Terminologies and Glossary

Synoptic Systems

Type of system	Description
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Cyclonic Circulation (Cycir)

Atmospheric wind flow in upper levels associated with any low pressure system. The wind flow is counter clockwise in the Northern Hemisphere and clockwise in the Southern Hemisphere.

Anticyclonic circulation

Atmospheric wind flow in upper levels associated with any high pressure system. The wind flow is clockwise in the Northern Hemisphere and counter clockwise in the Southern Hemisphere.

Low pressure Area (LOPAR)/ well marked LOPAR

Area in the atmosphere in which the pressures are lower than those of the surrounding region at the same level and is represented on a synoptic chart by a system of one closed isobar (wind speed on the surface < 17 Knots (Kts) when the system is at sea or one closed isobar in the radius of 3 Deg. from the centre over land).

Depression

Intense low pressure system represented on a synoptic chart by two or three closed isobars at 2 hPa interval and wind speed from 17 to 27 Kts at sea and two closed isobars in the radius of 3 Deg. from the centre over land.

Deep Depression

Intense low pressure system represented on a synoptic chart by two or three closed isobars at 2 hPa interval and wind speed from 28 to 33 Kts at sea and three to four closed isobars in the radius of 3 Deg. from the centre over land.

Cyclonic Storm

Intense low pressure system represented on a synoptic chart by more than four closed isobars at 2 hPa interval and in which the wind speed on surface level is in between 34 – 47 Kts.

Severe Cyclonic Strom

Intense low pressure system represented on a synoptic

chart by more than four closed isobars at 2 hPa interval and in which the wind speed on surface level is in between 48 – 63 Kts.

Very Severe Cyclonic Storm

Intense low pressure system represented on a synoptic chart by more than four closed isobars at 2 hPa interval and in which the wind speed on surface level is in between 64 – 119 Kts.

Super cyclonic storm

Intense low pressure system represented on a synoptic chart by more than four closed isobars at 2 hPa interval and in which the wind speed on surface level is 120 Kts. and above.

Western Disturbance

Weather disturbances noticed as cyclonic circulation/trough in the mid and lower tropospheric levels or as a low pressure area on the surface, which occur in middle latitude westerlies and originate over the Mediterranean Sea, Caspian Sea and Black Sea and move eastwards across north India.

Western Depression

Weather system which originate over the Mediterranean Sea, Caspian Sea and Black Sea and approach northwest India and is defined by two or more closed isobars on the surface.

Induced low

Under the influence of the western disturbance, sometimes a low is developed to the south of the system called as induced low.

Induced cyclonic circulation

Under the influence of the western disturbance, sometimes a cyclonic circulation is developed to the south of the system called as induced cyclonic circulation.

Trough

A line or curve along which the atmospheric pressure is minimum. Pressure increases on both sides of the line or curve.

Trough in westerlies

A moving wave perturbation in mid latitude regions which are present throughout the year which move from west to east and entire globe. These systems generally affect the northern parts of India.

Trough in easterlies A moving wave

A moving wave perturbation in the equatorial easterly

wave, moving from east to west.

Easterly Waves A shallow trough disturbance in the easterly current of

the tropics, more in evidence in the upper level winds than in surface pressure, whose passage westwards is followed by a marked intensification of cloudy, showery weather. The southern peninsular region is affected by

easterly waves.

Shear line A line or narrow zone across which there is an abrupt

change in the horizontal wind component; a line of

maximum horizontal wind shear.

Ridge An elongated area of relatively high atmospheric

pressure almost always associated with and most clearly identified as an area of maximum anticyclonic

curvature of wind flow.

Wind-discontinuity A line across which there is an abrupt change in wind

direction

Troposphere An atmospheric layer in which all significant weather

phenomena occur. The troposphere is characterized by

decreasing temperature with height.

Lower troposphere

level

Part of the troposphere upto 2.1 km above mean Sea

level (a.s.l)

Mid troposphere level Part of the troposphere from 2.1 km a.s.l. but below 7.6

km a.s.l

Upper troposphere

level

Part of the troposphere from 7.6 km a.s.l to a height

upto which temperature decreases with height.

