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**SOLICITATION AMENDMENT
MODIFICATION DE L'INVITATION**

The referenced document is hereby revised; unless otherwise indicated, all other terms and conditions of the Solicitation remain the same.

Ce document est par la présente révisé; sauf indication contraire, les modalités de l'invitation demeurent les mêmes.

Comments - Commentaires

Address inquiries to the Contracting Authority at
Lesley.Martin2@pwgsc-tpsgc.gc.ca

Vendor/Firm Name and Address

**Raison sociale et adresse du
fournisseur/de l'entrepreneur**

Issuing Office - Bureau de distribution

Public Works and Government Services Canada
Ontario Region
33 City Centre Drive
Suite 480
Mississauga
Ontario
L5B 2N5

Title - Sujet Radiosondes	
Solicitation No. - N° de l'invitation K3D33-170264/A	Amendment No. - N° modif. 002
Client Reference No. - N° de référence du client K3D33-170264	Date 2017-01-19
GETS Reference No. - N° de référence de SEAG PW-\$TOR-033-7238	
File No. - N° de dossier TOR-6-39109 (033)	CCC No./N° CCC - FMS No./N° VME
Solicitation Closes - L'invitation prend fin at - à 02:00 PM on - le 2017-02-06	
Time Zone Fuseau horaire Eastern Standard Time EST	
F.O.B. - F.A.B. Plant-Usine: <input type="checkbox"/> Destination: <input checked="" type="checkbox"/> Other-Autre: <input type="checkbox"/>	
Address Enquiries to: - Adresser toutes questions à: Martin, Lesley	Buyer Id - Id de l'acheteur tor033
Telephone No. - N° de téléphone (905) 615-2069 ()	FAX No. - N° de FAX (905) 615-2060
Destination - of Goods, Services, and Construction: Destination - des biens, services et construction:	

Instructions: See Herein

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Name and title of person authorized to sign on behalf of Vendor/Firm (type or print) Nom et titre de la personne autorisée à signer au nom du fournisseur/ de l'entrepreneur (taper ou écrire en caractères d'imprimerie)	
Signature	Date

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AMENDMENT 002 IS ISSUED TO CORRECT THE TABLE NUMBERING IN APPENDIX A

At ANNEX A, Appendix A – Upper Air Coded Messages

Delete : in its entirety

Insert :

Appendix A

Upper Air Coded Messages

1.1 General

Upper air coded messages are used for international exchange of meteorological information. The upper air data is transmitted from Canadian aerological stations based on two general formats established by the World Meteorological Organization (WMO) for Region IV. These formats are:

- Radiosonde observations of altitude, pressure, temperature, dew point depression and wind speed and direction are coded using WMO Code FM 35-XI Ext. TEMP for land based stations, WMO Code FM 36-XI Ext. TEMP SHIP for sea based stations and WMO Code FM 38-XI Ext. TEMP MOBIL for mobile land stations.
- Upper wind observations are coded using WMO Code FM 32-XI Ext. PILOT for land based stations, WMO Code FM 33-XI Ext. PILOT SHIP for sea based stations and FM 34-XI Ext. PILOT MOBIL for mobile land stations.

1.2 Message section, part and header

1.2.1 Message sections

The data contained in the messages are grouped into sections. The TEMP, TEMP SHIP and TEMP MOBIL messages may contain up to 10 sections depending on WMO Regional and National practices. These sections are:

Section 1: identification and position data (latitude, longitude, height, height confidence)

Section 2: data for surface and mandatory levels

Section 3: data for tropopause level(s)

Section 4: data for maximum wind level(s) and vertical wind shear

Section 5: data for significant levels with respect to temperature and/or relative humidity

Section 6: data for significant levels with respect to wind

Section 7: data on sounding system and sea surface

Section 8: cloud data

Section 9: regional code groups

Section 10: national code groups

Canadian aerological stations do not include all sections in their transmitted messages. TEMP, TEMP SHIP and TEMP MOBIL messages consist of sections 1, 2, 3, 4, 5, 7, 9 and 10. PILOT, PILOT SHIP, and PILOT MOBIL messages consist of sections 1 and 4.

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1.2.2 Message parts

The data contained in the coded messages are divided into parts A, B, C, and D. For Canadian TEMP, TEMP SHIP and TEMP MOBIL messages contain:

Part A: the data up to and including the 100 hPa level for sections 1, 2, 3, and 4

Part B: the data up to and including the 100 hPa for sections 1, 5, 7, 9, and 10

Part C: the data above the 100 hPa level for sections 1, 2, 3, and 4

Part D: the data above the 100 hPa level for sections 1, 5, 9, and 10

The TEMP MOBIL message contains elevation data in Section 1.

1.2.3 Message headers

The data contained in the coded message are also divided into message headers. For Canadian TEMP and PILOT messages, headers contain:

US Bulletin: TEMP data for mandatory pressure levels.

UK Bulletin: TEMP data for significant levels as determined by the ground equipment.

UG Bulletin: contains PILOT data for fixed and significant wind levels. The format is not changed.

UL Bulletin: TEMP data for mandatory pressure levels.

UE Bulletin: TEMP data for significant levels as determined by the ground equipment.

UQ Bulletin: contains PILOT data for fixed and significant wind levels. The format is not changed.

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1.3 Message code form

1.3.1 TEMP or TEMP SHIP message, Part A (US)

Below are symbolic code forms of Part A of the first transmission of a radiosonde message used by land and ship stations.

1.3.1.1 Section 1: identification and position data

Identification groups for land stations:

$M_i M_i M_j M_j$ $YYGGI_d$ $IIiii$

or

Identification position groups for ship stations:

$M_i M_i M_j M_j$ $D D$ $YYGGI_d 99L_a L_a L_a$

$Q_c L_o L_o L_o L_o$ $MMMU_{L_a} U_{L_o}$

1.3.1.2 Section 2: surface and mandatory levels

Surface data:

$99P_o P_o P_o$ $T_o T_o T_{ao} D_o D_o$ $d_o d_o f_o f_o$

Mandatory levels:

00hhh $TTT_a DD$ d d f f f

92hhh $TTT_a DD$ d d f f f

85hhh $TTT_a DD$ d d f f f

70hhh $TTT_a DD$ d d f f f

50hhh $TTT_a DD$ d d f f f

40hhh $TTT_a DD$ d d f f f

30hhh $TTT_a DD$ d d f f f

25hhh $TTT_a DD$ d d f f f

20hhh $TTT_a DD$ d d f f f

15hhh $TTT_a DD$ d d f f f

10hhh $TTT_a DD$ d d f f f

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1.3.1.3 Section 3: tropopause level(s)

Tropopause data:

88P_tP_tP_t T_tT_tT_{at}D_tD_t d_td_tf_tf_tf_t

or

88999

1.3.1.4 Section 4: maximum wind level(s) and vertical wind shear

Maximum wind data:

77P_mP_mP_m

or

d_md_mf_mf_mf_m

66P_mP_mP_m

or

77999

1.3.2 TEMP or TEMP SHIP message, Part B (UK)

Below are symbolic code forms of Part B of the first transmission of a rawinsonde message used by land and ship stations.

1.3.2.1 Section 1: identification and position data

Identification groups for land stations:

M_iM_iM_jM_j YYGGa₄ llll

or

Identification position groups for ship stations:

M_iM_iM_jM_j D . . . D YYGGa₄ 99L_aL_aL_a

Q_cL_oL_oL_oL_o MMMU_{La}U_{Lo}

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1.3.2.2 Section 5: significant temperature and/or relative humidity

Surface data:

00P_oP_oP_o T_oT_oT_{ao}D_oD_o

11PPP TTT_aDD

and significant levels:

22PPP TTT_aDD

33PPP TTT_aDD

etc.

1.3.2.3 Section 7: sounding system and sea surface data

Sounding system data and sea surface data:

31313 s_rr_ar_as_as_a 8GGgg 9s_nT_wT_wT_w

1.3.2.4 Section 9: regional code groups

Regional codes - additional data:

51515 101A_{df}A_{df}

1.3.2.5 Section 10: national code groups

National codes - additional data:

61616 101A_{df}A_{df}

1.3.3 TEMP or TEMP SHIP message, Part C (UL)

Below are symbolic code forms of Part C of the second transmission of a radiosonde message used by land and ship stations.

1.3.3.1 Section 1: identification and position data

Identification groups for land stations:

M_iM_iM_jM_j YYGGI_d Iliii

or

Identification position groups for ship stations:

M_iM_iM_jM_j D . . . D YYGGI_d99L_aL_aL_a

Q_cL_oL_oL_oL_o MMMU_{La}U_{Lo}

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1.3.3.2 Section 2: surface and mandatory levels

Mandatory levels:

70hhh	TTT _a DD	ddfff
50hhh	TTT _a DD	ddfff
30hhh	TTT _a DD	ddfff
20hhh	TTT _a DD	ddfff
10hhh	TTT _a DD	ddfff
07hhh	TTT _a DD	ddfff
05hhh	TTT _a DD	ddfff
03hhh	TTT _a DD	ddfff
02hhh	TTT _a DD	ddfff
01hhh	TTT _a DD	ddfff

1.3.3.3 Section 3: tropopause level(s)

Tropopause data:

88P_tP_tP_t T_tT_tT_{at}D_tD_t d_td_tf_tf_tf_t

or

88999

1.3.3.4 Section 4: maximum wind level(s) and vertical wind shear

Maximum wind data:

77P_mP_mP_m

or

d_md_mf_mf_mf_m

66P_mP_mP_m

or

77999

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1.3.4 TEMP or TEMP SHIP message, Part D (UE)

The symbolic code forms of Part D of the second transmission of a radiosonde message are used by land and ship stations.

