Nuts and bolts of communicating climate science to diverse audience

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Image: 20th Century Fox

Madison Youth Climate Action Sum
May 2

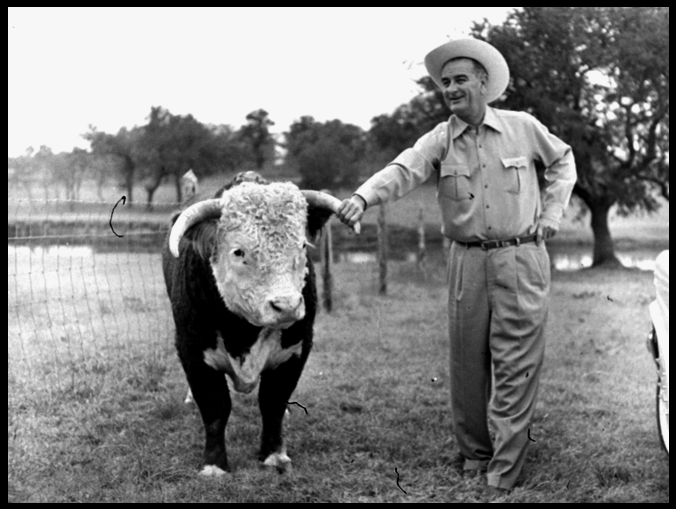
Three things about me

- I was born and raised in New Jersey
- I live in Madison with my wife (West High teacher) and three daughters (one at West)
- I am a climate scientist and UW-Madison professor who has spent that past 2 decades studying how plants, climate, and weather all influence each other

Let’s play a game

- Pair up
- Grab a scenario strip
- How would you respond as a climate activist to this line of thinking?

The continued release of CO_2 to the atmosphere from burning fossil fuels would "almost certainly cause significant changes" and "could be deleterious from the point of view of human beings […] and marked changes in climate, not controllable through local or even national efforts.



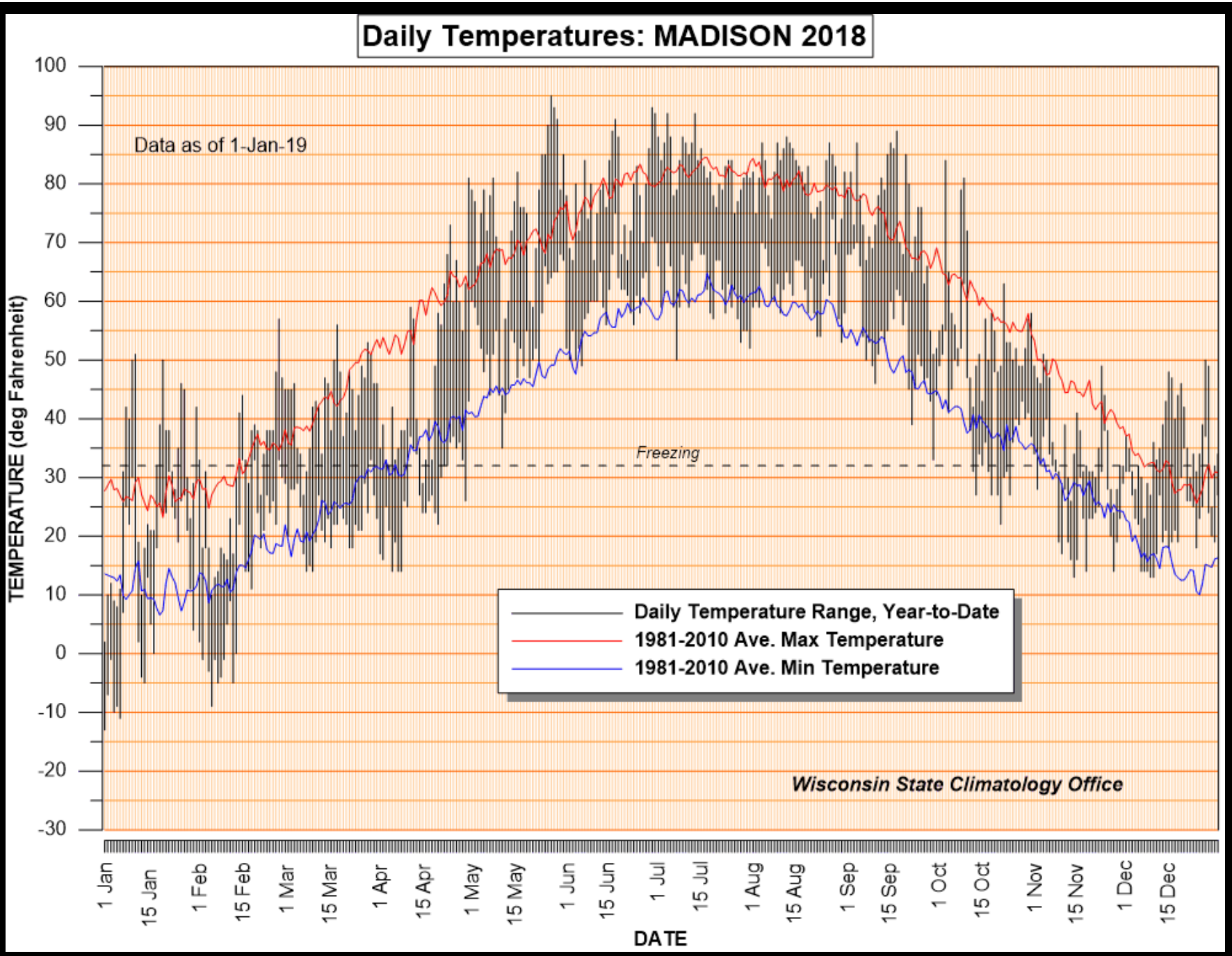
U.S. President's Science Advisory to President Lyndon B. Johnson 1966

Bottom Line

- Climate is warming and change is projected to accelerate in next century with continued increases in fossil fuel emissions
- Without significant reduction in emissions over next few decades, the negative effects and costs of climate to society and ecosystems will overtake any possible benefits.
- The public increasingly supports action on climate change and is hungry for credible, legitimate, salient information on how to do so

What is Climate?

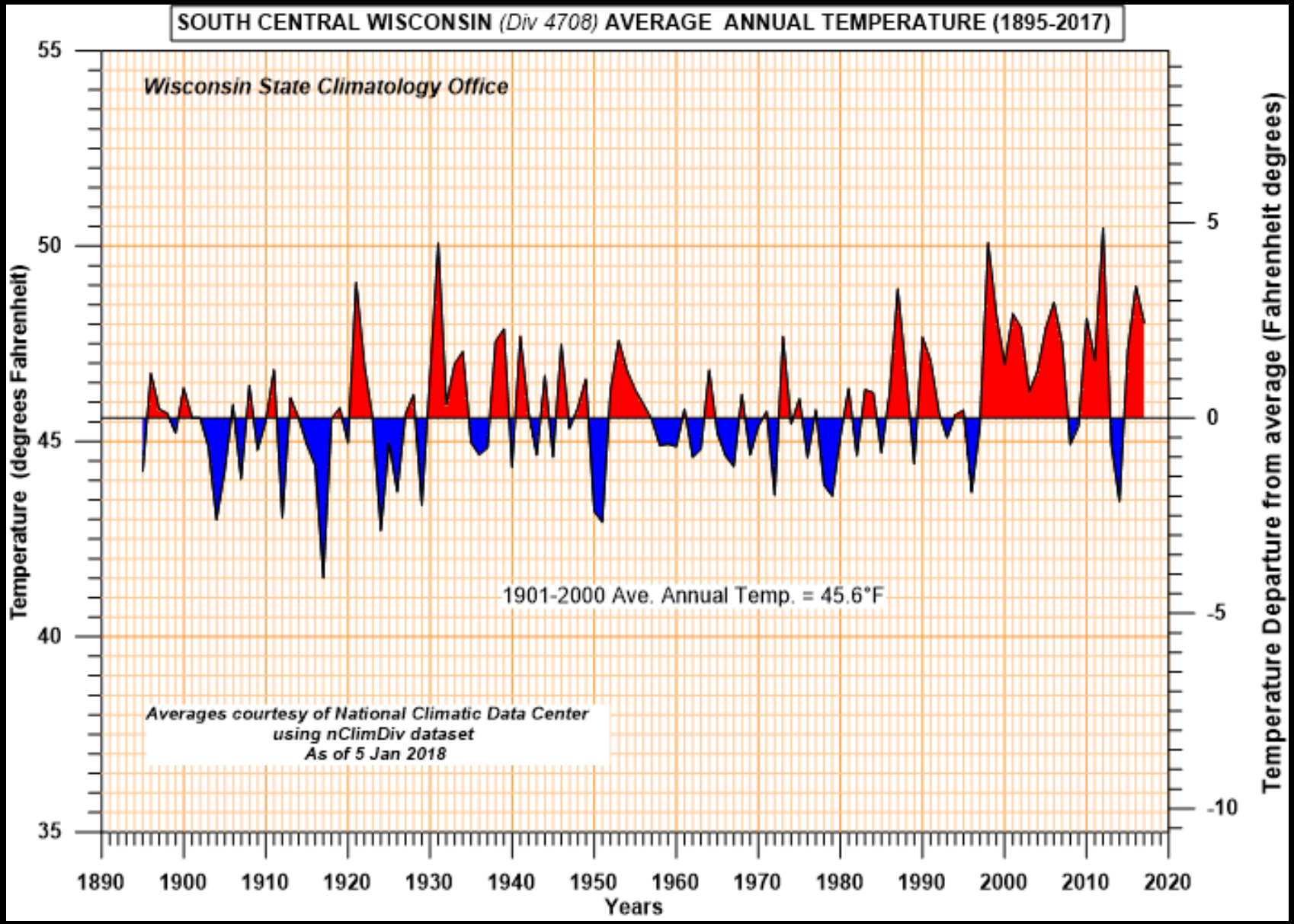
- Climate is the average of weather
  - "Climate is what you expect, weather is what you get" –Andrew John Herbertson
  - "Climate is your personality, weather is your mood" –Marshall Shepherd
- Climate changes naturally (over eons) and by humans (over centuries)



