



Lecture 1: ***Post Election Status,*** ***Issues, and Concerns***

Learners: Climate Redux

February 5, 2021

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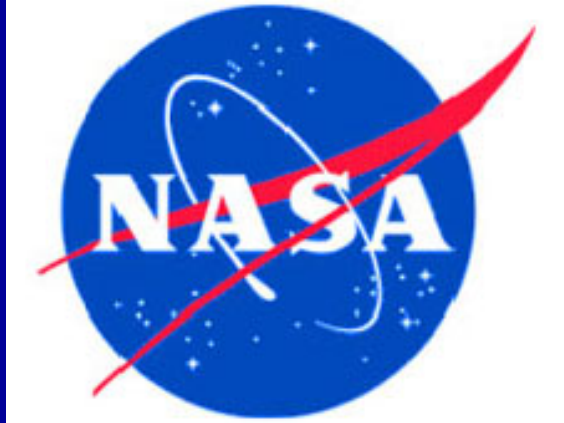
JFOrmes@gmail.com

Stanford University

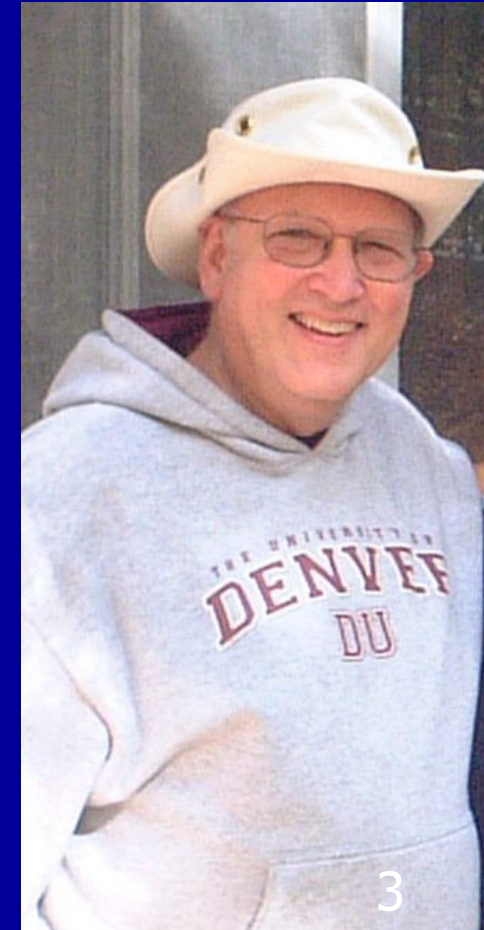
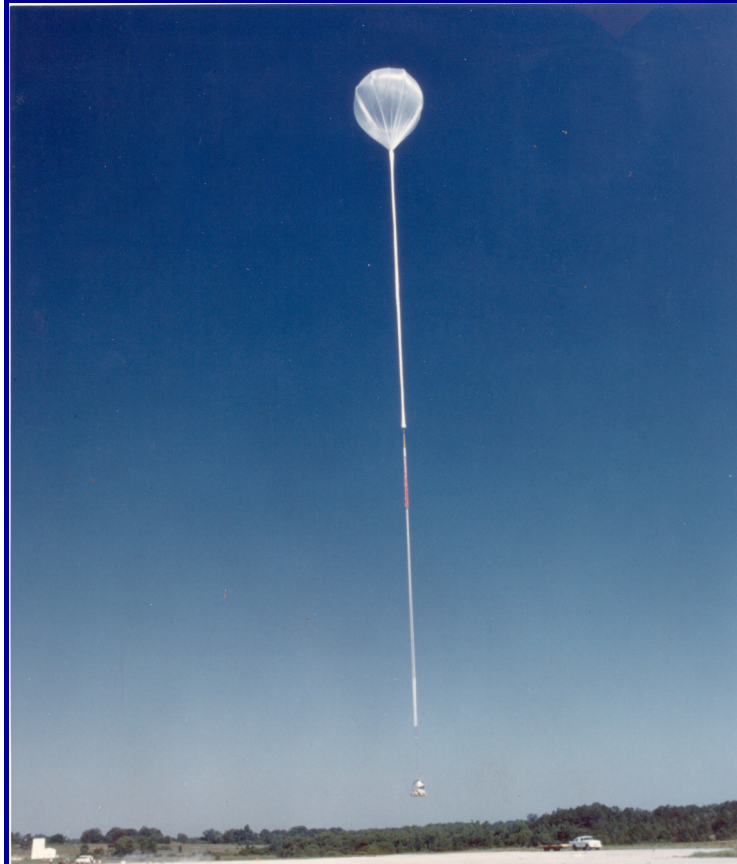


 UNIVERSITY OF MINNESOTA

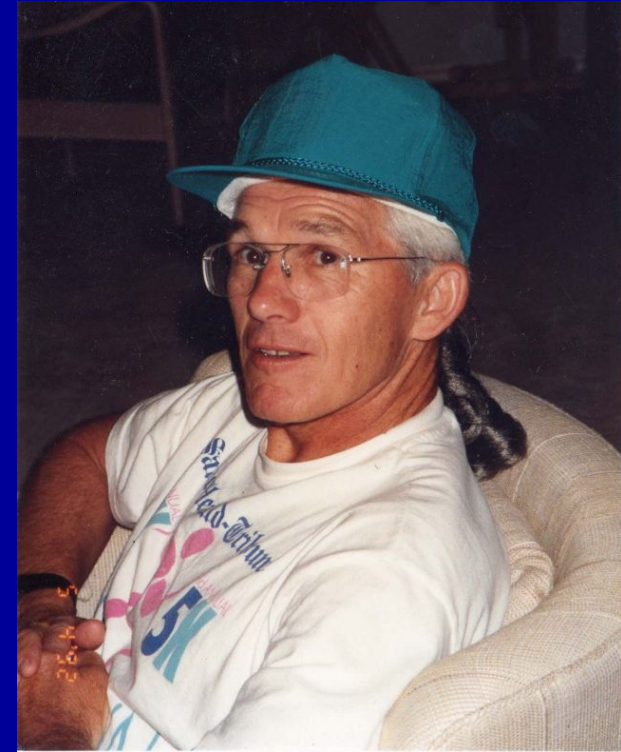




Director of Space Sciences 2000-2004



Thanks to
George E Ulrich
for his help,
especially with zoom



If you have problems with zoom,
call him at (941) 544-0485
Email him at geulrich@gmail.com

Announcement

Presentation slides and handouts can be downloaded from
my public Web site at DU:

Go to: <http://portfolio.du.edu/>
Add: <http://portfolio.du.edu/OurClimate>

The site is public.
You do not need to create an account.

Lectures will be posted at the bottom of column 1 under the label
Climate Redux

Today's class

- The problem
- What this class will cover
- What the Biden Administration is doing

We aren't supposed to be doing this. Normally we pay to dispose of our sewage properly.



We are spewing 152 million tons of manmade global warming pollution into the thin shell of our atmosphere every 24 hours — as if it were an open sewer — and there are no discharge fees.



Evolution of wording

- Global warming
- Climate change
- Climate crisis
 - Existential threat

Existential
“has to do with human existence”

So now it is being said
“Global warming represents
a threat to human existence”