Forecast

Types of forecast

Description

Nowcasting

A short range forecast having a lead time/validity

of less than 24 hrs

Short range forecasts

Forecasts having a lead time / validity period of 1

to 3 days

Medium range forecasts

Forecasts having a lead time /validity period of 4

to 10 days

Long range /Extended Range forecasts

Forecasts having a lead time /validity period beyond 10 days. Usually this is being issued for a season. IMD issues Long Range Forecast for southwest Monsoon rainfall and onset date for Kerala, Northeast Monsoon Rainfall and Winter precipitation over Northwest India.

Local Forecast

In local forecast, whenever any weather phenomenon is expected, its intensity, frequency and time of occurrence is indicated. In the absence of a weather phenomenon, the local forecast describes anticipated sky conditions. The other parameters for which the local forecast issued include maximum temperature and/or minimum temperature, rainfall, wind and special phenomenon.

It is valid for a radius of 50 km around the station and is updated 4 times in a day.

Seasons

Winter Season January – February

Pre Monsoon Season March – May

Southwest Monsoon Season June - September **Northeast Monsoon Season** October - December

Sky Conditions

Reported in terms of Octa wherein the sky is divided into 8 equal parts

Clear sky 0 Octa

Mainly clear 1-2 Octa of sky covered

Partly cloudy 3-4 Octa of sky covered

Generally cloudy 5-7 Octa of sky covered

Cloudy > 7 Octa of sky covered

Weather phenomena

<u>ion</u>

One or two spells of rain

In a 24 hrs time, rainfall occurring with a frequency of 1-2

spells.

A few spells of rain In a 24 hrs time, rainfall occurring with a frequency of

more than 2 spells but with well defined dry spells in

between.

In a 24 hrs time, rainfall occurring with a frequency more Intermittent rain

than that defined in "A Few Spells" but is discontinuous

and without presenting the character of a shower.

Drizzle Liquid precipitation in the form of water drops of very

small size (by convention, with radius of water drops

between about 100 and 500 µm).

Liquid precipitation in the form of water drops of radius Rain

between about 500 and 2500 µm.

Shower

Solid or liquid precipitation from a vertically developed cloud is designated a shower and is distinguished from the precipitation, intermittent or continuous, from layer clouds. Showers are often characterized by short duration and rapid fluctuations of intensity (by convention, with radius of water drops more than $2500 \, \mu m$).

Hail

Solid precipitation in the form of balls or pieces of ice (hailstones) with diameters ranging from 5 to 50 mm or even more.

Thunderstorm

One or more sudden electrical discharges manifested by a flash of light (Lightning) and a sharp rumbling sound (thunder).

Duststorm

An ensemble of particles of dust or sand energetically lifted to great heights by a strong and turbulent wind.

Surface visibility is reduced to low limits; the qualification for a synoptic report is visibility below 1000 m.

Mist Dew Mist is a phenomenon of small droplets suspended in air Condensation of water vapour on a surface whose temperature is reduced by radiational cooling to below the DEW-POINT of the air in contact with it

Fog

Fog is a phenomenon of small droplets suspended in air and the visibility is one kilometer or less

Frost

Frost occurs when the temperature of the air in contact with the ground, or at thermometer-screen level, is below the freezing-point of water ('ground frost' or 'air frost', respectively). The term is also used of the icy deposits which may form on the ground and on objects in such temperature conditions (glaze, hoar-frost).

Haze

Haze is traditionally an atmospheric phenomenon where dust, smoke and other dry particles obscure the clarity of the sky.

Smog

Smoke and fog together reduce the visibility

Squally weather Squally weather is meant to cover occasional or frequent

squalls with rain or persistent type of strong gusty winds (mean wind speed not less than 20 knot) accompanied by rain. Such conditions are associated with low pressure

systems or onset and strengthening of monsoon.

Visibility The greatest distance that prominent object can be seen

and identified by unaided, normal eyes.

