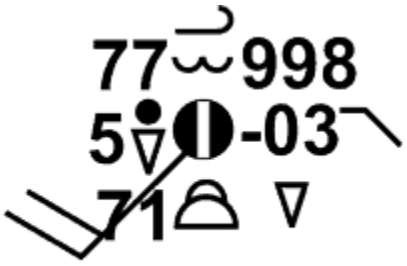
How to read weather maps



Typical station weather plot

On surface maps you will often see station weather plots. Since meteorologists must convey a lot of information without using a lot of words, plots are used to describe the weather at a station for a specific time. When all stations are plotted on a map, a "picture" of where the high and low pressure areas are located, as well as the location of fronts, can be obtained.

There are a large number of weather symbols used for station plotting. Some are used for weather elements such as rain, snow, and lightning. Others represent the speed of the wind, types of clouds, air temperature, and air pressure. All of these symbols help meteorologists depict the weather occurring at a weather observing station.

This sample plot represents the maximum amount of information about the current weather at an observing station. Hand plotted maps usually contain the full weather information. However, most computer generated surface weather maps omit some data such as clouds types and heights.

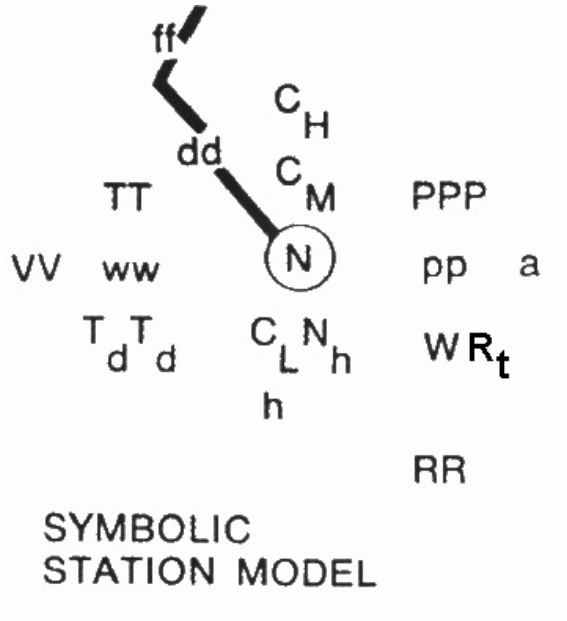
Before computers, the plotting of weather maps was considered an art. In fact, Aerographers (weathermen) in the U.S. Navy continue to plots maps by hand. A skilled plotter can easily fit the above information under the space covered by a dime.

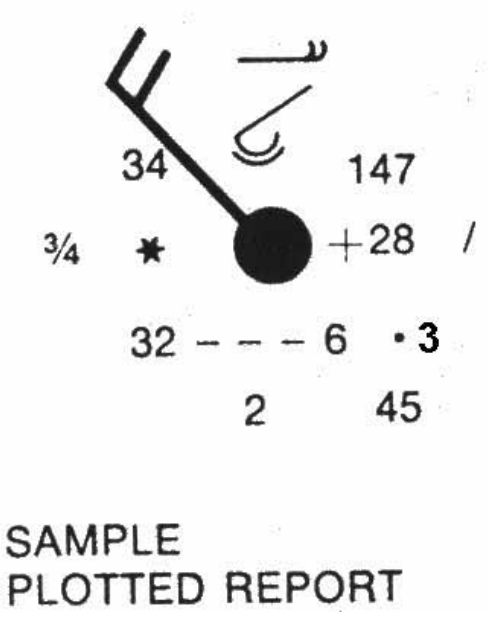
Decoding these plots is easier than it may seem. The station model shown above left is decoded and explained below. Note that this example does not contain all possible weather elements. Following this explanation will be a full station model for you to examine.

