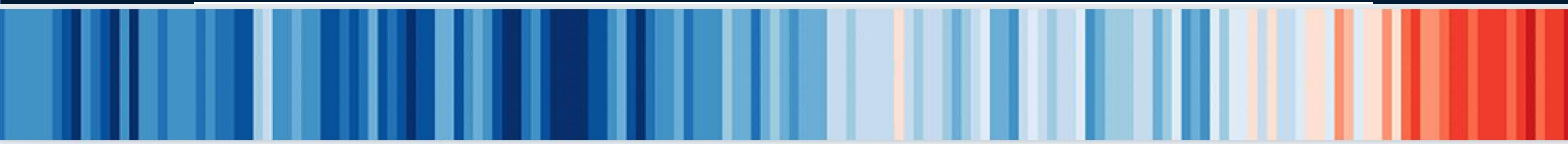
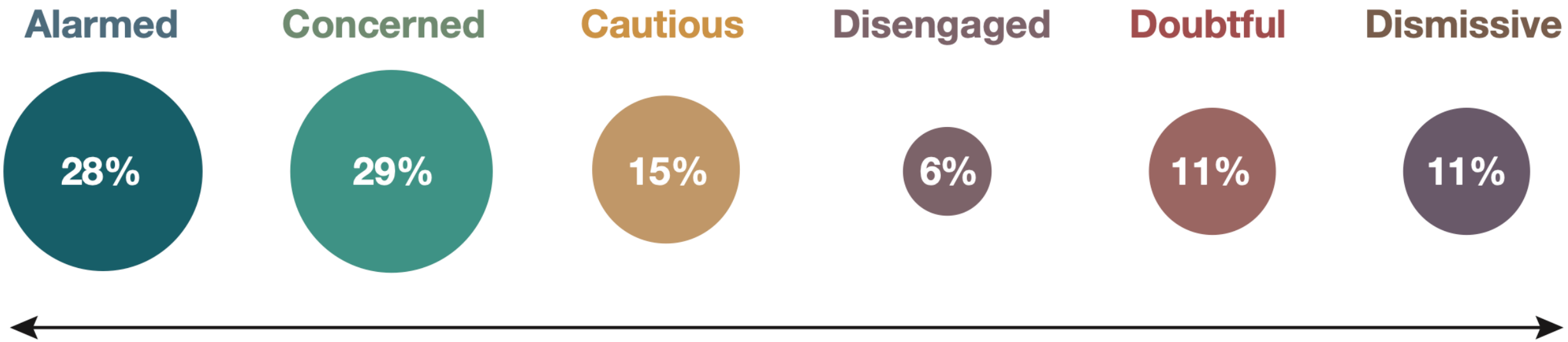
Our Changing Climate



CLIMATE CENTRAL

CLIMATE CENTRAL

CLIMATE CENTRAL



Global Warming's Six Americas, Fall 2023
Base: 1,033 U.S. adults

Source: Yale Program on Climate Change Communication;
George Mason University Center for Climate Change Communication

CLIMATE CENTRAL

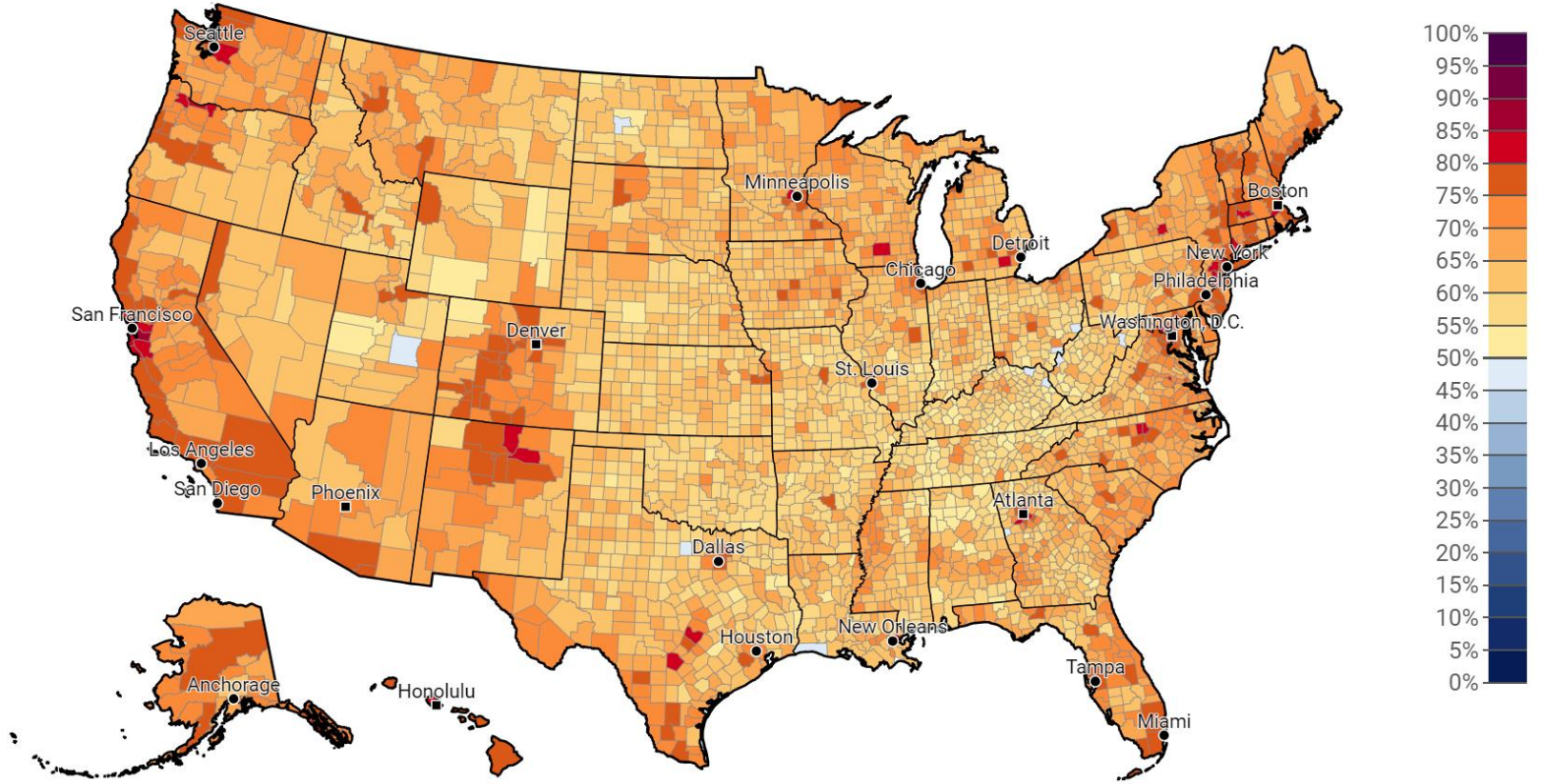
Estimated % of adults who think global warming is happening (nat'l avg. 72%), 2023

Select Question: Global warming is happening

Click map or: Select a State | Select a County

Absolute Value

National | States | Cong. Districts | Metro Areas | **Counties**



CLIMATE CENTRAL

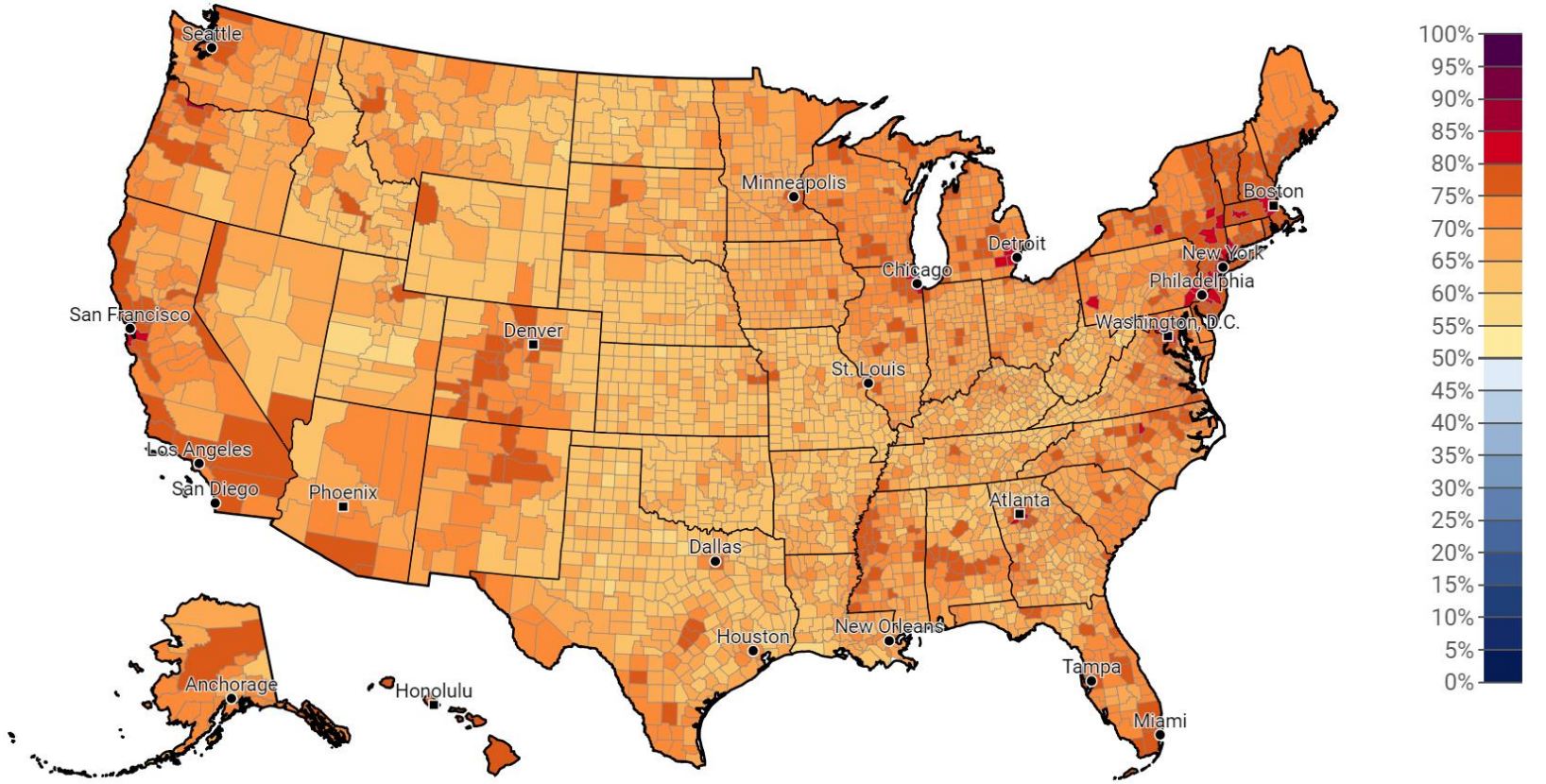
Estimated % of adults who support regulating CO2 as a pollutant (nat'l avg. 74%), 2023

Select Question: Regulate CO2 as a pollutant

Click map or: Select a State | Select a County

Absolute Value

National | States | Cong. Districts | Metro Areas | **Counties**



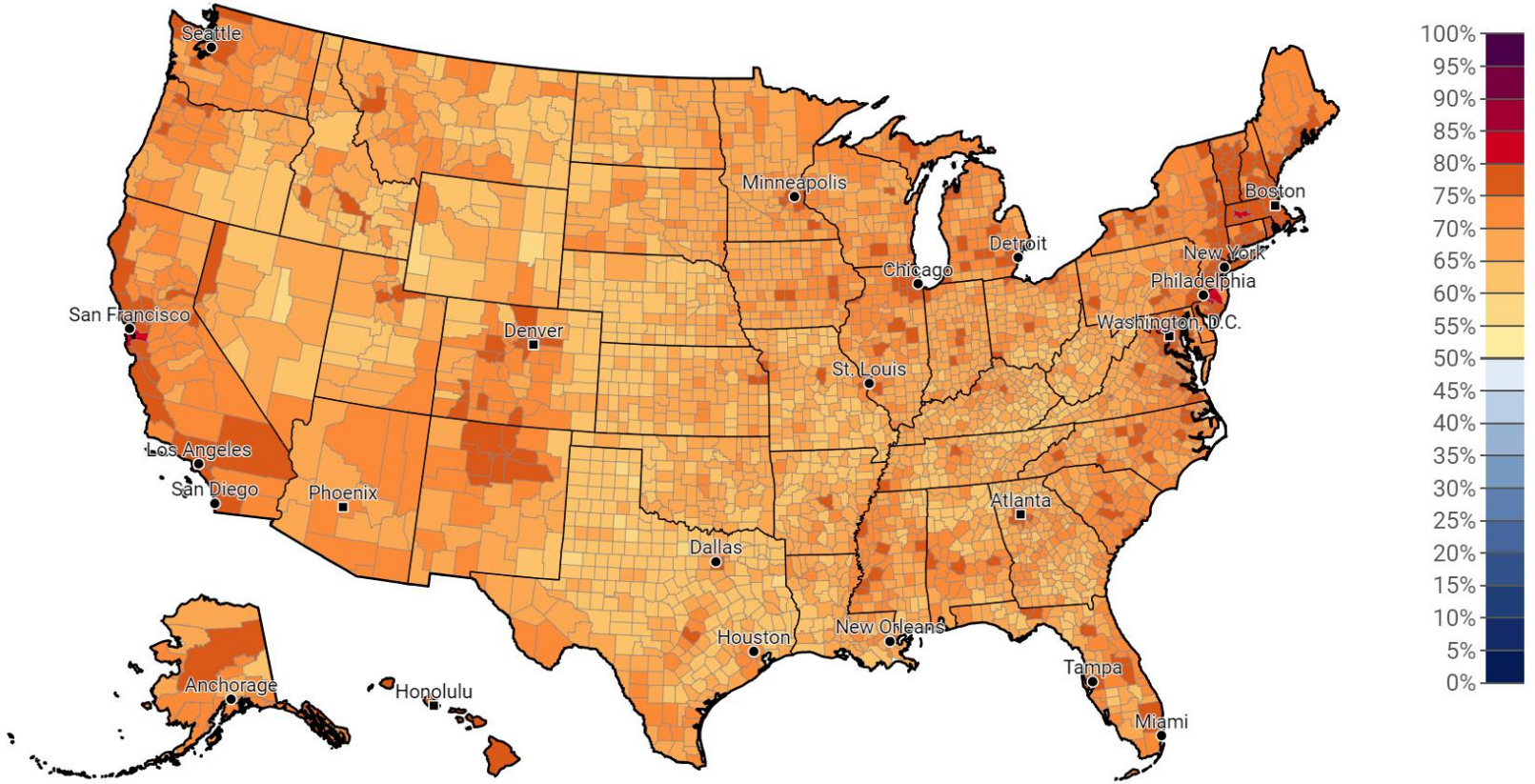
Estimated % of adults who support tax rebates for people who purchase energy-efficient vehicles or solar panels (nat'l avg. 74%), 2023

Select Question: Provide tax rebates for energy-efficient vehicles or solar panels