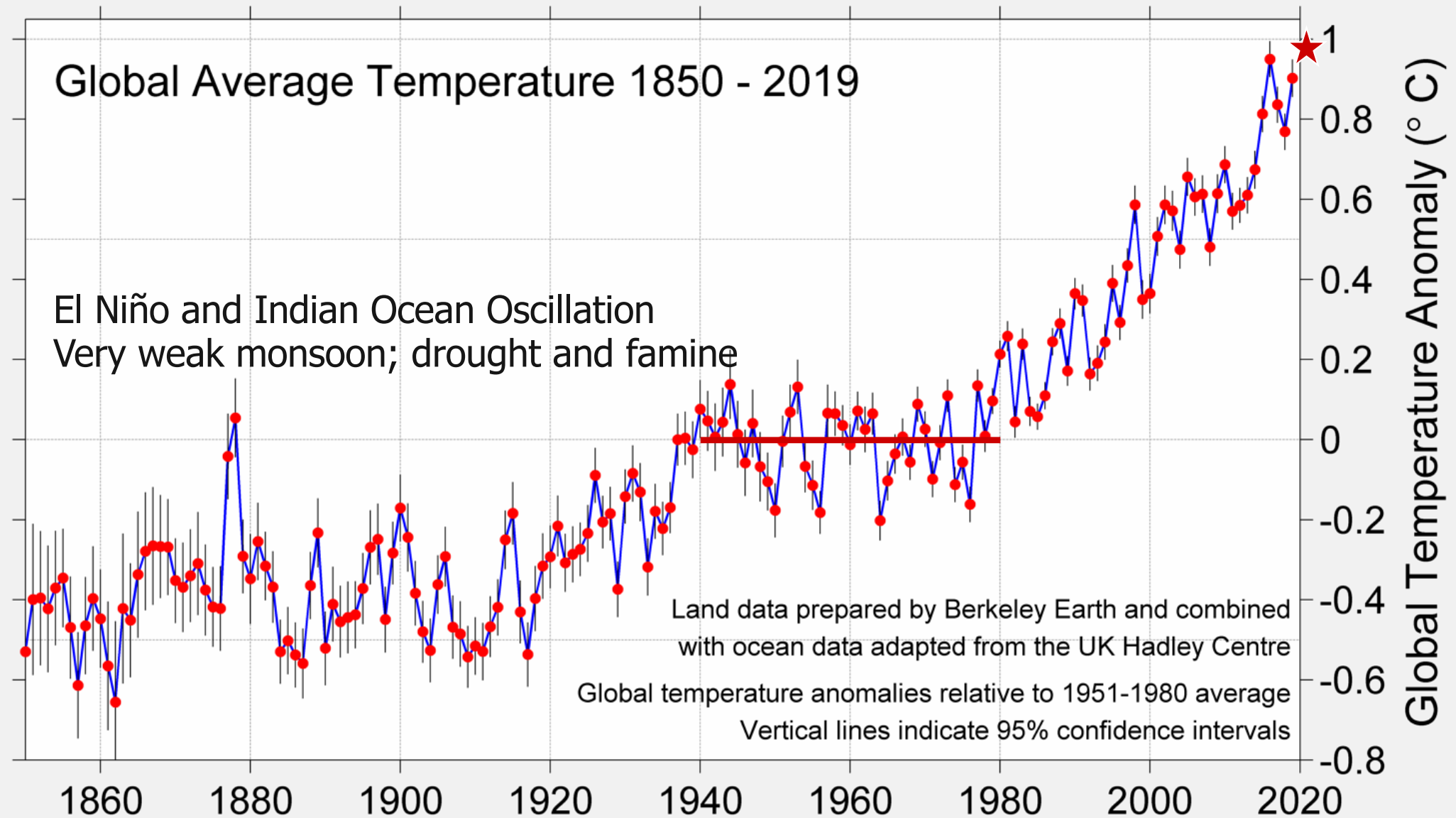




Discussion ground rules

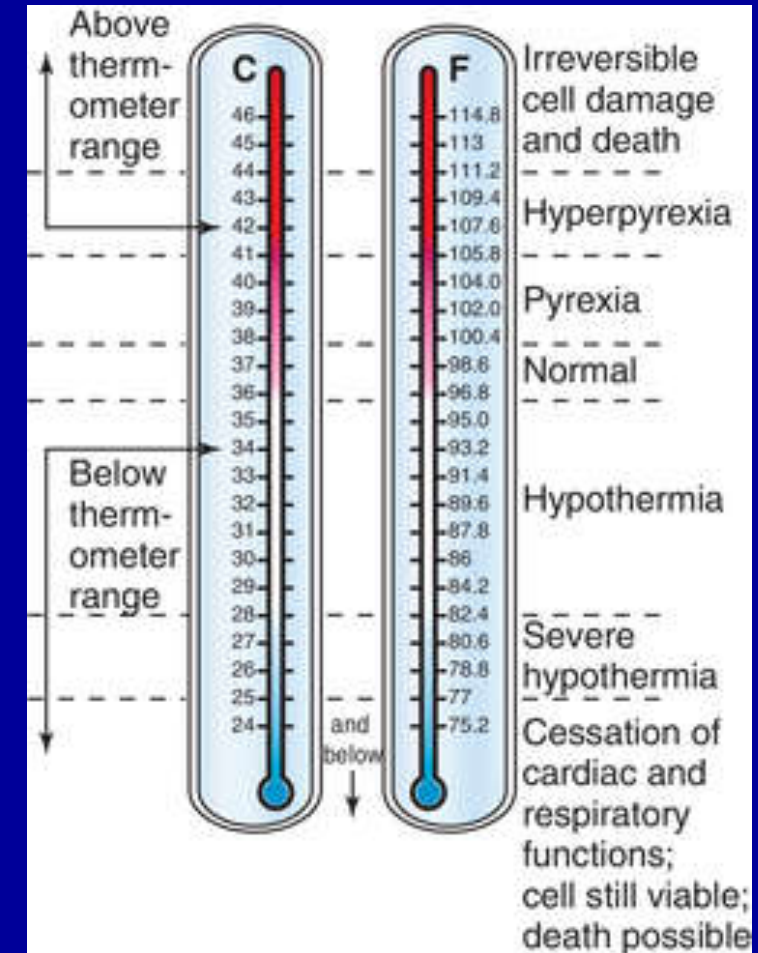
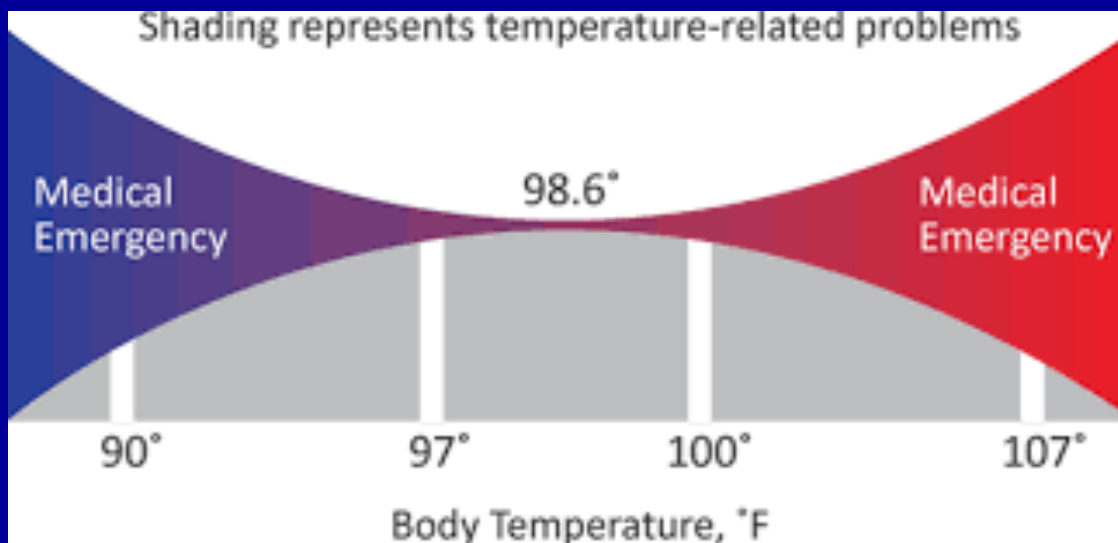
- No ad hominem attacks
 - Me or George
 - Fellow students
- Be respectful of all opinions
- I will do my best to stick to the facts as I know them.
 - Renewal of respect for science
 - Please challenge me if you have alternative facts and we will explore

Global Average Surface Temperature



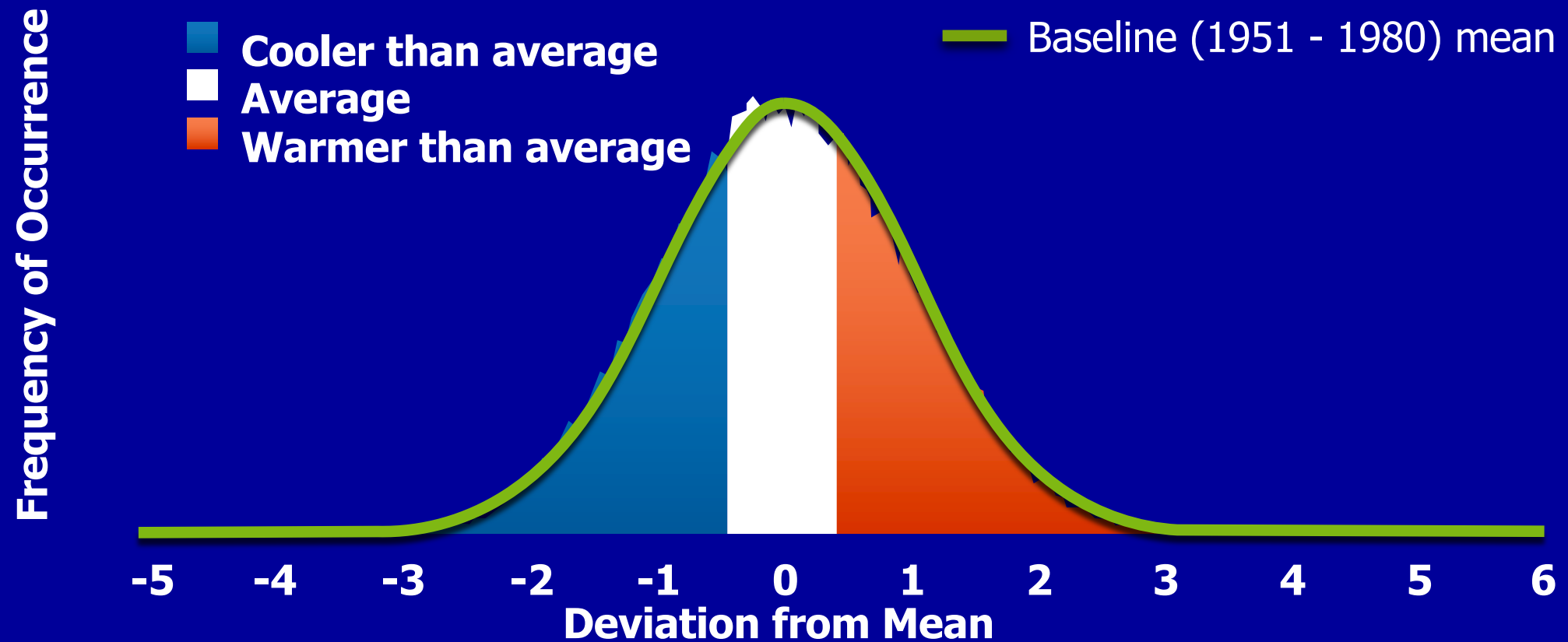
Heat: A danger to human life?

