

# UNIT 4

## UNIT 4.ATMOSPHERE: WEATHER AND CLIMATE



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UNIT 4

## 1. THE EARTH'S ATMOSPHERE

Remember: the Earth's atmosphere is a gaseous layer that surrounds the planet, provides oxygen and protects us from solar radiation.

The atmosphere is divided into different layers:

- **Troposphere (0-12 Km)**
  - The main meteorological phenomena happen here.
  - It is the closest layer to Earth's surface.
  - It is the layer we live in.
  - higher altitude=colder temps (temperatures drop by 0,65 °C for every 100 m of altitude).
- **Stratosphere (12-50 km).**
  - Ozone layer is here. It absorbs ultraviolet radiation from the sun.
  - Higher altitude=warmer temps.
- **Mesosphere (50-100 km)**
  - Where meteors and comets are destroyed
  - Higher altitude=colder temps (temperatures sometimes reach -100 °C).
- **Thermosphere (Ionosphere) (85-600 km)**
  - Solar radiation produces electrically-charged.
  - Borealis auroras are here.
  - Higher altitude=warmer temps (reach up to 1500 °C).
- **Exosphere (600-10.000 km).**
  - The outermost layer, where satellites orbit Earth.

Most meteorological phenomena, such as cloud formation, wind and rain occur in Troposphere.

## 2. THE PROPERTIES OF AIR

**Composition of gases.** Air is a mixture of gases: 78% nitrogen, 21% oxygen and various other components such as water vapour.

**Temperature.** **Warm air** (lower levels) weighs less (became lighter) and rises. **Cold air** (higher levels) weighs more (became heavier) and decreases or fall down.

**Atmospheric pressure.** Is the term used to describe the pressure exerted on Earth by the weight of the air. It is measured with a barometer. Both altitude and temperature determine atmospheric pressure.

**Relatively humidity.** It refers to the amount of water vapour that air contains. When water vapour begins to condense into droplets, **clouds** are formed.

### 3. ATMOSPHERIC DYNAMICS

The Sun's rays warm up the atmosphere and our planet's surface. The energy from the Sun is responsible for the Earth's weather and climate.

You have to distinguish these two concepts:

- **Weather** is the state of the lower layers of the atmosphere at a certain time and place on Earth.
  - o The science that deals with predicting what the weather will be like in a certain zone is called Meteorology.
- **Climate** refers to the state of the weather in a certain region of the planet over a long period of time. It is necessary to analyze a region in 30 years intervals to establish the climate of a region.
  - o The science that studies different types of climate is referred to as Climatology.

#### 3.1. FACTORS THAT INFLUENCE WEATHER

- **ATMOSPHERIC PRESSURE** Atmospheric pressure is the weight of air over a particular Earth's surface. It is measured in hectopascals (hPa). It varies from one place to another and depends on:
  - o **ALTITUDE.** atmospheric pressure is lower at higher altitudes. For example, the amount of air at the top of a mountain is less than at the base.
  - o **TEMPERATURE:** warm air weighs less than cold air. As a result: **warm air** rises and exerts less pressure on the Earth's surface, while **cold air** descends and exerts more pressure.
- **TEMPERATURE** It is measured in degrees on the Fahrenheit (°F) or Celsius (°C) scales by a thermometer. Temperature varies according to:
  - o **Altitude:** temperatures decrease with elevation (temperatures drop by 0,65 °C for every 100 m of altitude).
  - o **Latitude:** temperatures decrease as you move away from the equator. Sun rays go directly over the equator areas, so temperatures are higher. In polar regions are colder because the Sun's rays are dispersed over a larger area of land.
  - o **Distance from the sea:** water heats and cool more slowly than the land does; temperature of the land near large bodies of water is often milder, with no big variations in temperature.
- **WIND** Masses of air move around in the atmosphere. This movement causes wind. There are different types of wind:

- **Prevailing winds (vientos predominantes)**, such as trade winds (vientos alisios), always blow in the same direction (NE en el hemisferio norte y del SE en el hemisferio sur) and in the same regions.
  - **Periodic winds**, such as monsoons, vary depending on the season.
  - **Local winds** are found in small areas. They usually blow in the same direction. For example, Tramontana (Islas Baleares), Galerna (Mar Cantábrico) and Cierzo (Aragón).
- **HUMIDITY AND PRECIPITATION**
- All air masses contain a certain amount of water vapour.
  - As a **mass of warm air rises**, its temperature decreases. The humidity it contains **is transformed into a liquid state** and falls to the Earth's surface in the form of precipitation.