Click map or: Select a State | Select a County

Absolute Value

National | States | Cong. Districts | Metro Areas | **Counties**



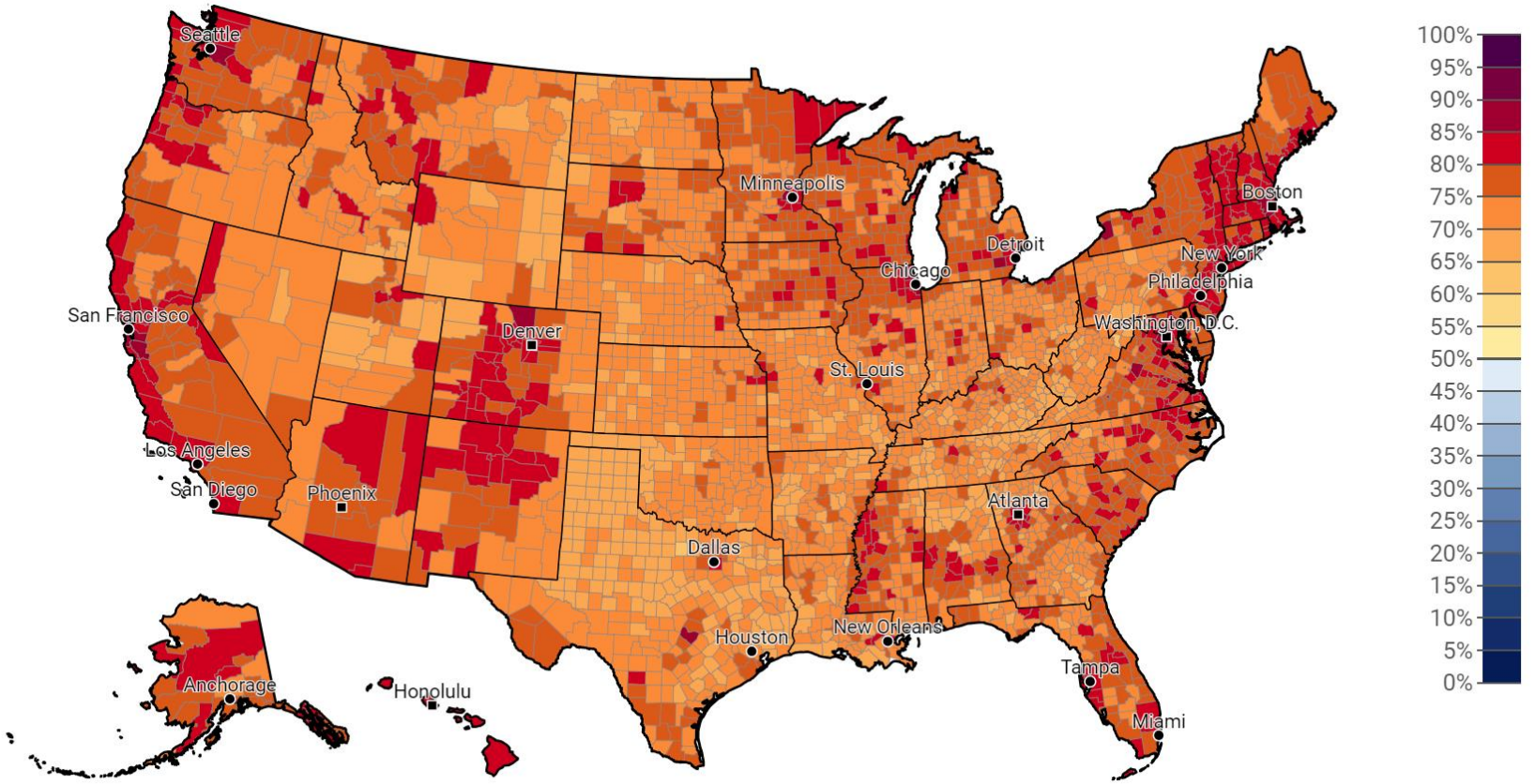
Estimated % of adults who support funding research into renewable energy sources (nat'l avg. 79%), 2023

Select Question: Fund research into renewable energy sources

Click map or: Select a State | Select a County

Absolute Value

National | States | Cong. Districts | Metro Areas | **Counties**



CLIMATE CENTRAL

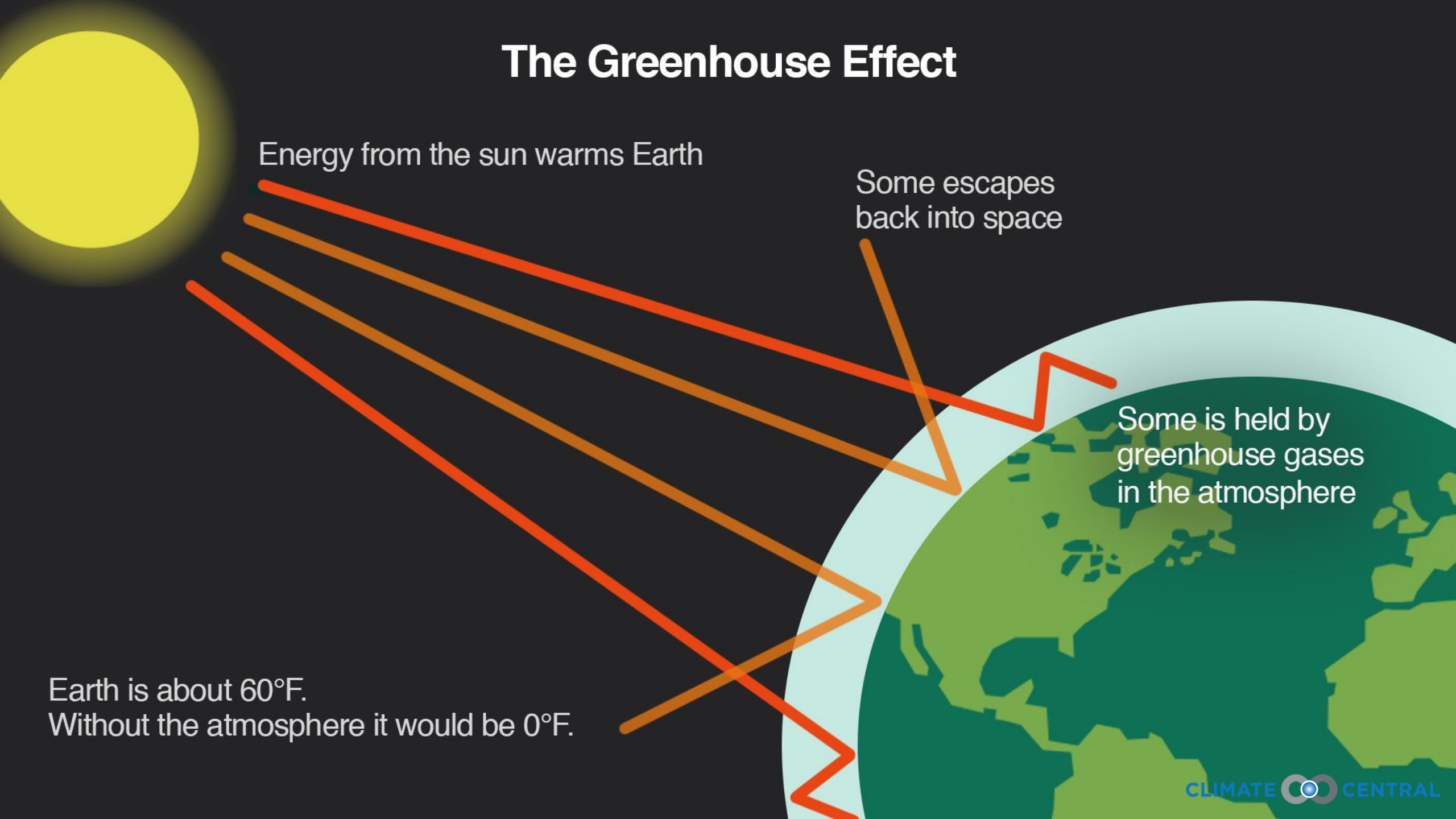
How We Know
Why It Matters

CLIMATE CENTRAL

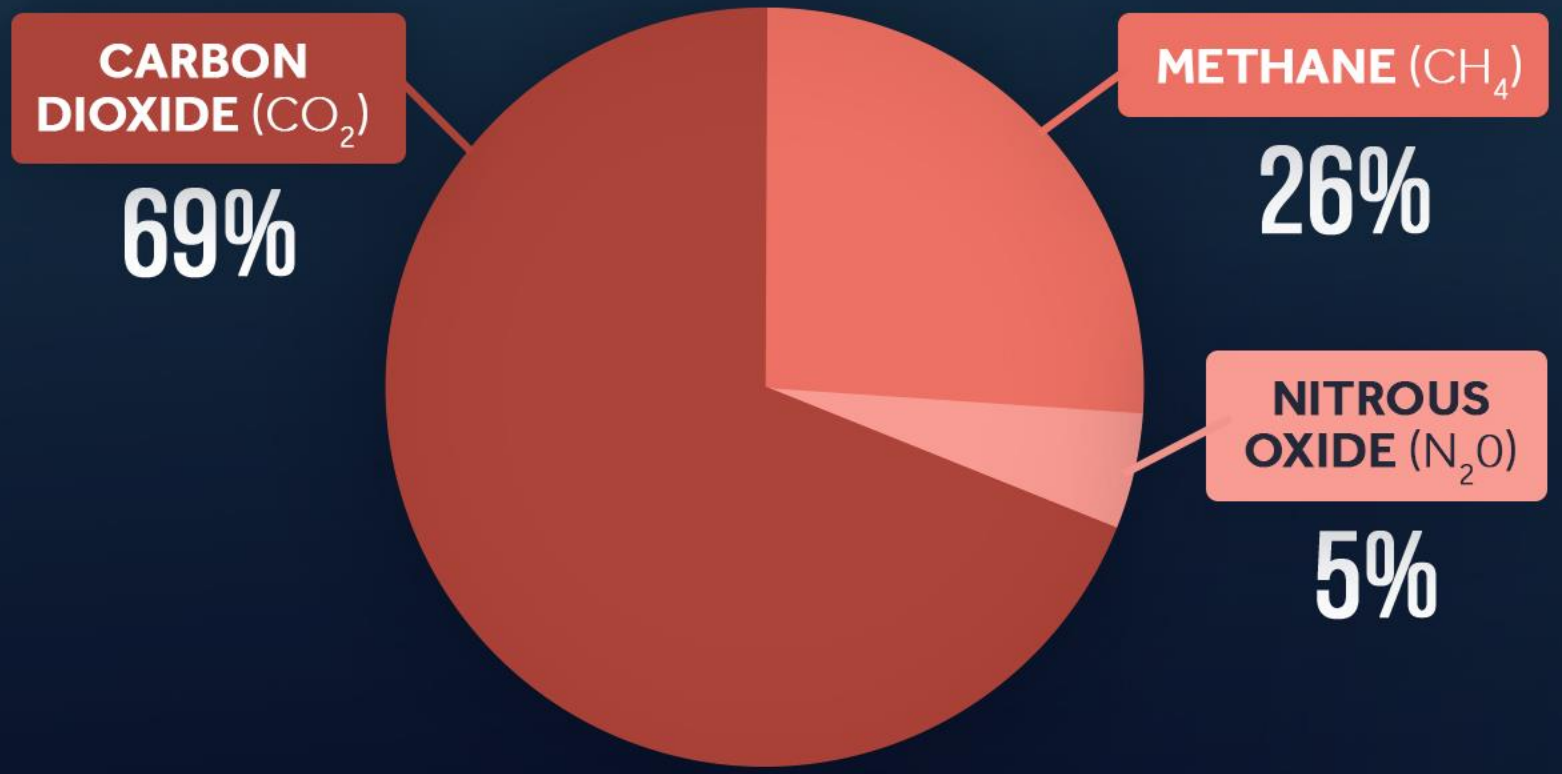
How We Know
Why It Matters

CLIMATE CENTRAL

The Greenhouse Effect



WARMING FROM MAIN GREENHOUSE GASES

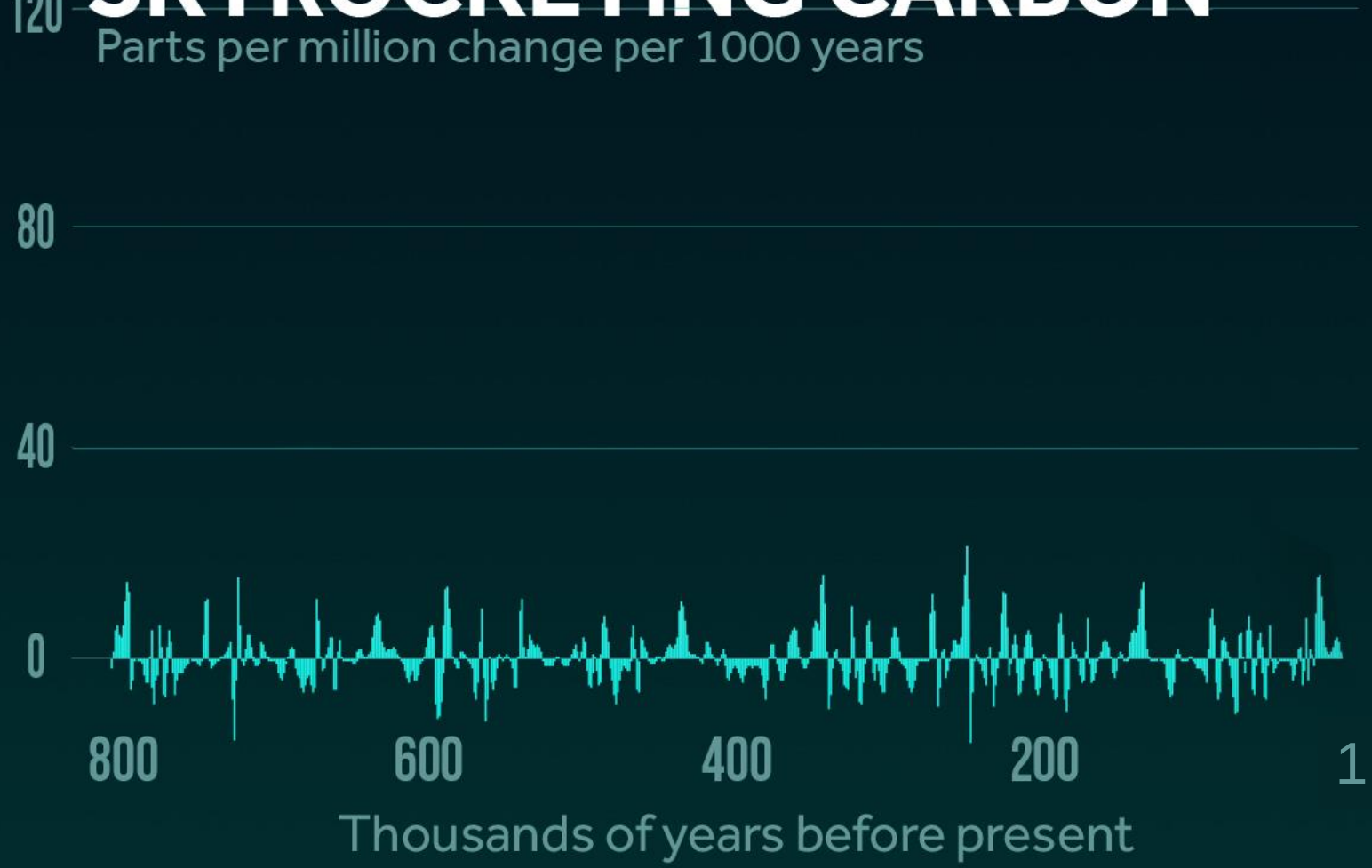


CO2, CH4, and N2O are key human-driven GHGs widely regulated by the UNFCCC.
Source: Jones et al. (2023)

