

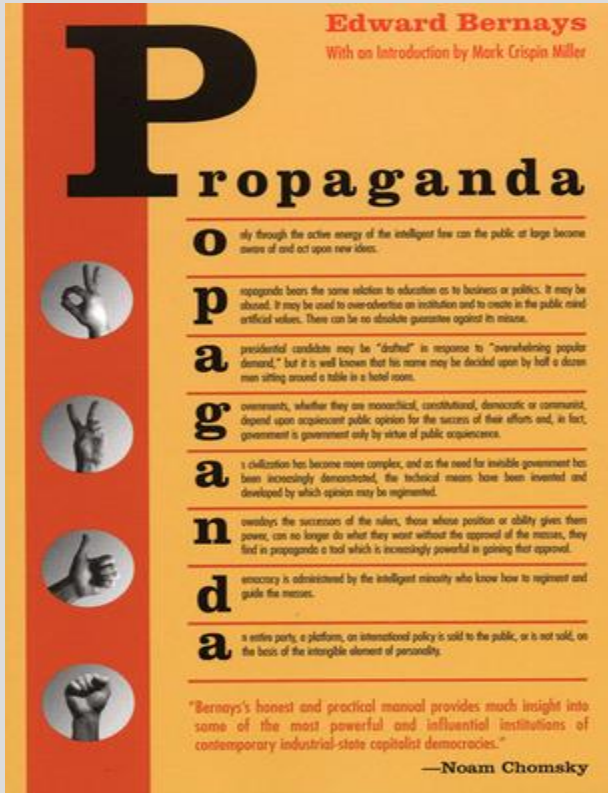
A photograph of a two-lane asphalt road curving to the right, shrouded in thick fog. The road has white lane markings. On the right side of the road, there is a grassy shoulder with a white signpost. Tall trees are visible in the background, their details softened by the fog. The overall atmosphere is misty and ethereal.

**Climate:  
Change & Constancy  
Predictability & Unpredictability**

# Steve's Brain Fog



# A Circuitous Introduction



- Edward Bernays(1928)
- Nephew of Freud
- *Life* 100 most influential
- US WWI Propaganda
- Pioneer - Public Relations
- Large societies & changing media make propaganda inevitable

# Propaganda

- *“**The conscious and intelligent manipulation of the organized habits and opinions of the masses is an important element in democratic society.** Those who manipulate this unseen mechanism of society constitute an invisible government which is the true ruling power of our country. ...**We are governed, our minds are molded, our tastes formed, our ideas suggested, largely by men we have never heard of.** This is a logical result of the way in which our democratic society is organized. Vast numbers of human beings must cooperate in this manner if they are to live together as a smoothly functioning society.”*

# *Propaganda*

- Perhaps prehistoric?
- Origin of the name was from the Catholic counter reformation effort known as: ***Congregatio de Propaganda Fide*** (Congregation of Propagating the Faith)
- Bernays argues propaganda to homogenize opinion benefits society because opinion diversity leads to chaos

# *Propaganda Tool For*

- *Warring Nations*
- *Corporate Interests*
- *Governments and Political Parties*
- *Religions*
- *Special Interest and Other Groups*

# *Propaganda*

- ***“A campaign to improve public health through vaccinations...is no less a propaganda drive than any anti-clerical or socialist or nativist campaign.”***
- Techniques include numerous cognitive fallacies, notably:
  - ***Slogans***
    - Cliches
    - simplified stories a la advertising
  - ***Thought leaders***
    - Politicians
    - Celebrities
    - “experts”
    - “social media influencers”

# Slogans: Bite Sized Ideology?

- JP: Go 1 week, stop every time quoting a cliché, slogan, or other simplified narrative
- What percentage of what we believe of various truths are promoted propaganda?
- Certainly, politics, advertising and media
- Propaganda in science?



# *Climate Change Slogans*

- *'Existential threat to humanity'*
- *'Global climate crisis'*
- *'Extinction rebellion'*
- *'Number one issue facing this country'*

- *'Greatest hoax ever'*
- *CO2 is just a trace gas*

# Slogan: *Climate Change*

- “Climate change” means a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods.”
- Reasonable, but also contains grants primacy to **human activity**

# *Climate Change*

- *Climate* = C + C + C

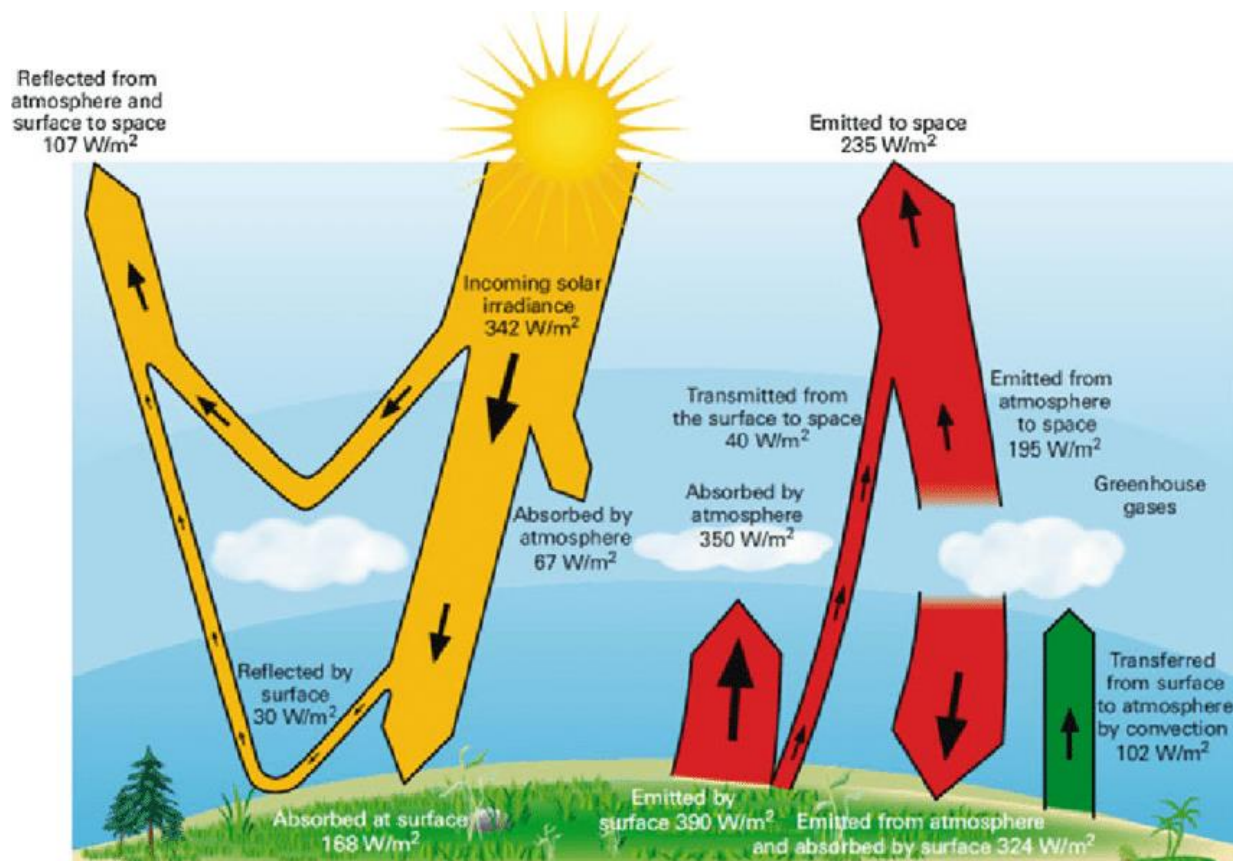
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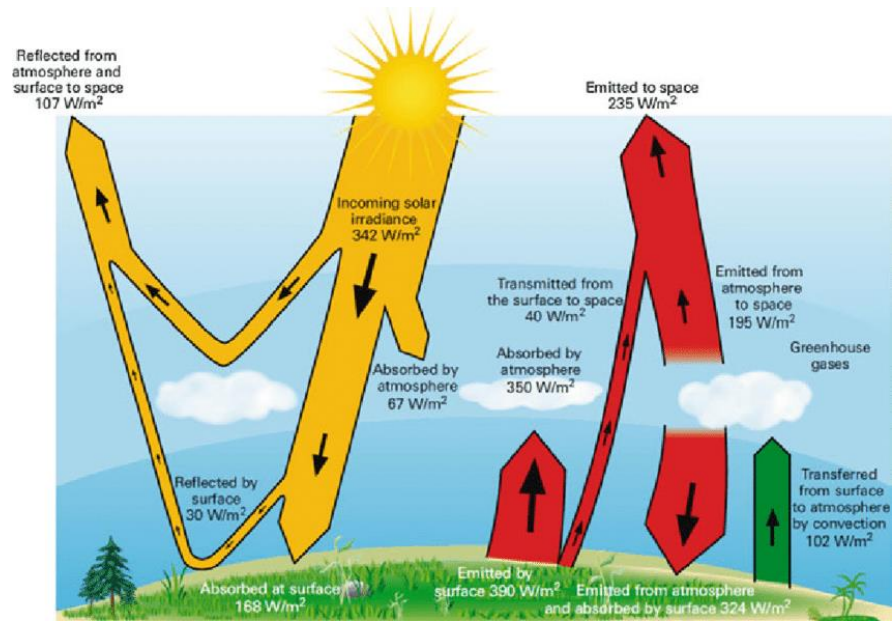
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# Climate Change



