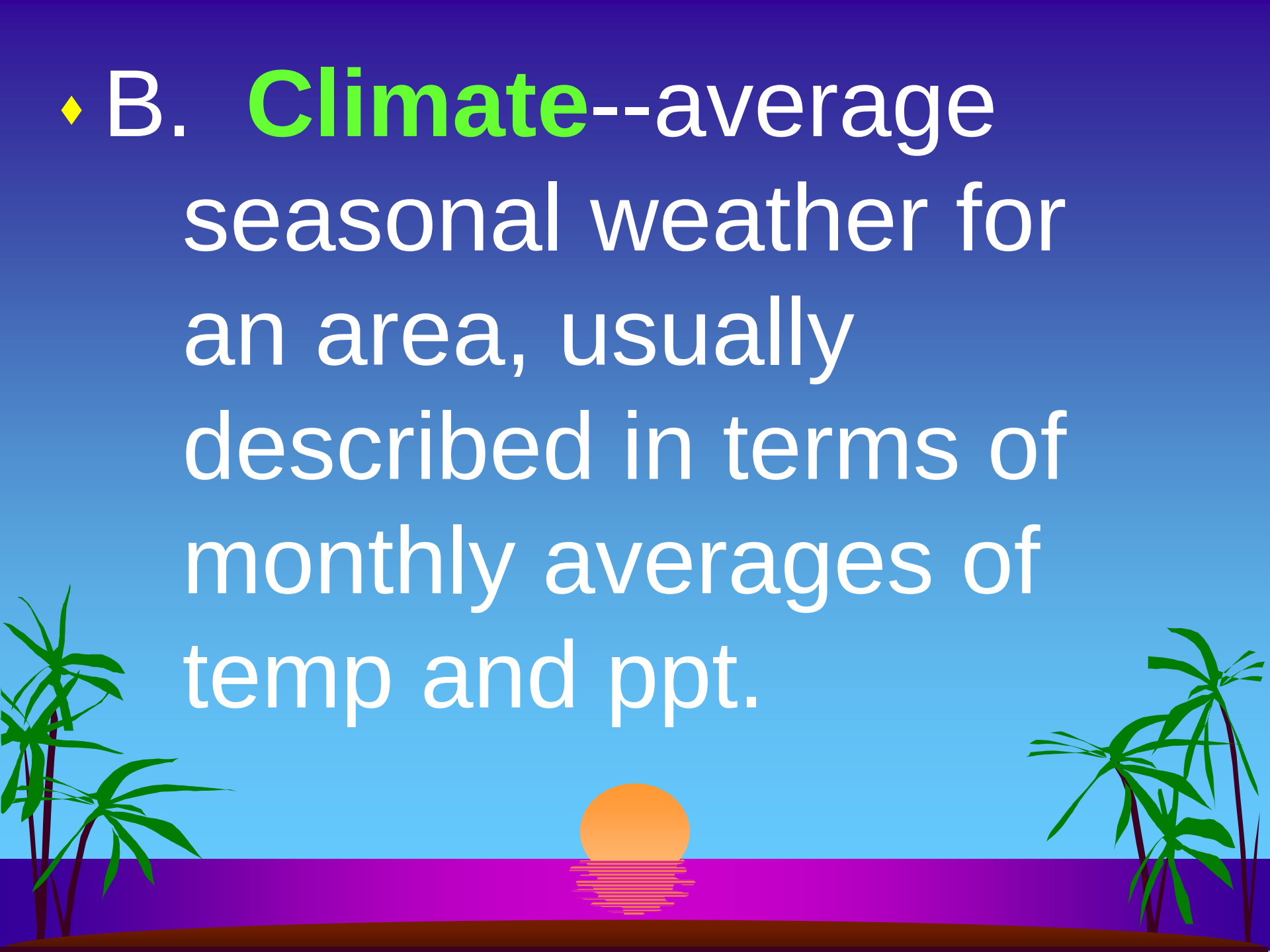

CLIMATE
UNIT

I. Definitions

- A. **Weather**--day by day variations in temperature (temp), winds, pressure and precipitation (ppt)

- B. **Climate**--average seasonal weather for an area, usually described in terms of monthly averages of temp and ppt.

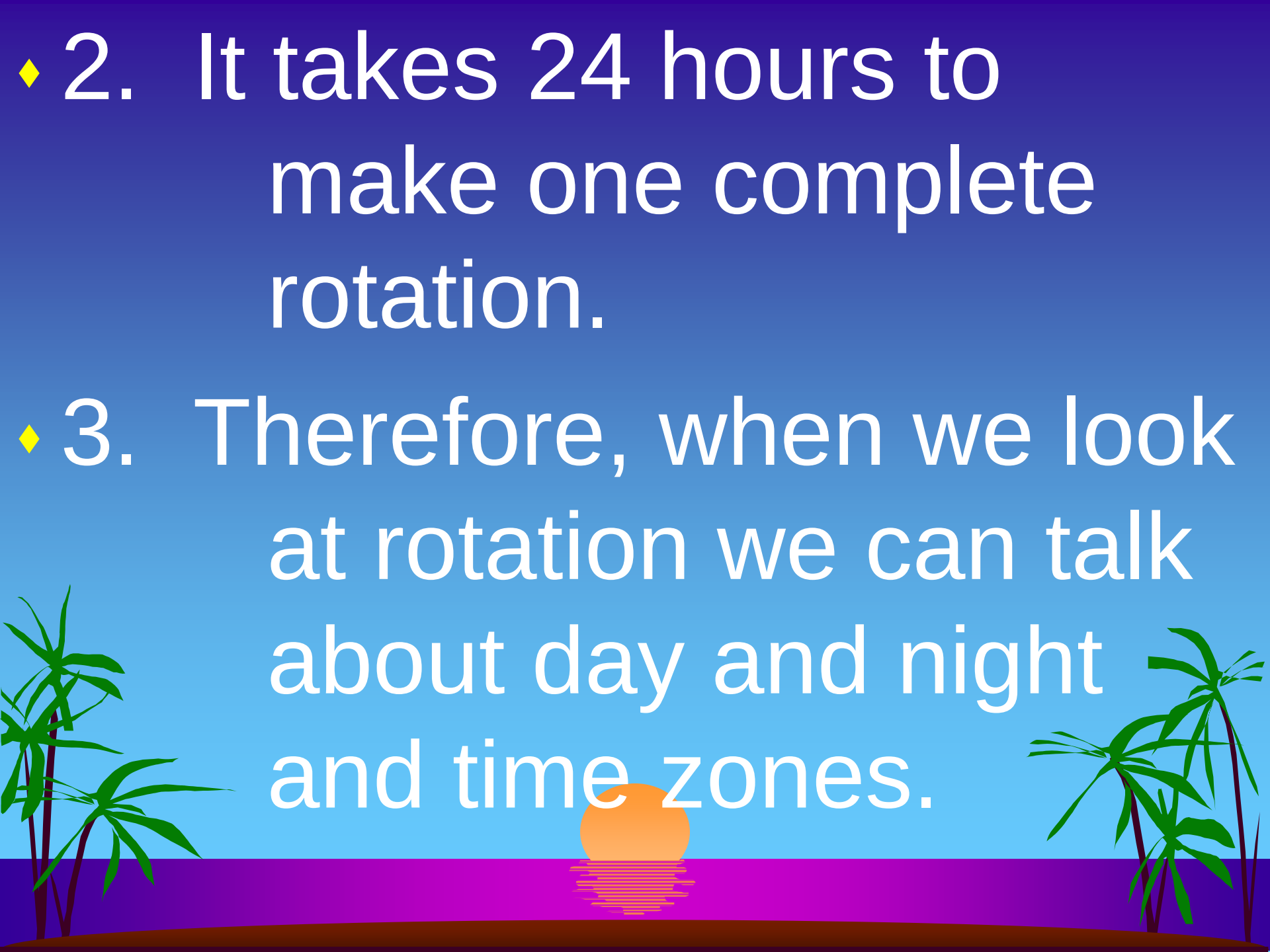


Before we can study about weather and climate we need to know a little about Earth movements and Earth/Sun relations.

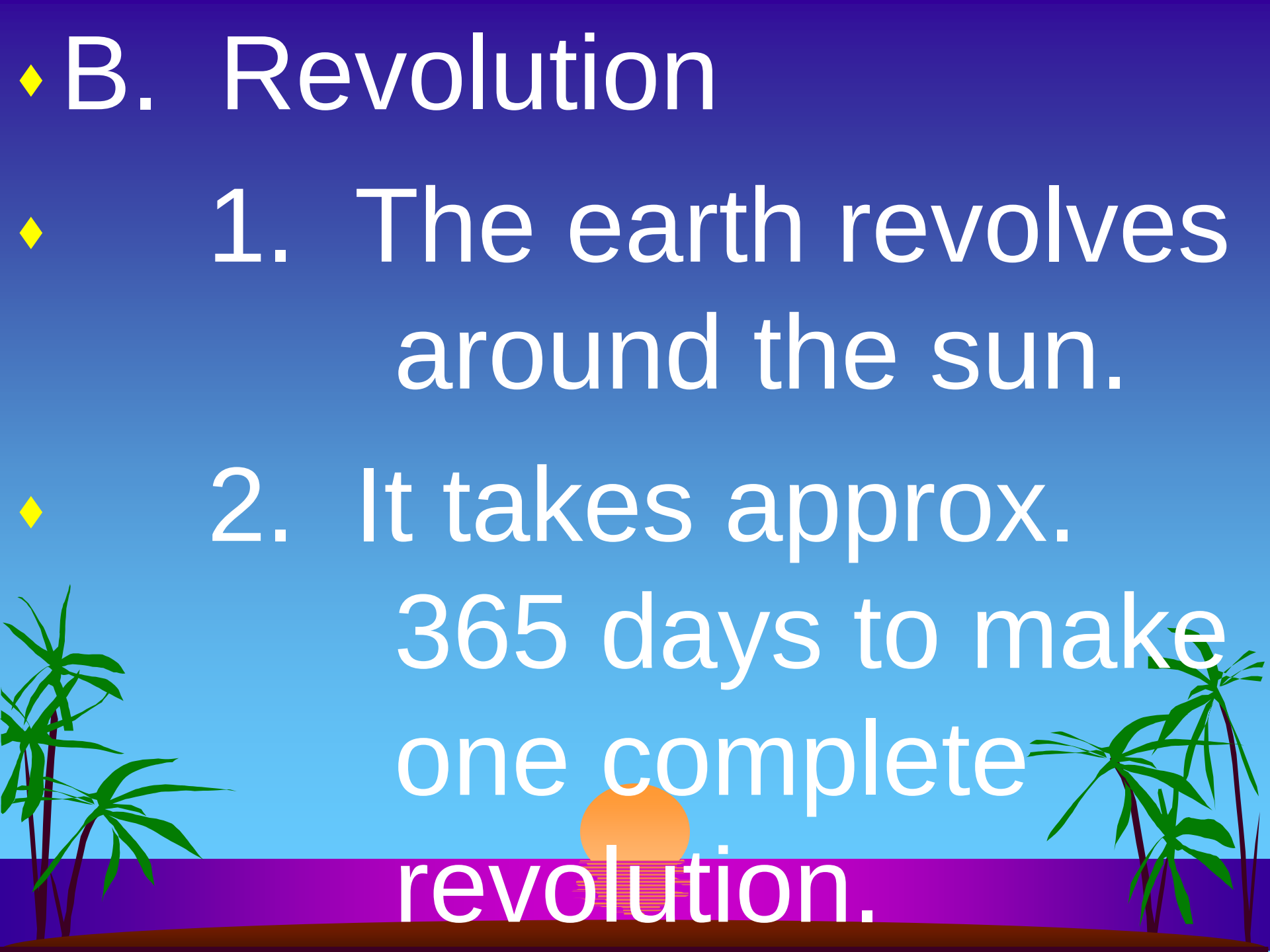
II. Earth Movements &Earth/Sun Relations

- A. Rotation
  - 1. The earth rotates on its axis.

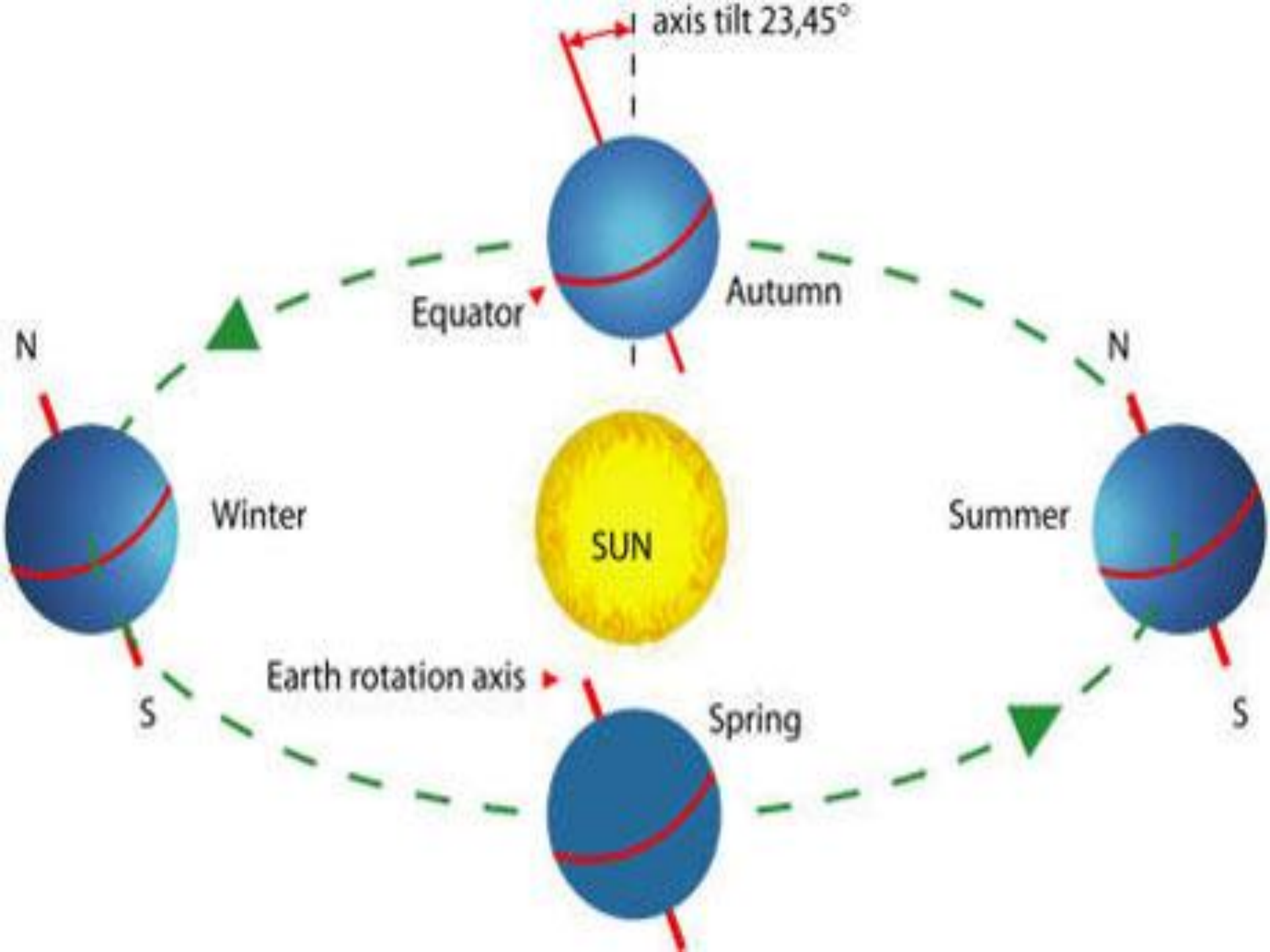
- 2. It takes 24 hours to make one complete rotation.
- 3. Therefore, when we look at rotation we can talk about day and night and time zones.



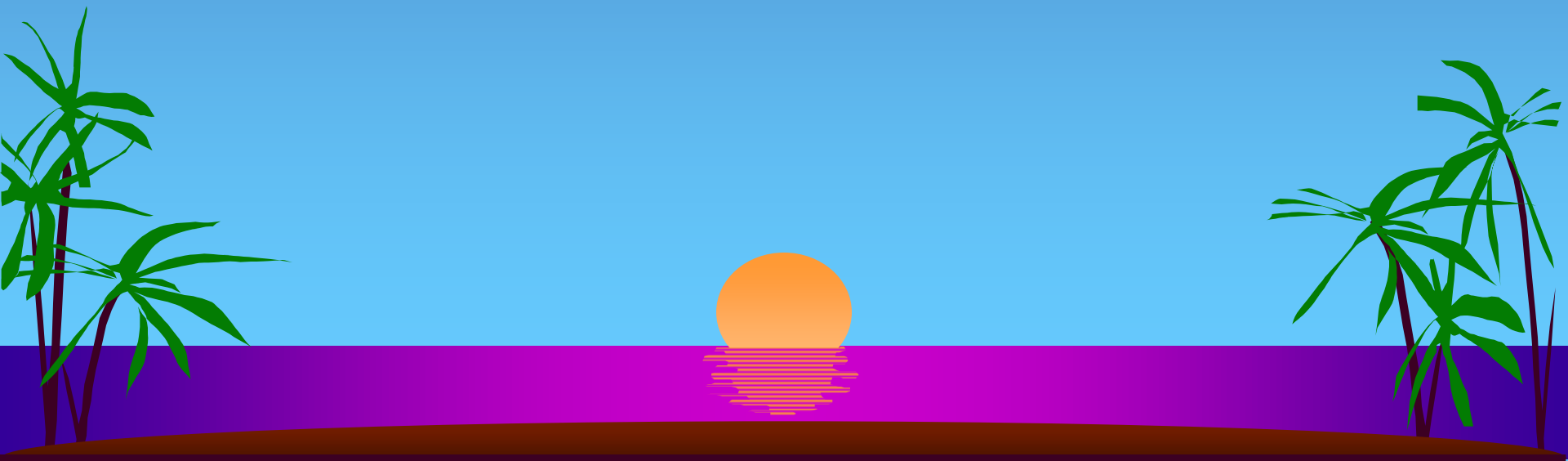
- B. Revolution
- 1. The earth revolves around the sun.
- 2. It takes approx. 365 days to make one complete revolution.