- E.g. Heat wave Europe 2003
- health crises; death toll 70,000
 - heat
 - crop failures/drought
- Among most lethal weather



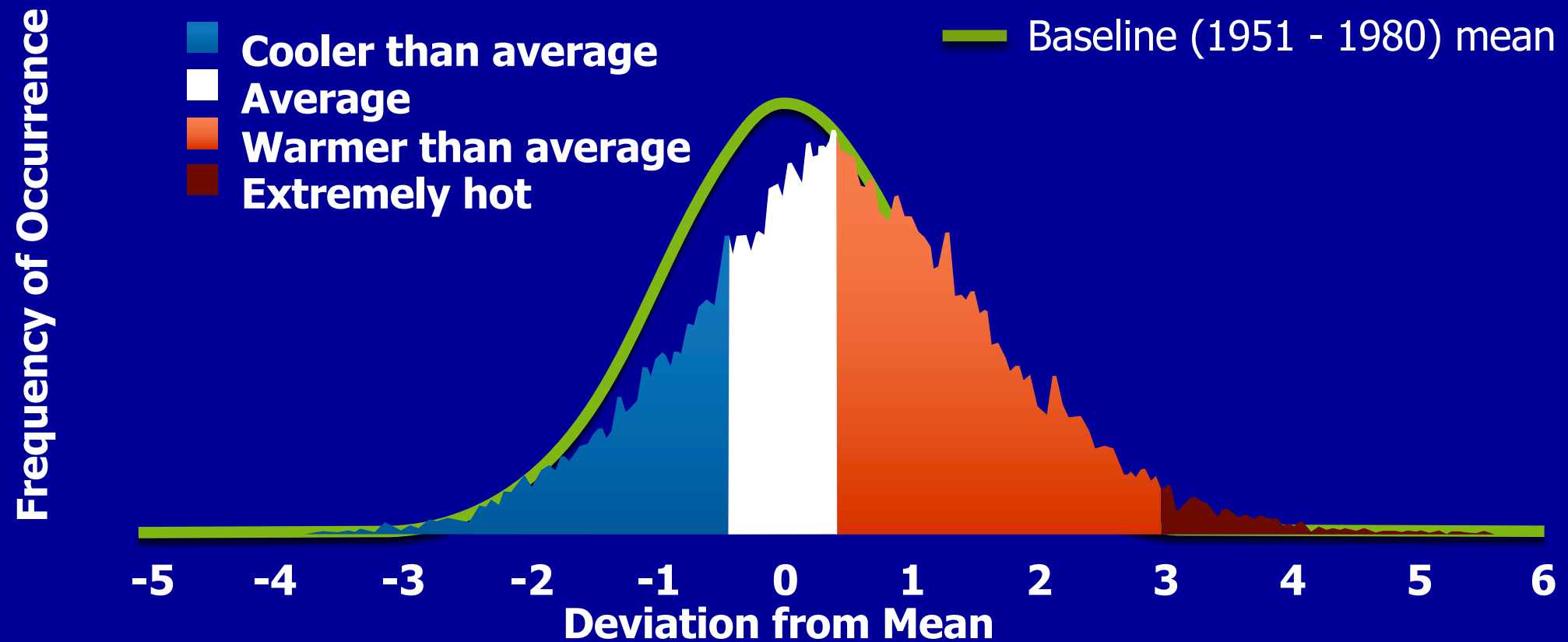
Summer Temperatures Have Shifted

- 1951 – 1980



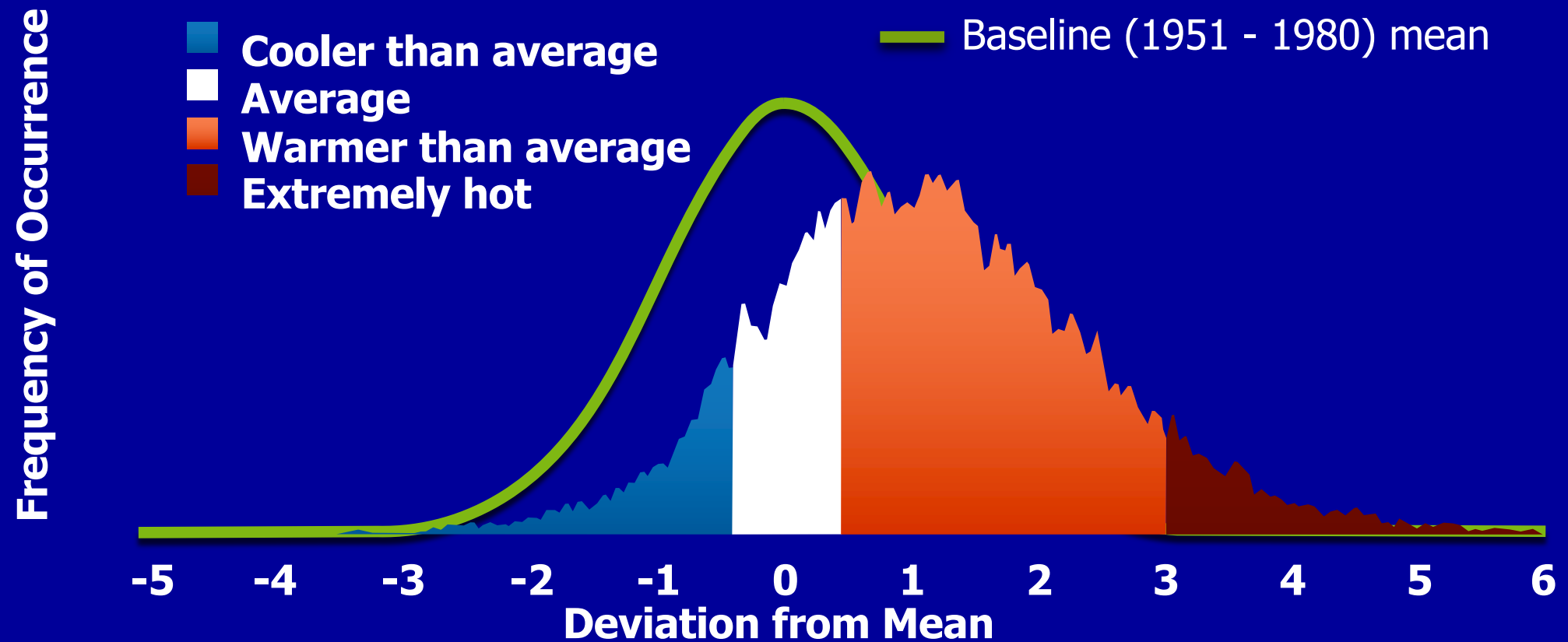
Summer Temperatures Have Shifted

- 1983 – 1993



Summer Temperatures Have Shifted

- 1994 – 2004



Middle east temperatures occasionally reach into the 120°Fs.

Northern Kuwait reached 126°F (52.2°C) on June 8, 2019.

Jacobabad, Lahore, Pakistan reached 124°F (51.1°C) on 2 June 2021.

Northern India reached 123°F (50.6°C) on 2 June 2021.

People become desperate for cooling water.



Storms, droughts, fires & floods

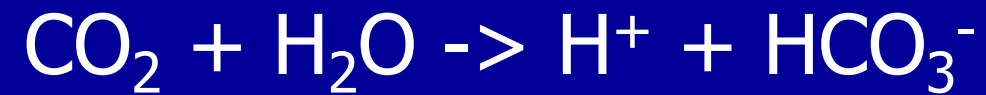


So frequent they don't make the news. Disaster fatigue.

