Section D

SYSTEM OF STATION INDEX NUMBERS

a. **Meteorological observing stations**

b. **Hydrological observing stations**

a. METEOROLOGICAL OBSERVING STATIONS

A station index number in the form IIiii is included in the reports of meteorological observations made at land meteorological stations or aboard lightships using land code forms. This group permits the identification of the meteorological station at which the observation has been made.

The station index number is composed of the *block number* (II) and the *station number* (iii).

The block number defines the area in which the reporting station is situated. The station index numbers have been allocated as follows:

Region I:	Africa	60001 – 69998
Region II:	Asia	20001 – 20099 20200 – 21998 23001 – 25998 28001 – 32998 35001 – 36998 38001 – 39998 40350 – 48599 48800 – 49998 50001 – 59998
Region III:	South America	80001 – 88998
Region IV:	North America, Central America and the Caribbean	70001 – 79998
Region V:	South-West Pacific	48600 – 48799 90001 – 98998
Region VI:	Europe	00001 – 19998 20100 – 20199 22001 – 22998 26001 – 27998 33001 – 34998 37001 – 37998 40001 – 40349
Stations in the Antarctic		80001 – 88998

Block numbers are allotted to the services within each Region by regional agreement.

Station numbers (iii) corresponding to a common block number (II) except 89 are usually distributed so that the zone covered by this block number is divided into horizontal strips; e.g., one or several degrees of latitude. Where possible, station numbers within each strip increase from west to east and the first figure of the three-figure station number increases from north to south.

Station index numbers for stations in the Antarctic are allocated by the Secretary-General in accordance with the following scheme:

Each station has an international number 89xxy, where xx indicates the nearest 10° meridian which is numerically lower than the station longitude. For east longitudes, 50 is added; e.g., 89124 indicates a station between 120° and 130°W and 89654 indicates a station between longitudes 150° and 160°E. The figure “y” is allocated roughly according to the latitude of the station with “y” increasing towards the south.

For stations for which international numbers are no longer available within the above scheme, the algorithm will be expanded by adding 20 to xx for west longitudes (range of index numbers 200–380) and 70 for east longitudes (range of index numbers 700–880) to provide new index numbers.

Antarctic stations which held numbers before the introduction of this scheme in 1957 retain their previously allocated index numbers.

Station index numbers consisting of one figure repeated five times, e.g. 55555, 77777, etc., or ending with 000 or 999, or duplicating special code indicators used in code forms including station index numbers, shall not be assigned to meteorological stations (see list of these special code indicators in the note hereafter).

Modifications to the index numbers of synoptic land stations or aeronautical meteorological stations on land, the reports of which are included in international exchanges, shall be made effective on 1 January or 1 July. They shall be communicated to the Secretariat at least six months prior to becoming effective.

Other information relating to station index numbers shall be sent to the Secretariat at least two months prior to becoming effective.

The general list of station index numbers is published by the WMO Secretariat in a separate volume (*Weather Reporting* (WMO–No. 9), Volume A).

Positions of reporting ships or aircraft are given as geographical coordinates by position groups in the appropriate code forms. However, in order that a meteorological service or centre may follow and recognize the successive reports of a given ship, it is recommended that additional information be given in the report, permitting the identification of the ship. This information is given, whenever possible, by the inclusion of the call sign of ships. These call signs shall also be included in all collective messages of reports from selected and supplementary ships. In cases where the inclusion of the call signs is not possible, selected and supplementary ships are identified by name or by special numbers.

In the case of transport aircraft and for this same purpose, provision is made for the necessary identification information in the first group of the report.

Note: Figure groups used as special code indicators in FM 20, FM 32, FM 35 and FM 85 and which shall not be assigned to meteorological stations, in addition to groups consisting of one figure repeated five times and those ending with 000 or 999:

21212	**Data for fixed regional and/or significant levels with respect to wind follow. (FM 32)**
21212	**Data for significant levels with respect to wind follow. (FM 35)**
31313	**Data on sounding system, launch time and sea-surface temperature follow. (FM 35)**
41414	**Cloud information follows. (FM 35)**
51515 52525 53535 54545 55555 56565 57575 58585 59595	**Additional data in regional code follow. (FM 20, FM 32, FM 35, FM 85)**
61616 62626 63636 64646 65656 66666 67676 68686 69696	**Additional data in national code follow. (FM 20, FM 32, FM 35)**

b. HYDROLOGICAL OBSERVING STATIONS

An international hydrological observing station identification number in the form (000AC_i) BB$i_Hi_Hi_H$ is included in the reports of hydrological observation for a hydrological station and in a hydrological forecast. The two groups permit the identification of the WMO Region (A), country (C_i), river basin or group of basins (BB) and the station ($i_Hi_Hi_H$).

The allocation of identification numbers is the responsibility of regional associations, for C_i and BB, and Member countries, for $i_Hi_Hi_H$.

A Region may have a maximum of 99 indicators for large basins or groups of small basins. The number BB = 00 is not used.

If a country straddles several basins (BB), it should nevertheless have only one and the same figure for C_i.

If a basin BB comprises all or part of the territory of more than ten countries, C_i should be allocated starting with the largest countries, giving joint national numbers to others (the smallest). In the latter case, the national identification numbers of the station ($i_Hi_Hi_H$) should be allocated by regional agreement.

Alternatively large river basins composed of more than nine countries may be divided into several sub-basins, each one of which may be allocated a separate BB; thus the number of countries will be less than ten in each BB.

In each country and for a portion of a basin BB, the national identification numbers of stations ($i_Hi_Hi_H$) increase from 010 to 999 from west to east and from north to south. The numbers from $i_Hi_Hi_H$ = 000 to $i_Hi_Hi_H$ = 009 may be reserved to designate the identification of hydrological forecast centres.

Modifications to the identification numbers of hydrological observing stations, the reports of which are included in international exchanges, shall be made effective on 1 January or 1 July. They shall be communicated to the Secretariat at least six months prior to becoming effective.

Other information relating to station identification numbers shall be sent to the Secretariat at least two months prior to becoming effective.

The lists of C_i and BB are published in Volume II of the *Manual on Codes* (WMO–No. 306) and the lists of $i_Hi_Hi_H$ will be published in a separate volume (Operational Hydrology Report No. . . ., WMO–No. . . .). (This publication will appear at a later stage.)

Section E

BEAUFORT SCALE OF WIND

BEAUFORT SCALE OF WIND

BEAUFORT NUMBER	DESCRIPTIVE TERM	VELOCITY EQUIVALENT AT A STANDARD HEIGHT OF 10 METRES ABOVE OPEN FLAT GROUND				SPECIFICATIONS			Probable wave height* in metres	Probable wave height* in feet
		Mean velocity in knots	$m\ s^{-1}$	$km\ h^{-1}$	m.p.h.	Land	Sea	Coast		
0	Calm	< 1	0–0.2	< 1	< 1	Calm; smoke rises vertically	Sea like a mirror	Calm	—	—
1	Light air	1–3	0.3–1.5	1–5	1–3	Direction of wind shown by smoke drift but not by wind vanes	Ripples with the appearance of scales are formed, but without foam crests	Fishing smack just has steerage way	0.1 (0.1)	$\frac{1}{4}$ ($\frac{1}{4}$)
2	Light breeze	4–6	1.6–3.3	6–11	4–7	Wind felt on face; leaves rustle; ordinary vanes moved by wind	Small wavelets, still short but more pronounced; crests have a glassy appearance and do not break	Wind fills the sails of smacks which then travel at about 1–2 knots	0.2 (0.3)	$\frac{1}{2}$ (1)
3	Gentle breeze	7–10	3.4–5.4	12–19	8–12	Leaves and small twigs in constant motion; wind extends light flag	Large wavelets; crests begin to break; foam of glassy appearance; perhaps scattered white horses	Smacks begin to careen and travel about 3–4 knots	0.6 (1)	2 (3)
4	Moderate breeze	11–16	5.5–7.9	20–28	13–18	Raises dust and loose paper; small branches are moved	Small waves, becoming longer; fairly frequent white horses	Good working breeze, smacks carry all canvas with good list	1 (1.5)	$3\frac{1}{2}$ (5)
5	Fresh breeze	17–21	8.0–10.7	29–38	19–24	Small trees in leaf begin to sway; crested wavelets form on inland waters	Moderate waves, taking a more pronounced long form; many white horses are formed (chance of some spray)	Smacks shorten sail	2 (2.5)	6 ($8\frac{1}{2}$)
6	Strong breeze	22–27	10.8–13.8	39–49	25–31	Large branches in motion; whistling heard in telegraph wires; umbrellas used with difficulty	Large waves begin to form; the white foam crests are more extensive everywhere (probably some spray)	Smacks have double reef in mainsail; care required when fishing	3 (4)	$9\frac{1}{2}$ (13)
7	Near gale	28–33	13.9–17.1	50–61	32–38	Whole trees in motion; inconvenience felt when walking against wind	Sea heaps up and white foam from breaking waves begins to be blown in streaks along the direction of the wind	Smacks remain in harbour and those at sea lie to	4 (5.5)	$13\frac{1}{2}$ (19)
8	Gale	34–40	17.2–20.7	62–74	39–46	Breaks twigs off trees; generally impedes progress	Moderately high waves of greater length; edges of crests begin to break into the spindrift; the foam is blown in well-marked streaks along the direction of the wind	All smacks make for harbour, if near	5.5 (7.5)	18 (25)
9	Strong gale	41–47	20.8–24.4	75–88	47–54	Slight structural damage occurs (chimney pots and slates removed)	High waves; dense streaks of foam along the direction of the wind; crests of waves begin to topple, tumble and roll over; spray may affect visibility	—	7 (10)	23 (32)
10	Storm	48–55	24.5–28.4	89–102	55–63	Seldom experienced inland; trees uprooted; considerable structural damage occurs	Very high waves with long overhanging crests; the resulting foam, in great patches, is blown in dense white streaks along the direction of the wind; on the whole, the surface of the sea takes on a white appearance; the tumbling of the sea becomes heavy and shock-like; visibility affected	—	9 (12.5)	29 (41)
11	Violent storm	56–63	28.5–32.6	103–117	64–72	Very rarely experienced; accompanied by widespread damage	Exceptionally high waves (small and medium-sized ships might be for a time lost to view behind the waves); the sea is completely covered with long white patches of foam lying along the direction of the wind; everywhere the edges of the wave crests are blown into froth; visibility affected	—	11.5 (16)	37 (52)
12	Hurricane	64 and over	32.7 and over	118 and over	73 and over	—	The air is filled with foam and spray; sea completely white with driving spray; visibility very seriously affected	—	14 (—)	45 (—)

* This table is only intended as a guide to show roughly what may be expected in the open sea, remote from land. It should never be used in the reverse way; i.e., for logging or reporting the state of the sea. In enclosed waters, or when near land, with an offshore wind, wave heights will be smaller and the waves steeper. Figures in brackets indicate the probable maximum height of waves.

APPENDIX

National practices regarding the coding of certain elements in reports, analyses or forecasts for international exchange

NATIONAL PRACTICES REGARDING THE CODING OF CERTAIN ELEMENTS IN REPORTS, ANALYSES OR FORECASTS FOR INTERNATIONAL EXCHANGE

Reporting of horizontal visibility at surface in meteorological reports

By WMO circular letter W/SY/CO (PR-3195) of 16 September 1980, Members were invited to inform the Secretariat of their national practices regarding the coding of horizontal visibility at surface (VV) in meteorological reports.

The information received is given below. This table will be kept up to date through supplements.

Member	*Practices conform to Regulation 12.2.1.3.1*	*Other procedures used*	*No information available*
Afghanistan	X		
Albania			X
Algeria			X
Angola			X
Antigua and Barbuda			X
Argentina	X		
Armenia	X		
Australia		X	
Austria	X		
Azerbaijan	X		
Bahamas	X		
Bahrain	X		
Bangladesh			X
Barbados			X
Belarus	X		
Belgium	X		
Belize			X
Benin	X		
Bolivia (Plurinational State of)			X
Bosnia and Herzegovina			X
Botswana			X
Brazil	X		
British Caribbean Territories			X
Brunei Darussalam			X
Bulgaria	X		
Burkina Faso	X		
Burundi			X
Cambodia			X
Cameroon	X		
Canada		X	
Cape Verde	X		
Central African Republic	X		
Chad			X
Chile			X
China		X	
Colombia	X		
Comoros			X
Congo			X
Costa Rica			X
Côte d’Ivoire	X		

Member	*Practices conform to Regulation 12.2.1.3.1*	*Other procedures used*	*No information available*
Croatia			X
Cuba			X
Curaçao and Sint Maarten	X		
Cyprus	X		
Czech Republic	X		
Democratic People's Republic of Korea			X
Democratic Republic of the Congo	X		
Denmark		X	
Djibouti			X
Dominica			X
Dominican Republic	X		
Ecuador			X
Egypt	X		
El Salvador	X		
Eritrea			X
Estonia			X
Ethiopia	X		
Fiji			X
Finland		X	
France	X		
French Polynesia	X		
Gabon	X		
Gambia			X
Georgia	X		
Germany		X	
Ghana	X		
Greece	X		
Guatemala			X
Guinea			X
Guinea-Bissau			X
Guyana			X
Haiti			X
Honduras			X
Hong Kong, China	X		
Hungary	X		
Iceland		X	
India	X		
Indonesia	X		
Iran, Islamic Republic of			X
Iraq			X
Ireland	X		
Israel	X		
Italy	X		
Jamaica			X
Japan	X		
Jordan	X		
Kazakhstan	X		
Kenya	X		

Member	*Practices conform to Regulation 12.2.1.3.1*	*Other procedures used*	*No information available*
Kuwait	X		
Kyrgyzstan	X		
Lao People's Democratic Republic			X
Latvia			X
Lebanon			X
Lesotho			X
Liberia			X
Libya	X		
Lithuania			X
Luxembourg	X		
Macao, China			X
Madagascar	X		
Malawi	X		
Malaysia	X		
Maldives			X
Mali	X		
Malta	X		
Mauritania	X		
Mauritius	X		
Mexico	X		
Micronesia, Federated States of			X
Monaco			X
Mongolia			X
Montenegro			
Morocco	X		
Mozambique	X		
Myanmar	X		
Namibia			X
Nepal			X
Netherlands	X		
New Caledonia			X
New Zealand		X	
Nicaragua			X
Niger	X		
Nigeria			X
Niue			X
Norway		X	
Oman	X		
Pakistan	X		
Panama	X		
Papua New Guinea			X
Paraguay			X
Peru			X
Philippines	X		
Poland			X
Portugal	X		
Qatar			X
Republic of Korea	X		

Member	*Practices conform to Regulation 12.2.1.3.1*	*Other procedures used*	*No information available*
Republic of Moldova	X		
Romania	X		
Russian Federation	X		
Rwanda		X	
Saint Lucia			X
Sao Tome and Principe			X
Saudi Arabia	X		
Senegal			X
Serbia			
Seychelles	X		
Sierra Leone			X
Singapore			X
Slovakia	X		
Slovenia			X
Solomon Islands			X
Somalia			X
South Africa			X
Spain			X
Sri Lanka	X		
Sudan	X		
Suriname			X
Swaziland			X
Sweden		X	
Switzerland			X
Syrian Arab Republic	X		
Tajikistan	X		
Thailand	X		
The former Yugoslav Republic of Macedonia	X		
Togo	X		
Tonga			X
Trinidad and Tobago	X		
Tunisia	X		
Turkey	X		
Turkmenistan	X		
Uganda			X
Ukraine	X		
United Arab Emirates			X
United Kingdom of Great Britain and Northern Ireland	X		
United Republic of Tanzania	X		
United States of America		X	
Uruguay			X
Uzbekistan	X		
Vanuatu	X		
Venezuela (Bolivarian Republic of)	X		
Viet Nam	X		
Yemen			X
Zambia	X		
Zimbabwe			X

Information on the procedures used by Members other than those specified by Regulation 12.2.1.3.1 is given below:

Australia: When the horizontal visibility is not the same in different directions, the greatest distance prevailing over half or more of the horizon is given for VV. Significant reductions of visibility in other sectors are given in plain language at the end of the report.

