

Real Science Radio – Introduction to
Earth's Energy Balance, Climate
Change and a Christian Biblical Earth
Keeping Ethic

Dr. Paul Homan



Purpose/Overview

- Introduction to larger presentation given at Rocky Mountain Creation Fellowship on 8 Dec 23 at 7pm – Littleton Baptist Church
- 2nd Radio show on
- The purpose of this presentation is to dig deeper into the climate change discussion and to compare and contrast anthropogenic (man-made) forcings to natural forcings in the climate system in light of a biblical world view of creation
- We will cover:
 - Introduction to Earth's Energy Balance
 - Overview of Climate Change Theory
 - The role of Greenhouse Gases
 - Biblical Earth Keeping Ethic vs. Modern Environmentalism
 - Inspect Modern Temperature and CO2 datasets
 - Verify how well climate model predictions are doing when compared to measured data
 - Look at trends of extreme weather (tornadoes, hurricanes, etc.)

Major Hypothesis/Claims of “Global Warming/Climate Change” Theory

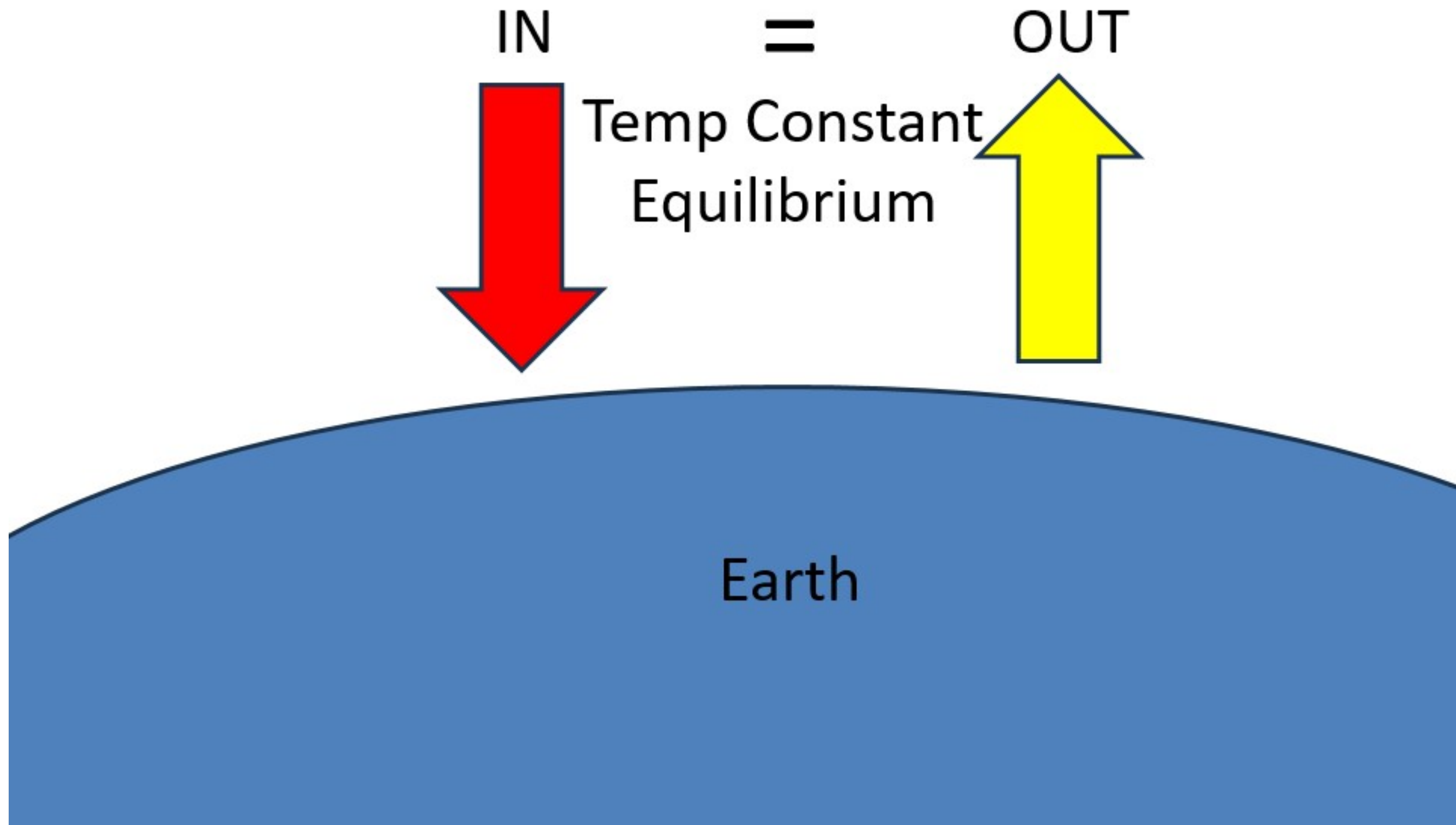
Natural causes have always played a role in the Earth’s climate, but are now being overwhelmed by human-induced changes.

Warming the planet will cause other climatic patterns to change at speed unprecedented in modern times, including increasing rates of sea-level rise and alterations in the hydrologic cycle (more floods, droughts, hurricanes, tornadoes, etc.)

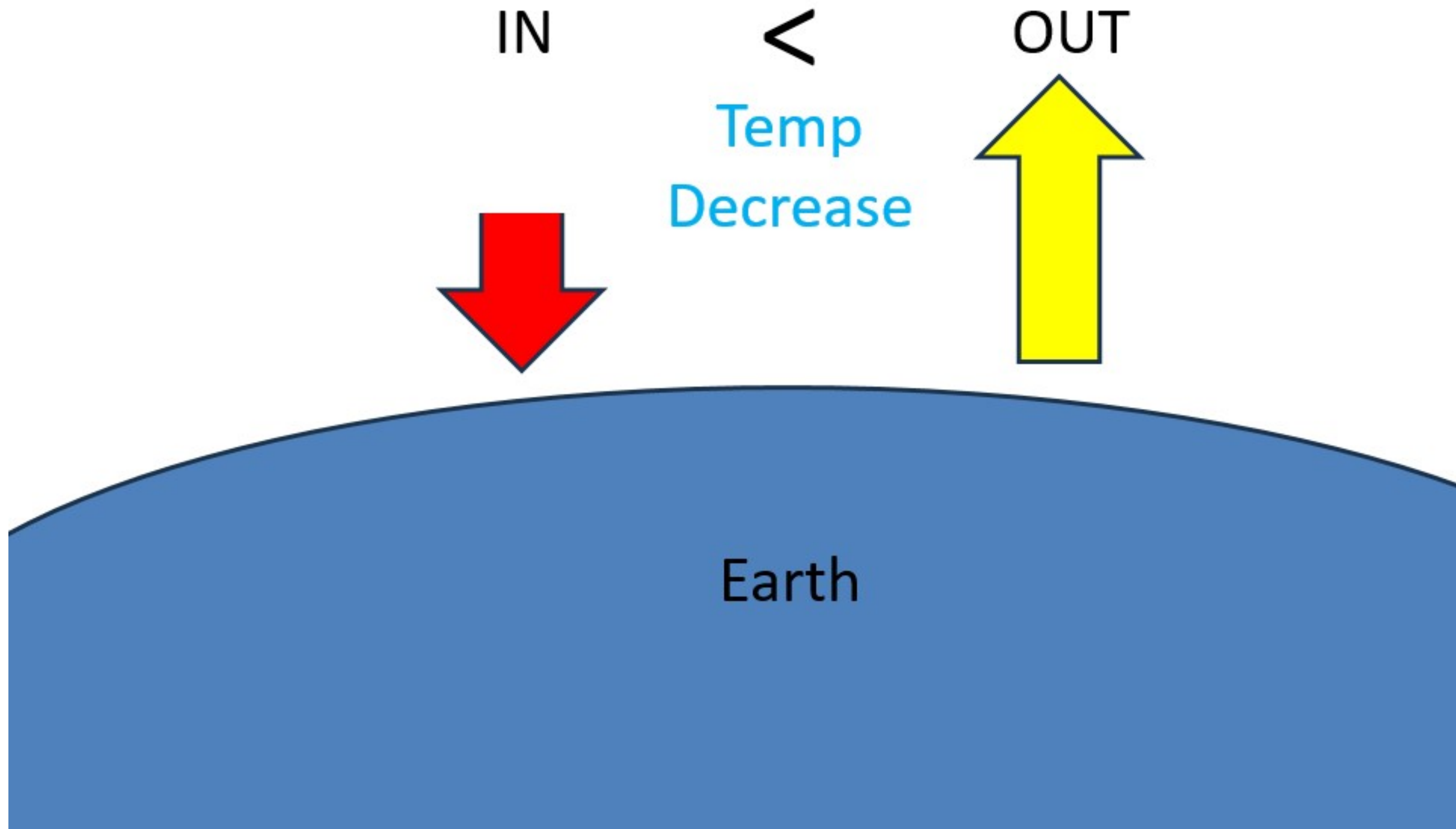
Science Magazine, 2010

- **Definitions**
 - Climate: The sum or average of weather over time
 - Global Warming (Natural) vs. Anthropogenic Global Warming (AGW)
 - Climate Change....Climate Crisis...Climate Emergency...Climate Catastrophe...etc.

