

Unit - 2

Weather and Climate



Learning Objectives

- ▶ To understand the importance of weather and climate
- ▶ To learn about the nature of the elements of weather and climate.
- ▶ To know the instruments used for measuring weather elements
- ▶ To be able to recognize the kind of weather and climate of a place



Introduction

Climate is one of the basic elements in the natural environment. It affects landforms, soil types, fauna and flora. It influences man to a large extent.

In a small village in Dharmapuri district, Tamil nadu, in the month of May, Yuktha enjoys her vacation with her brother and family. She always wears cotton cloths. Her mother makes food like porridge, buttermilk, lemonade, watermelon etc which suits to summer. At the same time (In May month) Tiya who lives in Auckland, New Zealand with her father and mother wear fleece jacket, jeans, gloves and socks. Her mother makes hot food like sandwich, salmon, oatmeal, soups etc. Yuktha celebrates Christmas with friends in winter, where as Tiya celebrates Christmas during summer. Can you think of why?

Yuktha and Tiya stay in two different hemispheres and have different way of life. This is because of the difference in weather condition of those places.

Weather and climate influence man's activities like what we eat, wear, the house

in which we live and work, farming, sailing, fishing, modern transport and even our play time etc. Hence one should have knowledge about the weather and climate. So, in this chapter we are going to learn about weather and climate, its elements and how they influence our lifestyle.

Weather

Weather is the day today conditions (state) of the atmosphere at any place as regards sunshine, temperature, cloud cover, wind fog condition, air pressure, humidity, precipitation and such other elements. It refers to short periods like a day, a week, a month or a little longer and as such the weather changes from time to time in a day and one period to the other in an year. In the



Earth's atmosphere is a layer of gases surrounding the planet earth and retained by the earth's gravity. It contains about 78% nitrogen, 21% oxygen, 0.97% argon, 0.03% carbon dioxide and 0.04% trace amounts of other gases and water vapour.



Find out

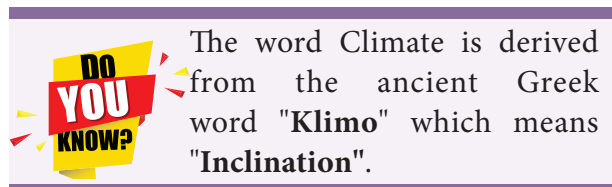
Do all the planets in the solar system have atmosphere?

morning the weather might be sunny with a clear sky in a place and evening there might be clouds and rain. Similarly the weather is cool in winter and hot in summer.

We often hear people saying “Today the climate is good or bad”. It is incorrect to say like that. Instead it has to be said that the weather is good or bad. We could observe the television news readers saying weather report and not the climate report for e.g. cricket match have been postponed due to bad weather etc.

Climate

Climate is generally defined as the average conditions (state) of the weather of a place or a region. The average atmospheric conditions are determined by measuring the weather elements for a long period of time which is usually for 35 years. The elements of weather and climate are the same. The climate does not change often like weather.



Controlling factors of weather and climate

Angle of the sun's rays, the length of daytime, altitude, distribution of land and water bodies, location and direction of mountain ranges, air pressure, winds and ocean currents are the major factors which affect the weather and climate of a region.

The earth is spherical in shape. So, the sun's rays fall unevenly on the earth's surface. The Polar regions receive slanting sun's rays. Hence there is little or no sunlight, thus there is an extreme cold winters. Vertical sun's ray's fall directly on regions around the equator,



Scientific study of weather is called **Meteorology** and the scientific study of climate is called **climatology**.

hence the climate is very hot and almost no winters. The difference in temperature makes the air and water move in currents. Warm air rises and creates more space for air beneath, while cool air settles down.

ACTIVITY

Discuss in the class room how altitude, distribution of land and water bodies, direction of mountain ranges, air pressure, winds and ocean currents affect weather/climate.

Elements of weather and climate

Temperature, rainfall, pressure, humidity and wind are the major elements of weather and climate.



a) Temperature



Thermometer

Temperature is one of the key elements of weather and climate. The earth and its atmosphere get heated from the sun through insolation. The degree of heat present in the air is termed as temperature. Apart from sun's rays, the heat in air also depends the atmospheric mass to a small extent.



Distribution of weather elements are shown by means of Isolines on maps. Isolines are those which join the places of equal values. Isolines are given different names based on the weather element they represent.