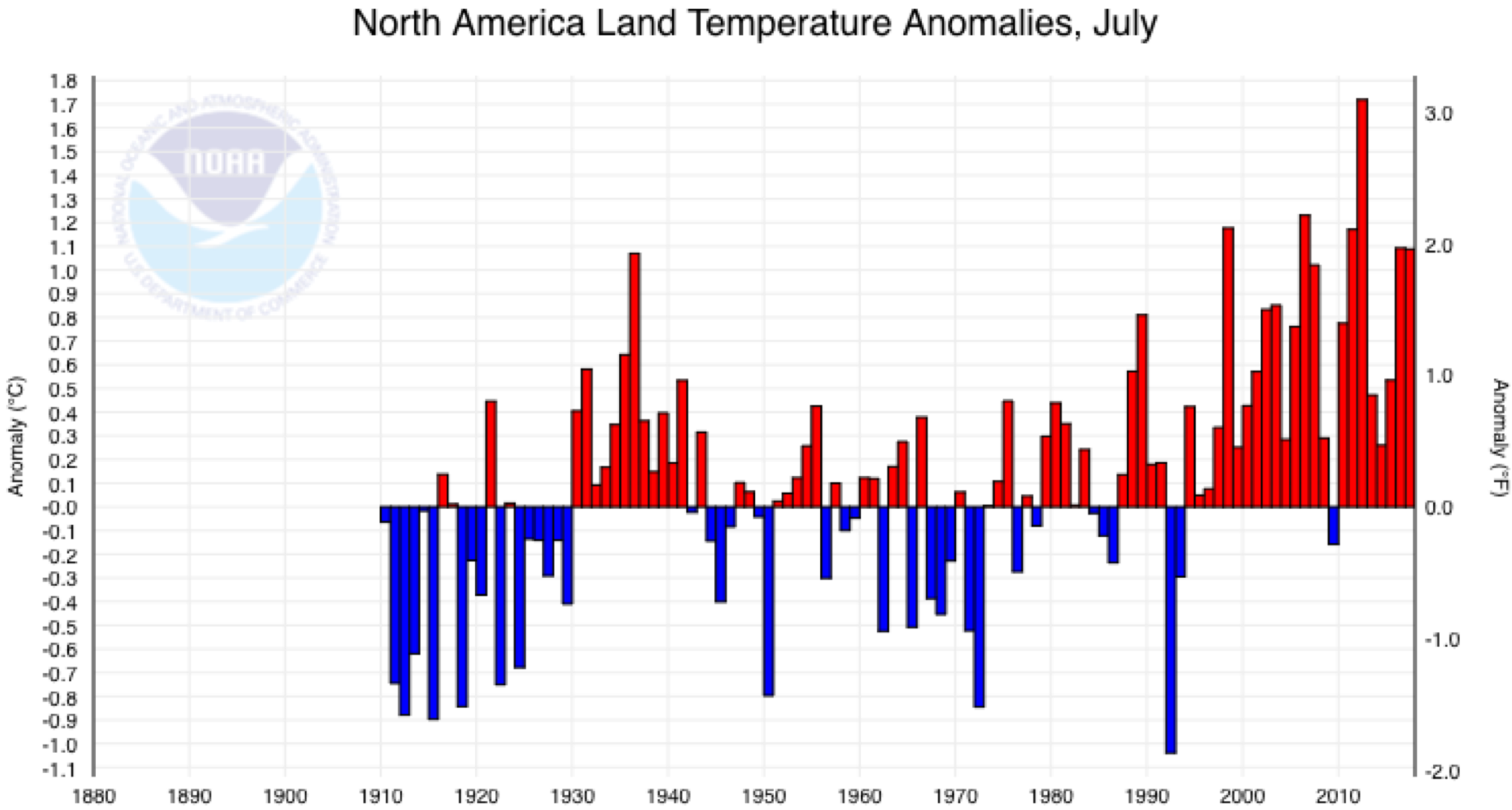
Madison, WI

1981-2010 average high and low temperature and 2018 weather

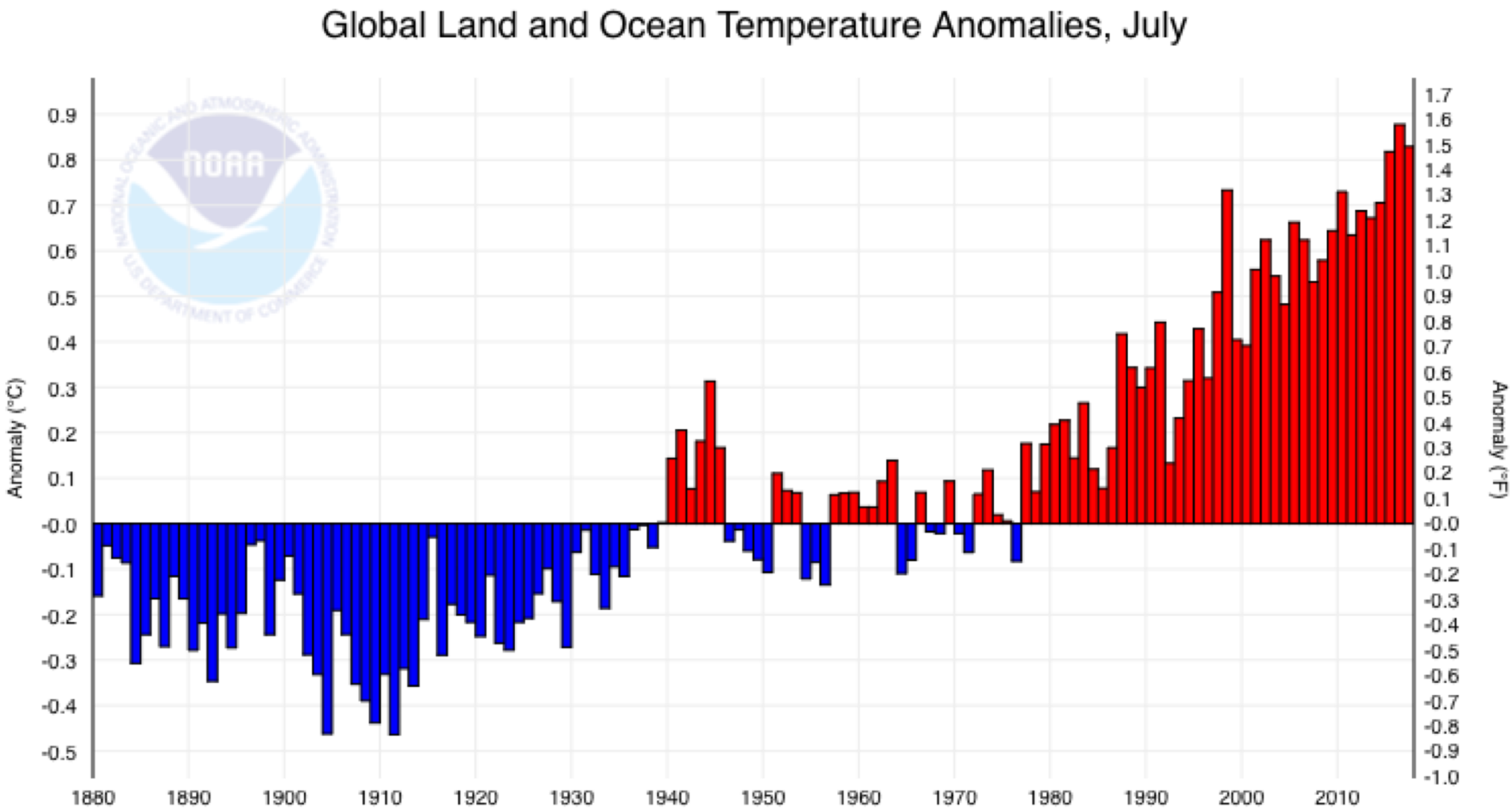
South Central Wisconsin

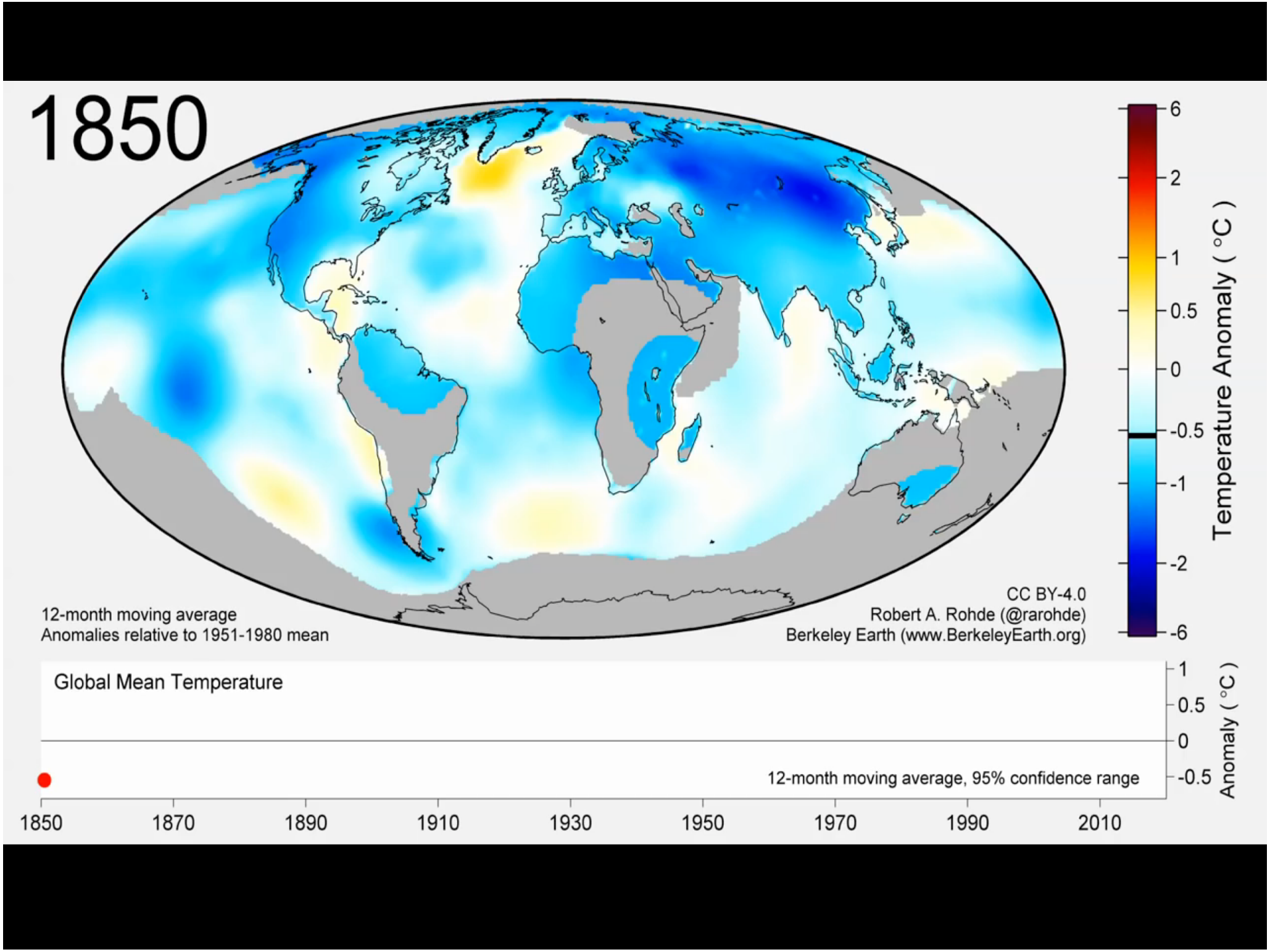


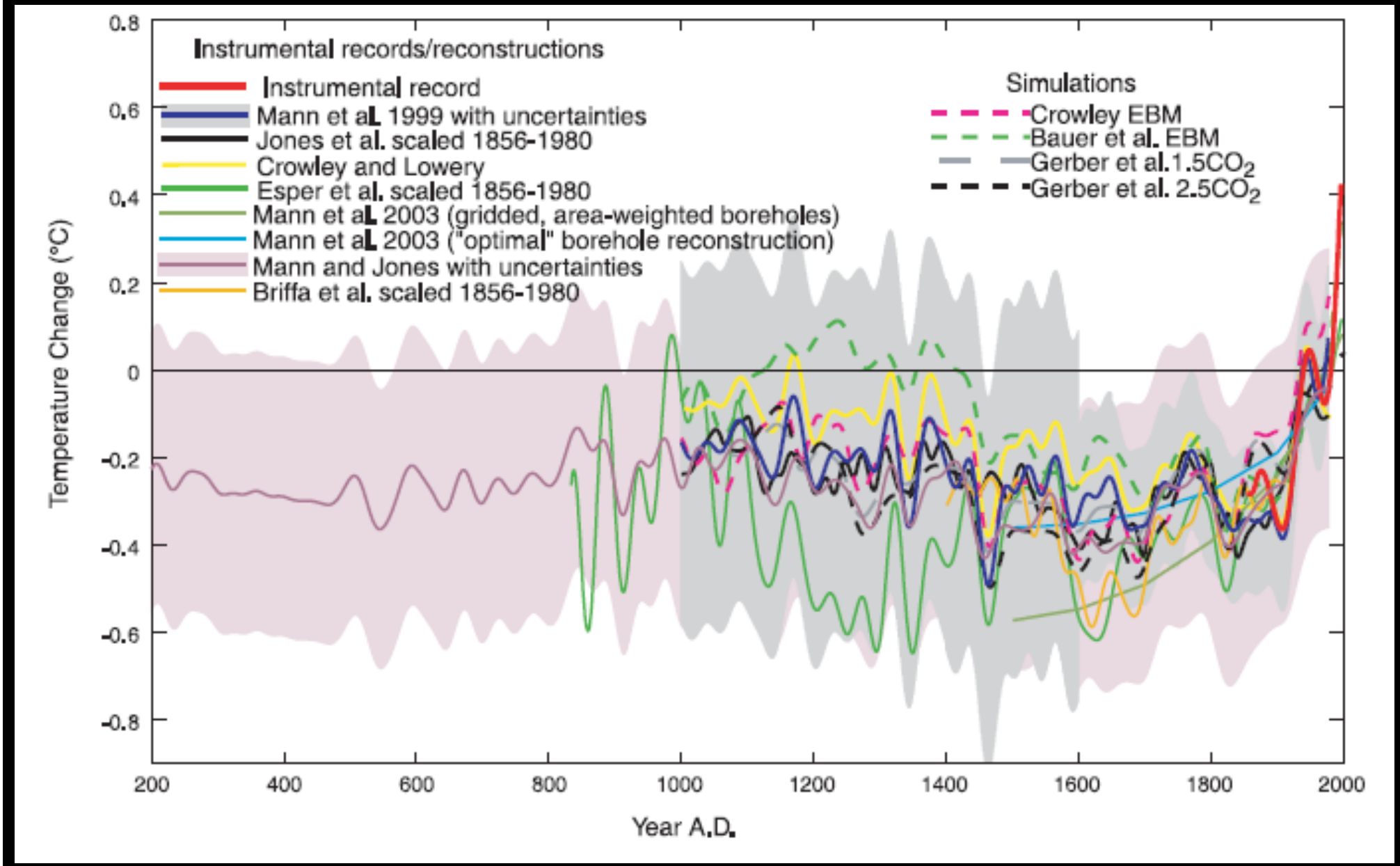
North America



WORLD


Global Land and Ocean Temperature Anomalies, July
Anomaly (°C)
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
-0.0
-0.1
-0.2
-0.3
-0.4
-0.5
1880
1890
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010
Anomaly (°F)
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
-0.0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1.0


1850
6
2
1
0.5
0
-0.5
-1
-2
-6
Temperature Anomaly (°C)
12-month moving average
Anomalies relative to 1951-1980 mean
CC BY-4.0
Robert A. Rohde (@rarohde)
Berkeley Earth (www.BerkeleyEarth.org)
Global Mean Temperature
1
0.5
0
-0.5
Anomaly (°C)