Canada: The horizontal visibility which is reported in all surface observations is the "prevailing visibility" which is defined as the maximum visibility value common to sectors comprising one-half or more of the horizon circle.

China: The effective visibility is defined as the longest distance of visibility over more than one-half of all the directions.

Denmark: At manually operated stations if the horizontal visibility is not the same in different directions, the shorter distance is given for VV. However, if local phenomena reduce the visibility in a sector covering less than one-quarter of the horizon, this sector is disregarded provided that the visibility in it is 1 km or more. At automatic stations the visibility is given as a short distance – or a point – measurement.

Finland: When the horizontal visibility is not the same in different directions, the shortest distance shall be given for VV. However, visibility reduction in one or several small sectors caused by local phenomena is disregarded.

Germany: If the horizontal visibility is not the same in different directions, the shorter distance is given for VV. However, small sectors of the horizon in which local phenomena reduce visibility are disregarded, provided the extent of the sector or sectors concerned is not more than 30 degrees of the horizon circle in whole.

Iceland: When the horizontal visibility is not the same in different directions, the shortest distance shall be given for VV. Reduction of visibility confined to a sector of not more than 45 degrees shall not influence the selection of the code figure for VV. This reduction in visibility may be caused, for example, by precipitation, fog or haze not present at the observing station at the time of observation.

New Zealand: If the horizontal visibility is not the same in different directions, the shortest distance shall be given for VV or VVVV. However, if in one or more small sectors visibility is reduced, these are disregarded, provided the extent of the sector or sectors concerned is not more than one-quarter of the horizon circle in whole. When the horizontal visibility is 10 km or more, VVVV is coded in the form V´V´KM, where V´V´ is the visibility in whole kilometres.

Norway: If the horizontal visibility is not the same in different directions, the shortest distance shall be given for VV. However, small sectors of the horizon in which local phenomena such as showers or distant fog reduce the visibility are disregarded. The total of such small sectors should be less than 45 degrees.

Rwanda: If the horizontal visibility is not the same in different directions, the shorter distance is given for VV. However, if in one or more small sectors visibility is reduced, these are disregarded, provided the extent of the sector or sectors concerned is not more than one-quarter of the horizon circle.

Sweden: Regulation 12.2.1.3.1 is practiced with the following restriction: a reduction of the visibility within a limited area, extended at most 45 degrees of the horizon, shall not influence the choice of the code figure for VV. This reduction of the visibility can be caused by precipitation, fog or mist which is not present at the station at the time of observation.

United States of America: The national practice is to report the greatest visibility equalled or exceeded throughout at least half the horizon circle, which needs not necessarily be continuous. If this distance is between two values given in the code table, the code figure for the lower code table value will be reported.

ATTACHMENTS

I. **Common code tables to binary and alphanumeric codes (copy of Volume I.2, Part C/c.: Common Features to Binary and Alphanumeric Codes)**

II. **List of alphanumeric code tables related to BUFR Table B**

III. **International Seismic Code**

ATTACHMENT I

COMMON CODE TABLES TO BINARY AND ALPHANUMERIC CODES

COMMON CODE TABLE C–1: ***Identification of originating/generating centre***

F_1F_2 for alphanumeric codes

$F_3F_3F_3$ for alphanumeric codes

Code table 0 in GRIB Edition 1/Code table 0 01 033 in BUFR Edition 3

Octet 5 in Section 1 of GRIB Edition 1/Octet 6 in Section 1 of BUFR Edition 3

COMMON CODE TABLE C–2: ***Radiosonde/sounding system used***

Code table 3685 – r_ar_a (Radiosonde/sounding system used) – for alphanumeric codes

Code table 0 02 011 (Radiosonde type) in BUFR

COMMON CODE TABLE C–3: ***Instrument make and type for water temperature profile measurement with fall rate equation coefficients***

Code table 1770 – $I_XI_XI_X$ (Instrument type for XBT, with fall rate equation coefficients) – for alphanumeric codes

Code table 0 22 067 (Instrument type for water temperature/salinity profile measurement) in BUFR

COMMON CODE TABLE C–4: ***Water temperature profile recorder types***

Code table 4770 – X_RX_R (Recorder type) – for alphanumeric codes

Code table 0 22 068 (Water temperature profile recorder types) in BUFR

COMMON CODE TABLE C–5: ***Satellite identifier***

$I_6I_6I_6$ for alphanumeric codes

Code table 0 01 007 in BUFR

Code used in GRIB Edition 2

COMMON CODE TABLE C–6: ***List of international units***

(Used only in Volume I.2, Parts B and C)

COMMON CODE TABLE C–7: ***Tracking technique/status of system used***

Code table 3872 – s_as_a for alphanumeric code

Code table 0 02 014 in BUFR

COMMON CODE TABLE C–1: *Identification of originating/generating centre*

Common Code table { F_1F_2 for alphanumeric codes
$F_3F_3F_3$ for alphanumeric codes
Code table 0 in GRIB Edition 1/Code table 0 01 033 in BUFR Edition 3
Octet 5 in Section 1 of GRIB Edition 1/Octet 6 in Section 1 of BUFR Edition 3

Code figure for F_1F_2	Code figure for $F_3F_3F_3$	Octet 5 in Section 1 of GRIB Edition 1 Octet 6 in Section 1 of BUFR Edition 3	
00	000	0	WMO Secretariat
			01–09: WMCs
01	001	1	Melbourne
02	002	2	Melbourne
03	003	3	)
04	004	4	Moscow
05	005	5	Moscow
06	006	6	)
07	007	7	US National Weather Service – National Centres for Environmental Prediction (NCEP)
08	008	8	US National Weather Service Telecommunications Gateway (NWSTG)
09	009	9	US National Weather Service – Other
			10–25: Centres in Region I
10	010	10	Cairo (RSMC)
11	011	11	)
12	012	12	Dakar (RSMC)
13	013	13	)
14	014	14	Nairobi (RSMC)
15	015	15	)
16	016	16	Casablanca (RSMC)
17	017	17	Tunis (RSMC)
18	018	18	Tunis-Casablanca (RSMC)
19	019	19	)
20	020	20	Las Palmas
21	021	21	Algiers (RSMC)
22	022	22	ACMAD
23	023	23	Mozambique (NMC)
24	024	24	Pretoria (RSMC)
25	025	25	La Réunion (RSMC)
			26–40: Centres in Region II
26	026	26	Khabarovsk (RSMC)
27	027	27	)
28	028	28	New Delhi (RSMC)
29	029	29	)
30	030	30	Novosibirsk (RSMC)
31	031	31	)
32	032	32	Tashkent (RSMC)
33	033	33	Jeddah (RSMC)
34	034	34	Tokyo (RSMC), Japan Meteorological Agency

Code figure for F_1F_2	Code figure for $F_3F_3F_3$	Octet 5 in Section 1 of GRIB Edition 1 Octet 6 in Section 1 of BUFR Edition 3	
35	035	35	)
36	036	36	Bangkok
37	037	37	Ulaanbaatar
38	038	38	Beijing (RSMC)
39	039	39	)
40	040	40	Seoul
			41–50: Centres in Region III
41	041	41	Buenos Aires (RSMC)
42	042	42	)
43	043	43	Brasilia (RSMC)
44	044	44	)
45	045	45	Santiago
46	046	46	Brazilian Space Agency – INPE
47	047	47	Colombia (NMC)
48	048	48	Ecuador (NMC)
49	049	49	Peru (NMC)
50	050	50	Venezuela (Bolivarian Republic of) (NMC)
			51–63: Centres in Region IV
51	051	51	Miami (RSMC)
52	052	52	Miami (RSMC), National Hurricane Centre
53	053	53	Montreal (RSMC)
54	054	54	)
55	055	55	San Francisco
56	056	56	ARINC Centre
57	057	57	US Air Force – Air Force Global Weather Central
58	058	58	Fleet Numerical Meteorology and Oceanography Center, Monterey, CA, United States
59	059	59	The NOAA Forecast Systems Laboratory, Boulder, CO, United States
60	060	60	United States National Center for Atmospheric Research (NCAR)
61	061	61	Service ARGOS – Landover
62	062	62	US Naval Oceanographic Office
63	063	63	International Research Institute for Climate and Society (IRI)
			64–73: Centres in Region V
64	064	64	Honolulu (RSMC)
65	065	65	Darwin (RSMC)
66	066	66	)
67	067	67	Melbourne (RSMC)
68	068	68	Reserved
69	069	69	Wellington (RSMC)
70	070	70	)
71	071	71	Nadi (RSMC)
72	072	72	Singapore
73	073	73	Malaysia (NMC)

Code figure for F_1F_2	Code figure for $F_3F_3F_3$	Octet 5 in Section 1 of GRIB Edition 1 Octet 6 in Section 1 of BUFR Edition 3	
			74–99: Centres in Region VI
74	074	74	UK Meteorological Office – Exeter (RSMC)
75	075	75	)
76	076	76	Moscow (RSMC)
77	077	77	Reserved
78	078	78	Offenbach (RSMC)
79	079	79	)
80	080	80	Rome (RSMC)
81	081	81	)
82	082	82	Norrköping
83	083	83	)
84	084	84	Toulouse (RSMC)
85	085	85	Toulouse (RSMC)
86	086	86	Helsinki
87	087	87	Belgrade
88	088	88	Oslo
89	089	89	Prague
90	090	90	Episkopi
91	091	91	Ankara
92	092	92	Frankfurt/Main
93	093	93	London (WAFC)
94	094	94	Copenhagen
95	095	95	Rota
96	096	96	Athens
97	097	97	European Space Agency (ESA)
98	098	98	European Centre for Medium-Range Weather Forecasts (ECMWF) (RSMC
99	099	99	De Bilt
			Additional Centres
Not applicable	100	100	Brazzaville
Not applicable	101	101	Abidjan
Not applicable	102	102	Libya (NMC)
Not applicable	103	103	Madagascar (NMC)
Not applicable	104	104	Mauritius (NMC)
Not applicable	105	105	Niger (NMC)
Not applicable	106	106	Seychelles (NMC)
Not applicable	107	107	Uganda (NMC)
Not applicable	108	108	United Republic of Tanzania (NMC)
Not applicable	109	109	Zimbabwe (NMC)
Not applicable	110	110	Hong Kong, China
Not applicable	111	111	Afghanistan (NMC)
Not applicable	112	112	Bahrain (NMC)
Not applicable	113	113	Bangladesh (NMC)
Not applicable	114	114	Bhutan (NMC)
Not applicable	115	115	Cambodia (NMC)
Not applicable	116	116	Democratic People’s Republic of Korea (NMC)

Code figure for F_1F_2	Code figure for $F_3F_3F_3$	Octet 5 in Section 1 of GRIB Edition 1 Octet 6 in Section 1 of BUFR Edition 3	
Not applicable	117	117	Islamic Republic of Iran (NMC)
Not applicable	118	118	Iraq (NMC)
Not applicable	119	119	Kazakhstan (NMC)
Not applicable	120	120	Kuwait (NMC)
Not applicable	121	121	Kyrgyzstan (NMC)
Not applicable	122	122	Lao People's Democratic Republic (NMC)
Not applicable	123	123	Macao, China
Not applicable	124	124	Maldives (NMC)
Not applicable	125	125	Myanmar (NMC)
Not applicable	126	126	Nepal (NMC)
Not applicable	127	127	Oman (NMC)
Not applicable	128	128	Pakistan (NMC)
Not applicable	129	129	Qatar (NMC)
Not applicable	130	130	Yemen (NMC)
Not applicable	131	131	Sri Lanka (NMC)
Not applicable	132	132	Tajikistan (NMC)
Not applicable	133	133	Turkmenistan (NMC)
Not applicable	134	134	United Arab Emirates (NMC)
Not applicable	135	135	Uzbekistan (NMC)
Not applicable	136	136	Viet Nam (NMC)
Not applicable	137–139	137–139	Reserved for other centres
Not applicable	140	140	Bolivia (Plurinational State of) (NMC)
Not applicable	141	141	Guyana (NMC)
Not applicable	142	142	Paraguay (NMC)
Not applicable	143	143	Suriname (NMC)
Not applicable	144	144	Uruguay (NMC)
Not applicable	145	145	French Guiana
Not applicable	146	146	Brazilian Navy Hydrographic Centre
Not applicable	147	147	National Commission on Space Activities (CONAE) – Argentina
Not applicable	148–149	148–149	Reserved for other centres
Not applicable	150	150	Antigua and Barbuda (NMC)
Not applicable	151	151	Bahamas (NMC)
Not applicable	152	152	Barbados (NMC)
Not applicable	153	153	Belize (NMC)
Not applicable	154	154	British Caribbean Territories Centre
Not applicable	155	155	San José
Not applicable	156	156	Cuba (NMC)
Not applicable	157	157	Dominica (NMC)
Not applicable	158	158	Dominican Republic (NMC)
Not applicable	159	159	El Salvador (NMC)
Not applicable	160	160	US NOAA/NESDIS
Not applicable	161	161	US NOAA Office of Oceanic and Atmospheric Research
Not applicable	162	162	Guatemala (NMC)
Not applicable	163	163	Haiti (NMC)
Not applicable	164	164	Honduras (NMC)
Not applicable	165	165	Jamaica (NMC)
Not applicable	166	166	Mexico City

Code figure for F_1F_2	Code figure for $F_3F_3F_3$	Octet 5 in Section 1 of GRIB Edition 1 Octet 6 in Section 1 of BUFR Edition 3	
Not applicable	167	167	Curaçao and Sint Maarten (NMC)
Not applicable	168	168	Nicaragua (NMC)
Not applicable	169	169	Panama (NMC)
Not applicable	170	170	Saint Lucia (NMC)
Not applicable	171	171	Trinidad and Tobago (NMC)
Not applicable	172	172	French Departments in RA IV
Not applicable	173	173	US National Aeronautics and Space Administration (NASA)
Not applicable	174	174	Integrated Science Data Management/Marine Environmental Data Service (ISDM/MEDS) – Canada
Not applicable	175	175	University Corporation for Atmospheric Research (UCAR) – United States
Not applicable	176	176	Cooperative Institute for Meteorological Satellite Studies (CIMSS) – United States
Not applicable	177	177	NOAA National Ocean Service – United States
Not applicable	178–189	178–189	Reserved for other centres
Not applicable	190	190	Cook Islands (NMC)
Not applicable	191	191	French Polynesia (NMC)
Not applicable	192	192	Tonga (NMC)
Not applicable	193	193	Vanuatu (NMC)
Not applicable	194	194	Brunei Darussalam (NMC)
Not applicable	195	195	Indonesia (NMC)
Not applicable	196	196	Kiribati (NMC)
Not applicable	197	197	Federated States of Micronesia (NMC)
Not applicable	198	198	New Caledonia (NMC)
Not applicable	199	199	Niue
Not applicable	200	200	Papua New Guinea (NMC)
Not applicable	201	201	Philippines (NMC)
Not applicable	202	202	Samoa (NMC)
Not applicable	203	203	Solomon Islands (NMC)
Not applicable	204	204	National Institute of Water and Atmospheric Research (NIWA – New Zealand)
Not applicable	205–209	205–209	Reserved
Not applicable	210	210	Frascati (ESA/ESRIN)
Not applicable	211	211	Lannion
Not applicable	212	212	Lisbon
Not applicable	213	213	Reykjavik
Not applicable	214	214	Madrid
Not applicable	215	215	Zurich
Not applicable	216	216	Service ARGOS – Toulouse
Not applicable	217	217	Bratislava
Not applicable	218	218	Budapest
Not applicable	219	219	Ljubljana
Not applicable	220	220	Warsaw
Not applicable	221	221	Zagreb
Not applicable	222	222	Albania (NMC)
Not applicable	223	223	Armenia (NMC)
Not applicable	224	224	Austria (NMC)
Not applicable	225	225	Azerbaijan (NMC)

Code figure for F_1F_2	Code figure for $F_3F_3F_3$	Octet 5 in Section 1 of GRIB Edition 1 Octet 6 in Section 1 of BUFR Edition 3	
Not applicable	226	226	Belarus (NMC)
Not applicable	227	227	Belgium (NMC)
Not applicable	228	228	Bosnia and Herzegovina (NMC)
Not applicable	229	229	Bulgaria (NMC)
Not applicable	230	230	Cyprus (NMC)
Not applicable	231	231	Estonia (NMC)
Not applicable	232	232	Georgia (NMC)
Not applicable	233	233	Dublin
Not applicable	234	234	Israel (NMC)
Not applicable	235	235	Jordan (NMC)
Not applicable	236	236	Latvia (NMC)
Not applicable	237	237	Lebanon (NMC)
Not applicable	238	238	Lithuania (NMC)
Not applicable	239	239	Luxembourg
Not applicable	240	240	Malta (NMC)
Not applicable	241	241	Monaco
Not applicable	242	242	Romania (NMC)
Not applicable	243	243	Syrian Arab Republic (NMC)
Not applicable	244	244	The former Yugoslav Republic of Macedonia (NMC)
Not applicable	245	245	Ukraine (NMC)
Not applicable	246	246	Republic of Moldova (NMC)
Not applicable	247	247	Operational Programme for the Exchange of weather RAdar information (OPERA) – EUMETNET
Not applicable	248	248	Montenegro (NMC)
Not applicable	249	249	Barcelona Dust Forecast Center
Not applicable	250	250	COnsortium for Small scale MOdelling (COSMO)
Not applicable	251	251	Meteorological Cooperation on Operational NWP (MetCoOp)
Not applicable	252	252	Max Planck Institute for Meteorology (MPI-M)
Not applicable	253	253	Reserved for others centres
Not applicable	254	254	EUMETSAT Operation Centre
Not applicable	255	255	Missing value
Not applicable	256–999	Not applicable	Not used

Notes:

(1) The closed bracket sign) indicates that the corresponding code figure is reserved for the previously named centre.

