

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

GEO 435
Oceanography

Dr. Sattam Abdulkareem Almadani

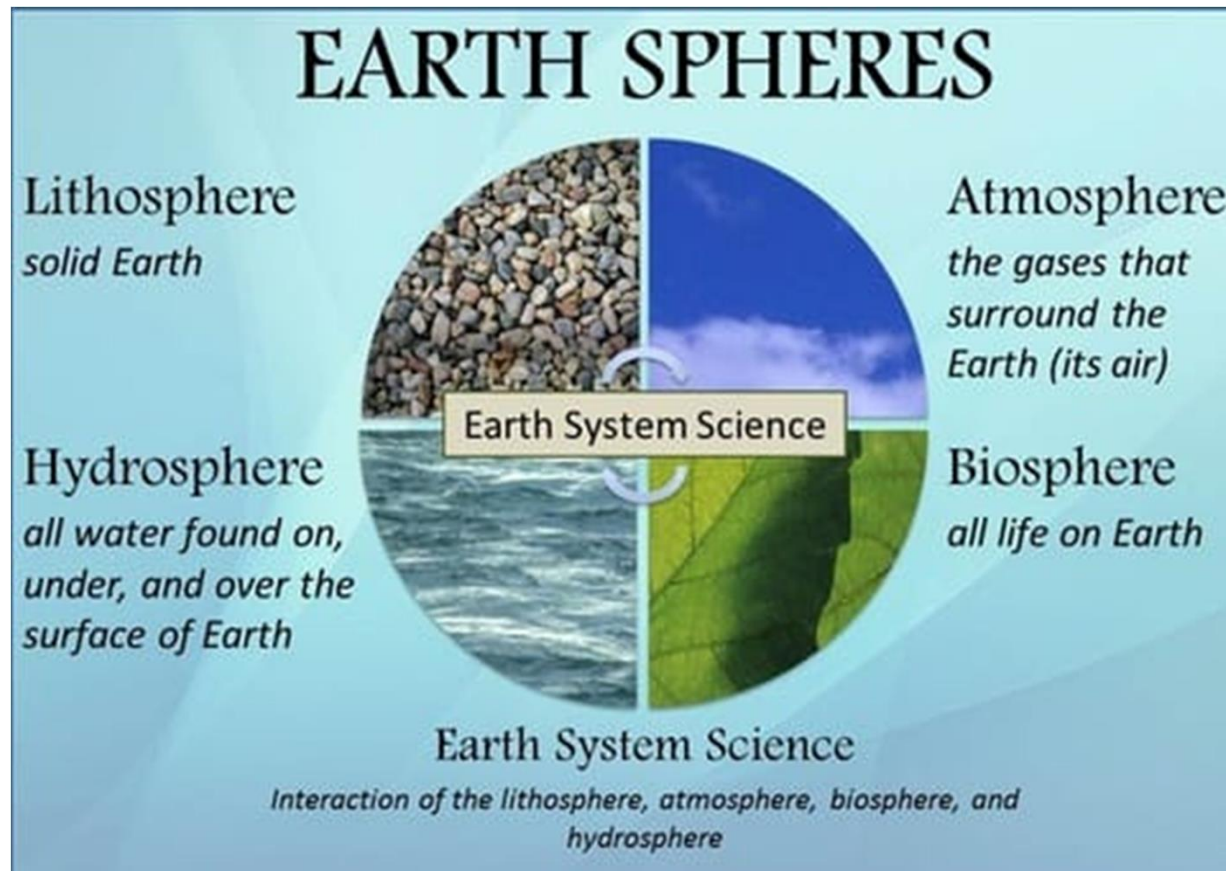
Air-Sea Interaction:

- Geo-Spheres.
- Earth's seasons.
- Earth's rotation.
- Solar heating.
- Atmosphere and ocean.
- Global wind belts.
- Weather and climate.
- Greenhouse effect.

Q. What are the geospheres?

Geospheres:

The area near the surface of the earth can be divided into four interconnected “geo-spheres”:

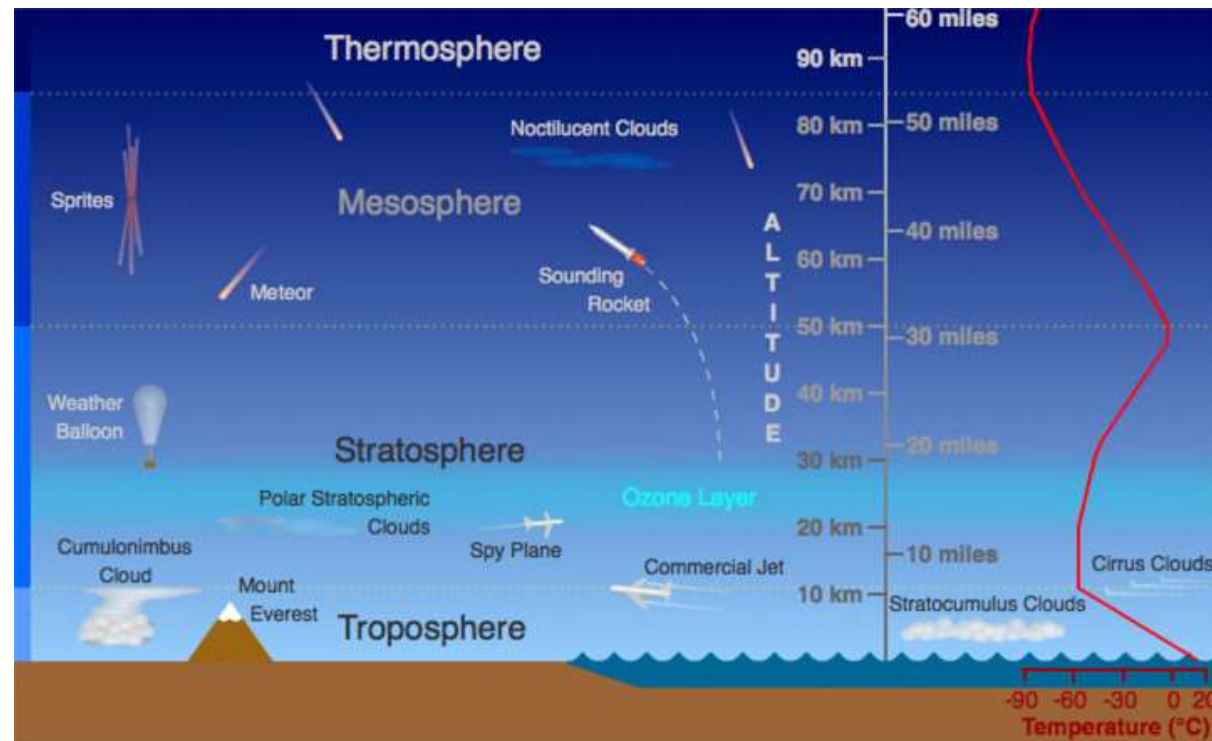


The Earth's Four Spheres

- The area near the surface of the earth can be divided up into four inter-connected "geo-spheres:"
 - **Lithosphere**
 - **Hydrosphere**
 - **Biosphere**
 - **Atmosphere**
- The names of the four spheres are derived from the Greek words for stone (litho), air (atmo), water (hydro), and life (bio).

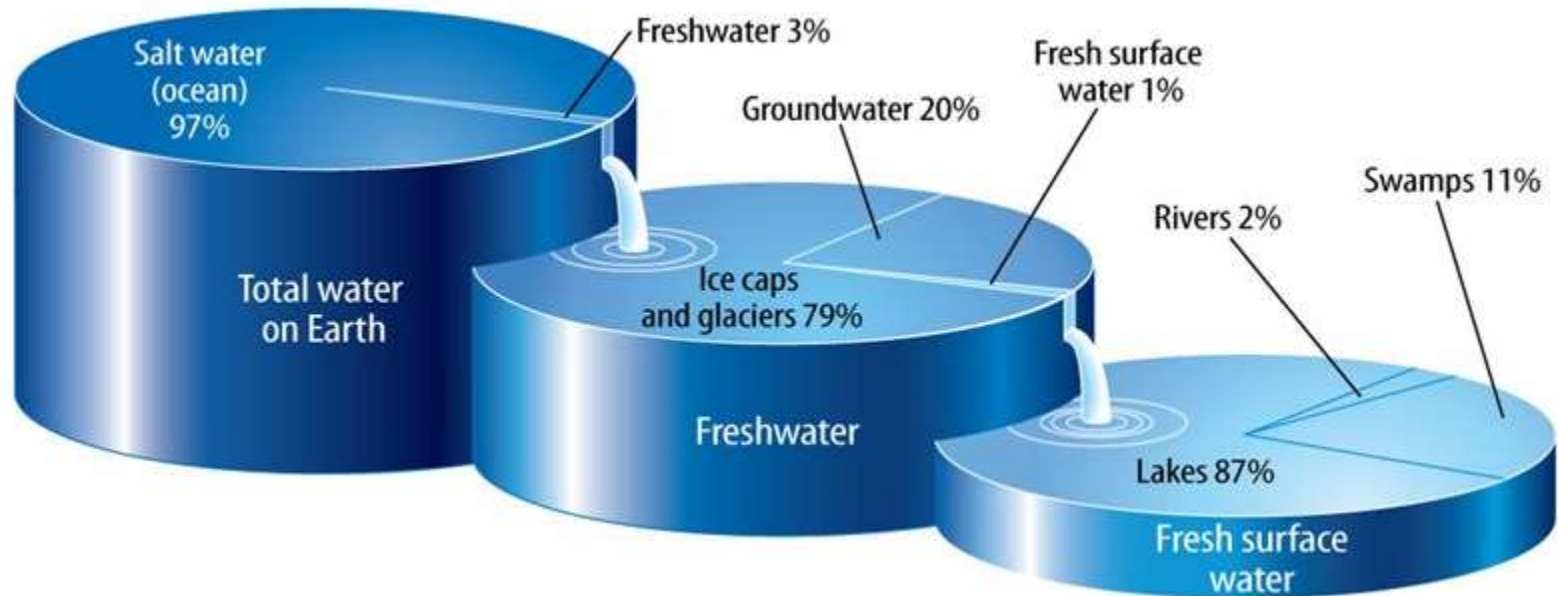
Atmosphere

- Is the body of air which surrounds our planet and located near the earth's surface.
- Provide air and protect us from the Sun's intense heat and dangerous ultraviolet radiations.



