Room for notes

WEATHER AND CLIMATE 1

Weather is the **state** of the **atmosphere** in a certain place at a certain time. Weather always changes and is different all around the world. It **depends on** many elements. It may be warm and sunny in one place, but cold, windy, and rainy somewhere else.

Climate **refers to** the weather conditions in a certain area over a longer period of time.

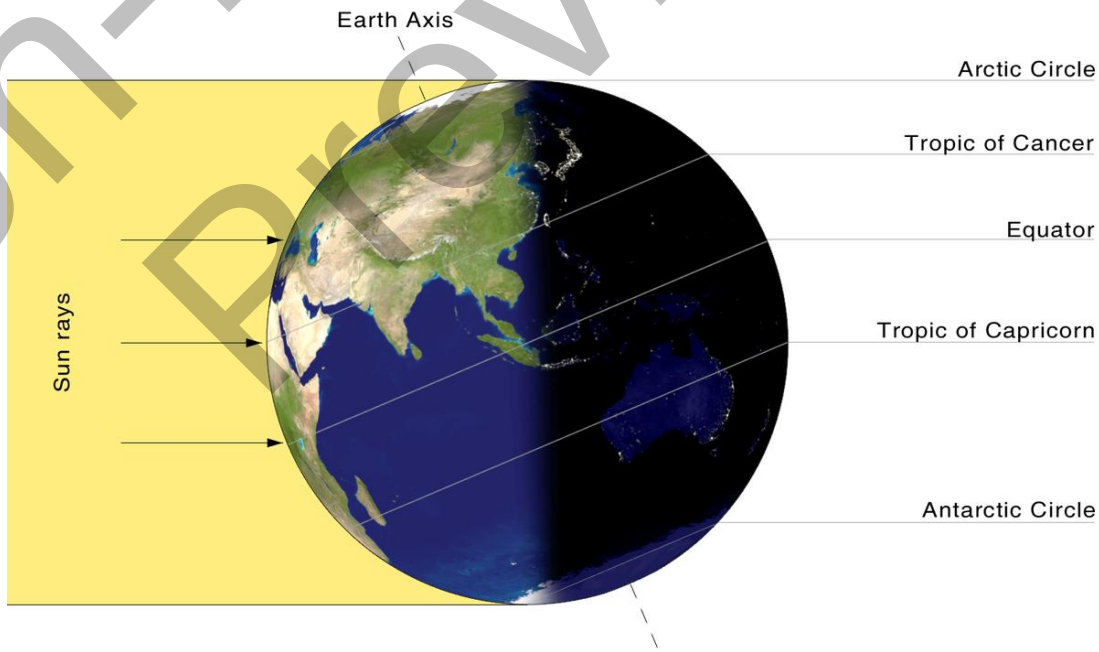
Weather is important to everyone. It **affects** our daily lives in many ways. What we wear depends on the weather. Weather affects the way plants and **crops** grow. **Extreme** weather may lead to dangerous situations. Hurricanes and storms may even kill people and **destroy** houses and roads.

Our weather is made in the troposphere—the lower **layer** of the atmosphere. Our atmosphere **consists of** 78% **nitrogen** and about 21 % **oxygen**. Water **vapor** in the atmosphere produces clouds, rain, snow, and **fog**.

Elements of the Weather

Temperature

Temperature is one of the most important elements in our weather. How warm or cold it is **depends on** many factors.



In the summer, the northern half of the earth is tilted towards the sun - leading to higher temperatures

Image: Image by Przemyslaw "Blueshade" Idzkiewicz, CC BY-SA 2.0, via Wikimedia Commons

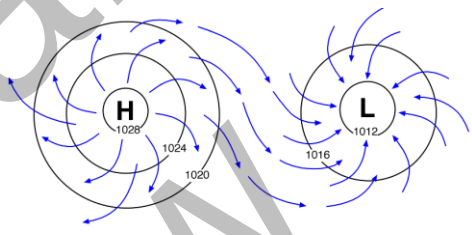
The temperature of the air is higher when sun **rays** hit the earth. Temperatures also **vary** from season to season. During the summer the earth's **axis** is **tilted** towards the sun, so the rays of the sun hit us more directly. The days are longer, and we get more sunlight.

Temperatures also depend on **altitude**. It gets colder when you are higher up in the mountains and it's warmer near **sea level**. The temperature **decreases** about 0.7°C per 100 meters.

