Sixth Grade Weather Unit
Parent Information

Unequal Heating of Materials on Earth

The Earth is covered by an unequal distribution of large masses of land and water which absorb heat at different rates. Oceans have a very large heat capacity as compared to land which means that the heat is lost at a much slower rate. So, during the daytime, air over land is warmer than the air over water. This can be seen at the beach. The warm, less dense air over the sand rises while the cooler, denser air over the water sinks which results in an on-shore breeze. At night, the effect is reversed as the land becomes cooler than the water.

Many differences in local geography affect the annual temperature pattern of a region. Differences in the land and water, distance from large bodies of water and/or mountains, and the ocean currents all have an effect. As an example, think about water mass formation in the high latitudes of the North Atlantic. There is a loss of heat to the atmosphere which lowers the temperature of the ocean's surface and causes the more dense cooler water to sink. Warmer water then moves in from lower latitudes to replace this. This raises the ocean surface temperatures and this water is moved eastward towards Europe. This partially explains the milder European winters as compared to American cities at the same latitude. (ex. New York versus Madrid)

Wind

Water heats up much more slowly than land with the result that continents are warmer than the oceans. The warmer air above the continents leads to wind and weather. Wind is air in motion. If there are differences in air temperature, the warmer air expands, becomes lighter, and rises while the cold air sinks. This movement produces winds which are also affected by the rotation of the earth. The Coriolis effect causes moving masses of air to be deflected toward the east in the Northern Hemisphere and to the west in the Southern Hemisphere. These winds drive Earth's weather systems. Temperatures along ocean coasts are moderated by these sea and land breezes, while the interior of larger landmasses get hotter.

Air Pressure

Colder air has higher air pressure and will move into areas of lower air pressure which also produces wind. Around the Earth, there are several major atmospheric "bands" where high or low pressure predominates with a general pattern of high pressure air movement to lower pressure areas. The greater the difference in air pressure between any two places at the same altitude, the stronger the wind will be. The boundaries where these high and low pressure areas meet are called *fronts*, and these fronts are usually very active in producing precipitation. Weather forecasters track the movement of high and low pressure areas, because they affect the patterns of other weather variables such as temperature, cloudiness, and wind.

Storms

Thunderstorms form within cumulonimbus clouds when warm air is forced upward at a cold front or on hot, humid summer afternoons. The warm, humid air rises quickly, cools, and forms tall, dense clouds ("thunderheads") that produce heavy rain and sometimes hail. The transition from a small cloud into a turbulent, electrified storm front can occur in as little as 30 minutes. The sharper, darker, and lower the front edge of the cloud, the more severe the storm. The anvil-shaped top of the storm cloud points in the direction that the storm is moving. When warm ground air rises and meets colder air, it condenses and forms water droplets. Condensation releases energy, which charges the atmosphere. When the dissimilar charge between the negatively charged surface air and the positively charged highest parts of the cloud gets large enough, *lightning* occurs.

Tornadoes develop in the same type of cumulonimbus cloud. They occur under the same conditions as thunderstorms, in the spring and summer and usually late in the afternoon when the ground is warm. Tornadoes form when the warm, humid air mass meets a cold, dry air mass. The cold air moves under the warm air, which rises. Squall lines of thunderstorms form and can cause numerous tornadoes.