Isotherm	Equal temperature
Isocryme	Equal lowest mean temperature for a specified period
Isohel	Equal sunshine
Isollobar	Equal pressure tendency showing similar changes over a given time
Isobar	Equal atmospheric pressure
Isohyet	Equal amount of rainfall

Temperature varies with time due to changes in the level of radiation which reach the earth surface. This is due to motions of the earth (The rotation and revolution) and inclination of the earth's axis.

The temperature influences the level of humidity, the process of evaporation, condensation and precipitation.

Heat energy from solar radiation is received by the earth through three mechanisms. They are radiation, conduction and convection. The Earth's atmosphere is heated more by terrestrial radiation than insolation.

Temperature varies both horizontally and vertically. Temperature decreases with increasing height is known as Lapse rate which is 6.5 degree celsius per 1000 meters in troposphere .

b) Factors affecting the distribution of temperature

Latitude, altitude, nature of land, ocean currents, prevailing winds, slope, shelter and distance from the sea, natural vegetation and soil are the major factors which affect the distribution of temperature.

c) Measuring Temperature

The temperature of a unit volume of air at a given time is measured in scales like Celsius, Fahrenheit, and Kelvin. Meteorologist measures the temperature by the Thermometer, Stevenson screen and minimum and maximum Thermometer. The energy received by the earth through insolation is lost by outgoing radiation. Atmosphere is mainly heated by outgoing radiation from 2 to 4pm .So the maximum temperature is recorded between 2 and 4 pm regularly and minimum temperature is recorded around 4 am before sunrise.

Mean Temperature

The average of maximum and minimum temperatures within 24 hours is called **mean daily temperature** $[(87^{\circ}\text{F}+73^{\circ}\text{F})/2=80^{\circ}\text{F}]$. **Diurnal range of temperature** is the difference between the maximum and minimum temperatures of a day. **Annual range of temperature** is the difference between the highest and lowest mean monthly temperatures of a year. The distribution of temperature is shown by means of Isotherms. **Isotherms** are imaginary lines which connect the same temperatures of different places.

d) Heat zones of the earth

The fact that the earth is spherical in shape results in different parts of the earth

getting heated differently. Based on the heat received from the sun, Earth is divided into three heat zones. They are

Torrid Zone

It is a region between the tropic of cancer and the tropic of Capricorn. This region receives the direct rays of the sun and gets the maximum heat from the sun. This zone known as the torrid or the tropical zone

Temperate zone

This zone lies between the Tropic of cancer and the Arctic circle in the Northern Hemisphere and between the Tropic of Capricorn and the Antarctic circle in the southern Hemisphere. This zone gets the slanting rays of the sun and the angle of the sun's rays goes on decreasing towards the poles. Thus this zone experiences moderate temperature.

