

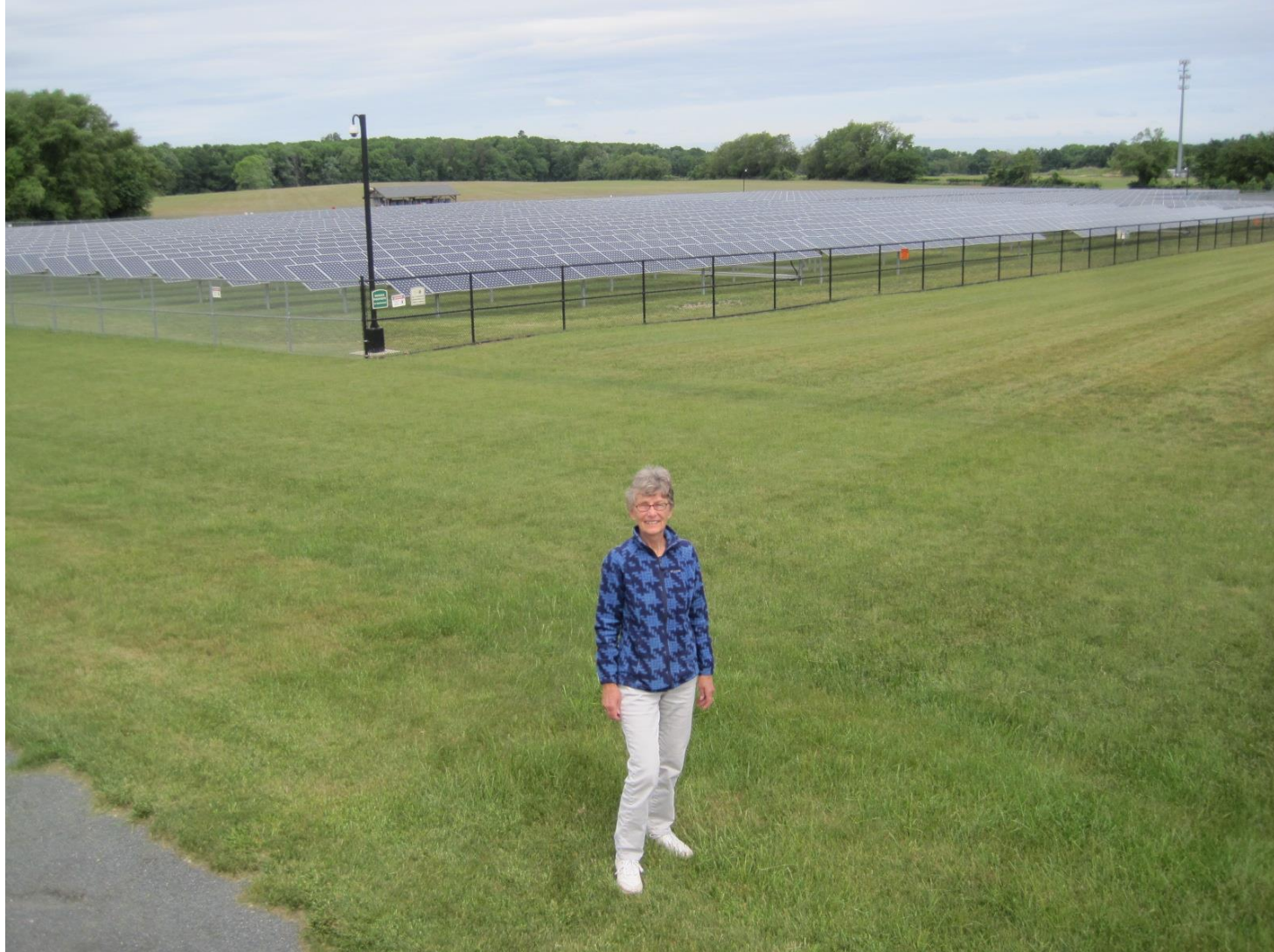
The Real Story on Climate Change

William Happer
Princeton University

ICON Lecture Series
Chapel Hill, North Carolina
September 12, 2017

Everyone wants a clean environment

(Foreground: Barbara Happer at NJ solar farm)



Qualifications: Will Happer, Climate Scientist, 1982

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Professor of Theoretical Physics, California Institute of Technology

THE LONG-TERM IMPACTS OF INCREASING ATMOSPHERIC CARBON DIOXIDE LEVELS

Edited by
GORDON J. MACDONALD

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http://www.thebestschools.org/special/karoly-happer-dialogue-global-warming/happer-major-statement/?utm_referrer=https://www.google.com/

From: *The Adaptive Optics Revolution*, by R. W. Duffner

“At the Jasons’ 1982 summer session in La Jolla, Will Happer from Princeton presented the revolutionary concept that the mesospheric sodium layer could be used to generate a high-altitude artificial guide star for use with an adaptive optics telescope. He proposed using a specially tuned yellow laser beam to excite the sodium atoms in the mesosphere to induce resonance fluorescence (glow)—the sodium atom emits a photon at the same wavelength as was absorbed—to create a high-altitude artificial star. The use of this artificial star would make it possible for an adaptive optics system to improve space-object images generated from the collection of light transmitted through the atmosphere by removing the effects of turbulence.”

A sodium guide star laser built by Boeing at Kirtland AFB, NM



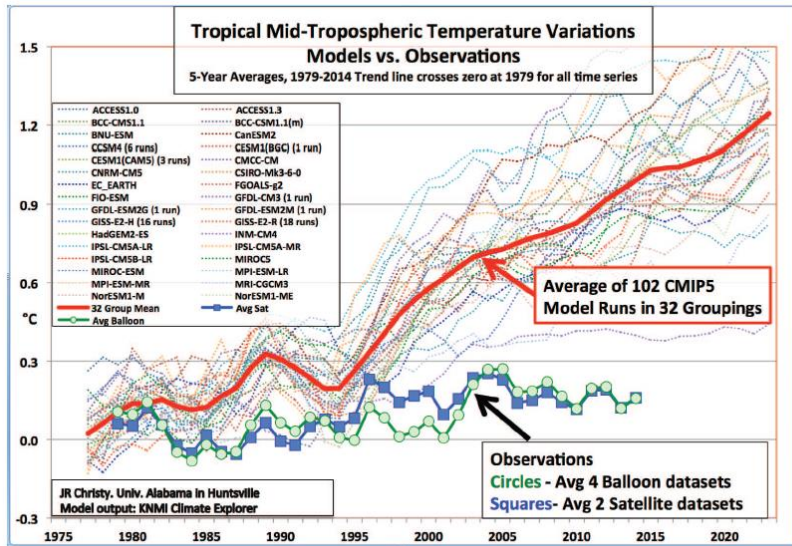
Take Home Messages from Today's Talk

- Climate models don't work.
- Climate will change with or without CO₂ changes.
- More CO₂ will benefit humanity. Earth flourished with much more CO₂ in the past.
- It is immoral to deprive the world of fossil fuels.
- As much climate science as time permits.

Message 1

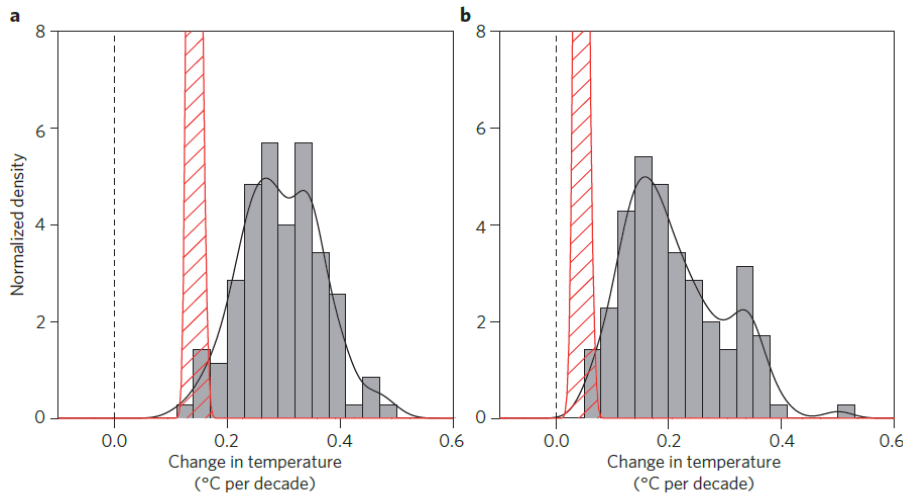
- Policies to slow CO₂ emissions are based on flawed computer models which exaggerate warming by factors of at least 2 or 3.
- These policies are all pain, no gain.

Global-Warming Models Don't Work!



Observations and Models from J. R. Christy:

<http://energycommerce.house.gov/sites/rep-publicans.energycommerce.house.gov/files/Hearings/EP/20120920/HHRG-112-IF03-WState-ChristyJ-20120920.pdf>



Observations and Models from Fyfe et al.

J. C. Fyfe, N. P. Gillett, F. W. Zwiers, *Overestimated Global Warming over the Past 20 Years*, *Nature Climate Change*, **3**, 767 (2013).

Figure 1 | Trends in global mean surface temperature. **a**, 1993–2012. **b**, 1998–2012. Histograms of observed trends (red hatching) are from 100 reconstructions of the HadCRUT4 dataset¹. Histograms of model trends (grey bars) are based on 117 simulations of the models, and black curves are smoothed versions of the model trends. The ranges of observed trends reflect observational uncertainty, whereas the ranges of model trends reflect forcing uncertainty, as well as differences in individual model responses to external forcings and uncertainty arising from internal climate variability.

Message 2

- Who does not believe in climate change? The climate has been changing since the world began, and it will continue to change whether CO₂ levels increase or not.
- Current climate change is mild compared to what has been observed in the past

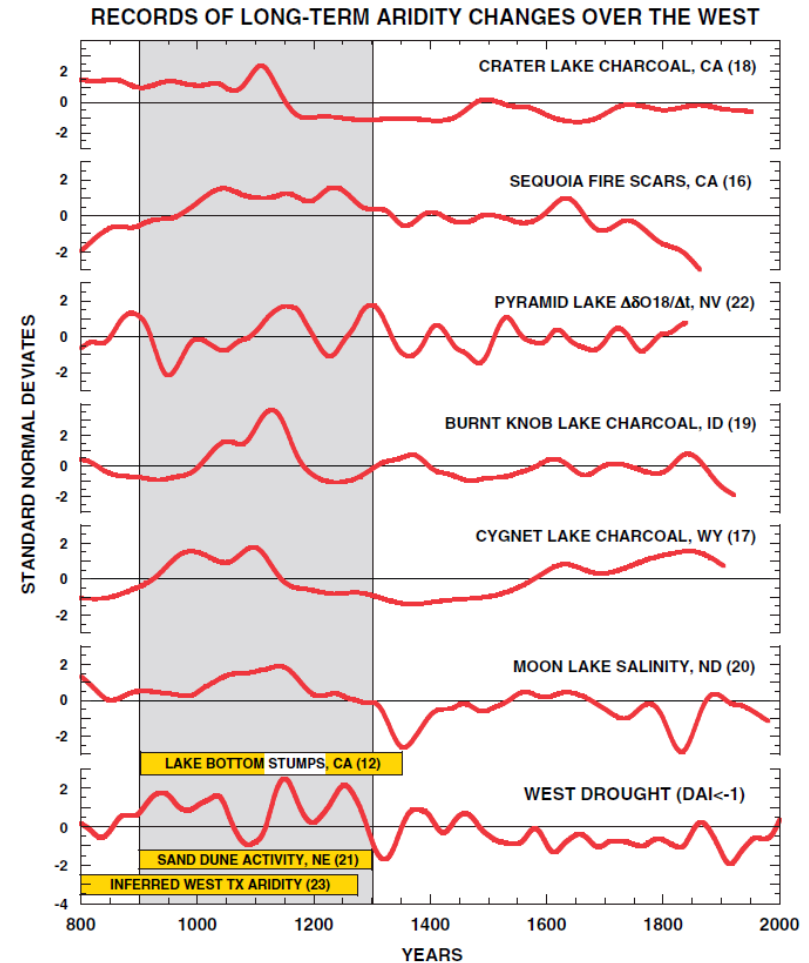
- King Canute (1016-1035 a.d.) knew he could not stop the tides.
- Today's politicians claim they can stop climate change !



