

A Study of Climatology and Climate Controls

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ABSTRACT-

The atmospheric science discipline of climatology examines the causes of climatic variations and changes, as well as the effects they have on human behaviour. The same atmospheric processes that meteorology examines are also dealt with by climatology, but it also aims to pinpoint the slower-moving factors and more significant long-term changes, such as ocean circulation and minute but quantifiable changes in solar radiation intensity. Here we give a concise overview of climatology, its types, history and also the climate control elements.

KEYWORDS- *Atmospheric science, meteorology, climatology, radiation intensity etc.*

I. INTRODUCTION

The study of the atmosphere and changing weather patterns is known as climatology. This branch of study focuses on observing, analysing, and comprehending global weather patterns and the atmospheric conditions that produce them. Meteorology, the study of the weather and weather forecasting, is commonly confused with it. However, the primary focus of climatology is on the natural and man-made factors that affect long-term weather patterns. Climatologists are the name given to scientists who specialise in this area. The study of climatic differences and changes, as well as its practical ramifications, are addressed by the field of atmospheric sciences known as climatology. The same atmospheric processes that meteorology examines are also dealt with by climatology, but it also aims to pinpoint the slower-moving factors and more significant long-term changes, such as ocean circulation and minute but quantifiable changes in solar radiation intensity.

HISTORY AND BACKGROUND- The earliest climate studies date back to ancient Greece, but modern climate science did not develop until the nineteenth century, with the coming of the industrial age. As scientists' interest in weather patterns increased, climatology as a science grew. Climate scientists have recently concentrated much of their attention on the climatic changes that have taken place since the industrial revolution. As human activity has expanded and added more carbon to the atmosphere, Earth has been getting warmer and warmer. For climatologists, the effect known as global warming is of great importance. Climatologists can better comprehend and foresee the long-term effects of climate change by studying global warming.

WHAT DO CLIMATOLOGISTS STUDY?- Three key facets of climate are the core topics of climatologists' research. The weather patterns that control typical circumstances in many parts of the world make up the first aspect. Second, climate scientists work to comprehend the connection between various weather factors like temperature and sunlight. The way that weather varies through time is the third feature of climate that climatologists examine. Results from this kind of research have demonstrated how human actions, such as rising global temperatures, are having an impact on the Earth's general climate. As a result, climatologists also research human influences on climate change. They have a special focus on human activities that create greenhouse gases and their connection to global warming.

Climate scientists also take into account the cyclical variations in air and ocean temperatures over the Pacific Ocean, such as El Nio and La Nia, which are phases in the cycle. Climates all across the world are impacted by the oscillation between the warm El Nio and the chilly La Nia phases. The typical disparity between ocean and air temperatures changes as a result of these ocean current patterns. Scientists also take into account how changes in solar energy and activity throughout time affect climate. Natural occurrences like volcanic eruptions, which spew vast volumes of ash and other materials into the sky, can have an impact on global warming. Large volumes of greenhouse gases are released into the atmosphere as a result of these events, protecting Earth from solar radiation, but they also contribute to global warming. Nevertheless, a significant portion of the climate change that climatologists research is linked to human activity, particularly the use of fossil fuels by humans, which are the primary source of greenhouse gases in the atmosphere at this time. Scientists can learn more about how human activity has impacted Earth's climate by examining the effects of these gases, as well as how those changes might continue if people continue to emit greenhouse gases into the atmosphere.

STUDY OF CLIMATE CONTROLS- The atmosphere is made up of a combination of gases, moisture, and temperatures that, in one way or another, regulate the circumstances necessary for the existence of life on Earth.

These circumstances are constantly relatively dynamic and open to alter at any given moment. The fluctuations in the atmosphere and the energy dynamics of the earth have a significant impact on how people behave in the environment on a daily basis. Together, these factors—the rotation of the earth and the sun's radiation—produce ongoing, cumulative circumstances of climate and weather events that have an impact on human life on earth.

- **Weather and Climate** - The atmospheric conditions of a location are referred to as the weather, and they are often influenced by variables like temperature, wind, air pressure, and water vapour at any given time. Thus, although climate is the accumulation of weather patterns over a certain period of time at a particular location or region, weather may be regarded as a continuous change in the atmospheric state at a given time and place. As a result, forecasts for the weather are rarely longer than 10 days, in contrast to considerably longer forecasts for a region's climate, which is often stable and predictable.

- **Climatology** - As its name implies, climatology is the study of climate, or more specifically, the average weather conditions over a specific time period. It is regarded as one among the "atmospheric sciences," which are frequently grouped under the umbrella term "earth sciences." Using various analogue climate models, climatology knowledge can be used to produce short-term weather forecasts. In order to comprehend climate patterns and forecast future weather and climate, climatology may look at historical climates using geological information and other sources in addition to present climate data. In order to understand climate, climatology uses statistical data and mathematical models, but because there are so many complicated processes and factors at play, climate science is not an exact science because the equations used to apply physical principles are typically approximations.

