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 8 Dec at 3pm

- 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

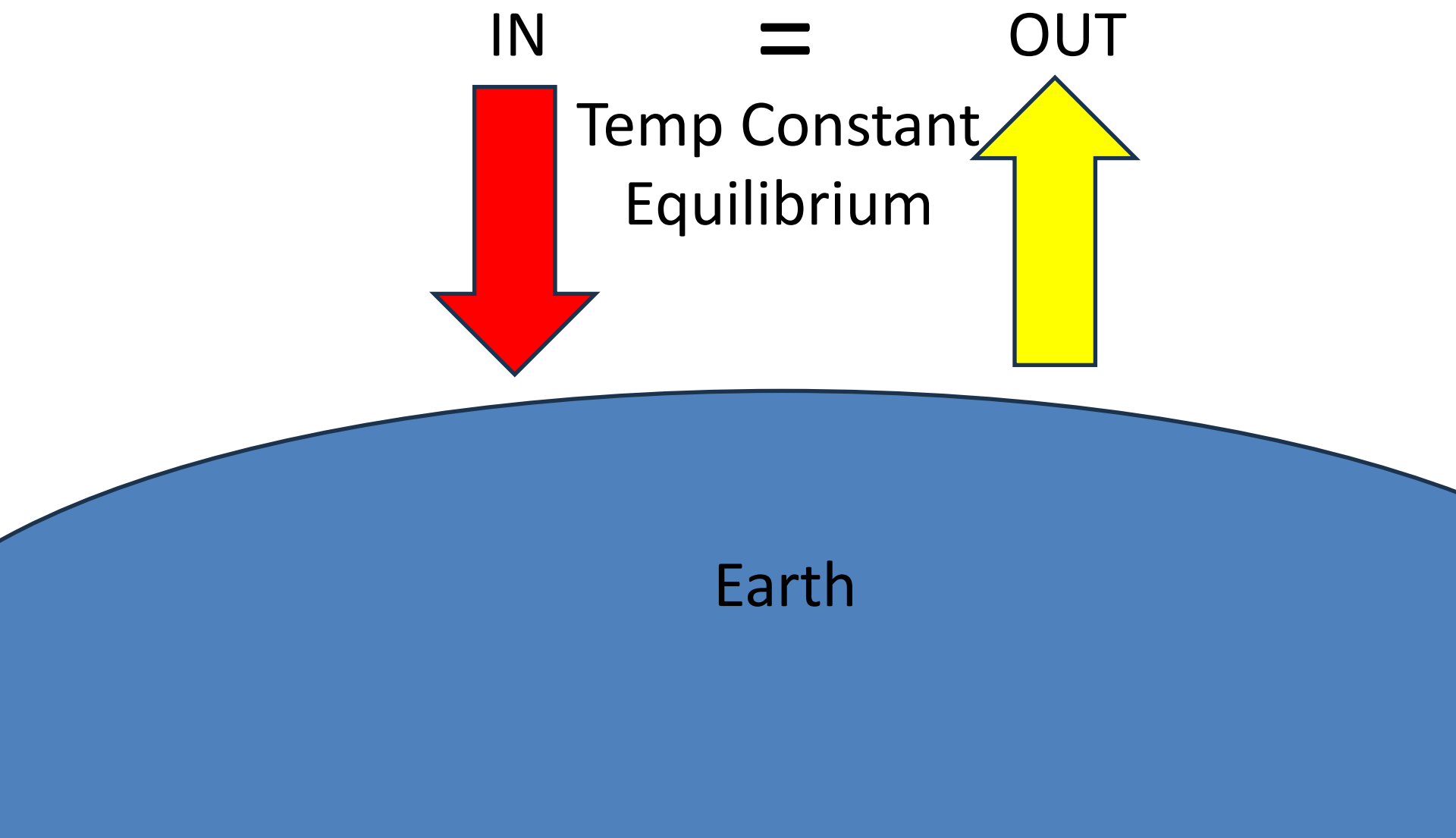
Natural causes have always played a role in the Earth's climate, but are now being overwhelmed by human-induced changes.

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.)

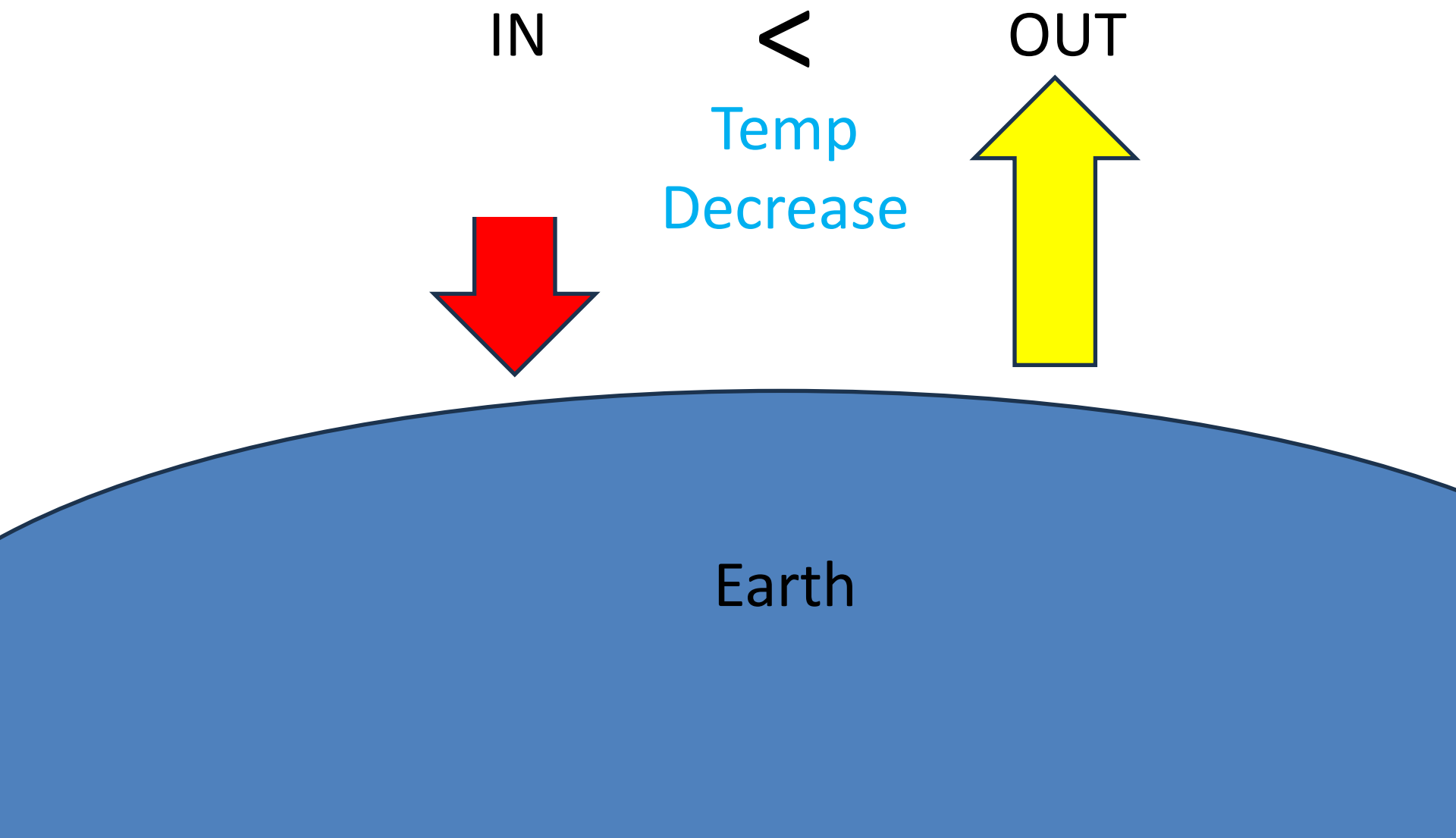
Science Magazine, 2010

- 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



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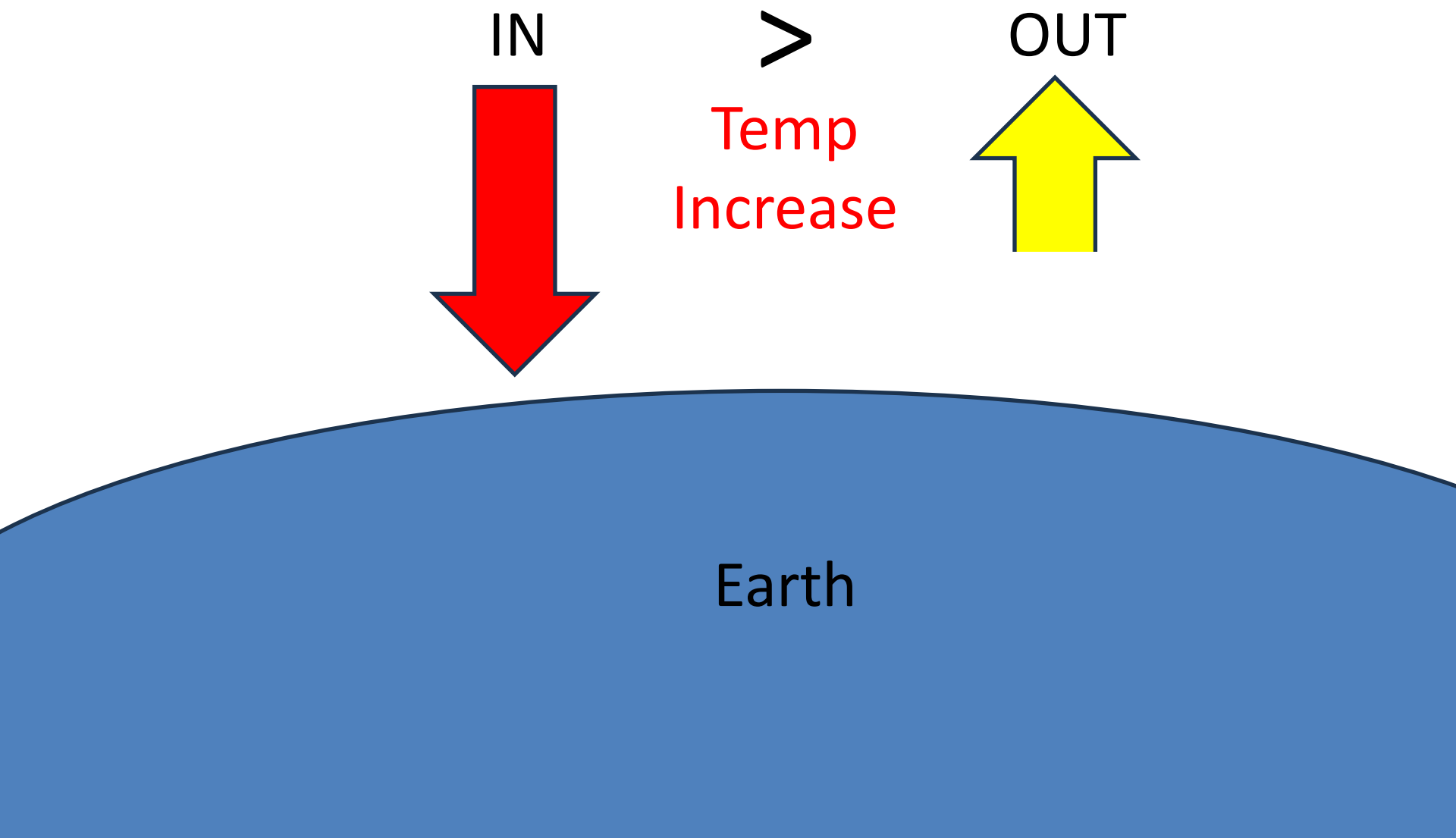
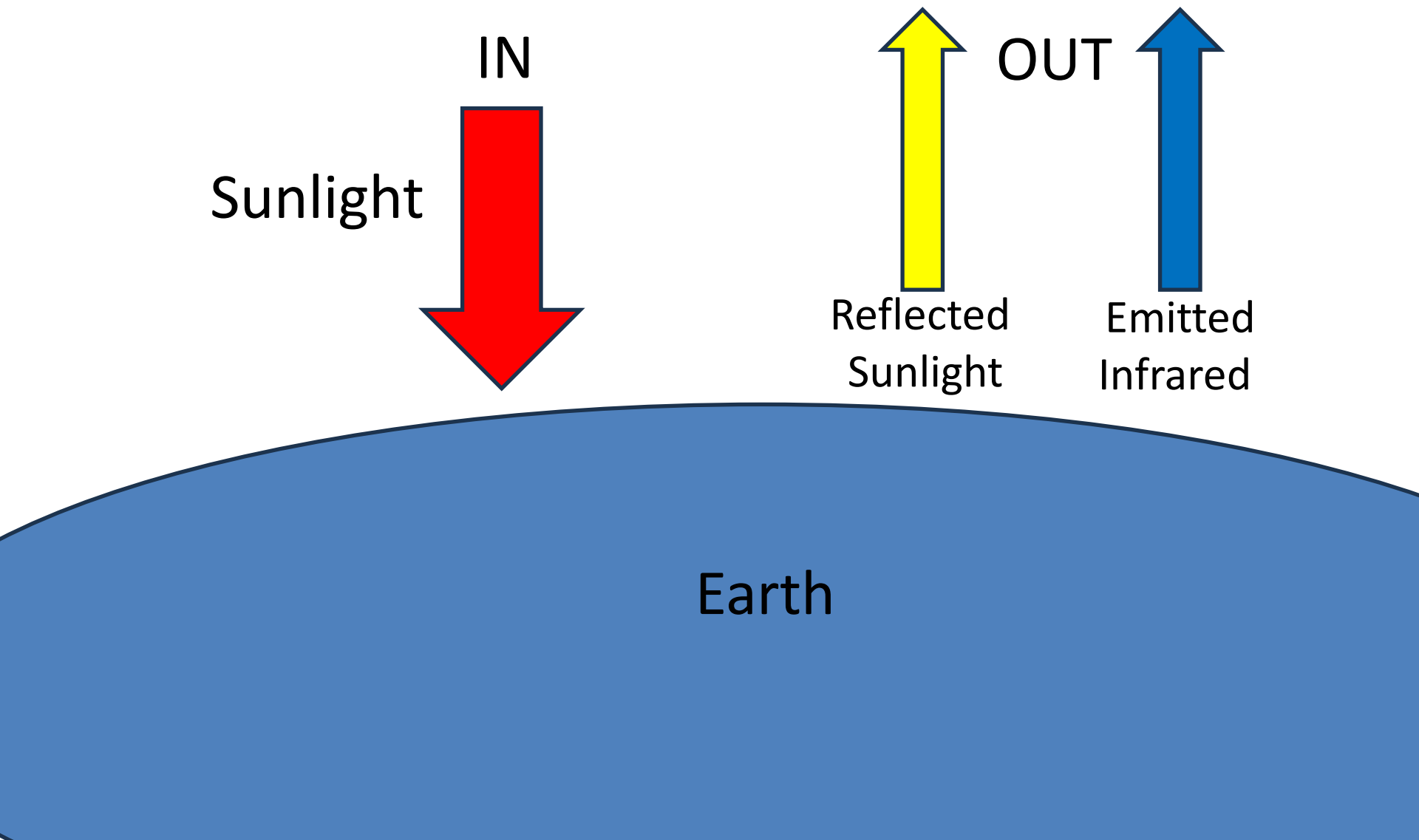


