

ELEMENTS OF CLIMATE AND WEATHER

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Introduction:

The climate of a region is ultimately determined by the radiation energy of the sun, and its distribution and temporal fluctuations. The long-term state of the atmosphere is a function of a variety of interacting elements. They are: Solar radiation, Air masses, Pressure systems (and cyclone belts), Ocean Currents, Topography.

1. Solar radiation : Solar radiation is the radiation, or energy we get from the sun. It is also known as short-wave radiation. Solar radiation is probably the most important element of climate.

Solar radiation first and foremost heats the Earth's surface which in turn determines the temperature of the air above. The receipt of solar radiation drives evaporation, so long as there is water available. Heating of the air determines its stability, which affects cloud development and precipitation.

Unequal heating of the Earth's surface creates pressure gradients that result in wind.

Every location on Earth receives sunlight at least part of the year.

The amount of solar radiation that reaches any one spot on the Earth's surface varies according to: Geographic location, Time of day, Season, Local landscape, Local weather.

Solar radiation comes in many forms, such as visible light, radio waves, heat (infrared), x-rays, and ultraviolet rays.

Measurements for solar radiation are higher on clear, sunny day and usually low on cloudy days. When the sun is down, or there are heavy clouds blocking the sun, solar radiation is measured at zero.

2. Temperature : Temperature is a very important factor in determining the weather, because it influences or controls other elements of the weather, such as precipitation, humidity, clouds and atmospheric pressure.

3. Air masses-wind and storms : An air mass is a large body of air with generally uniform temperature and humidity. Air masses control the characteristics of temperature, humidity, and stability.

Location relative to source regions of air masses in part determines the variation of the day-to-day weather and long-term climate of a place.

Winds :-

- The horizontal movement of the atmosphere is called wind.
- Wind can be felt only when it is in motion.
- Wind is the result of the horizontal differences in the air pressure.
- Wind is simply the movement of air from high pressure to low pressure.
- The speed of the wind is determined by the difference between the high and low pressure.
- The greater the difference the faster the wind speed.
- Closer the isobars stronger the winds.

- The wind brings with it the temperature of the area it is coming from, therefore a high pressure in a warm region will make the temperature in the low pressure area higher.
- Wind-chill is the effect of the wind making it feel colder than it actually is.
- As the wind speed increases air is moving more quickly and therefore removes warm air therefore making it seem colder than the actual temperature.

4. Pressure systems:

- Air pressure is the weight of air resting on the earth's surface.

- Air has specific weight.
- This weight exerted by the air is atmospheric pressure.
- It is defined as the force per unit area exerted against a surface by the weight of air above that surface in the Earth's atmosphere.

Pressure systems have a direct impact on the precipitation.

In general, places dominated by low pressure tend to be moist, while those dominated by high pressure are dry.

The seasonality of precipitation is affected by the seasonal movement of global and regional pressure systems.

5. Ocean Currents:

Ocean currents greatly affect the temperature and precipitation of a climate.

Those climates bordering cold currents tend to be drier as the cold ocean water helps stabilize the air and inhibit cloud formation and precipitation. Air traveling over cold ocean currents lose energy to the water and thus moderate the temperature of nearby coastal locations.

Air masses traveling over warm ocean currents promote instability and precipitation. Additionally, the warm ocean water keeps air temperatures somewhat warmer than locations just inland from the coast during the winter.

6. Topography:

Topography affects climate in a variety of ways.

The orientation of mountains to the prevailing wind affects precipitation.

Windward slopes, those facing into the wind, experience more precipitation due to orographic uplift of the air.

Leeward sides of mountains are in the rain shadow and thus receive less precipitation.

Air temperatures are affected by slope and orientation as slopes facing into the Sun will be warmer than those facing away.

Temperature also decreases as one moves toward higher elevations.

7. Humidity :

- Atmospheric moisture is the most important element of the atmosphere which modifies the air temperature.
- Humidity is the measurable amount of moisture in the air of the lower atmosphere.

- There are three types of humidity:-

- a) Absolute humidity:-

- The total amount of water vapor present in per volume of air at a definite temperature.

- b) Relative humidity:- Is the ratio of the water vapors present in air having a definite volume at a specific temperature compared to the maximum water vapors that the air is able to hold without condensing at that given temperature.

c) Specific humidity:-

Is defined as the mass of water vapor in grams contained in a kilogram of air and it represents the actual quantity of moisture present in a definite air.

- The humidity element of weather makes the day feel hotter and can be used to predict coming storms.
- The humidity element of climate is the prolonged moisture level of an area that can affect entire ecosystems.

8. Precipitation :

- Precipitation is the term given to moisture that falls from the air to the ground.
- Precipitation includes snow, hail, sleet, drizzle, fog, mist and rain.
- Precipitation is simply any water form that falls to the Earth from overhead cloud formations.
- As an element of weather, precipitation determines whether outdoor activities are suitable or if the water levels of lakes and rivers will rise.

- As an element of climate, precipitation is a long-term, predictable factor of a region's makeup.
- For instance, a desert may experience a storm (weather) though it remains a typically dry area (climate).

9. Cloudiness :

Clouds are suspended water in the atmosphere.

- Clouds are usually the most obvious feature of the sky.
- Clouds give us a clue about what is going on in our atmosphere and how the weather might change in the hours or even days to come.

- Each type of cloud forms in a different way, and each brings its own kind of weather.
- Clouds play multiple critical roles in the climate system.
- In particular, being bright objects in the visible part of the solar spectrum, they efficiently reflect light to space and thus contribute to the cooling of the planet.
- A small increase in cloud cover could, in principle, balance the heating resulting from greenhouse gases.
- Clouds are the base for precipitation.
- In summer cloudy days provide protection from the rays of the sun.

- In winter cloudy skies at night diminish nocturnal radiation and check the fall of temperature.
- Clear calm winter nights are usually the coldest and helps in condensation.

10. Visibility :

- The most critical weather element.
- Obstructions to visibility include clouds, fog, smoke, haze, and precipitation.
- is represented by the meteorological optical range (MOR).
- b) varies with the background illumination.

- In extremely clean air in Arctic or mountainous areas, the visibility can be up to 70 kilometres (43 mi) to 100 kilometres (62 mi).
- visibility is often reduced somewhat by air pollution and high humidity.

Fog and smoke can reduce visibility to near zero, making driving extremely dangerous.

- The same can happen in a sandstorm in and near desert areas, or with forest fires.

Heavy rain (such as from a thunderstorm) not only causes low visibility, but the inability to brake quickly due to hydroplaning.

- Blizzards and ground blizzards (blowing snow) are also defined in part by low visibility.

Controls of climate:

1. Latitudes;
2. Altitude;
3. Land and water;
4. Distance from land and water;
5. Low and high pressure cells
6. Winds and air masses;
7. Mountains barriers/Relief;
8. Ocean currents.