Paper: CC5
Unit 2 Topic 3

Fronts

Dr. Mitrajit Chatterjee

What is a Front?

- A front is a boundary of separation between two air masses with varying temperature, pressure and density properties.

Types of Front

- There are two different meanings used within meteorology to describe weather around a frontal zone.
- The term "anafront" describes boundaries which show instability, meaning air rises rapidly along and over the boundary to cause significant weather changes.
- A "katafront" is weaker, bringing smaller changes in temperature and moisture, as well as limited rainfall.

Cold front

- A cold front is located at the leading edge of the temperature drop off, which in an isotherm analysis shows up as the leading edge of the isotherm gradient, and it normally lies within a sharp surface trough.
- Cold fronts often bring heavy thunderstorms, rain, and hail.
- Cold fronts can produce sharper changes in weather and move up to twice as quickly as warm fronts, since cold air is denser than warm air and rapidly replaces the warm air preceding the boundary.
- Cold fronts come in association with a low-pressure area. The concept of colder, dense air "wedging" under the less dense warmer air is often used to depict how air is lifted along a frontal boundary. The cold air wedging underneath warmer air creates the strongest winds just above the ground surface, a phenomenon often associated with property-damaging wind gusts.
- This lift would then form a narrow line of showers and thunderstorms if enough moisture were present.

Warm front

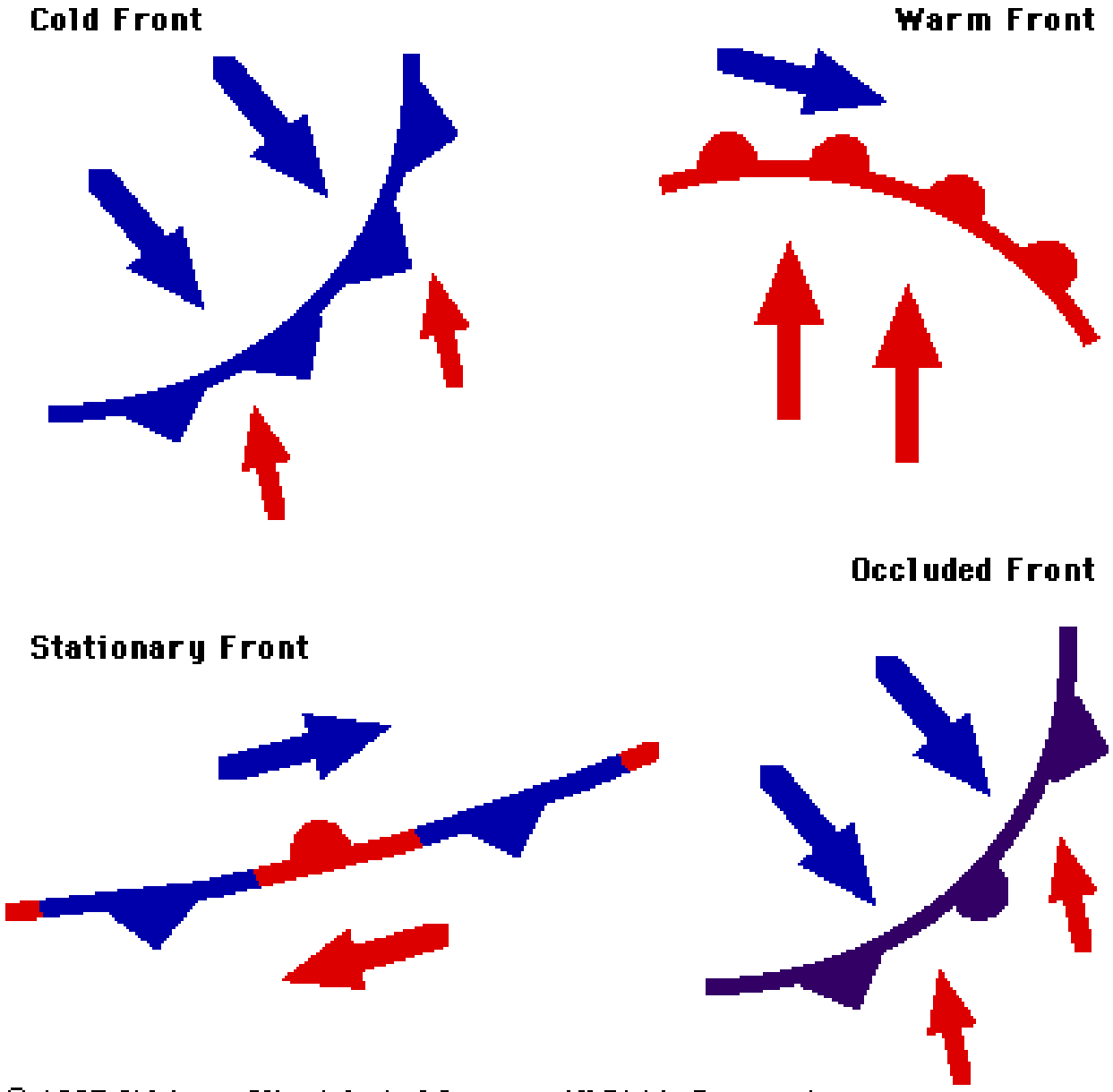
- Warm fronts are at the leading edge of a homogeneous warm air mass, which is located on the equatorward edge of the gradient in isotherms, and lie within broader troughs of low pressure than cold fronts.
- A warm front moves more slowly than the cold front which usually follows because cold air is denser and harder to remove from the Earth's surface.
- This also forces temperature differences across warm fronts to be broader in scale.
- Clouds ahead of the warm front are mostly stratiform, and rainfall gradually increases as the front approaches.
- Fog can also occur preceding a warm frontal passage. Clearing and warming is usually rapid after frontal passage.
- If the warm air mass is unstable, thunderstorms may be embedded among the stratiform clouds ahead of the front, and after frontal passage thundershowers may continue.

