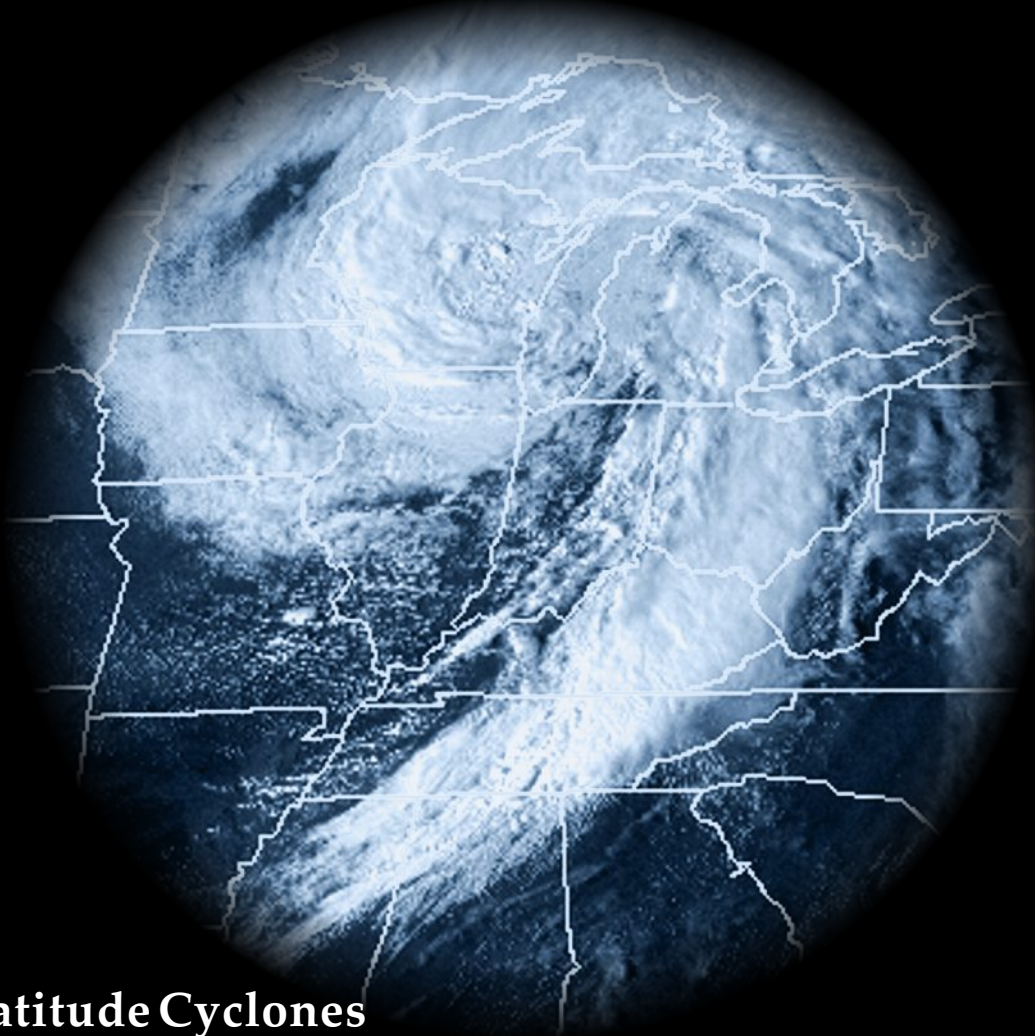


U N D E R S T A N D I N G

# Fronts and Frontal Weather



## Mid-latitude Cyclones

Mid-latitude cyclones are also known as depressions or low pressure systems. On average, depending on the season, 2 - 3 mid-latitude cyclones move west to east across North America per week. The weather associated with these disturbances will vary, depending on the temperature, moisture, and stability characteristics of the two air masses involved in their creation. The examples below depict a classic northern hemisphere situation with warm moist air to the south and cold dry air to the north.



Environment  
Canada

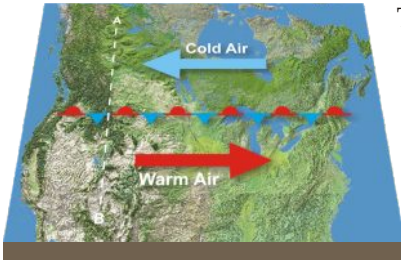
Environnement  
Canada

Canada

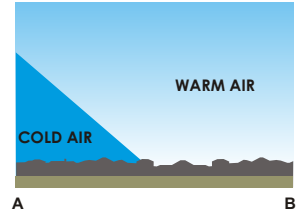
# Cyclogenesis

Cyclogenesis refers to the process of a cyclone forming, maturing, occluding, and then disappearing completely. A small cyclone, once formed, evolves through a 4-stage process as it moves, taking several days from start to finish.

