

Higher 2 (9173)	Tropical Environments	TMJC
C2 Lecture 1	Characteristics of Tropical Climates	2025

LECTURE OBJECTIVES

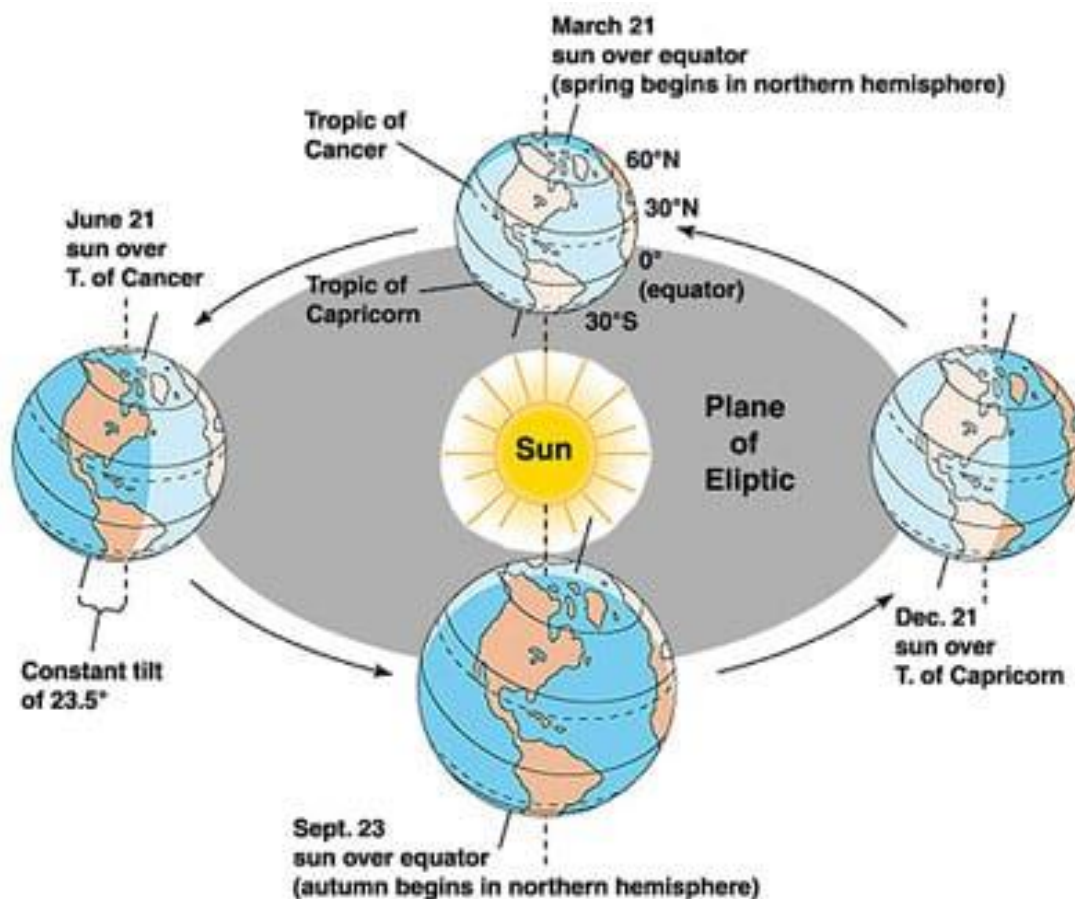
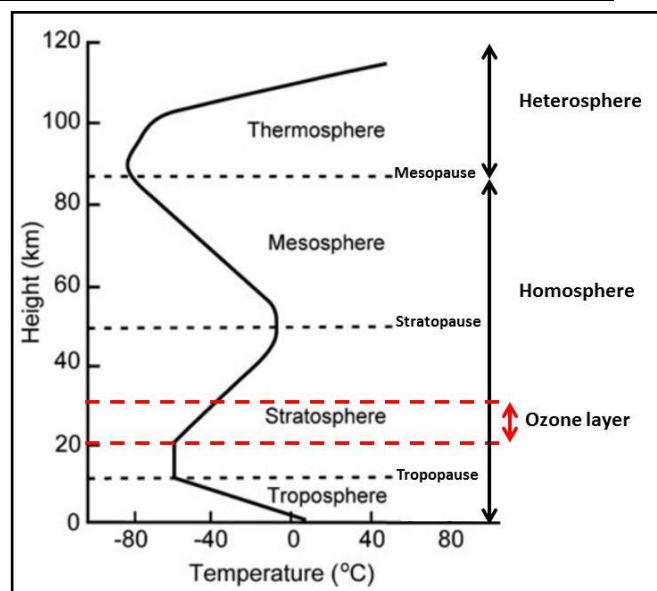
1. Discuss the dynamism of natural environments in the tropics
 - Distinguish tropical climates based on the Koppen-Geiger climate classification system