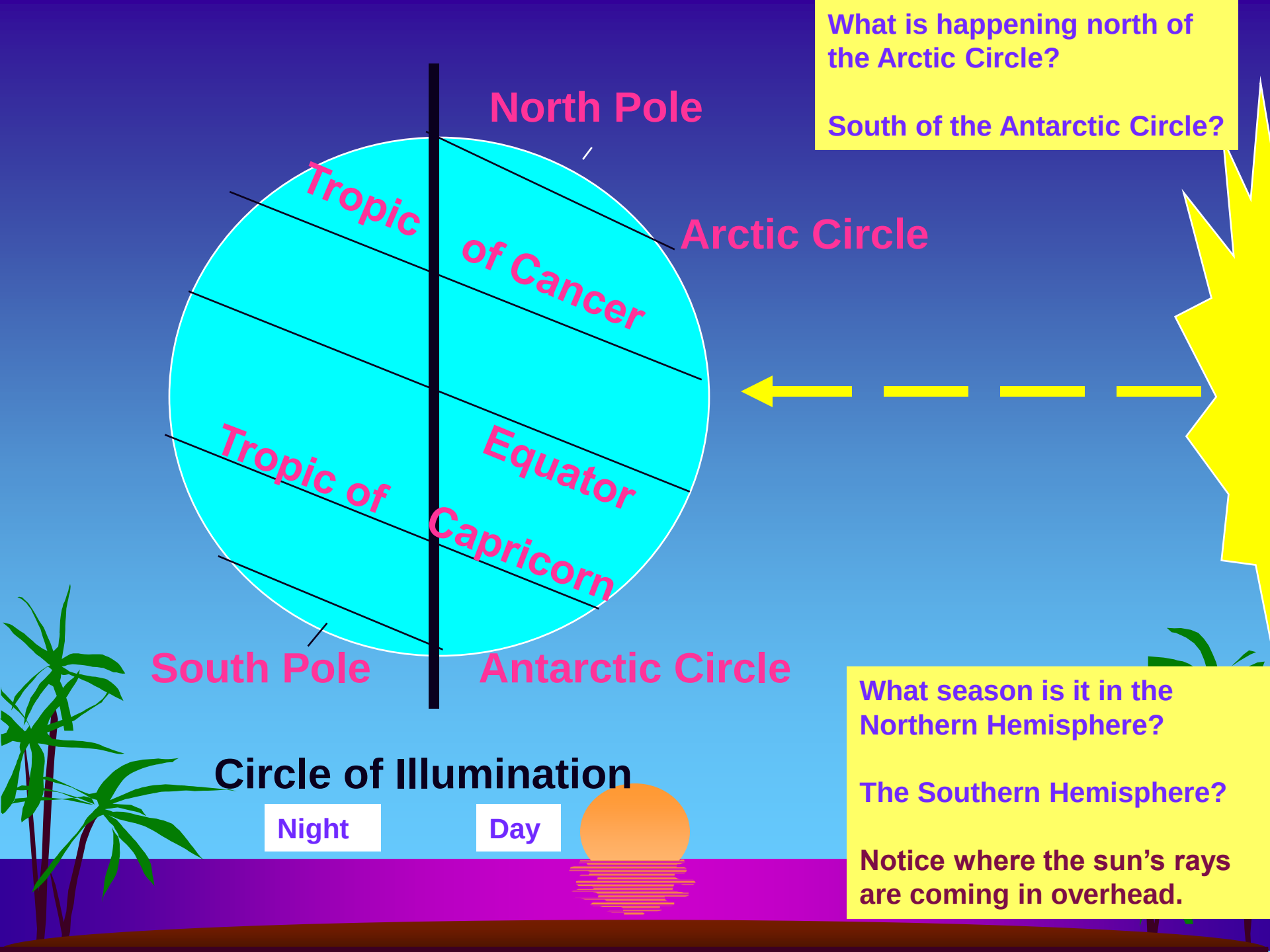


- 3. Therefore, when we look at revolutions of Earth around the sun we can explain seasons.


axis tilt 23,45°
Equator
Autumn
N
Winter
SUN
Summer
N
Earth rotation axis
S
Spring
S

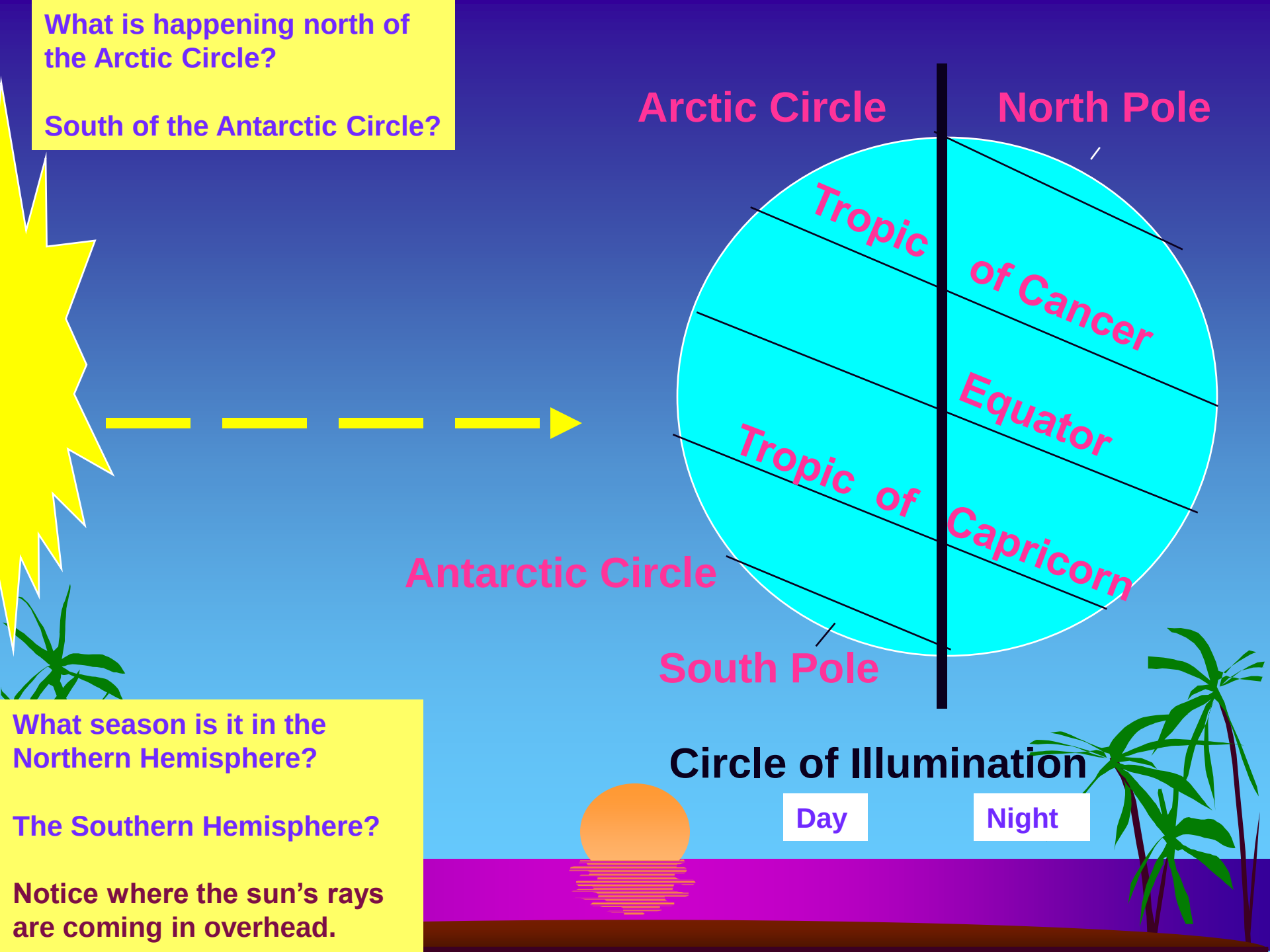
See diagrams and handout.




What is happening north of the Arctic Circle?
South of the Antarctic Circle?
North Pole
Tropic of Cancer
Arctic Circle
Equator
Tropic of Capricorn
South Pole
Antarctic Circle
Circle of Illumination
Night
Day
What season is it in the Northern Hemisphere?
The Southern Hemisphere?
Notice where the sun's rays are coming in overhead.

What is happening north of the Arctic Circle?

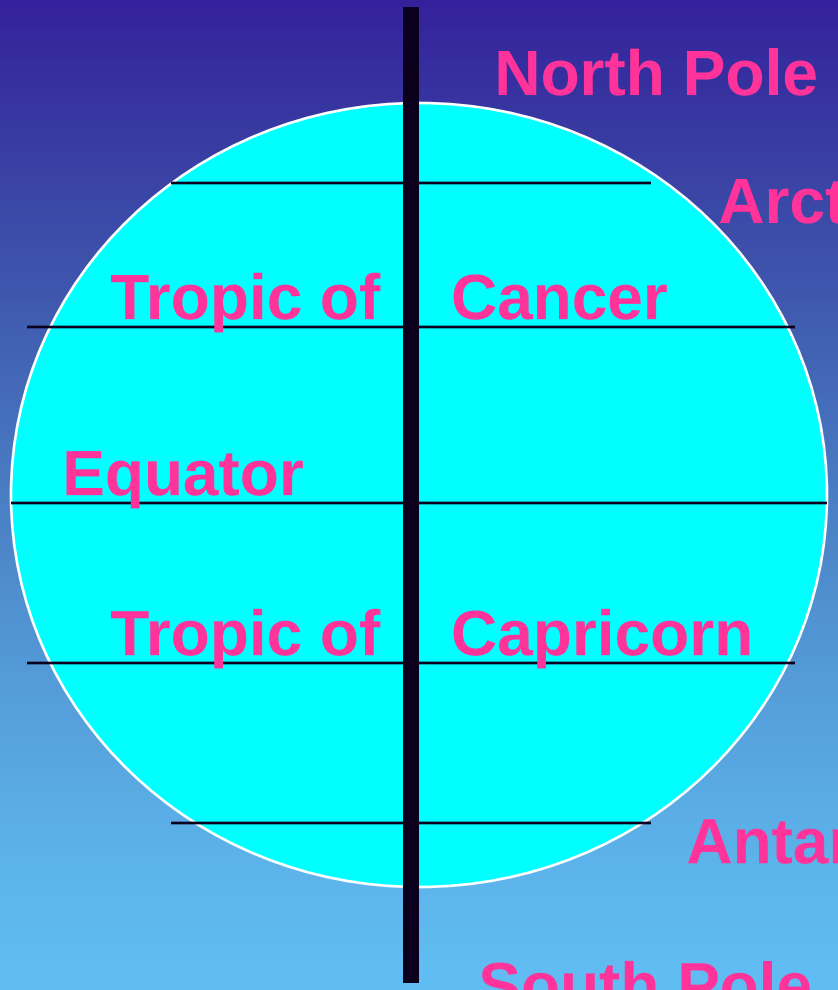
South of the Antarctic Circle?



What season is it in the Northern Hemisphere?

The Southern Hemisphere?

Notice where the sun's rays are coming in overhead.



What is happening north of the Arctic Circle?
South of the Antarctic Circle?
In College Station, Texas?

Circle of Illumination

Night

Day

What season is it in the Northern Hemisphere?

The Southern Hemisphere?

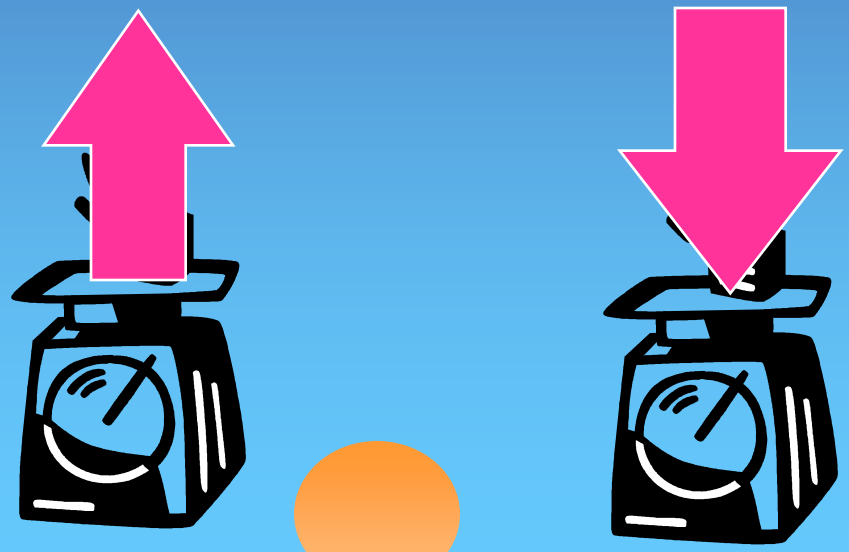
Notice where the sun's rays are coming in overhead.

III. Climate Elements

- A. **Temperature** (temp.)--the amount of heat in the atmosphere.

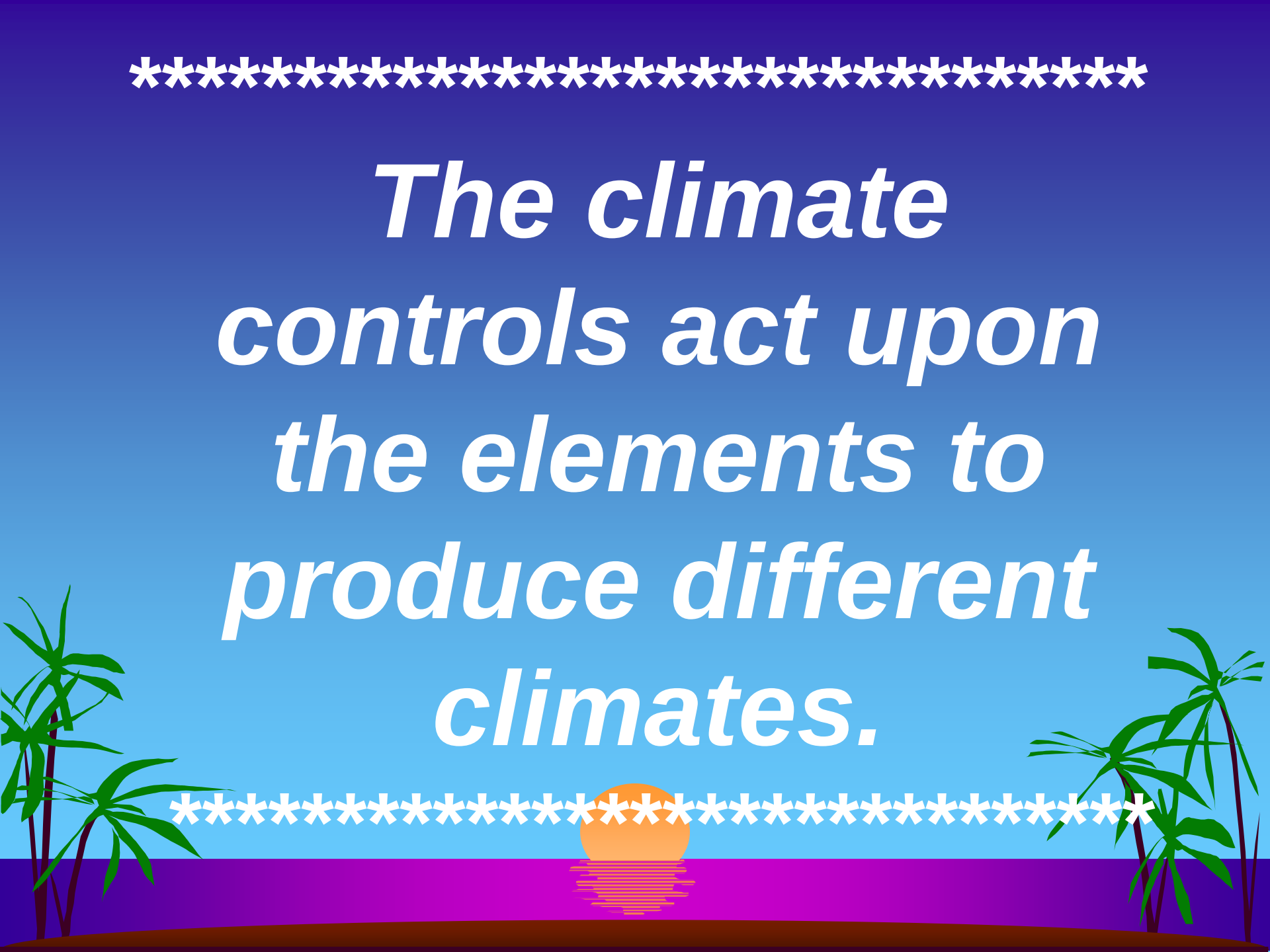
- B. **Precipitation** (ppt)-- the falling moisture onto the earth, rain, snow, sleet, hail, fog, etc.

- C. **Air Pressure & Wind**
  - 1. Air Pressure--is the weight of the air (the air being forced down or let up.)



- 2. Wind--horizontal movement of air.

Remember that winds are named from where they come from.