Rainfall

The latest practices followed are summarised below:

Spatial Distribution of Rainfall

Distribution	No. of Places	Description
Isolated	One or two Places	<25% of stations gets rainfall
Scattered	At a few Places	(26–50)% of stations gets rainfall
Fairly Widespread	At many Places	(51–75)% of stations gets rainfall
Wide spread	At Most place	(76–100)% of stations gets rainfall
Dry	-	No station reported rainfall

Intensity of Rainfall

Descriptive Term used	Rainfall amount in mms		
No Rain	0.0		
Very light Rain	0.1- 2.4		
Light Rain	2.5 – 7.5		
Moderate Rain	7.6 – 35.5		
Rather Heavy	35.6 – 64.4		
Heavy Rain	64.5 – 124.4		
Very Heavy Rain	124.5 – 244.4		
Extremely Heavy Rain	>244.5		
Exceptionally Heavy Rain	When the amount is a value near about the highest recorded rainfall at or near the station for the month or season. However, this term will be used only when the actual rainfall amount exceeds 12 cm.		

Weekly/Seasonal Rainfall Distribution on regional scale

Percentage departure of realised rainfall from normal Excess

rainfall is + 20% or more.

Normal Percentage departure of realised rainfall from normal

rainfall is between - 19 % to + 19 %.

Deficient Percentage departure of realised rainfall from normal

rainfall is between - 20 % to - 59 %.

Scanty Percentage departure of realised rainfall from normal

rainfall is between - 60 % to - 99 %.

No rain Percentage departure of realised rainfall from normal

rainfall is- 100 %

Rainfall distribution on All India scale

Normal percentage departure of realised rainfall is within ±

10 % of the Long Period Average

Below Normal percentage departure of realised rainfall is < 10% of

the Long Period Average

Above Normal percentage departure of realised rainfall is > 10% of

the Long Period Average

All India

When the rainfall deficiency is more than 10% and when 20 to 40% of the country is under drought **Drought Year**

conditions, then the year is termed as All India

Drought Year

All India Severe **Drought Year**

When the rainfall deficiency is more than 10% and when the spatial coverage of drought is more than

40% it is called as All India Severe Drought Year

Temperature

Description of 24 hrs temperature changes.

Maximum temperature

(a) When the normal maximum temperature of a station is 40° C or below.

Nomenclature Past 24 hours change

Little change -1°C to 1°C

Rise 2° C

Appreciable rise 3° C to 4° C Marked rise 5° c to 6° C Large rise 7° C or more

(b) When the normal maximum temperature of a station is more than 40° C.

Nomenclature Past 24 hours change

Little change -1 C to 1 C

Rise 2° C

Marked rise 3° C to 4° C Large rise 5° C or more

Minimum temperature

(a) When the normal minimum temperature of a station is 10° C or more.

Nomenclature Past 24 hours change

Little change 1° C to -1° C

Fall -2° C

Appreciable fall -3° C to -4° C Marked fall -5° C to -6° C Large fall -7° C or less

(b) When the normal minimum temperature of a station is less than 10° C.

Nomenclature Past 24 hours change

Little change 1° C to -1° C

Fall -2° C

Marked fall -3° C to -4° C Large fall -5° C or less

Criteria for Heat Wave:

Heat wave need not be considered till maximum temperature of a station reaches at least 40° C for Plains and at least 30° C for Hilly regions.

a) When normal maximum temperature of a station is less than or equal to 40°C

Heat Wave Departure from normal is 5° C to 6° C Severe Heat Wave Departure from normal is 7° C or more

b) When normal maximum temperature of a station is more than 40° C

Heat Wave Departure from normal is 4° C to 5° C Severe Heat Wave Departure from normal is 6° C or more

c) When actual maximum temperature remains 45°C or more irrespective of normal maximum temperature, heat wave should be declared.

Hot day

In the northern plains of the country, dust in suspension occurs in many years for several days, bringing minimum temperature much higher than normal and keeping the maximum temperature around or slightly above normal. Sometimes increase in humidity also adds to this discomfort. Nights do not get cooled and become uncomfortable. To cover this situation, hot day concept has been introduced as given below:

Whenever, the maximum temperature remains 40°C or more and minimum temperature is 5° C or more above normal, it may be defined as Hot Day, provided it is not satisfying the heat wave criteria given above.

<u>Criteria for describing Hot Day for coastal stations</u>

When maximum temperature departure is 5° C or more from normal, Hot Day may be described irrespective of the threshold value of 40° C. If the threshold value of 40° C is reached Heat Wave may be declared.

When a station satisfies both the Heat Wave and Hot Day criteria, then Heat Wave should be given higher priority and be declared.