## STAGE 1: Stationary Front



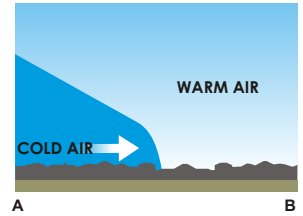
The first stage is the development of a stationary front. Although multiple air masses are commonly present over North America, the transition from one to the other can be so gradual and over such a great distance that no front will exist. If the contrast between air masses is sharper and occurs over a shorter distance, then a front is said to exist; if neither air mass is advancing, it's called a stationary front.



## STAGE 2: Formation of a cyclone



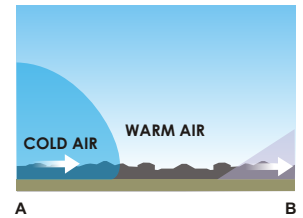
The passage overhead of a disturbance in the upper levels of the atmosphere induces an area of lower pressure along the front, and winds begin to eddy weakly around it in a counter-clockwise fashion. This circulation causes the cold air to advance southward on the west side of the new depression while the warm air to the east side advances northward. The stationary front is thereby transformed into a cold front to the west of the low pressure centre and into a warm front to the east of the low.



## STAGE 3: Maturing depression



Once distinct fronts have been established, the cold denser air pushing southward undercuts the warm lighter air, lifting it into the upper atmosphere. The counter-clockwise circulation funnels the warm air toward the centre of the depression, causing the pressure at the storm's centre to drop and the storm itself to intensify. Because of the cyclonic circulation pattern, the warmest air is to the south of the low in what is called the warm sector. The cold air is retreating to the east ahead of the warm front, but advancing again

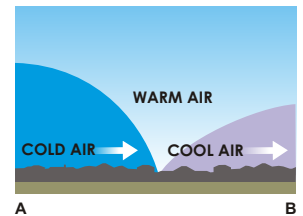
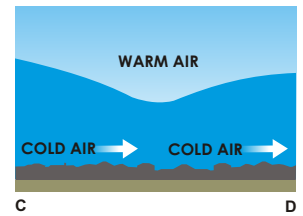


from the west behind the cold front.

## STAGE 4: Occlusion



The cold front travels much faster than the warm front. As a result, in the late stages of cyclogenesis, the cold front overtakes the warm front, forcing the warm air completely aloft, allowing the cold and cool air masses to mix. The warm air aloft gradually cools and stops rising. In the absence of any new influx of warm air, the pressure stops falling and the storm dies. Initially, the boundary between the cold and cool air is called an occluded front, but as the air masses become well-mixed, the occluded front dissipates and a stationary front may form again on the southern boundary of the cold air mass.

