Plot manual

Introduction

Meteorological bulletins are distributed worldwide and must be readable by persons have all nationalities and backgrounds. That is one of the reasons these bulletins are coded. The codes have been defined exactly and they have been agreed on internationally. There are various coding types in meteorology, to distribute all sorts of bulletins worldwide. Examples of various bulletins are hourly surface observations from meteorological stations, upper-air rawinsonde observations and aviations bulletins. Every coded bulletin must be recognisable, to prevent ambiguity or confusion.

During this practical we will use only coded bulletins of hourly surface observations as performed both on land and at sea. The basic part of this bulletin is the so-called SYNOP (from synoptic). The structure and meaning of all of the codes can be found on the website of the practical.

A good way to learn to decode these bulletins is to plot the values of the observations on a weather map. The large amount of data in a SYNOP bulletin makes then unsuitable for getting an overview of the weather. That is why the data is usually plotted on the weather map at the location of each station that is mentioned in the bulletin. In such a 'plot' a large amount of information such as temperature, pressure, weather type, amount of clouds and humidity is presented in a consistent way. When this is done for all stations a good overview of the weather emerges.

This manual contains a description, using international standards, how to 'plot' all data on the map for both land surface based and ship based observations.

'Synop' of a landstation

The basic form of the SYNOP bulletin for a landstation is:

AAXX YYGGi_w IIiii

$i_R i_X$hVV Nddff 1s_nTTT 2$s_n T_d T_d T_d$ 4PPPP 5appp

6RRRt_R 7wwW_1W_2 8$N_h C_L C_M C_H$

The rain group (6RRRt_R) is not plotted. All other groups will be plotted using the plot model in Figure 1 (left figure).

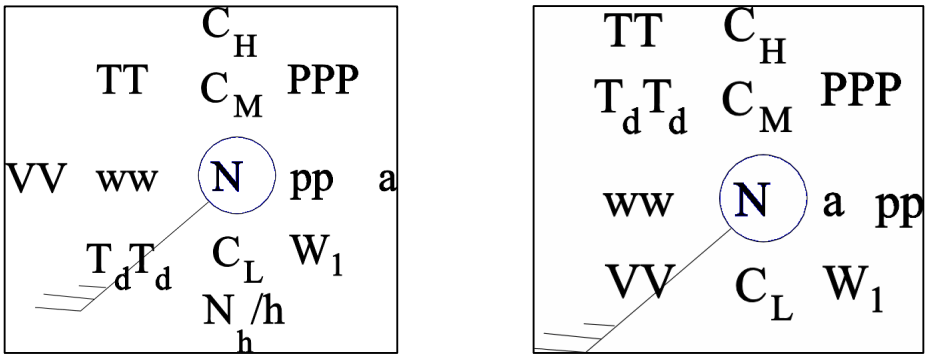


Figure 1. Plotmodels: the official WMO plot model (*left*) and a model frequently used by Meteo Consult (*right*).

The following groups must be plotted in ***red*** :
- temperature ***TT*** (in degrees) with optional minus sign (s_n=1)
- dew point T_dT_d (*ibid*), with optional minus sign (s_n=1)
- the pressure tendency ***a*** and ***pp*** if pressure is falling, i.e. if ***a*** >= 5.
- past weather W_1. Note that W_2 is NOT plotted.

The plot symbols for C_h, C_m, C_l, ***ww***, ***a*** and W_1 are given in the symbol table (see last page).
Note that:
- temperature must be rounded off to an integer value (*i.e.* no decimals).
- sea level pressure is plotted in tenths of hPa (mbar) omitting the preceding ***10*** or ***9***, i.e. 248 instead of 1024.8 and 763 instead of 976.3

Synop of a ship

The SYNOP bulletin of a ship contains additional data the direction and velocity of the ship and sometimes seawater temperature and wave observation data. The code format is:

BBXX DDDD YYGGi_w 99$L_aL_aL_a$ $Q_cL_oL_oL_oL_o$

i_Ri_xhVV Nddff 1s_nTTT 2$s_nT_dT_dT_d$ 4PPPP 5appp

6RRRt_R 7wwW_1W_2 8$N_hC_LC_MC_H$

222D_sv_s (0$s_nT_wT_wT_w$) (1$P_wP_wH_wH_w$) (2$P_wP_wH_wH_w$)

The plot model is given in Figure 2.

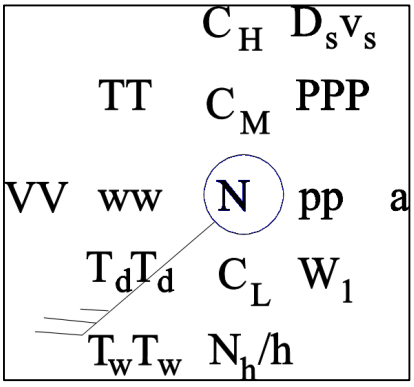


Figure 2. Plot model of observations made on a ship.

