# Weather charts
# I. Surface Analysis

**PROF. S. K. PARK and PROF. C. CASSARDO**

UNIVERSITÀ DEGLI STUDI DI TORINO

# Weather Charts

**Surface**

- 12h, 3h

**Upper Level**

- 925, 850, 700, 500, 300, 200, 100 hPa

# Consideration on pressure

Remembering that $Pressure = \frac{Force}{Area}$, in the International system of measure, being Force measured in N (1 N = 1 kg m $s^{-2}$), and Area in $m^2$, a force of 1 N over an area of 1 $m^2$ exert a pressure of 1 Pa (Pascal) = 1 N $m^{-2}$ = 1 kg $m^{-1}$ $s^{-2}$

The International System of measures has as fundamental units the length (basic unit: 1 m), the mass (1 kg), the time (1 s), the temperature (1 K), the current (1 A)…

In meteorology, mean sea level pressure (SLP) is about $10^5$ Pa, thus a multiple is used: the hPa; mean SLP is thus 1000 hPa.

In the past, another international system was used: it was called CGS, acronym of Centimeter-Gram-Second, because the fundamental units were: length (1 cm), mass (1 g), time (1 s)

In this system, the unit of force was called dyne: so the pressure was measured in dyn/$cm^2$. Thus, 1 dyne $cm^{-2}$ = 1 g $cm^{-1}$ $s^{-2}$

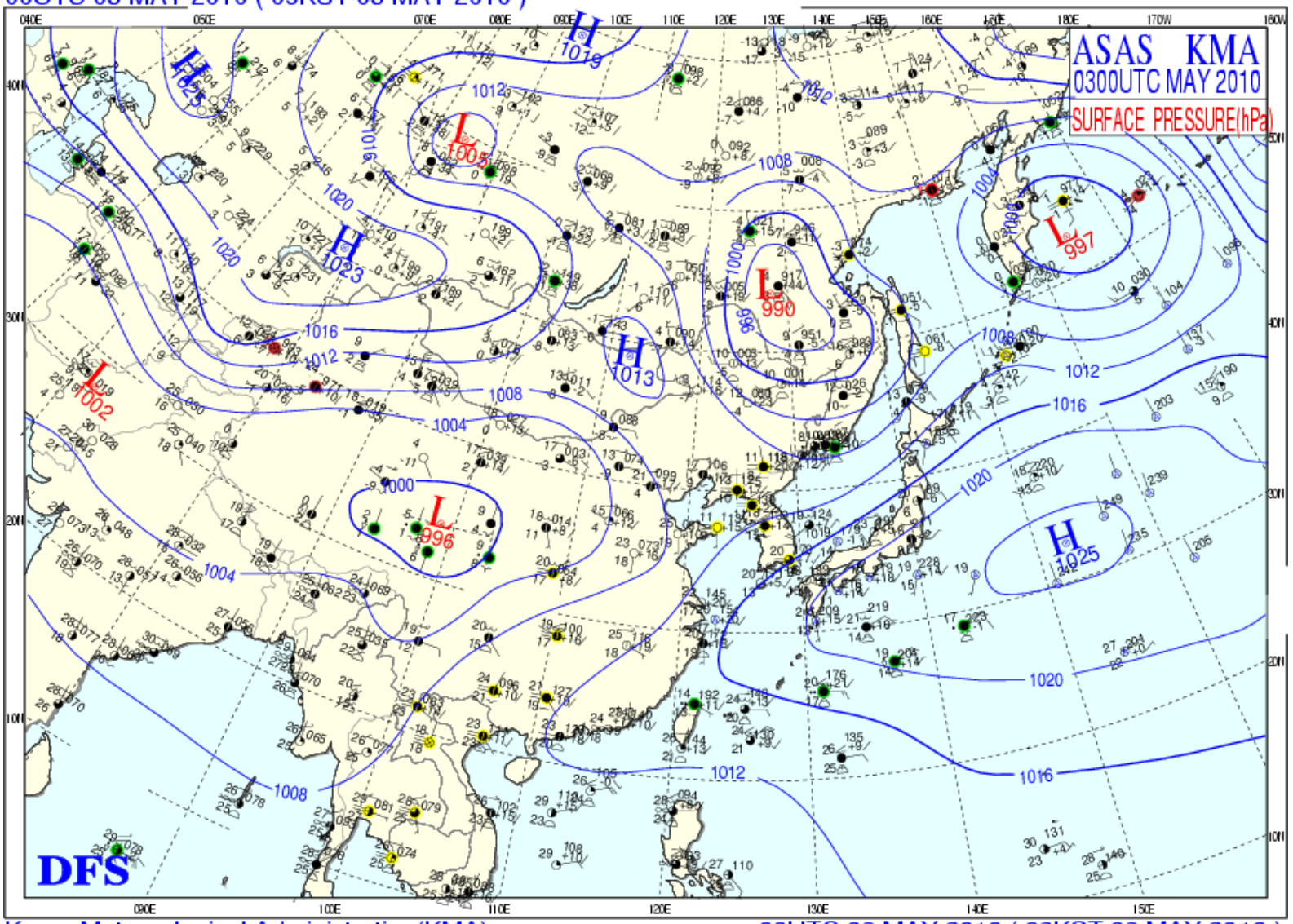
Also, a pressure unit was defined: the bar. 1 bar = $10^6$ dynes $cm^{-2}$.

What relation exist between Pa and bar?

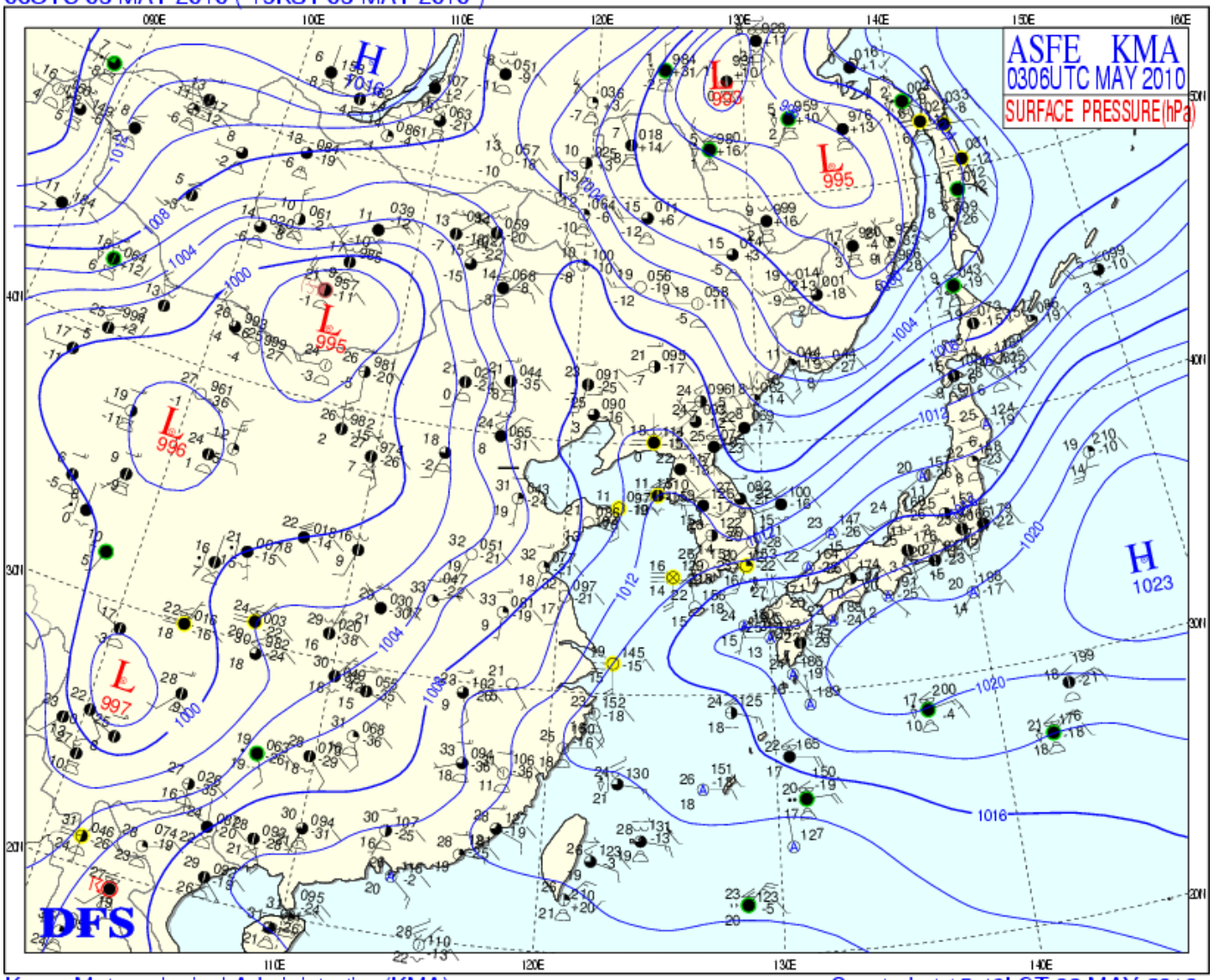
1 Pa = 1 N $m^{-2}$ = 1 kg $m^{-1}$ $s^{-2}$ = 1 ($10^3$) g $(10^2)^{-1}$ $cm^{-1}$ $s^{-2}$ = 10 dynes $cm^{-2}$ = $10^{-5}$ bar

Thus, 1 hPa = $10^{-2}$ Pa = $10^{-3}$ bar = 1 mb: they are the same!!!!