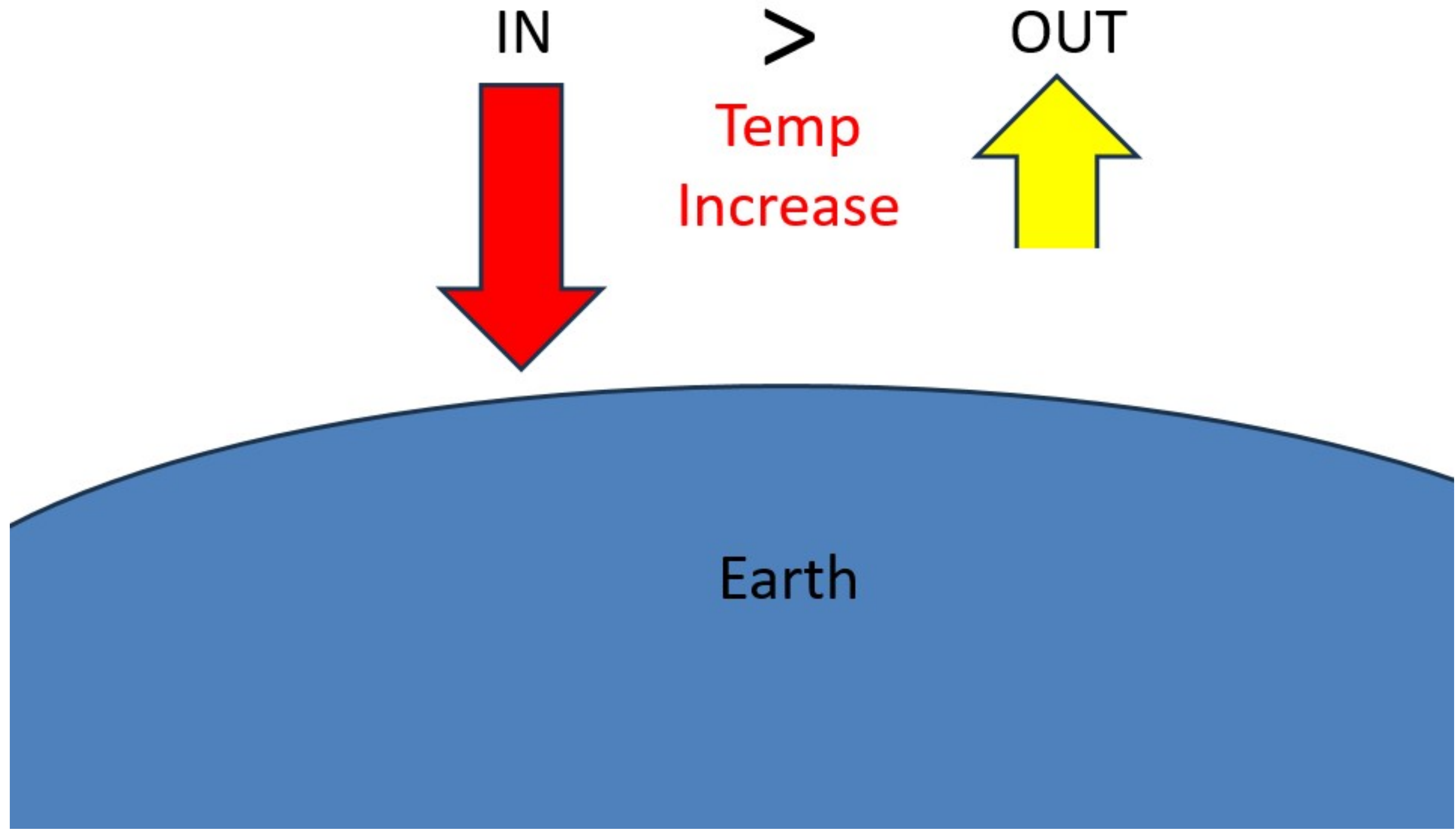
Earth's Energy Balance



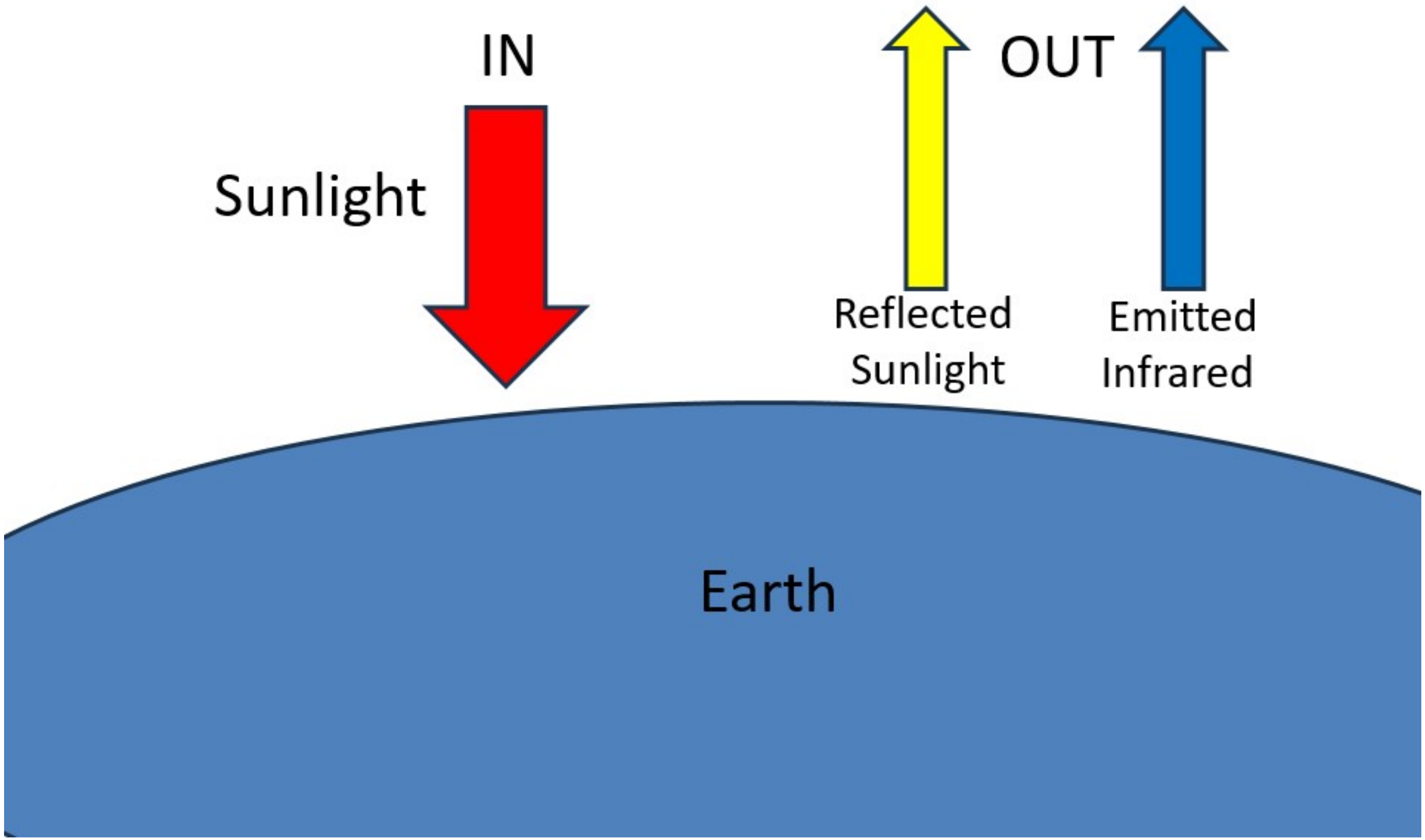
Earth's Energy Balance



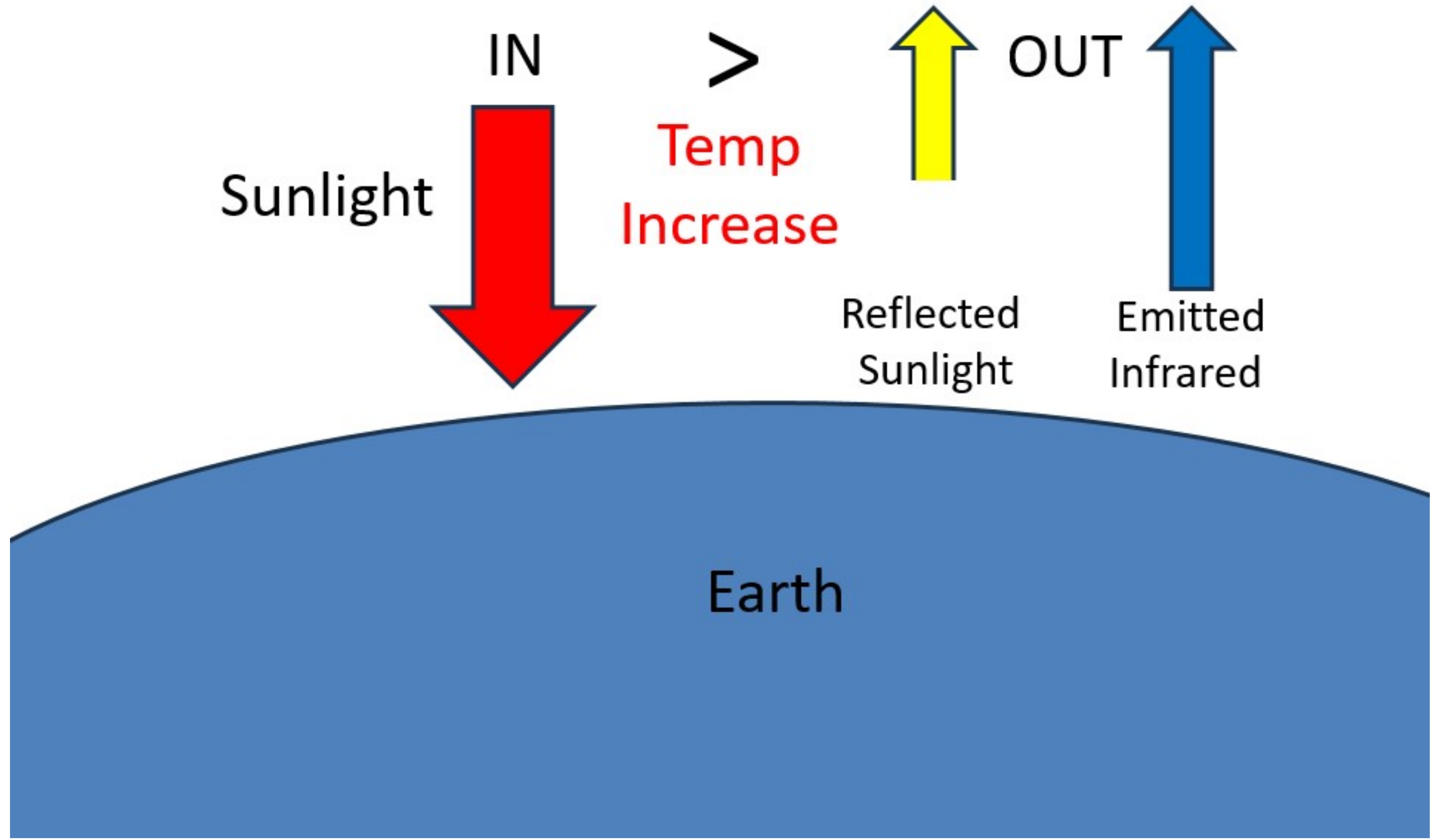
Earth's Energy Balance



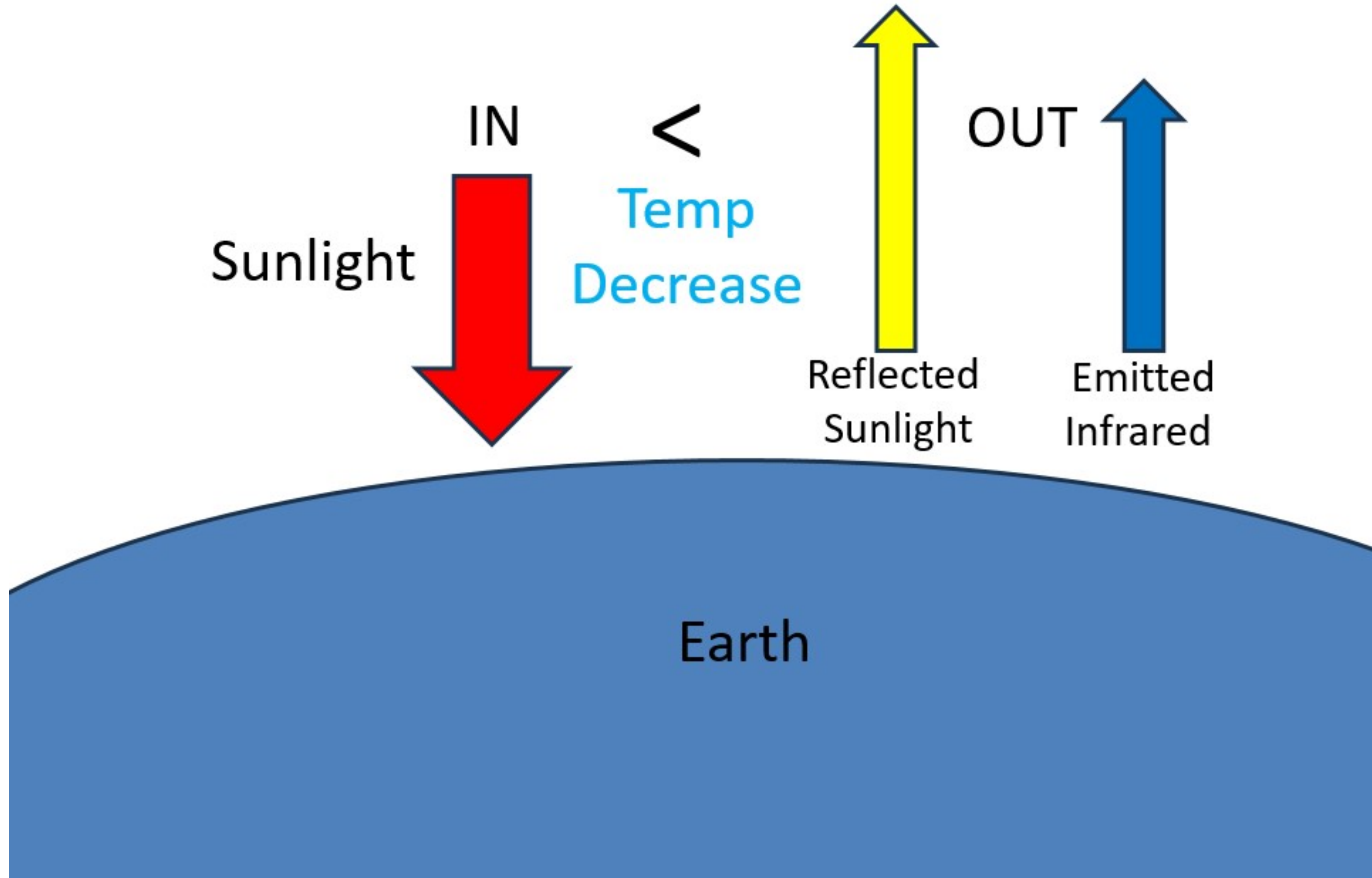
Earth's Energy Balance



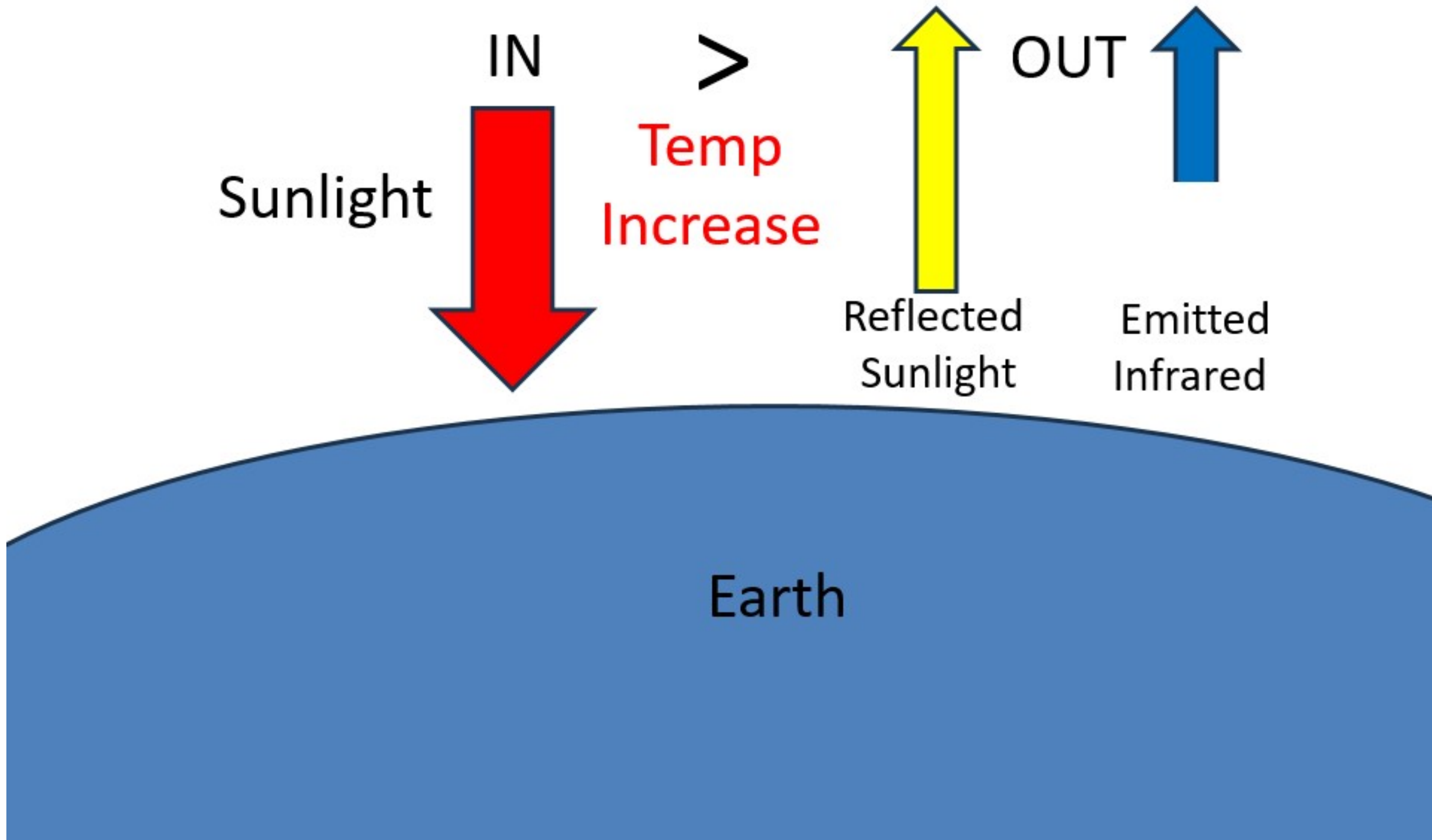
