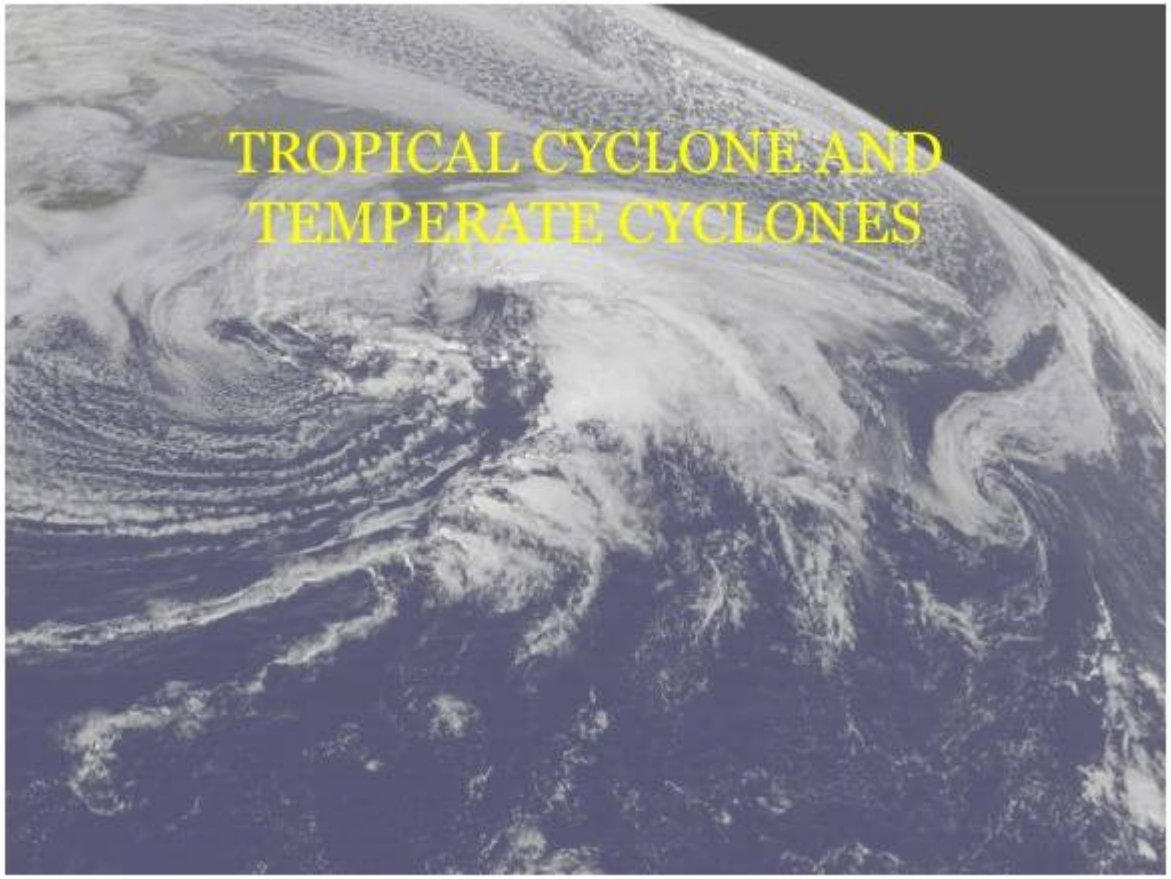

TROPICAL CYCLONE AND
TEMPERATE CYCLONES

CYCLONES:-

Cyclones are centers of low pressure surrounded by closed isobars having increasing pressure outward and closed air circulation(convergent air circulation) from outside towards the central low pressure in such a way that winds blow in antic clockwise and clockwise directions in the northern and the southern hemisphere respectively.

TYPES OF CYCLONES:-

There are two types of cyclones based on forms of locations are as:-

1. Tropical cyclones and
2. Temperate cyclones (extratropical cyclones)

Tropical cyclones:-

cyclones developed in the regions lying between the tropics of Capricorn and Cancer are called tropical cyclones, which are not regular and uniform. The tropical cyclone is powerful manifestation of the Earth's energy and moisture system. They originate entirely within the tropical air masses. The weather conditions of low latitudes mainly rainfall regimes are largely controlled by cyclones.

