

[Print](#) | [Close Window](#)

Subject: week 1, email #2: 2 diagrams clarified: 1. earth heat budget and 2. troposphere warming/stratosphere cooling]

From: pebelanger@glassdesignresources.com

Date: Mon, Sep 22, 2014 6:16 pm

To: "Paul Belanger" <pebelanger@glassdesignresources.com>

Attach: clip0008.jpg

clip0008.jpg

clip0000.jpg

clip0000.jpg

clip0001.jpg

clip0001.jpg

clip0008.jpg

clip0008.jpg

clip0000.jpg

clip0000.jpg

clip0001.jpg

clip0001.jpg

clip000d.jpg

clip000e.jpg

WG1AR5_global mean energy budget.pdf

solar heat budget.png

solar heat budget modified.png

Class, 9/22/2014 email #2 emended with new diagram

1. Earth heat budget diagrams

I realize the Earth's budget diagram is not entirely clear.

I replied to Mike and now augmenting for all - I'll take some time in class but can't take too much and stay on track - so I ask you to read this and attachments if it interests you - either before class tomorrow or after.

FOR DIAGRAM BELOW and attached - labelled modified:

First yellow = short wave (visible); orange = long wave (infrared); also note the lower left red box 0.6 imbalance between short and long wave.**top row:** 340 short wave down = 100 short wave reflected up (76 clouds +24 ice/water/earth) + 239 up infrared**bottom row:****left- 185 = 340 - 79 and - 76****161 is what reaches earth's surface (185 - 24****right-**the infrared has a hard time getting out because of water vapor and other GHGs (greenhouse gases)The heat received by the 161 watts/m² is retained and accumulates creating the ambient warming - otherwise it would get very cold at night. Ultimately, across the period of a year it all escapes to space and there is net balance - the Earth neither warms nor cools.

This changes when forcings act on

Class,

1. Earth heat budget diagrams

I realize the Earth's budget diagram is not entirely clear.

I replied to Mike and now augmenting for all - I'll take some time in class but can't take too much and stay on track - so I ask you to read this and attachments if it interests you - either before class tomorrow or after.

FOR DIAGRAM BELOW and attached - labelled modified:

First yellow = short wave (visible); orange = long wave (infrared); also note the lower left red box 0.6 imbalance between short and long wave.**top row:** 340 short wave down = 100 short wave reflected up (76 clouds +24 ice/water/earth) + 239 up infrared**bottom row:****left- 185 = 340 - 79 and - 76****161 is what reaches earth's surface (185 - 24****right-**the infrared has a hard time getting out because of water vapor and other GHGs (greenhouse gases)The heat received by the 161 watts/m² is retained and accumulates creating the ambient warming - otherwise it would get very cold at night. Ultimately, across the period of a year it all escapes to space and there is net balance - the Earth neither warms nor cools.

This changes when forcings act on the earth - either Milankovitch orbital parameters or changes in atmospheric composition - these are collectively called forcing agents and they change in time - causing climate change. Some is natural and what how we are changing the atmospheric composition is called Anthropogenic or Anthropomorphic. It affects our sustainability regarding changing climate, food production, the economics of moving cities and accommodating refugees, etc. etc.....

Earth's W/m² depends on it's temperature: see http://spectralcalc.com/blackbody_calculator/blackbody.phpGive it 289.5K and calculation comes up with **398 W/m²**

Blackbody Calculator			
Inputs		Results	
Units: Watts ▼ Wavelength (μm) ▼ Kelvin ▼			
Blackbody Properties: Temperature: 289.5 K Emissivity: 1 Recession Velocity: 0 km/s		Radiant emittance: 398.307 W/m ² Radiance: 126.785 W/m ² /sr Peak spectral radiance: 8.3288 W/m ² /sr/μm Wavelength of peak: 10.0095 μm	
Wavelength 10 μm		Spectral Radiance: 8.32879 W/m ² /sr/μm (5.03412e+19 photons/J)	
Lower Limit 8 μm Upper Limit 12 μm		Band Radiance: 32.2351 W/m ² /sr	