Earth's Energy Balance



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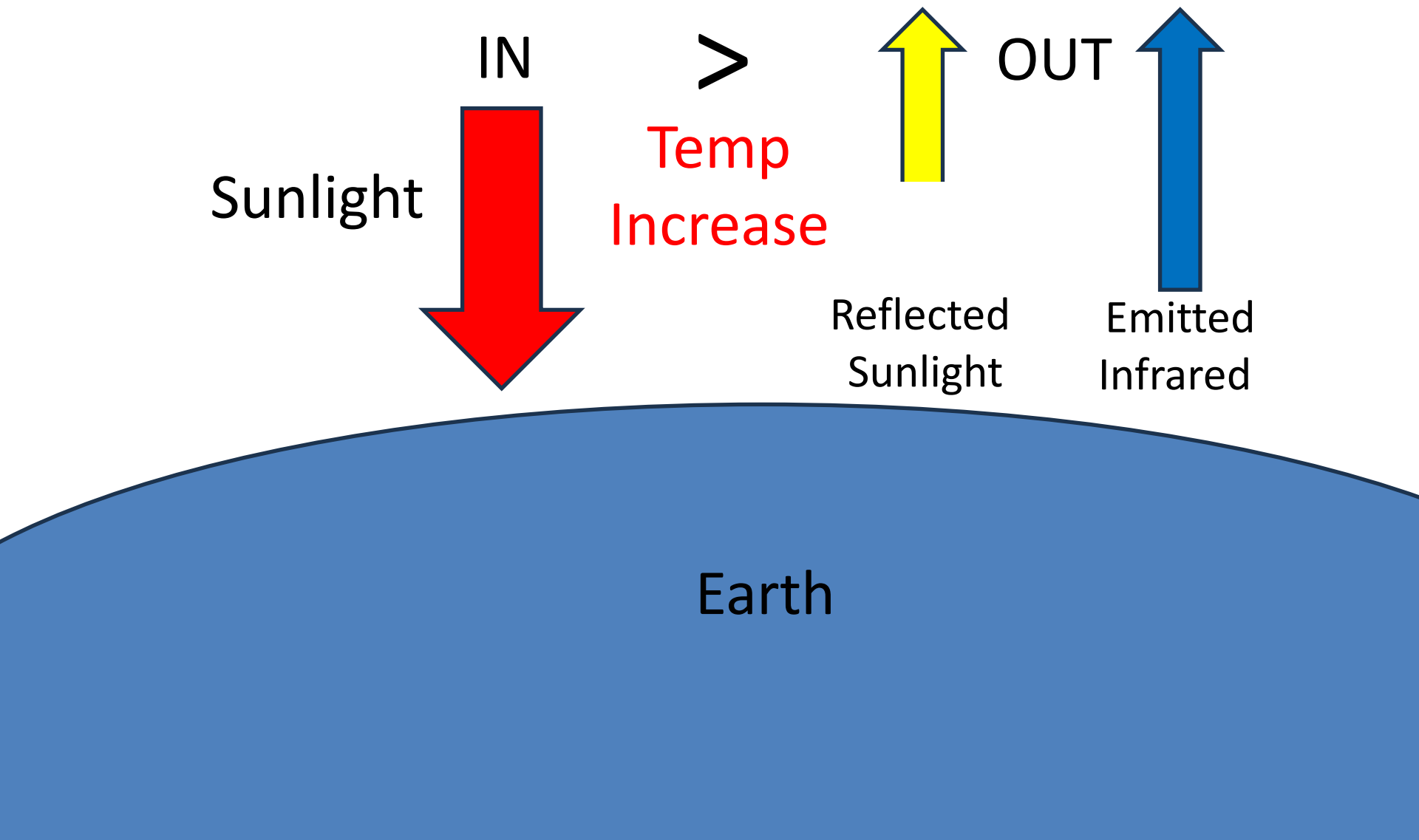
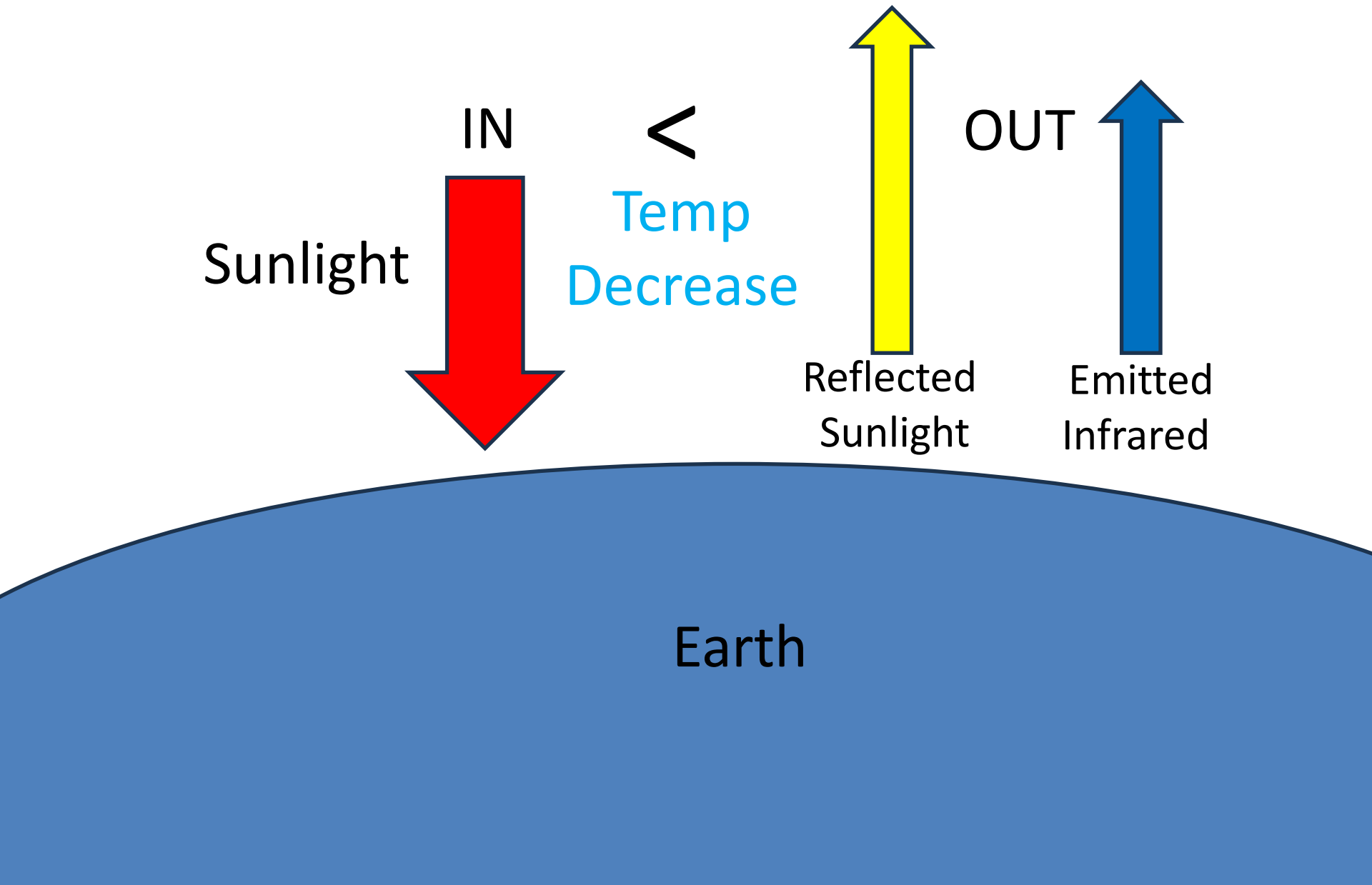
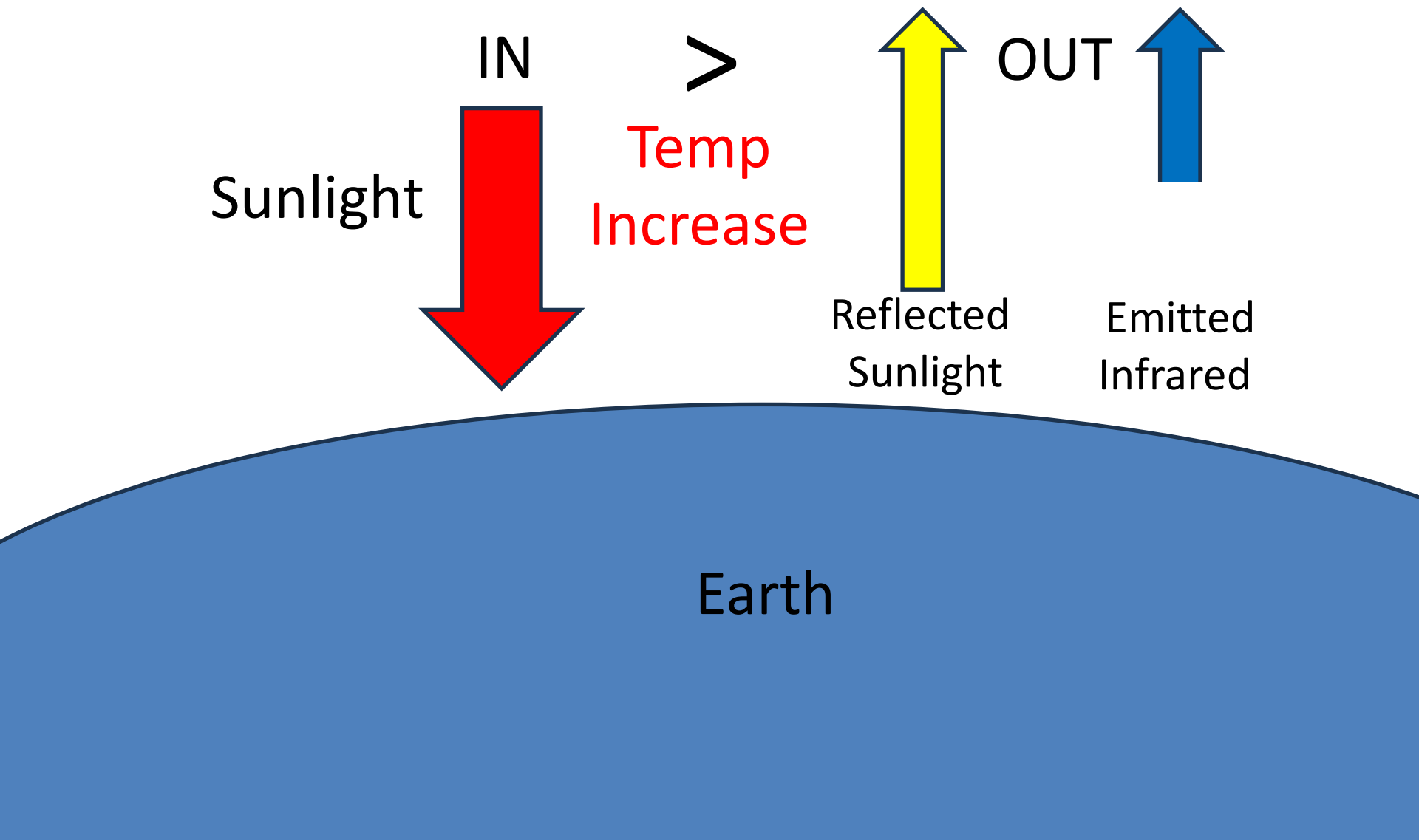