	In the upper left, the temperature is plotted in Fahrenheit. In this example, the temperature is 77°F.
	Along the center, the cloud types are indicated. These cloud types use the same cloud codes as found in the cloud chart section. The top symbol is the high-level cloud type followed by the mid-level cloud type. The lowest symbol represents low-level cloud. In this example, the high level cloud is Cirrus, the mid-level cloud is Altocumulus and the low-level clouds is a cumulonimbus. See block 3.
	At the upper right is the atmospheric pressure reduced to mean sea level in millibars (mb) to the nearest tenth with the leading 9 or 10 omitted. In this case the pressure would be 999.8 mb. If the pressure was plotted as 024 it would be 1002.4 mb. When trying to determine whether to add a 9 or 10 use the number that will give you a value closest to 1000 mb.
	On the second row, the far left number is the visibility in miles. In this example, the visibility is 5 miles.
	Next to the visibility is the present weather symbol. There 95 symbols which represent the weather that is either presently occurring or has ended within the previous hour. In this example, a light rain shower was occurring at the time of the observation. [See block 8]

	The circle symbol in the center represents the amount of total cloud cover reported in eighths. This cloud cover includes all low, middle, and high level clouds. In this example, 7/8th of the sky was covered with clouds. [see block 6]
	This number and symbol tell how much the pressure has changed (in tenths of millibars) in the past three hours and the trend in the change of the pressure during that same period. In this example, the pressure was steady then fell (lowered) becoming 0.3 millibars LOWER than it was three hours ago. [see block 10]
	These lines indicate wind direction and speed rounded to the nearest 5 knots. The longest line, extending from the sky cover plot, points in the direction that the wind is blowing **FROM**. Thus, in this case, the wind is blowing **FROM** the southwest. The shorter lines, called barbs, indicate the wind speed in knots (kt). The speed of the wind is determined by the barbs. Each long barb represents 10 kt with short barbs representing 5 kt. In this example, the station plot contains two long barbs so the wind speed is 20 kt, or about 24 mph. [see block 9]
	The 71 at the lower left is the dewpoint temperature. The dewpoint temperature is the temperature the air would have to cool to become saturated, or in other words reach a relative humidity of 100%.
	The lower right area is reserved for the past weather, which is the most significant weather that has occurred within the past six hours excluding the most recent hour. [see block 11]

Below are the full station models in symbolic and sample plotted format. These include all possible observed weather elements. Refer to these when practicing with the problems given in class and when plotting your station models for your observation exercise.





EXPLANATION OF SYMBOLS AND MAP ENTRIES ❷

Symbols in order as they appear in the message	Explanation of symbols and decode of example above	Remarks on coding and plotting
TT	Current air temperature 34 = 34°F	Plotted in actual value in whole degrees F. Always located to the upper left of the station circle.
T_dT_d	Temperature of dewpoint 32 = 32°F	Plotted in actual value in whole degrees F. Always located to the lower left of the station circle.
PPP	Barometric pressure (in millibars) reducted to sea level 147 = 1014.7 mb	Coded and plotted in tens, units, and tenths of millibars. The initial 9 or 10 and the decimal point are omitted. Plotted as a 3-digit number. Normal range of pressures varies between about 960 mb and 1050 mb. Use this as your guide in determining whether the 9 or 10 should be the leading digit.
ww	Present weather * = intermittent fall of snow flakes, slight at time of observation	Coded in symbols taken from the "ww" table (block ❽). Entries for code symbols 00, 01, 02, and 03 are omitted from the map. The symbol is plotted immediately to the left of the station circle.
N	Total amount of cloud 8 = completely covered	Observed in tenths of cloud cover and coded according to code table in block ❻. Plotted within the station circle using symbols shown in same table.
N_h	Fraction of sky covered by low or middle clouds 6 = 7/10 or 8/10	Observed and coded in tenths of cloud cover. Plotted on map as number found in block ❼.
dd	True direction from which the wind is blowing 32 = 320° = NW	Plotted as a line extending from the station circle and pointing towards the direction from which the wind is coming. Plotted to the nearest 10° taking north as 360°, east as 90°, south as 180°, and west as 270°. Example: a north wind would be a line towards the top.
ff	Wind speed in knots 20 = 20 knots	Coded in knots (nautical miles per hour) and plotted as feathers and half-feathers representing 10 and 5 knots, respectively, on the shaft of the wind direction arrow. See block ❾. Unit conversions for wind speeds (1 knot [kt] = 1.15 mph; 1 mph = 0.87 kt; 1 kt = 0.5 m/s)
VV	Visibility in miles and fractions 12 = 12/16 or 3/4 mile	Decoded and plotted in miles and fractions up to 3 1/8 miles. Visibilities about 3 1/8 miles but less than 10 miles are plotted to the nearest whole mile. Values higher than 10 miles are not plotted.
W	Past weather • = rain	Coded in symbols taken from the "W" table (block ⓫). Past weather covers the 3 hrs. preceding the actual observation time if obs. are taken every 3 hrs. No entry is made for code figures 0, 1, or 2.
C_L	Cloud type - Low 7 = Fractostratus and/or Fractocumulus of bad weather (scud)	Predominating clouds of types in C_L table (block ❸) are plotted using corresponding symbols.
C_M	Cloud type - Middle 9 = Altocumulus of chaotic sky	See C_M table in block ❸.
C_H	Cloud type - High 2 = Dense cirrus in patches	See C_H table in block ❸.
h	Height of base of cloud 2 = 300 to 599 feet	Observed in feet and coded according to table in block ❺. Height of clouds is the distance between the ground and the base of the cloud (the ceiling).
a	Characteristic of barograph trace 2 = rising steadily or unsteadily (barometer now higher than 3 hrs ago)	Coded according to table in block ❿ and plotted in corresponding symbols
pp	Pressure change in 3 hrs preceding observation 28 = 2.8 millibars	Coded and given in tenths. +28 means a pressure increase of 2.8 mb Located to the right of the station circle.
RR	Amount of precipitation 45 = 0.45 inches	Precipitation amount in the preceding 6 hrs. Coded and plotted in inches to the nearest hundredth of an inch.
R_t	Time precipitation began or ended 3 = 2 to 3 hours ago	Coded and plotted with numbers from table in block ❹.