****
The climate controls act upon the elements to produce different climates.
****

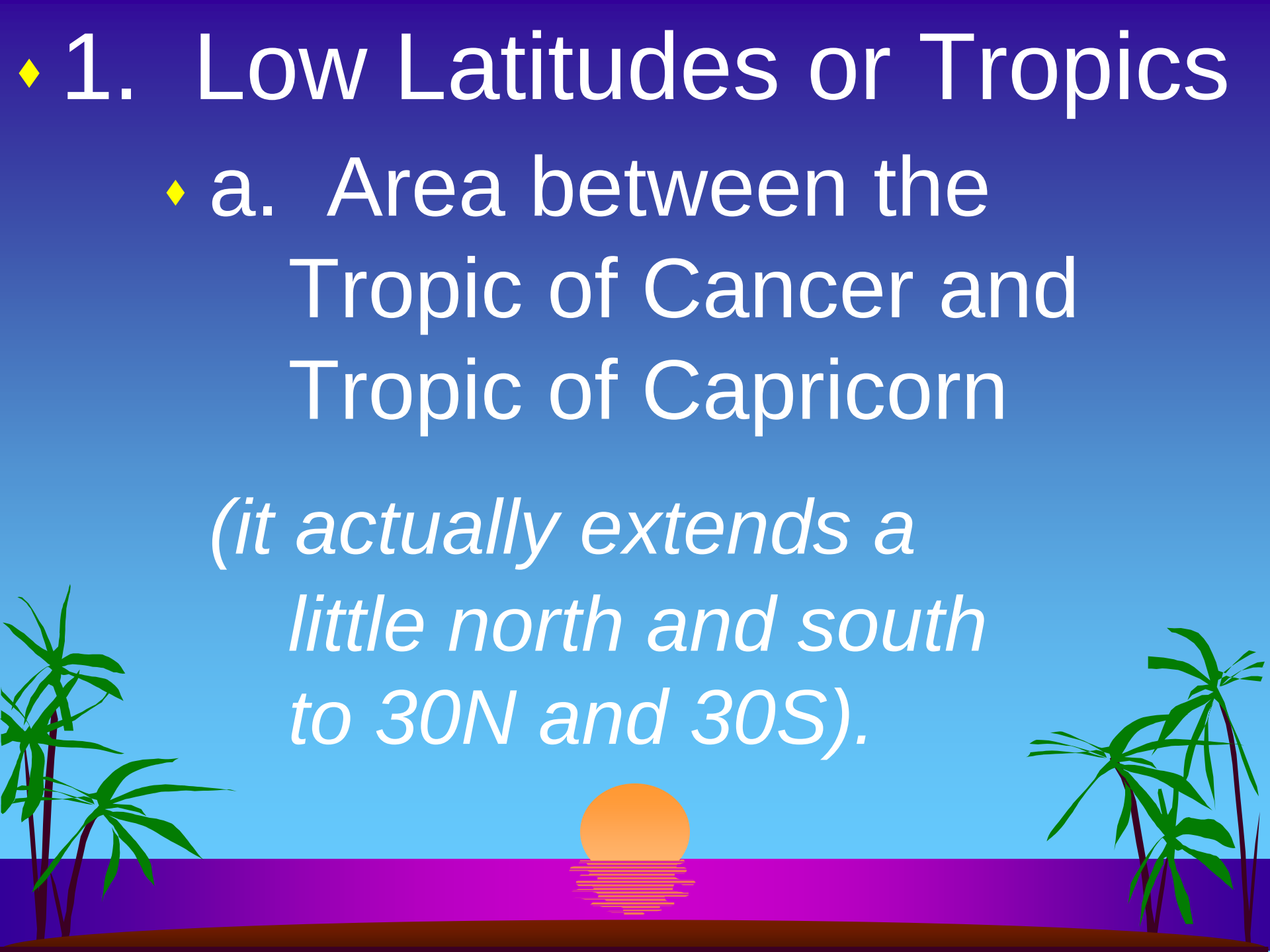
IV. Climate Controls

- **A. Latitude**

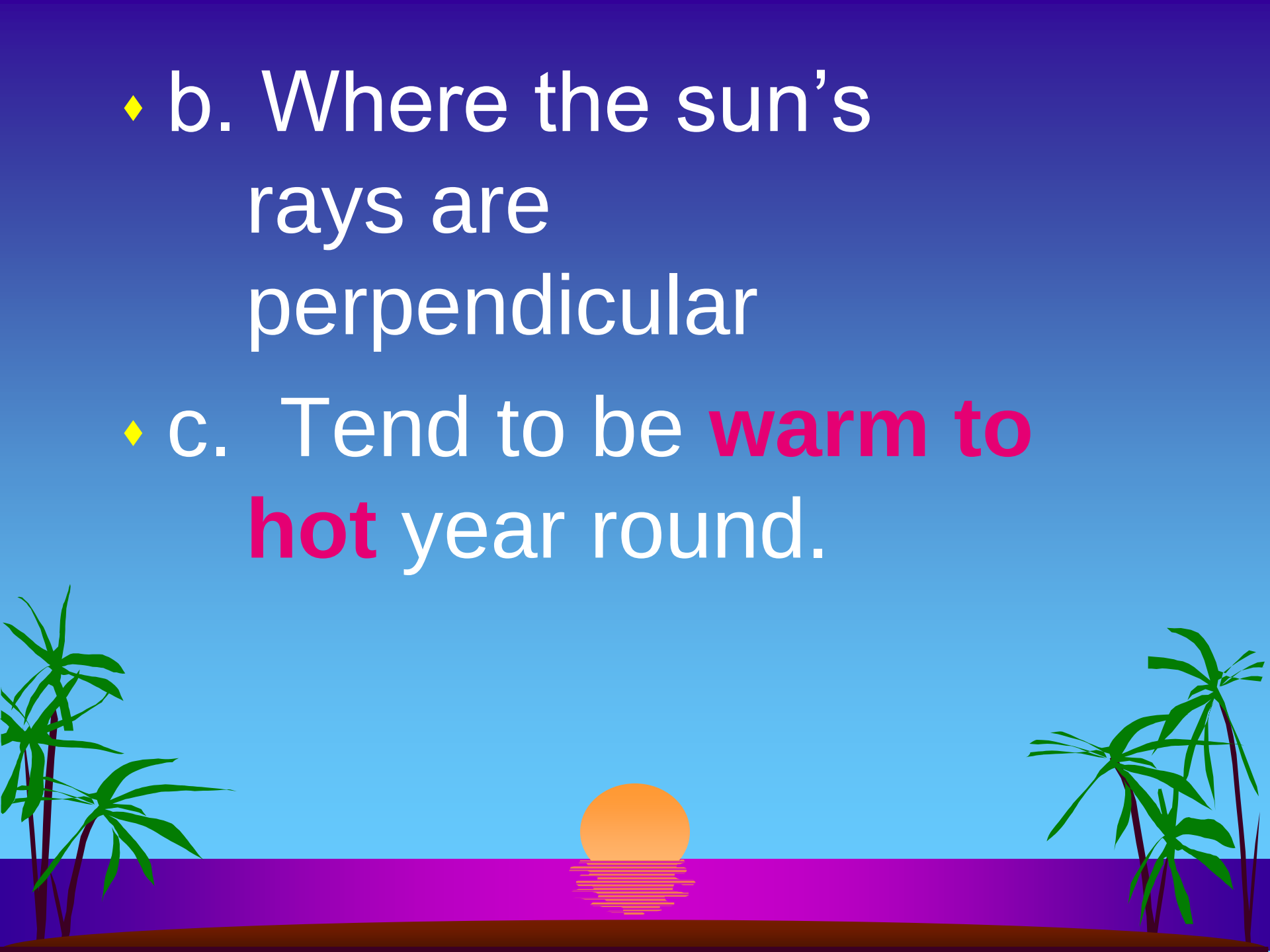
Influences Temperature

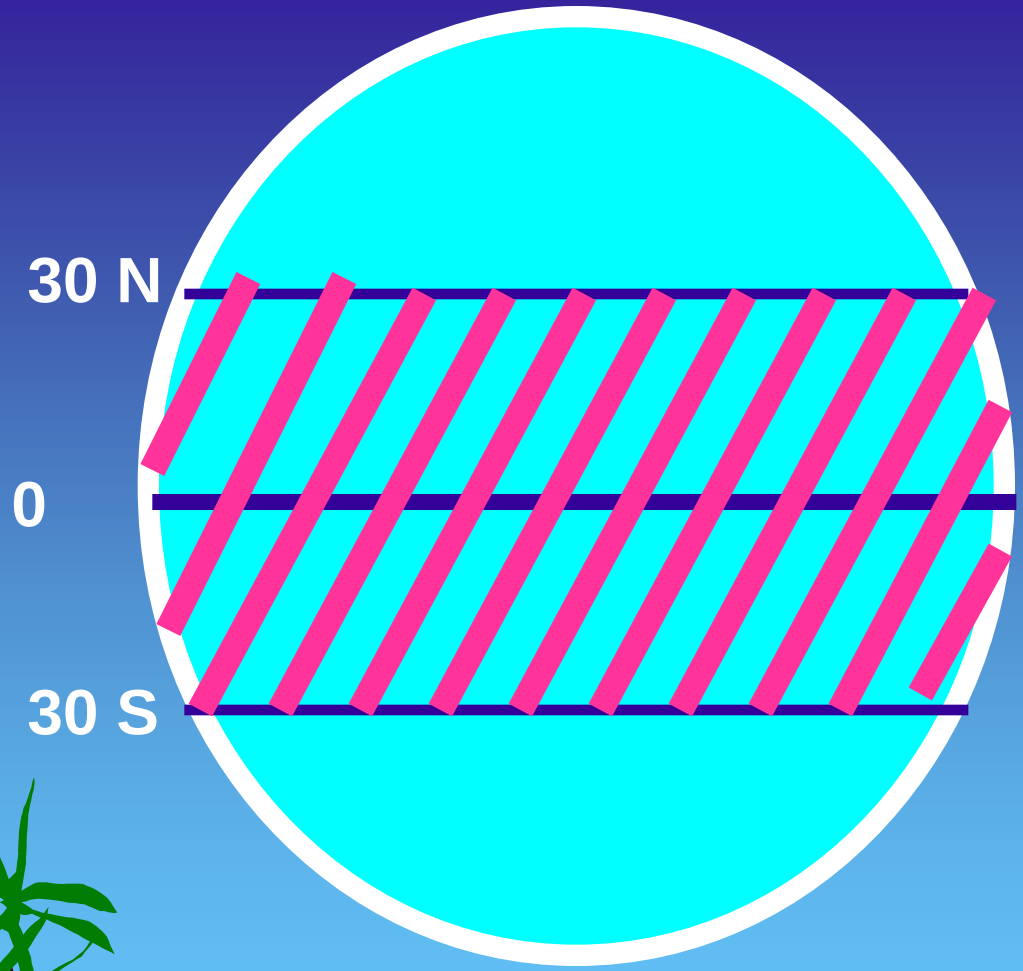
- 1. Low Latitudes or Tropics
  - a. Area between the Tropic of Cancer and Tropic of Capricorn

    (it actually extends a little north and south to 30N and 30S).



- b. Where the sun's rays are perpendicular
- c. Tend to be **warm to hot** year round.

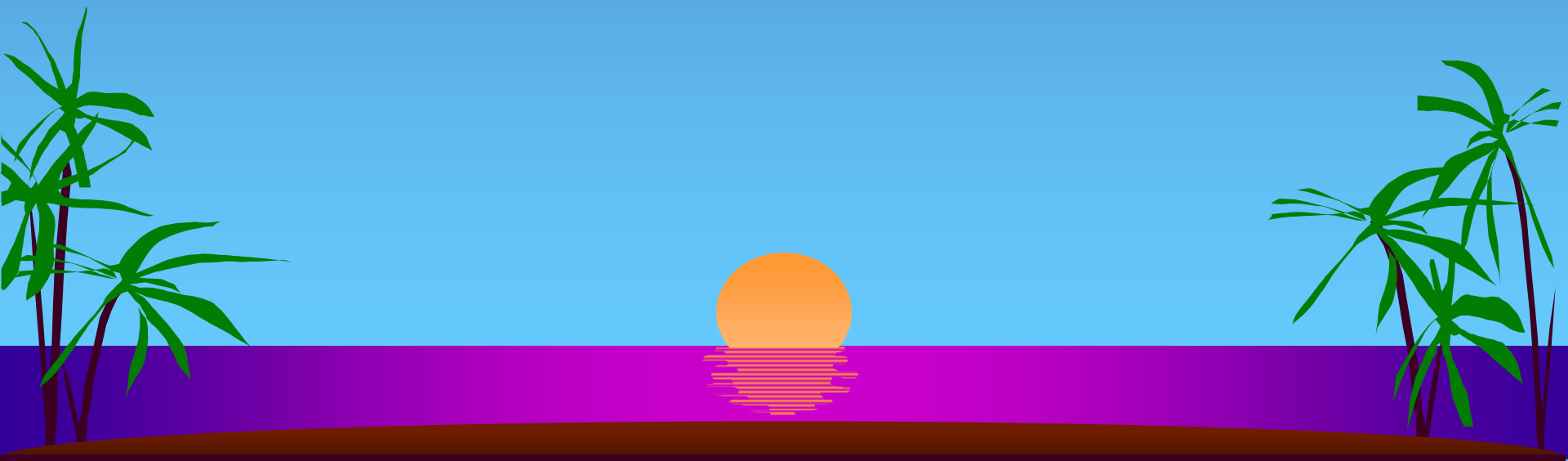


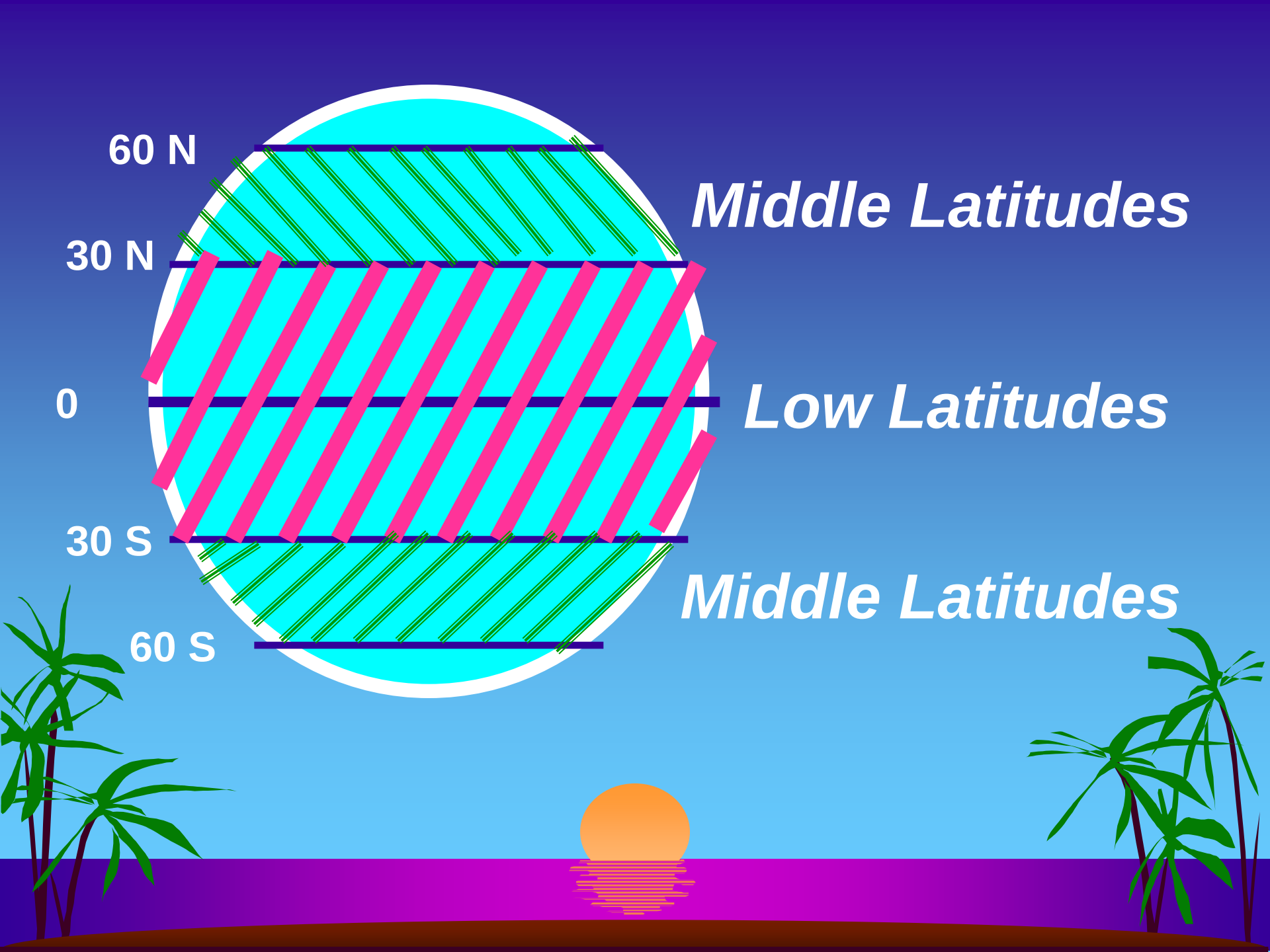


Low Latitudes

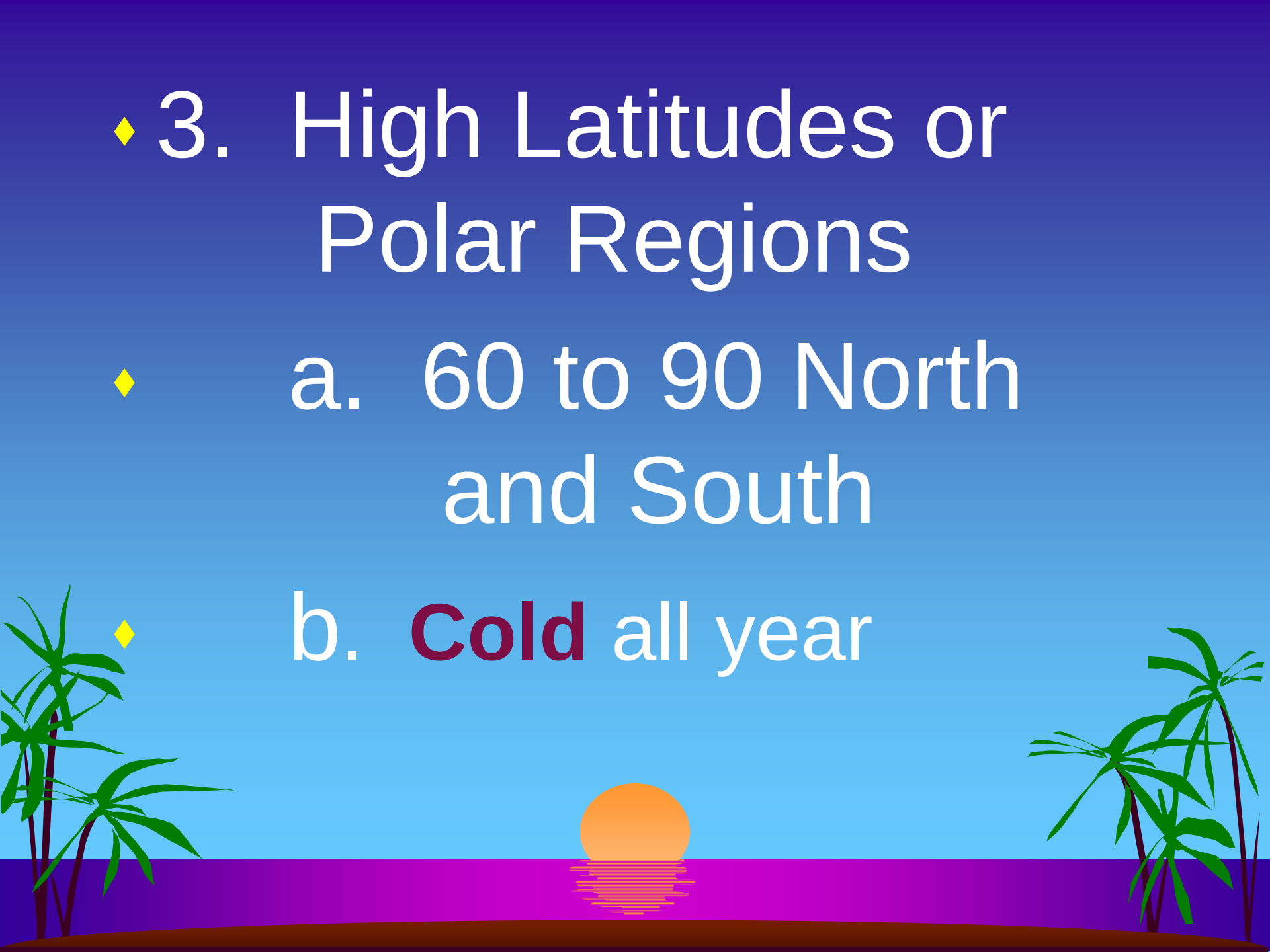
- 2. Middle Latitudes or Temperate Region
- a. 30 to 60 North and 30 to 60 South