Earth's Energy Balance



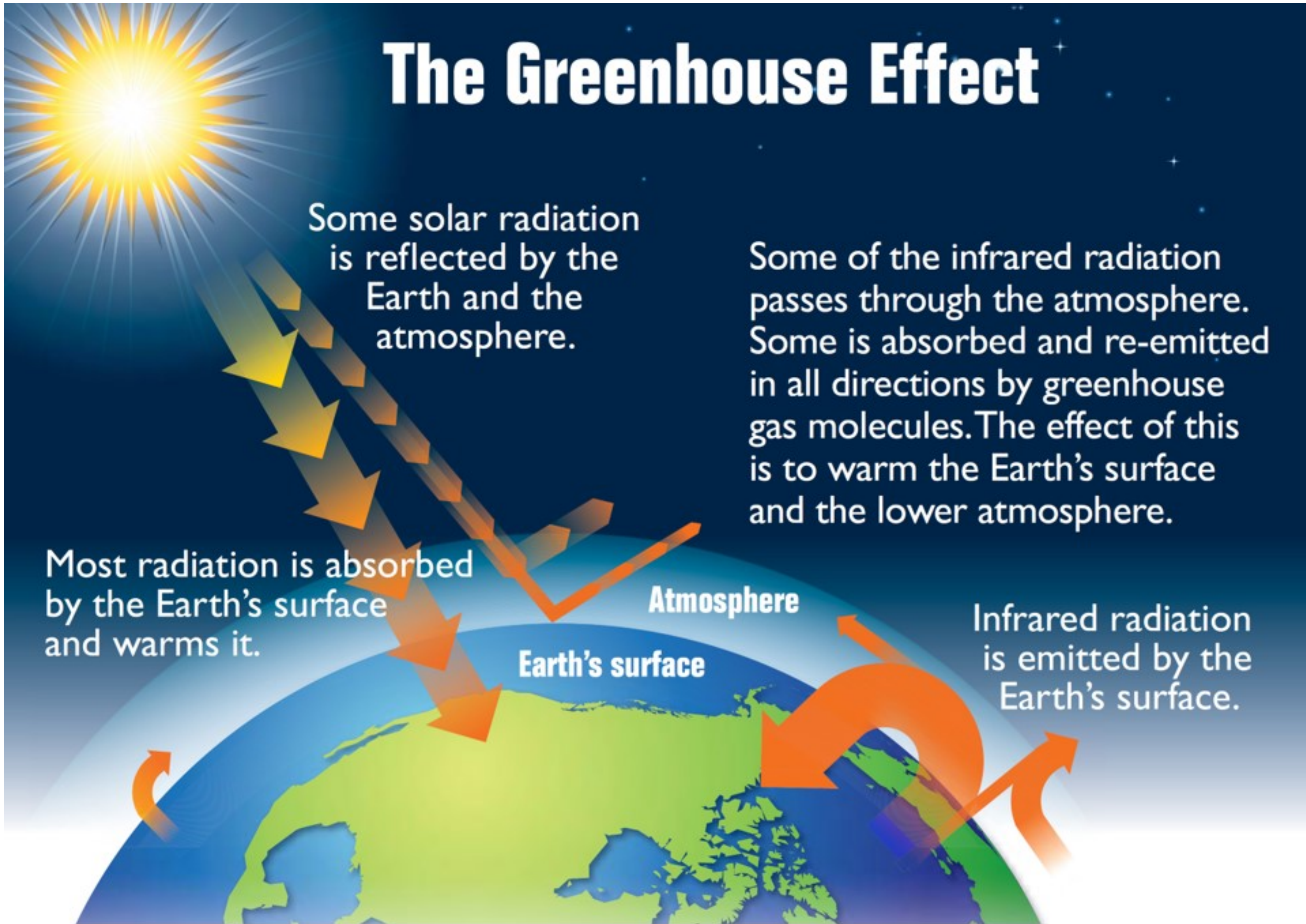
Earth's Energy Balance



Earth's Energy Balance

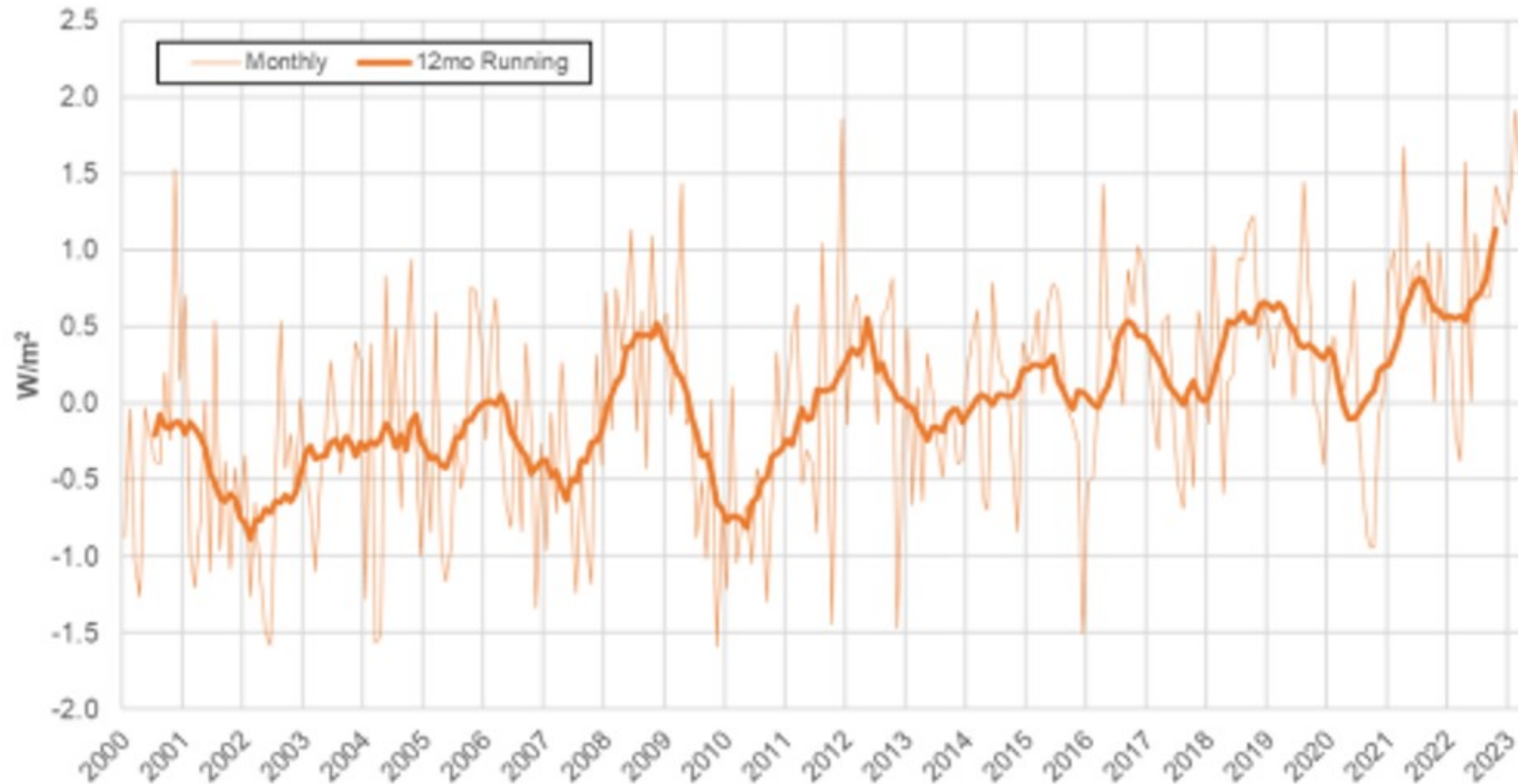


The Greenhouse Effect

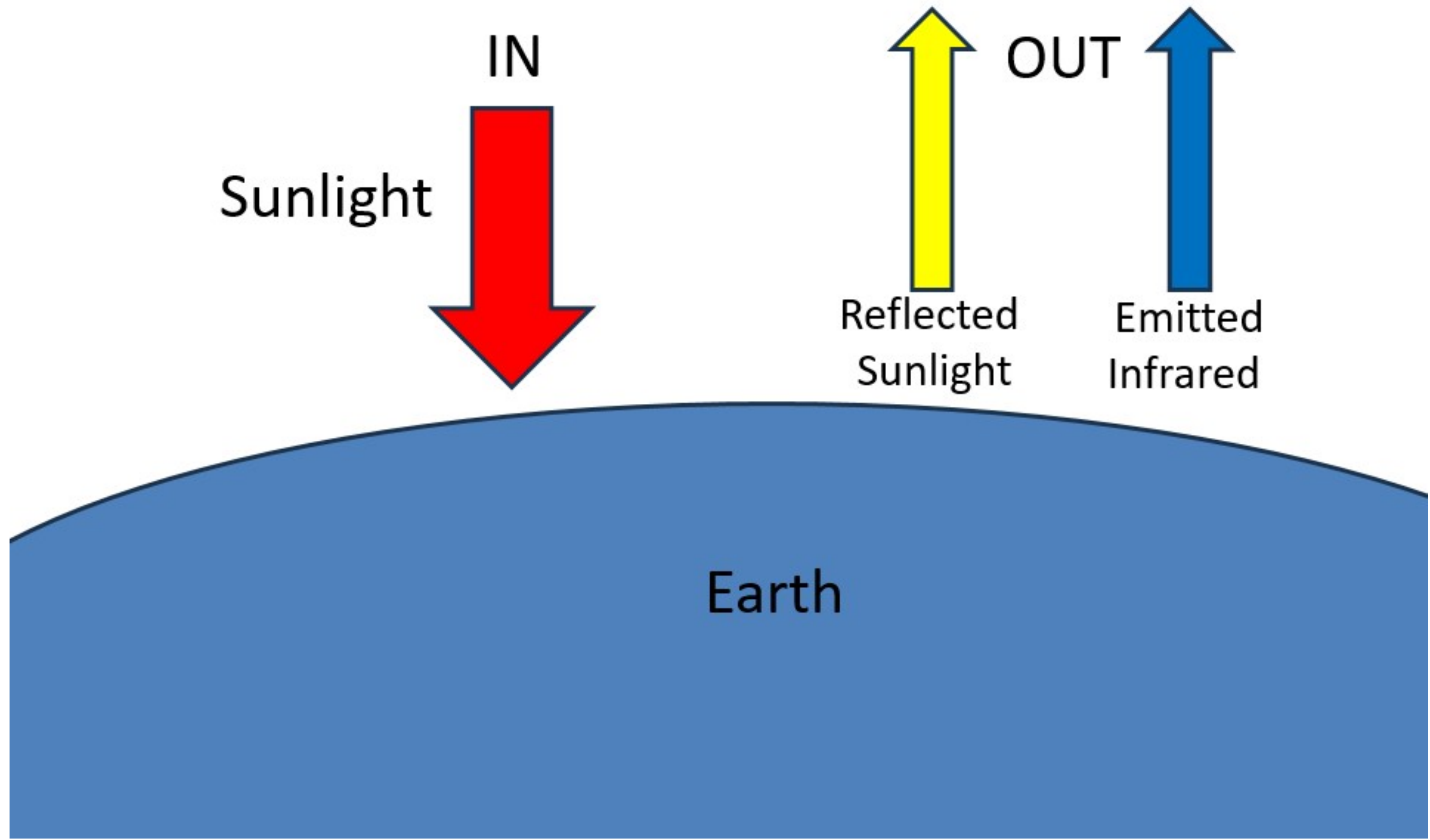


$\text{Net Flux}_{\text{top}} = \text{Incoming Solar} - \text{Reflected Solar} - \text{Outgoing Longwave}$