(2) With GRIB or BUFR, to indicate whether the originating/generating centre is a sub-centre or not, the following procedure should be applied:

In GRIB edition 1, use octet 26 of section 1, or in BUFR edition 3, use octet 5 of section 1, with the following meaning:

Code figure	
0	Not a sub-centre, the originating/generating centre is the centre defined by octet 5 in section 1 of GRIB edition 1, or by octet 6 in section 1 of BUFR edition 3.
1 to 254	Identifier of the sub-centre which is the originating/generating centre. The identifier of the sub-centre is allocated by the associated centre which is defined by octet 5 in section 1 of GRIB edition 1, or by octet 6 in section 1 of BUFR edition 3. The sub-centre identifiers should be supplied to the WMO Secretariat by the associated centre(s) for publication.

(3) For the definitions of sub-centres provided to the WMO Secretariat, see Common code table C-12.

COMMON CODE TABLE C–2: ***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 assignment of number (necessary after 30/06/2007)	Code figure for r_ar_a (Code table 3685)	Code figure for BUFR (Code table 0 02 011)	
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 assignment of number (necessary after 30/06/2007)	Code figure for r_ar_a (Code table 3685)	Code figure for BUFR (Code table 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)

Date of assignment of number (necessary after 30/06/2007)	Code figure for r_ar_a (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
01/01/2008	11	111	Sippican LMS6 w/Chip Thermistor, external boom mounted capacitance relative humidity sensor, and derived pressure from GPS height
Needed	12	112	Vacant
15/09/2010	13	113	Vaisala RS92/MARWIN MW32 (Finland)
03/11/2011	14	114	Vaisala RS92/DigiCORA MW41 (Finland)

Date of assignment of number (necessary after 30/06/2007)	Code figure for r_ar_a (Code table 3685)	Code figure for BUFR (Code table 0 02 011)	
01/12/2011	15	115	PAZA-12M/Radiotheodolite-UL (Ukraine)
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
	20–21	120–121	Not vacant
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 form 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)
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
Needed	50	150	Vacant
	51	151	Not vacant
03/11/2011	52	152	Vaisala RS92-NGP/Intermet IMS-2000 (United States)
	53–59	153–159	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 r_ar_a (Code table 3685)	Code figure for BUFR (Code table 0 02 011)	
Needed	60	160	Vacant
	61	161	Not vacant
Needed	62–66	162–166	Vacant
	67–72	167–172	Not vacant
Needed	73	173	Vacant
	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
	Not available	190–196	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 radiosounding reports*.

COMMON CODE TABLE C–3: ***Instrument make and type for water temperature profile measurement with fall rate equation coefficients***

Common Code table { Code table 1770 – $I_XI_XI_X$ (Instrument type for XBT, with fall rate equation coefficients) – for alphanumeric codes
Code table 0 22 067 (Instrument type for water temperature/salinity profile measurement) in BUFR

Code figure for $I_XI_XI_X$	Code figure for BUFR (Code table 022 067)	Meaning		
		Instrument make and type	Equation coefficients	
			a	*b*
001	1	Sippican T-4	6.472	–2.16
002	2	Sippican T-4	6.691	–2.25
011	11	Sippican T-5	6.828	–1.82
021	21	Sippican Fast Deep	6.346	–1.82
031	31	Sippican T-6	6.472	–2.16
032	32	Sippican T-6	6.691	–2.25
041	41	Sippican T-7	6.472	–2.16
042	42	Sippican T-7	6.691	–2.25
051	51	Sippican Deep Blue	6.472	–2.16
052	52	Sippican Deep Blue	6.691	–2.25
061	61	Sippican T-10	6.301	–2.16
071	71	Sippican T-11	1.779	–0.255
081	81	Sippican AXBT (300m probes)	1.52	0.0
201	201	TSK T-4	6.472	–2.16
202	202	TSK T-4	6.691	–2.25
211	211	TSK T-6	6.472	–2.16
212	212	TSK T-6	6.691	–2.25
221	221	TSK T-7	6.472	–2.16
222	222	TSK T-7	6.691	–2.25
231	231	TSK T-5	6.828	–1.82
241	241	TSK T-10	6.301	–2.16
251	251	TSK Deep Blue	6.472	–2.16
252	252	TSK Deep Blue	6.691	–2.25
261	261	TSK AXBT		
401	401	Sparton XBT-1	6.301	–2.16
411	411	Sparton XBT-3	5.861	–0.0904
421	421	Sparton XBT-4	6.472	–2.16
431	431	Sparton XBT-5	6.828	–1.82
441	441	Sparton XBT-5DB	6.828	–1.82
451	451	Sparton XBT-6	6.472	–2.16
461	461	Sparton XBT-7	6.472	–2.16
462	462	Sparton XBT-7	6.705	–2.28
471	471	Sparton XBT-7DB	6.472	–2.16
481	481	Sparton XBT-10	6.301	–2.16
491	491	Sparton XBT-20	6.472	–2.16
501	501	Sparton XBT-20DB	6.472	–2.16
510	510	Sparton 536 AXBT	1.524	0
700	700	Sippican XCTD Standard		
710	710	Sippican XCTD Deep		
720	720	Sippican AXCTD		

Code figure for $I_XI_XI_X$	Code figure for BUFR (Code table 022 067)	Meaning: Instrument make and type	Equation coefficients *a*	*b*
730	730	Sippican SXCTD		
741	741	TSK XCTD/XCTD-1	3.42543	–0.47
742	742	TSK XCTD-2	3.43898	–0.31
743	743	TSK XCTD-2F	3.43898	–0.31
744	744	TSK XCTD-3	5.07598	–0.72
745	745	TSK XCTD-4	3.68081	–0.47
751	751	TSK AXCTD		
780	780	Sea-Bird SBE21 SEACAT Thermosalinograph	Not applicable	
781	781	Sea-Bird SBE45 MicroTSG Thermosalinograph	Not applicable	
800	800	Mechanical BT	Not applicable	
810	810	Hydrocast	Not applicable	
820	820	Thermistor chain	Not applicable	
825	825	Temperature (sonic) and pressure probes	Not applicable	
830	830	CTD	Not applicable	
831	831	CTD-P-ALACE float	Not applicable	
837	837	ARVOR_C, SBE conductivity sensor		
838	838	ARVOR_D, SBE conductivity sensor		
839	839	PROVOR-II, SBE conductivity sensor		
840	840	PROVOR, no conductivity sensor	Not applicable	
841	841	PROVOR, Sea-Bird conductivity sensor	Not applicable	
842	842	PROVOR, FSI conductivity sensor	Not applicable	
843	843	Polar Ocean Profiling System (POPS), PROVOR, SBE CTD		
844	844	Profiling float, ARVOR, Sea-Bird conductivity sensor		
845	845	Webb Research, no conductivity sensor	Not applicable	
846	846	Webb Research, Sea-Bird conductivity sensor	Not applicable	
847	847	Webb Research, FSI conductivity sensor	Not applicable	
848	848	APEX-EM, SBE conductivity sensor		
849	849	APEX_D, SBE conductivity sensor		
850	850	SOLO, no conductivity sensor	Not applicable	
851	851	SOLO, Sea-Bird conductivity sensor	Not applicable	
852	852	SOLO, FSI conductivity sensor	Not applicable	
853	853	Profiling float, SOLO2 (SCRIPPS), Sea-Bird conductivity sensor		
854	854	S2A, SBE conductivity sensor	Not applicable	
855	855	Profiling float, NINJA, no conductivity sensor	Not applicable	
856	856	Profiling float, NINJA, SBE conductivity sensor	Not applicable	

Code figure for $I_XI_XI_X$	Code figure for BUFR (Code table 022 067)	Meaning: Instrument make and type	Equation coefficients *a*	Equation coefficients *b*
857	857	Profiling float, NINJA, FSI conductivity sensor	Not applicable	
858	858	Profiling float, NINJA, TSK conductivity sensor	Not applicable	
859	859	Profiling float, NEMO, no conductivity sensor	Not applicable	
860	860	Profiling float, NEMO, SBE conductivity sensor	Not applicable	
861	861	Profiling float, NEMO, FSI conductivity sensor	Not applicable	
862	862	SOLO_D, SBE conductivity sensor		
863	863	NAVIS-A, SBE conductivity sensor		
864	864	NINJA_D, SBE conductivity sensor		
865	865	NOVA, SBE conductivity sensor		
866	866	ALAMO, no conductivity sensor		
867	867	ALAMO, RBR conductivity sensor		
868	868	ALAMO, SBE conductivity sensor		
869–899	869–899	Reserved		
900	900	Sippican LMP-5 XBT	9.727	–0.0000473
901	901	Ice-tethered Profiler (ITP), SBE CTD		
902	902	Brooke Ocean Moving Vessel Profiler (MVP)		
903	903	Sea-Bird CTD		
904	904	AML Oceanographic CTD		
905	905	Falmouth Scientific CTD		
906	906	Ocean Sensors CTD		
907	907	Valeport CTD		
908	908	Oceanscience MVP		
909	909	IDRONAUT CTD		
910	910	Sea-Bird SBE 38		
911–994	911–994	Reserved		
995	995	Instrument attached to marine mammals	Not applicable	
996	996	Instrument attached to animals other than marine mammals	Not applicable	
997–999	997–999	Reserved		
	1000–1022	Reserved		
	1023	Missing value		

Notes:

(1) The depth is calculated from coefficients *a* and *b* and the time *t* as follows: $z = at + 10^{-3}bt^2$.

(2) All unassigned numbers are reserved for future use.

(3) The values of *a* and *b* are supplied for information only.

COMMON CODE TABLE C–4: *Water temperature profile recorder types*

Common Code table { Code table 4770 – X_RX_R (Recorder type) – for alphanumeric codes
Code table 0 22 068 (Water temperature profile recorder types) in BUFR

Code figure for X_RX_R	Code figure for BUFR (Code table 0 22 068)	Meaning
01	1	Sippican Strip Chart Recorder
02	2	Sippican MK2A/SSQ-61
03	3	Sippican MK-9
04	4	Sippican AN/BHQ-7/MK8
05	5	Sippican MK-12
06	6	Sippican MK-21
07	7	Sippican MK-8 Linear Recorder
08	8	Sippican MK-10
10	10	Sparton SOC BT/SV Processor Model 100
11	11	Lockheed-Sanders Model OL5005
20	20	ARGOS XBT-ST
21	21	CLS-ARGOS/Protecno XBT-ST Model-1
22	22	CLS-ARGOS/Protecno XBT-ST Model-2
30	30	BATHY Systems SA-810
31	31	Scripps Metrobyte Controller
32	32	Murayama Denki Z-60-16 III
33	33	Murayama Denki Z-60-16 II
34	34	Protecno ETSM2
35	35	Nautilus Marine Service NMS-XBT
40	40	TSK MK-2A
41	41	TSK MK-2S
42	42	TSK MK-30
43	43	TSK MK-30N
45	45	TSK MK-100
46	46	TSK MK-130 Compatible recorder for both XBT and XCTD
47	47	TSK MK-130A XCTD recorder
48	48	TSK AXBT RECEIVER MK-300
49	49	TSK MK-150/MK-150N Compatible recorder for both XBT and XCTD
50	50	JMA ASTOS
60	60	ARGOS communications, sampling on up transit
61	61	ARGOS communications, sampling on down transit
62	62	Orbcomm communications, sampling on up transit
63	63	Orbcomm communications, sampling on down transit
64	64	Iridium communications, sampling on up transit
65	65	Iridium communications, sampling on down transit
70	70	CSIRO Devil-1 XBT acquisition system
71	71	CSIRO Devil-2 XBT acquisition system
72	72	TURO/CSIRO Quoll XBT Acquisition System
80	80	Applied Microsystems Ltd, MICRO-SVT&P
81	81	Sea Mammal Research Unit, Univ. St Andrews, UK, uncorrected salinity from a sea mammal mounted instrument
82	82	Sea Mammal Research Unit, Univ. St Andrews, UK, corrected salinity from a sea mammal mounted instrument
99	99	Unknown
	127	Missing value

Note: All unassigned numbers are reserved for future use.

COMMON CODE TABLE C–5: *Satellite identifier*

Common Code table { $I_6I_6I_6$ for alphanumeric codes
Code table 0 01 007 in BUFR
Code used in GRIB Edition 2 }

Code figure for $I_6I_6I_6$	Code figure for BUFR (Code table 0 01 007)	Code figure for GRIB Edition 2	
000	0	0	Reserved
	001–099: Numbers allocated to Europe		
001	1	1	ERS 1
002	2	2	ERS 2
003	3	3	METOP-1 (Metop-B)
004	4	4	METOP-2 (Metop-A)
005	5	5	METOP-3 (Metop-C)
020	20	20	SPOT 1
021	21	21	SPOT 2
022	22	22	SPOT 3
023	23	23	SPOT 4
040	40	40	OERSTED
041	41	41	CHAMP
042	42	42	TerraSAR-X
043	43	43	TanDEM-X
044	44	44	PAZ
046	46	46	SMOS
047	47	47	CryoSat-2
048	48	48	AEOLUS
050	50	50	METEOSAT 3
051	51	51	METEOSAT 4
052	52	52	METEOSAT 5
053	53	53	METEOSAT 6
054	54	54	METEOSAT 7
055	55	55	METEOSAT 8
056	56	56	METEOSAT 9
057	57	57	METEOSAT 10
058	58	58	METEOSAT 1
059	59	59	METEOSAT 2
060	60	60	ENVISAT
061	61	61	Sentinal 3A
070	70	70	METEOSAT 11
	100–199: Numbers allocated to Japan		
120	120	120	ADEOS
121	121	121	ADEOS II
122	122	122	GCOM-W1
140	140	140	GOSAT
150	150	150	GMS 3
151	151	151	GMS 4
152	152	152	GMS 5

Code figure for $I_6I_6I_6$	Code figure for BUFR (Code table 0 01 007)	Code figure for GRIB Edition 2	
153	153	153	GMS
154	154	154	GMS 2
171	171	171	MTSAT-1R
172	172	172	MTSAT-2
173	173	173	Himawari-8
174	174	174	Himawari-9
	200–299: Numbers allocated to the United States		
200	200	200	NOAA 8
201	201	201	NOAA 9
202	202	202	NOAA 10
203	203	203	NOAA 11
204	204	204	NOAA 12
205	205	205	NOAA 14
206	206	206	NOAA 15
207	207	207	NOAA 16
208	208	208	NOAA 17
209	209	209	NOAA 18
220	220	220	LANDSAT 5
221	221	221	LANDSAT 4
222	222	222	LANDSAT 7
223	223	223	NOAA 19
224	224	224	NPP
240	240	240	DMSP 7
241	241	241	DMSP 8
242	242	242	DMSP 9
243	243	243	DMSP 10
244	244	244	DMSP 11
245	245	245	DMSP 12
246	246	246	DMSP 13
247	247	247	DMSP 14
248	248	248	DMSP 15
249	249	249	DMSP 16
250	250	250	GOES 6
251	251	251	GOES 7
252	252	252	GOES 8
253	253	253	GOES 9
254	254	254	GOES 10
255	255	255	GOES 11
256	256	256	GOES 12
257	257	257	GOES 13
258	258	258	GOES 14
259	259	259	GOES 15
260	260	260	JASON 1
261	261	261	JASON 2