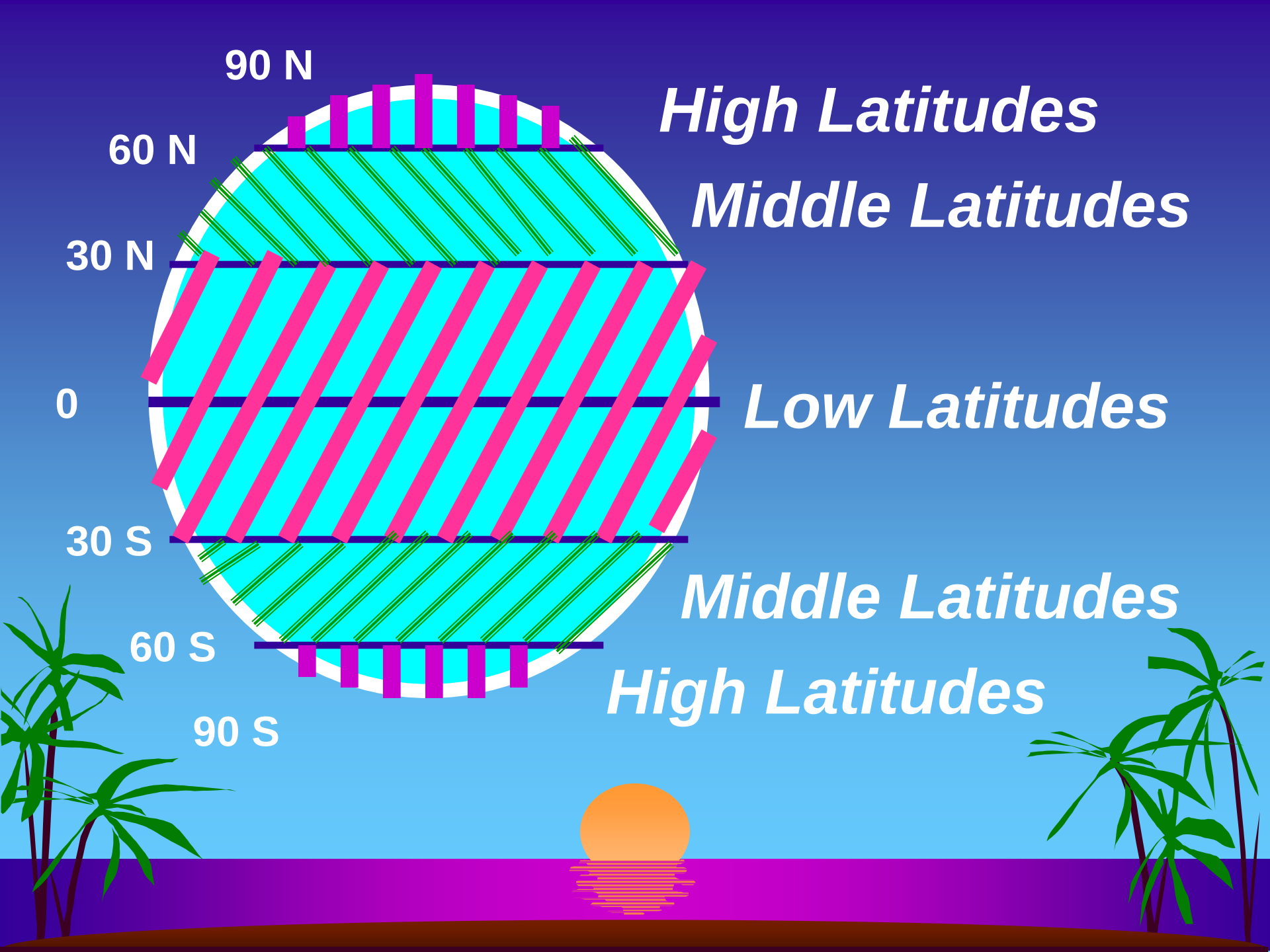
b. Has seasons

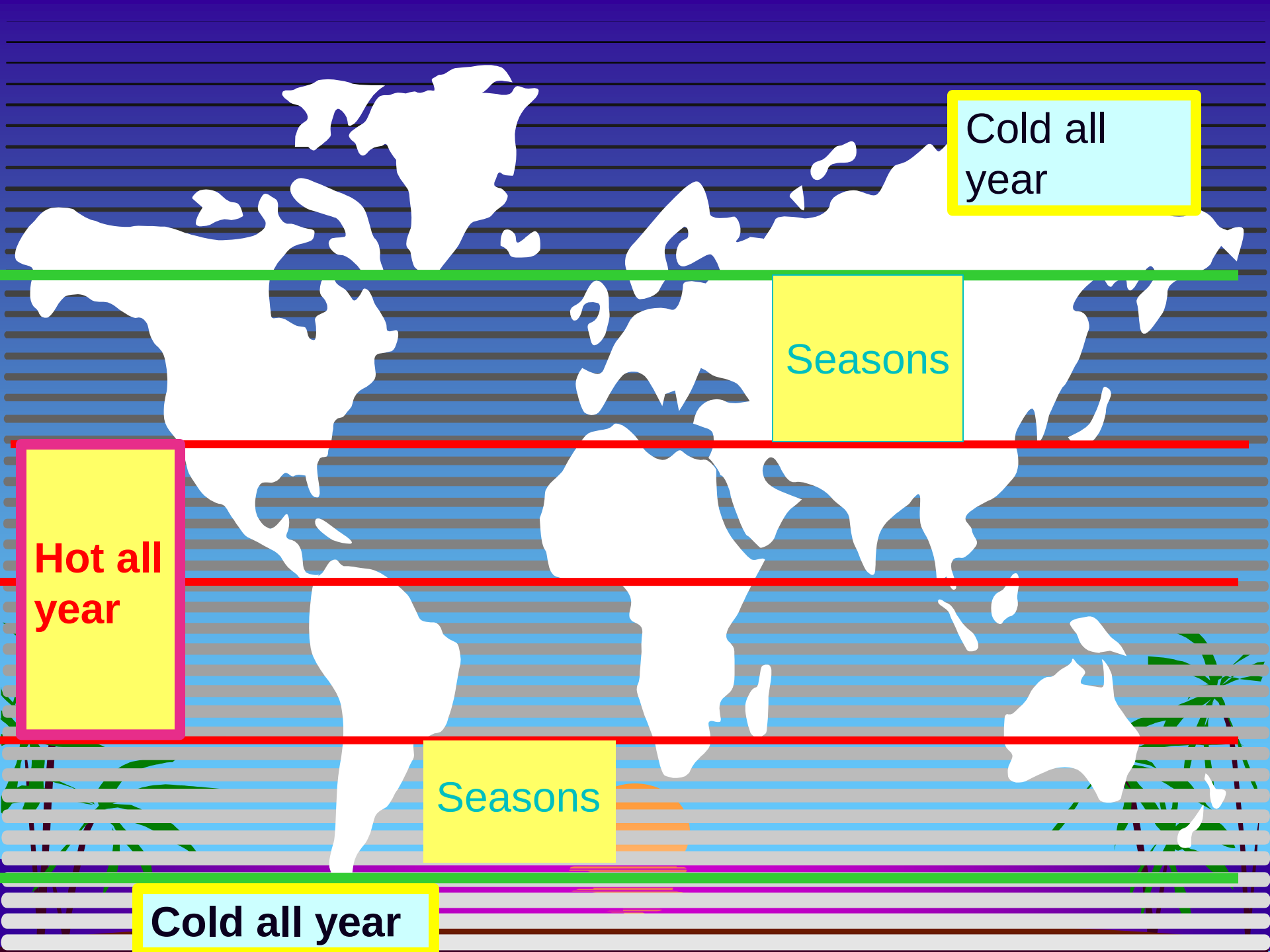



60 N
30 N
0
30 S
60 S
Middle Latitudes
Low Latitudes
Middle Latitudes

- 3. High Latitudes or Polar Regions
- a. 60 to 90 North and South
- b. **Cold** all year




90 N
60 N
30 N
0
30 S
60 S
90 S
High Latitudes
Middle Latitudes
Low Latitudes
Middle Latitudes
High Latitudes


Cold all year
Seasons
Hot all year
Seasons
Cold all year

Facebook is about to get a little cooler. The social media giant announced plans to build a server farm, or a cluster of servers, just 60 miles south of the Arctic Circle in Lulea, Sweden. The small city of 45,000 people, which has an average temperature of 27 degrees Fahrenheit, will be home to Facebook's first server farm outside the U.S. So why the frigid location? The new facility's high-powered computers, which are used for storing billions of status updates and photos, need to be kept cool. The new data center, which is about the size of 11 football fields, will use cooling systems powered by evaporated water (which is a renewable energy source). Since more of Facebook's 800 million users live outside the U.S., the chilly server site will also provide faster service to the site's European users. But Facebook isn't the first to use northern Europe's natural elements. In 2009, Google opened a data center in Finland which uses Baltic Sea water for its cooling systems. Facebook's new facility will be ready in 2014.

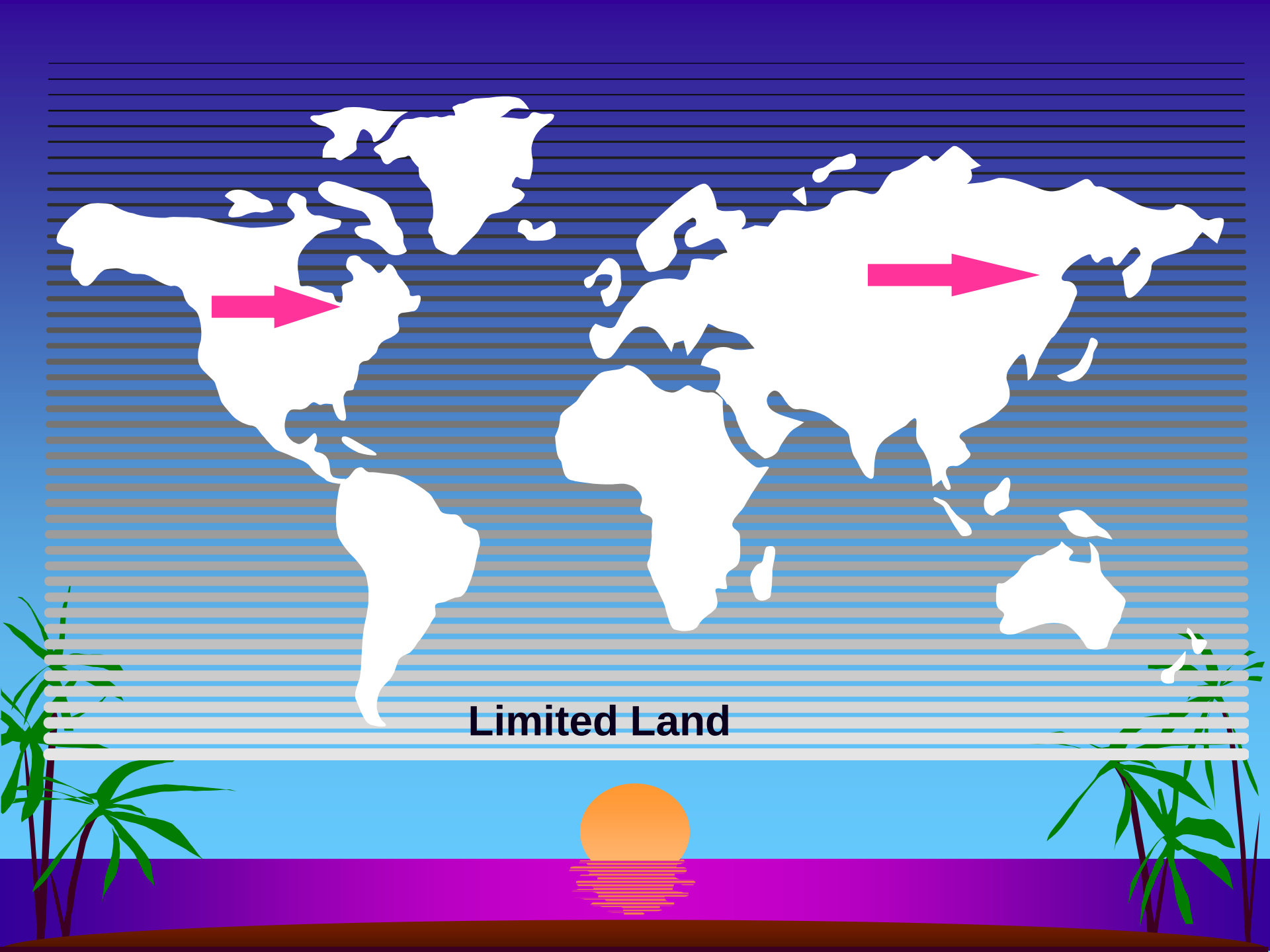
B. Continentality

Influences Temperature

- 1. If wind crosses over water to get to a place it will stay relatively the **same temp.** all year.


Should have seasons—
but it is “cool all year.”

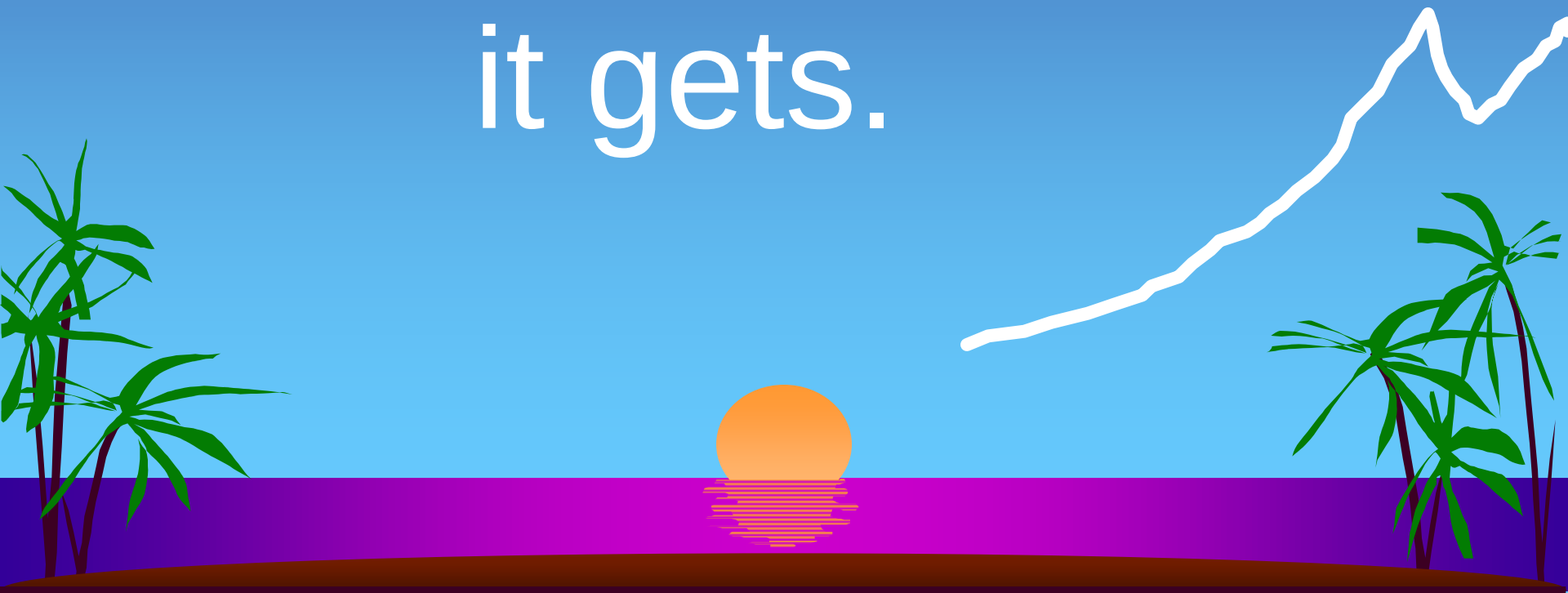
- If wind crosses over land there will be **greater variations of temperature** change.


Limited Land

C. Elevation

Influences Temperature

- 1. The higher up a mountain you go--the cooler it gets.



- 2. For every 1000’ the temp.drops 3.6°F.

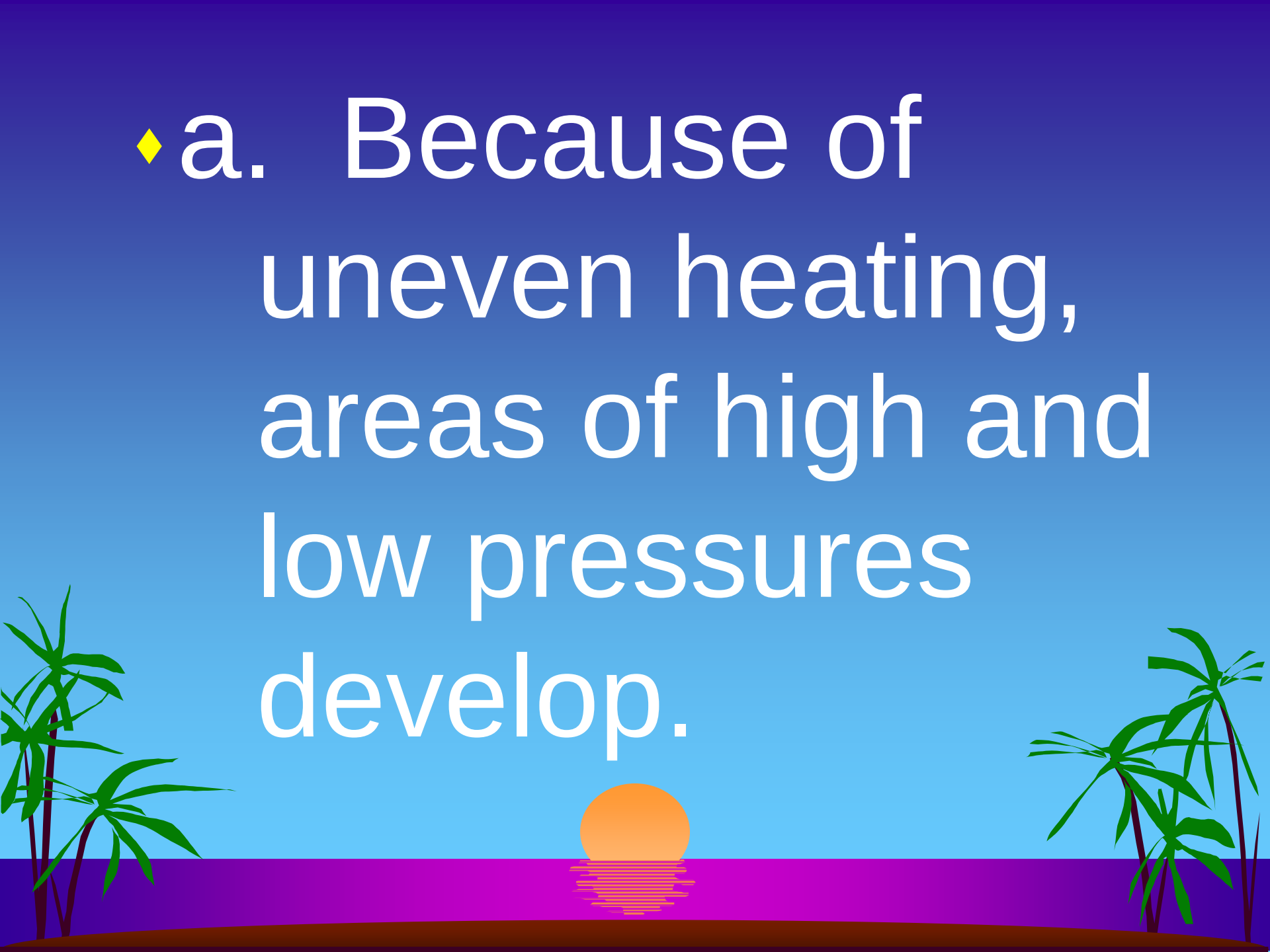
- 3. Therefore, in highland areas the **temp. will vary** depending on where you are on the mountain side.

D. Atmospheric Circulation

Influences Precipitation

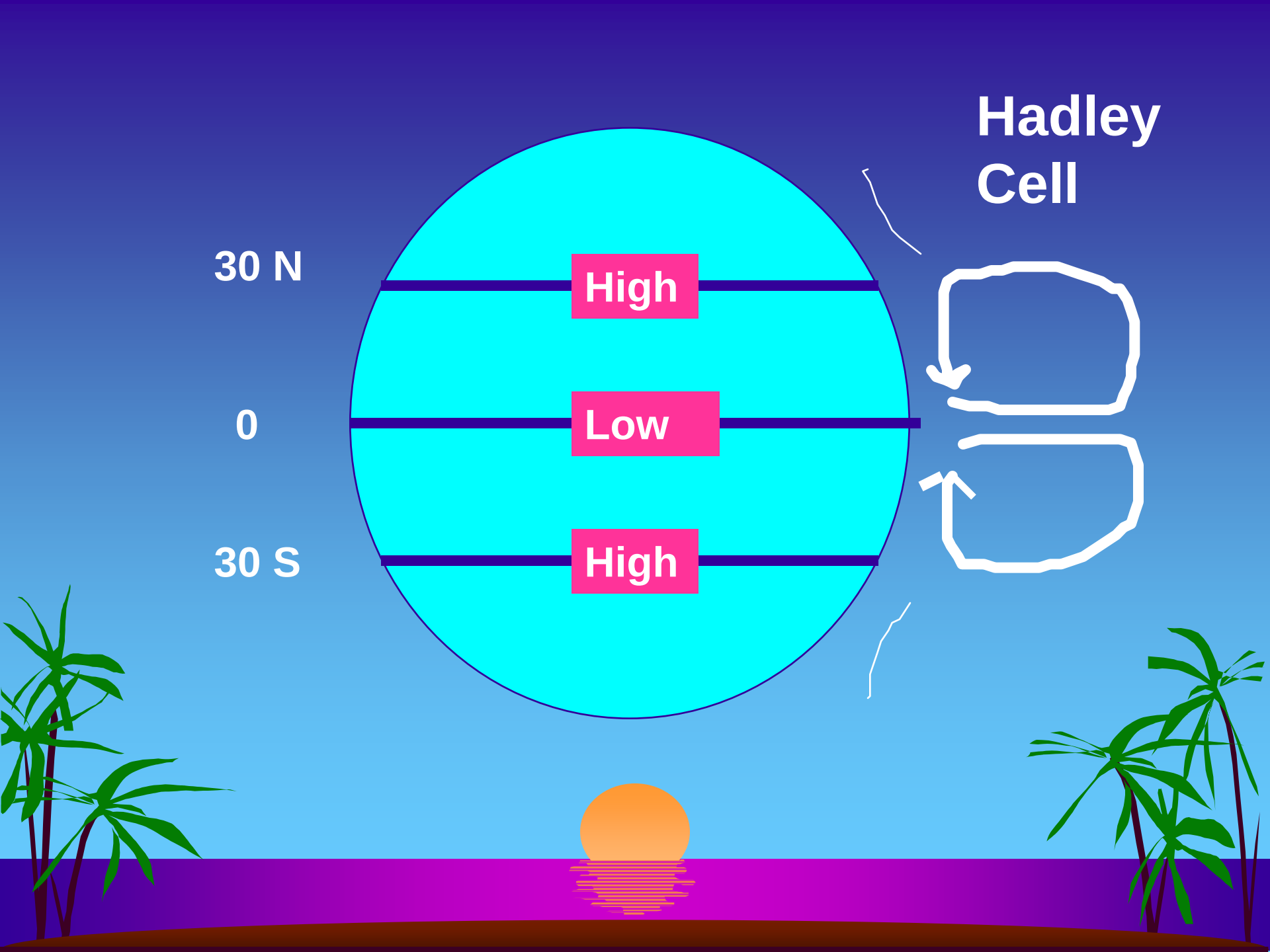
- 1. Pressure Systems

- a. Because of uneven heating, areas of high and low pressures develop.

