), day (0 04 003)> and hour (0 04 004), minute (0 04 005) and second (0 04 006) of the actual time of launch shall be reported. [35.2.5]
Note:
(1) Time of launch <3 01 013> shall be reported with the highest possible accuracy available. If the launch time is not available with second accuracy, the entry 0 04 006 for seconds shall be set to zero.

B/C 25.4 Horizontal and vertical coordinates of launch site <3 01 114>

Latitude (0 05 001) and longitude (0 06 001) of the launch site shall be reported in degrees with precision in 10^{-5} of a degree.

Height of station ground above mean sea level (0 07 030) and height of barometer above mean sea level (0 07 031) shall be reported in meters with precision in tenths of a meter.

Height of release of sonde above mean sea level (0 07 007) shall be reported in meters.

Station elevation quality mark (Code table 0 33 024) shall be reported to indicate the accuracy of the vertical coordinates of the mobile land station. Fixed land stations and sea stations shall report this datum as a missing value. [35.2.1]

B/C 25.5 Cloud information reported with vertical sounding <3 02 049>

B/C 25.5.1 Vertical significance – Code table 0 08 002

To specify vertical significance (0 08 002) within the sequence 3 02 049, a code figure shall be selected in the following way:

(a) If low clouds are observed, then code figure 7 (Low cloud) shall be used.
(b) If there are no low clouds but middle clouds are observed, then code figure 8 (Middle clouds) shall be used.
(c) If there are no low and there are no middle clouds but high clouds are observed, then code figure 0 shall be used.
(d) If sky is obscured by fog and/or other phenomena, then code figure 5 (Ceiling) shall be used.
(e) If there are no clouds (clear sky), then code figure 62 (Value not aplicable) shall be used.
(f) If the cloud cover is not discernible for reasons other than (d) above or observation is not made, then code figure 63 (Missing value) shall be used.

B/C 25.5.2 Cloud amount (of low or middle clouds) – Code table 0 20 011

Amount of all the low clouds (clouds of the genera Stratocumulus, Stratus, Cumulus, and Cumulonimbus) present or, if no low clouds are present, the amount of all the middle clouds (clouds of the genera Altocumulus, Altostratus, and Nimbostratus) present.

B/C 25.5.2.1

Cloud amount shall be reported as follows:

(a) If there are low clouds, then the total amount of all low clouds, as actually seen by the observer during the observation shall be reported for the cloud amount.
(b) If there are no low clouds but there are middle clouds, then the total amount of the middle clouds shall be reported for the cloud amount.
(c) If there are no low clouds and there are no middle clouds but there are high clouds (clouds of the genera Cirrus, Cirrocumulus, and Cirrostratus), then the cloud amount shall be reported as zero. [35.3.4.1] [12.2.7.2.1]

B/C 25.5.2.2

Amount of Altocumulus perlucidus or Stratocumulus perlucidus (“mackerel sky”) shall be reported using code figure 7 or less since breaks are always present in this cloud form even if it extends over the whole celestial dome. [35.3.4.1] [12.2.7.2.2]

B/C 25.5.2.3

When the clouds reported for cloud amount are observed through fog or an analogous phenomenon, the cloud amount shall be reported as if these phenomena were not present. [35.3.4.1] [12.2.7.2.3]

B/C 25.5.2.4

If the clouds reported for cloud amount include contrails, then the cloud amount shall include the amount of persistent contrails. Rapidly dissipating contrails shall not be included in the value for the cloud amount. [35.3.4.1] [12.2.7.2.4]

B/C 25.5.3 Height of base of lowest cloud

Height above surface of the base (0 20 013) of the lowest cloud seen shall be reported in meters (with precision in tens of a meter).

Note:

(1) The term « height above surface » shall be considered as being the height above the official aerodrome elevation or above station elevation at a non-aerodrome station.

B/C 25.5.3.1

When the station is in fog, a sandstorm or in blowing snow but the sky is discernable, the base of the lowest cloud shall refer to the base of the lowest cloud observed, if any. When, under the above conditions, the sky is not discernible, the base of the lowest cloud shall be reported as missing. [35.3.4.1] [12.2.1.2]

B/C 25.5.3.2

When no cloud are reported (Total cloud cover = 0) the base of the lowest cloud *shall be reported as a missing value.*

B/C 25.5.3.3

When, by national decision, clouds with bases below the station are reported from the station and clouds with bases below and tops above the station are observed, the base of the lowest cloud *shall be reported having a negative value if the base of cloud is discernible, or as a missing value.*

B/C 25.5.4. Cloud type of low, middle and high clouds - Code table 0 20 012

Clouds of the genera Stratocumulus, Stratus, Cumulus, and Cumulonimbus (low clouds) shall be reported for the first entry 0 20 012, clouds of the genera Altocumulus, Altostratus, and Nimbostratus (middle clouds) shall be reported for the second entry 0 20 012 and clouds of the genera Cirrus, Cirrocumulus, and Cirrostratus (high clouds) shall be reported for the third entry 0 20 012.

B/C 25.5.4.1

The reporting of type of low, middle and high clouds shall be as specified in publication WMO-NO. 407 – International Cloud Atlas, Volume I. [35.3.4.1], [12.2.7.3]

B/C 25.6 Sea/water temperature

Sea/water temperature (0 22 043) shall be reported in degrees Kelvin (with precision in hundredths of a degree Kelvin); if produced in CREX, in degrees Celsius (with precision in hundredths of a degree Celsius). Sea/water temperature data shall be reported with precision in hundredths of a degree even if they are available with the accuracy in tenths of a degree.

Note:

(1) Notes (1) and (2) under Regulation B/C 25.7.2.6 shall apply.

B/C 25.6.1

Sea/water temperature shall always be included in reports from sea stations, when data are available. [35.2.5]

B/C 25.7 Temperature, dew-point and wind data at pressure levels

Temperature, dew-point and wind data at pressure levels obtained during the radiosonde ascent shall be included in descending order with respect to pressure. Data at each pressure level shall be included only once. For example, if a significant level with respect to air temperature and relative humidity and a standard isobaric surface coincide, data for that level shall be included only once, the multiple attributes being indicated by Extended vertical sounding significance (Flag table 0 08 042) as specified in Regulation B/C 25.7.2.2.

Note:

(1) If data are produced and collected in traditional TEMP codes, the order of pressure levels may correspond to the order of levels in Parts A, B, C and D, when converted into BUFR or CREX. In this case, data at a level may be included more than once.

B/C 25.7.1 Number of reported pressure levels

The number of reported pressure levels shall be indicated by Extended delayed descriptor replication factor 0 31 002 in BUFR and by a four-digit number in the Data Section corresponding to the position of the replication descriptor in the Data Description Section of CREX.

Notes:

(1) The number of pressure levels shall never be set to a missing value.

(2) The number of pressure levels shall be set to a positive value in a NIL report.

B/C 25.7.1.1

All required data from the entire radiosonde ascent shall be reported in a BUFR (or CREX) message that shall be produced when the sounding is completed. In interest of

timely data delivery, however, a BUFR (or CREX) message should be sent when level 100 hPa is reached.

B/C 25.7.2 Temperature, dew-point and wind data at a pressure level <3 03 054>

B/C 25.7.2.1 Long time displacement (since launch time)

Long time displacement (0 04 086) represents the time offset from the launch time specified in Regulation 25.3, and shall be reported in seconds if available.

B/C 25.7.2.2 Extended vertical sounding significance – Flag table 0 08 042

This datum shall be used to specify vertical sounding significance in the following way:

(a) Bit No. 1 set to 1 indicates surface (see Regulation B/C 25.8.1).
(b) Bit No. 2 set to 1 indicates a standard level (see Regulation B/C 25.8.2).
(c) Bit No. 3 set to 1 indicates a tropopause level (see Regulation B/C 25.8.3).
(d) Bit No. 4 set to 1 indicates a maximum wind level (see Regulation B/C 25.8.4).
(e) Bit No. 5 set to 1 indicates a level significant with respect to temperature (see Regulation B/C 25.8.5).
(f) Bit No. 6 set to 1 indicates a level significant with respect to relative humidity (see Regulation B/C 25.8.6).
(g) Bit No. 7 set to 1 indicates a level significant with respect to wind (see Regulation B/C 25.8.7).
(h) Bit No. 8 set to 1 indicates beginning of missing temperature data and bit No. 9 set to 1 indicates end of missing temperature data (see Regulation B/C 25.8.8).
(i) Bit No. 10 set to 1 indicates beginning of missing humidity data and bit No. 11 set to 1 indicates end of missing humidity data (see Regulation B/C 25.8.9).
(j) Bit No. 12 set to 1 indicates beginning of missing wind data bit No. 13 set to 1 indicates end of missing wind data (see Regulation B/C 25.8.10).
(k) Bit No. 14 set to 1 indicates the top of wind sounding.
(l) Bit No. 15 set to 1 indicates a level determined by regional decision.
(m) All bits set to 0 indicate a level determined by national decision.
(n) All bits set to 1 indicate a missing value.

B/C 25.7.2.3 Pressure

Pressure (0 07 004) shall be reported in pascals (with precision in tens of a pascal).

