**Study Guide Science 5th grade -Weather and Climate**

**Weather-** the day to day changes of :

temperature, precipitation, wind and air pressure. Weather in a certain time and a certain place. Weather is always changing.

**Climate-** long term patterns over a period of time of an area. The average over many years. Climate changes very slowly.

**3 Major Climate Zones**

1. Tropical –warm and wet most of the year (equator)

2. Temperate (go through cycles of cold and snowy or hot and dry) in between areas

Temperate zones usually have four seasons (winter, spring, summer, fall)

3. Polar (cold and dry most of the year (North/South Poles)

**Temperature** – the measurement of the condition of the air. How warm or cool is the air?

**Wind Direction** – Which way is the wind blowing? Named for the direction from which it is blowing. IF the wind is blowing from the SW (Southwest) then the winds are considered SW winds.

**Types of Precipitation** – water that falls from clouds in either liquid or solid form.

1. Rain

2. Sleet

3. Hail

4. Snow

**Air Pressure – the weight of the air.**  Warm air rising and cold air sinking combined with the spinning of Earth causes the air to spin forming high and low pressure regions.

**HIGH PRESSURE**:

**Cold air** is heavy and wants **to sink**, therefore making the air feel heavy and creating

**HIGH PRESSURE. (cold air is more dense so it drops) A high pressure system usually signals fair weather with winds circulating around the system in a clockwise direction.**

***The Weather is Cold and Dry when it is HIGH***

**LOW PRESSURE:**

**Warm air** is light and **wants to rise**, therefore making the air feel light and creating

**LOW PRESSURE. Warm air can hold more water than cold air. (warm air is less dense so it floats or rises) A low pressure system will signal rainy and stormy weather conditions with winds in a counterclockwise direction.**

***The Weather is Warm and Wet when it is Low Pressure***

**HIGH PRESSURE ALWAYS FLOWS INTO LOW PRESSURE.**

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**Differences in Air Pressure/Temperature Cause Wind**

When air moves from places with high pressure to places with low air pressure this creates wind.

The greater the difference in air pressure between the two places- and the shorter the distance between them- the stronger the wind.

**Storms-** Severe weather conditions called *storms* occur when air pressure differences cause rapid air movement.

* *Thunderstorm* is storm with thunder, lightning, heavy rains and strong winds; form within large cumulonimbus clouds; usually form along a cold front but can form within an air mass.
* *Tornado* is a rapidly whirling, funnel-shaped cloud that extends down from a storm cloud; the very low pressure and strong winds can cause great damage to people and property; are likely to form within the frontal regions where strong thunderstorms are also present.
* *Hurricane* is a low pressure tropical storm that forms over warm ocean water; winds form a spinning circular pattern around the center, or eye, of the storm; the lower the air pressure at the center, the faster the winds blow toward the center of the storm. Winds must be 74 mph to be classified as a hurricane.
* *Blizzard* is a long-lasting snowstorm with very strong winds and intense snowfall. You need three things to have a **blizzard**; cold air at the surface, lots of moisture, and lift. Warm air must rise over cold air.

**Cloud Chart**

 **Cloud Type Weather and Location**

|  |  |
| --- | --- |
| Cirrus (Curl) 689381_cirrus_clouds | High clouds, clear skies, no precipitation, formed from ice crystals, called thin, wispy or stringy, predict a change in the weather is coming  |
| Cumulus (Heap) MCj03111160000[1] | Middle clouds, fair weather, look like fluffy cotton balls |
| Stratus (blanket) clouds2 | Low clouds, looks like a flat blanket, arranged in layers, cloudy skies, usually gray in color, most likely bring drizzle or rain |
| cumulonimbus-cloud-akbhhf-swCumulonimbus | Storm clouds that form in all layers of the atmosphere, strong winds, heavy precipitation. Dark in color. Thunderstorms. |

**Fog-** a stratus cloud that form when condensation occurs at or near the ground

alto = medium-level clouds, altocumulus or altostratus.

Nimbo or Nimbus= means rain

Cirrus= high, curl

**Rain Shadow –** lack of precipitation on the side of a mountain away from the wind, and can create deserts



**Mountain and Valley Breezes**



**Valley Breeze**- During the day, the sun heats up valley air rapidly. This causes it to rise, causing a warm, up slope wind.