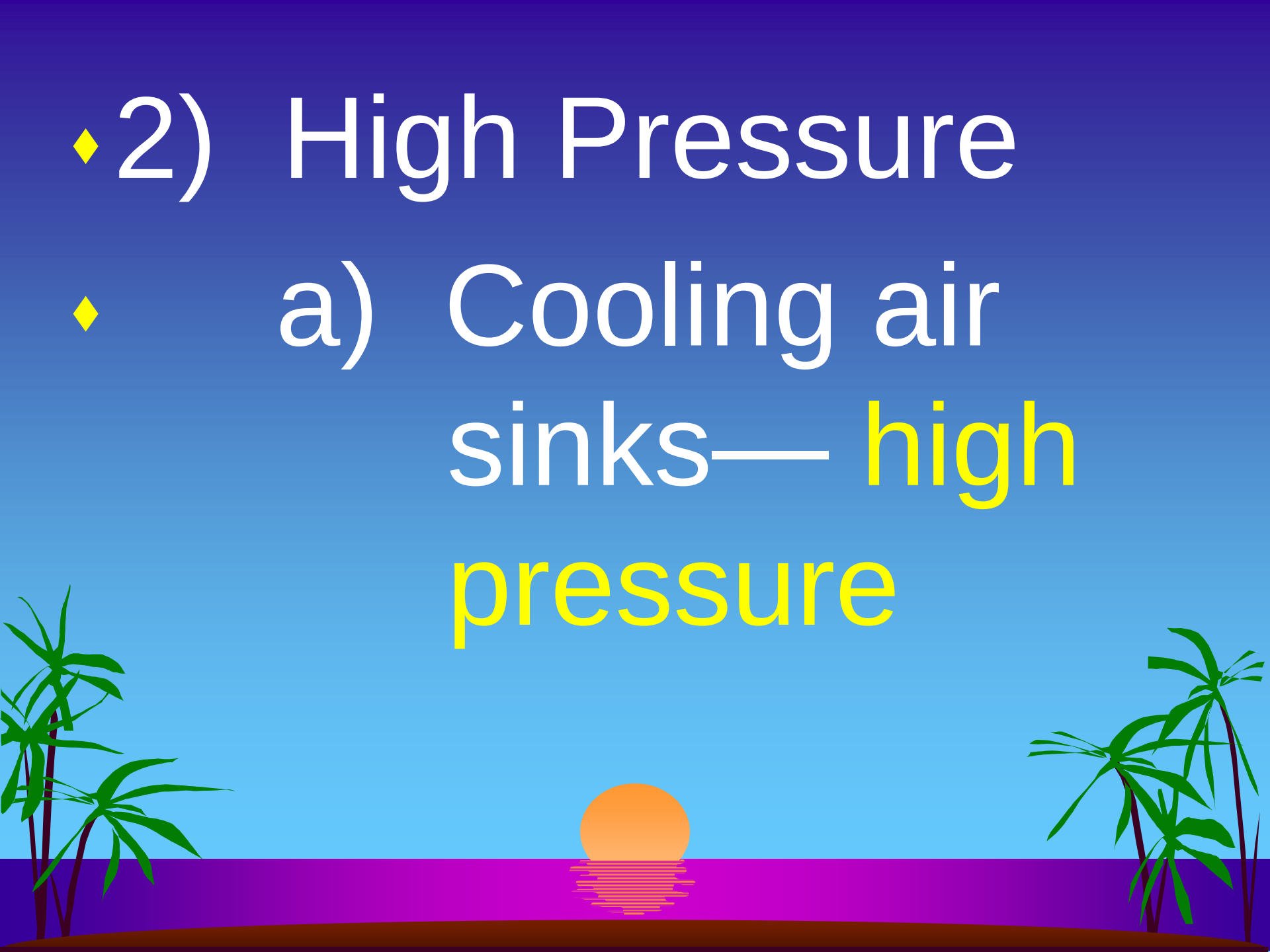


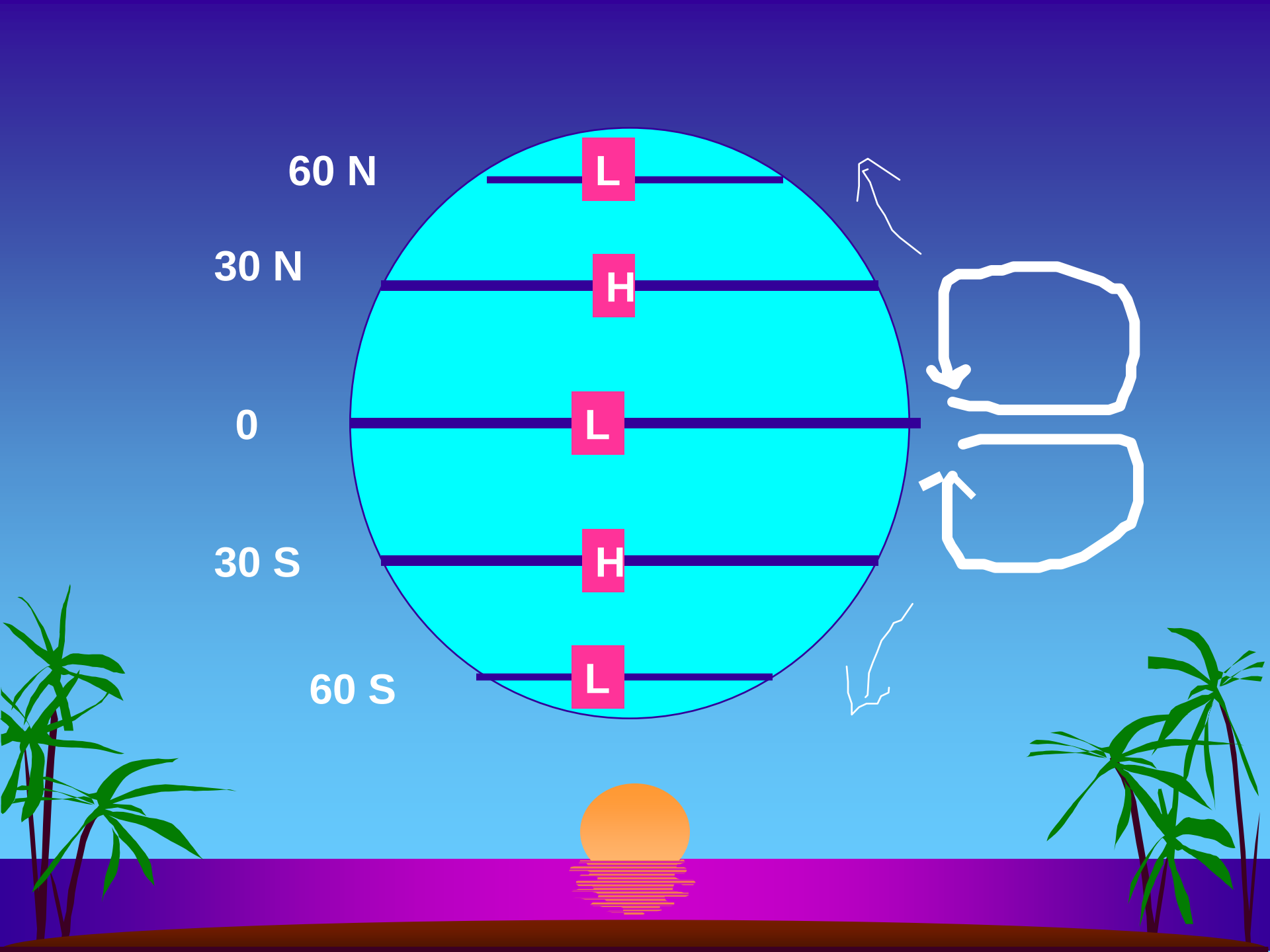
- 1) Heated air rises--expands and is less dense--**low pressure.**

Hadley Cell

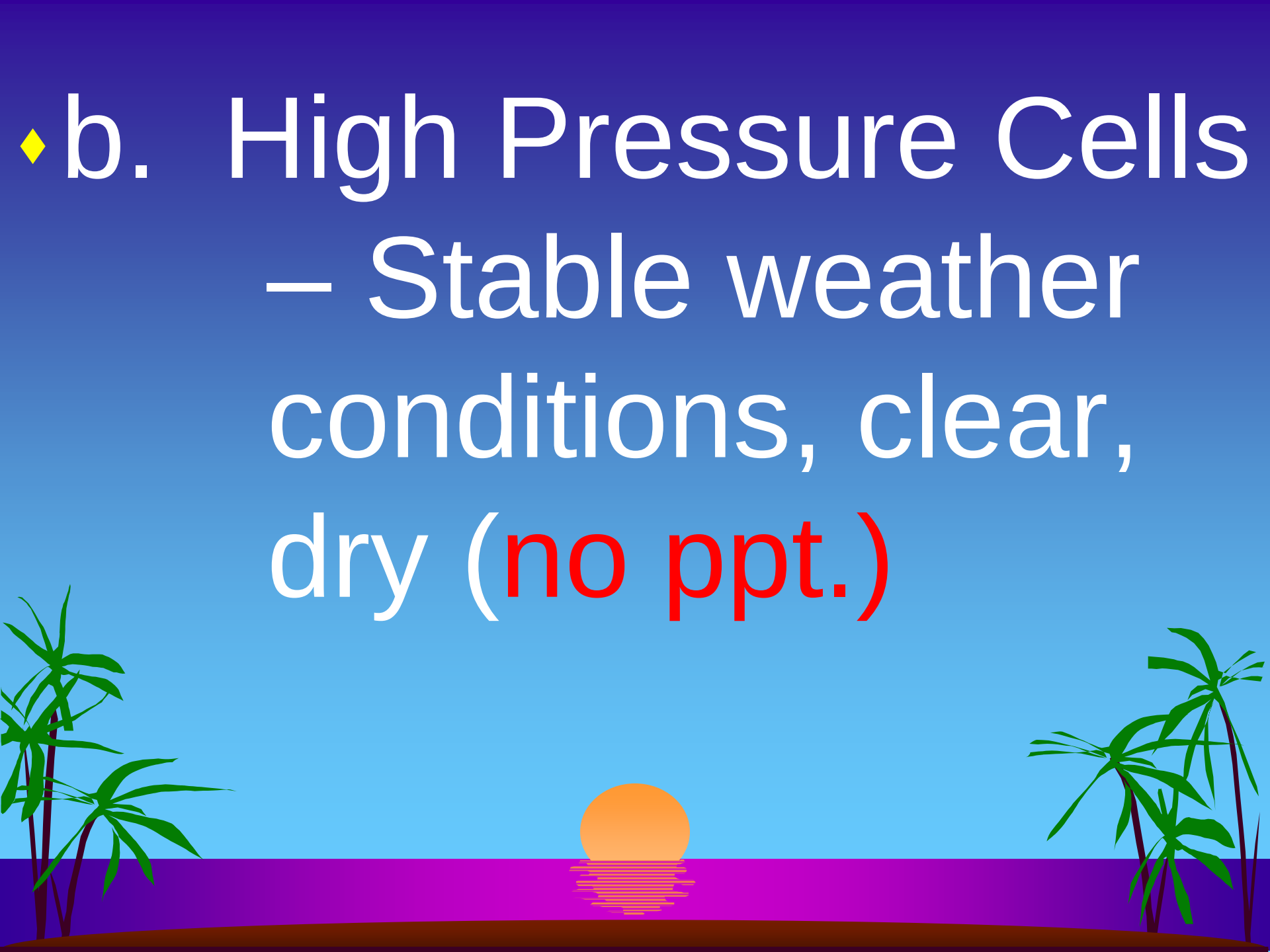


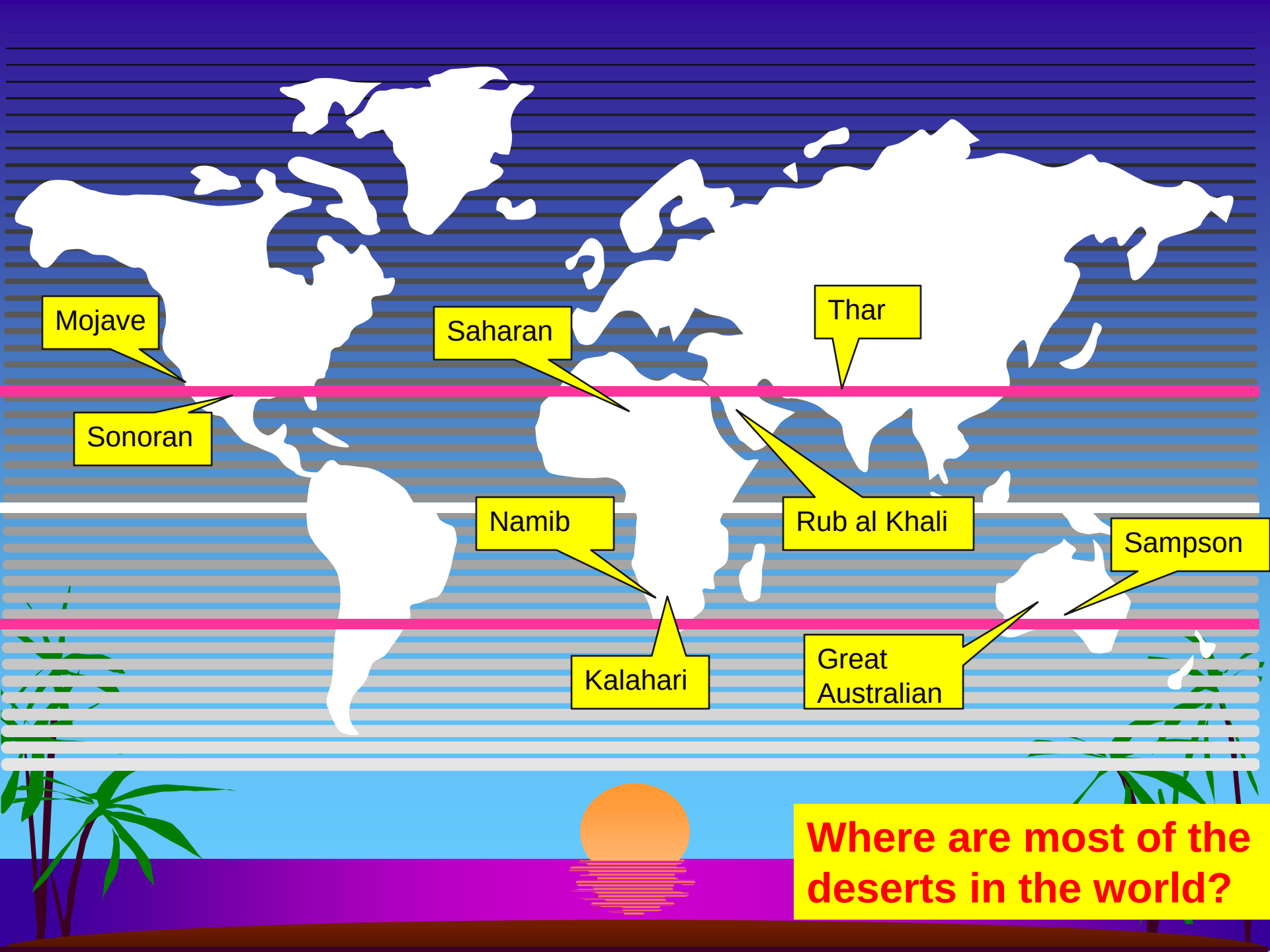
- 2) High Pressure
- a) Cooling air sinks— high pressure



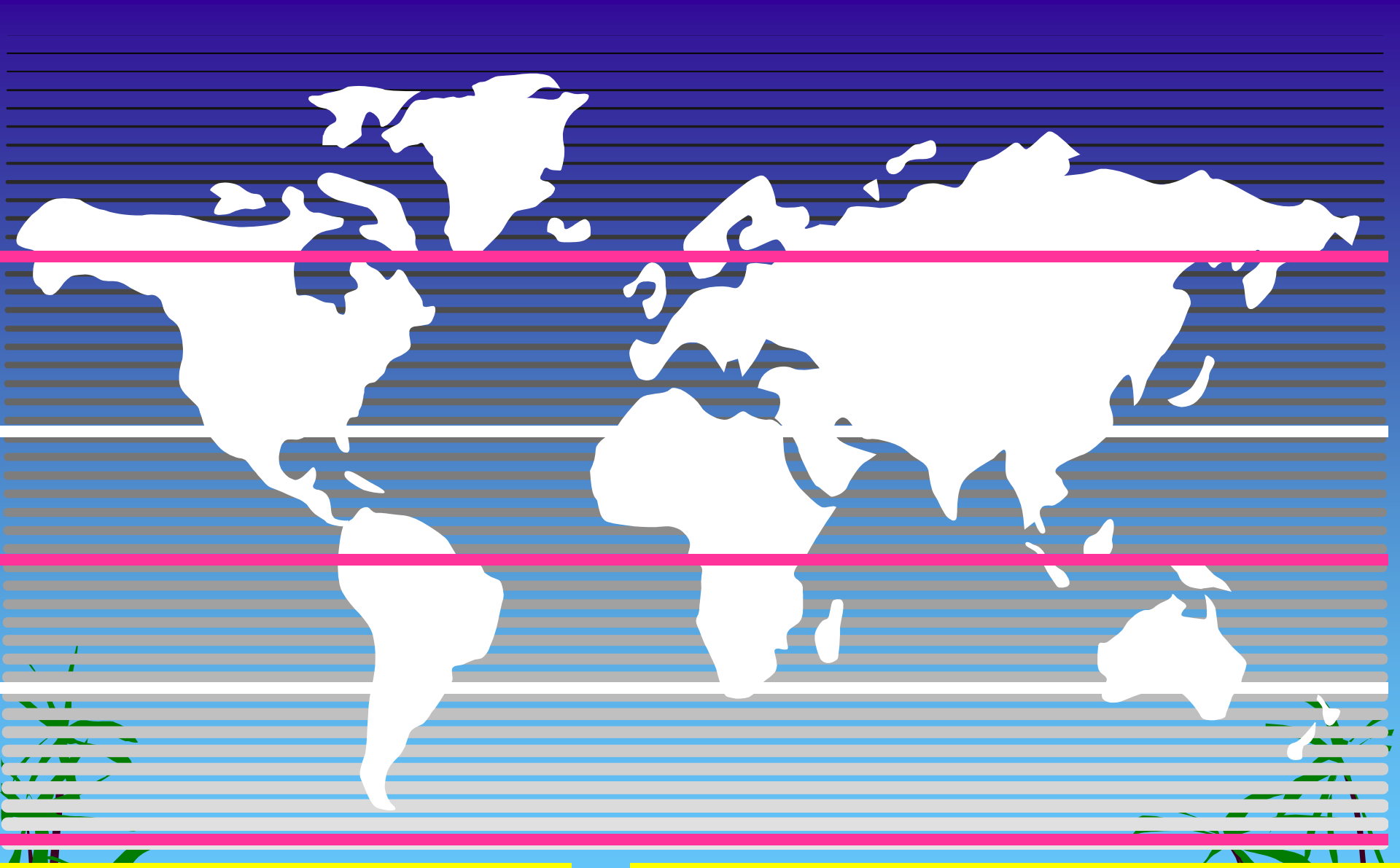

60 N
30 N
0
30 S
60 S
L
H
L
H
L

- b. High Pressure Cells – Stable weather conditions, clear, dry (no ppt.)




Mojave
Saharan
Thar
Sonoran
Namib
Rub al Khali
Sampson
Kalahari
Great Australian
Where are most of the deserts in the world?

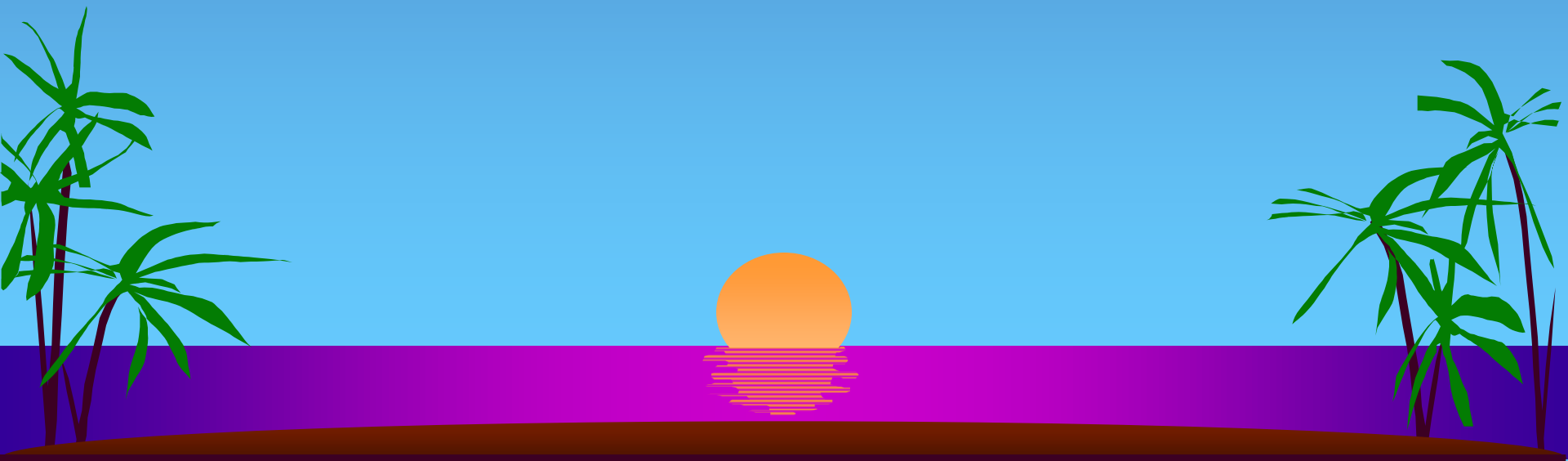
- c. Low Pressure-- unstable, **rainy**, windy.
- (hurricanes, typhoons, cyclones, tornadoes, willy willies, etc.)



