Meteorological Synoptic Observations

Met Station Models (Encoding & Decoding)

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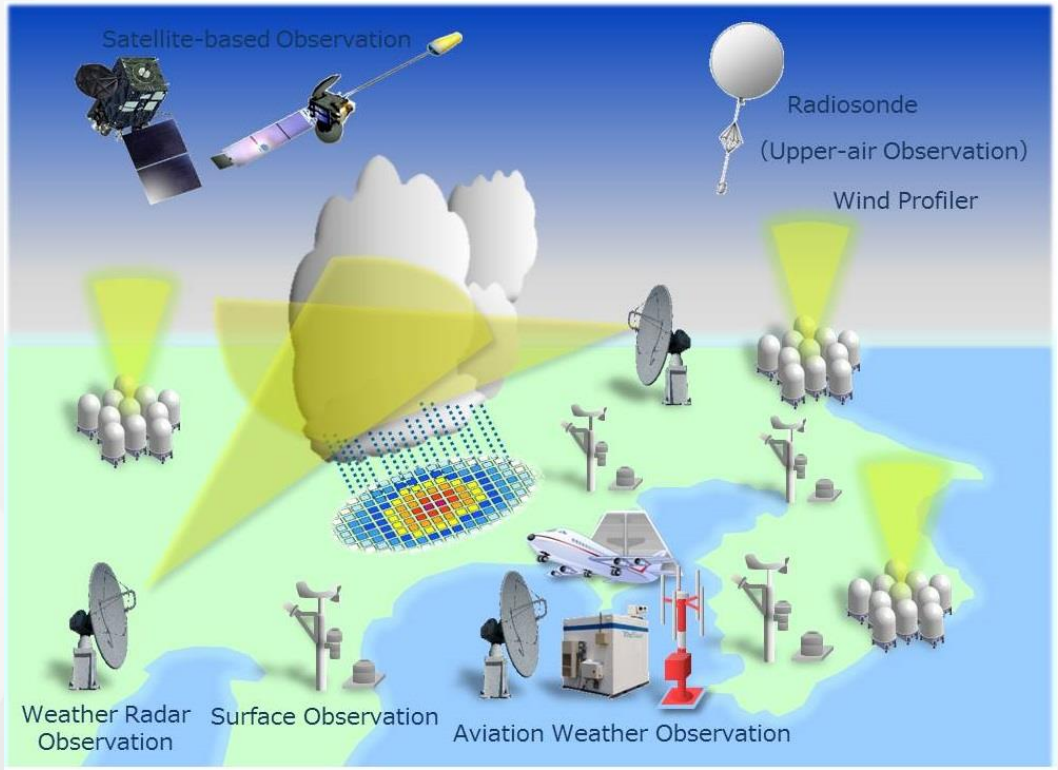
Weather Observation System

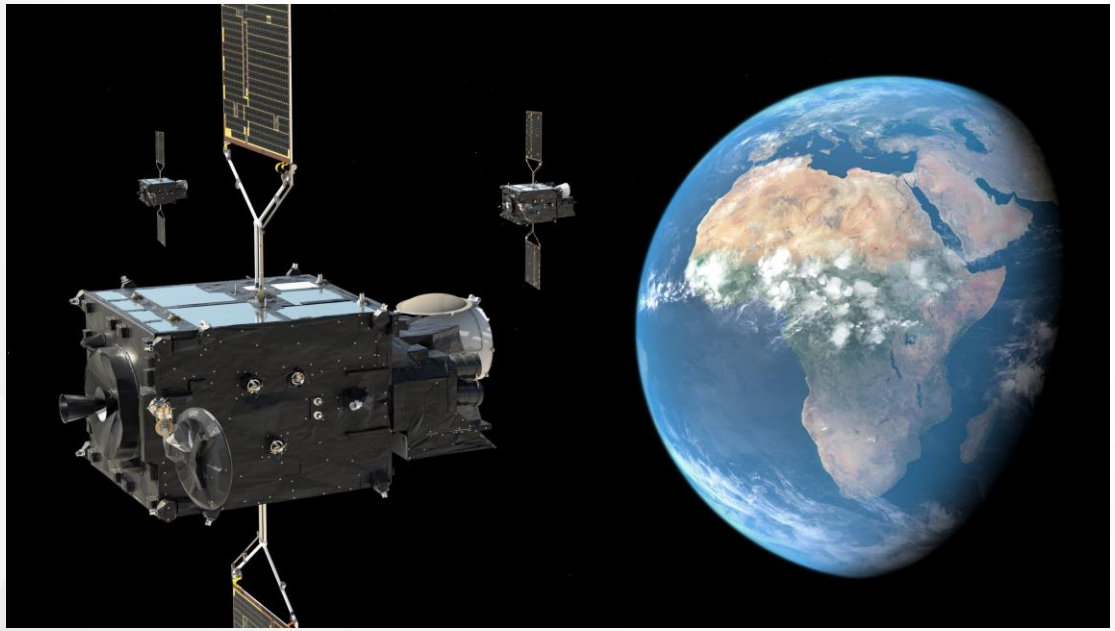
Weather observation systems are essential for monitoring and understanding the Earth's atmosphere. These systems use different techniques to collect data about various atmospheric parameters, providing valuable insights .for weather forecasting