**Mountain Breeze**-At night, the process is reversed. Mountain air cools rapidly at night and "falls" down slope, causing a wind going in the other direction.

**Lake-Effect Snow:** created as wind moves over a body of water, picking up moisture and falling as snow

**Windward:** the side of something facing the prevailing or MAIN wind

**Leeward:** The side of something facing away from the wind

**Land and Sea Breezes (High Pressure goes to Low Pressure)**

 Sea Breeze

 **Low Pressure High Pressure**

 **Air is warm and light Air is cool and heavy**

 **because the warm land is because the cool water is**

 **heating up the air above it. cooling the air above it.**



When you are on the beach, **during the day** the sun heats **the land faster than the water** and makes the air above it hot this air rises and pulls in air from the sea to replace it, this is a **sea breeze.**

Land Breeze

 **High Pressure Low Pressure**

 **Air is cool and heavy Air is warm and light**

 **because the cool land is because the warmer water is**

 **cooling the air above it. heating up the air above it.**



**At night the land cools down** and when it is colder than the sea (**which remains almost the same temperature day and night**) then hot air rises from the sea surface and it pulls in air form the land, this is a **land breeze.**



***Jet stream****-* A fast-moving flow of air that moves from west to east in the Northern Hemisphere. Weather systems follow it’s path.

**Caused by 1) Earth’s rotation on its axis 2) Uneven heating of Earth**

The polar jet stream can bring down cold polar conditions from the north.

The subtropical jet stream can bring warm tropical conditions from the south (in the northern hemisphere).

**Air Mass-** An air mass is a large body of air that has similar temperature and humidity throughout.

**Air Masses can be warm/wet, warm/dry, cold/dry, cold/wet etc.**



**Fronts-** Fronts are boundary lines where to air masses meet. Storms often occur at fronts.

**Cold Front: Cold Air Replaces Warm Air**

 **(shown by a blue line with triangles pointing to where the air is moving)**

**The warm air, which holds a lot of water vapor, gets pushed upward quickly.**

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**When a cold front passes through, temperatures can drop more than 15 degrees within the first hour. Also, usually causes heavy rains, sometimes with hail, thunder and lightning. This type of storm is often violent, but it ends quickly. After the front moves through, one can expect fair, cooler weather.**

* **Creates Cumulonimbus Clouds**

**Warm Front: Warm Air replaces Cold Air**

**(Shown by solid red line with semicircles pointing towards the colder air and in the direction of movement.)**

**The warm, humid air eventually rises high enough for water droplets and clouds to form, and rain to fall.**

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**When a warm front passes through, the air becomes noticeably warmer and more humid than it was before. Precipitation will be steady rain and will last longer than a cold front. When the warm front has passed through, it leaves warmer, more humid weather.**

* **Creates rain clouds (stratus or certain types of cumulus)**

**Stationary Front**: When two air masses meet, but neither of them wants to move. This lack of movement may happen because there is not enough wind to keep the air masses moving. During the front, one can expect many days of continuous rain. After the front, one can expect continued rain.



**Occluded Front:**

An occluded front forms when a warm air mass is caught between two cold air masses and the warm air between them is pushed upward. During the front, one can expect light rain or other precipitation. After the front moves in, there will be fair and cooler weather.



**Weather Instruments (Tools Meteorologists use to measure weather)**

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| **Name of Tool** | **What it Measures** |
| **H**ygrometer | the **H**umidity or moisture in the air (how much water vapor) |
| **T**hermometer | **Measures T**emperature |
| Anemometer  | Measures Wind Speed (how many miles per hour) |
| **R**ain Gauge | Measures Precipitation (Amount of **R**ainfall**)** |
| Weather Vane (Wind Vane) | Measures Wind Direction (North, East, South, West) |
| BarometerImage result for barometer | **Measures** air pressure **(high or low)** Based on inches ranging from 28-31High Pressure: Increasing/Rising = dry or fair weather Low Pressure: Decreasing/falling=rain or stormy  |



The Water Cycle is always moving between the atmosphere and the surface of Earth. There is always the same amount of water on Earth.

*Precipitation-* After condensation occurs (forming clouds), water droplets fall in various forms of *precipitation* – rain, snow, freezing rain, sleet, or hail, depending upon weather conditions.