Recent California drought is nothing compared to past droughts with unchanging CO₂

Science, Cook et al., 5 Nov. 2004, Vol. 306, p. 1018

Tree that grew during 200-year medieval drought in Fallen Leaf Lake, CA (about 100 ft under water).



Message 3

- CO₂ is not a pollutant.
- More CO₂ will benefit the Earth.

CO₂ is not a pollutant!



Power plant's breath:

70% N₂
5% O₂
5% H₂O
20% CO₂

Alice's breath:

75% N₂
15% O₂
6% H₂O
4% CO₂

Real Air Pollution in Shanghai. If you can see it, it's not CO2!



**The Turk ultra-supercritical coal-fired power plant in Texarkana, AR
There are virtually no emissions of NO_x, SO_x, Hg, fly ash, etc.**



Photo by Norman Rogers

More CO₂ will be a very significant benefit to agriculture!



Is CO2 Plant Food?

Here is what happens with more CO2



385 ppm



535 ppm



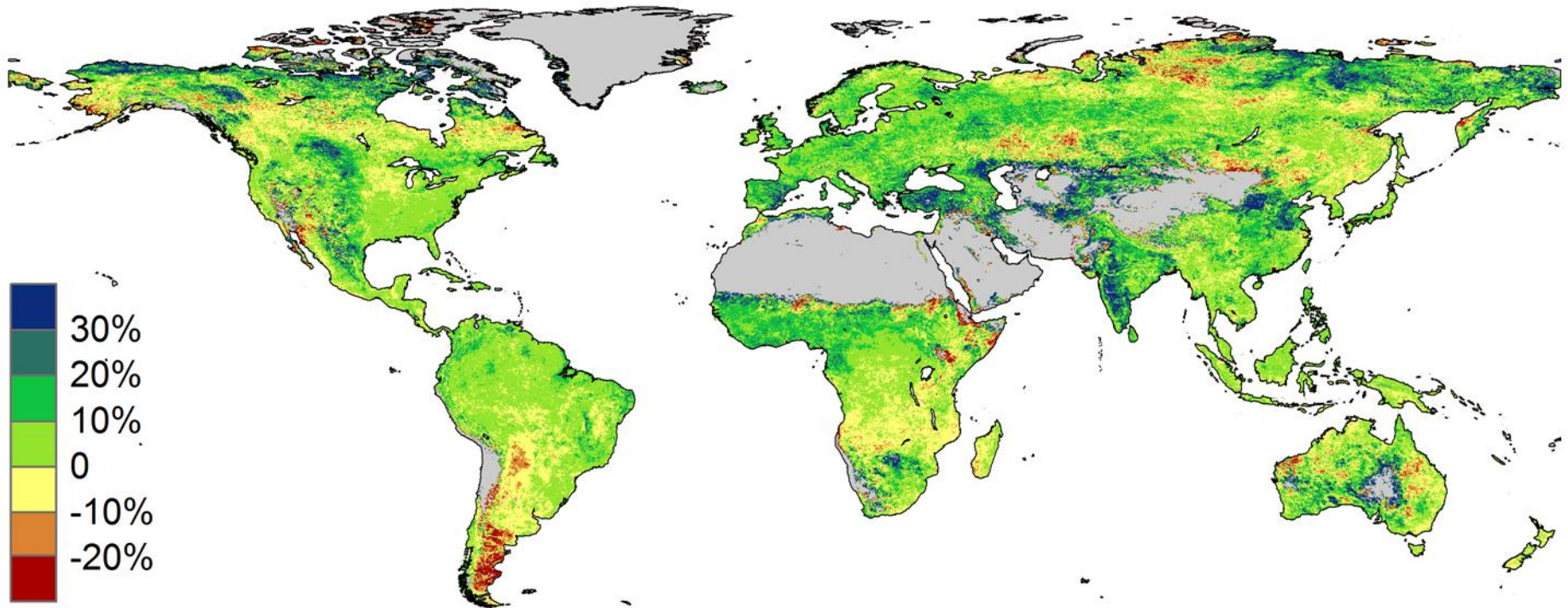
685 ppm



835 ppm

Atmospheric CO2 is Very Beneficial to Plants

Global Greening From CO2 Fertilization: 1982-2010



Increase = 11% in areas studied

Donohue et al, GRL (June 2013) DOI: 10.1002/grl.50563

Message 4

- It is immoral for the privileged people of the world to deny the benefits of dependable, reliable fossil fuels to the less privileged people of Africa, India, etc.

Home cooking with biofuels (wood) in Nepal



Virtue signaling by the privileged.



James Oatway/Panos/ActionAid

Julio Ngoene, farmer. 'Our livelihood was dependent on the farms and [the biofuels company] has taken our farms.'



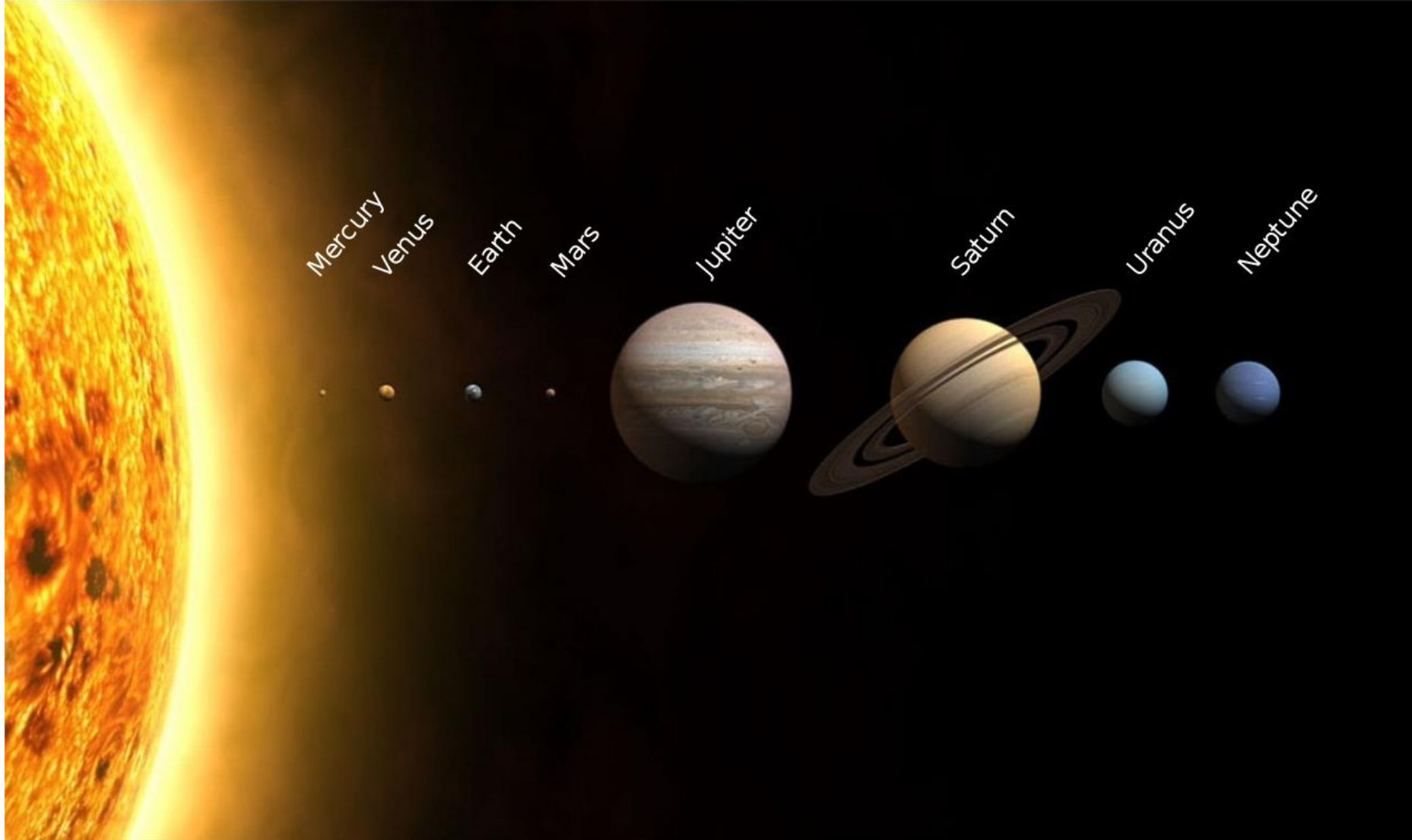
Chris Coxon/ActionAid

Henganani Merakini (26, mother of two) is a smallholder farmer. Her house is located on land earmarked for a biofuels plantation. Henganani's family has occupied this land for over a hundred years. She has not been offered any alternative land or compensation.

Fueling the Food Crisis, The Cost to Developing Countries of US Corn Ethanol Expansion, Actionaid, USA

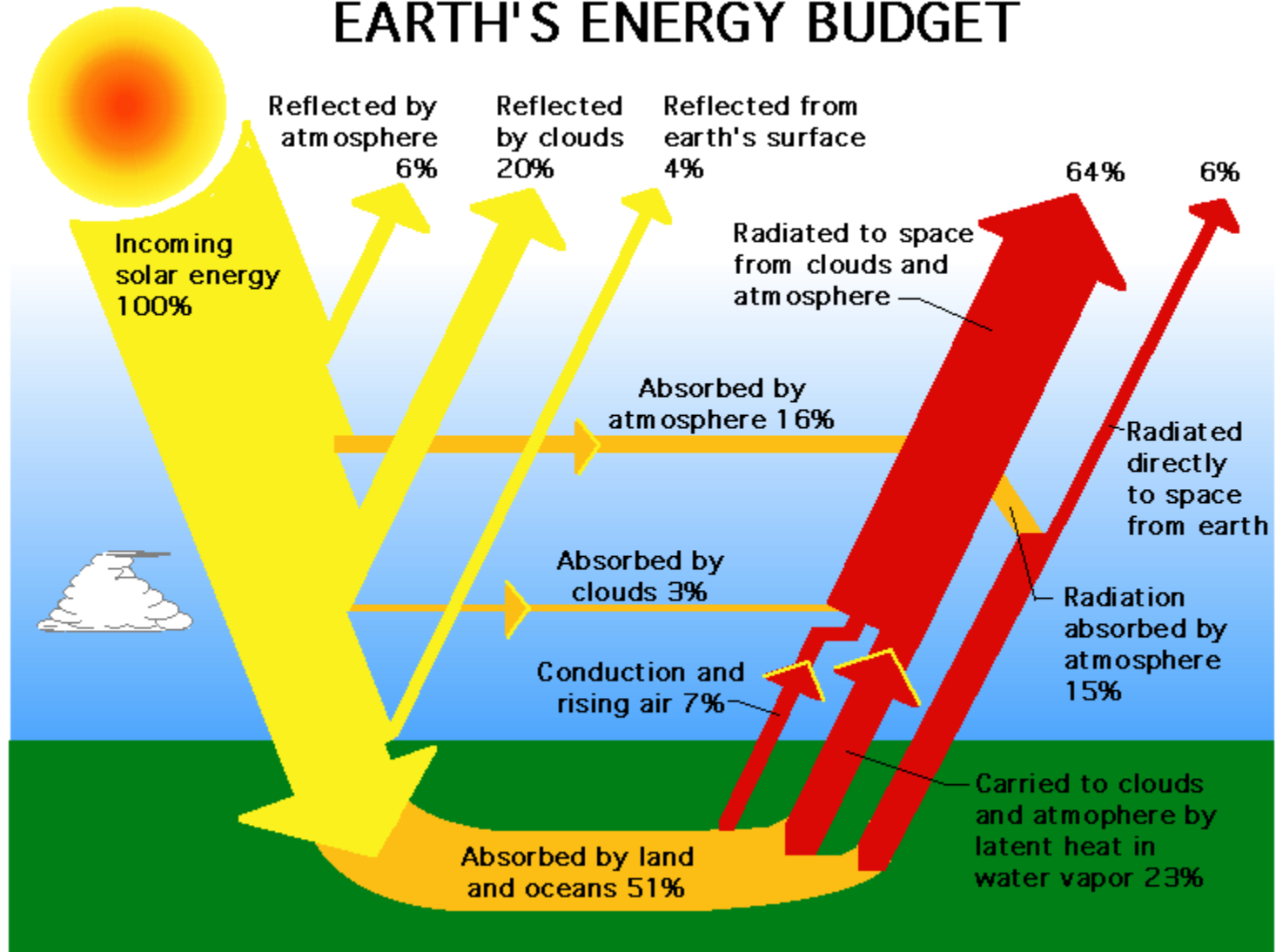
A Brief Review of Climate Science

The radii of the Sun and the planets are to scale, but the distances from the Sun are not. The Earth is at the “Goldilocks” distance, Venus is too hot, Mars is too cold, Earth is just right.