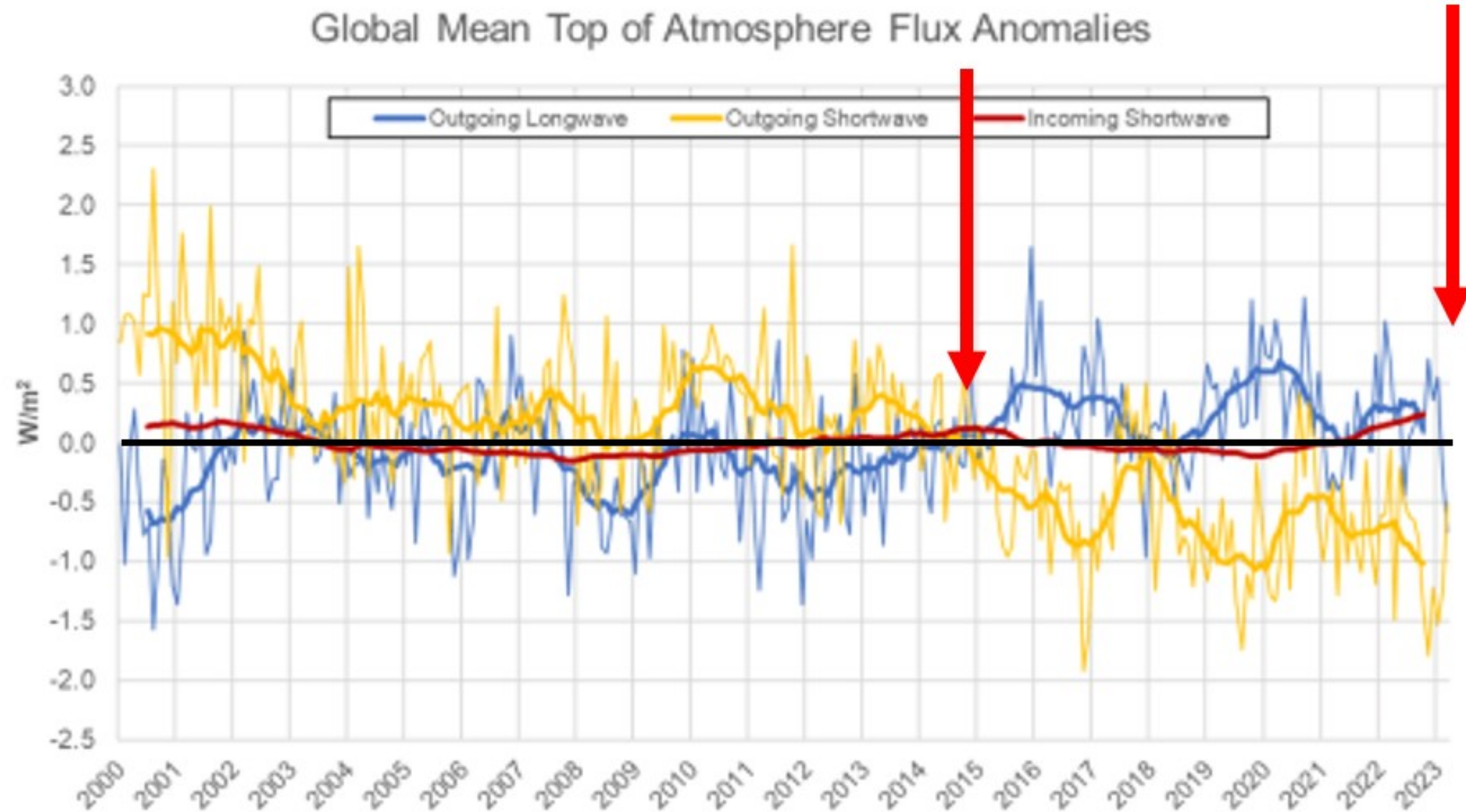
Global Mean Net Flux Anomaly

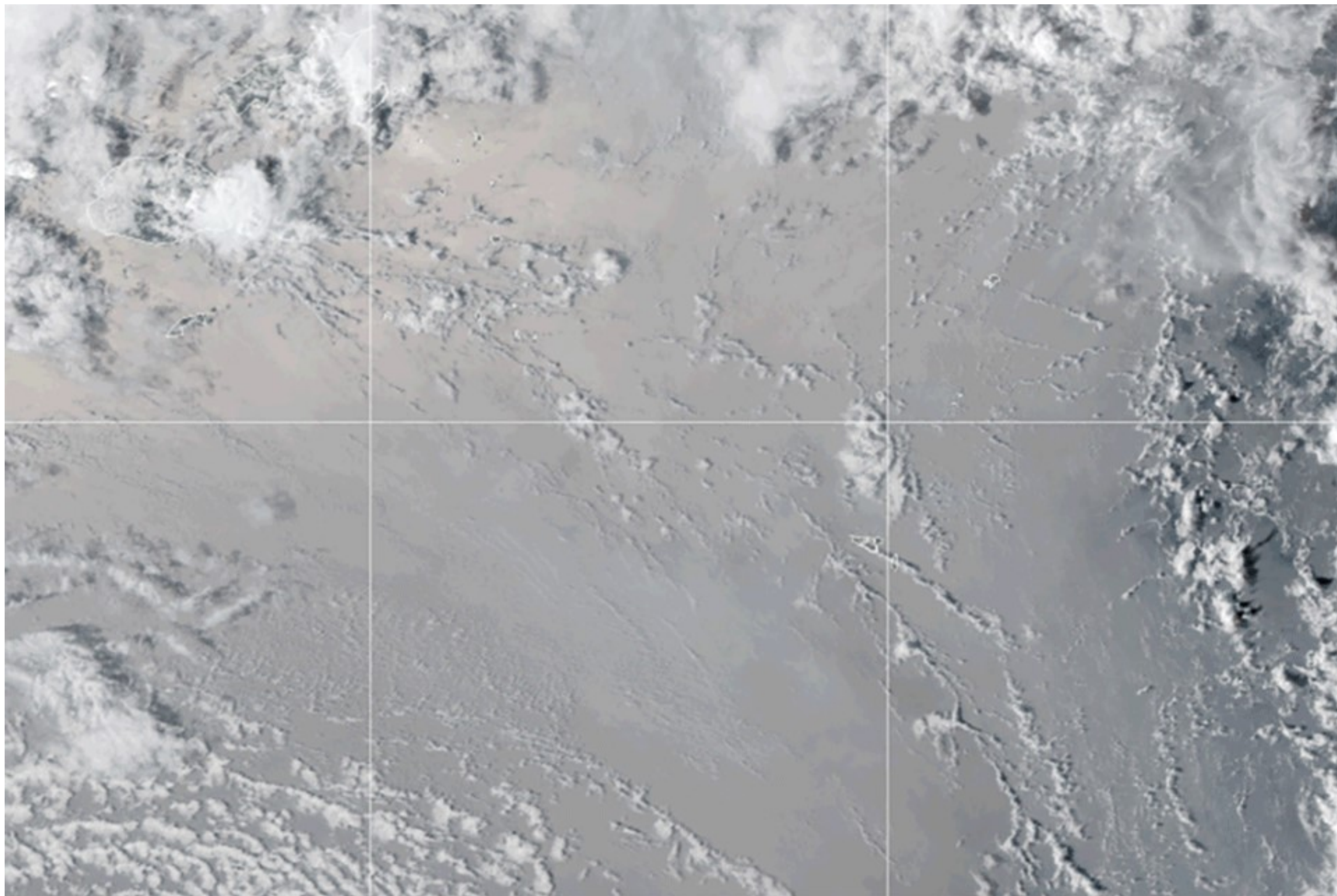


Earth's Energy Balance



Satellite Measurements of Energy Balance





<https://www.nasa.gov/centers-and-facilities/goddard/tonga-eruption-blasted-unprecedented-amount-of-water-into-stratosphere/> Aug 2, 2022

What is the most abundant greenhouse gas by volume in the atmosphere?

Greenhouse Gas: A Gas that is efficient at absorbing the longer wavelengths of the [infrared radiation](#) emitted by the earth and [atmosphere](#). (AMS Glossary)

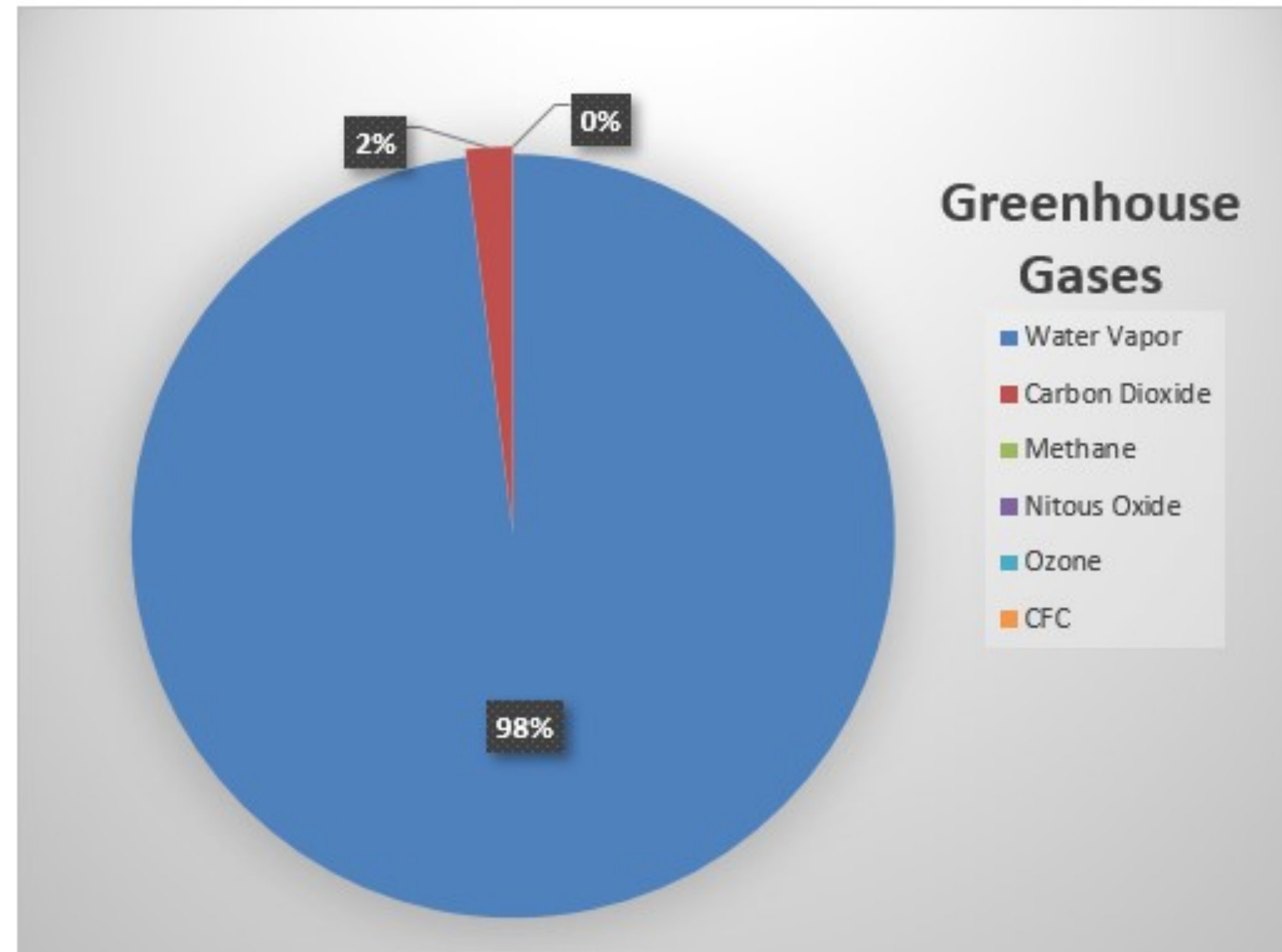
▼ TABLE 1.1 Composition of the Atmosphere near the Earth's Surface

PERMANENT GASES			VARIABLE GASES			
Gas	Symbol	Percent (by Volume) Dry Air	Gas (and Particles)	Symbol	Percent (by Volume)	Parts per Million (ppm)*
Nitrogen	N ₂	78.08	Water vapor	H ₂ O	0 to 4	
Oxygen	O ₂	20.95	Carbon dioxide	CO ₂	0.038	385 [†]
Argon	Ar	0.93	Methane	CH ₄	0.00017	1.7
Neon	Ne	0.0018	Nitrous oxide	N ₂ O	0.00003	0.3
Helium	He	0.0005	Ozone	O ₃	0.000004	0.04 [†]
Hydrogen	H ₂	0.00006	Particles (dust, soot, etc.)		0.000001	0.01–0.15
Xenon	Xe	0.000009	Chlorofluorocarbons (CFCs)		0.00000002	0.0002

*For CO₂, 385 parts per million means that out of every million air molecules, 385 are CO₂ molecules.
[†]Stratospheric values at altitudes between 11 km and 50 km are about 5 to 12 ppm.

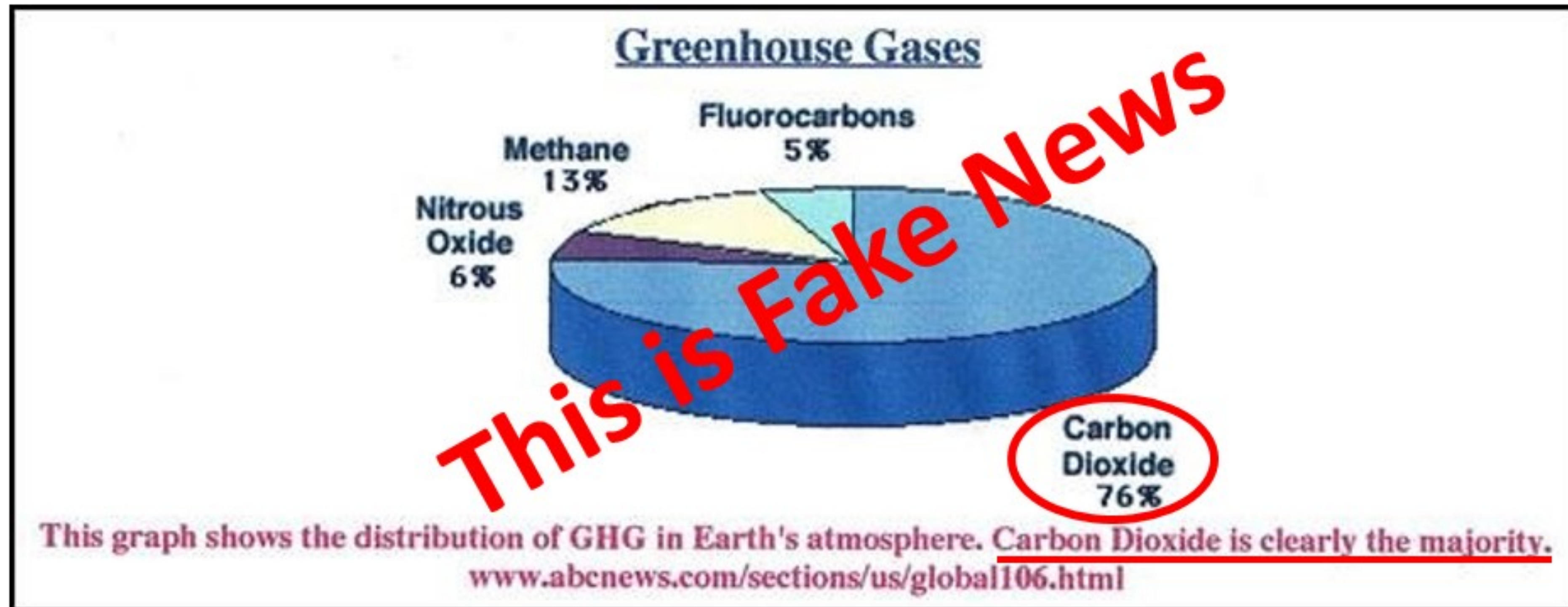
Average Distribution of Greenhouse Gases

	ppm	%
Water Vapor	20000	98.0294%
Carbon Dioxide	400	1.9606%
Methane	1.7	0.0083%
Nitous Oxide	0.3	0.0015%
Ozone	0.04	0.0002%
CFC	0.0002	0.0000%
Total	20402.04	



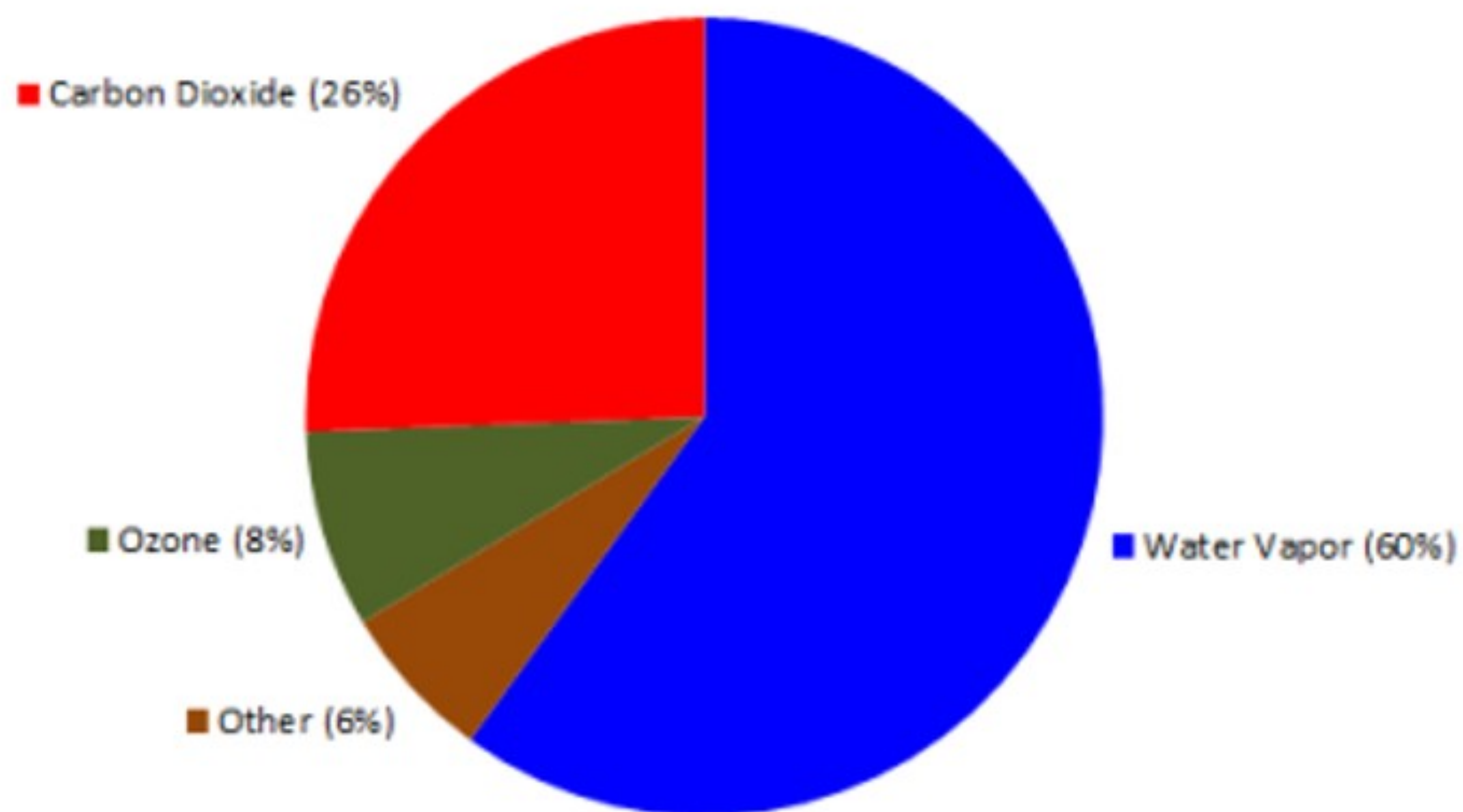
Google Image Search

“most abundant greenhouse gases by volume in the atmosphere”