Alpine Flower season is expanded by 1 month



Ocean Acidification

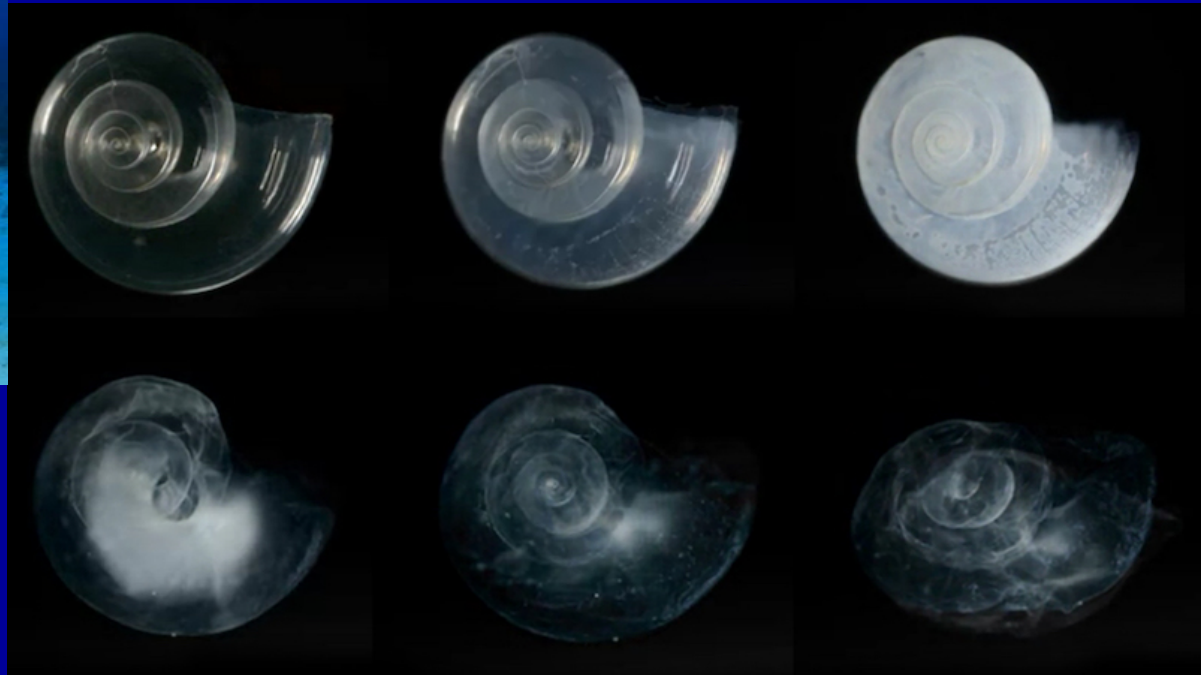


Carbon dioxide and water combine to make a hydrogen ion & carbonic acid ion



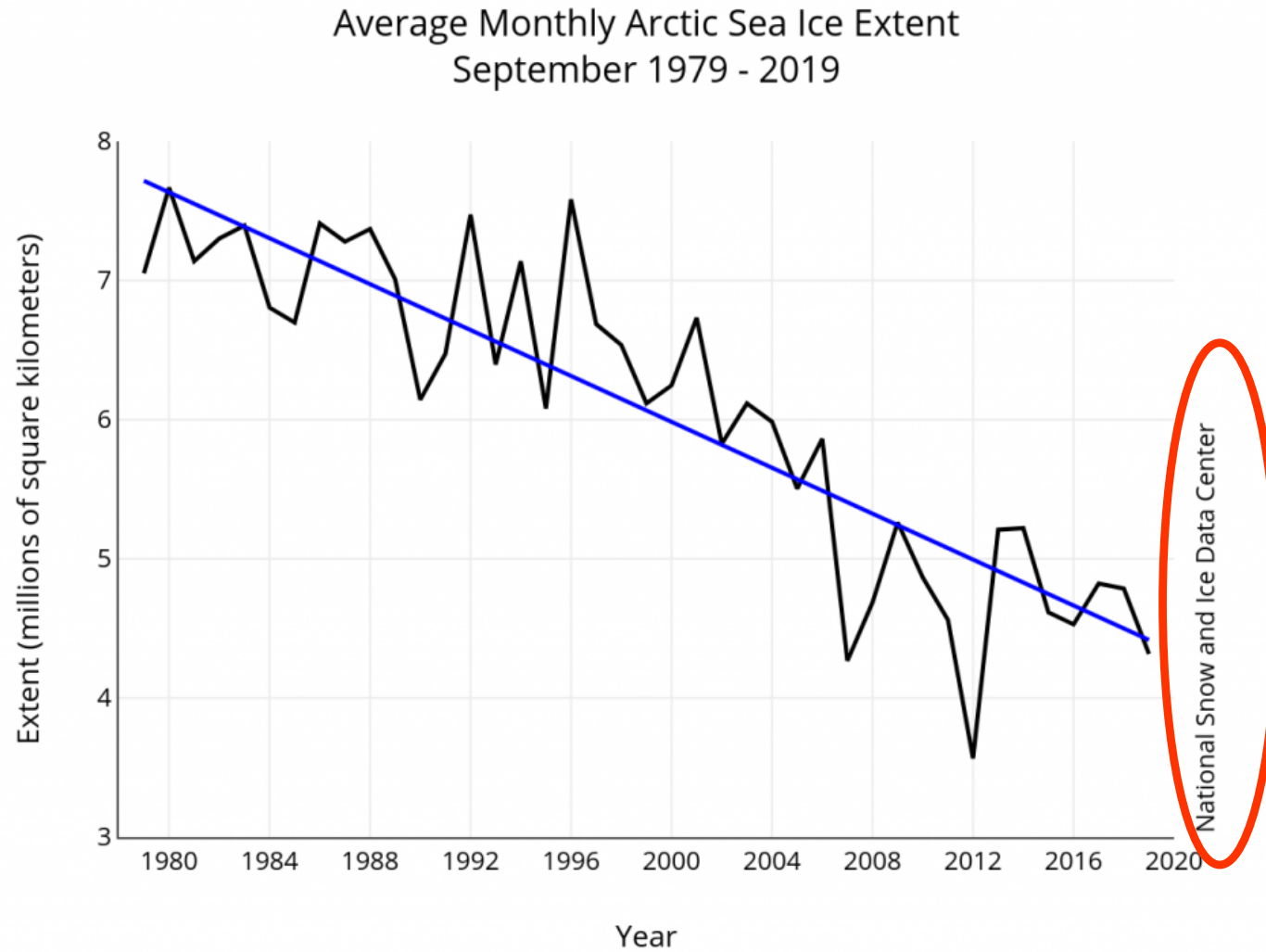
Coral bleaching

Acids dissolve stuff



Shells dissolve

Arctic Sea Ice Extent



Located at the U. of Colorado in Boulder

From climate.nasa.gov

Evidence for climate change

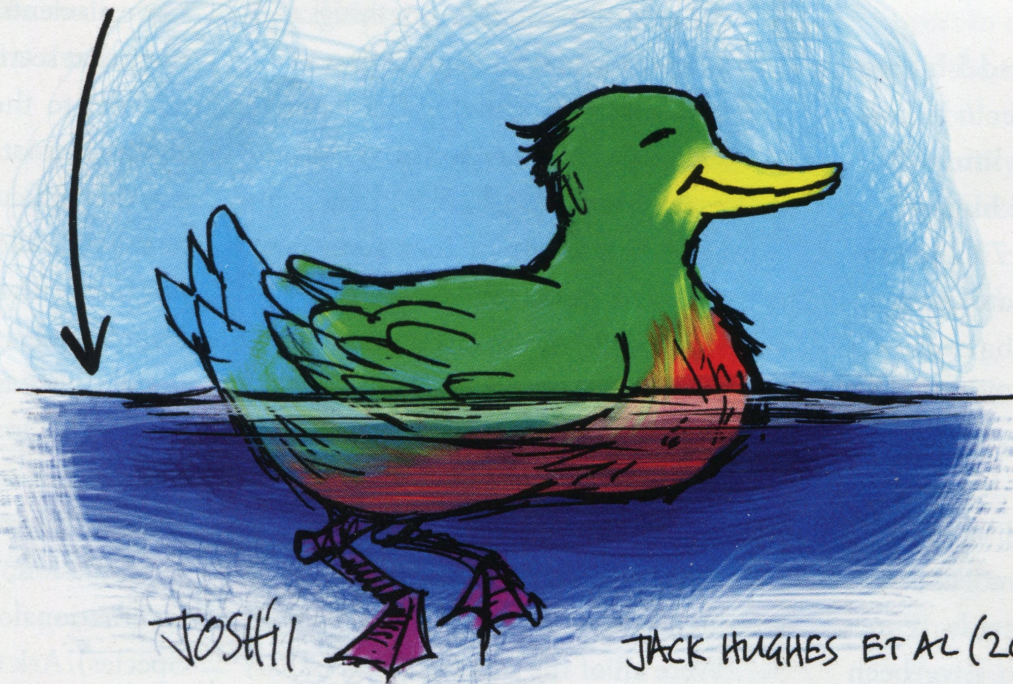
- Global temperature rise
- Oceans warming and acidifying
- Shrinking Ice Sheets (Greenland and Antarctica)
- Land glacial retreat
- Sea Level Rise
- Declining Arctic sea ice
- Extreme weather events

These things are happening now; they are not some future threats.

Measuring Sea Level

CONCLUSIVE PROOF OF STABLE SEA LEVELS

STILL ONLY COMES
HALF-WAY UP A DUCK



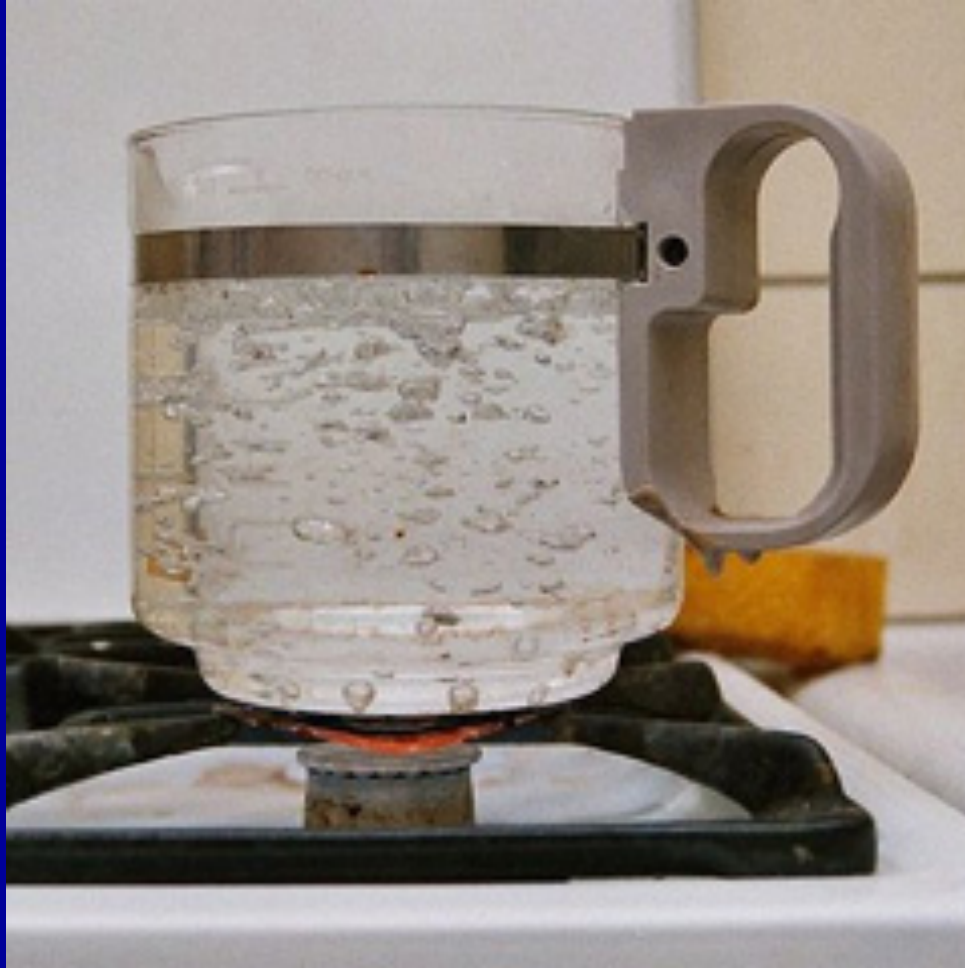
Forests under attack



© 2008 AP Photo/Colorado State Forest Service, Jen Chase

2008 Near Granby, CO

Why worry?

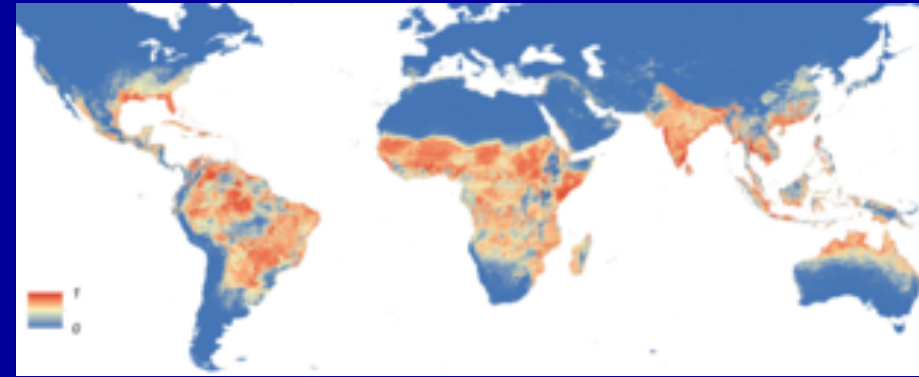


heat -> instability
&
instability -> problems

I'm worried because of
the consequences of the
rapid rise in temperature
on us and especially on
future generations.