1.3.4.1 Section 1: identification and position data

Identification groups for land stations:

$M_i M_i M_j M_j$ YYGG/ llll

or

Identification position groups for ship stations:

$M_i M_i M_j M_j$ D D YYGGa₄ 99L_aL_aL_a

Q_cL_oL_oL_oL_o MMMU_{La}U_{Lo}

1.3.4.2 Section 5: significant temperature and/or relative humidity levels

Significant levels:

11PPP TTT_aDD

22PPP TTT_aDD

33PPP TTT_aDD

44PPP TTT_aDD

etc.

1.3.4.3 Section 9: regional groups

Regional codes - additional data:

51515 101A_{df}A_{df}

1.3.4.4 Section 10: national groups

National codes - additional data:

61616 101A_{df}A_{df}

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1.4 TEMP message content

1.4.1 Section 1: identification and position data

The purpose of Section 1 is to identify the type, origin and time of the message, and is included in each part.

1.4.1.1 Message indicator $M_i M_i M_j M_j$

This four-letter group contains identification data and is the first group in the coded message.

$M_i M_i$: Symbolic code for identifying a radiosonde or radiosonde message originating from a land or ship station. A TEMP message is coded as TT, a TEMP SHIP is coded as UU and a TEMP MOBIL is coded as II.

$M_j M_j$: Symbolic code for identifying the part of the message that is to follow (i.e. parts A, B, C or D) Part A is coded as AA, Part B as BB, etc.

1.4.1.2 Date indicator $YYGGI_d$ (parts A, C, D) and $YYGGa_4$ (Part B)

YY: Identifies the day of the month and the unit of wind speed (i.e. knots or meters per second) used in the message.

The day of the month is reported through the use of code figures 01 to 31, inclusive, where code figure 01 means the first day of the month, 02 means second day of the month, etc.

The unit of wind speed is reported as follows:

- When wind speeds are reported in knots, 50 is added to YY (Canadian upper air messages always use knots);
- When wind speeds are reported in meters per second, YY is not modified.

GG: Identifies the time of observation in whole hours, coordinated universal time (UTC), based on the twenty-four hour clock (i.e. 00 to 23).

The standard hour of observation, H, is coded for GG whenever the release time is within the time range of H-45 to H+29 inclusive (e.g. If the release time is 2315, GG is coded as 00).

If the release time is outside of the range of H-45 to H+29, GG is coded to the nearest hour UTC (e.g. if the release time is 0030, GG is coded as 01).

I_d : Identifies the last mandatory level for which wind data is reported.

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Table 1–1: Table for selection of code figure I_d – WMO code table 1734

Code figure	Pressure of mandatory level – Part A	Pressure of mandatory level – Part C
1	100 or 150 hPa	10 hPa
2	200 or 250 hPa	20 hPa
3	300 hPa	30 hPa
4	400 hPa	-
5	500 hPa	50 hPa
6	-	-
7	700 hPa	70 hPa
8	850 hPa	-
9	925 hPa	-
0	1000 hPa	-
/	No wind group included for any mandatory level.	No wind group included for any mandatory level.

1.4.1.3 International index number Iliii

This five-figure group constitutes the international index number.

II: Identifies the block number which defines the area in which the reporting station is situated. Each block contains 1000 station numbers and is allocated to one or more countries within a WMO region. All stations within Canada use the block number 71.

iii: Refers to the three digit number allocated to Meteorological Services in one or more countries within a WMO Region.

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1.4.2 Section 2: surface and mandatory levels

The purpose of Section 2 is to report temperature, dew point depression, altitude and wind data corresponding to the mandatory pressure levels. The data for a mandatory level is normally coded into three consecutive groups. The first group contains the level identifier and the altitude expressed in geopotential meters; the second group contains temperature and dew point depression data; while the third group is the coded wind direction and speed.

1.4.2.1 Mandatory levels (pressure) 99P_oP_oP_o

99: The digits 99 indicate that surface level data is to follow.

P_oP_oP_o: The hundreds, tens and units digits corresponding to the surface pressure expressed in hPa.

1.4.2.2 Mandatory levels (height) XXhhh

XX: Level identifier (refer to Tables 1–2 and 1–3).

hhh: Indicates whole geopotential metres for the altitudes of the 1000, 925, 850 and 700 hPa levels; and indicates the hundreds, tens and ones digits and indicates the thousands, hundreds and tens digits of the altitude in geopotential metres for the 500 hPa level and higher.

Example (1): 700 hPa at 3034 gpm is coded as 034

Example (2): 500 hPa at 5560 gpm is coded as 556.

Example (3): 100 hPa at 16280 gpm is coded as 628.

Note: When the altitude of the 1,000 hPa level is computed to be below sea level (i.e. a negative number), 500 is added to its value.

Example (1): 1000 hPa at a negative (-)75 gpm (below sea level) is coded as 10575.

Example (2): 1000 hPa at a negative (-)125 gpm (below sea level) is coded as 00375.

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Table 1–2: Pressure corresponding to level identifiers XX – Part A

Part A	Level
00	1000 hPa
92	925 hPa
85	850 hPa
70	700 hPa
50	500 hPa
30	300 hPa
25	250 hPa
20	200 hPa
15	150 hPa
10	100 hPa

Table 1–3: Pressure corresponding to level identifiers XX – Part C

Part C	Level
70	70 hPa
50	50 hPa
30	30 hPa
20	20 hPa
10	10 hPa
07	7 hPa
05	5 hPa

1.4.2.3 Mandatory levels (temperature) $T_o T_o T_{ao} D_o D_o$ and $TT_a DD$

These groups contain temperature and dew point depression data corresponding to the mandatory level, XX, in the immediately preceding group. The subscript “_o” in the symbolic code indicates surface level data.

$T_o T_o$ and TT : Represent the tens and unit's value of the temperature.

T_{ao} and T_a : Represent the approximate tenths value and the sign (i.e. positive or negative) of the values for TT and $T_o T_o$. When this digit is an odd number, the temperature is negative and when this digit is an even number, the temperature is positive (refer to Table 1–4).

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D_oD_o and **DD**: Represent the dew point depression with respect to water, (i.e. the difference between the air temperature and the dew point temperature expressed in degrees Celsius, refer to Table 1–5).

Table 1–4: Table for selection of code figure T_aT_{ao}T_{at} – WMO code table 3931

Tenths figure of observed air temperature	Code figure positive temperature	Code figure negative temperature
0	0	1
1	0	1
2	2	3
3	2	3
4	4	5
5	4	5
6	6	7
7	6	7
8	8	9
9	8	9

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Table 1–5: Determining code figures for dew point depression – WMO code table 0777

Dew point depression °C	Code figure	Dew point depression °C	Code figure	Dew point depression °C	Code figure
0.0	00	3.4	34	18	68
0.1	01	3.5	35	19	69
0.2	02	3.6	36	20	70
0.3	03	3.7	37	21	71
0.4	04	3.8	38	22	72
0.5	05	3.9	39	23	73
0.6	06	4.0	40	24	74
0.7	07	4.1	41	25	75
0.8	08	4.2	42	26	76
0.9	09	4.3	43	27	77
1.0	10	4.4	44	28	78
1.1	11	4.5	45	29	79
1.2	12	4.6	46	30	80
1.3	13	4.7	47	31	81
1.4	14	4.8	48	32	82
1.5	15	4.9	49	33	83
1.6	16	5	50	34	84
1.7	17	not used	51	35	85
1.8	18	not used	52	36	86
1.9	19	not used	53	37	87
2.0	20	not used	54	38	88
2.1	21	not used	55	39	89
2.2	22	6	56	40	90
2.3	23	7	57	41	91
2.4	24	8	58	42	92
2.5	25	9	59	43	93
2.6	26	10	60	44	94
2.7	27	11	61	45	95
2.8	28	12	62	46	96
2.9	29	13	63	47	97
3.0	30	14	64	48	98
3.1	31	15	65	49	99
3.2	32	16	66	-	-
3.3	33	17	67	-	-

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1.4.2.4 Mandatory levels (wind) $d_o d_o f_o f_o$ and $ddfff$

This group contains wind direction and speed data for the mandatory level XX. The subscript “ o ” in the symbolic form indicates surface data.

dd: The hundreds and tens digits of the wind direction.

fff: The first digit represents the units value of the wind direction rounded to the nearest five degrees. The final two digits represent the tens and units value of the wind speed. If, however, the wind speed is 100 knots or greater, the hundreds digit of the wind speed is added to the value of the first digit.

Example (1):

Wind direction: 291

Wind speed: 55 knots

Coded value: 29055

Example (2):

Wind direction: 293

Wind speed: 55 knots

Coded value: 29555

Example (3):

Wind direction: 289

Wind speed: 106 knots

Coded value: 29106

Example (4):

Wind direction: 304

Wind speed: 201 knots

Coded value: 30701

1.4.3 Section 3: tropopause level(s), parts A and C

This section reports tropopause data in parts A and C of the message.

1.4.3.1 Tropopause (pressure) $88P_t P_t P_t$

88: The digits 88 indicate that tropopause data are to follow.

$P_t P_t P_t$: The hundreds, tens and units digits corresponding to the pressure at the tropopause level.

88999: Indicates the message does not contain tropopause data.

1.4.3.2 Tropopause (temperature) $T_t T_t T_{at} D_t D_t$

Tropopause temperature and dew point depression data. These are coded in the same manner as $TTT_a DD$ (refer to 1.4.2.3).

1.4.3.3 Tropopause (wind) $d_t d_t f_t f_t$

Tropopause wind direction and speed. These are coded in the same manner as $ddfff$ (refer to 1.4.2.4).

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1.4.4 Section 4: maximum wind level and vertical wind shear, parts A and C

This section reports maximum wind data in parts A and C of the message. A level of maximum wind is defined as a level at which the wind speed is greater than at levels adjacent to it (i.e. immediately above and below it). If the highest wind speed occurs in a layer of equal winds, then the level at the top of this layer is considered the maximum wind.