B/C 25.7.2.4 Geopotential height

Geopotential height of the level (0 10 009) shall be reported in geopotential meters.

B/C 25.7.2.5 Radiosonde drift - latitude and longitude displacements

Latitude displacement (0 05 015) represents the latitude offset from the latitude of the launch site specified in Regulation 25.4, and shall be reported in degrees with precision in 10^{-5} of a degree if available. Longitude displacement 0 06 015 represents the longitude offset from the longitude of the launch site specified in Regulation 25.4, and shall be reported in degrees with precision in 10^{-5} of a degree if available.

B/C 25.7.2.6 Temperature

Temperature (0 12 101) shall be reported in degrees Kelvin (with precision in hundredths of a degree Kelvin); if produced in CREX, in degrees Celsius (with precision in hundredths of a degree Celsius). Temperature data shall be reported with precision in hundredths of a degree even if they are measured with the accuracy in tenths of a degree.

Notes:

(1) This requirement is based on the fact that conversion from the Kelvin to the Celsius scale has often resulted into distortion of the data values.

(2) Temperature t (in degrees Celsius) shall be converted into temperature T (in degrees Kelvin) using equation: T = t + 273.15.

B/C 25.7.2.7 Dew-point temperature

Dew-point temperature (0 12 103) shall be reported in degrees Kelvin (with precision in hundredths of a degree Kelvin); if produced in CREX, in degrees Celsius (with precision in hundredths of a degree Celsius).

Note:

(1) Notes (1) and (2) under Regulation B/C 25.7.2.6 shall apply.

B/C 25.7.2.7.1

Dew-point temperature data shall be derived using the function (or a near equivalent) for a relationship between saturation vapour pressure over water and air temperature (specified in publication WMO-No. 49 – *Technical Regulations*). Dew-point temperature data shall not be reported when the air temperature is outside the range stated by WMO for the application of the function; a lesser range may be used as a national practice. [35.3.1.1]

B/C 25.7.2.8 Wind direction and speed

The wind direction (0 11 001) shall be reported in degrees true and the wind speed (0 11 002) shall be reported in meters per second (with precision in tenths of a meter per second).

B/C 25.7.2.8.1

When during an ascent the pressure data can no longer be obtained, but wind data can be obtained, the wind data so obtained shall not be reported in the BUFR (or CREX) message in which data are described by the common sequence 3 09 052. These wind data so obtained may be reported using BUFR template TM 309051 suitable PILOT, PILOT SHIP or PILOT MOBIL data. [35.1.5]

B/C 25.7.2.8.2

Only wind data obtained from the radiosonde ascent by either visual or electronic means shall be included in the BUFR (or CREX) message in which data are described by the common sequence 3 09 052. Wind data obtained by means other than a radiosonde-type ascent shall not be included in a message under common sequence 3 09 052. [35.1.6]

B/C 25.8 Criteria for reporting standard and significant levels

B/C 25.8.1 Surface

The surface level shall be always reported.

Note:

(1) The value of Extended vertical sounding significance 0 08 042 at the surface level shall indicate that this level is also a level significant with respect to temperature, relative humidity and wind, i.e. not only bit No.1 but also bits No. 5, 6 and 7 shall be set to 1.

B/C 25.8.2 Standard levels

B/C 25.8.2.1

The standard levels of 1 000, 925, 850, 700, 500, 400, 300, 250, 200, 150, 100, 70, 50, 30, 20 and 10 hPa shall be reported in ascending order with respect to altitude. [35.2.2.1]

B/C 25.8.2.2

When the geopotential of a standard level is lower than the altitude of the reporting station, the time displacement, latitude displacement and longitude displacement for that level shall be set to zero and the air temperature, dew-point temperature and wind data for that level shall be reported as missing values. [35.2.2.2]

B/C 25.8.2.3

When air temperature, dew-point temperature or wind data at a standard level are not available, the corresponding entries for that level shall be reported as missing values.

B/C 25.8.2.4

Whenever it is desired to extrapolate a sounding for the computation of the geopotential at a standard level, the following rules shall apply:

(a) Extrapolation is permissible if, and only if, the pressure difference between the minimum pressure of the sounding and the isobaric surface for which the extrapolated value is being computed does not exceed one quarter of the pressure at which the extrapolated value is desired, provided the extrapolation does not extend through a pressure interval exceeding 25 hPa;

(b) For the purpose of geopotential calculation, and for this purpose only, the sounding will be extrapolated, using two points only of the sounding curve on a T-log p diagram, namely that at the minimum pressure reached by the sounding and that at the pressure given by the sum of this minimum pressure and the pressure difference, mentioned in (a) above. [35.2.2.4]

B/C 25.8.3 Tropopause level(s)

B/C 25.8.3.1

When a tropopause (one or more) is observed, the corresponding number of levels shall be included (indicated by 0 08 042 - bit No. 3 set to 1).

Note:

(1) For a definition of tropopause, see publication WMO-No. 100 – *Guide to Climatological Practices.* [35.2.3.1]

B/C 25.8.3.2

When no tropopause data are observed, no level shall be indicated by bit No. 3 of 0 08 042 set to 1. [35.2.3.2]

B/C 25.8.4 Maximum wind level(s)

B/C 25.8.4.1

When a maximum wind level (one or more) is reported, the corresponding number of levels shall be included in the report indicated by 0 08 042 - bit No. 4 set to 1.

Notes:

(1) Criteria for determining maximum wind levels are given in Regulations B/C 25.8.4.3 and B/C 25.8.4.4 below. [35.2.4.1]

(2) As a maximum wind level is also a level significant with respect to wind, bit No. 7 as well as bit No. 4 shall be set to 1 in the Extended vertical sounding significance 0 08 042.

B/C 25.8.4.2

When no maximum wind level is observed, no level shall be indicated by bit No. 4 of 0 08 042 set to 1. [35.2.4.2]

B/C 25.8.4.3

A maximum wind level:

(a) Shall be determined by consideration of the list of significant levels for wind speed, as obtained by means of the relevant recommended or equivalent national method (see Note under Regulation B/C 25.8.7.2) and *not* by consideration of the original wind-speed curve;

(b) Shall be located above the 500-hPa isobaric surface and shall correspond to a speed of more than 30 meters per second.

Note:

(1) A maximum wind level is defined as a level at which the wind speed is greater than that observed immediately above and below that level. [35.2.4.1], [32.2.3.1]

B/C 25.8.4.4

Whenever more than one maximum wind level exists, these levels shall be reported as follows:

(a) The level of greatest maximum wind speed shall be always included;

(b) The other levels shall be included in the report only if their speed exceeds those of the two adjacent minima by at least 10 meters per second;

(c) Furthermore, the highest level attained by the sounding shall be indicated as a maximum wind level, provided:

a. It satisfies the criteria set forth in Regulation B/C 25.8.4.3 above;

b. It constitutes the level of the greatest speed of the whole sounding. [35.2.4.1], [32.2.3.2]

B/C 25.8.4.5

If the top of the wind sounding corresponds to the highest wind speed observed throughout the ascent, this level shall be indicated by 0 08 042 - bit No. 4 set to 1 (maximum wind level), bit No. 7 set to 1 (level significant with respect to wind) and bit No. 14 set to 1 (top of wind sounding).

Note:

(1) For the purpose of the above regulation, the "top of the wind sounding" is to be understood as the highest level for which wind data are available. [35.2.4.3]

B/C 25.8.5 Levels significant with respect to temperature

B/C 25.8.5.1

The reported significant levels *alone* shall make it possible to reconstruct the air temperature profile within the limits of the criteria specified.

If the criteria for determination of significant levels with respect to air temperature are satisfied at a particular point of altitude, data for all variables (if available) shall be reported for that level. [35.3.1.1]

B/C 25.8.5.2

The following shall be included as "mandatory" significant temperature levels:

(a) Surface level and the highest level of the sounding;

(b) A level between 110 and 100 hPa;

(c) Bases and tops of inversions and isothermal layers which are at least 20 hPa thick, provided that the base of the layer occurs below the 300-hPa level or the first tropopause, whichever is the higher;

(d) Bases and tops of inversion layers which are characterized by a change in temperature of at least 2.5ºC, provided that the base of the layer occurs below the 300-hPa level or the first tropopause, whichever is the higher.

Note:

(1) The inversion layers of (c) and (d) may be comprised of several thinner inversion layers separated by thin layers of temperature lapse. To allow for this situation, the tops of the inversion layers of (c) and (d) shall each be at a level such that no further inversion layers, whether thick or thin, shall occur for at least 20 hPa above the level. [35.3.1.2]

B/C 25.8.5.3

The following shall be included as "additional" significant levels. They shall be selected in the order given, thereby giving priority to representing the temperature profile. As far as possible, these additional levels shall be the actual levels at which prominent changes in the lapse rate of air temperature occur:

(a) Levels which are necessary to ensure that the temperature obtained by linear interpolation (on a T-log P or essentially similar diagram) between adjacent significant levels shall not depart from the observed temperature by more than 1ºC below the first significant level reported above the 300-hPa level or the first tropopause, whichever level is the lower, or by more than 2ºC thereafter;

(b) Levels which are necessary to limit the interpolation error on diagrams other than T-log P. These levels shall be such that the pressure at one significant level divided by the pressure of the preceding significant layer shall exceed 0.6 for levels up to the first tropopause and shall be determined by use of the method for selecting additional levels but with application of tighter criteria. [35.3.1.3]

B/C 25.8.5.4

When a significant level with respect to air temperature and a standard level coincide, data for that level shall be reported only once.