Places near the sea usually have more **moderate** climates than areas far away from the coast. There, the summers are very hot and winters very cold.

Air pressure

Air pressure is the **weight** of the air. Cold air is heavier and **sinks** to the ground while warm air **rises**. When air moves it produces wind. Air moves from high **pressure** areas to places where the air is not so **dense**.



Air moves from high pressure to low pressure areas

Humidity

Humidity is the **amount** of **moisture** that is in the air. Warm air **expands** and can hold more moisture than cold air. When the air can hold no more moisture it forms small **droplets** called clouds.

Meteorologists measure the relative humidity in the air. That is the amount of water in the air compared to how much water the air at that temperature can really hold. Relative humidity can **reach** nearly 100%. The air is completely **saturated** with water.

Precipitation

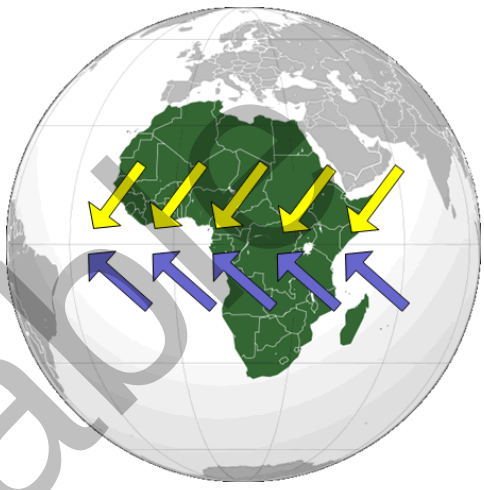
Precipitation is what comes down to earth from the clouds in the **atmosphere**. The most **common** forms are rain and snow. Other forms include **hail**, **sleet**, **drizzle**.

The **amount** of precipitation that a place gets **depends on** many **factors**. Areas near the coast get more rain than places in inner regions. Sometimes high mountains stop wet air from getting to other places.

Hailstones
Image: Bdahl, Public domain, via Wikimedia Commons

Wind systems

Because the earth **rotates** around its **axis** air does not move directly from high to low pressure areas. The Coriolis effect makes winds **shift**. There are three big **global** wind systems:



Trade winds blow from the northeast and southeast towards the equator
Image (modified) : Martin23230, CC BY-SA 3.0, via Wikimedia Commons

- **Trade winds** blow near the **equator** between 30° north and 30° south **latitude**. The trade winds north of the equator blow from the northeast, those south of the equator from the southeast.
  When they meet at the equator they rise. Rising air leads to the formation of clouds and **therefore** it starts to rain. A system of clouds and rainy weather is always around the equator, but it moves its position **depending on** the position of the sun.
- **Westerlies** blow in the middle latitudes, between 30° and 60 ° north and south of the equator. These winds are **especially** strong in higher regions.
  This area of western winds is also called the jet stream. Airplanes travelling from west to east **benefit** from strong **tailwinds**. They need much less **fuel** and can travel faster.
- **Polar winds** are easterly winds that blow in the Arctic and Antarctic regions. Fronts **develop** where polar winds and westerlies meet. Storms and **cyclones arise** around this area where warm and cold air meets.