Code figure for $I_6I_6I_6$	Code figure for BUFR (Code table 0 01 007)	Code figure for GRIB Edition 2	
281	281	281	QUIKSCAT
282	282	282	TRMM
283	283	283	CORIOLIS
285	285	285	DMSP 17
286	286	286	DMSP 18
287	287	287	DMSP 19
288	288	288	GPM-core
300–399: Numbers allocated to the Russian Federation			
310	310	310	GOMS 1
311	311	311	GOMS 2
320	320	320	METEOR 2-21
321	321	321	METEOR 3-5
322	322	322	METEOR 3M-1
323	323	323	METEOR 3M-2
341	341	341	RESURS 01-4
400–499: Numbers allocated to India			
410	410	410	KALPANA-1
421	421	421	Oceansat-2
430	430	430	INSAT 1B
431	431	431	INSAT 1C
432	432	432	INSAT 1D
440	440	440	Megha-Tropiques
441	441	441	SARAL
450	450	450	INSAT 2A
451	451	451	INSAT 2B
452	452	452	INSAT 2E
470	470	470	INSAT 3A
471	471	471	INSAT 3D
472	472	472	INSAT 3E
500–599: Numbers allocated to China			
500	500	500	FY–1C
501	501	501	FY–1D
510	510	510	FY–2
512	512	512	FY-2B
513	513	513	FY-2C
514	514	514	FY-2D
515	515	515	FY-2E
516	516	516	FY-2F
517	517	517	FY-2G
520	520	520	FY-3A
521	521	521	FY-3B
522	522	522	FY-3C
600–699: Numbers allocated to Europe			
700–799: Numbers allocated to the United States			
700	700	700	TIROS M (ITOS 1)
701	701	701	NOAA 1

Code figure for $I_6I_6I_6$	Code figure for BUFR (Code table 0 01 007)	Code figure for GRIB Edition 2	
702	702	702	NOAA 2
703	703	703	NOAA 3
704	704	704	NOAA 4
705	705	705	NOAA 5
706	706	706	NOAA 6
707	707	707	NOAA 7
708	708	708	TIROS-N
710	710	710	GOES (SMS 1)
711	711	711	GOES (SMS 2)
720	720	720	TOPEX
721	721	721	GFO (GEOSAT follow on)
722	722	722	GRACE A
723	723	723	GRACE B
731	731	731	GOES 1
732	732	732	GOES 2
733	733	733	GOES 3
734	734	734	GOES 4
735	735	735	GOES 5
740	740	740	COSMIC-1
741	741	741	COSMIC-2
742	742	742	COSMIC-3
743	743	743	COSMIC-4
744	744	744	COSMIC-5
745	745	745	COSMIC-6
763	763	763	NIMBUS 3
764	764	764	NIMBUS 4
765	765	765	NIMBUS 5
766	766	766	NIMBUS 6
767	767	767	NIMBUS 7
780	780	780	ERBS
781	781	781	UARS
782	782	782	EARTH PROBE
783	783	783	TERRA
784	784	784	AQUA
785	785	785	AURA
786	786	786	C/NOFS
787	787	787	CALIPSO
788	788	788	CloudSat
800–849: Numbers allocated to other satellite operators			
800	800	800	SUNSAT
810	810	810	COMS-1
811	811	811	COMS-2
820	820	820	SAC-C
821	821	821	SAC-D
825	825	825	KOMPSAT-5
850	850	850	Combination of TERRA and AQUA
851	851	851	Combination of NOAA 16 to NOAA 19
852	852	852	Combination of Metop-1 to Metop-3

Code figure for $I_6I_6I_6$	Code figure for BUFR (Code table 0 01 007)	Code figure for GRIB Edition 2	
853	853	853	Combination of METEOSAT and DMSP
854	854	854	Non-specific mixture of geostationary and low Earth-orbiting satellites
870–998	870–998	870–998	Reserved
999 Missing value	999–1022	999–65534	Reserved
	1023	65535	Missing value

Note: Within the ranges 000 to 849 and 870 to 998, even deciles indicate polar-orbiting satellites and odd deciles indicate geostationary satellites. The range from 850 to 869 shall be used to indicate combinations of satellites, so the aforementioned decile rule does not apply to values in this range.

COMMON CODE TABLE C–6: ***List of international units***

(Used only in Volume I.2, Parts B and C)

COMMON CODE TABLE C–7: *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 $s_a s_a$	Code figure for BUFR (Code table 0 02 014)	
00	0	No windfinding
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
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
24–28	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

Code figure for s_as_a	Code figure for BUFR (Code table 0 02 014)	
44	44	Pneumatic/hydraulic failure
45	45	Other problems
46	46	Compressor problems
47	47	Balloon problems
48	48	Balloon release problems
49	49	Launcher damaged
		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
	100–126	Reserved
	127	Missing value

ATTACHMENT II

LIST OF ALPHANUMERIC CODE TABLES RELATED TO BUFR TABLE B

Related specification/code table/ regulation/code form in alphanumeric codes	BUFR code/flag table	Remarks
A — Code table 0101	0 20 063	—
A_N — Code table 0114	0 02 169	—
A_a — Code table 0131	0 23 001	—
A_c — Code table 0133	0 23 005	—
A_e — Code table 0135	0 23 006	—
A_1 — Code table 0161	0 01 003	—
A_3 — Code table 0163	0 20 063	—
AA — Code table 0177	0 23 002	—
a — Code table 0200	0 10 063	—
a_4 — Code table 0265	0 02 003	—
B_A — Code table 0302	0 11 031	—
B_T — Code table 0324	0 23 003	—
B_tB_t — Code table 0370	0 02 149	—
b_i — Code table 0439	0 20 035	—
C — Code table 0500	0 20 012	—
C_H — Code table 0509	0 20 012	—
C_L — Code table 0513	0 20 012	—
C_M — Code table 0515	0 20 012	—
C_a — Code table 0531	0 20 136	—
C_c — Code table 0533	0 20 063	—
C_t — Code table 0552	0 20 017	—
C_0 — Code table 0561	0 20 136	—
c_i — Code table 0639	0 20 034	—
D_s — Code table 0700	0 25 041	—
E — Code table 0901	0 20 062	—
E_c — Code table 0933	0 23 007	—
E_e — Code table 0935	0 23 018	—
E_s — Code table 0943	0 23 008 0 23 009	—
E´ — Code table 0975	0 20 062	—
F_t — Code table 1152	0 08 011	—
F_1F_2 — Common Code table C–1	0 01 033	—
$F_3F_3F_3$ — Common Code table C–1	0 01 033	—
$F_4F_4F_4$	0 01 034	To be specified
g_rg_r — Code table 1487	0 29 001	—
I_n — Code table 1743	0 23 032	—
I_s — Code table 1751	0 20 033	—
I_3	0 02 021	—
I_4 — Code table 1765	0 02 022	—
$I_6I_6I_6$ — Common Code table C-5	0 01 007	—
$I_XI_XI_X$ — Code table 1770	0 22 067	Defined in Common Code table C–3
i — Code table 1800	0 11 031	—
i_E — Code table 1806	0 02 004	—

Related specification/code table/ regulation/code form in alphanumeric codes	BUFR code/flag table	Remarks
i_u — Code table 1853	0 02 001	—
i_y — Code table 1857	0 02 051	—
I_X — Code table 1860	0 02 001*	—
k_1 — Code table 2262	0 02 032	Numerical variation in each table
k_2 — Code table 2263	0 02 033	—
k_3 — Code table 2264	0 02 031	—
k_4 — Code table 2265	0 02 031	—
k_5 — Code table 2266	0 02 030	—
k_6 — Code table 2267	0 02 040	—
N — Code table 2700	0 20 011	—
N_m — Code table 2745	0 20 136	—
N_t — Code table 2752	0 20 136	—
N_v — Code table 2754	0 20 136	—
n_3 — Code table 2863	0 20 137	—
P_a — Code table 3131	0 23 004	—
Q_A — Code table 3302	0 33 027	—
Q_z — Code table 3318	0 25 086	—
R_c — Code table 3533	0 24 003	—
R_d — Code table 3534	0 13 051	—
R_e — Code table 3535	0 23 016	—
R_p — Code table 3548	0 23 031	—
R_s — Code table 3551	0 20 032	—
r_ar_a — Code table 3685 (0–89)	0 02 011	Defined in Common Code table C–2
r_ar_a — Code table 3685 (91–95)	0 02 015	Defined in Common Code table C–2
S — Code table 3700	0 22 061	—
S_i — Code table 3739	0 20 037	—
S_0 — Code table 3761	0 20 063	—
$S_PS_Ps_ps_p$ — Code table 3778	0 20 063	To be developed
s_p — Code table 3847	0 13 041	—
s_q — Code table 3848	0 20 063	—
s_r — Code table 3849	0 02 013	—
s_s — Code table 3850	0 02 038	—
s_w — Code table 3855	0 02 039	—
s_1 — Code table 3866	0 02 061	—
s_2 — Code table 3867	0 02 062	—
s_as_a — Code table 3872	0 02 014	Defined in Common Code table C–7
T_w — Code table 3955	0 20 063	—
v_s — Code table 4451	0 25 042	—
W_{a1} — Code table 4531	0 20 004	—
W_{a2} — Code table 4531	0 20 005	—
W_1 — Code table 4561	0 20 004	—
W_2 — Code table 4561	0 20 005	—
w_i — Code table 4639	0 02 023	—
ww — Code table 4677	0 20 003*	—
w_aw_a — Code table 4680	0 20 003*	—
w_1w_1 — Code table 4687	0 20 003*	—

* See note at end of Attachment II.

Related specification/code table/ regulation/code form in alphanumeric codes	BUFR code/flag table	Remarks
X_RX_R — Code table 4770	0 22 068	Defined in Common Code table C–4
X_tX_t — Code table 4780	0 02 034	—
Z_0 — Code table 5161	0 20 063	—
z_i — Code table 5239	0 20 036	—
AMDAR — Regulation 42.2	0 08 004	—
SYNOP/SHIP — Regulation 12.4.10.1	0 08 002	—
TEMP/TEMP SHIP — Sections 2 to 6	0 08 001	—

Note: Encoding/decoding of SYNOP/SHIP i_x — Code table 1860 to/from BUFR code tables

Code figure	Type of station operation	0 02 001 Type of station	0 20 003 Present weather
1	Manned station (group $7wwW_1W_2$ included) (but actually missing)	1 (1)	00–99 (200–299) (510)
2	Manned station (group 7ww W_1W_2 omitted, no significant phenomenon to report)	1	508
3	Manned station (group 7ww W_1W_2 omitted, no observation, data not available)	1	509
4	Automatic station (group 7ww W_1W_2 included, using Code tables 4677 and 4561) (but actually missing)	0 (0)	00–99 (200–299) (510)
5	Automatic station (group $7w_aw_aW_{a1}W_{a2}$ omitted, no significant phenomenon to report)	0	508
6	Automatic station (group $7w_aw_aW_{a1}W_{a2}$ omitted, no observation, data not available)	0	509
7	Automatic station (group $7w_aw_aW_{a1}W_{a2}$ included, using Code tables 4680 and 4531) (but actually missing)	0 (0)	100–199 (200–299) (510)

ATTACHMENT III

INTERNATIONAL SEISMIC CODE

INTRODUCTION

The 1985 version of the *International Seismic Code* has been developed by an international working group. Although quite a few new features have been added, *upward compatibility* with the previous code has been maintained – the previous code is a subset of this 1985 version. That is to say, the new version does not make any of the features of the old version obsolete but simply increases the scope of data types that can be transmitted. If a data contributor does not wish to include any of the newly reportable items, the old version may be used without having to violate the format of this new version.

This version of the seismic code consists of three parts:

1. **Code form**. A precise description of the syntax using a modification of a widely used *metalanguage* – a set of symbols and words used to describe another language (in which these symbols do not appear). This metalanguage is fully defined and illustrated in the last section of this introduction.
2. **Definitions and usage** . A supplement to the code form in which various codes are defined, expanded explanations are given, and usage and scaling criteria are discussed.
3. **Examples**. Sample messages, exercising nearly the full range of parameters defined by the code, are given.

Among the various agencies receiving seismic data in the telegraphic format, few may wish to receive, or be prepared to process, all of the types of data and messages that can be sent with the new seismic code. These agencies should communicate their precise needs to their traditional contributors in order to avoid confusion and processing problems.

Stations contributing data to agencies such as the ISC, the United States Geological Survey's NEIC or other international data centres are advised NOT to send ANY of the types of data newly permitted by the 1985 version NOR to implement ANY of the new formats until they have been notified by the recipient to do so.

The seismic code is intended for transmittal via any telegraphic circuit employing CCITT *International Alphabets Nos. 2 and 5* and it is also the format in which computer-to-computer transfers of such seismic data take place. However, there is one internal heading field that should be used only by those sending via the WMO/GTS circuits. Also, WMO advises that the maximum length of the text of a seismic message is about 2100 characters for transmission on the GTS.

BACKUS-NAUR FORM

In order to precisely describe the syntax of the International Seismic Code a widely used *metalanguage*, known as *Backus-Naur Form* (*Backus Normal Form* or *BNF*), has been employed in a modified form – using BNF, syntactically valid sequences of symbols have been specified.

BNF consists of the four symbols (*metacharacters*) "⟨", "⟩", "|" and "::=" together with *terminal* and *non-terminal* symbols. Non-terminal symbols, *metalinguistic variables* (or *metanames*) are enclosed in *angle-brackets* "⟨⟩" and are used to define the components of the seismic code. The values of these metanames are chosen so as to suggest their semantics. Terminal symbols appear outside the angle-brackets and denote themselves – thus they are characters that actually appear in the seismic code. The vertical stroke "|" has the meaning "or" and the metacharacter "::=" means "is defined as". Juxtaposition of terms implies concatenation – any sequence of terminal symbols and metanames implies linking together in a series.

The seismic code is herein initially defined in terms of four components, two terminal symbols (SEISMO and STOP) and the metanames ⟨standard delimiter⟩ and ⟨text⟩. These metanames and each metaname introduced thereafter are then defined by their components until each is reduced to the terminal symbols found in the seismic code. The components designating the seismic code have been chosen and expanded so as to make the BNF definition *context-free.* In a context-free grammar, any occurrence of a particular metavariable may be replaced by one of its alternative values, irrespective of the other elements in the language.

For an example, here is how the original BNF definition of an integer was developed:

⟨integer⟩::=⟨unsigned integer⟩|+⟨unsigned integer⟩|–⟨unsigned integer⟩ (1)

⟨unsigned integer⟩::=⟨digit⟩|⟨unsigned integer⟩⟨digit⟩ (2)

⟨digit⟩::=0|1|2|3|4|5|6|7|8|9| (3)

By introducing braces "{}" with indices into the notation, (1) can be written as:

⟨integer⟩::={+|–}$^{1}_{0}$⟨unsigned integer⟩ (4)

and the recursive definition (2) can be written as:

⟨unsigned integer⟩::={⟨digit⟩}$^{n}_{1}$ (5)

where n = number of digits in the integer.

By combining (4) and (5) we can replace (1) and (2) with (6):

⟨integer⟩::={+|–}$^{1}_{0}${⟨digit⟩}$^{n}_{1}$ or ⟨integer⟩::=[+|–]{⟨digit⟩}$^{n}_{1}$ (6)

Here, the braces represent repeated concatenation of the object within the braces with itself and the indices specify the upper and lower bounds of the number of repetitions.

A subscript of zero indicates that the enclosed item is not required (*optional*). The frequently encountered optional case with a superscript of 1 will be written as [...] rather than {...}$^{1}_{0}$ as shown in (6) above. A superscript without a subscript is used to indicate a *required* number of repetitions.