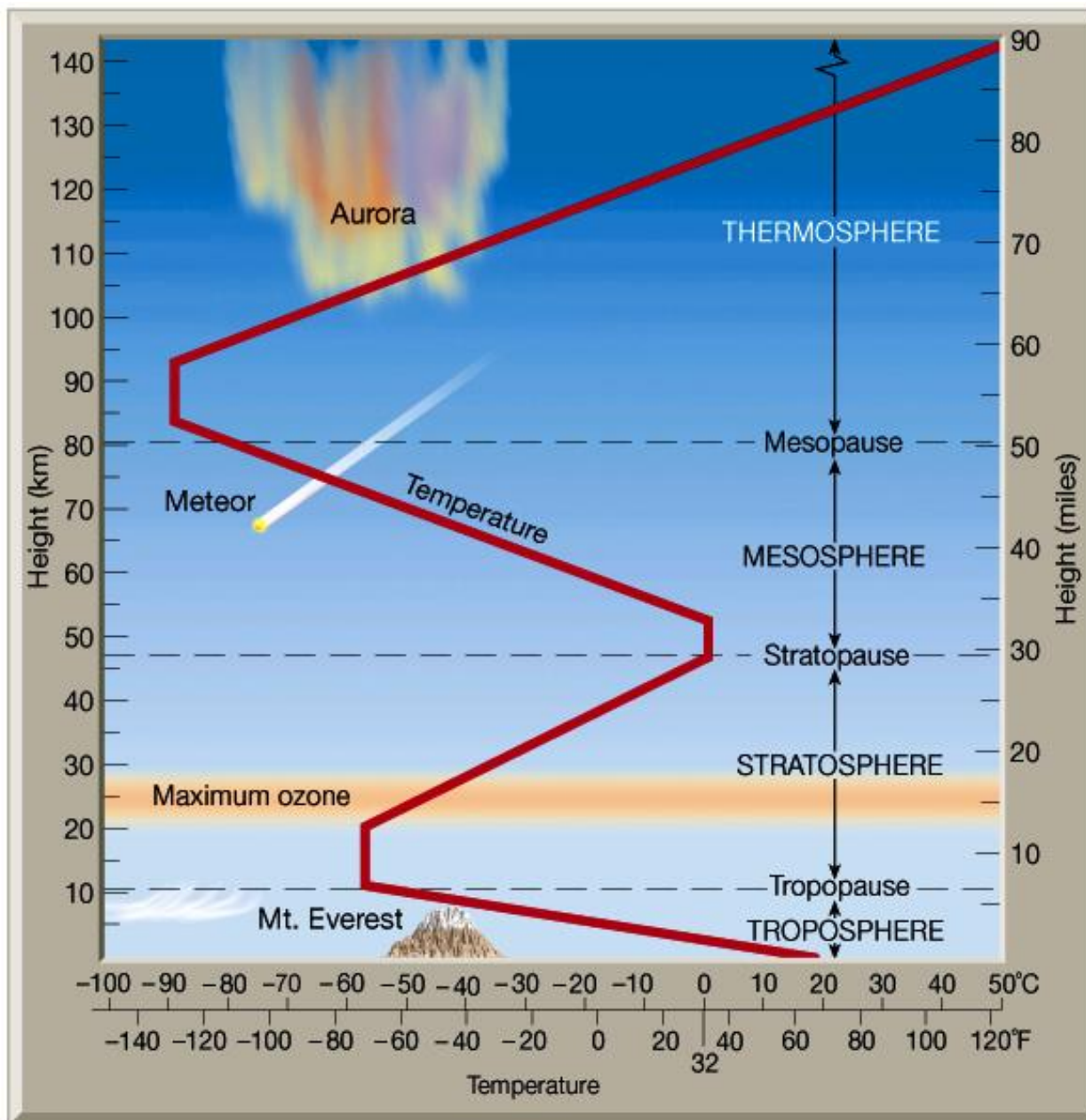


Basic physics of the picture is ok. The Devil is in the details

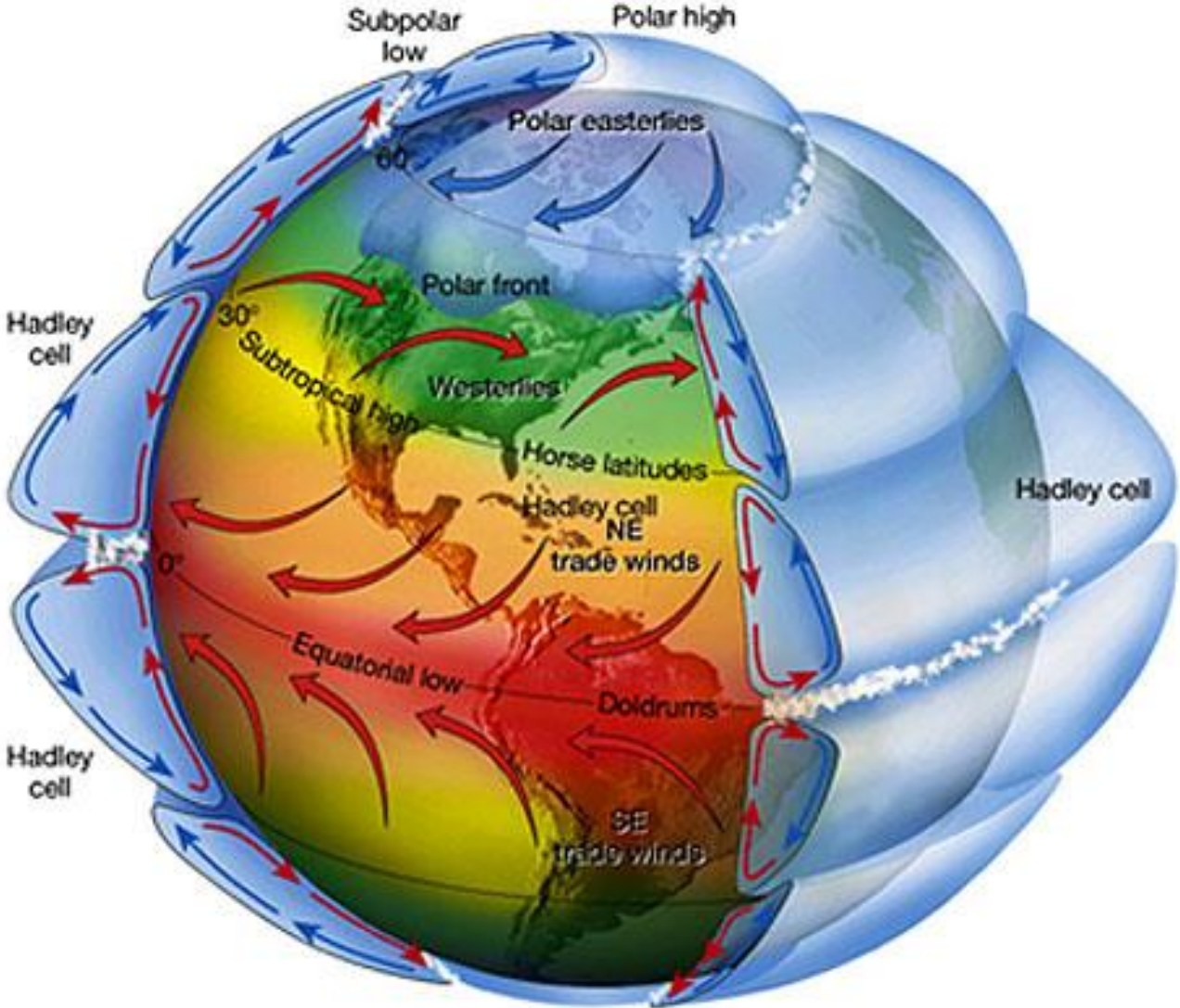
EARTH'S ENERGY BUDGET



Blowing Rock, NC, about 1 km higher than Lenoir, averages about 10 °F cooler.



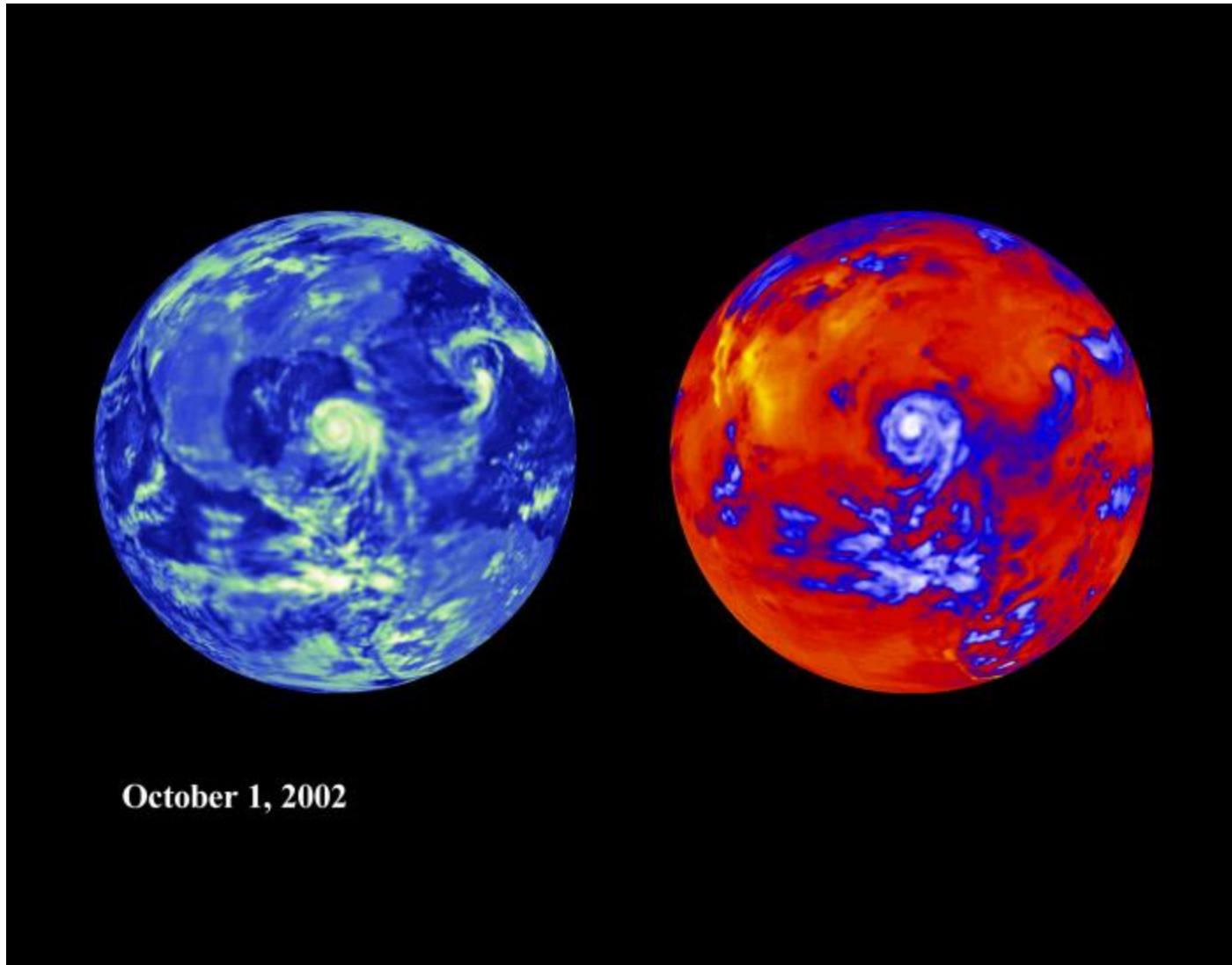
Atmospheric circulation transports heat from the equator to the poles



CERES Images (Sun-synchronous satellite to measure cloud cover, radiation, etc.)