12-month moving average, 95% confidence range
1850
1870
1890
1910
1930
1950
1970
1990
2010



Mann et al., 2003, EOS

Three things about climate

- Climate is the average of weather
- Climate changes naturally and by humans
- The study of climate change is well-established. We know how climate changes and what's is mostly causing current change

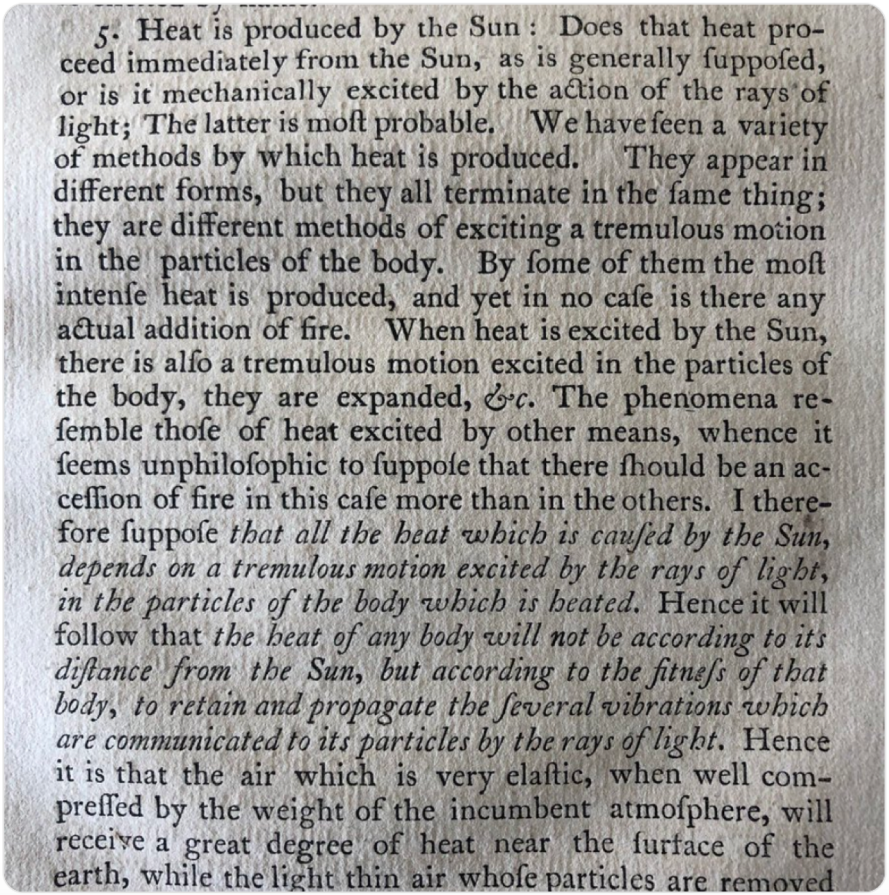
Planet
E

In most general terms, the Earth's temperature is determined by the balance between incoming energy from the sun and the heat it radiates back to space.

CoffeeFueled
@EponymousBreeze

Follow

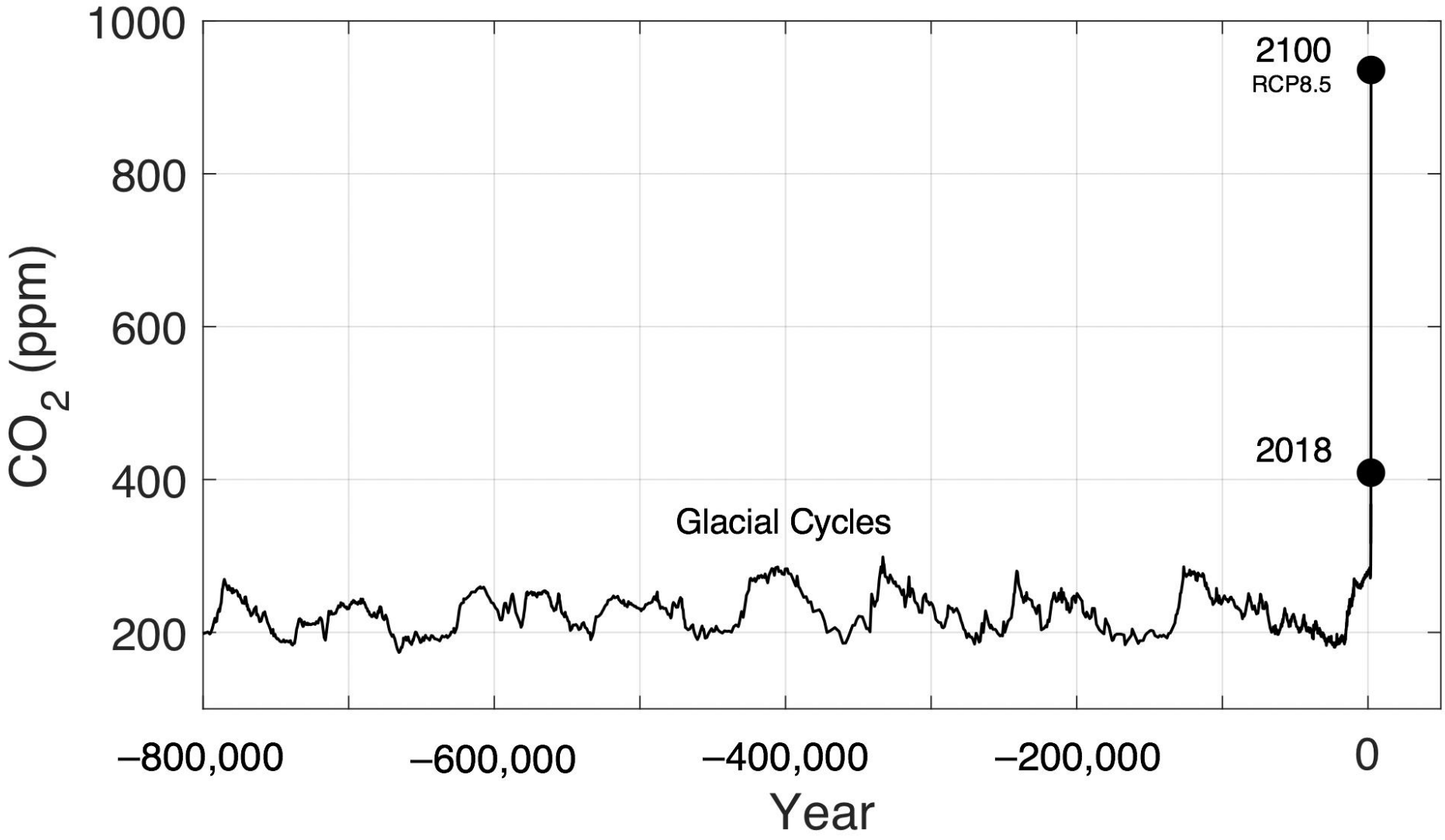
An essay by Hugh Williamson first published in 1771 with an important climate science concept; the heat of a planet is dependent on its atmospheric composition, not just distance from the Sun. A scientist & politician, he was a signatory to the US Constitution. @mtobis @kevpluck