Occluded front

- An occluded front is formed when a cold front overtakes a warm front and usually forms around mature low-pressure areas.
- The cold and warm fronts curve naturally poleward into the point of occlusion, which is also known as the triple point.
- It lies within a sharp trough, but the air mass behind the boundary can be either warm or cold.
- In a cold occlusion, the air mass overtaking the warm front is cooler than the cool air ahead of the warm front and plows under both air masses. In a warm occlusion, the air mass overtaking the warm front is warmer than the cold air ahead of the warm front and rides over the colder air mass while lifting the warm air.
- A wide variety of weather can be found along an occluded front, with thunderstorms possible, but usually their passage is associated with a drying of the air mass. Within the occlusion of the front, a circulation of air brings warm air upward and sends drafts of cold air downward, or vice versa depending on the occlusion the front is experiencing.

Stationary front

- A stationary front is a non-moving (or stalled) boundary between two air masses, neither of which is strong enough to replace the other.
- They tend to remain essentially in the same area for extended periods of time, usually moving in waves.
- There is normally a broad temperature gradient behind the boundary with more widely spaced isotherm packing.
- A wide variety of weather can be found along a stationary front, but usually clouds and prolonged precipitation are found there.
- Stationary fronts either dissipate after several days or devolve into shear lines, but they can transform into a cold or warm front if conditions aloft change.
- Stationary fronts may bring snow or rain for a long period of time.