*Evaporation/Transpiration-*Water enters the atmosphere as water vapor (gas) through evaporation and transpiration, plants releasing water vapor. (Liquid to a gas)

*Condensation-* happens in the atmosphere as water vapor (gas) changes to water droplets (liquid).Clouds form because of condensation. *Dew* forms when water vapor condenses directly onto a surface

*Run-off-* If precipitation falls on land surfaces, it always attempts to move back toward sea level

**WEATHER FORECASTING -** Weather conditions and patterns can be predicted based on weather data collected from various sources.

Basic weather conditions can be observed and/or measured by *meteorologists (a scientist that studies the weather)* at national weather data collection sites.

In order to make weather predictions, the data should be collected on a regular basis over a period of time.

*Weather maps*

Weather maps can help predict weather patterns by indicating high or low pressure systems, movement of air masses and fronts, or temperature ranges

**CONVECTION CURRENTS:**

**GLOBAL WINDS-** Because warm air near Earth’s surface rises and then cools as it goes up, a *convection current* is set up in the atmosphere.

Because of the unequal heating of Earth, *climate zones* (tropical, temperate, and polar) occur.

Because convection cells are in place in the atmosphere and Earth is spinning on its axis, these global winds appear to curve. This is known as the *Coriolis effect*.



The *trade winds* blow from east to west in the tropical region moving warm tropical air in that climate zone.

The *prevailing* *westerlies* blow from west to east in the temperate region. These control our weather. Since the United States is in the westerly wind belt, **the weather systems move across the country from west to east.**

The *polar easterlies* blow east to west in the polar region moving cold polar air in that climate zone from the poles toward the west.

The winds determine the direction of the weather systems. For example, Tropical weather systems, for example hurricanes, are moved in the prevailing direction of the trade winds. If they enter the westerly wind belt, they are often turned, and move in the direction of that prevailing system.

**Ocean Currents:**

**Gulf Stream**- is a powerful, warm, and swift Atlantic ocean current that originates in the **Gulf of Mexico** and stretches to the tip of Florida, and follows the eastern coastlines of the United States

Warm current water influences the eastern Atlantic shoreline of the United States, while the cold California current influences its western Pacific shoreline.

**EL NINO**
El Niño is a climate pattern where the water in the Pacific Ocean near the equator gets hotter than usual and affects the atmosphere and weather around the world. El Niño climate conditions occur about every 4 years, and they are not predictable. El Niño is Spanish for The Little Boy. It refers to the Christ child and was named by a Peruvian fisherman, who noticed the climate pattern often formed around Christmastime.

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| --- | --- |
| Normal Year | El Nino Year |
| OneIn a normal year, the warmest water is in the far western Pacific. This forms thunderstorms. | TwoIn an El Niño year, the warmest water moves eastward across the Pacific. Thunderstorms disrupt the jet stream changing the weather pattern. |

**What type of a climate pattern do we see with an El Niño?**
The climate pattern can change the weather of the United States, particularly in California and the southern states. Usually, El Niño brings more rain and higher temperatures. Also, warm ocean currents come farther north and all kinds of tropical fish can be caught in the waters far north along the United States West Coast. El Niño may also bring warmer than normal winter temperatures to the eastern part of the United States.
**LA NINA:**
La Niña is sort of the opposite of El Niño. During a La Niña, the water in the same area along the equator gets colder than usual. La Niña cycles generally create a more active hurricane season in the Atlantic.

**What type of climate pattern do we see with La Niña?**
In the United States, La Niña is expected to bring above normal temperatures throughout most of the Southwest and southern Florida in the late summer and fall. These warmer conditions will extend across the Southeast during the winter months. Cooler than normal winter temperatures are expected in the Pacific Northwest. Cooler than normal temperatures are also expected across the Great Lakes and Northeast later in the winter into spring. In addition to temperature effects, La Niña is also expected to affect rainfall. Drier than normal conditions will persist in west Texas, New Mexico and Arizona into October. The late fall and early winter forecasts indicate continued dry conditions throughout much of the southern U.S. and into portions of the Midwest. Above normal precipitation is predicted for much of the Pacific Northwest throughout the fall and into the winter months, and in the Ohio and Tennessee River Valley in the winter.