Basic types of climatology-Climatology consists of the basic presentation of data and its verbal or cartographic description.

1. Physical Climatology deals largely with the energy exchanges and physical components.

2. Dynamic Climatology is more concerned with atmospheric motion and exchanges that lead to and result from that motion.

3. Applied Climatology is the scientific application of climatic data to specific problems within such areas of forestry, agriculture, and industry. It can involve the application of climatic data and theory of other disciplines, such as geomorphology and soil science.

CLIMATE CONTROLS

Several factors known as climatic controls are what cause the variations in climatic elements from location to location and from season to season. Every ocean and continental region's climate is mostly controlled by four climatic factors. Latitude, water and land distribution, terrain, and ocean currents are some of these controls. Man is now a substantial impact in shaping the climate of a region. As a climate factor, man's impact on the environment through pollution, deforestation, and irrigation is now recognised.

Latitude: The position of the earth in relation to the Sun, or latitude, significantly affects climatic factors. The distance of the Sun from the equator determines the angle at which sunlight strikes Earth and the amount of Sun hours per day. Therefore, the latitude directly affects the origins, directions, and weather that air masses bring into a place.

Distribution of Land and Water

The positioning of continents and seas has a significant impact on both the sources of air mass movement and the pattern of air temperature on Earth.

(a) Air Temperature Influence

The temperature parameters of the land or water that is on the windward side of a coastal location are assumed. For instance, west coastlines of continents have oceanic temperatures while east coasts have continental temperatures depending on the latitude of the predominant westerly winds. Over oceanic regions, air temperature differences between day and night and between winter and summer are significantly lessened by mixing processes in the upper layer of the ocean. Due to the lack of heat redistribution via turbulence and the low influence of conduction, the interior of the continents exhibits strong seasonal and nocturnal variations. Due to more ocean surface in the Southern Hemisphere and the Southern Hemisphere's landmass narrowing toward the poles, the temperature gradient in the Southern Hemisphere does not experience the same seasonal variation as it does in the Northern Hemisphere.

Another crucial aspect affecting air temperature is the distribution of clouds and water vapour. Due to the greenhouse effect, solar energy is easily trapped in the lower layers in places with a high percentage of clouds. Therefore, locations with a lot of moisture have a comparatively high temperature.

(b) Impact on Air Circulation

Due to the influx of warm equatorial waters from the Southern Hemisphere into the Northern Hemisphere brought on by the southeast trade winds across the equator, the Northern Hemisphere has a higher mean temperature due to its higher percentage of land and warmer oceans. Another issue is that physical barriers partially shield the oceans of the Northern Hemisphere from the arctic ice and chilly polar waters. The Antarctic region and the southern oceans are not separated by such a barrier.

Topography:

A region's topography has a significant impact on the climate there. An area's elevation above sea level has a significant impact on its climate. Surface elevation has an impact on all climatic parameters. Mountainous terrain, particularly the long, high chains of mountains that serve as climatic divisions, has a significant impact on climate. Certain air masses may be blocked by the mountain range's direction and unable to reach the lee side of the mountains. For instance, the Himalayas' east-west direction hinders the advance of arctic air masses southward. As a result, India has a warmer winter climate than other places at the same latitude. The dispersion of precipitation is the most prominent effect of mountains (higher values of precipitation on windward side than on the leeward side). Lakes are a significant geographical element as well. For large, ice-free bodies of water, the lake effect might be noticeable. The lee sides of lakes exhibit significant diurnal and annual variation, including more temperate temperatures, greater moisture, cloud cover, and precipitation, stronger winds (owing to reduced friction), and effects of land and sea breezes.

Ocean currents: The climate of some areas is significantly influenced by ocean currents. Ocean currents carry heat by pushing the heated equatorial water pole ward into cooler waters and the warm polar water equator ward into warmer waters. Since the main wind systems are what drive currents, warm northward-moving currents flow along the east coasts of continents and cold southward-moving currents along their west coasts. Both hemispheres agree that this is true. In essence, this causes the east coastlines to have warmer climates and the west coasts to have cooler climates.

II. CONCLUDING REMARKS

The study of atmospheric conditions over a longer time horizon is called climatology. It comprises researching the many weather patterns that exist in a location. Dynamic changes in the environment lead to variety and occasionally extreme conditions that require both short- and long-term management. As a result, climatology can be summed up as the weather at a location over a specific time frame. It's intriguing to study climatology. Along with the operations and makeup of the environment, it also directly links to how people live their daily lives. Applied climatology is used to: a) increase the effectiveness of a variety of economic operations that are influenced by the climate; b) support social demands; and c) lessen the losses brought on by climatic disasters.

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