5. Heat is produced by the Sun: Does that heat proceed immediately from the Sun, as is generally ſuppoſed, or is it mechanically excited by the action of the rays of light; The latter is moſt probable. We have ſeen a variety of methods by which heat is produced. They appear in different forms, but they all terminate in the ſame thing; they are different methods of exciting a tremulous motion in the particles of the body. By ſome of them the moſt intenſe heat is produced, and yet in no caſe is there any actual addition of fire. When heat is excited by the Sun, there is alſo a tremulous motion excited in the particles of the body, they are expanded, &c. The phenomena reſemble thoſe of heat excited by other means, whence it ſeems unphiloſophic to ſuppoſe that there ſhould be an acceſſion of fire in this caſe more than in the others. I therefore ſuppoſe *that all the heat which is cauſed by the Sun, depends on a tremulous motion excited by the rays of light, in the particles of the body which is heated.* Hence it will follow that *the heat of any body will not be according to its diſtance from the Sun, but according to the fitneſs of that body, to retain and propagate the ſeveral vibrations which are communicated to its particles by the rays of light.* Hence it is that the air which is very elaſtic, when well compreſſed by the weight of the incumbent atmoſphere, will receive a great degree of heat near the ſurface of the earth, while the light thin air whoſe particles are removed

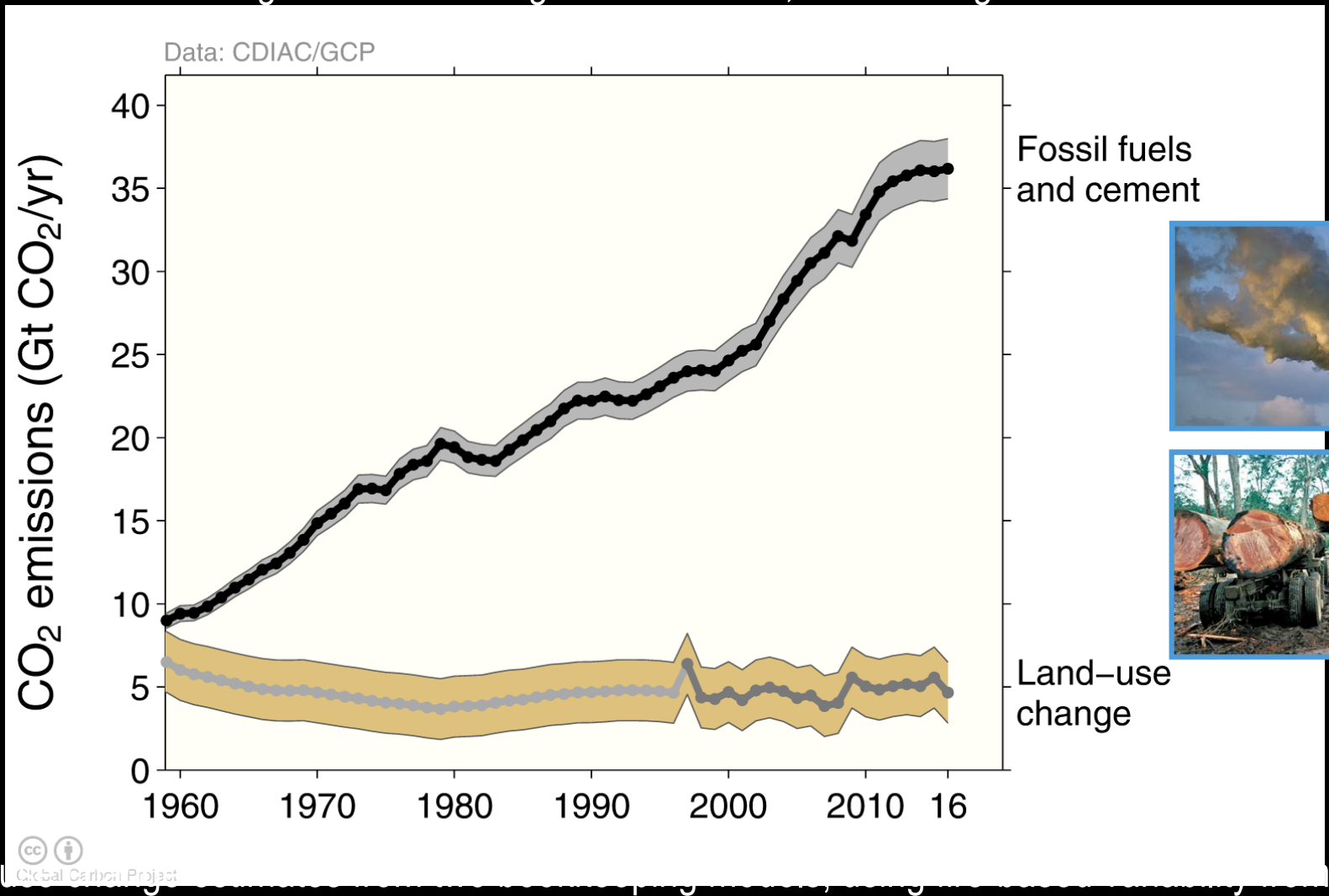

Hotter
What's Really Warming the World?
Skeptics of manmade climate change offer various natural causes to explain why the Earth has warmed 1.4 degrees Fahrenheit since 1880. But can these account for the planet's rising temperature? Watch to see how much different factors, both natural and industrial, contribute to global warming, based on findings from NASA's Goddard Institute for Space Studies.
1880
1880
2014
Colder
Based on an interactive by Bloomberg

Bloomberg


1000
800
600
400
200
CO_2 (ppm)
2100
RCP8.5
2018
Glacial Cycles
–800,000
–600,000
–400,000
–200,000
0
Year

Total global emissions

Total global emissions: 40.8 ± 2.7 $GtCO_2$ in 2016, 52% over 1990
Percentage land-use change: 42% in 1960, 12% averaged 2007-2016

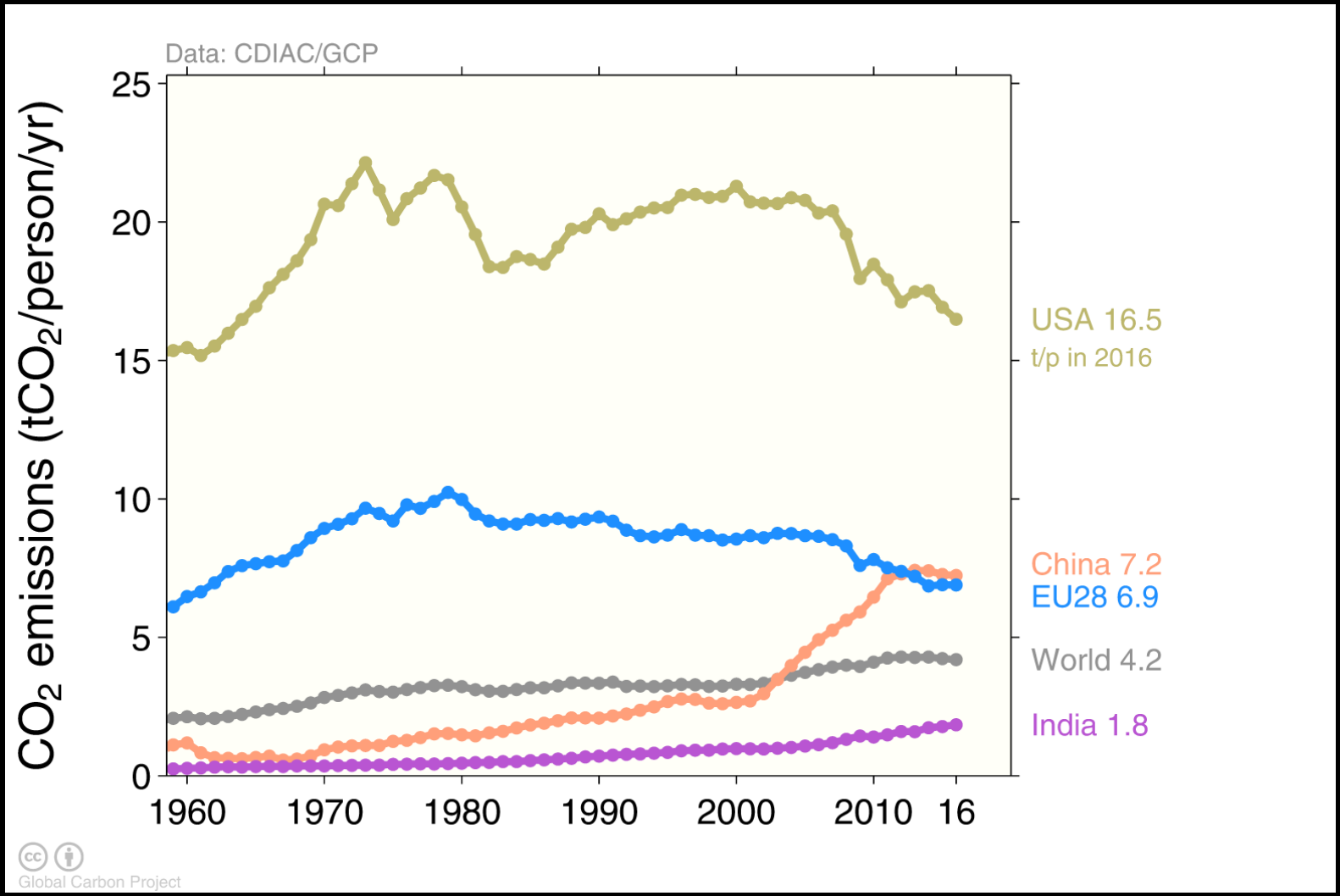


Land-use change emissions have [illegible] 1997

Source: CDIAC; Houghton and Nassikas 2017; Hansis et al 2015; van der Werf et al. 2017; Le Quéré et al 2017; Global Carbon Budget 2017

Top emitters: fossil fuels and industry (per capita)

Countries have a broad range of per capita emissions reflecting their national circumstances