Introduction

Climate is defined as the average weather conditions of a place over a long period of time, usually 30 years or more. It should not be confused with the weather, which is defined as the condition of the atmosphere at a particular time, or over a short period of time (hours or days).

Most of the atmosphere, and therefore our climate and weather, is concentrated within the troposphere, within 16km of the Earth's surface at the Equator and 8km at the Poles. (Don't need to Memorise!)

Before we begin: Recall the difference between the earth's revolution and rotation.



(A) WHAT IS THE TROPICS?

1. The tropics is defined as a climatic region of radiation surplus¹ located between 30-35 degrees north and south of the equator (Fig. 1).
 - a. Due to radiation surplus, areas within the tropics have high average annual temperatures of at least 18°C. There is however, some variation in the annual temperature range and diurnal temperature range within the tropics.
 - b. Unlike temperature, precipitation patterns within the tropics differ widely, ranging from the:
 - i. Humid tropics: Tropical Rainforest (Af) climate.
 - ii. Seasonally Humid tropics: Tropical Monsoon (Am) climate and Tropical Savanna (Aw) climate.
 - iii. Arid tropics: Sub-tropical steppe (BSh) climate and Tropical desert climate (BWh).

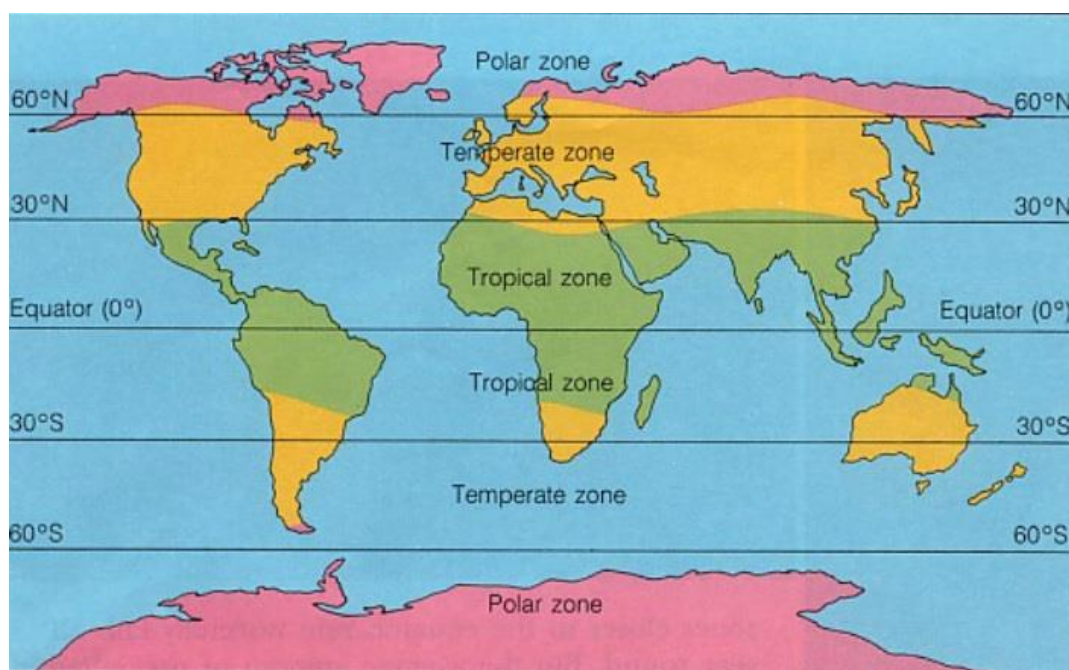


Fig. 1: Areas defined as 'tropics'

(B) WHAT ARE VARIOUS TYPES OF CLIMATES PRESENT IN THE TROPICS?