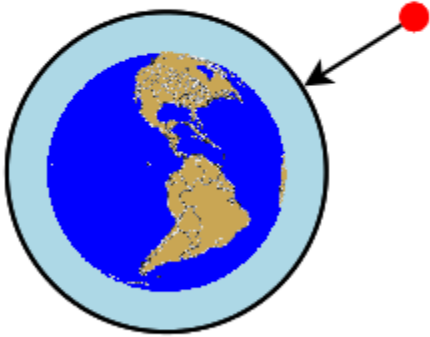
# Climate Change

- Increased greenhouse gasses imply reduced output to space at the top of the atmosphere (red arrow) and subsequent warming
- Oceanic variations (green arrow) can add to or subtract atmospheric energy at the bottom of the atmosphere on various time scales from diurnal to centennial or more ( ENSO, PDO, et. al. )



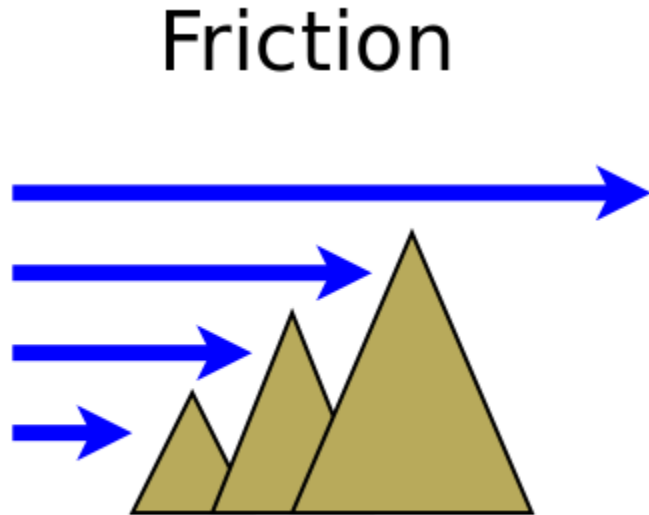
# *Climate Constancy*

Gravity



- Gravity will remain relatively constant
- Equations of motion

# *Climate Constancy*



- Friction due to orography ( mountains and oceans ) will remain relatively constant, though vegetation may change
- Equations of motion

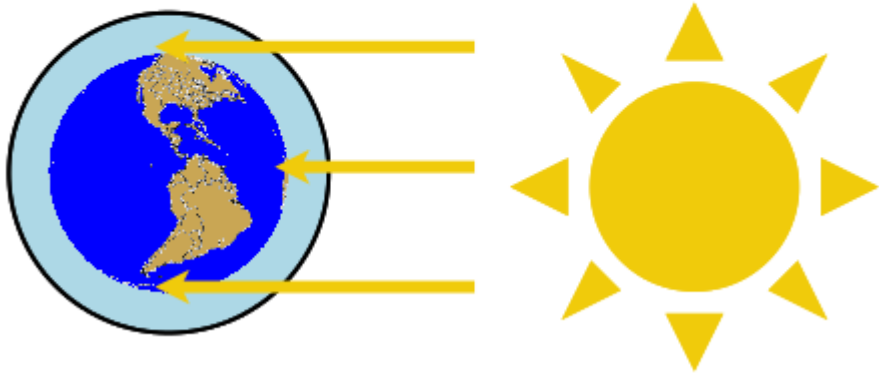
# *Climate Constancy*

- ***Geography*** - little change to distribution of continents and oceans
- Channeled fluid flow little changed
- Available fluid flow of humidity little changed



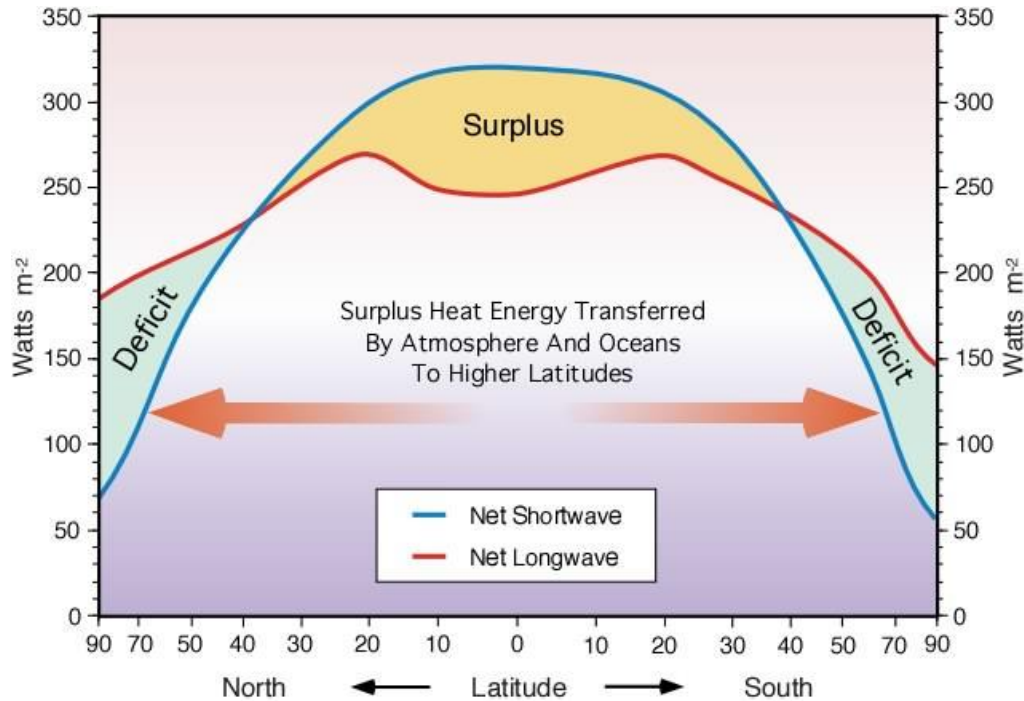
# *Climate Constancy*

Spheroidal Earth



- Shape and size of earth will remain relatively constant
- Implies energy deficit at poles and energy surplus near equator