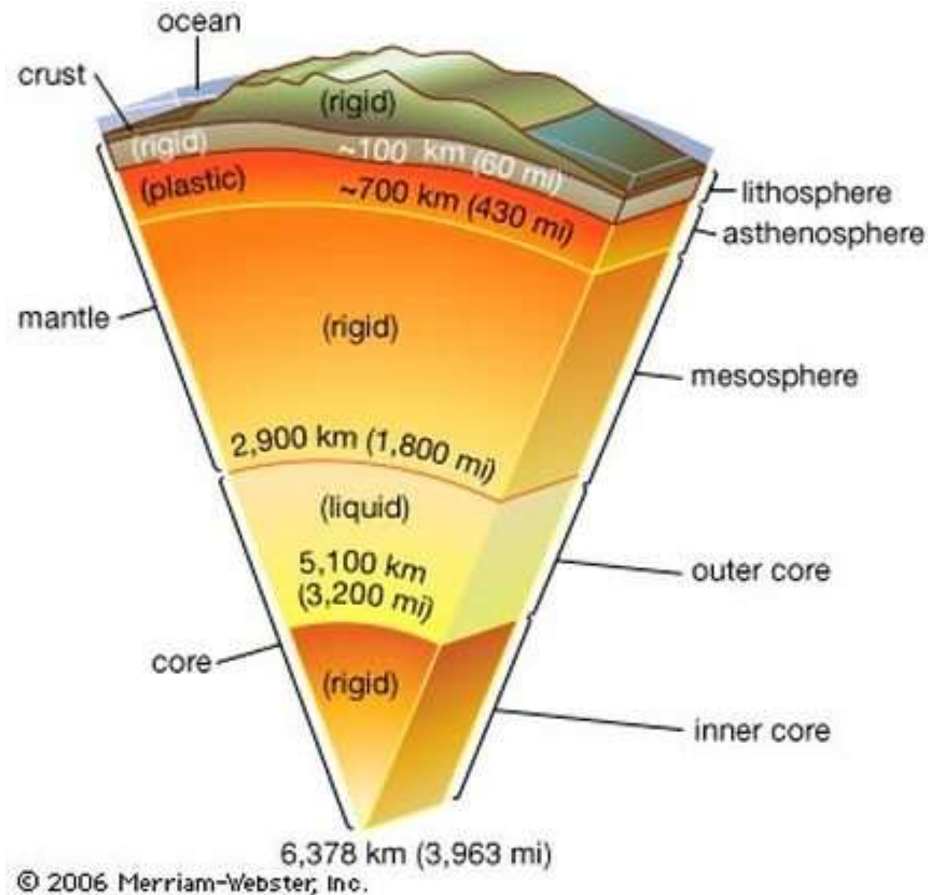
Hydrosphere

- Composed of all of the water on or near the earth. Includes oceans, rivers, lakes, and even moisture in the air. 97% in the oceans. 3% fresh water: 1/3 is solid and exists in ice sheets.



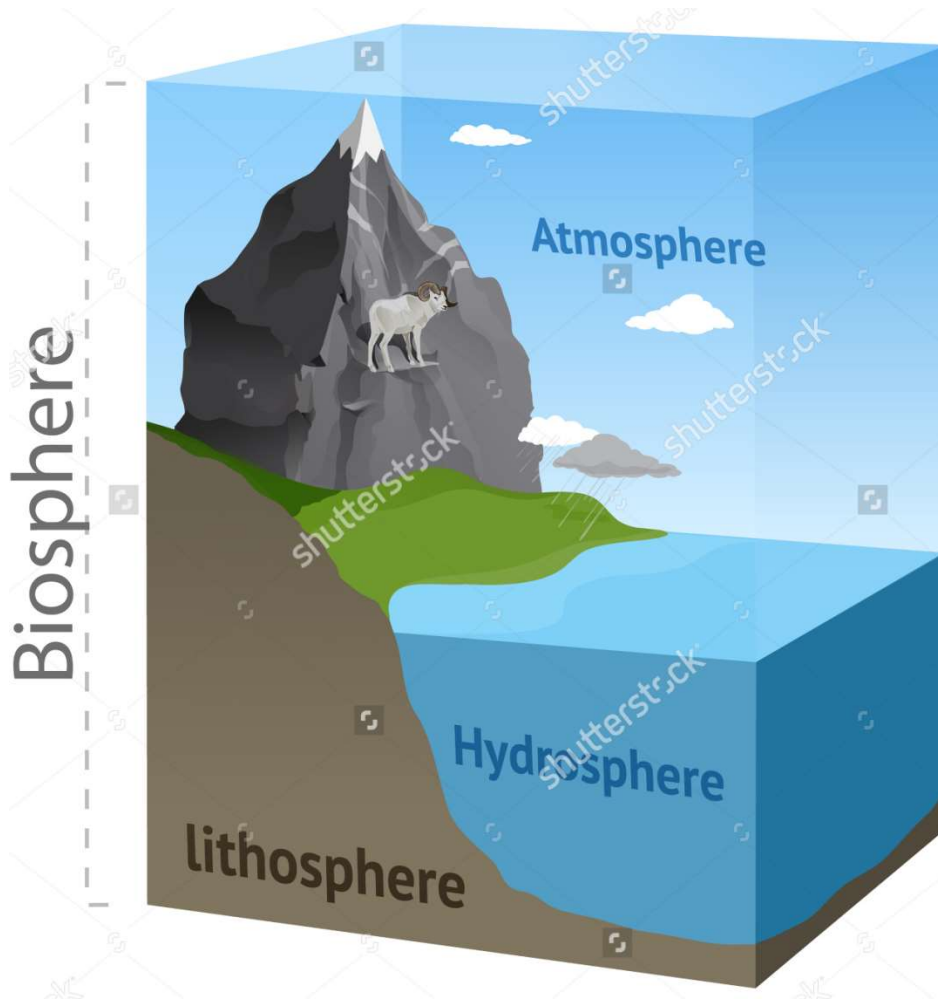
Lithosphere

- Beneath the atmosphere and the oceans is the solid Earth, or lithosphere.
- It is the solid, rocky crust covering entire planet.



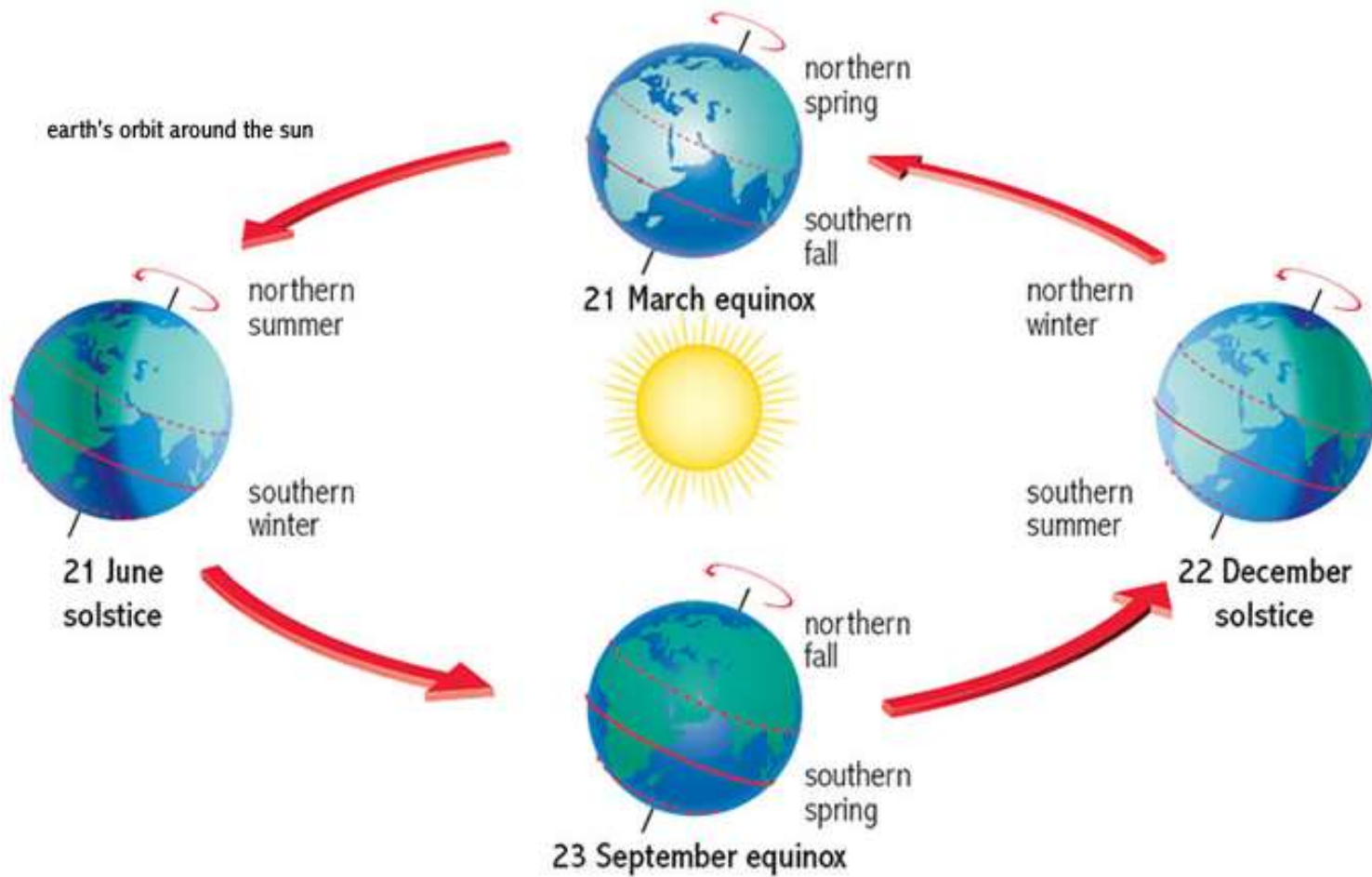
Biosphere

- Composed of all living organisms. Plants, animals, and non-celled organisms are part of it.