Frigid Zone

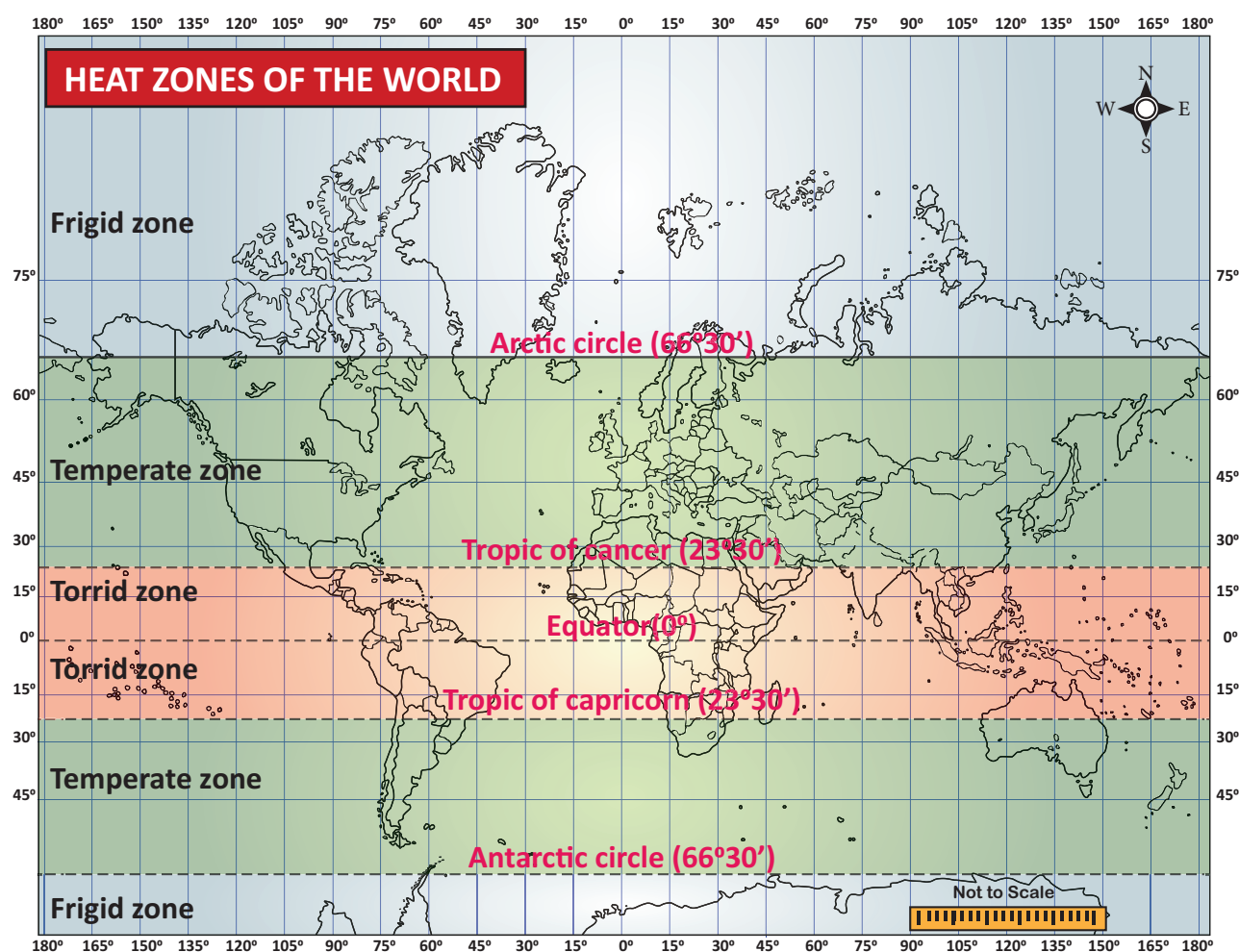
The frigid zone lies between the Arctic circle and the North Pole and between the Antarctic circle and the South Pole. This region also known as Polar region. Since it receives the extremely low temperature throughout the year, these regions are covered with snow.

Highest Temperature ever recorded

The highest temperature ever recorded on the earth is **56.7°C (134°F)**. It was recorded on 10th July 1913 at **Greenland Ranch of Death Valley, California, USA**.

Lowest Temperature ever recorded

The lowest temperature ever recorded on the earth is **-89.2 °C (-128.6 °F; 184.0 K)**. It was recorded on 21st July, 1983 at **Soviet Vostok Station in Antarctica**.



Rainfall

Rain is a liquid water in the form of droplets that have condensed from atmospheric water vapour and then become heavy enough to fall under gravity. Rain is a major component of the water cycle and is responsible for depositing most of the fresh water on the Earth. It is the source of water for all purposes. There is a close relationship between the temperature and rainfall distribution. Generally rainfall is high in the equatorial region and decreases gradually towards poles. Rainfall is measured by **Raingauge**.



Raingauge

Air Pressure



Aneroid Barometer

The weight of air above a given area on the earth's surface is called atmospheric pressure or air pressure. The air pressure is measured by Barometer. **The standard air pressure at sea level is 1013.25mb.** At the earth's surface the pressure is 1.03kg.per sq cm. The variation in standard atmospheric pressure is found both horizontally and vertically. Based on the level of pressure, it is categorised into low pressure and high pressure. Low pressure area is an area in the atmosphere where the pressure is lower than its surrounding areas. In this situation, the wind from the surroundings blow towards the centre of pressure. High pressure is an area of atmosphere where the barometric pressure is higher than its surrounding areas. In this case, the wind from the centre of high pressure blows towards the surrounding low pressure areas. Low pressure system is marked as "L" on weather map, where as the high pressure system is marked as "H". Low pressure systems are also called as a **depression and cyclones**. High pressure system is called **anti cyclones**. **Low pressure leads** to cloudiness, wind, and precipitation. High pressure leads to fair and calm weather. **Isobar** is used to show the distribution of air pressure.



Highest pressure ever recorded.

The highest ever air pressure at sea level was recorded at Agata, Russia on 31st December, 1968. The pressure was 1083.8mb

Lowest pressure ever recorded

The lowest pressure of 870mb was recorded at Typhoon Tip, near Guam, Mariana Island in Pacific Ocean on 12th October, 1979.