# Weather Charts (Surface)

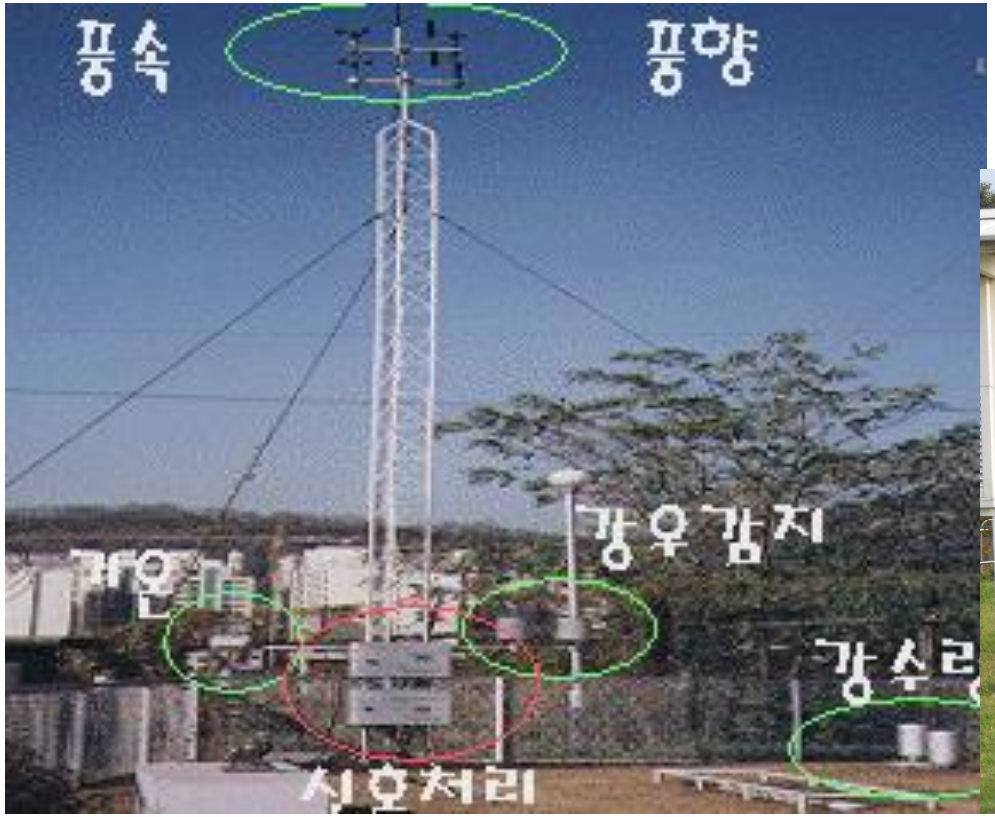


# Weather Charts (Surface)



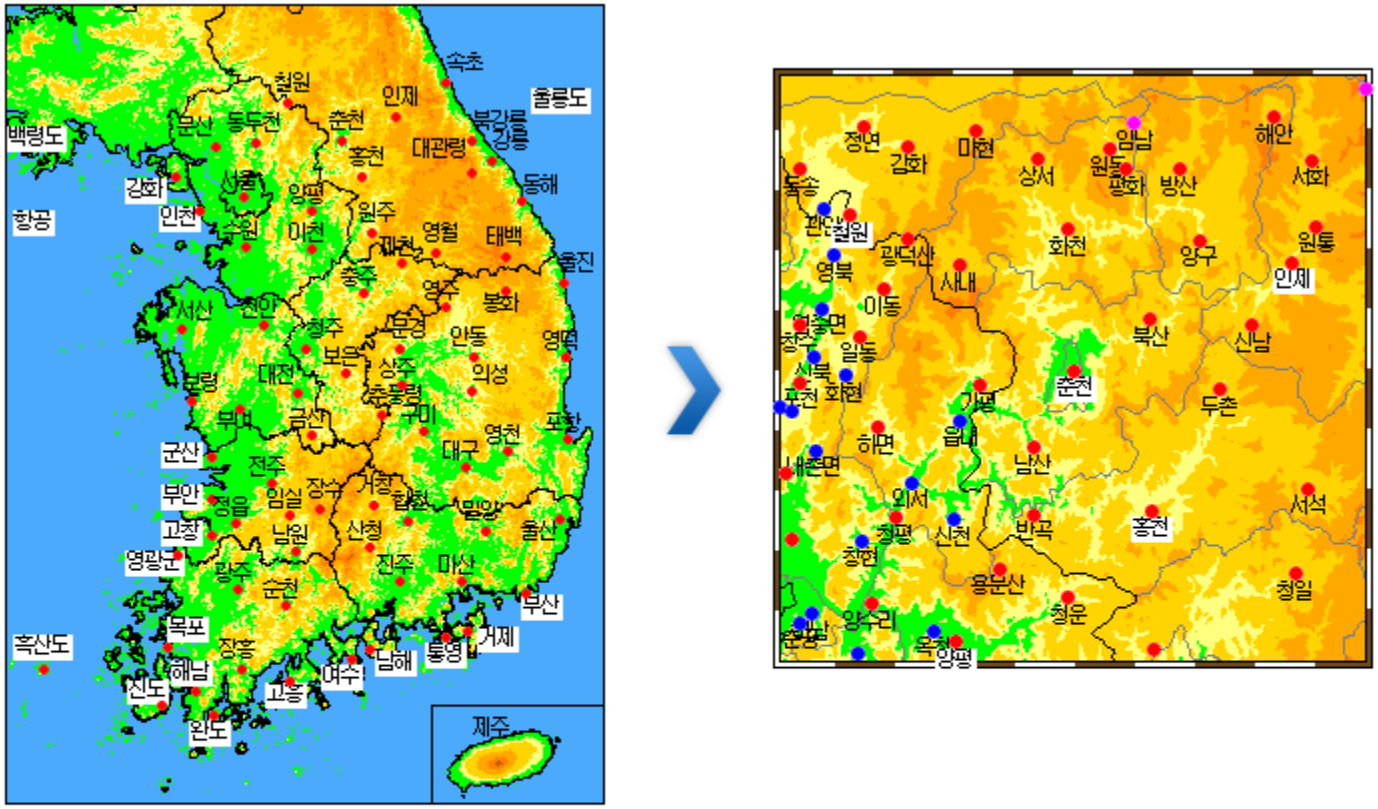
# Surface Observation

## AWS (Automated Weather Station)




# Surface Observation

## AWS (Automated Weather Station)




매분관측자료 진주 192 (27m) / 2009년 11월 09일 15시 09분 / 경상남도 진주시 평거동

| 지점 | 날씨 | | | | 기온(℃) | | | 강수 | | 바람 | | 기압(hpa) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 현재일기 | 시정 km | 운량 1/10 | 중하운량 | 현재 | 이슬점 | 체감 | 일감수 | 습도 | 풍향 | 풍속 | 해면 | 변화 | 변화량 |

# Surface Observation

## AWS (Automated Weather Station)

[ 매분관측자료 ] 서울 108 / 2010.05.04.00:56

< 서울 >

| AWS 지점 / 고도 | | | 강수 | 강수15 | 강수60 | 강수12H | 일강수 | 기온 | 풍향1 | | 풍속1 | 풍향10 | | 풍속10 | 습도 | 해면기압 | 위치 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 108 | 서울 | 86m | ○ | 0 | 0 | 0 | 0 | 18.3 | 237.9 | WSW | 2.9 | 237.3 | WSW | 3.3 | 81.2 | 1015.2 | 서울특별시 종로구 송월동 |
| 420 | 북한산 | 455m | ○ | 0 | 0 | 0 | 0 | 15.3 | 160.1 | SSE | 3.3 | 145.5 | SE | 3.3 | . | . | 서울특별시 종로구 구기동 |
| 419 | 중구 | 267m | ○ | 0 | 0 | 0 | 0 | 16.9 | 249.4 | WSW | 1.5 | 246.3 | WSW | 1.7 | . | . | 서울특별시 중구 회현동1가 |
| 415 | 용산 | 29m | ○ | 0 | 0 | 0 | 0 | 19.4 | 229.8 | SW | 5.1 | 233.1 | SW | 5.3 | . | . | 서울특별시 용산구 이촌동 |
| 421 | 성동 | 25m | ○ | 0 | 0 | 0 | 0 | 19.4 | 247.9 | WSW | 3.6 | 246.8 | WSW | 4.6 | . | . | 서울특별시 성동구 성수동1가 |
| 413 | 광진 | 52m | ○ | 0 | 0 | 0 | 0 | 19.8 | 219.9 | SW | 3.6 | 230.5 | SW | 3.5 | . | . | 서울특별시 광진구 화양동 |
| 408 | 동대문 | 35m | ○ | 0 | 0 | 0 | 0 | 19.5 | 208.6 | SSW | 2.7 | 228.8 | SW | 3.1 | . | . | 서울특별시 동대문구 전농동 |
| 409 | 중랑 | 40m | ○ | 0 | 0 | 0 | 0 | 19.7 | 255.4 | WSW | 4.1 | 286.3 | WNW | 4.3 | . | . | 서울특별시 중랑구 면목동 |
| 414 | 성북 | 127m | ○ | 0 | 0 | 0 | 0 | 18.5 | 231.9 | SW | 2.2 | 224.4 | SW | 3.3 | . | . | 서울특별시 성북구 정릉동 |
| 424 | 강북 | 56m | ○ | 0 | 0 | 0 | 0 | 18.9 | 226.4 | SW | 2.0 | 221.1 | SW | 2.7 | . | . | 서울특별시 강북구 수유동 |
| 406 | 도봉 | 56m | ○ | 0 | 0 | 0 | 0 | 19.0 | 207.9 | SSW | 2.3 | 208.0 | SSW | 2.6 | . | . | 서울특별시 도봉구 방학동 |
| 407 | 노원 | 53m | ○ | 0 | 0 | 0 | 0 | 19.3 | 224.7 | SW | 3.6 | 226.4 | SW | 2.8 | . | . | 서울특별시 노원구 공릉동 |
| 416 | 은평 | 67m | ○ | 0 | 0 | 0 | 0 | 18.5 | 175.2 | S | 0.6 | 212.4 | SSW | 1.1 | . | . | 서울특별시 은평구 불광동 |
| 412 | 서대문 | 101m | ○ | 0 | 0 | 0 | 0 | 18.2 | 195.3 | SSW | 3.5 | 201.2 | SSW | 2.0 | . | . | 서울특별시 서대문구 신촌동 |
| 411 | 마포 | 24m | ○ | 0 | 0 | 0 | 0 | 18.7 | 188.5 | S | 2.6 | 203.2 | SSW | 2.3 | . | . | 서울특별시 마포구 망원동 |
| 405 | 양천 | 11m | ○ | 0 | 0 | 0 | 0 | 19.0 | 196.1 | SSW | 2.5 | 209.7 | SSW | 2.6 | . | . | 서울특별시 양천구 목동 |
| 404 | 강서 | 79m | ○ | 0 | 0 | 0 | 0 | 17.8 | 158.2 | SSE | 1.3 | 195.5 | SSW | 1.5 | . | . | 서울특별시 강서구 화곡동 |

# Surface Observation

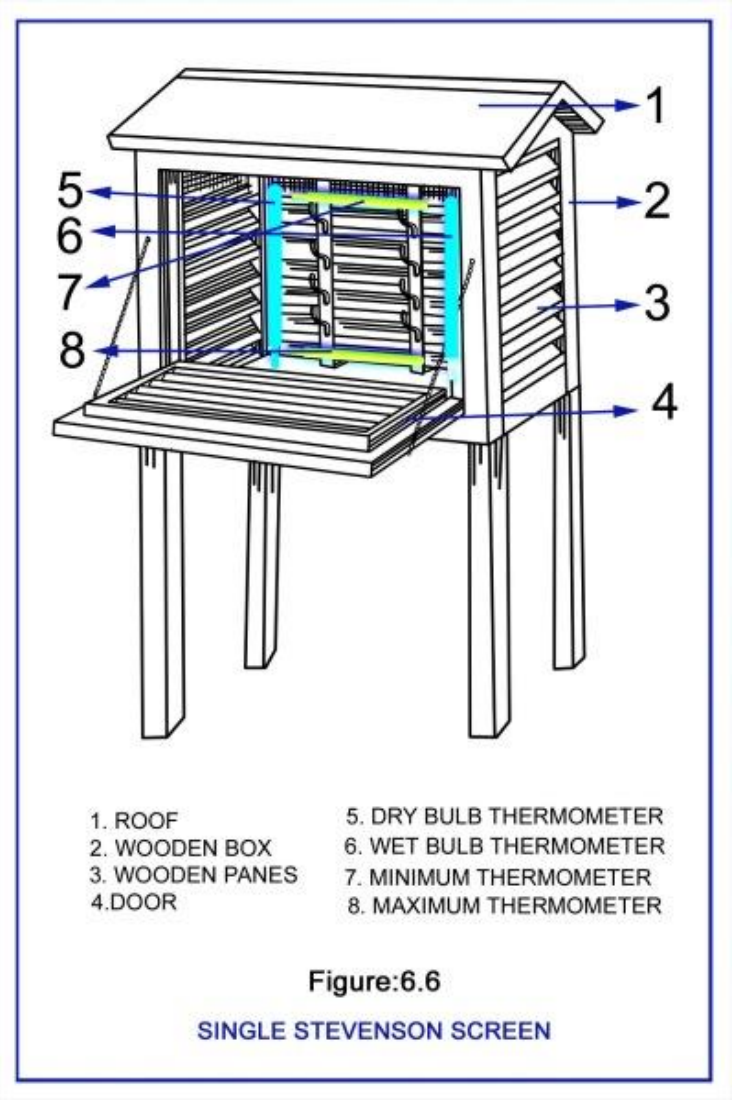
## AWS (Automated Weather Station)