B/C 25.8.6 Levels significant with respect to relative humidity

B/C 25.8.6.1

The reported significant levels *alone* shall make it possible to reconstruct the relative humidity profiles within the limits of the criteria specified.

If the criteria for determination of significant levels with respect to relative humidity are satisfied at a particular point of altitude, data for all variables (if available) shall be reported for that level. [35.3.1.1]

B/C 25.8.6.2

The following shall be included as "mandatory" significant humidity levels:

(a) Surface level and the highest level of the sounding;

(b) A level between 110 and 100 hPa;

(c) Bases and tops of inversions and isothermal layers which are at least 20 hPa thick, provided that the base of the layer occurs below the 300-hPa level or the first tropopause, whichever is the higher;

(d) Bases and tops of inversion layers which are characterized by a change in relative humidity of at least 20 per cent, provided that the base of the layer occurs below the 300-hPa level or the first tropopause, whichever is the higher.

Note:

Note (1) under Regulation B/C 25.8.5.2 shall apply. [35.3.1.2]

B/C 25.8.6.3

The following shall be included as "additional" significant levels. They shall be selected in the order given, thereby giving priority to representing the temperature profile. As far as possible, these additional levels shall be the actual levels at which prominent changes in the lapse rate of air temperature occur:

(a) Levels which are necessary to ensure that the relative humidity obtained by linear interpolation between adjacent significant levels shall not depart by more than 15 per cent from the observed values. (The criterion of 15 per cent refers to an amount of relative humidity and NOT to the percentage of the observed value, e.g. if an observed value is 50 per cent, the interpolated value shall lie between 35 per cent and 65 per cent.);

(b) Levels which are necessary to limit the interpolation error on diagrams other than T-log P. These levels shall be such that the pressure at one significant level divided by the pressure of the preceding significant layer shall exceed 0.6 for levels up to the first tropopause and shall be determined by use of the method for selecting additional levels but with application of tighter criteria. [35.3.1.3]

B/C 25.8.6.4

When a significant layer with respect to relative humidity and a standard level coincide, data for that level shall be reported only once.

B/C 25.8.7 Levels significant with respect to wind

B/C 25.8.7.1

Significant wind levels shall be chosen so that the data from them *alone* shall make it possible to reconstruct the wind profile with sufficient accuracy for practical use. [35.3.2.1]

If the criteria for determination of significant levels with respect to wind speed and direction are satisfied at a particular point of altitude, data for all variables (if available) shall be reported for that level.

B/C 25.8.7.2

Criteria for determining significant levels with respect to changes in wind speed and direction:

(a) The direction of speed curves (in function of the log of pressure or altitude) can be reproduced with their prominent characteristics;

(b) These curves can be reproduced with the accuracy of at least 10 for direction and five meters per second for speed;

Note:

To satisfy these criteria, the following method of successive approximations is recommended, but other methods of attaining equivalent results may suit some national practices better and may be used:

(i) The surface level and highest level for which wind data are available constitute the first and the last significant levels.

The deviation from the linearly interpolated values between these two levels is then considered. If no direction deviates by more than 10 and no speed by more than five meters per second, no other significant level need be reported. Whenever one parameter deviates by more than the limit specified in paragraph (b) above the level of greatest deviation becomes a supplementary significant level for both parameters.

(ii) The additional significant levels so introduced divide the sounding into two layers. In each separate layer, the deviation from the linearly interpolated values between the base and the top are then considered. The process used in paragraph (i) above is repeated and yields other significant levels. These additional levels in turn modify the layer distribution, and the method is applied again until any level is approximated to the above-mentioned specified values. [35.3.2.1], [32.3.1.1]

B/C 25.8.8 Beginning and end of missing temperature data

B/C 25.8.8.1

A layer for which temperature data are missing shall be indicated by reporting the boundary levels of the layer, provided that the layer is at least 20 hPa thick. The boundary levels are the levels closest to the bottom and the top of the layer for which temperature data are available. The boundary levels are not required to meet “significant temperature level” criteria. [35.3.1.6]

B/C 25.8.9 Beginning and end of missing humidity data

B/C 25.8.9.1

A layer for which dew-point temperature data are missing shall be indicated by reporting the boundary levels of the layer, provided that the layer is at least 20 hPa thick. The boundary levels are the levels closest to the bottom and the top of the layer for which dew-point temperature data are available. The boundary levels are not required to meet “significant humidity level” criteria. [35.3.1.6]

B/C 25.8.10 Beginning and end of missing wind data

B/C 25.8.10.1

A layer for which wind data are missing shall be indicated by reporting the boundary levels of the layer, provided that the layer is at least 50 hPa thick. The boundary levels are the levels closest to the bottom and the top of the layer for which the observed data are available. The boundary levels are not required to meet “significant wind level” criteria. [35.3.2.2]

B/C 25.9 Wind shear data

B/C 25.9.1 Number and order of levels for which wind shear is reported

B/C 25.9.1.1

The number of levels with wind shear data shall be indicated by Delayed descriptor replication factor 0 31 001 in BUFR and by a four-digit number in the Data Section corresponding to the position of the replication descriptor in the Data Description Section of CREX.

Notes:

(1) The number of levels with wind shear data shall never be set to a missing value.

(2) The number of levels with wind shear data shall be set to a positive value in a NIL report.

(3) The number of levels with wind shear data shall be set to zero if data for vertical wind shear are not computed and required. [35.2.4.4]

B/C 25.9.1.2

Whenever wind shear data are reported for more than one level, these maximum wind levels shall be included in the same order as in the sequence <3 03 054>, i.e. in descending order with respect to pressure.

B/C 25.9.2 Wind shear data at a pressure level <3 03 051>

B/C 25.9.2.1 Long time displacement (since launch time)

Long time displacement (0 04 086) represents the time offset from the launch time specified in Regulation 25.3, and shall be reported in seconds if available.

B/C 25.9.2.2 Extended vertical sounding significance – Flag table 0 08 042

A level, for which wind shear data are reported, shall be indicated by vertical sounding significance 0 08 042 - bit No. 4 set to 1 (maximum wind level) and by bit No. 7 set to 1 (level significant with respect to wind). Moreover, if the top of the wind sounding corresponds to the highest wind speed observed throughout the ascent, this level shall be indicated also by bit No. 14 set to 1 (top of wind sounding).

B/C 25.9.2.3 Pressure

Pressure (0 07 004) shall be reported in pascals with precision in tens of a pascal.

B/C 25.9.2.4 Latitude and longitude displacements

Latitude displacement (0 05 015) represents the latitude offset from the latitude of the launch site specified in Regulation 25.4, and shall be reported in degrees with precision in 10^{-5} of a degree if available. Longitude displacement 0 06 015 represents the longitude offset from the longitude of the launch site specified in Regulation 25.4, and shall be reported in degrees with precision in 10^{-5} of a degree if available.

B/C 25.9.2.5 Wind shear data

Absolute wind shear in 1 km layer below (0 11 061) and absolute wind shear in 1 km layer above (0 11 062) shall be reported in meters per second (with precision in tenths of a meter per second), if data for vertical wind shear are computed and required. [35.2.4.4]

B/C 25.10 Data required by regional or national reporting practices

If regional or national reporting practices require inclusion of temperature, humidity and/or wind data at additional levels, these data shall be reported using sequence <3 03 054> for Temperature, dew-point, wind at a pressure level. Regulation B/C 25.7 shall apply.

Notes:

(1) A level determined by regional decision shall be indicated by Extended vertical sounding significance 0 08 042 - bit No. 15 set to 1.

(2) A level determined by national decision shall be indicated by Extended vertical sounding significance 0 08 042 – all bits set to 0.

B/C 25.10.1 Additional data required by reporting practices in RA I

Temperature, dew-point, wind data at additional levels shall be reported in compliance with Regulation B/C 25.10.

B/C 25.10.2 Additional data required by reporting practices in RA II

B/C 25.10.2.1

No additional data are required by regional reporting practices in RA II.

B/C 25.10.2.2

The inclusion of wind shear data shall be left to national decision. Members are recommended to include these data as often as possible. [2/35.2]

B/C 25.10.3 Additional data required by reporting practices in RA III

No regional requirements are indicated for reporting TEMP, TEMP SHIP and TEMP MOBIL data in RA III.

B/C 25.10.4 Additional data required by reporting practices in RA IV

B/C 25.10.4.1

When available, temperature, dew-point, wind data for levels 7, 5, 3, 2 and 1 hPa shall be reported in compliance with Regulation B/C 25.10. [4/35.2.1]

B/C 25.10.4.2

When required, additional information shall be reported using RA IV BUFR template for data representation of TEMP, TEMP SHIP and TEMP MOBIL data as shown in the Annex. [4/35.1] [4/35.2.2]

B/C 25.10.5 Additional data required by reporting practices in RA V

No regional requirements are indicated for reporting TEMP, TEMP SHIP and TEMP MOBIL data in RA V.

