

# Terminology and Glossary

Synoptic Systems	
Type	Description
<b><u>Cyclonic Circulation</u></b> <b><u>(Cycir)</u></b>	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.
<b>Anticyclonic Circulation</b>	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.
<b>Low pressure Area (LOPAR)/ well marked LOPAR</b>	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).
<b>Depression</b>	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.
<b>Deep Depression</b>	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.
<b>Cyclonic Storm</b>	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.
<b>Severe Cyclonic Storm</b>	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.

<b>Type</b>	<b>Description</b>
<b>Very Severe Cyclonic Storm</b>	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.
<b>Super cyclonic storm</b>	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.
<b>Western Disturbance</b>	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.
<b>Western Depression</b>	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.
<b>Induced low</b>	Under the influence of the western disturbance, sometimes a low is developed to the south of the system called as induced low.
<b>Induced cyclonic circulation</b>	Under the influence of the western disturbance, sometimes a cyclonic circulation is developed to the south of the system called as induced cyclonic circulation.
<b>Trough</b>	A line or curve along which the atmospheric pressure is minimum. Pressure increases on both sides of the line or curve.
<b>Trough in westerlies</b>	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.
<b>Trough in easterlies</b>	A moving wave perturbation in the equatorial easterly wave, moving from east to west.

<b>Type</b>	<b>Description</b>
<b>Easterly Waves</b>	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.
<b>Shear line</b>	A line or narrow zone across which there is an abrupt change in the horizontal wind component; a line of maximum horizontal wind shear.
<b>Ridge</b>	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.
<b>Wind-discontinuity</b>	A line across which there is an abrupt change in wind direction
<b>Troposphere</b>	An atmospheric layer in which all significant weather phenomena occur. The troposphere is characterized by decreasing temperature with height.
<b>Lower troposphere level</b>	Part of the troposphere upto 2.1 km above mean Sea level (a.s.l)
<b>Mid troposphere level</b>	Part of the troposphere from 2.1 km a.s.l. but below 7.6 km a.s.l
<b>Upper troposphere level</b>	Part of the troposphere from 7.6 km a.s.l to a height upto which temperature decreases with height.

<b>Forecast</b>	
<b>Types of forecast</b>	<b>Description</b>
<b>Nowcasting</b>	A short range forecast having a lead time/validity of less than 24 hrs
<b>Short range forecasts</b>	Forecasts having a lead time / validity period of 1 to 3 days
<b>Medium range forecasts</b>	Forecasts having a lead time /validity period of 4 to 10 days
<b>Long range /Extended Range forecasts</b>	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.
<b>Local Forecast</b>	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.

<b>Seasons</b>	
<b>Winter Season</b>	January - February
<b>Pre Monsoon Season</b>	March - May
<b>Southwest Monsoon Season</b>	June - September
<b>Northeast Monsoon Season</b>	October - December

## Sky Conditions

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

<b>Clear sky</b>	0 Octa
<b>Mainly clear</b>	1-2 Octa of sky covered
<b>Partly cloudy</b>	3-4 Octa of sky covered
<b>Generally cloudy</b>	5-7 Octa of sky covered
<b>Cloudy</b>	> 7 Octa of sky covered

## Nomenclature for different parts of Day

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

<b>Weather Phenomena</b>	
<b>Types</b>	<b>Description</b>
<b>One or two spells of rain</b>	In a 24 hrs time, rainfall occurring with a frequency of 1-2 spells.
<b>A few spells of rain</b>	In a 24 hrs time, rainfall occurring with a frequency of more than 2 spells but with well defined dry spells in between.
<b>Intermittent rain</b>	In a 24 hrs time, rainfall occurring with a frequency more than that defined in <b>A Few Spells</b> but is discontinuous and without presenting the character of a shower.
<b>Drizzle</b>	Liquid precipitation in the form of water drops of very small size (by convention, with radius of water drops between about 100 and 500 $\mu\text{m}$ ).
<b>Rain</b>	Liquid precipitation in the form of water drops of radius between about 500 and 2500 $\mu\text{m}$ .
<b>Shower</b>	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 $\mu\text{m}$ ).
<b>Hailstorm</b>	Solid precipitation in the form of balls or pieces of ice (hailstones) with diameters ranging from 5 to 50 mm or even more.
<b>Thunderstorm</b>	One or more sudden electrical discharges manifested by a flash of light (Lightning) and a sharp rumbling sound (thunder).
<b>Duststorm</b>	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.
<b>Mist</b>	Mist is a phenomenon of small droplets suspended in air

<b>Types</b>	<b>Description</b>
<b>Dew</b>	Condensation of water vapour on a surface when temperature is reduced by radiational cooling to below the DEW-POINT of the air in contact with it.
<b>Fog</b>	Fog is a phenomenon of small droplets suspended in air and the visibility is one kilometre or less.
<b>Frost</b>	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).
<b>Haze</b>	Haze is traditionally an atmospheric phenomenon where dust, smoke and other dry particles obscure the clarity of the sky.
<b>Smog</b>	Smoke and fog together reduce the visibility.
<b>Squally weather</b>	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.
<b>Visibility</b>	The greatest distance that prominent object can be seen and identified by unaided, normal eyes.