1. For the current A-Level Geography syllabus, we will examine 5 main types of climates present in the tropics, classified according to the Koppen-Geiger climate classification system. They are the:
 - a) Tropical rainforest (Af) climate
 - b) Tropical monsoon (Am) climate
 - c) Tropical savanna (Aw) climate
 - d) Sub-tropical steppe (BSh) climate &
 - e) Tropical desert (BWh) climate

¹ Radiation surplus means that the outgoing energy from the Earth (in the form of longwave terrestrial radiation) is smaller than the incoming energy from the sun (in the form of shortwave solar radiation) for the particular area.

(C) WHAT ARE THE FEATURES OF THE TROPICAL RAINFOREST (Af) CLIMATE?

1. Temperature characteristics (Fig. 2):
 - a. *Mean annual temperature* is high, usually between 26°C to 28°C.
 - b. *Seasonality of temperature* is absent, with temperatures being constantly high throughout the year.
 - c. *Annual temperature range* is small, usually less than 3°C.
 - d. *Diurnal temperature range* is small at around 10°C, with average temperatures of 32°C in the day and 22°C at night.
2. Rainfall characteristics:
 - a. *Annual total rainfall* is high, at more than 1500mm.
 - b. *Seasonality of rainfall* is absent, with an even distribution of precipitation for each month at a minimum of 60mm. Rainfall is mainly in the form of convective rainfall in the late afternoons.