Hot Wind

Hot wind reduces moisture causing dehydration and a prolonged exposure may prove to be fatal.

The phenomena of Loo over the plains of northwest India is very well known. It is also described in the Weather bulletins and appropriate warnings are being issued at present. The present practice should continue.

Criteria for Cold Wave

Wind chill factor plays an important role and brings down the actual minimum temperature depending upon the wind speed. The actual minimum temperature of a station should be reduced to "wind chill effective minimum temperature (WCTn)" based on wind chill factor using the enclosed table Enclosure I, WMO No. 331/ Tech note No. 123 on "The assessment of human bio-climate. A limited review of physical parameters, 1972).

For declaring "Cold Wave" and "Cold Day" WCTn should only be used.

If WCTn is 10°C or less, then only the conditions for cold wave should be considered.

a) When normal minimum temperature is equal to 10°C or more.

Cold Wave Departure from normal is -5°C to -6°C. Severe Cold Wave Departure from normal is -7°C or less

b) When normal minimum temperature is less than 10°C.

Cold Wave Departure from normal is -4°C to -5°C. Severe Cold Wave Departure from normal is -6°C or less.

When WCTn is 0°C or less, Cold Wave should be declared irrespective of normal minimum temperature of the station. However, this criteria is not applicable for those stations whose normal minimum temperature is below 0°C.

Cold Wave conditions for coastal stations

For coastal stations the threshold value of minimum temperature of 10°C is rarely reached. However, the local people feel discomfort due to wind chill factor which reduces the minimum temperature by a few degrees depending upon the wind speed. The "Cold Day" concept may be used following the criteria given below:

Criteria for describing "Cold Day" for coastal stations

- i) Actual minimum temperature of a station be reduced to WCTn.
- ii) This WCTn should be used to declare "Cold Wave" or "Cold Day".
- iii) When minimum temperature departure is -5°C or less over a station, "Cold Day" may be described irrespective of threshold value of 10°C
- iv) However, when a threshold of 10°C is reached "Cold Wave" be declared.
- v) When a station satisfies both the Cold Wave and Cold Day criteria, then Cold Wave has a higher priority and has to be declared.

Heat wave/ Cold Wave and hot Day/ Cold Day are area specific phenomena. Therefore they may be described for a Met. Sub-division or a part thereof, when at least two stations satisfy the criteria

Winds

Wind Atmospheric motion characterized by direction and speed. The direction of the wind is the direction from which the wind approaches the station (Example Northerly wind – Wind approaching the station from North)

Gales A gale is a very strong wind (34 to 47 knots)

Squall A sudden increase of wind speed by atleast 3 stages on the Beaufort Scale, the speed rising to force 6 or more, and lasting for atleast one minute is called a squall

Gust A rapid increase in the strength of the wind relative to the mean strength at the time

Monsoon

"MONSOON" has originated from the Arabic word "MAUSIM" which means season. It is most often applied to the seasonal reversals of the wind direction along the shores of the Indian Ocean, especially in the Arabian Sea, that blow from the southwest during one half of the year and from the northeast during the other.

Onset & Advance of Monsoon

The guidelines to be followed for declaring the onset of monsoon over Kerala and its further advance over the country are enlisted below:

Onset over Kerala

a) Rainfall

If after 10th May, 60% of the available 14 stations enlisted*, viz. Minicoy, Amini, Thiruvananthapuram, Punalur, Kollam, Allapuzha, Kottayam, Kochi, Thrissur, Kozhikode, Thalassery, Kannur, Kasargode and Mangalore report rainfall of 2.5 mm or more for two consecutive days, the onset over Kerala be declared on the 2nd day, provided the following criteria are also in concurrence.

b) Wind field

Depth of westerlies should be maintained upto 600 hPa, in the box equator to Lat. 10°N and Long. 55°E to 80°E. The zonal wind speed over the area bounded by Lat. 5-10°N, Long. 70-80°E should be of the order of 15 – 20 Kts. at 925 hPa. The source of data can be RSMC wind analysis/satellite derived winds.

3. Outgoing Longwave Radiation (OLR)

INSAT derived OLR value should be below 200 wm⁻² in the box confined by Lat. 5-10°N and Long. 70-75°E.