	C_L	DESCRIPTION (Abridged From W.M.O. Code)		C_M	DESCRIPTION (Abridged From W.M.O. Code)		C_H	DESCRIPTION ❸ (Abridged From W.M.O. Code)
1		Cu of fair weather, little vertical development and seemingly flattened	1		Thin As (most of cloud layer semi-transparent)	1		Filaments of Ci, or "mares tails," scattered and not increasing
2		Cu of considerable development, generally towering, with or without other Cu or Sc bases all at same level	2		Thick As, greater part sufficiently dense to hide sun (or moon), or Ns	2		Dense Ci in patches or twisted sheaves, usually not increasing, sometimes like remains of Cb; or towers or tufts
3		Cb with tops lacking clear-cut outlines, but distinctly not cirriform or anvil-shaped; with or without Cu, Sc, or St	3		Thin Ac, mostly semi-transparent; cloud elements not changing much and at a single level	3		Dense Ci, often anvil-shaped, derived from or associated with Cb
4		Sc formed by spreading out of Cu; Cu often present also	4		Thin Ac in patches; cloud elements continually changing and/or occurring at more than one level	4		Ci, often hook-shaped, gradually spreading over the sky and usually thickening as a whole
5		Sc not formed by spreading out of Cu	5		Thin Ac in bands or in a layer gradually spreading over sky and usually thickening as a whole	5		Ci and Cs, often in converging bands, or Cs alone; generally overspreading and growing denser; the continuous layer not reaching 45° altitude
6		St or Fs or both, but no Fs of bad weather	6		Ac formed by the spreading out of Cu	6		Ci and Cs, often in converging bands, or Cs alone; generally overspreading and growing denser; the continuous layer exceeding 45° altitude
7		Fs and/ or Fc of bad weather (scud)	7		Double-layered Ac, or a thick layer of Ac, not increasing; or Ac with As and/or Ns	7		Veil of Cs covering the entire sky
8		Cu and Sc (not formed by spreading out of Cu) with bases at different levels	8		Ac in the form of Cu-shaped tufts or Ac with turrets	8		Cs not increasing and not covering entire sky
9		Cb having a clearly fibrous (cirriform) top, often anvil-shaped, with or without Cu, Sc, St, or scud	9		Ac of a chaotic sky, usually at different levels; patches of dense Ci are usually present also	9		Cc alone or Cc with some Ci or Cs, but the Cc being the main cirriform cloud

Cloud abbreviations: St or Fs = Stratus or Fractostratus; Ci = Cirrus; Cs = Cirrostratus; Cc = Cirrocumulus; Ac = Altocumulus; As = Altostratus; Sc = Stratocumulus; Ns = Nimbostratus; Cu or Fc = Cumulus or Fractocumulus; Cb = Cumulonimbus

