



Elements of Weather – Clouds

There are six elements of weather that interact, pair up, or collide to give us our ever-changing weather. So far we have covered four of the six elements: temperature, air pressure, wind, and humidity. Next up on our list are clouds. I love what Richard Hamblyn on a TED-Ed video said about clouds, "Clouds write a journal on the sky that allows us to understand the circulating patterns of weather and climate." Out of the six elements of weather we will study, clouds, to me, are probably the most fascinating.

The Purpose of Clouds

When you look up into the sky on a cloudy day it can be mesmerizing as you watch them move and change shape. At some point we have all found pictures of bunnies, puppies, or some other animal within their cottony masses. But clouds have a greater purpose than for our daydream entertainment. You have already learned that clouds are a major part of the never-ending water cycle that provides the precipitation that waters the earth. However, because the wind puts clouds in motion, they are also transporting that fresh water around the globe. You could think of the sky as a type of freeway for fresh water transport! Another purpose clouds serve is to help regulate earth's temperatures. Clouds can both reflect and absorb solar radiation which keeps our planet from getting too hot or too cold. Lastly, clouds are great weather predictors when you get to know them well.

What Makes a Cloud?

We covered the water cycle in a previous lesson, which means you already know a great deal about how clouds are formed. The sun heats up the water on earth's surface and it evaporates into water vapor. The water vapor in the air, which you learned in our last lesson is humidity, rises up into the atmosphere, but starts to cool as it increases in altitude. Remember all the crazy talk about dew point last lesson? I didn't put your brains through the wringer for nothing! When that water vapor cools to its dew point or point of saturation, it condenses back into liquid as millions of tiny water droplets or ice crystals which then gather together to form clouds. See how these elements work together to make earth's weather?

BUT wait! That is too simple of an explanation that overlooks one of the most fascinating things about clouds. The water vapor cannot just condense into water droplets midair without a non-gaseous or solid surface to condense on to. Lucky for us, our air is dirty! Our air is filled with millions of tiny, solid particles such as dust, grains of salt, clay, smoke, and even airborne bacteria. When the making of clouds is involved, these particles are called **cloud condensation nuclei (CCNs)**. The word nuclei means central and most important part of an object forming the basis for its growth. Without the CCNs, we could not have clouds! This is why cloud condensation nuclei are also known as **cloud seeds** since they are the start to a cloud's growth. Water vapor collides with these particles and condenses around them forming teeny, tiny water droplets or ice crystals, depending on the temperature. These tiny water droplets collide with other tiny water droplets, forming larger droplets or ice crystals. Eventually enough droplets or crystals collect together and get large enough to form visible clouds. One cloud can be made up of both water droplets and ice crystals. If the droplets continue to collect together, they can get large and heavy enough to cause precipitation, which is water, as a liquid or a solid, falling from the sky.

The Weight of Clouds

The phrase "looks can be deceiving" certainly applies to clouds. They may LOOK like light and fluffy pieces of cotton, but the truth is, they are heavy! I mean, like, really heavy! Some as much as 100 elephants or a jumbo jet kind of heavy! Remember, they are made up of teeny, tiny water droplets or ice crystals, which have weight. There are approximately 350 billion of these droplets in just one cubic foot. That is a lot of water! I'm sure you have carried a bucket of water before and know how heavy water can be. So, if clouds are that heavy, how do they stay up in the sky? There may be billions of water droplets that form the cloud, BUT they are still individual droplets moving within the cloud. Updrafts or circulating air currents push up on the individual droplets keeping them suspended in the air. It is only when growing droplets become heavy enough to overcome the updrafts that they fall from the sky as some form of precipitation. It takes approximately one million of these droplets to make up just ONE falling raindrop. I'd like to know the scientist responsible for having to make that count! HA!

Types of Clouds

I grew up in Michigan where I spent most winters of my childhood playing in snow or trudging through deep snow to wait for the school bus! Snow was so common to me that I can recognize a snow cloud from a rain cloud. I can't really explain it but there is something different about the look of a snow cloud. I do not tell you this so you feel sorry for the snowy sacrifice I had to make to get to school on time, but to make the point that it is through observation of the many different clouds that you can predict weather. The more you look up at the clouds, the more you will notice their differences and learn about what weather to expect. Observation is key to learning about clouds so there are no special weather instruments to measure and study clouds except your eyes! Meteorologists have lots of high tech satellites to be able to see Earth's clouds from space, but they are ultimately using their eyes too. Since 2/3 of the earth is always covered in clouds at any given time, there is plenty of opportunity to be a student of the sky and learn about the many types of clouds.

No two clouds are exactly alike, but they can be organized into many categories based on their similarities. **Clouds are classified by three things: shape, altitude, and precipitation.** Starting with shape, there are three main types of cloud shapes that have Latin names describing their appearance. Fluffy **cumulus clouds** have the Latin root, "cumulo," which means "heap or pile." "Strato," means "sheet or layer," which describe the non-shape of stratus clouds. Lastly, the root word in **cirrus clouds** means "wisp of hair or thread-like."

You can further group clouds into three altitude levels (low, middle, and high). Low clouds are found at 6,000 feet or lower. Middle clouds are usually found between 6,000 and 20,000 feet from the ground. The Latin root word, "alto," means "tall," and is added to the name of many middle level clouds. Made up of ice crystals, high clouds are found in below-freezing temperatures at altitudes above 20,000 feet. The Latin root, "cirro" means "very high" and is often added to the names of clouds found in this range.

The third way to classify clouds is by what precipitation they produce. If you see a cloud with the Latin root "nimbus" in it, it means it is a "rain bearer" or cloud that bring rain.

There are ten basic types of clouds whose names are made up of a combination of these Latin roots: cumulus, stratocumulus, stratus, altocumulus, altostratus, nimbostratus, cumulonimbus, cirrus, cirrostratus, and cirrocumulus. Now that you know what the Latin root words mean, what can you tell about these clouds just by their name? Read the information sheet on these cloud types to learn more.