1.4.4.1 Maximum wind (upper level) 77P_mP_mP_m

77: Indicates that maximum wind data, meeting these criteria, are to follow:

- wind data are available both above and below the level of maximum wind;
- the wind speed is greater than 60 knots;
- Part A of the message, it is the highest wind speed occurring above 500 hPa and up to and including 100 hPa; and
- for Part C of the message, it is the highest wind speed above 100 hPa.

P_mP_mP_m: Indicates the pressure at the level of the maximum wind:

- In Part A of the message, this represents the hundreds, tens and units digits corresponding to the pressure at the level of the maximum wind.
- In Part C of the message, this represents the tens, units and tenths digits corresponding to the pressure at the level of the maximum wind.

77999: Indicates the message does not contain maximum wind data.

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1.4.4.2 Maximum wind (sounding) 66P_mP_mP_m

66: The digits 66 indicate that maximum wind data, meeting these criteria, are to follow:

- It is at the terminating level of the wind sounding;
- The wind speed is greater than 60 knots;
- It is the highest wind speed in the sounding; and
- It occurs above the 500 hPa level.

P_mP_mP_m: Indicates the pressure at the level of the maximum wind:

- In Part A of the message, this represents the hundreds, tens and units digits corresponding to the pressure at the level of the maximum wind.
- In Part C of the message, this represents the tens, units and tenths digits corresponding to the pressure at the level of the maximum wind.

1.4.4.3 Wind direction d_md_mf_mf_mf_m

dd: The hundreds and tens digits of the wind direction.

fff: The first digit represents the units value of the wind direction rounded to the nearest five degrees. The final two digits represent the tens and units value of the wind speed. If, however, the wind speed is 100 knots or greater, the hundreds digit of the wind speed is added to the value of the first digit.

1.4.5 Section 5: significant temperature and/or relative humidity

The purpose of Section 5 is to report significant levels selected for coding on the basis of temperature and humidity.

1.4.5.1 Surface level 00P_oP_oP_o

00: The digits 00 indicate that surface level data is to follow.

P_oP_oP_o: Indicates the hundreds, tens and units values corresponding to the surface pressure.

1.4.5.2 Significant levels (pressure) XXPPP

XX: These are the indicator figures used to identify the significant levels selected for coding. The significant levels are numbered in consecutive order with respect to height (i.e. 11, 22, 33, 44, etc.). After 99, the numbers restart at 11 (i.e. 99, 11, 22, etc.).

PPP: Indicates the pressure of the significant levels.

All pressures up to and including the 100 hPa level are reported to the nearest whole hPa using the hundreds, tens and units digits (e.g. 1023.4 hPa would be coded 023, 991.7 as 992).

All pressures above the 100 hPa level are reported to 0.1 hPa using the tens, units and tenths digits (e.g. 76.0 hPa would be coded 760, 9.6 as 096).

1.4.5.3 Significant levels (temperature) TTT_aDD and T_oT_oT_{ao}D_oD_o

These groups are coded in the same manner as their corresponding groups in Section 2 (refer to 1.4.2).

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1.4.6 Section 7: sounding system and sea surface data

The purpose of this section is to report additional data about the sounding, i.e.: type of radiosonde, type of tracking system, time of launch (release), and sea surface data (if applicable).

31313: This is the indicator for Section 7.

s_r: This is the indicator for the solar radiation correction that is applied to the sounding (refer to Table 1–6).

r_ar_a: Radiosonde sounding system used (refer to Table 1–7 – WMO code table 3685).

s_as_a: Tracking technique/status of system used (refer to Table 1–8).

8GGgg: Actual time of launch (release) of the radiosonde (hours and minutes: UTC).

9_{sn}T_wT_wT_w: Report of sea surface temperature in tenths of degrees Celsius, its sign being given by s_n (optional group).

Table 1–6: Solar and infrared radiation correction – s_r – WMO code table 3849

Code figure	s _r – Specification
0	No correction
1	Commission for Instruments and Methods of Observation (CIMO) solar corrected and CIMO infrared corrected
2	CIMO solar corrected and infrared corrected
3	CIMO solar corrected only
4	Solar and infrared corrected automatically by radiosonde system
5	Solar corrected automatically by radiosonde system
6	Solar and infrared corrected as specified by country
7	Solar corrected as specified by country

Table 1-7: Radiosonde/sounding system used

Common Code table { Code table 3685 – r_ar_a (Radiosonde/sounding system used) – for alphanumeric codes
Code table 0 02 011 (Radiosonde type) in BUFR

Date of	Code figure for	Code figure for
assignment of	r _a r _a	BUFR
number (necessary	(Code table	(Code table
after 30/06/2007)	3685)	0 02 011)

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K3D33-170264		TOR-6-39109		
Not applicable	00	0	Reserved	
Before	01	1	iMet-1-BB (United States)	
Not applicable	02	2	No radiosonde – passive target (e.g. reflector)	
Not applicable	03	3	No radiosonde – active target (e.g. transponder)	
Not applicable	04	4	No radiosonde – passive temperature-humidity profiler	
Not applicable	05	5	No radiosonde – active temperature-humidity profiler	
Not applicable	06	6	No radiosonde – radio-acoustic sounder	
Before	07	7	iMet-1-AB (United States)	
Not applicable	08	8	No radiosonde –... (reserved)	
Not applicable	09	9	No radiosonde – system unknown or not specified	
Before	10	10	VIZ type A pressure-commutated (United States)	
Before	11	11	VIZ type B time-commutated (United States)	
Before	12	12	RS SDC (Space Data Corporation – United States)	
Before	13	13	Astor (no longer made – Australia)	
Before	14	14	VIZ MARK I MICROSONDE (United States)	
Before	15	15	EEC Company type 23 (United States)	
Before	16	16	Elin (Austria)	
Before	17	17	Graw G. (Germany)	
Before	18	18	Graw DFM-06 (Germany)	
Before	19	19	Graw M60 (Germany)	
Before	20	20	Indian Meteorological Service MK3 (India)	
Before	21	21	VIZ/Jin Yang MARK I MICROSONDE (Republic of Korea)	
Before	22	22	Meisei RS2-80 (Japan)	
Before	23	23	Mesural FMO 1950A (France)	
Before	24	24	Mesural FMO 1945A (France)	
Before	25	25	Mesural MH73A (France)	
Before	26	26	Meteolabor Basora (Switzerland)	
Before	27	27	AVK-MRZ (Russian Federation)	
Before	28	28	Meteorit MARZ2-1 (Russian Federation)	
Before	29	29	Meteorit MARZ2-2 (Russian Federation)	
Before	30	30	Oki RS2-80 (Japan)	
Before	31	31	VIZ/Valcom type A pressure-commutated (Canada)	
Before	32	32	Shanghai Radio (China)	
Before	33	33	UK Met Office MK3 (UK)	
Before	34	34	Vinohrady (Czech Republic)	
Before	35	35	Vaisala RS18 (Finland)	
Before	36	36	Vaisala RS21 (Finland)	

Date of	Code figure for	Code figure for
assignment of	rafa	BUFR
number (necessary	(Code table	(Code table

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after 30/06/2007)	3685)	0 02 011)		
Before	37	37	Vaisala RS80 (Finland)	
Before	38	38	VIZ LOCATE Loran-C (United States)	
Before	39	39	Sprenger E076 (Germany)	
Before	40	40	Sprenger E084 (Germany)	
Before	41	41	Sprenger E085 (Germany)	
Before	42	42	Sprenger E086 (Germany)	
Before	43	43	AIR IS - 4A - 1680 (United States)	
Before	44	44	AIR IS - 4A - 1680 X (United States)	
Before	45	45	RS MSS (United States)	
Before	46	46	AIR IS - 4A - 403 (United States)	
Before	47	47	Meisei RS2-91 (Japan)	
Before	48	48	VALCOM (Canada)	
Before	49	49	VIZ MARK II (United States)	
Before	50	50	Graw DFM-90 (Germany)	
Before	51	51	VIZ-B2 (United States)	
Before	52	52	Vaisala RS80-57H	
Before	53	53	AVK-RF95 (Russian Federation)	
Before	54	54	Graw DFM-97 (Germany)	
Before	55	55	Meisei RS-01G (Japan)	
Before	56	56	M2K2 (France)	
Before	57	57	Modem M2K2-DC (France)	
Before	58	58	AVK-BAR (Russian Federation)	
Before	59	59	Modem M2K2-R 1680 MHz RDF radiosonde with pressure sensor chip (France)	
Before	60	60	Vaisala RS80/MicroCora (Finland)	
Before	61	61	Vaisala RS80/Loran/Digicora I, II or Marwin (Finland)	
Before	62	62	Vaisala RS80/PCCora (Finland)	
Before	63	63	Vaisala RS80/Star (Finland)	
Before	64	64	Orbital Sciences Corporation, Space Data Division, transponder radiosonde, type 909-11-XX, where XX corresponds to the model of the instrument (United States)	
Before	65	65	VIZ transponder radiosonde, model number 1499-520 (United States)	
Before	66	66	Vaisala RS80 /Autosonde (Finland)	
Before	67	67	Vaisala RS80/Digicora III (Finland)	
Before	68	68	AVK-RZM-2 (Russian Federation)	
Before	69	69	MARL-A or Vektor-M-RZM-2 (Russian Federation)	
Before	70	70	Vaisala RS92/Star (Finland)	
Before	71	71	Vaisala RS90/Loran/Digicora I, II or Marwin (Finland)	
Before	72	72	Vaisala RS90/PC-Cora (Finland)	
Before	73	73	Vaisala RS90/Autosonde (Finland)	
Before	74	74	Vaisala RS90/Star (Finland)	