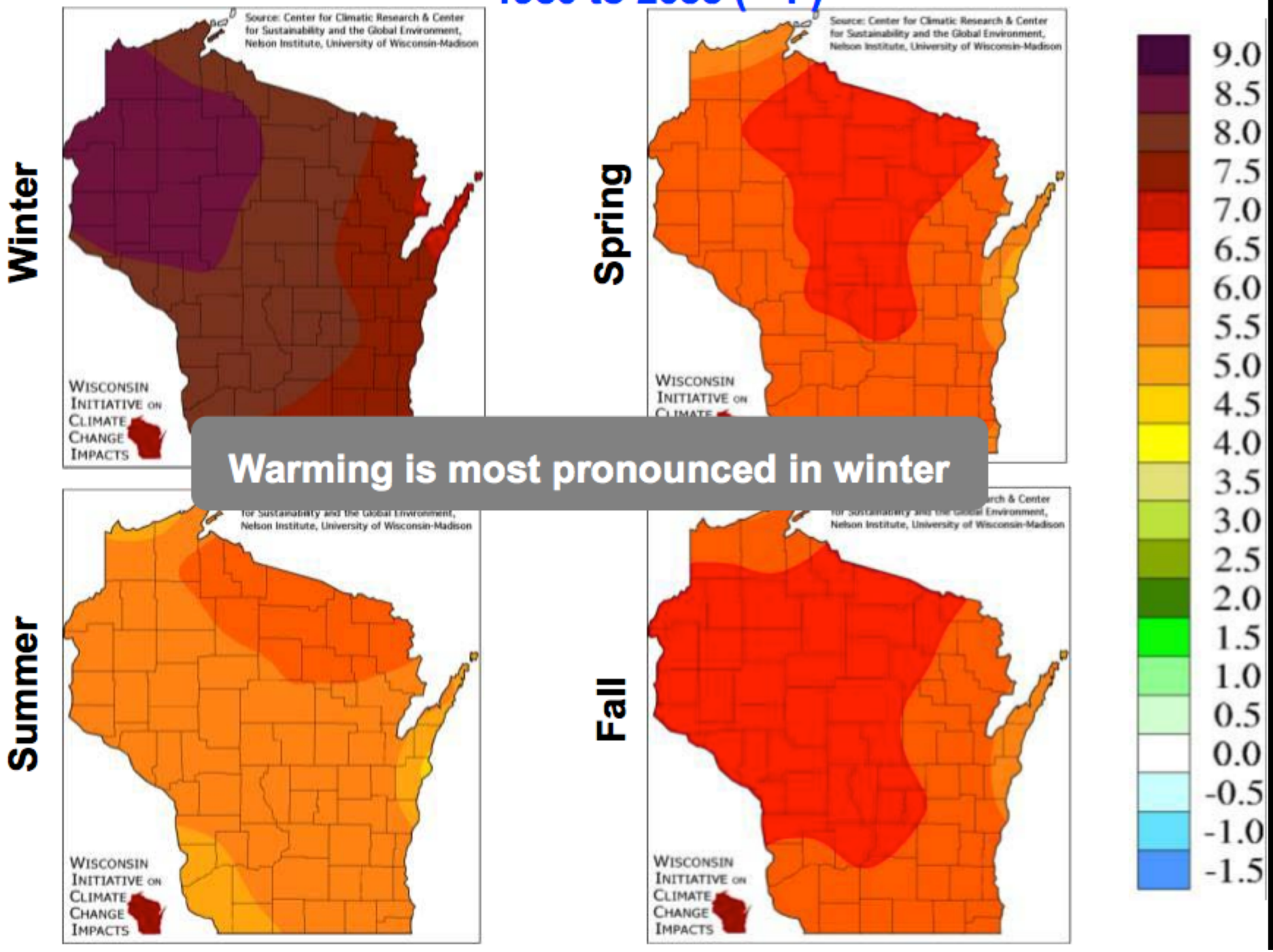


Source: CDIAC; Le Quéré et al 2017; Global Carbon Budget 2017

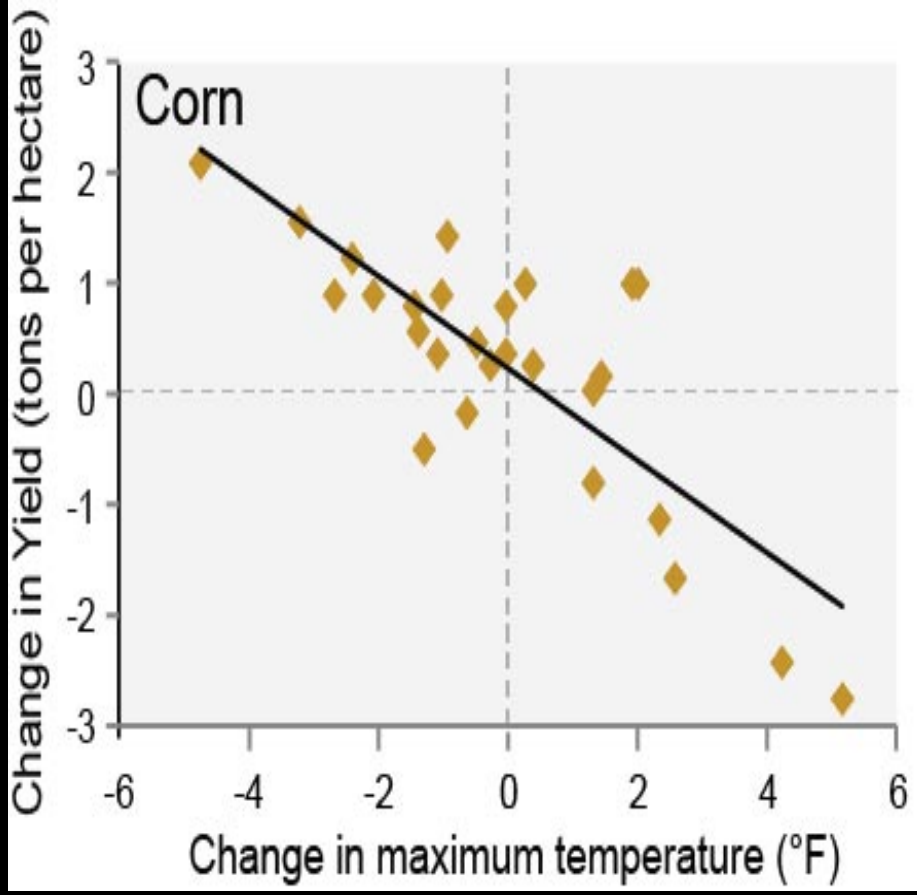
So what’s the big deal?

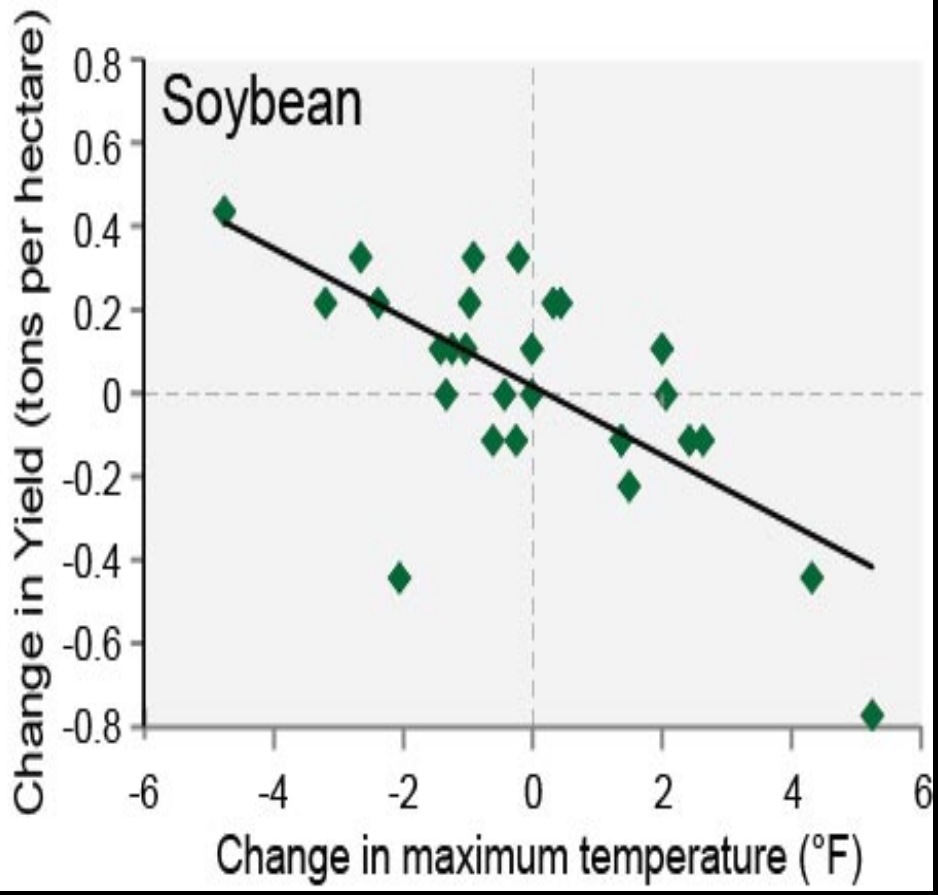
Projected Change in Seasonal Temperatures

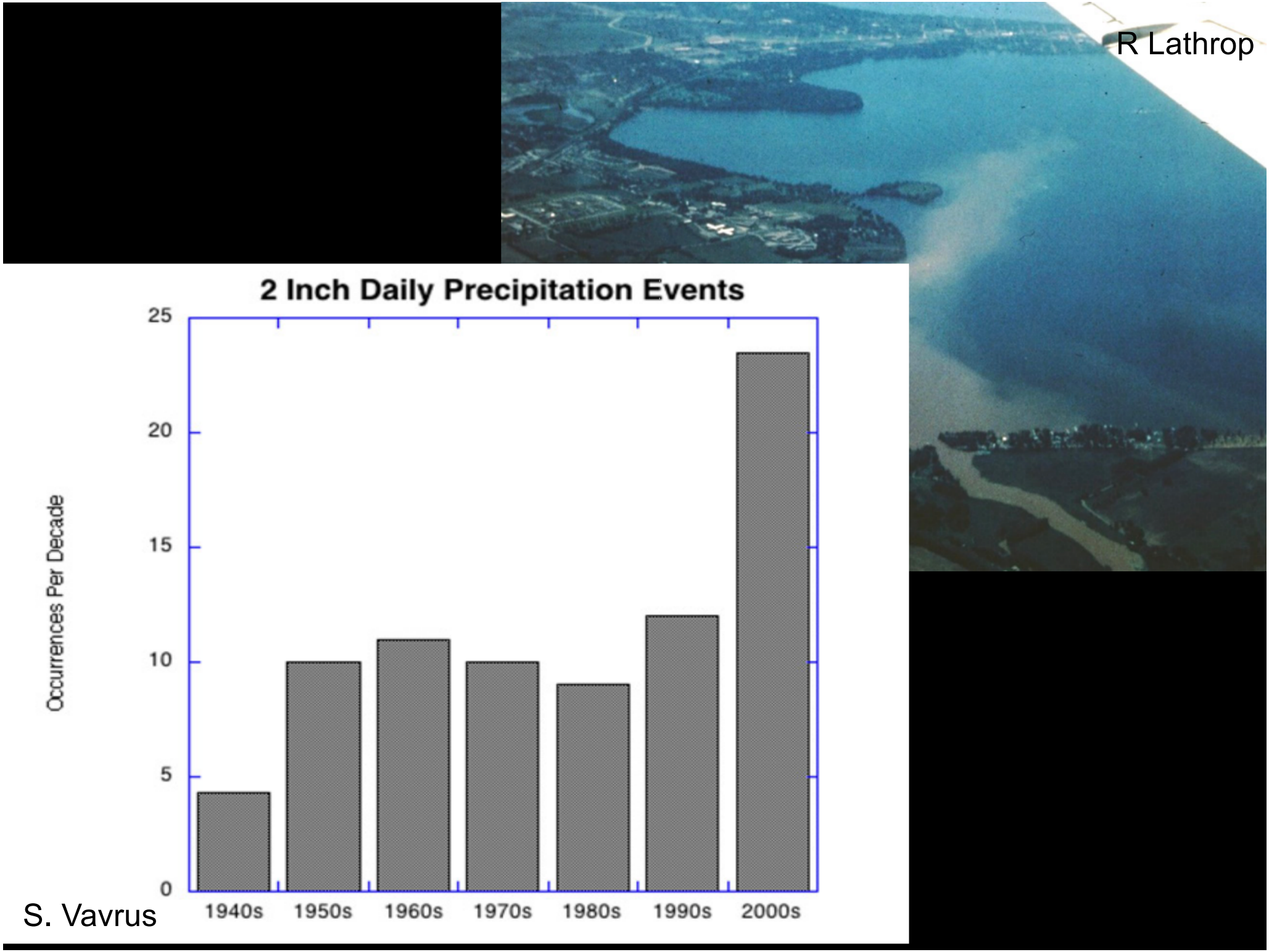
1980 to 2055 (° F)