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

<b>Intensity of Rainfall</b>	
<b>Descriptive Term used</b>	<b>Rainfall amount in mms</b>
<b>No Rain</b>	0.0
<b>Very Light Rain</b>	0.1 ó 2.4
<b>Light Rain</b>	2.5 ó 7.5
<b>Moderate Rain</b>	7.6 ó 35.5
<b>Rather Heavy</b>	35.6 ó 64.4
<b>Heavy Rain</b>	64.5 ó 124.4
<b>Very Heavy Rain</b>	124.5 ó 244.4
<b>Extremely Heavy Rain</b>	> 244.5
<b>Exceptionally Heavy Rain</b>	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.

<b>Weekly/Seasonal Rainfall distribution</b> (On Regional Scale)	
<b>Descriptive Term used</b>	<b>% Departure of Realised rainfall from Normal rainfall</b>
<b>Excess</b>	+ 20% or more.
<b>Normal</b>	Between - 19 % to + 19 %.
<b>Deficient</b>	Between - 20 % to - 59 %.
<b>Scanty</b>	Between - 60 % to - 99 %.
<b>No rain</b>	- 100 %

<b>Weekly/Seasonal Rainfall distribution</b> (On All India Scale)	
<b>Descriptive Term used</b>	<b>% Departure of Realised rainfall</b>
<b>Normal</b>	Within $\pm 10$ % of the Long Period Average
<b>Below Normal</b>	< 10% of the Long Period Average
<b>Above Normal</b>	> 10% of the Long Period Average

<b>All India Drought Year</b>	
<b>Descriptive Term used</b>	<b>When Rainfall Deficiency is more than</b>
<b>All India Drought Year</b>	10% and when 20 to 40% of country is under drought conditions
<b>All India Severe Drought Year</b>	10% and when Spatial coverage of drought is more than 40%

<b>Temperatures</b>		
Description of 24 hrs temperature changes		
<b>Maximum Temperature</b>		
<b>(a) When the normal maximum temperature of a station is 40°C or below</b>		<b>(b) When the normal maximum temperature of a station is more than 40° C.</b>
<b>Nomenclature</b>	<b>Past 24 hrs change</b>	<b>Past 24 hrs change</b>
Little change	-1° C to 1° C	-1° C to 1° C
Rise	2° C	2° C
Appreciable rise	3° C to 4° C	---
Marked rise	5° C to 6° C	3° C to 4° C
Large rise	7° C or more	5° C or more
<b>Minimum Temperature</b>		
<b>(a) When the normal minimum temperature of a station is 10° C or more.</b>		<b>(b) When the normal minimum temperature of a station is less than 10° C.</b>
<b>Nomenclature</b>	<b>Past 24 hrs change</b>	<b>Past 24 hrs change</b>
Little change	1° C to -1° C	1° C to -1° C
Fall	-2° C	-2° C
Appreciable Fall	-3° C to -4° C	---
Marked Fall	-5° C to -6° C	-3° C to -4° C
Large Fall	-7° C or less	-5° C or less

<b>Criteria for Heat Wave</b>	
Heat wave need not be considered till	
<b>Stations In</b>	<b>Maximum temperature of a station reaches at</b>
<b>Plains</b>	least 40°C
<b>Hilly Region</b>	least 30°C

When normal maximum temperature of a station is	Heat Wave	Severe Heat Wave
	Departure from Normal	
a) less than or equal to 40°C	5° C to 6° C	7° C or more
b) is more than 40° C	4° C to 5° C	6° C or more
c) When actual maximum temperature remains 45°C or more irrespective of normal maximum temperature, heat wave should be declared.		

Criteria for describing Hot Day	
Plain Stations	Coastal Stations
Whenever, Maximum temperature remains 40°C or more and Minimum temperature is 5° C or more above normal, Provided it is not satisfying the heat wave criteria given above.	Whenever, Maximum temperature departure is 5° C or more from normal, Irrespective of the threshold value of 40°C. If the threshold value of 40° C is reached Heat Wave may be declare.

**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
It is phenomena of Loo over the plains of northwest. 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:
Reduced the actual minimum temperature of a station to wind chill effective minimum temperature (WCTn) by using the table Enclosure I, WMO No. 331/ Tech note No. 123 on "The assessment of human bio-climate. A limited review of physical parameters, 1972).
<b>For declaring "Cold Wave" and "Cold Day" WCTn should only be used.</b>
If WCTn is 10°C or less, then only the conditions for cold wave should be considered.