#### 4. THE EARTH'S CLIMATES

Climatologists divide the Earth into different **climate zones**

##### 4.1. THE EARTH'S CLIMATES ZONES

We can identify three major climates zones: **cold, hot and temperate.**

###### 4.1.1. COLD ZONES

Very little sunshine and annual average temperatures are below 0 °C.

There are two cold climate zones located within the polar circles:

One in the Northern Hemisphere made up of the Arctic Ocean, Greenland and the northern coasts of Asia, Europe and America.

One in the Southern Hemisphere made up of the Antarctic.

###### 4.1.2. HOT ZONES

There is a single hot climate zone, which is known as the intertropical zone: It is located between the two tropics.

The intense sunshine in this region produces annual average temperatures of above 18 °C.

###### 4.1.3. TEMPERATE ZONES

There are two temperate zones: are located between the tropics and the polar circles.

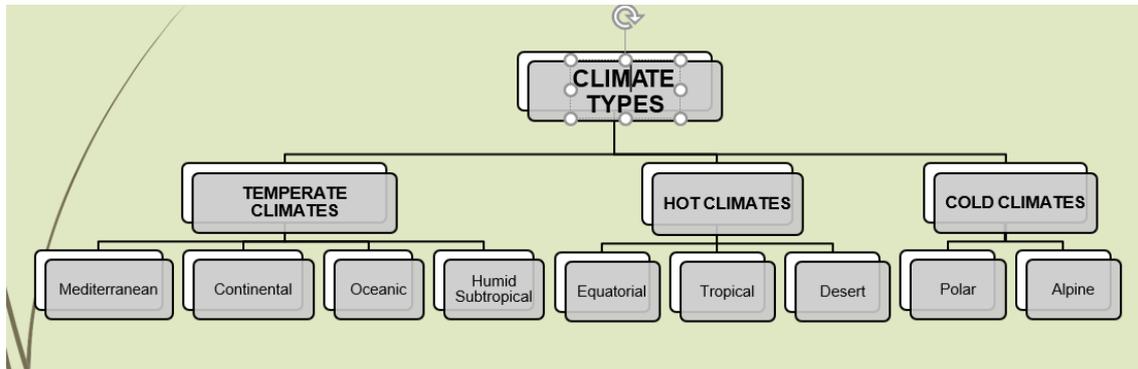
Annual average temperatures are between 0 °C and 18 °C.

The amount of sunshine varies throughout the year, resulting in four seasons. In the Northern hemisphere, the hot season coincides with the summer months. In the Southern hemisphere, it coincides with the winter months.

## 4.2. THE EARTH'S CLIMATES TYPES

Within climates zones there are regions with different types of climates.

The combination of annual temperature and precipitation data results in nine different climate types:



### 4.2.1. HOT CLIMATES

Hot climates are situated between the Tropic of Cancer and the Tropic of Capricorn and the Equator. The average annual temperature is above 20°C. The three main tropical climates are:

- Equatorial climate: its most important feature is consistency. It rains all year and there are no seasons (it's always hot). This climate is near the Equator.
- Tropical climate: temperatures are very high and there are two seasons: a rainy season in summer and a dry season in winter. It is located between the equatorial climate and the Tropic of Capricorn.
- Monsoon climate: in the summer, the monsoon (seasonal wind) blows from the sea to the continent, creating strong rains; in the winter, the monsoon blows from the continent to the sea (dry monsoon).

### 4.2.2. TEMPERATE CLIMATES

These climates are found between the Tropic of Cancer and the Arctic Circle in the Northern Hemisphere, and the tropic of Capricorn and the Antarctic Circle in the Southern Hemisphere.