[ 매분관측자료 ] 서대문 412 (101m) / 2010.05.04.00:58 / 서울특별시 서대문구 신촌동

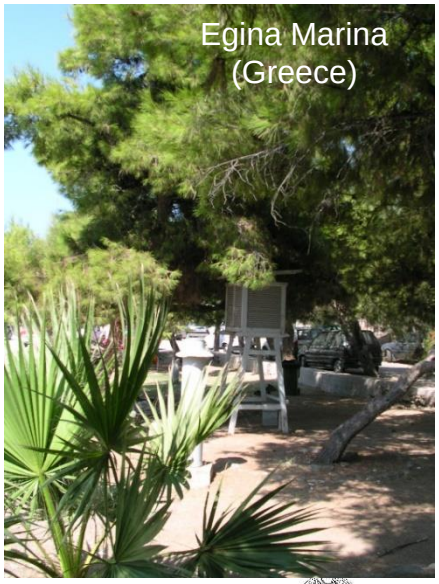
| 시:분 | 강수 | 강수15 | 강수60 | 강수12H | 일강수 | 기온 | 풍향1 | | 풍속1 | 풍향10 | | 풍속10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 00:58 | . | . | . | . | . | . | | | | | | |
| 00:57 | . | . | . | . | . | . | | | | | | |
| 00:56 | ○ | 0 | 0 | 0 | 0 | 18.2 | 225.1 | SW | 2.8 | 204.5 | SSW | 2.1 |
| 00:55 | ○ | 0 | 0 | 0 | 0 | 18.2 | 195.3 | SSW | 3.5 | 201.2 | SSW | 2.0 |
| 00:54 | ○ | 0 | 0 | 0 | 0 | 18.2 | 192.3 | SSW | 1.3 | 203.8 | SSW | 1.9 |
| 00:53 | ○ | 0 | 0 | 0 | 0 | 18.2 | 212.1 | SSW | 1.2 | 203.7 | SSW | 1.9 |
| 00:52 | ○ | 0 | 0 | 0 | 0 | 18.2 | 217.2 | SW | 1.0 | 200.8 | SSW | 2.0 |
| 00:51 | ○ | 0 | 0 | 0 | 0 | 18.3 | 245.6 | WSW | 1.9 | 197.4 | SSW | 2.1 |
| 00:50 | ○ | 0 | 0 | 0 | 0 | 18.2 | 181.5 | S | 2.8 | 195.2 | SSW | 2.2 |
| 00:49 | ○ | 0 | 0 | 0 | 0 | 18.2 | 190.1 | S | 1.5 | 198.3 | SSW | 2.2 |
| 00:48 | ○ | 0 | 0 | 0 | 0 | 18.2 | 200.3 | SSW | 1.9 | 198.0 | SSW | 2.2 |
| 00:47 | ○ | 0 | 0 | 0 | 0 | 18.2 | 188.4 | S | 3.0 | 198.0 | SSW | 2.2 |
| 00:46 | ○ | 0 | 0 | 0 | 0 | 18.2 | 193.1 | SSW | 1.6 | 200.3 | SSW | 2.2 |
| 00:45 | ○ | 0 | 0 | 0 | 0 | 18.2 | 220.4 | SW | 2.5 | 201.7 | SSW | 2.3 |
| 00:44 | ○ | 0 | 0 | 0 | 0 | 18.2 | 191.4 | SSW | 1.5 | 200.3 | SSW | 2.1 |
| 00:43 | ○ | 0 | 0 | 0 | 0 | 18.2 | 183.8 | S | 2.3 | 200.4 | SSW | 2.1 |
| 00:42 | ○ | 0 | 0 | 0 | 0 | 18.2 | 185.4 | S | 1.9 | 199.5 | SSW | 2.1 |
| 00:41 | ○ | 0 | 0 | 0 | 0 | 18.2 | 218.3 | SW | 2.7 | 200.1 | SSW | 2.1 |
| 00:40 | ○ | 0 | 0 | 0 | 0 | 18.2 | 212.6 | SSW | 2.9 | 198.1 | SSW | 1.9 |

# "Old style" atmospheric measurements

- Main characteristics: instrument sensitivity, error, answer time
- Problems: representativity of data (obstacles, orography, wind, snow, …)
- Typical setup (according with WMO regulations): **Stevenson screen**, at 1.5 m of elevation over the soil, at ~ 100m of distance from major obstacles (trees, buildings, …)
- Wind speed measured at the height of **10 m over the soil**

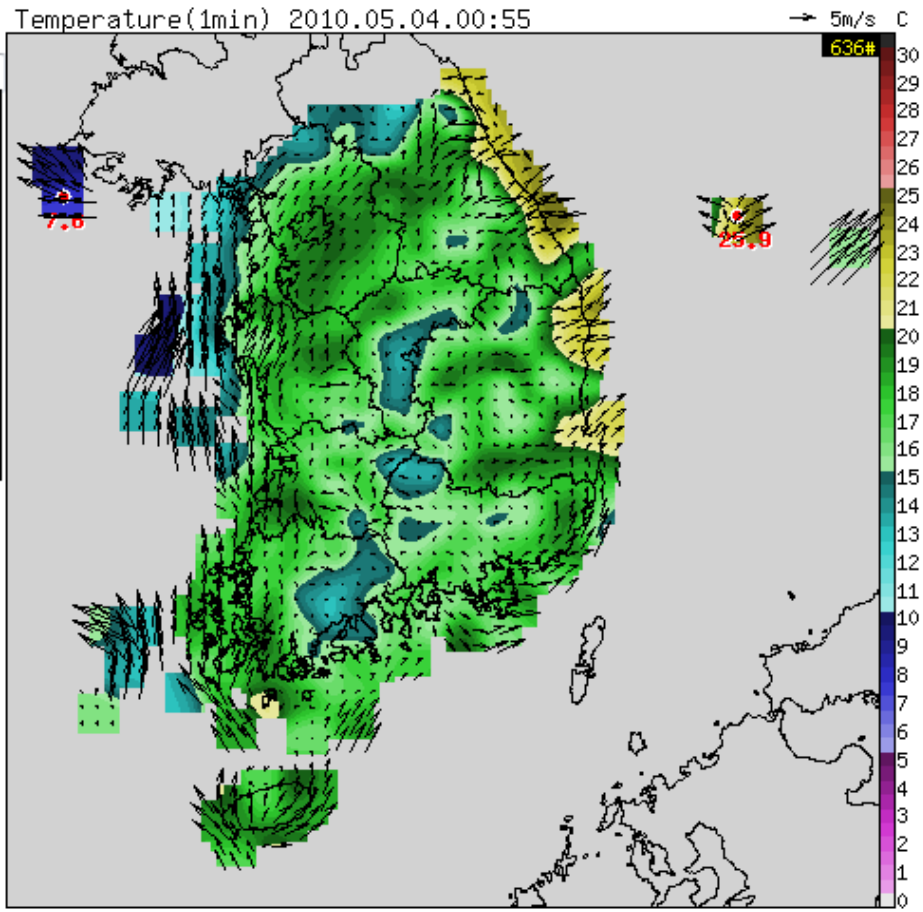


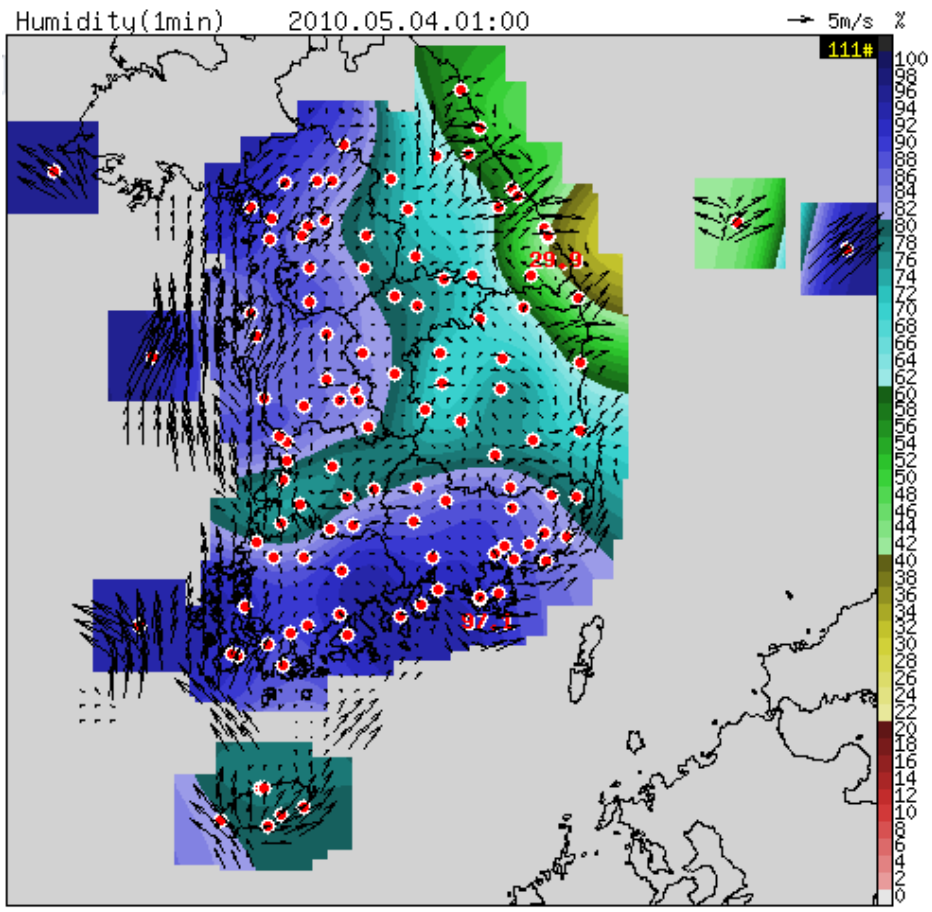
# Examples of meteorological screens

# Surface Observation

## AWS (Automated Weather Station)



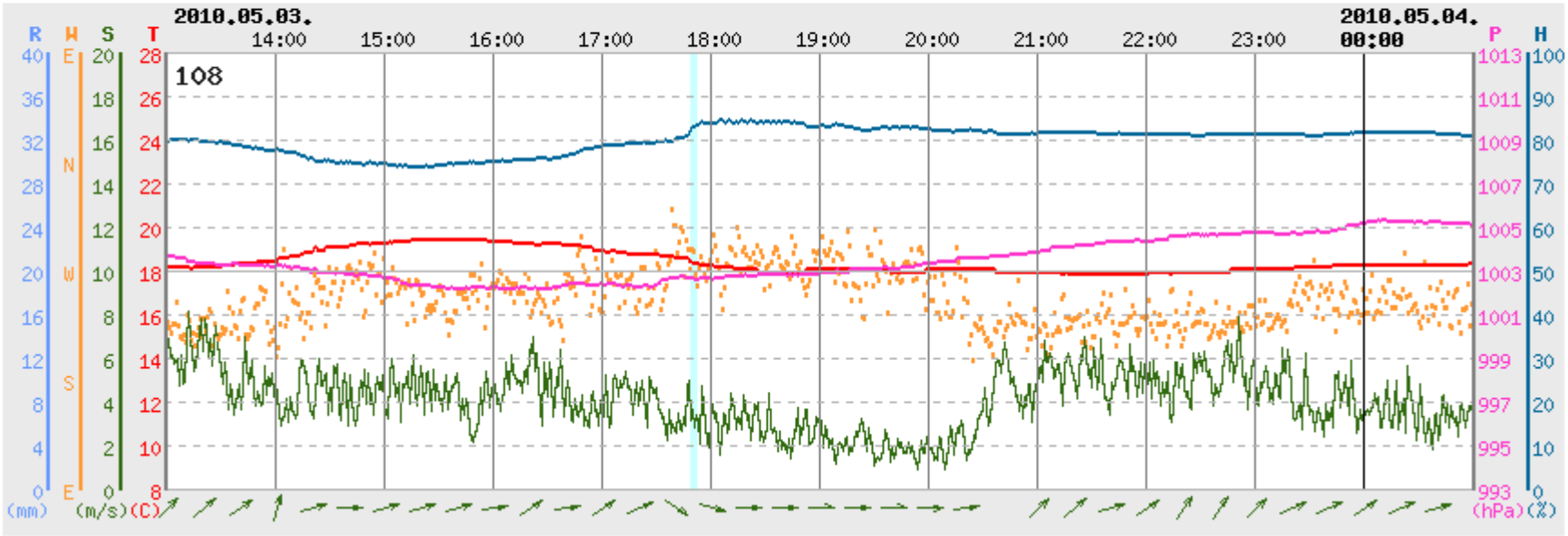
# Surface Observation

## AWS (Automated Weather Station)

[ 매분분석자료 ] 서울 108 / 2010.05.04.01:00

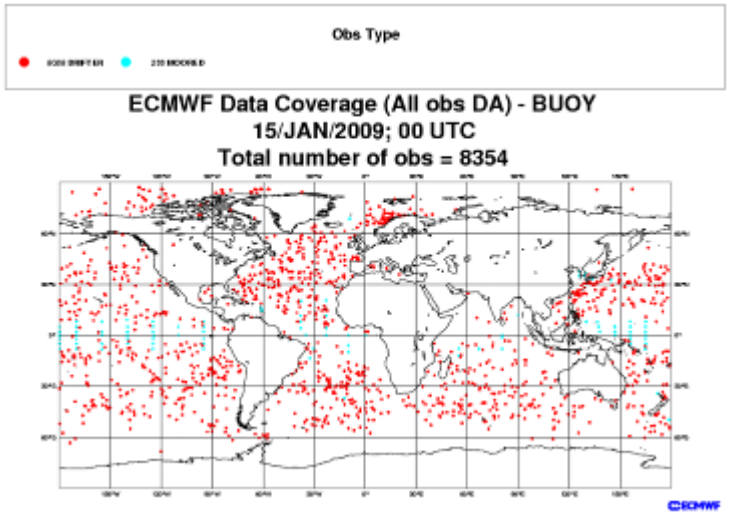
{ 설명 } 하늘색 : 강우감지기 / 파란색 : 60분이동누적 / 분홍색 : 15분이동누적강수량