Q. What causes Earth's seasons?

- Earth revolves around the sun along an elliptical path.
- The plane traced by earth's orbit is called the ecliptic.
- Earth's axis of rotation is not perpendicular on the ecliptic, it tilts at an angle of 23.5 degrees.
- The tilt of earth's rotational axis causes earth to have seasons (spring, summer, fall, and winter).



Spring

- Occurs on or about March 21.
- The sun is directly overhead along the equator.
- During this time, all places in the world experience equal length of nights and day.

Summer

- Occurs on or about June 21.
- The sun reaches its most northerly point in the sky.
- The sun is directly overhead along the Tropic of Cancer.

Fall

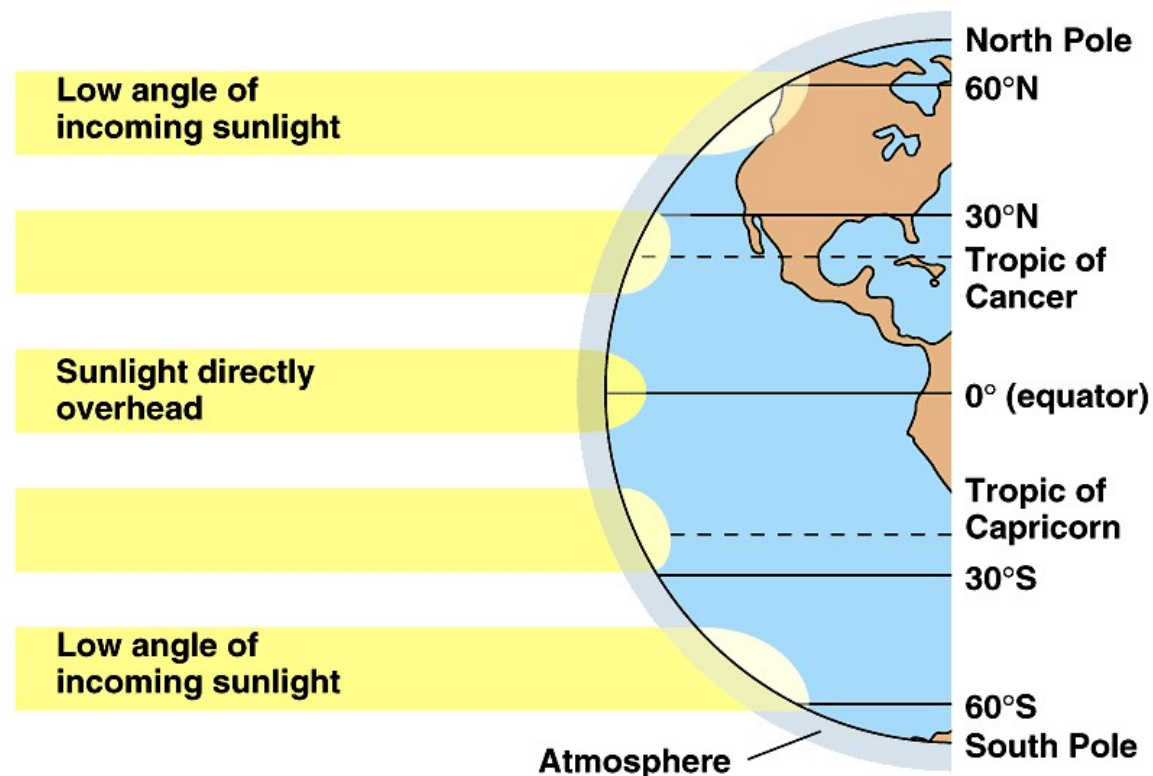
- Occurs on or about Sept. 23.
- The sun is directly overhead along the equator.

Winter

- Occurs on or about Dec. 22.
- The sun is directly overhead along the Tropic of Capricorn.

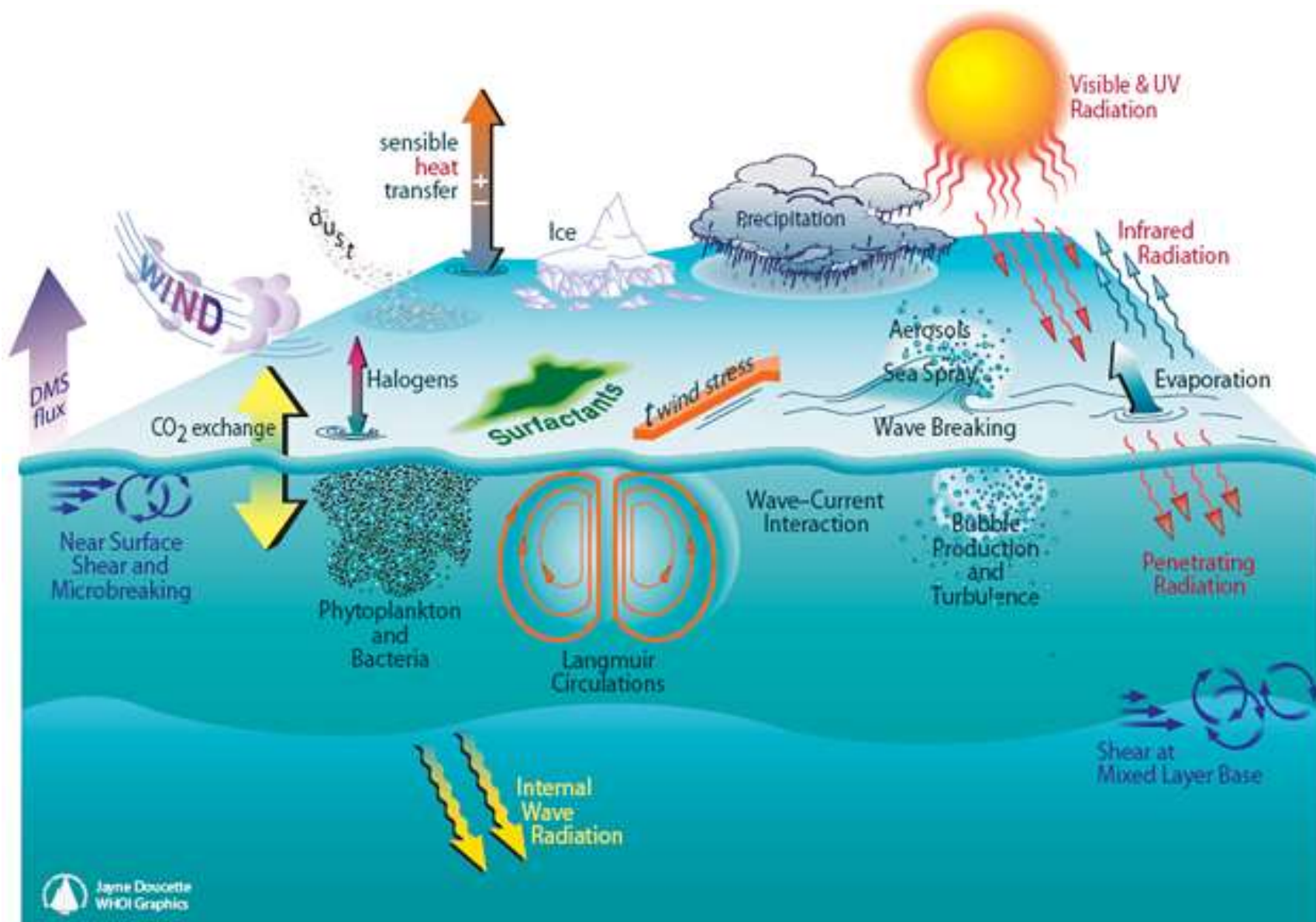
Q. Does solar heating has an effect on every parts of earth?

- In winter, Arctic receives no direct solar radiation at all and experiences up to six months of darkness (Arctic Circle).
- In winter, Antarctic receives continuous radiation and experiences up to six months of light (Antarctic Circle).