Weather Observation System

01 Remote Sensing

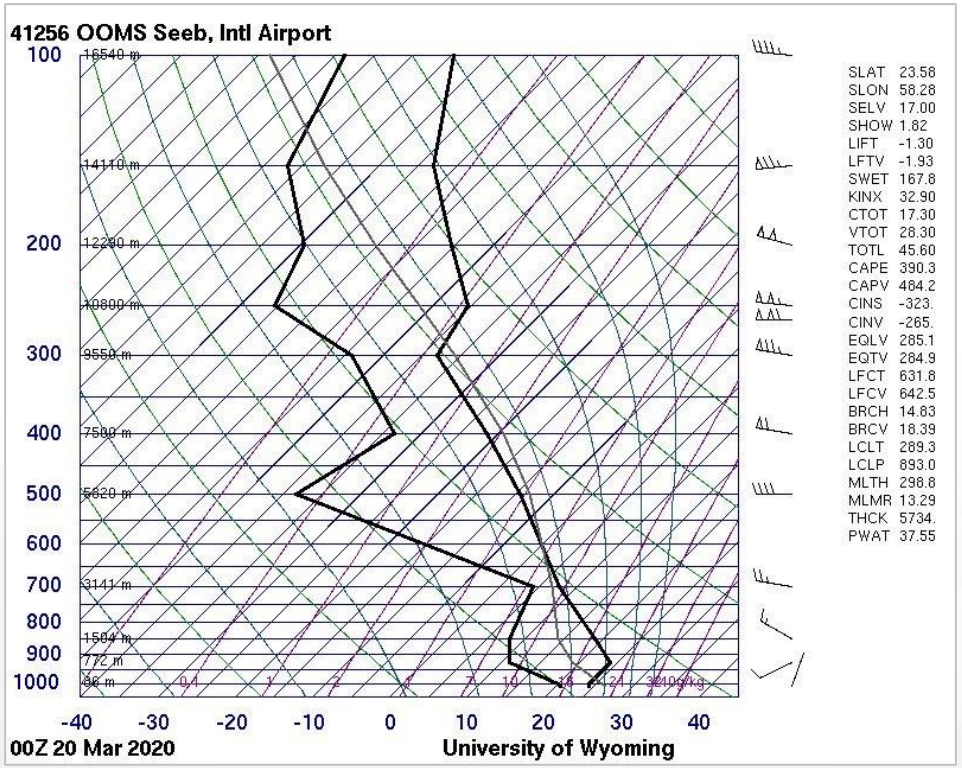
Remote sensing techniques: weather satellite imagery and radar, provide broad-scale information about atmospheric conditions over large areas.



Weather Observation System

02 Upper Air

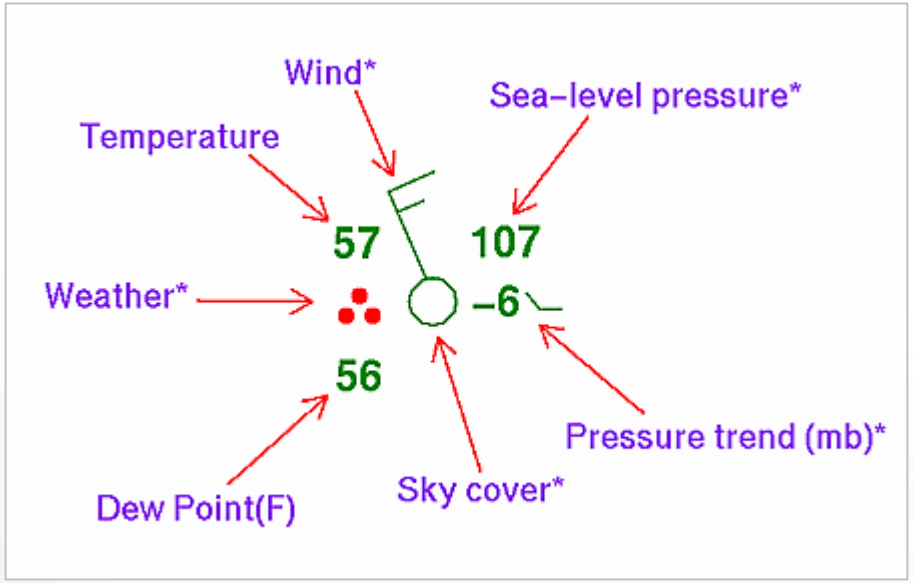
Upper air measurements of the atmosphere properties at different altitudes are obtained using weather balloons.