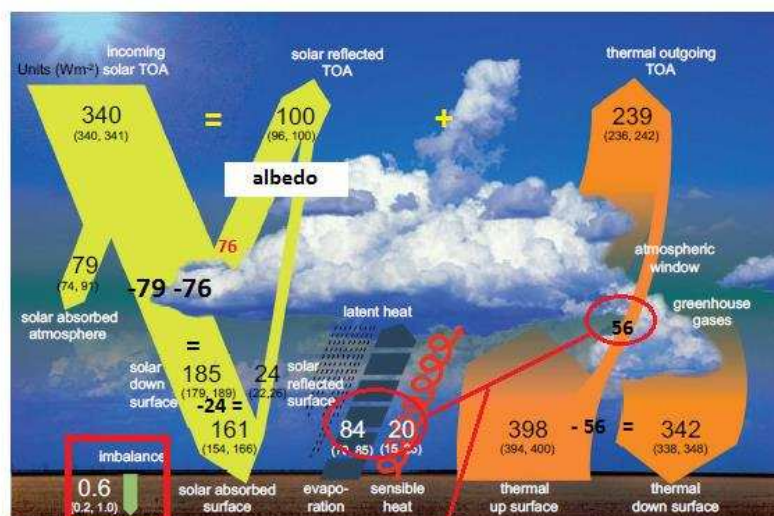


Figure 2.11: | Global mean energy budget under present-day climate conditions. Numbers in the magnitudes of the individual energy fluxes in W m^{-2} , adjusted within their uncertainty ranges to close the energy budgets. Numbers in parentheses attached to the energy fluxes cover the range of values in line with observational constraints. (Adapted from Wild et al., 2013.)

from Wild et al., 2013.)

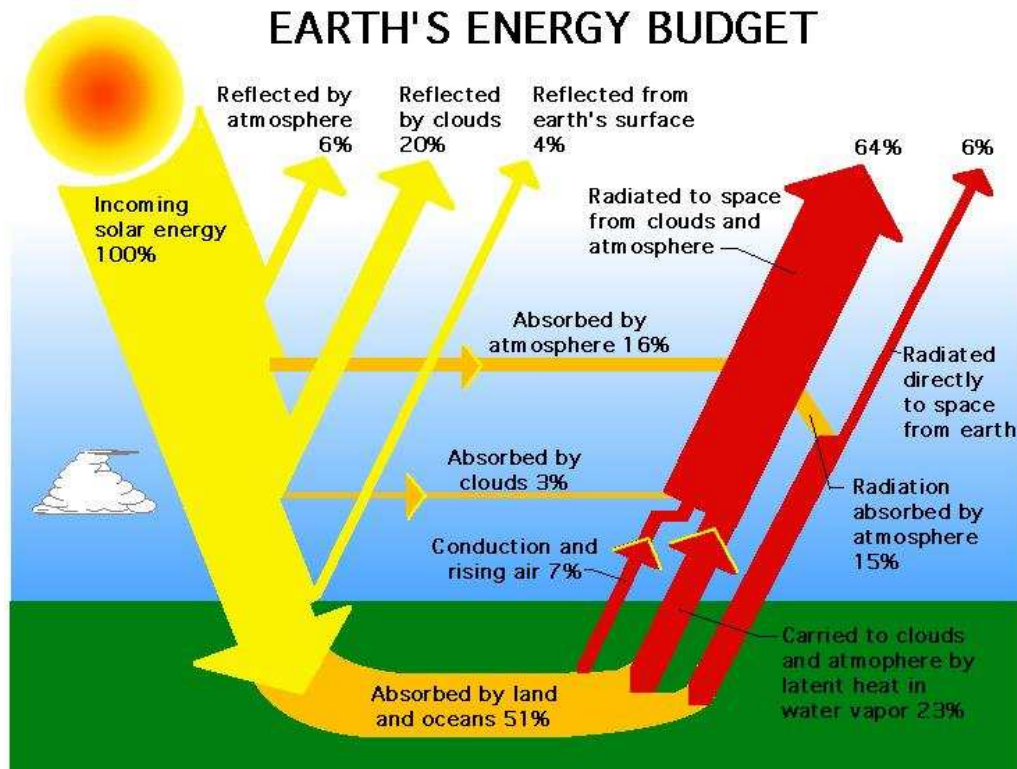
$161 + 342 = 503$ - 2 outside
vs. $84 + 20 + 398 = 502$ - 3 inside
arrows