B/C 25.10.6 Additional data required by reporting practices in RA VI

B/C 25.10.6.1

The inclusion of wind shear data shall be left to national decision. Members are recommended to include these data as often as possible. [6/35.1]

B/C 25.10.6.2

Wind direction and speed shall be reported:

(i) For 900 or 1000 meters above the surface;
(ii) For 800 hPa level;
(iii) For 600 hPa level.

[6/35.2.2]

B/C 25.11 Other additional data

If additional information on sounding instrumentation is required, the sequence <3 09 052> for representation of TEMP, TEMP SHIP and TEMP MOBIL data may be supplemented by one or more additional parameters to allow data representation of this information. The list of such parameters is shown in Annex II, others may be added in compliance with the future requirements.

ANNEX I TO B/C25 – Regulations for reporting TEMP, TEMP SHIP and TEMP MOBIL data in TDCF

RA IV BUFR template for TEMP, TEMP SHIP and TEMP MOBIL data

The RA IV Regional coding procedures for TEMP and TEMP SHIP data require data representation of additional information that is specified in Manual on Codes, WMO-No. 306, Volume II, by supplementary groups $101A_{df}A_{df}$ (code table 421 for $A_{df}A_{df}$ – Form of additional data reported). The sequence <3 09 052> for representation of TEMP, TEMP SHIP and TEMP MOBIL data is supplemented by additional parameters to allow data representation of this information, if it is required.

3 09 052	**Sequence for representation of TEMP, TEMP SHIP and TEMP MOBIL observation type data**	
	Reason for no report or incomplete report	
0 35 035	Reason for termination	Code table
	Corrected data	
1 04 000	Delayed replication of 4 descriptors	
0 31 001	Delayed descriptor replication factor	Numeric
2 04 001	Add associated field of 1 bit in length	
0 31 021	Associated field significance = 21 (indicator of correction)	Code table
	Associated field set to 1 (corrected value)	
3 03 054	Temperature, dew-point, wind at a pressure level with radiosonde position	
2 04 000	Cancel Add associated field	
0 08 042	Extended vertical sounding significance = missing (to cancel the previous value)	Flag table
	Stability index and mean wind data	
0 13 047	Modified Showalter stability index	K
0 11 044	Mean wind direction for surface – 1500 m	Degree true
0 11 045	Mean wind speed for surface – 1500 m	m s^{-1}, scale 1
0 11 054	Mean wind direction for 1500 m – 3000 m	Degree true
0 11 055	Mean wind speed for 1500 m – 3000 m	m s^{-1}, scale 1
	Doubtful data	
1 12 000	Delayed replication of 12 descriptors	
0 31 001	Delayed descriptor replication factor	Numeric
1 11 002	Replicate next 11 descriptors 2 times	
0 04 086	Long time period or displacement (since launch time)	Second
0 08 040	Flight level significance In the 1st replication = 4 (Begin doubtful temperature, height data); In the 2nd replication = 9 (End doubtful temperature, height data).	Code table
0 07 004	Pressure	Pa, scale –1
0 05 015	Latitude displacement since launch site (high accuracy)	Degree, scale 5
0 06 015	Longitude displacement since launch site (high accuracy)	Degree, scale 5
1 01 000	Delayed replication of 1 descriptor	
0 31 000	Short delayed descriptor replication factor	Numeric
0 10 009	Geopotential height	gpm
1 01 000	Delayed replication of 1 descriptor	
0 31 000	Short delayed descriptor replication factor	Numeric

0 12 101	Temperature/dry-bulb temperature (scale 2)	K, scale 2
	Extrapolated geopotential data	
1 08 000	Delayed replication of 8 descriptors	
0 31 001	Delayed descriptor replication factor	Numeric
0 04 086	Long time period or displacement (since launch time)	Second
0 08 040	Flight level significance = 31 (Incremented height level (generated))	Code table
0 07 004	Pressure	Pa, scale –1
0 05 015	Latitude displacement since launch site (high accuracy)	Degree, scale 5
0 06 015	Longitude displacement since launch site (high accuracy)	Degree, scale 5
0 10 009	Geopotential height	gpm
0 11 001	Wind direction	Degree true
0 11 002	Wind speed	m s^{-1}, scale 1

Note:
The “Modified Showalter stability index” 0 13 047 is defined as the temperature difference between the ambient 500 hPa temperature and the temperature a parcel of air, initially at a selected base level, would have if brought from its condensation level to the 500 hPa surface by a moist adiabatic process. Positive values denote stable conditions, while negative values denote unstable conditions. The base level is 850 hPa, 800hPa or 750 hPa, if the station elevation is less than 1000, 1000 to 1400 or 1401 to 2000 gpm above mean sea level, respectively.

ANNEX II TO B/C25 – Regulations for reporting TEMP, TEMP SHIP and TEMP MOBIL data in TDCF

List of parameters for representation of additional information on sounding instrumentation

TABLE REFERENCE			ELEMENT NAME	UNIT, SCALE
0	01	081	Radiosonde serial number	CCITT IA5, 0
0	01	082	Radiosonde ascension number	Numeric, 0
0	02	067	Radiosonde operating frequency	Hz, -5
0	02	081	Type of balloon	Code table, 0
0	02	082	Weight of balloon	kg, 3
0	02	084	Type of gas used in balloon	Code table, 0
0	02	095	Type of pressure sensor	Code table, 0
0	02	096	Type of temperature sensor	Code table, 0
0	02	097	Type of humidity sensor	Code table, 0
0	25	061	Software identification and version number	CCITT IA5, 0

B/C26 – Regulations for reporting TEMP DROP data in TDCF

TM 309053 - BUFR template for P, T, U and wind vertical profiles suitable for TEMP DROP observation data

3 09 053		**Sequence for representation TEMP DROP observation type data**
	3 01 112	Identification of launch point and instrumentation of dropsonde
	3 01 113	Date/time of launch
	3 01 114	Horizontal and vertical coordinates of launch site
	1 01 000	Delayed replication of 1 descriptor
	0 31 002	Extended delayed descriptor replication factor
	3 03 054	Temperature, dew-point and wind data at a pressure level
	1 01 000	Delayed replication of 1 descriptor
	0 31 001	Delayed descriptor replication factor
	3 03 051	Wind shear data at a pressure level

This BUFR template for P, T, U and wind profiles further expands as follows:

3 01 112		**Identification of launch point and instrumentation of dropsonde**	
	0 01 006	Aircraft identifier	CCITT IA5
	0 02 011	Radiosonde type	Code table
	0 02 013	Solar and infrared radiation correction	Code table
	0 02 014	Tracking technique/status of system used	Code table
	0 02 003	Type of measuring equipment used	Code table
3 01 113		**Date/time of launch**	
	0 08 021	Time significance (= 18 (launch time))	Code table
	3 01 011	Year	Year
		Month	Month
		Day	Day
	3 01 013	Hour	Hour
		Minute	Minute
		Second	Second
3 01 114		**Horizontal and vertical coordinates of launch site**	
	3 01 021	Latitude (high accuracy)	Degree, scale 5
		Longitude (high accuracy)	Degree, scale 5
	0 07 030	Height of station ground above mean sea level	m, scale 1
	0 07 031	Height of barometer above mean sea level	m, scale 1
	0 07 007	Height of release of sonde above mean sea level	m
	0 33 024	Station elevation quality mark	Code table
		Temperature, dew-point and wind data at pressure levels	
1 01 000		Delayed replication of 1 descriptor	
0 31 002		Extended delayed descriptor replication factor	Numeric
3 03 054		**Temperature, dew-point and wind data at a pressure level with radiosonde position**	
	0 04 086	Long time period or displacement (since launch time)	Second
	0 08 042	Extended vertical sounding significance	Flag table
	0 07 004	Pressure	Pa, scale –1
	0 10 009	Geopotential height	gpm

	0 05 015	Latitude displacement since launch site (high accuracy)	Degree, scale 5
	0 06 015	Longitude displacement since launch site (high accuracy)	Degree, scale 5
	0 12 101	Temperature/dry-bulb temperature (scale 2)	K, scale 2
	0 12 103	Dew-point temperature (scale 2)	K, scale 2
	0 11 001	Wind direction	Degree true
	0 11 002	Wind speed	m s^{-1}, scale 1
		Wind shear data	
1 01 000		Delayed replication of 1 descriptor	
0 31 001		Delayed descriptor replication factor	Numeric
3 03 051		**Wind shear data at a pressure level**	
	0 04 086	Long time period or displacement (since launch time)	Second
	0 08 042	Extended vertical sounding significance	Flag table
	0 07 004	Pressure	Pa, scale –1
	0 05 015	Latitude displacement since launch site (high accuracy)	Degree, scale 5
	0 06 015	Longitude displacement since launch site (high accuracy)	Degree, scale 5
	0 11 061	Absolute wind shear in 1 km layer below	m s^{-1}, scale 1
	0 11 062	Absolute wind shear in 1 km layer above	m s^{-1}, scale 1

Notes:

(1) Time of launch 3 01 013 shall be reported with the highest possible accuracy available. If the launch time is not available with second accuracy, the entry for seconds shall be put to zero.