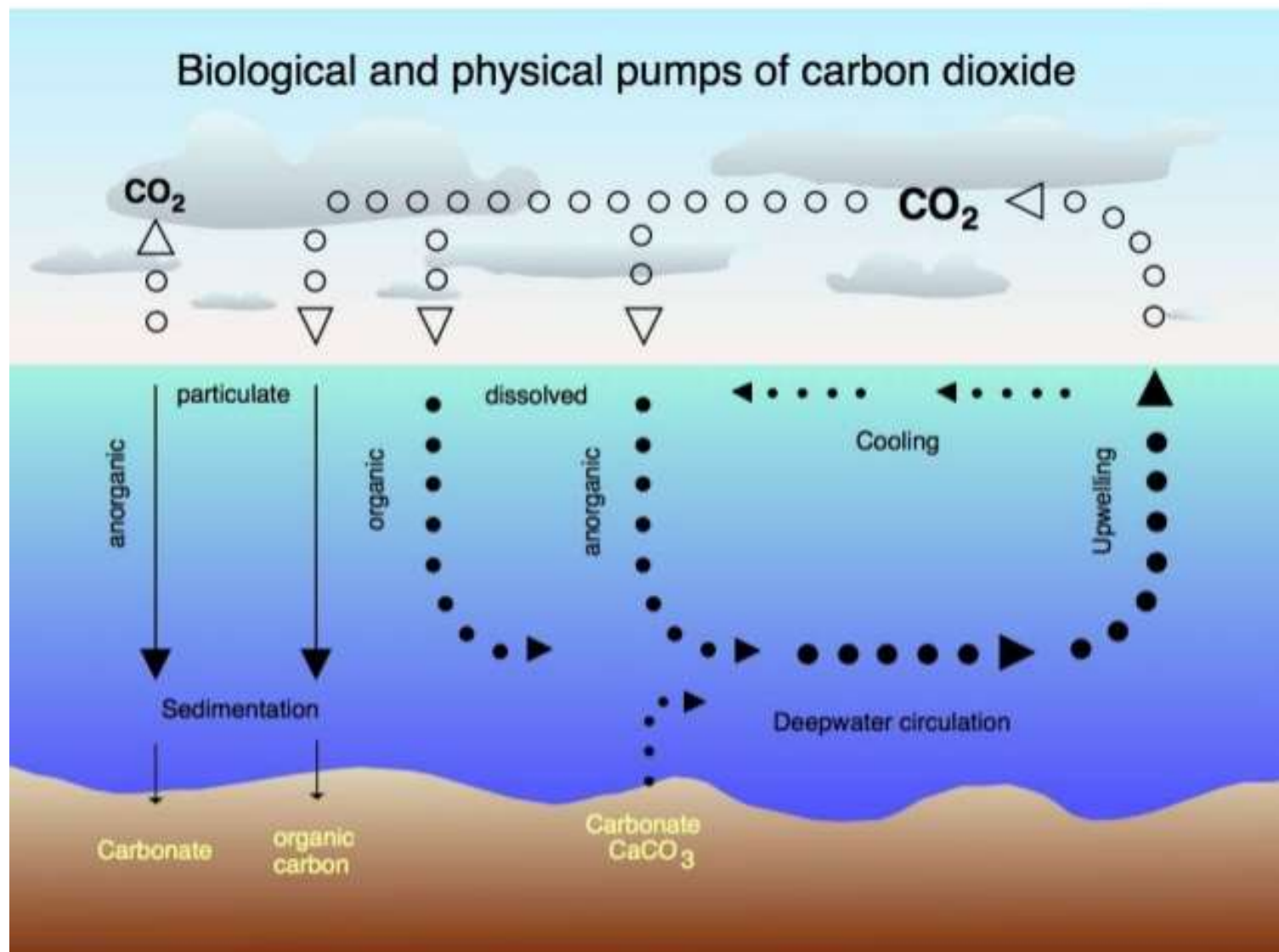


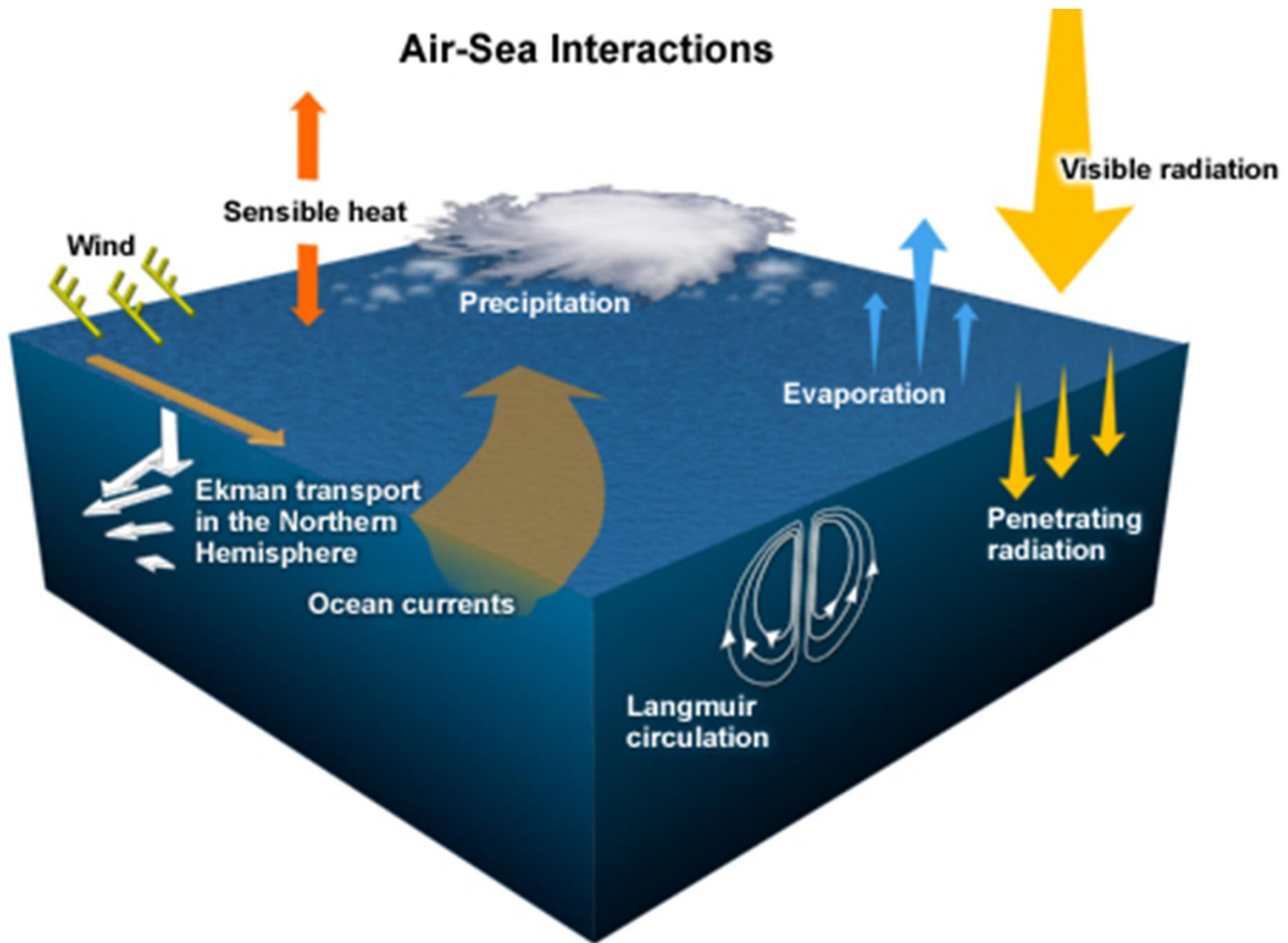
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Q. What is the relationship between atmosphere and ocean?



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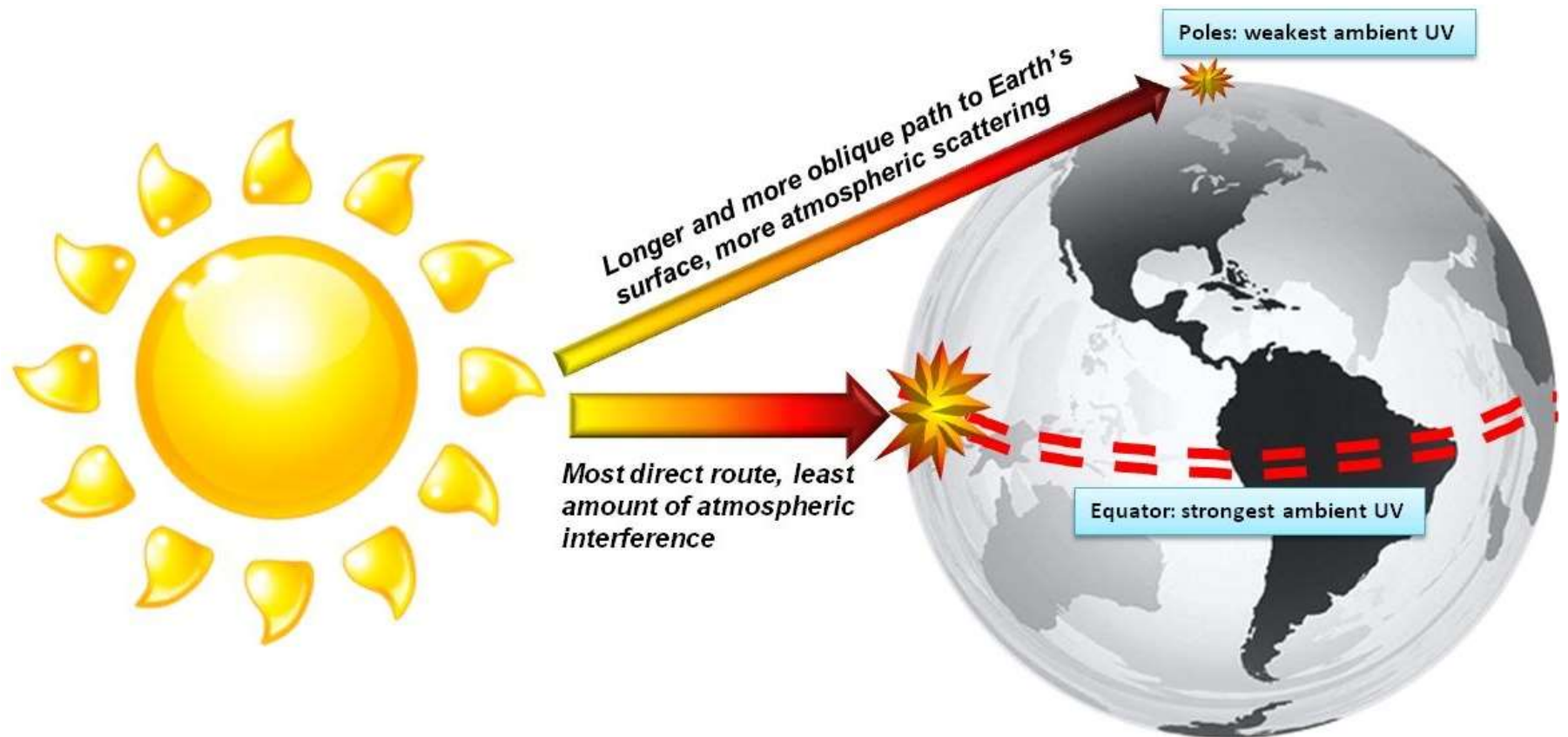




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Q. How does uneven solar heating affect earth?