R_t	TIME OF PRECIPITATION ❹	h	HEIGHT IN FEET (Rounded Off)	HEIGHT IN METERS ❺ (Approximate)	N	SKY COVERAGE ❻ (Total Amount)	N_h	SKY COVERAGE ❼ (Low and/or Middle Clouds)
0	No Precipitation	0	0-149	0-49	○	No clouds	0	No clouds
1	Less than 1 hour ago	1	150-299	50-99	◔	Less than one-tenth or one-tenth	1	Less than one-tenth or one-tenth
2	1 to 2 hours ago	2	300-599	100-199	◔	Two-tenths or three-tenths	2	Two-tenths or three-tenths
3	2 to 3 hours ago	3	600-999	200-299	◑	Four-tenths	3	Four-tenths
4	3 to 4 hours ago	4	1,000-1,999	300-599	◑	Five-tenths	4	Five-tenths
5	4 to 5 hours ago	5	2,000-3,499	600-999	◕	Six-tenths	5	Six-tenths
6	5 to 6 hours ago	6	3,500-4,999	1,000-1,499	◕	Seven-tenths or eight-tenths	6	Seven-tenths or eight-tenths
7	6 to 12 hours ago	7	5,000-6,499	1,500-1,999	●	Nine-tenths or overcast with openings	7	Nine-tenths or overcast with openings
8	More than 12 hours ago	8	6,500-7,999	2,000-2,499	●	Completely overcast	8	Completely overcast
9	Unknown	9	At or above 8,000, or no clouds	At or above 2,500, or no clouds	⊗	Sky obscured	9	Sky obscured

Present Weather (Block 8)

	0	1	2	3	4	5	6	7	8	9
00	 Cloud development not observed or not observable during past hour	 Clouds generally dissolving or becoming less developed during past hour	 State of sky on the whole unchanged during past hour	 Clouds generally forming or developing during past hour	 Visibility reduced by smoke	Haze	 Widespread dust in suspension in the air, not raised by wind, at time of obs	 Dust or sand raised by wind, at time of obs	 Well developed dust devil(s) within past hour	 Duststorm or sandstorm within sight of station or at station during past hour
10	 Light fog	 Patches of shallow fog at station not deeper than 6 feet on land	 More or less continuous shallow fog at station not deeper than 6 feet on land	 Lightning visible, no thunder heard	 Precipitation within sight, but not reaching the ground	 Precipitation within sight, reaching ground, but distant from station	 Precipitation within sight, reaching the ground, near to but not at station	 Thunder heard but no precipitation at the station	 Squall(s) within sight during past hour	 Funnel cloud(s) within sight during past hour
20	 Drizzle (not freezing, not showers) during past hour, not at time of obs	 Rain (not freezing, not showers) during past hour, not at time of obs	 Snow (not falling as showers) during past hour, not at time of obs	 Rain and snow (not falling as showers) during past hour, not at time of obs	 Freezing drizzle or rain (not showers) during past hour, not at time of obs	 Showers of rain during past hour, but not at time of obs	 Showers of snow, or of rain and snow during past hour, but not at time of obs	 Showers of hail, or of hail and rain during past hour, but not at time of obs	 Fog during past hour, but not at time of obs	 Thunderstorm (with or without precip) during past hour, but not at time of obs
30	 Slight or moderate duststorm or sandstorm, has decreased during past hour	 Slight or moderate duststorm or sandstorm, no appreciable change during past hour	 Slight or moderate duststorm or sandstorm, has increased during past hour	 Severe duststorm or sandstorm, has decreased during past hour	Severe duststorm or sandstorm, no appreciable change during past hour	 Severe duststorm or sandstorm, has increased during past hour	 Slight or moderate drifting snow, generally low	 Heavy drifting snow, generally low	 Slight or moderate drifting snow, generally high	 Heavy drifting snow, generally high
40	Fog at distance at time of obs but not at station during past hour	Fog in patches	Fog, sky discernable, has become thinner during past hour	Fog, sky not discernable, has become thinner during past hour	Fog, sky discernable, no appreciable change during past hour	Fog, sky not discernable, no appreciable change during past hour	Fog, sky discernable, has begun or become thicker during past hour	Fog, sky not discernable, has begun or become thicker during past hour	Fog, depositing rime, sky discernable	Fog, depositing rime, sky not discernable
50	Intermittent drizzle (not freezing), slight at time of obs	Continuous drizzle (not freezing), slight at time of obs	Intermittent drizzle (not freezing), moderate at time of obs	Continuous drizzle (not freezing), moderate at time of obs	Intermittent drizzle (not freezing), thick at time of obs	Continuous drizzle (not freezing), thick at time of obs	Slight freezing drizzle	Moderate or thick freezing drizzle	Drizzle and rain, slight	Drizzle and rain, moderate or heavy
60	Intermittent rain (not freezing), slight at time of obs	Continuous rain (not freezing), slight at time of obs	Intermittent rain (not freezing), moderate at time of obs	Continuous rain (not freezing), moderate at time of obs	Intermittent rain (not freezing), heavy at time of obs	Continuous rain (not freezing), heavy at time of obs	Slight freezing rain	Moderate or heavy freezing rain	Rain or drizzle and snow, slight	Rain or drizzle and snow, moderate or heavy
70	Intermittent fall of snowflakes, slight at time of obs	Continuous fall of snowflakes, slight at time of obs	Intermittent fall of snowflakes, moderate at time of obs	Continuous fall of snowflakes, moderate at time of obs	Intermittent fall of snowflakes, heavy at time of obs	Continuous fall of snowflakes, heavy at time of obs	Ice needles (with or without fog)	Granular snow (with or without fog)	Isolated starlike snow crystals (with or without fog)	Ice pellets (sleet, U.S. definition)
80	Slight rain shower(s)	Moderate or heavy rain shower(s)	Violent rain shower(s)	Slight shower(s) of rain and snow mixed	Moderate or heavy shower(s) of rain and snow mixed	Slight snow shower(s)	Moderate or heavy snow shower(s)	Slight shower(s) of soft or small hail, with or without rain, and/or snow	Moderate or heavy shower(s) of soft or small hail, with or without rain and/or snow	Slight shower(s) of hail, with or without rain and/or snow, not assoc with thunder
90	Moderate of heavy shower(s) of hail and/or rain/snow, not associated with thunder	Slight rain at time of obs; thunderstorm during past hour not at time of obs	Moderate or heavy rain at time of obs; TS during past hour not at time of obs	Slight snow and/or rain/hail at time of obs; TS during past hour not at time of obs	Moderate or heavy snow and/or rain/ hail at time of obs; TS past hour not at obs time	Slight or moderate thunderstorm without hail but with rain and/or snow at obs time	Slight or moderate thunderstorm with hail at time of obs	Heavy thunderstorm without hail but with rain and/or snow at time of obs	Thunderstorm combined with duststorm or sandstorm at time of obs	Heavy thunderstorm with hail at time of obs

