

Air Masses and Weather Fronts

By recognizing that the earth's surface is composed of different materials such as land, water, and vegetation, it is easy to understand that these substances all absorb and reflect sunlight in different ways. The result is the surface of the earth heats unevenly, creating regions of warm and cool air. Remembering that as air is warmed its pressure increases, and as air is cooled its pressure decreases, we can now see the origin of air masses on earth. When the air is heated by a warm surface, it generates a region of high pressure. When air is cooled by the surface, it creates a region of low pressure. These high and low pressure areas can be found on weather maps marked as H for high and L for low.

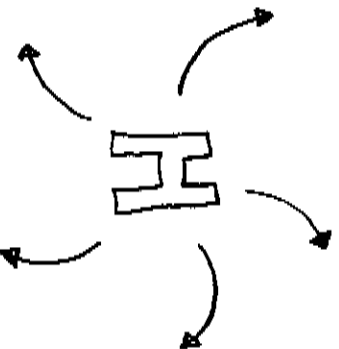
The regions of high and low pressure are referred to as air masses. As air masses form, they move due to the rotation of the earth and global wind belts. We can recognize the movement of air masses by observing the national map for 24 hours. By studying the national weather map one day to the next, you can clearly see the movement of these pressure systems. In the latitude of the United States, air masses move from west to east. The rate of movement of an air mass varies from season to season during the year. They can become stationary, but rarely for very long. Air masses are important to us because they bring the changes in our atmosphere we call weather.

High Pressure

High pressure is generally associated with fair weather (e.g. clear sky and warm temperature). The air in a high pressure air mass flows out from the center in all directions. The reason air flows away from a high is the same reason air flows out of a punctured tire. The air inside the tire is at higher pressure than the air outside the tire, so the air inside flows outward through the hole.

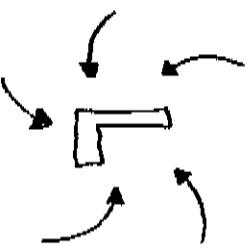
We can understand why high pressure generates clear skies if we remember that warm air expands and can hold more water vapor than cool air. When high pressure enters a region, it causes air to warm and evaporate clouds.

The movement of air away from a high pressure center is curved, due to the rotation of the earth. The air moves outward in a clockwise direction in the northern hemisphere because the atmosphere is affected by the rotation of the earth.



Low Pressure

Low pressure is the opposite of high pressure. The air in the atmosphere flows in toward a low, which generates a different set of weather conditions. Since air flows in toward the center of a low, these air masses pull in air of different characteristics. The result of air flowing inward generates what are called weather fronts. To understand how a low generates weather fronts, we need to examine the kind of air that is being pulled into the center of the low. Circulation around a low pressure center is inward and counterclockwise in the northern hemisphere.

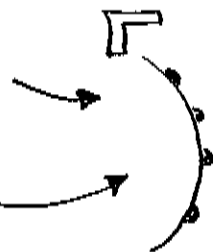


Cold and Warm Fronts

A weather front is simply defined as the boundary between air of different temperature and pressure. When air flows into a low pressure center, it comes from different regions. The air flowing into a low is different, depending on where it has come from. In our latitude the air flowing into the west side of a low comes from the north, which means it's generally cooler than the air flowing into the east side of a low that comes from the south. A mass of air that is cold generates what is called a cold front. These are often associated with air flowing into the low from the north where air is cold. On the east side of a low, air is pulled up from the south and creates a warm front. In both kinds of weather fronts, wind is associated with their passage. The reason we see wind along a weather front is there is different pressure on either side of the front.

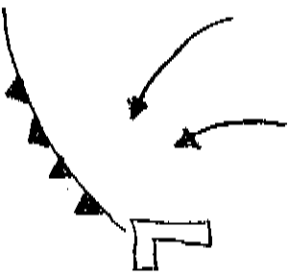
Warm Fronts

Warm fronts form on the east side of lows as air from the south flows in toward the center of the pressure system. Warm fronts are associated with clear skies and warm temperatures. The warm air evaporates moisture and is generally clear. Warm fronts are often accompanied by strong winds as higher pressure air flows into cooler regions of low pressure.

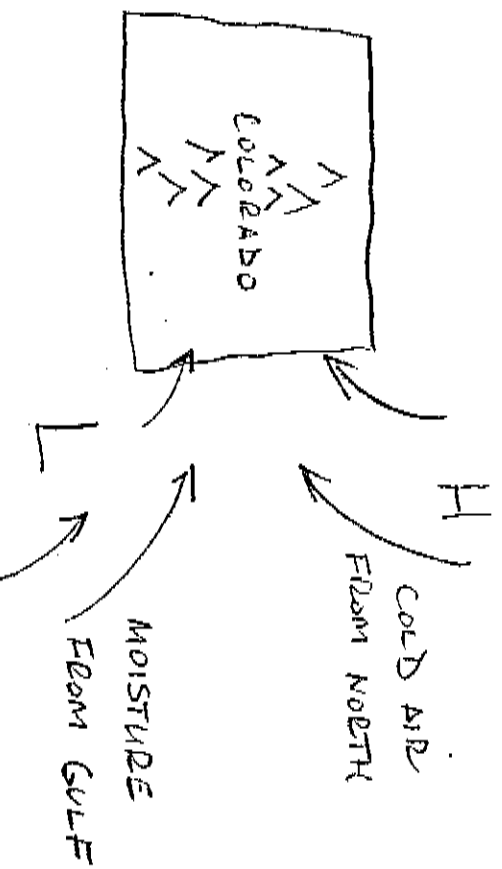


Cold Fronts

Cold fronts are the major producer of stormy weather in the United States. Cold fronts form on the west side of low pressure systems as air flows in from the north toward the center of the low. Cold fronts are associated with cloudy and cool weather. The reason for this is cold air is heavy and tends to stay near the surface. As the cold air enters a region of warmer air, the cold air pushes the warm air aloft, causing it to cool and form clouds. This process is known as frontal uplift and produces most of the storms we experience in the United States. The boundary between the cool and warm air is often windy and stormy.



The weather we experience is the result of air circulating around both high and low pressure systems in the atmosphere. These large regions of air movement are responsible for moving moisture from the oceans inland. Below is a typical looking weather map that would create snow along the eastern slope of the Rockies.



The map shown above is what weather reporters refer to as an upslope condition. Both the low and the high pressure systems work together to push air up the eastern slope of the Rockies. The result in winter months is heavy snow along the Front Range of Colorado.

