Weather Communications Codes

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Sample messages recorded by Ary Boender

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0. Why Weather Reporting Codes?

In a word, clarity.

Weather observation codes are very similar from one country to another, facilitating the exchange of information despite the Babel of languages, measurement units, and time zones. Meteorological groups meet regularly to deal with these issues. The resulting codes are appropriate to the type of information being exchanged. They also provide well-documented national practice exceptions such as the use of inches, feet, and miles for pressure, clouds, and visibility in United States aviation weather.

In another word, brevity.

When these codes were invented, back in the age of mechanical teleprinters, 50 WPM wasn't bad and 75 was screaming. There was no alternative to compact coding systems, if weather wires were to move a whole world's information in anything approaching a timely manner. After all, nothing's older than yesterday's weather forecast.

Extreme brevity is no longer as important in an age of real-time binary observations being plotted in 3 dimensions on wide-area networked computer screens, but standardization is. Standards are currently maintained by the World Meteorological Organization, a UN body in Geneva with over 150 members. Changes are periodically agreed on and codified in the canonic WMO Handbook No. 306, available from the WMO web site. (Be ready to pay in Swiss francs.)

Most current issues in the text-based communications have to do with the very gradual changeover from the practices of different countries into the more standard WMO formats. These changes are minor. In the US, for example, the two big ones are the switch to Celsius in reporting airport temperatures and dewpoints, and a gradual change from one bulletin heading syntax to another.

1. Weather Bulletin Structure

Most of the world's thousands of different weather reports use a standard format. The United States is adopting this, however slowly, for its 6000+ products.

Here's an example of the kind of thing one will copy on utility radio stations. Landlines (the "weather wire" aka the "big wire") and computer servers use very similar structures:

ZCZC
SAUS80 KWBC 011200 RRC
METAR
KDAL 011150Z 00000KT SKC 14/11 A3010 RMK 10170 20133=
[more lines of data]
NNNN

Item One : START SIGNAL

In this example: ZCZC
Some standard starting signal such as a Telex code, ASCII string, or whatever is used by the particular network.

Item Two: STANDARD INTERNATIONAL HEADER (in WMO format)

In this example: SAUS80 KWBC 011200 RRC
The header identifies the type of product, and to whom it applies.

Syntax: TTLLii CCCC DDHHMM (BBB),

where TT=Type, LL=Location, ii=Number, CCCC=Collection center ID, DDHHMM = date/time group of day/hour/minute, and (BBB) is an extra information string not always used.

These headers contain a great deal of information in their compact text strings, with many characters pointing into the infamous "WMO tables" of very highly organized information on just about every weather possibility anywhere in the world.

There are a number of computer programs, and even web sites, that allow the decoding of these headers. One drops the header into a text box and gets back several lines of information. A useful decoder of this type is at the US National Weather Service site. The URL is:

http://www.nws.noaa.gov/oso/hdecode.shtml

Sometimes US bulletins have a slightly different header, either by itself or next to the WMO format. This is the notorious "AFOS PIL," formerly the standard wire ID for all US weather product.

AFOS is the Automated Field Operations and Services network used since 1982, currently being phased out for AWIPS, the Advanced Weather Interactive Processing System. AFOS uses an older ID number called the PIL for "Product Inventory Lookup," but all AWIPS communications will use either the WMO style or both.

Item 3: Text

The content of the bulletin.
In our example: METAR
KDAL 011150Z 00000KT SKC 14/11 A3010 RMK 10170 20133=[.]

METAR is a code specifier, indicating that the following lines of data will be in the METeorological observation, Aviation, Routine format, as currently set forth in WMO standard code FM 15-IX, Extended. This is a very common single-line format for hourly aviation reports. If more timely information needs to be passed it's done in the similarly structured SPECI (SPECIal weather change notice, WMO FM-16). There are also standards for TEMPO (TEMPOrary), and TAF (Terminal aerodrome Forecast). For example, FTUS in a header always means a standard set of TAF.

Since METARs use a lot of plain text, it's easy to decode them in your head. In fact, their expansion into ordinary language provides much of the ATIS (Automated Terminal Information System) and VOLMET ("Flying Weather") transmissions we hear. They can also be automatically stored on web sites that provide weather information for pilots, and expanded when looked up.

For a start, KDAL is the 4-letter ICAO international airport identifier (for Love Field, Dallas, TX). The next two groups are a date/time stamp and a wind direction/speed, followed by a number of observations that change with type of weather station and country. Finally there's an optional RMK (ReMarKs) field followed

by the appropriate codes for things like storm activity, dust, snow, and such. The = at the end of the METAR is a terminator, corresponding roughly to the old CW BT (short-break) signal. The key word in METAR is Routine. Significant, non-routine, weather features that affect aviation will be passed in numbered warnings called SIGMET, for SIGnificant METeorological. It the
US, these are divided into convective SIGMETs (thunderstorms, tornadoes) and non-convective SIGMETs (turbulence, icing, etc.).

Along with all these aviation formats, we will also see surface synoptic observations in their own codes. These will be designated as AAXX or SYNOP (land synoptic code, WMO FM-12), and BBXX or SHIP (ship synoptic code, WMO FM-13) Moored weather buoys can be treated as stationary ships. Drifting ones, or those with special observations, have a BUOY code (SSVX, WMO FM-18X , replaces DRIFTER) for them. We'll have way more about all these codes.

Item 4: End-Of-Message signal

A standard ending signal such as the NNNN in our example.

2. Special Weather Identifiers

Weather stations use three different types of identifiers. One is the numeric WMO form that we see in some data fields. These can be looked up in a list available online or from WMO as a
loose-leaf publication that is updated frequently by subscription. The list is hundreds of pages long in ASCII text, unfortunately, so it is not reproduced here.

Another is the radio callsign, which we typically see only for Volunteer Observation System (VOS) "ships of opportunity," which have agreed to put certain standard instruments aboard and train
one or more crew members in their proper use. The Beaufort wind arrows and sky condition reports shown on oceanic weather charts are usually labeled with these callsigns, as are their synoptic
reports in SHIP code.

Sometimes a hurricane warning or other advisory will also show the callsign of a VOS ship whose report has been used. These are the only times, typically, that radio calls appear in a weather
product. WMO maintains a database of those callsigns. A semicolon-delimited record dump from 1999 is available on their web site, or a subscription can be purchased for more timely data.

More important for our uses, though, are the 4-letter identifiers that show in the CCCC field of bulletin headings, or in the source field of many coded observations. These look like radio callsigns, but they are international IDs that happen to mimic the ICAO 4-letter airport convention, and in fact actually use it in the case of civilian airport METARs. However, many of these identifiers can also refer to central weather offices, information collection and relay points, or even automated
instruments in the field.

CONUS airports form the 4-character ICAO ID by prepending K to the three-letter IATA identifiers we're used to seeing on our baggage. Alaskan IDs begin with PA, Hawaiian with PH, and Puerto
Rico with TJ.

The actual callsigns of the transmitters subsequently used to pass information from this system will vary. Many US military broadcasts are in fact completely unidentified except for the product sources in the headers, which have nothing to do with who ultimately broadcasts the information.

US military transmitters are usually at Elkhart, NE, near Offutt Air Force Base; Saddlebunch Key, near the Key West Naval Communication Station; Roosevelt Roads, the US Navy base in Puerto Rico. Schedules

change almost weekly, as all remaining US military HF weather transmissions are by request from the fleet or the Air Force. Here are some commonly seen identifiers:

ID	Country/Agency	Office
AMMC	Australia	Bureau Of Meteorology, Brisbane
BABJ	China	Beijing
CWAO	Canada	Canadian Met. Centre, CN
CWEG	Canada	Alberta Weather Centre, AB
CYYZ	Canada	Toronto Weather Centre, ON
EBBR	Belgium	Brussels
EDZW	Germany	Met. Communications Office
EGRR	UK	British Met. Office, Bracknell, GB
EHAM	Netherlands	Amsterdam
EKMI	Denmark	Met. Institute
FABL	South Africa	Bloemfontein
FAJS	South Africa	Johannesburg
FAPR	South Africa	Pretoria
KAWN	US Air Force	Aviation Weather Network, Offutt AFB, NE
KGWC	US Air Force	Global Weather Center, Offutt AFB, NE
KKCI	NWS/NCEP	Aviation Weather Center, Kansas City, MO
KMKC	NWS/NCEP	SIGMET Center, Kansas City, MO
KNGU	US Navy	US Navy Weather Center, Norfolk, VA
KNHC	NOAA/NWS/NCEP	National Hurricane Center, Tropical Prediction Center, FL
KWBC	NWS/NCEP	NWS Central Operations, MD
KWBx	NCEP	Output from NWS models, per table below
KWNC	NWS/NCEP	Climate Prediction Center
KWNO	NWS/NCEP	Aviation Weather Center, Kansas City, MO
KWNS	NWS/NCEP	Storm Prediction Center
LEMM	Spain	Met. Communication Center, Madrid
LFPW	Meteo France	Met. Center, Toulouse
LIIB	Italy	Met. Communication Center, Rome
LIMC	Italy	Milan
LOWM	Austria	TAF, Surface Observations
MMGL	Mexico	Guadalajara/Miguel Hidalgo y Costilla Int'l (See Mexican METAR sources below)
MMMD	Mexico	Merida/Lic. Manuel Crecencio Rejon Int'l
MMMX	Mexico	Mexico/Lic. Benito Juarez Int'l
MMMZ	Mexico	Mazatlan/General Rafael Beulna Int'l
MNMG	Nicaragua	Managua, Surface Observations
MPTO	Panama	Tocumen, Surface Observations
MYNN	Bahamas	Nassau METAR, Bahamas
NZKL	New Zealand	Metservice Wellington, NZ
NZWN	New Zealand	Wellington
PAFA	NWS/NCEP	Fairbanks, AK
PAJN	NWS/NCEP	Juneau, AK
PANC	NWS/NCEP	Anchorage, AK
PHNL	NWS/NCEP	Honolulu, HI
RJAA	Japan	New Tokyo Airport
RJTD	Japan	Japanese Met. Agency, Tokyo
RPLL	Philippines	Aquino International Airport
RUMS	Russia	Moscow

SABM	Argentina	Natl. Met. Office, Buenos Aires
SBBR	Brazil	INMET, Brasilia Airport
TJSJ	NWS/NCEP	Puerto Rico
TJNR	US Navy	Roosevelt Roads Naval Station, PR
TTPP	Trinadad & Tobago	Caribbean METAR
VTBB	Thailand	Bangkok METAR
YBBN	Australia	Airport Met. Office, Brisbane
YMMC	Australia	Met. Centre, Melbourne

In KWBx, (x) can be:
C = NCEP AVN and all other products not listed below
D = Eta/Early Eta
E = ETA/mesoEta
F = Nested Grid Model
G = Rapid Update Cycle
H = Medium Range Forecast Model
I = Sea Surface Temperature Analysis
J = Wind/Wave model
K = ENS/Global Ensemble FCST
L = ENS/Regional Ensemble FCST
M = Ocean Analysis Models
N = Ocean Forecast Models
O = Merge of Models
Z = NCEP "tiles" from models

Mexican METAR sources are as follows:

SAMX41 MMMX
METAR
MMAA - Acapulco/General Juan N. Alvarez Int'l
MMBT - Bahias Dehuatulco
MMCB - Cuernavaca
MMMX - Mexcio/Lic. Benito Juarez Int'l
MMOX - Oaxaca
MMPA - Poza Rica
MMPB - Puebla
MMPS - Puerto Escondido
MMQT - Queretaro
MMTL - Tulancingo
MMTM - Tampico/General Francisco Javier Mina Int'l
MMTO - Toluca/Lic. Adolfo Lopez M.
MMVR - Veracruz/General Heriberto Jara Int'l
MMZH - Zihuatanejo

SAMX42 MMGL
METAR
MMAS - Aguascalientes
MMEP - Tepic
MMGL - Guadalajara/Miguel Hidalgo y Costilla Int'l
MMIA - Colima

MMLO - Del Bajio/Int'l Guanajuato
MMMM - Morelia
MMPN - Uruapan
MMPR - Puerto Vallarta/Lic. Gustavo Dias Ordaz Int'l
MMSP - San Luis Potosi
MMZC - Zactecas
MMZO - Manzanillo Int'l

SAMX43 MMMZ
METAR
MMCL - Culiacan
MMCN - Ciudad Obregon
MMDO - Durango
MMGM - Guaymas/General Jose Maria Yanez Int'l
MMHO - Hermosillo/Int'l
MMLM - Los Mochis
MMLP - La Paz/General Manuel Marquez de Leon Int'l
MMLT - Loreto Int'l
MMML - Mexicali/General Rodolfo Sanchez Taboada Int'l
MMMZ - Mazatlan/General Rafael Beulna Int'l
MMSD - San Jose del Cabo Int'l
MMTJ - Tijuana/General Abelardo L. Rodriguez Int'l

SAMX44 MMMD
METAR
MMCE - Ciudad del Carmen
MMCM - Chetumal Int'l
MMCP - Campeche
MMCZ - Cozumel/Int'l
MMMD - Merida/Lic. Manuel Crecencio Rejon Int'l
MMMT - Minatitlan
MMTG - Tuxtla Gutierrez (mil)
MMTP - Tapachula Int'l
MMUN - Cancun Int'l
MMVA - Villahermosa

SAMX45 MMMY
METAR
MMAN - Monterrey Int/Aeropuerto del Norte
MMCS - Ciudad Juarez/Abraham Gonzales Int'l
MMCU - Chihuahua/Int'l
MMCV - Ciudad Victoria
MMIO - Satillo
MMMA - Matamoros/Int'l
MMMY - Monterrey/General Marianao Escobedo Int'l
MMNL - Nuevo Laredo Int'l
MMRX - Reynosa/Genral Lucio Blanco Int'l
MMTC - Torreon Int'l.

3. A Few North American Military Weather Frequencies

Most frequencies are assigned channel center. The dial/window frequency for FAX is usually 1.9 kHz lower, as we tune it in USB. RTTY can vary as much as 2 kHz either way, depending on receiver and habits of the operator.

RTTY is 850 Hz shift, 75 baud, ITA2 Baudot code. FAX is 120 lines per minute, with an Index Of Cooperation of 576. The US Air Force transmissions are not necessarily parallel, and not all frequencies are in use at all times.

This list is far from exhaustive, and frequencies change a couple of times in the average year. Consult Internet and published lists for more recent data.