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Date of assignment of number (necessary after 30/06/2007)	Code figure for rafa (Code table 3685)	Code figure for BUFR (Code table 0 02 011)	
Before	75	75	AVK-MRZ-ARMA (Russian Federation)
Before	76	76	AVK-RF95-ARMA (Russian Federation)
Before	77	77	GEOLINK GPSonde GL98 (France)
Before	78	78	Vaisala RS90/Digicora III (Finland)
Before	79	79	Vaisala RS92/Digicora I, II or Marwin (Finland)
Before	80	80	Vaisala RS92/Digicora III (Finland)
Before	81	81	Vaisala RS92/Autosonde (Finland)
Before	82	82	Sippican MK2 GPS/STAR (United States) with rod thermistor, carbon element and derived pressure
Before	83	83	Sippican MK2 GPS/W9000 (United States) with rod thermistor, carbon element and derived pressure
Before	84	84	Sippican MARK II with chip thermistor, carbon element and derived pressure from GPS height
Before	85	85	Sippican MARK IIA with chip thermistor, carbon element and derived pressure from GPS height
Before	86	86	Sippican MARK II with chip thermistor, pressure and carbon element
Before	87	87	Sippican MARK IIA with chip thermistor, pressure and carbon element
Before	88	88	MARL-A or Vektor-M-MRZ (Russian Federation)
Before	89	89	MARL-A or Vektor-M-BAR (Russian Federation)
Not applicable	90	90	Radiosonde not specified or unknown
Not applicable	91	91	Pressure only radiosonde
Not applicable	92	92	Pressure only radiosonde plus transponder
Not applicable	93	93	Pressure only radiosonde plus radar reflector
Not applicable	94	94	No pressure radiosonde plus transponder
Not applicable	95	95	No pressure radiosonde plus radar reflector
Not applicable	96	96	Descending radiosonde
Before	97	97	BAT-16P (South Africa)
Before	98	98	BAT-16G (South Africa)
Before	99	99	BAT-4G (South Africa)
	Not available	100	Reserved for BUFR only
	01	101	Not vacant
	Not available	102–106	Reserved for BUFR only
	07	107	Not vacant
	Not available	108–109	Reserved for BUFR only
01/01/2008	10	110	Sippican LMS5 w/Chip Thermistor, duct mounted capacitance relative humidity sensor and derived pressure from GPS height

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01/01/2008	11	111	Sippican LMS6 w/Chip Thermistor, external boom mounted capacitance relative humidity sensor, and derived pressure from GPS height	
06/05/2015	12	112	Jin Yang RSG-20A with derived pressure from GPS height/GL-5000P (Republic of Korea)	
15/09/2010	13	113	Vaisala RS92/MARWIN MW32 (Finland)	
03/11/2011	14	114	Vaisala RS92/DigiCORA MW41 (Finland)	
01/12/2011	15	115	PAZA-12M/Radiotheodolite-UL (Ukraine)	
Date of assignment of number (necessary after 30/06/2007)	Code figure for rafa (Code table 3685)	Code figure for BUFR (Code table 0 02 011)		
01/12/2011	16	116	PAZA-22/AVK-1 (Ukraine)	
02/05/2012	17	117	Graw DFM-09 (Germany)	
	18	118	Not vacant	
Needed	19	119	Vacant	
	20	120	Not vacant	
06/05/2015	21	121	Jin Yang 1524LA LOLAN-C/GL5000 (Republic of Korea)	
02/05/2012	22	122	Meisei RS-11G GPS radiosonde w/thermistor, capacitance relative humidity sensor, and derived pressure from GPS height (Japan)	
03/11/2011	23	123	Vaisala RS41/DigiCORA MW41 (Finland)	
03/11/2011	24	124	Vaisala RS41/AUTOSONDE (Finland)	
03/11/2011	25	125	Vaisala RS41/MARWIN MW32 (Finland)	
07/05/2014	26	126	Meteolabor SRS-C34/Argus 37 (Switzerland)	
	27	127	Not vacant	
15/09/2011	28	128	AVK - AK2-02 (Russian Federation)	
15/09/2011	29	129	MARL-A or Vektor-M - AK2-02 (Russian Federation)	
01/01/2010	30	130	Meisei RS-06G (Japan)	
03/11/2011	31	131	Taiyuan GTS1-1/GFE(L) (China)	
03/11/2011	32	132	Shanghai GTS1/GFE(L) (China)	
03/11/2011	33	133	Nanjing GTS1-2/GFE(L) (China)	
Needed	34	134	Vacant	
07/05/2014	35	135	Meisei iMS-100 GPS radiosonde w/thermistor sensor, capacitance relative humidity sensor, and derived pressure from GPS height (Japan)	
Needed	36	136	Vacant	
	37	137	Not vacant	
Needed	38-40	138-140	Vacant	
03/11/2011	41	141	Vaisala RS41 with pressure derived from GPS height/ DigiCORA MW41 (Finland)	

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03/11/2011	42	142	Vaisala RS41 with pressure derived from GPS height/ AUTOSONDE (Finland)
07/05/2014	43	143	NanJing Daqiao XGP-3G (China)*
07/05/2014	44	144	TianJin HuaYunTianYi GTS(U)1 (China)*
07/05/2014	45	145	Beijing Changfeng CF-06 (China)*
07/05/2014	46	146	Shanghai Changwang GTS3 (China)*
	47	147	Not vacant
02/05/2012	48	148	PAZA-22M/MARL-A
	49	149	Not vacant
02/11/2016	50	150	Meteolabor SRS-C50/Argus (Switzerland)
	51	151	Not vacant

* All GPS radiosondes are with thermistor, silicon piezoresistive pressure sensor or pressure derived from GPS height, capacitive relative humidity sensor and wind derived from GPS height.

Date of assignment of number (necessary after 30/06/2007)	Code figure for rafa (Code table 3685)	Code figure for BUFR (Code table 0 02 011)	
03/11/2011	52	152	Vaisala RS92-NGP/Intermet IMS-2000 (United States)
06/05/2015	53	153	AVK – I-2012 (Russian Federation)
	54–59	154–159	Not vacant
06/05/2015	60	160	MARL-A or Vektor-M – I-2012 (Russian Federation)
	61	161	Not vacant
06/05/2015	62	162	MARL-A or Vektor-M – MRZ-3MK (Russian Federation)
Needed	63–66	163–166	Vacant
	67–72	167–172	Not vacant
02/11/2016	73	173	MARL-A (Russian Federation) – ASPAN-15 (Kazakhstan)
	74–76	174–176	Not vacant
15/03/2010	77	177	Modem GPSonde M10 (France)
	78–81	178–181	Not vacant
07/11/2012	82	182	Lockheed Martin LMS-6 w/chip thermistor; external boom mounted polymer capacitive relative humidity sensor; capacitive pressure sensor and GPS wind
07/11/2012	83	183	Vaisala RS92-D/Intermet IMS 1500 w/silicon capacitive pressure sensor, capacitive wire temperature sensor, twin thin-film heated polymer capacitive relative humidity sensor and RDF wind
Needed	84	184	Vacant
	85-89	185-189	Not vacant

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Not available	190	NCAR research dropsonde NRD94 with GPS and Vaisala RS92-based sensor module (United States)
Not available	191	NCAR research dropsonde NRD41 with GPS and Vaisala RS41-based sensor module (United States)
Not available	192	Vaisala/NCAR dropsonde RD94 with GPS and Vaisala RS92-based sensor module (Finland/USA)
Not available	193	Vaisala/NCAR dropsonde RD41 with GPS and Vaisala RS41-based sensor module (Finland/USA)
Not available	194–196	Reserved for BUFR only
97–99	197–199	Not vacant
Not available	200–254	Reserved for BUFR only
	255	Missing value

Notes:

- (1) References to countries in brackets indicate the manufacturing location rather than the country using the instrument.
- (2) Some of the radiosondes listed are no longer in use but are retained for archiving purposes.
- (3) The alphanumeric code format reports only 2 digits, and the first digit for BUFR is identified from the date: the first digit is 0 if the introduction of the radiosonde for observation was before 30 June 2007, or 1 otherwise. Entries in the second part of the table (after 99), which are declared "Vacant" can be used for new radiosondes because the 2-digit number was originally attributed to sondes, which are no longer used. This system has been adopted to accommodate reporting in TEMP traditional alphanumeric code format up to the time BUFR is fully used for radiosonding reports.

Table 1-8: Tracking technique/status of system used

Common Code table	{	Code table 3872 – s _a s _a for alphanumeric codes
		Code table 0 02 014 in BUFR
		Code figure for
Code figure for		BUFR
s _a s _a	(Code table 0 02 014)	
00	0	No wind finding
01	1	Automatic with auxiliary optical direction finding
02	2	Automatic with auxiliary radio direction finding
03	3	Automatic with auxiliary ranging
04	4	Not used
05	5	Automatic with multiple VLF-Omega signals
06	6	Automatic cross chain Loran-C
07	7	Automatic with auxiliary wind profiler
08	8	Automatic satellite navigation

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09–18	9–18	Reserved	
19	19	Tracking technique not specified	
		TRACKING TECHNIQUES/STATUS OF ASAP SYSTEM	
		STATUS OF SHIP SYSTEM	
20	20	Vessel stopped	
21	21	Vessel diverted from original destination	
22	22	Vessel's arrival delayed	
23	23	Container damaged	
24	24	Power failure to container	
25–28	25–28	Reserved for future use	
29	29	Other problems	
		SOUNDING SYSTEM	
30	30	Major power problems	
31	31	UPS inoperative	
32	32	Receiver hardware problems	
33	33	Receiver software problems	
34	34	Processor hardware problems	
35	35	Processor software problems	
36	36	NAVAID system damaged	
37	37	Shortage of lifting gas	
38	38	Reserved	
39	39	Other problems	
		LAUNCH FACILITIES	
40	40	Mechanical defect	
41	41	Material defect (hand launcher)	
42	42	Power failure	
43	43	Control failure	
44	44	Pneumatic/hydraulic failure	

Code figure for		
Code figure for	BUFR	
SaSa	(Code table 0 02 014)	
45	45	Other problems
46	46	Compressor problems
47	47	Balloon problems
48	48	Balloon release problems
49	49	Launcher damaged

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	DATA ACQUISITION SYSTEM	
50	50	R/S receiver antenna defect
51	51	NAVAID antenna defect
52	52	R/S receiver cabling (antenna) defect
53	53	NAVAID antenna cabling defect
54–58	54–58	Reserved
59	59	Other problems
	COMMUNICATIONS	
60	60	ASAP communications defect
61	61	Communications facility rejected data
62	62	No power at transmitting antenna
63	63	Antenna cable broken
64	64	Antenna cable defect
65	65	Message transmitted power below normal
66–68	66–68	Reserved
69	69	Other problems
70	70	All systems in normal operation
71–98	71–98	Reserved
99	99	Status of system and its components not specified
Not available	100–126	Reserved
Not available	127	Missing value

1.4.7 Section 9: regional groups

The purpose of this section is to report regionally developed code groups.