Effects of instability

- Fresh water
 - Evaporation
 - Runoff
 - Seasonality
- Forest destruction & loss
- Loss of biodiversity
- Stresses to food production
 - Fish
 - Topsoil
- Infectious disease propagation (temp dependent)
 - malaria, dengue fever, diarrheal diseases, tic borne encephalitis
 - foodborne salmonella, vibrio parahaemolyticus



zika virus
Predicted distribution

The precipitation paradox

As global temperatures rise, both drought and heavy rains are increasing.

How can this be?

Over land: warmer air rises, sucking moisture from dry land, intensifying drought



UCAR

Over the oceans: more water evaporates into warmer air, helping increase precipitation intensity worldwide



UCAR

The real problem

- It's not that climate is changing.
 - Climate changes constantly.
 - Geologic time scales: millions of years
- Human population and affluence are drivers
 - Very hard to control either
- Concern is that the *rate-of-change* is so large
 - Time scales of the human population
 - Much shorter than mammalian adaptation times

Questions

- Do you believe this evidence?
- What questions do you have about this evidence?
- What do you think is causing these changes?

Possible lecture topics

1. Climate basics. Why is CO₂ so important?
2. Methane and clathrates
3. Ocean acidification
4. Weather vs. climate
5. Current trends e.g. Greenland and Antarctica
6. Atmospheric circulations
7. Ocean currents and oscillations
8. Carbon cycling
9. Paleoclimate; past changes in Earth's climate
10. Ice ages
11. Mass extinctions
12. Isotopes of carbon and proof of human cause
13. Population & affluence as drivers
14. Aerosols and clouds
15. Your topic not listed above
16. Helpful solutions
17. Geoengineering

US CO₂ emissions

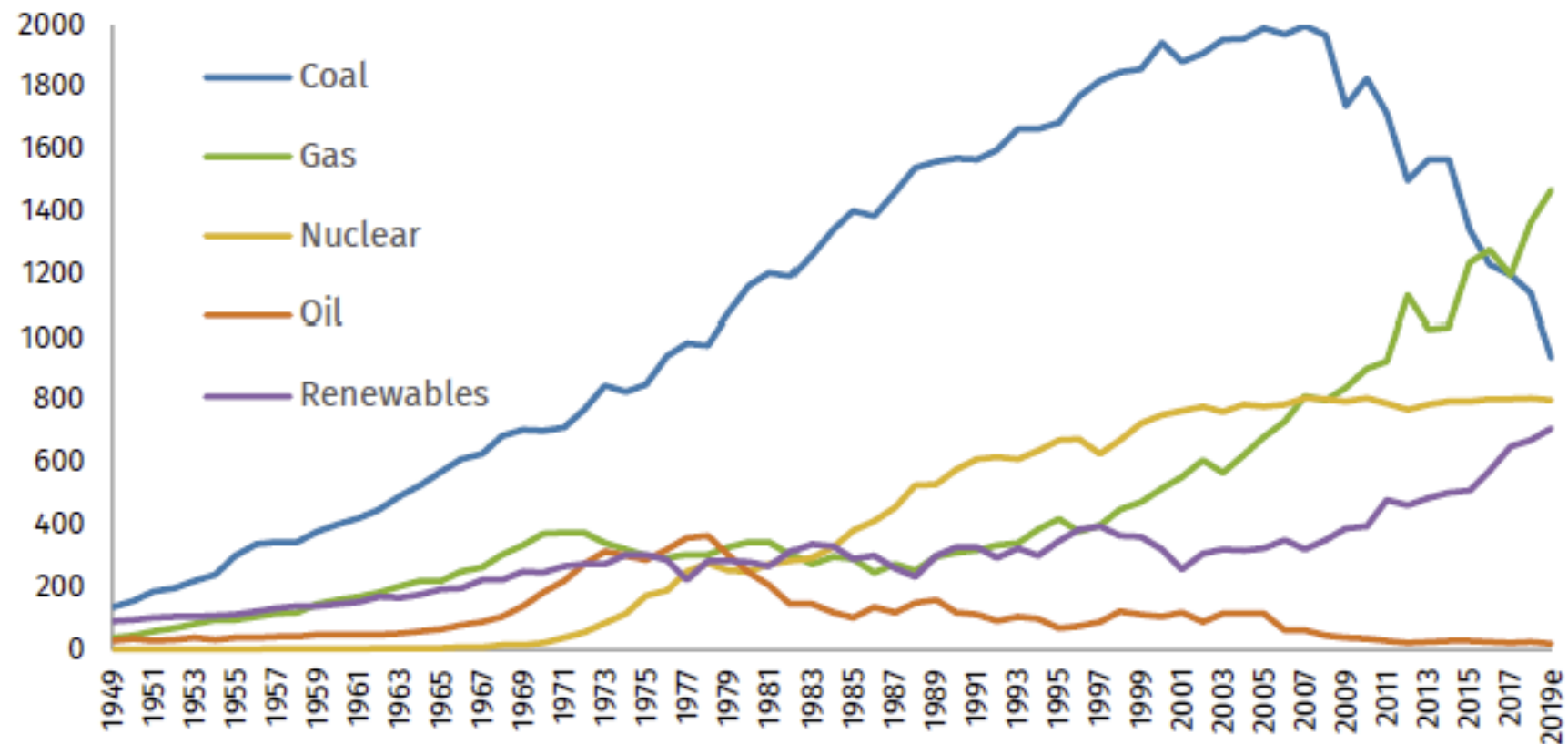


What is changing?

FIGURE 1

US power generation by energy source

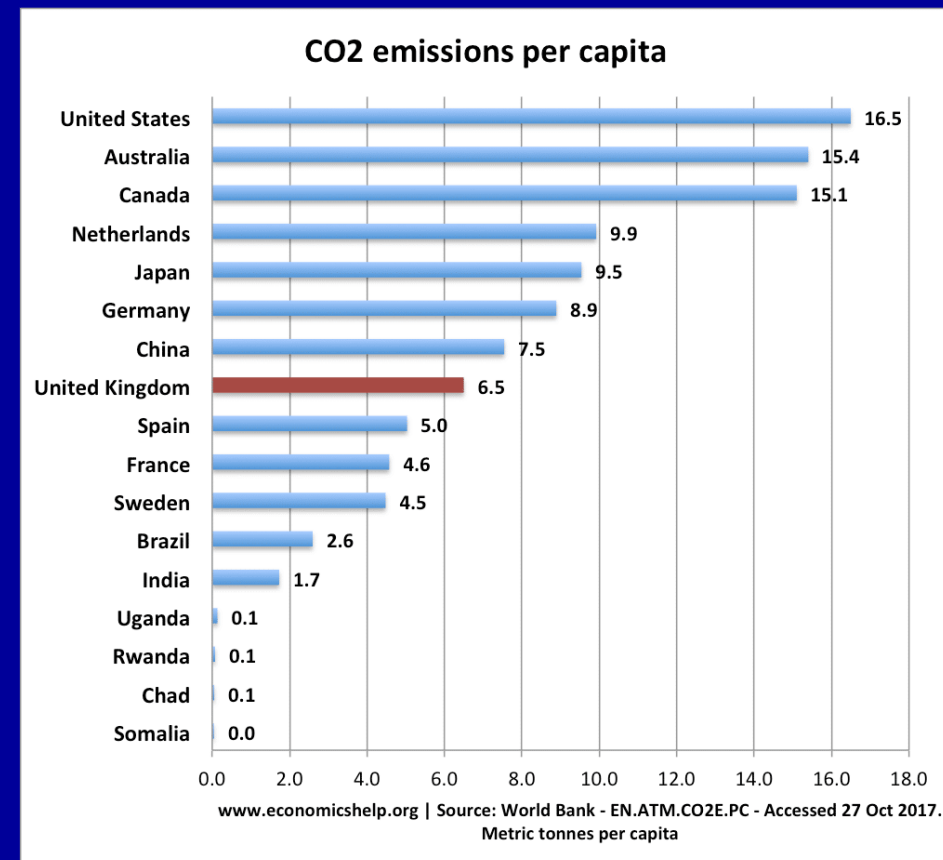
Billion kWh, electric power sector only, does not include distributed generation