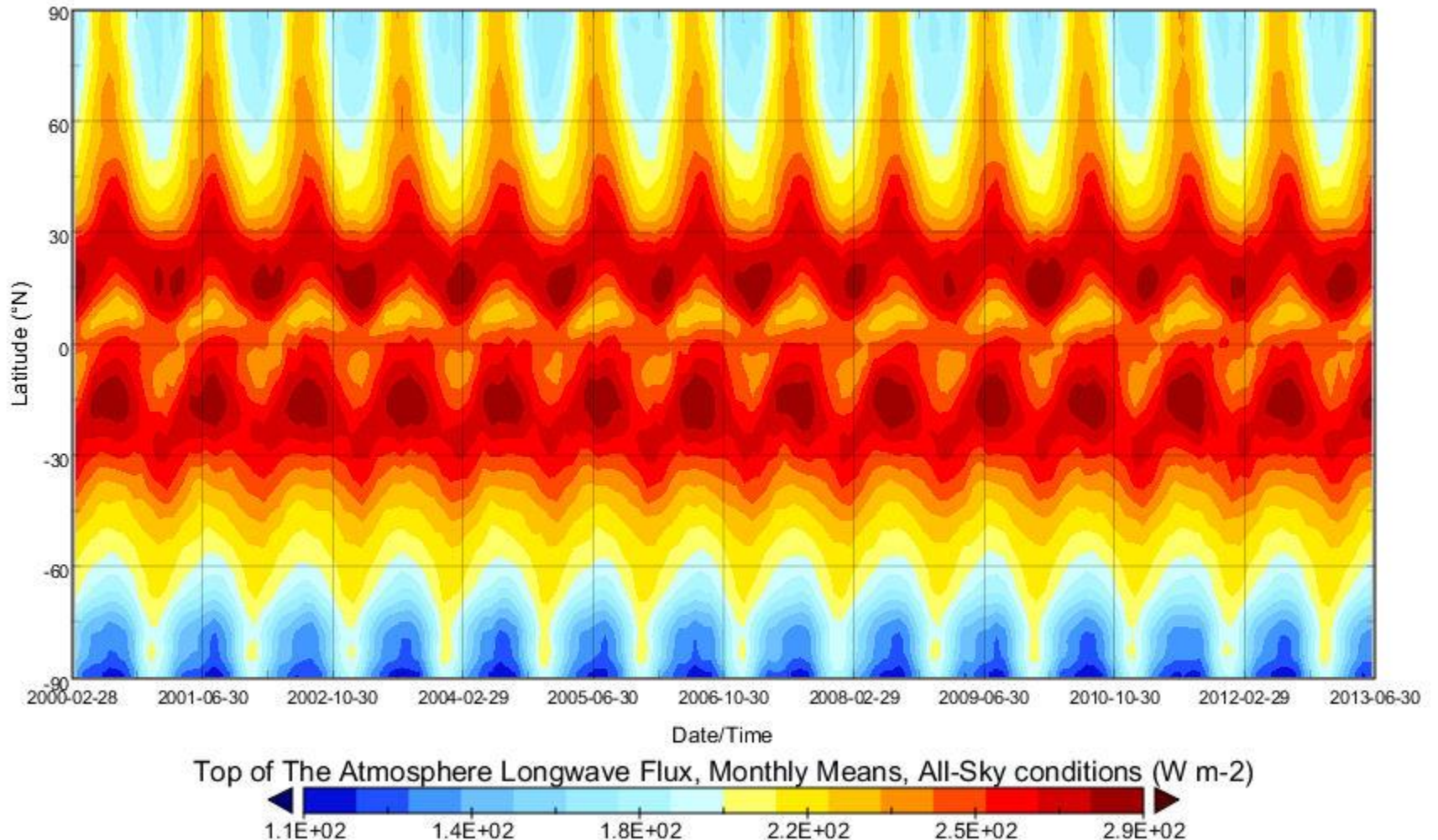
Left: Image of Earth in reflected sunlight.

Right: Image of the Earth “glowing in the dark” with long-wave infrared radiation.

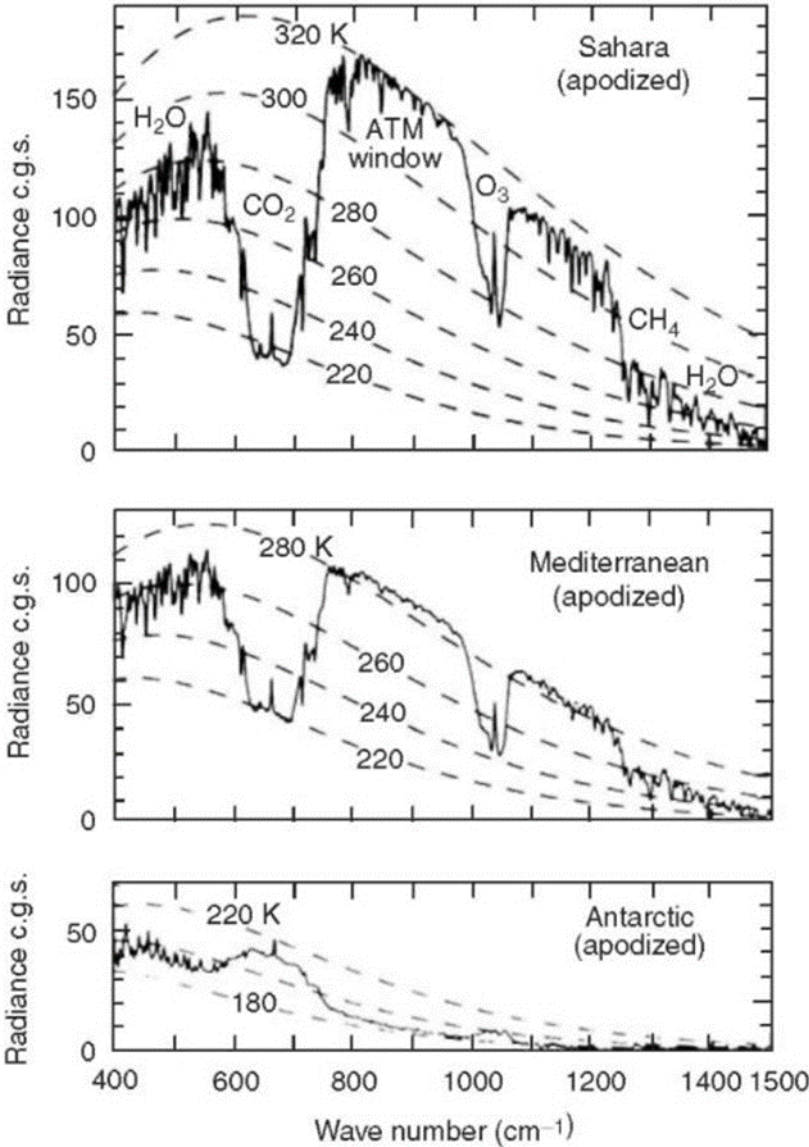


Seasonal thermal radiation of Earth versus latitude

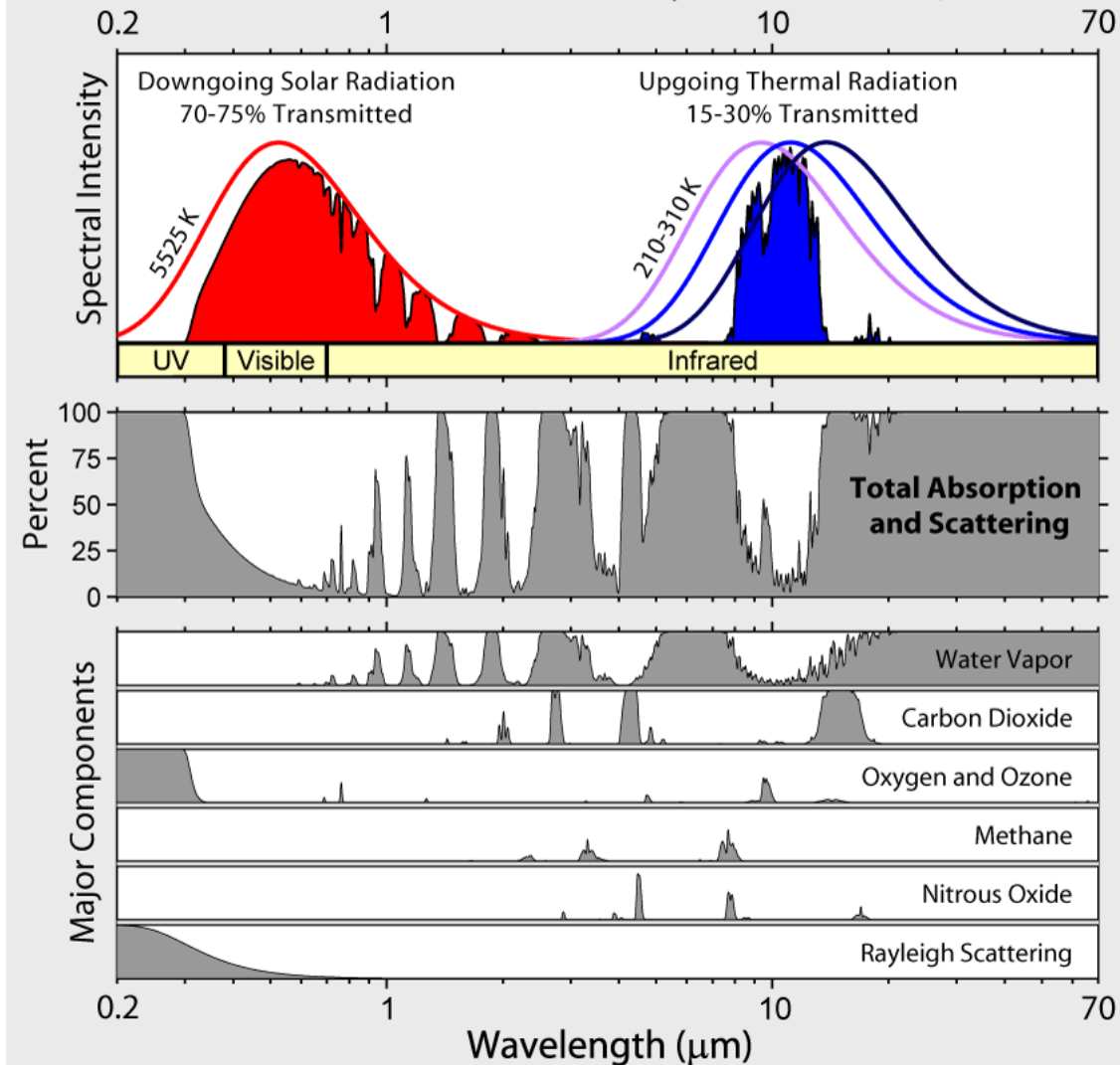
CERES Satellite Outgoing Longwave Radiation Flux, All-Sky



Satellite observations of heat radiation leaving the Earth

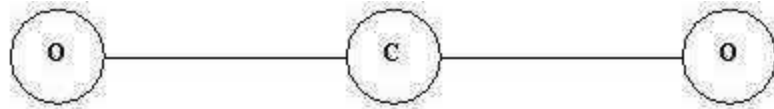


Radiation Transmitted by the Atmosphere

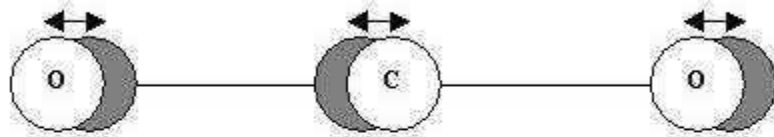


Water vapor and clouds cause most of the greenhouse warming of the Earth. Laws needed to control clouds and water vapor?

