

## Temperate Cyclone

Cyclones are centres of low pressure surrounded by closed isobars having increasing pressure outward and air blow from outside towards inward, anticlockwise in N.H and clockwise in S.H.



From locational point of view cyclones are classified into two - (i) Extratropical cyclone / Temperate / Wave cyclone (ii) Tropical cyclone.

### Characteristics of Temperate cyclones :-

- (i) Low pressure in the centre & increasing pressure outward.
- (ii) Produced in middle latitudes.
- (iii) Characterise by converging & rising air, cloudiness & precipitation.
- (iv) They may be near circular, elliptical or wedge shaped so called 'low', 'depressions' or 'troughs'.
- (v) Formed in regions lying between 35° - 65° latitudes in both the hemispheres.
- (vi) Formed due to convergence of polar & tropical airmasses & form polar fronts.
- (vii) They move in easterly direction under the influence of westerly winds.

### Types of temperate cyclones

Based on formation of some local cyclones temperate cyclones are divided into three :-

- 1) Dynamic cyclone - They are real temperate cyclone, affect weather condition of very large areas, different warm & cold front, sectors are fully developed & produced due to convergence of two contrasting air masses into territories of one another.
- 2) Thermal cyclone - According to Brent it is formed due to development of L.P centre on continents in summers & are stationary at their place of origin. Humphreys says about L.P centres over warm ocean water in winter & call it insolation cyclones.
- 3) Secondary cyclones - Develop due to passage of cold wind over warm sea due to occlusion of main cyclone.

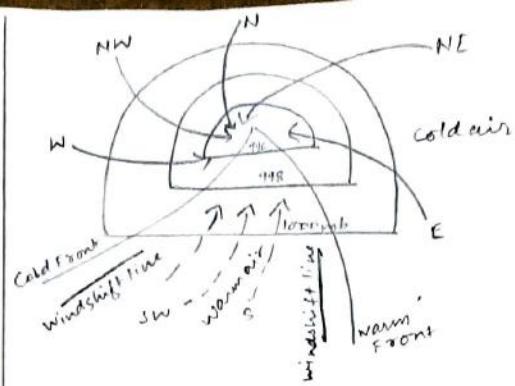
### Wind system

winds blow from H.P periphery towards L.P centres, & do not reach centre straight but cut isobars at an angle of  $20^\circ$  to  $40^\circ$  due to friction & coriolis force

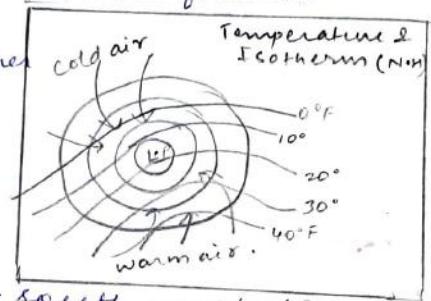
so wind direction becomes anticlockwise in N.H & clockwise in S.H. At centre wind ascend upward and expand outward so L.P. centre is maintained.

Before the arrival of warm front wind direction is easterly but it changes to southerly & southwesterly at the arrival of warm front & it changes to westerly, northwesterly & northly at the arrival of cold front. There is sudden change in wind direction along warm & cold front. Line along which wind changes its direction is called windshift line.

Southern part of cyclone has higher temperature due to warm air and north, NE, NW has low temperature due to cold air. Western part has lowest temperature. Isotherms tend in north-northeast to south-southwest direction in



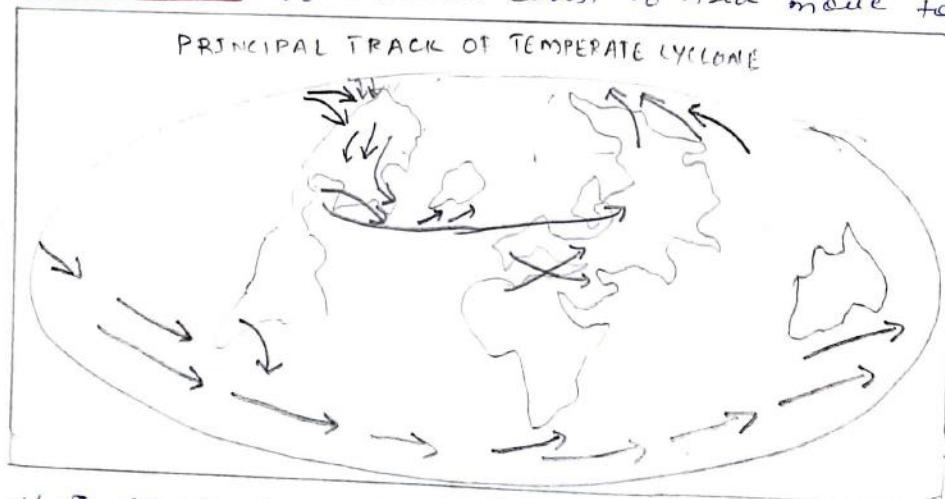
WIND PATTERN IN TEMPERATE CYCLONE (N.H.)