CLIMATE CENTRAL

SKYROCKETING CARBON

Parts per million change per 1000 years

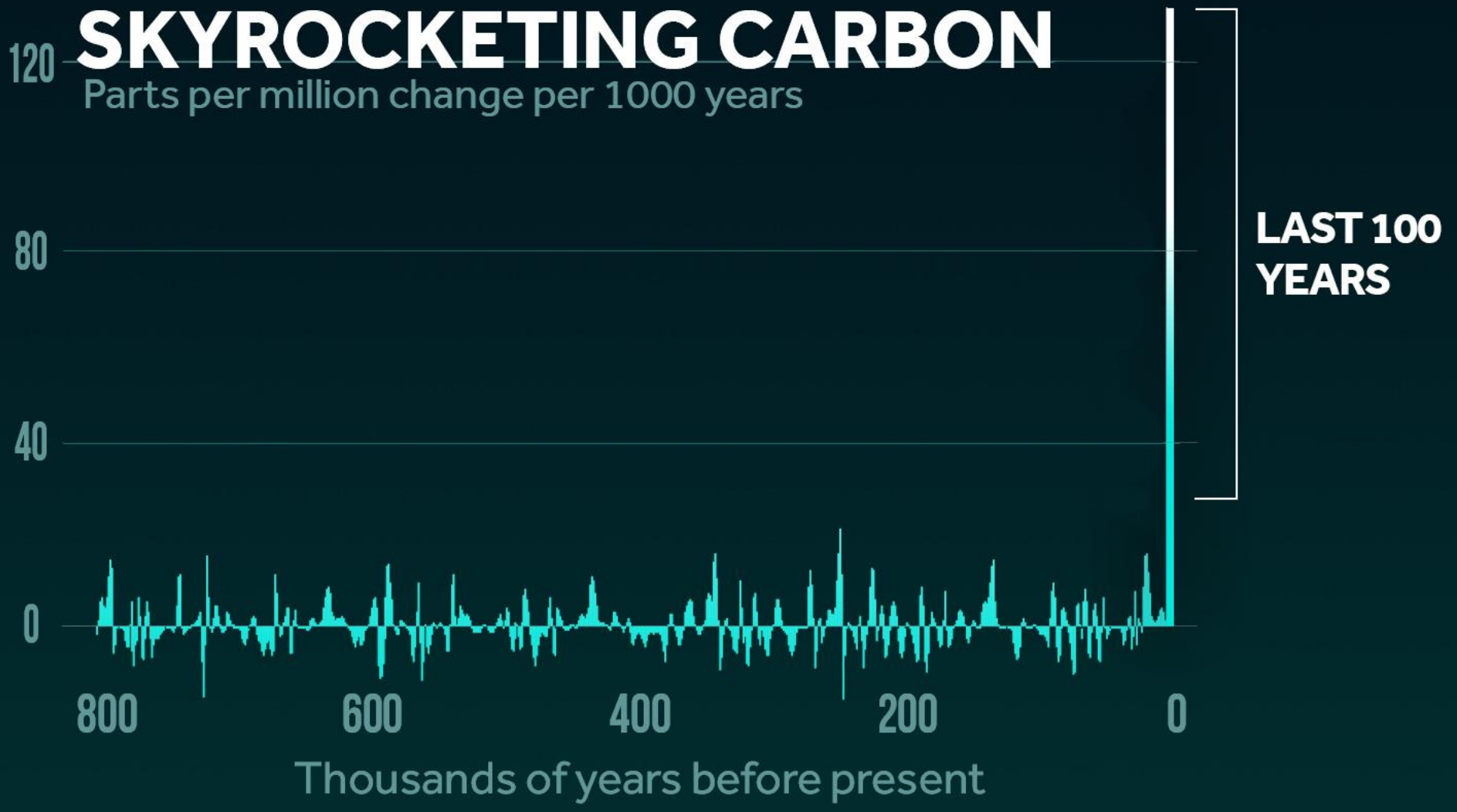


Changes in carbon dioxide levels in the atmosphere during the past 1 million years.
Source: Bereiter et al. (2015), Brook (2020), NOAA ESRL.
Additional interpolation developed by Climate Central.

CLIMATE CENTRAL

SKYROCKETING CARBON

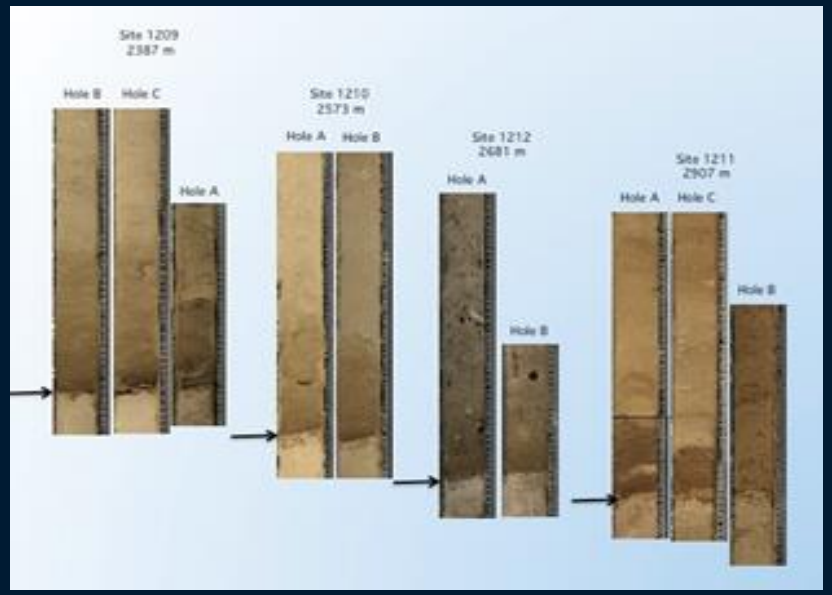
Parts per million change per 1000 years



Changes in carbon dioxide levels in the atmosphere during the past 1 million years.
Source: Bereiter et al. (2015), Brook (2020), NOAA ESRL.
Additional interpolation developed by Climate Central.