ORIGINE OF TROPICAL CYCLONES:-

The mechanism that leads to the origin and development of tropical cyclones is not fully known due to the inadequacy of data. There are, certain conditions which result in the origin of tropical cyclones. These conditions are:-

- ❖ large and continuous supply of warm and moist air.
- ❖ large value of coriolis force.
- ❖ weak vertical wind.
- ❖ upper level anticyclone
- ❖ presence of anticyclonic circulation.

In tropical cyclones, cyclonic motion begins with slow moving easterly waves of low pressure in the trade wind belt of the tropics, such as the Caribbean Sea and the China Sea.

MAIN CHARACTERISTICS OF TROPICAL CYCLONES:-

Following are the main characteristics of tropical cyclones:-

I. They have circular and enclosed isobars.

II. The isobars are close to each other and consequently, the isobaric gradient is steep.

III. Their diameter varies between 150 and 300 km.

IV. In initial stage their speed varies between 15 and 30 kmph which accelerates subsequently up to 200 km and even more per hour.

V. Heavy rainfall continues even after the winds have become weak.

CLASSIFICATION OF TROPICAL CYCLONES

DESIGNATION	WINDS	FEATURES
Tropical Disturbance	Variable low	Definite area surface low pressure, patches of clouds
Tropical Depression	Up to 34 kmph	Gale force, organising circulation, light to moderate rain.
Tropical Storm	35 to 64 kmph	Close isobars, definite circular organisation, heavy rain,
Hurricane(Atlantic and Pacific), Cyclones Indian Ocean, Willy willy(Northern Australia).	40 to 200 kmph	steep gradient, cumulus-nimbus clouds, heavy rains, thunder and lightning.

Structure of Tropical Cyclones

(1) Eye of the cyclone
(2) Eye wall
(3) **Spiral bands**
(4) **Annular belt**
(5) **Outer convective belt**
(6) Peripheral belt

Distribution of Tropical Cyclones

Mostly develop over the ocean surface between 5°-20°latitudes

There are 6 major regions of tropical cyclones *e.g.*

(1) West Indies, Gulf of Mexico, and Caribbean Sea,
(2) Western North Pacific Ocean including Philippines Islands, China Sea, and Japanese Islands,
(3) Arabian Sea and Bay of Bengal,
(4) South Indian Ocean coastal regions off Madagascar (Malagasi), and
(5) Western South Pacific Ocean, in the region of Samoa and Fiji Island and
(6) The east and north coasts of Australia.

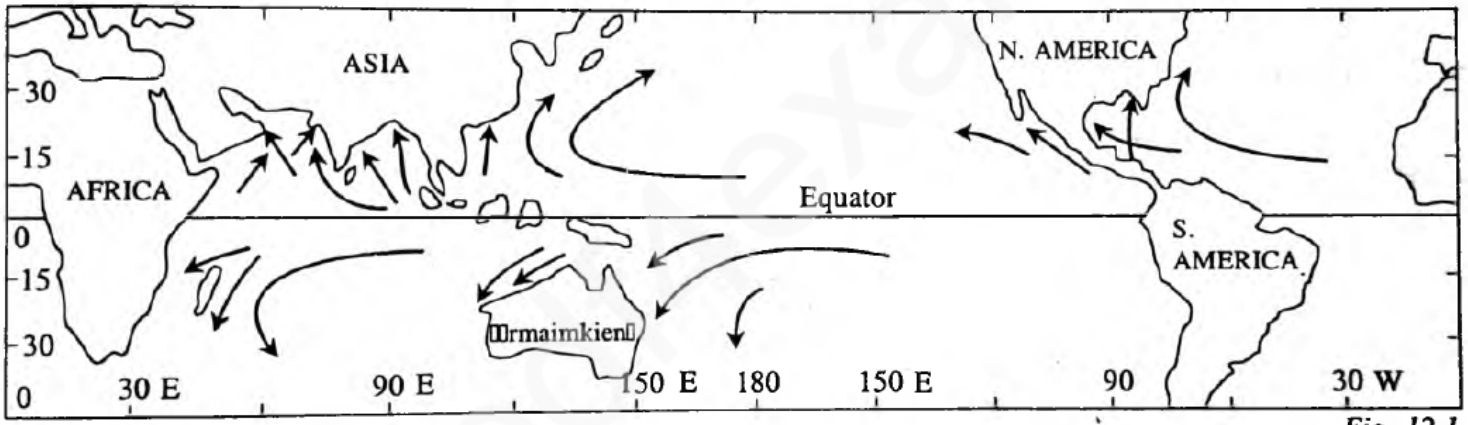


Fig. 12.1

Fig. 12.1 : Tracks of Tropical Cyclones.