3231.0 KAWN RTTY (Tune in LSB)
3131.0 KGWC FAX (Tune in USB)
4271.4 CFH FAX (Canadian Forces, Halifax; also RTTY)
4855.0 KGWC FAX
6496.4 CFH FAX (Canadian Forces, Halifax; also RTTY)
7398.0 KGWC FAX
7784.0 KAWN RTTY
7870.0 KGWC FAX
10536.0 CFH FAX (Canadian Forces, Halifax; also RTTY)
11120.0 KAWN RTTY (Tune in LSB)
11120.0 KGWC FAX (Tune in USB)
13510.0 CFH FAX (Canadian Forces, Halifax; also RTTY)
13530.0 KAWN RTTY
15781.0 KGWC FAX
19324.5 KAWN RTTY
19363.0 KGWC FAX
19530.0 KAWN RTTY (Usually "fox" marker)

4. "Old" Bulletin Type Codes

These use the first two letters TT in the group TTLLii at the beginning of the heading. These provide a quick indication most of the time, but WMO has subsequently adopted a far more detailed system which we will see in the appendices to this document.

Syntax: TTLL, where:

TT	**Explanation**
AB	Weather summaries
AC	Convective outlooks
AS	Surface analyses
AU	Upper level analyses
AX	Tropical discussions
CS	Climatic data
CU	Upper air climatic data
FA	Area forecasts
FB	Aviation forecasts
FC	Recovery forecasts
FD	Winds aloft forecasts
FE	Extended forecasts
FK	Air stagnation forecasts
FO	Model output forecasts
FP	Public forecasts
FQ	Metropolitan forecasts
FS	Surface forecasts
FT	Terminal forecasts
FU	Upper level forecasts
FV	Avalanche forecasts
FW	Recreational forecasts
FX	Prog discussions
FZ	Marine forecasts

NF	Special notices
NO	General notices
RW	River conditions, flood info and forecasts
SA	Surface observations
SD	Radar observations
SE	Earthquake observations
SF	Sferics weather data
SH	Synoptic ship reports
SI	Intermediate synoptic reports
SM	Synoptic observations
SP	Special reports
SR	River and rainfall observations
SS	Ship reports
ST	Ice reports
SX	Miscellaneous observations
TB	Satellite data
UA	Pilot reports
UC	Upper air data from ships
UE	Upper air data from ships
UF	Upper air data from ships
UG	Pibal/Rawinsonde data
UH	Pibal/Rawinsonde data
UI	Pibal/Rawinsonde data
UJ	Radiosonde data
UK	Radiosonde data
UM	Radiosonde data
UN	Radiosonde data
UQ	Radiosonde data
UP	Pibal/Rawinsonde data
UR	Aircraft reconnaissance data
US	Radiosonde data
UW	Radiosonde data
UX	Radiosonde data
UT	Aircraft reports
UY	Upper air data
UZ	Upper air data
WF	Tornado warnings
WO	Tropical depression advisories
WR	Flash flood warnings
WS	Sigmets
WT	Tropical storm/hurricane advisories
WU	Severe thunderstorm warnings
WW	Special weather statements and weather watches

5. WMO Heading Regional Codes

These are used in most bulletin headings in the LL or AA part of the TTLLii / TTAAii group.

LL	**Region**
AB	Albania
AG	Argentina
AH	Afghanistan
AI	Ascension Island
AJ	Azerbaijan, Republic of
AK	Alaska
AL	Algeria
AN	Angola
AT	Antigua, St. Kitts
AU	Australia
AY	Armenia. Republic of
AZ	Azores Islands
BA	Bahamas
BC	Botswana
BD	Brunei Darussalam
BE	Bermuda
BG	Bosnia & Herzegovina
BH	Belize
BI	Burundi
BJ	Benin
BK	Banks Islands
BM	Myanmar (Burma)
BN	Bahrain
BO	Bolivia
BR	Barbados
BU	Bulgaria
BV	Bouvet Island
BW	Bangladesh
BX	Belgium, Luxembourg
BY	Belarus, Republic of
BZ	Brazil
CD	Chad
CE	Central African Rep
CG	Congo
CH	Chile
CI	China
CM	Cameroon
CN	Canada
CR	Canary Islands (Spain)
CS	Costa Rica
CT	Canton Island
CU	Cuba
CV	Cape Verde Islands
CY	Cyprus
CZ	Czech Republic
DJ	Djibouti
DL	Germany

DN	Denmark
DO	Dominica
DR	Dominican Republic
DY	Democratic Yemen
EG	Egypt
EO	Estonia
EQ	Ecuador
ER	United Arab Emirates
ES	El Salvador
ET	Ethiopia
FA	Faeroes Islands
FG	French Guyana
FI	Finland
FJ	Fiji Islands
FK	Falkland Isl. (Malvinas)
FP	Saint Pierre Island & Miquelon
FR	France
FW	Wallis and Futuna Isl.
GB	Gambia
GC	Cayman Islands
GD	Grenada
GE	Gough Island
GG	Georgia, Republic of
GH	Ghana
GI	Gibraltar
GL	Greenland
GM	Guam Island
GN	Guinea
GO	Gabon
GQ	Equatorial Guinea
GR	Greece
GU	Guatemala
GW	Guinea-Bissau
GY	Guyana
HA	Haiti
HE	St. Helena Island
HK	Hong Kong
HO	Honduras
HU	Hungary
HV	Burkina Faso
HW	Hawaiian Islands
IC	Comoros
ID	Indonesia
IE	Ireland
IL	Iceland
IN	India
IQ	Iraq
IR	Iran
IS	Israel
IV	Cote d'Lvoire
IY	Italy
JD	Jordan
JM	Jamaica
JP	Japan
KA	Caroline Islands
KB	Kiribati
KG	Kirgiristan, Republic of
KI	Christmas Islands
KK	Cocos Islands
KN	Kenya
KO	Korea, Republic of
KP	Cambodia
KR	Democratic People's Republic of Korea
KU	Cook Island
KW	Kuwait
KY	Kyrghyzstan, Republic of
KZ	Kazakhstan,Republic of
LA	Lao People's Democratic Rep
LB	Lebanon
LC	Saint Lucia
LI	Liberia
LJ	Slovenia
LN	Southern Line Islands
LS	Lesotho
LT	Lithuania
LV	Latvia
LY	Libyan Arab Jamahiriya
MA	Mauritius
MB	Marion Island
MC	Morocco
MD	Madeira Island
MF	Saint-Martin, Saint-Bartholomew, Guadeloupe, etc
MG	Madagascar
MH	Marshall Islands
MI	Mali
MJ	Former Yugoslav Rep. of Macedonia
ML	Malta
MN	St.Maarten, St.Eustatius & Saba
MO	Mongolia
MR	Martinique Island
MS	Malaysia
MT	Mauritania
MU	Macao
MV	Maldives Islands
MW	Malawi
MX	Mexico
MY	Mariana Islands
MZ	Mozambique
NC	New Caledonia Island
NG	Papua New Guinea
NI	Nigeria

NK	Nicaragua
NL	Netherlands
NM	Namibia
NO	Norway
NP	Nepal
NR	Niger
NU	Aruba, Bonaire, Curacao
NV	Vanuatu
NW	Nauru Island
NZ	New Zealand
OM	Oman
OR	South Orkney Islands
OS	Austria
PF	French Polynesia Islands
PH	Philippines
PI	Phoenix Islands
PK	Pakistan
PL	Poland
PM	Panama
PO	Portugal
PR	Peru
PT	Pitcairn Island
PU	Puerto Rico
PY	Paraguay
QT	Qatar
RA	Russia, Republic of (East)
RE	Reunion and assoc. islands
RH	Croatia
RM	Republic of Moldova
RO	Romania
RS	Russia, Republic of (West)
RW	Rwanda
SB	Sri Lanka
SC	Seychelles Islands
SD	Saudi Arabia
SG	Senegal
SI	Somalia
SK	Sarawak
SL	Sierra Leone
SM	Suriname
SN	Sweden
SO	Solomon Islands
SP	Spain
SQ	Slovakia
SR	Singapore
SU	Sudan
SV	Swaziland
SW	Switzerland
SX	Santa Cruz Island
SY	Syria
SZ	Spitzbergen Islands
TC	Tristan da Cunha
TD	Trinidad and Tobago
TG	Togo
TH	Thailand
TI	Turks and Caicos Islands
TK	Tokelau Islands
TM	Timor
TN	Tanzania, United Rep of
TO	Tonga
TP	Sao Tome and Principe
TR	Turkmenistan, Republic of
TS	Tunisia
TU	Turkey
TV	Tuvalu
TZ	Tajikistan, Republic of
UG	Uganda
UK	United Kingdom and Northern Ireland
UR	Ukraine, Republic of
US	United States of America
UY	Uruguay
UZ	Uzbekistan, Republic of
VG	St. Vincent and the Grenadines
VI	Virgin Islands
VN	Venezuela
VS	Vietnam
YE	Yemen
YG	Yugoslavia
ZA	South Africa
ZB	Zambia
ZM	Western Samoa
ZR	Zaire
ZS	American Samoa
ZW	Zimbabwe

6. Full List Of Weather Codes

Text-Based Codes

Text-based codes pass data as letters and numbers (alphanumerics), as opposed to a continuous bit stream. They are usually broken up into standard groups for readability.

Baudot (ITA2), SITOR, and ASCII (ITA 5) are examples of text-based transmission modes. These codes are usually substitutions into lookup tables of longer strings or amounts, though occasionally raw data is

transmitted this way, as numbers or encoded into alphanumerics that represent the appropriate binary bits for direct crunching by computers.

SYNOP	(WMO FM-12) Surface Synoptic Reports
SHIP	(WMO FM-13) Ship Synoptic Reports
	Both of the above use a ship callsign or a WMO sea or land station number, followed by a time stamp. Up to four more sections follow, in 5 number groups except for the word ICE + a short text string, if ice observations are being passed in that section of the synopsis.
METAR	(WMO FM-15) Aviation Routine Observations. Hourly reports, usually at airports.
SPECI	(WMO FM-16) Special Aviation Weather Change
	For important changes before the next scheduled. METAR. Expands to word "SPECIAL" in voice ATIS or VOLMET, both of which use an altered METAR format.
DRIFTER	(WMO FM-18IX) Drifting Buoy Obs, now BUOY
BUOY	(WMO FM-18X) Buoy Observations
	Weather buoys can be treated as ships and pass data in SHIP code, or use this special format labeled SVXX in bulletins.
RADOB	(WMO FM-20) Radar Observations
RADREP	(WMO FM-22) Radiological Data
PILOT	(WMO FM 32) Upper Level Wind
PILOT SHIP	(WMO FM 33) Upper Level Wind
PILOT MOBIL	(WMO FM 34) Upper Level Wind
TEMP	(WMO FM-35) Upper Level Observations
TEMP SHIP	(WMO FM-36) Upper Level Observations
TEMP DROP	(WMO FM-37) Aircraft Dropsonde Obs.
TEMP MOBIL	(WMO FM-38) Upper Level Observations
ROCOB	(WMO FM-39) Rocketsonde Reports
ROCOB SHIP	(WMO FM-40) Rocketsonde Reports
CODAR	(WMO FM-41) Aircraft Report
AMDAR	(WMO FM-42) Aircraft Report
ICEAN	(WMO FM-44) Ice report
IAC	(WMO FM-45) Ship surface observation
IAC FLEET	(WMO FM-46) Ship surface observation
GRID	(FM 47-IX Ext) Gridded Data (sent as text)
	GRID provides observation data and information on how to plot it. The result is a picture.
WINTEM	(WMO FM-50) Upper-level Winds, Temperatures
TAF	(WMO FM-51) Terminal Aerodrome Forecasts
	A series of standard groups for valid times, starting FM "(in voice, "from") for the first, then with BCMG (in voice, "becoming,"). If weather is expected to change before the first valid time, a TEMPO ("temporarily") group is included. TAF, when expanded into plain speech, is part of the VOLMET.
ARFOR	(WMO FM-53) Aviation Routine Forecasts
ROFOR	(WMO FM-54) On-Route Aviation Forecasts
RADOF	(WMO FM-57) Radiological Dose Predictions
MAFOR	(WMO FM-61) Shipping Area Forecasts
TRACKOB	(WMO FM-62) Oceanographic Data
BATHY	(WMO FM-63) Oceanographic Data
TESAC	(WMO FM-64) Oceanographic Data
WAVEOB	(WMO FM-65) Oceanographic Data
HYDRA	(WMO FM-67) Hydrological River Reports
HYFOR	(WMO FM-68) Hydrological Forecast
CLIMAT	(WMO FM-71) Surface climatic data

CLIMAT SHIP (WMO FM-72) Surface marine climatic data
NACLI, CLINP,
SPCLI, CLISA,
INCLI (WMO FM-73) Oceanic climatic data
CLIMAT TEMP (WMO FM-75) Upper-air climatic data
CLIMAT TEMP SHIP (WMO FM-76) Upper-air marine climatic data
SFAZI (WMO FM-81) Special Atmospheric Reports
SFLOC (WMO FM-82) Special Atmospheric Reports
SAREP (WMO FM-85) Satellite Cloud Interpretations
SATEM (WMO FM-86) Satellite Remote Upper Soundings
SARAD (WMO FM-87) Satellite Radiance Observations
SATOB (WMO FM-88) Satellite Temps & Radiance Balance
CREX (None A.P.) Coded raw data table driven obs.
AIRMET Aviation Weather Advisory. Like a SIGMET, in a special clipped text format, but for less serious weather features.
AIREP ICAO Air Report, like a PIREP
PIREP Pilot Report of standard items. PIREPs go into a database, to be used by weather offices when briefing pilots.
RECCO Aircraft Reconnaissance Report. One important use of the RECCO format is for data returned by hurricane aircraft every 30 minutes.
TEMPO Rapidly Changing Weather. TEMPO is usually part of a TAF, describing weather expected to change within the hour.
SIGMET SIGnificant METeorological warning
A weather feature that poses a hazard to aviation. In the US, divided into convective (severe thunderstorms or tornadoes), and non- convective (things like turbulence and icing). Interestingly, SIGMET is also an officially defined hypertext markup document type. SIGMETs are in a clipped text format.
VORTEX Aircraft Hurricane Observations
Data passed from dropsonde aircraft while on the actual pass through the hurricane, including position fix, pressure, wind, and eye structure.

Binary Codes

BUFR (WMO FM-94) Binary Universal Form for the Representation of met. Data . BUFR is a completely binary code for computer crunching, passing data in octets as a binary stream, beginning with the designator BUFR in CCITT ITA5)
GRIB (FM 92-IX Ext) Gridded Binary Data
GRIB provides observation data and information on how to plot it, but unlike GRIB the data is intended for computer crunching alone. It, too is passed as octets, but in a text form these can show as hexadecimal bytes 00 through FF. The result looks like a "hex dump" with numbers and letters A through F.

7. Weather Code FAQ

Here are some common questions seen on Internet, and in mail to Utility World:

1. Q. I found an unid RTTY transmission that looks like "numbers," but the format is weird and some groups have letters. A. Look for things we've talked about, like AAXX, BBXX, METAR, SPECI, TEMPO, or KAWN, and you might be surprised.