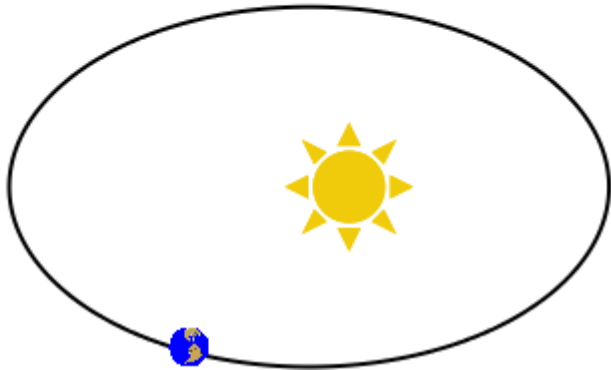
# Climate Constancy



- Spheroidal earth implies continued energy deficit at the poles and energy surplus at the equator
- This implies continuation of the pole to equator temperature gradient

# *Climate Constancy*

## Orbital Variations



- Very slowly changing
- But for century timescales, orbital variations relatively constant
- Implies continued seasonality both of extratropics and of ITCZ

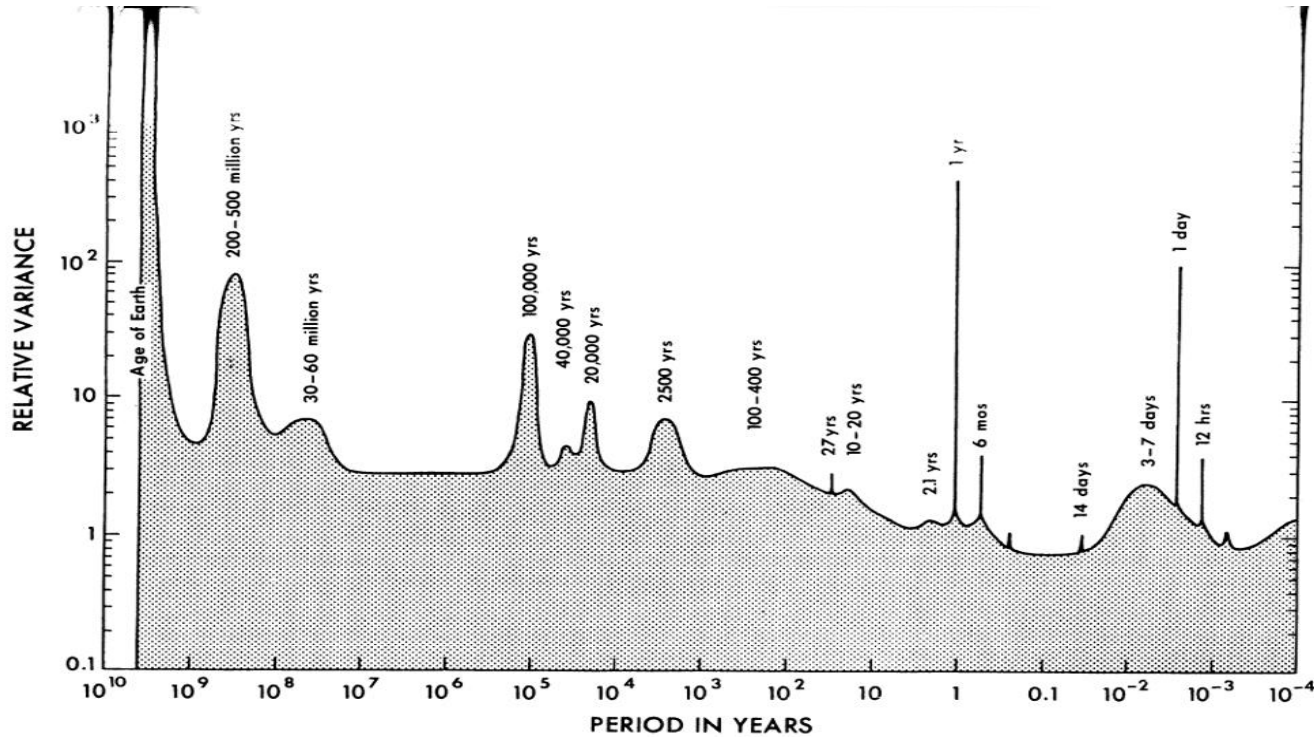
# *Constant Climate Factors*

- Orbital Parameters
- Spheroidal Earth
- Gradients
- Gravity
- Friction
- Geography
- What else?

# *Natural Climate Change Factors*

- Solar Output
- Solar Magnetic Field Modulating CCN
- Volcanic Activity Producing Dust Veil
- Internal Circulation (ENSO,PDO,AMO,etc.)
- What Else?

# Power Spectrum–Natural Variations



**FIGURE 2.7.** Idealized, schematic spectrum of atmospheric temperature between  $10^{-4}$  and  $10^{10}$  yr adapted from Mitchell (1976).