Terminal and non-terminal symbols are considered *optional*, either if their inclusion is entirely a matter of choice or preference or else if their use is *required* because of circumstances or the inclusion of related optional data. For example, ⟨date⟩ is frequently shown as optional [⟨date⟩] simply because it is *required* with the initial occurrence of the group in which it is included and is only *required* thereafter when its value changes. If a required non-terminal group consists only of optional components, then at least one such component must be chosen.

Braces without indices will be used to group terms in a sequence. Parentheses inside angle-brackets "⟨(...)⟩" will occasionally be used to define a non-terminal symbol in plain language, where continued decomposition will not lead to greater clarity.

CODE FORM

⟨code form⟩::=SEISMO⟨standard delimiter⟩⟨text⟩STOP

⟨standard delimiter⟩::=⟨b⟩::={(space)|(return)|(line feed)}$^{n}_{1}$

The ⟨standard delimiter⟩ is used to separate groups and subgroups. As it consists of any number or combinations of spaces, carriage-returns and line-feeds, it also serves to indicate where lines of code may be broken. Henceforth this delimiter is indicated by ⟨b⟩ and is shown only where required. Only single spaces are permitted in certain other positions which will be illustrated in the examples.

⟨text⟩::=[⟨message heading⟩]{⟨administrative messages⟩|⟨seismic data⟩}$^{2}_{1}$

MESSAGE HEADING

⟨message heading⟩::=[⟨content designator⟩]⟨message number⟩[⟨originator⟩]

⟨content designator⟩::=GSE⟨gse code⟩⟨b⟩

⟨gse code⟩::=CR|DC|FB|NC|PA|PL|RP|RR|ST|XY (Refer to Definitions and usage)

⟨message number⟩::=N⟨last digit of year⟩⟨nnn⟩⟨b⟩

⟨last digit of year⟩::=0|1|2|3|4|5|6|7|8|9

⟨nnn⟩::=001|002|003...999

⟨nnn⟩ is the ordinal number from the first seismic message of the calendar year.

⟨originator⟩::=(([⟨gse test⟩]⟨message centre⟩[⟨transmission time⟩]))

⟨originator⟩ ought to be included only in those messages sent via the Global Telecommunication System (GTS) of the World Meteorological Organization (WMO).

⟨gse test⟩::=GSE⟨(value to be specified by GSE for each *ad hoc* test)⟩

⟨message centre⟩: : =⟨(WMO GTS group TTAAii)⟩⟨b⟩

⟨transmission time⟩: : =[19]⟨yymmdd⟩⟨b⟩⟨hhmm⟩⟨b⟩ (See Definitions and usage)

⟨yymmdd⟩: : =⟨(6-digit year-month-day)⟩

⟨hhmm⟩: : =⟨(4-digit hour-minute)⟩

ADMINISTRATIVE MESSAGES

⟨administrative messages⟩: : ={(((⟨(free form and contents)⟩))⟨b⟩}$_0^n$

n = number of separate messages

SEISMIC DATA FORMAT OPTIONS

⟨seismic data⟩: : ={⟨single-station group form⟩}$_1^s$ | ⟨net-event group form⟩

s = number of stations reported

DATA ARRANGED BY STATION

⟨single-station group form⟩: : =⟨station⟩[⟨report times⟩][⟨status code⟩][⟨process code⟩][⟨magnification⟩]
{[⟨date⟩]{⟨station-event⟩ | ⟨delimited station-event⟩}}$_1^e$

e = number of events reported

DATA ARRANGED BY SEISMIC EVENT

⟨net-event group form⟩: : ={⟨station⟩⟨report times⟩}$_0^s$[⟨status code⟩][⟨process code⟩][channel]{⟨net-event⟩ |
⟨delimited net-event⟩}$_1^e$

e = number of net-events reported

⟨net-event⟩: : ={[⟨date⟩]{⟨station⟩[⟨process code⟩][⟨magnification⟩]{⟨station-event⟩ | ⟨delimited station-event⟩} |
[⟨net⟩]⟨computations⟩}}$_1^n$

n = number of stations reported
(add 1 to *n* if a ⟨computations⟩ group is included)

⟨delimited net-event⟩: : =BEGEV⟨b⟩⟨net-event⟩ENDEV

The content of a ⟨net-event⟩ never requires that the event be delimited. Whether or not an event is given as a ⟨delimited net-event⟩ may depend strictly on the preference of the sender or receiver.

⟨station-event⟩: : =[⟨first-arrival phase group⟩]{⟨secondary phase group⟩}$_0^n$ [⟨LP surface-wave group⟩]
[⟨old surface-wave group⟩][⟨event class⟩][⟨local magnitude data⟩][⟨comments⟩]

n = number of secondary phases reported

⟨delimited station-event⟩: : =/⟨b⟩⟨station event⟩⟨b⟩/[⟨b⟩]

A ⟨station-event⟩ must be enclosed in *solidi* whenever its ⟨first-arrival phase group⟩ is either absent or contains more than one ⟨1st phase code⟩. A single *solidus* (/) cannot serve as both an ending and beginning delimiter when two delimited station-events are adjacent. Two must separate the two station-events.

⟨computations⟩: : ={⟨hypocentre⟩ | ⟨magnitude⟩ | ⟨moment⟩}$_1^n$

PARAMETERS

The following parameters, once established, remain in effect until changed. All dates and times are UTC.

⟨station⟩: : =[:]⟨(3–5 character station abbreviation)⟩⟨b⟩

⟨net⟩: : =[:]⟨(3–5 character network abbreviation)⟩⟨b⟩

A colon (:) must be prefixed to a station or net abbreviation whenever the abbreviation is identical to a phase code or symbolic identifier used in the *International Seismic Code.*

⟨report times⟩: : ={⟨begin⟩⟨end⟩}{⟨out⟩⟨to⟩}$_0^n$

⟨report times⟩ may not be set within a ⟨net-event⟩.

⟨beg⟩::=BEG⟨b⟩⟨month⟩⟨day⟩⟨b⟩⟨hhmmss⟩⟨b⟩

⟨end⟩::=END⟨b⟩⟨month⟩⟨day⟩⟨b⟩⟨hhmmss⟩⟨b⟩

⟨out⟩::=OUT⟨b⟩⟨channels⟩⟨b⟩⟨month⟩⟨day⟩⟨b⟩⟨hhmmss⟩⟨b⟩

⟨channels⟩::={⟨instrument class⟩⟨components⟩ | ALL}⟨b⟩

⟨instrument class⟩::=SP | LP | MP | BP | UP

⟨components⟩::=Z | ZN | ZNE | ZE | N | NE | E

⟨to⟩::=TO⟨b⟩⟨month⟩⟨day⟩⟨b⟩⟨hhmmss⟩⟨b⟩

⟨hhmmss⟩::=⟨(6-digit hour-minute-second)⟩

⟨date⟩::=[⟨year⟩]⟨month⟩⟨day⟩⟨b⟩

⟨year⟩::=YR19⟨(2-digit year)⟩⟨b⟩

⟨month⟩::=JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC

⟨day⟩::=01 | 02 | 03...31

⟨status code⟩::=STAT{P | F}⟨b⟩

P = message contains preliminary interpretations and/or computations

F = message contains final interpretations and/or computations

The ⟨status code⟩ cannot be changed within a ⟨net-event⟩. It should be used especially by those contributors sending preliminary interpretations and then sending revisions and more complete interpretations later. Any data which are not the first set of interpretations for a reporting period for a given station are considered final.

⟨process code⟩::=PROC{A | D | G}⟨b⟩ (Refer to Definitions and usage)

The following parameter, once established, remains in effect only until a station abbreviation is encountered.

⟨magnification⟩::=[TRACE | GRND]{⟨SPZ magnification⟩ | ⟨SPH magnification⟩ |
⟨LPZ magnification⟩ | ⟨LPH magnification⟩}$_0^4$

If *double* trace amplitudes are included in the current station's data, inclusion of TRACE is *strongly recommended,* prefixing the *required* relevant channel magnification(s).

If all of the amplitudes reported for the current station are *ground* amplitudes, the sender *may choose* to include the channel magnification(s) *for informational purposes only.* If so, GRND is *required.*

See also under Definitions and usage for detailed discussion.

⟨SPZ magnification⟩::=⟨mk⟩K[C]

⟨SPH magnification⟩::=⟨mk⟩H[C]

⟨mk⟩::=⟨(magnification of SPZ or SPH instruments in thousands)⟩

⟨LPZ magnification⟩::=⟨m⟩M[C]

⟨LPH magnification⟩::=⟨m⟩J[C]

⟨m⟩::=⟨(magnification of LPZ or LPH instruments)⟩

The horizontal magnifications are required only if they differ from their respective vertical magnifications. The optional C is used to confirm that the indicated magnification represents a change from that previously reported by this station, for this component.

The following parameter (⟨channel⟩) is used to indicate the instrument type (*class*) and component from which a phase and its associated measurements were obtained. ⟨channel⟩ may be changed within a ⟨station-event⟩ as often as necessary. However, once established (either explicitly or by default) within a ⟨station-event⟩, it remains in effect until changed or until the next ⟨station-event⟩ is encountered.

Since, within a given message, the overwhelming majority of the first phases reported within a ⟨station-event⟩ will begin with data from the same ⟨channel⟩, a method of indicating this ⟨channel⟩ without repeating the value of ⟨channel⟩ with each ⟨station-event⟩ is available. This *default* value is established using the optional symbol "DEFAULT" as indicated below, with the first ⟨channel⟩ appearing in the message. This *default* may be reset to a new value if necessary. This default value may be overridden for a given first phase reported within a ⟨station-event⟩ by simply including the correct ⟨channel⟩ value; the default value will be resumed with the next ⟨station-event⟩ not beginning with ⟨channel⟩.

If no ⟨channel⟩ is given within the message, its value will be considered "unknown" unless implied by amplitudes available with the previous version of the seismic code.

⟨channel⟩::=⟨instrument class⟩⟨component⟩⟨b⟩[DEFAULT⟨b⟩]

⟨instrument class⟩::=⟨(*See above under* ⟨report times⟩)⟩

⟨component⟩::=Z | N | E

Z = vertical, N = north-south, E = east-west

BASIC SEISMIC DATA

The data covered in this section are obtained from both body and surface-wave recordings. In general, only their syntax is given here. For a complete discussion of all the groups relating to periods and amplitudes, refer also to the Definitions and usage section.

As used in this specification of the seismic code, the term long-period (LP) is a generic term applied to data from intermediate-period (MP), broad-band (BP) and ultra long-period (UP) recordings as well as data from long-period recordings *per se.* This terminology is used herein simply to indicate that the forms and groups that accommodate long-period data *per se* are used for MP, BP and UP data as well. However, the appropriate specific ⟨channel⟩ designators must be used in these various LP groups.

SCALING TIMES

⟨arrival time⟩::=[⟨2-digit hour⟩]⟨2-digit minute⟩⟨seconds⟩

⟨2-digit hour⟩::=00 | 01 | 02...23

The hour is required for the first ⟨arrival time⟩ reported within any ⟨station-event⟩ and whenever the hour changes within a ⟨station-event⟩.

⟨2-digit minute⟩::=00 | 01 | 02...59

⟨seconds⟩::=$\{$⟨digit⟩$\}^2$[.][⟨digit⟩] | $\{$⟨digit⟩$\}^2$.$\{$⟨digit⟩$\}^2$

⟨arrival time⟩ must be given to at least the nearest whole second. Usually it is given to the nearest tenth of a second when taken from SPZ. In either case the decimal point "." is optional, but *recommended.* However, if given to hundredths of a second, the decimal point *must* be included.

⟨seconds⟩ should be quoted only to the precision actually obtained in scaling. However, in dealing with surface waves, the seconds may be filled with one or two zeros, if reasonable. Arrival times scaled from most long-period seismograms will generally not be legible to a precision closer than one second. However, they may be given to a closer precision whenever it is obtainable.

A sixty-first second may be included when the scaling falls within a leap second.

⟨zero-crossing amplitude scaling time⟩::=⟨(Use the same rules that apply to ⟨arrival time⟩)⟩

This time is measured where the trace crosses the equilibrium point between the peak and trough that comprise the cycle whose amplitude was obtained.

PHASE CODES

The ⟨2nd phase code⟩ has been expanded to six characters. The clarity is *not* included in this limit.

Phases pP, pwP, pPcP, pPP, pS, etc. are encoded as AP, AWP, APCP, APP, AS, etc.; and sP, sPcP, sS, sSKS, etc. are encoded as XP, XPCP, XS, XSKS, etc.

The T-phase is encoded as TT to avoid confusion with T used as a symbolic prefix for periods.

Phase PKPPKPPKP (P′P′P′) is encoded as RRPKP, likewise PKPPKP (P′P′) is encoded as either PKPPKP or RPKP.

P′ and P* are alternative phase code designators for PKP and PB respectively. They are acceptable to computers processing seismic data, and may thus be exchanged by computer links or by air mail. However, "′" and "*" are generally not available to teletype circuits, so PKP and PB are the codes for teletype transmission even if the originator's circuit is capable of sending either "′" or "*".

CLARITY OR ONSET QUALITY

⟨clarity⟩: : = I | E | Q   (See Definitions and usage)

⟨clarity⟩ is required if phase code is absent from a secondary phase.

PERIODS AND AMPLITUDES

⟨amplitude⟩

The amplitude units are not expressly given in a telegraphic message, but are implied by the channel from which they were scaled and the presence or absence of a corresponding magnification field. A decimal point must be included in every amplitude value.

⟨period⟩

A decimal point must be included in every period value except in the long-period surface-wave groups and the ⟨10–30 second noise⟩ group.

⟨LP maximum amplitude⟩: : = XM[⟨(zero-crossing amplitude scaling time)⟩]⟨b⟩
T⟨period⟩[G]A⟨amplitude⟩⟨b⟩

An LP maximum amplitude can be scaled for any phase. Occasionally, this amplitude may also meet the criteria for the reporting of one of the several GSE amplitude groups. If a contributor is committed to supplying both groups but wishes to avoid duplication in this case, he may do so by using the optional "M" provided in the Rayleigh wave period-range designator of the ⟨gse Rayleigh amplitudes⟩ group and omitting the ⟨LP maximum amplitude⟩ group.

⟨SP maximum amplitude⟩: : = XM[⟨(zero-crossing amplitude scaling time)⟩]⟨b⟩
T⟨period⟩[G]A⟨amplitude⟩⟨b⟩

An SP maximum amplitude can be scaled for any body wave and the Lg phase. Occasionally, this amplitude may also meet the criteria for the reporting of one of the several GSE amplitude groups. If a contributor is committed to supplying both groups but wishes to avoid duplication in this case, he may do so by using the optional "M" provided in the P-coda interval-time designator of the gse SPZ first-arrival amplitudes group. Frequently, the SP maximum amplitude, scaled from recordings of intermediate or deep focus events, will be found in the first few cycles. When this situation occurs, report the amplitude in the SP maximum amplitude group, or, if reporting ⟨gse SPZ first-arrival amplitudes⟩, report it as an XAM prefixed group.

FIRST MOTIONS

⟨first motion⟩: : = FM[⟨SP 1st-motion(s)⟩][,⟨LP 1st-motion(s)⟩]

⟨SP 1st-motion(s)⟩: : = [C | D][N | S][E | W]

⟨LP 1st-motion(s)⟩: : = [C | D][N | S][E | W]

The short-period first-motion code(s), if any, are appended to the symbolic prefix FM. The long-period first-motion code(s), if any, together with their prefixed comma are appended to the ⟨SP 1st-motion(s)⟩ if it exists, or else directly to the FM. The comma (,) is *required* whenever LP first-motion codes are given.

Long-period, intermediate-period, broad-band or ultra long-period are indicated by the ⟨channel⟩ value. If a first-motion group included in any SP channel contains first-motion codes to the right of the comma, they are simply considered generic LP first motions. Whenever LP, MP, BB or UP first motions are included in a first-motion group, a preceding comma is required.