2. Q. I went to the Air Force frequencies you wrote about, but nothing happened. A. Since all US HF military weather is on request, the schedules and frequencies are nearly as changeable as, well, the weather.

3. Q. I found the US Air Force FAX you talk about, and I seem to be in sync, but all I get is a skinny white line.
A. A lot of these faxes are apparently some sort of raster grid, and if there's no significant weather to plot, all that comes out on the amateur's typical computer screen is the sync beep at the edge. When there is significant weather, it can show up as standard synoptic symbols such as the two lines and a jagged arrow meaning "thunderstorm," or as a number, presumably for a SIGMET or similar. Everything else is black, except for a few groups looking like WMO headers, and maybe a couple of chicken scratchings that are there just because the equipment does these things. This is a good reason not to leave the printer on for Air Force weather fax.

4. Q. I'm getting good copy of the RTTY, but it's all numbers and doesn't fit any of these codes.
A. Yes, you've noticed this too. My guess is that it's raw output in some military version of something like GRID, GRIB, or BUFR.

5. Q. So where is the KAWN transmitter anyway?
A. It's wherever the US Air Force Automated Weather Network, formerly the Aviation Weather Network, is being picked up and relayed onto the radio. Since KAWN is not a radio callsign, it contains no information as to transmitter locations. The same holds for KGWC, KNHC, etc..

6. Q. What is QNH?
A. Altimeter setting in international and/or Metric units. Below a certain altitude, pilots manually offset their altimeters to compensate for changing barometric pressures which would otherwise cause measurement errors. It comes from an old international procedural "Q" signal from the days of Morse code. Simplified meaning of the old prosign is:

QNH? = "What is your station's altimeter setting (usually in Hectopascals) [at -?]," and
QNH = "Set your altimeter to - [at - hours]."

In the US national practice, "Altimeter" is substituted for "QNH," and the unit is inches of mercury. This is one way to tell whether a voice bulletin is coming from the US or somewhere else.

8. Useful WWW URLs

BUFR Code Specifications:
http://www-dd.fsl.noaa.gov/bufrFormat.html

Details of "Hurricane Hunter" use of RECCO and VORTEX codes:
http://www.hurricanehunters.com/

Entry point into weather station designator database:
http://www.nws.noaa.gov/oso/oso1/oso12/siteid.htm

NCDC Weather Station Locator:
http://www.ncdc.noaa.gov/ol/climate/stationlocator.html

SHIP synoptic code, with US Navy extensions
http://waves.ncdc.noaa.gov/ship/sec1-ch1.htm

Terminal Aerodrome Forecast code:
http://www.nws.noaa.gov/oso/oso1/oso12/d31/D31links.htm

UK Meteorological Office:
http://www.met-office.gov.uk/index.html

US Federal Meteorological Handbook:
http://www.nws.noaa.gov/oso/oso1/oso12/fmh1.htm

WMO Technical Library:
http://www.wmo.ch/web/arep/lib1/index.html

Appendices to this document

1. Full WMO Heading Decoder
2. Guide to the (BBB) Codes
3. The METAR Code
4. The SYNOP Code
5. The SVXX/BUOY Code

Appendix #1: Full WMO Heading Decoder, With Tables

The FULL symbolic form of the WMO abbreviated heading is:

T1T2A1A2ii CCCC YYGGgg (BBB)

The full lookup format for the WMO Abbreviated Heading uses a format where the first character of the "Type" field (T1) becomes the key to what the subsequent characters mean, and then some of these can also affect what happens next. This is how a 6-character group can store so much information.

The key list of T1 values is Table A from WMO Manual 306, (Code) or Observing / Product Type. It's best visualized as a matrix of jumps to subsequent tables, so that's just what we'll do. Get the first letter T1 from your bulletin, then look across to determine how to interpret subsequent characters, then drop down to the appropriate table and find them.

If this whole thing looks like a potentially good use for hypermedia like HTML code, well, it's been done. Try the US web site at http://www.nws.noaa.gov/

TABLE A
Data Type Designator T1 Matrix Table
for
T2A1A2ii definitions

T1	Data type	T2	A1	A2	ii	Priority	Max Lgth
A	Analyses	B1	C1	C1	**	3	3800
B	Service message	**	**	**	**	1/2/4*	3800
C	Climatic data	B1	C1	C1	**	4	3800
D	Grid point information (GRID)	B2	C3	C4	D2	3	3800
E	Satellite imagery	B5	C1	C1	**	3	(1)
F	Forecast	B1	C1	C1	**	3	3800
G	Grid point information (GRID)	B2	C3	C4	D2	3	3800
H	Grid point information (GRIB)	B2	C3	C4	D2	3	15,000

I Binary observation - BUFR	B3	C6	C3	**	3	15,000
J Binary forecast - BUFR	B3	C6	C3	**	3	15,000
K CREX	C7	C7	C3	**	2	3800
L --						
M --						
N Notices	B1	C1	C1	**	4	3800
O Oceanographic (GRIB)	B4	C3	C4	D1	3	15,000
P Pictorial information(binary)	B2	C3	C4	D2	3	15,000
Q Pictorial information regional	B2	C3	C5	D2	3	(1)
R --						
S Surface data	B1	C1/C2	C1/C2	**	2/4*	3800
T Satellite data	B1	C3	C4	**	2	3800
U Upper-air data	B1	C1/C2	C1/C2	**	2	3800
V National data	(3)	C1	C1	**	(2)	(1)
W Warnings	B1	C1	C1	**	1	3800
X GRID regional use	B2	C3	(2)	D2	3	3800
Y GRIB regional use	B2	C3	(3)	D2	3	15,000
Z GRIB National use	(3)	(3)	(3)	(3)	3	15,000

* Priority level:
1 is allocated to service messages
2 is allocated to data and request messages
4 is allocated to seismologic data (T1T2 = SE) or administrative messages
** See Para.2.3.2.2 (of WMO manual) for definition and use
*** See Para.2.4.2.3 for definition and use

(1) Size to be defined at a later date
(2) To be determined later date
(3) Table B2 or national table

DATA TYPES Y and Z uses National tables in some countries

This then selects one of the following:

Table B1 - Data Type Designator
Table B2 - Data Type Designator
Table B3 - Data Type designator
Table B4 - Data Type Designator
Table B5 - Data Type Designator
Table C1 - Geographical Designator
Table C2 - Geographical Designator (ships & Ocean)
Table C3 - Geographical Designator
Table C4 - Reference Time Designator
Table C5 - Reference Time Designator
Table C6 - Data Type Designator
Table C7 - Geographical Designator
Table D1 - Level Designator (ocean)
Table D2 - Level Designator
And U.S. National Tables
Table B6 - Data Type Designator
Table C8 - Geographical Area Designator (including WMC Washington GRID Numbers)

Table C9 - Geographical Area (Tiles) used with KWBx when x = Z
Table C10 - Reference Time Designator
Table D3 - Level Designator ii

T1 is taken from WMO Manual 386 table A. It is an alpha character that designates the general code form of the contents of the bulletin (Coded or plain text).

T2 is taken from WMO Manual 386 tables B1 through B6 depending on the designator T1 in table A. It is an alpha character that designates the data type.

A1 is taken from WMO Manual 386 tables C1 through C6 depending on designator T1 in table A (U.S. National practice through C9). It is an alpha character that designates the geographical area the content of the bulletin covers.

A2 is taken from WMO Manual 386 tables C1 through C5 depending on designator T1 in table A (U.S. National practice through C9). It is an alpha character that designates the geographical area, or may define the forecast period.

ii is taken from the WMO Manual 386 paragraph 2.3.2.2 definition, or from table D1 or D2 depending on designator T1 in table A (U.S. National practice table D3 replaces D2). It is a numeric set of two characters. Go to the WMO message structure for more details on this group.

When the group ii is used as a US designator, which it is not always the case, it expands to:

ii = 40, 50, ... 80 Issued from U.S. Pacific WFO
41, 51, ... 81 Issued from Northeast U.S. WFO or RFC
42, 52, ... 82 Issued from southeast U.S. WFO or RFC
(Includes San Juan, PR)
43, 53, ... 83 Issued from North Central U.S. WFO or RFC
44, 54, ... 84 Issued from South Central U.S. WFO or RFC
45, 55, ... 85 Issued from U.S. Rocky Mountains WFO or RFC
46, 56, ... 86 Issued from West Coast WFO or RFC
47, 57, ... 87 Issued from SE Alaska WFO (Juneau, AK)
48, 58, ... 88 Issued from Central Alaska WFO or RFC
(Anchorage, AK)
49, 59, ... 89 Issued from NE Alaska WFO (Fairbanks, AK).

CCCC is the 4-character international code.

YYGGgg is the standard date/time stamp of day, hours, minutes.

(BBB) is an optional group of alpha characters, reference BBB Group explanation in the next appendix to this document.

Here are the tables for the first group -

T1T2A1A2ii:

Table A
T1:
A Analyses
B Service message
C Climatic data
D Grid point information (GRID)
E Satellite imagery
F Forecast
G Grid point information (GRID)
H Grid point information (GRIB)
I Binary observation - BUFR
J Binary forecast - BUFR
K CREX
L --
M --
N Notices
O Oceanographic (GRIB)
P Pictorial information(binary)
Q Pictorial information regional
R --
S Surface data
T Satellite data
U Upper-air data
V National data
W Warnings
X GRID regional use
Y GRIB regional use
Z GRIB National use

Table B1
T2 (T1 = A, C, F, N, S, T, U or W)
T1 = A Analyses

C	Cyclone	[TEXT]
G	Hydro/Marine	[TEXT]
H	Thickness	[TEXT]
I	Ice	FM 44 (ICEAN)
O	Ozone layer	[TEXT]
R	Radar	[TEXT]
S	Surface	FM 45 (IAC)/FM 46 (IAC FLEET)
U	Upper air	FM 45 (IAC)
W	Weather Summary	[TEXT]
X	Miscellaneous	[TEXT]

T2 (T1 = C Climatic data):

A	Climatic anomalies	TEXT]
E	Monthly means (upper air)	FM 76 (CLIMAT TEMP SHIP)
H	Monthly means (surface)	FM 72 (CLIMAT SHIP)

	Monthly means (ocean areas)	FM 73 (NACLI, CLINP, SPCLI, CLISA, INCLI)
S	Monthly means (surface)	FM 71 (CLIMAT)
U	Monthly means (upper air)	FM 75 (CLIMAT TEMP)

T2 (T1 = F Forecasts)

A	Aviation area /GAMET/advisories	FM 53 (ARFOR)/[TEXT]
B	Upper winds and temperatures	FM 50 (WINTEM)
C	Aerodrome (VT › 12 hours)	FM 51 (TAF)
D	Radiological trajectory dose	FM 57 (RADOF)
E	Extended	[TEXT]
F	Shipping	FM 46 (IAC FLEET)
G	Hydrological	FM 68 (HYFOR)
H	Upper air thickness	[TEXT]
I	Iceberg	[TEXT]
J	Radio warning service (incl IUWDS data)	[TEXT]
K	Tropical cyclone advisories	[TEXT]
L	Local/Area	[TEXT]
M	Temperature extremes	[TEXT]
O	Guidance	[TEXT]
P	Public	[TEXT]
Q	Other shipping	[TEXT]
R	Aviation route	FM 54 (ROFOR)
S	Surface	FM 45 (IAC)/FM46 (IAC FLEET)
T	Aerodrome (VT > 12 hours)	FM 51 (TAF)
U	Upper air	FM 45 (IAC)
V	Volcanic ash advisories	[TEXT]
W	Winter sports	[TEXT]
X	Miscellaneous	[TEXT]
Z	Shipping area	FM 61 (MAFOR)

T2 (T1=N Notices)

G	Hydrological	[TEXT]
H	Marine	[TEXT]
N	Nuclear emergency response	[TEXT]
O	METNO/WIFMA	[TEXT]
P	Product generation delay	[TEXT]
T	TEST MSG[System related]	[TEXT]
W	Warning related and/or cancellation	[TEXT]

T2 (T1=S Surface Data)

A	Aviation routine reports	FM 15 (METAR)
B	Radar reports (part A)	FM 20 (RADOB)
C	Radar reports (part B)	FM 20 (RADOB)
D	Radar reports (parts A & B)	FM 20 (RADOB)
E	Seismic data (SEISMIC)	
F	Atmospherics reports	FM 81 (SFAZI)/FM 82 (SFLOC)/ FM 83 (SFAZU)
G	Radiological data report	FM 22 (RADREP)
I	Intermediate synoptic hour	FM 12 (SYNOP)/FM 13 (SHIP)
L	Table driven coded reports	FM ?? (CREX)
M	Main synoptic hour	FM 12 (SYNOP)/ FM 13 (SHIP)
N	Non-standard synoptic hour	FM 12 (SYNOP)/ FM 13 (SHIP)
O	Oceanographic data	FM 63 (BATHY)/FM 64 (TESAC)/FM 65 (WAVEOB)/FM 62 (TRACKOB)

P	Special aviation weather reports	FM 16 (SPECI)
R	Hydrological (river) reports	FM 67 (HYDRA)
S	Drifting buoy reports	FM 18 (DRIFTER)
T	Sea Ice	[TEXT]
U	Snow depth	[TEXT]
V	Lake ice	[TEXT]
X	Miscellaneous	[TEXT]

T2 (T1=T Satellite Data)

B	Satellite orbit parameters	[TEXT]
C	Satellite cloud interpretations	FM 85 (SAREP)
H	Satellite remote upper-air soundings	FM 86 (SATEM)
R	Clear radiance obs	FM 87 (SARAD)
T	Sea surface temperatures	FM 88 (SATOB)
W	Winds & cloud temperatures	FM 88 (SATOB)
X	Miscellaneous	[TEXT]
Y	Radiance Balance	TM 88 (SATOB)

T2 (T1=U Upper Air Data)