CLIMATE CENTRAL

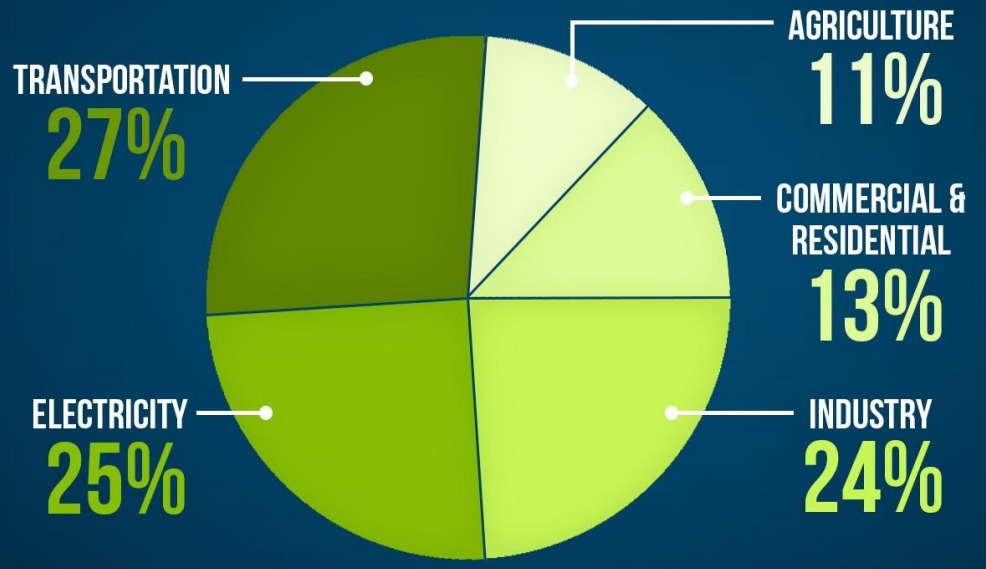
Reconstructing Past Climates



CLIMATE CENTRAL

GREENHOUSE GAS EMISSIONS

U.S. Emissions by Sector

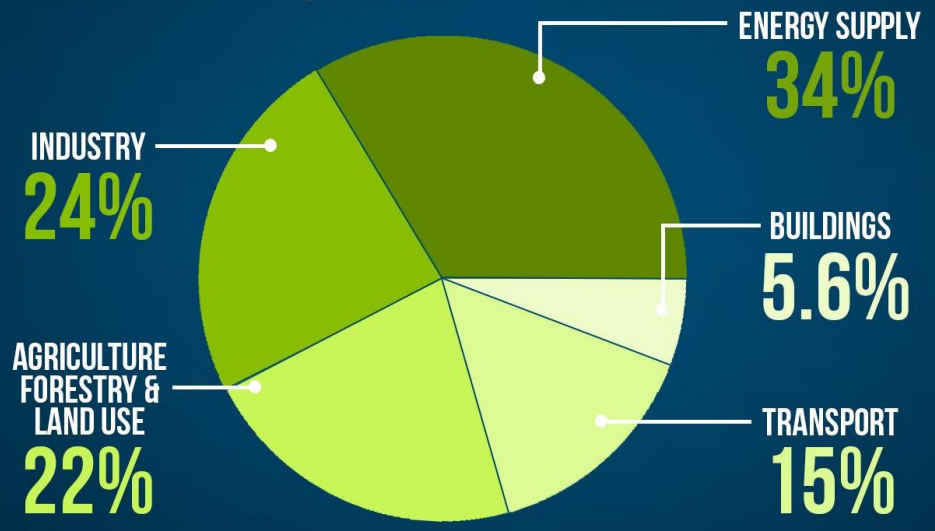


U.S. greenhouse gas emissions (2020) by sector.
Source: U.S. EPA

CLIMATE CENTRAL

GREENHOUSE GAS EMISSIONS

Global Emissions by Sector

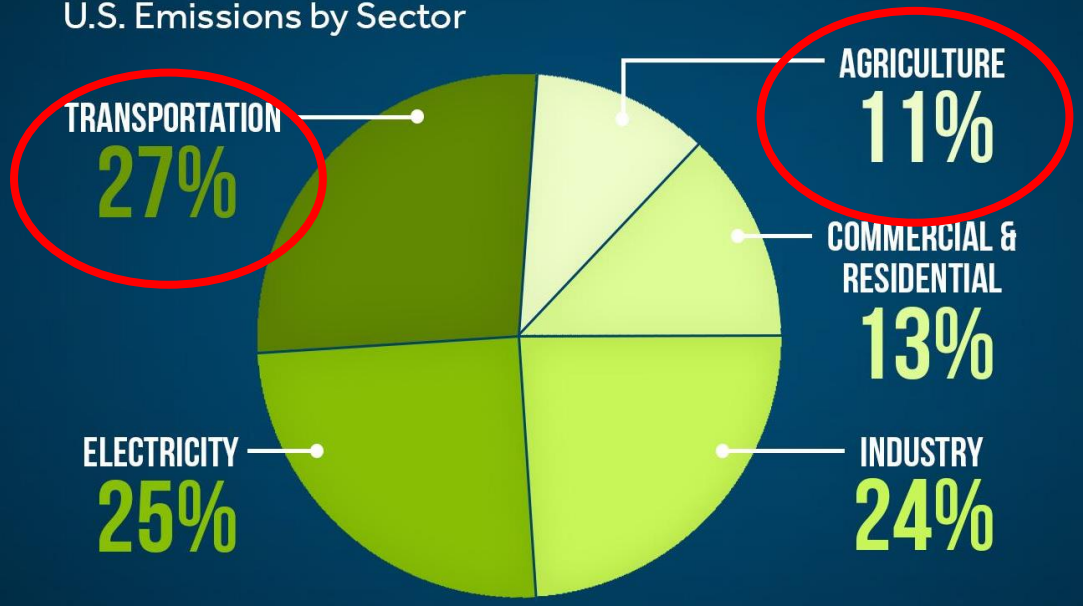


Global greenhouse gas emissions (2019) by sector.
Source: IPCC

CLIMATE CENTRAL

GREENHOUSE GAS EMISSIONS

U.S. Emissions by Sector

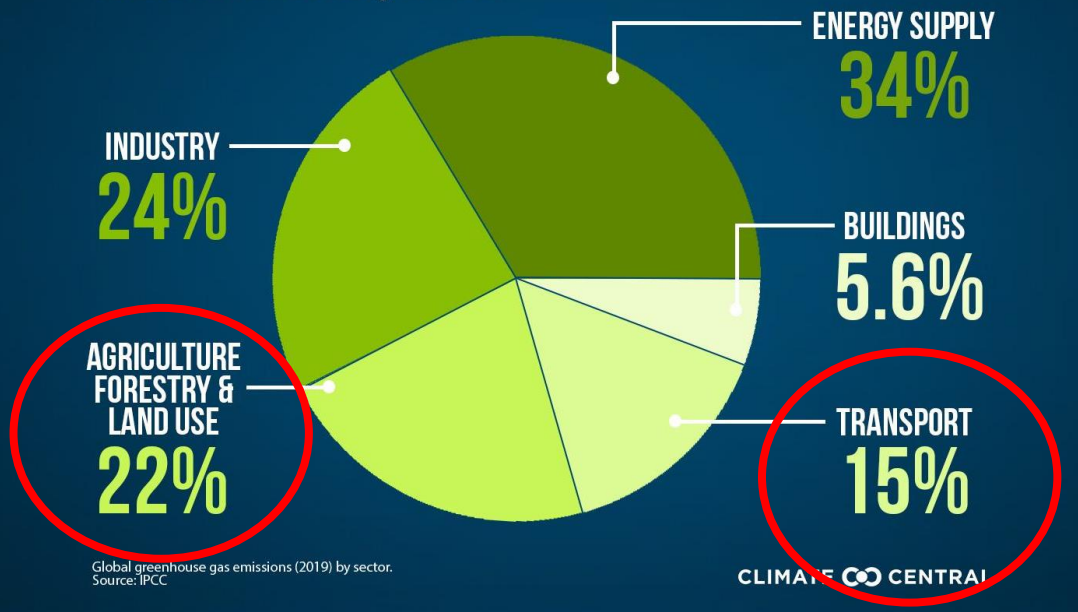


U.S. greenhouse gas emissions (2020) by sector.
Source: U.S. EPA

CLIMATE CENTRAL

GREENHOUSE GAS EMISSIONS

Global Emissions by Sector



Global greenhouse gas emissions (2019) by sector.
Source: IPCC

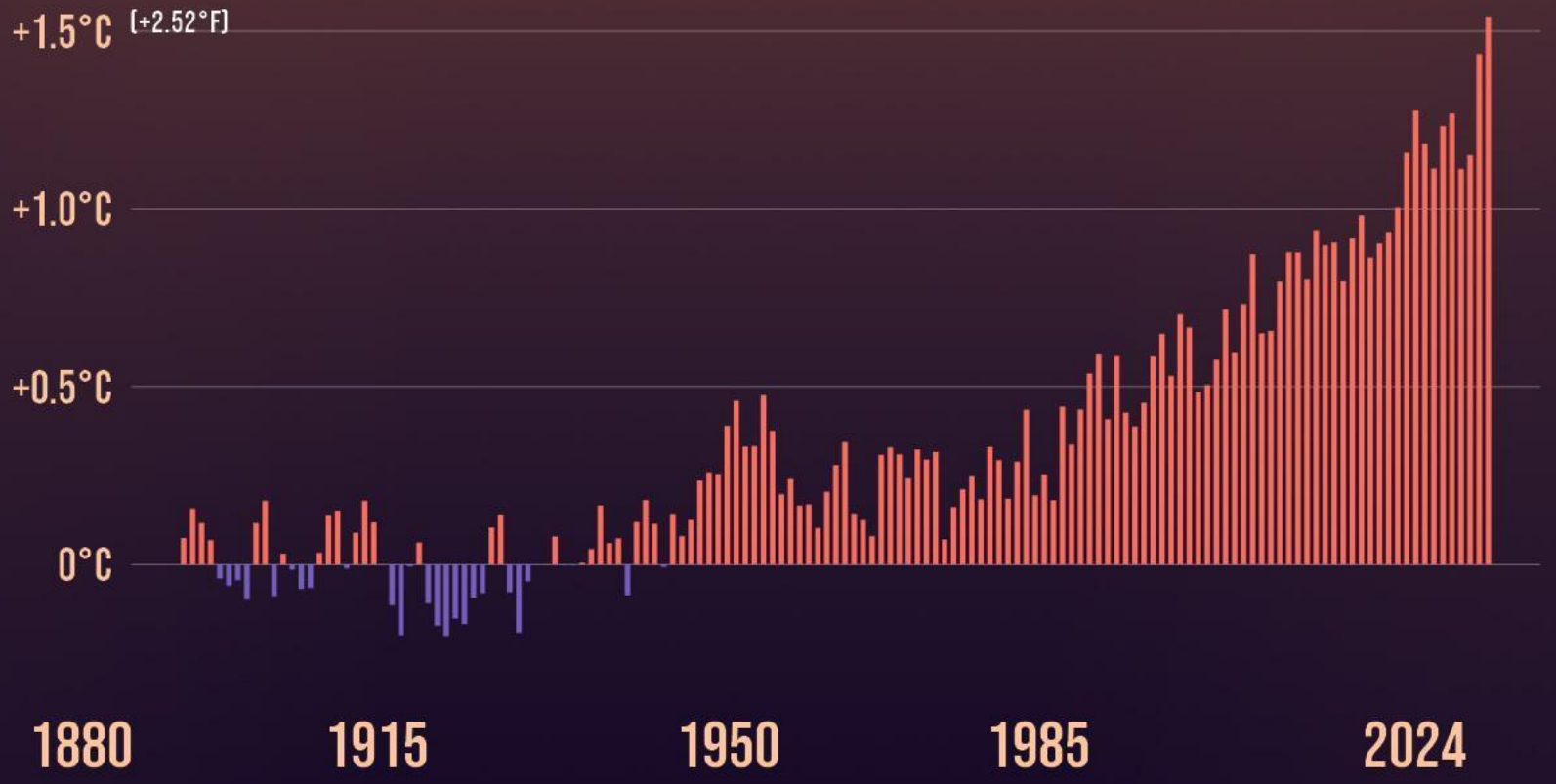
CLIMATE CENTRAL

How We Know
Why It Matters

CLIMATE CENTRAL

GLOBAL TEMPERATURE

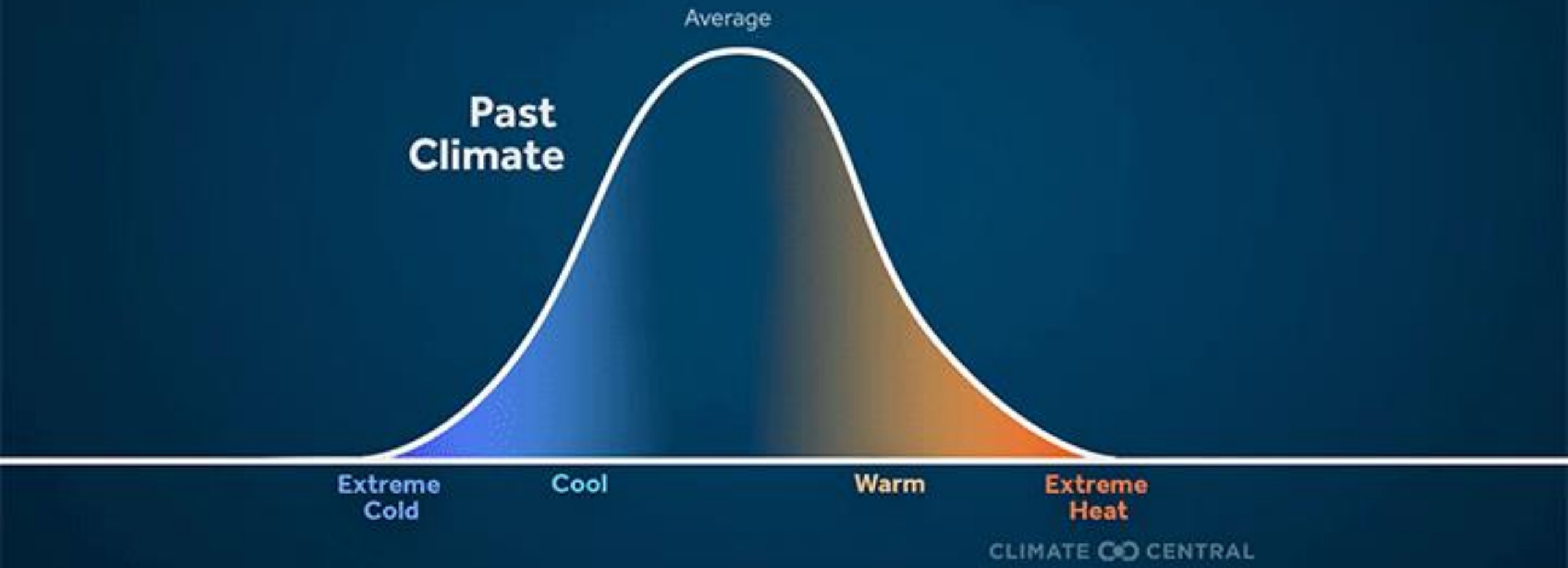
Departure from 1881-1910 average



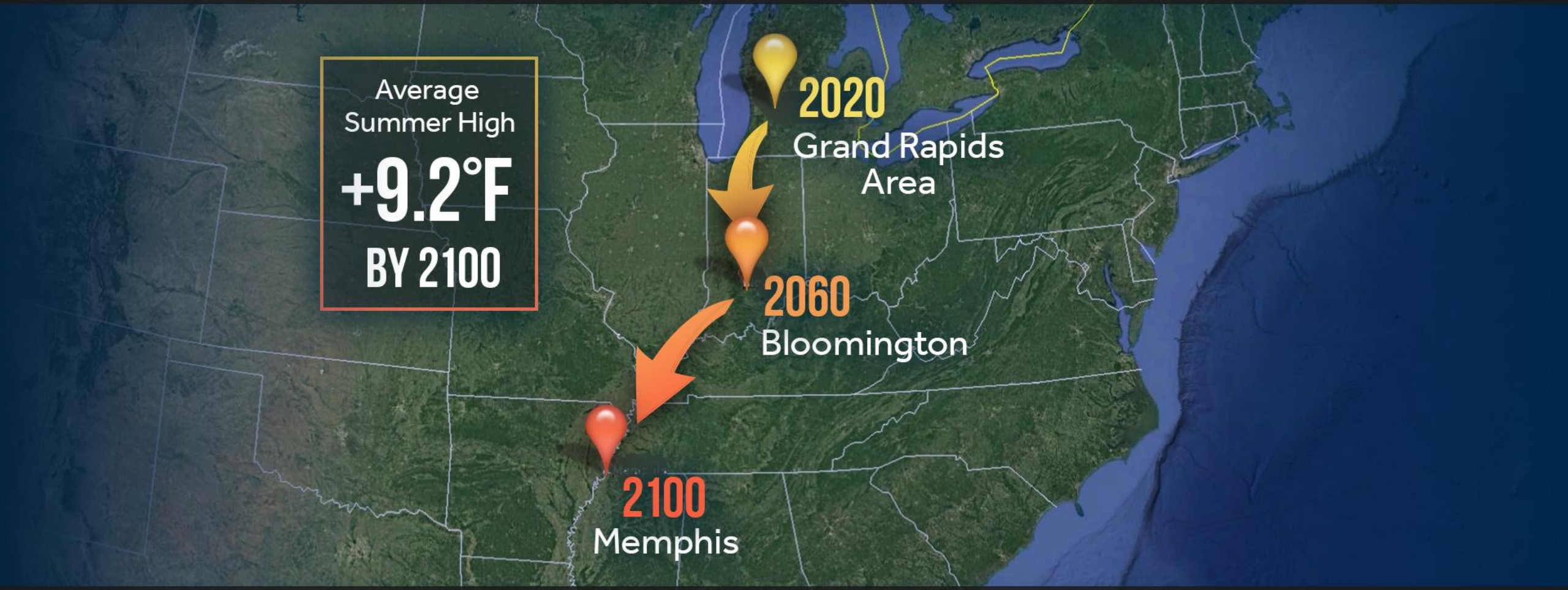
Global temperature anomalies averaged and adjusted to early industrial baseline (1881-1910).
Data as of 1/10/2025.
Source: NASA GISS & NOAA NCEI