51515: This is the indicator group for Section 9.

101A_{df}A_{df}: This is the form of additional regional data reported.

101: The three digit indicator 101 identifies the additional data group.

A_{df}A_{df}: This two-digit group identifies the additional data as specified in Table 1–9.

Table 1–9: Additional data code figures 40-99 – A_{df}A_{df} – WMO code table 0421

Code figure	A _{df} A _{df} – Specification
40-59	Reason for no report or incomplete report
40	Report not filed
41	Not used
42	Ground equipment failure

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Code figure	A _{df} A _{df} – Specification
43	Observation delayed
44	Power failure
45	Unfavourable weather conditions
46	Low maximum altitude (less than 500 m above ground)
47	Leaking balloon
48	Ascent not authorized for this period
49	Alert
50	Ascent did not ascend above 400 hPa
51	Balloon forced down by icing conditions
52	Balloon forced down by precipitation
53	Atmospheric interference
54	Local interference
55	Fading signal
56	Weak signal
57	Preventive maintenance
58	Flight equipment failure
59	Any reason not listed above
60-64	Miscellaneous
60	Not used
61	Not used
62	Radiosonde report precedes
63	Not used
64	Not used
65-69	Doubtful data
65	Geopotential and temperature data are doubtful between the following levels 0P _n P _n P _n P _n
66	Geopotential data doubtful between the following levels 0P _n P _n P _n P _n
67	Temperature data doubtful between the following levels 0P _n P _n P _n P _n

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Code figure	$A_{df}A_{df}$ – Specification
68	Dew point depression is missing for reasons other than motor boating between the following levels $0P_nP_nP_nP_n$ (not used when T_nT_n is also missing)
69	Not used
70-74	Not allocated
75-89	Corrected data
75	Not used
76	Not used
77	Not used
78	Corrected tropopause data section follows
79	Corrected maximum wind section follows
80	Corrected report for the entire report (first plus second transmission) precedes
81	Corrected report for the entire first transmission precedes
82	Corrected report for entire second transmission precedes
83	Corrected data for mandatory levels follows
84	Corrected data for significant levels follows
85	Minor errors in this report: correction follows
86	Significant levels not included in original report follow
87	Corrected data for surface follow
88	Corrected additional data groups follow
90	Extrapolated geopotential data follows
91	Extrapolated surface data precede (used only in dropsonde)
92	Termination altitude data follows
93	Not used
94	Averaged wind for the surface to 1500 m layer and the 1500 – 3000 m layer follows
95	Early transmission of 850 and 500 hPa data and stability index follows
96	Early transmission of 850, 700 and 500 hPa data and stability index follows
97	Early transmission of 500 hPa data and stability index follow
98	Early transmission of 700 hPa data and stability index follow

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Code figure	A _{df} A _{df} – Specification
99	Not to be allocated

1.4.8 Section 10: national code groups

The purpose of this section is to report nationally developed code groups.

61616: Indicates data in national code follows.

101A_{df}A_{df}: This is coded in the same manner as in Section 9 (refer to 1.4.7).

1.5 TEMP SHIP message content

The TEMP SHIP message is coded the same as a TEMP message with the exception of Section 1. Therefore, only the differences in the coding of Section 1 will be explained.

1.5.1 Section 1: identification and position data

1.5.1.1 Location – latitude 99L_aL_aL_a

99: This is the group identifier.

L_aL_aL_a: These three digits represent the latitude of the point of observation. The latitude is reported in tens, units and tenths of degrees (e.g. 74.15 N is coded as 741).

1.5.1.2 Location – longitude Q_cL_oL_oL_o

Q_c: Represents the quadrant of the globe where the point of observation is located (refer to Table 1–10). If the ship is located on the equator or a prime meridian, two possible values occur, either one of which is acceptable.

L_oL_oL_oL_o: These digits represent the longitude of the point of observation. The longitude is reported in hundreds, tens, units and tenths of degrees (e.g. 103.65 is coded as 1036).

Table 1–10: Values of Q_c in each quadrant of the earth – WMO code table 3333

Latitude	Longitude	Q _c
North	East	1
South	East	3
South	West	5
North	West	7

Note: The choice is left to the observer in the following cases:

- When the ship is on the Greenwich meridian or 180th Meridian (L_oL_oL_oL_o = 0000 or 1800 respectively)
 - Q_c = 1 or 7 (Northern Hemisphere); or
 - Q_c = 3 or 5 (Southern Hemisphere).

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- When the ship is on the equator ($L_a L_a L_a = 000$)

- $Q_c = 1$ or 7 (eastern longitude); or
- $Q_c = 3$ or 5 (western longitude).

1.5.1.3 Location – SHIP MMMU_{La}U_{Lo}

This is the ship position verification group and is used to check the position of the ship in ship station messages.

MMM: This represents the Marsden square number in which the ship is located at the time of observation. The Marsden square number is determined from Figure 1–1 by using the latitude and longitude corresponding to the ship's position (e.g. If the ship's position is 46.0 N and 146.1 W, the Marsden square number is 159).

U_{La}: This is the units digit from the latitude corresponding to ship's position (e.g. If the latitude is 45.9 N, U_{La} is coded as 5).

U_{Lo}: This is the units digit from the longitude corresponding to the ship's position (e.g. If the longitude is 145 W, U_{Lo} is coded as 5).

1.5.2 Marsden squares

When the latitude and longitude of the ship's position places the ship at the common intersection point of four Marsden squares, or the common side of two adjacent squares orientated East-West or North-South, the Marsden square number to be coded is determined by using the appropriate grid of the four grids shown in Figure 1–2. Each grid shows the 10-degree Marsden square divided into one-degree sub squares with a number assigned to each sub square (only a pattern of numbers is shown). The grid labeled "A" is used for Marsden squares in the North latitudes and West longitudes, i.e., $Q_c = 7$, and the grid labeled "B" is used for Marsden squares in the North latitudes and East longitudes, i.e. $Q_c = 1$, etc. It will be noted that the number of any sub square corresponds to the U_{La}U_{Lo} for a ship positioned in the sub square. When the latitude and longitude values of the ship's position place the ship on the common side of two adjacent squares orientated North-South, the Marsden square number **shall** be determined as illustrated by the following example.

Example: Assume the ship's position to be 50.0 N and 145.0 W. This position is on the boundary line of Marsden squares 195 and 159 (refer to Figure 1–1).

Determine the U_{La}U_{Lo} value from the ship's position. In the example U_{La}U_{Lo} is 05; Superimpose the appropriate grid which, in this example, is Grid A, (refer to Figure 1–2), on the adjacent Marsden squares, 195 and 159, and select the Marsden square which, when so subdivided, displays the sub square numbered 05 adjacent to the ship's position. In the example the Marsden square is 195; code 195 for MMM.

The procedure for determining the Marsden square number of a ship's position that places it on the common side of two squares which have oriented East-West is the same as that used for the squares orientated North-South. When the latitude and longitude values of the ship's position place the ship at a common intersection of four squares, the appropriate grid must be applied to the four adjacent Marsden squares to determine the correct Marsden number. If the ship's position is on the equator, or on the 0 degree or 180 degree meridian, the number selected for Q_c **shall** determine the relevant Marsden square.

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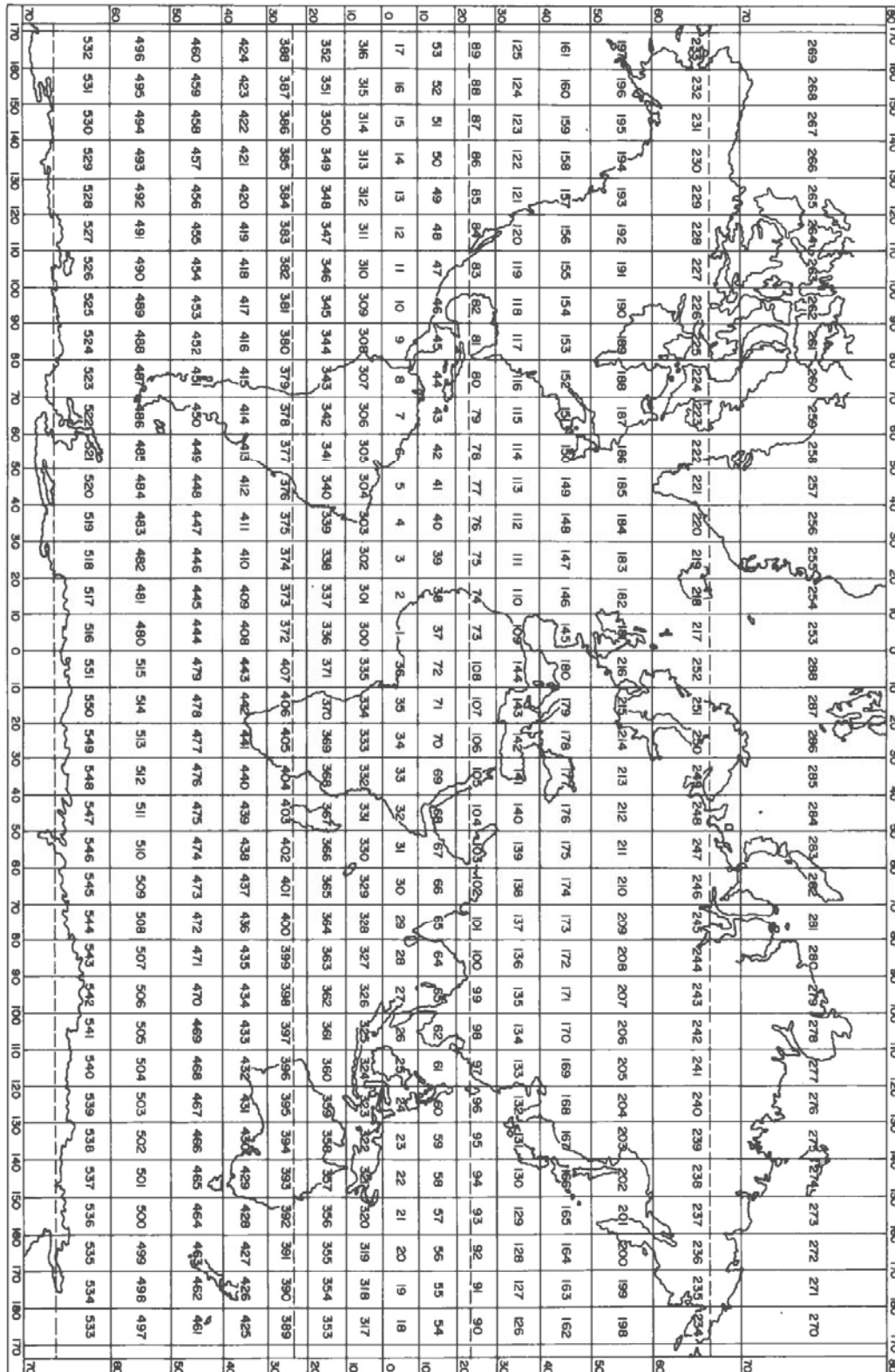
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Figure 1–1: 10-degree Marsden squares