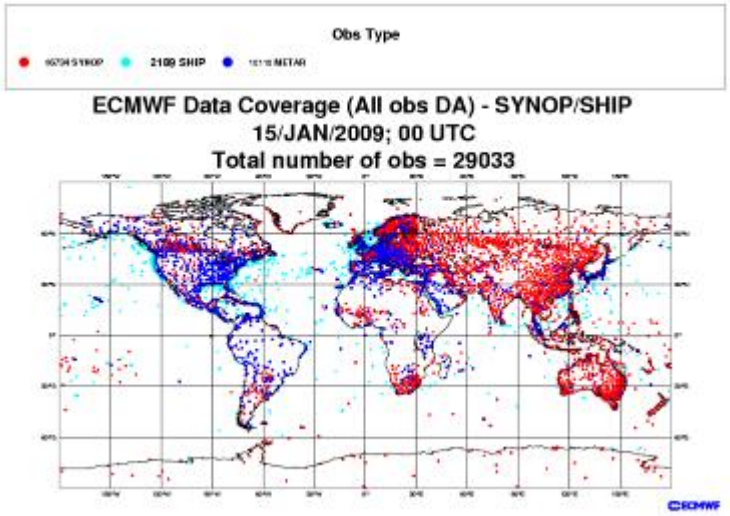
[ 서울 ] 서울

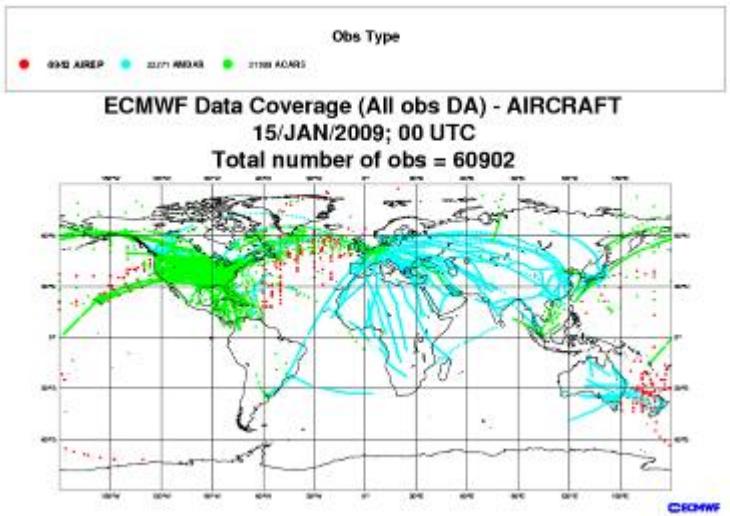


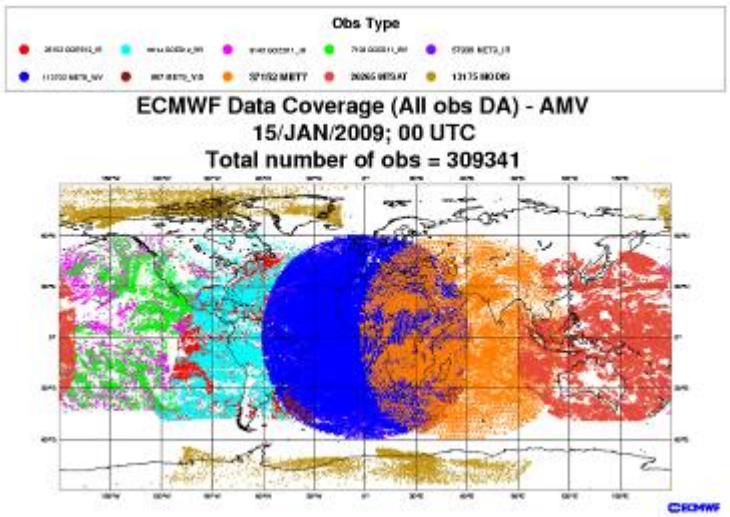
# Observing networks

Observations **at synoptic scale**: each hour, at the main synoptic hours (00, 06, 12, 18 UTC), except rain (9, 21 LT) – they compose the WWW (World Weather Watch)



