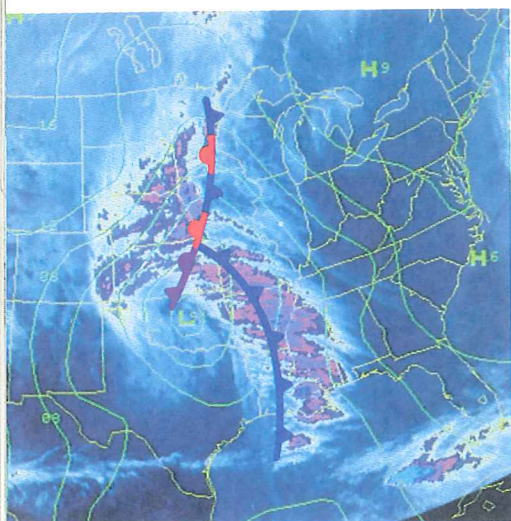


OBJECTIVES

- A** Describe the winds and weather in a low, including the relationship between condensation and the strengthening of the low.
- B** List the sequence of clouds and weather associated with both warm and cold fronts.
- C** Summarize the typical winds and weather in a high.



29.10 A strong low-pressure area with cold, stationary, and occluded fronts. Notice that the thick (white) clouds are mostly around the low and fronts. Heavy snows were falling in the Midwest at the time of this picture. The colored areas are probably the tops of precipitating clouds.

III Weather Associated with Lows, Fronts, and Highs

Topic 9 Winds and Weather in a Low

In the Northern Hemisphere, the winds near the surface blow counterclockwise and toward the center of a low. The air converging into the low-pressure area rises, resulting in clouds and precipitation. The air also rises at the cold, warm, and occluded fronts, resulting in more clouds and precipitation. Notice the extensive cloudiness in the low shown in Figure 29.10.

The condensation that produces clouds and precipitation also releases heat energy. The air heated by this energy lowers the pressure at the surface, and the low becomes stronger. This increases the pressure gradient, and the winds also become stronger, particularly near the low center. If other factors do not weaken the low, it will continue to strengthen as long as condensation continues.

Figure 29.11 shows a vertical section through a typical low. The following weather changes occur when a low passes to the north of a locality in the Northern Hemisphere:

1. A long period of steady precipitation in advance of the warm front.
2. Warming and slow clearing after the warm front passes. If the air is humid, showery precipitation may occur, particularly nearer the center of the low.
3. Showery precipitation around the time the cold front passes.
4. Cooling and rapid clearing, with a change toward the weather characteristic of the newly arrived cold air mass.

Topic 10 Warm-Front Weather

A warm front affects the weather long before the arrival of the rains. As shown in Figure 29.11, high cirrus clouds appear first, followed by cirrostratus and lower and thicker stratiform clouds.

These clouds form in the air sliding up the frontal surface. The warm air may travel 1000 kilometers before rising 2 or 3 kilometers. The air is usually stable, so the rising air forms a vast system of stratiform clouds. The clouds may stretch 1500 kilometers ahead of the place where the warm front touches the ground.

Following the cirrus and cirrostratus are altostratus clouds, which almost screen out the sun and moon. Finally, the heavy nimbostratus clouds arrive, and steady rain or snow begins. This area of rain and snow can stretch hundreds of kilometers ahead of where the front touches the ground. Warming follows the passage of the front at the surface. Thunderstorms may form, but they are not typical of warm fronts. Stationary fronts have the same kind of weather as warm fronts.

Topic 11 Cold-Front Weather

Cold fronts are steeper and move faster than warm fronts. Thus, the air forced upward by the cold front rises quickly. Also, the air ahead of cold fronts is usually unstable. For these reasons, rapidly growing cumuliform clouds grow around the cold front. Precipitation falls from cumulonimbus clouds. Weather is showery, with heavy precipitation starting and ending quickly, and thunderstorms are common. Because of the cold front's steep slope, its precipitation covers at most 300 to 500 kilometers. The precipitation can occur both before and after a cold front passes at the surface.

When a cold front passes, sharp changes of weather occur. Temperatures fall fast as the cold air arrives. The wind rises in speed and may shift suddenly from a southerly direction to a northerly one. The rain usually ends shortly after the front passes.

Sometimes very humid mT air is being pushed forward ahead of a cold front. In such cases, a whole line of thunderstorms may form ahead of the front, creating a squall line that may be hundreds of kilometers long.

Topic 12 Weather in a High

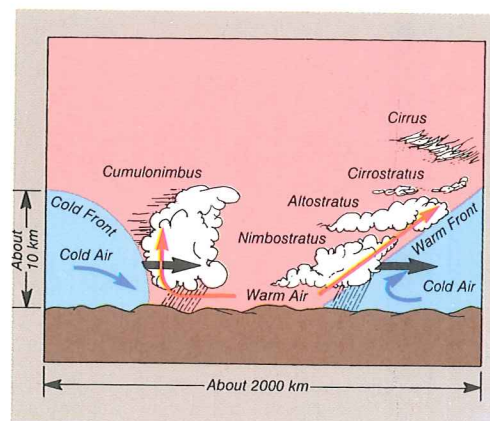
Between the lows and their fronts lie areas of high pressure, or **anticyclones**. Highs usually appear on weather maps as a series of smooth circular isobars. Unlike a low, a high represents a single air mass. Its diameter may be more than 1500 kilometers. Since the air pressure is highest at its center, the winds in a high blow outward. The air moves in a clockwise direction in the Northern Hemisphere and counterclockwise in the Southern Hemisphere. Isobars are generally farther apart than in lows; therefore, the winds are weaker.

Bright, clear weather is usually present throughout a high because of the sinking dry air at its center. Small cumulus clouds may form over the heated ground during the day. At night, heavy dew, frost, and radiation fogs may form in the quiet lower air. Inversions can also form in the mornings, trapping pollution until the sun warms the ground.

TOPIC QUESTIONS

Each topic question refers to the topic of the same number.

9. Give the typical sequence of weather as a low passes to the north.
10. (a) List the sequence of clouds and weather that comes before and during the passing of a warm front at the surface. (b) Why are the clouds along a warm front stratiform?
11. (a) Describe the clouds, precipitation, and weather changes that occur as a cold front passes. (b) Why are the clouds along a cold front cumuliform?
12. What is the weather like in a high?



29.11 A cross section through the cold and warm fronts of a fully developed low. The large arrows show the direction of movement of the fronts; the red and blue arrows show the direction of movement of warm and cold air. Notice that the horizontal and vertical scales are very different.



29.12 Squall lines like this one occur ahead of cold fronts in spring and early summer.