

Topic/Objective: Energy and the Earth	Name: Hannah Daley
	Class/Period: AOSC200
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Essential Question:

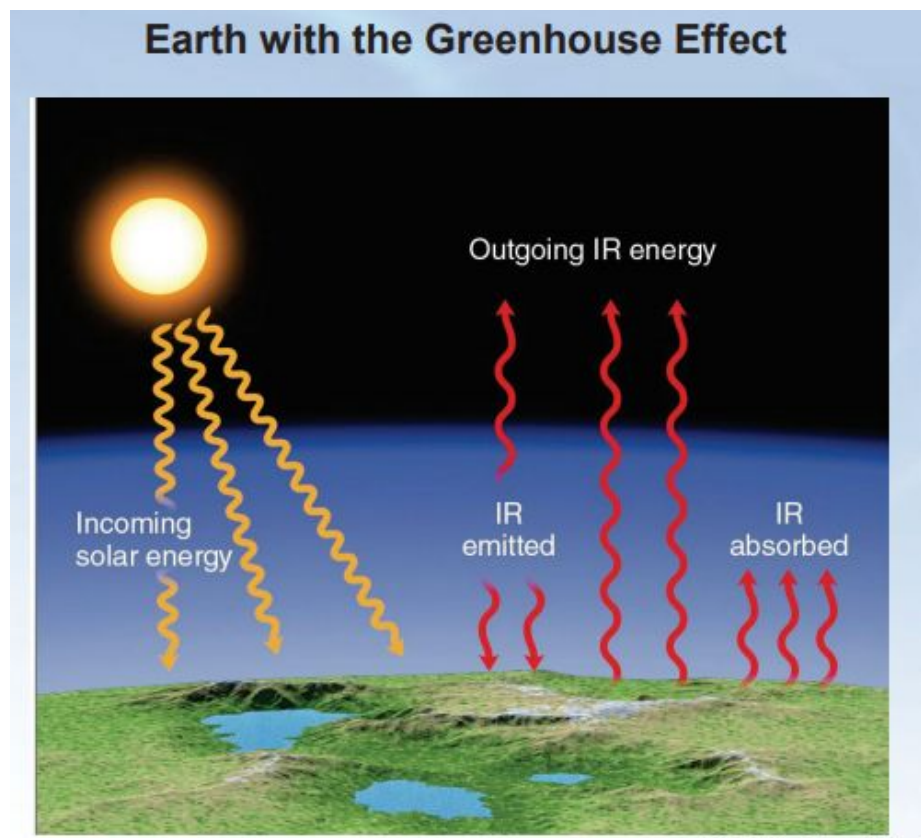
How do greenhouse gases impact incoming and outgoing radiation? What is solar zenith angle and how does it create an energy balance? How does sunlight relate to seasons?

Questions:

Review of Greenhouse Gas Effect

Notes:

When we do not consider Greenhouse Gases, the balance is incoming UV and Visible radiation balanced with outgoing IR/thermal radiation. The temperature would be -18C (super cold!!)



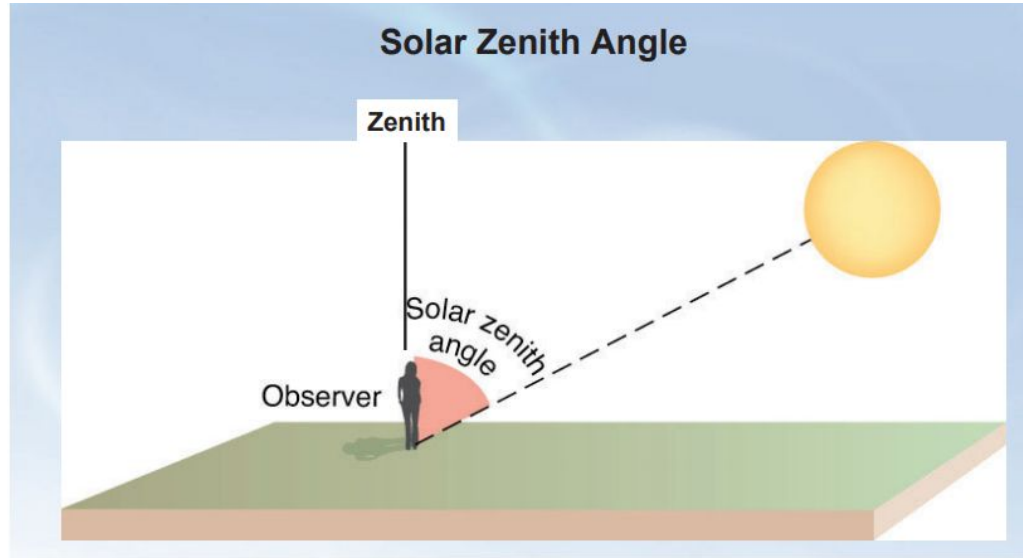
We need greenhouse gases to make the Earth habitable. When we include the impact of water vapour in our atmosphere (a very effective GHG) the Earth's average temperature becomes 18C (habitable)

What is a solar zenith angle

- Put both hands straight up! That is your zenith. Zenith just means straight above
- Keep one hand above your head and point the other one at the sun. The

angle between your arms is known as the solar/sun zenith angle.

- The zenith angle would be zero if you are at the equator at noon. Zenith angle is 90 degrees at sunrise and sunset.