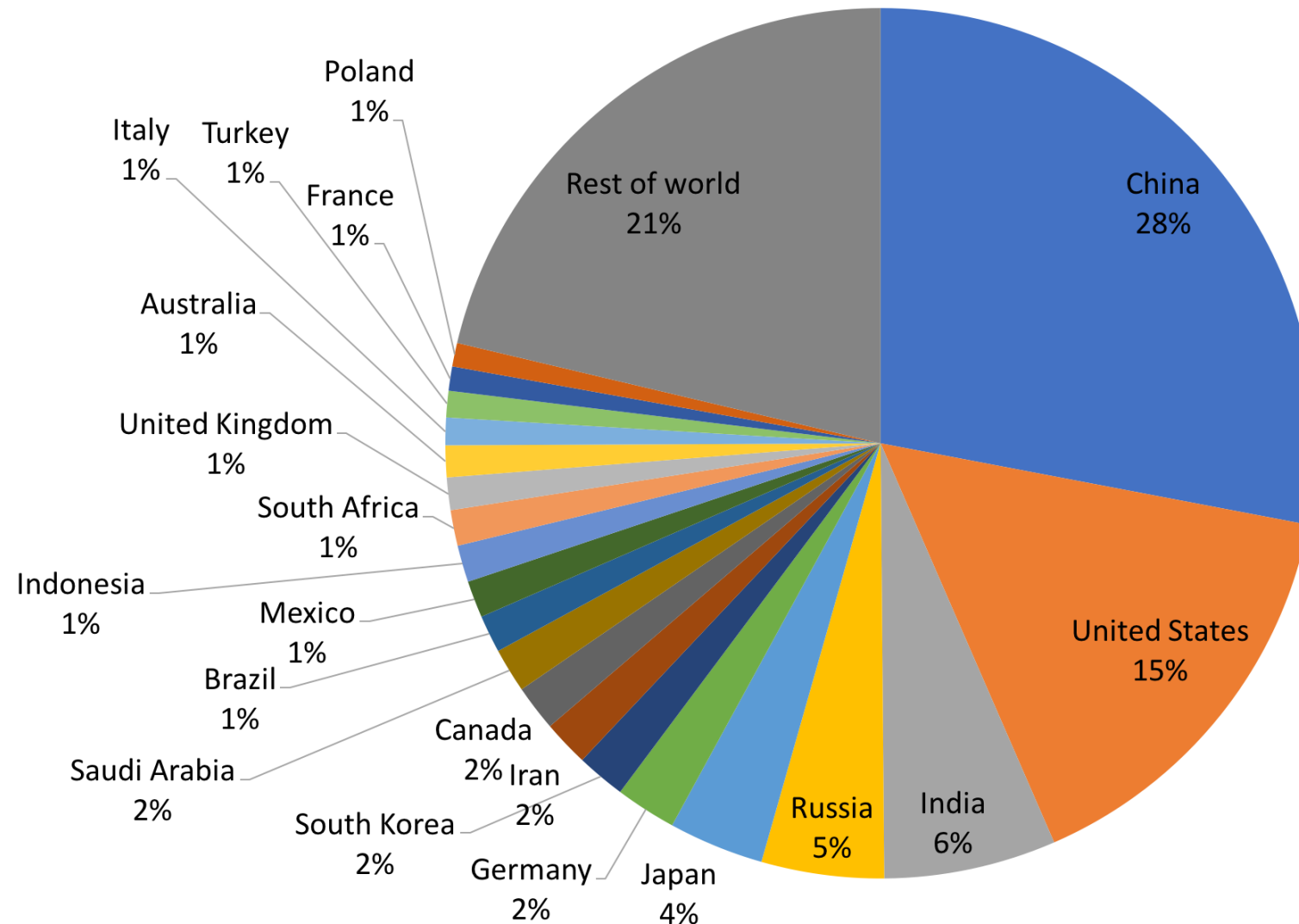
Source: Rhodium Climate Service

Current political status

- New administration
 - Rejoined Paris Accord
 - First international agreement about climate
- US vs. the world
 - China
 - India



Share of global carbon dioxide emissions from fuel combustion (2015)



Data: IEA
Image: Union of Concerned Scientists

The Trump EPA

- 1) weakened limits on CO₂ emissions from power plants cars and trucks;
- 2) removed protections from more than half the nation's wetlands;
- 3) withdrawn the legal justification for restricting mercury emissions from power plants.

The Trump Interior Dept.

- opened up more land for oil and gas leasing by
- 1) limiting wildlife protections and
 - 2) weakening environmental requirements for projects.

Source NYTimes 10 Nov. 2020

<https://www.nytimes.com/interactive/2020/climate/trump-environment-rollbacks-list.html>

Environmental team

**Secretary John Kerry,
Climate Czar on National Security Council**

Work international
treaties and persuasion issues
on behalf of the President.



- **Brenda Mallory, White House Council on Environmental Quality**
 - the first Black person to head the Council

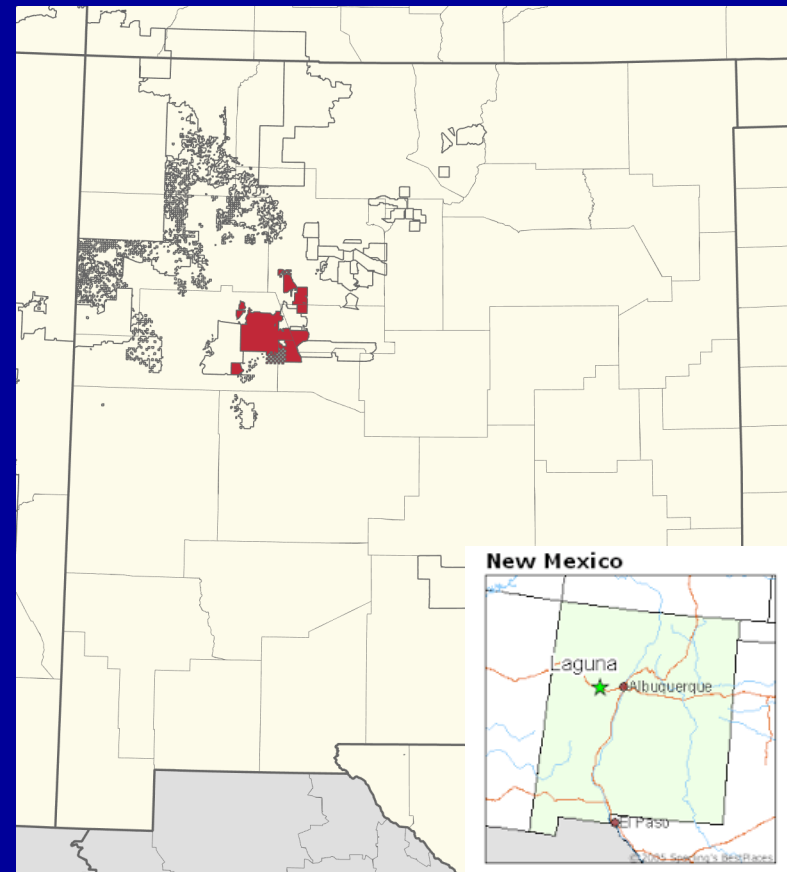
Coordinates federal efforts across
departments and agencies
related to health and the environment
on behalf of the President.



Interior Department



- Deb Haaland
 - New Mexico Congresswoman
 - Laguna Pueblo people
 - West of Albuquerque N of I40
- Oil and gas leases under Trump
 - Federal & Indian lands
 - 1B barrels oil in 2018
 - Growth rates 11%, 17%, 11%



Environmental Protection Agency



- Michael Regan
 - Formerly of EPA; air quality
 - Rebuilt North Carolina's Department of Environmental Quality after previous Republican governor trashed it
 - Replaces Andrew Wheeler, an attorney

Trump's EPA: policies and rules that free companies and industries from the restrictions that inhibit economic growth without regard to environmental protection

EPA plans

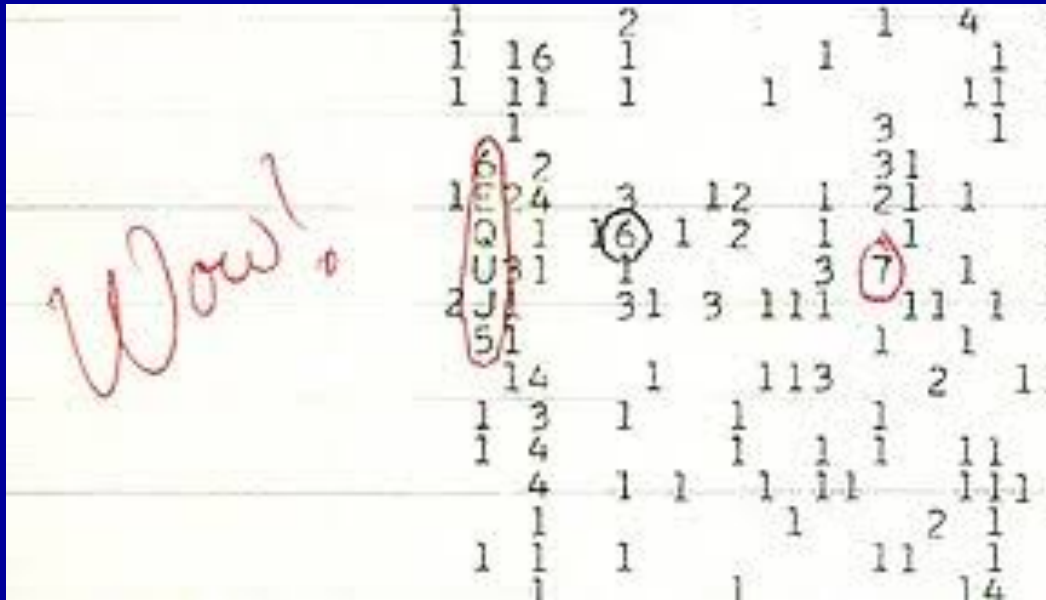
- Executive actions
 - Cancel individual infrastructure projects
 - XL pipeline
 - Reinstate federal protections for land & water
 - Cancel leases on federal and tribal lands
- Restore environmental protections
- Review more than 100 rules & regulations

May take 2-3 years, or in some cases more time.

Environmental team

- Gov. Jennifer Granholm, Secretary of Energy
 - former Michigan governor
- Gina McCarthy, National Climate Adviser
 - Former EPA administrator
- Ali Zaidi, Deputy National Climate Advisor
 - New York's deputy secretary for energy and environment





Science comes back.

It's nerd time again!

No more alternative reality.



Science Advisor, OSTP

- Eric Lander
 - Office of Science and Technology Policy
 - **Cabinet level**
 - Mathematician and geneticist
- Alondra Nelson, deputy OSTP
 - Social scientist: intersections of science, technology, medicine and inequality.
- Maria Zuber, Francis H. Arnold
 - Co-chairs, Council of Scientific Advisors
- Trump left the OSTP vacant
 - Served as his own “science advisor”



"What the Senate Vote Could Mean", by Lisa Friedman, NYTimes, 6 Jan 2021

Congressional Review Act:

- **Allows Congress to disapprove of rules by a simple majority**
- **Reverse many last-minute policies of the Trump Administration**

That would be significant, because President Trump's top officials have worked overtime recently to tie their successors' hands with a flurry of new regulations.

A measure by EPA finalized this week to
restrict the type of scientific studies for air and water
liability protection to companies that accidentally kill migratory birds.

Rushed to lock in weakened pollution rules.

The fight is on

“Trump’s EPA launches surprise attack on Biden’s climate rules”

- Politico 1/12/21 by Alex Guillén

“The rule will effectively prohibit the future regulation of greenhouse gases from any stationary industry other than power plants.”

“It never sought public comment on the proposal to exempt a wide swath of industries from carbon restrictions.”

“This unlawful rule is a transparent attempt to erect roadblocks to protecting public health and the environment for the new administration,” said Jay Duffy, an attorney for a group called the Clean Air Task Force.