A	Aircraft reports	FM 41(CODAR), ICAO (AIREP)
D	Aircraft reports	FM 42(AMDAR)
E	Upper-level pressure,	FM 35(TEMP)/FM 36 (TEMP SHIP) temperature, humidity and wind (Part D) FM 38(TEMP MOBIL)
F	Upper-level pressure, temperature,	FM 35(TEMP)/FM 36 (TEMP SHIP)/ FM 38 (TEMP MOBIL)humidity and wind (Parts C and D) [National and bilateral option]
G	Upper-wind (Part B)	FM 32(PILOT)/FM 33 (PILOT SHIP)/FM 34 (PILOT MOBIL)
H	Upper-wind (Part C)	FM 32 (PILOT)/FM 33 (PILOT SHIP)/FM 34 (PILOT MOBIL)
I	Upper-wind (Parts A and B) [National and bilateral option]	FM 32 (PILOT)/FM 33 (PILOT SHIP)/FM 34 (PILOT MOBIL)
K	Upper-level pressure, temperature, (TEMP SHIP)/FM 38 (TEMP MOBIL) humidity and wind (Part B)	FM 35(TEMP)/FM 36
L	Upper-level pressure, temperature, humidity and wind (Part C)	FM 35 (TEMP)/FM 36 (TEMP SHIP)/FM 38 (TEMP MOBIL)
M	Upper-level pressure, temperature, humidity and wind (Parts A and B) [National and bilateral option]	FM 35 (TEMP)/FM 36 (TEMP SHIP)/FM 38 (TEMP MOBIL)
N	Rocketsonde reports	FM 39 (ROCOB)/FM 40 (ROCOB SHIP)
P	Upper-wind (Part A)	FM 32 (PILOT)/FM 33 (PILOT SHIP)/FM 34 (PILOT MOBIL)
Q	Upper-wind (Part D)	FM 32 (PILOT)/FM 33 (PILOT SHIP)/FM 34 (PILOT MOBIL)
R	Aircraft report	[NATIONAL*] (RECCO)
S	Upper-level pressure, temperature, FM 38 (TEMP MOBIL)	FM 35 (TEMP)/FM 36 (TEMP SHIP) humidity and wind (Part A)
T	Aircraft report	FM 41 (CODAR)
X	Miscellaneous	TEXT]
Y	Upper-wind (Parts C and D)	FM 32 (PILOT)/FM 33 (PILOT SHIP)/FM 34 (PILOT MOBIL) [National and bilateral option]
Z	Upper-level pressure, temperature,	FM 37(TEMP DROP), humidity and wind from a sonde released by carrier balloon or aircraft (Parts A, B, C, D)

T2 (T1=W Warnings)

A	Airmet	[TEXT]
C	Tropical cyclone (SIGMET)	[TEXT]

E	Tsunami	[TEXT]
F	Tornado	[TEXT]
G	Hydrological/River Flood	TEXT]
H	Marine/Coastal Flood	[TEXT]
O	Other	[TEXT]
S	SIGMET	[TEXT]
T	Tropical cyclone (Typhoon/Hurricane)	[TEXT]
U	Severe Thunderstorm	[TEXT]
V	Volcanic Ash Clouds (SIGMET)	[TEXT]
W	Warnings & weather summary	[TEXT]

Table B2

T2 (T1 = D, G, H, P, Q, V, X or Y)

A	Radar data
B	Cloud
C	Clear air turbulence
D	Thickness (relative topography)
E	Precipitation
F	Aerological diagrams (Ash cloud)
G	Significant weather
H	Height
I	Ice flow
J	
K	Swell height + combinations
L	Plain language
M	For national use
N	Radiation
O	Vertical velocity
P	Pressure
Q	Wet bulb potential temperature
R	Relative humidity
S	Snow cover
T	Temperature
U	Eastward wind component
V	
X	Lifted index
Y	Observational plotted chart
Z	Not assigned

Table B3

T2 (T1=I or J Binary Data - BUFR)

S	Surface/sea level
U	Upper AirOceanographic/limnographic (water properties)
P	Pictorial
T	Text (plain language information)
X	Other data types
Z	Mixed data types

Table B4

T2 (T1=O Oceanographic - GRIB)

D	Depth

E Ice concentration
F Ice thickness
G Ice drift
H Ice growth
I Ice convergence/divergence
Q Temperature anomaly
R Depth anomaly
S Salinity
T Temperature
U Current component
V not assigned
W Temperature warming
X Mixed data values

Table B5

T2 (T1 = E Satellite Imagery)

C Cloud top temperature
F Fog
I Infrared Range
S Surface temperature
V Visible Range
W Water vapor
Y User specified
Z Unspecified

Table C1

Land observation locations A1A2 use the same country codes as seen previously for the identical LL in part 5 of our main document. Please refer to that section.

Other Geographical Area Designators:

AA Antarctic
AC Arctic
AE South-East Asia
AF Africa
AM Central Africa
AO West Africa
AP Southern Africa
AS Asia
AW Near East
AX Arabian Sea area

BQ Baltic Sea area

CA Caribbean & Central America

EA East Africa
EC East China Sea area
EE Eastern Europe
EM Middle Europe

MP Central Mediterranean
MQ Western Mediterranean

NA North America
NT North Atlantic area

OC Oceana
OH Sea of Okhotsk

PA Pacific area
PE Persian area
PN North Pacific area
PQ Western North Pacific
PS South Pacific area
PW Western Pacific area
PZ Eastern Pacific area

SA South America
SE Southern Ocean area

EN Northern Europe
EU Europe
EW Western Europe

FE Far East

GA Gulf of Alaska area
GX Gulf of Mexico area

IO Indian Ocean area
ME Eastern Mediterranean area
MM Mediterranean area

SJ Sea of Japan area
SS South China Sea area
ST South Atlantic area

XE Eastern hemisphere
XN Northern hemisphere
XS Southern hemisphere
XT Tropical belt
XW Western hemisphere
XX For use when others are not appropriate

Table C2

Geographical Designator A1 A2

1. The first letter A1 will denote the nature of the ship or automatic marine station:

For ocean weather stations: W
For mobile ships and other marine stations: V

2. The second letter A2 will denote the area from which the reports contained in the bulletin originate:

Designator	Data Area
A	Area between 30o N - 60o S, 035o W - 070o E
B	Area between 90o N - 05o N, 070o E - 180o E
C	Area between 05o N - 60o S, 120o W - 035o W
D	Area between 90o N - 05o N, 180o W - 035o W
E	Area between 05o N - 60o S, 070o E - 120o W
F	Area between 90o N - 30o N, 035o W - 070o E
J	Area between 60o S
X	More than one area

Table C3
Location Codes

(A1 when T1=D,G,O,P,or T, A2 when T1= I, J, or K

A	0 - 90 W northern hemisphere
B	90W - 180 northern hemisphere
C	180 - 90E northern hemisphere
D	90E - 0 northern hemisphere
E	0 - 90W tropical belt
F	90W - 180 tropical belt
G	180 - 90E tropical belt
H	90E - 0 tropical belt
I	0 - 90W southern hemisphere
J	90W - 180 southern hemisphere
K	180 - 90E southern hemisphere

L	90E - 0 southern hemisphere
N	Northern hemisphere
P	Area between 64.69N - 136.76W, 55.61N - 13.43W 64.69N - 156.76W, 55.61N - 33.43W
S	Southern hemisphere
T	45W - 180 northern hemisphere
U	Area between 21.0N - 128.1W, 36.0N - 130.9W 21.1N - 113.0W, 36.2N - 110.5W
V	Area between 30.3N - 83.7W, 51.0N - 68.9W 19.8N - 64.5W, 33.3N - 47.1W
X	Global Area (area not definable)

When T1=H:

A	0 - 180 E northern hemisphere [21]
B	180 W - 0 northern hemisphere [22]
C	0 - 180 E southern hemisphere [23]
D	180 W - 0 southern hemisphere [24]
E	0 - 355 E northern hemisphere [25]
F	0 - 355 E southern hemisphere [26]
G	Regional use
H	Not Assigned
I	30 W - 60 E northern hemisphere [37]
J	60 W - 150 E northern hemisphere [38]
K	150 E - 120 W northern hemisphere [39]
L	120 W - 30 W northern hemisphere [40]
M	30 W - 60 E southern hemisphere [41]
N	60 W - 150 E southern hemisphere [42]
O	150 E - 120 W southern hemisphere [43]
P	120 W - 30 W southern hemisphere [44]
Q-S	Not Assigned
T	0 - 180 E northern hemisphere [61]
U	180 W - 0 northern hemisphere [62]
V	0 - 180 E southern hemisphere [63]
W	180 W - 0 southern hemisphere [64]
X	Regional use
Y-Z	Not Assigned

Table C4

Time Designators

A2 when T1 = D,G,H,O, P, or T

A	Analysis (00 hour)
B	6 hours forecast
C	12 hours forecast
D	18 hours forecast
E	24 hours forecast
F	30 hours forecast
G	36 hours forecast
H	42 hours forecast
I	48 hours forecast
J	60 hours forecast

K 72 hours forecast
L 84 hours forecast
M 96 hours forecast
N 108 hours forecast
O 120 hours forecast
P 132 hours forecast
Q 144 hours forecast
R 156 hours forecast
S 168 hours forecast
T 10 days forecast
U 15 days forecast
V 30 days forecast
W...Z Not assigned

Table C5
Reference Time Designators
(A2 when T1 = Q, X, or Y)

A Analysis (00 hour)
B 3 hours forecast
C 6 hours forecast
D 9 hours forecast
E 12 hours forecast
F 15 hours forecast
G 18 hours forecast
H 21 hours forecast
I 24 hours forecast
J 27 hours forecast
K 30 hours forecast
L 33 hours forecast
M 36 hours forecast
N 39 hours forecast
O 42 hours forecast
P 45 hours forecast
Q 48 hours forecast
R 54 hours forecast [48+6]
S 66 hours [+12]
T 78 hours
U 90 hours
V 102 hours
W 114 hours
X 126 hours
Y 138 hours
Z 150 hours

Table C6
Data Type Designator
(A1 = I, or J)

1. The designators specified in this table should be used to the greatest extent possible to indicate the type of data contained within the body of the BUFR bulletin.

2. Where more than one data type is contained in the bulletin, the designators for only one of the data types should be used.

3. When the table does not contain a suitable designator for the data type, an alphabetic designator which is not assigned in the table should be introduced and the WMO Secretariat notified.

T1 = I Observational Data and
T2 = S Surface

Designator	Data type
A	Land based hourly reports
C	Climatic reports
I	Land intermediate synoptic reports
M	Land based Main synoptic reports
N	Land based asynoptic intermediate reports
P	Land based hourly specials
S	Floating platforms (ship, buoy, etc.)
R	Hydrologic reports
X	Other surface data
Z	Bulletins with mixed data type reports

T1 = I Observational Data and
T2 = U Upper Air

Designator	Data type
A	Single level aircraft reports
B	Single level balloon reports
C	Single level satellite derived reports
D	Dropsonde/dropwindsondes
M	Model derived sondes
N	Rocketsondes
P	Profilers
R	Radiance data
S	Radiosondes/pibal reports
T	Satellite derived sondes
X	Other upper air reports
Z	Mixed upper air reports

T2 = T TEXT

Designator	Data type
A	Administrative message
B	Service message
R	Request for data (inclusive of type)
X	Other text messages of information
Z	Mixed text types

T1 = I Observational Data and
T2 = P PICTORIAL

Designator	Data type
I	Satellite imagery data
R	Radar reports
X	Not defined
Z	Mixed data types

T1 = I or J Observational Data / Forecast Products) and
T2 = O Oceanographic/Limnographic

Designator	Data type
I	Sea ice
S	Sea surface and below soundings
T	Sea surface temperature
W	Sea surface waves
X	Other sea environmental
Z	Mixed collection of oceanographic types

T1 = J (Forecast Products) and
T2 = S Surface/Sea Level

Designator	Data type
A	Surface area forecast (e.g. airway)
M	Surface forecast (e.g. MOS)
P	Forecast amendments (e.g. airways)
R	Hydrologic forecast
S	Forecast amendments (TAF)
T	Aerodrome forecast (TAF)
X	Other surface forecasts
Z	Mixed collection of forecast types

T1 = J (Forecast Products) and
T2 = U Upper Air

Designator	Data type
A	Forecast at single levels
S	Forecast soundings
X	Other upper air forecasts
Z	Mixed collection of forecast types

T1 = J (Forecast Products) and
T2 = T TEXT WARNINGS/Notices

Designator	Data type
E	Tsunami
H	Hurricane, typhoon, tropical storm warning
S	Severe weather, SIGMET
T	Tornado warning
X	Other warnings
Z	Mixed collection of warnings

Table C7

Data Type Designator A1 for Values of T2 = S, U, O, F, and V (when T1 = K - CREX) CBS XI, Cairo 1996

1. The designators specified in this table should be used to the greatest extent possible to indicate the CREX type of observational data contained within the body of the bulletin.

2. When the table does not contain a suitable designator for the observational data type, an alphabetic designator which is not assigned in the table should be introduced and the WMO Secretariat notified.

3. In the event no standard format has been established for a particular data type, and there is a recommended format, that format is given in square brackets under the column labeled Code Form (e.g. [ASCII]). This is a character code - International Alphabet No.5 (Attachment II-2) will be used.

T2 = S Surface

A1

Designator	Data type	Code Form (CREX)
A	Land based hourly reports	[ASCII]
C	Climatic reports	[ASCII]
I	Land intermediate synoptic reports	[ASCII]
M	Land based main synoptic reports	[ASCII]
N	Asynoptic intermediate reports	[ASCII]
P	Land based hourly specials	[ASCII]
S	Floating platforms (ship, buoy, etc.)	[ASCII]
R	Hydrologic reports	[ASCII]
X	Other surface reports	[ASCII]
Z	CREX bulletins with mixed data type rpts	[ASCII]

T2 = U Upper Air

A1

Designator	Data type	Code Form (CREX)
A	Single Level aircraft reports	[ASCII]
B	Single level balloon reports	[ASCII]
C	Single level satellite derived reports	[ASCII]
D	Dropsondes/dropwindsondes	[ASCII]
L	Ozone data	[ASCII]
N	Rocketsondes	[ASCII]
P	Profiler	[ASCII]
R	Radiance data	[ASCII]
S	Radiosonde/pibal	[ASCII]
T	Satellite derived sondes	[ASCII]
X	Other upper air reports	[ASCII]
Z	Mixed upper air data type reports	[ASCII]

T2 = O Oceanographic/Liminographic

A1

Designator	Data type	Code Form (CREX)
I	Sea Ice	[ASCII]
S	Sea surface and below sounding	[ASCII]

T	Sea surface temperature	[ASCII]
W	Sea surface waves	[ASCII]
X	Other sea environmental	[ASCII]
Z	Mixed collection of oceanographic types	[ASCII]

T2 = F FORECASTS - Surface/Sea Level
A1

Designator	Data type	Code Form (CREX)
A	Surface area forecast (e.g. airways)	[ASCII]
M	Surface forecasts (e.g. MOS)	[ASCII]
P	Forecast amendments (airways)	[ASCII]
R	Hydrologic forecasts	[ASCII]
S	Forecast amendments (TAF)	[ASCII]
T	Aerodrome forecasts (TAF)	[ASCII]
X	Other surface forecasts	[ASCII]
Z	Mixed collection of forecasts	[ASCII]

T2 = V FORECASTS - Upper Air
A1

Designator	Data type	Code Form (CREX)
A	Single level	[ASCII]
S	Soundings	[ASCII]
X	Other upper air forecasts	[ASCII]
Z	Mixed collection of forecasts	[ASCII]

Note: The allocation of abbreviated headings for CREX messages is pending the formal approval of the code CREX.