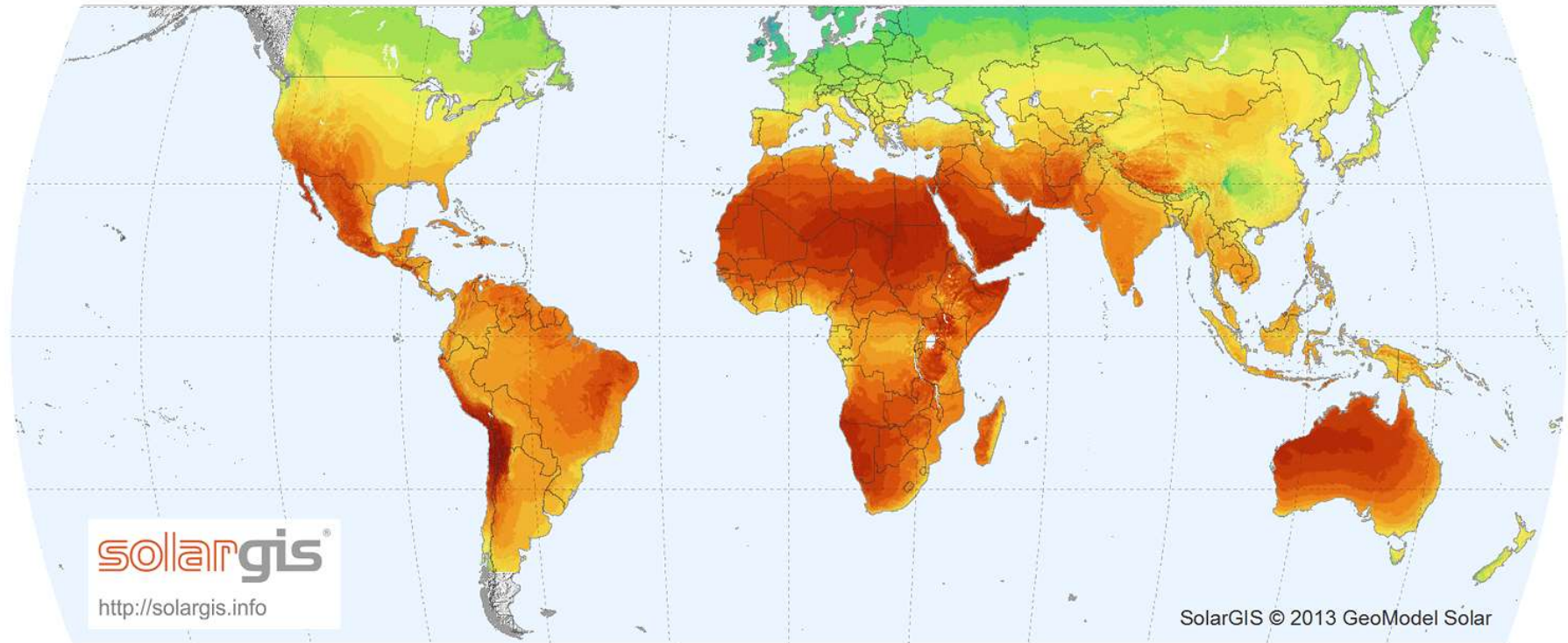
- The side of earth facing the sun (the daytime side) receives a tremendous dose of intense solar energy.
- This energy drives the global ocean-atmosphere engine, creating pressure and density differences that stir currents and waves in both atmosphere and the ocean.



- If the earth were a flat plate in space, with its flat side directly facing the sun, then sunlight would fall equally on all parts of earth.
- Earth is spherical, however, so the amount and intensity of solar radiation received at higher latitude are much less than at lower latitudes

WORLD MAP OF GLOBAL HORIZONTAL IRRADIATION

GeoModel
SOLAR

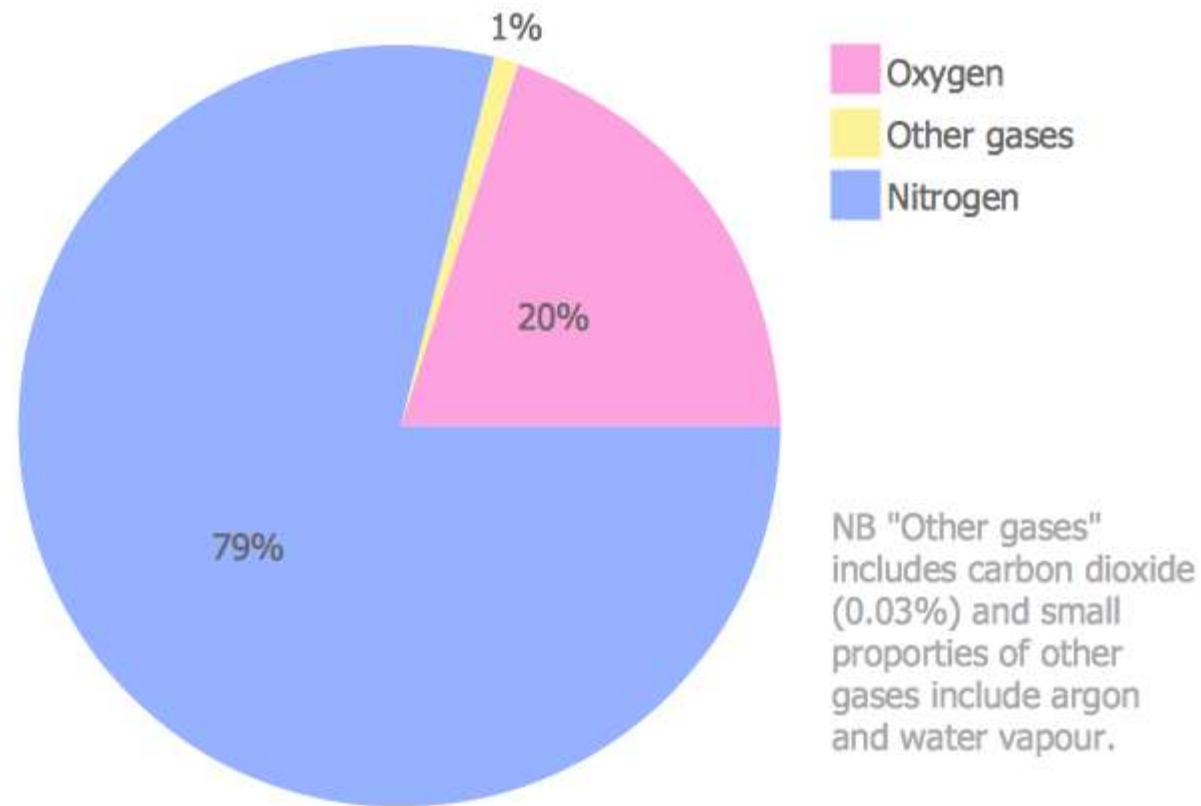


Long-term average of: Annual sum < 700 900 1100 1300 1500 1700 1900 2100 2300 2500 2700 >
Daily sum < 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5 > kWh/m²

Q. What physical properties does the atmosphere possess?

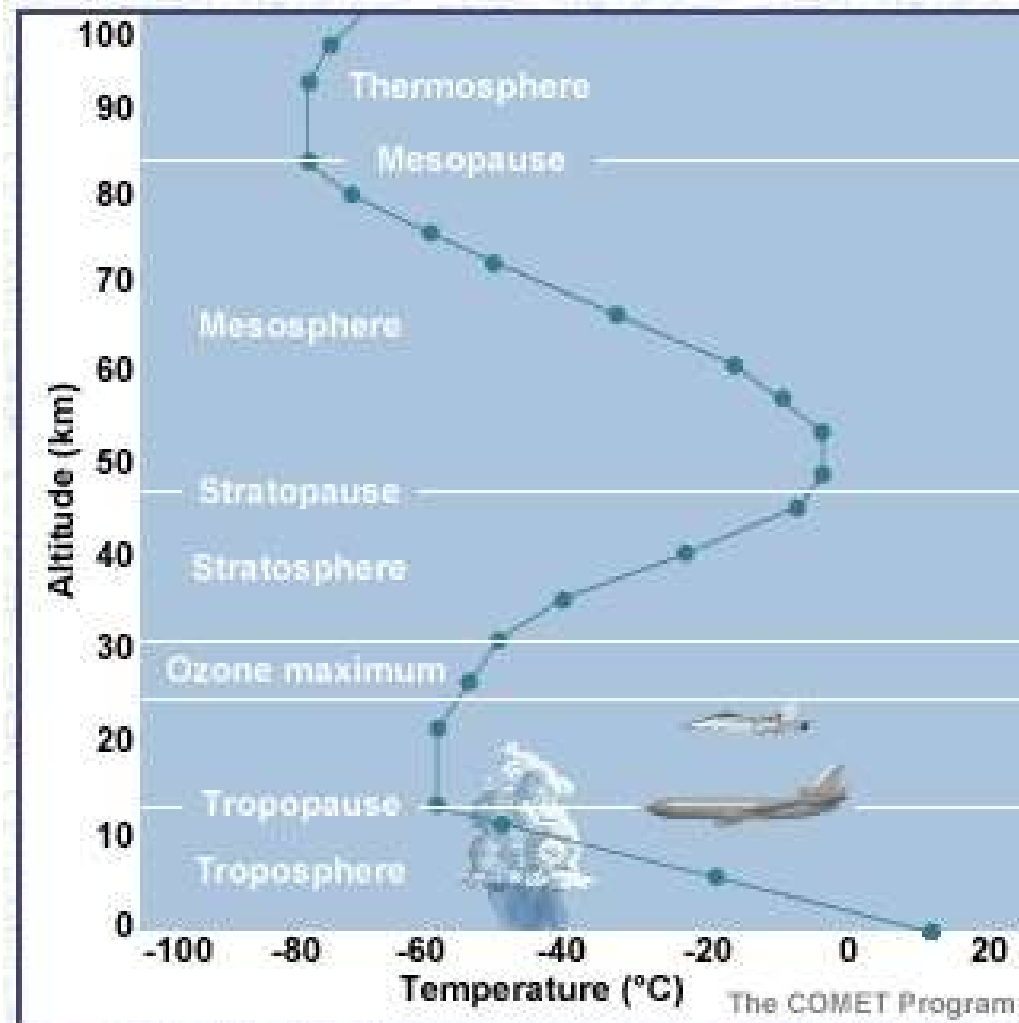
- The atmosphere transfers heat and water vapor from place to place on earth.
- Within the atmosphere, complex relationships exist among air composition, temperature, density, water vapor content, and pressure.

Air composition: gases can trap significant amounts of heat within the atmosphere.