FIRST-ARRIVAL PHASE GROUP

⟨first-arrival phase group⟩: : = [⟨SP first-arrival phase group⟩]
[⟨LP first-arrival phase group⟩]

SHORT-PERIOD DATA

⟨SP first-arrival phase group⟩:: = [⟨SPZ 1st phase group⟩]{⟨SPH 1st phase group⟩}$_0^2$

⟨SPZ 1st phase group⟩::=[⟨channel⟩]⟨1st phase group⟩⟨arrival-time⟩[⟨first motion⟩]
[⟨SPZ amplitudes⟩][⟨gse SPZ first-arrival amplitudes⟩]
[⟨SPZ noise⟩][⟨slowness⟩][⟨complexity⟩]
[⟨station scalar moment⟩]

⟨SPZ amplitudes⟩::=[⟨1st few cycles amplitude⟩][⟨SP maximum amplitude⟩]

⟨1st few cycles amplitude⟩::=T⟨period⟩[G]A⟨amplitude⟩⟨b⟩

⟨gse SPZ first-arrival amplitudes⟩::={X⟨t⟩⟨zero-crossing amplitude scaling time⟩
T⟨period⟩A⟨amplitude⟩$\}_1^4$

⟨t⟩::={A | B | C | D}[M] These are the P-coda interval-time designators.

The optional “M” may be used when the associated amplitude also meets the criteria of the ⟨SP maximum amplitude⟩ to avoid reporting under both categories.

⟨SPZ noise⟩::=NT⟨period⟩A⟨amplitude⟩⟨b⟩

⟨complexity⟩::=CPX⟨(complexity value)⟩⟨b⟩

⟨station scalar-moment⟩::=SM⟨mantissa⟩⟨exponent⟩ (newton-m.)

⟨mantissa⟩::=.{⟨digit⟩$\}_2^3$⟨b⟩

⟨exponent⟩::=E{⟨digit⟩$\}^2$⟨b⟩

⟨SPH 1st phase group⟩::=[⟨channel⟩][⟨1st phase group⟩][⟨arrival time⟩]
[⟨first motion⟩][⟨SP maximum amplitude⟩]

where ⟨channel⟩ value is SPN or SPE and will usually be required.

LONG-PERIOD DATA

⟨LP first-arrival phase group⟩::=[⟨LPZ 1st phase group⟩]{⟨LPH 1st phase group⟩$\}_0^2$

⟨LPZ 1st phase group⟩::=[⟨channel⟩][⟨1st phase group⟩][⟨arrival time⟩][⟨first motion⟩]
[⟨LP maximum amplitude⟩][⟨LPZ noise⟩][⟨slowness⟩]

where ⟨channel⟩ value is LPZ, MPZ, BPZ or UPZ.

⟨LPZ noise⟩::=⟨1 minute before P noise⟩⟨10-30 second noise⟩

⟨1 minute before P noise⟩::=NAT⟨period⟩A⟨amplitude⟩⟨b⟩

⟨10–30 second noise⟩::=NBT⟨period⟩A⟨amplitude⟩⟨b⟩

⟨LPH 1st phase group⟩::=[⟨channel⟩][⟨1st phase group⟩][⟨arrival time⟩]
[⟨first motion⟩][⟨LP maximum amplitude⟩]

where ⟨channel⟩ value is LPN, MPN, BPN, UPN, LPE, MPE, BPE or UPE.

ELEMENTS COMMON TO SHORT-PERIOD AND LONG-PERIOD GROUPS

⟨1st phase group⟩::=[⟨clarity⟩]⟨1st phase code⟩[⟨appended first-motion⟩]

⟨1st phase code⟩::=P | PN | PB | PG | PLOC | UNK | PKP | PDIF

⟨appended first-motion⟩::=C | D | U | R | CU | CR | DU | DR

Available only with vertical channels when ⟨first motion⟩ is not used anywhere in ⟨first-arrival phase group⟩.

⟨slowness⟩::=SLO⟨(slowness value)⟩⟨b⟩AZ⟨(azimuth)⟩⟨b⟩

Slowness is given to a precision of 0.1 s deg.$^{-1}$; decimal point required when given to such precision. Azimuth may be given to a precision of up to 0.1 deg.; decimal point required.

The N *and* E *channel data may appear in either order. The first channel reported for any phase must include the phase code (and/or clarity) and, except for long-period surface-wave groups, the arrival time. Arrival times may be given for each channel reported for a phase and need not be identical, but must be preceded by the phase code. More than one channel cannot be given for a secondary phase identified only by its clarity, otherwise it would be indistinguishable from a succeeding phase so identified.*

SECONDARY PHASE GROUP

⟨secondary phase group⟩::=[⟨SP secondary phase group⟩]
[⟨LP secondary phase group⟩]

SHORT-PERIOD DATA

⟨SP secondary phase group⟩::=[⟨SPZ 2nd phase group⟩]{⟨SPH 2nd phase group⟩}$^{2}_{0}$

⟨SPZ 2nd phase group⟩::=[⟨channel⟩][⟨2nd phase group⟩][⟨arrival time⟩]
[⟨first motion⟩][⟨SP maximum amplitude⟩]

⟨SPH 2nd phase group⟩::=[⟨channel⟩][⟨2nd phase group⟩][⟨arrival time⟩]
[⟨first motion⟩][⟨SP maximum amplitude⟩]
[⟨gse SPH S-wave amplitude⟩]

⟨gse SPH S-wave amplitude⟩::=XA[M]⟨zero-crossing amplitude scaling time⟩⟨b⟩
T⟨period⟩A⟨amplitude⟩⟨b⟩

available only if phase code is “S”. The optional “M” is used to indicate that the amplitude also meets the criteria of the ⟨SP maximum amplitude⟩.

LONG-PERIOD DATA

⟨LP secondary phase group⟩::=[⟨LPZ 2nd phase group⟩]{⟨LPH 2nd phase group⟩}$^{2}_{0}$

⟨LPZ 2nd phase group⟩::=[⟨channel⟩][⟨2nd phase group⟩][⟨arrival time⟩]
[⟨first motion⟩][⟨LP maximum amplitude⟩]

⟨LPH 2nd phase group⟩::=[⟨channel⟩][⟨2nd phase group⟩][⟨arrival time⟩]
[⟨first motion⟩][⟨LP maximum amplitude⟩]
[⟨gse LPH S-wave amplitude⟩]

⟨gse LPH S-wave amplitude⟩:: =XA[M]⟨zero-crossing amplitude scaling time⟩⟨b⟩
T⟨period ⟩A⟨amplitude⟩⟨b⟩

available only if phase code is “S”. The optional “M” is used to indicate that the amplitude also meets the criteria of the ⟨LP maximum amplitude⟩.

⟨2nd phase group⟩::={⟨clarity⟩ | ⟨2nd phase code⟩}$^{2}_{1}$

LONG-PERIOD SURFACE-WAVE GROUPS

⟨surface-wave groups⟩::={⟨Love waves⟩}$^{2}_{0}${⟨Rayleigh waves⟩}$^{3}_{0}$

LOVE WAVES

⟨Love waves⟩::=⟨channel⟩[⟨clarity⟩]⟨Love phase code⟩[⟨arrival time⟩]
[⟨Love mantle-wave amplitude⟩][⟨Love-wave maximum amplitude⟩]

where: ⟨channel⟩ is LPN, LPE, MPN, MPE, BPN, BPE, UPN or UPE.

⟨Love phase code⟩::={G | G1 | LQ} | G2

⟨Love mantle-wave amplitude⟩::=T⟨period⟩A⟨amplitude⟩⟨b⟩

⟨Love-wave maximum amplitude⟩::=⟨LP maximum amplitude⟩

RAYLEIGH WAVES

⟨Rayleigh waves⟩::=⟨channel⟩[⟨clarity⟩]⟨Rayleigh phase code⟩[⟨arrival time⟩]
[⟨Rayleigh mantle-wave amplitude⟩][⟨Rayleigh max amplitude⟩]
[⟨gse Rayleigh amplitudes⟩]

⟨Rayleigh phase code⟩::={R | R1 | LR} | R2

⟨Rayleigh mantle-wave amplitude⟩::=T⟨period⟩A⟨amplitude⟩⟨b⟩

⟨Rayleigh max amplitude⟩::=⟨LP maximum amplitude⟩

⟨gse Rayleigh amplitudes⟩::={X⟨p⟩⟨zero-crossing amplitude scaling time⟩⟨b⟩

T⟨period⟩A⟨amplitude⟩$\}_1^4$

⟨p⟩::={A | B | C | D}[M]   This is the Rayleigh wave period-range designator.

The optional “M” may be used when the associated amplitude also meets the criteria of the ⟨Rayleigh max amplitude⟩ to avoid reporting under both categories. These designators are for data from vertical channels only, with the exception of B, which may also be used with horizontal components to report “20-second” wave data.

OLD SURFACE-WAVE GROUP

⟨old surface-wave group⟩::={{LZT | LNT | LET}⟨period⟩A⟨amplitude⟩⟨b⟩$\}_0^3$

where ⟨amplitude⟩ is applied to the “20-second” Rayleigh-waves from the Z, N or E components. Note that this group has been retained for upward compatibility only and one may continue to send data using this group. For a discussion of how data in this group can be included in the groups new to this code, see this heading under Definitions and usage.

LOCAL MAGNITUDE DATA

⟨local magnitude data⟩::={[⟨SP duration time⟩][⟨maximum local amplitude⟩]$\}_1^n$

⟨SP duration time⟩::=[⟨channel⟩]⟨b⟩DUR⟨(total seconds)⟩⟨b⟩

where total seconds is measured between the first-arrival onset and the time the trace never again exceeds twice the noise level encountered immediately prior to the first arrival. Data are taken from an SP channel. Total seconds is used to compute duration magnitude.

⟨maximum local amplitude⟩::=[⟨channel⟩]{T | G}AMAX⟨(maximum amplitude)⟩

Scaled from a local event, when either the period cannot be measured or the amplitude assigned to a particular phase. This amplitude must have been recorded by an SP instrument whose response is nearly constant over the period range within which the signal can be presumed to lie. If preceded by TAMAX the amplitude is a *trace* (*not double-trace*) amplitude in millimetres (mm). If preceded by GAMAX the amplitude is a *ground* amplitude in millimicrons (mμ).

COMMENTS

⟨comments⟩::=(⟨(unformatted plain-language text)⟩)⟨b⟩

These comments contain information concerning the effects of the seismic occurrence to which the preceding station event data pertain. When a hypocentre is included for the event, it is preferable that the comments be given in the hypocentre comments, as a specific time can then be attached when processed. These comments may include:

1. Macroseismic information such as: casualty, damage, intensity and other cultural effects and unusual animal behaviour;
2. Tsunami wave heights, damage, casualties and run-up data;
3. information on artificial or induced events such as explosions, collapses, rockbursts, coal-bumps and meteoritic impacts;
4. Geological observations of associated faulting, uplift, eruptions, landslides, liquefaction, sand-boils, earthquake lights, etc.

NETWORK COMPUTATIONS

⟨computations⟩::=[⟨hypocentre⟩][⟨magnitude⟩][⟨moment⟩]

⟨hypocentre⟩::=FOCUS⟨b⟩⟨origin-time⟩LAT⟨b⟩⟨latitude⟩LON⟨b⟩⟨longitude⟩
[DEP⟨b⟩⟨depth⟩][NS⟨number of stations⟩]
[(⟨(hypocentre comments)⟩)⟨b⟩]

⟨hypocentre⟩ may be used to transmit rough hypocentres obtained from slowness and azimuth as well as computations using arrival-times from a net. If a slowness-derived hypocentre has been given, “SLO” should appear in the hypocentre comments. It may also be used to transmit rockburst and explosion coordinates, with appropriate hypocentre comments.

⟨origin time⟩::=⟨hour⟩⟨minutes⟩⟨seconds⟩.[⟨tenths⟩][⟨hundredths⟩]⟨b⟩

⟨latitude⟩::={⟨digit⟩}$_1^2$.{⟨digit⟩}$_0^3${N | S}⟨b⟩

⟨longitude⟩::={⟨digit⟩}$_1^3$.{⟨digit⟩}$_0^3${E | W}⟨b⟩

⟨depth⟩::={⟨digit⟩}$_1^3$.{⟨digit⟩}$_0^1$[FIX]⟨b⟩

where FIX indicates a fixed-depth solution.

⟨number of stations⟩::={⟨digit⟩}$_1^4$⟨b⟩

⟨magnitude⟩::=MAG⟨b⟩{[⟨magnitude type⟩]}⟨magnitude value⟩[⟨distance estimate⟩]
[T⟨(average period of waves used)⟩][NS⟨number of stations⟩]

⟨magnitude type⟩::=ML | MS | MSZ | MSH | MB | MBSH | MW | MBW | MBLG | MSRG | MD | ...

where:

ML Richter (local) magnitude (M_L)
MS IASPEI formula Rayleigh wave (M_s)
MSZ IASPEI formula Z-component Rayleigh wave
MSH IASPEI formula H-component Rayleigh wave
MB Gutenburg-Richter body-wave magnitude (m_b)
MBSH G-R body wave from horizontal S
MW Moment magnitude (M_w)
MBW Moment magnitude (m_w)
MBLG Nuttli's m_b from Lg
MSRG Nuttli's M_s from Rg
MD Duration magnitude

This magnitude list is not comprehensive. Additional magnitude types and their appropriate symbols may be included.

⟨magnitude value⟩::=⟨digit⟩.{⟨digit⟩}$_1^2$⟨b⟩

⟨distance estimate⟩::=D⟨(distance estimate in degrees)⟩

⟨moment⟩::=MOM⟨mantissa⟩⟨exponent⟩[NS⟨number of stations⟩]

⟨mantissa⟩::=.{⟨digit⟩}$_2^3$⟨b⟩

⟨exponent⟩::=E{⟨digit⟩}^{2}⟨b⟩ (newton-m.)

DEFINITIONS AND USAGE

The sequence in which subjects are introduced in this section corresponds to the order in which they are found in the code form. Those subjects treated adequately in the code form will not be dealt with further in this section.

MESSAGE HEADING

⟨gse code⟩

The gse code used in the message heading is primarily intended for transmissions to and from data centres via the Global Telecommunication System of the World Meteorological Organization. Use of this code early in the message permits the receiving computer to determine the contents of the message without decoding past the heading.

The gse codes and their definitions follow:

CR Coordinator message
DC Data centre message
FB Final event bulletin from IDC
NC Request by a national centre (or station)

PA	Parameter message to IDC (includes measurements of seismic signals)
PL	Preliminary event list from IDC
RP	Retransmission of PA message
RR	Request retransmission of PA message
ST	Status or other administrative message
XY	Reserved for other messages to be defined by GSE as needed

⟨originator⟩

This group ought to be included only in messages sent via WMO/GTS circuits. The ⟨message centre⟩ code is the GTS data/geographical designator. The ⟨transmission time⟩ should indicate the time the message was originally transmitted. This field could be completed by the teletypist. If this is a problem, the time that the message is to be given to the sender's message centre could be used.

SEISMIC DATA FORMAT OPTIONS

⟨single-station group form⟩

With data arranged by station, all of the data for one station for its reporting period are given and they are then followed by data from the next station, etc.

Data arranged by station are further ordered by increasing first *reported* arrival time (which is usually the first-arrival time) for each seismic event reported.

⟨net-event group form⟩

When data are arranged by event, all of the data from several stations pertaining to one seismic event are given, followed by such data from the next event, etc. A net event may include net computations such as hypocentres and magnitudes. On the other hand each event may consist of only hypocentre computations, in which case the report is reduced to an event list.

Data arranged by event is the usual method of sending data from local networks reporting mostly data pertaining to local events and their computational results. Reporting trace amplitudes with data arranged by event is awkward, as the station's magnification must be given each time the station appears with an amplitude. The net computations may appear anywhere within an event.

A contributor sending data arranged by event may wish, occasionally, within a message, to include data arranged by station. It may be that these data belong to two or more teleseisms mixed together on the records, or he may wish to treat local and teleseismic data differently.

⟨delimited net-event⟩ is strictly optional.

⟨delimited station-event⟩

A ⟨station-event⟩ *must* be enclosed with *solidi* when the following conditions are met:

1. A legitimate first-arrival is not available for the ⟨station-event⟩. It could be missing because of a recording interruption or it may happen when a weak local event yields only a legible Sg or Lg. Also a high-gain long-period station may be able to send only surface-wave data for smaller events.
2. A first-arrival time from more than one channel has been included.
3. Whenever there is likely to be some question as to whether two sequentially reported phases belong to the same seismic event.