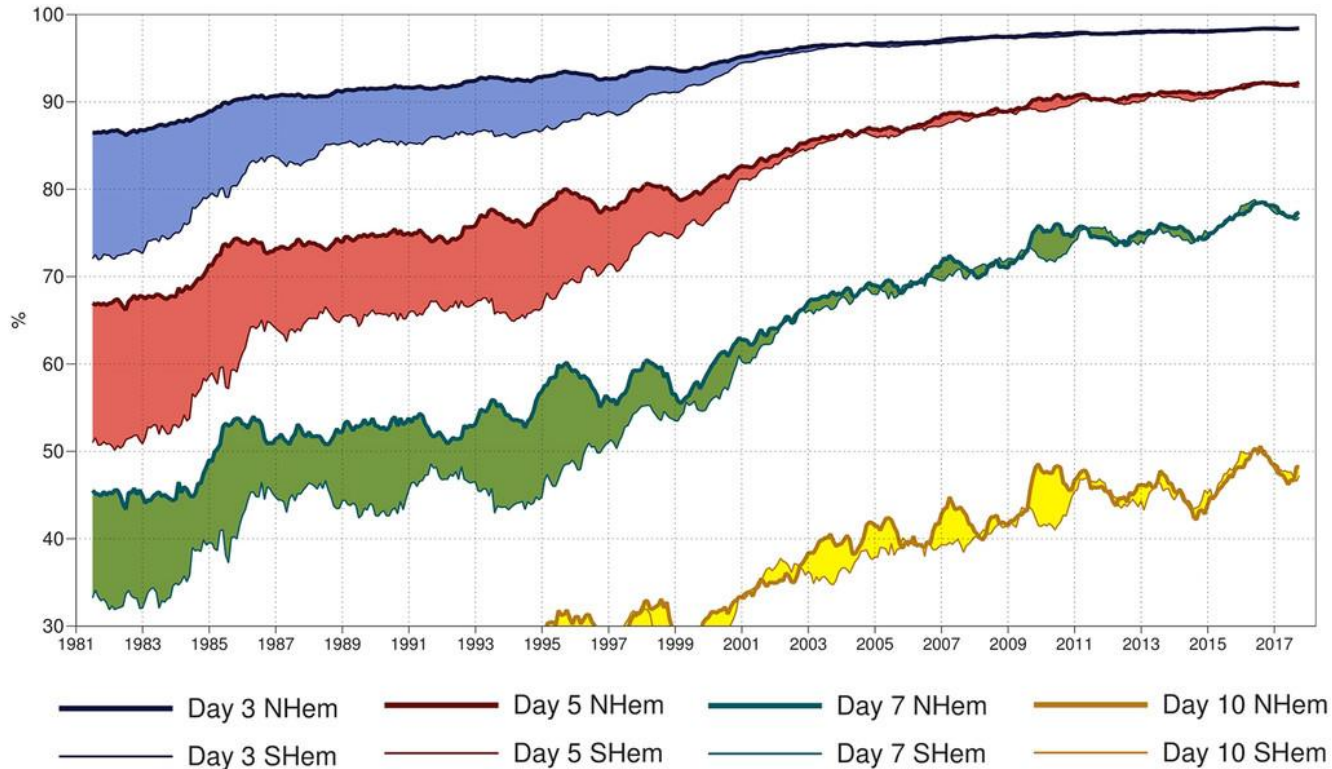
# Predictability

Which aspects of anthropogenic climate change may be predictable? Unpredictable?

What factors might govern the limits of predictability?