Content

03 Surface Observations

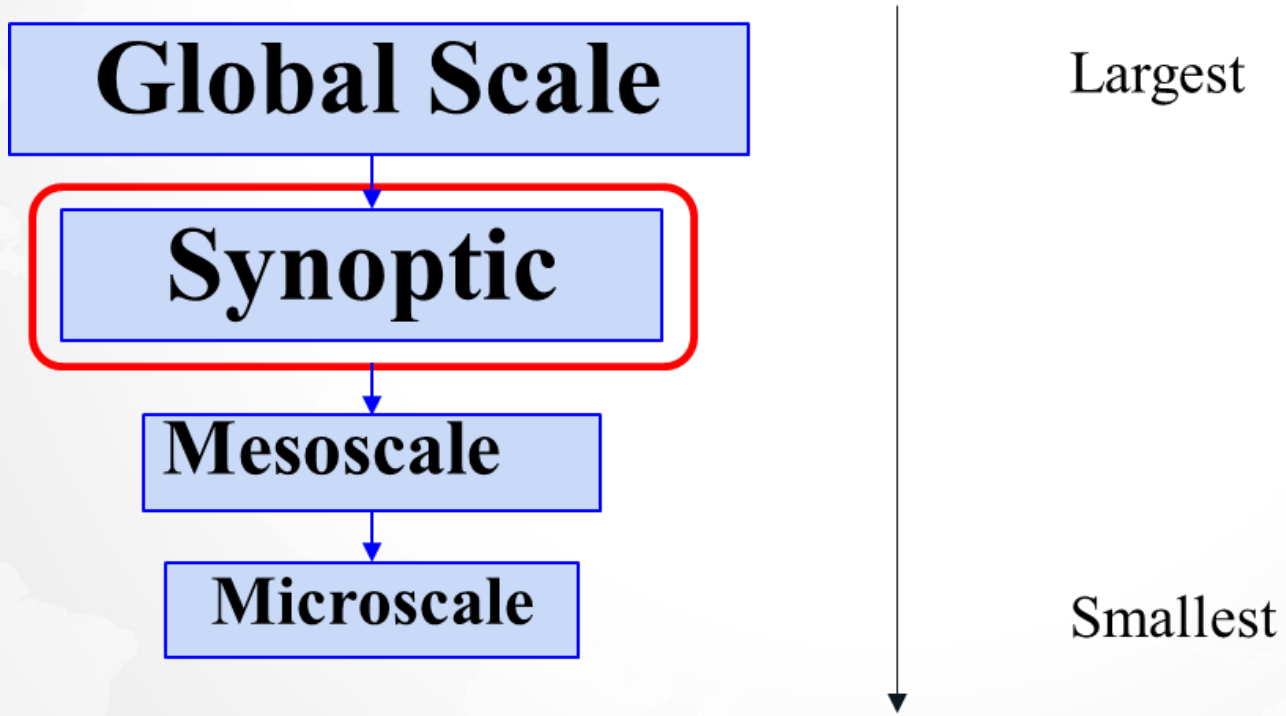
Surface observations are made at ground-based weather stations using instruments like thermometers, anemometers, and rain gauges.



Content

- Scale of Motion
- Ship Report
- METAR
- Practice

Scale of Motion

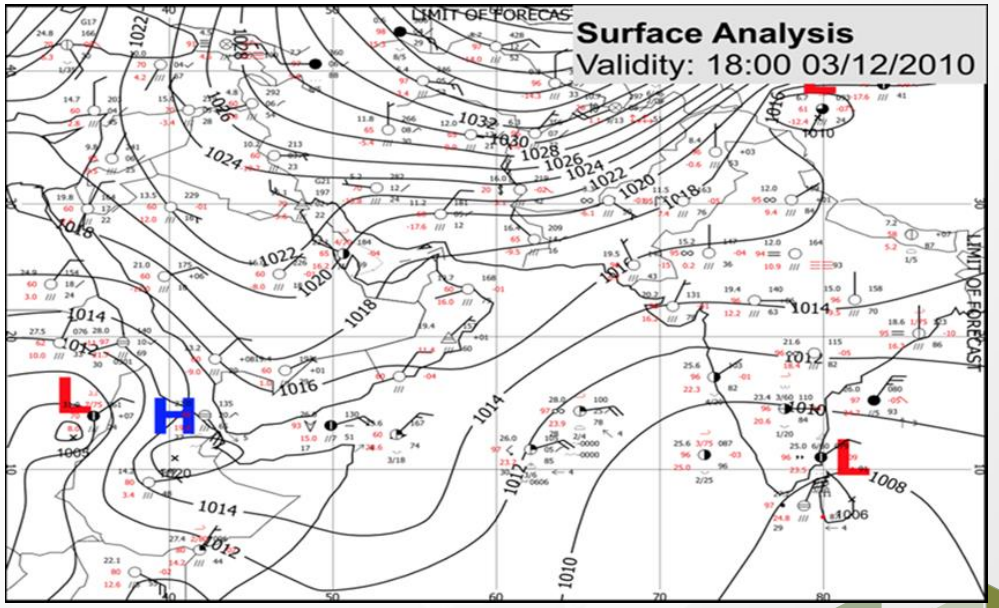


TYPES & Importance of these reports

In order for Meteorological Specialist to send information around the world using the WMO , the information has to be in a language understood by everyone around the world.
In order to do that, the information of the observation data encoded in special reports.

List of the Reports

Name	Purpose
SYNOP	Report of surface observation from a fixed land station
SHIP	Report of surface observation from a sea station
METAR	Aviation routine weather report (with or without trend forecast)
SPECI	Aviation selected special weather report (with or without trend forecast)



surface observations (SYNOP & Ship) Reports

SYNOP and Ship Reports

- **SYNOP (surface synoptic observations) is a numerical code (called FM-12 by WMO) used for reporting weather observations made by manned and automated weather stations.**
- **A report consists of groups of numbers and symbols describing meteorological parameters, that observes at a weather station.**

SYNOP report: refers to a surface synoptic observation report from a fixed land station. It provides meteorological data like temperature, humidity, wind speed, and atmospheric pressure.

SHIP report: refers to a surface synoptic observation report from a sea station, typically from ships. These reports include similar data but are gathered from the ocean.