CLIMATE CENTRAL

SMALL CHANGE IN AVERAGE
BIG CHANGE IN EXTREMES

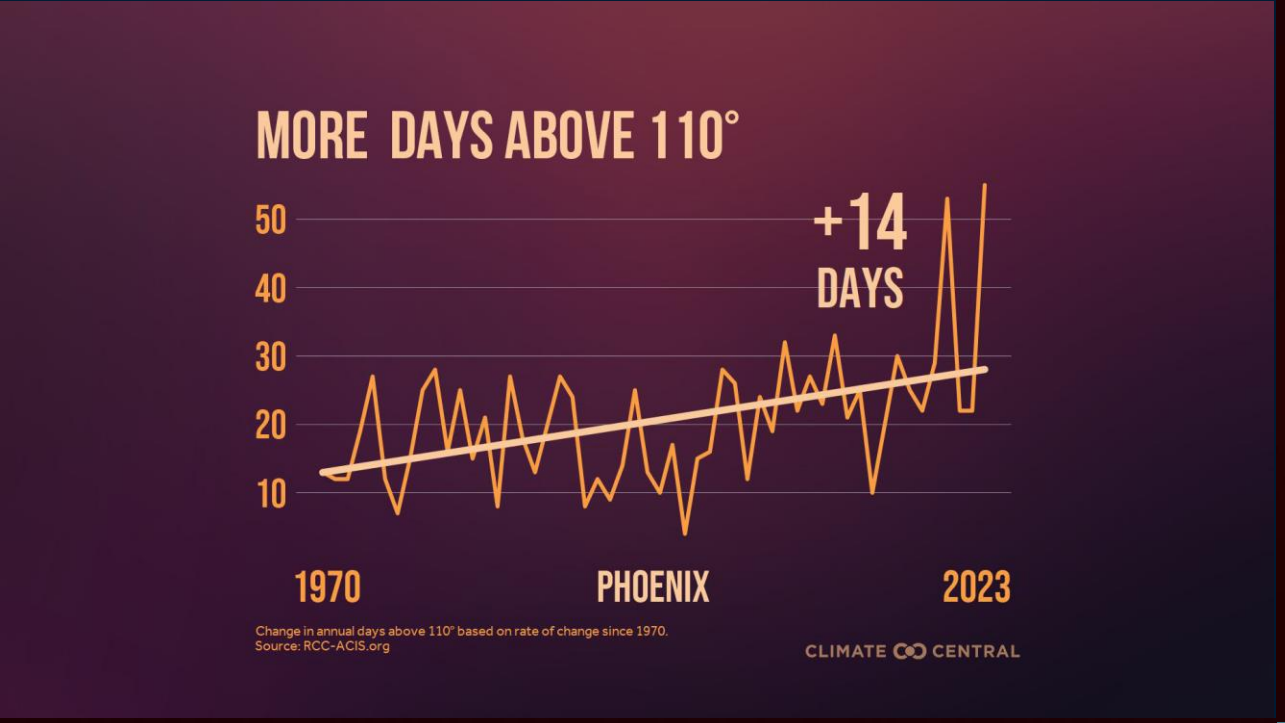


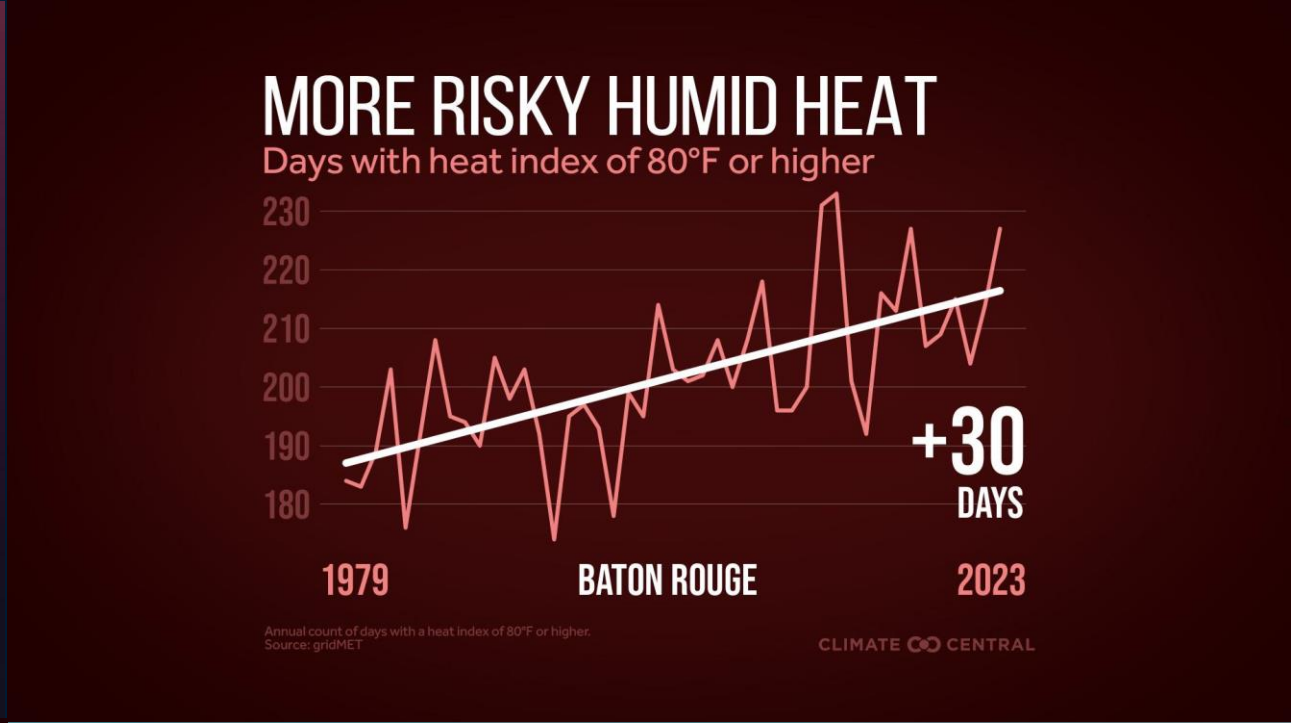
WHERE YOUR SUMMER IS HEADED

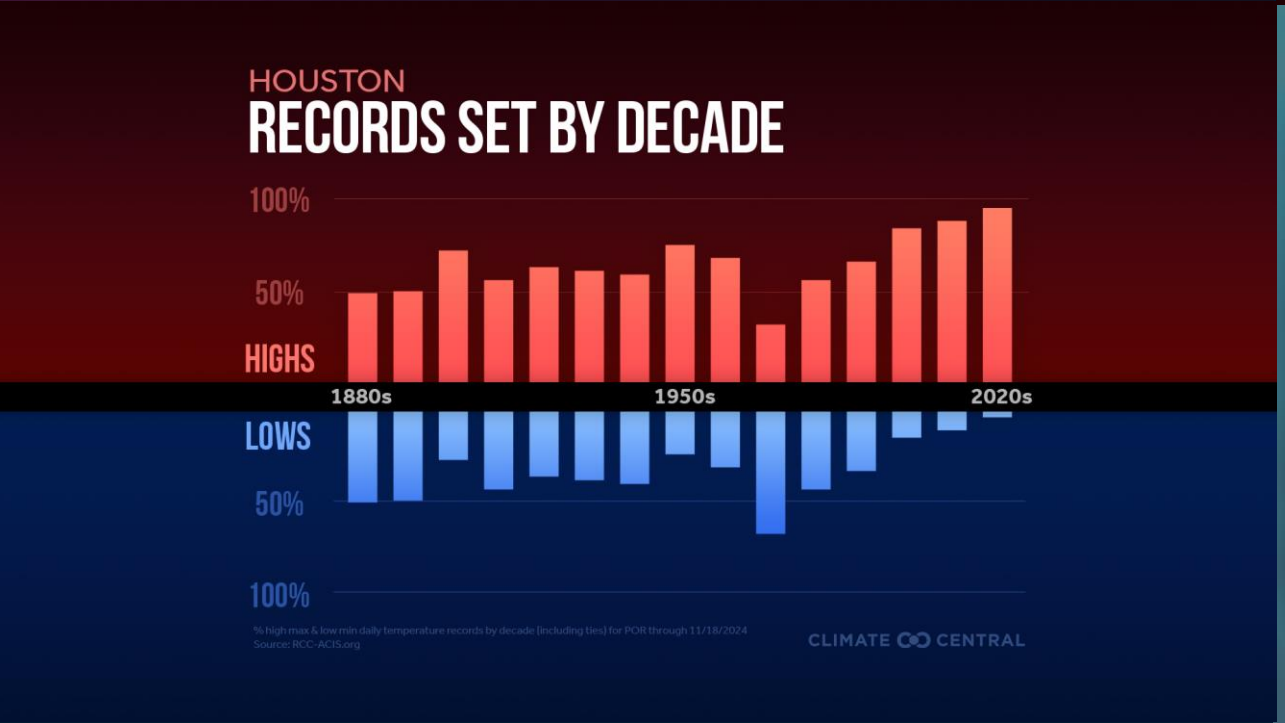


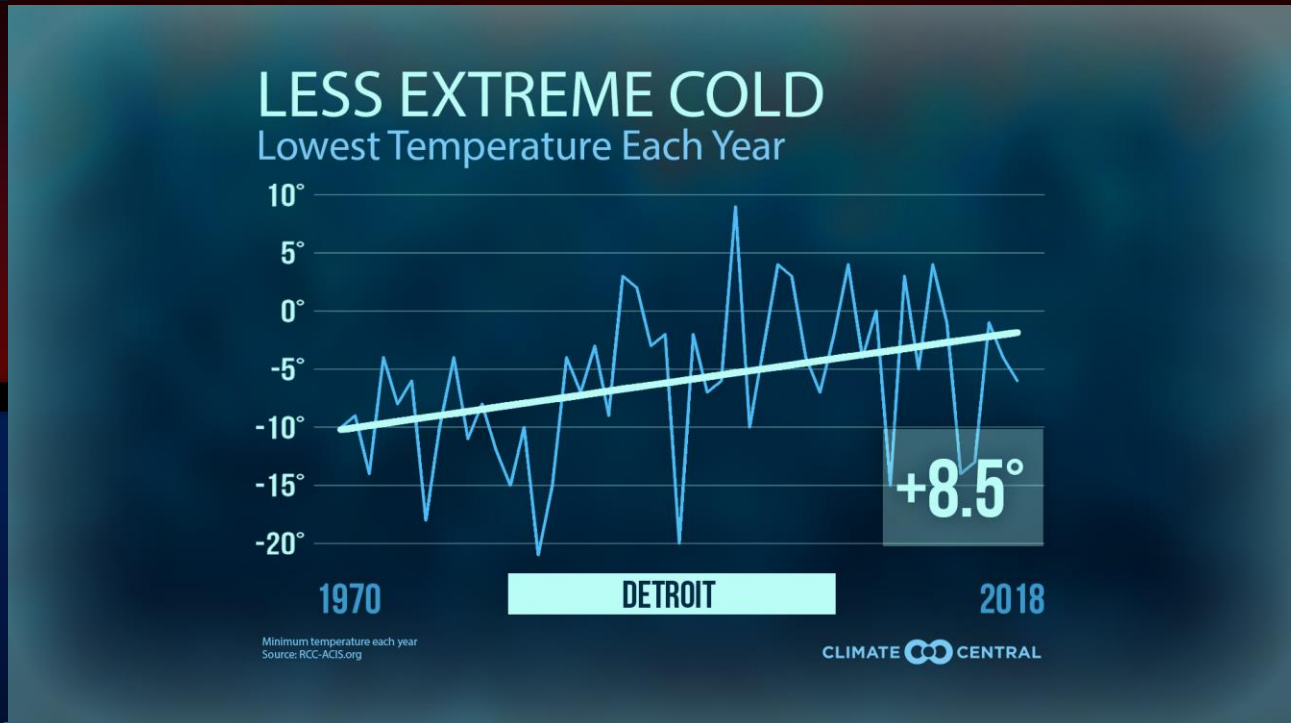
Current temperatures: ERA5, European Centre for Medium-Range Weather Forecasts, accessed 6/15/2022
CMIP6 multi-model ensemble dataset based on current emissions trends (SSP3)

CLIMATE CENTRAL


MORE DAYS ABOVE 110°
50
40
30
20
10
+14
DAYS
1970
PHOENIX
2023
Change in annual days above 110° based on rate of change since 1970.
Source: RCC-ACIS.org
CLIMATE CENTRAL


MORE RISKY HUMID HEAT
Days with heat index of 80°F or higher
230
220
210
200
190
180
+30
DAYS
1979
BATON ROUGE
2023
Annual count of days with a heat index of 80°F or higher.
Source: gridMET
CLIMATE CENTRAL


HOUSTON
RECORDS SET BY DECADE
100%
50%
HIGHS
1880s
1950s
2020s
LOWS
50%
100%
% high max & low min daily temperature records by decade (including ties) for POR through 11/18/2024
Source: RCC-ACIS.org
CLIMATE CENTRAL


LESS EXTREME COLD
Lowest Temperature Each Year
10°
5°
0°
-5°
-10°
-15°
-20°
+8.5°
1970
DETROIT
2018
Minimum temperature each year
Source: RCC-ACIS.org
CLIMATE CENTRAL

CLIMATE CENTRAL

Share | Screenshot Map | EN

Explore our new CSI: Ocean map →

Climate Shift Index® Global Map

Select type of map:

- Climate Shift Index
- Temperature anomaly
- Temperature

City

Type a city name

Date

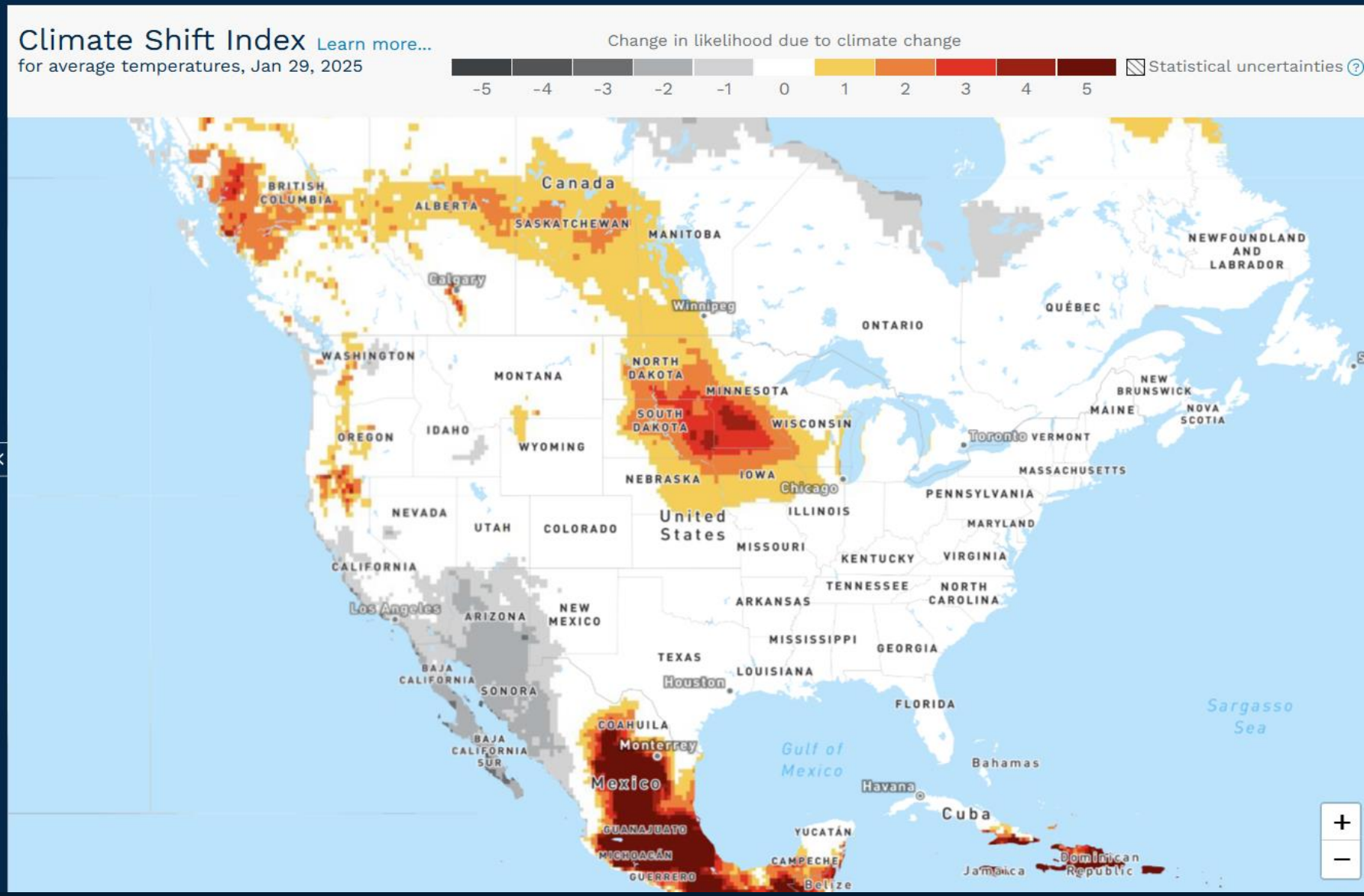
◂ Today ▸

Single date | Multi-day average

› Advanced settings

Sign up for daily CSI data in KML format →

Based on NOAA GFS forecasts through 2025-01-28T18Z.