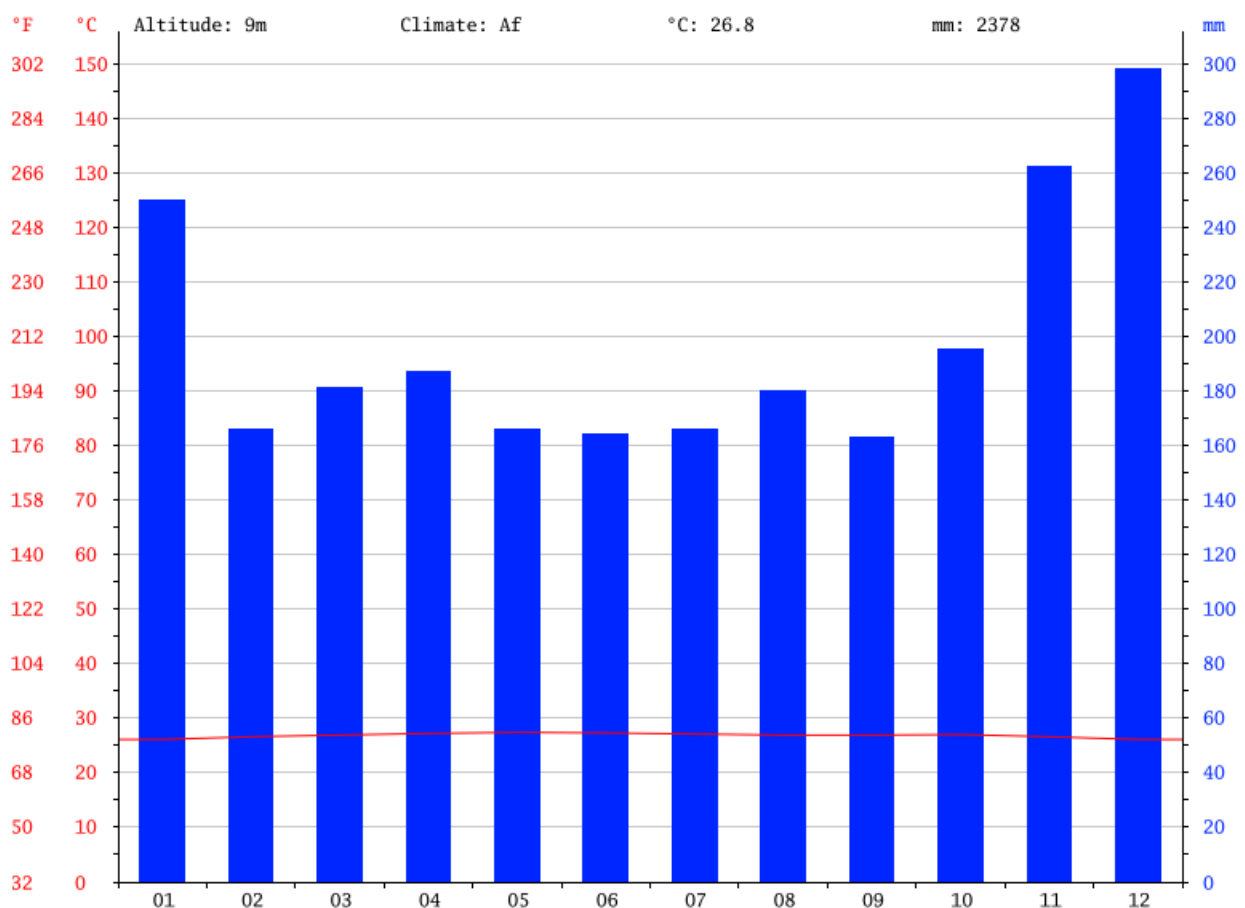


Fig. 2: A climograph of a tropical rainforest (Af) climate

E.g. Singapore

(D) WHAT ARE THE FEATURES OF THE TROPICAL MONSOON (Am) CLIMATE?

1. Temperature characteristics (Fig. 3):

- Mean annual temperature* is high, above 18°C.
- Seasonality of temperature* is present, with temperatures being higher during summer, when the sun is more directly overhead. This occurs during the middle of the year (June) in the northern hemisphere and the end of the year (December) in the southern hemisphere.
- Annual temperature range* is small, but larger than that of tropical rainforest climate, ranging from 3°C to 6°C.
- Diurnal temperature range* is greater than tropical rainforest climate. It is variable depending on season (10°C - 25°C). It may exceed 25°C during dry season when cloud cover is absent, but will be lower during wet season when cloud cover is present.

2. Rainfall characteristics:

- Annual total rainfall* is high, at more than 1500mm.
- Seasonality of rainfall* is present, with a marked short dry season with one or more months receiving less than 60mm. The rainy season is excessively wet, with large amounts of rainfall falling mainly during the wet season.

