

Quadrant II –Notes

Programme: Bachelor of Arts and Science

Subject: Geography

Course Code: GEC 106

Course Title: Climatology and Oceanography.

Unit: II– Extreme Events and Climatic Classification

Module Name: Classification of World Climates: Schemes of Thornwaite's.

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Notes:

➤ Climate

- Climate is defined as the average weather conditions over a long period of time in a region.
- **Basis for Climatic Classification:**
- On the basis of empiricism and genetics, the climate of the world is classified into various types.
 1. Empirical classification is based on statistics, experiments or physical characteristics relating to climate.
 2. Genetic classification is based on the causes or the genesis of climatic variation.
- Climatic classification is closely correlated with categorization of biomes as climate is a major influence on biotic life.
- There are different schemes with regards to climatic classification like:
 1. Koppens Climatic Classification
 2. Thornwaites Climatic classification
 3. Trewarthas Climatic Classification.

❖ **Thornwaite's Climatic Classification:**

- Charles Warren Thornthwaite's, an American climatologist attempted classification of world climates in 1931. He later modified the climatic classification and revised it in 1948.
- Thornthwaite's classification is an improved and modified form of Koppen's classification of climates. The classification of climates is based on the concept of potential evapotranspiration (PET).

A. Thornwaite's 1931 Classification:

- In 1931 Thornwaite devised a complex and empirical classification which is very close to Koppen's scheme. He also considered natural vegetation of a region as the indicator of climate of that region. He accepted the concept that the amount of precipitation and temperature had paramount control on vegetation.
- He also pleaded for inclusion of evaporation as important factor of vegetation and climate. Thornwaite used two factors e.g. Precipitation effectiveness and Temperature effectiveness for delimitation of different climatic regions.

1. Precipitation Effectiveness:

- It is also known as precipitation efficiency and it refers to the amount of precipitation available for the growth of vegetation. He used P/E ratio to calculate the amount of water available to vegetation.
- P/E ratio is thus calculated by dividing total monthly Precipitation by evaporation. It is derived by summing the P/E ratio of 12 months. On the basis of P/E index, Thornwaite indentify 5 Humidity Zones.

- **Climatic Groups Based on Precipitation Effectiveness:**

Humidity Province	Vegetation	P/E Index
A (Wet)	Rain Forest	127
B (Humid)	Forest	64-127
C (Subhumid)	Grassland	32-63
D (Semi-arid)	Steppe	16-31
E (Arid)	Desert	< 16

On the basis of the Seasonal distribution of Precipitation the Humidity province were sub-divided into the following:

Ar	Bw	Cs	Dd
Aw	Bs	Cd	Er
As	Bd	Dr	Es
Ad	Cr	Ds	Ew
Br	Cw	Dw	Ed

- Where, r- Rainfall adequate in all seasons.
- S- Rainfall deficient in summer
- w- Rainfall deficient in winter and
- d- Rainfall deficient in all seasons.

2. Temperature Efficiency:

- Temperature efficiency relates to variation in temperature and its role in the growth of plants. Thermal or Temperature efficiency index is calculated by sum of 12 monthly values of T-E ratio.
- He divided the world into six temperature provinces on the basis of T/E index.
- **Main Climatic Groups Based on Thermal Efficiency:**

Temperature Province	T/E Index
A'– Tropical	127
B' - Mesothermal	64-127
C' - Microthermal	32-64
D' - Taiga	16-31
E' -Tundra	1-15
F' - Frost	0

- Thus, on the basis of Precipitation and thermal effectiveness and seasonal distribution of rainfall there exist 120 climatic types but Thornwaite has shown only 32 Climatic types on the world map.

❖ **Thornwaite's 1948 Classification:**

- In 1948 Thornwaite proposed a new classification of climate which is his most valuable contribution. His second classification is based on the concept of Potential Evapotranspiration which represents the amount of moisture that would be transferred to the atmosphere by evaporation of liquid or solid water plus transpiration from plants.
- The Potential Evapotranspiration (PE) is calculated from the mean monthly temperature with respect to 30 day –month (12-hours days).
- Thornwaite developed four indices to determine boundaries of different climatic types e.g.
 - A. Moisture index (Im)
 - B. Potential evapotranspiration or thermal efficiency index (PE)
 - C. Aridity and Humidity index, and
 - D. Index of concentration of thermal efficiency or potential evapotranspiration.

1. Moisture Index (Im):

- It refers to moisture deficit or surplus and it is calculated by $Im = (100S - 60D)/PE$.
- The sum of 12 monthly values of Im gives the annual moisture index.

2. Thermal Efficiency Index:

- It is simply the potential evapotranspiration expressed in cm. It is derived from the PE value as it a function of temperature.

3. Aridity and Humidity Index:

- It is used to determine the seasonal distribution of moisture adequacy. Aridity index – In moist climates water deficit taken as a % of annual PE becomes aridity index.
- Humidity index- In dry climates annual water surplus taken as a % of annual PE becomes humidity index.

4. Concentration of Thermal Efficiency:

- It refers to the percentage of mean annual potential evapotranspiration (PE) accumulating in three summer months.

❖ Criticism of Thornwaite's classification:

- Thornwaite's classification has ignored the role of prevailing winds, relative humidity, air pressure and air masses.
- It is not satisfactory for tropical and semiarid areas.
- Availability of data for all the meteorological variables over time and space is a serious problem.
- Despite being an improved classification qualitatively, it is being less used and of limited application because of its complex nature.