ff	Miles (Statute) Per Hour	Knots	⑨ Kilometers Per Hour
◎	Calm	Calm	Calm
—	1-2	1-2	1-3
⟍	3-8	3-7	4-13
⟍	9-14	8-12	14-19
⟍	15-20	13-17	20-32
⟍	21-25	18-22	33-40
⟍	26-31	23-27	41-50
⟍	32-37	28-32	51-60
⟍	38-43	33-37	61-69
⟍	44-49	38-42	70-79
⟍	50-54	43-47	80-87
⟍	55-60	48-52	88-96
⟍	61-66	53-57	97-106
⟍	67-71	58-62	107-114
⟍	72-77	63-67	115-124
⟍	78-83	68-72	125-134
⟍	84-89	73-77	135-143
⟍	119-123	103-107	144-198

Code Number	a	⑩ Barometric Tendency	
0	⌒	Rising, then falling	
1	⌒	Rising, then steady; or rising, then rising more slowly	Barometer now higher than 3 hours ago
2	/	Rising steadily, or unsteadily	
3	✓	Falling or steady, then rising; or rising, then rising more quickly	
4	—	Steady, same as 3 hours ago	
5	⌒	Falling, then rising, same or lower than 3 hours ago	
6	⌒	Falling, then steady; or falling, then falling more slowly	Barometer now lower than 3 hours ago
7	\	Falling steadily, or unsteadily	
8	⌒	Steady or rising, then falling; or falling, then falling more quickly	

Code Number	W	⑪ Past Weather	
0		Clear or few clouds	Not plotted
1		Partly cloudy (scattered) or variable sky	
2		Cloudy (broken) or overcast	
3	≡	Sandstorm or duststorm, or drifting or blowing snow	
4	≡	Fog, or smoke, or thick dust haze	
5	,	Drizzle	
6	•	Rain	
7	*	Snow, or rain and snow mixed, or ice pellets (sleet)	
8	▽	Shower(s)	
9	⌒	Thunderstorm, with or without precipitation	