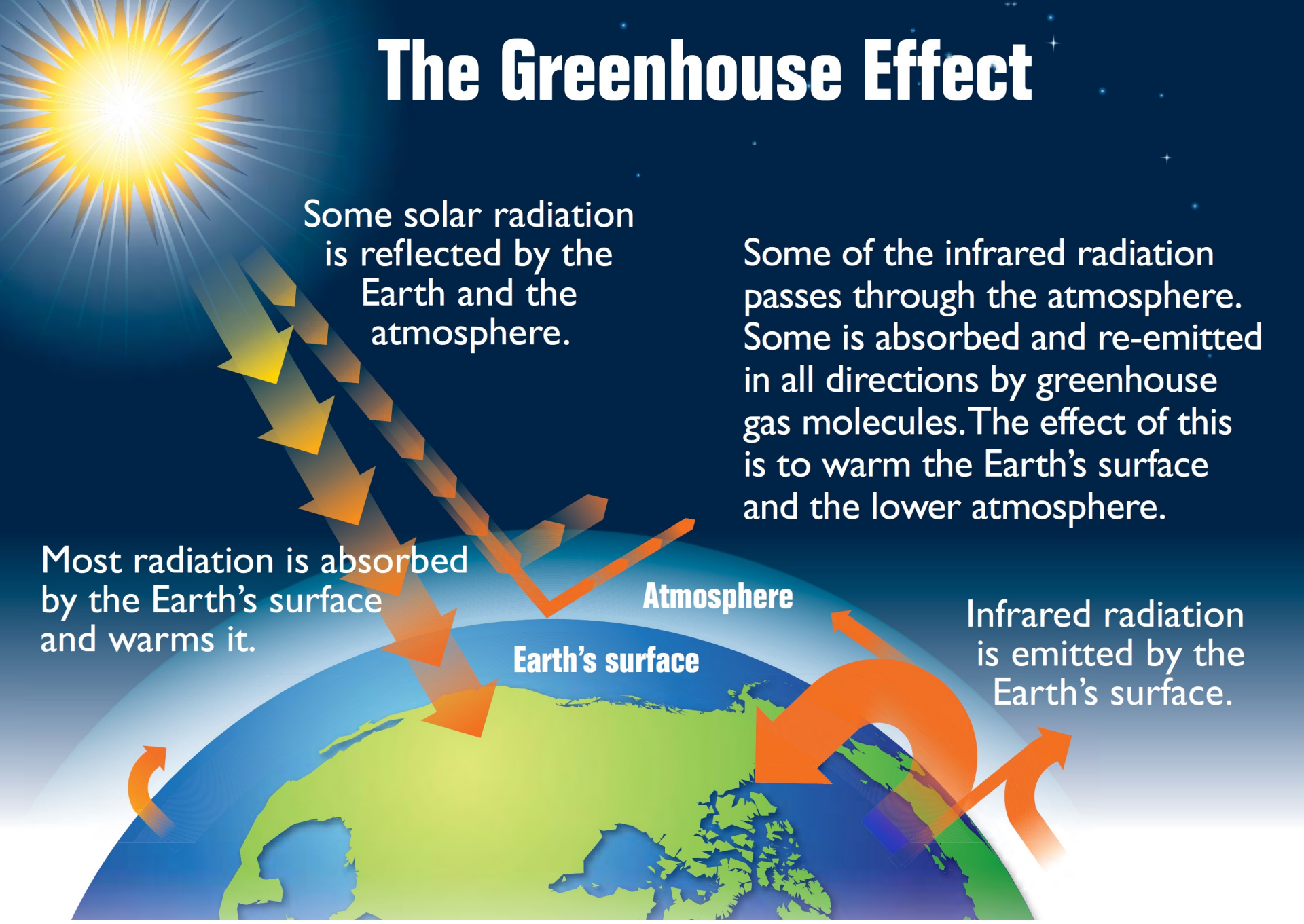
Earth's Energy Balance



Earth's Energy Balance

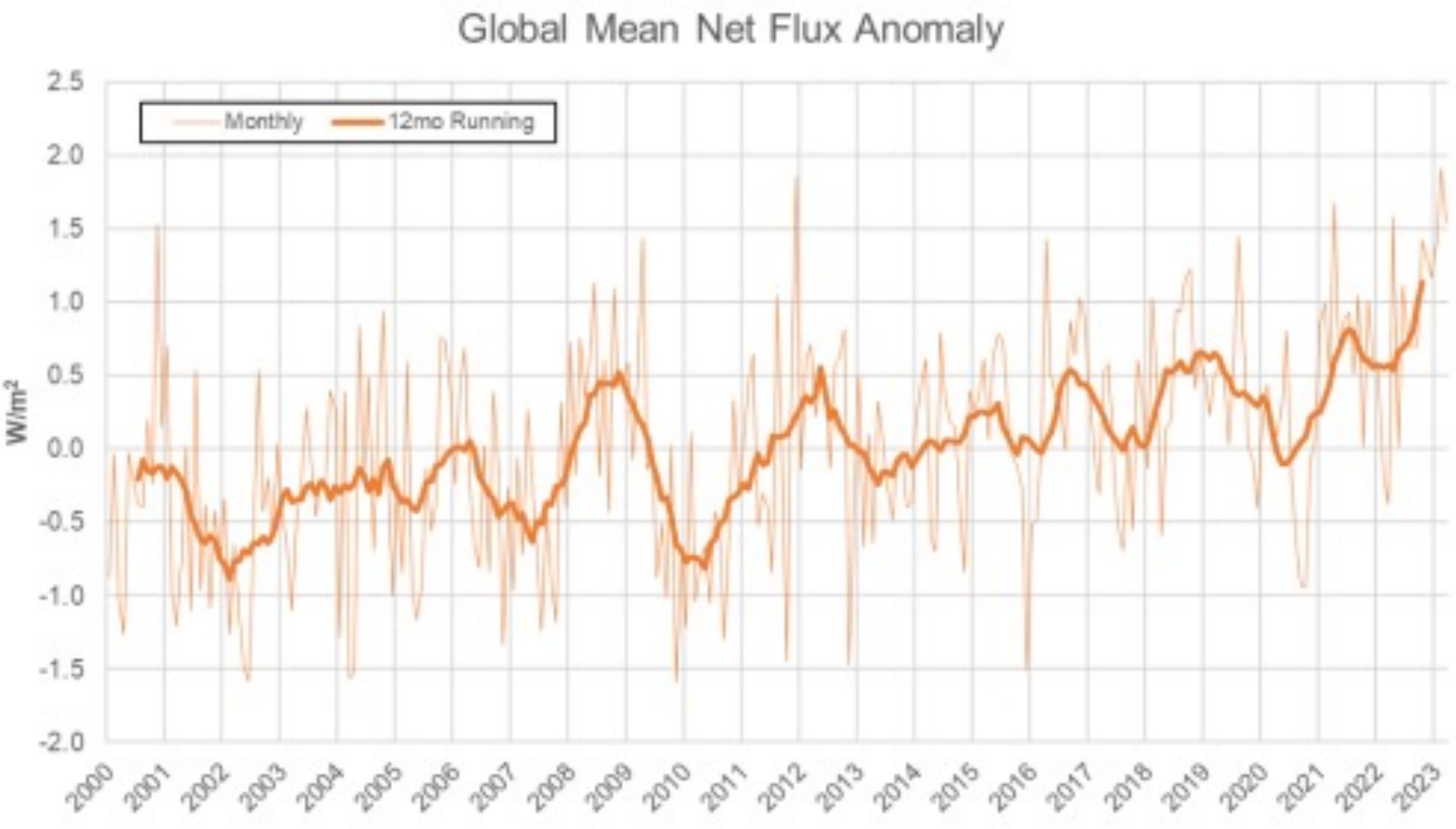


The Greenhouse Effect



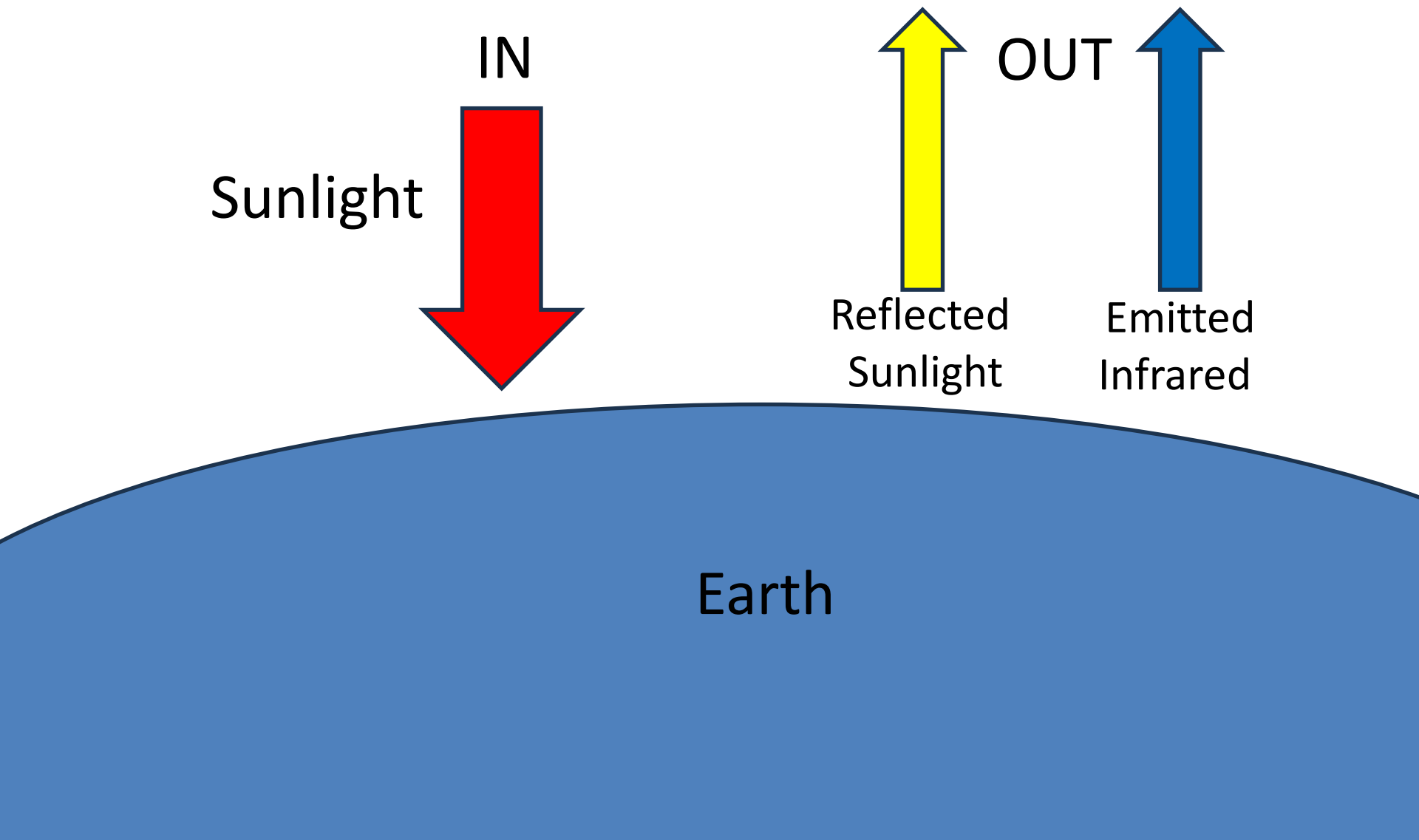
https://upload.wikimedia.org/wikipedia/commons/8/8e/Earth%27s_greenhouse_effect_(US_EPA,_2012).png