SYNOP and Ship Reports

ELEMENTS TO BE OBSERVED

- Cloud height, amount, and type
- Visibility;
- Wind speed and direction;
- Air and wet-bulb temperatures, and dew point;
- Atmospheric pressure, tendency and its characteristic;
- Weather - present and past;
- Sea surface temperature
- Sea waves and swell - period, direction, and height;
- Ice conditions, including icing on board ship;

Examples of Ship Reports:

BBXX
BRAVO 20123 99252 10595 41494
81412 10285 20269 40100 53012 79586 8587/ 22265 00280 20405 31705 40506
50407=

BBXX
SHIP 24121 99122 71353 31475
82706 10252 20225 40061 55008 76062 83223 91312 22242 00234 20805 31215
40806 51005 62052 80122 ICE 23223

Examples of Ship Reports:

BBXX

BRAVO 20123 99252 10595 41494

81412 10285 20269 40100 53012 79586 8587/ 22265 00280 20405 31705 40506 50407=

BBXX Identifier for Ship weather report

Surface report from Coastal Station	**AAXX**
Surface report from Ship	**BBXX**

Examples of Ship Reports:

BBXX

BRAVO **20123 99252 10595 41494**

81412 10285 20269 40100 53012 79586 8587/ 22265 00280 20405 31705 40506 50407=

BRAVO Call sign of the Ship

Examples of Ship Reports:

BBXX

BRAVO **20 12 3** **99252 10595 41494**

81412 10285 20269 40100 53012 79586 8587/ 22265 00280 20405 31705 40506 50407=

20 12 3

20: Day of the month (20th)

12: UTC Time (4 PM Local) Time)

3: wind speed type / unit (table1)

Code Figure	Iw indicator	
0	**Wind Speed Estimated**	m/s
1	**Wind Speed from anemometer**	m/s
3	**Wind Speed Estimated**	knots
4	**Wind Speed from anemometer**	knots

Examples of Ship Reports:

BBXX

BRAVO 20123 99252 10595 41494

81412 10285 20269 40100 53012 79586 8587/ 22265 00280 20405 31705 40506 50407=

99252

99: Ship Position Group (Latitude)

252 : Degrees and tenth (25.2°)

Examples of Ship Reports:

BBXX

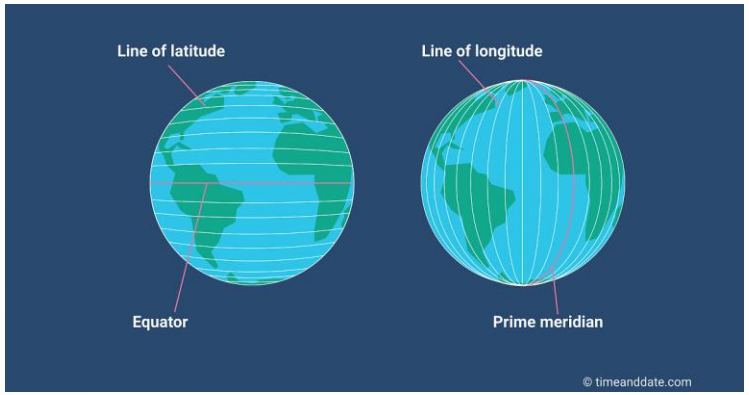
BRAVO 20123 99252 10595 41494

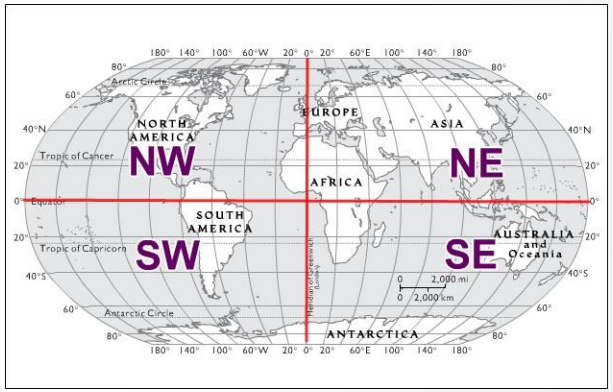
81412 10285 20269 40100 53012 79586 8587/ 22265 00280 20405 31705 40506 50407=

10595

1: Quadrant of the Glob

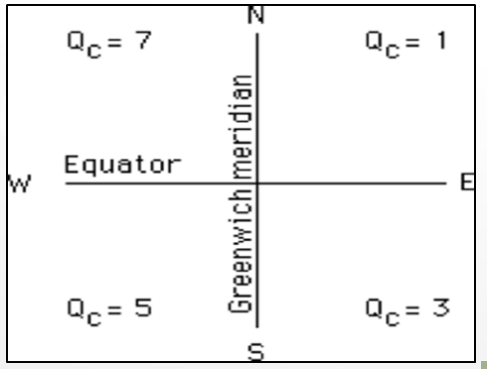
0595: Longitude, Degrees and tenth (59.5°)





Latitude: 25.2° **N**

Longitude: 59.5° **E**



Examples of Ship Reports:

BBXX

BRAVO 20123 99252 10595 41494

81412 10285 20269 40100 53012 79586 8587/ 22265 00280 20405 31705 40506 50407=

41494

4: Precipitation group indicator

1: Weather Group indicator

4: Hight of base of lowest cloud

94: horizontal visibility (table5

Examples of Ship Reports:

h = Height of base of lowest cloud

Code figure	Feet	Metres
0	0 to 150	0 to 50
1	150 to 300	50 to 100
2	300 to 600	100 to 200
3	600 to 1,000	200 to 300
4	1,000 to 2,000	300 to 600
5	2,000 to 3,000	600 to 1,000
6	3,000 to 5,000	1,000 to 1,500
7	5,000 to 6,500	1,500 to 2,000
8	6,500 to 8,000	2,000 to 2,500
9	8,000 or more or no cloud	2,500 or more or no cloud
/	Height of base of cloud unknown	

Examples of Ship Reports:

BBXX

BRAVO 20123 99252 10595 41494

81412 10285 20269 40100 53012 79586 8587/ 22265 00280 20405 31705 40506 50407=

41494

4: NotAvailable

1: Manned/Included

4: 1000 to 2000 ft

94: 1km

Examples of Ship Reports:

BBXX

BRAVO 20123 99252 10595 41494

81412 **10285 20269 40100 53012 79586 8587/ 22265 00280 20405 31705 40506 50407=**

81412

8: Total cloud amount

14: Wind Direction tenth of degrees

12: Wind Speed

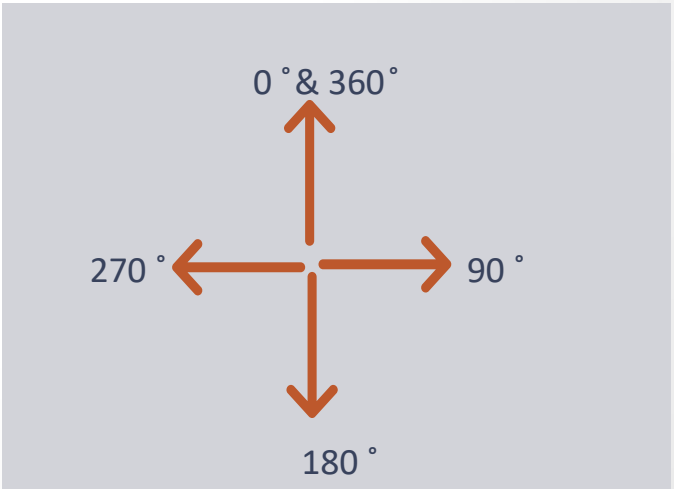
8: Overcast

14: 140°, SE

12: 12 Knot

Sky Cover (oktas)	Sym-bol	Name	Abbr.	Sky Cover (tenths)
0	○	Sky **Clear**	SKC	0
1	◴	**Few*** Clouds	FEW*	1
2	◔			2 to 3
3	◑	**Scattered**	SCT	4
4	◑			5
5	◕	**Broken**	BKN	6
6	◕			7 to 8
7	◕			9
8	●	**Overcast**	OVC	10
(9)	⊗	Sky **Obscured**		un-known
(/)	⊖	Not Measured		un-known

* "Few" is used for (0 oktas) < coverage ≤ (2 oktas).



Examples of Ship Reports:

BBXX

BRAVO 20123 99252 10595 41494

81412 10285 20269 40100 53012 79586 8587/ 22265 00280 20405 31705 40506 50407=

10285

1: Group indicator for air temperature

0: Temperature sign is + (if 1 Temperature sign is -)

285: Air Temperature is 28.5 **°C**

Examples of Ship Reports:

BBXX

BRAVO 20123 99252 10595 41494

81412 10285 20269 40100 53012 79586 8587/ 22265 00280 20405 31705 40506 50407=

20269

2: Group indicator for Dew Point Temperature

0: Temperature sign is + (if 1 Temperature sign is -)

269: Dew Point Temperature is 26.9 **°C**

Examples of Ship Reports:

BBXX

BRAVO 20123 99252 10595 41494

81412 10285 20269 40100 53012 79586 8587/ 22265 00280 20405 31705 40506 50407=

40100

4: Group indicator for MSL Pressure

0100: MSL Pressure of 1010.0 hPa

Examples of Ship Reports:

BBXX

BRAVO 20123 99252 10595 41494

81412 10285 20269 40100 53012 79586 8587/ 22265 00280 20405 31705 40506 50407=

53012

5: Group indicator for Pressure change

3: Code Identifier (Table 7)

Examples of Ship Reports:

BBXX

BRAVO 20123 99252 10595 41494

81412 10285 20269 40100 53012 79586 8587/ 22265 00280 20405 31705 40506 50407=

53012

5: Group indicator for Pressure change

3: Code Identifier (Table 7)

012 : Value of pressure Change

Examples of Ship Reports:

a = Characteristic of barometric tendency during the three hours preceding the time of observation

Code figure	Trace	Description of curve	Pressure *now*, compared with 3 hours ago
0		Rising, then falling Rising, then falling	The same Higher
1		Rising, then steady Rising, then rising more slowly	Higher
2		Rising (steadily or unsteadily)	Higher
3		Falling, then rising Steady, then rising Rising, then rising more quickly	Higher
4		Steady	The same
5		Falling, then rising Falling, then rising	The same Lower
6		Falling, then steady Falling, then falling more slowly	Lower
7		Falling (steadily or unsteadily)	Lower
8		Steady, then falling Rising, then falling Falling, then falling quickly	Lower

