

## **T-1: Introduction to Climatology and Atmosphere**

1. Definition, nature and scope
2. Importance of Climatology in modern times.
3. Weather and climate, elements of weather and climate
4. Composition and structure of the atmosphere

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### **1. Definition, nature and scope**

The study of the Earth falls into four broad categories:-

- The solid lithosphere
- The liquid hydrosphere
- The gaseous atmosphere
- The life biosphere

**Geo/Litho sphere:** The area from the surface of Earth down to its center is called the geosphere.

**Atmosphere:** The blanket of gases that surrounds our planet is called the atmosphere.

**Hydrosphere :** All the water on Earth, including the water in the atmosphere, makes up the hydrosphere.

**Biosphere:** The biosphere includes all organisms on Earth as well as the environments in which they live.

### **Climatology: Meaning and Definitions:**

- Climatology studies the gaseous atmosphere
- Climatology is the science of climate which study the Physical state of the atmosphere:-
  - over a specific region
  - during a specific period
  - on the basis of climatic data
- Climatology is compounded of two Greek words.....,
- **Klima** and **Logos**

--**Klima**- meaning *inclination that is latitude*

--**Logos**-meaning *science of study*

So, climatology is a science that seeks to describe and explain:-

- the nature of climate
- why it differs from place to place
- how it is related to other elements of the natural environment and human activities
- It is the study of the verities of climates found on the Earth and their distribution over the surface of the Earth

### **Definitions of Climatology:**

- Climatology is the science of climate which study the Physical and spatial state of the atmospheric conditions
- **According to Critchfield:-**
  - ‘climatology is the science that seeks to describe and explain the nature of climate, how it differs from place to place and how it is related to man’s activities.’

- **According to Austin Miller:-**
  - ‘Climatology is that branch of science which discusses the average conditions of weather.’
- **According to Koppen and De Lang:-**
  - ‘Climatology is a summery, a composition of weather conditions over a long period of time.’
- **According to Thornthwaite:-**
  - ‘Thornthwaite broadens the scope of climatology and suggest that it is the study of the atmosphere as well as the Earth’s surface.’

### **Nature of Climatology:**

With the help of following points, nature of climatology can explain in proper direction:

1. Descriptive
2. Dynamic
3. Scientific
4. Interdisciplinary
5. Applied
6. Complex

#### **1. Descriptive Nature:**

- In ancient period, Greeks geographers study and describe nature of atmosphere and its influence on human health and culture.
- Hippocrates (BC400), in his written document “Air, Water and Place” where he described the influence of climate on health.
- Theophrastus described different aspects of wind
- Ancient Greek described three temperature zone based on latitude...
  - i) tropical zone, ii) temperate zone, iii) frigid zone
  - The knowledge of weather and climate up to 16<sup>th</sup> century was descriptive.
- Because qualitatively observed data and description by non-professional individual.

#### **2. Age of Discovery and Exploration: (15<sup>th</sup> to 16<sup>th</sup>) Dynamic**

- Discovery and exploration of new areas and there features of weather and climate.
- Study of weather and climate outside the Europe.

#### **3. Scientific Nature: (Period Scientific Analysis)**

- Climatology as science blossomed in 17<sup>th</sup> century when few instrument invented to measure climatic variable.
- Measurement and recording of temperature started with invention of thermometer..... **by Galileo In 1593 and by Santorre in 1612.**
- Measurement of Pressure started with invention of barometer by Torricelli in 1643.
- availability of data on temperature and pressure leads to formulation of few laws about atmospheric condition.

Ex..... Francis Bacon’s treatise on wind in 1662, Boyle’ law about the air

pressure and atmospheric gases. Hadley's cell model on tropical circulation in 1735 known as Hadley Cell

**Period of Regional Description: (18<sup>th</sup> and 19<sup>th</sup>)**

- This period is characterized by study of weather phenomenon at regional and global levels
- Efforts were made to prepare maps of the countries, continents, and globe.
- Depicting climatic variables like... insolation, temperature, air pressure, and wind, atmospheric disturbances, precipitation etc..
- Description of all variables of climate and weather of different regions of world.
- Luke Howard, 1803, presented well documented on classification of clouds.
  - ❖ IMC : (International Meteorological Committee) in 1895.
  - ❖ WMO: World Meteorological Organization- published international Clouds atlas.
- ❖ Alexander Von Humboldt in 1817 prepared World map of mean annual temperature using isotherms

**Interdisciplinary- Applied and Complex:**

Modern nature: Period of Modern Climatology (20<sup>th</sup> century):

- climatology reached to study upper circulation and weather phenomena , information obtained through advanced techniques.

Period was marked by

1. Advancement in techniques to obtain detailed regular climatic data.
2. Concentration on classification of world climate.
3. Concerned about the climatic changes.
4. Weather forecasting.
5. International cooperation to tackle the future problems of climatic changes at local, regional and global levels caused mainly by anthropogenic factors.

\*Stratosphere and Ozone layer discovered in 1902, 1913 respectively

\*Jet Stream during II<sup>nd</sup> World War

\*Satellite Climatology as new branch and first meteorological satellite TIROS 1, USA launched in 1960.

\*Schema of Classification of World Climate-Walderimir Koppen, Geiger Pohl C W Thornthwaite

**Scope of Climatology:**

- Content or Scope of any discipline largely depend on its aims and objectives.
- The scope covering all the contents of climatology may be described through its major
  - **Branches** i.e.....
    - Physical and Dynamic climatology
    - Regional Climatology
    - Applied Climatology

**Physical & Dynamic climatology:-**

**Physical climatology:-**deals largely with energy exchanges and physical processes.



**Dynamic climatology** is more concerned with atmospheric motion and exchanges lead to and result from that motion

- seeks to explain the factors responsible for bringing out the temporal and spatial variations in heat exchange, moisture exchange and air movement

-- Physical climatology is closely related to meteorology

-- Physical climatology is a main aspect meteorology from which most of its basic principles are drawn

-- the focus is on:-

i. The study of solar energy- its transformation at a location and its transfer through the atmosphere

ii. The complicated patterns and exchange of energy from one phase to another- from solid state to liquid state and from liquid state to vapor and vice versa

### **Dynamic climatology:-**

- --is global in scope
- --it studies the thermodynamic processes in the atmosphere and the resultant atmospheric motions
- --it investigate the impact of changes in various physical parameters on climate
- --this branch of climatology includes:-

i. The effect of the increase of greenhouse gases in global temperature

ii. the role of mountains in determining the dynamics of the atmosphere  
An investigation into sea-surface temperature

### **Synoptic climatology:-**

--deals with local or hemispheric climate from the view point of atmospheric circulation

--different circulation patterns lead to differences in climates

--it studies the relationship between circulation features and severe weather conditions-E.g.- the effect of El Nino and La Nina in creating severe weather conditions

### **Regional climatology:-**

- -- This branch of climatology seeks to determine
- and describe the various types of world climates
- --it is also known as descriptive climatology because it is concerned with the identification of important climatic characteristics and the interaction of weather and climatic elements upon the life, health and economic conditions of the people and areas

### **Applied climatology:-**

-- This branch of climatology is concerned with the application of the climatological knowledge to practical problems

-- It analyses the relationship of climatology to other sciences

--The main purpose is to find out the ways and means to make use of our knowledge of climatic elements for the betterment of human life on the Earth