The average annual temperature varies between 0°C and 20°C. There are different seasons and there is a dramatic difference between summer and winter. The main temperate climates are:

- **Mediterranean climate:** temperatures are mild in the winter and hot in the summer. Precipitation is abundant in spring and autumn.

- **Sub-tropical climate** is similar, with rains in summer
- **Maritime climate:** characterised by its mild temperatures and abundant precipitation all year, specially in winter.
- **Continental climate:** there are strong contrasts in temperatures, with very cold winters and very hot summers. There is moderate precipitation, mostly in summer. In winter, there are intense cold spells (period of a particular kind of weather) with snow.

#### 4.2.3. COLD CLIMATES

These climates are found in the polar regions and in high mountain areas.

- **Polar Climate:** occurs at the two poles, where extreme cold is caused by the angle of the Sun's rays and the long polar night.
- **Alpine climate:** is caused by decreases in temperature with altitude.

Snow and ice are found in both climates. However, there is very little precipitation in the polar regions (there is very little evaporation, while precipitation increases in the mountains).

#### 4.2.4. DESERT CLIMATES

A desert climate receives less than 10 mm of precipitation annually and a semi-desert between 100 and 250 mm of rain a year. There are many types of deserts.

The Sahara, in Africa, is an example of **hot desert**.

The Atacama, in Chile (South America), is an example of **coastal desert**.

The Gobi desert, between China and Mongolia (Asia), is an example of a **continental desert**.

Antarctica, that has a surface area bigger than Europe, is the largest **frozen desert** in the world.

### 4.3. SPANISH CLIMATES.

#### 4.3.1. OCEANIC CLIMATE

It is characterized by very mild temperatures and high annual rainfall.

The characteristic vegetation is oceanic forest, with deciduous trees such as oaks or beech.

#### 4.3.2. CONTINENTAL CLIMATE

It is characterised by very hot summers and mild winters, with low rainfall. The characteristic vegetation is Mediterranean forest, with evergreen trees such as holm oak, olive and pine.

#### 4.3.3. MEDITERRANEAN CLIMATE

In coastal areas, in which temperatures are influenced by the regulatory action of the sea, trees like the coastal holm oak and some species of pine can be found.

#### 4.3.4. SUBTROPICAL CLIMATE

It has hot temperatures throughout the year, and low rainfall.

Its vegetation is adapted to altitude and includes native varieties such as the dragon tree or laurel forest.

#### 4.3.5. ALPINE CLIMATE

It is conditioned by altitude, and has cool summers and very cold winters, with very high rainfall.

Its vegetation varies with altitude.

### 5. WHAT IS A CLIMOGRAPH?

Temperature and precipitation make it possible to identify a climate.

Both elements can be shown graphically using a climograph which allows us to observe the annual change in temperature and precipitation in a specific place on the planet.

This information is represented using a combination chart with two systems of coordinates.

#### 5.1. HOW TO READ A CLIMOGRAPH

Climate is the average of daily weather conditions at a particular location. A climograph or climate graph is a visual representation of average monthly conditions at a location over the course of a year. It focuses on average monthly temperature and average monthly precipitation.

### 6. WEATHER HAZARDS

Some meteorological phenomena, such as hurricanes and tornadoes, can cause devastating effects on populated areas.

Hurricanes (tropical cyclones) are centres of low pressure with strong winds that spiral at high speeds. They destroy everything in their path, creating huge waves which flood coastal areas and strong rains, which also cause heavy flooding.

The most powerful hurricanes reach over 240 km/h, such as hurricane Katrina in 2005, which flooded the city of New Orleans (USA) causing more than 2.000 deaths

Tornadoes are also centres of low pressure, smaller than hurricanes, but much more intense. They are formed from clouds that take the form of a funnel with winds that destroy everything in their path with enormous speed. They occur almost exclusively in the area of the Great Plains of the United States, specially in spring and summer.

Other weather hazards are torrential rains that cause flooding, high temperatures which increase the risk of forest fires, hail that destroys crops, and heavily snowfall which cause avalanches on steep slopes in mountainous areas.