Table 7

Examples of Ship Reports:

BBXX

BRAVO 20123 99252 10595 41494

81412 10285 20269 40100 53012 79586 8587/ 22265 00280 20405 31705 40506 50407=

53012

5: Group indicator for Pressure change

3: Pressure Increasing

012: Pressure change of 0.12 hPa in the last three hours

Examples of Ship Reports:

BBXX

BRAVO 20123 99252 10595 41494

81412 10285 20269 40100 53012 79586 8587/ 22265 00280 20405 31705 40506 50407=

79586

7: Weather Type Indicator

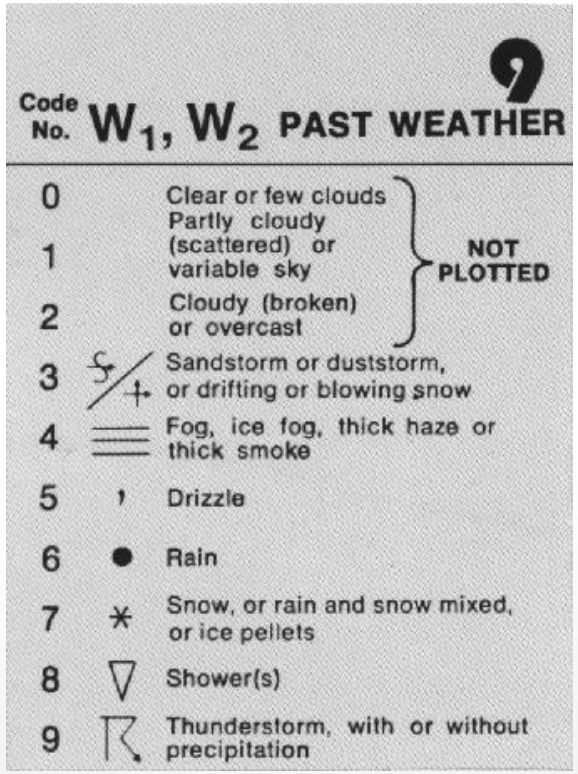
95: Current Weather

86: Past Weather

7: Weather Type Indicator

95: Thunderstorm and drizzle

86: shower and rain



Code No.	W_1, W_2 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, ice fog, thick haze or thick smoke	
5	Drizzle	
6	Rain	
7	Snow, or rain and snow mixed, or ice pellets	
8	Shower(s)	
9	Thunderstorm, with or without precipitation	

Examples of Ship Reports:

BBXX

BRAVO 20123 99252 10595 41494

81412 10285 20269 40100 53012 79586 8587/ 22265 00280 20405 31705 40506 50407=

8587/

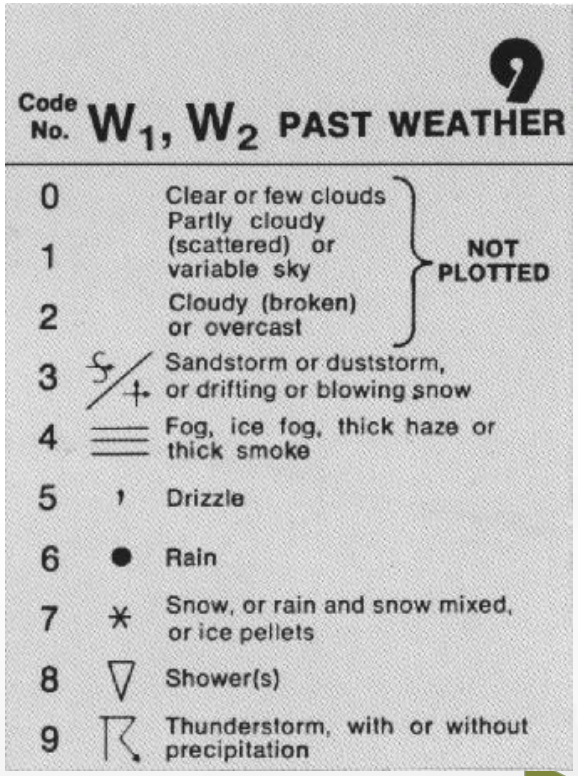
8: Cloud Indicator

5: Amount of Low or medium Cloud 5/8

8: low cloud type

7: Past Weather medium cloud type (Table 9)

/: High cloud type (Table 10)



Examples of Ship Reports:

C_L = Type of low cloud (Sc, St, Cu, Cb)

Code figure	
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 stratocumulus.

Table 8

Examples of Ship Reports:

C_L = Type of low cloud (Sc, St, Cu, Cb) — *continued*

9	Cumulonimbus, the upper part of which is clearly fibrous (cirriform), 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.

Notes. (1) If there is fog but the sky is discernible through the fog, the cloud type, height and amount are reported as if no fog were present.

(2) In deciding which code figure to use when more than one cloud type is present, the order of priority, irrespective of quantity, is 9, 3, 4, 8, 2, otherwise whichever of the types 1, 5, 6 or 7 covers the largest area of sky.

Table 8

Examples of Ship Reports:

C_L = Type of low cloud (Sc, St, Cu, Cb) — *continued*

9 Cumulonimbus, the upper part of which is clearly fibrous (cirriform), 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.

Notes. (1) If there is fog but the sky is discernible through the fog, the cloud type, height and amount are reported as if no fog were present.