   This ambiguity is seen when two different phase codes, both of which may be reported as first-arrivals, follow each other closely enough in time. For example, a station could record a Pn from a distant regional event, and then, before recording its associated secondary phases, a Pg and Sg from a nearby local could be recorded. Currently, computer programs decoding the resultant seismic message must resort to assumptions based on generalized travel-time tables to attempt to discern the proper relation. Note also that a P preceding a Pn by a few seconds could belong either to the same event as the Pn or to a tele-seism. Therefore, as a general rule,

   station-events which include P-type crustal phases should be delimited.
4. Whenever a secondary arrival-time or amplitude scaling time follow the first-arrival time by more than 66 minutes.

   This precautionary requirement is necessary for the receiver to distinguish such data from cases where data have been lost or delimiters forgotten.

PARAMETERS

⟨report times⟩

⟨beg⟩ and ⟨end⟩ are used to indicate the beginning and ending times of the recording period covered by the message for each station. If the data comprise strictly an event list, these times will indicate the range in time represented by the event list.

⟨out⟩ and ⟨to⟩ are used to delimit periods of interruption in the recording period covered by ⟨beg⟩ and ⟨end⟩. ⟨out⟩ and ⟨to⟩ groups may be repeated as often as needed. The ⟨instrument class⟩ and ⟨components⟩ groups indicate which instruments were not recording. If all instruments were out, "ALL" is used.

⟨process code⟩

The process code indicates the combination of recording and scaling techniques employed to obtain the arrival times (and perhaps amplitudes) reported for the associated station.

The three process codes are:

A The measurements were primarily obtained from *analog* recordings on *paper* or *film*, by an interpreter using *visual* and perhaps mechanical techniques. This is the default case – if no process code is given, "A" will be assumed.

D The data were recorded *digitally* or were originally analog recordings that have been digitized by computer. In addition, the arrival times (and perhaps amplitudes) were obtained solely by *automatic parameter extraction.*

G The data were recorded *digitally* or were originally analog recordings that have been digitized by computer. In addition, *man-machine interactive* methods utilizing a *graphics screen* showing wave-forms were used. The techniques used for process code D could have been employed in an early phase of this procedure.

⟨magnification⟩

See below under Periods, amplitudes and magnifications.

BASIC SEISMIC DATA

PHASE CODES

A phase code and/or a clarity code must accompany each arrival time reported. The first reported arrival time within each station event must be identified by a phase code.

RELATIVE IMPORTANCE OF SECONDARY PHASES

The most important secondary phases for hypocentre estimation are those which give an indication of the depth of focus. These include pP encoded as AP, pwP encoded as AWP, sP encoded as XP, pPKP encoded as APKP, Pg encoded as PG and Lg encoded as LG. Also of great value are S phases for local and regional shocks when their onset can be read accurately enough to yield a check on the computed origin time. They are especially valuable for analysing local and regional shocks with deeper than normal foci. When a large-magnitude shock is too deep to propagate significant surface waves, the amplitude of long-period S assumes greater importance.

Any strong phase following teleseismic P by less than 2 min 30 s, which might be a pP but which the interpreter does not wish to identify definitely as pP, should be encoded with a clarity of "e" or "i" (followed by the arrival time). A pPcP and/or sPcP together with PcP will yield depth information at epicentral distances too small to record pP or sP. The same considerations apply to ScP, PcS and ScS.

Phases which are generally prominent on short-period vertical instruments which are of some value in hypocentre estimation include PcP, ScP, PKKP and SKP. Identification of these phases by some stations may aid in the identification of these same phases from other stations which have reported them as P. Such phases as PP, PPP, SS, SSS, SP, PgPg, etc. are generally of lesser value in routine hypocentre work.

Phases closely following P, which have much larger amplitudes than P, may indicate a multiple or complex event. If their arrival times can be scaled accurately, they should be reported preceded by a clarity code (these may also include breakout or stopping phases), or they may be encoded as separate shocks if the interpreter suspects this is the case. In any case all significant increases in the SPZ amplitudes of complex-multiple events should be reported either as individual SP maximum amplitudes or as one or more of the gse SPZ first-arrival amplitudes.

CLARITY OR ONSET QUALITY

Clarity is the observer's estimation of the accuracy to which the associated arrival time has been measured.

The clarity codes are:

I indicates an accuracy to within ± 0.2 second.
E indicates an accuracy to within ± 1.0 second.
Q indicates a less accurate measurement.

These limits are, in general, most appropriately applied to the first-arrival, and must be relaxed somewhat for many secondary phases.

As the "shape" of the wave at the onset is a function of the transport speed of the drum or film and trace widths, the "character" of the onset is not as useful as the observer's indication of the timing accuracy, which also may reflect the accuracy of the chronometer.

it is difficult to establish firm clarity limits for secondary phases. For example, an accuracy of 1.0 second may rate an I for a teleseismic S, but only an E or a Q for an S recorded locally by a modern network.

PERIODS, AMPLITUDES AND MAGNIFICATIONS

A number of additional amplitude measurements may now be reported. Before discussing each individually, the general rules for reporting amplitudes, especially their units, will follow. In the past, reporting of amplitude measurements has caused considerable confusion and undoubtedly resulted in the entry of erroneous data into the databases of several seismic centres.

The period is the *apparent* or *dominant* period of the wave whose amplitude is given.

Amplitude measurements are given either in *double* trace amplitudes in *millimetres* (*mm*) or as *ground* amplitudes whose units depend on the channel from which they were scaled (see definition of ⟨channel⟩ under Parameters, in the Code form).

Amplitude data from a given station must be either double trace (with rare exceptions because of recording off-scale) or all ground amplitudes.

Double trace-amplitude measurements can be defined as either:

peak-to-trough deflection for symmetrical waves, or,

twice centre-to-peak for symmetrical or asymmetrical waves, where centre means base-line, zero-line or equilibrium.

Double trace amplitudes in millimetres (mm) may be given for any reportable amplitude group. When double trace amplitudes are given, the channel magnification *should* be given and it is *strongly re commended* that the magnification include the TRACE symbol.

Ground amplitudes scaled from an SP channel must be given in nanometres (nm).

Ground amplitudes scaled from an LP channel must be given in micrometres (μm).

Thus effectively, all reportable *surface-wave* amplitudes, except Lg scaled from SPZ, and all *long-period body-wave* amplitudes will be given in *micrometres* (*μm*) as well as the two *LP noise* amplitudes when ground amplitudes are given.

⟨magnification⟩

The standard magnification is that magnification, at the nominal period, to which the instrument magnification factor is normalized to 1. The period to which magnifications are normalized varies with the instrument type, but is generally one second for short-period instruments and that period at which the instrument magnification peaks for long-period instruments.

It is *strongly recommended* that *ground* amplitudes be furnished by all. However, contributors sending *double* trace amplitudes must obtain them from standardized instruments for which the response characteristics are known to the receiver, and they must have informed the receiver of their intention prior to transmission of such data.

Although the ⟨magnification⟩ is optional when the recipient is known to have a record of the *current* operating magnification(s) of the instruments from which *double* trace amplitudes have been supplied, it is *strongly recommended* that they be included. If a magnification has been changed since the last report, the new magnification is *required* and should have a C appended to the K or M identifier to confirm this fact. A station should not commence sending amplitudes until it has first informed the recipient(s) of the type of amplitudes (*double trace* or *ground*) that it intends to send. If *double* trace amplitudes are to be sent, the type of *standardized* instrument(s) and their magnifications must be supplied.

[G]

A station which routinely reports *double* trace amplitudes (from the channels for which they furnish magnifications) may wish to substitute *ground* amplitudes from recordings which did not go off-scale (clip) while recording a large earthquake – data from a low magnification SPZ when a 200K WWNSS SPZ clipped, for example.

To substitute a *ground* amplitude where a *double* trace amplitude would ordinarily be expected, prefix the ground amplitude with GA rather than A. This substitution is available for the 1st few cycles amplitude, the SP maximum amplitude, the LP maximum amplitude, and the Rayleigh and Love-wave maximum-amplitude groups.

⟨zero-crossing amplitude scaling times⟩

This field is available for all groups containing amplitudes except the 1st few cycles amplitude, the three noise groups, and the ⟨maximum local amplitude⟩ defined under local magnitude data.

This time is measured where the trace crosses the equilibrium point between the peak and trough that comprise the cycle whose amplitude was reported.

P–WAVE AMPLITUDES

⟨1st few cycles amplitude⟩

This amplitude is scaled from the first "few" cycles following the onset of the first-arrival, recorded on SPZ channels only. The associated period must lie between 0.1 and 3.0 seconds and the decimal point is *required.*

⟨SP maximum amplitude⟩

This amplitude is taken from the largest amplitude in the P-wave coda recorded on SPZ channels. However, it must be obtained before the arrival of another clear phase such as pP, sP, PcP or PP. This is generally the most important SPZ scaling of the P-wave amplitude. This group, as all maximum-amplitude groups, is designated by the prefix XM. No precise period range has been defined for SP maximum amplitudes. However, the period must include a decimal point.

⟨gse SPZ first-arrival amplitudes⟩

These amplitudes are each obtained from the maximum SPZ P-wave amplitude found within specified time-intervals of the P-wave coda. They must be reported only before the arrival of the next clear phase. However, they are reported even if the coda amplitude is, in general, decaying. No precise period range has been defined for these amplitudes. However, the periods must include a decimal point.

The P-coda interval-time designators prefixing these fields are:

XA[M] 0–6 seconds after P-wave onset
XB[M] 6–12 seconds after P-wave onset
XC[M] 12–18 seconds after P-wave onset
XD[M] 18–300 seconds after P-wave onset

where the optional M is used to indicate that the amplitude also meets the criteria of the SP maximum amplitude.

⟨LP maximum amplitude⟩

This amplitude is taken from the largest amplitude in the P-wave coda recorded on an LPZ channel. It must be obtained before the arrival of another clear phase. This amplitude is generally the most important P-wave amplitude recorded from large intermediate or deep focus events. No precise period range has been defined for LP maximum amplitudes; however, the period must include a decimal point even though periods greater than 9.9 seconds must be reported to the nearest second (e.g. 10.).

AMPLITUDES FROM THE HORIZONTAL COMPONENTS OF P

SP and LP maximum amplitudes for P may be reported from SPH and LPH channels respectively. However, to be most useful they must be obtained from matched horizontal channels and be measurements of the same cycle. Horizontal P-wave amplitudes are chiefly of interest when the vertical channels are unavailable or off-scale.

SECONDARY PHASE AMPLITUDES

Although the code allows for maximum trace amplitudes from any channel of any secondary phase, there are only a few from which data are sought. Chief among these are S, Lg and Rg. Although Lg and Rg are surface waves, they require the same format as the secondary body waves.

⟨SP maximum amplitude⟩

This amplitude is taken from the largest amplitude in the coda of the phase being measured. For regional earthquakes with foci in the upper crust and a continental propagation path, the amplitude of the Lg from the SPZ is important.

⟨gse SPH S-wave amplitude⟩

This amplitude is the largest SPN/SPE amplitude found within the first ten seconds of the S-wave and should be reported from both horizontal components. The respective zero-crossing amplitude scaling times should not differ by more than one-half the signal period. For large, shallow-focus earthquakes this amplitude will generally not correspond to the maximum for S.

⟨LP maximum amplitude⟩

This amplitude is taken from the largest amplitude in the coda of the phase. For regional earthquakes with foci in the upper crust and a continental path, the amplitude of the Rg from the SPZ is important in some localities.

⟨gse LPH S-wave amplitude⟩

This amplitude is the largest LPN/LPE amplitude found within the first 40–60 seconds of the S-wave. The respective zero-crossing amplitude scaling times should not differ by more than one-half the signal period.

LONG-PERIOD SURFACE-WAVE AMPLITUDES

Please note that for all long-period surface-wave groups (other than the old surface-wave group) the ⟨channel⟩ and *phase codes* are *required.* The ⟨channel⟩ must be given even if it is the same as that of the preceding phase.

LOVE WAVES

⟨mantle-wave amplitude⟩

This group is measured for large earthquakes, will have a period in the neighbourhood of 200 seconds and should be reported from both components. This group is not prefixed.

⟨Love maximum amplitude⟩

This group is obtained from the maximum *trace* amplitude observed in the Love-wave train, regardless of period, and should be reported from both components. This group is prefixed by XM.

RAYLEIGH WAVES

Data from the vertical components in these groups are emphasized.

⟨Rayleigh mantle-wave amplitude⟩

This group is measured for large earthquakes and will have a period near 200 seconds.

⟨Rayleigh max amplitude⟩

This group is obtained from the maximum *trace* amplitude observed in the Rayleigh-wave train regardless of period. For continental paths, this period might well be near 15 seconds. This group is prefixed with XM.

⟨gse Rayleigh amplitudes⟩

The four amplitudes are each obtained from the maximum trace amplitude associated with waves of their respective period range. They need not all be present to report one or more.

The Rayleigh-wave period-range designators are:

XA[M] 36–44-second waves
XB[M] 27–33-second waves
XC[M] 18–22-second waves
XD[M] 09–11-second waves

where the optional M is used to indicate that the amplitude also meets the criteria of the ⟨Rayleigh max amplitude⟩. These intervals are available for vertical channels only, with the exception of XC[M], which may be used for the horizontal “20-second” waves as well.

OLD SURFACE-WAVE GROUP

As this group has been retained in the seismic code to maintain upward compatibility, it is hoped that such data will be sent using the new forms available. Here is how the “20-second” Rayleigh waves may be sent using ⟨Rayleigh wave⟩:

1. If the period is between 17 and 23 seconds inclusive, and the amplitude is the maximum LPZ trace amplitude in the Rayleigh-wave train, use ⟨Rayleigh max amplitude⟩, employing the appropriate channel codes. The period and amplitude for each component will thus be prefixed with XM.
2. If the period lies between 18 and 22 seconds inclusive, but the amplitude is not the maximum LPZ trace amplitude in the Rayleigh-wave train, use ⟨gse Rayleigh amplitudes⟩ for each component, employing the appropriate channel codes. The period and amplitude for each group will thus be prefixed with XC.
3. If the period is either 17 or 23 seconds but not as in 1. above, do not report it.

NOISE AMPLITUDES

⟨SPZ noise⟩

The short-period noise amplitude is taken from the SPZ channel and is the maximum amplitude with a period either between 0.2 and 1.0 second or close to that of the signal, found within 30 seconds *before* the onset of the first arrival.

⟨1 minute before P noise⟩

This noise amplitude is taken from the LPZ channel and is the maximum amplitude with a period between 2.0 and 8.0 seconds found within one minute *before* the onset of the first arrival. The period should include a decimal point even if reported to the nearest second.

⟨1–30 second noise⟩

This noise amplitude is taken from the LPZ channel and is the maximum amplitude with a period between 10–30 seconds found within five minutes *before* the onset of the first arrival. The period should be reported to the nearest second.

FIRST MOTIONS

Generally, first motions will be reported only for the first arrival and then only when clear. However, if a Pg following a Pn is clear, its first motion may be reported with that phase – likewise that of pP when clear.

⟨appended first motion⟩

This field has been retained only for the sake of *upward compatibility* (see Introduction). It contains the short-period and/or long-period *vertical* first motions only. This field is found appended to the first-arrival phase code. Long-period compressions must be reported in this group as U and dilatations as R. *It is strongly recommended that the* ⟨first motion⟩ *field be used instead of the* ⟨appended first motion⟩.

⟨first motion⟩

This group has been introduced to facilitate the reporting of first motions from any channel, to make the reporting of compressions (C) and dilatations (D) uniform and to allow reporting of first motions from secondary P-type phases when desirable.

The ⟨first motion⟩ field consists of the symbolic prefix “FM” followed by the optional short-period first motions which is followed by the optional long-period first motions. The first character of the LP first-motion group is always a *comma.* Within each short- and long-period group the vertical component is given first, followed by the north-south and then east-west components. Any component may be absent, and corresponding long- and short-period components need not have the same directions.