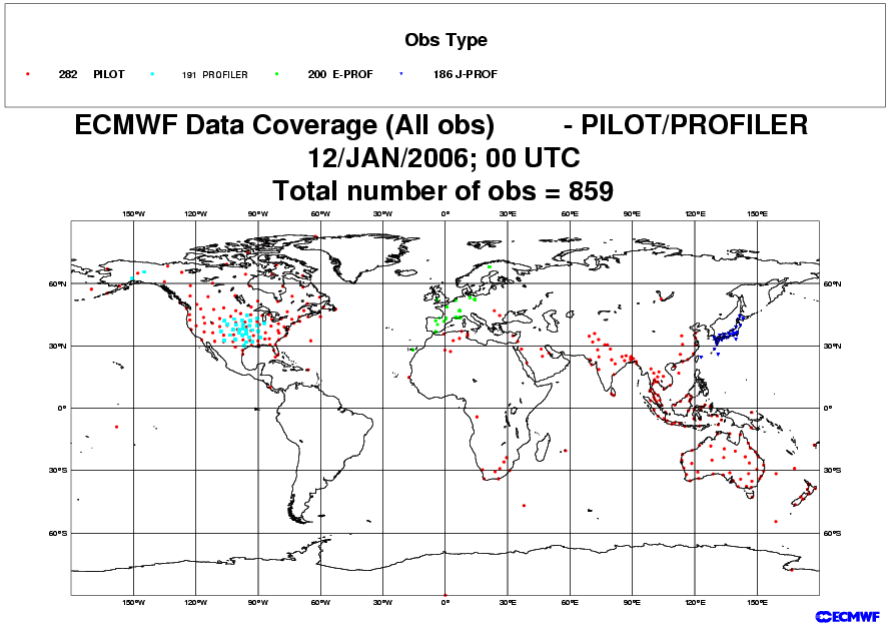



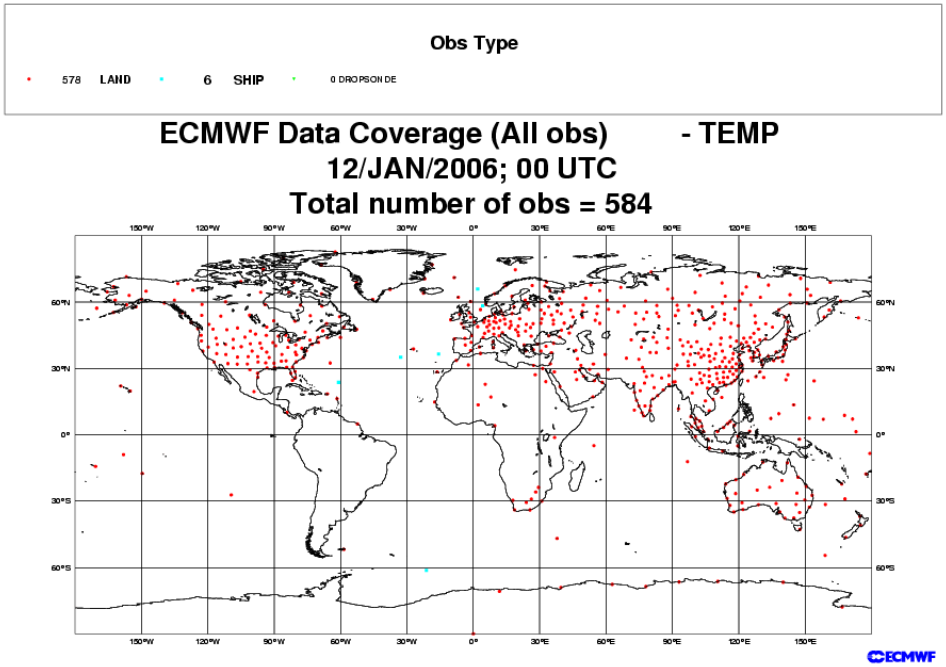



# Other data

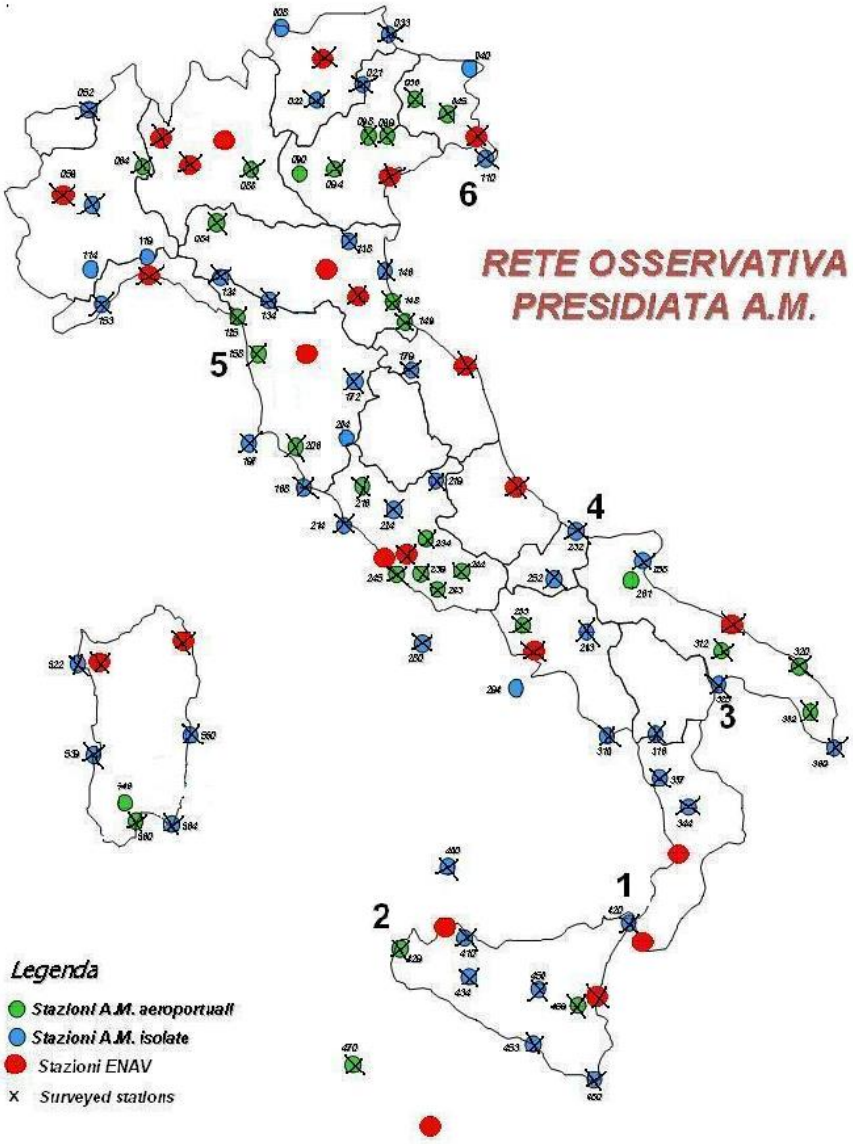
PILOT: balloons which measure wind

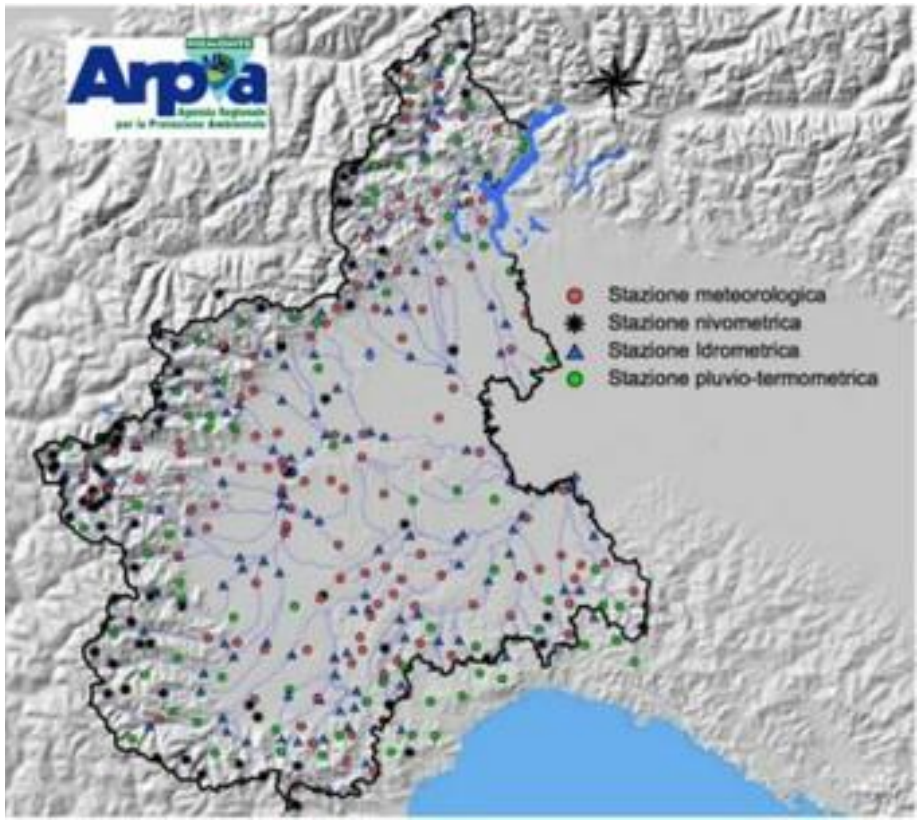


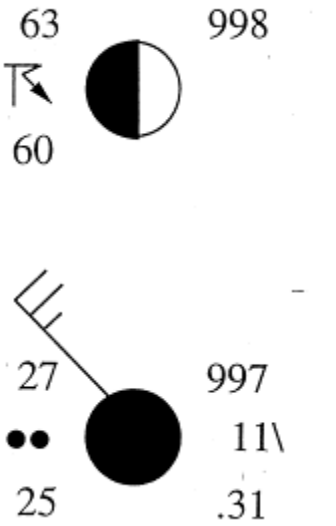

TEMP: radiosoundings with balloons (00, 12 UTC and sometimes 06, 18 UTC): measure T, RH, p, u, v, w

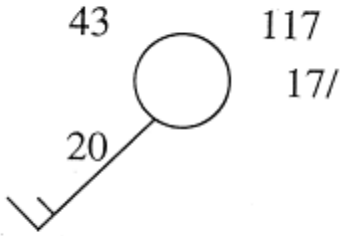
# Meteorological stations in Piemonte and Italy



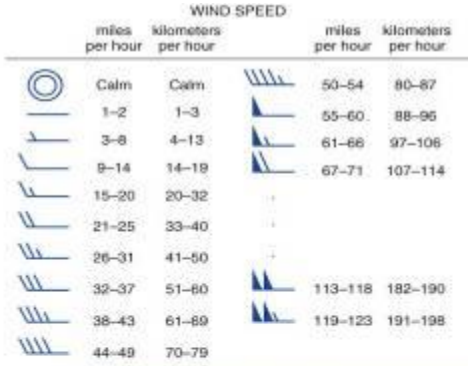



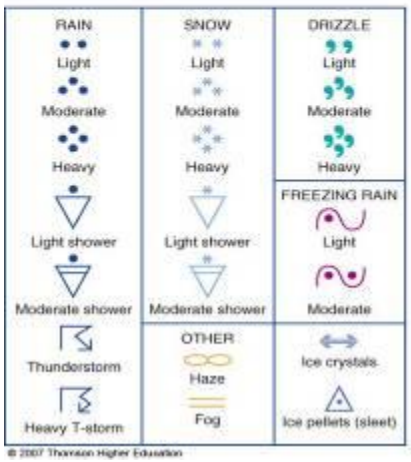
# Weather maps and plotting symbols



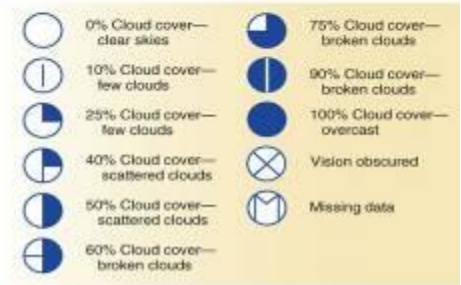



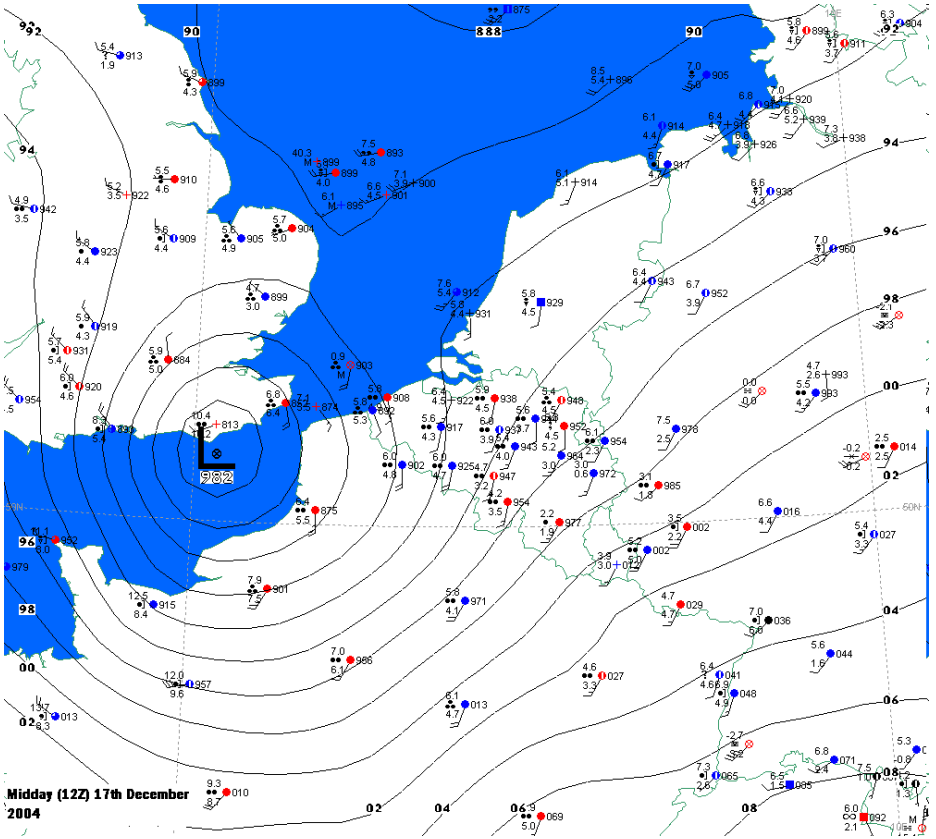


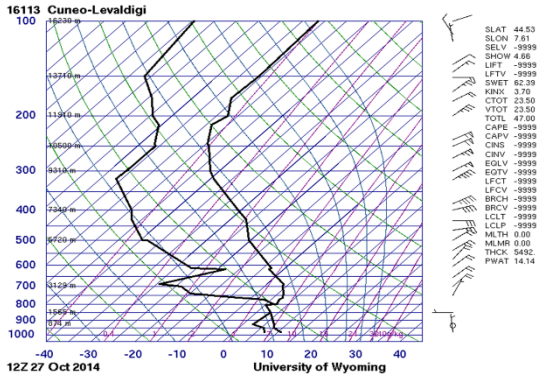




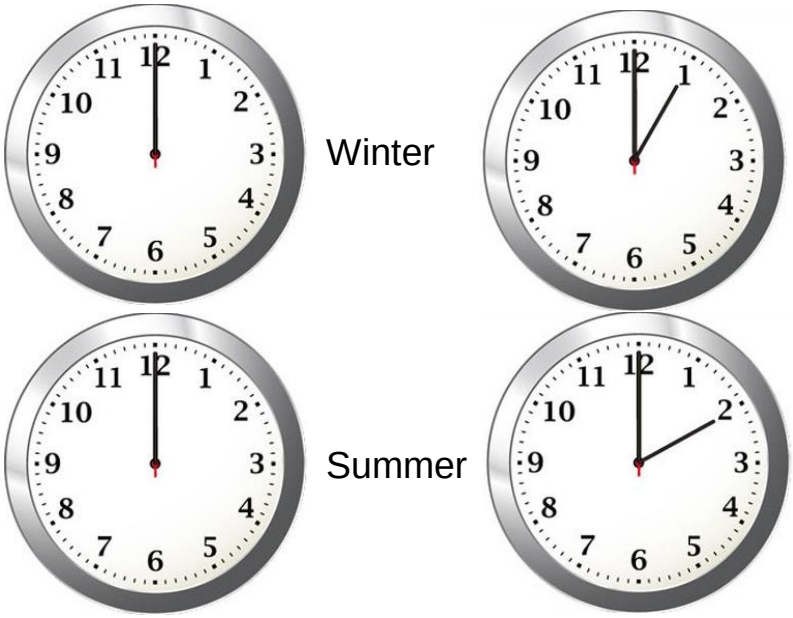



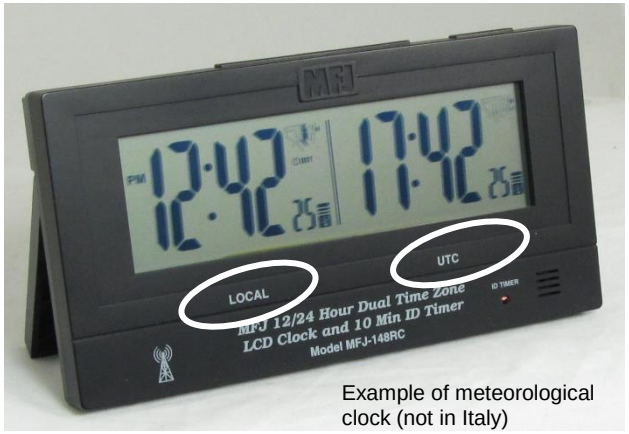
# Meteorological time

- All weather reports are labelled using Coordinated Universal Time (UTC), also called Greenwich Mean Time (GMT), and also denoted Zulu (Z).
- Zulu is the time along the 0° longitude line, which runs through Greenwich.
- Meteorology uses the 24 hour clock which omits the use of a.m. and p.m. (0900 = 9 a.m., 2100 = 9 p.m.)


In Italy:

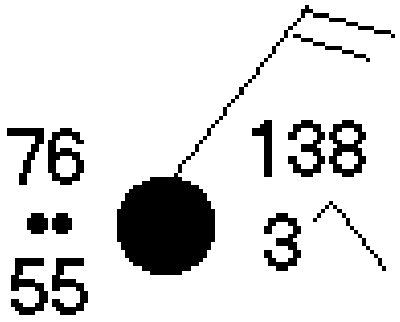



(Italian Standard Time)




Example of meteorological clock (not in Italy)

# Station Model

# Station Model

TT – Temperature: In the United States surface temperature is expressed in units of degrees Fahrenheit. In most other countries of the world it is expressed in degrees Celsius.