Table D1
Level Designators (ii when T1=O)

98	Surface	62	500
96	2.5	60	600
94	5.0	58	700
92	7.5	56	800
90	12.5	54	900
88	17.5	52	1000
86	25.0	50	1100
84	32.5	48	1200
82	40.0	46	1300
80	50.0	44	1400
78	62.5	42	1500
76	75.0	40	1750
74	100	38	2000
72	125	36	2500
70	150	34	3000
68	200	32	4000
66	300	30	5000
64	400	01	Primary layer depth

Table D2
Level Designators (ii when T1= D,G,H,P,Q,X or Y)

99	1000 hPa
98	Air properties for the earth's surface
97	Level of the tropopause
96	Level of maximum wind
95	950 hPa
94	Level of 0oC isotherm
93	Not assigned - 975 hPa(U.S. use)
92	925 hPa
91	Not assigned - 875 hPa(U.S. use)
90	900 hPa
89	Any parameter reduced/sea level (MSLP)
88	Ground/water properties for the earth's surface (i.e. snow cover, wave & swell)
87	1000-500 hPa thickness
86	Boundary Layer
85-01	Hundreds and tens digits of the hectopascal level (e.g. 70 = 700 hPa;03 = 030 hPa) TO INCLUDE: 81 = 810 hPa = 6000ft FL 82 = 825 hPa(U.S. use) 77 = 775 hPa(U.S. use) 73 = 730 hPa = 9000ft FL 72 = 725 hPa(U.S. use) 67 = 675 hPa(U.S. use) 65 = 650 hPa = 12000ft FL 62 = 625 hPa(U.S. use)
00	Entire Atmosphere (e.g. precipitable water)

US Tables

Table B6
Data Type designator T2 (when T1 = Y or Z)

U.S. Table for National GRIB Products
U.S. National Practice

1. The designator specified in this table should be used to the greatest extent possible to indicate the data types of the data contained within the text of the bulletin.

2. Where the data type does not correspond exactly with the designator, the designator for the most approximate type of the data may be used.

3. The NWS will assign designators to this table in place of the unassigned designators when needed.

Designator	Data Type
A	Cloud parameters (ice, water)
B	Vertical Wind Shear
C	Vorticity
D	Probability Values (Thunderstorm, Precip types, Cloud types)
E	Precipitation parameters (Precip. water, convective Precip.)
F	Long wave radiation
G	Temperature Values (Maximum, Minimum, Dew Point)
H	Height (geopotential)
I	unassigned
J	unassigned
K	Ocean wave properties (Period, Direction)
L	unassigned
M	unassigned
N	unassigned
O	Vertical velocity/Surface Lifted index
P	Pressure
Q	Stability Index
R	Relative humidity
S	Snow properties
T	Temperature
U	Wind components (U V)
V	unassigned
W	Cape/Cin/Helicity
X-Z	unassigned

Table C8

Geographical area designator A1
(when T1 = H)
U.S. National Table derived from WMO Table C3

1. The designator specified in this table should be used to the greatest extent possible to indicate the geographical area of the data contained within the text of the bulletin.

2. Where the geographical area of the data does not correspond exactly with the designator, the designator for the area most approximating that of the data may be used.

3. When the table does not contain a suitable designator for the geographical area, an alphabetic designator which is not assigned in the table will be introduced.

Designator	Geographical Area	
A	0 - 180 E northern hemisphere	[21]
B	180 W - 0 northern hemisphere	[22]
C	0 - 180 E southern hemisphere	[23]
D	180 W - 0 southern hemisphere	[24]
E	0 - 355 E northern hemisphere	[25]
F	0 - 355 E southern hemisphere	[26]
G	Regional use	
H	Not Assigned	

I	30 W - 60 E northern hemisphere [37]
J	60 W - 150 E northern hemisphere [38]
K	150 E - 120 W northern hemisphere [39]
L	120 W - 30 W northern hemisphere [40]
M	30 W - 60 E southern hemisphere [41]
N	60 W - 150 E southern hemisphere [42]
O	150 E - 120 W southern hemisphere [43]
P	120 W - 30 W southern hemisphere [44]
Q-S	Not Assigned
T	0 - 180 E northern hemisphere [61]
U	180 W - 0 northern hemisphere [62]
V	0 - 180 E southern hemisphere [63]
W	180 W - 0 southern hemisphere [64]
X	Regional use
Y-Z	Not Assigned

Geographical area designator A1
(when T1 = Y or Z)

Designator	Geographical Area	NCEP GRID No.
A	northern hemisphere	[201]
B	unassigned	
C	unassigned	
D	unassigned	
E	unassigned	
F	unassigned	
G	unassigned	
H	National CONUS w/ Double Resolution	[213]
I	National CONUS	[202]
J	National Alaska	[203]
K	National Hawaii	[204]
L	National Puerto Rico	[205]
M	Regional MARD	[206]
N	Regional Alaska	[207]
O	Regional Hawaii	[208]
P	Regional Puerto Rico	[210]
Q	Regional CONUS	[211]
R	Regional CONUS w/ Double Resolution	[212]
S	Regional MARD w/ Double Resolution	[209]
T	Regional Alaska w/ Double Resolution	[214]
U	Regional CONUS	[215]
V	Regional Alaska	[216]
W-Z	unassigned	

Table C9
Geographical-Tile Number designator T2 A1 (when T1 = Z and the CCCC = KWBZ)

(A DRAFT U.S. National Practice Table)
Instructions for the proper application of the Geographical "TILE" number designator - A two character field of the heading.

1. The designator specified in this table should be used to the greatest extent possible to indicate the geographical high resolution grid tile number of the data contained within the geographical area as specified by the grid squares defined by the producing center of the GRIB bulletin.

2. Where the geographical tile number for the area of the data does not correspond exactly with the designator, the number designator for the area most approximating that area of the data may be used. The exact area of coverage will be available within the GRIB Product Definition Section (PDS) of the bulletin.

Designator	Geographical Area Tile Number	NCEP Model
AA - AW	01 - 24 CONUS 20 km tiles	meso-Eta
AY - AZ	unassigned	
BA - BW	01 - 24 CONUS 20 km tiles	RUC
BY - BZ	unassigned	
CA - CW	unassigned	
CY - CZ	unassigned	
DA - DZ	unassigned	
EA - EZ	unassigned	
FA - FZ	unassigned	
GA - GZ	unassigned	
HA - KR	01 - 96 CONUS 10 km tiles	meso-Eta
KS - KZ	01 - 08 Alaska 20 km tiles	RUC
LA - OR	01 - 96 CONUS 10 km tiles	RUC
OS - OZ	01 - 08 Hawaii 20 km tiles	RUC
PA - QZ	unassigned	
RA - RF	01 - 06 CONUS 40 km tiles	meso-Eta
RG - RL	01 - 06 CONUS 40 km tiles	RUC
RM - RR	01 - 06 Alaska 40 km tiles	meso-Eta
RS - RX	01 - 06 Alaska 40 km tiles	RUC
RY - RZ	unassigned	
SA - SF	01 - 06 Hawaii 40 km tiles	meso-Eta
SG - SL	01 - 06 Hawaii 40 km tiles	RUC
SM - ZZ	unassigned	

Table C10

Reference Time designator A2 (when T1 = Y or Z)

1. The designator specified in this table should be used to the greatest extent possible to indicate the reference time of data contained within the text of the bulletin.

2. When the table does not contain a suitable designator for the reference time, use "Z" and obtain the forecast hour from the GRIB Product Definition Section.

Designator	Data Type	Designator	Data Type
A	Analysis (00 hour)	N	18 hours forecast
B	1 hour forecast	O	24 hours forecast
C	2 hours forecast	P	30 hours forecast
D	3 hours forecast	Q	36 hours forecast
E	4 hours forecast	R	42 hours forecast
F	5 hours forecast	S	48 hours forecast (2 days)
G	6 hours forecast	T	60 hours forecast
H	7 hours forecast	U	72 hours forecast (3 days)

I	8 hours forecast	V	84 hours forecast
J	9 hours forecast	W	96 hours forecast (4 days)
K	10 hours forecast	X	108 hours forecast
L	11 hours forecast	Y	120 hours forecast (5 days)
M	12 hours forecast	Z	Time contained in PD Block of GRIB code

Table D3

Level designator ii (when T1 = H, X, Y, or Z)

(U.S. National Practice definitions included)

Instructions for the proper application of level (elevations above the earth's surface) designator.

1. The designator specified in this table should be used to the greatest extent possible to indicate the level of the data contained within the text of the bulletin.

2. When data at more than one level are contained in the text, the designator for only one of the levels should be used.

3. When the table does not contain a suitable designator for the level, a designator which is not assigned in the table should be used.

The U.S. Practice uses 25 mb increments 1000-100 mb and are included below.

ii

Designator	Level
00	Entire Atmosphere (e.g. precipitable water)
99	1000 hPa
98	Air properties for the earth's surface
97	Level of the tropopause
96	Level of maximum wind
95	950 hPa
94	Level of 0oC isotherm
93	975 hPa
92	925 hPa
91	875 hPa
90	900 hPa
89	Any parameter reduced/sea level (MSLP)
88	Ground/water properties for the earth's surface (i.e. snow cover, wave & swell)
87	1000-500 hPa thickness
86	Boundary Layer
74	Cloud top level
85-01	Hundreds and tens digits of the hectopascal level(e.g. 70=700 hPa;03=030 hPa) TO INCLUDE: 81 = 810 hPa = 6000ft FL 82 = 825 hPa 84 = 875 hPa 77 = 775 hPa 73 = 730 hPa = 9000ft FL

72 = 725 hPa
67 = 675 hPa
65 = 650 hPa = 12000ft FL
62 = 625 hPa
50 = 510 hPa = 18000ft FL (U.S. National Practice uses 500 mb level)
11 = First 30 mb average thickness [from surface]
12 = Second 30 mb average thickness
13 = Third 30 mb average thickness
14 = Forth 30 mb average thickness
45 = Fifth 30 mb average thickness
16 = Sixth 30 mb average thickness

Note: The 810, 730, and 650 hPa levels are not being used as pressure levels, they are being used as geometric heights.

Appendix #2: What BBB Codes Mean

GUIDELINES on the USE of the INDICATOR BBB

T1T2A1A2ii CCCC YYGGgg (BBB)

This line, which is preceded by "format effectors" [cr] [cr] [lf], constitutes the complete WMO abbreviated heading line, which can contain the optional BBB group, indicated by the open and closed parenthesis ( ).

General Instructions

The WMO abbreviated heading line, including each unique YYGGgg (date time group), shall be used only once a month, due to the day of the month being part of the heading. The indicator BBB shall only be added when a WMO abbreviated heading has already been used for transmission of an initial bulletin. It indicates that the contents to be a delayed, corrected or amended bulletin. The indicator BBB can also be used for segmentation as described below in paragraph 5.

The indicator BBB shall only be included in the WMO abbreviated headings of delayed (retard), corrected, or amended bulletins by those centres which are responsible for preparing, or compiling the bulletins concerned, or for communication transmission reasons by any system as a segment sequence indicator when bulletins are segmented to control bulletin size.

Once the initial bulletin has been transmitted, the centre responsible for preparing or compiling the original bulletin uses the indicator BBB to transmit delayed or corrected reports or to amend information for the same abbreviated heading containing the same YYGGgg.

A centre shall not construct an abbreviated heading with the indicator BBB for delayed, corrected, amended, bulletins having a size larger than the limit defined in TABLE A as it would cause a communications system to segment it before transmission.

The Bulletin Segment Heading is a special form of the WMO abbreviated heading where the indicator BBB takes the form of Pxx.

The bulletin segment heading replaces the normal WMO abbreviated heading when bulletins are larger than size limit defined in WMO Table A. The bulletin segment heading shall take the place of the WMO abbreviated heading for electronic transmission purposes. The bulletin segment heading is a repeating heading, with a unique Pxx group for each segment. The original WMO bulletin shall be reconstructed from these segments before use.

The bulletin segment heading cannot be used in place of a standard WMO abbreviated heading of a bulletin if any of the other indicator BBB options are present. This normally will not be a problem as a delayed, corrected, or amended bulletin with the indicator BBB should be smaller then the initial message. However, the U.S. has established a National practice to support the transmission of plain text bulletins containing an abbreviated heading with a BBB group which are too large for transmission.

BBB Forms
The four forms of the BBB indicator group are:

RRx - Delayed (Retard)
CCx - Correction
AAx - Amendment
Pxx - Segment number
Each form precludes the use of the others in the same bulletin. The RRx, CCx, and AAx forms are attributes of the content of the bulletin, and the Pxx is an attribute of the segment number not the content. Each form is described separately below.

RRx Indicator Group - Delayed Routine Meteorological Reports [retard]

This indicator group has the form RRx; where: x = A through X. It is used to transmit a collection of one or more weather reports which are normally contained in the initial bulletin but which were received after the initial bulletin has been transmitted. The value of x = A is for the first bulletin containing additional reports; a value of x = B for a second bulletin containing additional reports, if necessary, and, so on up to and including x = X. For x = Y it represents a loss of the record of the sequence by the issuing center. For x = Z it represents the compiled bulletin is over 24 hours after the time of observation.

CCx Indicator Group -Corrections to Previously Transmitted Reports This indicator group has the form: CCx; where x = A through X. It is used to transmit a bulletin containing corrections to reports that have already been included in a bulletin previously transmitted. The value of x = A is for the first bulletin containing corrected reports; a value of x = B for a second bulletin containing additional corrected reports, if necessary, and, so on up to and including x = X. For x = Y it represents a loss of the record of the sequence by the issuing center. For x = Z it represents the compiled bulletin is over 24 hours after the time of observation.

AAx Indicator Group - Amendments to Processed Information This indicator group has the form AAx; where x = A through X. It is used to transmit a bulletin containing amendments to processed information in a bulletin which has previously been sent. The value of x = A is for the first bulletin containing information amending the basic (initial) bulletin; a value of x = B for a second bulletin containing information amending the basic (initial) bulletin, if necessary, and so on up to and including x = X. For x = Y it represents a loss of the record of the sequence by the issuing center. For x = Z it represents the compiled bulletin is over 24 hours after the time of observation.

Pxx Indicator Group - Segmentation of a Large Bulletin

When a bulletin exceeds the length limit defined in Table A, it shall be segmented for communications purposes using a bulletin segment heading line utilizing the Pxx Indicator Group. There are two different

structures possible for segments. Segmented alphanumeric products have a supplementary identification line which repeats information in addition to the bulletin segment heading line in each segment. Segmented binary products do not repeat the supplementary identification line information in a second line for each subsequent segment. Only the bulletin segment heading line is repeated.