### Path and movement of temperate cyclone

Temperate cyclone move in middle & high latitudes b/w 35° to 65° N & S on an average in easterly direction but they are highly variable and in zonal pattern. The paths followed by these cyclones are called 'Storm tracks'.

- 1.) North Pacific off eastern coast of Asia move towards



Gulf of Alaska & merge with Aleutian low reach Southern California & occlude at western slope of rocky mountain.

- 2.) North America -

- (i) East of Sierra Nevada Range
- (ii) Eastern Colorado (Colorado lows)
- (iii) East of Canadian Rocky mt. (Alberta lows)
- (iv) Great lake region.

- 3.) In Gulf of Mexico move east of Appalachian & merge with Icelandic zone.

- 4.) N.E. coast of N.A & move towards N.W. Europe.

- 5.) B/W Iceland & Barents sea & affect north Europe.

- 6.) Continental Europe.

## Baltic Sea.

(ii) Mediterranean sea - Majority of cyclones originating here move Northeastward & reach CIS, & some following easterly direction reach north India in winter & rainfall received through these storms.

## Origin of Temperate cyclone

### Polar front theory

Propounded by V. Bjerknes & J. Bjerknes in 1918.

- \* Based on processes of formation of fronts.
- \* When 2 contrasting air masses collide obliquely in the middle latitudes they move parallel to each other and stationary front is formed and try to attack the territory of each other, unstable waves are formed which help in origin & development of temperate cyclone.
- \* Surface separating 2 air masses become ~~flat~~ unstable and wave like; such a front is called Polar front.
- \* SW. warm & moist air mass enters territory of cold air mass along Polar front & warm air being lighter rises up and creating low pressure centre in which winds from all direction come to form cyclone.

### I<sup>st</sup> Stage

cold air  
front

warm air

stationary front - wave like

### II<sup>nd</sup> Stage Incipient

cold air stage

cold front

warm front

warm air

stationary front - wave like

Unstable Polar front.

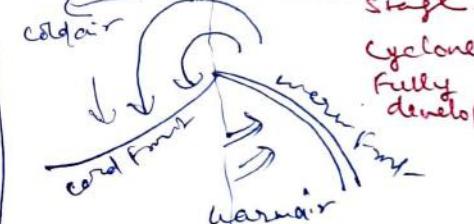
### III<sup>rd</sup> Stage Mature

stage.

Cyclone

Fully

developed



### IV<sup>th</sup> Stage

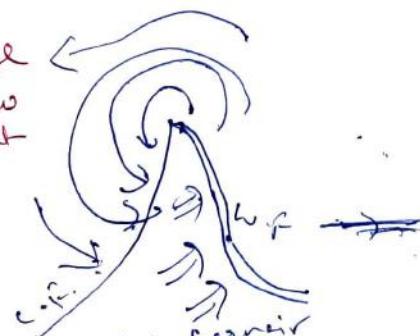
Eastern part

warm tropical

air mass ascend

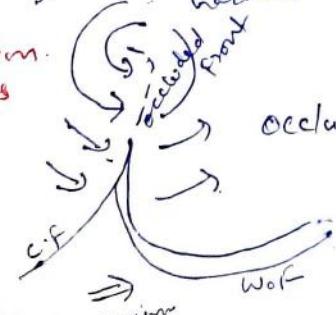
over cold air mass

to form warm front.



### V<sup>th</sup> Stage : Occlusion

cold front overtakes warm front.



Occlusion: Cold and warm front come close to each other resulting in destruction of warm front.

Cyclone dies due to disappearance of warm front.

VI<sup>th</sup> Stage warm sector completely disappear & cyclone dies out

- Weather condition - Easterly & S. Easterly.  
velocity, pressure decreases, temp. increases,  
1. Arrival of cyclone - cirrus & cirrostratus clouds  
2. Warm front Precipitation - slow gradual precipitation for long duration.  
3. Warm sector - southerly wind direction, clear sky  
4. cold front - temp decrease, westerly, S.W., cloudy sky.  
5. cold front Precipitation - cumulonimbus clouds, heavy downpour, thunder & lightning for short duration  
6. cold sector - clear sky, sharp decrease in temp.  
winds direction changes from  $45^\circ$  to  $180^\circ$  & becomes free westerly.

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months (Jan to Mar)