Further Advance of Monsoon over the Country

a) Further advance be declared based on the occurrence of rainfall over parts/sectors of the sub-divisions and maintaining the spatial continuity of the northern limit of monsoon, further advance be declared.

The following auxiliary features may also be looked into:

- b) Along the west coast, position of maximum cloud zone, as inferred from the satellite imageries may be taken into account.
- c) The satellite water vapour imageries may be monitored to assess the extent of moisture incursion.

Northern Limit of Monsoon (NLM)

Southwest monsoon normally sets in over Kerala around 1st June. It advances northwards, usually in surges, and covers the entire country around 15th July. The NLM is the northern most limit of monsoon upto which it has advanced on any given day.

Withdrawal of SW Monsoon

- a) Withdrawal from extreme north-western parts of the country should not be attempted before 1st September.
- b) After 1st September:

The following major synoptic features should be considered for the first withdrawal from the western parts of NW India.

- i) Cessation of rainfall activity over the area for continuous 5 days.
- ii) Establishment of anticyclone in the lower troposphere (850 hPa and below)
- iii) Considerable reduction in moisture content as inferred from satellite water vapour imageries and tephigrams.

Further Withdrawal from the Country

i) Further withdrawal from the country may be declared, keeping the spatial continuity, reduction in moisture as seen in the water vapour imageries and prevalence of dry weather for 5 days.

ii) SW monsoon should be withdrawn from the southern peninsula and hence from the entire country only after 1st October, when the circulation pattern indicates a change over from the southwesterly wind regime.

Commencement of NE monsoon rains

- i) Withdrawal of SW monsoon upto Lat. 15°N.
- ii) Onset of persistent surface easterlies over Tamil Nadu coast.
- iii) Depth of easterlies upto 850 hPa over Tamil Nadu coast.
- iv) Fairly widespread rainfall over coastal Tamil Nadu, south coastal Andhra Pradesh and adjoining areas.

Criteria for Declaring Onset of Northeast Monsoon

For declaring onset of Northeast Monsoon following criteria may be considered:

- (1) Withdrawal of south west Monsoon upto 15° N.
- (2) Onset of persistent surface easterlies over Tamil Nadu coast.
- (3) Depth of easterlies upto 850 hpa over Tamil Nadu coast.
- (4) Fairly widespread rainfall over the coastal Tamil Nadu and adjoining areas.
- (5) Onset is not to be declared before 10th October even, if the conditions described above exist.

Specifications for activity/ strength of Northeast Monsoon

Weak Monsoon:

Rainfall less than half the normal.

Normal Monsoon:

Rainfall half to less than one and a half (1½) times the normal.

Active Monsoon:

- i) Rainfall 1½ to 4 times the normal.
- ii) Rainfall in atleast two stations should be 3 cm in Coastal Tamil Nadu and south coastal Andhra Pradesh and 2 cm elsewhere.
- lii) Rainfall in that sub-division should be fairly widespread or widespread.

Vigorous Monsoon:

- i) Rainfall exceeding 4 times the normal.
- li) Rainfall in atleast two stations should be 5 cm in Coastal Tamil Nadu and south coastal Andhra Pradesh and 3 cm elsewhere.
- lii) Rainfall in that sub-division should be fairly widespread or widespread.

Strength of Southwest Monsoon

Descriptive term over the Sea

Wind speed (in knots) reported or inferred to be existing.

Weak monsoon	Upto 12 knots
Moderate monsoon	13 to 22 knots
Strong monsoon	23 to 32 knots

Vigorous monsoon 33 knots and above.

Descriptive term over land area

Weak monsoon

Rainfall less than half of the normal.

Normal monsoon

Rainfall half to less than 1½ times the normal (mention of 'normal' monsoon may not be necessary in general).

Active/ strong monsoon

- i) Rainfall 1 ½ to 4 times the normal.
- The rainfall in at least two stations should be 5 cm, if that sub-division is along the west coast and 3 cm, if it is elsewhere.
- Rainfall in that sub-division should be fairly widespread to widespread.