Net $Flux_{top}$ = Incoming Solar – Reflected Solar – Outgoing Longwave

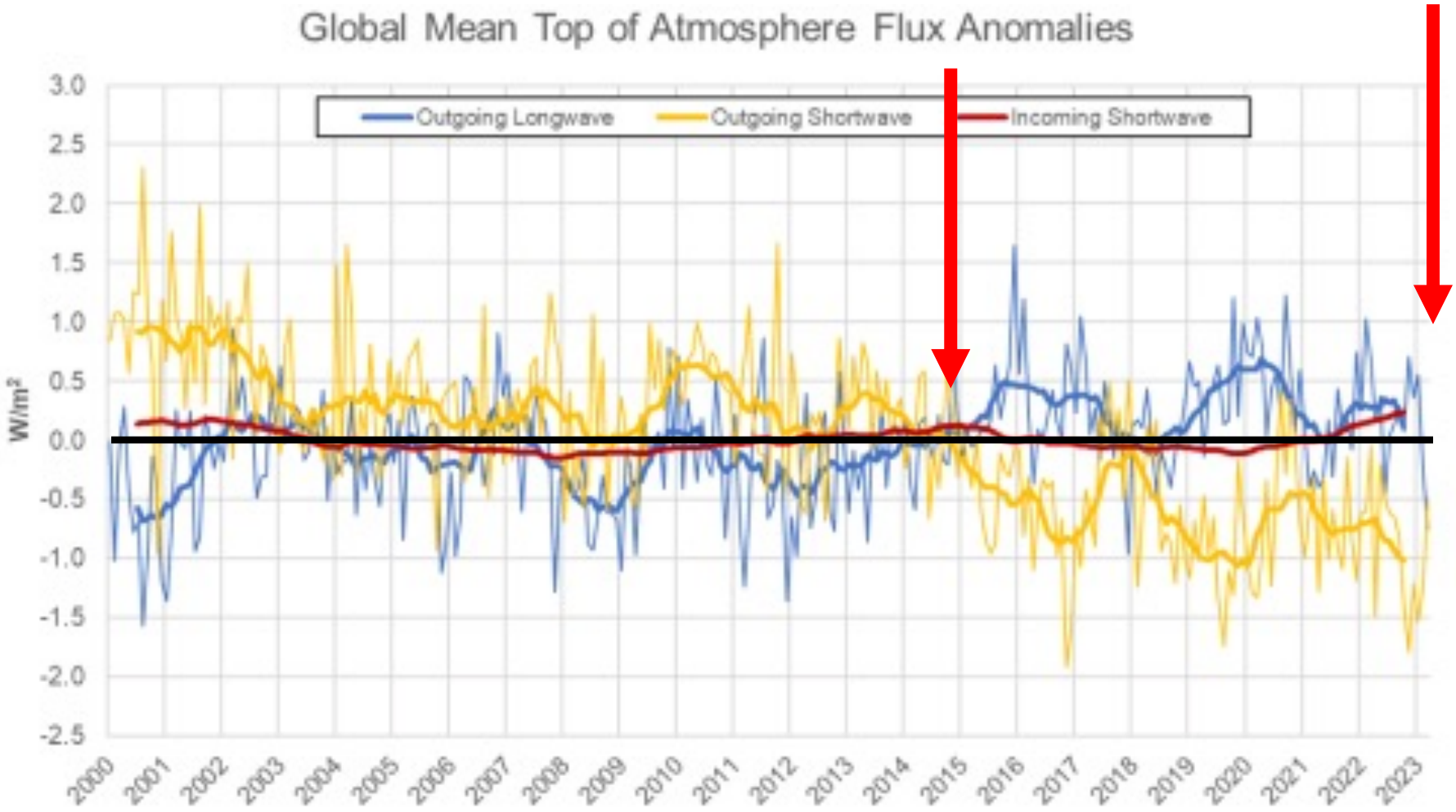


https://judithcurry.com/2023/08/14/state-of-the-climate-summer-2023/

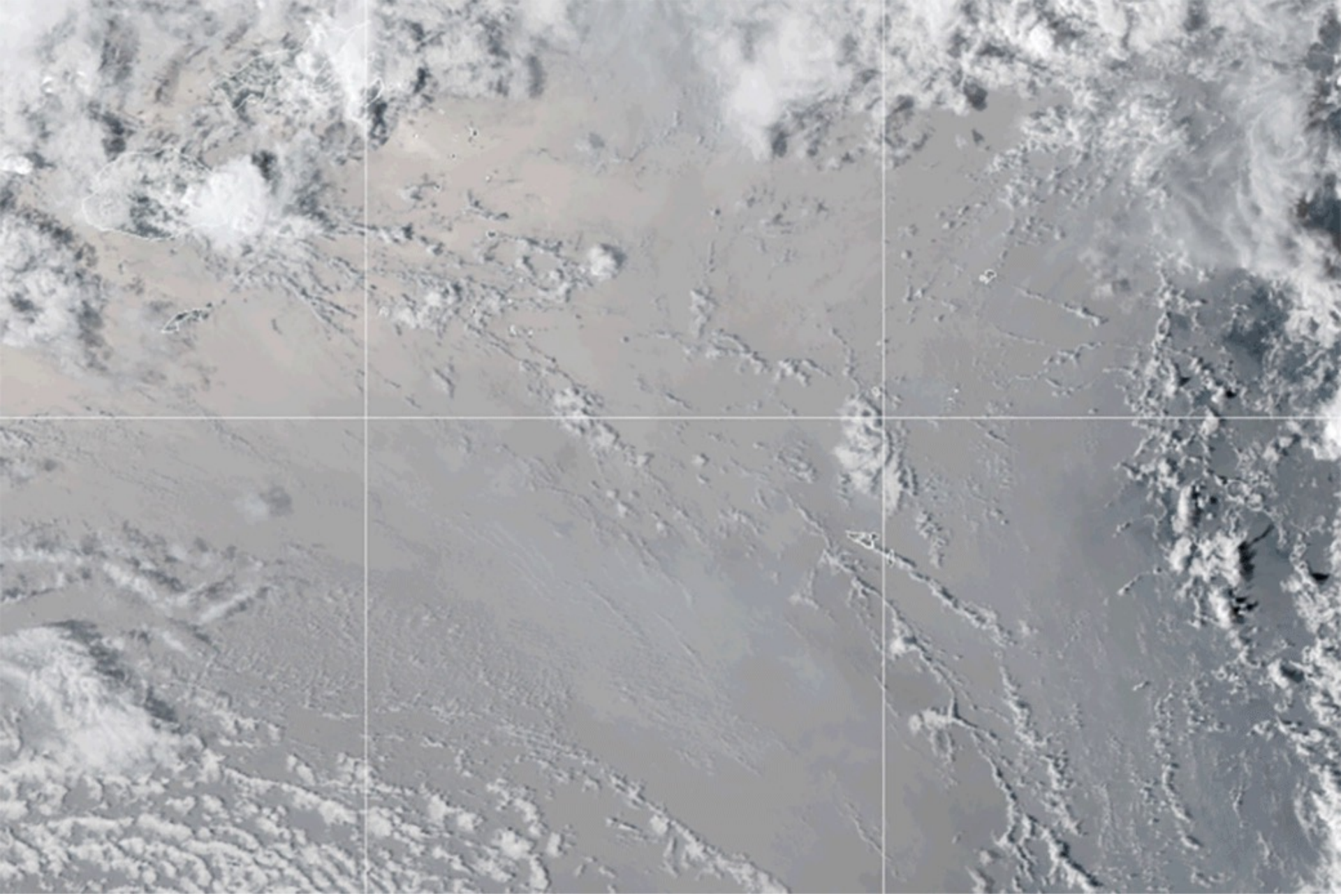
Earth's Energy Balance



Satellite Measurements of Energy Balance



https://judithcurry.com/2023/08/14/state-of-the-climate-summer-2023/



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

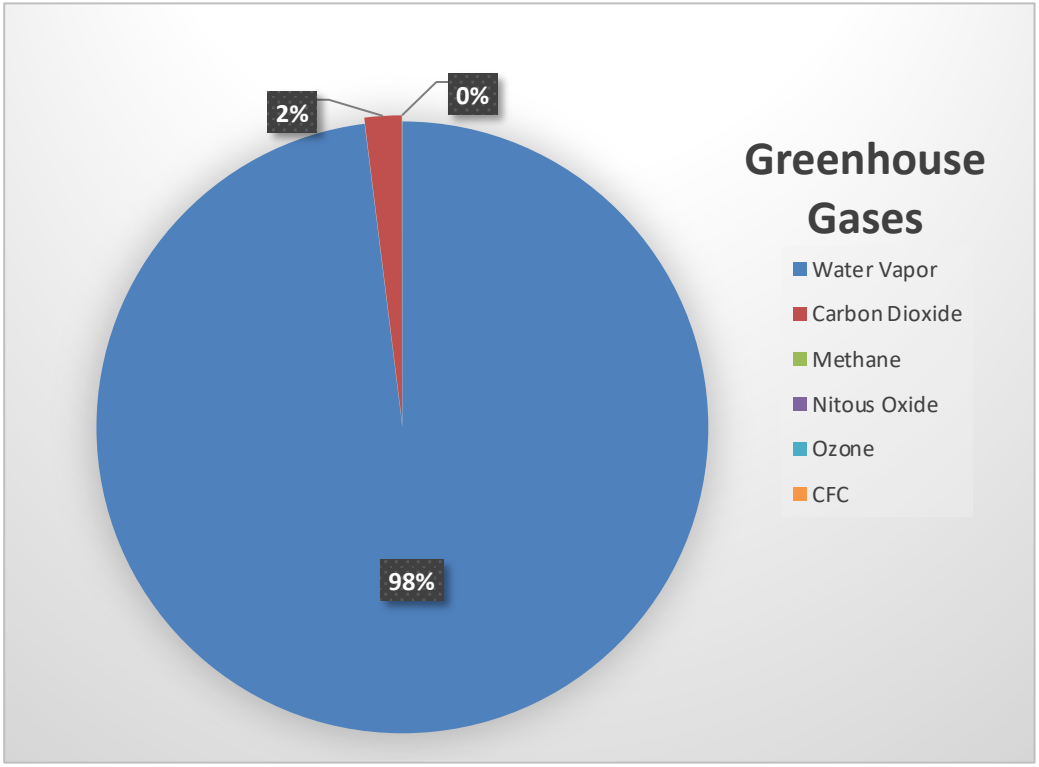
PERMANENT GASES			VARIABLE GASES			
Gas	Symbol	Percent (by Volume) Dry Air	Gas (and Particles)	Symbol	Percent (by Volume)	Parts per Million (ppm)*
Nitrogen	N_2	78.08	Water vapor	H_2O	0 to 4	
Oxygen	O_2	20.95	Carbon dioxide	CO_2	0.038	385*
Argon	Ar	0.93	Methane	CH_4	0.00017	1.7
Neon	Ne	0.0018	Nitrous oxide	N_2O	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 CO_2, 385 parts per million means that out of every million air molecules, 385 are CO_2 molecules.
†Stratospheric values at altitudes between 11 km and 50 km are about 5 to 12 ppm.