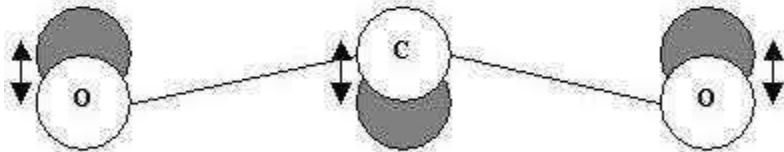
The CO₂ molecule is similar to a (tumbling) xylophone bar



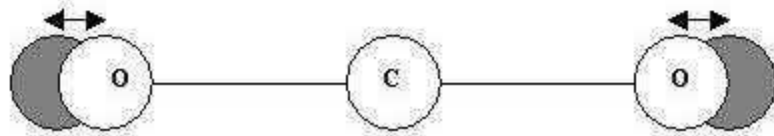
Molecular structure of Carbon Dioxide



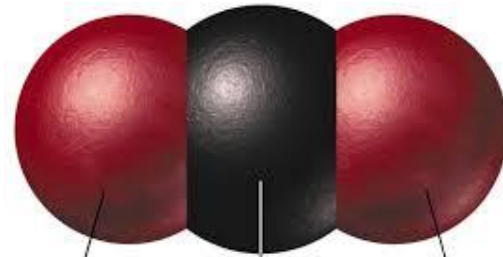
The asymmetric stretch mode



The bending mode



The symmetric stretch mode



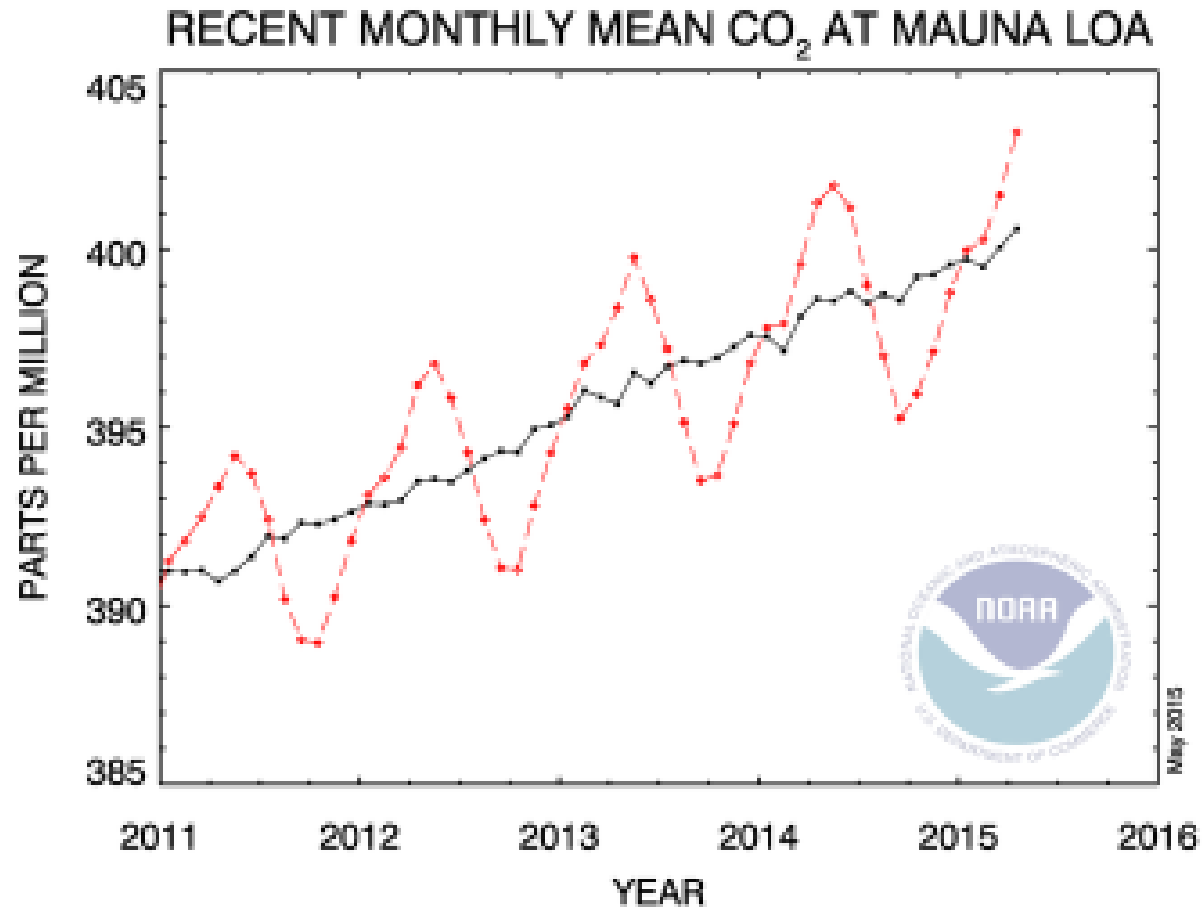
Oxygen atom Carbon atom Oxygen atom

2349 cm⁻¹
frequency too high for
greenhouse warming

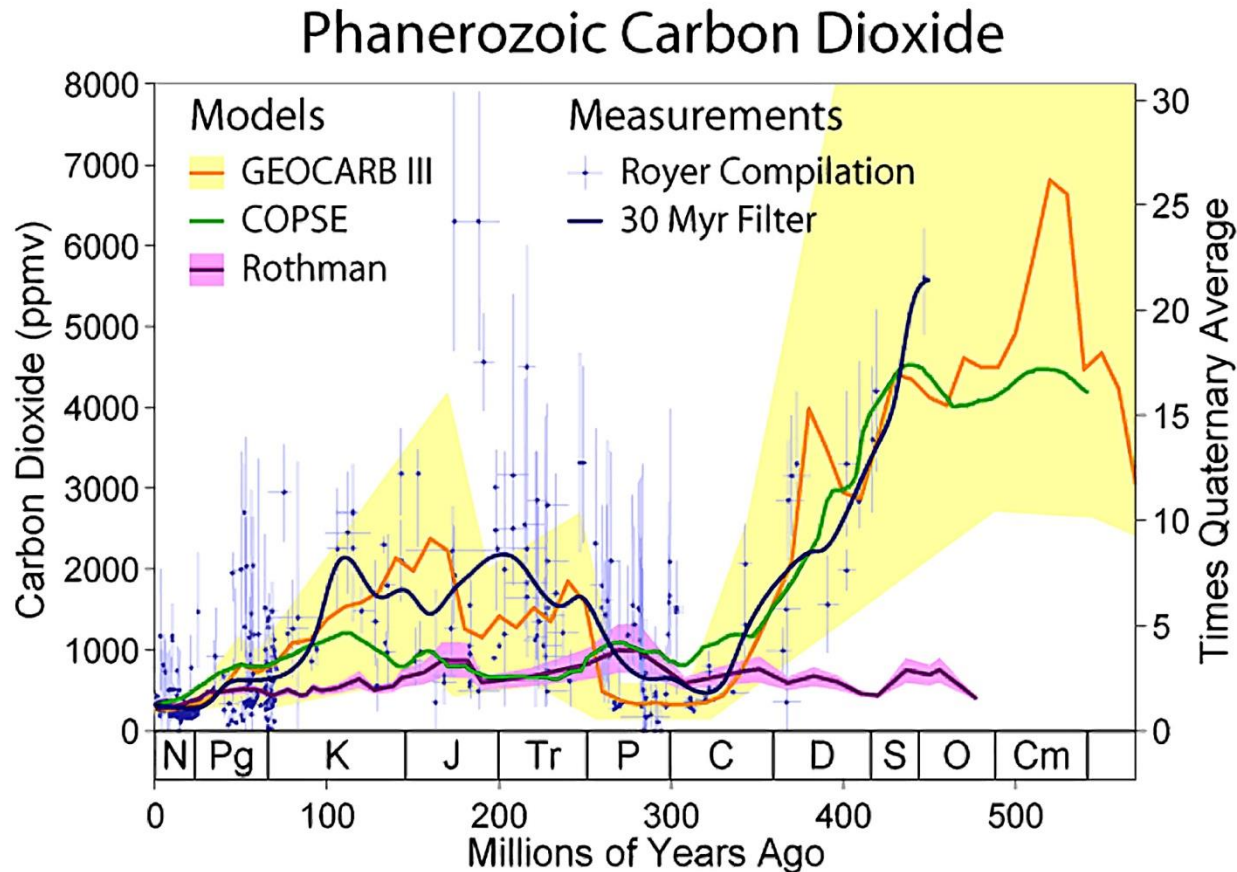
666 cm⁻¹ (Satan's number)
greenhouse warming

1388 cm⁻¹
no changing dipole moment,
no absorption or emission

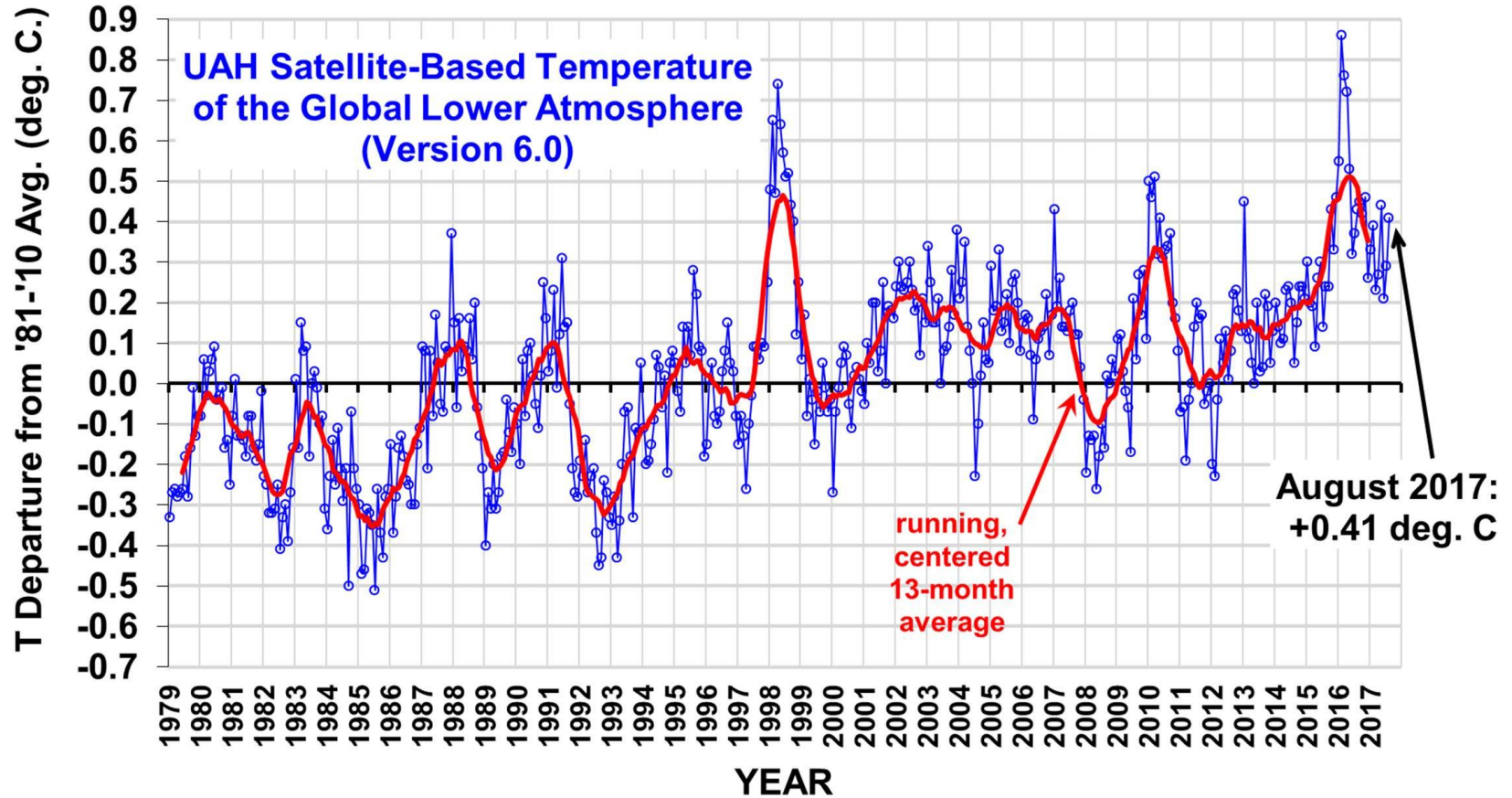
- CO₂ concentrations in the atmosphere are increasing year by year
- Consistent with about half of fossil-fuel emissions to atmosphere.

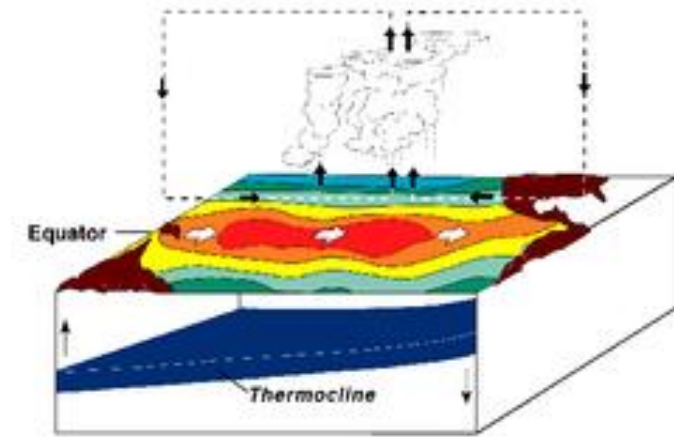


Compared to the levels of CO₂ that prevailed since the Cambrian, we have been in a CO₂ famine in recent geological times.