Humans are not sensitive to small variation in air pressure. But the small variations in pressure that do exist largely determine the wind and storm patterns of the earth. The distribution of atmospheric pressure is controlled by altitude, atmospheric temperature, air circulation, earth rotation, water vapour, atmospheric storms etc.

Measuring air pressure

Meteorologist uses barometer/aneroid barometer to measure the air pressure. Barograms are used for recording continuous variation in atmospheric pressure.

Why Do Your Ears Pop in Airplanes?

As you go up in an airplane, the atmospheric pressure becomes lower than the pressure of the air inside your ears. Your ears pop because they are trying to equalize or match the pressure. The same thing happens when the plane is on the way down and your ears have to adjust to a higher atmospheric pressure.

Humidity

Humidity refers to the degree of water vapour present in the atmosphere in gaseous form in particular time and place. It ranges from 0-5 percent by volume in atmosphere. Climatically it is an important constituent of the atmosphere and its quantity depends on the level of temperature. So, the level of humidity decreases towards poles from equator. Humidity is expressed in different ways.



Hygrometer

Specific humidity is a ratio of the water vapor content of the mixture to the total air content on a mass basis. It is expressed in grams of vapour per kilogram of air.

Absolute Humidity is the mass or weight of water vapour present per unit volume of air. It is expressed usually in grams per cubic meter of air.

Relative humidity is a ratio between the actual amount of water vapour present in the air and the maximum amount of water vapour it can hold at a given temperature. It is expressed as a percentage.

Generally, warm air holds more water vapour than the cold air. When relative humidity reaches 100%, the air gets saturated. In this condition the temperature is said to be at dew-point. Further cooling will condense the water vapour into the clouds and rain. Relative humidity affects human health and comfortness. Very high and very low humidity are injurious to health. It also affects the stability of different objects, buildings and electrical applications.

Measurement of Humidity

Hygrometer is used to measure the humidity. (which comprises wet and dry bulb-plate side by side in the Stevenson screen)

Find out

The effect of low and high humidity over Human beings in particular.



With decreasing air pressure, the availability of oxygen to breathe also decreases. At very high altitudes, atmospheric pressure and available oxygen get so low that people can become sick and even die. Mountain climbers use bottled oxygen when they ascend very high peaks. They also take time to get used to the altitude as the quick move from high pressure to low pressure can cause decompression sickness. Aircraft create artificial pressure in the cabin which makes the passengers remain comfortable while flying.

Wind

The horizontal movement of air is called wind. Vertical movement of air is said as air current. The winds move from high pressure to low pressure. Unlike other elements a wind is made up of a series of gusts and eddies which can only be felt and not seen. Winds get their name from the direction from which they blow i.e, wind blows from south west is called southwest wind.

The wind systems are broadly categorized into three as follows.

- Planetary winds
- Seasonal winds
- Local winds

Planetary Winds are the ones which blow almost in the same direction throughout the year. So, they are called as Permanent or planetary winds. Trade winds, Westerlies and polar easterlies are the types of prevailing winds. **Seasonal winds** are those which change their direction according to season in a year. They are called as monsoon winds. These winds blow from sea to land during summer and land to sea during winter. **Local winds** are the winds blow over a small area only during a particular time of a day or a short period of a year. Land and sea breezes are example of these winds.

The Beaufort scale is a scale for measuring wind speed. It is based on observation rather than accurate measurement. It is the most widely used system to measure wind speed today. The scale was developed in 1805 by Francis Beaufort, an officer of the Royal Navy and first officially used by HMS Beagle.



Al-Balakhi, an Arab Geographer collected climatic data from the Arab travellers and prepared the First climatic Atlas of the world.

Measuring wind direction and speed

Meteorologist measures wind direction using **wind vane or weather cock**. Wind speed is measured by **anemometer**. Wind rose is a diagram used to depict the direction and periods (No. of days) of prevailing winds on map. **Meteorograph or triple register** is an instrument which records wind speed and direction, sunshine and precipitation. It also provides graphic representation.



Anemometer



Brazil has a large area where the average wind speed is low. Gabon, Congo and DR Congo in Africa, Sumatra, Indonesia and Malaysia are the least windy places on earth.

Recap

- **Weather** is the day today condition of the atmosphere at any place. **Climate** is the average weather condition (state) of a place for a long period and is usually for 35 years.
- Temperature, precipitation, pressure, humidity and wind are the major elements of weather and climate.
- Temperature is the degree of heat present in the air.
- The weight of air above a given area on the earth's surface is called atmospheric pressure or air pressure.
- Horizontal movement of air is called wind.