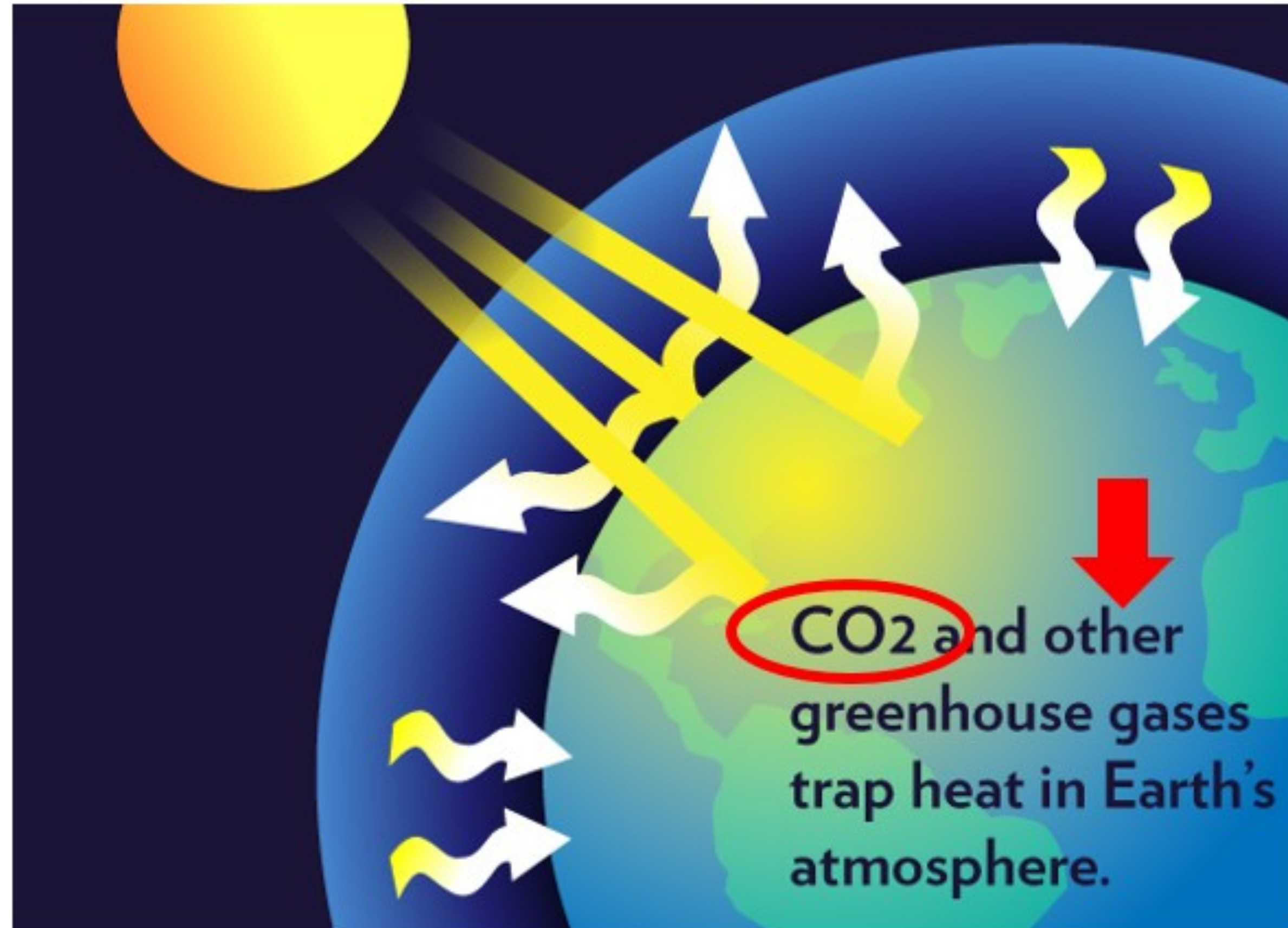
Is this graphic accurate?

**Percent Contribution of Individual Greenhouse Gases
(Natural & Manmade Including Overlaps)
Clear Sky (Kiehl & Trenberth 1997)**



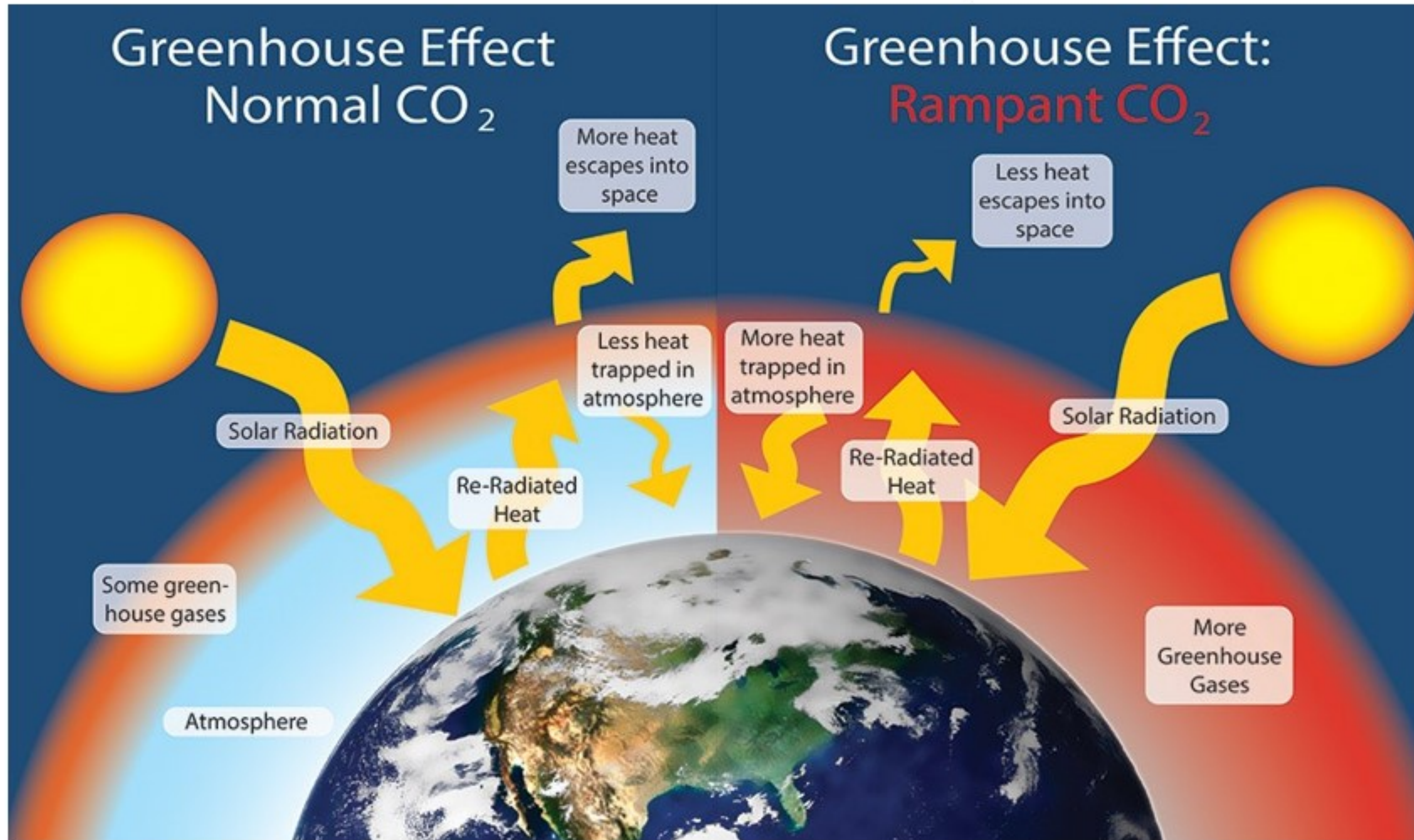
Google Image Search

“most abundant greenhouse gases by volume in the atmosphere”



Is this graphic accurate?

Where's Water Vapor?



Left - Regular levels of carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O) are created by normal life processes, trapping some of the sun's heat and preventing the planet from freezing.

Right - The rampant emission of CO₂ from burning fossil fuels traps excess heat and results in an increase in the average temperature of our planet. The solution is to reduce human activities that emit heat-trapping gases. Will Elder, NPS

Climate action

Our changing climate

What is climate change?

Impacts in King County

Graphics

Home » Services » Environment » Climate action » Our changing climate » Graphics

Climate change graphics





Greenhouse Gas Emissions

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Overview of Greenhouse Gases

[Sources of GHG Emissions and Removals](#)

[Global Emissions and Removals](#)

[National Emissions and Removals](#)

[State and Tribal GHG Data and Resources](#)

[Facility-Level Emissions](#)

[Carbon Footprint Calculator](#)

[GHG Equivalencies Calculator](#)

[Capacity Building for GHG](#)

Overview of Greenhouse Gases

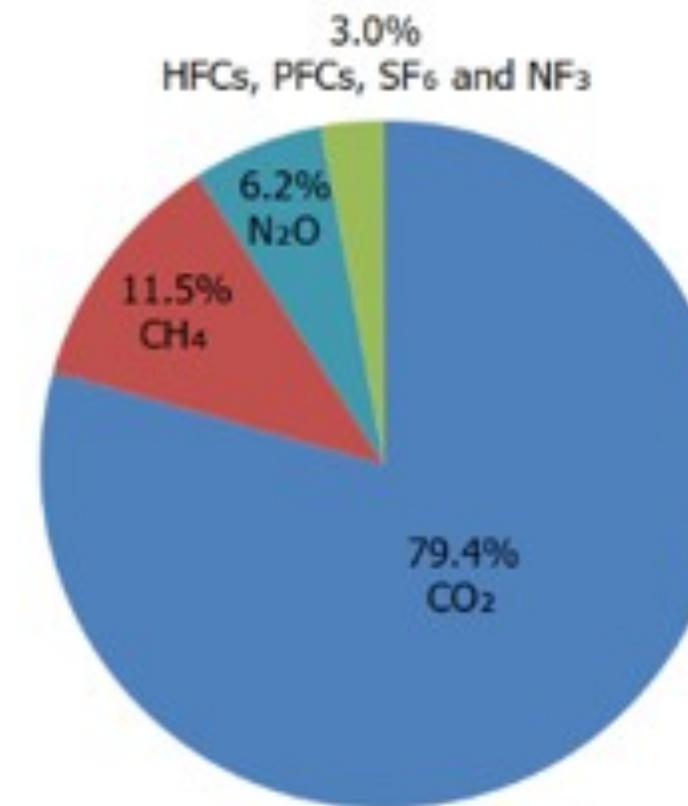
On this page:

[Overview](#) | [Carbon Dioxide](#) | [Methane](#) | [Nitrous Oxide](#) | [Fluorinated Gases](#)

Gases that trap heat in the atmosphere are called greenhouse gases. This section provides information on emissions and removals of the main greenhouse gases to and from the atmosphere. For more information on the other climate forcers, such as [black carbon](#), please visit the [Climate Change Indicators: Climate Forcing](#) page.

- **Carbon dioxide (CO₂)**: Carbon dioxide enters the atmosphere through burning fossil fuels (coal, natural gas, and oil), solid waste, trees and other biological materials, and also as a

Overview of Greenhouse Gas Emissions



Greenhouse Gases

Climate Monitoring
State of the Climate
Temp, Precip, and Drought
Climate at a Glance
Extremes
Societal Impacts
Snow and Ice
Teleconnections
GHCN Monthly
Monitoring References

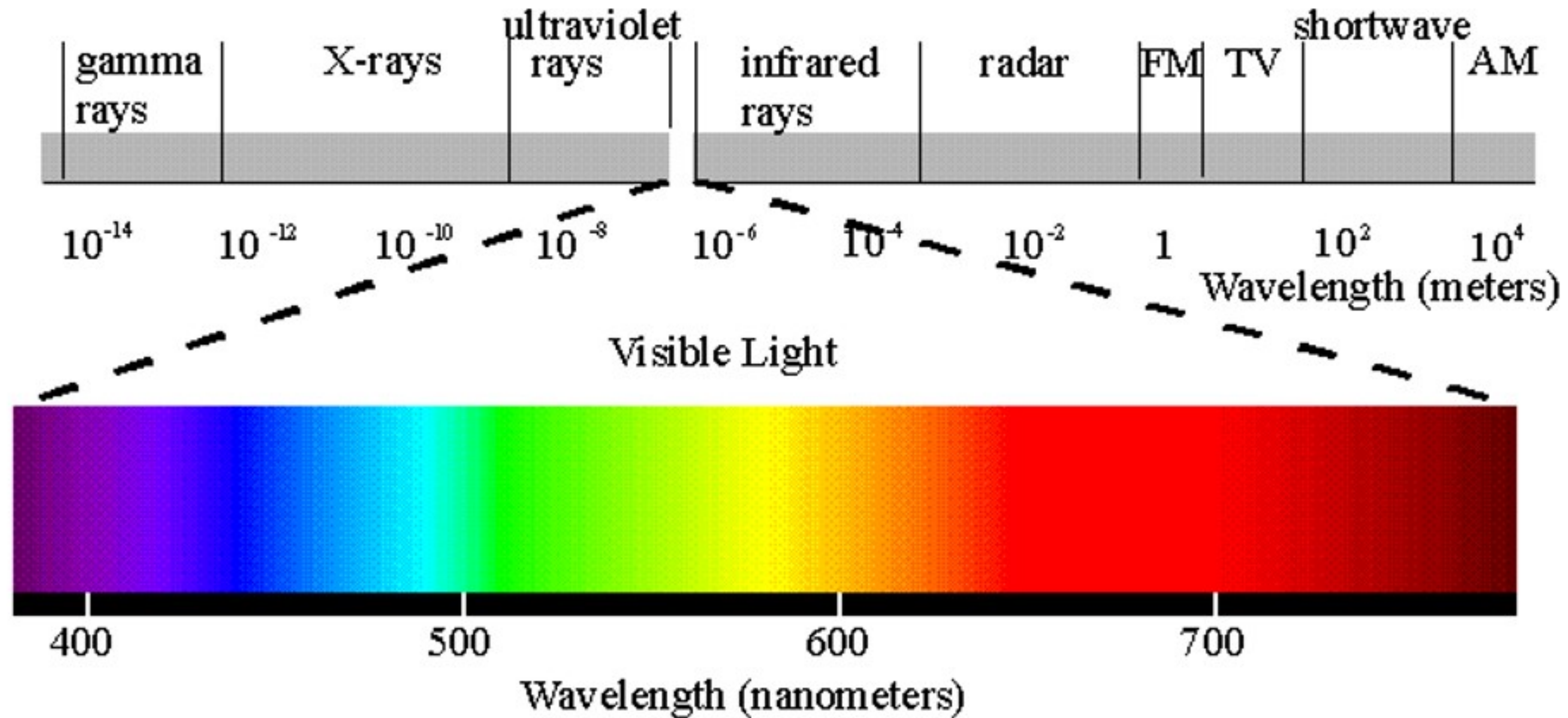
[Introduction](#) | [Water Vapor](#) | [CO₂](#) | [CH₄](#) | [Ozone](#) | [N₂O](#) | [CFCs](#) | [CO](#) | [Additional Information](#)