Temperate cyclones:

- Also called as **extratropical cyclones or wave cyclones or simply depressions.**
- Atmospheric disturbances **having low pressure in the centre** and **increasing pressure outward**.
- They are in fact low pressure centres produced **in the middle latitudes characterized by converging and rising air, cloudiness and precipitation**.
- Because of their varying shapes such as near circular, elliptical or wedge (V) they are variously called as 'low', **'depressions' or 'troughs'.**
- Extending between 35°-65° latitudes in both the hemispheres due to convergence of two contrasting air masses.
- The polar fronts created due to these two opposing air masses.
- After their formation temperate cyclones move in easterly direction under the influence of westerly winds and control the weather conditions in the middle latitudes.
- Moves counter clockwise in northern hemisphere & Clockwise in southern hemisphere.
- It takes 3-10 days to complete the cycle in birth, mature and death.

Wind System

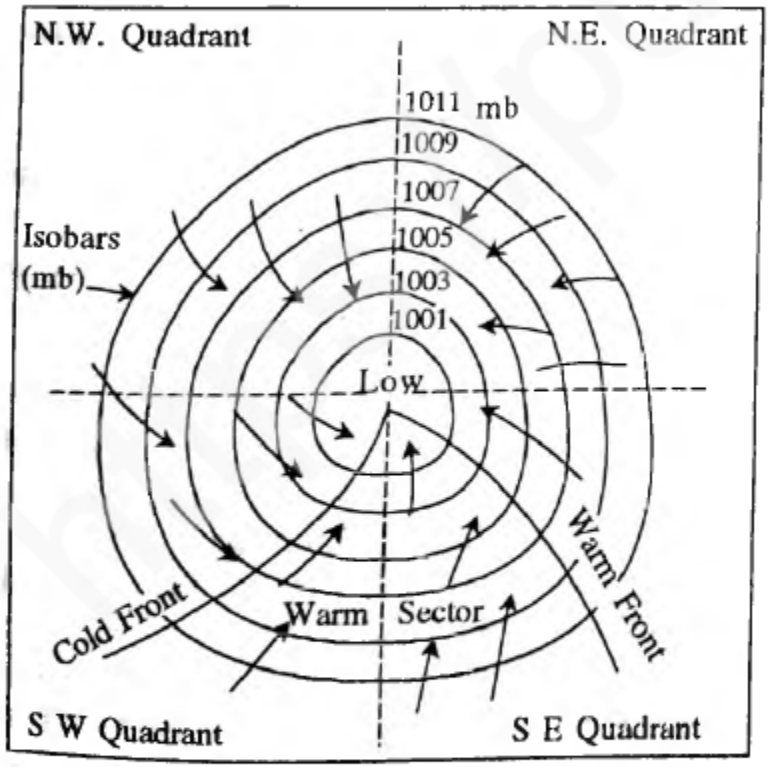


Fig. 11.5 : An average temperate cyclone in northern hemisphere.

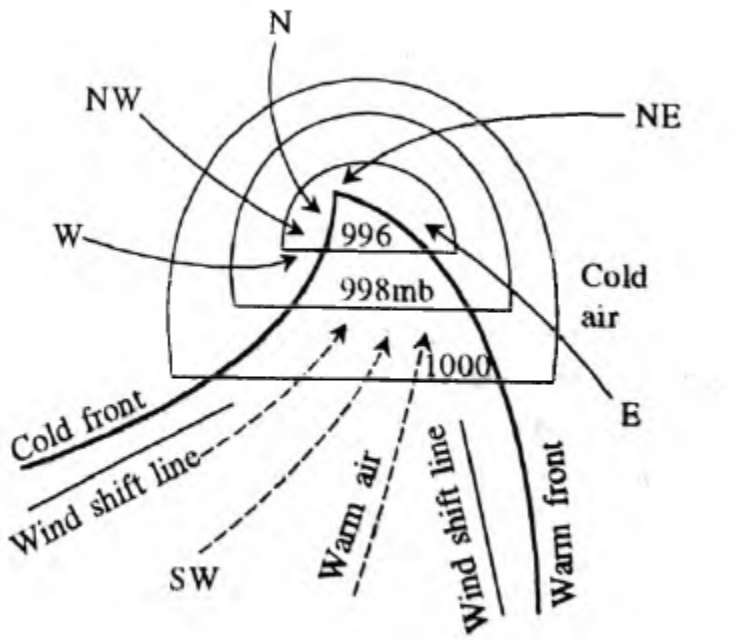


Fig. 11.6 : Wind pattern in temperate cyclone (northern hemisphere).