Ahrens, Meteorology Today. 9th Ed

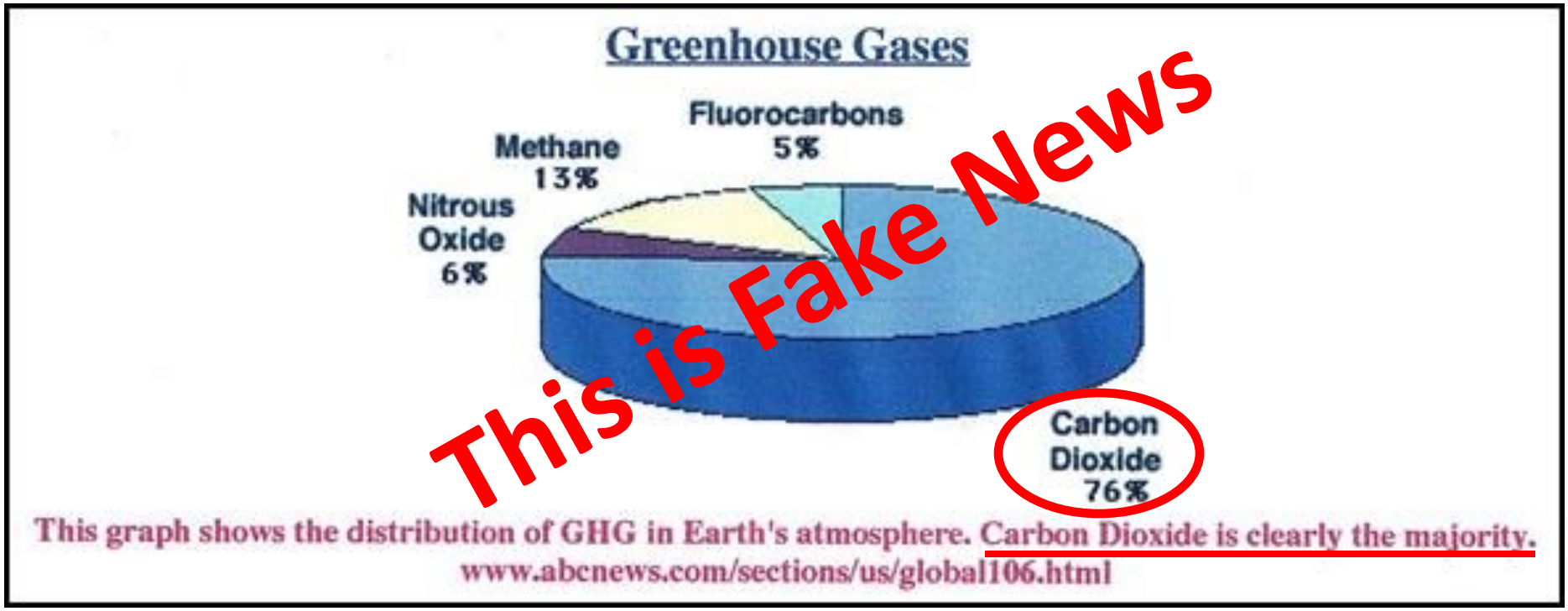
Average Distribution of Greenhouse Gases

	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?

https://wattsupwiththat.files.wordpress.com/2013/11/clip_image0027.jpg

Google Image Search

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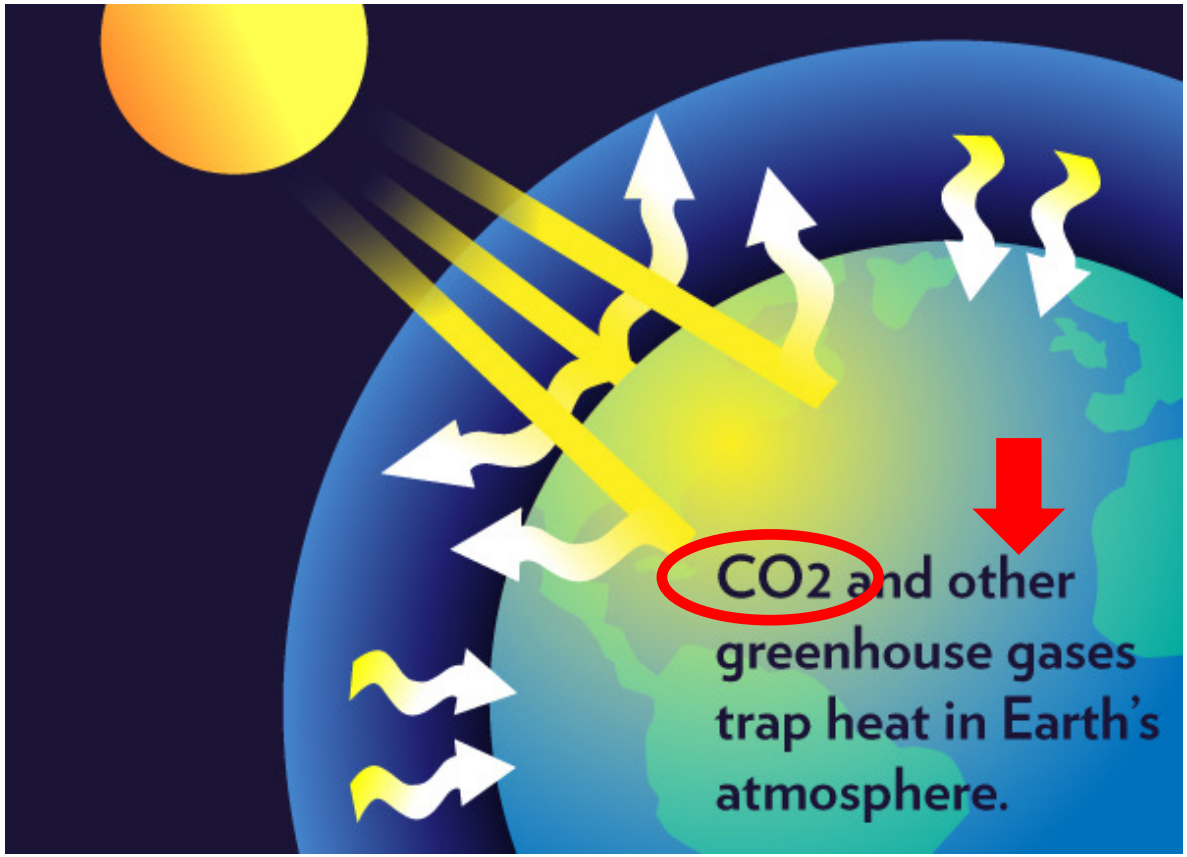


Is this graphic accurate?

http://icons.wxug.com/metgraphics/climate/sunearthdiagram.jpg

GHG Emissions and Removals Home

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

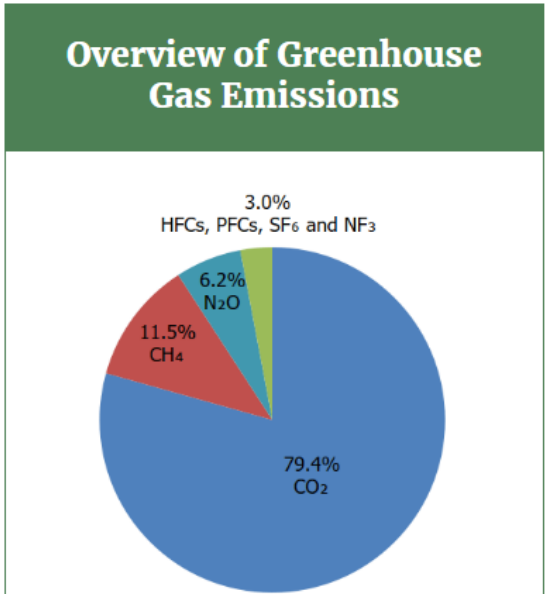
Overview of Greenhouse Gases

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 (CO_2)**: 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



https://www.epa.gov/ghgemissions/overview-greenhouse-gases

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 | CO_2 | CH_4 | Ozone | N_2O | CFCs | CO | Additional Information

