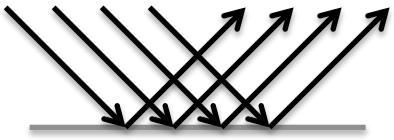
Class Notes Listening and Note-taking Practice 4

Topic: *Global Energy Balance and Temperature* Class: The Atmosphere

Speaker: Julie Ferguson, Ph.D

http://ocw.uci.edu/lectures/ess_5_lec_04_the_atmospere_global_energy_balance_and_temperature.html (7:30 – 43:09)

Questions/Main Ideas	Notes
Why is earth in the "Goldilocks Zone"? **What five things control the global temperature?** **Does the changes in the sun's power affect the earth's climate much?** **Does the earth's changes in the distance from the sun change our climate much?** **Where does the solar radiation go that enters the atmosphere?**	Earth and the "Goldilocks Zone" - Venus (too big), Mars (too small), Earth (just right) - Earth – perfect for water and life to exist AIMS: - Factors that sets the global temp - Examples: how factors have been altered in history but still complex life is able to exist - Use factors to predict temperatures that we might see if we were on Venus or Mars **What controls our global temperature and affects the global energy balance?** **1. Sun's luminosity (power) -- (solar constant)** 3.865×10^{26} watts (today) Sun => brighter and hotter Sun spots – show more activity. 11-year cycle. # of sunspots Increase and decrease Don't know WHY – need a longer record. And physics of the sun Changes in the sun during the 11-year cycle are small and do not have a big effect on climate **2. Distance from the Sun – isn't changing (solar constant)** **3. The Atmosphere and Albedo** *What happens to solar radiation in the atmosphere btween top of atmosphere and sea level?* - Less solar radiation - Big gaps of infrared a. Transmission: solar energy that comes through atmosphere b. Reflection and scattering – changing direction of radiation 1. Specular reflection - like a mirror 
	Summary: Earth is the perfect place for life to exist. Our global temperature is controlled by 5 things. Three of those include: the sun's power, our distance from the sun, the atmosphere and Albedo. When solar radiation enters our atmosphere, solar energy is (1) transmitted, (2) reflects off and scatters, and it is (3) absorbed.

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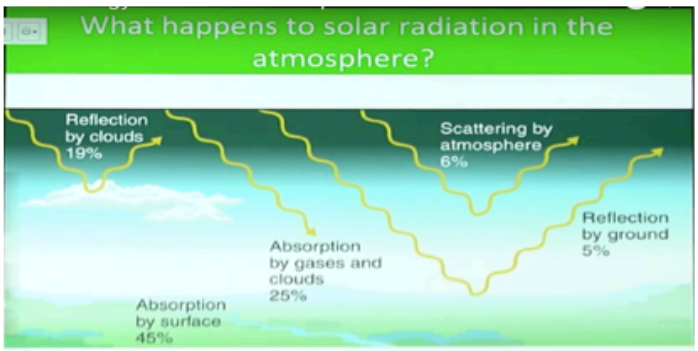
Why is the sky blue?	2. Rayleighing scattering: scatters in all direction; bounces off molecules; stronger for shorter wavelengths (blue) (reminder: sky is blue because of rayleighing scattering. This is also why we see red sunsets. Midday- energy comes straight down, not traveling through much atmosphere. In the evening, it travels through more atmosphere. It bumps into more gas molecules. More blue light is being scattered away. We are left with yellows and reds, the longest wave lengths) 3. Mie scattering - Forward scattering- - By particles – bigger than molecules; droplets in clouds - No strong wavelength preference - This causes more beautiful sunsets with more pollution
Why do we see plants as green?	c. Absorption Why do we see green plants? Blue and red are being absorbed. Green is being reflected back. Very little light is absorbed.  Why doesn't the Earth get hotter and hotter and hotter?
What is the planetary albedo?	We are absorbing 70%; reflecting 30% DEF: **Planetary albedo** – the fraction of incoming radiation that is reflected away. No part in heating earth. 30% .3

Summary:

Two ways that solar energy is scattered includes: Rayieighing scattering and mie scattering. Albedo is the fraction of incoming radiation that is reflected away. 30% of solar energy is reflected away.

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How could we change the planetary albedo?	How may we change the planetary albedo? How can we change the amount that is reflected back to space. - Ice melting - Cloud coverage- - Ice changes - Any surface changes will change albedo ↑ sea level would ↓ the Earth's albedo (the amount of solar radation reflect back to space.) Water = most absorbing surface. Why doesn't the Earth get hotter and hotter and hotter?
What kind of radiation does the sun give out? **What kind of radiation does the earth give out?**	4. **Earth's temperature and outgoing radiation** - We have a temp (evrthg over 0 degree Kelvin emits radiation => we emit radiation into space) - Planetary Energy Balance is Solar Energy Absorbed = Terrestrial Energy Emitted - What type of enrgy do we emit? - sun gives out shortwave radiation – visible light - earth emits longwave radiation – infrared light
What is the Greenhouse effect? **What gas absorbs the most infrared wavelengths?** **What is one example of the Greenhouse Effect?**	5. **Greenhouse Effect** - SW-lengths do not get absorbed - earth gives out infrared. A lot of gases get absorbed. Methane, CO_2 - Water Vapor absorbs the most infrared wavelengths. WV = most effective greenhouse gas - Atmosph. traps enrgy. Like recycling energy - nearly 100% UV rays being absorbed by ozone - Is the GH effect a bad thing? - Mainly good thing: Ave temp w/o greenhouse -18 degree C. Earth's ave temperature w green house +15 degrees - The GH Effect in NOT THE SAME as GLOBAL WARMING. Ex. Why your car heats up on at hot day? Visible lights comes in windows. Longwave radiations cannot escape. window shades reflect away short wave radiation.

Summary:

Water is the earth's most absorbing surface. The last 2 factors that control our global temperature is (4) Earth's temperature and outgoing radation, and (5) the greenhouse effect.