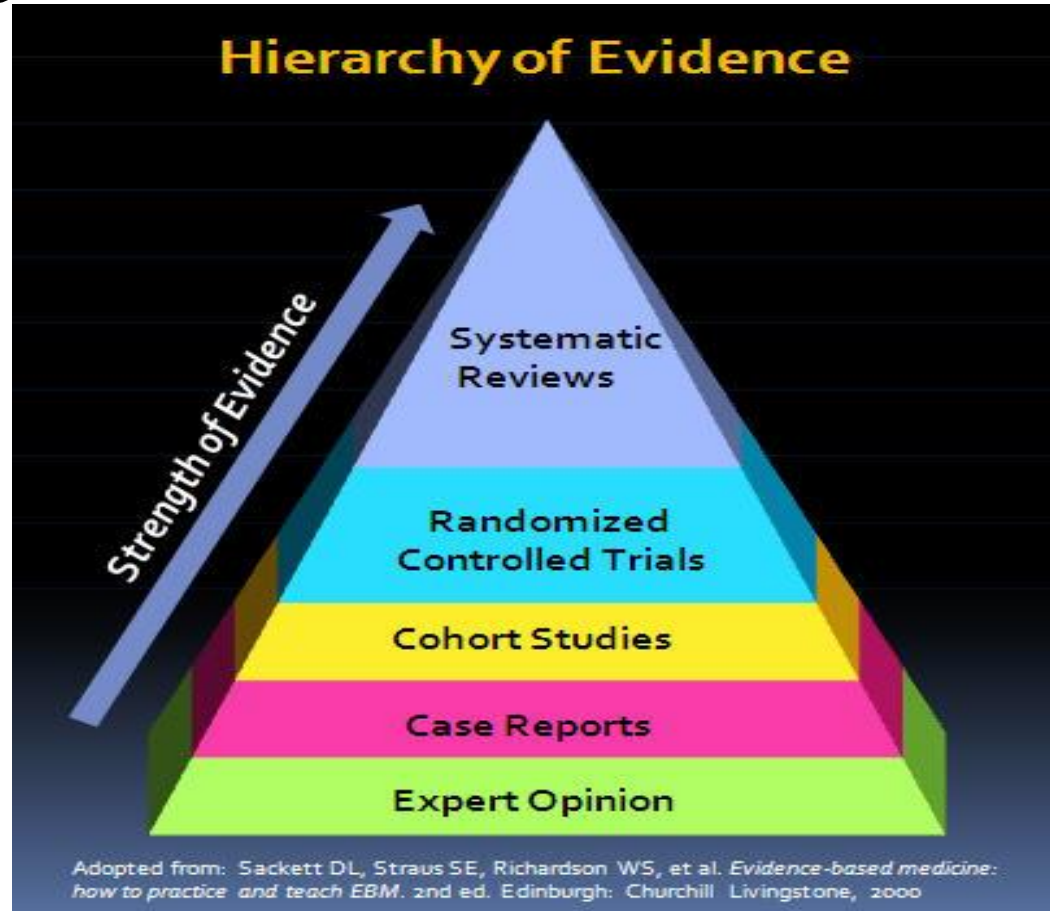
# Weather UNpredictability

## ”Auto correlation” of 500mb ECMWF

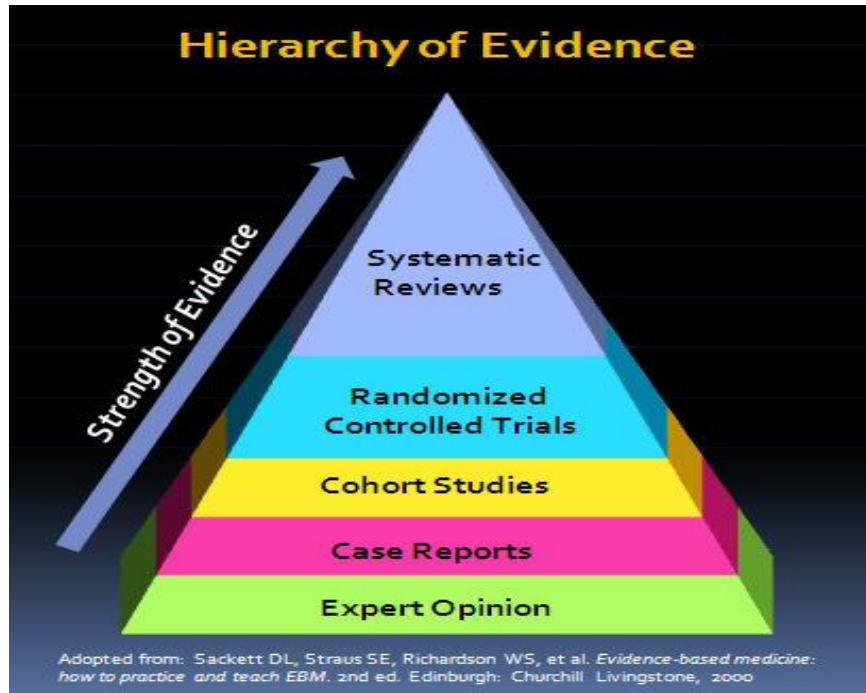




# Strength of Evidence In Medicine



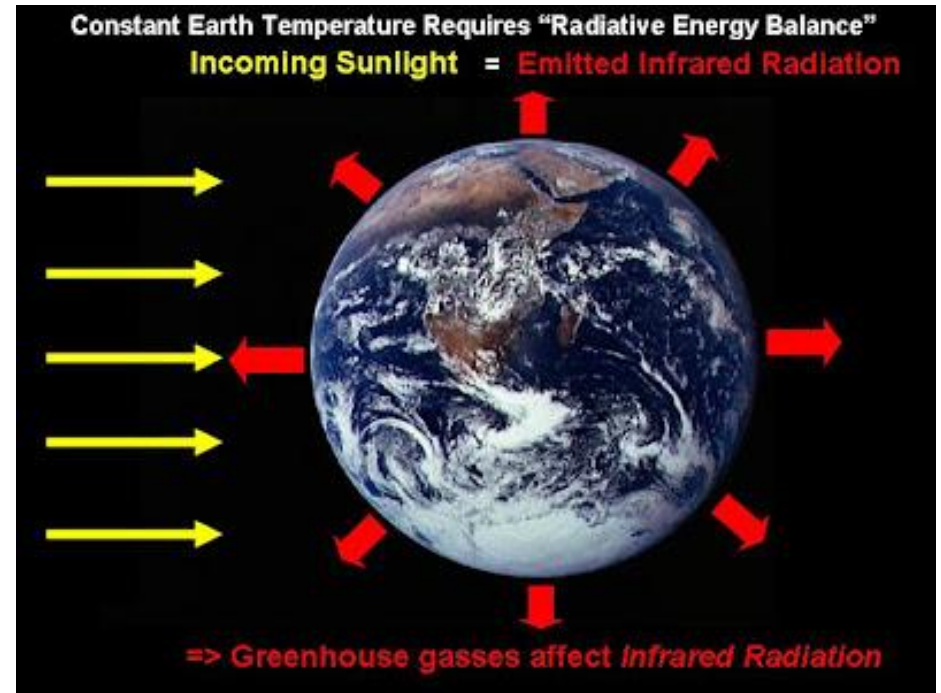
# Consider Climate Change Evidence (not predictability, but limit to evaluation of predictions)



- Single experiment – no meta-analysis
- Experiment unconstrained – not a controlled experiment
- Not blinded – bias from those theorized as well as those observing
- Single case report that's not yet complete – very weak evidence

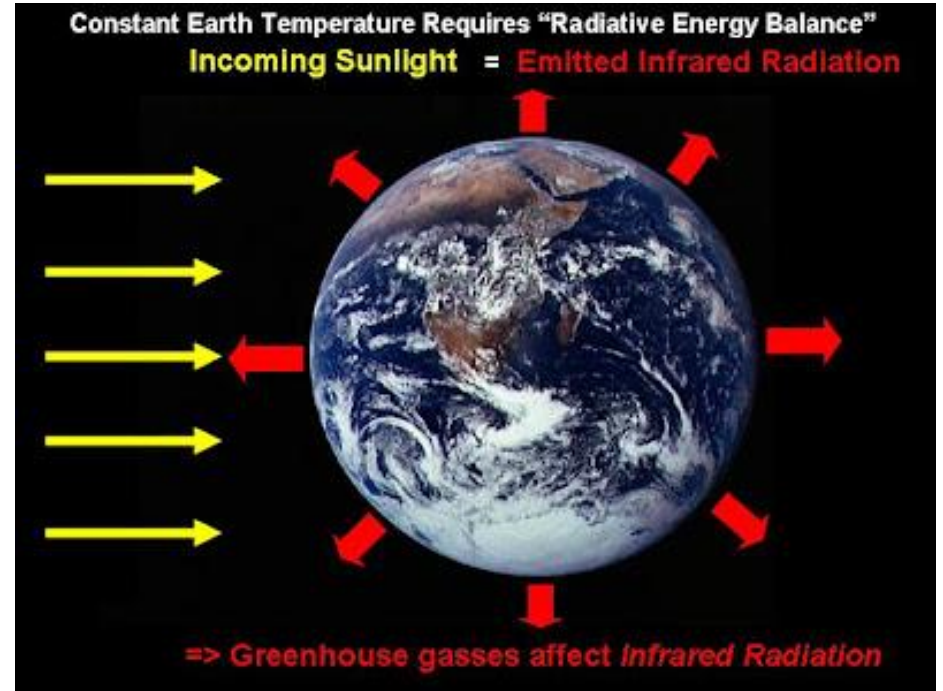
# Still, Thought Experiments

- *Iff* all else is constant, for a given mean temperature, increased CO decreases outgoing IR and increases temperature until equilibrium
- This is for the top of the atmosphere
- Large dynamic exchanges can still occur at the bottom of the atmosphere, mostly into and out of the oceans.



# Predictable Global Warming?

- Incoming radiation a function of solar emissions and clouds which can vary naturally
- Outgoing radiation is a function of profiles of temperature, humidity, clouds, and greenhouse gasses



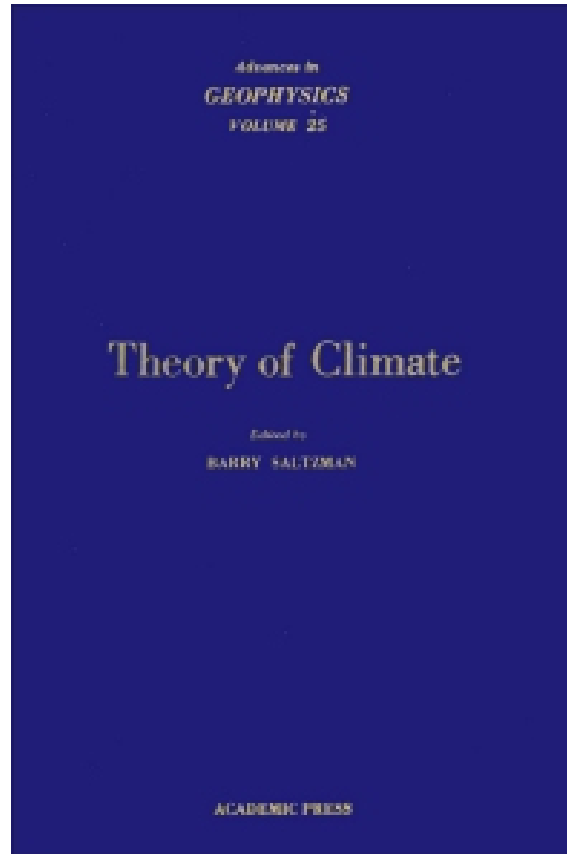
# Predictability?

- In the absence of intervening *natural* climate change...
- Global warming may be predictable because it is a ***bounded phenomenon*** – that is energy balance at a sphere representing the tropopause or top of the atmosphere as opposed to wave variations ***within*** the atmosphere
- Global warming may be predictable because it varies ***directly*** with increased radiative forcing from CO<sub>2</sub> as opposed to depending on intermediate steps
- Global warming may be predictable because it is not highly compounded with other terms

# Less Predictable?

- Tornadoes? Tornadoes are a function of *mesoscale* dynamics, not global temperature
- Ditto for hurricanes
- Ditto for floods & droughts
- Fires are even more complex, depending on previous season growth, previous fire suppression, current season drought, recent weather, combustion events, etc.