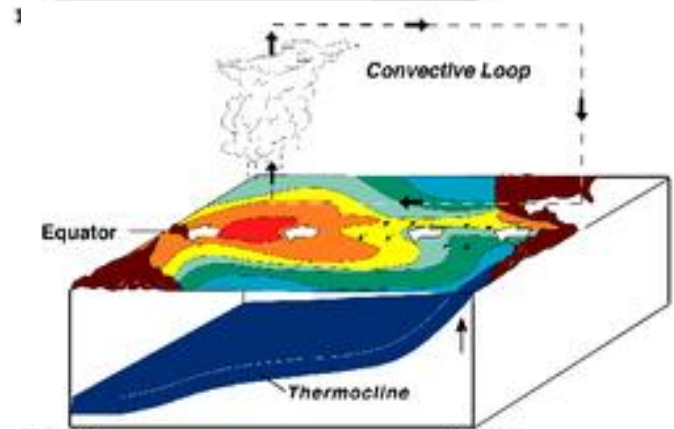


Satellite temperature measurements of lower atmosphere show little warming

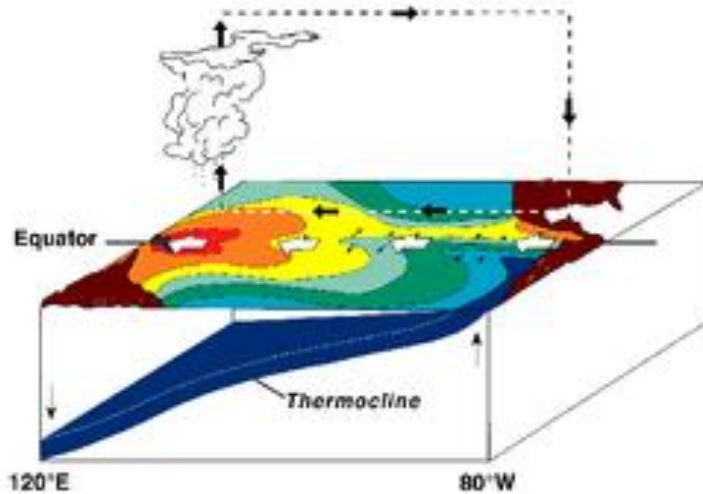




El Nino

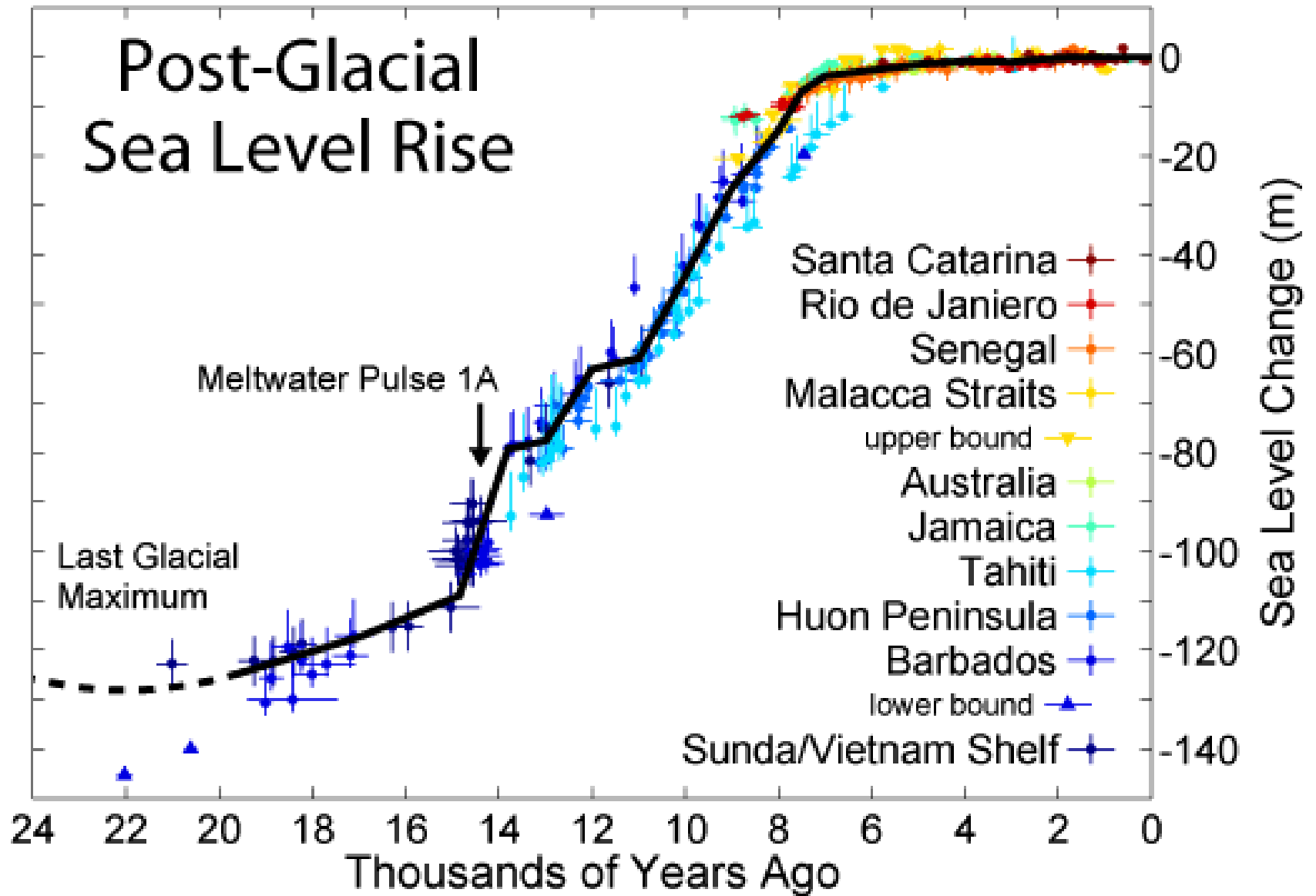


Normal

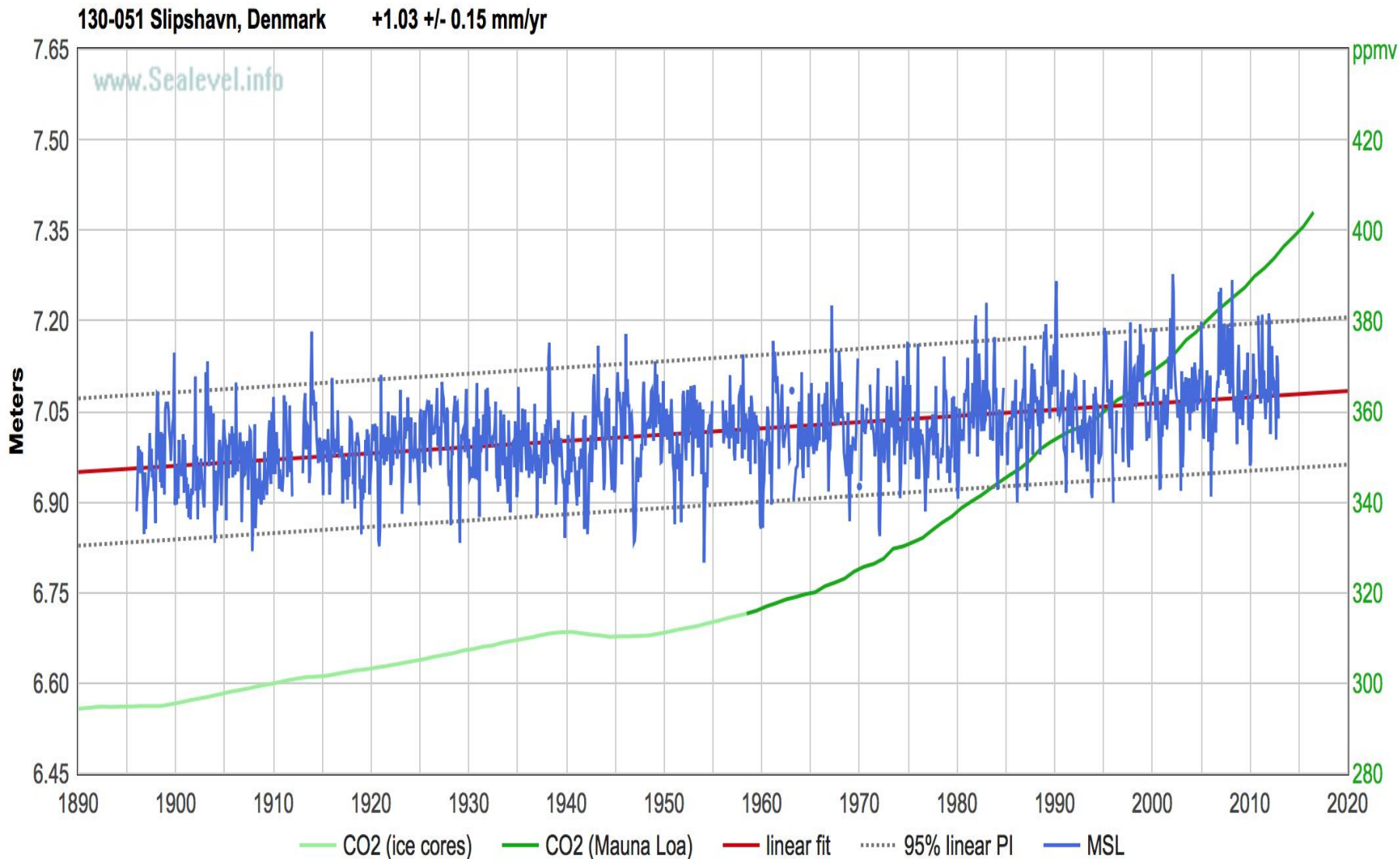


La Nina

Sea Level: It is rising at about the same rate as always!

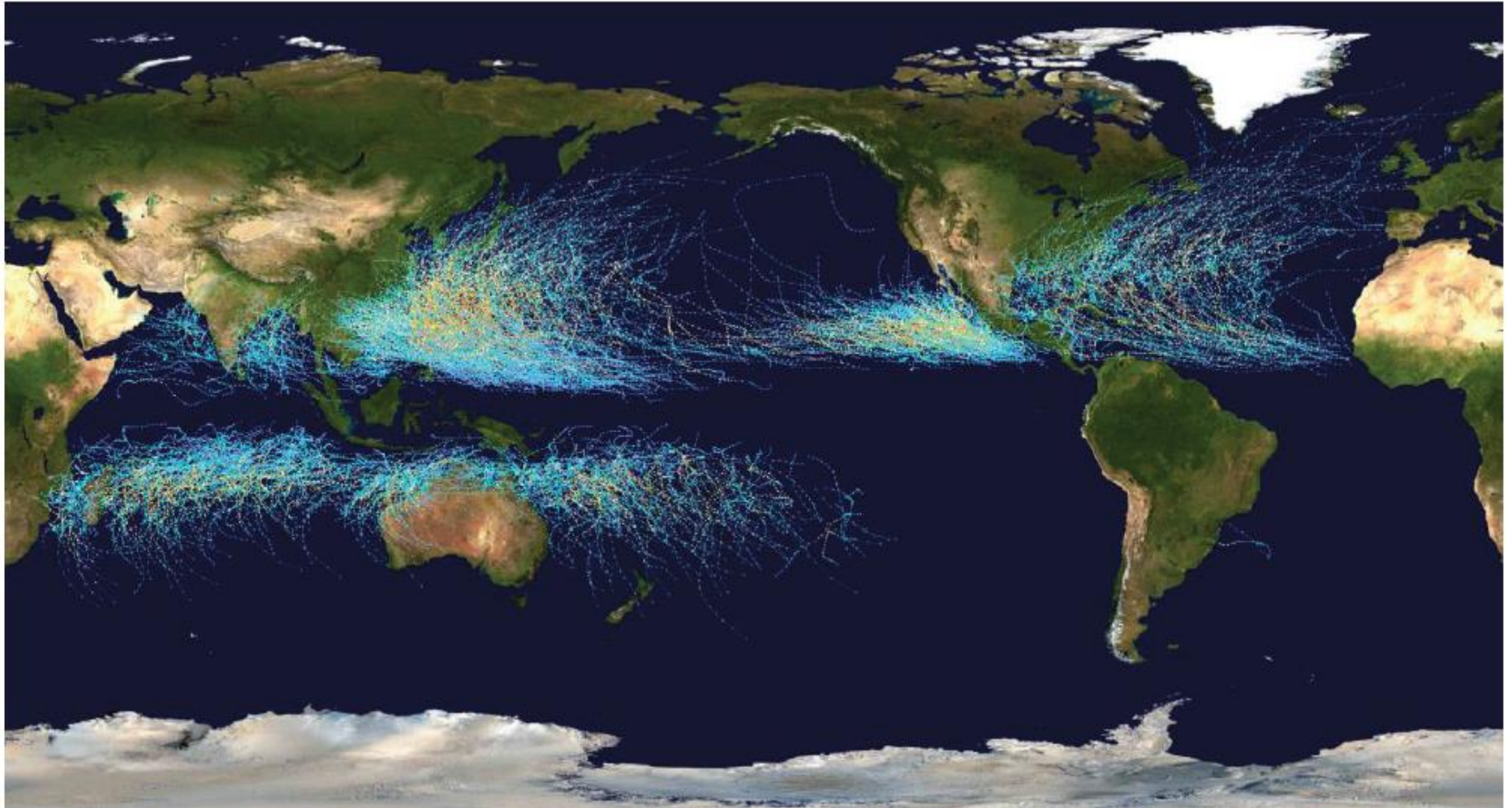


Mean Sea Level at Slipshavn, Denmark (NOAA [130-051](#), PSMSL [98](#))