GLOSSARY

Conduction	Transfer of heat energy from one place to another through the substances that are in direct contact with each other	வெப்பக்கடத்தல்
Condensation	The process in which the water vapour changes into liquid form.	ஆவிசுருங்குதல்
Eddies	They are the wind circulation that develops when the wind blows over or adjacent to rough terrain, buildings, mountains or other obstructions.	சுழற்சாற்று
Humidity	The amount of water vapour in the air	ஈரப்பதம்
Insolation	Incoming solar radiation	சூரியக்கதிர்வீச்சல்
Radiation	The transmission of heat energy from one body to the other body without any medium is called radiation	கதிர்வீச்சு



Evaluation

I Choose the correct answer

- Earth's atmosphere contains about _____ percentage of nitrogen and oxygen.
 - 78% and 21%
 - 22% and 1%
 - 21% and 0.97%
 - 10% and 20%
- _____ is generally defined as the average conditions of the weather of a place or a region.
 - earth
 - atmosphere
 - climate
 - sun
- The earth receives energy from _____.
 - current
 - electro magnetic radiation
 - waves
 - heat
- Which one the following represents places with equal amount of rainfall
 - isotherm
 - isohel
 - isobar
 - isohytes
- _____ is used to measure the humidity.
 - anemometer
 - barometer
 - hygrometer
 - thermometer

II Fill in the blanks

- _____ refers to the condition of atmosphere for a short period of time.

- The scientific study of weather is called ____.
- The highest temperature ever recorded on the earth is _____.
- _____ is a ratio between the actual amount of water vapour and the maximum amount of water vapour the air can hold.
- _____ and _____ are measured by anemometer and wind vane respectively.
- _____ are imaginary lines which connect the same temperatures of different places.

III Match the following

1. Climate	Locating and Tracking Storms
2. Isonif	Cyclone
3. Hygrometer	Equal Snowfall
4. Radar	Long Term Changes
5. Low Pressure	Humidity

IV State whether the following statements are True or False

- The atmosphere is a layer of gases surrounding the planet.
- The Scientific study of weather is called Climatology.
- Isohel refers equal sunshine.
- Humidity is calculated by Aneroid Barometer.

V Answer briefly

1. Define 'weather'.
2. What is insolation?
3. What is meant by atmospheric pressure?
4. Write a short note on "Planetary winds"
5. What are "Isolines"?

VI Distinguish between

1. Weather and climate.
2. Absolute and relative humidity.
3. Permanent and seasonal winds.

VII Give reasons

1. The Weather and climate in different regions vary.
2. Temperature decreases with increase in altitude.
3. Mountain climbers carry oxygen cylinders while ascending peaks.

VIII Answer in a paragraph

1. How is temperature measured?
2. Write about the wind and its types.
3. List out the weather elements and associated measuring instruments.

IX 1. Give any three suggestions to reduce global warming

1. _____.
2. _____.
3. _____.

2. Map Activity

On the outline map of world mark the following

1. Heat zones of the world
2. Pressure belt and planetary winds

X Activities

1. Make weather instruments like wind vane and rain gauge using web resources.
2. Make mini-meteorological station model in your school.
3. Observe and record the weather condition of your place in the following table.

Date			
Place and Time			
Temperature			
Barometric pressure			
Precipitation type and amount			
Wind direction			
Wind speed			
Source of information-			



REFERENCE BOOKS

1. *Climatology an atmospheric science* John E. Oliver, John J. Hildore, 2003, person education (singapore)pte,Ltd. India branch, Delhi.
2. Goh Cheng Lelong, *Certificate Physical and Human Geography*, Goh Cheng Lelong, oxford publication (india).
3. *Climatology*, Savindra Singh, 2005, Prayag pustak bhawan, Allahabad, India.



INTERNET RESOURCES

- <https://www.nationalgeographic.com/>
- <https://climatekids.nasa.gov/menu/atmosphere/>



ICT CORNER

Weather and Climate

- Step – 1 Open the Browser and type the URL given below (or) Scan the QR Code.
- Step – 2 Enter your location in search box (Ex.Tiruchirappalli)
- Step – 3 Use the Drag flag and zoom in your area.
- Step – 4 Go to menu in right side and select from the list to know the weather of your area (Ex.Temperature)

Website URL:

<https://www.windy.com>

Mobile: <https://play.google.com/store/apps/details?id=com.windyty.android>



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