# *Manabe, 1983*

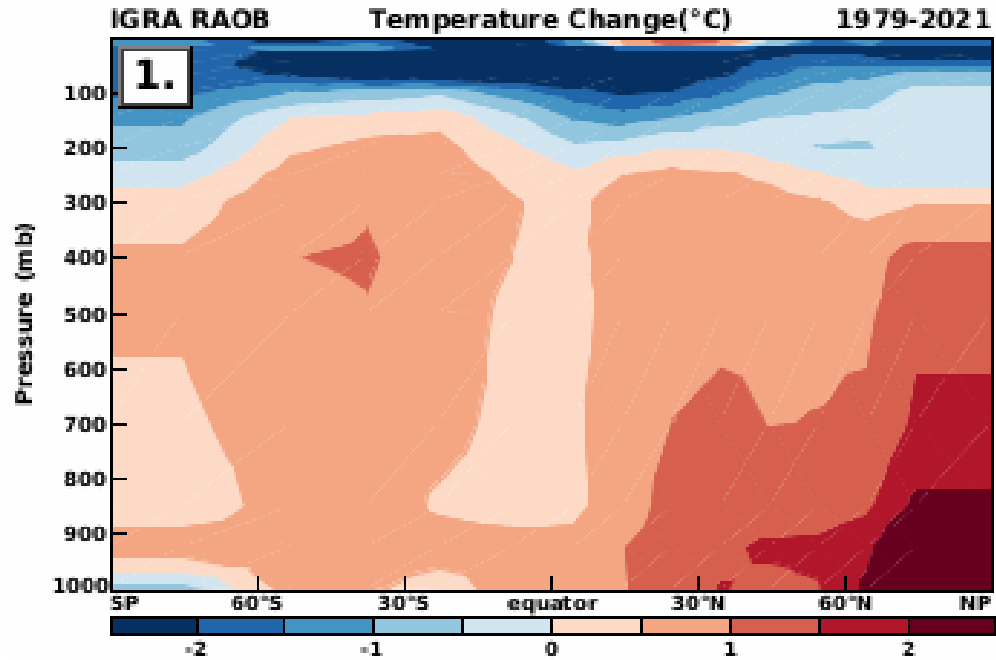


# *Manabe, 1983*

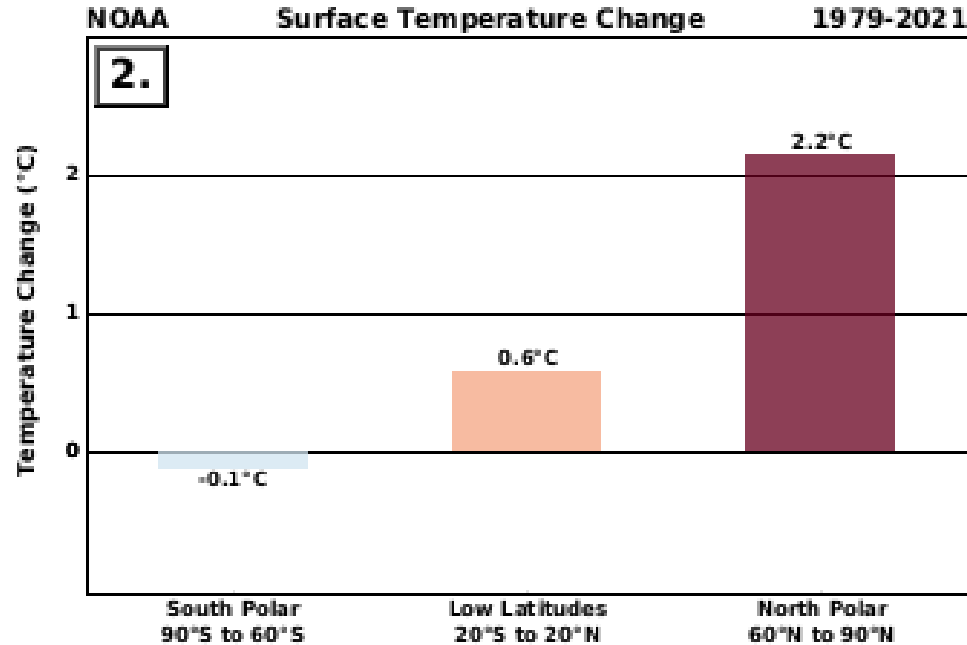
- Manabe made eight specific predictions based on models of the time.
- The following assessments of available data for the 'Satellite Era' ( 1979-2021 )
- Of course, correlation is not causation, but the case study may be the best evidence we have



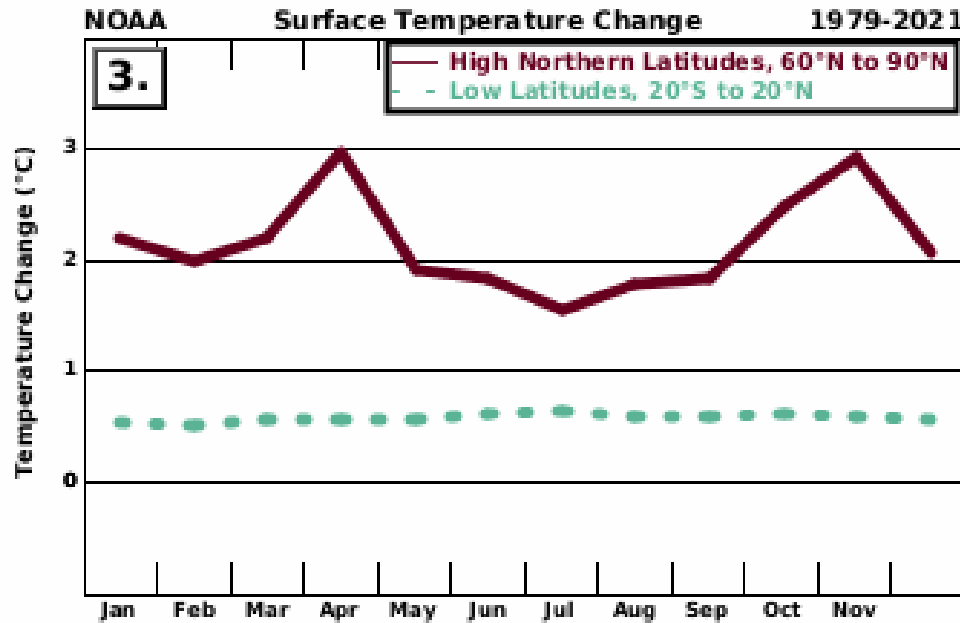
# Stratosphere Cools And Troposphere Warms



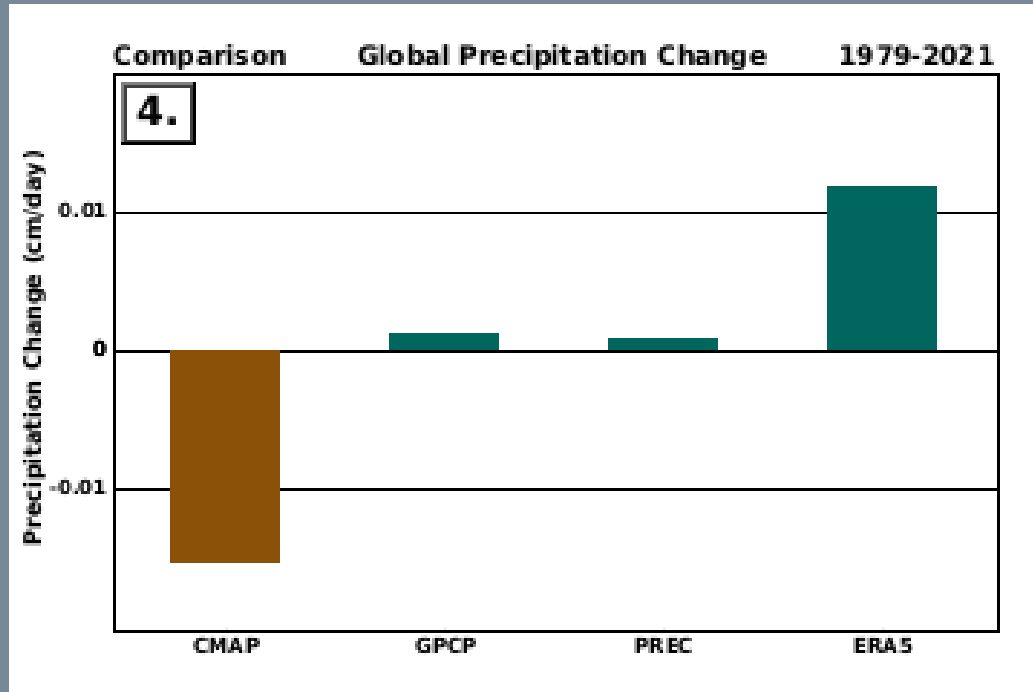
# Warming Greater At High Latitudes Than at Low Latitudes