Crop Yields Decline under Higher Temperatures





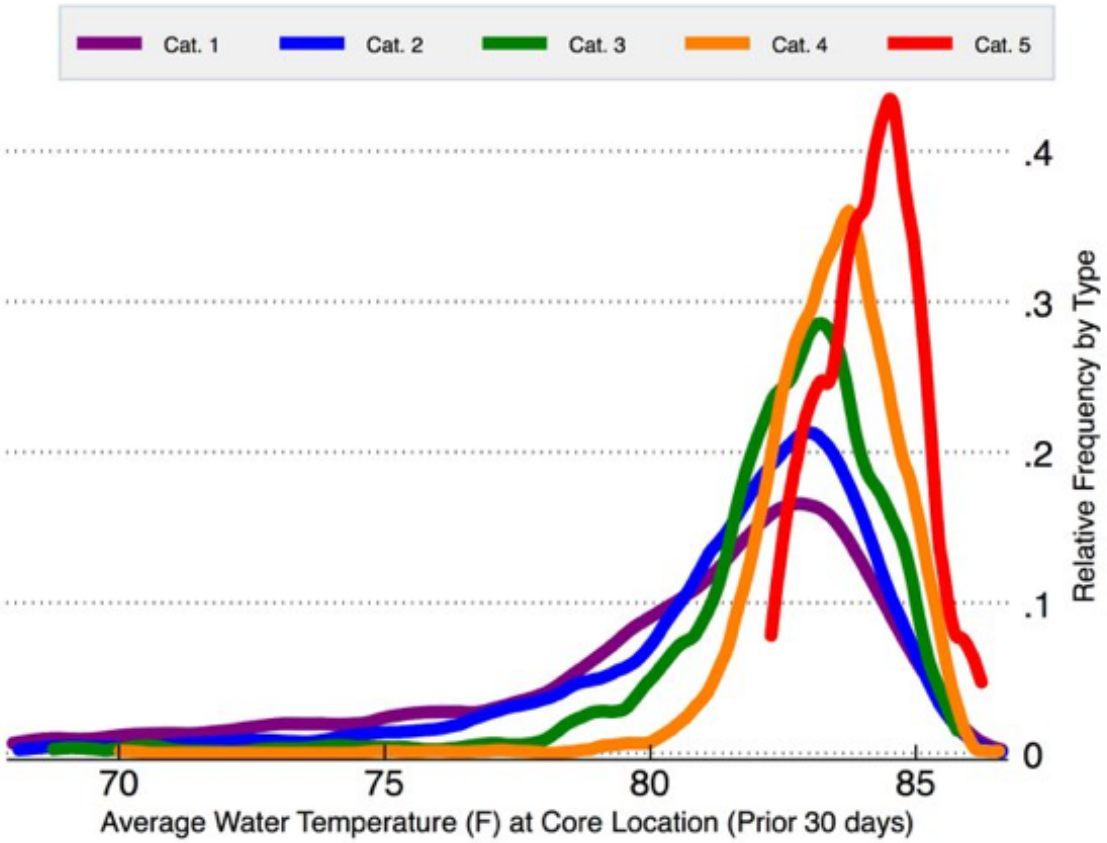

R Lathrop
2 Inch Daily Precipitation Events
Occurrences Per Decade
0
5
10
15
20
25
1940s
1950s
1960s
1970s
1980s
1990s
2000s
S. Vavrus

Sea level rise since 1880

@kevpluck
PixelMoversAndMakers.com

1881

Hurricane Strength and Ocean Temperatures



Kernal density functions of SSTs by hurricane category. Area under each curve represents 100% of hurricanes of that type. Hurricane wind speeds via HURDAT.

Why aren’t we doing something about it then?

So what do you do about climate change?

- Denialism is a normal doomsday response
- So is alarmism. Trying an “all of the above” solution is paralyzing
- But, there are some levers we know work:
  - Rethinking agriculture
  - Reducing deforestation
  - Expanding our energy choices
  - Providing incentives to change

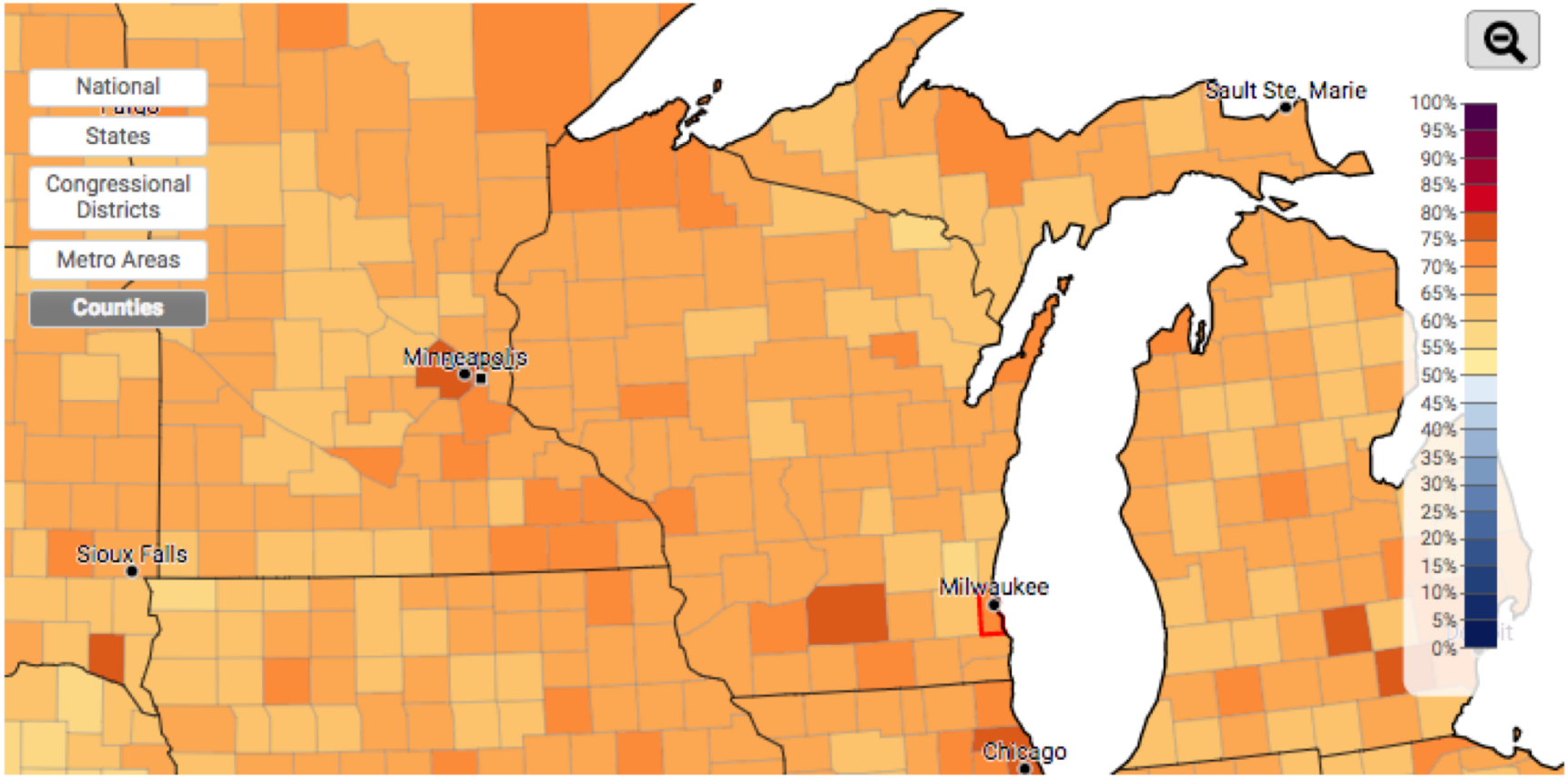
We do and believe like our neighbors

- Or at least, what we think are neighbors do and believe…

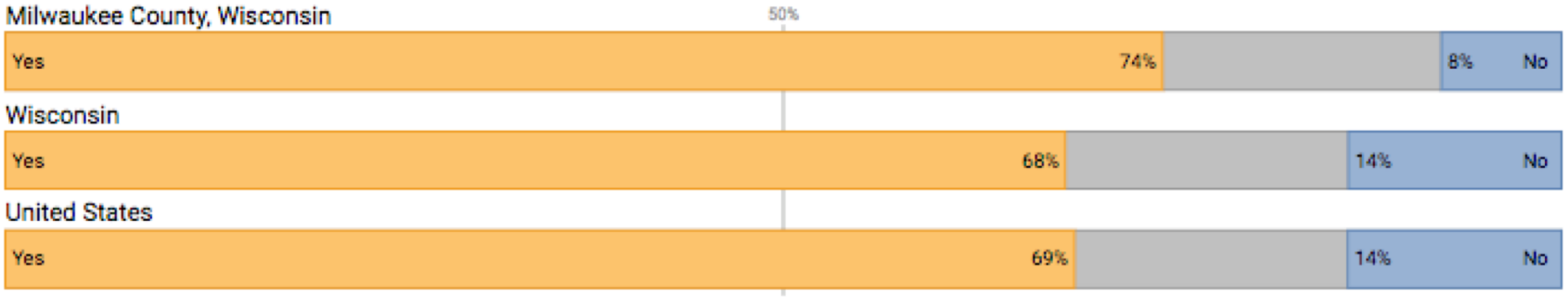
Estimated % of adults who think global warming is happening, 2016

Display model output: Global warming is happening | Absolute Value | Permalink

Click on map to select geography, or: Wisconsin | Milwaukee County, Wisconsin | Un-Select