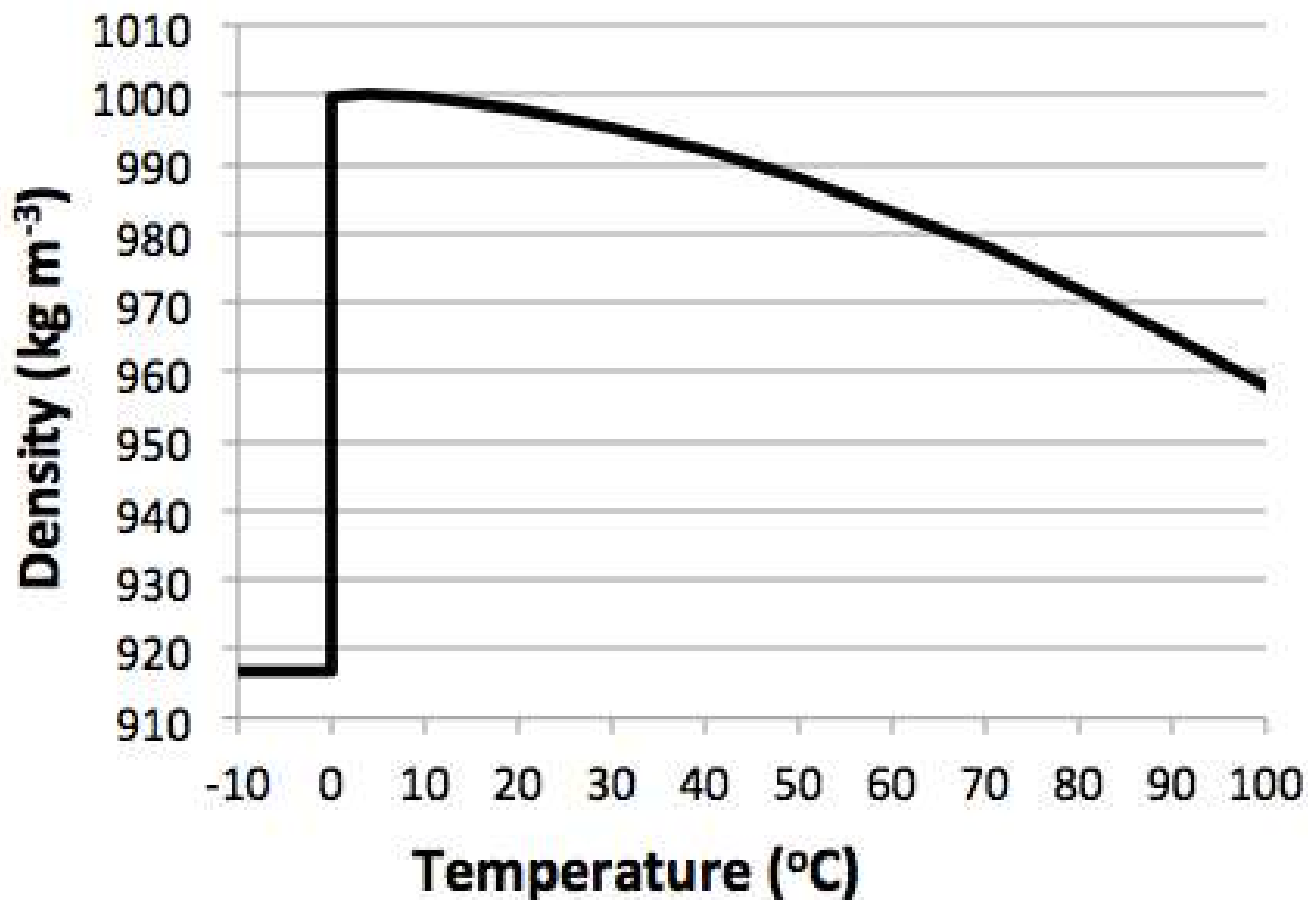


Temperature: in the troposphere all weather is produced.

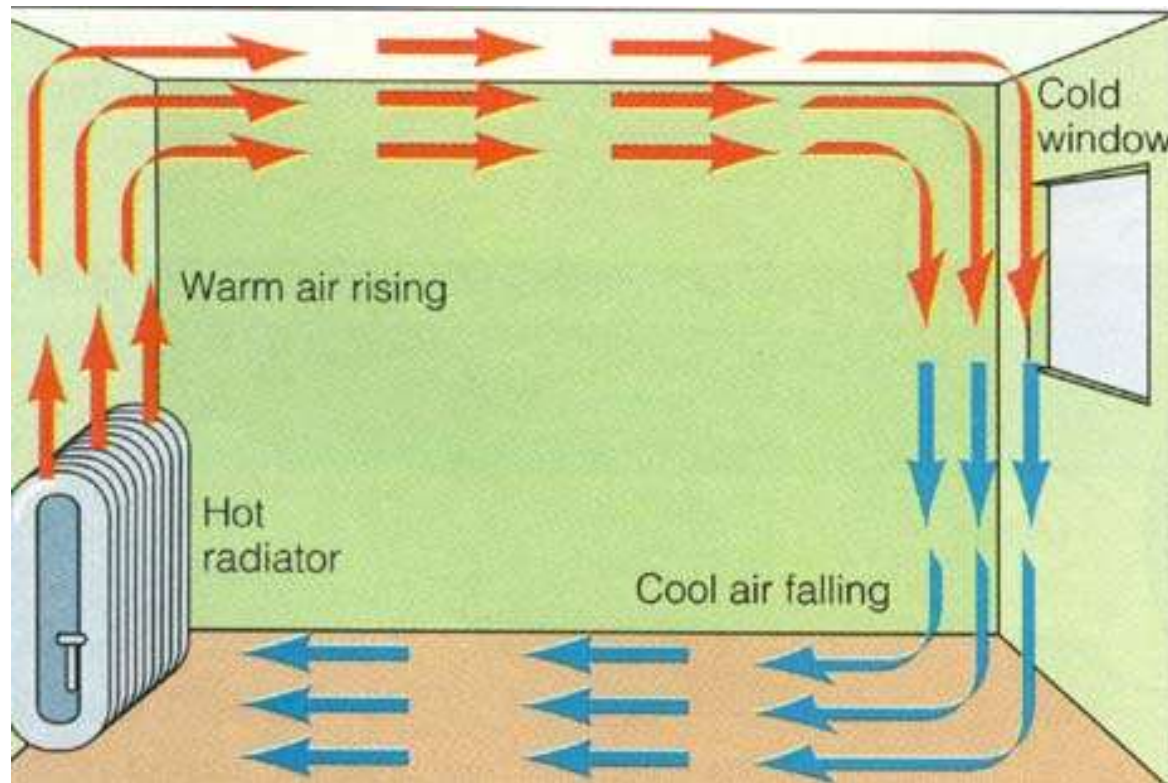
Temperature get cooler with latitude.



Density: At higher temperature, air molecules move more quickly, take up more space, and density decreases.

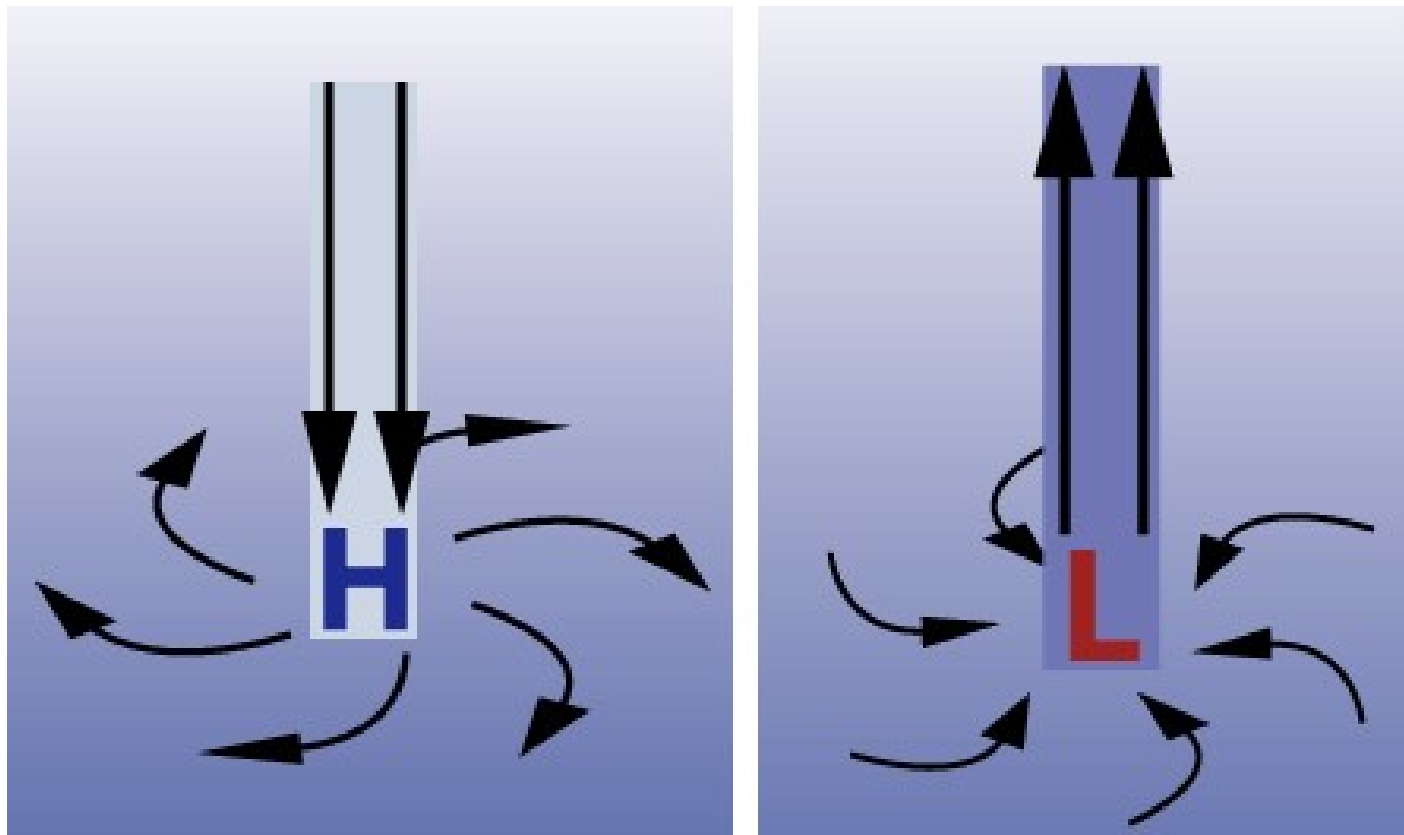


Water vapor: water vapor influences the density of air. The addition of water vapor decreases the density of air because water vapor has a lower density than air. Thus, humid air is less dense than dry air.