The mean sea level (MSL) trend at Slipshavn, Denmark is +1.03 mm/year with a 95% confidence interval of ± 0.15 mm/year, based on monthly mean sea level data from 1896/1 to 2012/12. That is equivalent to a change of 0.34 feet in 100 years. ([R-squared](#) = 0.242)

Hurricane (Tropical Cyclone) Tracks; 1985-2005; (Wikipedia)

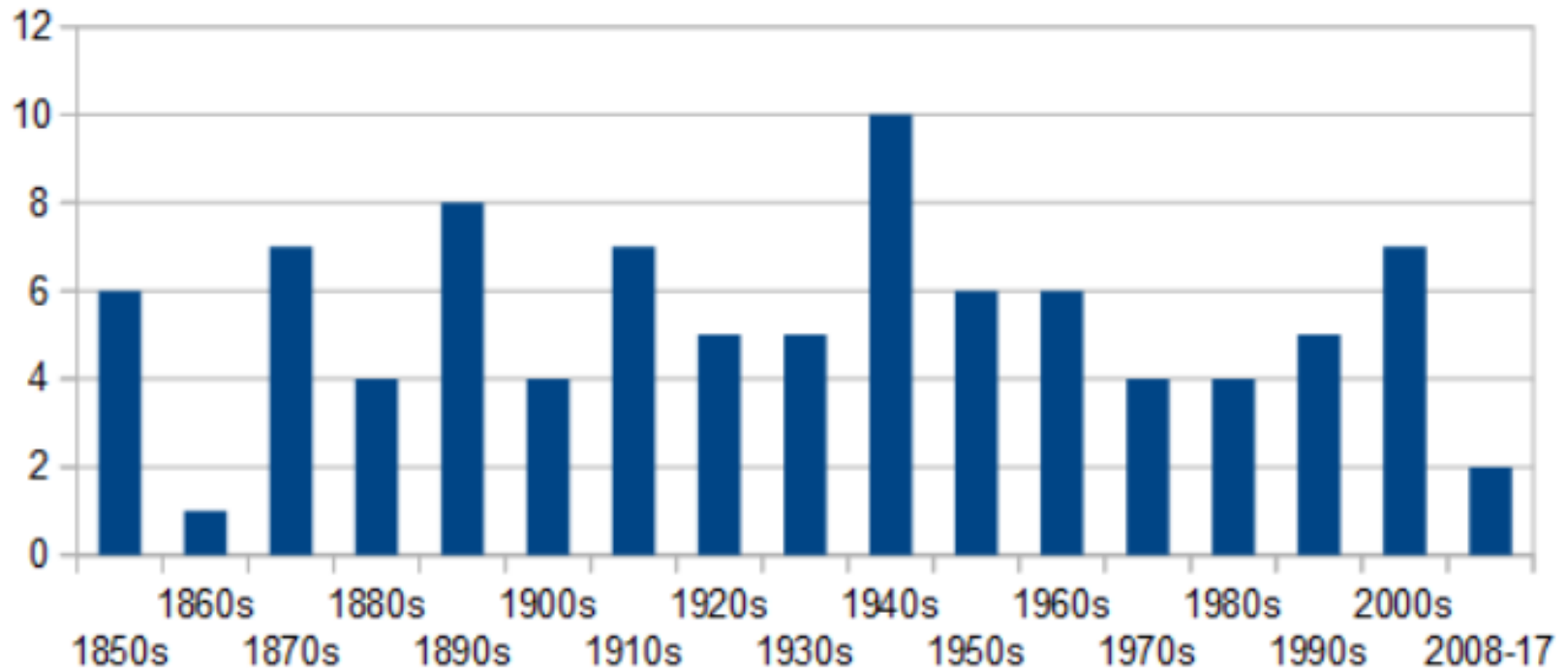


No Coriolis force at equator → No hurricanes

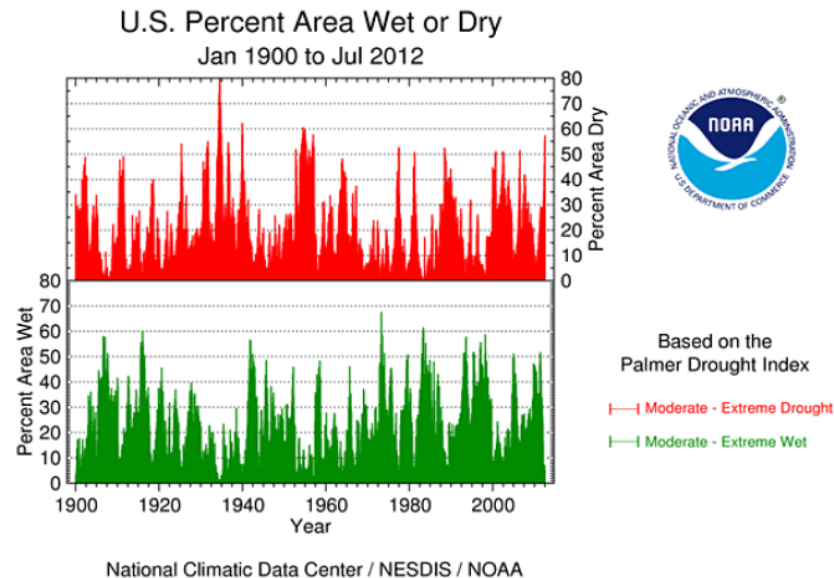
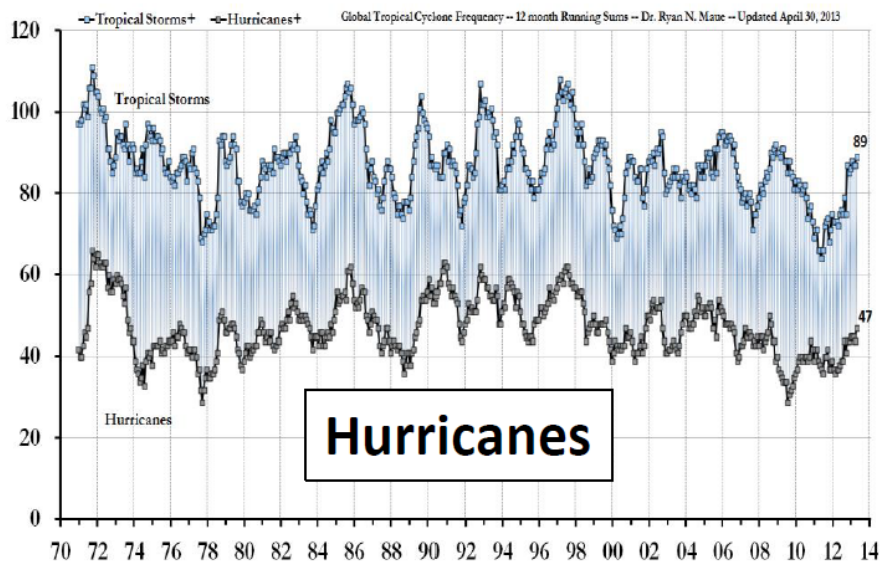
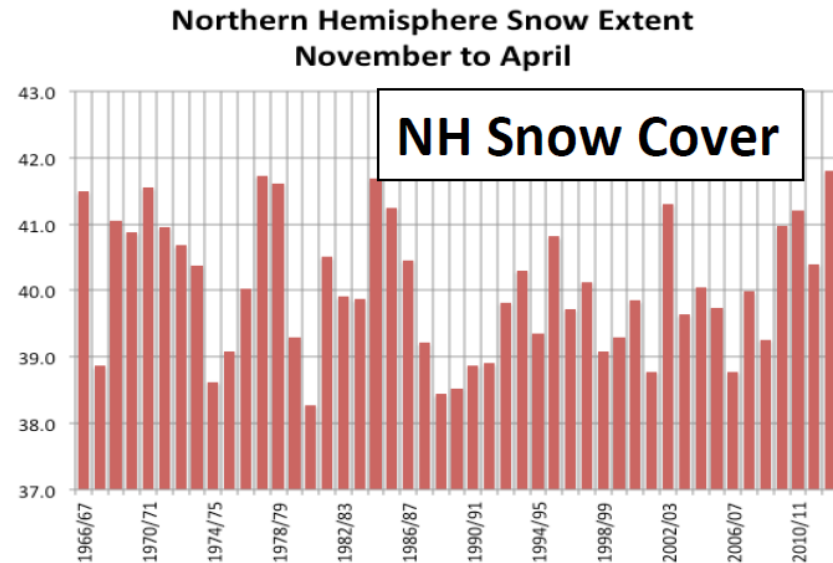
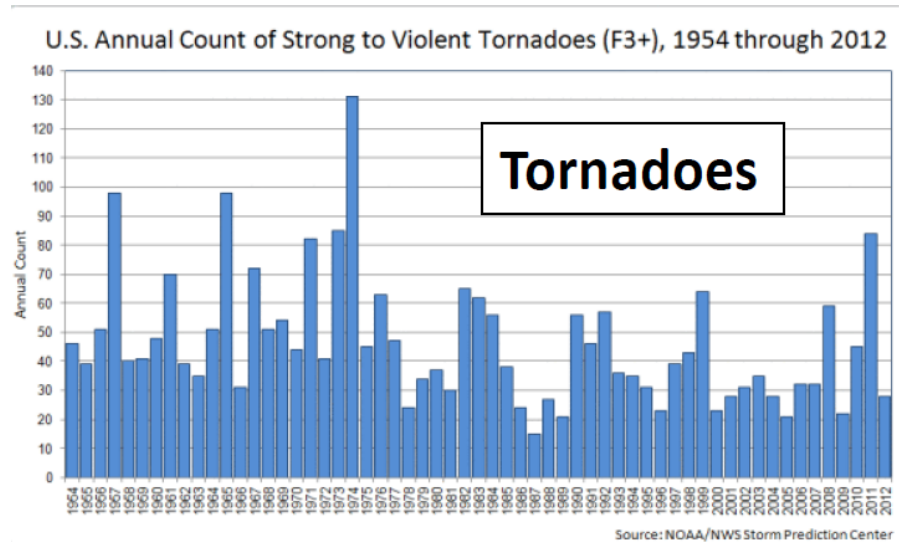
Low clouds spiral in counterclockwise in North; clockwise in South

No of US Landfalling Hurricanes by Decade

Cat 3 and Over



There has been no increase in extreme weather



Summary

- Policies to slow CO₂ emissions are based on flawed computer models which exaggerate warming by factors of 2 or 3.
- More CO₂ is an overall benefit, so costly “mitigation” schemes are harmful.
- In spite of these objective facts, alarmism continues, driven by many motives:

Virtue Signaling



From “Holy Willie”
by Rabbe Burns

Lord, bless Thy chosen in this place,
(i. e. saviors of the planet)

For here Thou hast a chosen race!

But God confound their stubborn face,
(i.e, “climate deniers”)

An' blast their name,

Wha brings Thy elders to disgrace,

An' open shame.



Politics

“The whole aim of practical politics is to keep the populace alarmed (and hence clamorous to be led to safety) by menacing it with an endless series of hobgoblins, all of them imaginary.”