Defining: Pxx = values of xx = AA through YZ and ZA through ZZ

The following principles shall apply when segmenting alphanumeric bulletins for transmission:

- The first bulletin segment heading will have sequence indicator xx = AA, the second AB and so on up to the last bulletin segment heading which shall have xx = Zx.
- The Z is a LAST SEGMENT FLAG and is placed in the first x position of the Pxx group of the last segment of the set of bulletin segments with the second x the sequence letter which would have normally been used if this was not the last segment.
- This special PZx group is required to inform the receiving center that no more bulletin segments exist for this product.
- Any original code form or product identification indicator shall be included in each bulletin segment heading and is called a supplementary identification line.
- Except for the last segment, segment lengths shall be as long as possible, within approved bulletin length limits [Table A] and formatting constraints.
- Segmented bulletin breaks shall immediately follow end-of-report indicator signals (= signs) when or where available in close proximity to the size limit. When end-of report indicators can't be used, segmented plain text bulletins will be broken on an end-of-line function or on a space if the end-of-line function can not
- be found in close proximity to the size limit.
- All WMO Regional Telecommunication Hubs on the Global Telecommunication System should relay bulletin segments as received on the Main Trunk Network.
- Upon receipt all plain text bulletin segments the receiving end shall re-built the original bulletin prior to use, as the segmentation procedure is for transmission purposes only.
- Bulletin segments must be processed to re-build the original bulletin to obtain a complete plain text product.

U.S. National Practice

If it is necessary to segment a bulletin which exceeds the limits established by WMO and the bulletin already utilizes a bulletin attribute (BBB), the following procedures will be used. A bulletin segmentation heading including the appropriate Pxx indicator group will be used; and the original bulletin attribute (BBB) will be included as a separate line followed immediately by the line function carriage return, carriage return, line feed in the first segment only. (see examples below)

Binary Bulletins

The following principles shall apply when segmenting binary bulletins (i.e. GRIB, BUFR, and T4 FAX bulletins): Bulletin segment lengths shall be as long as possible, as allowed by approved bulletin length limits (except for the last segment) RTHs should relay bulletin segments as received An example of the segmentation of a T4 FAX WMO bulletin that has been received too large according to Table A for onward transmission without segmentation:

Example:

FIRST BULLETIN SEGMENT

PGEE25 KWBC 181200 PAA
DFAX 1064 bbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbb
bbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbb
bbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbb
bbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbb
bbbbbbbbbbbbbbbbbbbb .....etc...

[until 15000 octets have been reached]

SECOND BULLETIN SEGMENT

PGEE25 KWBC 181200 PAB
bbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbb
bbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbb
bbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbb
bbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbb
bbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbb
bbbbbbbbbbbbbbbbbbbb .....etc...

[until 15000 octets have been reached]

THIRD BULLETIN SEGMENT

PGEE25 KWBC 181200 PAC
bbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbb
bbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbb
bbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbb
bbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbb
bbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbb
bbbbbbbbbbbbbbbbbbbb .....etc...

[until 15000 octets have been reached]

FOURTH and LAST BULLETIN SEGMENT

PGEE25 KWBC 181200 PZD
bbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbb
bbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbb
bbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbb
bbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbb
bbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbb
bbbbbbbbbbbbbbbbbbbb .....etc...

[until something less than 15000 octets have been reached]

Warning !
Bulletin segments must be processed to re-build the original bulletin from it's segment parts to be able to obtain the complete binary bulletin prior to further use.

All binary bulletins greater than 15,000 bytes will be segmented unless prior mutual agreement between adjacent centers has established otherwise. The segments will be based upon size only and no consideration will be given to where the break occurs. Bulletin segments will have no additional information added beyond the bulletin segment heading line itself, containing the BBB group of Pxx to accomplish the segmentation process.

Additional comments on the use of the BBB groups.

An RTH on the GTS should ensure the relay of any bulletins received in accordance with its routing directories even if the bulletins are in fact bulletin segment heading lines and have not been received in the correct sequence. All the bulletin segments containing the indicator Pxx shall be relayed to enable the end user to reconstruct and use the original bulletin.

In case of incomplete or incorrect reception, the use of the addressed message for request/reply may be required for recovering incomplete or incorrect bulletin(s). The request for a bulletin segment may be acceptable, or the request for the repeated transmission of the entire set of information (i.e. the whole sequence of bulletin segments) may be necessary, in which case the indicator Pxx would not be used in the request.

Appendix #3: The METAR Code

METAR was adopted in 1996 as the world standard, replacing the Airways Code used in the US. More recently, such US broadcasts as ATIS and VOLMET have gone to the METAR form for reporting observations. The biggest change is the use of Celsius for temperature in the US. Exceptions to the international standard allow for the use of feet, inches, and statute miles for other observations.

American observations will never have QNH (surface pressure in hectopascals or millibars), while European and other foreign ones usually do, and this is one way to tell them in voice weather traffic such as VOLMET.

Although not used in the US, "Ceiling And Visibility OK" (CAVOK) replaces visibility, weather and clouds if: 1) visibility greater than or equal to 10 kilometers; 2) no clouds below 1500 meters or below the highest minimum sector altitude, whichever is greater and no CB; and 3) no precipitation, TS, DS, SS, MIFG, DRDU, DRSA, or DRSN.

METAR Format (FM-15) Surface Meteorological Airways Format

Syntax: METAR CCCC TIME AUTO WIND VISIBILITY WEATHER CLOUDS TEMP/DEW ALTIMETER REMARKS

METAR
This defines the product type.

METAR	regularly reported observation (such as an hourly)
SPECI	special observation
TESTM	non-commissioned ASOS report

CCCC
CCCC is the 4 letter ICAO ID uniquely defining the reporting station.

CONUS sites begin with 'K', Alaskan sites begin with 'PA', Hawaiian sites begin with 'PH', Canadian sites begin with 'C', Mexican sites begin with 'MM'

TIME
The full universal time (UTC) that the observation was taken. The format is:

ddhhmmZ.
dd is the day of the month, hh is the hour, mm is the minute. Z refers to Zulu time.

AUTO
This is an optional grouping used in the US to specify a station as being automated.

COR
This is an optional grouping used in the US to specify an observation as being corrected.

WIND
The wind group

dddssKT or dddssGggKT
The value ddd is the wind direction in degrees. The value ss is the wind speed. The units are defined by the string "KT" which is knots. Some reports may have "MPS" for meters per second. If wind gusts are reported, they are specified with the group "Ggg".

VISIBILITY
The visibility group

vvSM or vvKM
This specifies the visibility is either statue miles "SM" (US), or kilometers "KM". The visibility can be partial values such as "1 1/2SM" or "3/16SM". Optionally a 4-digit minimum visibility in meters and as required, lowest value with direction.

RR/xxxx xxxx
Runway Visual Range (optional) R; 2-digit runway designator; Left, Center, or Right as needed; "/"; Minus or Plus (as needed); in U.S, 4-digit value; FeeT in U.S. <usually meters elsewhere>; as needed, 4-digit value; Variability; 4-digit value (and tendency Down, Up or No change)

WEATHER
The weather group

iiddppooxx
ii is intensity group ii Description
- light
moderate
+ heavy
VC in the vicinity

dd is the descriptor group dd Description
MI shallow
PR partial
BC patches

DR low drifting
BL blowing
SH shower
TS thunderstorm
FZ freezing

pp is the precipitation group pp Description
DZ drizzle
RA rain
SN snow
SG snow grains
IC ice crystals
PE ice pellets
GR hail
GS small hail/snow pellets
UP unknown

oo is the obscuration group oo Description
BR mist
FG fog
FU smoke
VA volcanic ash
DU dust
SA sand
HZ haze
PY spray

xx is the misc group xx Description
PO dust whirls
SQ squalls
FC funnel cloud/tornado/waterspout
SS duststorm

CLOUDS
The cloud levels

ccchhhtt
ccc is the coverage
CLR or SKC = clear
FEW = 1/8 coverage
SCT = 2,3,4/8 coverage
BKN = 5,6,7/8 coverage
OVC = overcast
VV = vertical visibility for obscuration

hhh is the height of base in 30m or 100ft increments. ie 30 = 3000 feet

tt is an optional type
CU = cumulus
CB = cumulonimbus
TCU = towering cumulus

CI = cirrus

CAVOK = clear skies, unlimited visibility

CAVOK is a widely used national practice, though not in the US. When placed in this group, it means Clouds And Visibility OK. Often NOSIG (No Siginficant features/changes)is placed in the comment field to indicate that this condition will not change for two hours.

In automated METAR reports only, CLeaR means "clear below 12,000 feet"

TEMP/DEW is the temperature and dewpoint in Celsius

TT/DD negative values are preceded with a M (M03 = -3)

ALTIMETER is the altimeter setting

Qpppp = altimeter in whole mb

Apppp = altimeter in .01 in Hg

REMARKS
The remark section:

RMK xxxx xxxx xxxx...

Remark	Description
AO1	AMOS station
AO2	ASOS station
OBS TAKEN	+xx minute offset for observation time
SLPppp	Sea level pressure in .1 mb (142 = 1014.2 mb)
WEA:www	Additional present weather information
Ttttdddd	Current temperature/dewpoint in .1C first digit 1 for negative
1xxxx	6 hour max temp in .1C, first digit 1 for negative
2nnnn	6 hour min temp in .1C, first digit 1 for negative
4/sss	Snow coverage in inches
4xxxxnnnn	24 hour max/min temps in .1C, first digit 1 for negative
5tppp	Pressure tendency in .1 mb for 3 hours, t is the trend
6pppp	6 hour precipitation in .01 inches
7pppp	24 hour precipitation in .01 inches
8/lmh	Cloud type for low, medium, high
933sss	New snow coverage, water equivalent
98mmm	Equivalent sunshine for day in minutes
CITY tt	City temperature
PCPN pppp	
Ppppp	1 hour precipitation
PK WND sss/nn	Peak wind, sss is speed, nn is the time
PRESFR	Pressure falling rapidly
PRESRR	Pressure rising rapidly
SNOINCR xxx	Snow increasing rapidly, where xxx is amount of snow in last hour
TSNO	Automated station has no thunderstorm detector (US)
WSHFT nn	Wind shift at time nn

Appendix #4: SYNOP Code
SYNOP Data Format (FM-12)
Surface Synoptic Observations

SYNOP code is the WMO standard method for transmitting surface weather information. It is universal in that separate optional formats exist for different units of measurement. The entire content, except for some plain-text ICE observations, is numeric, and that the format never varies beyond basic standard departures authorized for individual countries.

SYNOP is not as easy to read as METAR, but it is easier for a computer to encode and decode. Many programs exist to do just that. Unfortunately, SYNOP codes change frequently, keeping computer programmers on their toes.

The official reference for any surface observer in the United States is the Federal Meteorological Handbook No. 1, published jointly by the US Departments of Commerce (NWS), Transportation (FAA), and Defense (AWS/Navy). The complete synoptic code is described in the Federal Meteorological Handbook No. 2 (same publishers as above).

The coded report is given in six groups of data, or sections. Sections 0 and 1 are not identified by any special identifying groups, but Sections 2, 3, and 5 are recognizable by the 222, 333, or 555 included as part of the message (Section 4 is not used in the US). Surface marine data (from buoys which report hourly and ships-of-opportunity and weather ships, which report every 6 hours) are found in section 2, which contains reporting formats peculiar to the SHIP code.

Several forms of the observation were changed in the late 1990s and are not reflected in most online decoders. These include the 10 m and 20 m wind speed estimates (11 and 22 groups), time and values of maximum winds (3 & 4 groups in section 5), and 10-minute average winds, beginning at the time of observation and working backwards in time (the last 6 groups of section 5 in the CMAN code).

000 Group - Identification and Location
111 Group - Land Observations
222 Group - Sea Surface Observations
333 Group - Climatological Data
444 Group - Clouds below a mountain station, not used in US
555 Group - National Practice Observations

Groups 0 and 1 have no beginning designators, but the others, when present will be 222, 333, and 555.

Not all groups need occur in all SYNOP. Land stations will obviously not need group 2.

Syntax;
IIiii or IIIII YYGGi 99LLL QLLLL
iihVV Nddff 00fff 1sTTT 2sTTT 3PPPP 4PPPP 5appp 6RRRt 7wwWW 8NCCC
9GGgg
222Dv 0sTTT 1PPHH 2PPHH 3dddd 4PPHH 5PPHH 6IEER 70HHH 8aTTT
333 0.... 1sTTT 2sTTT 3Ejjj 4Esss 5jjjj jjjjj 6RRRt 7RRRR 8Nchh
9SSss
444 Not usually used
555 National practice - varies

Section 0: Station & Date/time information

IIiii or IIIII YYGGi 99LLL QLLLL

For land stations :

AAXX YYGGiw IIiii

For land stations, the AAXX indicates that the report type follows the WMO SYNOP FM-12 code. Land stations provide the date/time group as do ship stations (see above) through the YYGGiw group. This message usually appears at the start of a bulletin which may contain many reports (see example below). The IIiii group is for the WMO block number (II) and station number (iii) within each block.

In the US, the block numbers are:

41	Tropical North Atlantic Ocean (buoys)
42	Gulf of Mexico (buoys)
44	Extratropical N Atlantic Ocean (buoys)
45	Great Lakes (buoys)
46	Tropical NE Pacific Ocean (buoys)
51	Extratropical NE Pacific Ocean (buoys)
70	Alaska
71	Canada
72	Contiguous US (civilian)
74	US (military)*
76	Mexico
78	Central America and Caribbean
80	South America/Caribbean stations
91	Hawaii and US Pacific territories

WMO station numbers generally start with 200 and increase to the west along a latitude band, and then at 300 you move up the next latitude band, on the eastern edge of the block number, etc. The southeastern US has station numbers in the low 200's and the Pacific Northwest has station numbers in the high 700's.

For ships : BBXX DDDD YYGGiw 99LaLaLa QcLoLoLoLo

WMO SYNOP FM-13 is the standard reference for ship SYNOP, which will be designated in the heading by BBXX. It is published in the US by the Navy, and it is also available several places online. SYNOP, like METAR, can also be decoded online. Since buoys are fixed ships, they provide latitude and longitude positions, but also use a WMO station number format (IIiii) rather than the ship ID format DDDD. CMAN (coastal-marine) stations are special types of automated observing stations installed primarily to replace the old lighthouse stations which were staffed by Coast Guard observers. These stations also report in the synoptic code format.