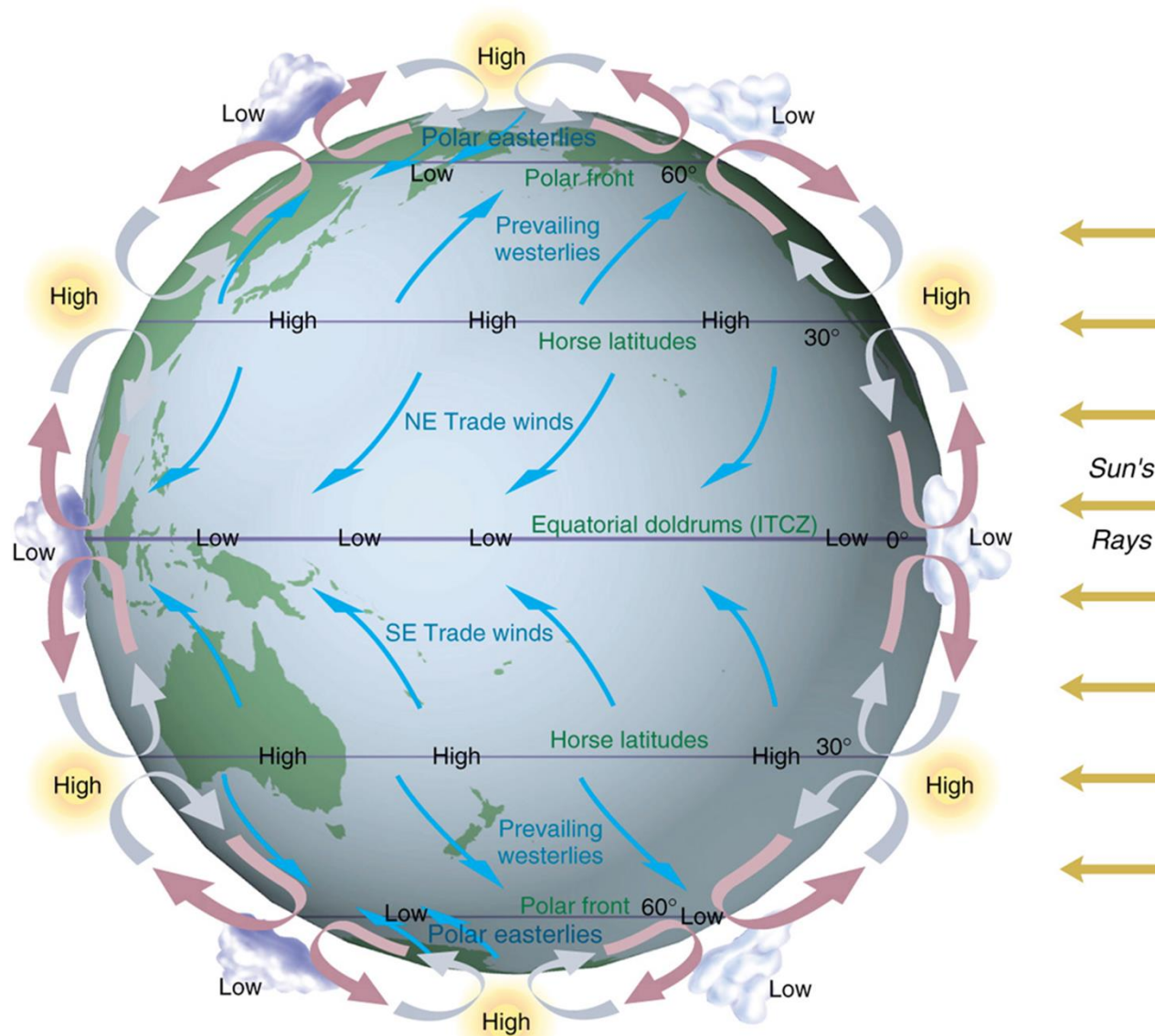
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Pressure: changes in atmospheric pressure cause air movement as a result of changes in the molecular density of the air.



Q. If earth is spinning so fast, why don't we feel it?

- In spite of earth's constant rotation, we have the illusion that earth is still.
- The reason that we don't feel the motion is because earth rotates smoothly and quietly, and the atmosphere moves along with us.
- Thus, all sensations we receive tell us there is no motion and the ground is comfortably at rest.

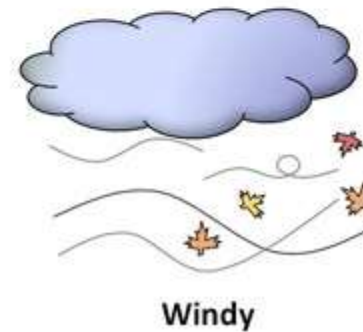


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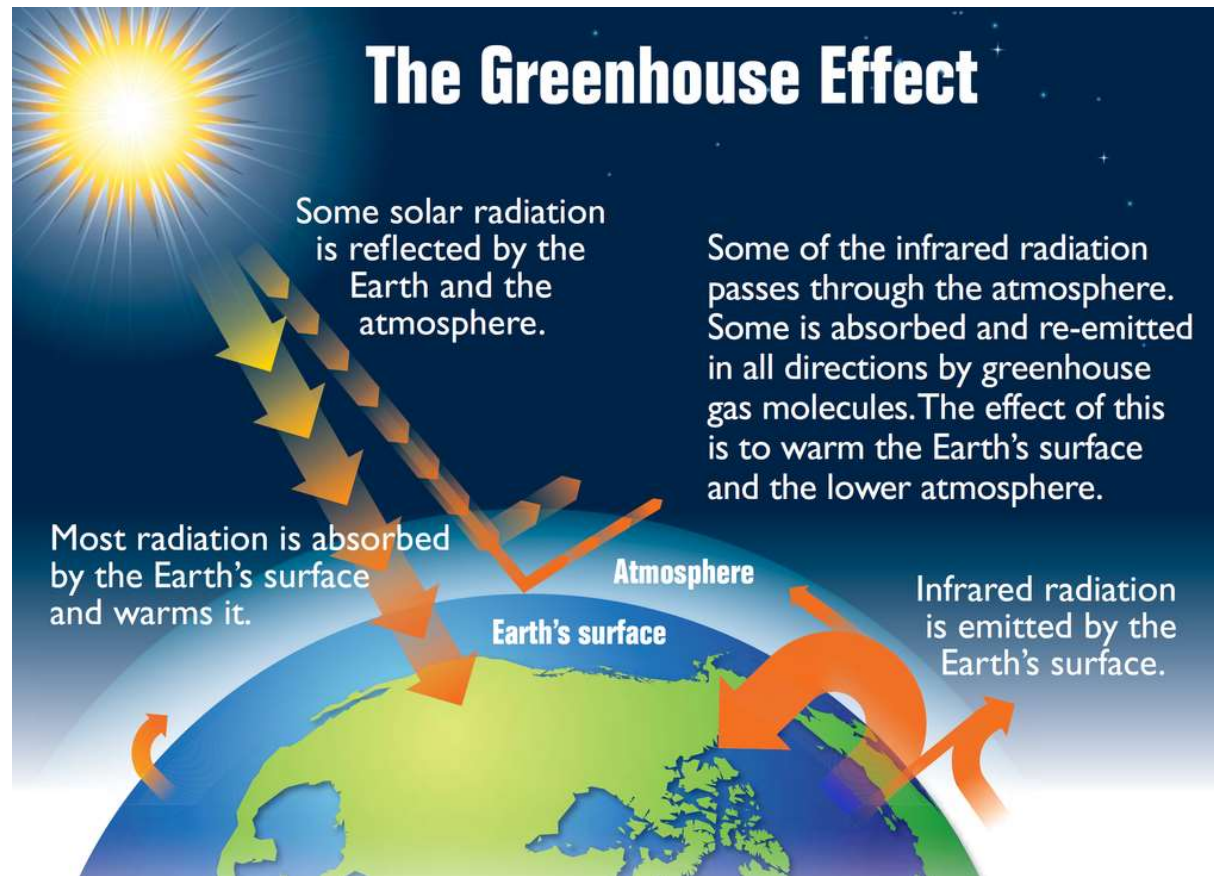
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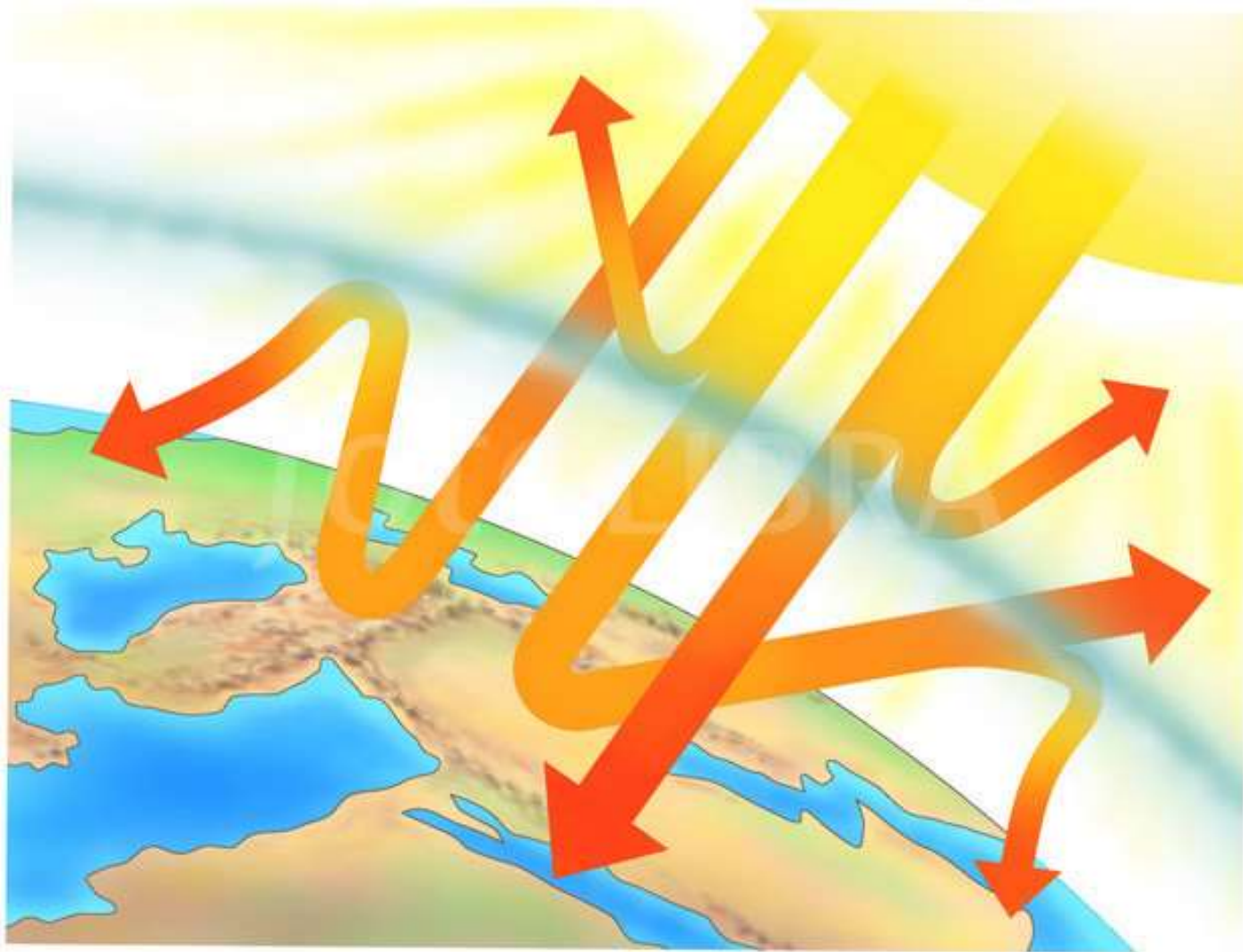
Q. What is the difference between weather and climate?