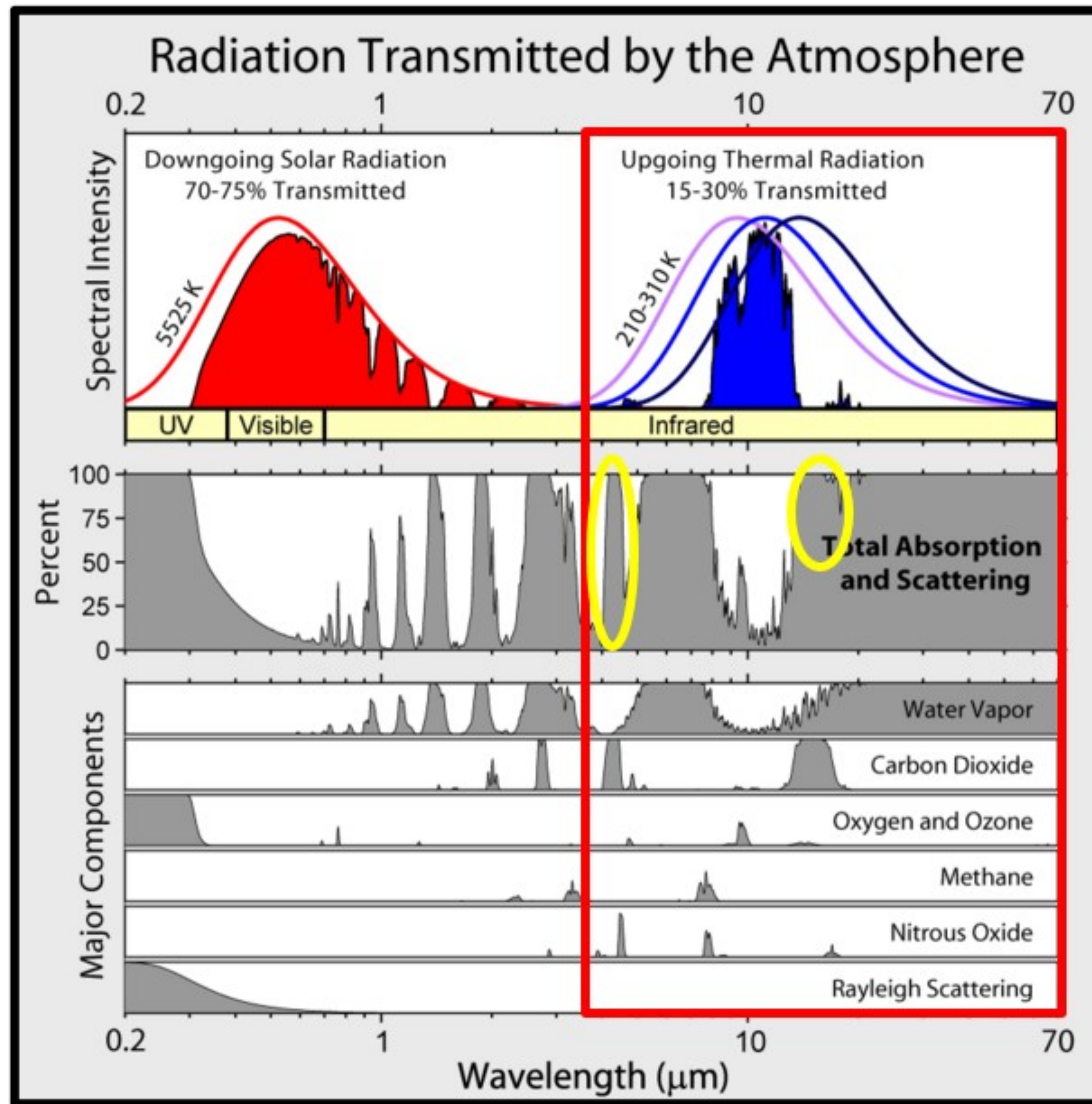
Water Vapor

Water Vapor is the most abundant greenhouse gas in the atmosphere, which is why it is addressed here first. However, changes in its concentration is also considered to be a result of climate *feedbacks* related to the warming of the atmosphere rather than a direct result of industrialization. The feedback loop in which water is involved is critically important to projecting future climate change but as yet is still fairly poorly measured and understood.

As the temperature of the atmosphere rises, more water is evaporated from ground storage (rivers, oceans, reservoirs, soil). Because the air is warmer, the absolute humidity can be higher (in essence, the air is able to 'hold' more water when it's warmer), leading to more water *vapor* in the atmosphere. As a greenhouse gas, the higher concentration of water vapor is then able to absorb more thermal IR energy radiated from the Earth, thus further warming the atmosphere. The warmer atmosphere can then hold more water vapor and so on and so on. This is referred to as a 'positive feedback loop'. However, huge scientific uncertainty exists in defining the extent and importance of this feedback loop. As water vapor increases in the atmosphere, more of it will eventually also condense into clouds, which are more able to reflect incoming solar radiation (thus allowing less energy to reach the Earth's surface and heat it up). The future monitoring of atmospheric processes involving water vapor will be critical to fully understand the feedbacks in the climate system leading to global climate change. As yet, though the basics of the hydrological cycle are fairly well understood, we have very little comprehension of the complexity of the feedback loops. Also, while we have good atmospheric measurements of other key greenhouse gases such as carbon dioxide and methane, we have poor measurements of global water vapor, so it is not certain by how much atmospheric concentrations have risen in recent decades or centuries, though satellite measurements, combined with balloon data and some in-situ ground measurements indicate generally positive trends in global water vapor.

Electromagnetic Spectrum

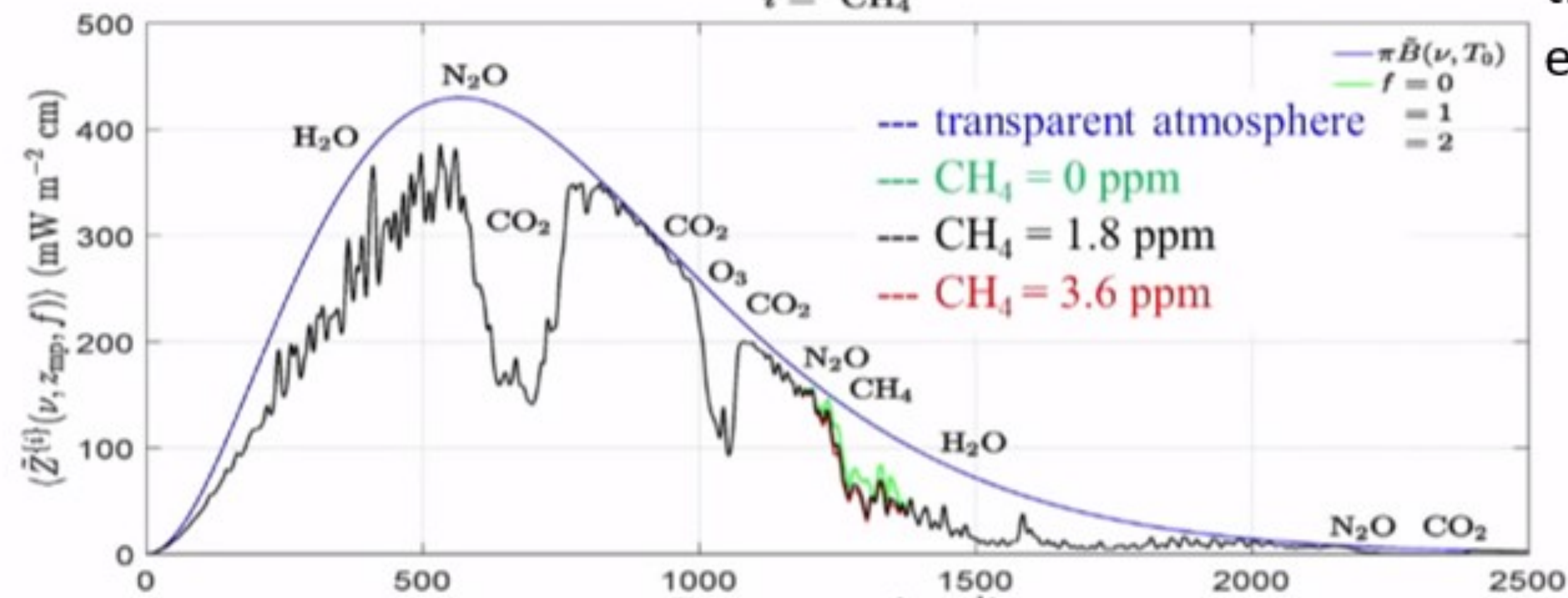
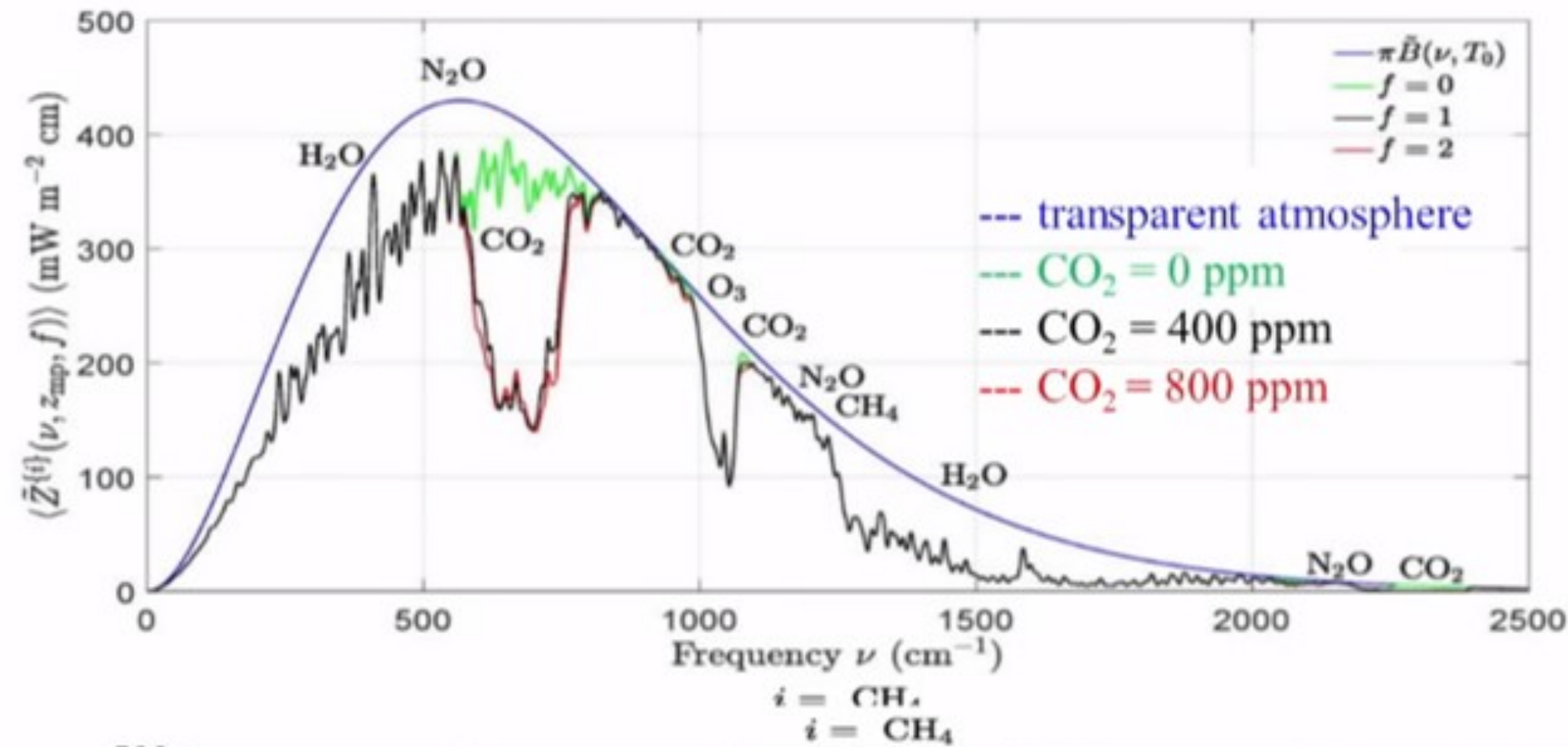




Water Vapor

- Most abundant
- Largest absorption bands in IR Window
- Accounts for the majority of the Greenhouse Effect
- ⇒ **By far the most important greenhouse gas**
- Latest IPCC reports mentions CO2 119 times in the Executive Summary and WV, clouds ZERO times