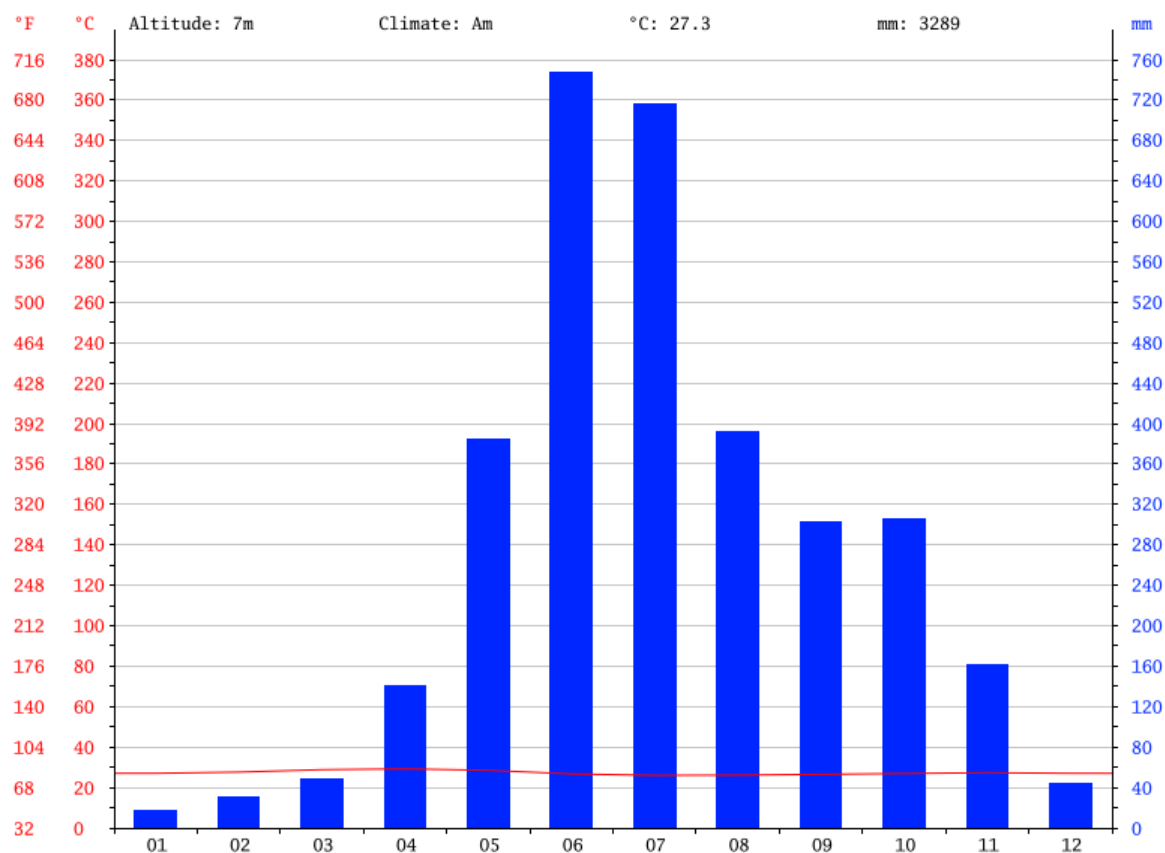


Fig. 3: A climograph of a tropical monsoon (Am) climate
e.g Kerala, India

(E) WHAT ARE THE FEATURES OF THE TROPICAL SAVANNA (Aw) CLIMATE?

1. Temperature characteristics (Fig. 4):

- Mean annual temperature* is high, above 18°C.
- Seasonality of temperature* is present, with temperatures being higher when the hemisphere in which the climate is located in gets more insolation due to the change in position in relation to the overhead sun. Temperature of coolest month is greater than 18°C.
- Annual temperature range* is small, but larger than that of tropical rainforest climate and tropical monsoon climate, ranging from 3°C to 10°C.
- Diurnal temperature range* is greater than tropical rainforest climate. It is variable depending on season (10°C - 25°C). It may exceed 25°C during dry season when cloud cover is absent, but will be lower during wet season when cloud cover is present.

2. Rainfall characteristics:

- Annual total rainfall* is moderate, at between 500mm to 1500mm.
- Seasonality of rainfall* is present, with monthly precipitation totals dropping below 60mm for four to six months during the dry season. The rainfall mainly falls during the wet season, with heavy convectional rainfall during wet season in summer giving 80% of the total annual rainfall in four or five months.