Temperature

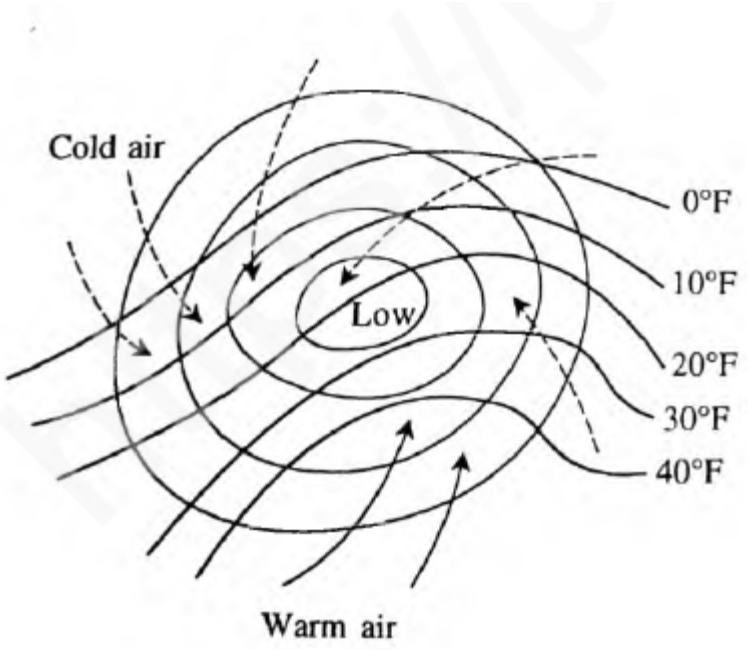


Fig. 11.7 : Temperature and isotherms in temperate cyclones (northern hemisphere).