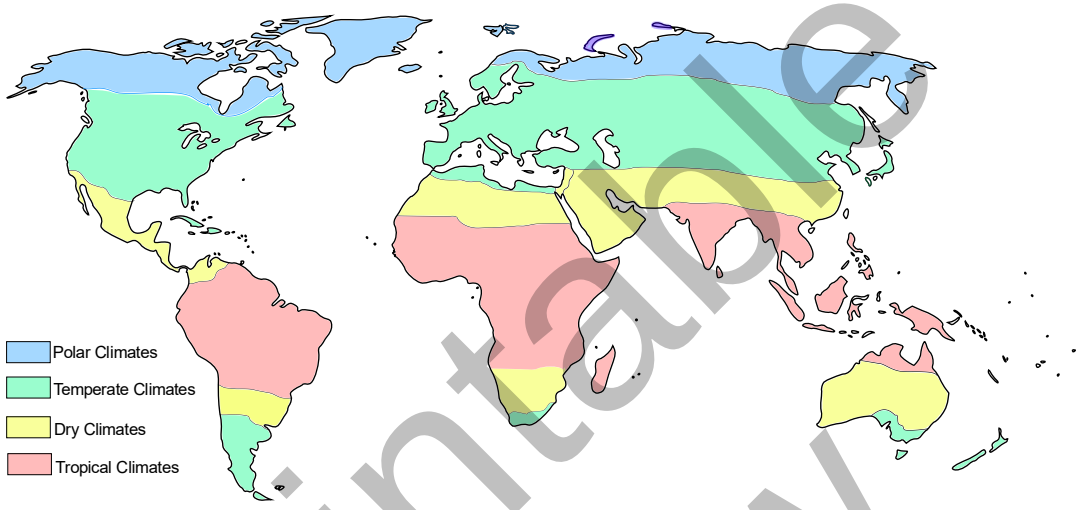
Air Masses

Air can be cold or warm, wet, or dry. When different kinds of **air masses** meet a front forms. When a warm front **approaches**, air starts to rise and forms clouds. Light rain usually comes with a warm front.

About a day later a cold front follows. Cold fronts move faster than warm fronts and often **catch up** with them. The cold air moves under the warm front and pushes the warm air up. Clouds and rainfall are the result. Sometimes such a front can even **cause** short showers and **thunderstorms**.

Climate Zones

Every place on Earth has a different climate, but there are four **main** climate zones that extend from the **equator** to the poles.



Climate Zones
Image (modified): Skimel, CC0, via Wikimedia Commons

Tropical Climate

Tropical climates are found around the equator. Temperatures are high the whole year and there is **little** difference between the hottest and coldest month. The air is very **humid**, and rainfall is at least 200 cm a year.

Near the equator it rains almost every day in the afternoon. Humid air **rises** and forms clouds that lead to **thunderstorms**. There are usually two rainy seasons a year, with drier periods in between. The world's largest **rainforests** are in this climate zone - the Amazon and Congo River **basin**.

As you move farther away from the equator, rainfall becomes less and the dry season becomes longer. Rainforests turn into **savannahs**.

Dry Climate

Dry climates are located between about 20° and 40° north and south of the equator. Because of **high pressure areas** the skies are clear and often **cloudless**. Deserts **stretch** across large parts of Africa, Arabia, and Australia. In some areas it hasn't rained in years.

Temperate Climate

Large parts of Europe, North America and Asia have seasons with warm summers and cold winters. Rain falls **throughout** the year, especially in **coastal** regions. Farther away from the sea the climate becomes continental with **extreme** summer and winter temperatures and little rainfall.

The **Mediterranean** climate is a special **temperate** zone found in southern Europe, northern Africa, California, South Africa and southern Australia. Summers are **typically** hot and dry while winters are cool and rainy.

Polar Climate

The polar region begins north and south of about 60°. In the **tundras** of North America, Europe and Asia winters are extremely cold and long. A short summer lets few plants grow in this treeless land.

The Arctic and Antarctic regions are covered with snow and ice.

Weather Forecasting

Scientists who study what goes on in our **atmosphere** are called **meteorologists**. They can tell us what the weather will be like in the next few days. They **gather** information from all **sorts** of instruments.

Today, weather **satellites** collect **data** from around the world. This data is entered into computers which produce weather **patterns** for the future.

Ten thousand weather stations on all continents **observe** the weather worldwide. They use many kinds of instruments to **measure** the condition of the atmosphere. A thermometer, for example, measures the air temperature , a barometer measures the **weight** of the air, and a hygrometer shows how much **moisture** is in the atmosphere.

Weather stations use weather **radar** to **monitor** areas of rain or snow, **track** storms or follow the **paths** of hurricanes. Weather balloons are sent into higher regions of the atmosphere and measure changes in temperature, winds and other elements. A radio **transmits** data back to earth.

Weather **forecasts** are not always **accurate**, **partly** because humans make mistakes when they enter data, partly because the **condition** of the atmosphere always changes and is **unpredictable**.

Meteorologists can therefore **predict** weather over a short period of time **fairly** well, however **long-term** weather predictions are very **inaccurate**.

Extreme Weather

Although weather experts **rely on** average data over a longer period of time to **predict** the weather, there are often extreme weather conditions.

The lowest temperature ever **recorded** on earth was at Vostok, a station in Antarctica. – 89° C was **measured** in 1983 . The highest temperature was recorded in the Libyan **desert** in 1922 (57°C). The highest **annual** rainfall was measured in Cherrapunji, India , at the **foot** of the Himalaya **mountain range**. 26 meters of rain fell over a one-year period.