Biden inaugurated

January 20, 2021



Biden Actions January 27, 2021

- Climate considerations are an essential element of U.S. foreign policy and national security.
 - US will exercise its leadership to promote a significant increase in global ambition.
 - Host a Leaders' Climate Summit on Earth Day, April 22, 2021

An obstacle: Senator from Coal, head of Senate Energy Committee

Biden Actions January 27, 2021

- Federal government policies
 - Buy carbon-free electricity
 - Convert federal fleet to electric vehicles
 - Clean energy jobs are the central pillar of Build Back Better
- Pause of coal, oil & gas leases on government owned land (BLM, Tribal)
 - Eliminate fossil fuel subsidies
 - Conserve 30% of lands and oceans by 2030
- CCC to conserve and restore public lands & waters
- Formalized commitment to prioritize environmental justice
- Restore science as a basis for planning & decision making
- Regenerative agriculture

A clash of values

Business as usual, capitalistic expansion and development of resources that promote growth and the good life for all.

Individualism

Freedom

Live for now

Conserving resources for the well being of our progeny and the future well being of humankind.

Globalism

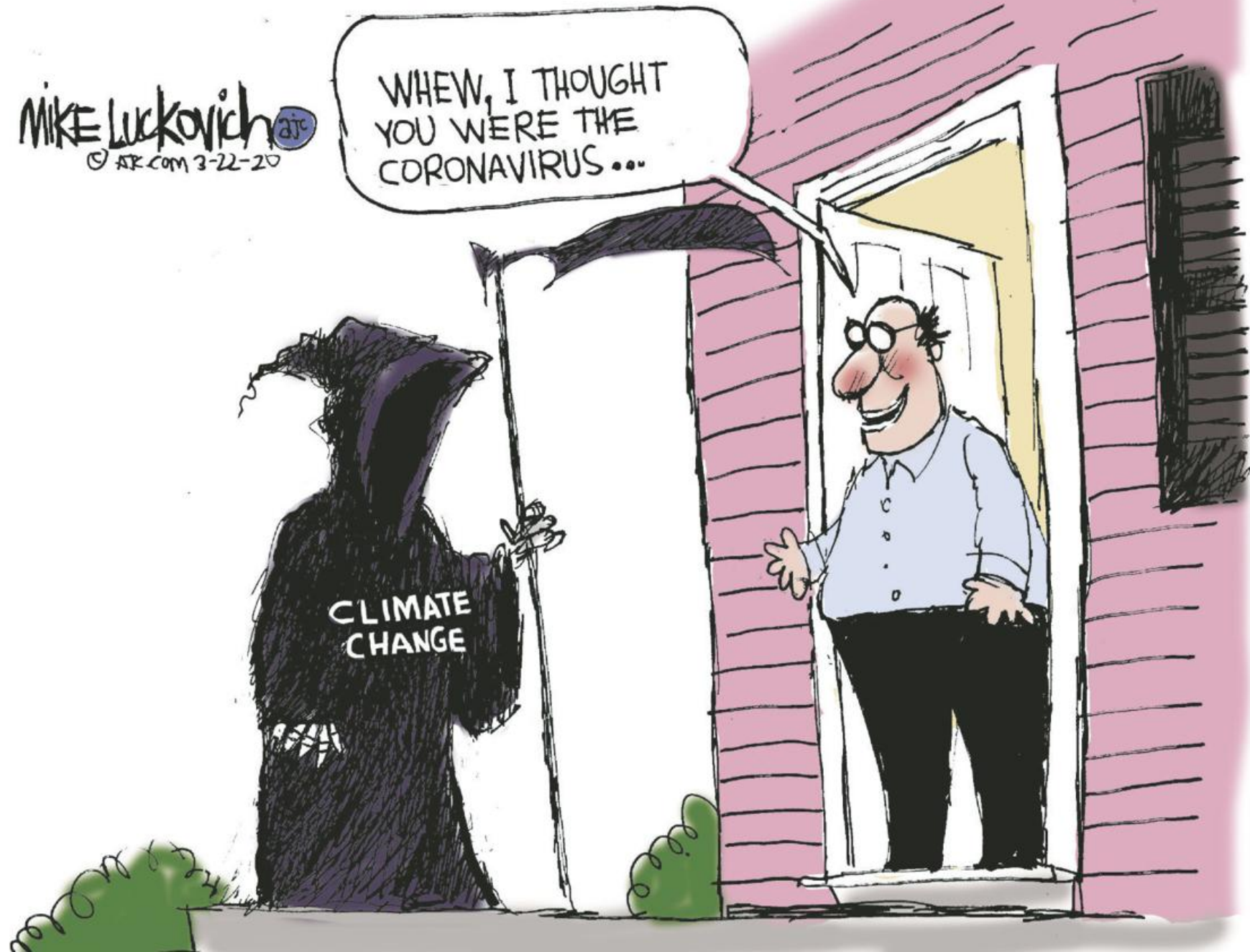
Communitarianism

Futuristic

MIKE LUCKOVICH 
© AK.COM 3-22-20

WHEW, I THOUGHT
YOU WERE THE
CORONAVIRUS...

CLIMATE
CHANGE



Course outline

1. Political climate and the climate crisis
2. Climate basics
3. Climate has changed before
 - Evolution of atmosphere
 - Snowball Earth events
 - Ice ages
 - Mass extinctions
4. Scientific proof it is “human caused”
5. Population and affluence as drivers
6. TBD
7. What can be done?
 - Geoengineering
 - Ethics and scarcity
 - Energy revolution and climate prospects
 - Predicting the future

May be revised

Garden of Earthly Delights
by Hieronymus Bosch, circa 1500





Garden of Earthly Delights
by Hieronymus Bosch

Trying to talk about climate is an
exercise in how to describe the
indescribable

"But I don't want to go among mad people," Alice remarked.
"Oh, you can't help that," said the Cat: "We're all mad here. I'm mad. You're mad."
"How do you know I'm mad?" said Alice.
"You must be," said the Cat, "or you wouldn't have come here."

—Lewis Carroll, *Alice in Wonderland*

Today's class

- The problem: an existential crisis
- What this class will cover: it's a big subject
- What the Biden Administration is doing:
 - Economics are helping.
 - We are late; I hope not too late.

The end



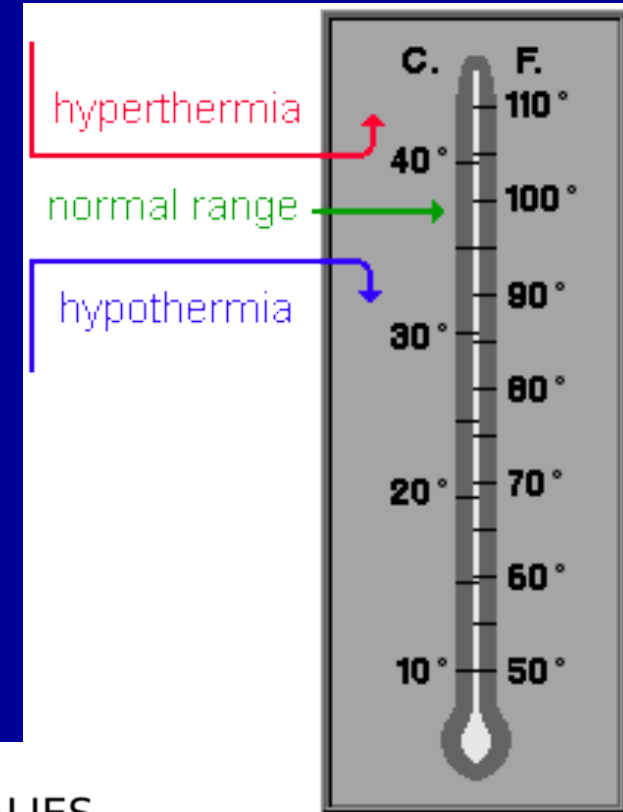
THE END OF CLASS 1

Why this lecture?

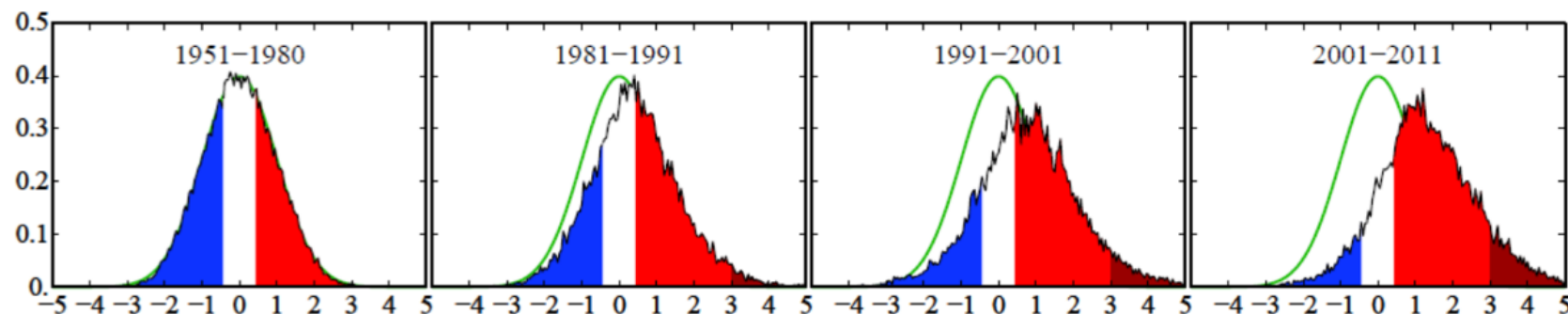
- Put homo sapiens in perspective
- Put Earth in perspective
- Give background as to where we came from to give some context for discussion of what might be in store in the future

Danger to human life?