$84 + 20 + 56 = 160$
which \approx incoming 161 shortwave

The figure above comes from this chapter - of which I'm attaching 2 pages - but it may not be complete enough.
http://www.climatechange2013.org/images/report/WG1AR5_Chapter02_FINAL.pdf

page 181 before/after to explain the 2 pages I'm attaching

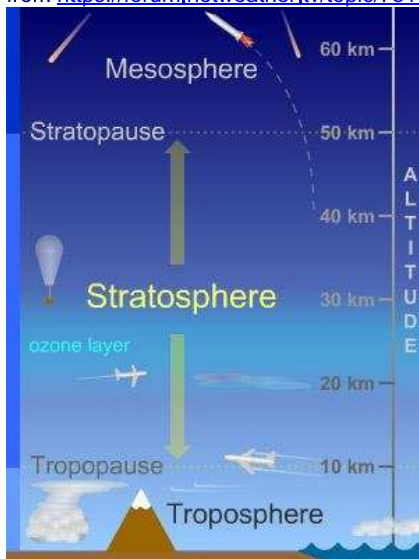
PLEASE READ THIS link: - It explains the diagram below: - http://science-edu.larc.nasa.gov/EDDOCS/radiation_facts.html



2. troposphere warming/stratosphere cooling

google troposphere warming/stratosphere cooling - both images and web sites:

from <https://forum.netweather.tv/topic/78161-stratosphere-temperature-watch-20132014/>



and this <http://jonova.s3.amazonaws.com/graphs/hot-spot/co2-signature.gif>



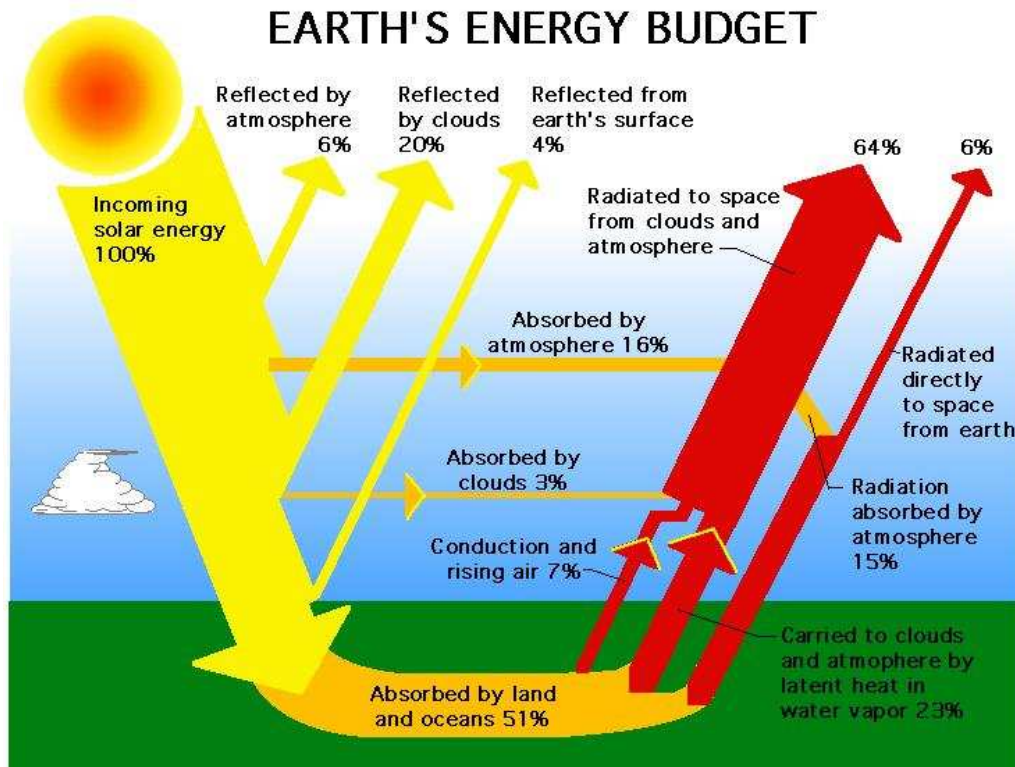
and this <http://www.yaleclimateconnections.org/2013/09/vertical-human-fingerprint-found-in-stratospheric-cooling-tropospheric-warming/>