IIiii The WMO number of the station.
Ship or Buoy Observations:
IIIII The ship or buoy identifier
YYGGi
YY -- The day of the month
GG -- The hour of the observation (UTC)
iw -- Wind type indicator

0 -- m/s (estimated)
1 -- m/s (from anemometer)
2 -- knots (estimated)
3 -- knots (from anemometer)
99LLL QLLLL
LLL -- Latitude of observation to .1 degrees
Q -- Quadrant of observation
1 -- North east
3 -- South east
5 -- South west
7 -- North west
LLLL -- Longitude of observation to .1 degrees

Section 1: International Land Observations
iRixhVV Nddff 1snTTT 2snTdTdTd 3PoPoPoPo 4PPPP
5appp 6RRRtR 7wwW1W2 8NhCLCMCH 9GGgg

111 Group - Land Observations
iihVV
iR -- Precipitation indicator
0 -- Precipitation in groups 1 and 3
1 -- Precipitation reported in group 1 only
2 -- Precipitation reported in group 3 only
3 -- Precipitation omitted, no precipitation
4 -- Precipitation omitted, no observation
ix -- Station type and present and past weather indicator

1 -- manned station -- weather group included
2 -- manned station -- omitted, no significant weather
3 -- manned station -- omitted, no weather observation
4 -- automated station -- weather group included (see automated weather codes 4677 and 4561)
5 -- automated station -- omitted, no significant weather
6 -- automated station -- omitted, no weather observation
7 -- automated station -- weather group included (see automated weather codes 4680 and 4531)
h -- Cloud base of lowest cloud seen (meters above ground)

0 -- 0 to 50 m
1 -- 50 to 100 m
2 -- 100 to 200 m
3 -- 200 to 300 m
4 -- 300 to 600 m
5 -- 600 to 1000 m
6 -- 1000 to 1500 m
7 -- 1500 to 2000 m
8 -- 2000 to 2500 m
9 -- above 2500 m
/ -- unknown
VV -- Visibility

00 -- less than 0.1 km
01 -- 0.1 km

02 -- 0.2 km
...
50 -- 5.0 km
56 -- 6 km
57 -- 7 km
...
80 -- 30 km
81 -- 35 km
82 -- 40 km
83 -- 45 km
84 -- 50 km
85 -- 55 km
86 -- 60 km
87 -- 65 km
88 -- 70 km
89 -- greater than 70 km
90 -- less than 0.05 km
91 -- 0.05 km
92 -- 0.2 km
93 -- 0.5 km
94 -- 1 km
95 -- 2 km
96 -- 4 km
97 -- 10 km
98 -- 20 km
99 -- greater than 50 km
// -- missing
Nddff
N -- Total cloud cover
0 -- 0 eighths (clear)
1 -- 1/8th
2 -- 2/8ths
3 -- 3/8ths
4 -- 4/8ths
5 -- 5/8ths
6 -- 6/8ths
7 -- 7/8ths
8 -- 8/8ths (overcast)
9 -- sky obscured
/ -- no observation
dd -- wind direction in 10s of degrees
ff -- wind speed in units determined by wind type indicator (see above)

00fff (optional)
fff -- wind speed if value greater than 100
1sTTT -- Temperature
s -- sign of temperature (0=positive, 1=negative)
TTT -- Temperature in .1 C
2sTTT -- Dewpoint
s -- sign of temperature (0=positive, 1=negative, 9 = RH)
TTT -- Dewpoint temperature in .1 C (if sign is 9, TTT is relative humidity)

3PPPP -- Station pressure in 0.1 mb (thousandths digit omitted, last digit can be slash, then pressure in full mb)
4PPPP -- Sea level pressure in 0.1 mb (thousandths digit omitted, last digit can be slash, then pressure in full mb)
4ahhh -- Geopotential of nearest mandatory pressure level (use for high altitude stations where sea level pressure reduction is not accurate)
a3 -- mandatory pressure level
1 -- 1000 mb
2 -- 925 mb
5 -- 500 mb
7 -- 700 mb
8 -- 850 mb
hhh -- geopotential height omitting thousandths digit

5appp -- Pressure tendency over 3 hours
a -- characteristics of pressure tendency
0 -- Increasing, then decreasing -- resultant pressure same or higher
1 -- Increasing, then steady -- resultant pressure higher
2 -- Increasing steadily -- resultant pressure higher
3 -- Decreasing or steady, then increasing -- resultant pressure higher
4 -- Steady -- resultant pressure same
5 -- Decreasing, then increasing -- resultant pressure lower
6 -- Decreasing, then steady -- resultant pressure lower
7 -- Decreasing steadily -- resultant pressure lower
8 -- Increasing or steady, then decreasing -- resultant pressure lower
ppp -- 3 hour pressure change in 0.1 mb

6RRRt -- Liquid precipitation
RRR -- Precipitation amount in mm
001 -- 1 mm
002 -- 2 mm
...
988 -- 988 mm
989 -- 989 or more mm
990 -- Trace
991 -- 0.1 mm
992 -- 0.2 mm
...
999 -- 0.9 mm
t -- Duration over which precipitation amount measured

1 -- 6 hours
2 -- 12 hours
3 -- 18 hours
4 -- 24 hours
5 -- 1 hour
6 -- 2 hours
7 -- 3 hours
8 -- 9 hours
9 -- 15 hours
/ -- 24 hours

7wwWW -- Present and past weather
ww -- Present weather
00 -- clear skies
01 -- clouds dissolving
02 -- state of sky unchanged
03 -- clouds developing
Haze, smoke, dust or sand
04 -- visibility reduced by smoke
05 -- haze
06 -- widespread dust in suspension not raised by wind
07 -- dust or sand raised by wind
08 -- well developed dust or sand whirls
09 -- dust or sand storm within sight but not at station
Non-precipitation events
10 -- mist
11 -- patches of shallow fog
12 -- continuous shallow fog
13 -- lightning visible, no thunder heard
14 -- precipitation within sight but not hitting ground
15 -- distant precipitation but not falling at station
16 -- nearby precipitation but not falling at station
17 -- thunderstorm but no precipitation falling at station
18 -- squalls within sight but no precipitation falling at station
19 -- funnel clouds within sight
Precipitation within past hour but not at observation time
20 -- drizzle
21 -- rain
22 -- snow
23 -- rain and snow
24 -- freezing rain
25 -- rain showers
26 -- snow showers
27 -- hail showers
28 -- fog
29 -- thunderstorms
Duststorm, sandstorm, drifting or blowing snow
30 -- slight to moderate duststorm, decreasing in intensity
31 -- slight to moderate duststorm, no change
32 -- slight to moderate duststorm, increasing in intensity
33 -- severe duststorm, decreasing in intensity
34 -- severe duststorm, no change
35 -- severe duststorm, increasing in intensity
36 -- slight to moderate drifting snow, below eye level
37 -- heavy drifting snow, below eye level
38 -- slight to moderate drifting snow, above eye level
39 -- heavy drifting snow, above eye level
Fog or ice fog
40 -- Fog at a distance
41 -- patches of fog
42 -- fog, sky visible, thinning

43 -- fog, sky not visible, thinning
44 -- fog, sky visible, no change
45 -- fog, sky not visible, no change
46 -- fog, sky visible, becoming thicker
47 -- fog, sky not visible, becoming thicker
48 -- fog, depositing rime, sky visible
49 -- fog, depositing rime, sky not visible
Drizzle
50 -- intermittent light drizzle
51 -- continuous light drizzle
52 -- intermittent moderate drizzle
53 -- continuous moderate drizzle
54 -- intermittent heavy drizzle
55 -- continuous heavy drizzle
56 -- light freezing drizzle
57 -- moderate to heavy freezing drizzle
58 -- light drizzle and rain
59 -- moderate to heavy drizzle and rain
Rain
60 -- intermittent light rain
61 -- continuous light rain
62 -- intermittent moderate rain
63 -- continuous moderate rain
64 -- intermittent heavy rain
65 -- continuous heavy rain
66 -- light freezing rain
67 -- moderate to heavy freezing rain
68 -- light rain and snow
69 -- moderate to heavy rain and snow
Snow
70 -- intermittent light snow
71 -- continuous light snow
72 -- intermittent moderate snow
73 -- continuous moderate snow
74 -- intermittent heavy snow
75 -- continuous heavy snow
76 -- diamond dust
77 -- snow grains
78 -- snow crystals
79 -- ice pellets
Showers
80 -- light rain showers
81 -- moderate to heavy rain showers
82 -- violent rain showers
83 -- light rain and snow showers
84 -- moderate to heavy rain and snow showers
85 -- light snow showers
86 -- moderate to heavy snow showers
87 -- light snow/ice pellet showers
88 -- moderate to heavy snow/ice pellet showers
89 -- light hail showers

90 -- moderate to heavy hail showers
Thunderstorms
91 -- thunderstorm in past hour, currently only light rain
92 -- thunderstorm in past hour, currently only moderate to heavy rain
93 -- thunderstorm in past hour, currently only light snow or rain/snow mix
94 -- thunderstorm in past hour, currently only moderate to heavy snow or rain/snow mix
95 -- light to moderate thunderstorm
96 -- light to moderate thunderstorm with hail
97 -- heavy thunderstorm
98 -- heavy thunderstorm with duststorm
99 -- heavy thunderstorm with hail
W1 -- Past weather (type 1)
W2 -- Past weather (type 2)

0 -- cloud covering less than half of sky
1 -- cloud covering more than half of sky during part of period and more than half during part of period
2 -- cloud covering more than half of sky
3 -- sandstorm, duststorm or blowing snow
4 -- fog, or thick haze
5 -- drizzle
6 -- rain
7 -- snow or mixed rain and snow
8 -- showers
9 -- thunderstorms

8NCCC -- Cloud type information
N -- Amount of low clouds covering sky, if no low clouds, the amount of the middle clouds
CL -- Low cloud type
0 -- no low clouds
1 -- cumulus humulis or fractus (no vertical development)
2 -- cumulus mediocris or congestus (moderate vertical development)
3 -- cumulonimbus calvus (no outlines nor anvil)
4 -- stratocumulus cumulogenitus (formed by spreading of cumulus)
5 -- stratocumulus
6 -- stratus nebulosus (continuous sheet)
7 -- stratus or cumulus fractus (bad weather)
8 -- cumulus and stratocumulus (multilevel)
9 -- cumulonimbus with anvil
/ -- low clouds unobserved due to darkness or obscuration
CM -- Middle cloud type

0 -- no middle clouds
1 -- altostratus translucidous (mostly transparent)
2 -- altostratus opacus or nimbostratus
3 -- altocumulus translucidous (mostly transparent)
4 -- patches of altocumulus (irregular, lenticular)
5 -- bands of altocumulus
6 -- altocumulus cumulogenitus (formed by spreading of cumulus)
7 -- altocumulus (multilayers)
8 -- altocumulus castellanus (having cumuliform tufts)
9 -- altocumulus of a chaotic sky

/ -- middle clouds unobserved due to darkness or obscuration
CH -- High cloud type

0 -- no high clouds
1 -- cirrus fibratus (wispy)
2 -- cirrus spissatus (dense in patches)
3 -- cirrus spissatus cumulogenitus (formed out of anvil)
4 -- cirrus unicus or fibratus (progressively invading sky)
5 -- bands of cirrus or cirrostratus invading sky (less than 45 degree above horizon)
6 -- bands of cirrus or cirrostratus invading sky (more than 45 degree above horizon)
7 -- cirrostratus covering whole sky
8 -- cirrostratus not covering sky but not invading
9 -- cirrocumulus
/ -- high clouds unobserved due to darkness or obscuration
9GGgg -- Time of observation in hours and minutes

Section 2: International Sea Surface Observations

222Dv 0sTTT 1PPHH 2PPHH 3dddd 4PPHH 5PPHH 6IEER 70HHH 8aTTT

222Dv
D -- direction of ship movement
0 -- calm
1 -- NE
2 -- E
3 -- SE
4 -- S
5 -- SW
6 -- W
7 -- NW
8 -- N
9 -- unknown
v -- ship's average speed
0 -- 0 knots
1 -- 1 to 5 knots
2 -- 6 to 10 knots
3 -- 11 to 15 knots
4 -- 16 to 20 knots
5 -- 21 to 25 knots
6 -- 26 to 30 knots
7 -- 31 to 35 knots
8 -- 36 to 40 knots
9 -- over 40 knots
0sTTT -- Sea surface temperature
s -- sign of temperature (0=positive, 1=negative)
TTT -- Temperature in .1 C
1PPHH -- Wave heights in 0.5 m increments
PP -- Period of waves in seconds
HH -- Height of waves in 0.5 m increments
2PPHH -- Wave period and heights (instrumented)
3dddd -- Direction of swells (up to 2 swells)

4PPHH -- Period and direction of first set of swells
5PPHH -- Period and direction of second set of swells
6IEER -- Ice accretion on ships
70HHH -- Wave heights to 0.1 m (instrumented)
8aTTT -- Wet bulb temperature

Section 3: Special Regional or Climatological Data

333 0.... 1sTTT 2sTTT 3Ejjj 4Esss 5jjjj jjjjj 6RRRt 7RRRR 8Nchh 9SSss

333
0.... -- Regionally developed data
1sTTT -- Maximum temperature over previous 24 hours
s -- sign of temperature (0=positive, 1=negative)
TTT -- Temperature in .1 C
2sTTT -- Minimum temperature over previous 24 hours
s -- sign of temperature (0=positive, 1=negative)
TTT -- Temperature in .1 C
3Ejjj -- Regionally developed data
4Esss -- Snow depth
E -- State of ground with snow cover
0 -- predominantly covered with ice
1 -- compact or wet snow covering less than half of ground
2 -- compact or wet snow covering more than half of ground but not completely covered
3 -- even layer of compact or wet snow covering entire ground
4 -- uneven layer of compact or wet snow covering entire ground
5 -- loose dry snow covering less than half of ground
6 -- loose dry snow covering more than half of ground but not completely covered
7 -- even layer of loose dry snow covering entire ground
8 -- uneven layer of loose dry snow covering entire ground
9 -- snow covering ground completely with deep drifts
sss -- snow depth in cm

5jjjj jjjjj -- Additional information (can be multiple groups)
6RRRt -- Liquid precipitation
RRR -- Precipitation amount in mm
001 -- 1 mm
002 -- 2 mm
...
988 -- 988 mm
989 -- 989 or more mm
990 -- Trace
991 -- 0.1 mm
992 -- 0.2 mm
...
999 -- 0.9 mm
t -- Duration over which precipitation amount measured
1 -- 6 hours
2 -- 12 hours
3 -- 18 hours
4 -- 24 hours

5 -- 1 hour
6 -- 2 hours
7 -- 3 hours
8 -- 9 hours
9 -- 15 hours
/ -- 24 hours
7RRRR -- 24 hour precipitation in mm
8NChh -- Cloud layer data
N -- cloud coverage of layer
C -- genus of cloud
0 -- cirrus (Ci)
1 -- cirrocumulus (Cc)
2 -- cirrostratus (Cs)
3 -- altocumulus (Ac)
4 -- altostratus (As)
5 -- nimbostratus (Ns)
6 -- stratocumulus (Sc)
7 -- stratus (St)
8 -- cumulus (Cu)
9 -- cumulonimbus (Cb)
/ -- cloud not visible
hh -- height of cloud base
00 -- less than 30 m
01 -- 30 m (100 ft)
02 -- 60 m (200 ft)
03 -- 90 m (300 ft)
...
50 -- 1500 m (5000 ft)
56 -- 1800 m (6000 ft)
57 -- 2100 m (7000 ft)
...
80 -- 9000 m (30000 ft)
81 -- 10500 m
82 -- 12000 m
...
88 -- 21000 m
89 -- greater than 21000 m
90 -- 0 to 50 m
91 -- 50 to 100 m
92 -- 100 to 200 m
93 -- 200 to 300 m
94 -- 300 to 600 m
95 -- 600 to 1000 m
96 -- 1000 to 1500 m
97 -- 1500 to 2000 m
98 -- 2000 to 2500 m
99 -- above 2500 m
9SSss -- Supplementary information
333 identifier for section 3
1snTxTxTx 6-hr maximum temperature
2snTnTnTn 6-hr minimum temperature

4E'sss E' is the state of the ground (normally / in the
US) and sss is the depth of snow on the ground, in cm.
7R24R24R24R24 24-hr precipitation amount, in 0.1 mm increments
8NsChshs This group is for the encoding of multiple cloud layers in terms of the ten basic cloud groups; each cloud group (identified by the C) may cover up to Ns oktas of the sky and may have a base encoded in hshs.
9SPSPspsp These are for special phenomena.