$T_dT_d$ – Dew point temperature: Expressed in the same units as temperature .

N – Cloud cover: Total cloud amount represents the fraction of sky covered by cloud.

VV – Visibility: How far we can see, expressed in units of miles.

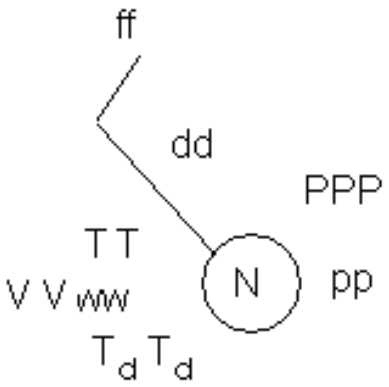
dd – Wind direction: The line drawn represents the direction from which the wind is blowing.

ff – Wind speed: The barbs on the lines representing wind direction give us information on the wind speed.

ww – present weather conditions: Symbols are used to convey information on the type of weather that was observed when the observations were made.

PPP – Surface Pressure adjusted to sea level. The units are coded in mb. The leading 9 or 10 are dropped as is the decimal. So 234 represents a pressure of 1023.4 mb while 834 represents a pressure of 983.4 mb.

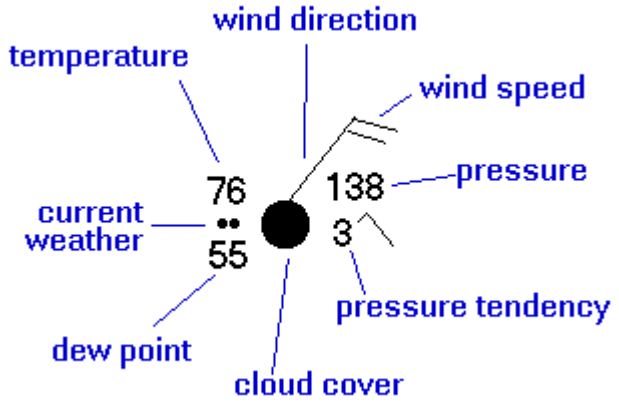
pp – Change in surface pressure over the last three hours. The change in pressure is represented by a value and a line that tells us how the pressure was changing.



# Station Model

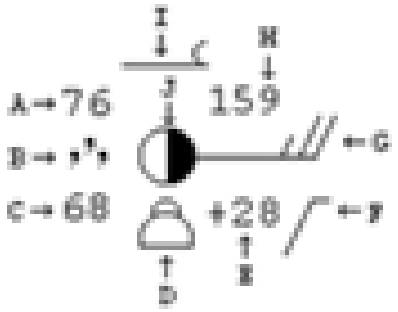
In the following (US) station plot:

- the temperature is 76 ˚F;
- the dew point 55 ˚F;
- the wind direction is northeast;
- the wind speed is 20 knots;
- the pressure is 1013.8 hPa;
- the pressure has increased (/) then decreased (\) and is now lower (decreasing sign larger than increasing sign) by 0.3 mb than three hours ago;
- the cloud cover is overcast;
- it is raining.



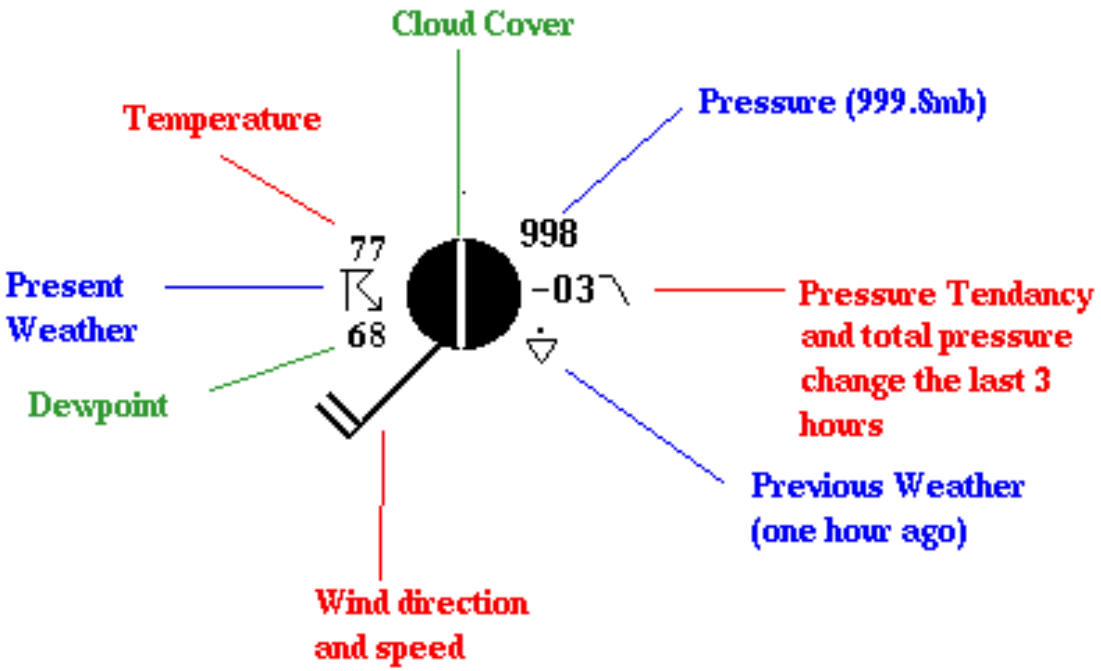
# Station Model

Weather Station Model Demo

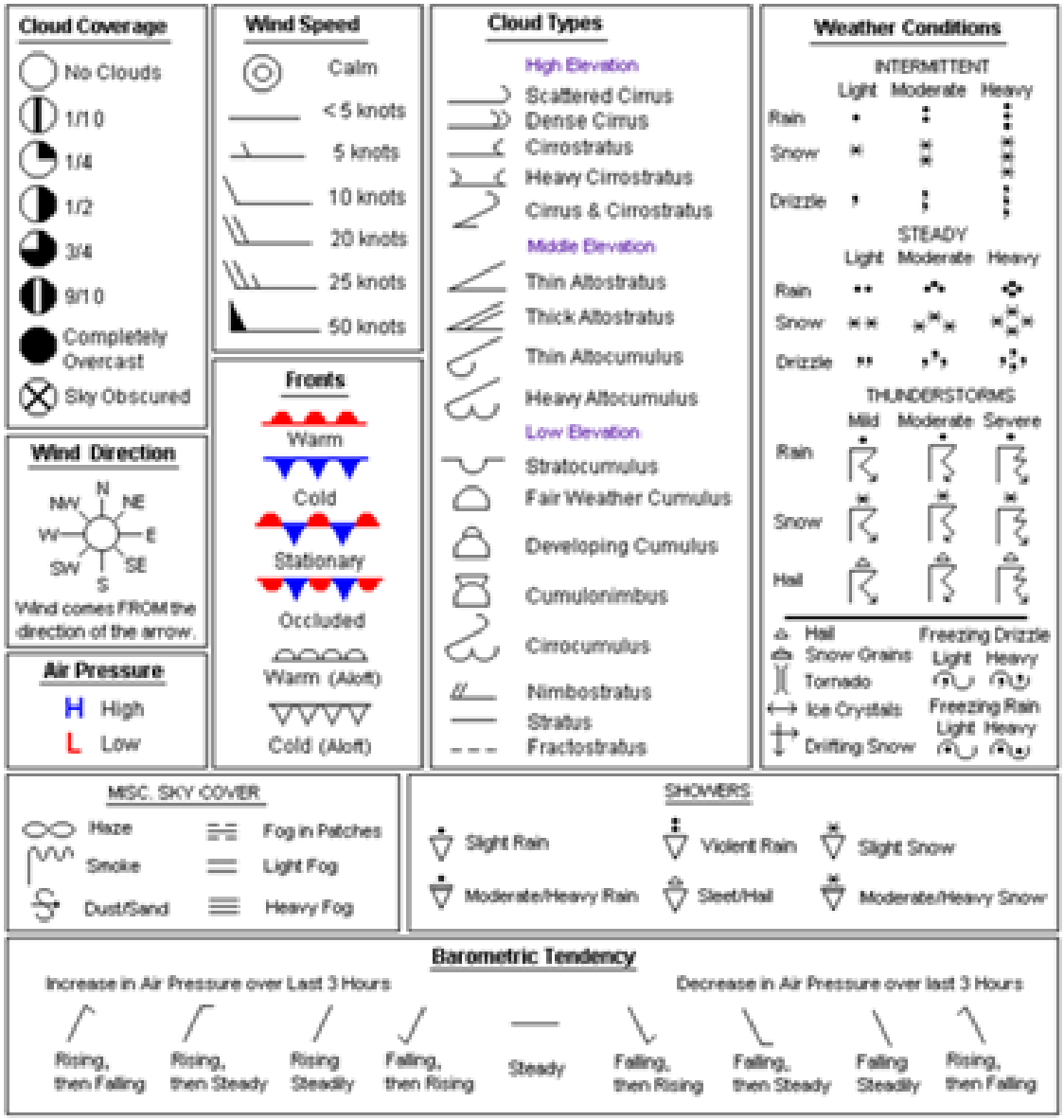



A - Temperature
B - Present Weather
C - Dew Point
D - Low Cloud Type
E - Pressure Change
F - Pressure Tendency
G - Wind Speed & Direction
H - Barometric Pressure
I - High Cloud Type
J - Cloud Coverage

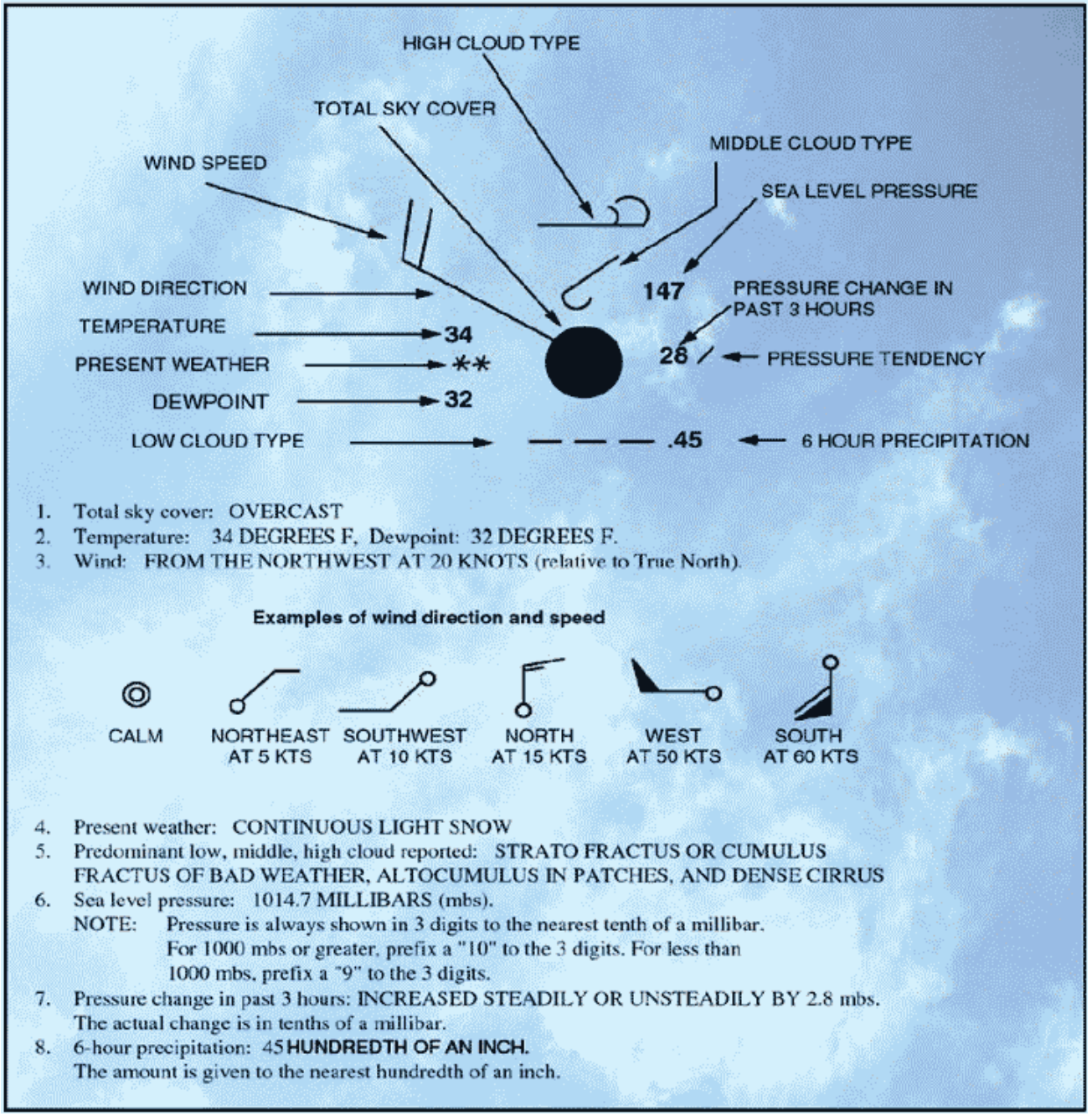
# Station Model



# Station Model



# Station Model




1. Total sky cover: OVERCAST
2. Temperature: 34 DEGREES F, Dewpoint: 32 DEGREES F.
3. Wind: FROM THE NORTHWEST AT 20 KNOTS (relative to True North).