In the bulletin the ship's position is indicated by the groups:

99$L_aL_aL_a$, geographical latitude in tenths of a degree, and
$Q_cL_oL_oL_oL_o$, geographical longitude in tenths of a degree. Q_c indicates the quadrant as follows:

Value	Latitude	Longitude
1	North	East
2	South	East
3	South	West
4	North	West

- The direction in which the ship is moving is given by the group $222D_sv_s$:

D_s	direction	v_s	velocity (knots)
0	stil	0	stil
1	NE	1	1 - 5
2	E	2	6 - 10
3	SE	3	11 - 15
4	S	4	16 - 20
5	SW	5	21 - 25
6	W	6	26 - 30
7	NW	7	31 - 35
8	N	8	36 - 40
9	unknown	9	> 40

Bulletin codes and plotting (abbreviated)

AAXX YYGGi_w IIiii

This is the standard code for a land station with date/time and station number. This group must not be plotted. We do indicate in the left bottom margin of the map the date and time (we would like to indicate of which date and time the observations are: **do not forget this**). The plots will simply be plotted on the location of the corresponding station.

BBXX DDDD YYGGi_w 99$L_aL_aL_a$ $Q_cL_oL_oL_oL_o$

This is the standard code for ships. For ships we plot the data on the ship's position. Also the 'name code' of the ship (given by DDDD) is plotted.

Nddff (wind group)

N Each plot starts with indicating the (total) cloud cover. The cloud cover is plotted by (1) a digit on the position of the station, or (2) a symbol (see Figure 3). If N=9 then the amount of cloud cover cannot be determined (e.g. because of fog).

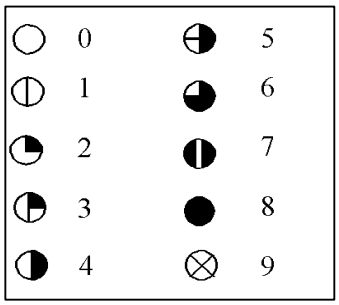
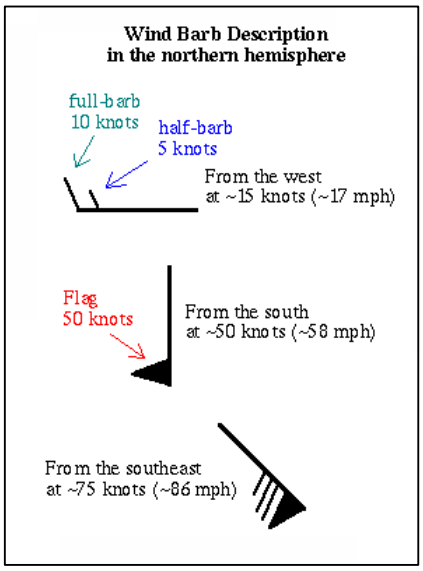


Figure 3 (top) Symbols for plotting the cloud cover N.

Figure 4 (right). Wind barbs for indicating wind speed.



dd Wind direction in tens of a degree (e.g. 23 means 230°). The wind direction is relative to North so drawing should be with respect with the local direction of longitude circles, which indicate true North.

ff Windspeed in knots. Each full-barb indicates 10 knots, a half -barb equals 5 knots and a flag 50 knots (Figure 4.).
Beware of the **unit** of the wind speed: meters per second or knots (a knot is approximately 0.5 m/s). We plot in knots. The unit of wind speed in the bulletin is given by the wind indicator i_w in the first group.

Note that:
- If there is no wind, ddff=0000 the only plot a circle around the cloud cover symbol.
- In very weak winds (ff <= 2 knots) but if a direction is indicated then only a line with no barbs.
- If wind speed is missing, draw a cross instead of ff, in case a weak and variable wind (ddff=9903) then only plot a half-barb and a cross.

1s_nTTT (temperature)

In the bulletin temperature is given in tenths of a degree, using s_n = 0 for T > 0°C or s_n=1 if T < 0°C. We plot the temperature in degrees, with minus sign if appropriate. Temperature is plotted in red.

2$s_n T_d T_d T_d$ (dew point)

See temperature: in degrees and in red.

4PPPP (sea level pressure)

Sea level pressure is given and plotted in tenths of hPa or mb, omitting the preceding 9 or 10: PPPP=0134 means 1013.4 mb or hPa (hectopascal). We plot sea level pressure in tenths of hPa or mb. In this example we plot 134.