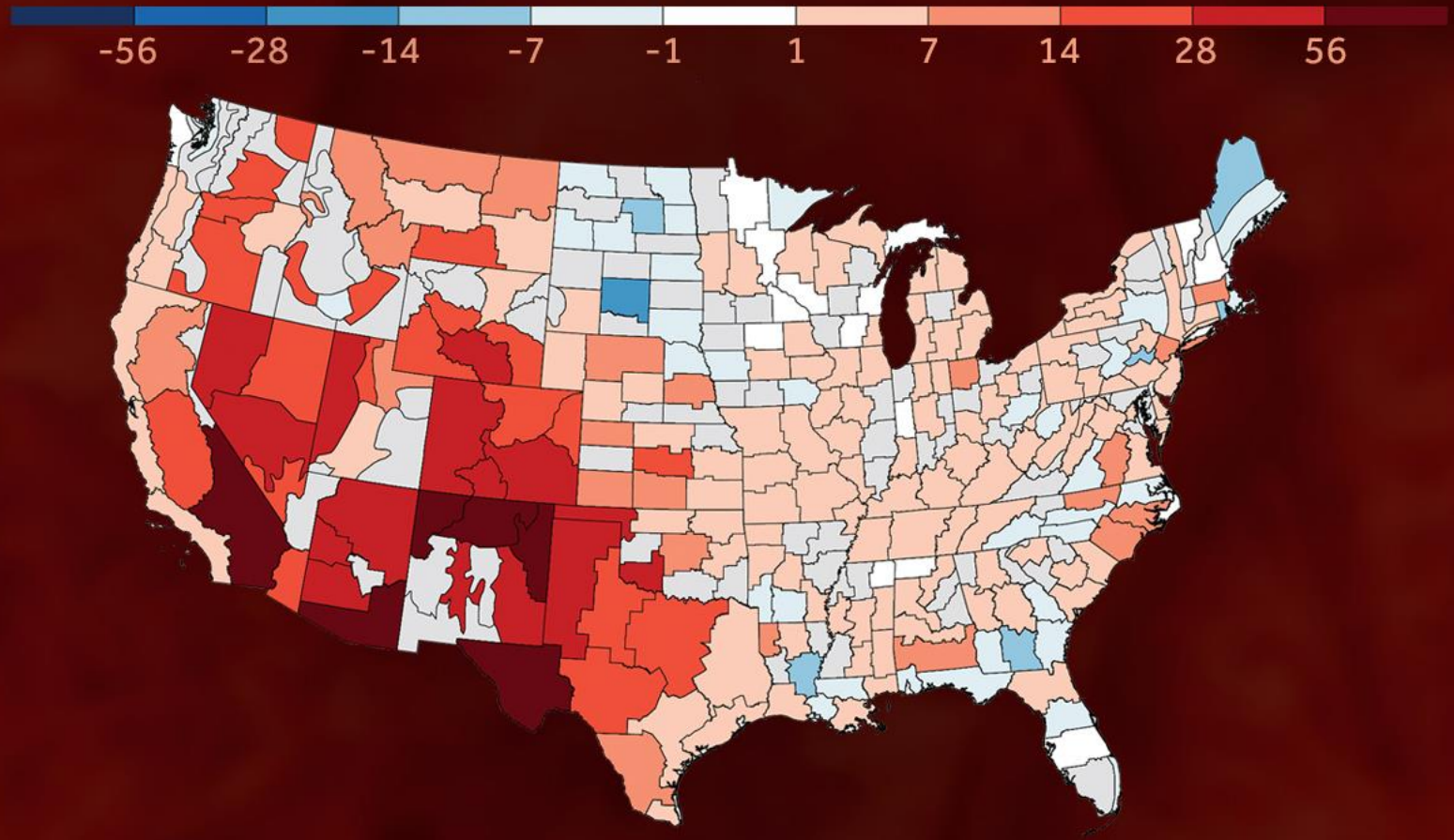


https://www.climatecentral.org/climate-shift-index

CLIMATE CENTRAL

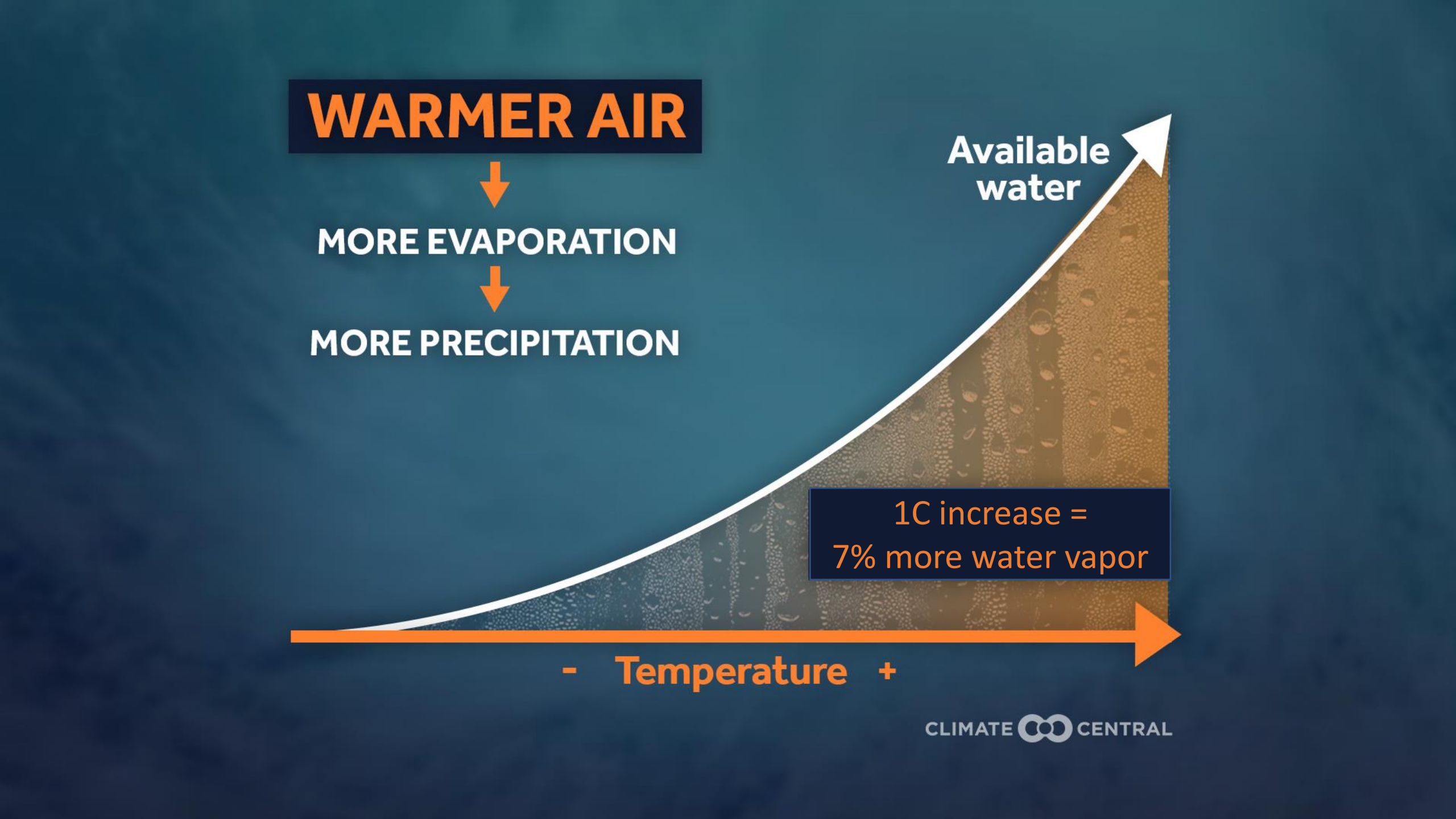
CHANGE IN FIRE WEATHER DAYS

Change in annual hot, dry, windy days, 1973-2023



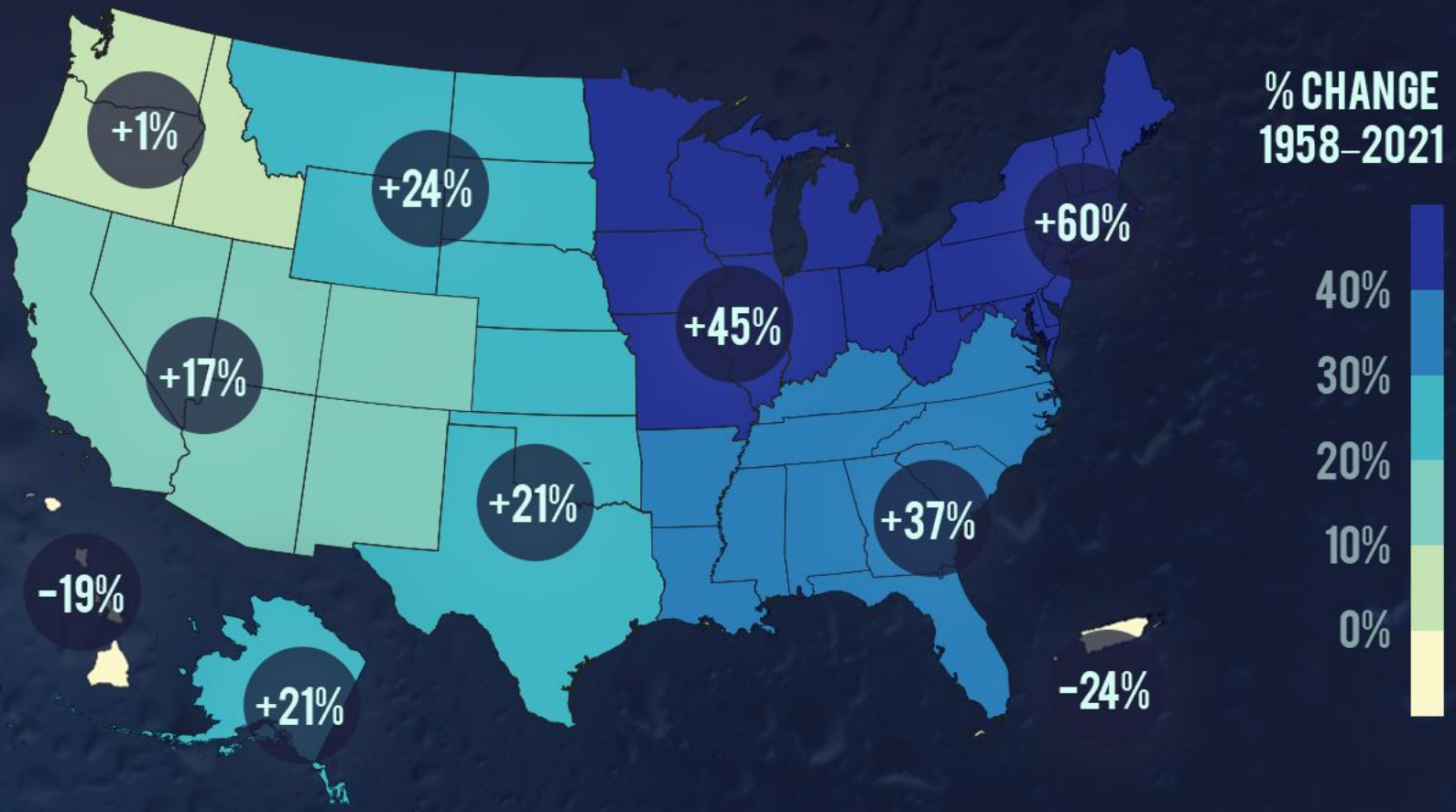
Change in average annual days (1973-2023) at/above fire weather thresholds in at least two hourly observations per day.
Source: NOAA/NCEI Local Climatological Data (LCD)

CLIMATE CENTRAL


WARMER AIR
MORE EVAPORATION
MORE PRECIPITATION
Available water
1C increase =
7% more water vapor
- Temperature +
CLIMATE CENTRAL

HEAVIER DOWNPOURS

Change in precipitation on heaviest 1% of days

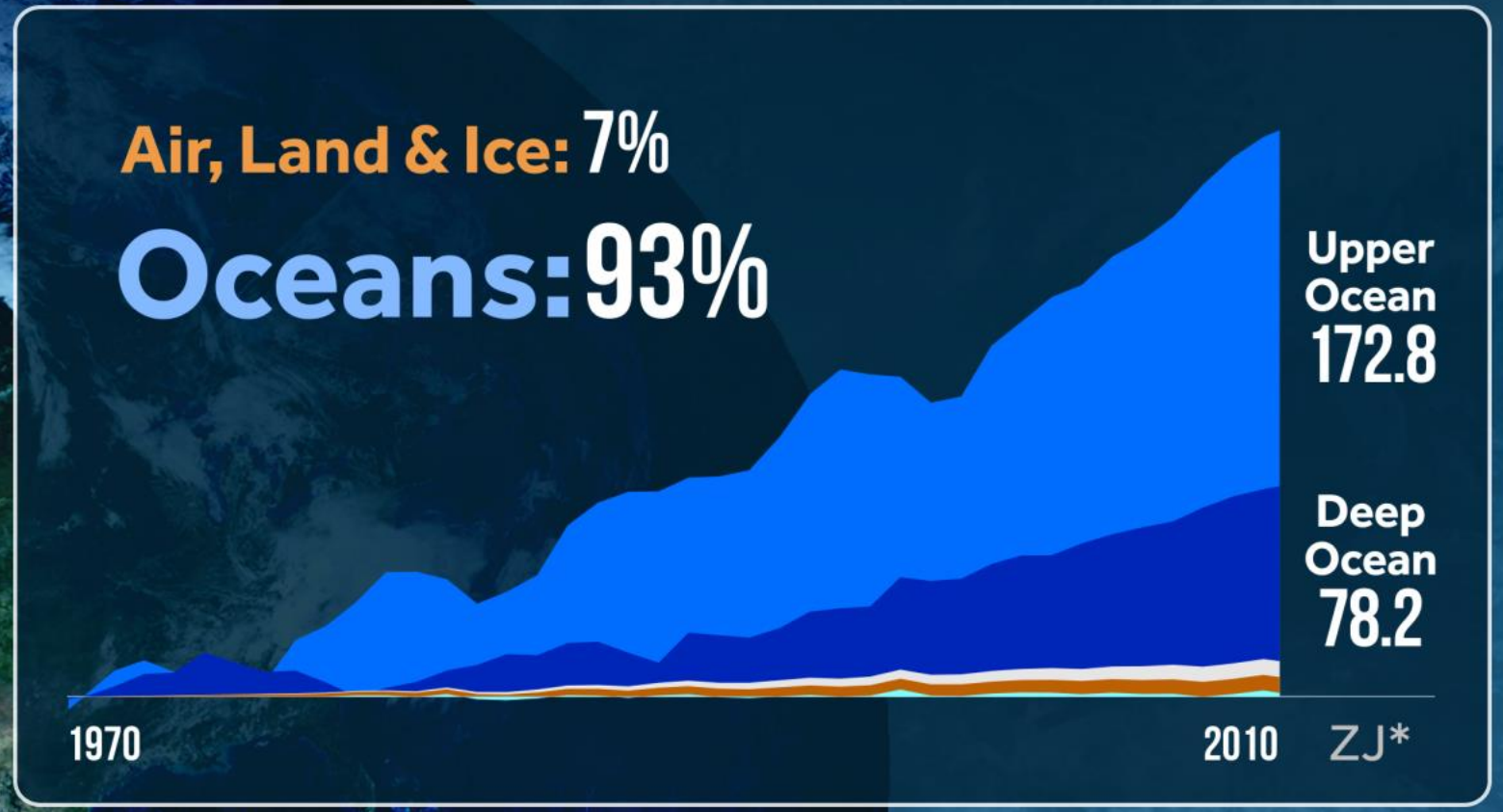


Change in total precipitation falling on the heaviest 1% of days, 1958–2021.
Source: USGCRP, 2023: Fifth National Climate Assessment.

CLIMATE CENTRAL

Where's the Heat?

Earth's Accumulated Energy



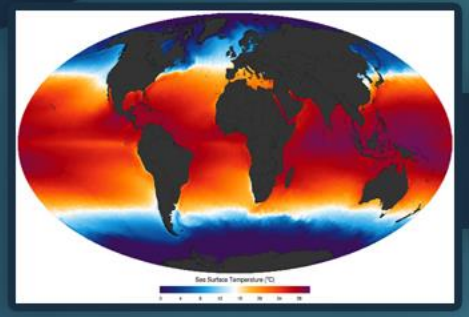
*Accumulated Heat Energy Measured in Zettajoules