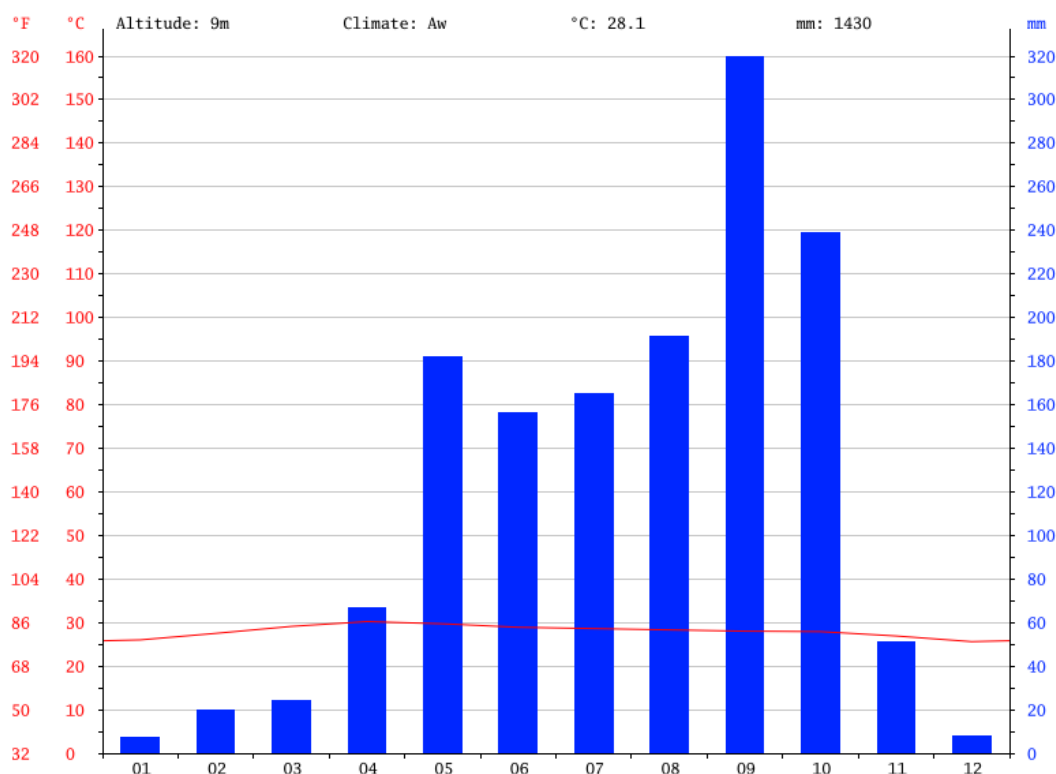


Fig. 4: A climograph of a tropical savanna (Aw) climate E.g. Bangkok, Thailand

(F) WHAT ARE THE FEATURES OF THE SUB-TROPICAL STEPPE (BSh) CLIMATE?

1. Temperature characteristics (Fig. 5):
 - a. *Mean annual temperature* is high, above 18°C.
 - b. *Annual temperature range* is large ranging from 20°C to 30°C.
 - c. *Diurnal temperature range* is very large, ranging from 20°C to 50°C), due to high daily temperatures which can exceed 40°C and low night-time temperatures which can drop below 0°C.
 - d. *Seasonality of temperature* is present, with temperatures being higher during the summer when maximum daytime temperatures can exceed 50°C. The lowest average temperatures occur during winter. Temperature of coolest month is greater than 18°C.
2. Rainfall characteristics
 - a. *Annual total rainfall* is very low, but larger than the tropical desert climate, between 250 and 500 mm.
 - b. *Seasonality of rainfall* is present, with some monthly precipitation totals at above 60mm. Precipitation may occur due to short incursions of the ITCZ or from occasional mid-latitude cyclones.