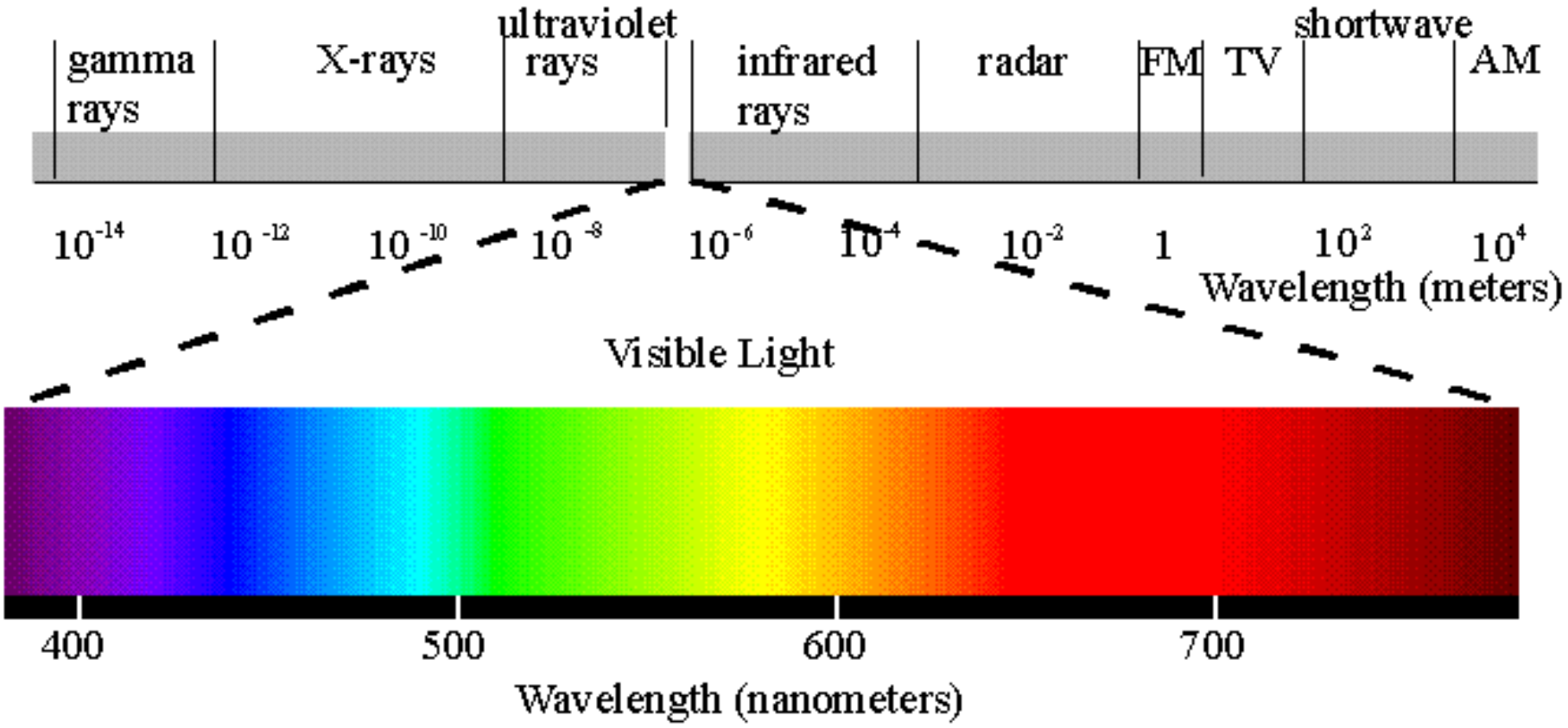
Water Vapor

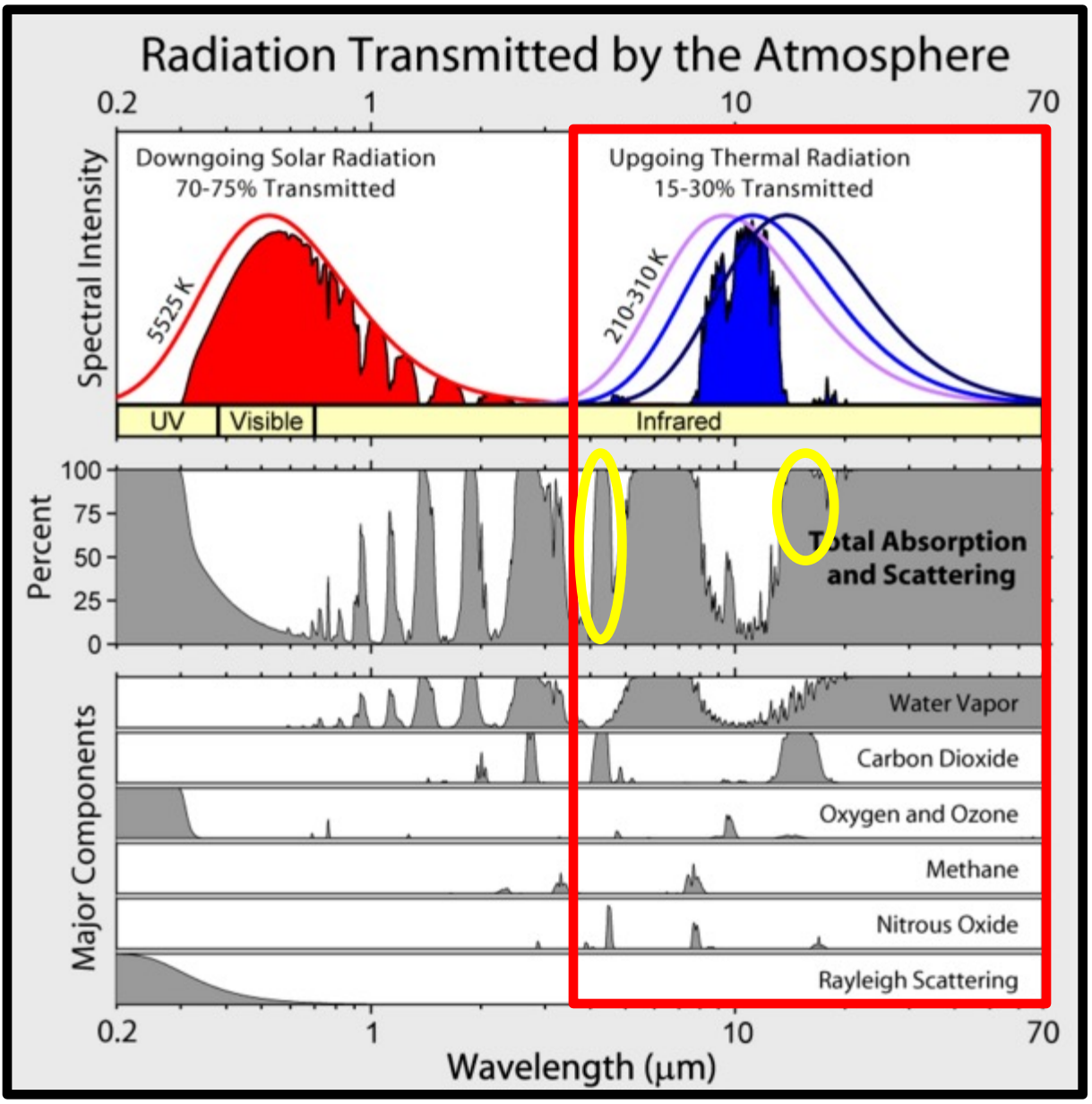
Water Vapor is the most abundant greenhouse gas in the atmosphere, which is why it is addressed here first. However, changes in its concentration is also considered to be a result of climate *feedbacks* related to the warming of the atmosphere rather than a direct result of industrialization. The feedback 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.

https://www.ncdc.noaa.gov/monitoring-references/faq/greenhouse-gases.php

Electromagnetic Spectrum





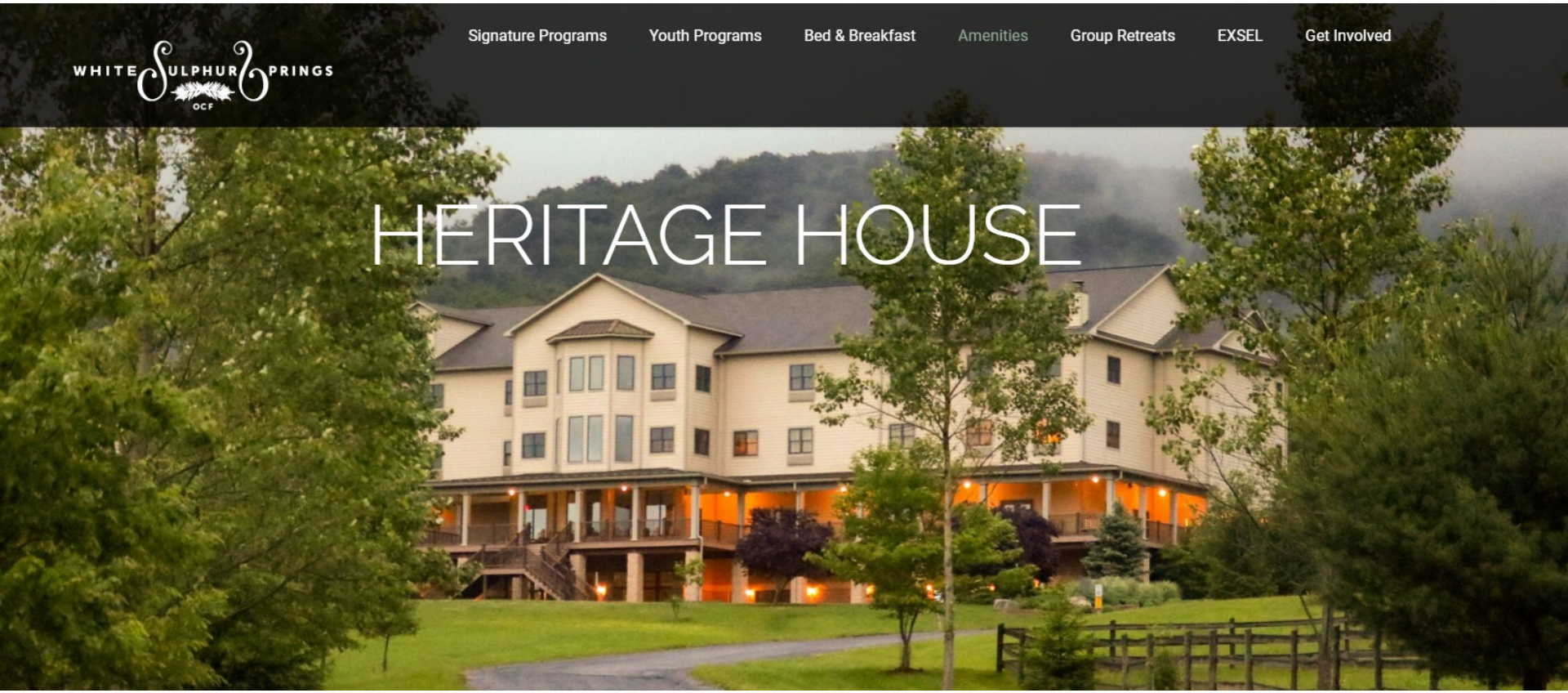
Water Vapor

- 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

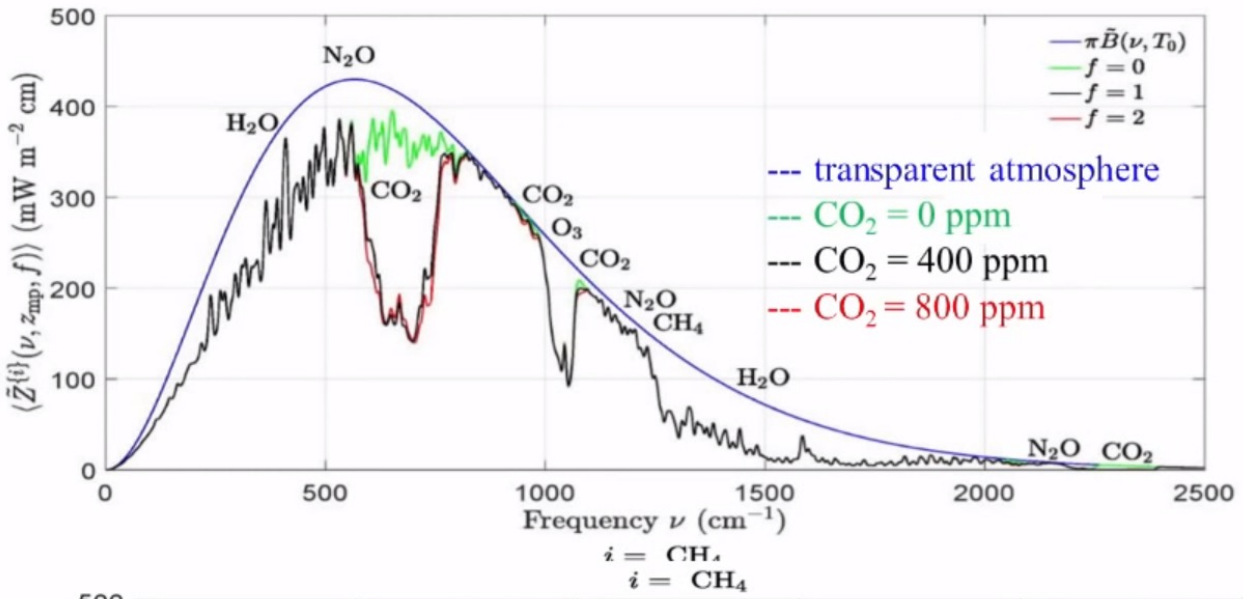
White Sulphur Springs

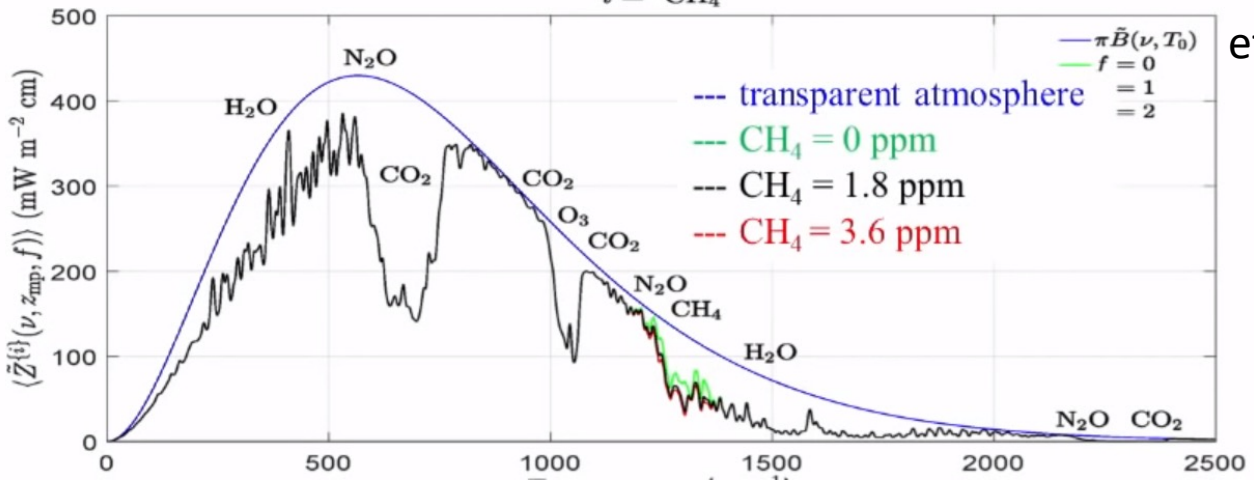


https://www.whitesulphursprings.org/summer-rnr/

- Dr. Paul Homan – Guest Speaker 8-15 Jun 2024

CO_2 & Methane Absorption Scenarios

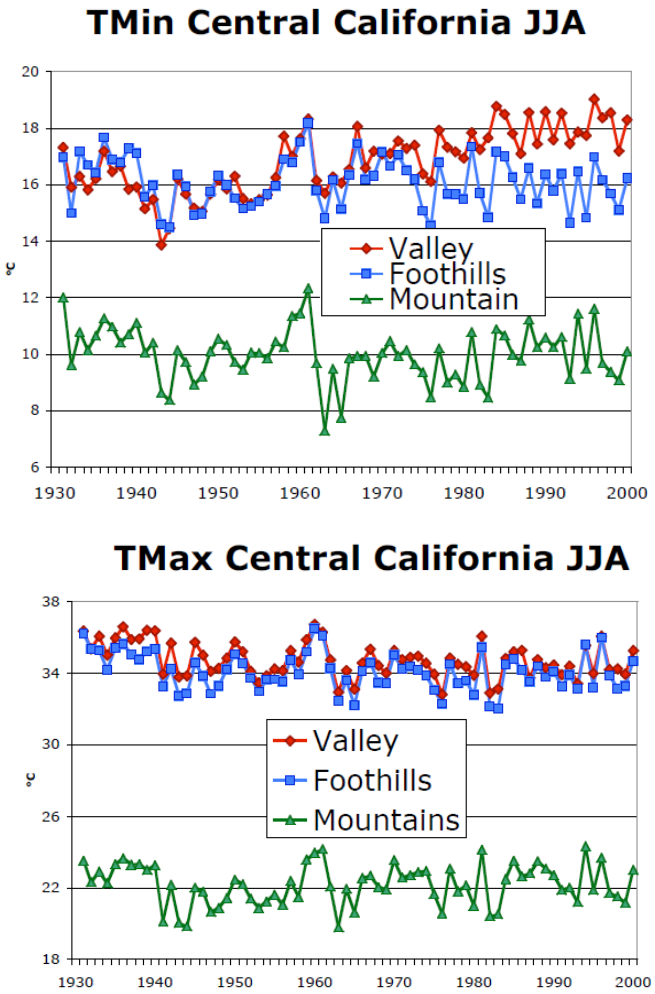




Doubling of CO2 and Methane (red lines) from current levels (black lines) show minimal impact to the Greenhouse effect.