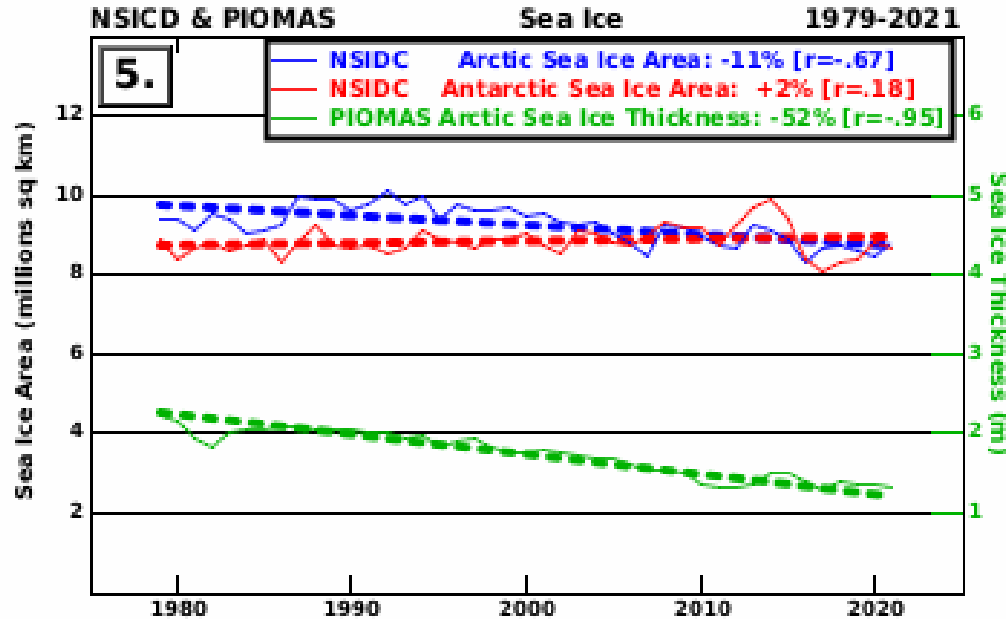
# Maximal Arctic Warming During Winter, Little Seasonality Of Warming At Low Latitudes



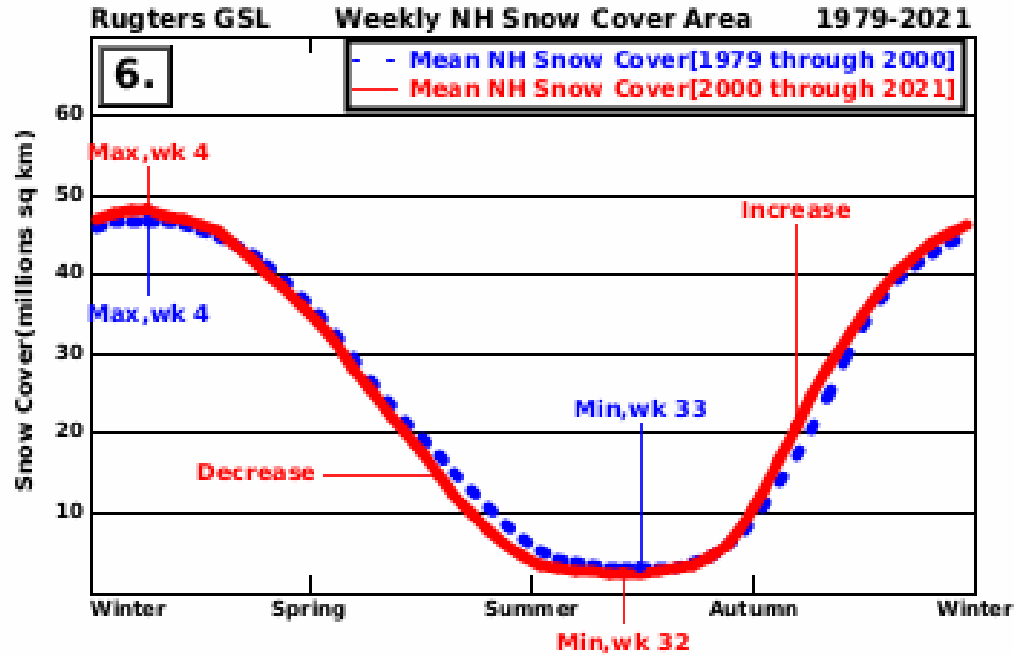
# *Global Mean Precipitation and Evaporation Increase*



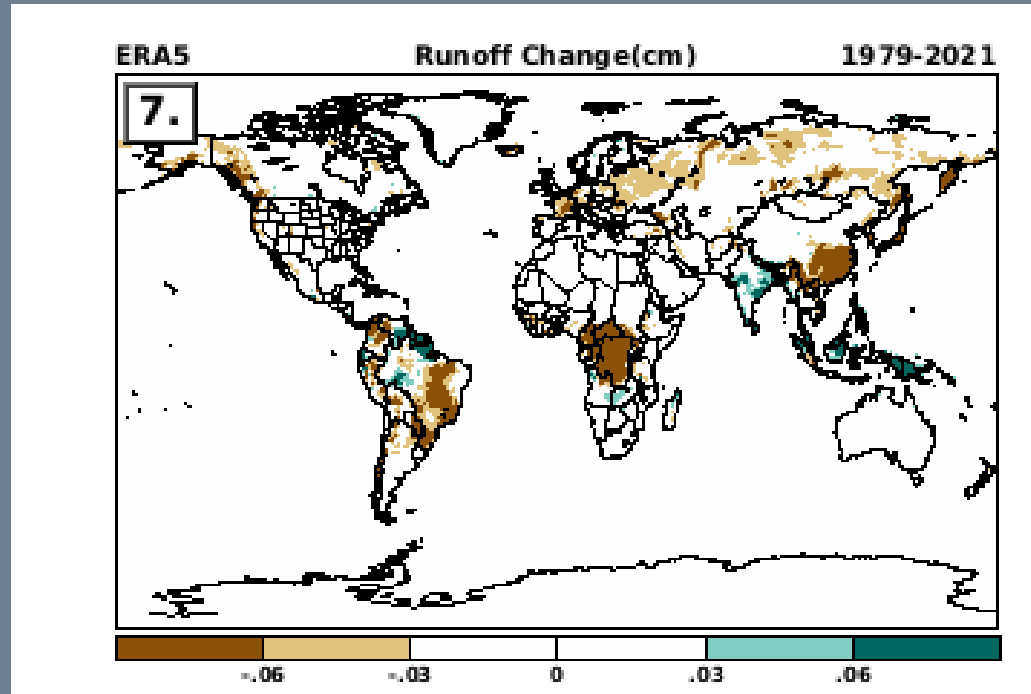
# Polar Sea Ice Area And Thickness Decrease