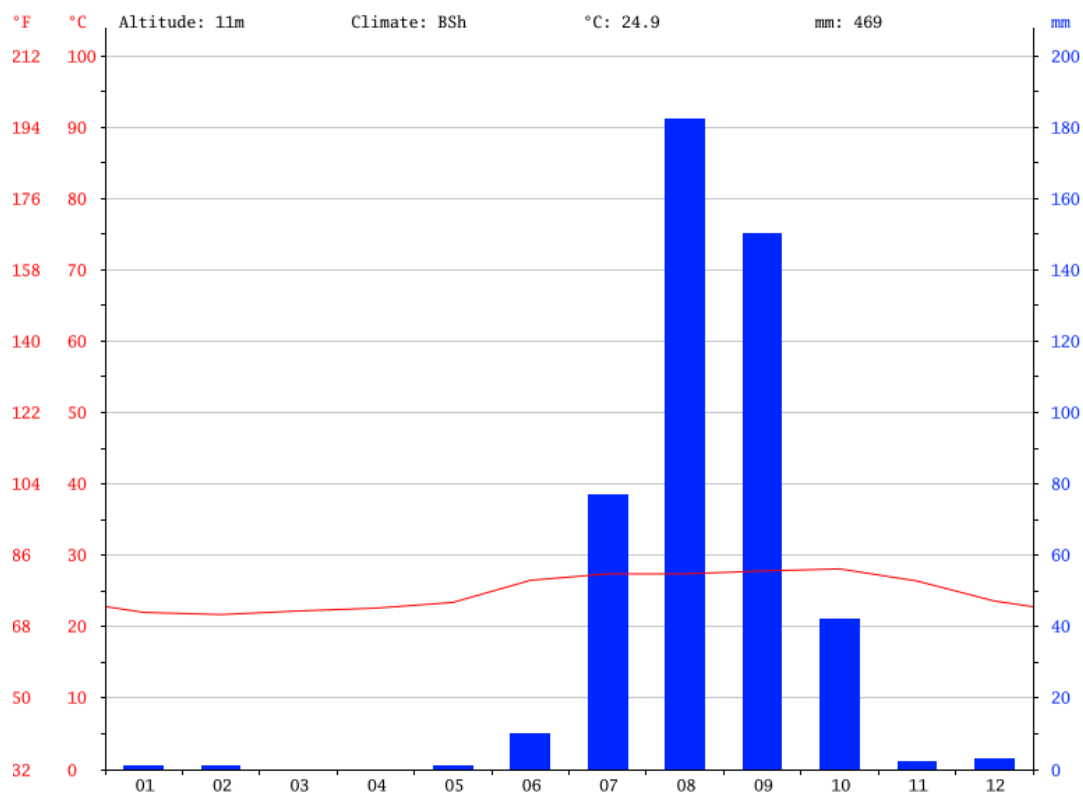


Fig. 5: A climograph of a sub-tropical steppe (BSh) climate (e.g. Dakar, Senegal)

(G) WHAT ARE THE FEATURES OF THE TROPICAL DESERT (BWh) CLIMATE?

1. Temperature characteristics (Fig. 6):

- a. *Mean annual temperature* is high, above 18°C.
- e. *Seasonality of temperature* is present, with temperatures being higher during the summer when maximum daytime temperatures can exceed 50°C. The lowest average temperatures occur during winter. Temperature of coolest month is greater than 18°C.
- b. *Annual temperature range* is large ranging from 20°C to 30°C.
- c. *Diurnal temperature range* is very large, ranging from 20°C to 50°C), due to high daily temperatures which can exceed 40°C and low night-time temperatures which can drop below 0°C.

2. Rainfall characteristics:

- a. *Annual total rainfall* is very low, at less than 250mm.
- b. *Seasonality of rainfall* is absent, with total monthly precipitation below 60mm for all months of the year. Precipitation is irregular and unreliable, usually in the form of convective rainfall during summer.