Dr. Will Happer - PhD Princeton Director or Energy (Bush and Clinton Administration)
https://www.youtube.com/watch?v=a3W8EVEEKQ8&pbjreload=10

Water Vapor – Forcing or Feedback?

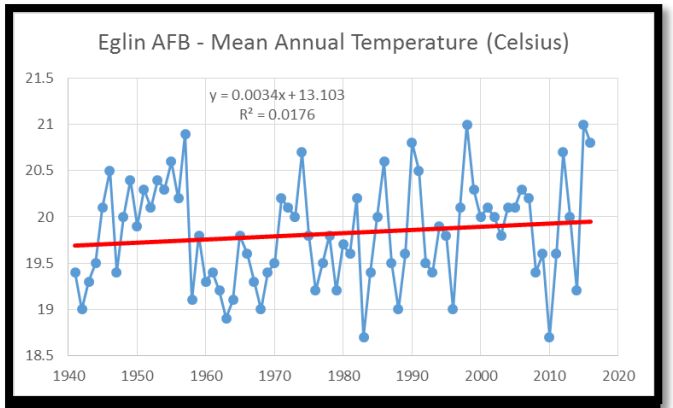


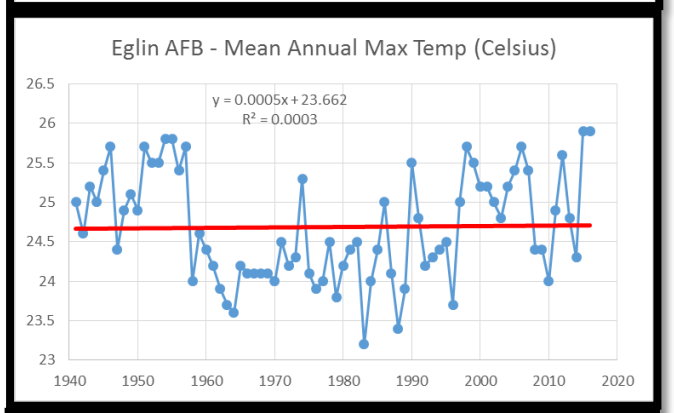
- IPCC/EPA, etc. – Changes in Water Vapor can be ignored – not forcing the climate
- Increased water vapor (humidity) in the Central Valley of CA is increasing the night time lows

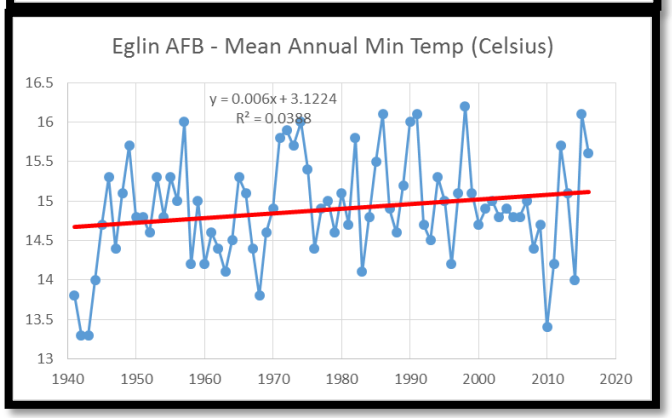
=> Water Vapor can be a forcing mechanism and both natural and manmade contributions must be studied and not ignored

Irrigation Induced Warming In Central CA, Christy and Norris 2006
http://wattsupwiththat.com/2010/09/12/christy-on-irrigation-and-regional-temperature-effects/

Eglin AFB – Temp Trends

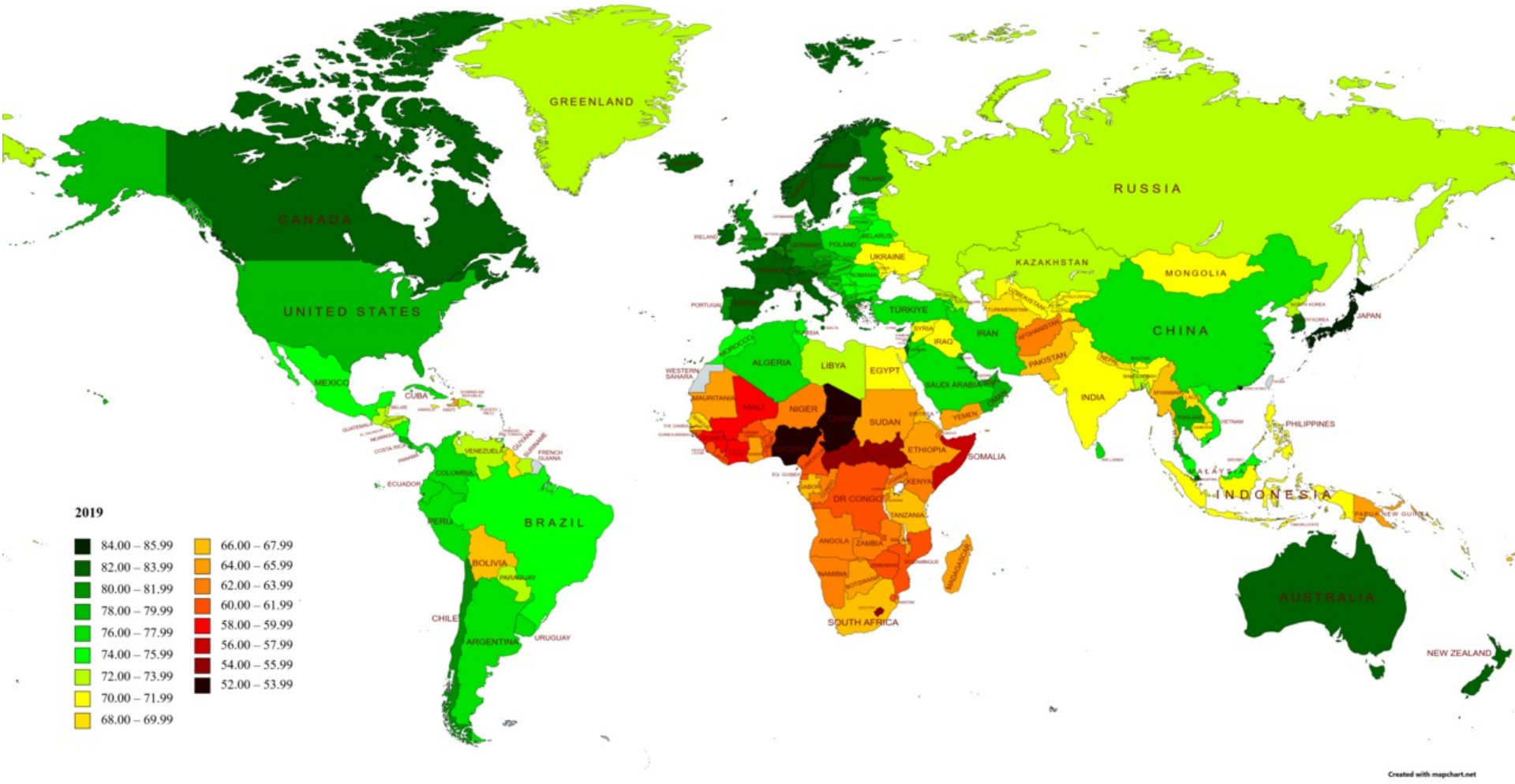






- **Mean Annual Temp at EAFB has increased ~0.25°C in the past 76 years.**
- **There is no discernable positive trend in the Mean Annual Max Temp.**
- **All the increase in the Mean Annual Temp is due to increase in the low (min) temperature.**
- **Why are low temperatures increasing?**
- **Can an increase in Carbon Dioxide explain why temps are increasing during the night, but not during the day?**
- **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?**

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

Story at a glance

- Wildfires have burned through a total of 10.3 million acres so far in 2020.
- That breaks the previous record of 10.1 million acres set in 2015.
- This is the third year on record that wildfires have burned more than 10 million acres across the country, with all three years taking place since 2015, E&E News reports.

The U.S. set a new record for the number of acres burned by wildfires, as 2020 saw some of the hottest months on record and large parts of the western U.S. experienced severe drought.

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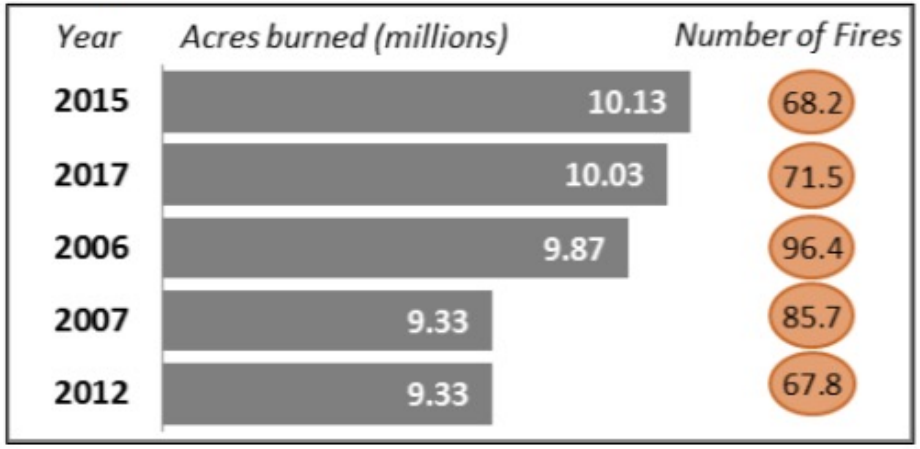
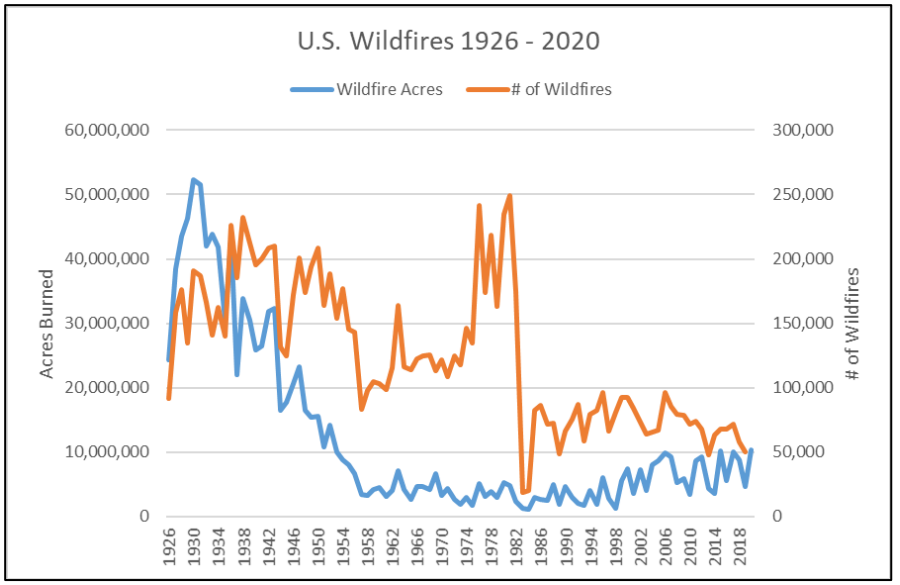
Wildfires

Figure 2. Top Five Years with Largest Wildfire Acreage Burned Since 1960



Source: NIFC.