Source: Climate Change 2013: The Physical Science Basis (IPCC) Chapter 3

CLIMATE CENTRAL

HURRICANES & CLIMATE CHANGE

What we know



Warmer water = more fuel

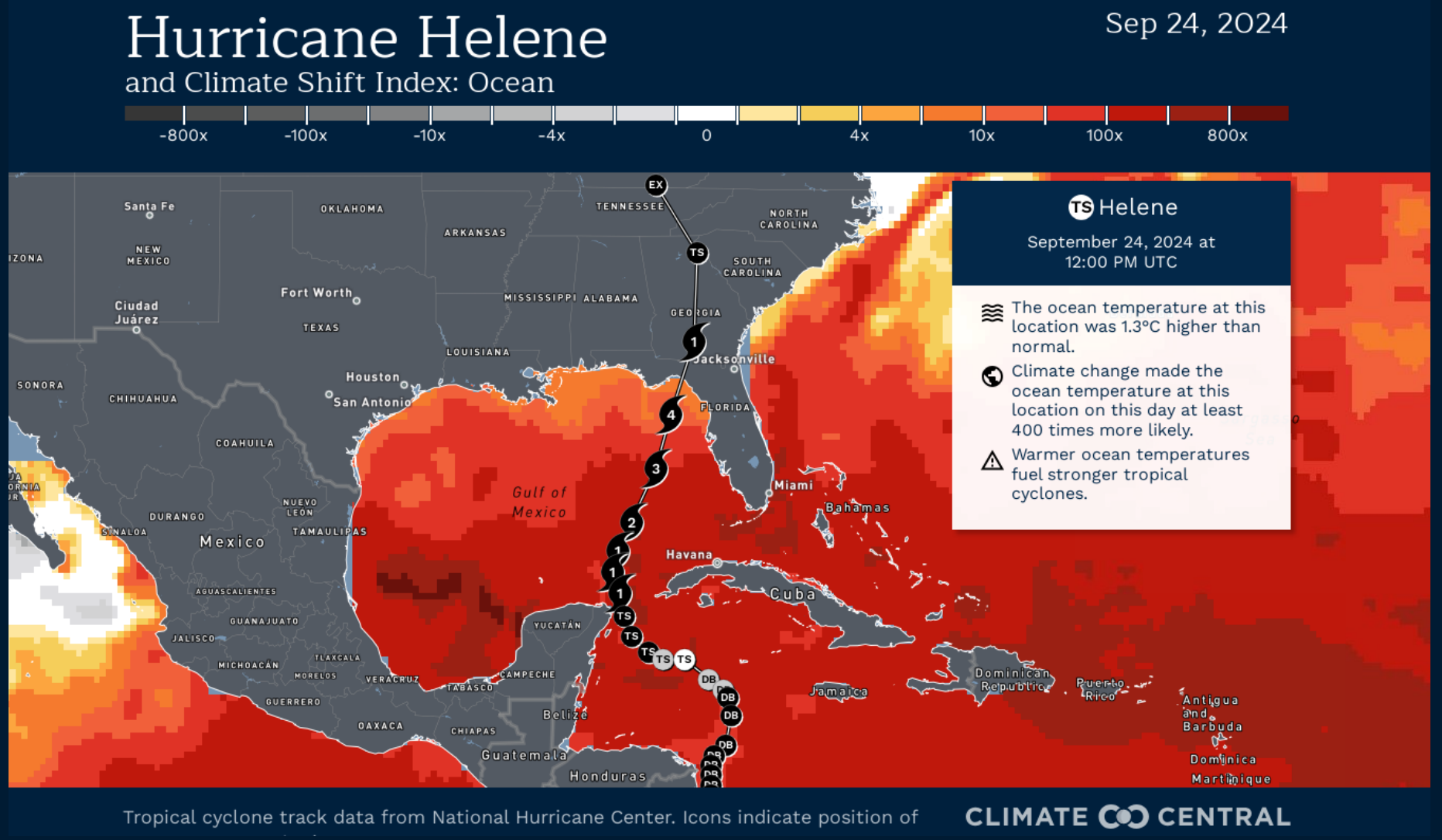
Heavier rain

Higher storm surge

from rising sea levels

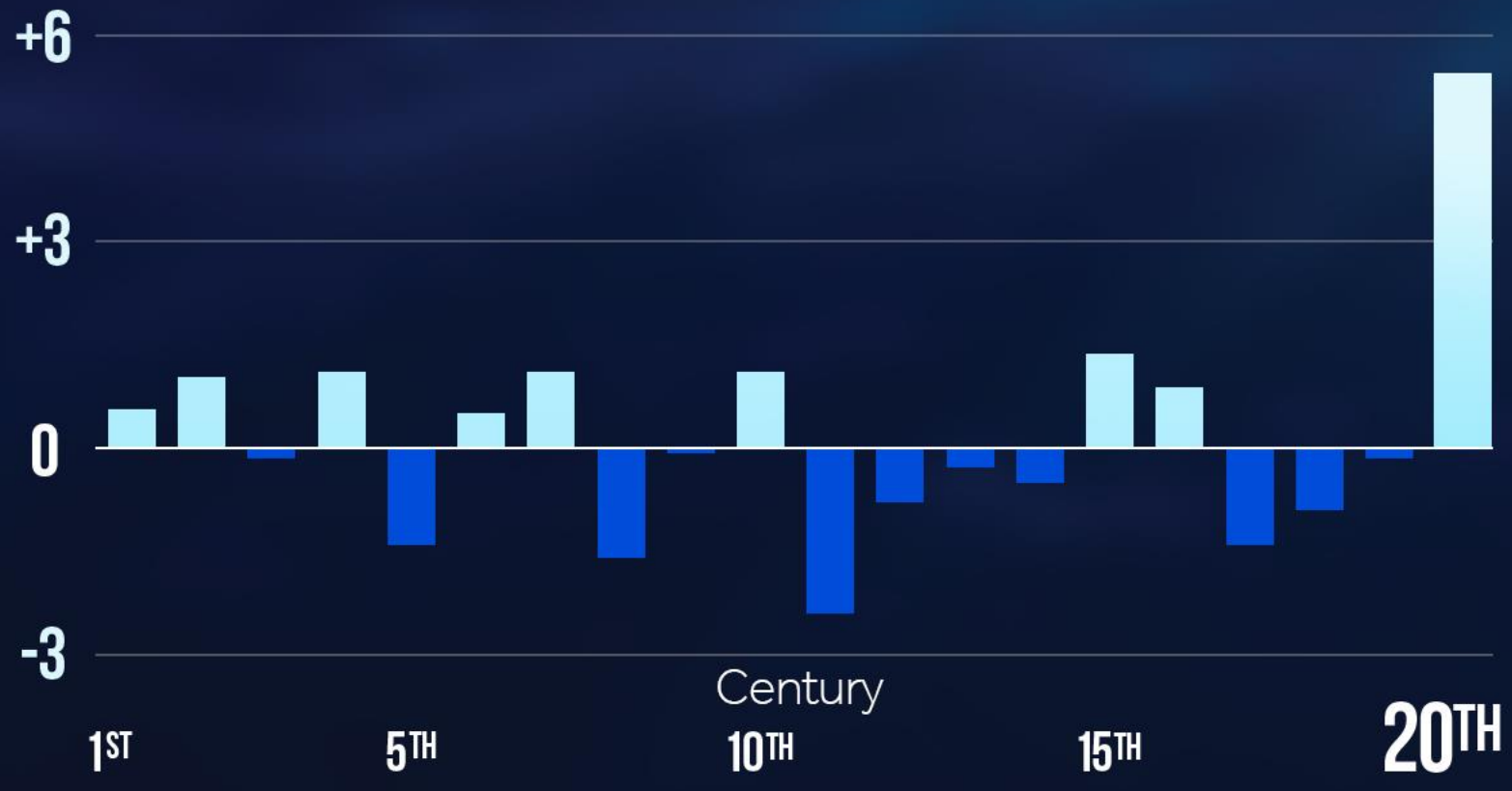
CLIMATE CENTRAL

Helene: record warm water 300-500x more likely because of climate change



CLIMATE CENTRAL

SEA LEVEL RISE
BY CENTURY

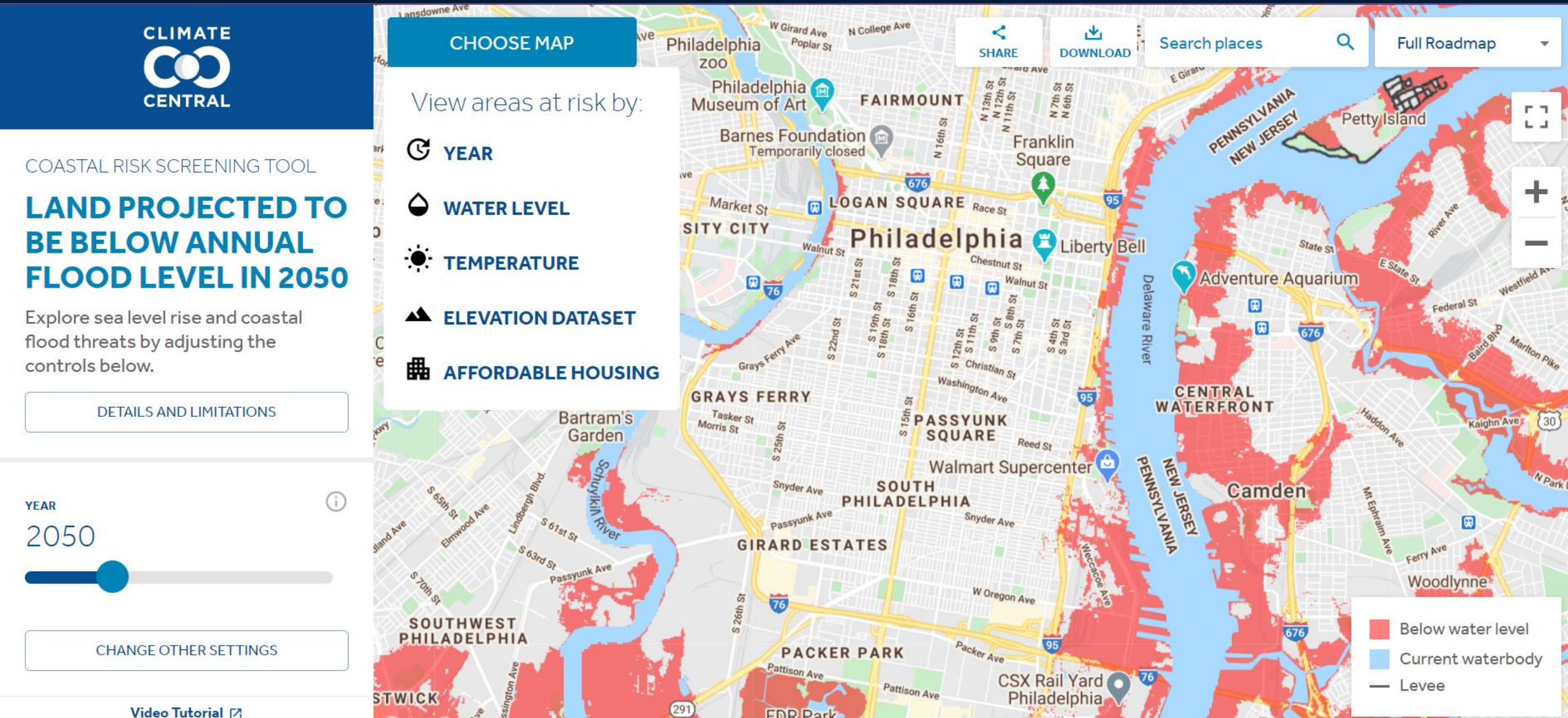


Central reconstruction shown
Source: Kopp et al. 2016 (PNAS)

CLIMATE CENTRAL

Surging Seas

Sealevel.climatecentral.org



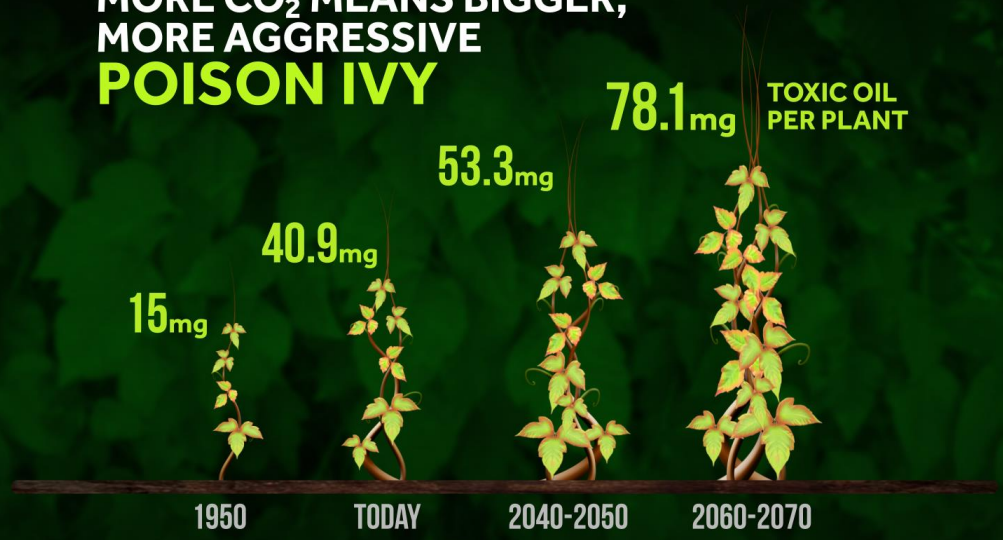
MORE MOSQUITO DAYS

Annual days suitable for mosquitoes

Mosquito days: 50-95°F, relative humidity >42%
Source: Yamana and Eltahir (2013); gridMET

CLIMATE CENTRAL

MORE CO_2 MEANS BIGGER, MORE AGGRESSIVE POISON IVY

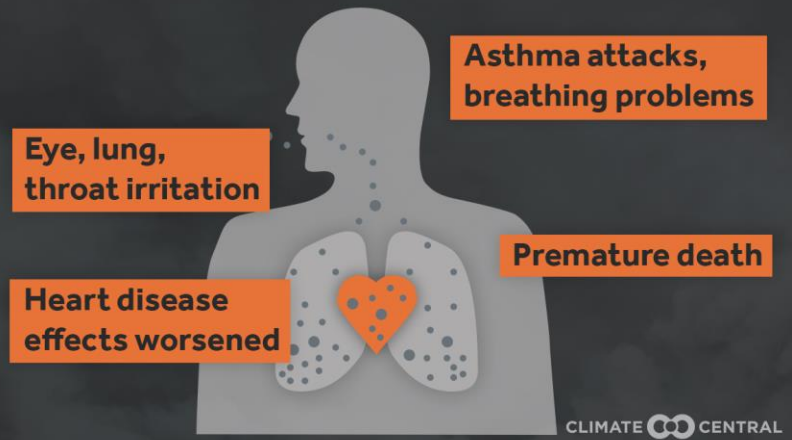


Average per plant in Ziska (2007) lab study

CLIMATE CENTRAL

WILDFIRE POLLUTION HARMS HEALTH

Fine particle ($PM_{2.5}$) effects



CLIMATE CENTRAL

LONGER GROWING SEASON = LONGER ALLERGY SEASON

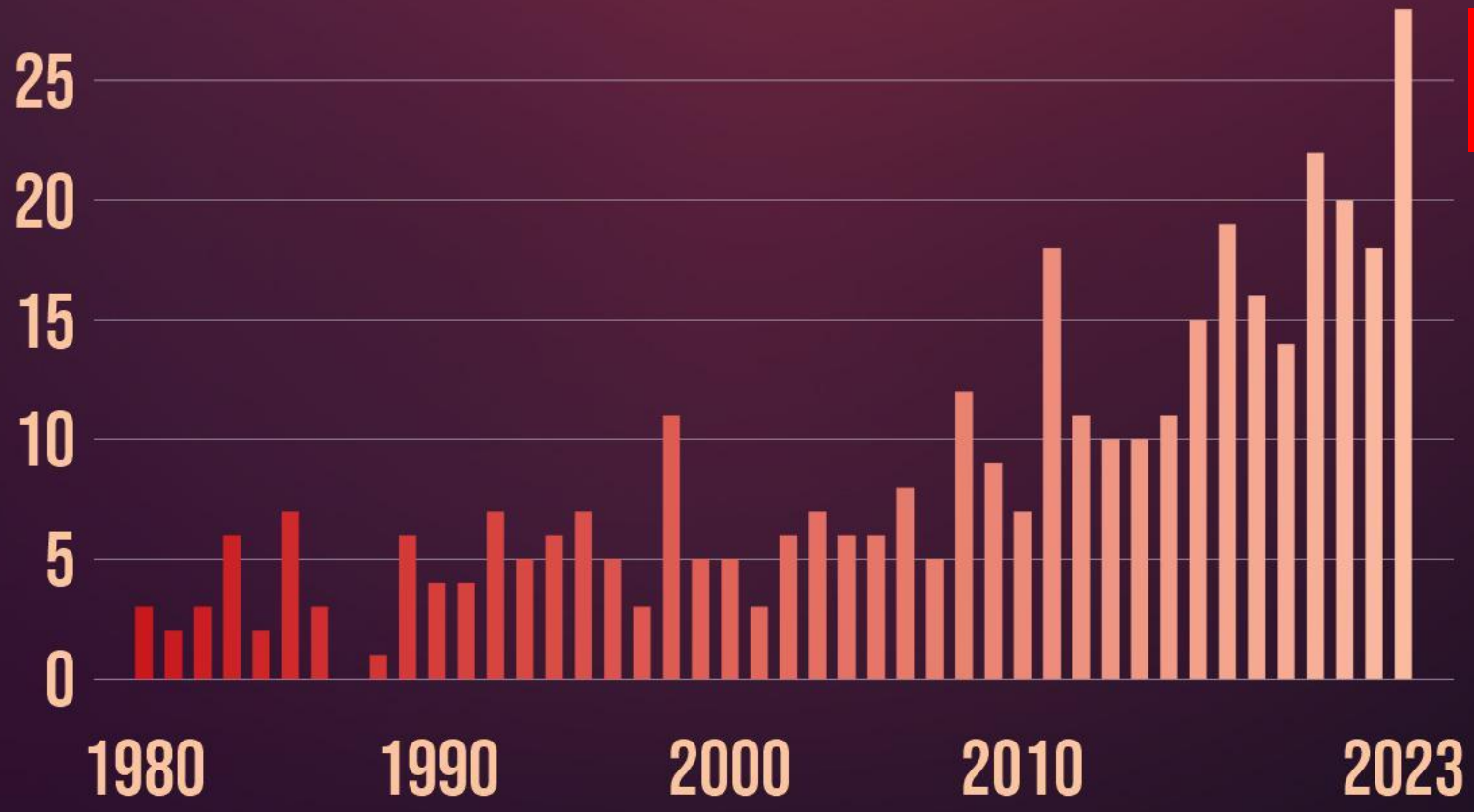
Freeze-free season (days)