- E.g. Heat wave Europe 2003
- health crises; death toll at 70,000
 - heat
 - crops/drought
- Among most lethal weather

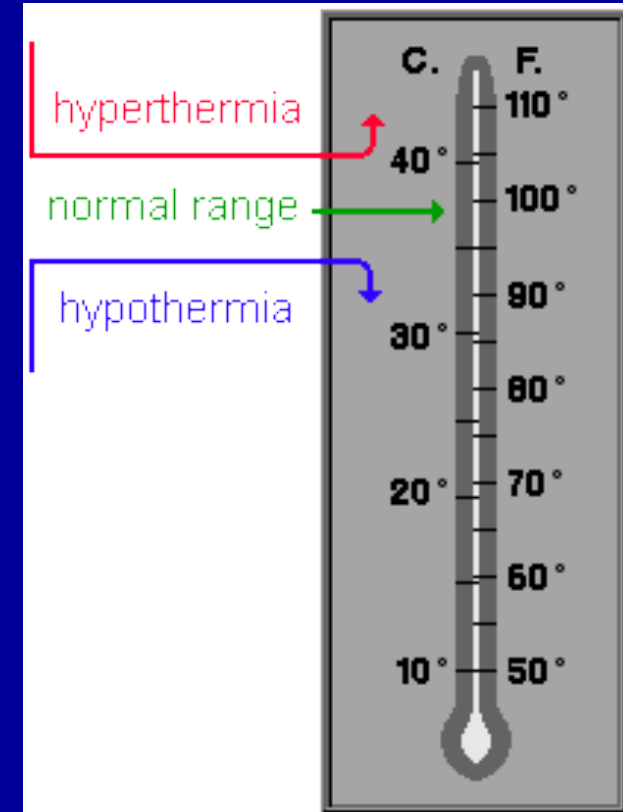


SHIFTING DISTRIBUTION OF SUMMER TEMPERATURE ANOMALIES

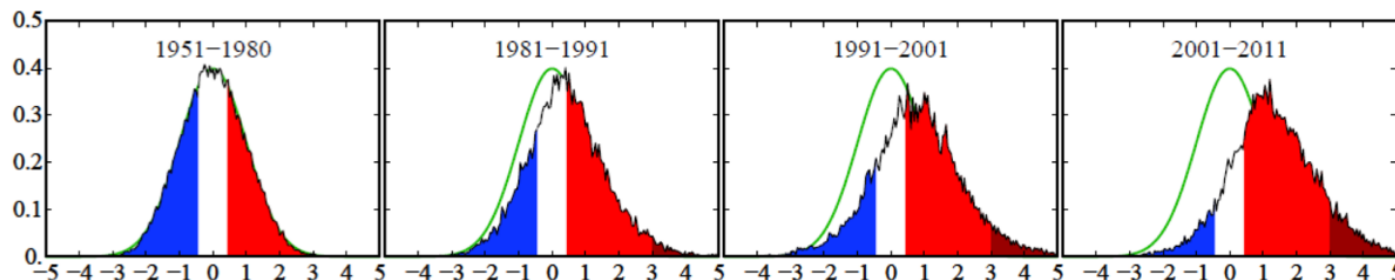


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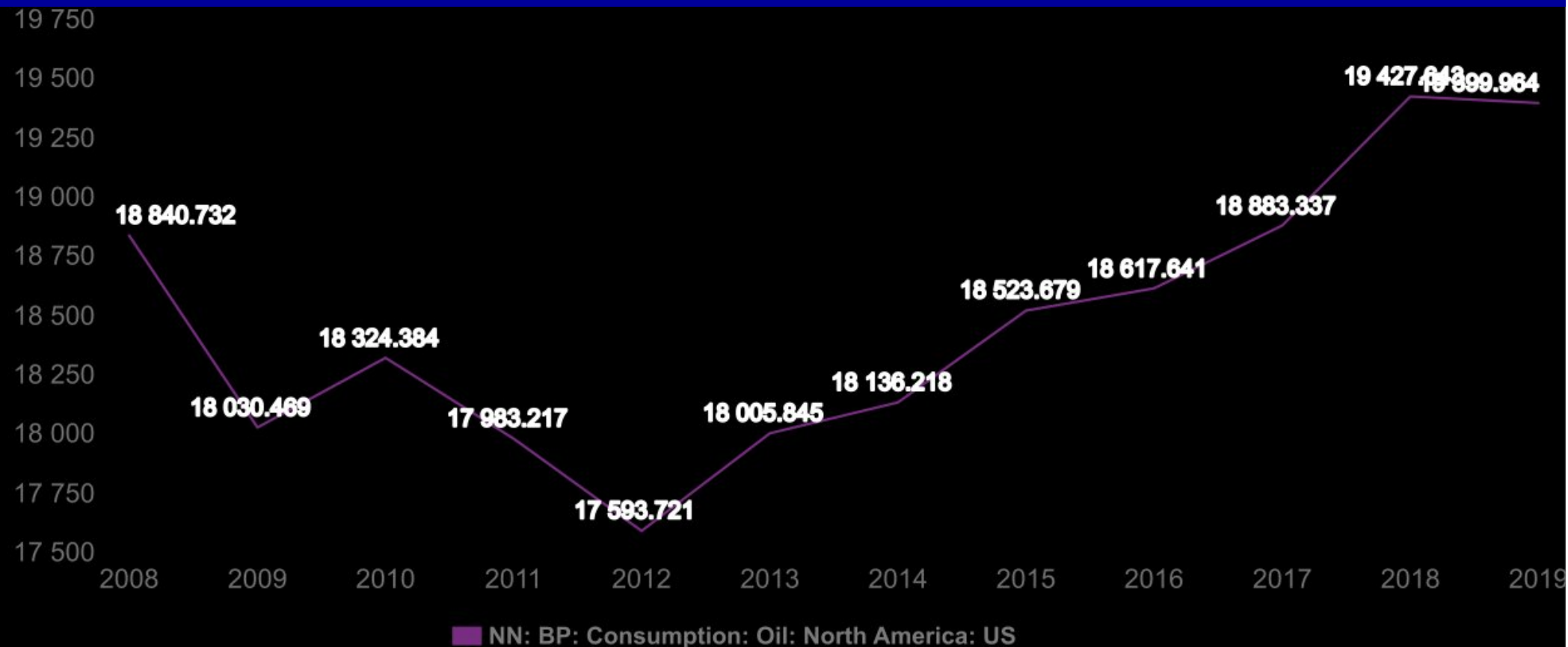


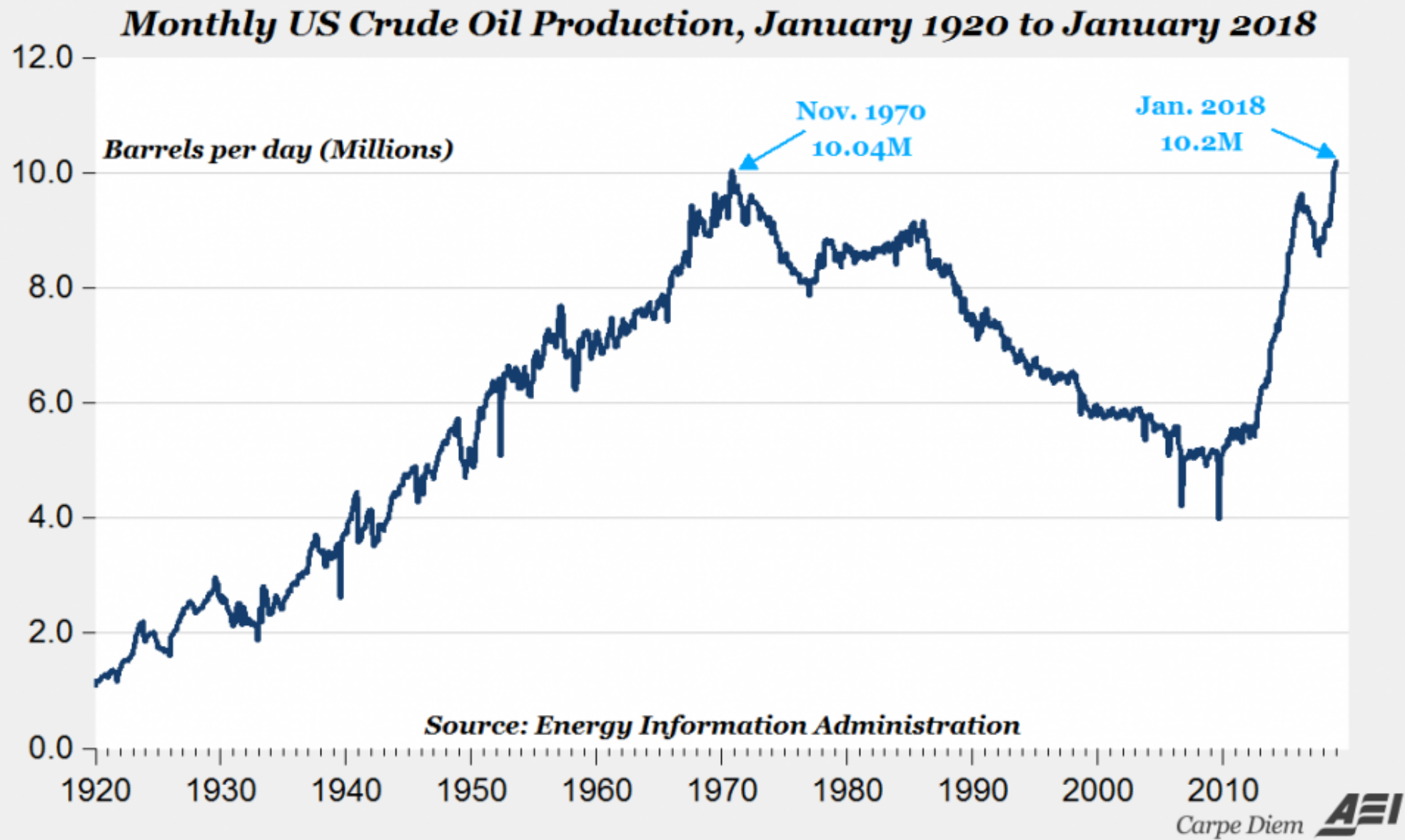
SHIFTING DISTRIBUTION OF SUMMER TEMPERATURE ANOMALIES



2019 oil consumption

- 2019: 20.5 M barrels/day







OXYMORON

P. Steiner