(2) Long time displacement 0 04 086 represents the time offset from the launch time 3 01 013 (in seconds)

(3) Latitude displacement 0 05 015 represents the latitude offset from the latitude of the launch site. Longitude displacement 0 06 015 represents the longitude offset from the longitude of the launch site.

Regulations:

B/C 26.1 Section 1 of BUFR or CREX
B/C 26.2 Identification of launch point and instrumentation of dropsonde
B/C 26.3 Date/time of launch
B/C 26.4 Horizontal and vertical coordinates of launch site
B/C 26.5 Temperature, dew-point and wind data at pressure levels
B/C 26.6 Criteria for reporting standard and significant levels
B/C 26.7 Wind shear data
B/C 26.8 Data required by regional or national reporting practices

B/C 26.1 Section 1 of BUFR or CREX

B/C 26.1.1 Entries required in Section 1 of BUFR

The following entries shall be included in BUFR Section 1:

- BUFR master table,
- identification of originating/generating centre,
- identification of originating/generating sub-centre,
- update sequence number,
- identification of inclusion of optional section,
- data category (= 002 for all TEMP type data),
- international data sub-category (1), (2),
- local data subcategory,
- version number of master table,
- version number of local tables,
- year (year of the century up to BUFR edition 3),
- month (standard time),
- day (standard time = YY in the abbreviated telecommunication header for TEMP DROP type data),
- hour (standard time = GG in the abbreviated telecommunication header for TEMP DROP type data),
- minute (standard time = 00 for TEMP DROP type data).

Notes:

(1) Inclusion of this entry is required starting with BUFR edition 4.
(2) If required, the international data sub-category shall be included at all observation times as follows:
= 007 for TEMP DROP data.

B/C 26.1.2 Entries required in Section 1 of CREX

The following entries shall be included in CREX Section 1:

- CREX master table,
- CREX edition number,
- CREX table version number,
- version number of BUFR master table (1),
- version number of local tables (1),
- data category (= 002 for all TEMP type data),
- international data sub-category (1), (2),
- identification of originating/generating centre (1),
- identification of originating/generating sub-centre (1),
- update sequence number (1),
- number of subsets (1),

- year (standard time) (1),
- month (standard time) (1),
- day (standard time = YY in the abbreviated telecommunication header for TEMP DROP type data) (1),
- hour (standard time = GG in the abbreviated telecommunication header for TEMP DROP type data) (1),
- minute (standard time = 00 for TEMP DROP type data) (1).

Notes:
(1) Inclusion of these entries is required starting with CREX edition 2.
(2) If inclusion of international data sub-category is required, Note (2) under B/C 26.1.1 applies.

B/C 26.2 Identification of launch point and instrumentation of dropsonde <3 01 112>

B/C 26.2.1 Identification of launch point of dropsonde

Aircraft identifier (0 01 006) shall be always reported.

B/C 26.2.1 Instrumentation for P, T, U and wind measurement

Radiosonde type (Code table 0 02 011), solar and infrared radiation correction (Code table 0 02 013), tracking techniques/status of system used (Code table 0 02 014) and type of measuring equipment used (Code table 0 02 003) shall be reported. [35.2.5]

B/C 26.3 Date/time of launch <3 01 113>

Time significance (0 08 021) shall be always set to 18 to indicate that the following entries specify the date and time of launching the dropsonde.

Date of launch <3 01 011> and time of launch <3 01 013> shall be reported, i.e. year (0 04 001), month (0 04 002), day (0 04 003)> and hour (0 04 004), minute (0 04 005) and second (0 04 006) of the actual time of launch shall be reported. [35.2.5]
Note:
(1) Time of launch <3 01 013> shall be reported with the highest possible accuracy available. If the launch time is not available with second accuracy, the entry 0 04 006 for seconds shall be set to zero.

B/C 26.4 Horizontal and vertical coordinates of launch site <3 01 114>

Latitude (0 05 001) and longitude (0 06 001) of the launch site shall be reported in degrees with precision in 10^{-5} of a degree.

Height of station ground above mean sea level (0 07 030) shall be reported as a missing value.

Height of barometer above mean sea level (0 07 031) shall be reported in meters with precision in tenths of a meter.

Height of release of dropsonde above mean sea level (0 07 007) shall be reported in meters.

Station elevation quality mark (Code table 0 33 024) shall be reported as a missing value. [35.2.1]

B/C 26.5 Temperature, dew-point and wind data at pressure levels

Temperature, dew-point and wind data at pressure levels obtained during the dropsonde descent shall be included in descending order with respect to pressure. Data at each pressure level shall be included only once. For example, if a significant level with respect to air temperature and relative humidity and a standard isobaric surface coincide, data for that level shall be included only once, the multiple attributes being indicated by

Extended vertical sounding significance (Flag table 0 08 042) as specified in Regulation B/C 26.5.2.2.

Note:

(1) If data are produced and collected in traditional TEMP DROP code, the order of pressure levels may correspond to the order of levels in Parts A, B, C and D, when converted into BUFR or CREX. In this case, data at a level may be included more than once.

B/C 26.5.1 Number of reported pressure levels

The number of reported pressure levels shall be indicated by Extended delayed descriptor replication factor 0 31 002 in BUFR and by a four-digit number in the Data Section corresponding to the position of the replication descriptor in the Data Description Section of CREX.

Notes:

(1) The number of pressure levels shall never be set to a missing value.
(2) The number of pressure levels shall be set to a positive value in a NIL report.

B/C 26.5.2 Temperature, dew-point and wind data at a pressure level <3 03 054>

B/C 26.5.2.1 Long time displacement (since launch time)

Long time displacement (0 04 086) represents the time offset from the launch time specified in Regulation 26.3, and shall be reported in seconds if available.

B/C 26.5.2.2 Extended vertical sounding significance – Flag table 0 08 042

This datum shall be used to specify vertical sounding significance in the following way:

(a) Bit No. 1 set to 1 indicates a surface (see Regulation B/C 26.6.1)
(b) Bit No. 2 set to 1 indicates a standard level (see Regulation B/C 26.6.2).
(c) Bit No. 3 set to 1 indicates a tropopause level (see Regulation B/C 26.6.3).
(d) Bit No. 4 set to 1 indicates a maximum wind level (see Regulation B/C 26.6.4).
(e) Bit No. 5 set to 1 indicates a level significant with respect to temperature (see Regulation B/C 26.6.5).
(f) Bit No. 6 set to 1 indicates a level significant with respect to relative humidity (see Regulation B/C 26.6.6).
(g) Bit No. 7 set to 1 indicates a level significant with respect to wind (see Regulation B/C 26.6.7).
(h) Bit No. 8 set to 1 indicates beginning of missing temperature data and bit No. 9 set to 1 indicates end of missing temperature data (see Regulation B/C 26.6.8).
(i) Bit No. 10 set to 1 indicates beginning of missing humidity data and bit No. 11 set to 1 indicates end of missing humidity data (see Regulation B/C 26.6.9).
(j) Bit No. 12 set to 1 indicates beginning of missing wind data bit No. 13 set to 1 indicates end of missing wind data (see Regulation B/C 26.6.10).
(k) Bit No. 14 set to 1 indicates the top of wind sounding (the lowest level for which wind data are available).
(l) Bit No. 15 set to 1 indicates a level determined by regional decision.
(m) All bits set to 0 indicate a level determined by national decision.
(n) All bits set to 1 indicate a missing value.

B/C 26.5.2.3 Pressure

Pressure (0 07 004) shall be reported in pascals (with precision in tens of a pascal).

B/C 26.5.2.4 Geopotential height

Geopotential height of the level (0 10 009) shall be reported in geopotential meters.

B/C 26.5.2.5 Radiosonde drift - latitude and longitude displacements

Latitude displacement (0 05 015) represents the latitude offset from the latitude of the launch site specified in Regulation 26.4, and shall be reported in degrees with precision in 10^{-5} of a degree if available. Longitude displacement 0 06 015 represents the

longitude offset from the longitude of the launch site specified in Regulation 26.4, and shall be reported in degrees with precision in 10^{-5} of a degree if available.

B/C 26.5.2.6 Temperature

Temperature (0 12 101) shall be reported in degrees Kelvin (with precision in hundredths of a degree Kelvin); if produced in CREX, in degrees Celsius (with precision in hundredths of a degree Celsius). Temperature data shall be reported with precision in hundredths of a degree even if they are measured with the accuracy in tenths of a degree.

Notes:

(1) This requirement is based on the fact that conversion from the Kelvin to the Celsius scale has often resulted into distortion of the data values.

(2) Temperature t (in degrees Celsius) shall be converted into temperature T (in degrees Kelvin) using equation: T = t + 273.15.

B/C 26.5.2.7 Dew-point temperature

Dew-point temperature (0 12 103) shall be reported in degrees Kelvin (with precision in hundredths of a degree Kelvin); if produced in CREX, in degrees Celsius (with precision in hundredths of a degree Celsius).

Note:

(1) Notes (1) and (2) under Regulation B/C 26.5.2.6 shall apply.