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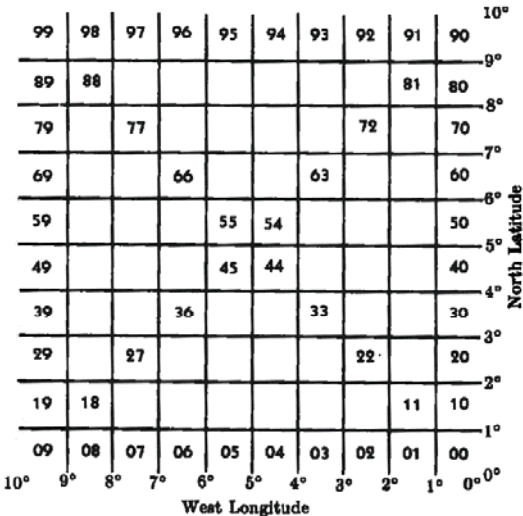
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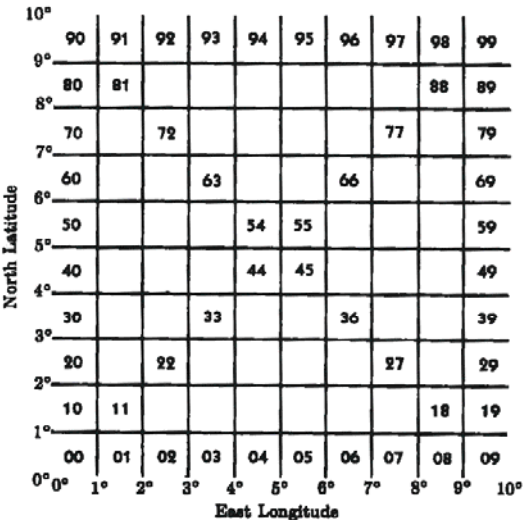
Grid A

$Q_c = 7$



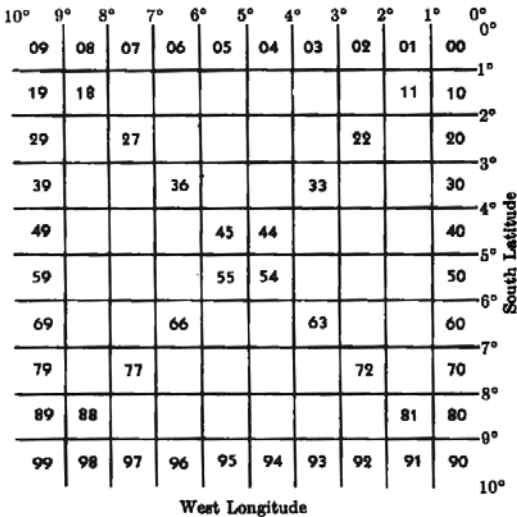
Grid B

$Q_c = 1$



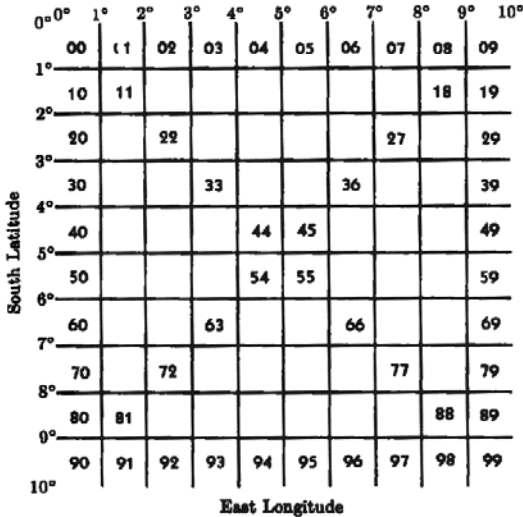
Grid C

$Q_c = 5$



Grid D

$Q_c = 3$



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Figure 1–2: Marsden ten degree squares divided into one degree sub-squares

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1.6 TEMP MOBIL message content

The Environmental Emergency Response (EER) message is coded the same as a TEMP message with the exception of Section 1.

Situations arise in which an aerological ascent is required from a location other than a fixed site. The hardware used to perform the ascent is identical to a fixed land station; however the coding of the messages generated contains differences.

1.6.1 Section 1: identification and position data

1.6.1.1 Location – latitude 99L_aL_aL_a

99: This is the group identifier.

L_aL_aL_a: These three digits represent the latitude of the point of observation. The latitude is reported in tens, units and tenths of degrees (e.g. 74.15 N is coded as 741).

1.6.1.2 Location – longitude Q_cL_oL_oL_o

Q_c: Represents the quadrant of the globe where the point of observation is located (refer to Table 1–11). If the mobile land station is located on the equator or a prime meridian, two possible values occur, either one of which is acceptable.

L_oL_oL_o: These digits represent the longitude of the point of observation. The longitude is reported in hundreds, tens, units and tenths of degrees (e.g. 103.65 is coded as 1036).

Table 1–11: Values of Q_c in each quadrant of the earth – WMO code table 3333

Latitude	Longitude	Q _c
North	East	1
South	East	3
South	West	5
North	West	7

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Note: The choice is left to the observer in the following cases:

- When the mobile land station is on the Greenwich meridian or 180th Meridian ($L_o L_o L_o L_o = 0000$ or 1800 respectively):
 - $Q_c = 1$ or 7 (Northern Hemisphere); or
 - $Q_c = 3$ or 5 (Southern Hemisphere).
- When the mobile land station is on the equator ($L_a L_a L_a = 000$):
 - $Q_c = 1$ or 7 (eastern longitude); or
 - $Q_c = 3$ or 5 (western longitude).

1.6.1.3 Location – land $MMM U_{La} U_{Lo}$

This is the ship position verification group and is used to check the position of the mobile land station messages.

MMM: This represents the Marsden square number in which the mobile land station is located at the time of observation. The Marsden square number is determined from Figure 1–1 by using the latitude and longitude corresponding to the mobile land station's position (e.g. If the mobile land station's position is 46.0 N and 146.1 W, the Marsden square number is 159).

U_{La} : This is the units digit from the latitude corresponding to the mobile land station's position (e.g. If the latitude is 45.9 N, U_{La} is coded as 5).

U_{Lo} : This is the units digit from the longitude corresponding to the mobile land station's position (e.g. If the longitude is 145 W, U_{Lo} is coded as 5).

1.6.1.4 Elevation – land $h_0 h_0 h_0 h_0 i_m$

$h_0 h_0 h_0 h_0$: Indicates the thousands, hundreds, tens and units elevation of the station in metres above sea level.

i_m : Indicates accuracy of the elevation (on a scale of $0-4$ where 0 equals good and 4 equals poor).

1.7 PILOT message content

1.7.1 Section 1: identification and position data

The purpose of Section 1 is to identify the type, origin and time of the pilot message, and is included in each part.

1.7.1.1 Message indicator $M_i M_i M_j M_j$

This four-letter group contains identification data and is the first group in the coded message.

$M_i M_i$: The symbolic code for identifying a radiosonde or radiosonde message originating from a land or ship station A PILOT message is coded as PP and a PILOT SHIP is coded as QQ.

$M_j M_j$: The symbolic code for identifying the part of the message that is to follow (i.e. parts A, B, C or D). Part B is coded as BB and Part D is coded as DD.

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1.7.1.2 Date indicator – YYGGa₄

YY: Identifies the day of the month and the unit of wind speed (i.e. knots or metres per second) that are used in the message.

The day of the month is reported through the use of code figures 01 to 31, inclusive, where code figure 01 means the first day of the month, 02 means second day of the month, etc.

When wind speeds are reported in knots, 50 is added to YY. (Canadian upper air messages always use knots); when wind speeds are reported in metres per second, YY is not modified.

GG: Identifies the time of observation in whole hours UTC, based on the twenty-four hour clock (i.e. 00 to 23). The standard hour of observation, "H", is coded for GG whenever the release time is within the time range of H-45 to H+29 inclusive (e.g. If the release time is 2315, GG is coded as 00).