What is it like along the equator?
Wet or Dry?

Based on that answer, what do you think is happening at 60N?

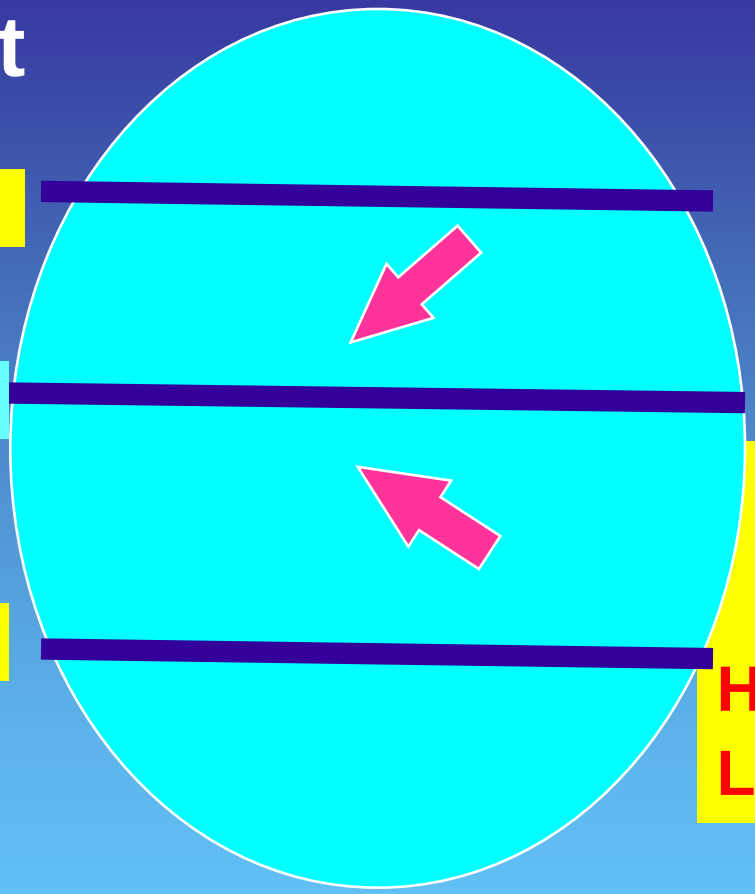
- High Cell--*Dry*
- Low Cell--*Wet*



- d. Air moves from a High Cell to a Low Cell along the surface of Earth.
- e. As the air moves parallel to Earth wind systems develop.

But they don't go straight north and south.

Coreolis Effect

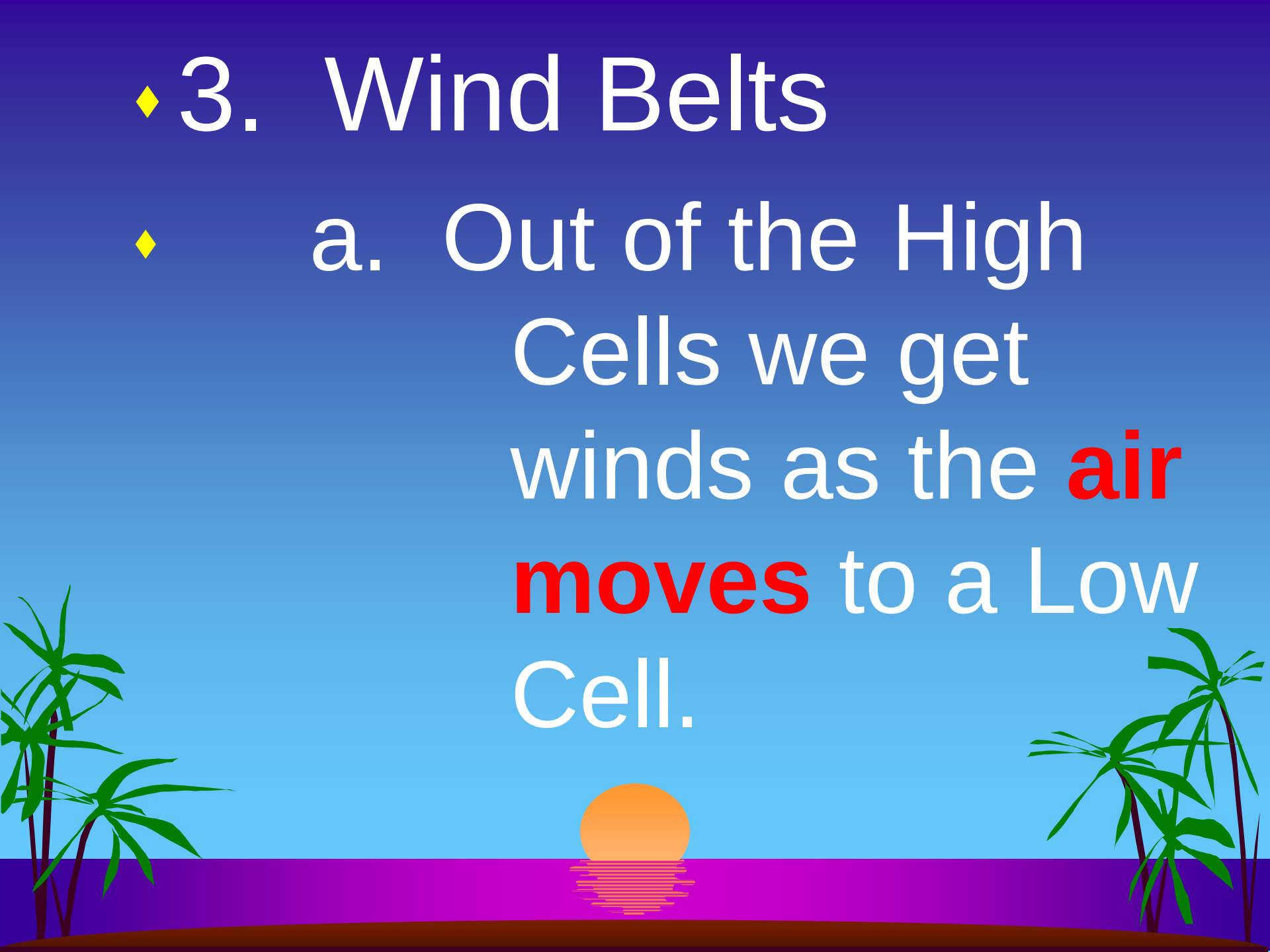


Because of Earth's rotation the winds are deflected to the left in both the Northern Hem. & the Southern Hem.

	Northern Hem.	Southern Hem.
High Cell	**Clockwise**	**Counter CW**
Low Cell	**Counter CW**	**Clockwise**

Which way does a tornado circulate in the NH? In the SH?

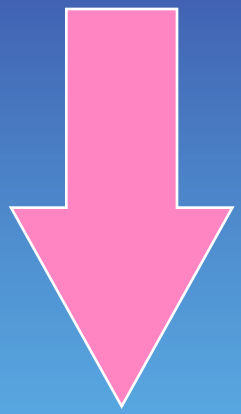
- 3. Wind Belts
- a. Out of the High Cells we get winds as the **air moves** to a Low Cell.

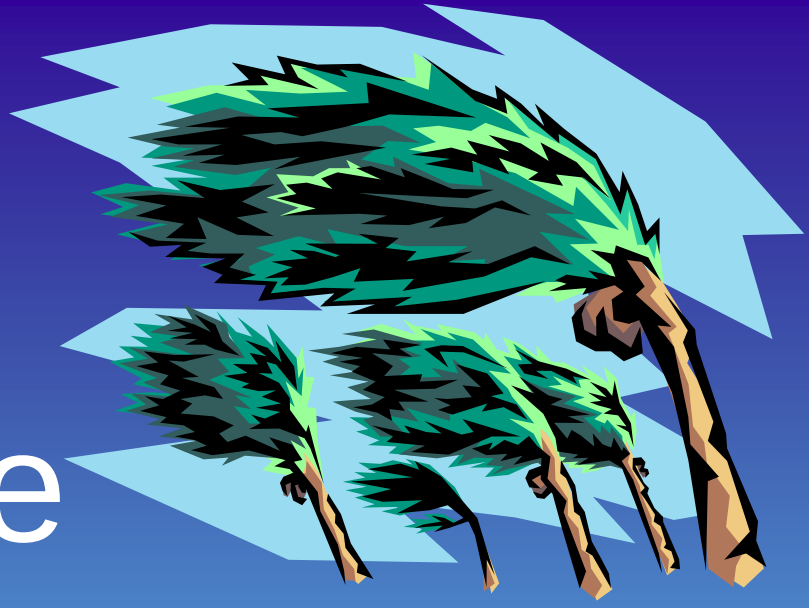


- b. In a Low cell the air is rising--no wind.

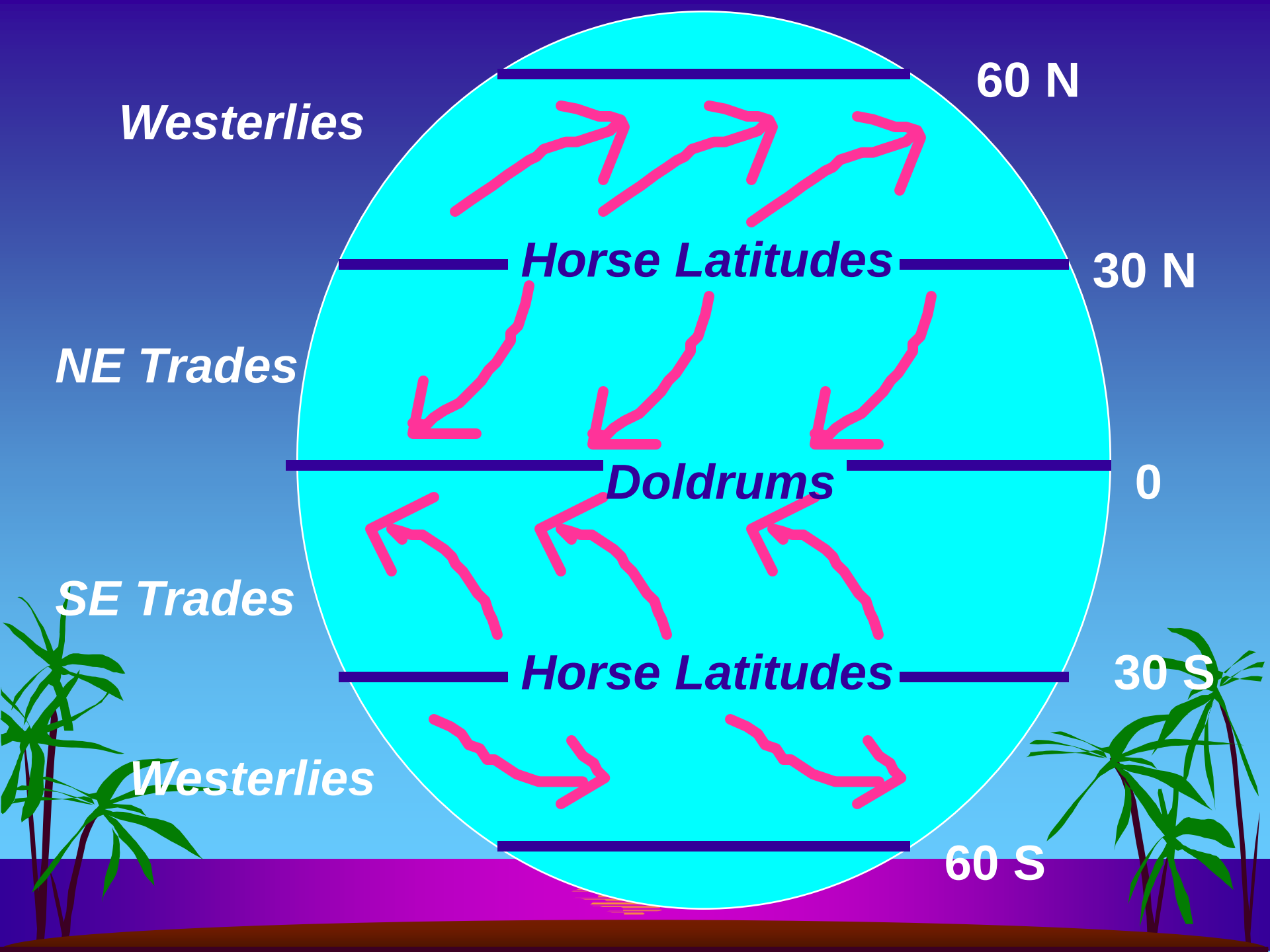
Remember, a hurricane is the result of excessive heating at the end of summer and is an intensive Low Cell. Therefore, what is happening in the eye of a hurricane?

- c. In a High cell the air is sinking-- no wind.





- d. Winds are named from where they come. --*See diagram.*


Westerlies
60 N
Horse Latitudes
30 N
NE Trades
Doldrums
0
SE Trades
Horse Latitudes
30 S
Westerlies
60 S

But why do we have cold fronts? Warm fronts from the Gulf of Mexico?

- 4. Air Masses
- a. Independent of the wind systems, masses of air move into an area causing weather differences **(not climate).**

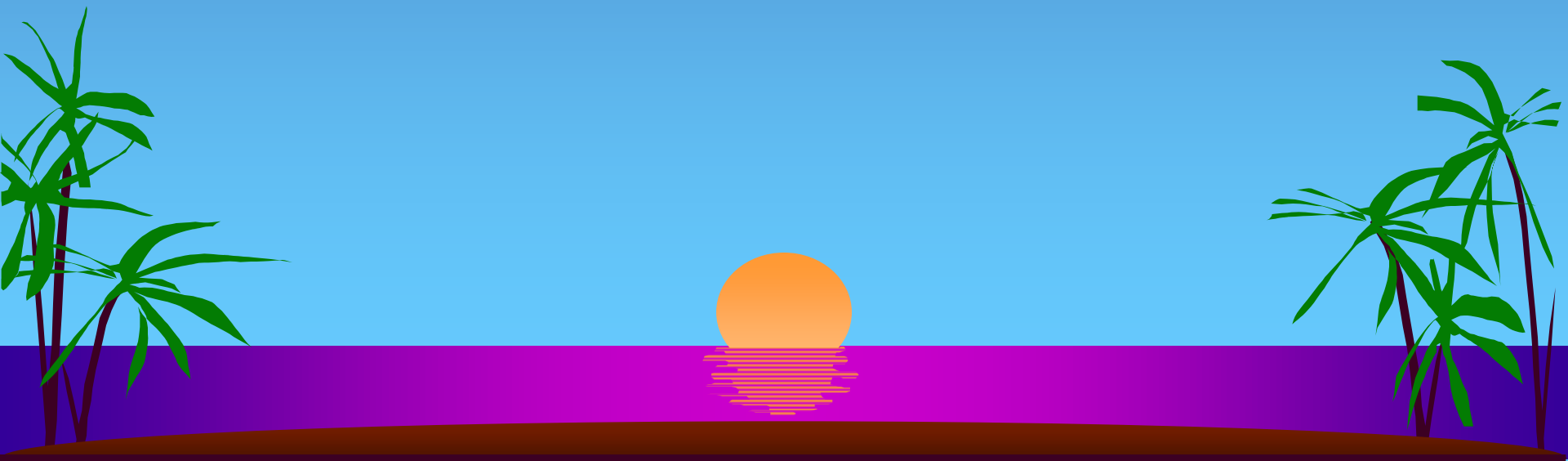
- b. Each has its own temp. & ppt. characteristics.
- 1) Warm Masses, Cold Fronts, etc.
- 2) Marine vs. Continental Air Masses.

- c. *Fronts* are places where a mass of warm air meets a mass of cold air.

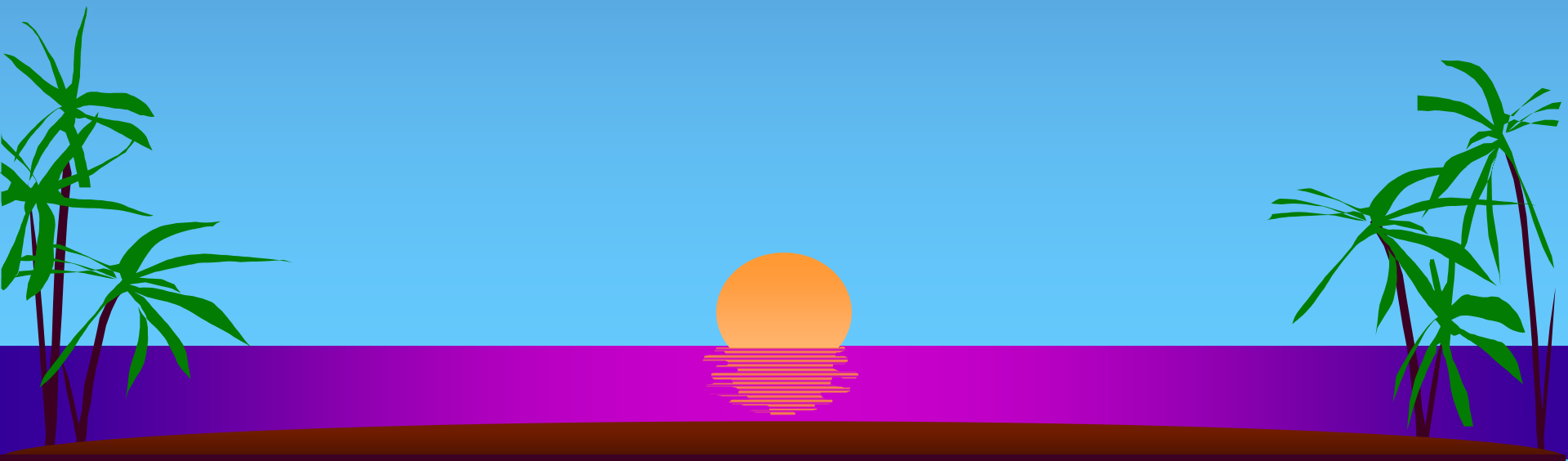
When they meet--clouds and ppt. occurs. Usually clear afterwards.