Vigorous monsoon

- i) Rainfall more than 4 times the normal.
- ii) The rainfall in at least two stations should be 8 cm if the sub-division is along the west coast and 5 cm if it is elsewhere.
- Rainfall in that sub-division should be fairly widespread or widespread

While describing the activity of the monsoon,

- i) The normals of stations, when ever available should be used.
- ii) Till normals for all the stations are available the following procedure should be adopted:

Number of stations in a sub-division with normals	а
Normal for these stations	b
Average normal for the sub-division	b/a
Total number of stations reporting rainfall	С
Actual total rainfall reported by these stations	d
Therefore, the average rainfall for the sub-division	d/c

Compare d/c with b/a and describe the activity of the monsoon accordingly, other conditions being fulfilled.

- 3. i) In the sub-divisions, w here the percentage of hill stations is high, the hill stations must be also taken into account for describing the activity of the monsoon. In other sub-divisions, the hill stations will be excluded.
- ii) The monsoon activity will be described in all the sub-divisions of northeast India as is done for sub-divisions of other regions.
- iii) The monsoon activity need not be described over the Bay Islands and the Arabian Sea Islands.

Subdued Monsoon activity

- 1. Whenever, a country wide dry spell continues for more than 3 days and is expected to continue for atleast 2 more days, the description of monsoon should be given as 'weak or subdued monsoon for the country as a whole. RC level bulletins may also include this information.
- 2. Information on prolonged dry spells/ subdued activity over the met. subdivisions also should be included in the RMC/ MC level bulletins if such a spell is persisting for 2 or more days and is expected to continue.
- 3. Monsoon activity for a sub-division might be considered subdued if the rainfall realised is less than ½ the normal.

Nomenclature for different parts of the day

Early hours of (date)	0000 – 0400 hrs, IST
Early morning	0400 – 0600 hrs. IST
Morning	0400 – 0800 hrs. IST
Forenoon	0800 – 1200 hrs. IST
Around noon	1100 – 1300 hrs. IST
Afternoon	1200 – 1600 hrs. IST
Evening	1600 – 2000 hrs. IST
Night	2000 – 2400 hrs. IST

Terminology used for state of Sea

Descriptive term	Height in Metres	Wind speed in knots (kmph)	Beaufort scale
Calm (glassy)	0	0	0
Calm (rippled)	0 - 0.1	1 - 3 (2 - 6)	1
Smooth (waveless)	0.1 - 0.5	4 - 10 (7 - 19)	2 - 3
Slight	0.5 - 1.25	11 - 16 (20 - 30)	4
Moderate	1.25 - 2.5	17 - 21 (31 - 39)	5
Rough	2.5 - 4.0	22 - 27 (41 - 50)	6
Very rough	4.0 - 6.0	28 - 33 (52 - 61)	7
High	6.0 - 9.0	34 - 40 (63 - 74)	8
Very high	9.0 - 14.0	41 - 63 (76 - 117)	9 - 11
Phenomenal	Over 14	64 or above (119 or above)	12

The Dvorak technique

The Dvorak technique is a method using enhanced Infrared and/or visible satellite imagery to quantitatively estimate the intensity of a tropical system. Cloud patterns in satellite imagery normally show an indication of cyclogenesis before the storm reaches tropical storm intensity. Indications of continued development and/or weakening can also be found in the cloud features. Using these features, the pattern formed by the clouds of a tropical cyclone, expected systematic development, and a series of rules, an intensity analysis and forecast can be made. This information is then standardized into an intensity code.

"T" classification of Cyclonic Storm

T. Number / C.I. Number	Classification of cyclonic disturbance	Wind speed in knots	Wind speed in kmph	Δρ	Wind criteria in knots	Wind criteria in kmph
T1.0	L				<17	<31
T1.5	D	25	46.3		17-27	31-49
T2.0	DD	30	55.6	4.5	28-33	50-61
T2.5	CS	35	64.9	6.1	34-47	62-88
T3.0		45	83.4	10.0		
T3.5	SCS	55	101.9	15.0	48-63	89-117
T4.0	VSCS	65	120.5	20.9	64-119	119-221
T4.5		77	142.7	29.4		
T5.0		90	166.8	40.2		
T5.5		102	189.0	51.6		
T6.0		115	213.1	65.6		
T6.5	SuCS	127	235.4	80.0	120 and above	222 and above
T7.0		140	259.5	97.2		
T7.5		155	287.3	119.1		
T8.0		170	315.1	143.3		