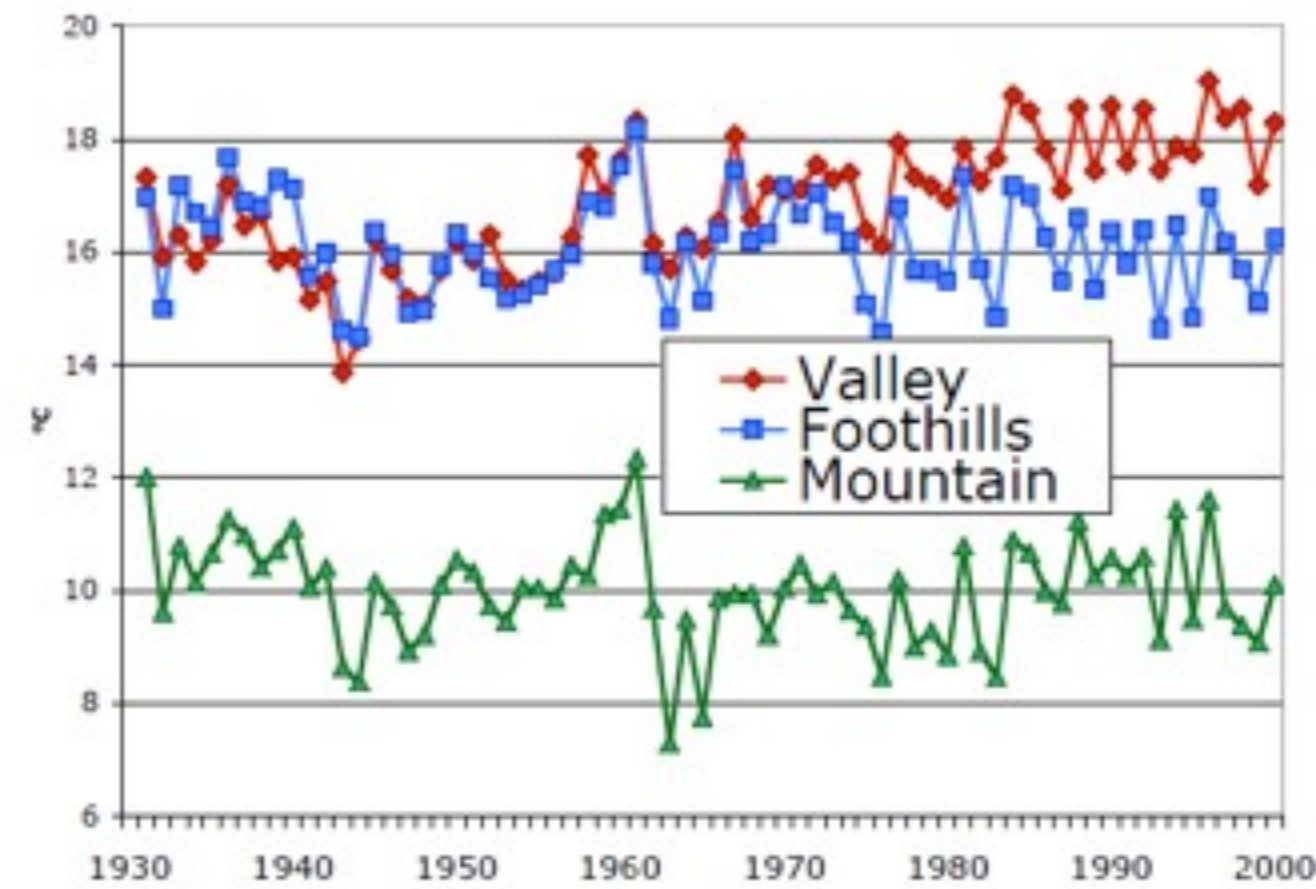
CO₂ & Methane Absorption Scenarios



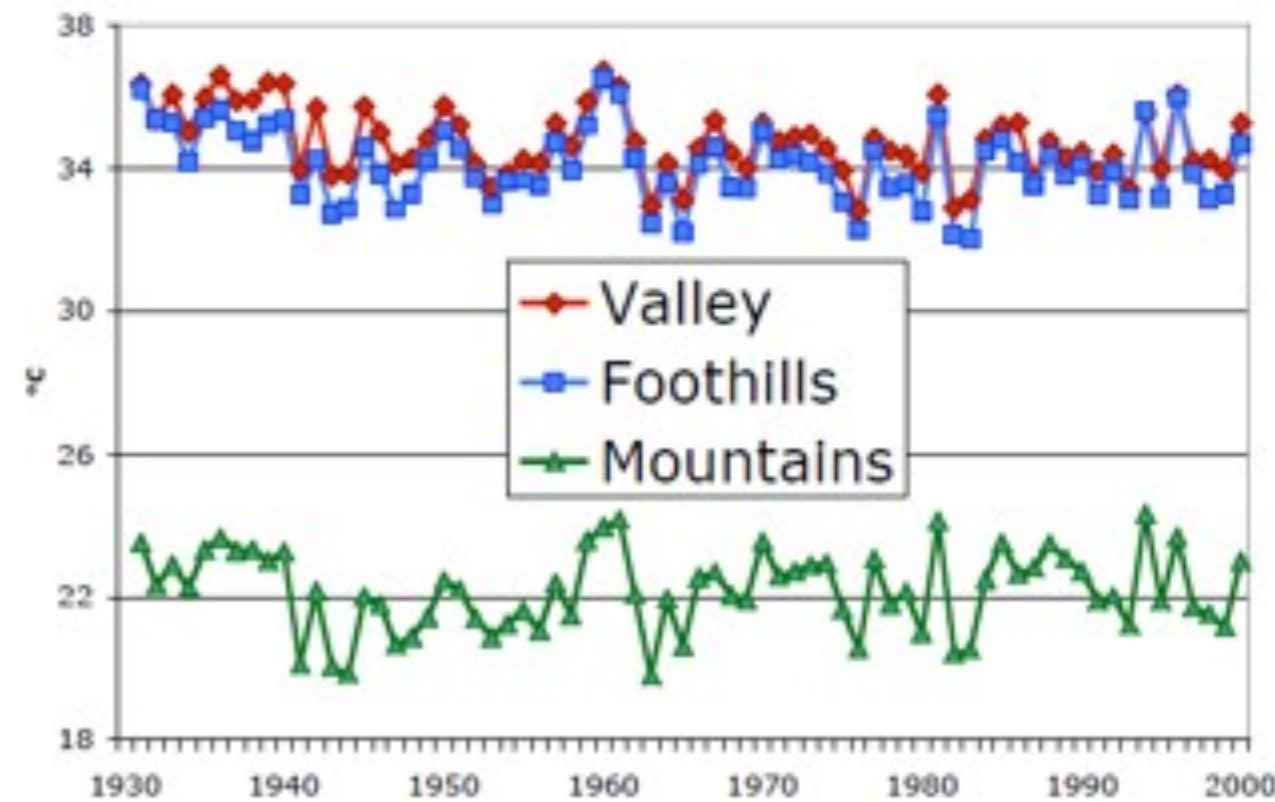
Doubling of CO₂ and Methane (red lines) from current levels (black lines) show minimal impact to the Greenhouse effect.

Water Vapor – Forcing or Feedback?

TMin Central California JJA



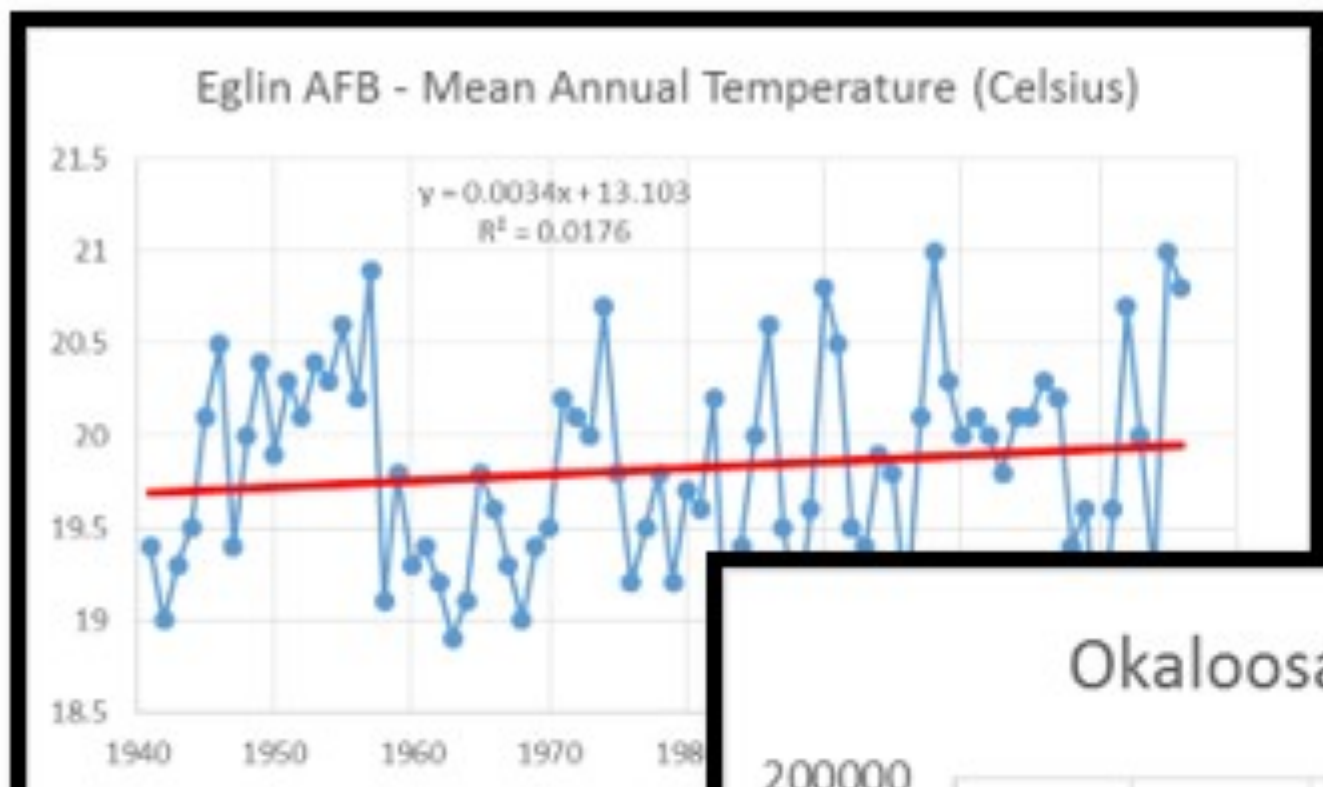
TMax Central California JJA



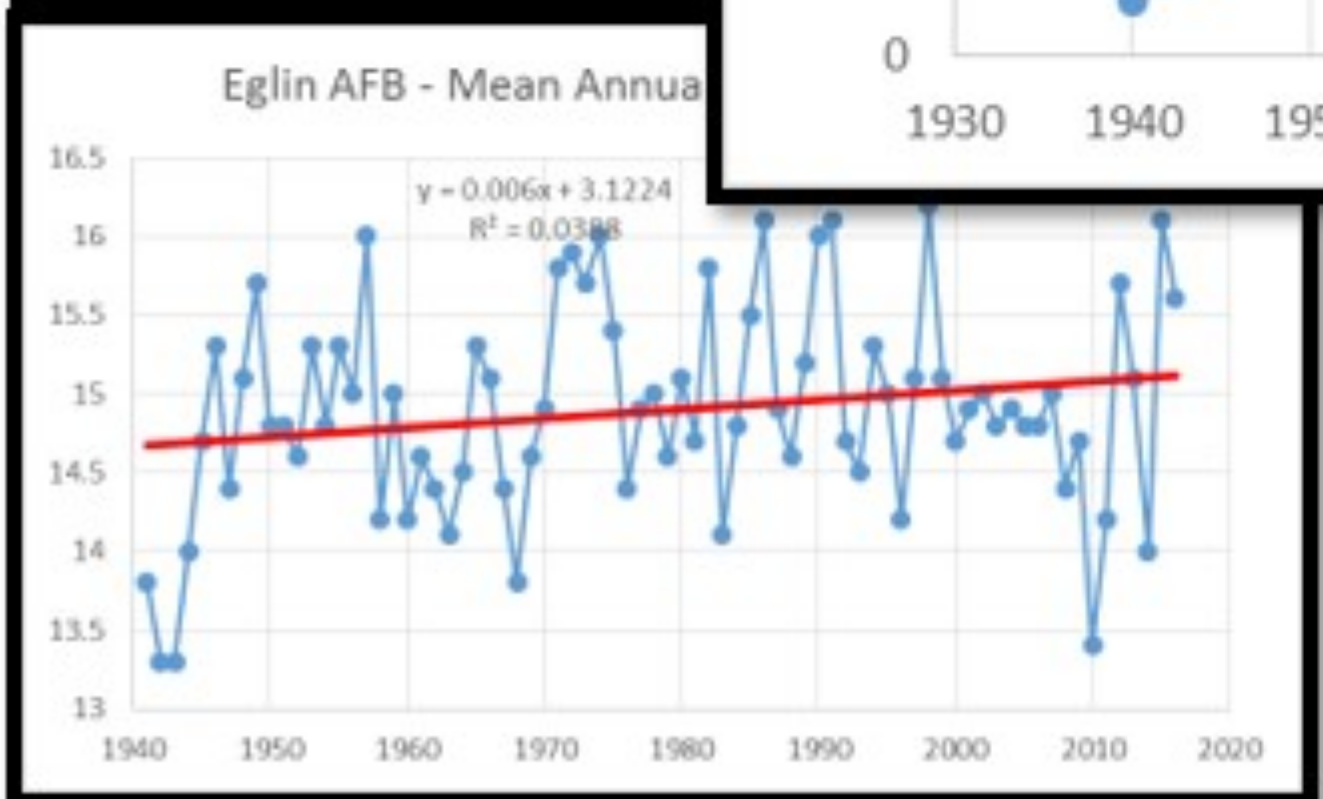
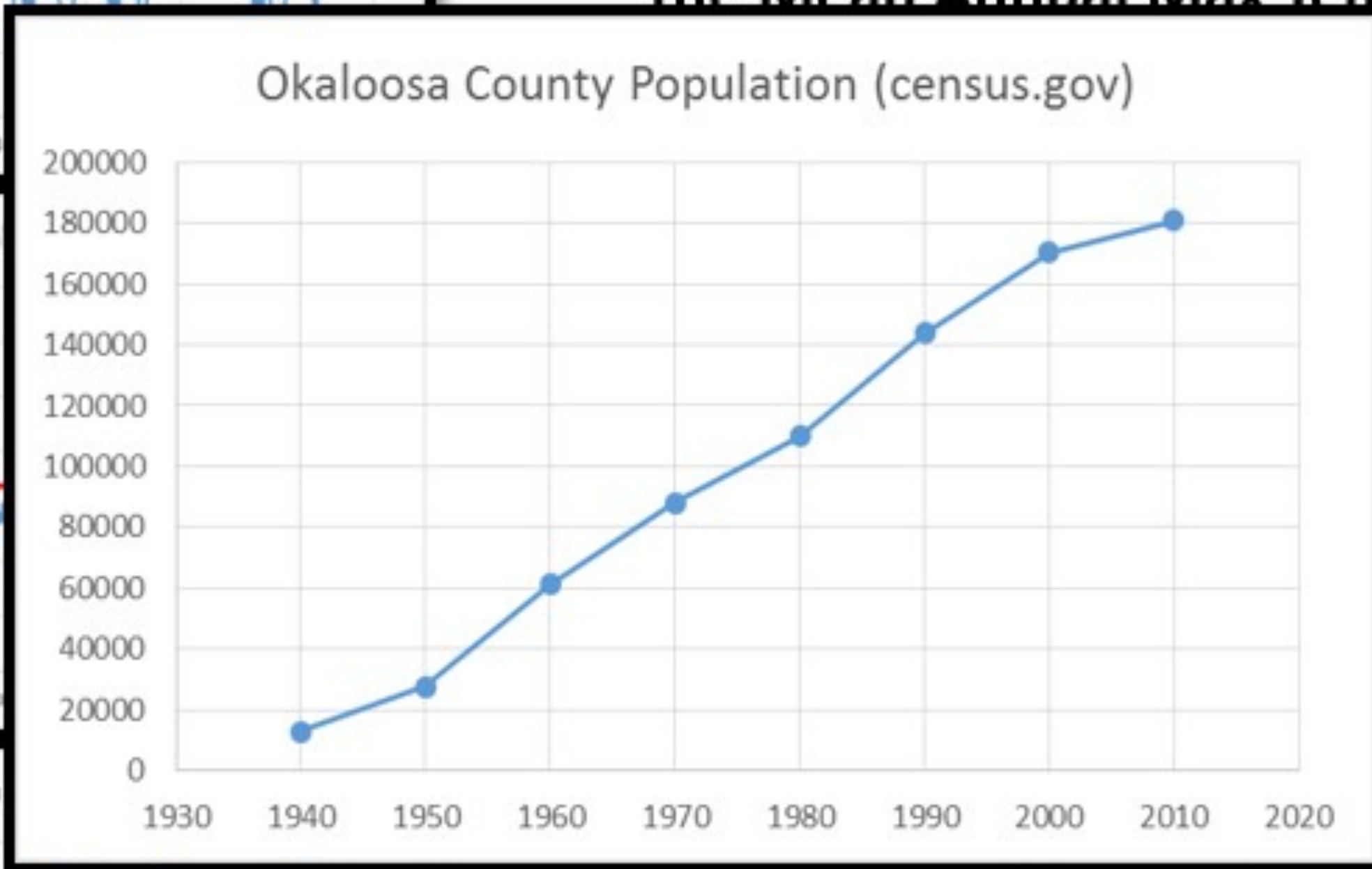
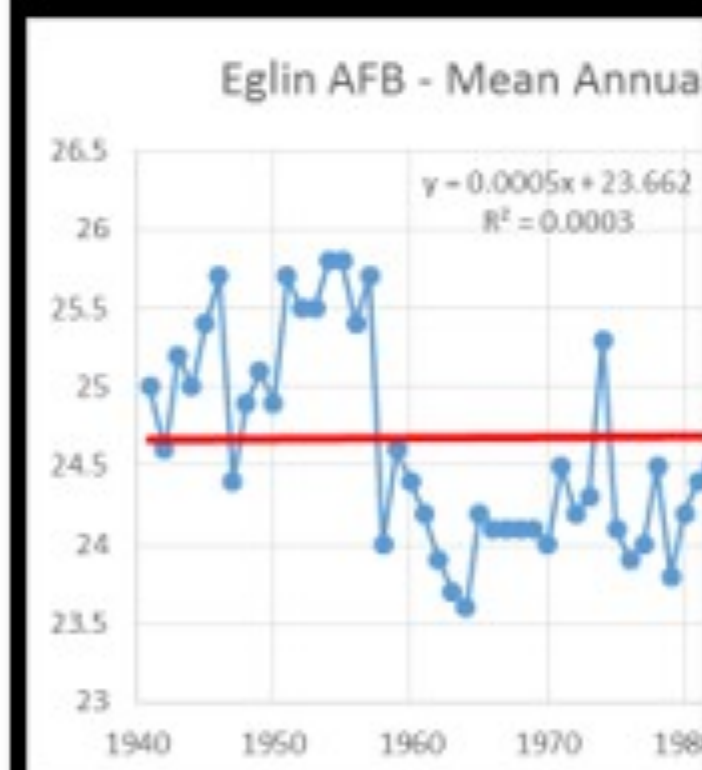
- IPCC/EPA, etc. – Changes in Water Vapor can be ignored – not forcing the climate
- Increased water vapor (humidity) in the Central Valley of CA is increasing the night time lows

=> Water Vapor can be a forcing mechanism and both natural and manmade contributions must be studied and not ignored

Eglin AFB – Temp Trends



- Mean Annual Temp at EAFB has increased $\sim 0.25^\circ\text{C}$ in the past 76 years.
- There is no discernable positive trend in the Mean Annual Max Temp.