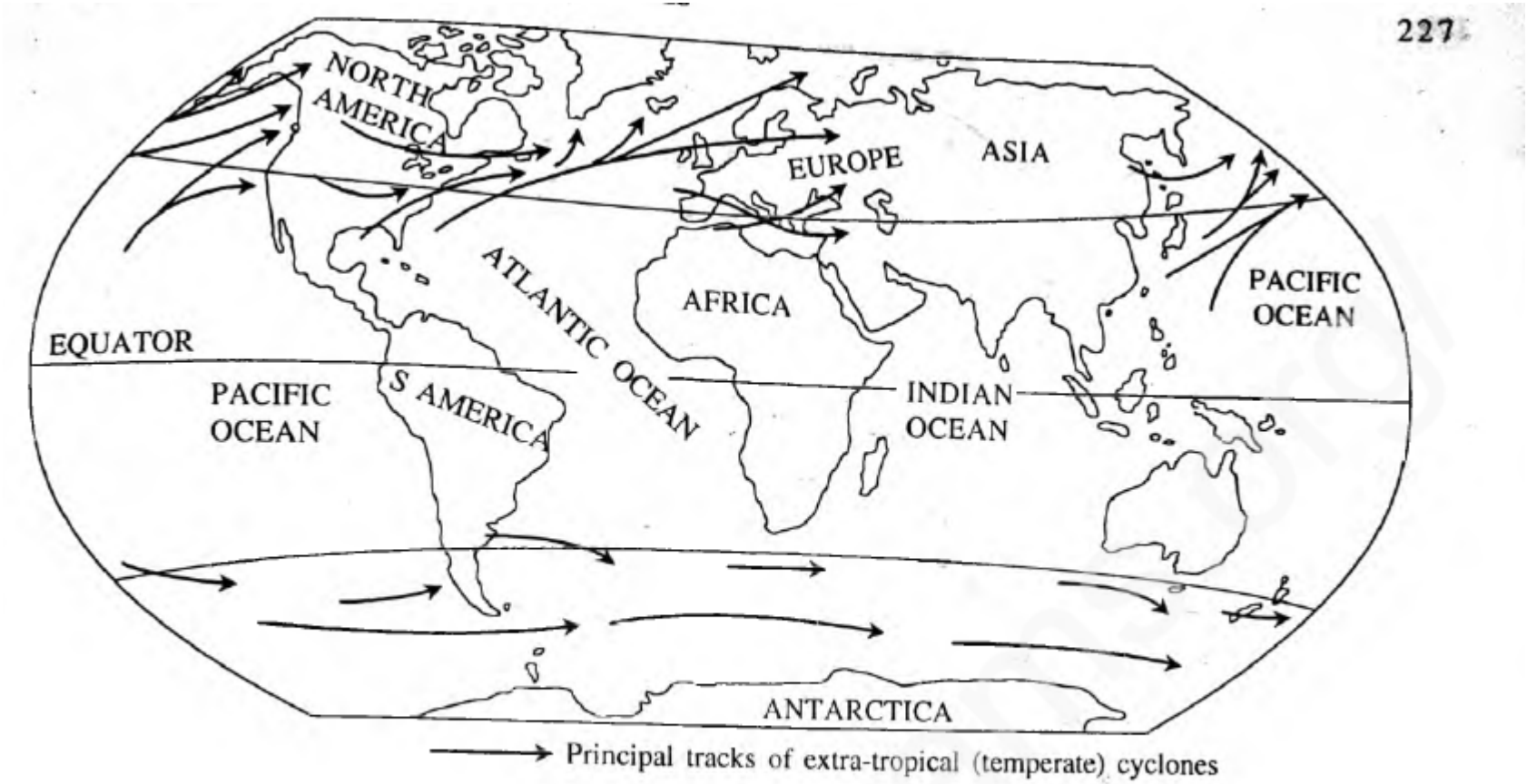
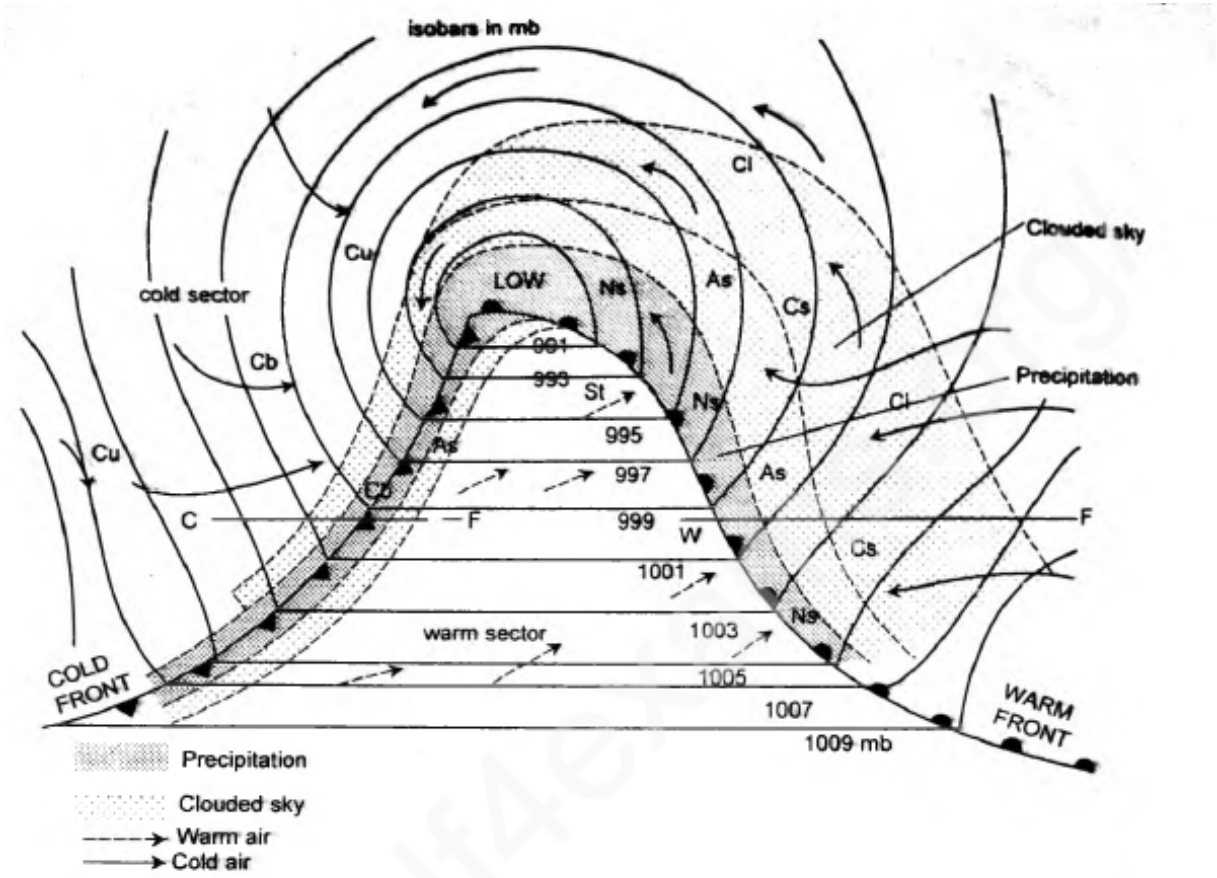