Section 4: Not used

Section 5: Meteorological data for national exchange

Begins with 555 if present

In the US:

555 [RECORD] [0itDtDtDt] [1snTT snTxTxsnTnTn]
[RECORD] [2R24R24R24R24]
[marine/CMAN stations] 11fff10 22fff20 3GGggvx 4dddffvx
6GGgg dddfff0 dddfff1 dddfff2 dddfff3
dddfff4 dddfff5
[US land stations] 9YYGG is repeated

[] = optional

Appendix #5: BUOY Code

The header SSVX identifies bulletins of observations coded in FM 18-X.

Note: This code form replaced the former FM 18-IX Ext DRIFTER code.

Observations from buoys similar to observations from ships are encoded in the SHIP code, FM 12 or FM 13, and are included in bulletins headed SMV/, SIV/ etc.

For a full decode please refer to the WMO Manual on Codes, Volume I.1 Part A: Alphanumeric codes, WMO Publication No 306, available from: The WMO Secretariat at PO Box 2300, CH-1211 Geneva 2, Switzerland, price Sw Fr 130.- (February 1998)

The following Sections are only included if there are dataavailable

SECTION 0 Identification, time and position data
MiMiMjMj A1bwnbnbnb YYMMJ GGggiw QcLaLaLaLaLa
LoLoLoLoLoLo (6QiQt//)

SECTION 1 Meteorological and other non-marine data
(111QdQx 0ddff 1snTTT 2snTdTdTd OR 29UUU 3P0P0P0P0
4PPPP 5appp

SECTION 2 Surface marine data
(222QdQx 0snTwTwTw 1PwaPwaHwaHwa ....

SECTION 3 Temperatures, salinity and current (when available) at selected depths

333Qd1Qd2 ....

SECTION 4 Information on engineering and technical parameters including quality control data)

444 (1QpQ2QTwQ4) ....

INTERPRETATION

SECTION 0 (Identification, time and position data)

MiMiMjMj		Always coded as ZZYY
A1bwnbnbnb		The buoy number or identifier
A1bw		The WMO Region and sub-region in which the buoy was deployed, eg 62 includes the seas around the UK and to the west and south-west of the British Isles.
nbnbnb		Type and serial number of the buoy (500 is added to the serial number when the buoy is a drifting buoy)
YYMMJ	YY	Date
	MM	Month
	J	Last digit of the year
GGggiw	GGgg	Time of the observation
	iw	Indicator for source and units of wind speed 0 or 1: Wind speed metres/sec; 3 or 4: Wind speed knots
QcLaLaLaLaLa	Qc	Quadrant of the globe N hemisphere: 7 is degrees West, 1 is degrees East S hemisphere: 5 is degrees West, 3 is degrees East
	LaLaLaLaLa	Latitude (eg 54126 decoded as 54.126 degrees, 54.12/ decoded as 54.12 degrees and 541// as 54.1 degrees)
LoLoLoLoLoLo		Longitude (eg 132463 decoded as 132.463 degrees, 05621/decoded as 56.21 degrees, and 1458// as 145.8 degrees
(6QiQt//)		Quality control indicators (see WMO Manual on Codes)

SECTION 1 (Meteorological and other non-marine data)

111QdQx		Quality control indicators for the section
0ddff	0	Indicator
	dd	Wind direction in tens of degrees
	ff	Wind speed in knots or m/s

1snTTT 1 Indicator
sn Sign of temperature - 0: positive or zero,
1: negative
TTT Dry-bulb temperature in tenths of a degree
Celsius

2snTdTdTd 2 Indicator
sn Sign of temperature
TdTdTd Dew-point temperature in tenths of a degree
Celsius

OR

29UUU 2 Indicator
9 Relative humidity follows
UUU Relative humidity expressed as a percentage:
first figure zero except when UUU is 100
percent

3P0P0P0P0 3 Indicator
P0P0P0P0 Pressure at station level, in tenths
of a millibar, omitting the thousands
digit

4PPPP 4 Indicator
PPPP Mean sea level pressure, in tenths of a
millibar,
omitting the thousands digit

5appp 5 Indicator
a Characteristic of pressure change
ppp Pressure change over last three hours in
tenths of a millibar

Sample messages transmitted by the Deutsche Wetter Dienst

cq cq cq de ddh47 ddh9 ddh8
frequencies 147.3 khz 11039 khz 14467.3 khz
ryryryryryryryryryryryryryryryryryryryryryryryryryryryryryryryry
zczc 641
nodl42 edzw 250000
cq cq cq cq cq cq cq cq cq cq cq cq cq cq cq cq cq cq cq cq cq cq
++
allen hoererinnen und hoerern
wuensche bwch frohe weihnachten und alles gute im neuen jahr.
wilfried behncke
deutscher wetterdienst hamburg
++

---

zczc 642
sxen40 edzuvc~~pp

wettermeldungen von mittwoch, demvc~qwmwpqe wtmqwmqe pocpp utc.

svinoy suedsuedost 7 // 7 grad 964 hpa
stavanger sued 5 regenschauer 7 grad 976 hpa
aberdeen suedsuedwest 5 // 5 grn~wiiivkvxxlhpa
tynemouth avvvmgvobo 5 // 4 grad 974 hpa
den helder suedwest 4 // 8 grad 986 hpa
norderney suedwest 4 // 7 grad 986 hpa
helgoland suedwest 5 // 8 grad 985 hpa
cuxhaven suedsuedwest 4 // 9 grad 986 hpa
bremerhaven suedwest 6 // 8 7xrad 987 hpa
list/sylt suedsuedwest 5 regen 7 grad 983 hpa
thyboroen sued 4 // 7 grad 982 hpa
skagen sued 4 spruehregen 6 grad 983 hpa
roesnaes sued 5 // 6 grad 983 hpa
kegnaes suedsuedwest 4 regen 7 grad 985 hpa
kiel-holtenau suedsuedwest 4 regen 9 grad 985 hpa
leucht.kiel suedsuedwest 7 // 9 grad 985 hpa
fehmarn suedsuedwest 4 // 11 grad 986 hpa
arkona suedsuedwest 6 // 8 grad 989 hpa
bornholm sued 5 spruehregen 9 grad 990 hpa
soederhamn -- -- //k. a. k. a.
visby suedsuedost 3 // 6 grad 993 hpa
utoe suedsuedwest 6 schauer 6 grad 995 hpa
riga suedsuedost 4 // 5 grad 1003 hpa
hel sued 4 // 6 grad 997 hpa
soesterberg suedsuedwest 4 // 7 grad 988 hpa
manston suedsuedwest 4 // 5 grad 986 hpa
jersey suedsuedwest 4 // 7 grad 986 hpa
culdrose westsuedwest 4 // 7 grad 981 hpa
belmullet westsuedwest 4 // 8 grad 975 hpa
stornoway west 5 regen 5 grad 959 hpa

seewetterdienst hamburg

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zczc 644
febq52 edzw 250600

mittelfrist - seewetterbericht fuer die ostsee herausgegeben vom seewetterdienst hamburg 25.12.13, 00 utc:

wetterlage:

donnerstag hoch 1030 westkasachstan, verstaerkend, mit keil
donnerstag 995 suedschweden, nordostschwenkend.
donnerstag tief 960 Norwegische see, abschwaechend, langsam nordnordostziehend, mit trog

donnerstag 995 bayern, abschwaechend. weiterer trog
donnerstag 995 ostgroenlandsee, nordostschwenkend.
donnerstag tief 960 weit westlich von irland, vertiefend, nordostziehend, freitag als orkantief 945 dicht westlich der hebriden, dann abschwaechend, samstag 960 oestlich von island, montag 980 nordteil norwegische see. freitag frueh neues tief 1020 neuengland, vertiefend, ostnordostziehend, Freitag mittag 1010 neuschottland, samstag 990 grand banks, montag 970 westnordwestlich von irland. hinweis zu modellvorhersagen:

vorhersagen von mi 25.12.2013 00 utc:
windstaerke beaufort, wellenhoehe meter

```
skagerrak (57.5n   8.9e) wt:  7 c
do 26. 00z: s-sw   4-5   6-7  2.5 m
do 26. 12z: s        3        2  m
fr 27. 00z: s        4      1.5 m
fr 27. 12z: se-s   6-7     8  2.5 m
sa 28. 00z: s      6-7     9  3.5 m
sa 28. 12z: s        5   7-8   3  m
so 29. 00z: sw       5     7   3  m
so 29. 12z: sw       5   6-7  2.5 m
mo 30. 00z: sw     5-6     7  2.5 m
mo 30. 12z: s-sw   8-9    11  6.5 m
```

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zczc 647
wodl45 edzw 251200
strongwizkwpnvolstormwarnings for sea areas:
german bigh, western and southern baltic.

german bigh:
no warning.

western baltic:
no warning.

southern baltic:
no warning.

coastal area warnings:
starkwind, sturmwarnungen fuer deutsche kuesten.

nr. 651
boeen - warnung des seewetterdienstes hamburg
fuer die deutsche nordseekueste
herausgegeben am mittwoch, den 25.12.2013 um 07:40 uhr gz

ostfriesische kueste:
boeen von 7 beaufort aus sued.

seegebiet helgoland:
boeen von 7 beaufort aus sued.

nordfriesische kueste:
boeen von 7 beaufort aus sued.

nr. 586
wind - warnung des seewetterdienstes hamburg
fuer die deutsche ostseekueste
herausgegeben am mittwoch, den 25.12.2013 um 07:40 uhr gz

flensburg bis fehmarn:
boeen von 7 beaufort aus sued.

oestlich fehmarn bis ruegen:
sued 5 bis 6, dabei boeen von 7 beaufort.

oestlich ruegen:
sued 5 bis 6, dabei boeen von 7 beaufort.

seewetterdienst hamburg

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zczc 684
smvx41 edzw 251800
bbxx

dbfr 25181 99535 10086 46/// /1804 10059 20039 49920 52018 22240 00066=
dbea 25181 99540 10083 46/// /2110 10070 20045 49912 52021 22210 00075=
dbjm 25181 99542 10079 46/// /2112 10072 2//// 49906 52021 22260 00079=
dbbc 25181 99536 10086 46/// /1703 10058 20041 49917 52018 22210 00061=
dbbi 25181 99535 10099 46/// /9901 10080 20049 49=
bareu13 25184 99535 70030 46/// ///// 4////22281=
bareu12 25184 99521 10034 46/// ///// 49892 52011 22242=
dk7210 25181 99540 10066 46/// /2110 39882=
pbeo 25183 99520 10027 41598 52009 10086 20038 49909 53017 75052 82560 22252 02098 20302 80063=
batfr15 25184 99510 10022 46/// /1006 10077 20047 49892 53001 22200 4104=
minuk05 2518/ 99560 70032 46/// ///// 10070 49779 52030=
pdgs 25184 99500 70014 41598 51733 10090 20044 49849 58017 70322 8499/ 22265 00110 20302 328//
40503=
pdwt 25183 99503 10001 41/97 42406 10127 20066 49868 51009 7//11
8//// 22223 2//// 80095 42240=
lf4h 25184 99596 10022 46/// /2332 10075 20029 49679 52018 8//// 22200 06082 104// 333 91139=
dj2400 25181 99552 10072 46/// /2315 10076 29082 39858 49885 52022
22200 333 553// 20001 60005 91017 91118 91216=
wdd3825 25184 99504 70011 41498 61715 10120 2007/ 49880 51004
70222 8579/ 22281 00131 20303 399// 40405 5//// 6//// 80095 ice
0/0//=
62023 25183 99514 70079 46/96 /2913 10073 2//// 49782 5////22200 10806 70031=
lf4c 25184 99584 10019 41597 72334 10081 20037 49725 52025 70222
89/// 22200 00065 10810 70051 333 91140=
minuk01 2518/ 99571 70021 46/// ///// 10063 49750 52030=
dbjm 25181 99542 10079 46/// /2112 10072 49906 52021 22260 00079=
dbfh 25181 99539 10087 46/// /1903 10059 20046 49918 52017 22220 00068=
62102 25184 99579 10018 47597 /2229 10079 20022 49745 52028 700//22200 10809 70043=

62134 25184 99580 10014 47996 /2435 10079 20032 49739 52027 700//22200 10810 70049=
62114 25184 99583 10000 46/// /2134 10078 20038 49710 52029 22200=
zqsd5 25184 99583 10008 47997 ///// 10078 20042 49712 52025 700//22200 1//11 70054=
62113 25184 99584 10002 47998 /2233 10074 20027 49732 52026 700//22200=
62129 25184 99584 10003 46/// /2230 10078 20026 49734 52030 22200=
62112 25184 99584 70002 47997 /2231 10077 20030 49708 52029 700//22200=
62128 25184 99587 10014 47997 /2238 10075 20042 49709 52025 700//22200 10810 70049=
63057 25184 99592 10015 47997 /2140 10075 20024 49685 52020 700//22200 10911 70054=

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Sources are many, but mostly:

World Meteorological Organization	http://www.wmo.ch/
National Oceanic and Atmospheric Agency	http://www.nws.noaa.gov/
The Weather Window	http://weather.mailasail.com