**Examples of wind direction and speed**




4. Present weather: CONTINUOUS LIGHT SNOW
5. Predominant low, middle, high cloud reported: STRATO FRACTUS OR CUMULUS FRACTUS OF BAD WEATHER, ALTOCUMULUS IN PATCHES, AND DENSE CIRRUS
6. Sea level pressure: 1014.7 MILLIBARS (mbs).
   NOTE: Pressure is always shown in 3 digits to the nearest tenth of a millibar. For 1000 mbs or greater, prefix a "10" to the 3 digits. For less than 1000 mbs, prefix a "9" to the 3 digits.
7. Pressure change in past 3 hours: INCREASED STEADILY OR UNSTEADILY BY 2.8 mbs. The actual change is in tenths of a millibar.
8. 6-hour precipitation: 45 **HUNDREDTH OF AN INCH.** The amount is given to the nearest hundredth of an inch.

# The METAR Code

**METAR , message d'observation météorologique régulière pour l'aviation, which is the French expression for Aviation Routine Meteorological Report.**

**SPECI is derived from the French expression for Aviation Selected Special Meteorological Report.**

**METAR tutorial:**

**https://www.wunderground.com/metarFAQ.asp**

**METAR or SPECI CCCC YYGGggZ AUTO or COR dddff(f)G$f_m f_m$($f_m$)KT $d_n d_n d_n V d_x d_x d_x$ VVVVVSM [$RD_R D_R/V_R V_R V_R V_R$ or $RD_R D_R V_N V_N V_N V_N VV_X V_X V_X V_X$FT] w'w' [$N_s N_s N_s h_s h_s h_s$ or $VVh_s h_s h_s$ or SKC/CLR] T'T'/$T'_d T'_d$ A$P_H P_H P_H P_H$ RMK (Automated, Plain Language) (Additive Data and Automated Maintenance Indicators)**

# The SYNOP messages

**SYNOP (surface synoptic observations) is a numerical code used for reporting weather observations made by manned and automated weather stations.**

**SYNOP reports are typically sent every three-six hours by Deutscher Wetterdienst.**

**A report consists of groups of numbers (and slashes where data is not available) describing general weather information, such as the temperature, barometric pressure and visibility at a weather station. It can be decoded by open-source software such as seaTTY, metaf2xml or Fldigi.**

**The general structure of a SYNOP message is the following. Numbers shown here are fixed (group indicators), numbers replacing the x's contain the weather data plus information about the station's position (and speed and direction where applicable).**

**IIiii or IIIII YYGGi 99LLL QLLLL**

**iihVV Nddff 00fff 1sTTT 2sTTT 3PPPP 4PPPP 5appp 6RRRt 7wwWW 8NCCC 9GGgg**

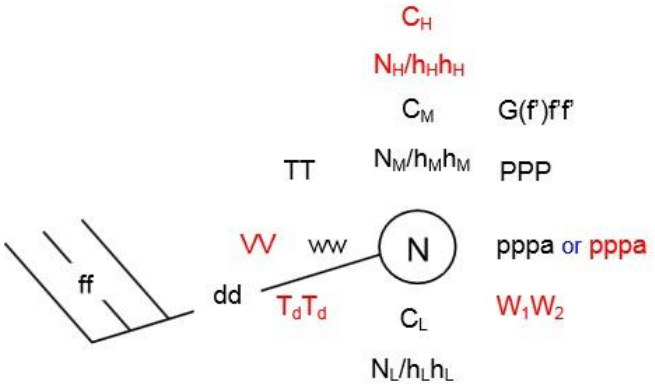
**222Dv 0sTTT 1PPHH 2PPHH 3dddd 4PPHH 5PPHH 6IEER 70HHH 8aTTT**

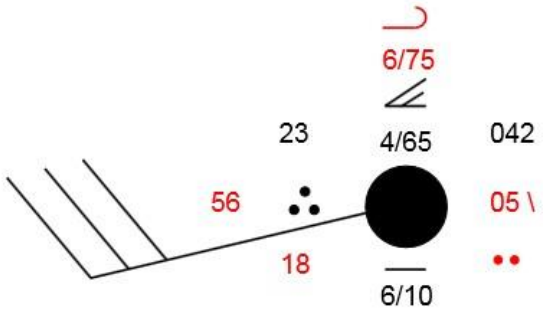
**333 0.... 1sTTT 2sTTT 3Ejjj 4Esss 5jjjj jjjjj 6RRRt 7RRRR 8Nchh 9SSss**

**SYNOP tutorial:**

**http://weather.unisys.com/wxp/Appendices/Formats/SYNOP.html**

# Example of symbol in a map




Decode of elements plotted on a land station circle (note the colour coding)

| Identifier | Description |
|---|---|
| N | Total amount of cloud (in oktas) |
| $C_L$ | Type of low cloud |
| $N_L$ | Amount of low cloud (in oktas) |
| $h_Lh_L$ | Height of low cloud (in feet) |
| $C_M$ | Type of medium cloud |
| $N_M$ | Amount of medium cloud (in oktas) |
| $h_Mh_M$ | Height of medium cloud (in feet) |
| $C_H$ | Type of high cloud |
| $N_H$ | Amount of high cloud (in oktas) |
| $h_Hh_H$ | Height of high cloud (in feet) |
| TT | Dry-bulb air temperature (in degrees Celsius) |
| ww | Present weather |
| dd | Wind direction (in degrees) |
| ff | Wind speed (in knots) |
| VV | Visibility (in metres or kilometres) |
| $T_dT_d$ | Dew point temperature (in degrees Celsius) |
| $W_1W_2$ | Past weather |
| pppa or pppa | Pressure tendency and trend (black: rising, red: falling) (in millibars) |
| PPP | Atmospheric pressure (in millibars) |
| G(f')f'f' | Wind gust (in knots) |

The decode of the above station plot is as follows:

| Weather as observed | Code group | Description |
|---|---|---|
| 8 oktas | N | Total amount of cloud (in oktas) |
| 23 ºC | TT | Dry-bulb air temperature (in degrees Celsius) |
| Continuous moderate rain | ww | Present weather |
| 260 º | dd | Wind direction (in degrees) |
| 30 knots | ff | Wind speed (in knots) |
| 6 km | VV | Visibility (in metres or kilometres) |
| 18 ºC | $T_dT_d$ | Dew-point temperature (in degrees Celsius) |
| Stratus (6 oktas at 1000 feet) | $C_L$ or C | Type of low cloud |
| Rain | $W_1W_2$ | Past weather |
| Falling 0.5mb in last 3 hours | pppa or pppa | Pressure tendency and trend (black: rising, red: falling) (in millibars) |
| 1004.2mb | PPP | Atmospheric pressure (in millibars) |
| Dense altostratus (4 oktas at 15000 feet) | $C_m$ or C | Type of medium cloud |
| Cirrus (6 oktas at 25000 feet) | $C_H$ or C | Type of high cloud |

# Wind, weather and cloudiness symbols

Weather symbols used on early synoptic charts and early daily weather summaries (ww)

| Symbol | Definition |
|---|---|
| ● | Rain |
| ✳ | Snow |
| ✳ | Sleet |
| ▲ | Hail |
| ☰ | Fog |
| ☰° | Mist |
| ⊤ | Thunder |
| ⊤↘ | Thunderstorm |
| ~~~ | Sea disturbance - rough |
| ≈≈≈ | Sea disturbance - high |

**Table 45.** Present weather symbols used on early synoptic charts.

Past weather symbols used on synoptic charts ($W_1W_2$)

| Symbol | Code Figure | Definition |
|---|---|---|
| | 0 | Cloud cover ½ or less of the sky throughout the appropriate period |
| | 1 | Cloud cover ½ or less for part of the appropriate period and more than ½ sky for part of the period |
| | 2 | Cloud cover more than ½ of the sky throughout the appropriate period |
| S→ / →S | 3 | Duststorm, sand storm or blowing snow – Visibility less than 1000 metres |
| ☰ | 4 | Fog or thick haze – Visibility less than 1000 metres |
| , | 5 | Drizzle |
| ● | 6 | Rain |
| ✳ | 7 | Snow or rain and snow mixed |
| ▽ | 8 | Shower(s) |
| ⊤↘ | 9 | Thunder, with or without precipitation |

| Symbol | Description | Symbol | Description |
|---|---|---|---|
| ○ | Sky clear (0 oktas) | ◕ | 6 oktas of sky covered |
| ◐ | 1 okta or less of sky covered, but not zero | ◕ | 7 oktas of sky covered |
| ◔ | 2 oktas of sky covered | ● | 8 oktas of sky covered |
| ◑ | 3 oktas of sky covered | ⊗ | Sky obscured by fog or other meteorological phenomena |
| ◑ | 4 oktas of sky covered | ⊖ | Cloud cover obscured for other reasons or not observed |
| ◒ | 5 oktas of sky covered | | |

| Symbol | Description | Symbol | Description |
|---|---|---|---|
| ◎ | Calm | ◣ | 53 – 57 knots |
| — | 1 - 2 knots | ◣ | 58 - 62 knots |
| ⌐ | 3 - 7 knots | ◣ | 63 - 67 knots |
| ⌐ | 8 - 12 knots | ◣ | 68 - 72 knots |
| ⌐ | 13 - 17 knots | ◣ | 73 - 77 knots |
| ⌐ | 18 - 22 knots | ◣ | 78 - 82 knots |
| ⌐ | 23 - 27 knots | ◣ | 83 - 87 knots |
| ⌐ | 28 - 32 knots | ◣ | 88 - 92 knots |
| ⌐ | 33 - 37 knots | ◣ | 93 – 97 knots |
| ⌐ | 38 - 42 knots | ◣ | 98 – 102 knots |
| ⌐ | 43 - 47 knots | ✳ | Wind direction variable |
| ⌐ | 48 – 52 knots | ✳← | Wind direction given but wind speed missing |