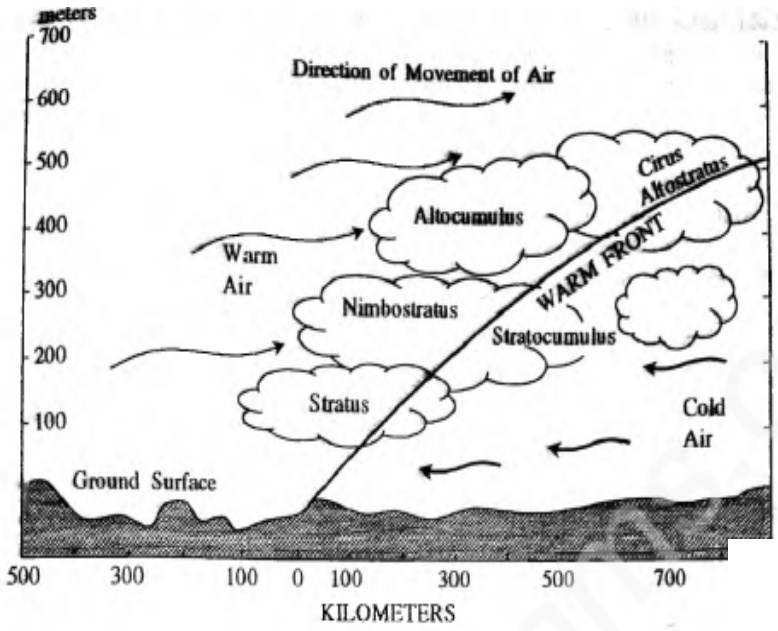
Fig. 11. 8 : Tracks of temperate cyclones. **Source :** *after Petterson, in G.T. Trewartha, 1954.*

Weather Conditions Associated With Temperate Cyclones

(i) Arrival of cyclone
(ii) Warm front precipitation
(iii) Warm sector
(iv) Cold Front
(v) Cold Frontal Precipitation
(vi) Cold Sector
(vii) Occluded front



g. 11.9 : *A section through a fully developed temperate cyclone and weather phenomena associated with different fronts and sectors. WF = vertical cross-section along warm front (fig. 11.10), CF = vertical cross-section along cold front (fig. 11.11), Ns = nimbostratus cloud, Cs = cirro-stratus cloud, As = alto-stratus clouds, Cb = cumulonimbus cloud.*



10 : Vertical cross-section across warm front (along WF line in fig. 11.9). Based on I