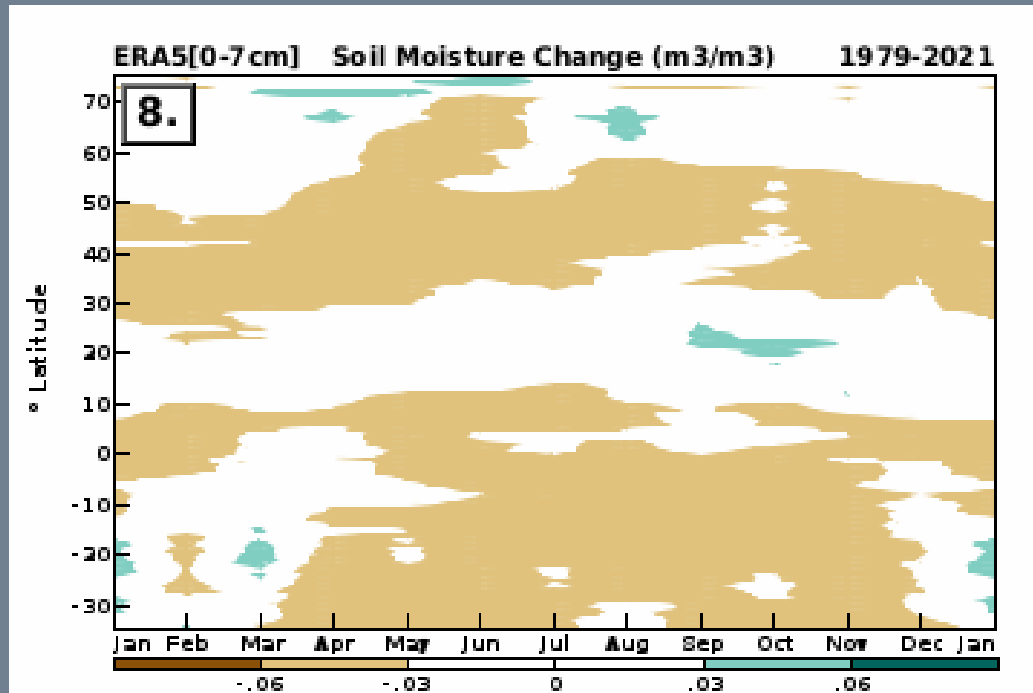
# Snowmelt Season Arrives Earlier



# *Runoff Increases At High Latitudes*

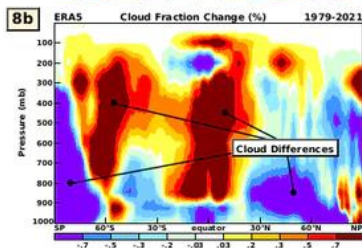
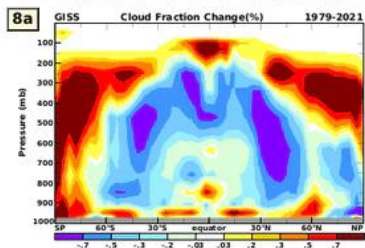
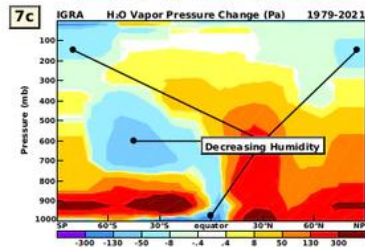
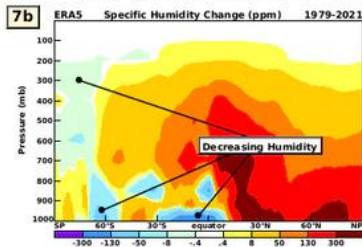
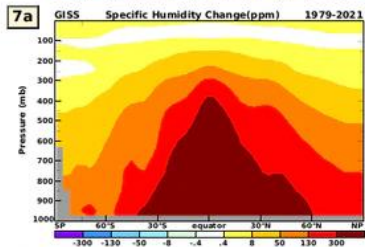
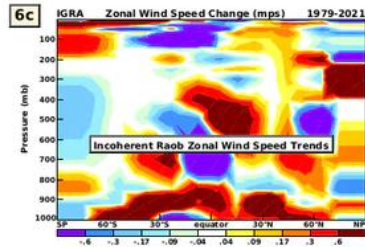
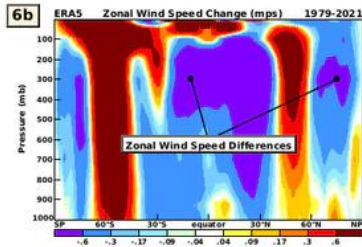
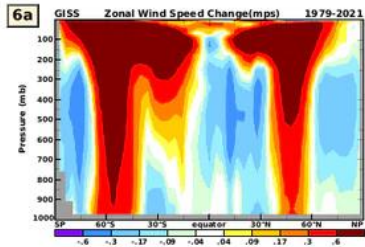
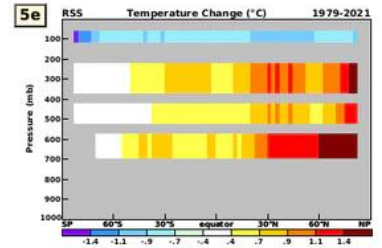
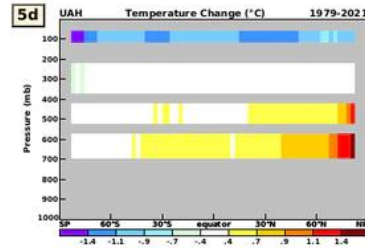
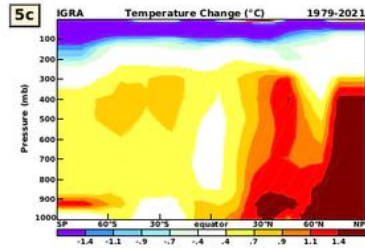
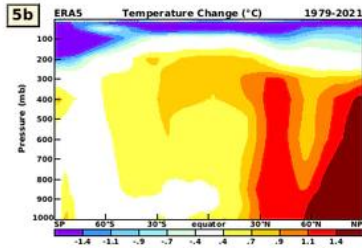
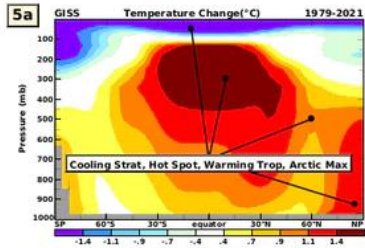


# *During Summers, Soil Moisture Decreases At Northern Middle And High Latitudes*





NASA GISS Model E, 1979-2021



Comparison of NASA GISS Model, ERA5 Reanalysis, IGRA radiosonde and UAH & MSU satellite estimates  
[https://data.giss.nasa.gov/modelE/tra/nsient/Rc\\_pj4.03.html](https://data.giss.nasa.gov/modelE/tra/nsient/Rc_pj4.03.html)  
<https://cds.climate.copernicus.eu>  
<https://www1.ncdc.noaa.gov/pub/data/igra/>  
<https://www.msstc.uah.edu/data/msu/v6.0/>  
[https://data.remss.com/msu/data/uah\\_compatible\\_format/](https://data.remss.com/msu/data/uah_compatible_format/)

# Global Warming May Have Occurred But Presumed Changes Have Not

- US Extreme High Temperature Records ~100 yr old
- Increased Global Vegetation and Phytoplankton
- Slight Decrease of US Drought Past Century
- Fewer Strong US Tornadoes since 1950
- No Increase US Hurricanes since 1850
- Decreased Global Fires (Satellite since 2000)

# Summary

- **Propaganda** pervades advertising, politics, health. Science?
- (Anthropogenic) '**Climate Change**' distracts from '*natural climate change*' and also from '*climate constancy*'
- Many important climate determinants will remain constant
- When considering an anthropogenic climate change claim, consider whether the effect is **direct**, primarily due to CO<sub>2</sub>, or bounded by constraints
- Some climate model predictions appear to have occurred, others have not, and observations are still woefully inadequate to assess precipitation, evaporation, soil moisture, runoff, clouds, and even winds.