# Low and middle cloud codes

| Symbol | Code Figure | Definition |
|---|---|---|
| | 0 | No stratocumulus, stratus, cumulus or cumulonimbus. |
|  | 1 | Cumulus with little vertical extent and seemingly flattened, or ragged cumulus other than of bad weather*, or both. |
|  | 2 | Cumulus of moderate or strong vertical extent, generally with protuberances in the form of domes or towers, either accompanied or not by other cumulus or by stratocumulus, all having their bases at the same level. |
|  | 3 | Cumulonimbus the summits of which, at least partially, lack sharp outlines, but are neither clearly fibrous (cirriform) nor in the form of an anvil; cumulus, stratocumulus or stratus may also be present. |
|  | 4 | Stratocumulus formed by the spreading out of cumulus; cumulus may also be present. |
|  | 5 | Stratocumulus not resulting from the spreading out of cumulus. |
|  | 6 | Stratus in a more or less continuous sheet or layer, or in ragged shreds, or both, but no stratus fractus of bad weather. |
|  | 7 | Stratus fractus of bad weather* or cumulus fractus of bad weather*, or both (pannus), usually below altostratus or nimbostratus. |
|  | 8 | Cumulus and stratocumulus other than that formed from the spreading out of cumulus; the base of the cumulus is at a different level from that of the stratocumulus. |
|  | 9 | Cumulonimbus, the upper part of which is clearly fibrous (cirroform), often in the form of an anvil; either accompanied or not by cumulonimbus without anvil or fibrous upper part, by cumulus, stratocumulus, stratus or pannus. |
| | / | Stratocumulus, stratus, cumulus or cumulonimbus are invisible owing to fog, darkness or other surface phenomena. |

| Symbol | Code Figure | Definition |
|---|---|---|
| | 0 | No altocumulus, altostratus or nimbostratus. |
|  | 1 | Altostratus, the greater part of which is semi-transparent; through this part the sun or moon may be weakly visible, as through ground glass. |
|  | 2 | Altostratus, the greater part of which is sufficiently dense to hide the sun or moon, or nimbostratus. |
|  | 3 | Altocumulus, the greater part of which is semi-transparent; the various elements of the cloud change only slowly and are all at a single level. |
|  | 4 | Patches (often in the form of almonds or fishes) of altocumulus, the greater part of which is semi-transparent; the clouds occur at one or more levels and the elements are continually changing in appearance. |
|  | 5 | Semi-transparent altocumulus in bands, or altocumulus in one or more fairly continuous layers (semi-transparent or opaque), progressively invading the sky; these altocumulus clouds generally thicken as a whole. |
|  | 6 | Altocumulus resulting from the spreading out of cumulus (or cumulonimbus). |
|  | 7 | Altocumulus in two or more layers, usually opaque in places and not progressively invading the sky; or opaque layer of altocumulus, not progressively invading the sky; or altocumulus together with altostratus or nimbostratus. |
|  | 8 | Altocumulus with sproutings in the form of small towers or battlements, or altocumulus having the appearance of cumuliform tufts. |
|  | 9 | Altocumulus of a chaotic sky, generally at several levels. |
| | / | Altocumulus, altostratus or nimbostratus are invisible owing to fog, darkness or other surface phenomena, or because of the presence of a continuous layer of lower cloud. |

# High cloud codes and visibility

| Symbol | Code Figure | Definition |
|---|---|---|
| | 0 | No Cirrus, cirrocumulus or cirrostratus. |
|  | 1 | Cirrus in the form of filaments, strands or hooks, not progressively invading the sky. |
|  | 2 | Dense cirrus, in patches or entangled sheaves, which usually do not increase and sometimes seem to be the remains of the upper part of cumulonimbus; or cirrus with sproutings in the form of small turrets or battlements, or cirrus having the appearance of cumuliform tufts. |
|  | 3 | Dense cirrus, often in the form of an anvil; being the remains of the upper parts of cumulonimbus. |
|  | 4 | Cirrus in the form of hooks or of filaments, or both, progressively invading the sky; they generally become denser as a whole. |
|  | 5 | Cirrus (often in bands converging towards one point or two opposite points of the horizon) and cirrostratus, or cirrostratus alone; in either case, they are progressively invading the sky, and generally growing denser as a whole, but the continuous veil does not reach 45° above the horizon. |
|  | 6 | Cirrus (often in bands converging towards one point or two opposite points of the horizon) and cirrostratus, or cirrostratus alone; in either case, they are progressively invading the sky, and generally growing denser as a whole, the continuous veil exceeds mare that 45° above the horizon, without the sky being totally covered. |
|  | 7 | Veil of cirrostratus covering the celestial dome. |
|  | 8 | Cirrostratus not progressively invading the sky and not completely covering the celestial dome. |
|  | 9 | Cirrocumulus alone, or cirrocumulus accompanied by cirrus or cirrostratus or both, but cirrocumulus is predominant. |
| | / | Cirrus, cirrocumulus or cirrostratus are invisible owing to fog, darkness or other surface phenomena, or because of the presence of a continuous layer of lower cloud. |

| Actual Cloud Height (feet) | Plotted Cloud Height | Actual Cloud Height (feet) | Plotted Cloud Height | Actual Cloud Height (feet) | Plotted Cloud Height | Actual Cloud Height (feet) | Plotted Cloud Height |
|---|---|---|---|---|---|---|---|
| <100 | 00 | 1700 | 17 | 3200 | 32 | 4900 | 49 |
| 100 | 01 | 1800 | 18 | 3300 | 33 | 5000 | 50 |
| 200 | 02 | 1900 | 19 | 3400 | 34 | 6000 | 56 |
| 300 | 03 | 2000 | 20 | 3500 | 35 | 7000 | 57 |
| 400 | 04 | 2100 | 21 | 3600 | 36 | 8000 | 58 |
| 500 | 05 | 2200 | 22 | 3700 | 37 | 9000 | 59 |
| 600 | 06 | 2300 | 23 | 3800 | 38 | 10000 | 60 |
| 700 | 07 | 2400 | 24 | 3900 | 39 | 11000 | 61 |
| 800 | 08 | 2500 | 25 | 4000 | 40 | 12000 | 62 |
| 900 | 09 | 2600 | 26 | 4100 | 41 | | |
| 1000 | 10 | 2700 | 27 | 4200 | 42 | | |
| 1100 | 11 | 2800 | 28 | 4300 | 43 | | |
| 1200 | 12 | 2900 | 29 | 4400 | 44 | | |
| 1300 | 13 | 1700 | 17 | 4500 | 45 | | |
| 1400 | 14 | 1800 | 18 | 4600 | 46 | | |
| 1500 | 15 | 3000 | 30 | 4700 | 47 | | |
| 1600 | 16 | 3100 | 31 | 4800 | 48 | 25000 | 75 |

# Present Weather Symbols

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 00  Cloud development NOT observed during past hour (not plotted) | 01  Clouds generally becoming less developed (not plotted) | 02  State of sky on the whole unchanged during past hour (not plotted) | 03  Clouds generally forming or developing during past hour (not plotted) | 04  Visibility reduced by smoke | 05  Haze | 06  Widespread dust in the air, not raised by wind at or near station | 07  Dust or sand due to wind at or near the station but no dust whirl/sandstorm | 08  Well developed dust whirl and/or sand whirl but no dust storm/sandstorm | 09  Dust storm or sandstorm within sight or at the station during past hour |
| 10  Mist | 11  Patches of shallow fog at station, NOT deeper than 6 feet on land | 12  More or less continuous shallow fog at station, NOT deeper than 6 feet | 13  Lighting visible, no thunder heard | 14  Precipitation within sight, but NOT reaching the ground | 15  Precipitation within sight, reaching the surface, but more than 3 miles away | 16  Precipitation within sight, reaching the surface within 3 miles | 17  Thunder heard, but no precipitation at the station | 18  Squall(s) within sight during past hour | 19  Funnel cloud(s) and/or Tornado(es) during the preceding hour |
| 20  Drizzle (not freezing) or snow grains, not as shower(s), has ended | 21  Rain (not freezing) not falling as shower(s) , ended in the past hour | 22  Snow not falling as shower(s) ended in the past hour | 23  Rain and snow or ice pellets, not as shower(s) ended in the past hour | 24  Freezing drizzle or freezing rain, not as shower(s) ended in the past hour | 25  Shower(s) of rain ended in the past hour | 26  Shower(s) of snow, or of rain and snow ended in the past hour | 27  Shower(s) of hail, or of rain and hail ended in the past hour | 28  Fog or ice fog ended in the past hour | 29  Thunderstorm (with or without precipitation) ended in the past hour |
| 30  Slight or moderate dust storm or sandstorm (has decreased in past hour) | 31  Slight or moderate dust storm/sandstorm (no change during past hour) | 32  Slight or moderate dust storm or sandstorm (has begun or increased) | 33  Severe dust storm or sandstorm, decreased during the past hour | 34  Severe dust storm or sandstorm, has no change during past hour | 35  Severe dust storm or sandstorm has begun or increased | 36  Slight or moderate drifting snow (generally below eye level) | 37  Heavy drifting snow (generally below eye level) | 38  Slight or moderate blowing snow (generally above eye level) | 39  Heavy blowing snow (generally above eye level) |
| 40  Fog at a distance, but not at the station during the preceding hour | 41  Fog in patches | 42  Fog, sky visible (has become thinner during preceding hour) | 43  Fog, sky obscured (has become thinner during preceding hour) | 44  Fog, sky visible (no appreciable change during the past hour) | 45  Fog, sky obscured (no appreciable change during the past hour) | 46  Fog, sky visible (has begun or has become thicker during past hour) | 47  Fog, sky obscured (has begun or has become thicker during past hour) | 48  Fog, depositing rime ice, sky visible | 49  Fog, depositing rime ice, or ice fog, sky obscured |
| 50  Drizzle, not freezing, intermittent (slight at time of observation) | 51  Drizzle, not freezing, continuous (slight at time of observation) | 52  Drizzle, not freezing, intermittent (moderate at time of observation) | 53  Drizzle, not freezing, continuous (moderate at time of observation) | 54  Drizzle, not freezing, intermittent (heavy at time of observation) | 55  Drizzle, not freezing, continuous (heavy at time of observation) | 56  Drizzle, freezing, slight | 57  Drizzle, freezing, moderate or heavy | 58  Drizzle and rain, slight | 59  Drizzle and rain, moderate or heavy |
| 60  Rain, not freezing, intermittent (slight at time of observation) | 61  Rain, not freezing, continuous (slight at time of observation) | 62  Rain, not freezing, intermittent (moderate at time of observation) | 63  Rain, not freezing, continuous (moderate at time of observation) | 64  Rain, not freezing, intermittent (heavy at time of observation) | 65  Rain, not freezing, continuous (heavy at time of observation) | 66  Rain, freezing, slight | 67  Rain, freezing, moderate or heavy | 68  Rain or drizzle and snow, slight | 69  Rain or drizzle and snow, moderate or heavy |
| 70  Intermittent fall of snowflakes (slight at time of observation) | 71  Continuous fall of snowflakes (slight at time of observation) | 72  Intermittent fall of snowflakes (moderate at time of observation) | 73  Continuous fall of snowflakes (moderate at time of observation) | 74  Intermittent fall of snowflakes (heavy at time of observation) | 75  Continuous fall of snowflakes (heavy at time of observation) | 76  Ice needles (with or without fog) | 77  Snow grains (with or without fog) | 78  Isolated star-like snow crystals (with or without fog) | 79  Ice pellets (sleet) |
| 80  Rain shower(s), slight | 81  Rain shower(s), moderate or heavy | 82  Rain shower(s), violent | 83  Shower(s) of rain and snow mixed, slight | 84  Shower(s) of rain and snow mixed, moderate or heavy | 85  Snow shower(s), slight | 86  Snow shower(s), moderate or heavy | 87  Shower(s) of snow pellets or small hail, slight with or without rain or rain/snow | 88  Shower(s) of snow pellets or small hail, moderate or heavy w/ or w/o rain/snow | 89  Shower(s) of hail, slight, w/ or w/o rain or rain/ snow mixed, no thunder |
| 90  Shower(s) of hail, w/ or w/o rain or rain/snow, no thunder, mod. or heavy | 91  Thunderstorm during past hour w/ slight rain at time of observation | 92  Thunderstorm during past hour w/ current moderate/ heavy rain | 93  Thunderstorm ended w/ current slight snow, rain/ snow mixed, or hail | 94  Thunderstorm ended w/ current moderate/heavy snow, rain/snow, or hail | 95  Thunderstorm, slight or moderate, w/o hail but w/ rain and/or snow | 96  Thunderstorm, slight or moderate, with hail at time of observation | 97  Thunderstorm, heavy, w/o hail but with rain and/or snow | 98  Thunderstorm combined with dust storm or sandstorm | 99  Thunderstorm, heavy, with hail at time of observation |

JetStream - An Online School for Weather
http://www.srh.noaa.gov/srh/jetstream/synoptic/wxmaps.htm