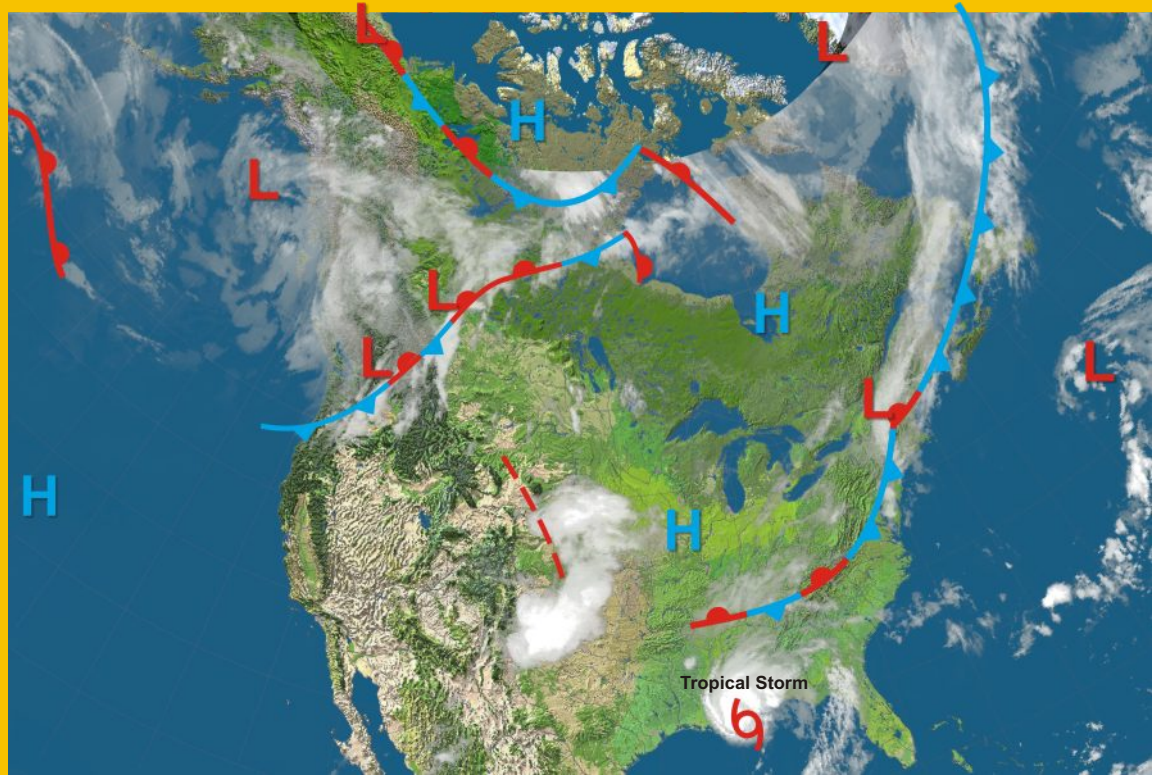




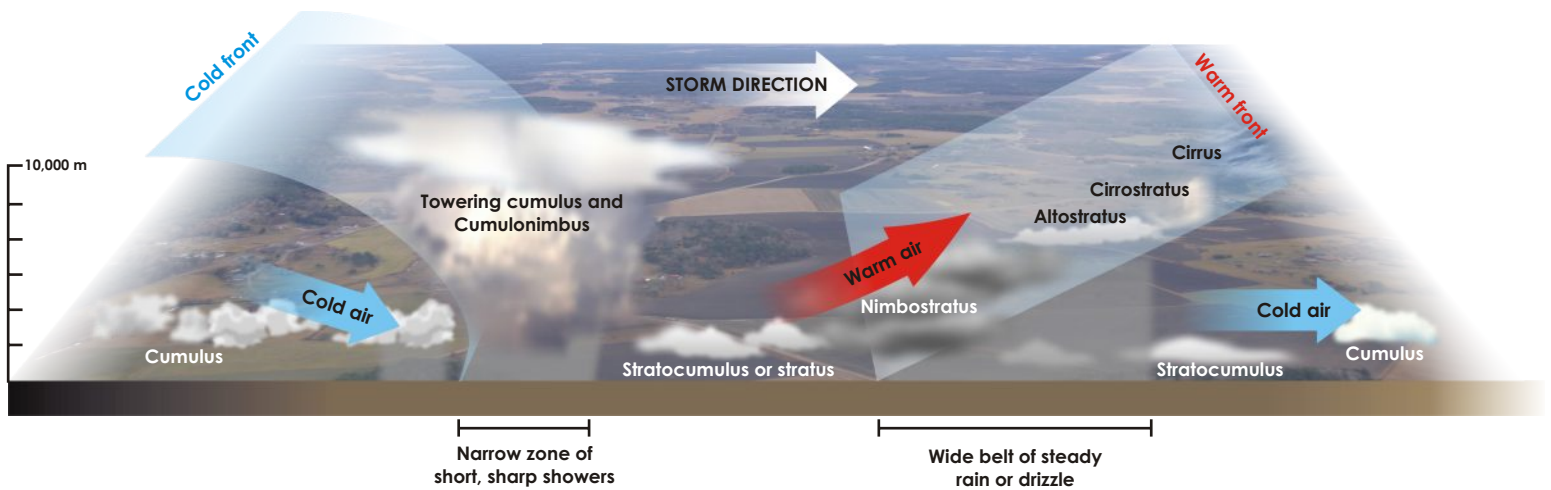
# FAST FACTS

## About a Typical Mid-latitude Cyclone

- **Life span:** 3–10 days
- **Horizontal extent:** 1000–1500 km wide
- **Speed of travel of the whole system:** 30–50 km/h or 1200 km in a day
- **Direction of travel:** generally eastward
- **Speed of fronts:** cold fronts travel at 40–60 km/h; warm fronts are about half that, 20–40 km/h
- **The slope of a warm front** is 1:200; a cold front is much steeper at 1:50.



## Cross-section of Frontal Weather with a Mature Cyclone



Frictional drag on the lower levels of the advancing cold air causes the leading edge to buckle, resulting in a relatively steep slope on the cold front. As a result, the fast moving cold air forces the warm air rapidly aloft, and if conditions are right, thunderstorms — even severe thunderstorms — can result. Precipitation occurs in a narrow band just ahead of and just behind the cold front.

At the warm front, the cold air is retreating and the warmer lighter air rides up over it so that the slope of the frontal surface is reversed. Because the surface friction is stronger, the slope is shallower which, in turn, slows the speed of the warm front. Along the gentle slope of the warm front, the overrunning warm air tends to produce stratus-type clouds. Precipitation is less intense along this front and occurs for hundreds of kilometers in advance of the front itself.