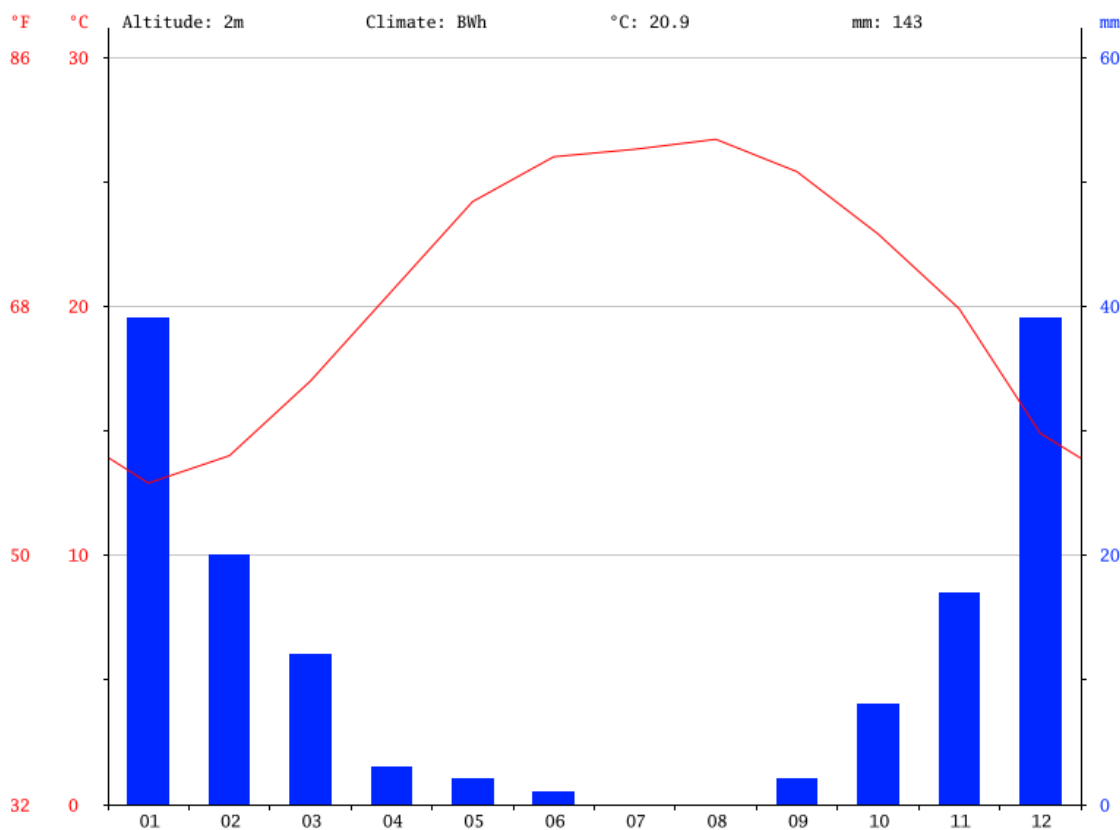


Fig. 6: A climograph of a tropical desert (BWh) climate e.g. Libya

Climatic Zones Summary Table

Climate	Tropical Rainforest	Tropical Monsoon	Tropical Savanna	Sub-Tropical Steppe	Hot Low Latitude Desert
Köppen classification	Af	Am	Aw	BSh	BWh
Temperature Characteristics	Mean annual temperature: Above 18°C (between 26°C to 28°C)	Mean annual temperature: Above 18°C	Mean annual temperature: Above 18°C	Mean annual temperature: Above 18°C	Mean annual temperature: Above 18°C
	Seasonality of temperature: None. Temperatures are high and constant throughout the year.	Seasonality of temperature: Present. Temperatures are higher when the ITCZ is overhead.	Seasonality of temperature: Present. Temperatures are higher when the ITCZ is overhead	Seasonality of temperature: Present. Temperatures are higher during summer when maximum daytime temperatures can exceed 50°C. The lowest average temperatures occur during winter.	Seasonality of temperature: Present. summer when maximum daytime temperatures can exceed 50°C. Lowest average temperatures during winter.
	Annual temperature range: Small (less than 3°C) due to equal length of day and night (lack of seasonality) in a year	Annual temperature range: Small but larger than tropical rainforest (3°C to 6°C)	Annual temperature range: Small but larger than tropical rainforest and tropical monsoon (3°C - 10°C)	Annual temperature range: Large (20°C - 30°C)	Annual temperature range: Large (20°C - 30°C)
	Diurnal temperature range: Small (10°C), with average high of 32°C in the day and average low of 22°C at night	Diurnal temperature range: Variable depending on season (10°C - 25°C). May exceed 25°C during dry season when cloud cover is absent. Lower during wet season.	Diurnal temperature range: Variable depending on season (10°C - 25°C). May exceed 25°C during dry season when cloud cover is absent. Lower during wet season.	Diurnal temperature range: Very large (ranging from 20°C to 50°C), due to high daily temperatures which can exceed 40°C and low nighttime temperatures which can drop below 0°C.	Diurnal temperature range: Very large (ranging from 20°C to 50°C), due to high daily temperatures which can exceed 40°C and low nighttime temperatures which can drop below 0°C.
Rainfall Characteristics	Annual total rainfall: More than 1500mm	Annual total rainfall: More than 1500mm	Annual total rainfall: 500mm to 1500mm	Annual total rainfall: Between 250mm to 500mm	Annual total rainfall: Less than 250mm
	Seasonality of rainfall: Absent. Even distribution of precipitation. <u>Total precipitation for each month exceeds 60mm</u> , no month is considered deficient of rainfall. Rainfall is mainly in the form of convectional rainfall in the late afternoons.	Seasonality of rainfall: Present, with a <u>marked short dry season with one or more months receiving less than 60mm</u> . Rainy season is excessively wet. Large amounts of rainfall fall mainly during the wet season.	Seasonality of rainfall: Present, with monthly precipitation totals <u>dropping below 60mm for four to six months during the dry season</u> . Rainfall concentrated in the wet season. Heavy convectional rainfall during wet season in summer can give 80% of the total annual rainfall in four or five months.	Seasonality of rainfall: Present, with some monthly precipitation totals at above <u>60mm</u> . Precipitation may occur due to short incursions of the ITCZ or from occasional mid-latitude cyclones. Some seasonality	Seasonality of rainfall: Absent, with <u>all monthly precipitation totals below 60mm</u> . Precipitation is irregular and unreliable, usually in the form of convectional rainfall during summer.