<b>(a) When the normal minimum temperature of a station is 10° C or more.</b>		<b>(b) When the normal minimum temperature of a station is less than 10° C.</b>
<b>Nomenclature</b>	<b>Departure from Normal</b>	<b>Departure from Normal</b>
<b>a) Cold Wave</b>	-5°C to -6°C.	-4°C to -5°C.
<b>b) Severe Cold Wave</b>	-7°C or less.	-6°C or less.
<b>c) 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.</b>		

### **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.

### **Criteria for describing “Cold Day”**

- i) Reduced actual minimum temperature of a station to WCTn.
- ii) Use this WCTn 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.

**For a Meteorological Sub-division or a part thereof Heat wave/ Cold Wave and hot Day/ Cold Day may be described, when at least two stations satisfy the criteria.**

<b>Winds</b>	
<b>Type</b>	<b>Description</b>
<b>Wind</b>	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)
<b>Gales</b>	A gale is a very strong wind (34 to 47 knots)
<b>Squall</b>	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
<b>Gust</b>	A rapid increase in the strength of the wind relative to the mean strength at the time

# MONSOON

It is 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 and Advance of Monsoon

### 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 up to 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.

#### c). Outgoing Longwave Radiation (OLR)

INSAT derived OLR value should be below  $200 \text{ wm}^{-2}$  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 1<sup>st</sup> June. It advances northwards, usually in surges, and covers the entire country around 15<sup>th</sup> July. The NLM is the northern most limit of monsoon up to 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 1<sup>st</sup> September.
- b) After 1<sup>st</sup> 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 1<sup>st</sup> October, when the circulation pattern indicates a change over from the southwesterly wind regime.

### **Commencement of NE monsoon rains**

- i) Withdrawal of SW monsoon up to Lat. 15°N.
- ii) Onset of persistent surface easterlies over Tamil Nadu coast.
- iii) Depth of easterlies up to 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 up to 15° N.
- (2) Onset of persistent surface easterlies over Tamil Nadu coast.
- (3) Depth of easterlies up to 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 10<sup>th</sup> October even, if the conditions described above exist.

## Specifications for Activity/ Strength of Southwest And Northeast Monsoon

<b>Descriptive term over the Land area</b>		
<b>Activity</b>	<b>Southwest Monsoon</b>	<b>Northeast Monsoon</b>
<b>Weak monsoon</b>	Rainfall less than half of the normal.	Rainfall less than half of the normal.
<b>Normal monsoon</b>	Rainfall half to less than one and a half (1½) times the normal. (Mention of 'normal' monsoon may not be necessary in general).	Rainfall half to less than one and a half (1½) times the normal.
<b>Active/ Strong monsoon</b>	<ul style="list-style-type: none"> <li>i) Rainfall 1 ½ to 4 times the normal.</li> <li>ii) 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.</li> <li>iii) Rainfall in that sub-division should be fairly widespread to widespread.</li> </ul>	<ul style="list-style-type: none"> <li>i) Rainfall 1½ to 4 times the normal.</li> <li>ii) Rainfall in at least two stations should be 3 cm in Coastal Tamil Nadu and South Coastal Andhra Pradesh and 2 cm, if it is elsewhere.</li> <li>Iii) Rainfall in that sub-division should be fairly widespread or widespread.</li> </ul>
<b>Vigorous monsoon</b>	<ul style="list-style-type: none"> <li>i) Rainfall more than 4 times the normal.</li> <li>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.</li> <li>iii) Rainfall in that sub-division should be fairly widespread or widespread</li> </ul>	<ul style="list-style-type: none"> <li>i) Rainfall exceeding 4 times the normal.</li> <li>Ii) Rainfall in atleast two stations should be 5 cm in Coastal Tamil Nadu and south coastal Andhra Pradesh and 3 cm elsewhere.</li> <li>Iii) Rainfall in that sub-division should be fairly widespread or widespread.</li> </ul>

<b>Descriptive term over the Sea (Southwest Monsoon)</b>	
Wind speed (in knots) reported or inferred to be existing.	
<b>Weak monsoon</b>	Up to 12 knots
<b>Moderate monsoon</b>	13 to 22 knots
<b>Strong monsoon</b>	23 to 32 knots
<b>Vigorous monsoon</b>	33 knots and above.

**While describing the activity of the monsoon:**

1. The normals of stations, when ever available should be used.
2. Till normals for all the stations are available the following procedure should be adopted:

Number of stations in a sub-division with normals	a
Normal for these stations	b
Average normal for the sub-division	b/a
Total number of stations reporting rainfall	c
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.

1. In the sub-divisions, where 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.
2. The monsoon activity will be described in all the sub-divisions of northeast India as is done for sub-divisions of other regions.
3. The monsoon activity need not be described over the Bay Islands and the Arabian Sea Islands.

**Subdued Monsoon activity:**

- a. Whenever, a country wide dry spell continues for more than 3 days and is expected to continue for at least 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.
- b. Information on prolonged dry spells/ subdued activity over the met. Sub-divisions 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.
- c. Monsoon activity for a sub-division might be considered subdued if the Rainfall realised is less than  $\frac{1}{2}$  the normal.