E. Ocean Circulation

Influences Precipitation



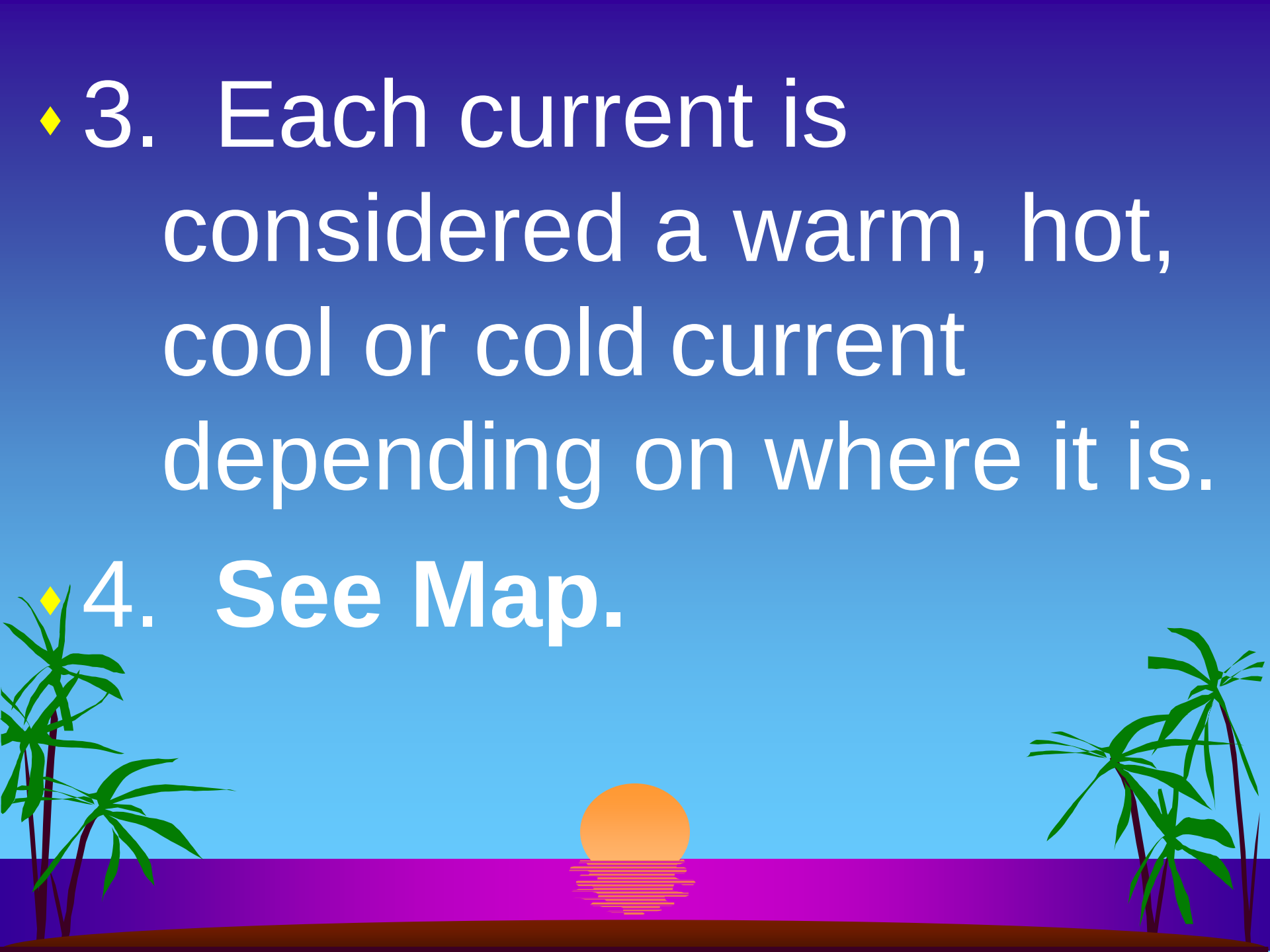
- 1. Ocean currents help move the heat from the equator to the poles.



- 2. Ocean Currents are clockwise in the N. hemisphere and counterclockwise in the S. hemisphere.

Have you ever wondered why hurricanes hit the southeastern part of the United States and not very often on the west coast? Where else do hurricanes/typhoons hit? What time of the year? Think of these questions as we continue.

- 3. Each current is considered a warm, hot, cool or cold current depending on where it is.
- 4. **See Map.**




3
4
1
11
12
10
9
3
2
1
5
8
7
13
14
16
15
6

- 5. In general,
- ***a. Hot currents:***

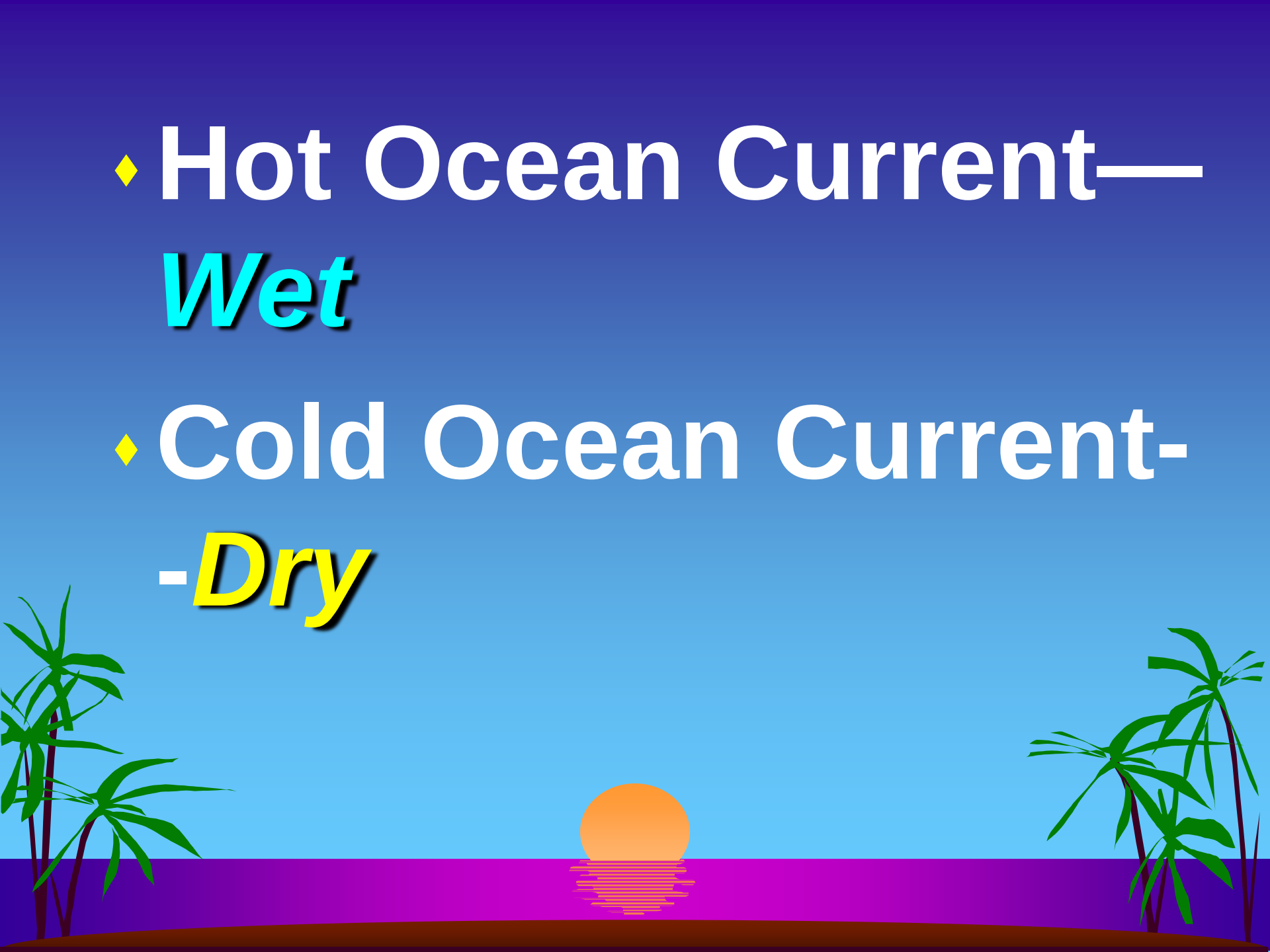
  W side of ocean—

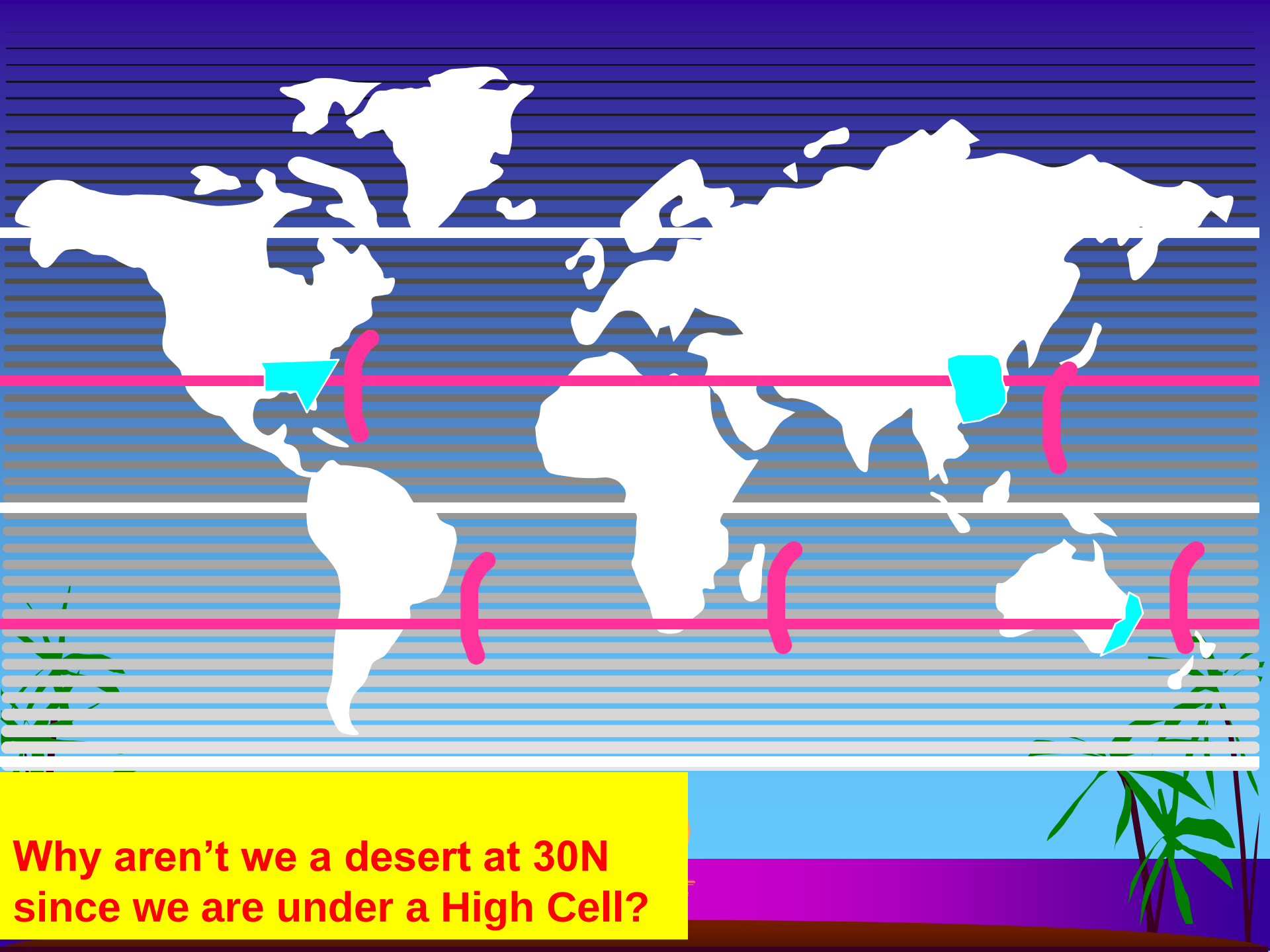
  E side of continents
- ***b. Cold currents:***

  E side of ocean—

  W side of continents

- **Hot Ocean Current—*Wet***
- **Cold Ocean Current--*Dry***





Why aren't we a desert at 30N since we are under a High Cell?

By the way…did you figure out the answers to the questions we asked earlier?

Have you ever wondered why hurricanes hit the southeastern part of the United States and not very often on the west coast?

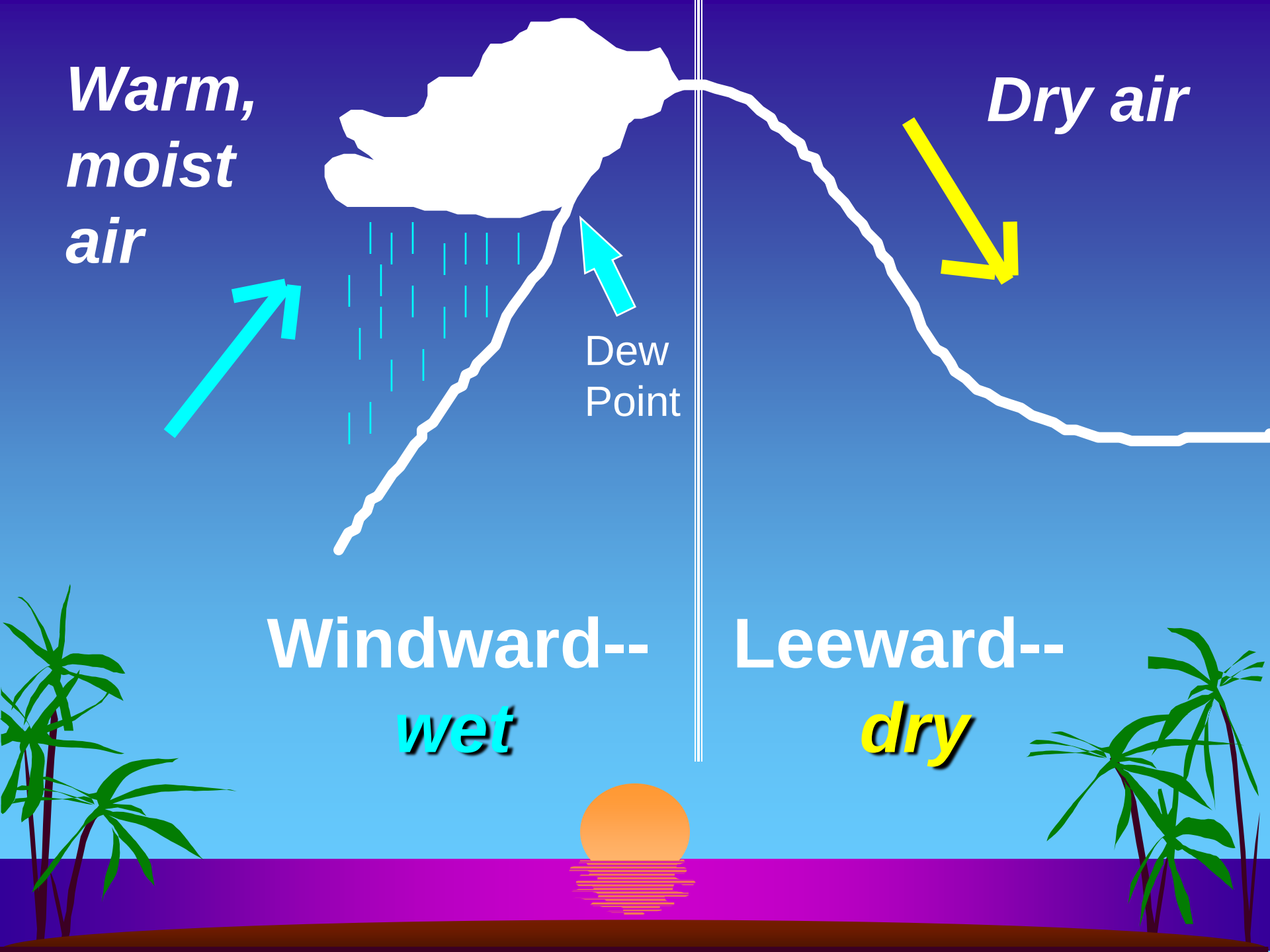
Where else do hurricanes/typhoons hit?

What time of the year?

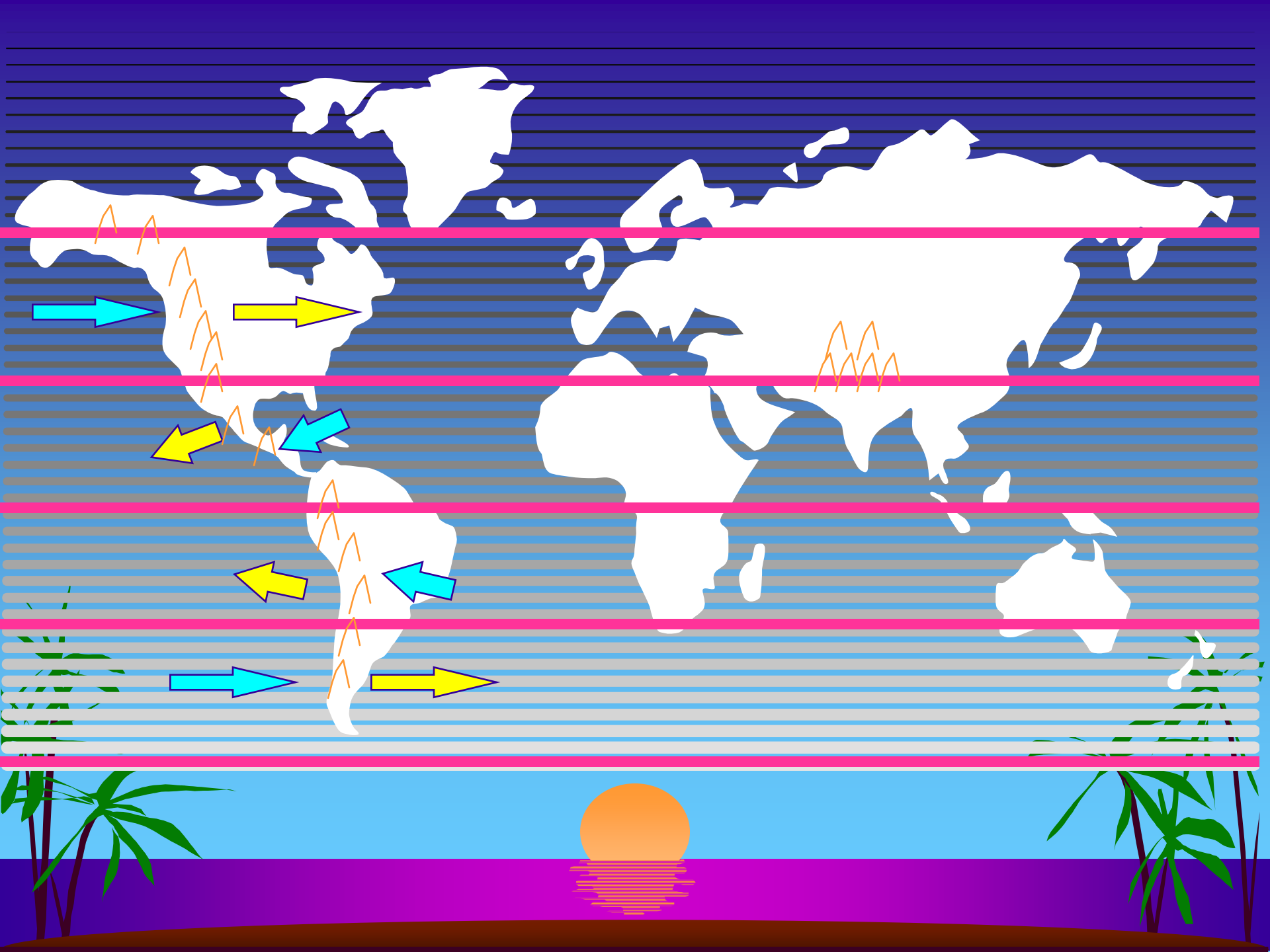
F. Mountain Barriers

- Orographic ppt.