(2) In deciding which code figure to use when more than one cloud type is present, the order of priority, irrespective of quantity, is 9, 3, 4, 8, 2, otherwise whichever of the types 1, 5, 6 or 7 covers the largest area of sky.

Table 8

Examples of Ship Reports:

C_L = Type of low cloud (Sc, St, Cu, Cb) — *continued*

9 Cumulonimbus, the upper part of which is clearly fibrous (cirriform), 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.

Notes. (1) If there is fog but the sky is discernible through the fog, the cloud type, height and amount are reported as if no fog were present.

(2) In deciding which code figure to use when more than one cloud type is present, the order of priority, irrespective of quantity, is 9, 3, 4, 8, 2, otherwise whichever of the types 1, 5, 6 or 7 covers the largest area of sky.

Table 8

Examples of Ship Reports:

C_M = Type of medium cloud (Ac, As, Ns)

Code figure	
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.

Table 9

Examples of Ship Reports:

C_H = Type of high cloud (Ci, Cc, Cs)

Code figure	
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 degrees 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 more than 45 degrees 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.

Table 10

Examples of Ship Reports:

BBXX

BRAVO 20123 99252 10595 41494

81412 10285 20269 40100 53012 79586 8597/ 22265 00280 20405 31705 40506 50407=

8597/

8: Cloud Indicator

5: Amount of Low or medium Cloud 5/8

9: cumulonimbus

7: Altocumulus

/: invisible

Examples of Ship Reports:

BBXX

BRAVO 20123 99252 10595 41494

81412 10285 20269 40100 53012 79586 8587/ 22265 00280 20405 31705 40506 50407=

22265

222: Section indicator of maritime data

6: Ship is moving West in the last 3 hours

5: Ship average speed last 3 hours 21 to 25 knots

v_s = Ship's average speed made good during the 3 hours preceding time of observation

Code figure	Speed in knots	Code figure	Speed in knots
0	Ship stopped	5	21 to 25
1	1 to 5	6	26 to 30
2	6 to 10	7	31 to 35
3	11 to 15	8	36 to 40
4	16 to 20	9	Over 40

Examples of Ship Reports:

BBXX

BRAVO 20123 99252 10595 41494

81412 10285 20269 40100 53012 79586 8587/ 22265 00280 20405 31705 40506 50407=

22265

222: Section indicator of maritime data

6: Ship is moving West in the last 3 hours

5: Ship average speed last 3 hours 21 to 25 knots

v_s = Ship's average speed made good during the 3 hours preceding time of observation

Code figure	Speed in knots	Code figure	Speed in knots
0	Ship stopped	5	21 to 25
1	1 to 5	6	26 to 30
2	6 to 10	7	31 to 35
3	11 to 15	8	36 to 40
4	16 to 20	9	Over 40

Examples of Ship Reports:

BBXX

BRAVO 20123 99252 10595 41494

81412 10285 20269 40100 53012 79586 8587/ 22265 00280 20405 31705 40506 50407=

00280 OSsTwTwTw

0: group indicator of SST

0: Temperature sign is + (if 1 Temperature sign is -)

280: SST is 28.0 °C

Examples of Ship Reports:

BBXX

BRAVO 20123 99252 10595 41494

81412 10285 20269 40100 53012 79586 8587/ 22265 00280 20405 31705 40506 50407=

20405 2PwPwHwHw

2: group indicator for wind waves

04: Period of wind wave (4 seconds)

05: Height of wind wave in units of half meters (2.5 m/s)

Examples of Ship Reports:

BBXX

BRAVO 20123 99252 10595 41494

81412 10285 20269 40100 53012 79586 8587/ 22265 00280 20405 31705 40506 50407=

31705 3dwdw1//

3: group indicator for swell direction

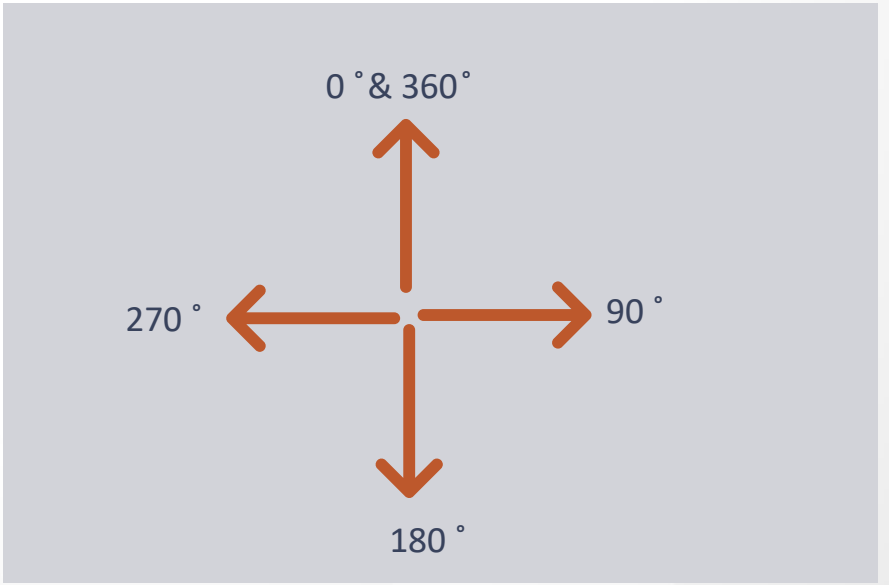
17: Direction of first Swell 170° , SE

05: Direction of Second Swell) 50° , NE

3: group indicator for swell direction

17: 170° , SE

05: 50° , NE



Examples of Ship Reports:

BBXX

BRAVO 20123 99252 10595 41494

81412 10285 20269 40100 53012 79586 8587/ 22265 00280 20405 31705 **40506** **50407=**

40506 4Pw1Pw1Hw1Hw1

4: indicator for period and height of first swell group.
05: period of first swell
06: height of first swell in unit of half meter.