Mean Annual Temp
w (min)

increasing?

Can CO2 explain
warming during the night,

- What is the role of water vapor/clouds, urban heat island effect in temp increase? Can irrigation for agriculture, lawns, golf courses, etc. explain this warming?



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RESOURCES

- "The Controversy"
- Evolution Education
- Religion
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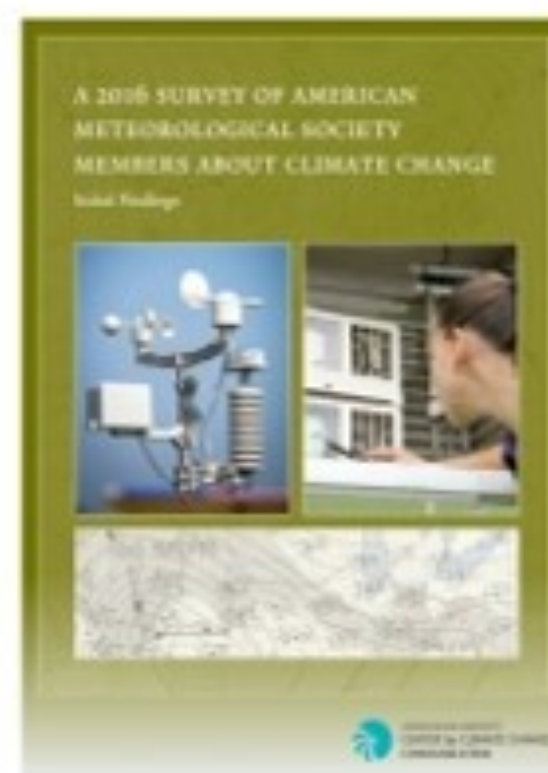
QUICK LINKS

- [What is "intelligent design" creationism?](#)

LATEST NEWS

Polling meteorologists on climate change

March 25th, 2016 [Read more](#)



A new survey of members of the American Meteorological Society [finds](#) (PDF) that nearly all respondents think that climate change is happening and that a majority of respondents think that human activity is causing most of the changes in the climate over the past fifty years.

Science standards definitively rejected in Idaho

March 24th, 2016 [Read more](#)



With the passage of [Senate Concurrent Resolution 140](#) by both the House of Representatives and the Senate in the Idaho legislature, the Idaho state science standards adopted in 2015 have been definitively rejected.

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IN THE SPOTLIGHT



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https://ncse.ngo/catalyzing-action

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What We Do What We're Monitoring Online Resources Need NCSE's Help? Sign up for the NCSE Monitor

NCSE vigilantly monitors efforts to interfere with the accurate teaching of climate change and evolution and strategically mobilizes local communities and educators to respond effectively when problems arise.

We can't afford to lose any time when it comes to the future of science education. [Donate Now](#)

Climate Scientist Targeted



University of Alabama in Huntsville climate scientist Dr. John Christy looks at a bullet hole in the window of the office next to his at the university. Seven shots were fired at the building over the weekend of April 22-23, and Christy believes his floor was targeted. (Lee Roop/lroop@al.com)

Why Should a Christian Care?

- It honors God and brings glory to him when we keep an accurate worldview consistent with the Bible
- The Bible warns us to be wary of false teachers and those that would lead us astray/away from God and to destroy false arguments
 - Colossians 2:8 – See to it that no one takes you captive by philosophy and empty deceit.
 - 2 Corinthians 10:5 – We destroy arguments and every lofty opinion raised against the knowledge of God.
- What is the worldview the Bible presents of the environment or God's creation and man's role in it?
 - Gen 2: 7 & 15
 - Intentional robust design by a Creator
 - Work it => Bring forth fruit
 - Keep it => Guard and protect it....but that doesn't mean not to use it
 - Gen 1:26-31 – God gives man dominion over the earth and tells him to use it to bring glory to himself

Modern Environmentalism

- What is their worldview?
 - There is no God
 - This earth and the life on it happened by random chance therefore life is very FRAGILE and must be protected at all costs
 - Human's are the enemy of nature
 - ⇒ This leads to worship of the creation rather than the Creator:
Pantheism
 - ⇒ Romans 1:25 They exchanged the truth of God for a lie and worshiped and served created things rather than the Creator
 - ⇒ Proverbs 1:7 The fear of the LORD is the beginning of knowledge, but fools despise wisdom and instruction.
 - Nature untouched by humans is not a biblical idea!

Manmade Climate Change

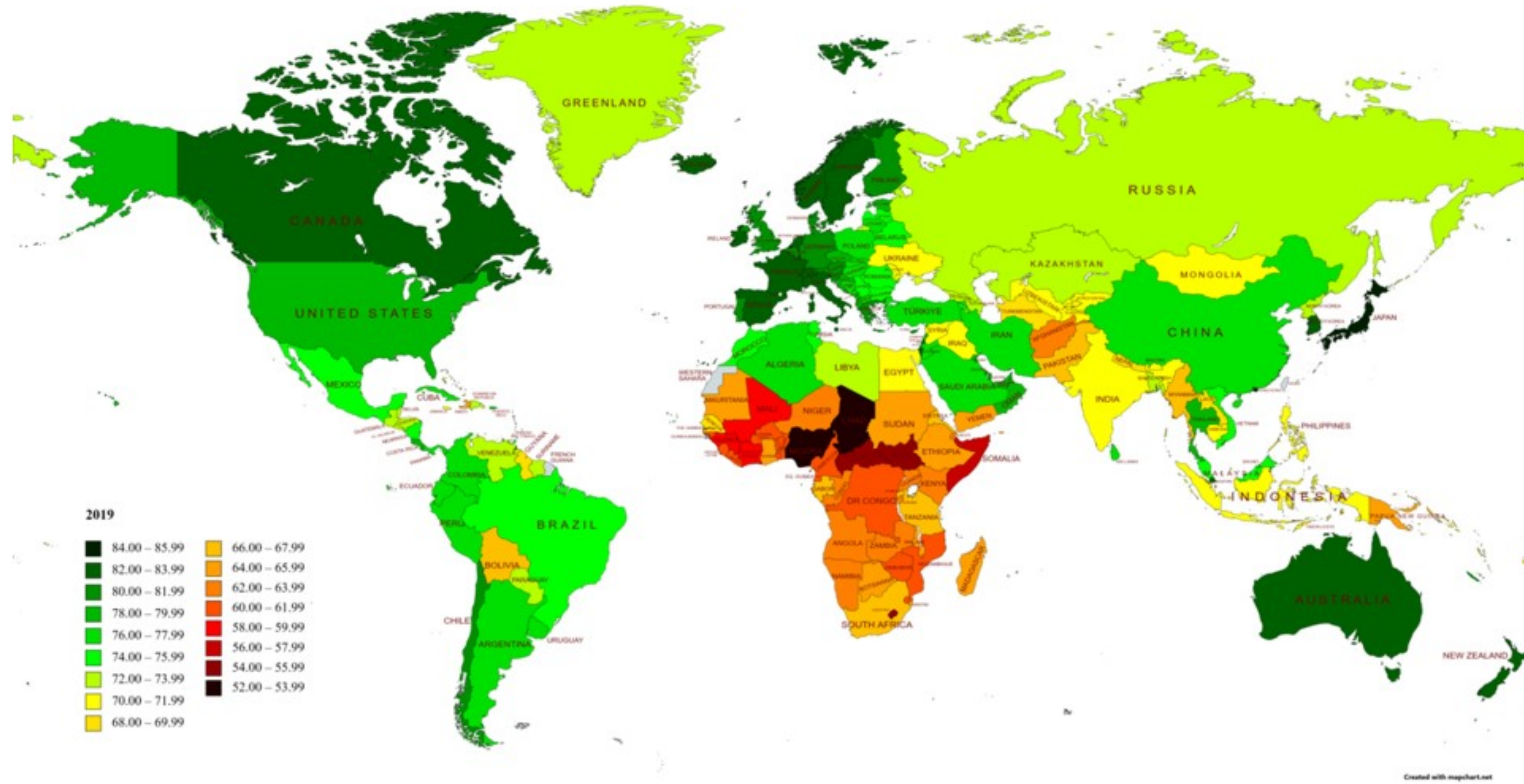


1903



Today

Life Expectancy



<https://data.worldbank.org/indicator/SP.DYN.LE00.IN>

Air pollution kills about 7 million people annually, and the major culprit is not fossil fuels, but burning biomass (wood, dung and crop waste). The provision of affordable electricity for cooking and heating of homes in developing countries could save millions of lives annually. Air quality in the developed world has improved greatly since the 1970s, thanks to catalytic converters, scrubbers and precipitators, removing 97 percent of the sulfur dioxide and 99 percent of coal's fly ash. Coal power in the U.S. is 17 times safer than that in India and China.

Only 25% of homes in Africa have electricity

Dr. Rossiter Testimony to Congress 30 Apr 2019 -

<https://wattsupwiththat.com/2019/05/01/skeptical-scientist-hijacks-aoc-congressional-climate-hearing/>

- Modern energy exploitation has been good for the advancement of mankind – medicine, communication, transportation
- Regulating or eliminating cheap forms of energy in developing nations hurts the poor
 - Don't unwittingly support policies that hurt the poor

What Should a Christian Do?

- **1 Thes 5:20-21**

Do not despise prophetic utterances. But **examine everything *carefully***; hold fast to that which is good; abstain from every form of evil.

- Holding fast to a biblical view of man and God's creation is good.
- Rejecting those and their theories that reject the presence and power of God is abstaining from evil
- Modern energy exploitation has been good for the advancement of mankind – medicine, communication, transportation => Has enabled the gospel to reach the corners of the earth
 - Regulating or eliminating cheap forms of energy in developing nations hurts the poor
 - Don't unwittingly support policies that hurt the poor
- **Gen 8: 21** The LORD said in his heart, "I will never again curse the ground because of man, for the intention of man's heart is evil from his youth. Neither will I ever again strike down every living creature as I have done. ²² While the earth remains, seedtime and harvest, cold and heat, summer and winter, day and night, shall not cease."
 - God created the climate and is ultimately in control...not man
 - Volcanoes, solar cycles, etc...

God created and sustains all things!

- **Genesis 8** ²² While the earth remains, seedtime and harvest, cold and heat, summer and winter, day and night, shall not cease.”
- **Proverbs 3** ¹⁹ The LORD by wisdom founded the earth; by understanding he established the heavens; ²⁰ by his knowledge the deeps broke open, and the clouds drop down the dew. ²¹ My son, do not lose sight of these—keep sound wisdom and discretion, ²² and they will be life for your soul and adornment for your neck.
- **Psalms 33** ⁶ By the word of the LORD the heavens were made, and by the breath of his mouth all their host. ⁷ He gathers the waters of the sea as a heap; he puts the deeps in storehouses. ⁸ Let all the earth fear the LORD; let all the inhabitants of the world stand in awe of him! ⁹ For he spoke, and it came to be; he commanded, and it stood firm.
- **Colossians 1** ¹⁵ He is the image of the invisible God, the firstborn of all creation. ¹⁶ For by ^[f] him all things were created, in heaven and on earth, visible and invisible, whether thrones or dominions or rulers or authorities—all things were created through him and for him. ¹⁷ And he is before all things, **and in him all things hold together.**

Conclusions

- The earth has warmed $\sim 1^{\circ}\text{C}$ since 1880
 - How much of this warming is due to man is still unclear – very complicated feedback processes and cyclical weather patterns (El Nino, Pacific Decadal Oscillation, Madden Julian Oscillation, North Atlantic Oscillation, etc.) not handled by climate models
- Climate models are not verifying well with observations – models being used to make risk assessments and drive policy
 - Climate sensitivity to CO₂ is less than models suggest
- Significant changes in the hydrologic cycle are not being observed – not seeing more tornadoes, hurricanes, floods, wildfires when compared to long term historical data
- The main hypothesis of AGW as put forth by Science Magazine in 2010 is not supported by observational data

Resources

- Pro AGW perspective
 - IPCC Reports - <http://www.ipcc.ch/> National Climate Assessment – www.globalchange.gov
- Alternate Points of View
 - Nongovernmental International Panel on Climate Change (NIPCC) - <http://www.nipccreport.org/>
www.wattsupwiththat.com – Updated graphs from numerous sources on climate issues
 - International Conference on Climate Change - <http://climateconferences.heartland.org/>
www.drroyspencer.com – Monthly UAH satellite temperature updates and climate articles
 - Climate Confusion – Dr. Roy Spencer
 - The Great Global Warming Blunder – Dr. Roy Spencer
 - <https://judithcurry.com/> – Dr. Judith Curry – Georgia Tech University
 - <https://everythingclimate.com/>
 - www.co2science.org - climatic and biological consequences of the ongoing rise in the air's CO2 content
 - George C. Marshall Institute - <http://marshall.org/climate-change/>
 - CATO Institute - <http://www.cato.org/research/global-warming>
 - The Heartland Institute - <http://news.heartland.org/climate-change-weekly>
 - Florida Climate Center - <http://climatecenter.fsu.edu/>
 - State of Fear by Michael Crichton

Questions??