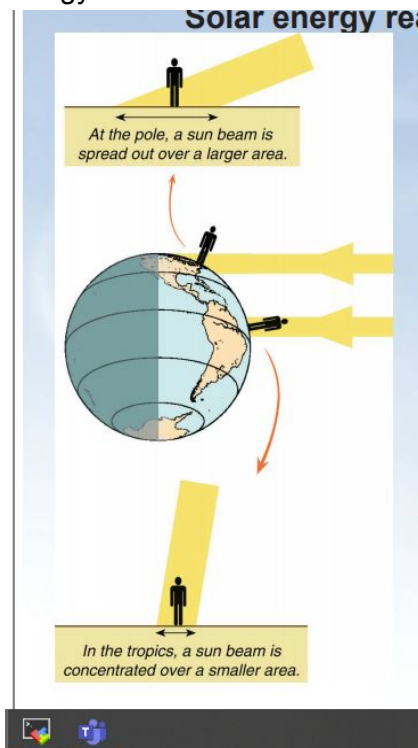


Zenith – the point directly over your head

Solar Zenith Angle – the angle between the sun and a point directly overhead

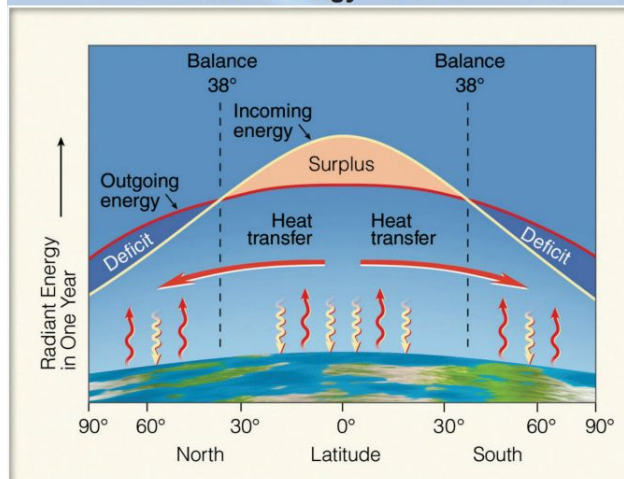
- As solar zenith angle (SZA) increases the intensity decrease. This makes sense because it is painful to look at the sun and noon but we are able to watch the sunset without scorching pain to our eye balls!

What is the Earth have an energy imbalance?



- The sun is a sphere and the amount of direct sunlight received varies based on latitude (distance from the equator)
- The equator receives the most direct solar radiation because the SZA at noon is zero.
- As you move farther from the equator the sun beam is spread out over a large area and the sun intensity is considered less direct.
- Also, the poles tend to have ice/snow which is more reflective of incoming energy
- This leads to an Energy imbalance (more energy distributed to the equator than to the poles) So heat needs to be transferred from the equator to poles

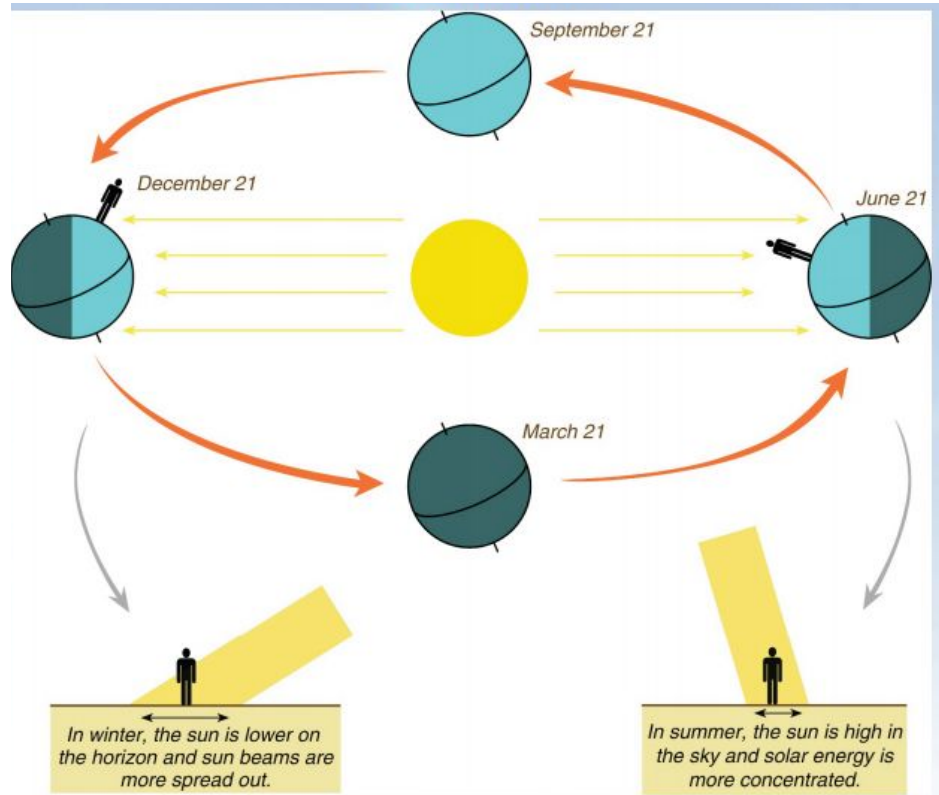
Global Energy Balance



Why do seasons occur?

Axial tilt!

Earth's axis is tilted towards the sun in the summer. This gives us longer sunshine in a day and more warmth. In the winter the axis is tilted away from the sun giving us shorter and thus colder days.



Summary:

Greenhouse gases **DO NOT** impact incoming radiation. The Earth absorbs UV and visible light from the sun and emits IR radiation back to the sky. Greenhouse gases absorb this outgoing radiation and re-emit this energy back to the surface (heating it)? Solar zenith angle tells us how high in the sky (how direct) the sun is. The more sun we receive the more will be absorbed and emitted from the Earth (warmth). Thus the more direct sunlight we receive the warmer the conditions are. This is why is it colder towards the poles. Seasons are created by axial tilt.