the earth - either Milankovitch orbital parameters or changes in atmospheric composition - these are collectively called forcing agents and they change in time - causing climate change. Some is natural and what how we are changing the atmospheric composition is called Anthropogenic or Anthropomorphic. It affects our sustainability regarding changing climate, food production, the economics of moving cities and accommodating refugees, etc. etc.....

The figure above comes from this chapter - of which I'm attaching 2 pages - but it may not be complete enough.
http://www.climatechange2013.org/images/report/WG1AR5_Chapter02_FINAL.pdf

page 181 before/after to explain the 2 pages I'm attaching

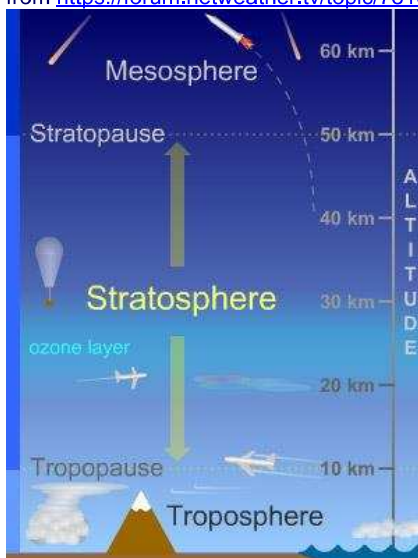
PLEASE READ THIS link: - It explains the diagram below: - http://science-edu.larc.nasa.gov/EDDOCS/radiation_facts.html



2. troposphere warming/stratosphere cooling

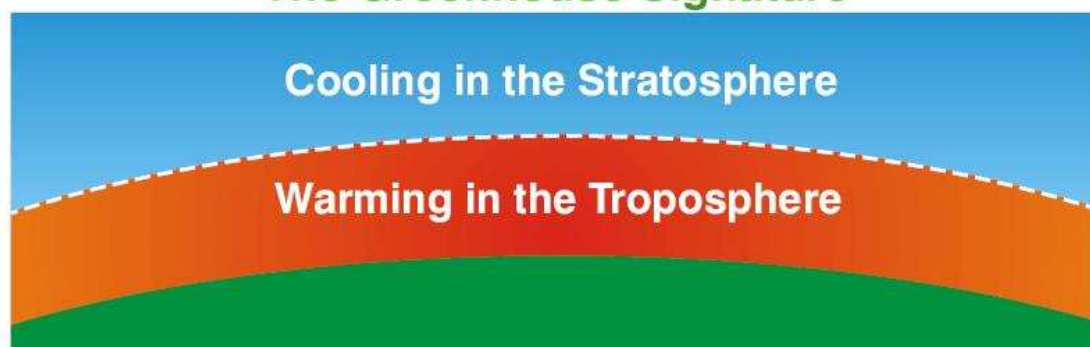
google troposphere warming/stratosphere cooling - both images and web sites:

from <https://forum.netweather.tv/topic/78161-stratosphere-temperature-watch-20132014/>



and this <http://ionova.s3.amazonaws.com/graphs/hot-spot/co2-signature.gif>

The Greenhouse Signature



and this <http://www.yaleclimateconnections.org/2013/09/vertical-human-fingerprint-found-in-stratospheric-cooling-tropospheric-warming/>



Copyright © 2003-2014. All rights reserved.