- Weather describes the conditions of the atmosphere at a given time and place
- Climate is the long-term average of weather.

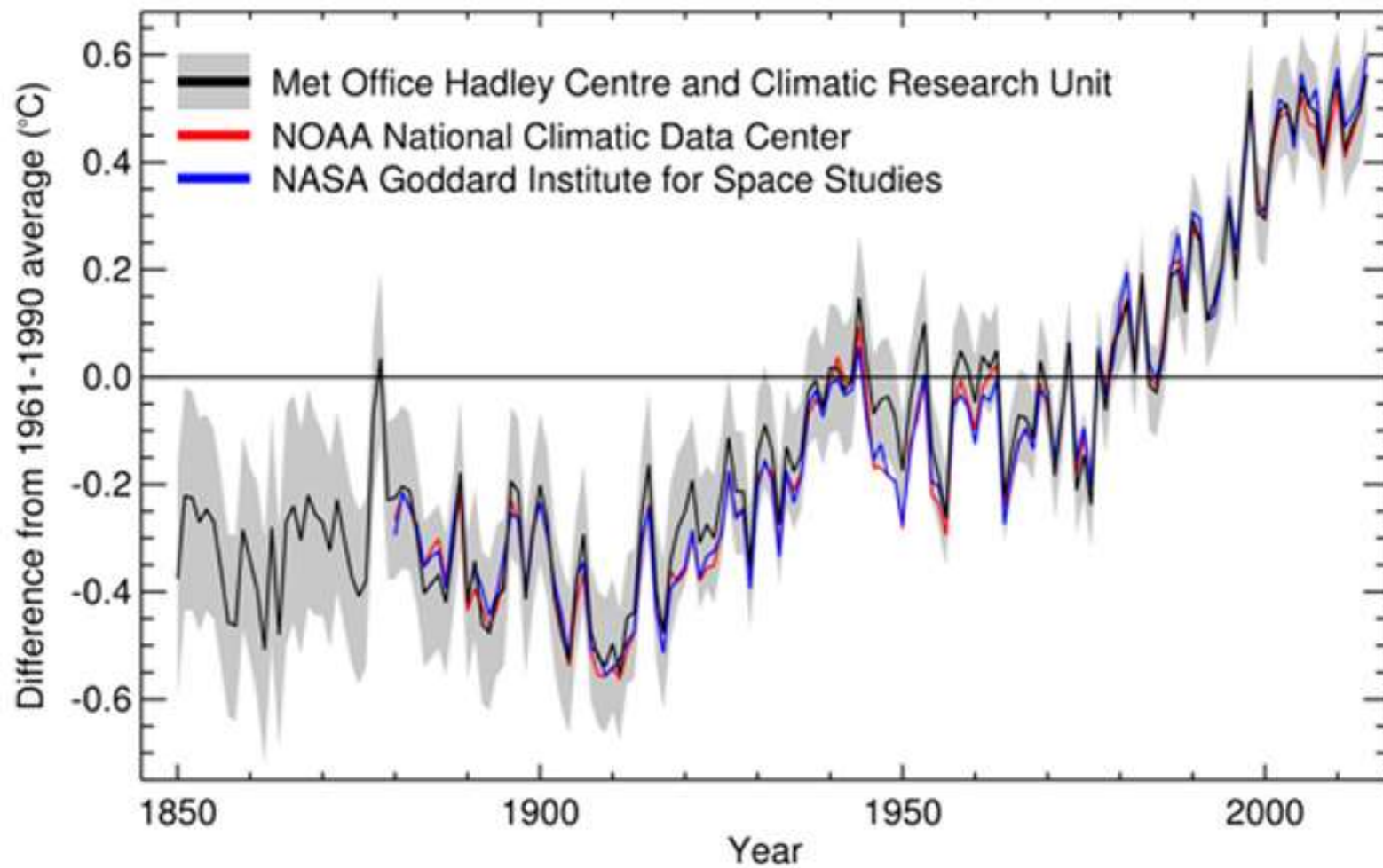


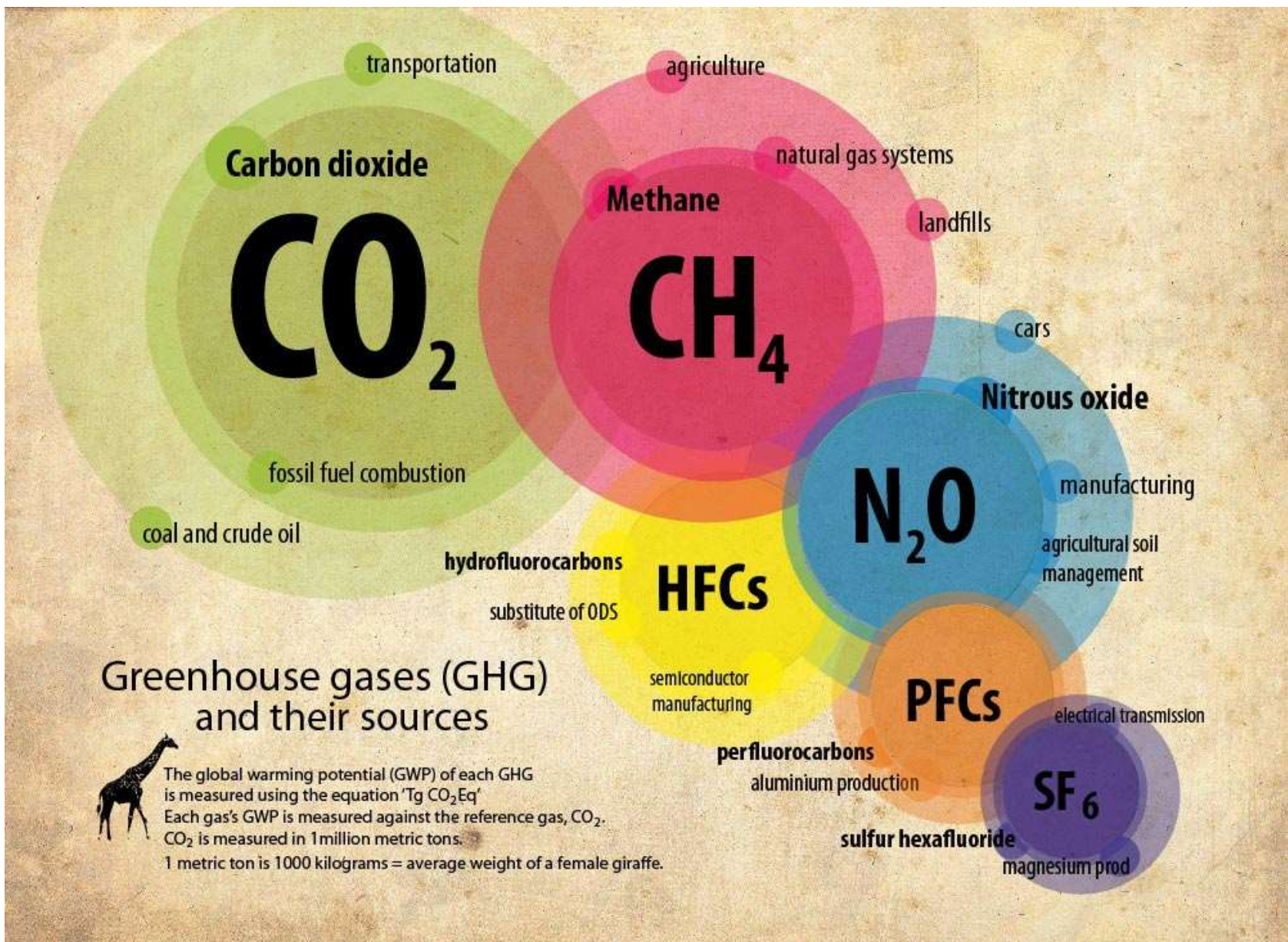
The greenhouse is caused by gases such as water vapor and carbon dioxide that allow sunlight to pass through but trap heat energy before it is reradiated back to space (trap heat).





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KYOTO PROTOCOL :

- ✓ *More than 140 countries across the world , marked one of the first and the largest international treaties in response to increasing global warming.*
- ✓ *This treaties were signed in Kyoto, Japan*
- ✓ *Hence the mission was named as 'KYOTO PROTOCOL'.*