If the release time is outside of the range of H-45 to H+29, GG is coded to the nearest hour UTC, (e.g. If the release time is 0030, GG is coded as 01).

a₄: Indicates the type of equipment used during the ascent to measure upper winds (refer to Table 1–12 – WMO code table 0265).

Table 1–12: Type of measuring equipment used – WMO code table 0265

Code figure	a ₄ – Specification
0	Pressure instrument associated with wind-measuring equipment
1	Optical theodolite
2	Radiotheodolite
3	Radar
4	Pressure instrument associated with wind-measuring equipment but pressure element failed during flight
5	VLF – Omega
6	Loran – C
7	Wind profiler
8	Satellite navigation
9	Reserved

1.7.1.3 International index number – IIIii

This five-figure group constitutes the international index number (refer to 1.4.1.3).

II: Identifies the block number which defines the area in which the reporting station is situated. Each block contains 1,000 station numbers and is allocated to one or more countries within a WMO region. All stations within Canada use the block number 71.

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iii: Refers to the three digit number allocated to meteorological services in one or more countries within a WMO region.

1.7.2 Section 4: maximum wind level(s) and vertical wind shear

The purpose of Section 4 is to report wind direction and speed at selected 1,000 foot (300 m) intervals above mean sea level (MSL). These intervals are selected along two different sets of criteria and then combined into a single message.

The direction and speed curves (in function of the log of pressure or altitude) can be reproduced with their prominent characteristics:

- These curves can be reproduced with an accuracy of at least 10° for direction and five metres per second for speed; and
- The number of significant levels is kept strictly to a necessary minimum.

1.7.2.1 Fixed regional levels

Selection criteria for 1,000 foot (300 m) levels:

- 140,000
- 110,000
- 100,000
- 90,000
- 70,000
- 50,000
- 35,000
- 30,000
- 25,000
- 20,000
- 16,000
- 14,000
- 12,000
- 9,000
- 8,000
- 7,000
- 6,000
- 4,000
- 3,000
- 2,000
- 1,000

1.7.2.2 Altitude of wind data $X_t u_1 u_2 u_3$

X: Indicator figure 9 is reported for altitudes up to but not including 100,000 feet. Indicator figure 1 is reported for altitudes at and above 100,000 feet.

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t_n: This is the ten thousands digit of the altitude of the levels for which wind data are being reported (e.g. for 9000 feet, t_n would be reported as 0, for 25,000 feet, t_n would be reported as 2).

u₁u₂u₃: These are the thousands digits of the wind levels for which wind data are being reported (e.g. For the 12000, 14000 and 16000-foot levels, u₁u₂u₃ would be coded as 246).

Note (1): A maximum of three levels can be reported by a 9t_nu₁u₂u₃ or 1t_nu₁u₂u₃ group.

Note (2): Each time that the value of t_n changes, another 9t_nu₁u₂u₃ or 1t_nu₁u₂u₃ group is added to the message.

Note (3): A 9t_nu₁u₂u₃ or 1t_nu₁u₂u₃ group may specify one, two or three levels and be followed by one, two or three wind data (ddfff) groups.

Note (4): A solidus, "/", is coded for u₂ and/or u₃ when a second or third wind data group is not included for a given sequence.

1.7.2.3 Wind data at specified altitudes – ddfff

This group contains wind direction and speed data for the levels reported by the preceding 9t_nu₁u₂u₃ or 1t_nu₁u₂u₃ group.

dd: The hundreds and tens digits of the wind direction.

fff: The first digit represents the units value of the wind direction rounded to the nearest 5. The final two digits represent the tens and units value of the wind speed. If, however, the wind speed is 100 knots or greater, the hundreds digit of the wind speed is added to the value of the first digit.

Example (1):

Wind direction: 291

Wind speed: 55 knots

Coded value: 29055

Example (2):

Wind direction: 293

Wind speed: 55 knots

Coded value: 29555

Example (3):

Wind direction: 289

Wind speed: 106 knots

Coded value: 29106

Example (4):

Wind direction: 304

Wind speed: 201 knots

Coded value: 30701

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1.8 PILOT SHIP message content

The PILOT SHIP message is identical to the PILOT message with the exception of Section 1. In the case of the PILOT SHIP message, the Iliii group of the PILOT message is replaced by the $99L_aL_aL_a Q_cL_oL_oL_oL_o$ MMMU_{La}U_{Lo} group. These groups are coded in the same manner as in the TEMP SHIP message (refer to 1.5.1.1 and 1.5.1.2).

1.8.1 PILOT or PILOT SHIP message, Part B (UG)

1.8.1.1 First transmission: Part B (UG)

Below are the symbolic code forms of Part B (UG) of the first transmission of an upper wind message for land and ship stations (data up to and including 100 hPa).

1.8.1.1.1 Section 1: identification and position data

Identification groups for land stations:

$M_iM_iM_jM_j$ YYGGa₄ Iliii

or

Identification-position groups for ship stations:

$M_iM_iM_jM_j$ YYGGa₄ $99L_aL_aL_a$

$Q_cL_oL_oL_oL_o$ MMMU_{La}U_{Lo}

1.8.1.1.2 Section 4: maximum wind level(s) and vertical wind shear

Fixed regional and significant levels:

$9t_nu_1u_2u_3$ ddfff ddfff ddfff

$9t_nu_1u_2u_3$ ddfff ddfff ddfff

1.8.2 PILOT or PILOT SHIP message, Part D (UQ)

1.8.2.1 Second transmission: Part D (UQ)

Below are the symbolic code forms of Part D (UQ) of the second transmission of an upper wind message for land and ship stations (data above 100 hPa).

1.8.2.1.1 Section 1: identification and position data

Identification groups for land stations:

$M_iM_iM_jM_j$ YYGGa₄ Iliii

or

Identification-position groups for ship stations:

$M_iM_iM_jM_j$ YYGGa₄ $99L_aL_aL_a$

$Q_cL_oL_oL_oL_o$ MMMU_{La}U_{Lo}

1.8.2.1.2 Section 4: maximum wind level(s) and vertical wind shear

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Fixed regional and significant levels:

9t_nu₁u₂u₃ ddfff

9t_nu₁u₂u₃ ddfff

or

1t_nu₁u₂u₃

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ddfff ddfff

ddfff ddfff

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1.9 Examples of coded messages

Table 1-13: Example of data reported for Part A (US) of the TEMP message

Symbolic form of group	Pressure of mandatory levels (hPa)	Geopotential height of mandatory levels (gpm)	Temperature °C	Dew point depression °C	Wind direction (degrees)	Wind speed (knots)	Code figure for T_a T_o T_{ao}	Coded groups
$M_i M_j M_j$	-	-	-	-	-	-	-	TTAA
$Y Y G I_d$	-	-	-	-	-	-	-	72121
IIIII	-	-	-	-	-	-	-	72934
$99 P_o P_o$	993.3	-	-	-	-	-	-	99993
$T_o T_o T_{ao} D_o D_o$	-	-	+06.0	1.0	-	-	0	06010
$d_o d_o f_o f_o$	-	-	-	-	010	02	-	01002
oohhh	1000	146	-	-	-	-	-	00146
$T T T_a D D$	-	-	-	-	-	-	-	////
ddfff	-	-	-	-	-	-	-	////
92hhh	925	826	-	-	-	-	-	92826
$T T T_a D D$	-	-	+04.9	2.7	-	-	9	04927
ddfff	-	-	-	-	185	06	-	18506
85hhh	850	1490	-	-	-	-	-	85490
$T T T_n D D$	-	-	+04.2	7.3	-	-	2	04273
ddfff	-	-	-	-	235	09	-	23509
70hhh	700	3034	-	-	-	-	-	70034
$T T T_a D D$	-	-	-08.9	0.3	-	-	9	08903
ddfff	-	-	-	-	247	20	-	24520
50hhh	500	5558	-	-	-	-	-	50556

Symbolic form of group	Pressure of mandatory levels (hPa)	Geopotential height of mandatory levels (gpm)	Temperature °C	Dew point depression °C	Wind direction (degrees)	Wind speed (knots)	Code figure for T_a T_o T_{ao}	Coded groups
TTT _n DD	-	-	-26.4	15.1	-	-	4	26565
ddfff	-	-	-	-	255	30	-	25530
40hhh	400	7141	-	-	-	-	-	40714
TTT _n DD	-	-	-35.9	10.1	-	-	9	35960
ddfff	-	-	-	-	257	44	-	25544
30hhh	300	9079	-	-	-	-	-	30908
TTT _a DD	-	-	-50.1	missing	-	-	-	501//
ddfff	-	-	-	-	253	45	-	25545
25hhh	250	10257	-	-	-	-	-	25026
TTT _a DD	-	-	-52.1	missing	-	-	1	521//
ddfff	-	-	-	-	251	42	-	25042
20hhh	200	11706	-	-	-	-	-	20171
TTT _a DD	-	-	-49.7	missing	-	-	7	497//
ddfff	-	-	-	-	236	35	-	23535
15hhh	150	13599	-	-	-	-	-	15360
TTT _a DD	-	-	-47.3	missing	-	-	3	473//
ddfff	-	-	-	-	247	23	-	24523
10hhh	100	16278	-	-	-	-	-	10628
TTT _a DD	-	-	-50.5	missing	-	-	5	505//
ddfff	-	-	-	-	222	13	-	22013

Symbolic form of group	Pressure of mandatory levels (hPa)	Geopotential height of mandatory levels (gpm)	Temperature °C	Dew point depression °C	Wind direction (degrees)	Wind speed (knots)	Code figure for T_a T_{ao}	Coded groups
$88P_t P_t$	273	-	-	-	-	-	-	88273
$T_t T_t D_t D_t$	-	-	-54.7	missing	-	missing	7	547//
$d_t d_t f_t f_t$	-	-	-	-	253	46	-	25546
$77P_m P_m$	-	-	-	-	missing	missing	-	77999