B/C 26.5.2.7.1

Dew-point temperature data shall be derived using the function (or a near equivalent) for a relationship between saturation vapour pressure over water and air temperature (specified in publication WMO-No. 49 – *Technical Regulations*). Dew-point temperature data shall not be reported when the air temperature is outside the range stated by WMO for the application of the function; a lesser range may be used as a national practice. [35.3.1.1]

B/C 26.5.2.8 Wind direction and speed

The wind direction (0 11 001) shall be reported in degrees true and the wind speed (0 11 002) shall be reported in meters per second (with precision in tenths of a meter per second).

B/C 26.5.2.8.1

Only wind data obtained from the radiosonde descent by electronic means shall be included in the BUFR (or CREX) message in which data are described by the common sequence 3 09 053. Wind data obtained by means other than a radiosonde-type descent shall not be included in a message under common sequence 3 09 053. [35.1.7]

B/C 26.6 Criteria for reporting standard and significant levels

B/C 26.6.1 Surface level

If extrapolated surface data are included in the report, the level shall be indicated by bit No. 1 of 0 08 042 set to 1.

B/C 26.6.2 Standard levels

B/C 26.6.2.1

The standard levels of 1 000, 925, 850, 700, 500, 400, 300, 250, 200, 150, 100, 70, 50, 30, 20 and 10 hPa shall be reported in descending order with respect to pressure. [35.2.2.1]

B/C 26.6.2.2

When air temperature, dew-point temperature or wind data at a standard level are not available, the corresponding entries for that level shall be reported as missing values.

B/C 26.6.2.3

Whenever it is desired to extrapolate a sounding for the computation of the geopotential at a standard level, the following rules shall apply:

(a) Extrapolation is permissible if, and only if, the pressure difference between the minimum pressure of the sounding and the isobaric surface for which the extrapolated value is being computed does not exceed one quarter of the pressure at which the extrapolated value is desired, provided the extrapolation does not extend through a pressure interval exceeding 25 hPa;

(b) For the purpose of geopotential calculation, and for this purpose only, the sounding will be extrapolated, using two points only of the sounding curve on a T-log p diagram, namely that at the minimum pressure reached by the sounding and that at the pressure given by the sum of this minimum pressure and the pressure difference, mentioned in (a) above. [35.2.2.4]

B/C 26.6.3 Tropopause level(s)

B/C 26.6.3.1

When a tropopause (one or more) is observed, the corresponding number of levels shall be included (indicated by 0 08 042 - bit No. 3 set to 1).

Note:

(1) For a definition of tropopause, see publication WMO-No. 100 – *Guide to Climatological Practices.* [35.2.3.1]

B/C 26.6.3.2

When no tropopause data are observed, no level shall be indicated by bit No. 3 of 0 08 042 set to 1. [35.2.3.2]

B/C 26.6.4 Maximum wind level(s)

B/C 26.6.4.1

When a maximum wind level (one or more) is reported, the corresponding number of levels shall be included in the report indicated by 0 08 042 - bit No. 4 set to 1.

Notes:

(1) Criteria for determining maximum wind levels are given in Regulations B/C 26.6.4.3 and B/C 26.6.4.4 below. [35.2.4.1]

(2) As a maximum wind level is also a level significant with respect to wind, bit No. 7 as well as bit No. 4 shall be set to 1 in the Extended vertical sounding significance 0 08 042.

B/C 26.6.4.2

When no maximum wind level is observed, no level shall be indicated by bit No. 4 of 0 08 042 set to 1. [35.2.4.2]

B/C 26.6.4.3

A maximum wind level:

(a) Shall be determined by consideration of the list of significant levels for wind speed, as obtained by means of the relevant recommended or equivalent national method (see Note under Regulation B/C 26.6.7.2) and *not* by consideration of the original wind-speed curve;

(b) Shall be located above the 500-hPa isobaric surface and shall correspond to a speed of more than 30 meters per second.

Note:

(1) A maximum wind level is defined as a level at which the wind speed is greater than that observed immediately above and below that level. [35.2.4.1] [32.2.3.1]

B/C 26.6.4.4

Whenever more than one maximum wind level exists, these levels shall be reported as follows:

(a) The level of greatest maximum wind speed shall be always included;

(b) The other levels shall be included in the report only if their speed exceeds those of the two adjacent minima by at least 10 meters per second. [35.2.4.1] [32.2.3.2]

B/C 26.6.4.5

If the top of the wind sounding corresponds to the highest wind speed observed throughout the descent, this level shall be indicated by 0 08 042 - bit No. 4 set to 1 (maximum wind level), bit No. 7 set to 1 (level significant with respect to wind) and bit No. 14 set to 1 (top of wind sounding).

Notes:

(1) For the purpose of the above regulation, the “top of the wind sounding” is to be understood as the lowest level (termination level of the sounding) for which wind data are available. [35.2.4.3]

(2) Although not very probable, the situation described in the above regulation cannot be excluded.

B/C 26.6.5 Levels significant with respect to temperature

B/C 26.6.5.1

The reported significant levels *alone* shall make it possible to reconstruct the air temperature profile within the limits of the criteria specified.

If the criteria for determination of significant levels with respect to air temperature are satisfied at a particular point of altitude, data for all variables (if available) shall be reported for that level. [35.3.1.1]

B/C 26.6.5.2

The following shall be included as “mandatory” significant temperature levels:

(a) Aircraft reference level and termination level of the sounding (the lowest level of the sounding);

(b) A level between 110 and 100 hPa;

(c) Bases and tops of inversions and isothermal layers which are at least 20 hPa thick, provided that the base of the layer occurs below the 300-hPa level or the first tropopause, whichever is the higher;

(d) Bases and tops of inversion layers which are characterized by a change in temperature of at least 2.5ºC, provided that the base of the layer occurs below the 300-hPa level or the first tropopause, whichever is the higher.

Note:

(1) The inversion layers of (c) and (d) may be comprised of several thinner inversion layers separated by thin layers of temperature lapse. To allow for this situation, the tops of the inversion layers of (c) and (d) shall each be at a level such that no further inversion layers, whether thick or thin, shall occur for at least 20 hPa above the level. [35.3.1.2]

B/C 26.6.5.3

The following shall be included as “additional” significant levels. They shall be selected in the order given, thereby giving priority to representing the temperature profile. As far as possible, these additional levels shall be the actual levels at which prominent changes in the lapse rate of air temperature occur:

(a) Levels which are necessary to ensure that the temperature obtained by linear interpolation (on a T-log P or essentially similar diagram) between adjacent significant levels shall not depart from the observed temperature by more than 1ºC below the first significant level reported above the 300-hPa level or the first tropopause, whichever level is the lower, or by more than 2ºC thereafter;

(b) Levels which are necessary to limit the interpolation error on diagrams other than T-log P. These levels shall be such that the pressure at one significant level divided by the pressure of the preceding significant layer shall exceed 0.6 for levels up to the first tropopause and shall be determined by use of the method for selecting additional levels but with application of tighter criteria. [35.3.1.3]

B/C 26.6.5.4

When a significant level with respect to air temperature and a standard level coincide, data for that level shall be reported only once.

B/C 26.6.6 Levels significant with respect to relative humidity

B/C 26.6.6.1

The reported significant levels *alone* shall make it possible to reconstruct the relative humidity profiles within the limits of the criteria specified.

If the criteria for determination of significant levels with respect to relative humidity are satisfied at a particular point of altitude, data for all variables (if available) shall be reported for that level. [35.3.1.1]

B/C 26.6.6.2

The following shall be included as “mandatory” significant humidity levels:

(a) Aircraft reference level and termination level of the sounding (the lowest level of the sounding);

(b) A level between 110 and 100 hPa;

(c) Bases and tops of inversions and isothermal layers which are at least 20 hPa thick, provided that the base of the layer occurs below the 300-hPa level or the first tropopause, whichever is the higher;

(d) Bases and tops of inversion layers which are characterized by a change in relative humidity of at least 20 per cent, provided that the base of the layer occurs below the 300-hPa level or the first tropopause, whichever is the higher.

Note:

Note (1) under Regulation B/C 26.6.5.2 shall apply. [35.3.1.2]

B/C 26.6.6.3

The following shall be included as “additional” significant levels. They shall be selected in the order given, thereby giving priority to representing the temperature profile. As far as possible, these additional levels shall be the actual levels at which prominent changes in the lapse rate of air temperature occur:

(a) Levels which are necessary to ensure that the relative humidity obtained by linear interpolation between adjacent significant levels shall not depart by more than 15 per cent from the observed values. (The criterion of 15 per cent refers to an amount of relative humidity and NOT to the percentage of the observed value, e.g. if an observed value is 50 per cent, the interpolated value shall lie between 35 per cent and 65 per cent.);

(b) Levels which are necessary to limit the interpolation error on diagrams other than T-log P. These levels shall be such that the pressure at one significant level divided by the pressure of the preceding significant layer shall exceed 0.6 for levels up to the first tropopause and shall be determined by use of the method for selecting additional levels but with application of tighter criteria. [35.3.1.3]

B/C 26.6.6.4

When a significant layer with respect to relative humidity and a standard level coincide, data for that level shall be reported only once.