5appp (change in pressure)
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ppp This part gives the change in sea level pressure in tenths of hPa or mb. We plot it in tenths of hPa or mb. Only plot the last nonzero digits e.g. for ppp = 005 plot 5.

a The value of a indicates the character of the pressure change (falling, strongly rising etc.) Plot with a symbol (see table on last page). If pressure is falling (a >= 5) plot both a and ppp in ***red***.

7wwW$_1$W$_2$ (actual and past weather)

This group indicates the general weather type.

ww The actual weather is given by ww. This is a number between 00 and 99. For the meaning: see webpage. For plotting use the symbols symboltable . Do NOT plot the ww codes 00 up to 03.

W$_1$ This digit indicates just like W$_2$, past weather over a number of preceding hours (the exact number of hours depend on the time of the bulletin). Only plot W$_1$, see the symbol-table. Note that we always have W$_1$>W$_2$.

VV (visibility)

Visibility (in the first group i$_R$i$_X$hVV) is plotted next to the actual weather (ww) and is simply plotted by its coded value.

8N$_h$C$_L$C$_M$C$_H$ (cloud group)

We only plot this first cloud group 8N$_h$C$_L$C$_M$C$_H$ for Low, Medium and High clouds. Each symbol (see symbol table) is plotted. We also plot the combination of cloud cover (of low and/or medium level clouds) together with the height of the cloud base (h) from the first group (i$_R$i$_X$hVV).

SOME FINAL REMARKS
- It is important to become familiar with the codes and symbols. Manual plotting a weather map is just a means and not a goal in itself.
- Try to work precise and meticulous: no sloppy plotting please!!
- Make sure that your plot are readable: not too smaal or too large. As a rule of thumb the complete plot for one station should fit under a 20 eurocent coin.

Example
For a certain station (0626) in the Netherlands we have the following data in the bulletin:

06260 41575 12224 10107 20072 40147 55007 78065 83524

The corresponding plot is given below.

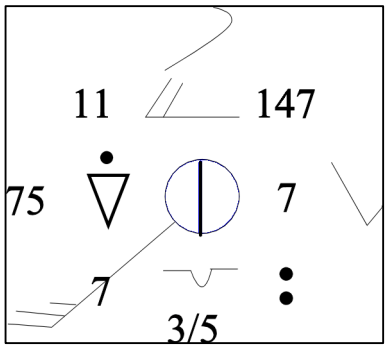

Figure 5. Example of a plot.

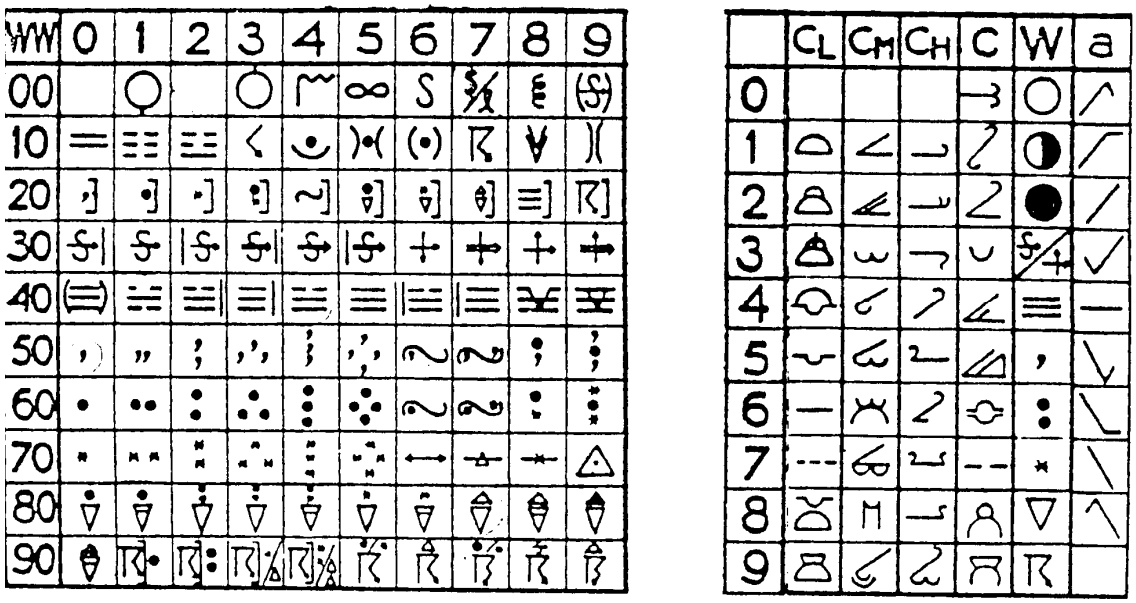

Figure 6. Common symbols used for plotting. Left: all *ww*-codes (present weather) from 00 to 99. Right: codes for clouds C_L , C_M , C_H and C (not used), past weather W_1 and pressure tendency a.