Table 1-14: Example of data reported for Part B (UK) of the TEMP message

Symbolic form of group	Level number	Pressure (hPa)	Temperature °C	Dew point depression °C	Code figure for T_a T_o T_{ao}	Coded groups
$M_i M_j M_j M_j$	-	-	-	-	-	TTBB
YYGG/	-	-	-	-	-	7212/
IIIII	-	-	-	-	-	72934
00P ₀ P ₀ P ₀	00	993.3	-	-	-	00993
$T_o T_o T_{ao} D_o D_o$	-	-	+0.60	1.0	0	06010
11PPP	11	976	-	-	-	11976
TTT _a DD	-	-	+11.2	11.6	2	11262
22PPP	22	968	-	-	-	22968
TTT _a DD	-	-	+10.8	8.4	8	10858
33PPP	33	928	-	-	-	33928
TTT _a DD	-	-	+9.5	12.4	4	09462
44PPP	44	910	-	-	-	44910
TTT _n DD	-	-	+8.2	7.1	2	08257
55PPP	55	814	-	-	-	55814
TTT _n DD	-	-	+01.6	7.6	6	01658
66PPP	66	793	-	-	-	66793
TTT _n DD	-	-	+00.0	1.7	0	00017
77PPP	77	690	-	-	-	77690

Symbolic form of group	Level number	Pressure (hPa)	Temperature °C	Dew point depression °C	Code figure for T _a T _o T _{ao}	Coded groups
TTT _a DD	-	-	-09.9	0.1	9	09901
88PPP	88	678	-	-	-	88678
TTT _a DD	-	-	-10.6	6.7	7	10757
99PPP	99	656	-	-	-	99656
TTT _a DD	-	-	-10.8	14.6	9	10965
11PPP	11	482	-	-	-	11482
TTT _a DD	-	-	-28.6	15.2	7	28765
22PPP	22	466	-	-	-	22466
TTT _a DD	-	-	-28.8	14.5	9	28965
33PPP	33	370	-	-	-	33370
TTT _a DD	-	-	-39.9	9.8	9	39960
44PPP	44	273	-	-	-	44273
TTT _a DD	-	-	-54.7	missing	7	547//
55PPP	55	195	-	-	-	55195
TTT _a DD	-	-	-48.7	missing	7	487//
66PPP	66	124	-	-	-	66124
TTT _a DD	-	-	-46.3	missing	3	463//
77PPP	77	100	-	-	-	77100

Symbolic form of group	Level number	Pressure (hPa)	Temperature °C	Dew point depression °C	Code figure for $T_a T_o T_{ao}$	Coded groups
TTT _a DD	-	-	-50.4	missing	5	505//
31313	-	-	-	-	-	-
S _r r _a r _a S _a S _a	-	-	-	-	-	-
8GGgg	-	-	-	-	-	-
(9S _n T _w T _w T _w)	-	-	-	-	-	-

Table 1-15: Example of data reported for Part C (UL) of the TEMP message

Symbolic form of group	Pressure of mandatory levels (hPa)	Geopotential height of levels (gpm)	Temperature °C	Dew point depression °C	Wind direction (degrees)	Wind speed (knots)	Code figure for T _a	Coded groups
M _i M _j M _j	-	-	-	-	-	-	-	TTCC
YYGGL _d	-	-	-	-	-	-	-	72121
IIIII	-	-	-	-	-	-	-	72934
70hhh	70	18591	-	-	-	-	-	70859
TTT _a DD	-	-	52.2	missing	-	-	3	523//
ddfff	-	-	-	-	162	05	-	16005
50hhh	50	20777	-	-	-	-	-	50078
TTT _a DD	-	-	-50.4	missing	-	-	5	505//
ddfff	-	-	-	-	0.93	06	-	09506
30hhh	30	24118	-	-	-	-	-	30412
TTT _a DD	-	-	50.0	missing	-	-	1	501//
ddfff	-	-	-	-	088	13	-	09013
20hhh	20	26788	-	-	-	-	-	20679
TTT _a DD	-	-	46.7	missing	-	-	7	467//
ddfff	-	-	-	-	080	13	-	08013
10hhh	10	31457	-	-	-	-	-	10146
TTT _a DD	-	-	-37.6	missing	-	-	7	377//
ddfff	-	-	-	-	072	18	-	07018
07hhh	7	33949	-	-	-	-	-	07395
TTT _a DD	-	-	31.2	missing	-	-	3	313//
ddfff	-	-	-	-	missing	missing	-	////
88P _t P _t P _t	86	-	-	-	-	-	-	88860

[illegible]

Table 1-16: Example of data reported for Part D (UE) of the TEMP message

Symbolic form of group	Level number	Pressure (hPa)	Temperature °C	Dew point depression °C	Code figure for T _a	Coded groups
M _i M _j M _j M _j	-	-	-	-	-	TTDD
YYGG/	-	-	-	-	-	7212/
IIiii	-	-	-	-	-	72934
11PPP	11	93	-	-	-	11930
TTT _a DD	-	-	-48.7	missing	7	487//
22PPP	22	86	-	-	-	22860
TTT _a DD	-	-	-53.3	missing	3	533//
33PPP	33	40	-	-	-	33400
TTT _a DD	-	-	-49.3	missing	3	493//
44PPP	44	31	-	-	-	44310
TTT _a DD	-	-	-50.3	missing	3	503//
55PPP	55	14	-	-	-	55140
TTT _a DD	-	-	-43.9	missing	9	439//
66PPP	66	6	-	-	-	66060
TTT _a DD	-	-	-28.5	missing	5	285//
51515	-	-	-	-	-	51515
101A _{dt} A _{dr}	-	-	-	-	-	10190
PPhhhh	-	5 (altitude 36365 gpm)	-	-	-	05637

Table 1-17: Example of data reported for Part B (UG) of the PILOT message

Symbolic form of group	Altitude (feet)	Wind direction (degrees)	Wind speed (knots)	Coded groups
$M_i M_j M_j M_j$	-	-	-	PPBB
$Y Y G G a_4$	-	-	-	59000
liiii	-	-	-	72600
$9t_n u_1 u_2 u_3$	-	-	-	90012
ddfff	Surface	290	07	29007
ddfff	1000	325	10	32510
ddfff	2000	341	12	34012
$9t_n u_1 u_2 u_3$	-	-	-	90346
ddfff	3000	336	12	33512
ddfff	4000	352	08	35008
ddfff	6000	338	06	34006
$9t_n u_1 u_2 u_3$	-	-	-	90789
ddfff	7000	322	03	32003
ddfff	8000	328	04	33004
ddfff	9000	330	08	33008
$9t_n u_1 u_2 u_3$	-	-	-	91246
ddfff	12000	314	16	31516
ddfff	14000	295	18	29518
ddfff	16000	273	22	27522
$9t_n u_1 u_2 u_3$	-	-	-	918//
ddfff	18000	255	19	25519
$9t_n u_1 u_2 u_3$	-	-	-	9205/
ddfff	20000	263	29	26529

Symbolic form of group	Altitude (feet)	Wind direction (degrees)	Wind speed (knots)	Coded groups
ddfff	25000	270	61	27061
$9t_n u_1 u_2 u_3$	-	-	-	9305/
ddfff	30000	278	91	28091
ddfff	35000	278	120	28120
$9t_n u_1 u_2 u_3$	-	-	-	94027
ddfff	40000	273	127	27627
ddfff	42000	278	124	28124
ddfff	47000	285	76	28576
$9t_n u_1 u_2 u_3$	-	-	-	950//
ddfff	50000	283	63	28563

Table 1-18: Example of data reported for Part D (UQ) of the PILOT message

Symbolic form of group	Altitude (feet)	Wind direction (degrees)	Wind speed (knots)	Coded groups
M _i M _j M _j M _j	-	-	-	PPDD
YYGGa ₄	-	-	-	59000
IIIII	-	-	-	72600
9t _n u ₁ u ₂ u ₃	-	-	-	954//
ddfff	54,000	278	41	28041
9t _n u ₁ u ₂ u ₃	-	-	-	96248
ddfff	62,000	299	17	30017
ddfff	64,000	326	13	32513
ddfff	68,000	312	09	31009
9t _n u ₁ u ₂ u ₃	-	-	-	9704/
ddfff	70,000	316	06	31506
ddfff	74,000	343	03	34503
9t _n u ₁ u ₂ u ₃	-	-	-	98369
ddfff	83,000	343	03	34503
ddfff	86,000	099	06	10006
ddfff	89,000	109	07	11007

1.10 Missing data

Missing data are reported in aerological messages through the use of the solidus (/).

1.10.1 Mandatory levels for a TEMP or TEMP SHIP message

When data for a mandatory level are missing, but are available for a higher mandatory level, the missing data for that level are coded as solidi. Note that the level indicator remains unchanged.

1.10.2 Significant levels in a TEMP message

A stratum of missing data in parts B or D of the TEMP (or TEMP SHIP) message is reported by assigning solidi to the temperature, dew point depression and wind data for a level within the stratum of missing data. The levels immediately before and after this level are therefore the boundary levels of the missing data stratum.

1.10.3 Fixed regional and significant levels in a PILOT message

A stratum of missing data in a PILOT (or PILOT SHIP) message is reported by assigning solidi to the wind direction and speed data for a level within a stratum of missing data. The levels immediately before and immediately after this level are therefore the boundary levels of the missing data stratum.

1.10.4 Special circumstances

Other rules for the reporting of missing data are as follows:

- Solidi are not included for missing wind data groups for mandatory levels in the TEMP or TEMP SHIP beyond the highest level specified by I_d (refer to 1.4.1.2);
- If a stratum of missing data prevents identification of a tropopause, the five-figure group is coded as 88999;
- If a stratum of missing data prevents identification of a maximum wind, the five-figure group is coded as 77999; and
- With the NAVAID system, dew point temperature evaluation does not cease because of cold temperatures.