B/C 26.6.7 Levels significant with respect to wind

B/C 26.6.7.1

Significant wind levels shall be chosen so that the data from them *alone* shall make it possible to reconstruct the wind profile with sufficient accuracy for practical use. [35.3.2.1]

If the criteria for determination of significant levels with respect to wind speed and direction are satisfied at a particular point of altitude, data for all variables (if available) shall be reported for that level.

B/C 26.6.7.2

Criteria for determining significant levels with respect to changes in wind speed and direction:

(a) The direction of speed curves (in function of the log of pressure or altitude) can be reproduced with their prominent characteristics;

(b) These curves can be reproduced with the accuracy of at least 10 for direction and five meters per second for speed.

Note:

To satisfy these criteria, the following method of successive approximations is recommended, but other methods of attaining equivalent results may suit some national practices better and may be used:

(ii) The lowest level for which wind data are available and the aircraft reference level constitute the first and the last significant levels.

The deviation from the linearly interpolated values between these two levels is then considered. If no direction deviates by more than 10 and no speed by more than five meters per second, no other significant level need be reported. Whenever one parameter deviates

by more than the limit specified in paragraph (b) above the level of greatest deviation becomes a supplementary significant level for both parameters.

(ii) The additional significant levels so introduced divide the sounding into two layers. In each separate layer, the deviation from the linearly interpolated values between the base and the top are then considered. The process used in paragraph (i) above is repeated and yields other significant levels. These additional levels in turn modify the layer distribution, and the method is applied again until any level is approximated to the above-mentioned specified values. [35.3.2.1] [32.3.1.1]

B/C 26.6.8 Beginning and end of missing temperature data

B/C 26.6.8.1

A layer for which temperature data are missing shall be indicated by reporting the boundary levels of the layer, provided that the layer is at least 20 hPa thick. The boundary levels are the levels closest to the bottom (beginning of the missing data) and the top (end of the missing data) of the layer for which temperature data are available. The boundary levels are not required to meet “significant temperature level” criteria. [35.3.1.6]

B/C 26.6.9 Beginning and end of missing humidity data

B/C 26.6.9.1

A layer for which dew-point temperature data are missing shall be indicated by reporting the boundary levels of the layer, provided that the layer is at least 20 hPa thick. The boundary levels are the levels closest to the bottom (beginning of the missing data) and the top (end of the missing data) of the layer for which dew-point temperature data are available. The boundary levels are not required to meet “significant humidity level” criteria. [35.3.1.6]

B/C 26.6.10 Beginning and end of missing wind data

B/C 26.6.10.1

A layer for which wind data are missing shall be indicated by reporting the boundary levels of the layer, provided that the layer is at least 50 hPa thick. The boundary levels are the levels closest to the bottom (beginning of the missing data) and the top (end of the missing data) of the layer for which the observed data are available. The boundary levels are not required to meet “significant wind level” criteria. [35.3.2.2]

B/C 26.7 Wind shear data

B/C 26.7.1 Number and order of levels for which wind shear is reported

B/C 26.7.1.1

The number of levels with wind shear data shall be indicated by Delayed descriptor replication factor 0 31 001 in BUFR and by a four-digit number in the Data Section corresponding to the position of the replication descriptor in the Data Description Section of CREX.

Notes:

(1) The number of levels with wind shear data shall never be set to a missing value.

(2) The number of levels with wind shear data shall be set to a positive value in a NIL report.

(3) The number of levels with wind shear data shall be set to zero if data for vertical wind shear are not computed and required. [35.2.4.4]

B/C 26.7.1.2

Whenever wind shear data are reported for more than one level, these maximum wind levels shall be included in the same order as in the sequence <3 03 054>, i.e. in descending order with respect to pressure.

B/C 26.7.2 Wind shear data at a pressure level <3 03 051>

B/C 26.7.2.1 Long time displacement (since launch time)

Long time displacement (0 04 086) represents the time offset from the launch time specified in Regulation 26.3, and shall be reported in seconds if available.

B/C 26.7.2.2 Extended vertical sounding significance – Flag table 0 08 042

A level, for which wind shear data are reported, shall be indicated by vertical sounding significance 0 08 042 - bit No. 4 set to 1 (maximum wind level) and by bit No. 7 set to 1 (level significant with respect to wind).

B/C 26.7.2.3 Pressure

Pressure (0 07 004) shall be reported in pascals with precision in tens of a pascal.

B/C 26.7.2.4 Latitude and longitude displacements

Latitude displacement (0 05 015) represents the latitude offset from the latitude of the launch site specified in Regulation 26.4, and shall be reported in degrees with precision in 10^{-5} of a degree if available. Longitude displacement 0 06 015 represents the longitude offset from the longitude of the launch site specified in Regulation 26.4, and shall be reported in degrees with precision in 10^{-5} of a degree if available.

B/C 26.7.2.5 Wind shear data

Absolute wind shear in 1 km layer below (0 11 061) and absolute wind shear in 1 km layer above (0 11 062) shall be reported in meters per second (with precision in tenths of a meter per second), if data for vertical wind shear are computed and required. [35.2.4.4]

B/C 26.8 Data required by regional or national reporting practices

If regional or national reporting practices require inclusion of temperature, humidity and/or wind data at additional levels, these data shall be reported using sequence <3 03 054> for Temperature, dew-point, wind at a pressure level. Regulation B/C 26.5 shall apply.

Notes:

(1) A level determined by regional decision shall be indicated by Extended vertical sounding significance 0 08 042 - bit No. 15 set to 1.

(2) A level determined by national decision shall be indicated by Extended vertical sounding significance 0 08 042 – all bits set to 0.

B/C 26.8.1 Additional data required by reporting practices

No regional requirements are indicated for reporting TEMP DROP data in Manual on Codes, WMO-No. 306, Volume II.

B/C35 – Regulations for reporting CLIMAT TEMP and CLIMAT TEMP SHIP and data in TDCF

General

A BUFR (or CREX) message shall contain reports for one specific month only. [75.8]

TM 309054 - BUFR template for reports of monthly aerological means suitable for CLIMAT TEMP and CLIMAT TEMP SHIP data

3 09 054		**Sequence for representation CLIMAT TEMP and CLIMAT TEMP SHIP data**

Sequence BUFR descriptor <3 09 054> expands as it is shown in the leftmost column below:

		Identification of launch site	Unit, scale
3 01 001	0 01 001	WMO block number	Numeric, 0
	0 01 002	WMO station number	Numeric, 0
0 01 011		Ship's call sign	CCITT IA5, 0
		Date/time(1)	
3 01 011	0 04 001	Year(1)	Year, 0
	0 04 002	Month(1)	Month, 0
	0 04 003	Day (= 1) (1)	Day, 0
3 01 012	0 04 004	Hour (= 0) (1)	Hour, 0
	0 04 005	Minute (= 0) (1)	Minute, 0
		Horizontal and vertical coordinates	
3 01 021	0 05 001	Latitude (high accuracy)	Degree, 5
	0 06 001	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 07 007		Height release of sonde above mean sea level	m, 0
		Monthly mean data	
0 04 023		Time period (= number of days in the month)	Day, 0
0 04 059		Times of observations used to compute the reported mean values	Flag table, 0
1 15 000		Delayed replication of 15 descriptors	
0 31 001		Delayed descriptor replication factor	Numeric, 0
0 08 001		Vertical sounding significance	Flag table, 0
0 08 023		First order statistics (= 4; mean value)	Code table, 0
0 07 004		Pressure	Pa, –1
0 10 009		Geopotential height	gpm, 0
0 12 101		Temperature/dry-bulb temperature	K, 2
0 12 103		Dew-point temperature	K, 2
0 08 023		First order statistics (= 32; vector mean)	Code table, 0
0 11 001		Wind direction	Degree true, 0
0 11 002		Wind speed	m s^{-1}, 1
0 08 023		First order statistics (= 63; missing value)	Code table, 0
0 11 019		Steadiness of wind	%, 0
0 08 050		Qualifier for number of missing values in calculation of statistic (= 2; temperature)	Code table, 0

0 08 020		Total number of missing entities (days)	Numeric, 0
0 08 050		Qualifier for number of missing values in calculation of statistic (= 9; wind)	Code table, 0
0 08 020		Total number of missing entities (days)	Numeric, 0

Note:

(1) The time identification refers to the beginning of the one-month period.

Regulations:

B/C 35.1 Section 1 of BUFR or CREX
B/C 35.2 Identification of launch site
B/C 35.3 Date/time (of the beginning of the one-month period)
B/C 35.4 Horizontal and vertical coordinates of launch site
B/C 35.5 Monthly mean data
B/C 35.5.1 Period of reference for monthly mean data
B/C 35.5.2 Times of observation used to compute the reported mean values
B/C 35.5.3 Number of reported pressure levels
B/C 35.5.4 Monthly mean data reported for a pressure level
B/C 35.6 Data required by regional or national reporting practices

B/C 35.1 Section 1 of BUFR or CREX

B/C 35.1.1 Entries required in Section 1 of BUFR

The following entries shall be included in BUFR Section 1:

- BUFR master table,
- identification of originating/generating centre,
- identification of originating/generating sub-centre,
- update sequence number,
- identification of inclusion of optional section,
- data category (= 002 for CLIMAT TEMP and CLIMAT TEMP SHIP data),
- international data sub-category (1), (2),
- local data subcategory,
- version number of master table,
- version number of local tables,
- year (year of the century up to BUFR edition 3) (3),
- month (for which the monthly mean values are reported) (3),
- day (= 1) (3),
- hour (= 0) (3),
- minute (= 0) (3).