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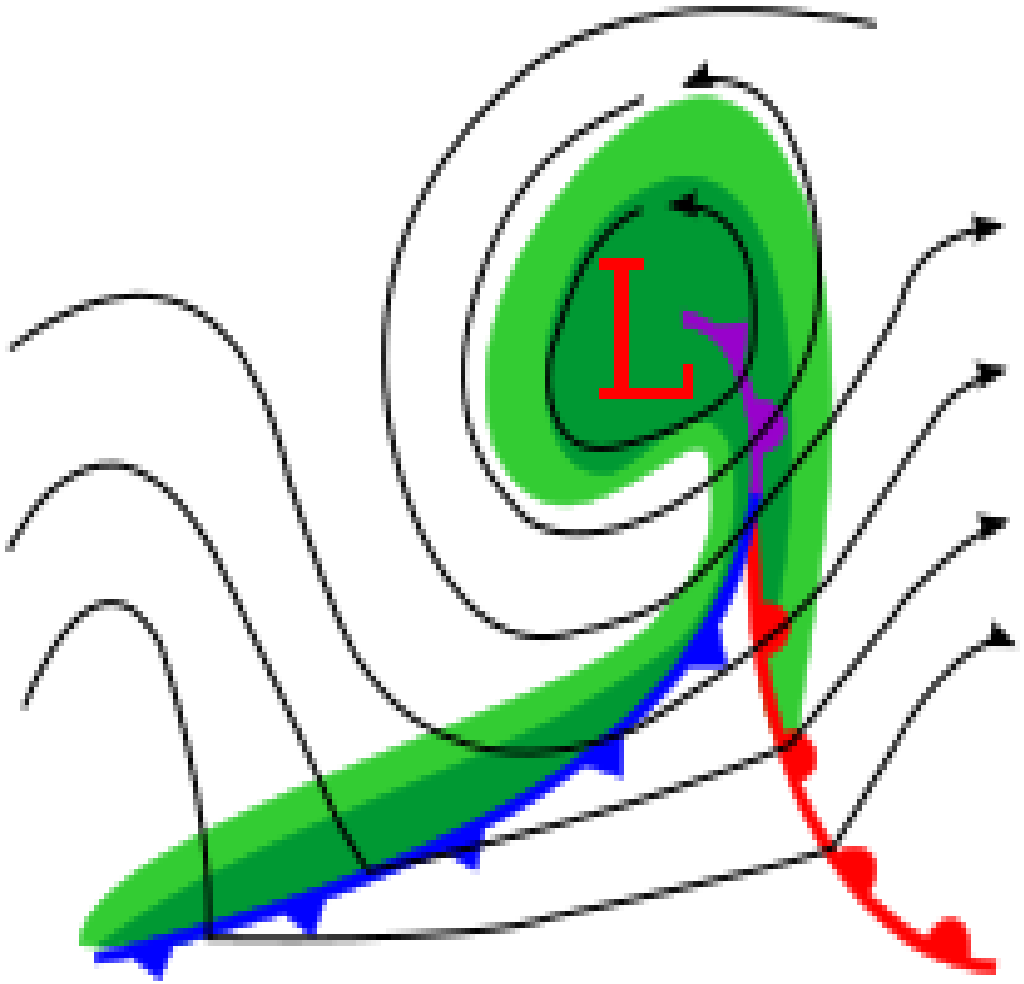
Occluded front depiction for the Northern Hemisphere



Frontogenesis & Frontolysis

- The process of formation of a front is known as **Frontogenesis** (war between two air masses), and dissipation of a front is known as **Frontolysis** (one of the air masses win against the other).
- **Frontogenesis** involves convergence of two distinct air masses. **Frontolysis** involves overriding of one of the air mass by another.

- **Frontogenesis** is a meteorological process of tightening of horizontal temperature gradients to produce fronts.
- In the end, two types of fronts form: cold fronts and warm fronts.
- A cold front is a narrow line where temperature decreases rapidly.
- A warm front is a narrow line of warmer temperatures and essentially where much of the precipitation occurs.
- Frontogenesis occurs as a result of a developing baroclinic wave.
- According to Hoskins & Bretherton (1972, p. 11), there are eight mechanisms that influence temperature gradients: horizontal deformation, horizontal shearing, vertical deformation, differential vertical motion, latent heat release, surface friction, turbulence and mixing, and radiation.

- **Frontolysis** in meteorology, is the dissipation or weakening of an atmospheric front.
- In contrary to areas of "Frontogenesis", the areas where air masses diverge are called areas of frontolysis.

THANK YOU