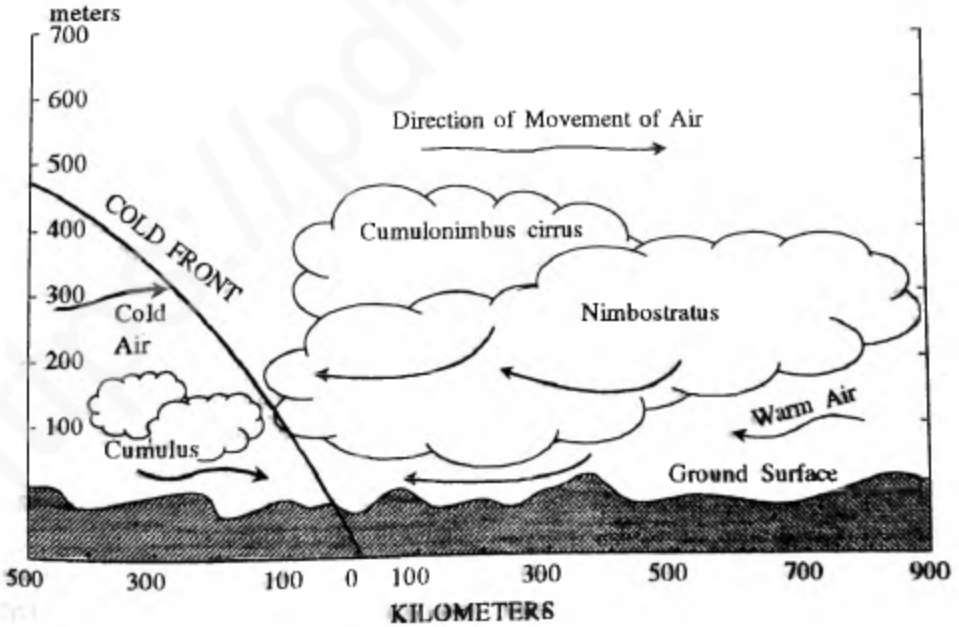


Fig. 11.11 : Vertical cross-section across cold front (along CF in fig. 11.9). Based on H.J. Critchfield

ORIGINE OF TEMPERATE CYCLONES:-

The first pioneer serious attempt was made by Fitzroy in the year 1863 in this precarious field. He postulated that extra tropical or temperate cyclones originated because of the convergence of two opposing air masses of contrasting physical properties i.e. temperature, pressure, density and humidity.

POLAR FRONT THEORY

The Polar Front Theory was propounded by Bjerkines in 1918. it deals with the stages of development of temperate cyclones. According to Bjerknes, a cyclone originates through the following six stages.

Stage I:- Involves the convergence of two air masses of contrasting physical properties and directions. Initially , the air masses move parallel to each other and a stationary front is formed. This is called initial stage.

Stage II:- is also called as 'incipient stage' during which the warn and cold air masses penetrate into the territories of each other and thus a wave-line front id formed.

Stage II:- is the mature stage when the cyclone is fully developed and isobars become almost circular.

Stage IV:- warm sector is narrowed in extent due to the advancement of cold front than warm extent due to the advancement of cold front than warm front, as cold front comes nearer to warm front.

Stage V:- starts with the occlusion of cyclone when the advancing clod front finally overtakes the warm front and an occluded front is formed.

Stage VI:- warm sector completely disappears , occluded front is eliminated and ultimately cyclone dies out.

What is the difference between tropical and temperate cyclones?

Major differences between cyclones in Tropical and |Temperature climates.

- In general, the cyclones which form in tropical regions (0–30° N and 0–30°S) are called tropical cyclones.
- The cyclones which form in Temperate regions (30–60°N and 30–60°S) are called Temperate cyclones.
- One of the major differences between these is '**source**' to form a cyclone. i.e. in tropical regions, cyclones generally form by **thermal convection** but, whereas in temperate climates, cyclones form by **fronts** (Boundary between two different air masses)**.**

- Tropical cyclones are mesoscale weather systems, the diameter of the storm is of the order a few hundred km. Temperate cyclones are synoptic scale systems, thousands of km across.

- Tropical cyclones are warm cored (centre warmer than their surroundings), and winds decrease with height. Temperate cyclones are cold cored, and winds increase with height.
- Tropical cyclones have much more intense rainfall that temperate cyclones, since deep convection is their source of energy. Temperate cyclones tend to have more moderate rainfall, although in extreme cases still enough to cause destructive flooding.
- Tropical cyclones have strongest winds in the lower troposphere, near the top of the boundary layer, a few hundred meters above the ground. Temperate cyclones have their strongest winds at the top of the troposphere in the core of the jet stream.

There are many differences between these two cyclones like intensity, wind speed, eye diameter, maximum spatial and temporal extent of cyclone, landfall etc.. but Main differences among all are **Source** and the **place** where do they form. based on these two only they got named like tropical and temperate cyclones.

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