Notes:

(1) Inclusion of this entry is required starting with BUFR edition 4.

(2) If required, the international data sub-category shall be included as follows:
= 025 for CLIMAT TEMP data,
= 026 for CLIMAT TEMP SHIP data.

(3) The time identification refers to the beginning of the one-month period for which the monthly mean values are reported.

B/C 35.1.2 Entries required in Section 1 of CREX

The following entries shall be included in CREX Section 1:

- CREX master table,
- CREX edition number,
- CREX table version number,
- version number of BUFR master table (1),
- version number of local tables (1),
- data category (= 002 for CLIMAT TEMP and CLIMAT TEMP SHIP data),
- international data sub-category (1), (2),
- identification of originating/generating centre (1),

- identification of originating/generating sub-centre (1),
- update sequence number (1),
- number of subsets (1),
- year (1), (3),
- month (for which the monthly mean values are reported) (1), (3),
- day (= 1) (1), (3),
- hour (= 0) (1), (3),
- minute (= 0) (1), (3).

Notes:
(1) Inclusion of these entries is required starting with CREX edition 2.
(2) If inclusion of international data sub-category is required, Note (2) under B/C 35.1.1 applies.
(3) Note (3) under B/C 35.1.1 applies.

B/C 35.2 Identification of launch site

WMO block number station (0 01 001) and WMO station number (0 01 002) shall be always included as a non-missing value in reports from land stations.

Ship identifier (0 01 011), if available, shall be included in reports from a sea station not exceeding 9 characters.

B/C 35.3 Date/time (of the beginning of the one-month period)

Date <3 01 011> and time <3 01 012> shall be reported, i.e. year (0 04 001), month (0 04 002), day (0 04 003) and hour (0 04 004), minute (0 04 005) of the beginning of the one-month period for which the monthly mean values are reported. Day (0 04 003) shall be set to 1 and both hour (0 04 004) and minute (0 04 005) shall be set to 0.

B/C 35.4 Horizontal and vertical coordinates of launch site

Latitude (0 05 001) and longitude (0 06 001) of the launch site shall be reported in degrees with precision in 10^{-5} of a degree.

Height of station ground above mean sea level (0 07 030) and height of barometer above mean sea level (0 07 031) shall be reported in meters with precision in tenths of a meter.

Height release of sonde above mean sea level (0 07 007) shall be reported in meters.

B/C 35.5 Monthly mean data

The monthly mean values of temperature, dew-point and wind data shall include information for station level (surface) and for standard levels 850, 700, 500, 300, 200, 150, 100, 50, and 30 hPa. Each of the levels shall be reported even if the monthly mean data are not available. Any missing element shall be reported as a missing value. [75.4]

B/C 35.5.1 Period of reference for monthly mean data

Time period (0 04 023) represents the number of days in the month for which the monthly mean data are reported, and shall be expressed as a *positive value* in days.
Note:
(1) A BUFR (or CREX) message shall contain reports for one specific month only. [75.8]

B/C 35.5.2 Times of observation used to compute the reported mean values – Flag table 0 08 059

This datum shall be used to specify the observation times used to compute the reported mean values:
(a) Bit No. 1 set to 1 indicates usage of data from 0000 UTC.
(b) Bit No. 2 set to 1 indicates usage of data from 0600 UTC.
(c) Bit No. 3 set to 1 indicates usage of data from 1200 UTC.
(d) Bit No. 4 set to 1 indicates usage of data from 1800 UTC.
(e) Bit No. 5 set to 1 indicates usage of data from other hours.

B/C 35.5.3 Number of reported pressure levels

The number of reported pressure levels shall be indicated by Delayed descriptor replication factor 0 31 001 in BUFR and by a four-digit number in the Data Section corresponding to the position of the replication descriptor in the Data Description Section of CREX.

Notes:

(1) The number of pressure levels shall never be set to a missing value.

(2) The number of pressure levels shall be set to a positive value in a NIL report.

(3) In compliance with Regulation B/C 35.5, the number of pressure levels shall be set to 10. If reporting of monthly mean data for additional levels is requested, the number of pressure levels shall be modified accordingly.

B/C 35.5.4 Monthly mean data reported for a pressure level

B/C 35.5.4.1 Vertical sounding significance – Flag table 0 08 001

This datum shall be used to specify vertical sounding significance in the following way:

(a) Bit No. 1 set to 1 indicates surface (station level).

(b) Bit No. 2 set to 1 indicates a standard level.

(c) All bits set to 1 indicate a missing value.

B/C 35.5.4.2 First order statistics – Code table 0 08 023

This datum shall be set to 4 (mean value) to indicate that the following entries represent mean values of the elements (pressure, geopotential height, temperature and dew-point temperature).

B/C 35.5.4.3 Monthly mean value of pressure

Monthly mean value of pressure (0 07 004) shall be reported in pascals (with precision in tens of a pascal).

Notes:

(1) The mean value of station-level pressure shall be reported in the first replication. It shall be the monthly mean value of station-level pressure data measured at the time of release of the radiosonde. [75.5]

(2) The values 85000, 70000, 50000, 30000, 20000, 15000, 10000, 5000, and 3000 Pa shall be reported in the other replications in compliance with Regulation B/C 35.5.

B/C 35.5.4.4 Monthly mean value of geopotential height

Monthly mean value of geopotential height of the level (0 10 009) shall be reported in geopotential meters.

B/C 35.5.4.5 Monthly mean value of temperature

Monthly mean value of temperature (0 12 101) shall be reported in degrees Kelvin (with precision in hundredths of a degree Kelvin); if produced in CREX, in degrees Celsius (with precision in hundredths of a degree Celsius). Temperature data shall be reported with precision in hundredths of a degree even if they are measured with the accuracy in tenths of a degree.

Notes:

(1) This requirement is based on the fact that conversion from the Kelvin to the Celsius scale has often resulted into distortion of the data values.

(2) Temperature t (in degrees Celsius) shall be converted into temperature T (in degrees Kelvin) using equation: $T = t + 273.15$.

(3) The mean value of station-level temperature shall be the monthly mean value of station-level temperature data measured at the time of release of the radiosonde. [75.5]

B/C 35.5.4.6 Monthly mean value of dew-point temperature

Monthly mean value of dew-point temperature (0 12 103) shall be reported in degrees Kelvin (with precision in hundredths of a degree Kelvin); if produced in CREX, in degrees Celsius (with precision in hundredths of a degree Celsius).

Note:

(1) Notes (1) and (2) under Regulation B/C 35.5.4.5 shall apply.

(2) The mean value of station-level dew-point temperature shall be the monthly mean value of station-level dew-point temperature data measured at the time of release of the radiosonde. [75.5]

B/C 35.5.4.7 First order statistics – Code table 0 08 023

This datum shall be set to 32 (vector mean) to indicate that the two following entries wind direction (0 11 001) and wind speed (0 11 002) represent the monthly mean vector wind.

B/C 35.5.4.8 Monthly mean vector wind

The wind direction (0 11 001) of the monthly mean vector wind shall be reported in degrees true and the wind speed (0 11 002) of the monthly mean vector wind shall be reported in meters per second (with precision in tenths of a meter per second).

Notes:

(1) The mean vector wind data shall be reported for all standard levels specified in Regulation B/C 35.5. [75.7.1]

(2) The mean vector wind data shall be reported as missing values for the station level.

B/C 35.5.4.9 Steadiness of wind

Steadiness of wind (0 11 019) at specified standard levels represents the ratio of speed of the monthly mean vector wind to the speed of the monthly mean scalar wind. It shall be reported in units of a percent.

Notes:

(1) Steadiness of wind shall be reported for all standard levels specified in Regulation B/C 35.5.

(2) Steadiness of wind shall be reported as a missing value for the station level.

B/C 35.5.4.10 Number of days in the month for which temperature observations are missing

Number of days in the month for which temperature observations are missing for the specified standard level shall be reported using Total number of missing entities (0 08 050) being preceded by Qualifier for number of missing values in calculation of statistic (0 08 050) set to 2 (temperature).

B/C 35.5.4.11 Number of days in the month for which wind observations are missing

Number of days in the month for which wind observations are missing for the specified standard level shall be reported using Total number of missing entities (0 08 050) being preceded by Qualifier for number of missing values in calculation of statistic (0 08 050) set to 9 (wind).

B/C 35.6 Data required by regional or national reporting practices

No regional requirements are indicated for reporting CLIMAT TEMP and CLIMAT TEMP SHIP data in Manual on Codes, WMO-No. 306, Volume II.

If national reporting practices require inclusion of monthly mean data at additional levels, these data shall be reported using sequence <3 09 054>. Note (3) under Regulation B/C 35.5.3 shall apply.

Note:

(1) A level determined by national decision shall be indicated by Vertical sounding significance 0 08 001 – all bits set to 0.