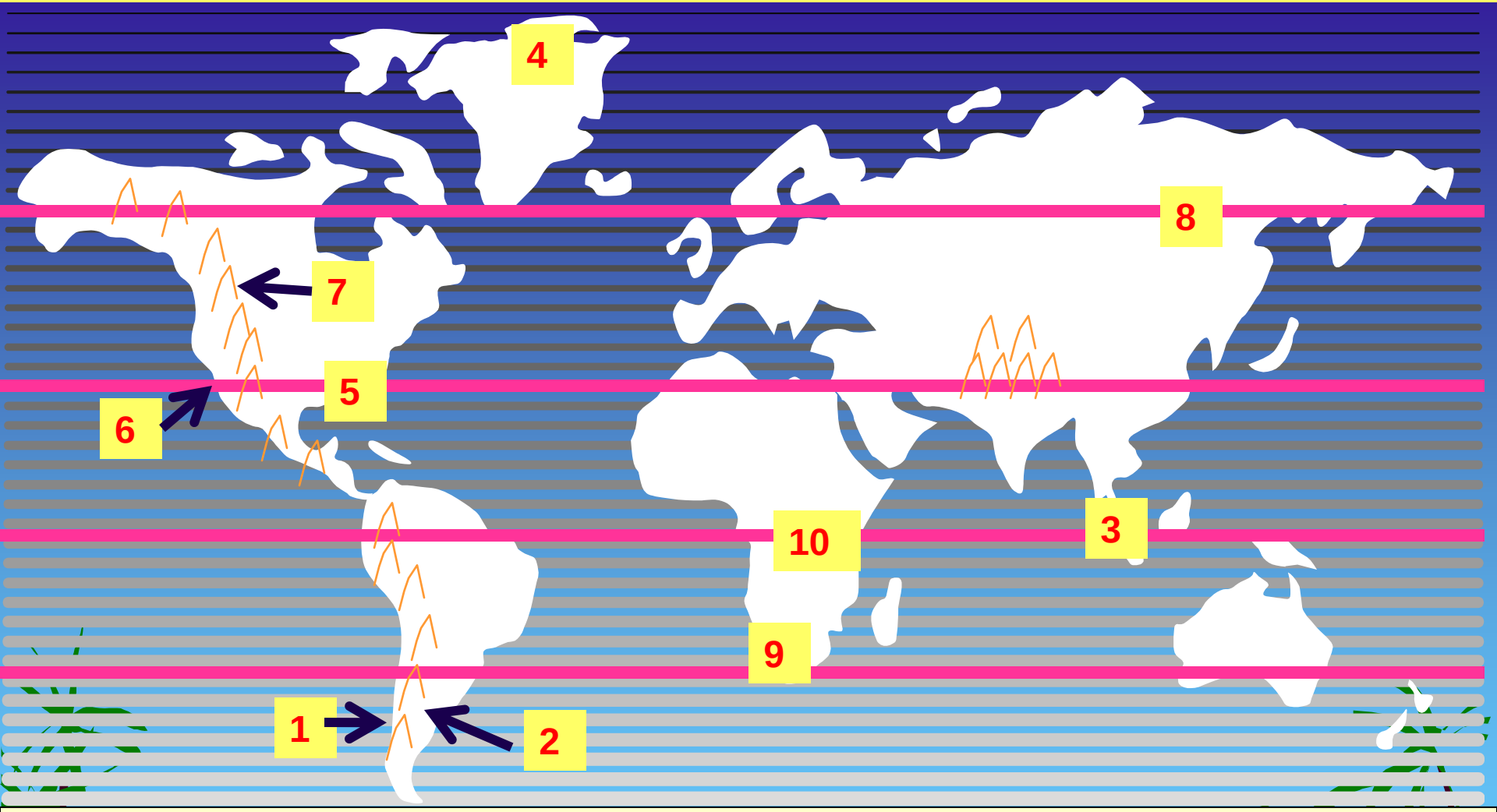
Influences Precipitation


Warm, moist air
Dry air
Dew Point
Windward--
wet
Leeward--
dry

- a. Deserts can result on the leeward side (Atacama)
- b. Rainy on the windward side (Washington & Oregon--windward of the Cascade Mts.)



What controls the temp. and ppt. conditions at each of these locations?



1 Cool with rain all year

#2 Hot summers and cold winters; dry all year

#3 Hot and rainy all year

#4 Temperature always below freezing

#5 Hot summers & cool winters; some rain all year.

#6 Hot and very dry all year

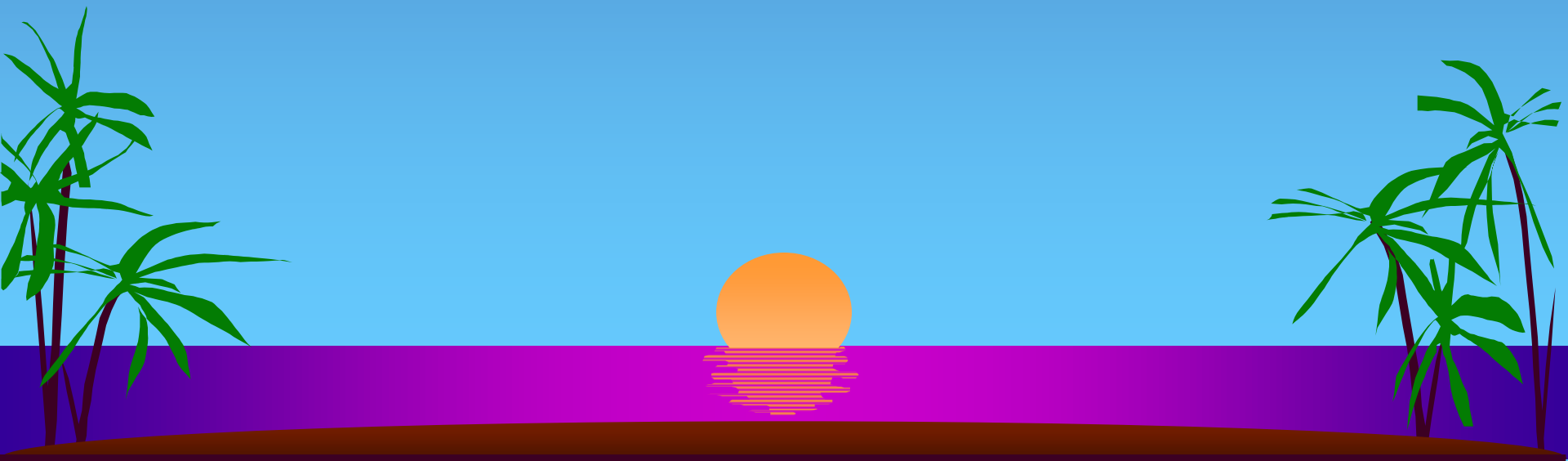
#7 Highland—temp. and ppt. vary greatly

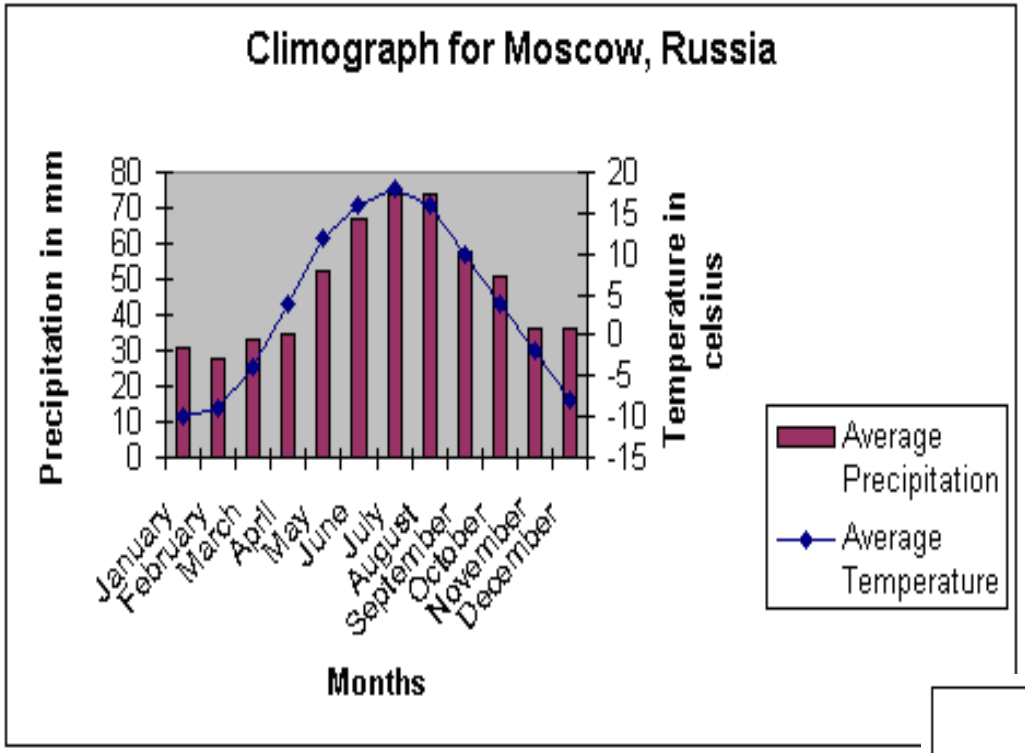
#8 Short cool summers w/ rain; long cold winters w/ snow.

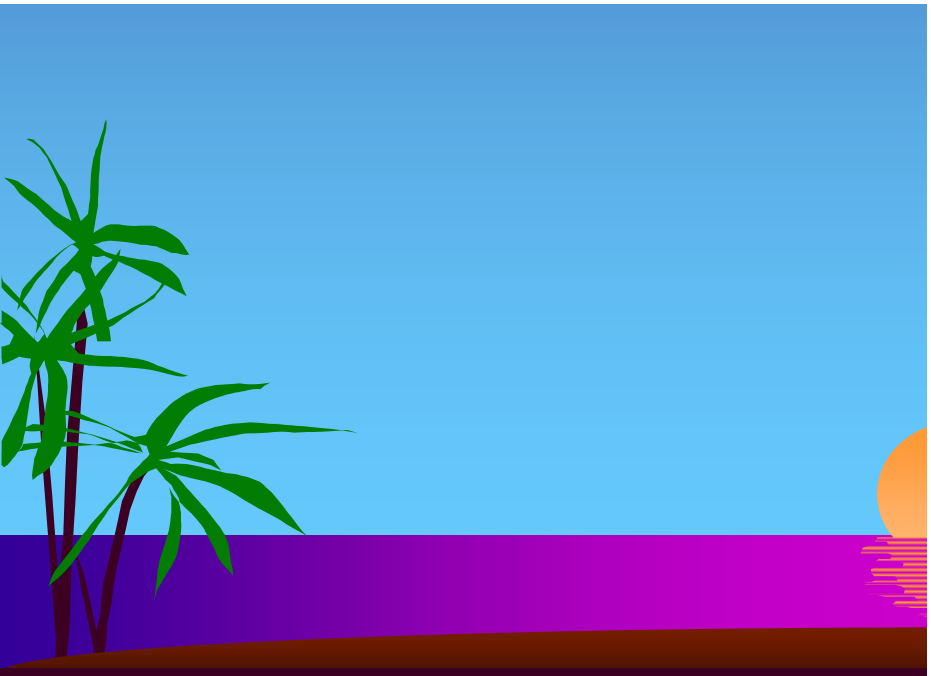
#9 Hot and very dry all year.

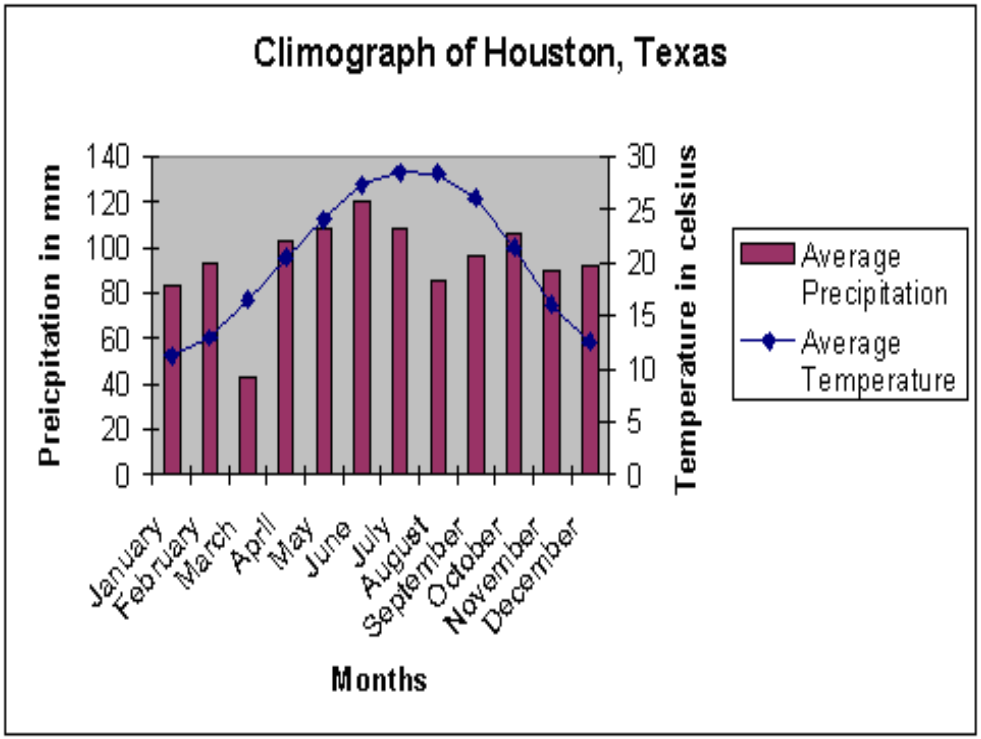
#10 Hot and rainy all year.

Another way of looking at climates of locations is to study Climographs.



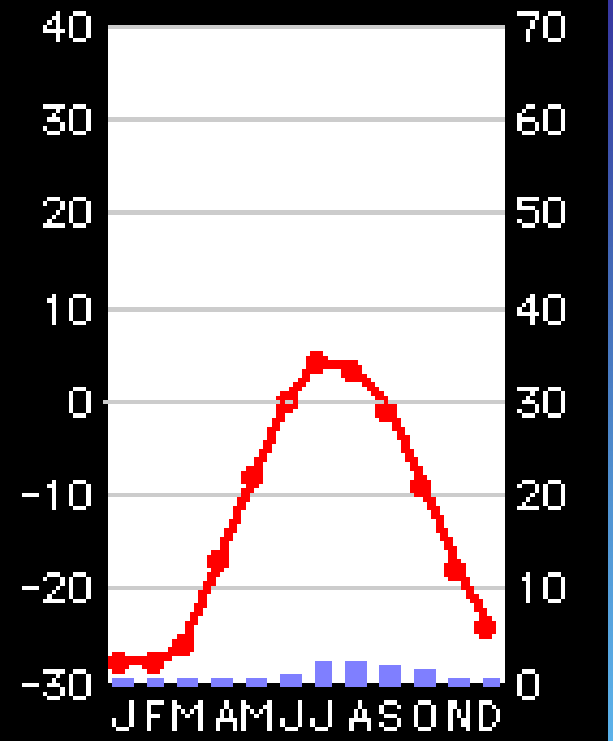

Climograph for Moscow, Russia
Precipitation in mm
Temperature in celsius
80
70
60
50
40
30
20
10
0
20
15
10
5
0
-5
-10
-15
January
February
March
April
May
June
July
August
September
October
November
December
Months
Average Precipitation
Average Temperature




Climograph of Houston, Texas
Preicpitation in mm
Temperature in celsius
140
120
100
80
60
40
20
0
30
25
20
15
10
5
0
January
February
March
April
May
June
July
August
September
October
November
December
Months
Average Precipitation
Average Temperature

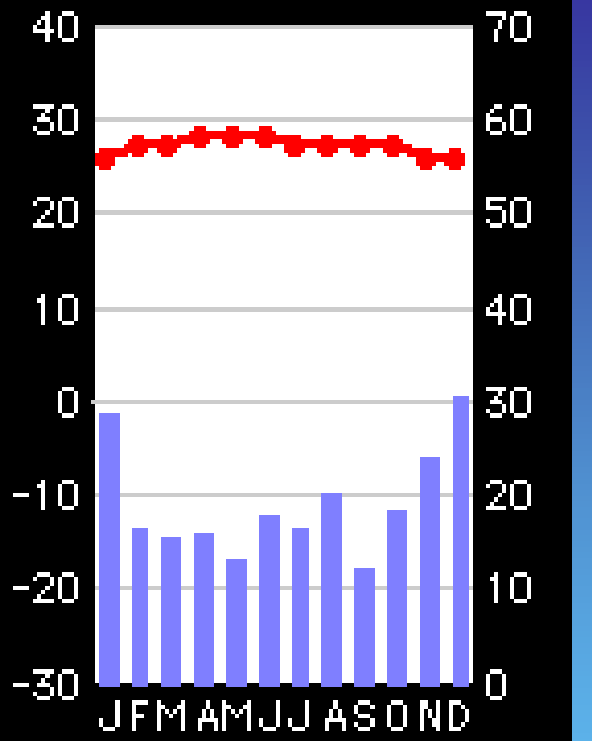
Barrow, AK, USA

71°N, 156° W
Elev. 9 m



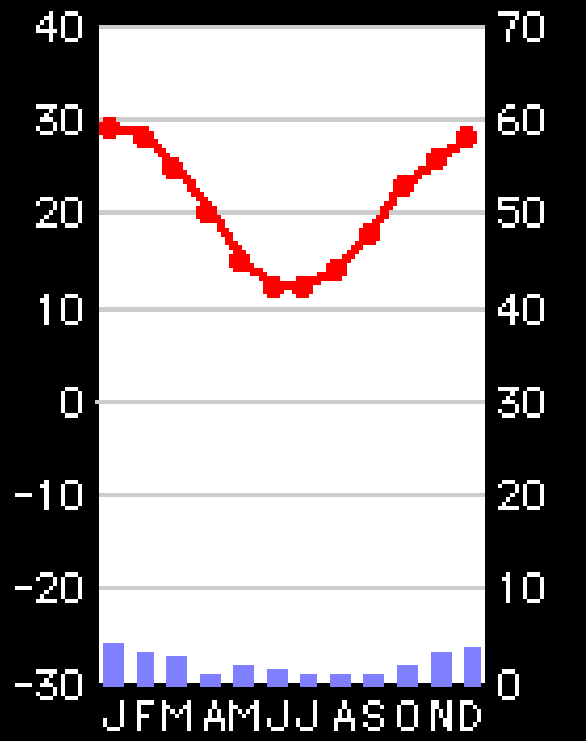
Singapore, Singapore

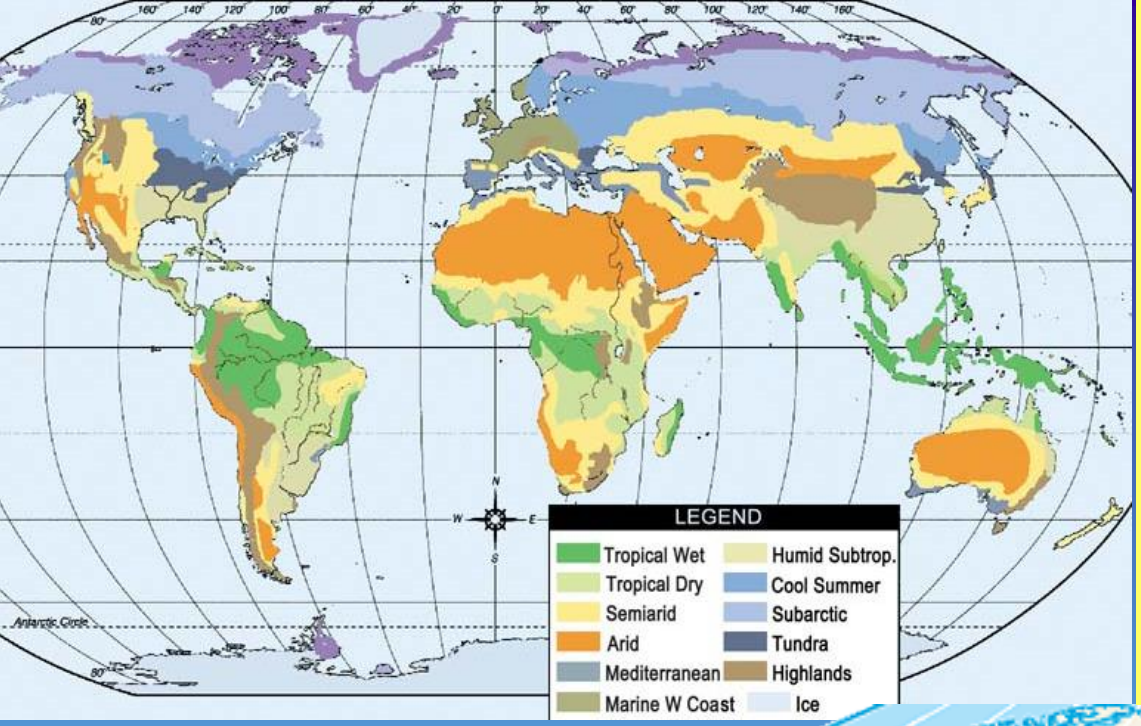
1° N, 104° E
Elev. 10 m



Alice Springs, Aus.

23.5° S, 134° E
Elev. 570 m





What is the correlation between the climate and where people live?

Why don't many people live in the central part of the US? Northern Asia? The Amazon Basin? Congo Basin? Why is Indonesia with the same climate densely settled?

What type of climate is found in India?

Why do most of the people live in the eastern part of China and not in the west?

What type of climates are found in Europe?