Freeze-free season = consecutive days between the annual last and first occurrence of 32°F (min temp)
Source: RCC-ACIS.org

CLIMATE CENTRAL

U.S. BILLION-DOLLAR DISASTERS

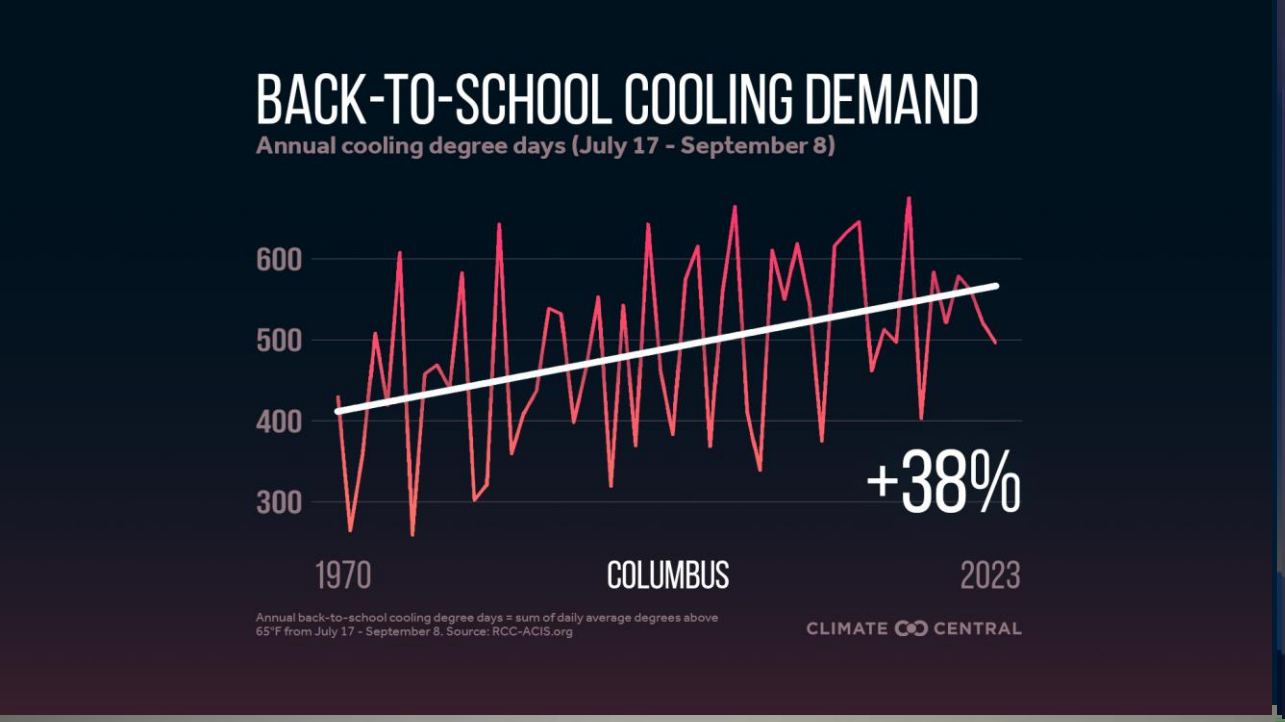
Annual number of events

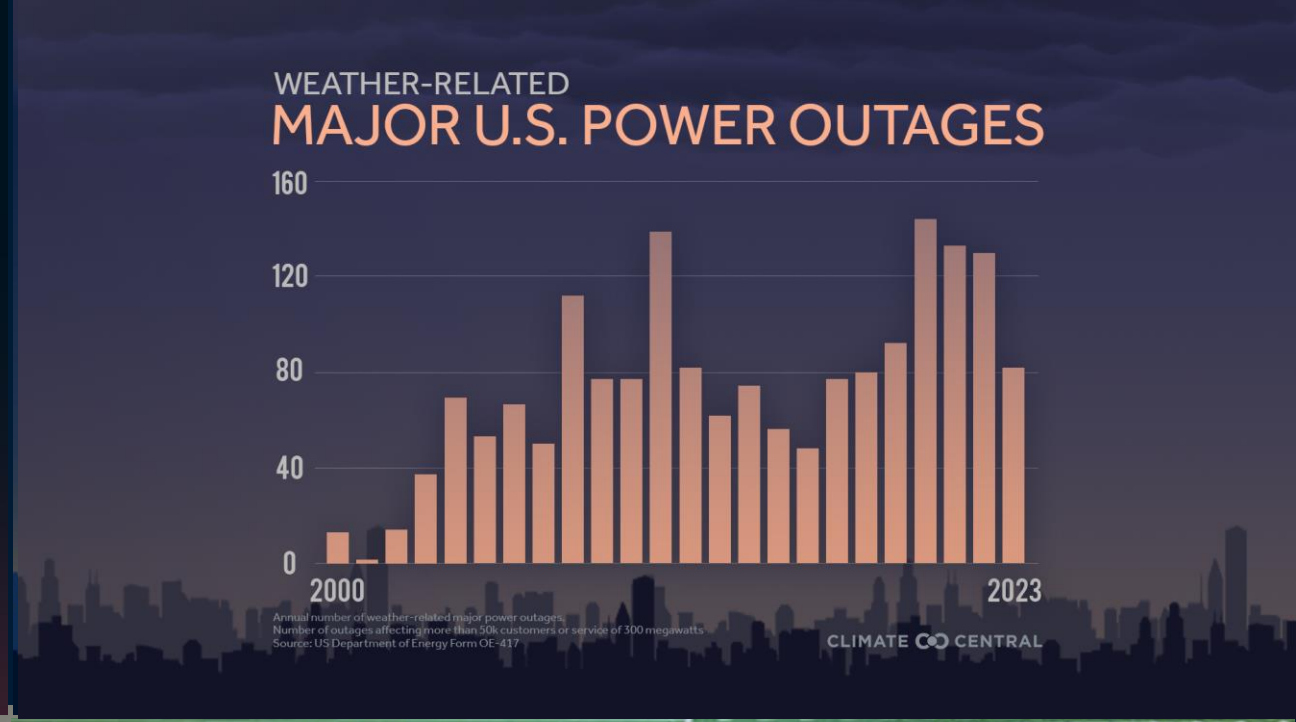


2024:
27 events

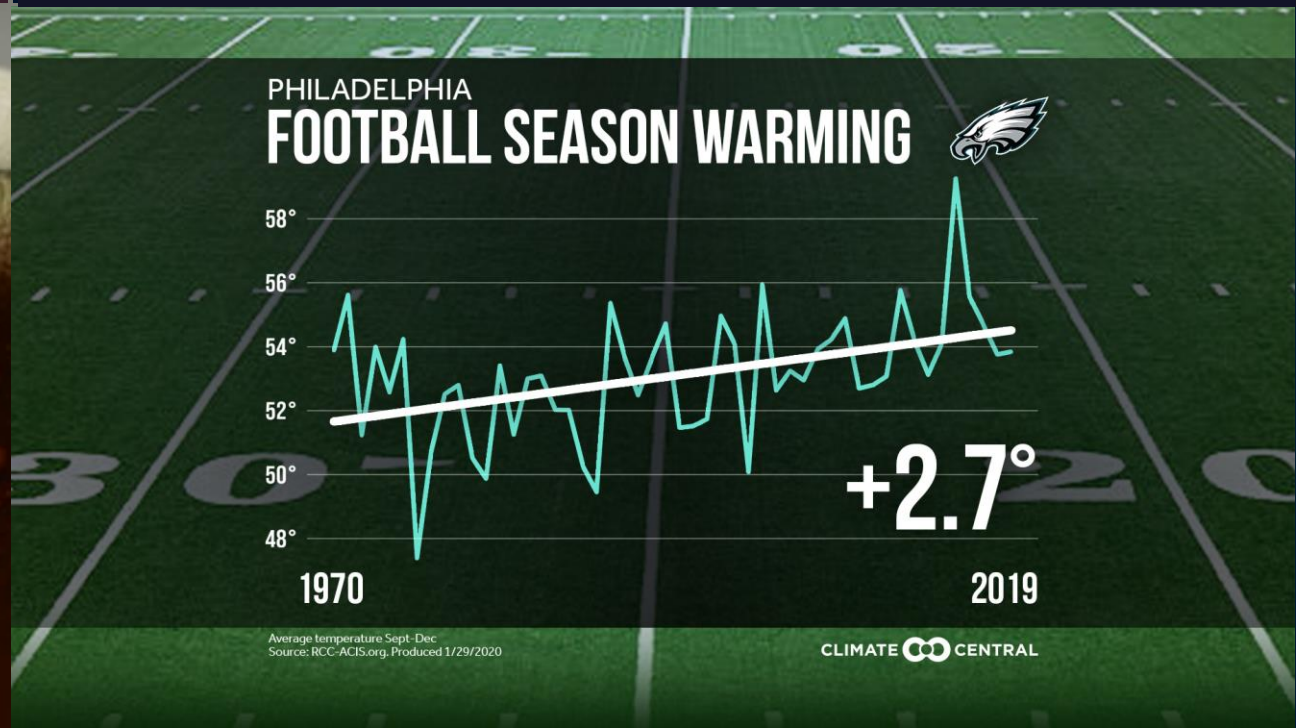
No disasters in 1987. Data as of 1/9/2024.
Source: NOAA/NCEI

CLIMATE CENTRAL


BACK-TO-SCHOOL COOLING DEMAND
Annual cooling degree days (July 17 - September 8)
600
500
400
300
+38%
1970
COLUMBUS
2023
Annual back-to-school cooling degree days = sum of daily average degrees above 65°F from July 17 - September 8. Source: RCC-ACIS.org
CLIMATE CENTRAL


WEATHER-RELATED
MAJOR U.S. POWER OUTAGES
160
120
80
40
0
2000
2023
Annual number of weather-related major power outages.
Number of outages affecting more than 50k customers or service of 300 megawatts
Source: US Department of Energy Form OE-417
CLIMATE CENTRAL


TROUBLE BREWING
BARLEY
HOPS
WATER
Climate Change is Impacting the Key Elements in Beer
CLIMATE CENTRAL


PHILADELPHIA
FOOTBALL SEASON WARMING
58°
56°
54°
52°
50°
48°
+2.7°
1970
2019
Average temperature Sept-Dec
Source: RCC-ACIS.org. Produced 1/29/2020
CLIMATE CENTRAL

Weather • Food–Land and Sea • Water

Health • Economy • Racial & Social Equity

Infrastructure–Buildings, Roads • Energy • Transportation

Coastal Flooding, Changing Oceans • Shifting Ecosystems

Shifting Seasons • National Security • Migration • Tourism

Sports, Recreation • Ways of Life

CLIMATE CENTRAL

Our Future is Our Choice

Resources

CLIMATE CENTRAL

Climate Shift Index Alert • November 18, 2024

Analysis: Climate Change-Driven Ocean Warming Intensifies Record November Typhoon Activity in the Western Pacific

For the first time on record, four named tropical systems were simultaneously active in the Western Pacific Ocean in November: Typhoon Yinxing, Typhoon Toraji, Super Typhoon Usagi, and Super Typhoon Man-Yi. Man-Yi was the strongest and most influenced by ocean temperatures boosted by climate change.

Climate Matters • November 13, 2024

2024 Winter Package

Winters have warmed by 4°F on average across 235 U.S. cities since 1970. Warmer, shorter winters have lingering effects on health, water supplies, and agriculture throughout the year.

Climate Matters • November 5, 2024

COP29: Global Climate Conference

COP29, the global climate conference, starts

Partnership Journalism • November 5, 2024

Drought, record warmth fuel historic wildfire risk in N.J.

https://www.climatecentral.org/climate-matters

WeatherPower

Create a graphic forecasting daily wind or solar electricity generation in your media market.

For a state graphic, select a state.

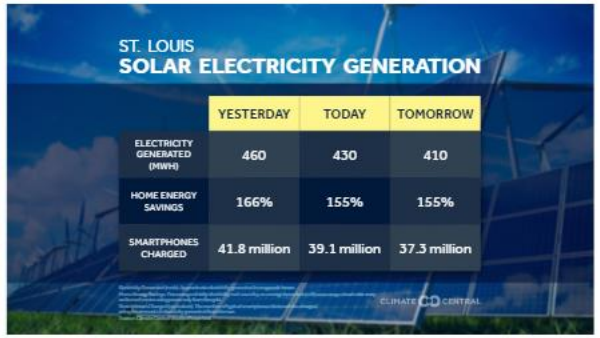
For a local graphic, first select a state, then click button for media market, county, or congressional district.

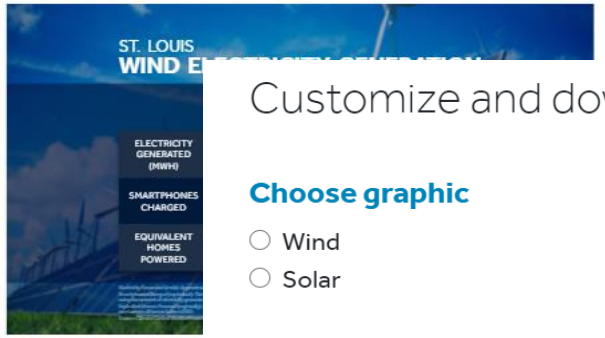
Missouri

State | Media market | County | Congressional district

St. Louis, MO

WeatherPower.climatecentral.org





Customize and download a production-ready forecast graphic:

Choose graphic

- ○ Wind
- ○ Solar

Choose background

- ◉ Wind/solar image
- ○ Black
- ○ Transparent

☑ Include title

Choose Days (columns) (up to 3)

- ☑ Yesterday
- ☑ Today
- ☑ Tomorrow
- ☐ Saturday
- ☐ Sunday
- ☐ Monday

Choose Equivalencies (rows) (up to 3 per graphic) ⓘ What do these mean?

- ☑ Electricity Generated (mwh)
- ☐ Equivalent Homes Powered (locally)
- ☑ Home Energy Savings (solar only)
- ☐ Power Index (0-10 scale)
- ☐ CO2 Avoided (tons)
- ☐ Car Miles
- ☐ Trees Planted
- ☑ Smartphones Charged
- ☑ Equivalent Homes Powered (regionally; wind only)

Download Graphic

Thank you!

Sign up for Climate Matters:
climatecentral.org/climate-matters

bplacky@climatecentral.org

CLIMATE CENTRAL