4: indicator for period and height of first swell group.
05: (05 sec)
06: (06 X 0.5)= 3m

Examples of Ship Reports:

BBXX

BRAVO 20123 99252 10595 41494

81412 10285 20269 40100 53012 79586 8587/ 22265 00280 20405 31705 40506 **50407**

50407 4Pw2Pw2Hw2Hw2

5: indicator for period and height of second swell group.
04: period of second swell
07: height of second swell in unit of half meter.

5: indicator for period and height of second swell group.
04: 04 sec
07: (07 X 0.5=3.5 meters)

METAR

METAR stands for routine Meteorological Aerodrome Report. It contains hourly observations of surface weather made at a manual or automatic weather station at an airport. It is formatted as a text message using codes (abbreviations, and a specified ordering of the data blocks separated by spaces) that concisely describe the weather.

SPESI

SPECI: If the weather changes significantly from the last routine METAR report, then a special weather observation is taken, and is reported in an extra, unscheduled SPECI report. The SPECI has all the same data blocks as the METAR plus a plain language explanation of the special conditions.

The criteria that trigger SPECI issuance are:

- Wind direction: changes >45° for speeds ≥ 10 kt.
- Visibility: changes across threshold: 3 miles, 2 miles, 1 mile, 0.5 mile or instrument approach minim.
- Runway visual range: changes across 2400 ft.
- Tornado, Waterspout: starts, ends, or is observed.
- Thunderstorm: starts or ends.
- Hail: starts or ends.
- Freezing precipitation: starts, changes, ends.
- Ceiling: changes across threshold: 3000, 1500, 1000, 500, 200 (or lowest approach minimum) feet.
- Clouds: when layer first appears below 1000 feet.
- Volcanic eruption: starts.

Examples of METAR Decoding

METAR	OOMS	172250Z	22003KT	190V250	CAVOK	24/14	Q1009	NOSIG

METAR

TYPE_ METAR :

- **METAR**
- **SPECI**

OOMS

STATION ID – OOMS : Muscat International Airport

Examples of METAR Decoding

METAR	OOMS	172250Z	22003KT	190V250	CAVOK	24/14	Q1009	NOSIG

172250Z

Date & Time:

17 : represents day of the month

2250: represents Time of observation 22:50

Z: represents that the time is in UTC (Universal Time Code)

Examples of METAR Decoding

METAR	OOMS	172250Z	22003KT	190V250	CAVOK	24/14	Q1009	NOSIG

22003KT

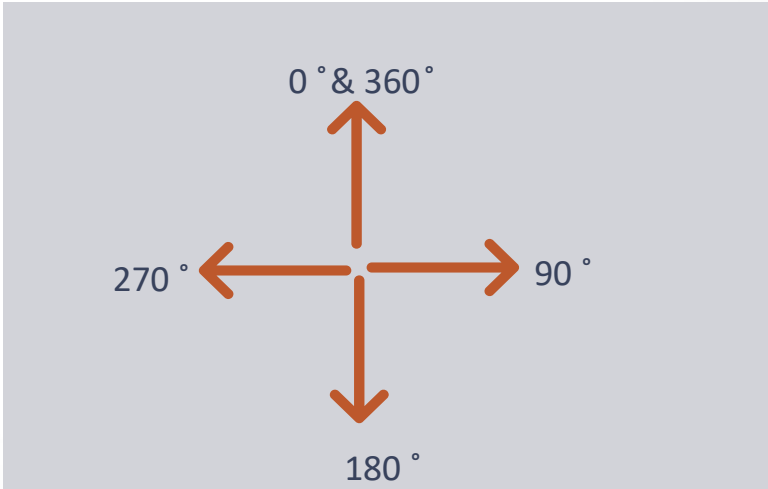
220: Wind Direction

03KT: Wind speed is 3 knots

190V250

220: Wind Direction

03KT: Wind speed is 3 knots



Examples of METAR Decoding

METAR	OOMS	172250Z	22003KT	190V250	CAVOK	Q1009	NOSIG

CAVOK

Clouds and Visibility is OK

* Visibility is 10km or more.

* no cloud below 5000 feet

* No significant weather at or in the vicinity of the aerodrome.

Examples of METAR Decoding

METAR	OOMS	172250Z	22003KT	190V250	CAVOK	24/14	Q1009	NOSIG

24/14

24: Temperature

14: Dewpoint

Examples of METAR Decoding

METAR	OOMS	172250Z	22003KT	190V250	CAVOK	24/14	Q1009	NOSIG

Q1009 Pressure 1009 mb

NOSIG NOSIG: No significant change expected

Examples of METAR Decoding

METAR	OOMS	172250Z	22003KT	190V250	CAVOK	24/14

1. Location:
2. Day&Time:
3. AUTO?
4. Wind

Thanks