National Interagency Fire Center

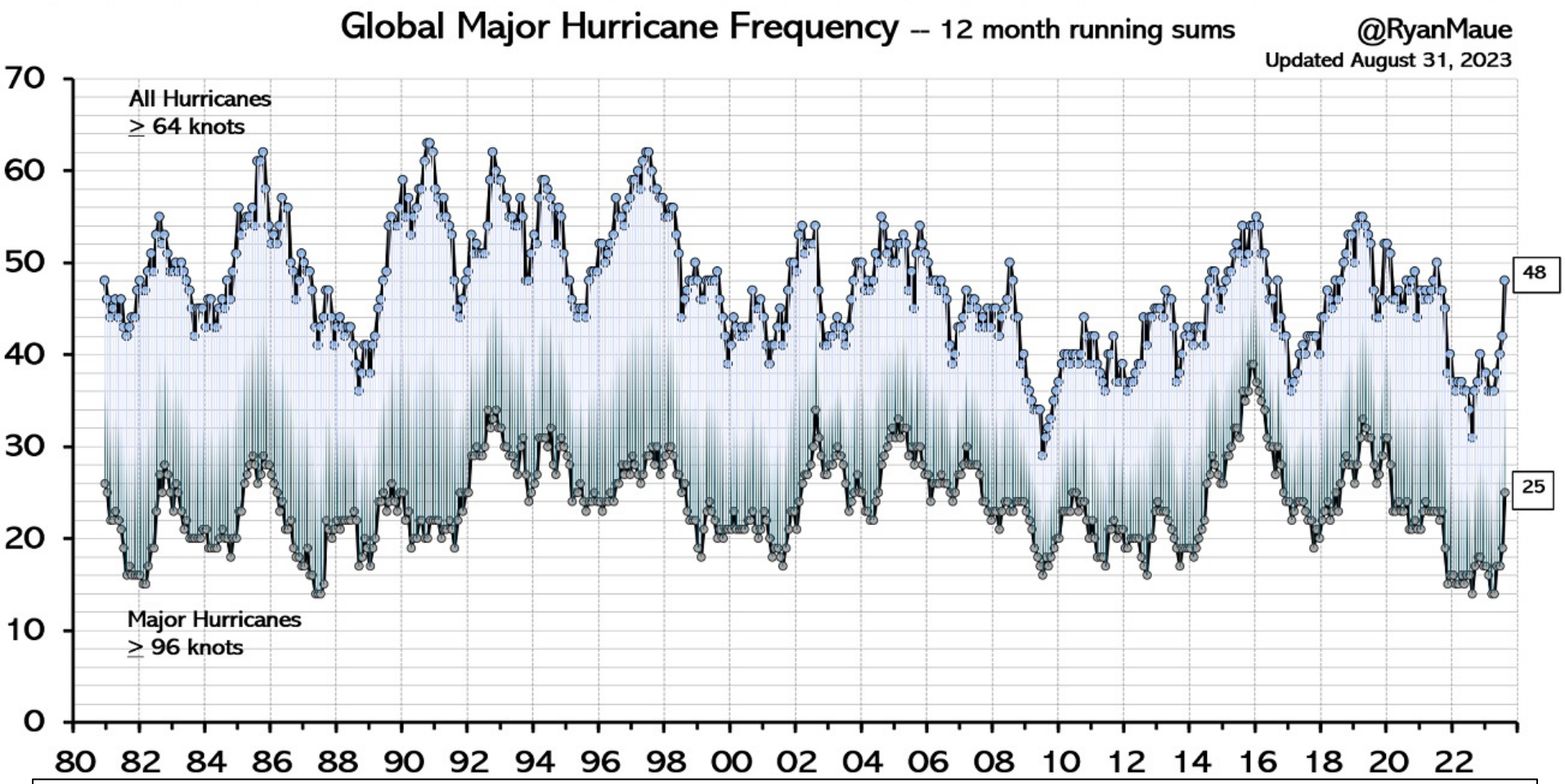
- 1930s had 5x recent acreage burned
- Recent wildfire seasons are only records if data prior to 1960 is ignored

https://www.nifc.gov/fireInfo/fireInfo_stats_totalFires.html

https://www.fs.fed.us/research/sustain/docs/national-reports/2003/data/documents/Indicator%2015/Indicator%2015.pdf

https://fas.org/sgp/crs/misc/IF10244.pdf

Global Hurricanes – 1981-2023



"there is only **low confidence** regarding changes in global tropical cyclone numbers under global warming over the last four decades." - IPCC
https://www.ipcc.ch/site/assets/uploads/sites/2/2019/02/SR15_Chapter3_Low_Res.pdf

http://climatlas.com/tropical/global_major_freq.png

Manmade Climate Change

1903

Today

Benefits of CO2?

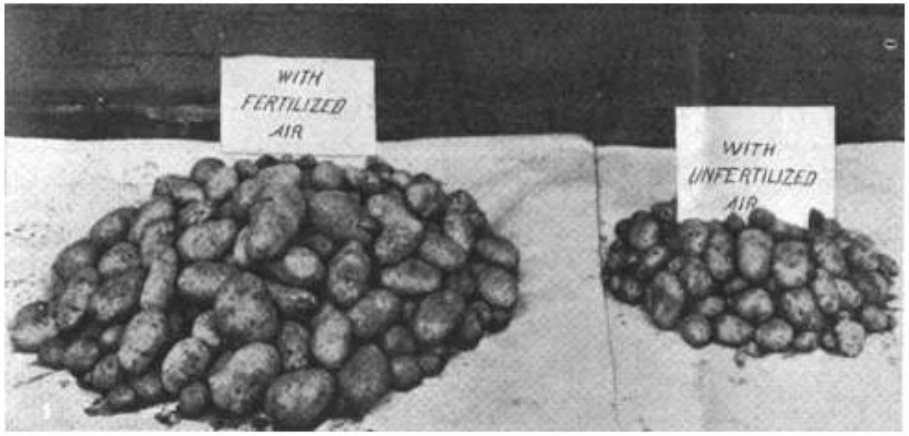
Table 2. Mean percentage yield increases produced by a 300-ppm increase in atmospheric CO_2 concentration for all crops accounting for 95% of total food production.

Crop	% Biomass Change	Crop	% Biomass Change
Sugar cane	34.0%	Rye	38.0%
Wheat	34.9%	Plantains	44.8%
Maize	24.1%	Yams	47.0%
Rice, paddy	36.1%	Groundnuts, with shell	47.0%
Potatoes	31.3%	Rapeseed	46.9%
Sugar beet	65.7%	Cucumbers and gherkins	44.8%
Cassava	13.8%	Mangoes, mangosteens, guavas	36.0%
Barley	35.4%	Sunflower seed	36.5%
Vegetables fresh nes	41.1%	Eggplants (aubergines)	41.0%
Sweet potatoes	33.7%	Beans, dry	61.7%
Soybeans	45.5%	Fruit Fresh Nes	72.3%
Tomatoes	35.9%	Carrots and turnips	77.8%
Grapes	68.2%	Other melons (inc.cantaloupes)	4.7%
Sorghum	19.9%	Chillies and peppers, green	41.1%
Bananas	44.8%	Tangerines, mandarins, clem.	29.5%
Watermelons	41.5%	Lettuce and chicory	18.5%
Oranges	54.9%	Pumpkins, squash and gourds	41.5%
Cabbages and other brassicas	39.3%	Pears	44.8%
Apples	44.8%	Olives	35.2%
Coconuts	44.8%	Pineapples	5.0%
Oats	34.8%	Fruit, tropical fresh nes	72.3%
Onions, dry	20.0%	Peas, dry	29.2%
Millet	44.3%		

Studies have shown that **higher concentrations of atmospheric carbon dioxide** affect crops in two important ways: they **boost crop yields** by increasing the rate of photosynthesis, which spurs growth, and **they reduce the amount of water crops lose** through transpiration. Plants transpire through their leaves, which contain tiny pores called stomata that open and collect carbon dioxide molecules for photosynthesis. During that process they release water vapor. As carbon dioxide concentrations increase, the pores don't open as wide, resulting in lower levels of transpiration by plants and thus increased water-use efficiency.

http://www.co2science.org/index.php

https://www.nasa.gov/feature/goddard/2016/nasa-study-rising-carbon-dioxide-levels-will-help-and-hurt-crops



1. Yield of potatoes in fields over which the air was fertilized with carbonic acid gas and left unfertilized. 2. A similar comparison for cauliflower plants. 3. An open-air carbonic-acid fertilizing plant.

Fertilizing the air with carbon dioxide to promote plant growth

Carbonic Acid Gas to Fertilize the Air

By Dr. Alfred Gradenwitz

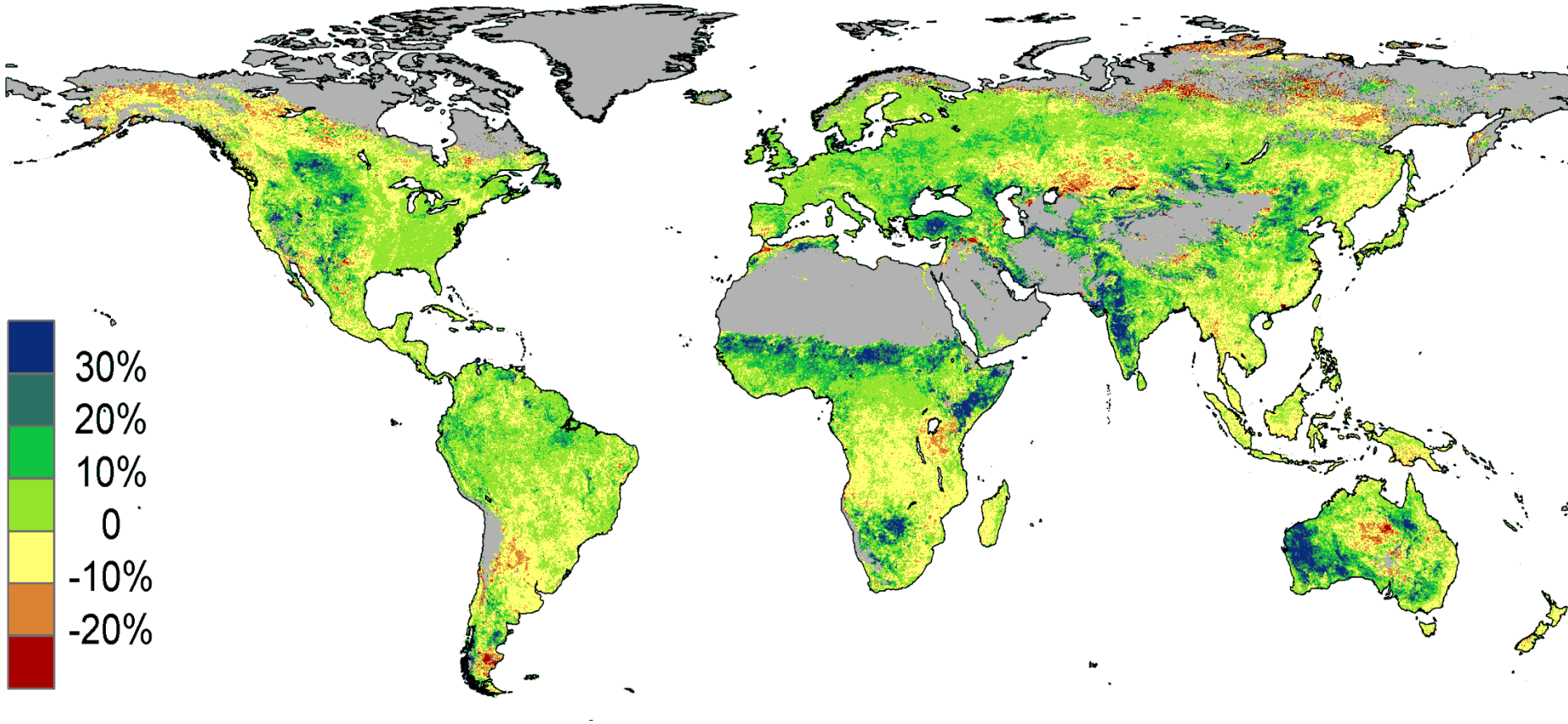
ONE of the principal con-

On account of the careful cleansing and complete elimination of constituents such as sulfur, the gas was found to exert no harmful effects. On the contrary, even a few days after starting the test, there could be ob-

per cent, with potatoes 180 per cent, with lupines (a legume) 174 per cent, and with barley 100 per cent. The potatoes in the field submitted to the action of carbonic acid gas were found to ripen much more quickly than in

https://sealevel.info/ScientificAmerican_1920-11-27_CO2_fertilization.html

Greener Planet 1982 - 2010?



https://agupubs.onlinelibrary.wiley.com/doi/epdf/10.1002/2013EO340010
http://wattsupwiththat.com/2013/07/08/deserts-greening-from-rising-co2/

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!

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.
- **Psalm 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 ~ 1°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??


GOOD NEWS! AT THE CURRENT RATE OF GLOBAL WARMING WE SHOULD BE ABLE TO JUST SWIM OVER THERE AND EAT HIM IN UNDER FIVE YEARS..!
SEA-LEVEL RISE