H. L. Mencken

Crony capitalists, research empires, etc.

“Where your treasure is, there will your heart be also.”

Matthew 6:21



было бы корыто, а свиньи-то будут

(If there happens to be a trough, there will be pigs)

A. S. Pushkin, Dubrovsky (1832)

Shopenhauer



“All truth passes through three stages. First it is ridiculed, second it is violently opposed, and third it is accepted as self-evident.”

- The truth, that CO₂ is not harmful but is actually good for the planet, is somewhere between the stages of ridicule and violent opposition.

Backup Slides

Stomata

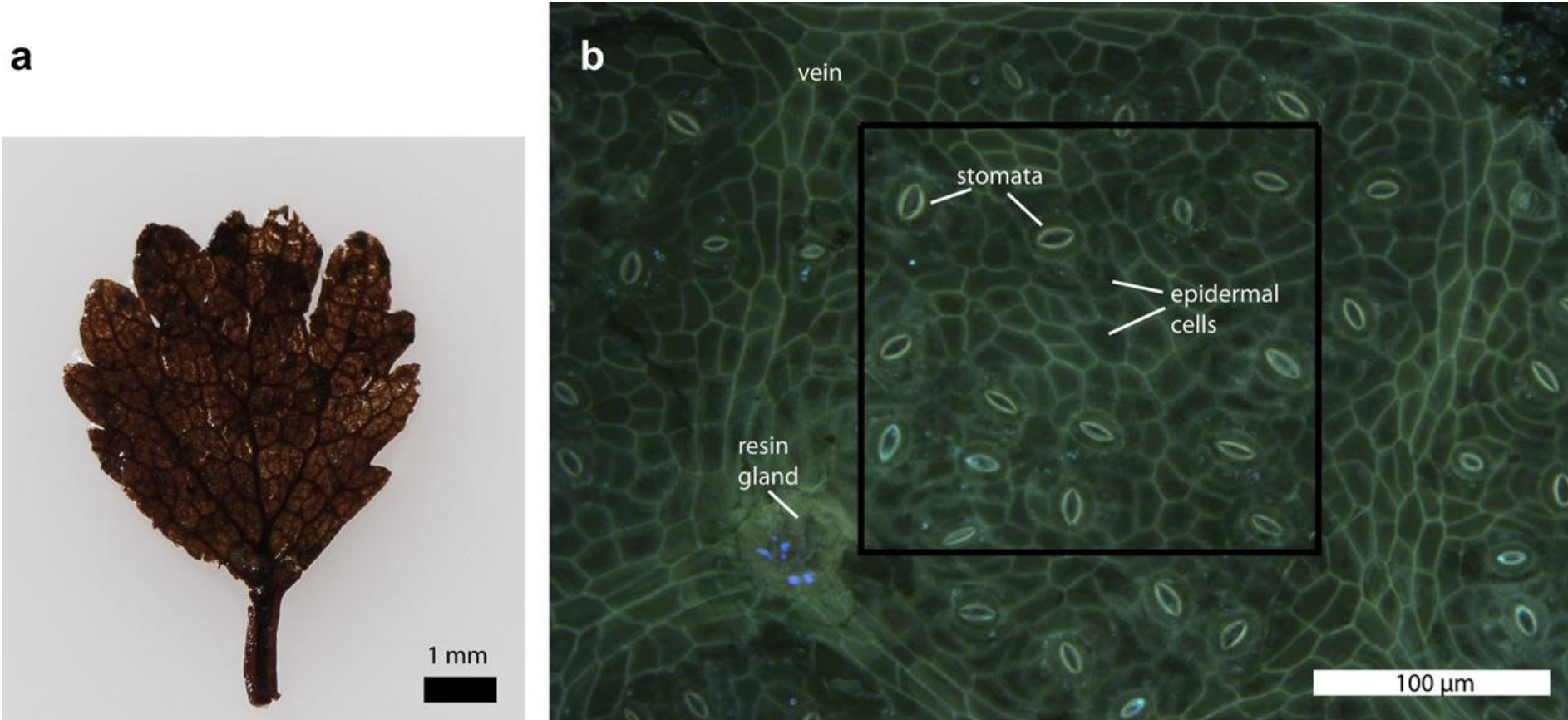
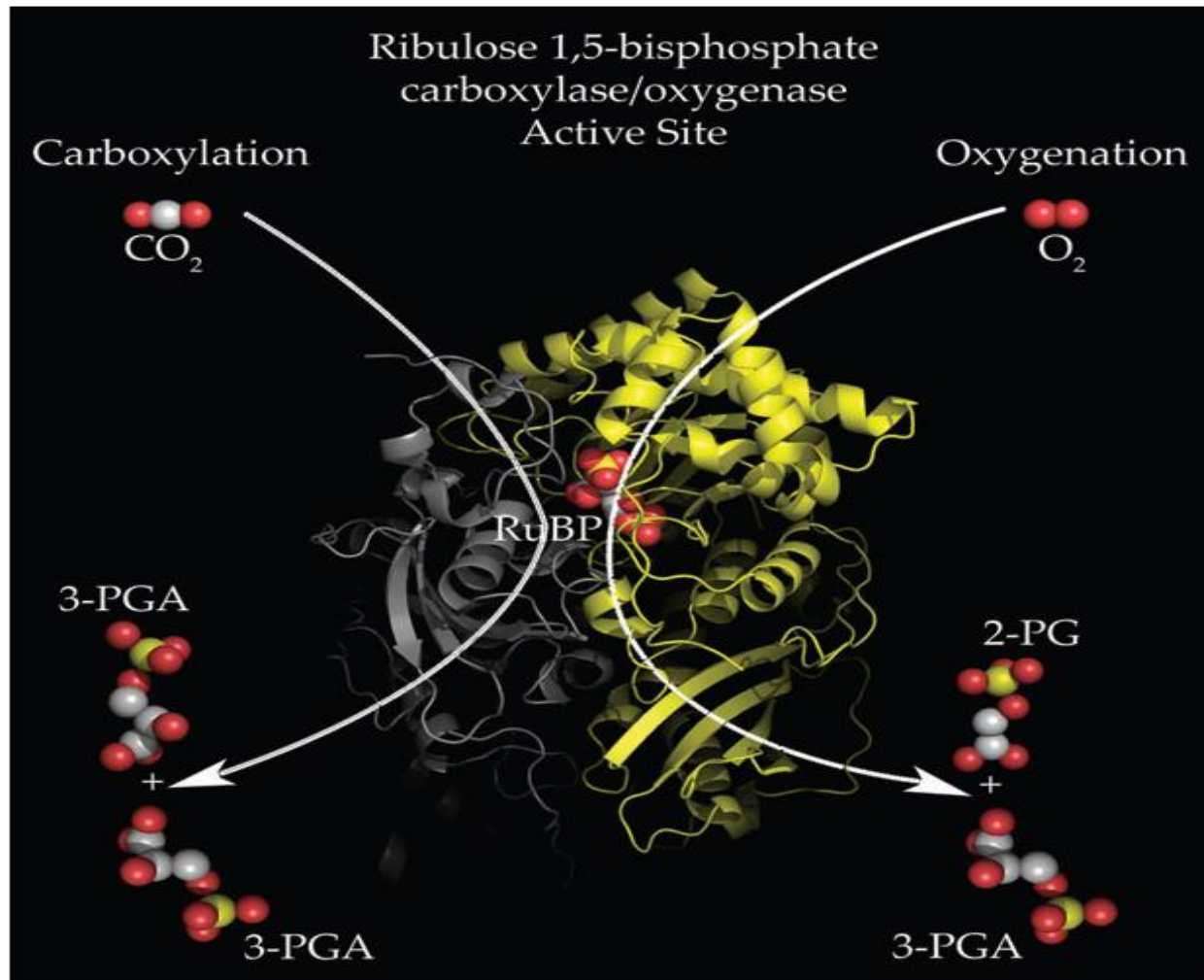


Fig. 3. Morphology of *Betula nana* leaf material from Hässeldala Port. Whole leaf macromorphology (a) (Photo: Björn Eriksson, Stockholm University). Micromorphology of an abaxial cuticle surface, captured using epifluorescence microscopy. (b) Stomata, epidermal cells, resin gland and vein areas indicated. [Steinhorstdottir et al., *Quaternary Science Reviews*, v. **68**, pp. 43-59 (2013)]

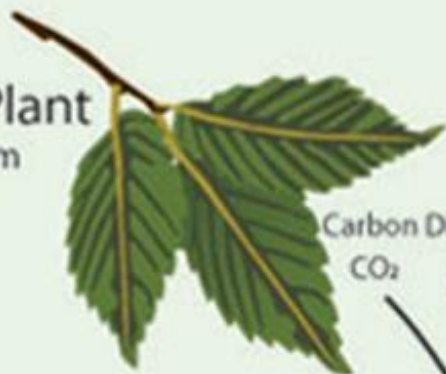
Rubisco, the most abundant protein in the world



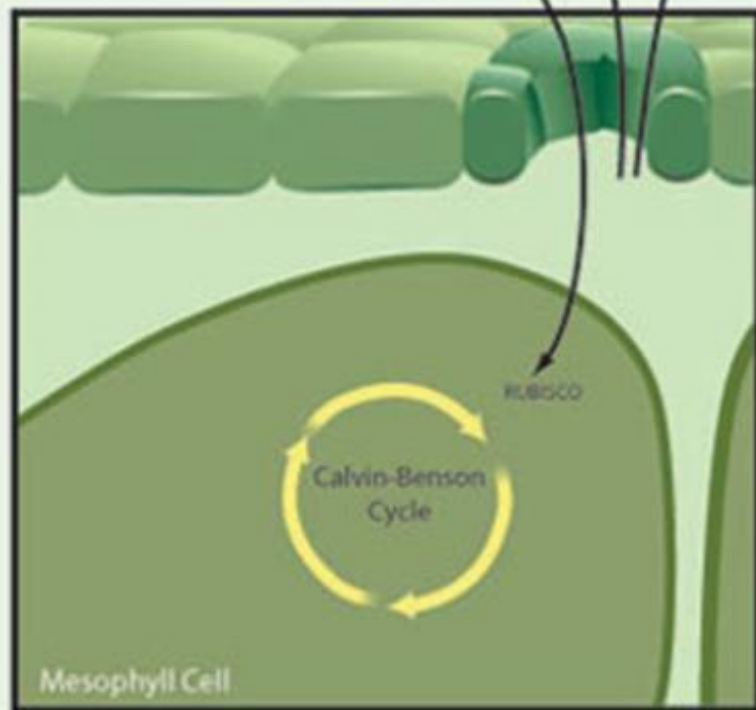
Carboxylation: good

Oxygenation: bad

C₃ Plant
Elm



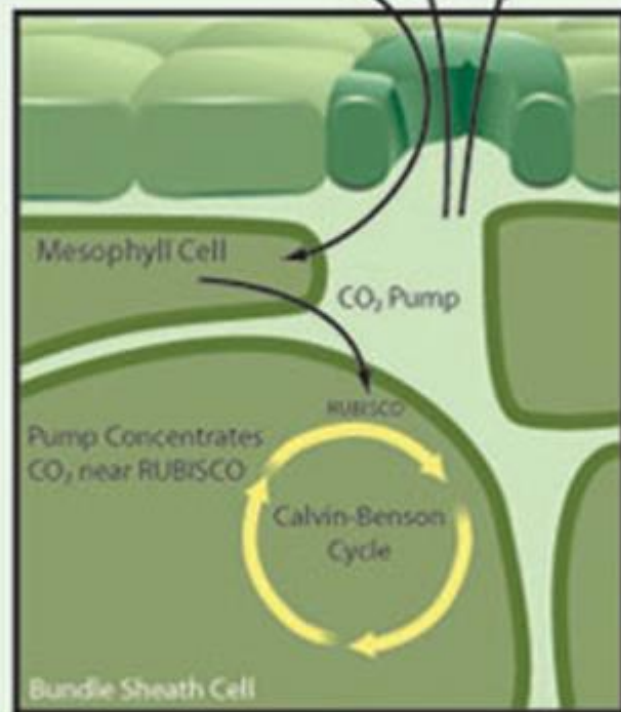
Carbon Dioxide
CO₂
Oxygen
O₂
Water
H₂O



C₄ Plant
Corn



Carbon Dioxide
CO₂
Oxygen
O₂
Water
H₂O



Much of the World has been misled into Climate Hysteria, an “Extraordinary Popular Delusion.”