The reported ⟨first motion⟩ field may be associated with any channel and generally it will be included with the SPZ channel data. However, when SPZ channel data are not reported, it may be associated with another channel. Also, since “long-period” is used as a generic term to indicate not only long-period but also intermediate-period (MP), broad-band (BP) and ultralong-period (UP) instruments, the contributor who wishes to make these long-period distinctions or to report first motions from several of these may do so by including this field with any channel of the appropriate class.

LOCAL MAGNITUDE DATA

When a local earthquake has been recorded, if individual phases are recognizable, their maxima may be reported using ⟨SP maximum amplitude⟩. Amplitudes from P and S from subcrustal events, and such crustal phases as Pn, Pg, Sg from crustal foci, may be reported in this manner.

However, when individual phases cannot be discerned or the period of the signal accurately measured, the ⟨maximum ground amplitude⟩ can be given for one or more components. This value will necessarily be a rough estimate if an associated period must be adopted.

⟨SP duration time⟩ may also be used in this case. However, it may also be used not only when the recording has clipped, but also for any local event where a suitably calibrated formula exists.

SECONDARY PHASE GROUP

A ⟨secondary phase group⟩ is specified for each secondary phase reported that is a body wave or Lg or Rg. All of the data for each secondary phase reported are thus given before data for the next secondary phase within a station-event appear.

EXAMPLES OF TELEGRAMS

SINGLE-STATION GROUP FORM

The first example shows a message in which the data are arranged by station. The first station, ALQ, supplied data using nearly all the new forms made available by this edition of the code form. The second station, TUC, employed many of the new forms, but in general did not supply gse first-arrival or gse Rayleigh amplitudes.

SEISMO GSEPA N5119 ((GSEXY SEXX1 850502 1445)) ALQ BEG APR30 141512 END MAY02 141522 OUT ALL MAY01 140816 TO MAY01 141522 OUT MAY02 140322 TO MAY02 141116 STATP PROCA TRACE 200K 3000M APR30 SPZ DEFAULT IPKP1606350 FMD T1.0A7.9 NT1.0A1.0 LPZ NAT7.7A2.0 SPZ I06440 LPZ EPP0840 EPPP1056 LPE ESKS1337 LPZ ESKKP2001 LPE ESS2528 ESSS2940 LPE LQ XM4112 T44A77 LPN XM T44A37 LPZ LR XAM4728 T41A112 XB4848 T30A70 XC5710 T20A56 LPE XC T20A52 LPN XC T20A47 EP225837.5 T1.5A8.0 IP225845.8 FMC T1.8A39.5 XA5851.0 T1.5A24.5 XB5858.0 T1.5A45.0 XC5901.9 T0.9A50.0 XDM5939.4 T1.1A302 NT1.0A0.3 LPZ NAT7.3A3.5 SPE ES230819.0 XM0903 T6.5A63.0 XA0827 T6.0A9.0 SPN XM0902 T6.5A38.5 XA T6.1A5.0 BPZ LR XM2740 T28GA54 MAY01 IP105316.8 FMCW,CNW XA5327.8 T1.1A31.0 XB5336.0 T1.1A31.0 XCM5333.3 T1.2A37.8 XD5344.0 T1.4A37.0 LPZ XM T15A38.0 NAT8.0A2.0 SPZ I5409.3 IPP5610.2 EPPP5803.5 SPN ES110253.0 XM T6.0A11.0 SPE ES0254.0 XM T6.0A8.0 LPN ES0256.0 XM T20A85.0 LPE ES0256.0 XM T20A64 ESS0742 ESSS1121 SPZ EPKPPKP2040.8 ESKPPKP2417 LPE LQ XM1408 T31A73 LPN XM T32A40 LPZ LR XB1942 T32A103 XCM2124 T20A286 LPN XC T20A218 LPE XCM T20A139 IPG 1459084 FMC ((ROCKBURST 31 DEG 14.6 MIN N, 111 DEG 2.42 MIN W 3 INJURED)) / ELG 150116.3 / IPLOC DUR126

TUC BEG APR30 151000 END MAY01 151000 OUT MPZNE APR30 151000 TO MAY01 151000 PROCG GRND IP1752303 FMC,C XM T0.8 A30.0 SLO6.84 AZ357 LPZ SLO7.0 AZ355 SPZ I52530 LPZ LR XM T31A100 LPN XM T32A99 LPE XM T32A00 / LPZ PDIF2355110 SPZ PKP2358101 I58452 ISKP00011401 / MAY01 QP003742 IUNK0123456 IP0200373 XM T2.9 A43.6 IAP00552 EAWP00581 EXP01042 / IPN041922.66 FMC,D IPB19252 FMD SPE IPG1930.1 FMCNE SPN ISN19558 ISB20024 SPZ ELG2006 XM2021 T1.2 A14.6 MAG ML5.8 D2.1 DR5.6 ((DAMAGE VII YUMA)) / IP0606150 FMC,C XM0606155 T1.0 A22.6 SPN ES09060 SPZ IPCP10521 IAPCP11280 EXPCP11520 ESCP14080 STOP

COMMENTS ON EXAMPLE

Following the message identifier, SEISMO, is the three-part message heading. GSEPA indicates that this message transmits primarily measurements from seismographic recordings. N5119 indicates this is the 119th message sent by ALQ to this receiver for 1985, and is used by the receiver to detect the loss of a message in transmission. The items enclosed in double parenthesis can be sent only via GTS. The first such item is the GSE test code, the second is the GTS data/geographical designator group and the last two fields are the date and time of transmission.

Following the station abbreviation, ALQ, is the report times group which indicates that the message covers the period from 30 April at 14:15:12 UTC to 2 May at 14:15:22 and includes two outage periods for all instruments, apparently the times during which the records were being changed. Note that the time spanned by the beginning and ending times will always be somewhat greater than the time spanned by the times of the first and last measurements reported in the seismic data.

STATP, the status code indicates that these data constitute a preliminary report for this period. Any report which represents reinterpreted data and/or additional data for a period is considered final.

PROCA, the process code indicates that the data were scaled from an analog recording (e.g. photographic paper or film, etc.). This is the default (i.e., had this field not been included, these recording and measuring conditions would have been assumed).

TRACE confirms that the amplitude data are double trace amplitudes. This is followed by the standard SPZ magnification in thousands and the standard LPZ magnification. Since no horizontal magnifications are given, the vertical values are understood to apply to their respective horizontal channels.

APR30 is the date of all the data which follow until a new date group is encountered. This field must be included even if this date can be inferred from that of the BEG indicator.

SPZ DEFAULT indicates that the data include channel codes and thus is establishing SPZ, as the channel that will be ascribed to the initial data of each first arrival, unless otherwise indicated, eliminating the need to include the channel code with each first arrival.

The data from the first seismic event reported pertain to an event about 13 900 km distant with a magnitude of about 6.6 M_S. The first arrival, PKP, has a clarity of I and an arrival time of 16:06:35.0 UTC. The time was scaled to the nearest tenth of a second. Had it been scaled to the nearest second, it would have been reported as 160635. The SPZ first motion is reported as D, for a dilatation, and is prefixed with FM, the first-motion field indicator. It is followed by a first few cycles amplitude group which reports a period of 1.0 s and an amplitude of 7.9 mm. The SPZ noise group is indicated by N. The noise period is 1.0 s with a double trace amplitude of 1.0 mm. The channel code, LPZ, indicates the data following it are from that component. NA indicates the one minute before P noise.

The next SPZ indicates that the group I06440 was scaled from the SPZ. The phase is unidentified, has a clarity code of I and an arrival time of 16:06:44.0. The hour was not included as it is the same as that of the preceding phase in this station-event. Next are found PP and PPP data obtained from the LPZ. Then SKS data from the LPE, followed by SKKP data taken from LPZ. The SS and SSS were scaled from the LPE.

The channel code LPE is repeated as the Love-wave group is introduced by the phase code LQ. The XM indicates that a Love-wave maximum trace-amplitude group will follow. The 4112 appended to XM is the zero-crossing amplitude scaling time, for the double trace amplitude of 77 mm with a period of 44 s. Data from the corresponding LPN channel follow, but the XM does not have a zero-crossing amplitude scaling time included as it is nearly identical to that of the east-west component.

The LPZ channel code precedes the phase code LR which indicates data from the Rayleigh-wave train follows. The XAM indicates the 36–44 s amplitude group, and that it is the maximum not only within that period range but also for the entire LPZ Rayleigh-wave train. XB and XC indicate the maximum within the 27–33 and 18–22 s groups respectively. The 18–22 s data taken from the LPE and LPN follow.

The P-phase at 22:58:37.5 signals the beginning of a new station-event. The decimal in the seconds was optional in this case. Notice that this event precedes a much larger event by only a few seconds.

The P-phase at 22:58:45.8 begins a station-event recorded at a distance of 8 400 km with a magnitude of 7.8 M_S. The first few cycles amplitude of 39.5 mm was scaled from the fifth cycle (a scaling time cannot be specified for this kind of amplitude). The XB and XC indicate the gse SPZ first-arrival amplitude for the time increments of 0–6, 6–12 and 12–18 s after the P onset. The XDM indicates the 18–300 s after the onset group and that it was also the largest amplitude in the P-coda. The SPZ noise and LPZ's one minute before P noise groups complete the P-phase data.

SPE then precedes the S-phase data. Note the inclusion of an hour in the S arrival time as the hour changed to 23 within the station-event. XM indicates the maximum S-coda SPE amplitude. XA indicates the maximum SPE amplitude within the first 10 s of the S arrival time. SPN precedes the same data groups from the north-south component.

BPZ indicates that data taken from a broad-band vertical component follow. The LR phase identifier means that Rayleigh-wave data are next. The XM indicates the maximum in the Rayleigh-wave train. The period is 28 s and the *ground amplitude* (*centre-to-peak*) is 54 μm. Evidently the quake was so large that the surface waves were off scale on the LP instruments, but a lower magnification broad-band instrument recorded the Z amplitude which was reduced to a ground amplitude by the observer. The amplitude in this case was preceded by GA rather than A to indicate ground amplitude as a trace amplitude was expected.

The next event is a 6.6 M_S aftershock of the previous event. C and W for the SP first motions and C, N and W for the LP first motions have been included. Note the *required comma* (,) preceding the LP first-motion group. PP and PPP data from the SPZ are the next phases reported. An arrival time of 110253.0 was reported for S from the SPN together with its maximum amplitude. A slightly later arrival time was reported from the SPE channel. This second arrival time for the same phase was strictly optional. The SP data for S are then followed by the corresponding LP data for S. SS and SSS from the LPE are given, followed by P′P′ and SKPP′ from the SPZ. Maximum Love-wave data and the gse Rayleigh-wave amplitudes follow, with the 20 s horizontal Rayleigh-wave data concluding this event.

The next event is represented by Pg from a rockburst. Note that the data inside double parenthesis may span several lines, which may be broken anywhere a space would normally occur.

The next station-event is delimited with *solidi* it contains no legitimate first arrival, but only an Lg from a weak local.

The last event from ALQ has a PLOC as a first-arrival phase code. This dummy phase code is used for reporting locals for which secondary phases cannot be read and for which first-arrival codes such as Pn, Pb or Pg cannot be interpreted. Use of PLOC in such cases enables analysts and computer association programs to distinguish a teleseismic P from a local P where no other clues are found by examining the phase codes within the station-event and their time differences – use of PLOC in cases of such isolated local station-events will prevent misassociation of such data with teleseisms. A duration of 126 s was furnished.

Data from TUC begin with a report period in which a three-component set of intermediate-period instruments were reported as inoperative for the entire reporting period.

The process code, G, indicates that sophisticated, computerized equipment was used in the recording and interpretation of the data.

GRND indicates that all of the amplitudes are ground amplitudes. Since no status code was given, the status code P for ALQ applies also to the TUC data. Also, since no default channel was given, the SPZ DEFAULT given by ALQ applies to TUC data.

Note the SPZ and LPZ slowness groups indicated by SLO and the related azimuths prefixed with AZ. The observer furnished maximum Rayleigh-wave amplitudes from three LP channels. The LPE amplitude has a value of 00, because the waves arrived from nearly due north. Furnishing an amplitude of 00 rather than omitting this channel served to distinguish it from the case where the LPE channel data were simply missing.

The station-event containing two legitimate first arrivals, PDIF and PKP, has been delimited so that the PDIF will not be separated from the rest of that event's data.

The clarity code Q was used for the P phase arriving on 1 May at 00:37:42 to indicate that the observer felt the timing was uncertain (questionable) by more than a second. This clarity code has been introduced to avoid some of the ambiguities surrounding the use of (P) or E(P). In no case should a time such as 0037(42) be sent.

UNK, as shown in the next group, has been introduced as a first-arrival code to indicate that the observer did not wish to identify the phase more specifically than as a first arrival. UNK must not be used for unidentified secondary phases.

Data from the next event illustrate encoding of pP, pwP and sP, very important secondary phases.

The data from a strong local were given as a delimited station-event to indicate that the phases Pn, Pb and Pg all pertained to the same event. Note that the SPZ and LPZ first motions of the Pn are of opposite sign. Do not "force" such observed first motions to be alike. Since the arrival time of Pn was reported to a precision of hundredths of a second, the decimal point was required. Pb was also scaled from the SPZ with an SPZ first-motion code of D. The Pg arrival time was scaled from the SPE, but SP first motions were given for three channels. Sn and Sb were read from the SPN and Lg was read from the SPZ.

The Lg period, amplitude and its scaling time were given and could be applied to an appropriate magnitude formula. An M_L magnitude estimate of 5.8 based on a distance of 2.1 deg. was also supplied as well as a duration magnitude of 5.6. The comment gives the maximum intensity (VII) at Yuma. The intensity scale is generally understood as being based on the geographical region to which it has been applied.

In the last station-event, “depth” phases associated with PcP were reported. These phases will yield depth information at distances which may be too small to record pP or sP.

STOP is absolutely necessary to end the message.

NET-EVENT GROUP FORM

The following example shows a message in which the data are arranged by event. Data from five seismic events are shown. Note that, within each event, the station-events have been arranged in any order convenient for the sender, probably reflecting the order of telemetered traces recorded on film strips. The blank lines between net-events are optional as is the placement of station-events on separate lines.

```
SEISMO N5041 STATP PROCA SPZ DEFAULT

MAR23
GIL    IP1919534 FMC XMT1.4 A463
ANV    IP1918485 FMC
SIT    EP1920528
KDC    EP1920528
PMR    EP1919478 FM,C XMT1.0 A65 LPZ LR XCT20A90 LPN XT21 A31 LPE XCT19 A65
NRA    EP1919058
GMA    EP1919063

ANV    EPLOC1927248

GIL    EP1953558 XMT1.5 A107
ANV    EP1952488
KDC    EP1953356
NRA    EP1953059

MAR24
GIL    IP0052368 FMD XMT1.0 A65 I53255
NKI    IP0054070
GMA    IP0053149
NRA    IP0053162
KDC    IP0053018
ADK    IP0054325
PMR    IP0052459 FMC,C XMT1.0 A102 E53305 E54582 LPZ LR XBT28 A14 LPN XBT29 A6 LPE XBT27
       A12
AVE    IP0053275 FMD

PMR    FOCUS 0532491 LAT 55.43N LON 157.84W DEP 33 NS 8 ((FELT III AT PERRYVILLE)) MAG ML6.1
       NS 2
SDN    IPLOC 0533159
KDC    IPN0533447
SVW    IPN0534155
PMR    IPN0534391
TTA    IPN0534391
TOA    IPN0534581
STOP
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COMMENTS ON EXAMPLE

As this example has been designed primarily to illustrate the structure of the net-event group form, it does not exhaust the parameters available to the code. Those using this form will benefit from an examination of the previous example.

In this message ground amplitudes were used throughout. If double trace amplitudes had been reported, the appropriate magnifications would have been required nearly each time an amplitude group appeared. Note also that the sender elected to insert a space between the period and amplitude groups. No other ⟨standard delimiter⟩ would be acceptable in this position and none is required.

The second event consists of just one station.

The fifth event includes a computations group with a hypocentre based on eight station-events and an M_L magnitude average from two stations. Local magnitudes shown in the examples are for illustrative purposes only and do not represent a comment on the use of local magnitude schemata developed for a particular area and depth range, but applied to a different region or depth range.

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