

Weather and Air Quality

What Is Weather?

Webster's Ninth Collegiate Dictionary defines weather as the "state of the atmosphere with respect to heat or cold, wetness or dryness, calm or storm, clearness or cloudiness." The term "weather" encompasses many factors, including temperature and precipitation conditions and air mass movements. Weather involves the daily variations of these factors. Knowledge about the basic elements of daily weather helps to explain how weather affects air quality.

The movement of huge air masses across the continent has the broadest impact on daily weather. In North America, these air masses, commonly termed weather systems, usually flow from west to east. The exact path of weather systems is determined by several factors, including the prevailing direction of "jet streams" and topographic features. The jet streams are enormous upper air currents of air that move across the continent at great speeds. The trends of weather systems depend upon whether the jet streams dip south or stay north. Topographic features, such as a mountain range, can alter the direction of air masses. The collision of different air masses also may affect the path of each air mass.

Weather systems typically are defined as being either high- or low-pressure systems. High-pressure systems are air masses with unique properties, such as warm or cool, or moist or dry. The winds of a high-pressure system rotate in a clockwise direction in the northern hemisphere (they rotate in the other direction in Australia). Consequently, as a high-pressure system rotates, it generally draws colder, northern air southward and warmer, southern air northward.

Low-pressure systems are pockets of air masses located between high-pressure systems. These systems flow in a counter-clockwise direction between two clockwise-rotating high-pressure systems (again, everything is backwards in Australia, due to the Coriolis force). Since several weather systems (high- and low-pressure systems) occur at the same time over North America, air masses are constantly colliding. When this occurs, weather fronts form, which often leads to some form of precipitation.

During the cooler seasons of the year, precipitation may encompass areas that are hundreds of miles across. Cold weather precipitation often falls as

snow, sleet or freezing rain. In the hotter seasons, precipitation often is limited to smaller areas. This precipitation ranges from rain showers to thunderstorms, and occasionally, hail.

Weather patterns also are affected by the sun and the position of the sun throughout the year. The amount of daylight and the angle of sunlight reaching the Earth affect the temperature and the types of precipitation. During the winter, because the sun is situated in the southern sky, resulting in less daylight, temperatures are colder. As daylight slowly increases as the sun shifts to the north, the temperature also slowly increases. The sun reaches its apex in the summer, resulting in the hottest temperatures, and starts to shift to the south again.

How Does Weather Affect Air Quality?

Daily weather conditions directly affect the quality of the air. Shifting air masses and wind can move air pollutants from one location to another. Conversely, stagnant air can result in increased concentrations of harmful pollutants. All forms of precipitation wash pollutants from the air and onto the ground. Although this cleanses the air, it may create land and surface water pollution.

What Is the Air Quality Index and How Does It Work?

The Air Quality Index (AQI) is a standardized index to classify and measure air pollution; it is used to report air pollution levels to the public. The reason citizens need to be informed about air pollution levels is to warn people who may be susceptible to air pollution (such as young children, senior citizens and those with breathing problems). These people may need to modify their behavior and take precautionary measures to protect themselves when air pollution is severe. Once air-monitoring data is collected, the AQI is used to convert the data to a scale that ranges from 0 to 100+. The scale intervals indicate the potential health effects of measured daily levels of major air pollutants, including carbon monoxide, nitrogen dioxide, sulfur dioxide, particulate matter and ozone. The AQI is based on the ambient air quality standards established by the U.S. Environmental Protection Agency. The AQI not only provides information about the health effects of air pollution, but also includes information about the effects of air pollution on property, vegetation and aesthetic values.

Source: The U.S. Environmental Protection Agency's Project A.I.R.E. at <http://www.epa.gov/region01/students/teacher/airqual.html>