Tweet 9 Like



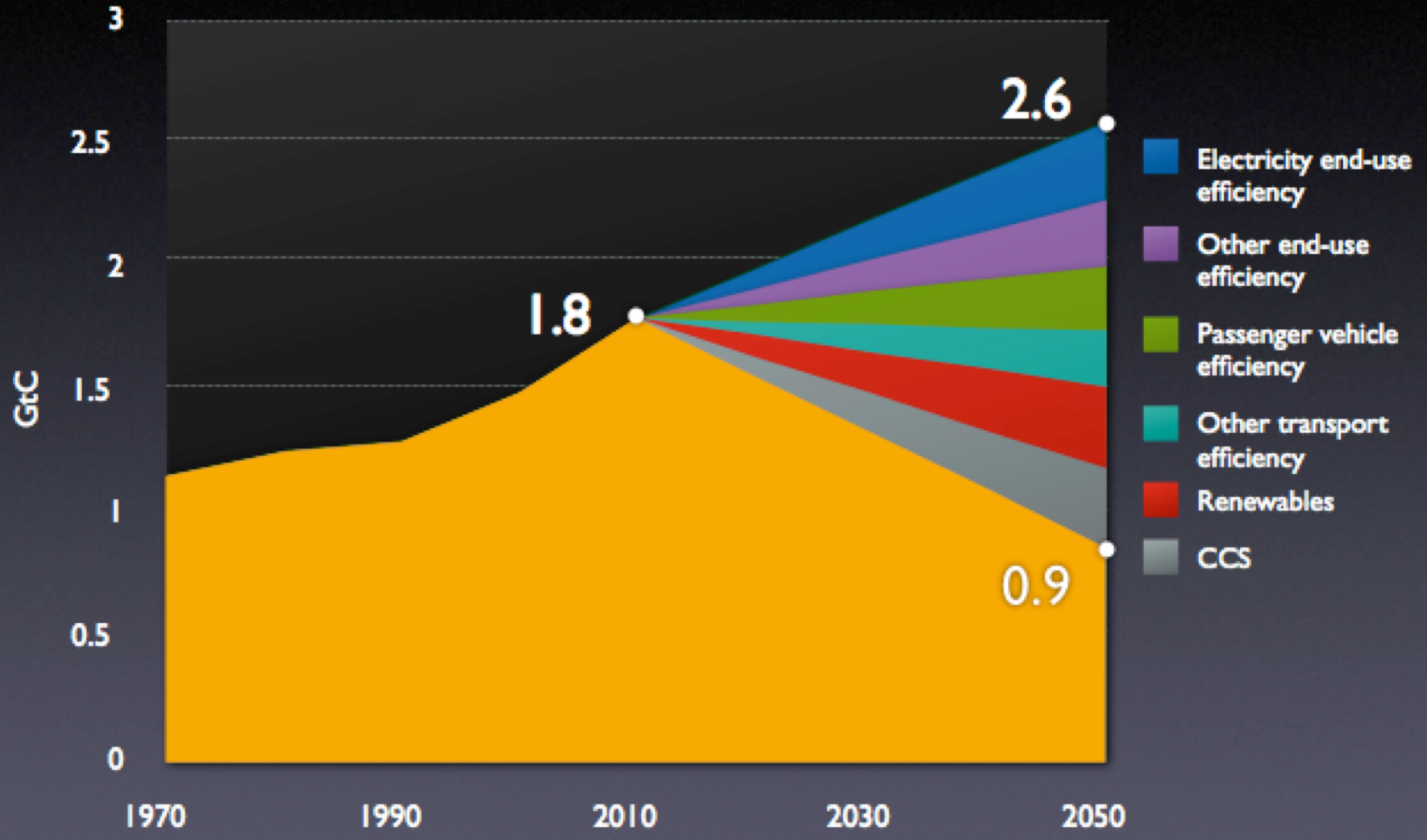
Community standards can change

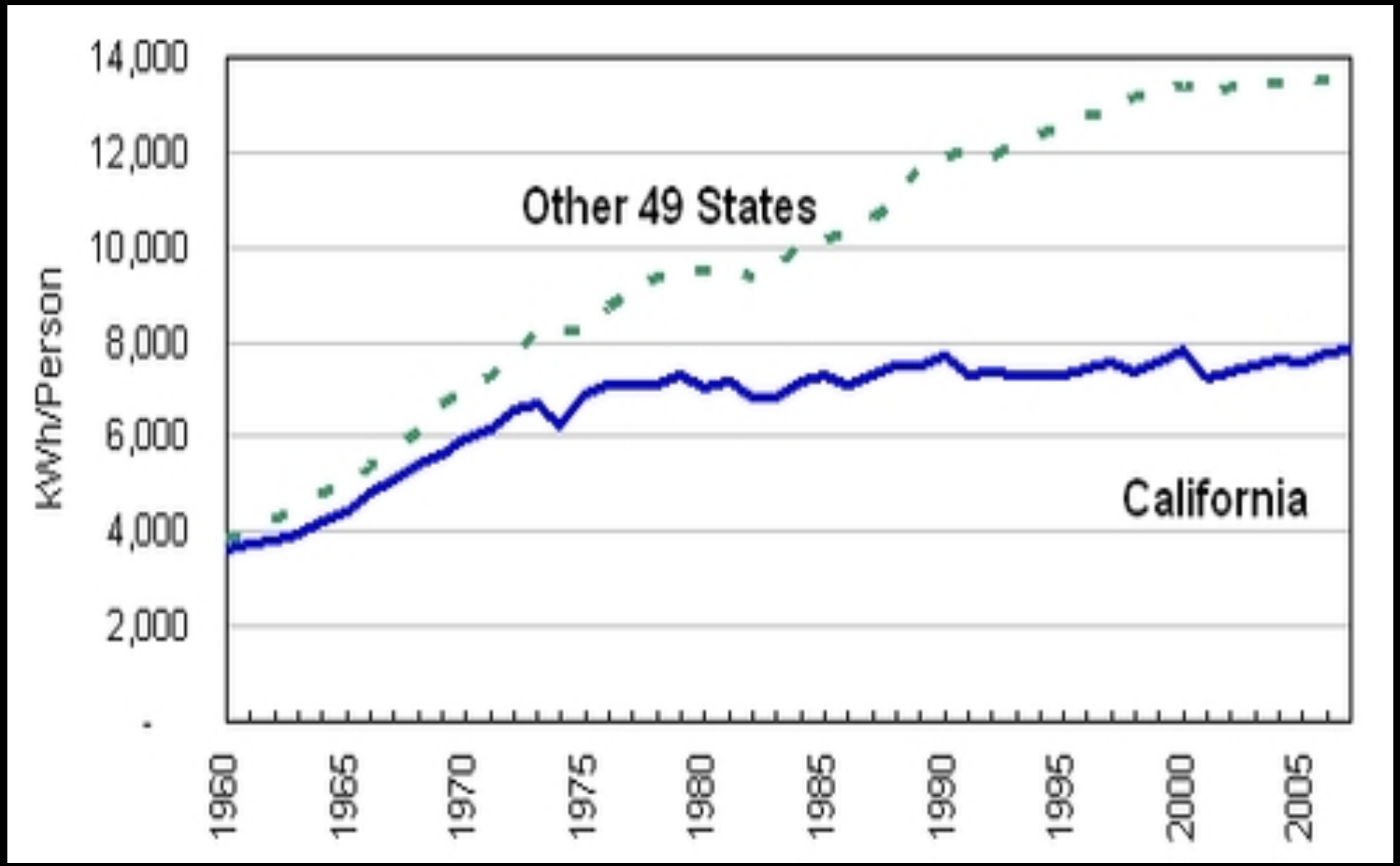
- Education and generational change
  - Recycling
- Regulation
  - Acid rain
- Innovation
  - The Ozone Hole

U.S. Emissions

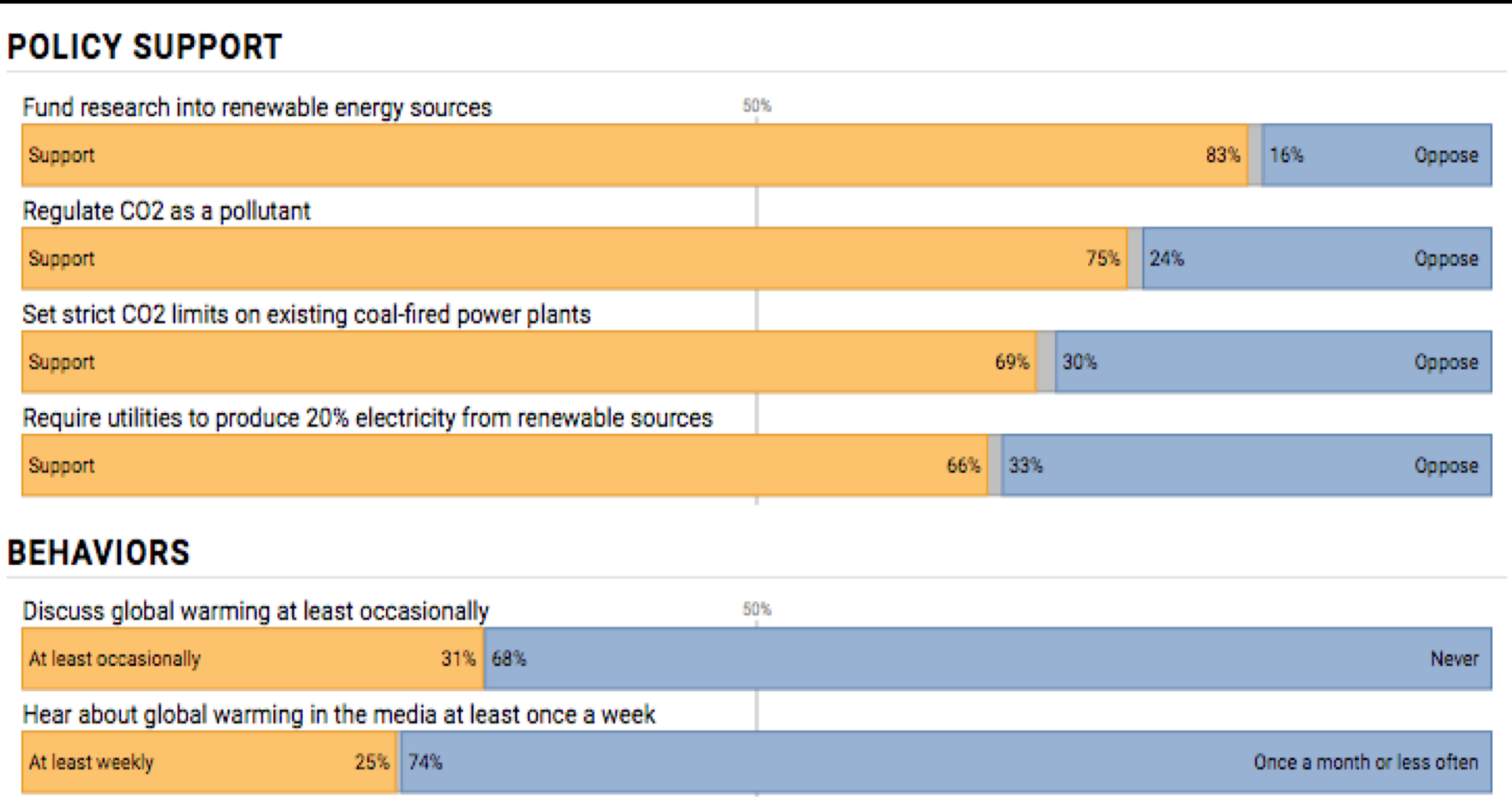
After Pacala and Socolow, 2004;
ARI CarBen3 Spreadsheet

