

SYNOP Data Format (FM-12)

Surface Synoptic Observations

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
```

000 Group - Identification and Location

- **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)
 - i_w** -- 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

111 Group - Land Observations

- **iihVV**

i_R -- 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

i_x -- 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

τ -- 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

w_1 -- Past weather (type 1)

w_2 -- 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

c_L -- Low cloud type

0 -- no low clouds

1 -- cumulus humilis 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

c_M -- 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

C_H -- 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

222 Group - **Sea Surface Observations**

- **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
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333 Group - **Special / Climatological Data**

- **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

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...
988 -- 988 mm
989 -- 989 or more mm
990 -- Trace
991 -- 0.1 mm
992 -- 0.2 mm
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999 -- 0.9 mm

- **t** -- Duration over which precipitation amount measured

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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