- Carbon Capture & Storage

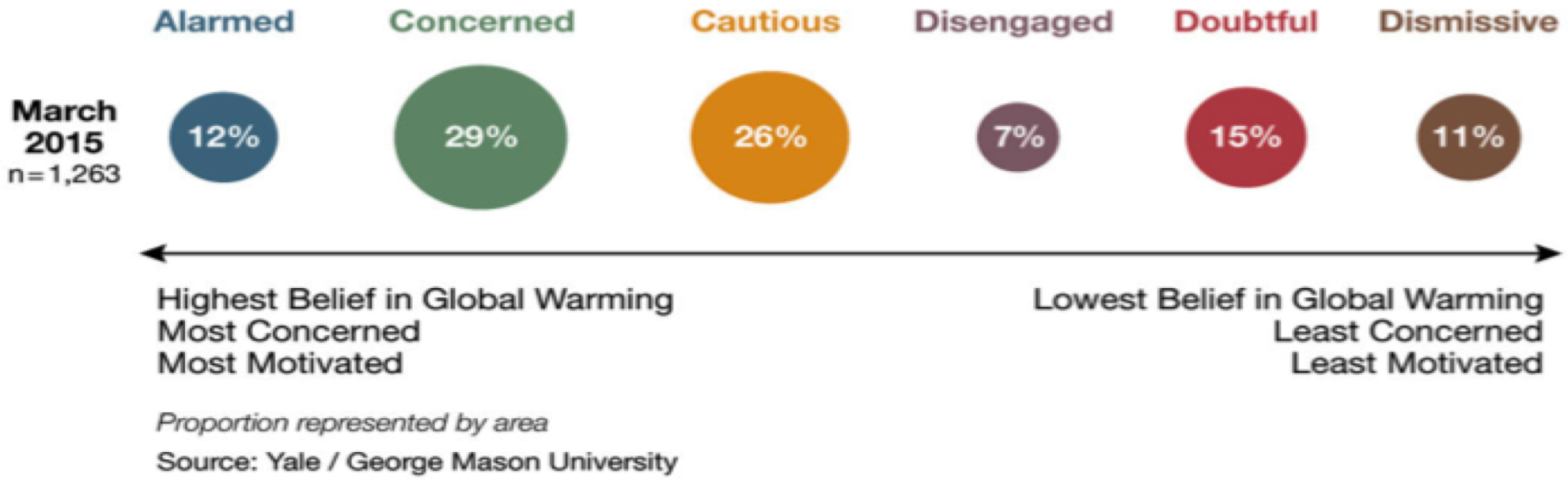


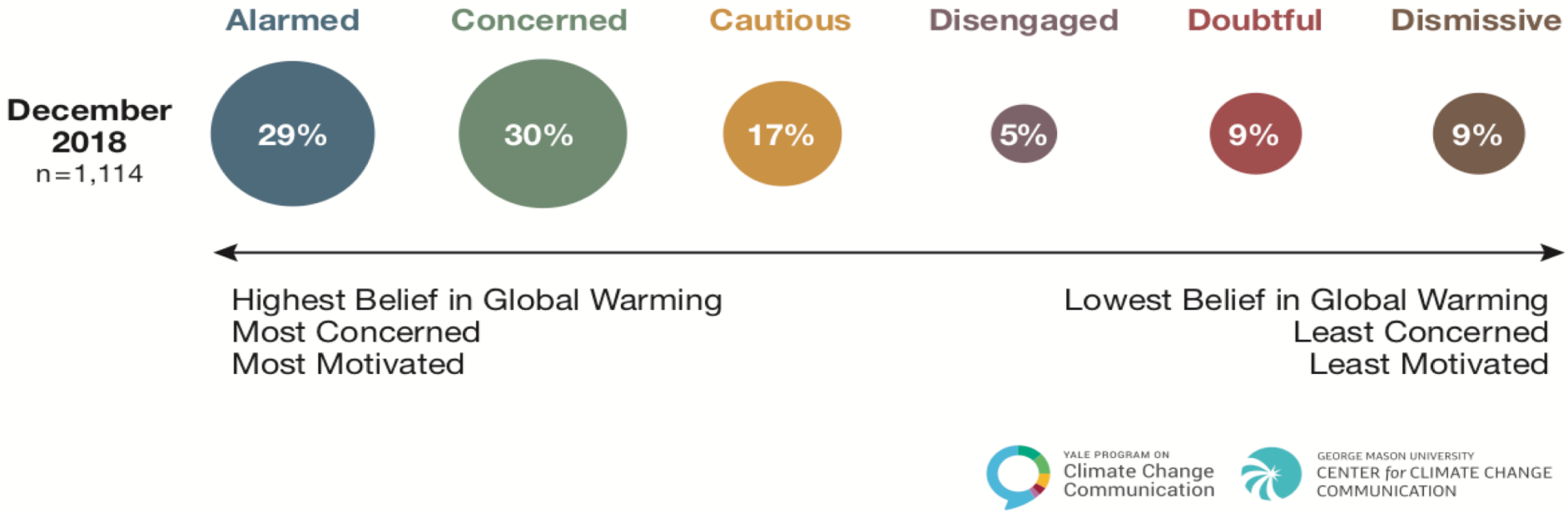

14,000
12,000
10,000
8,000
6,000
4,000
2,000
-
KWh/Person
Other 49 States
California
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005

There is support for policy



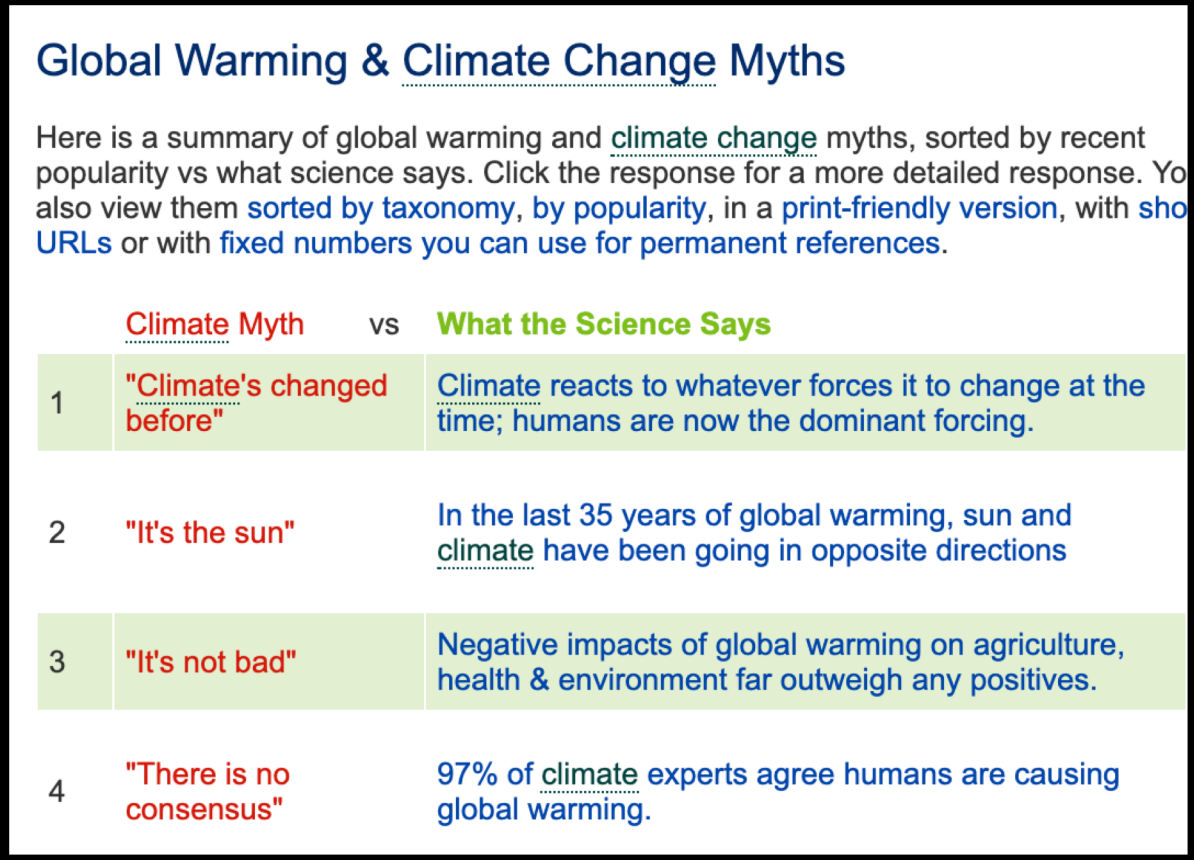
http://climatecommunication.yale.edu/visualizations-data/ycom-us-2016/


Alarmed
Concerned
Cautious
Disengaged
Doubtful
Dismissive
March 2015
n=1,263
12%
29%
26%
7%
15%
11%
Highest Belief in Global Warming
Most Concerned
Most Motivated
Lowest Belief in Global Warming
Least Concerned
Least Motivated
Proportion represented by area
Source: Yale / George Mason University


Alarmed
Concerned
Cautious
Disengaged
Doubtful
Dismissive
December 2018
n=1,114
29%
30%
17%
5%
9%
9%
Highest Belief in Global Warming
Most Concerned
Most Motivated
Lowest Belief in Global Warming
Least Concerned
Least Motivated
YALE PROGRAM ON
Climate Change
Communication
GEORGE MASON UNIVERSITY
CENTER for CLIMATE CHANGE
COMMUNICATION

Places to find good counter-arguments and solutions

- https://skepticalscience.com/argument.php



Global Warming & Climate Change Myths

Here is a summary of global warming and climate change myths, sorted by recent popularity vs what science says. Click the response for a more detailed response. Yo also view them sorted by taxonomy, by popularity, in a print-friendly version, with sho URLs or with fixed numbers you can use for permanent references.

	Climate Myth	vs	What the Science Says
1	"Climate's changed before"		Climate reacts to whatever forces it to change at the time; humans are now the dominant forcing.
2	"It's the sun"		In the last 35 years of global warming, sun and climate have been going in opposite directions
3	"It's not bad"		Negative impacts of global warming on agriculture, health & environment far outweigh any positives.
4	"There is no consensus"		97% of climate experts agree humans are causing global warming.

Places to find good counter-arguments and solutions

- https://www.drawdown.org/solutions

Solutions by Rank

Rank	Solution	Sector	TOTAL ATMOSPHERIC CO2-EQ REDUCTION (GT)	NET COST (BILLIONS US $)	SAVINGS (BILLIONS US $)
1	Refrigerant Management	Materials	89.74	N/A	$-902.77
2	Wind Turbines (Onshore)	Electricity Generation	84.60	$1,225.37	$7,425.00
3	Reduced Food Waste	Food	70.53	N/A	N/A
4	Plant-Rich Diet	Food	66.11	N/A	N/A
5	Tropical Forests	Land Use	61.23	N/A	N/A
6	Educating Girls	Women and Girls	51.48	N/A	N/A
7	Family Planning	Women and Girls	51.48	N/A	N/A
8	Solar Farms	Electricity Generation	36.90	$-80.60	$5,023.84
9	Silvopasture	Food	31.19	$41.59	$699.37
10	Rooftop Solar	Electricity Generation	24.60	$453.14	$3,457.63

SEE ALL SOLUTIONS BY RANK

A caveat

- Do not argue entirely from “facts”
- Psychological studies (see work by Dan Kahan at Yale) show arguing from fact alone on controversial topics tends to cause people to reinforce their pre-existing belief (abortion, evolution, gun control, climate change, etc…)
- People are more likely to trust you if you first demonstrate shared values and interest in learning from each other

- “Higher temperatures and less-predictable weather would hurt poor farmers […] It would be a terrible injustice to let climate change undo any of the past half-century’s progress against poverty and disease—and doubly unfair because the people who will be hurt the most are the ones doing the least to cause the problem.”

Linkedin.com

Let’s play again

- This time use arguments from skepticalscience, drawdown, or elsewhere to craft your response
- Consider how you introduce yourself and which climate concern category your person falls into and how that influences your response
- What questions might you ask this person?

Thanks!

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