



Climate Change

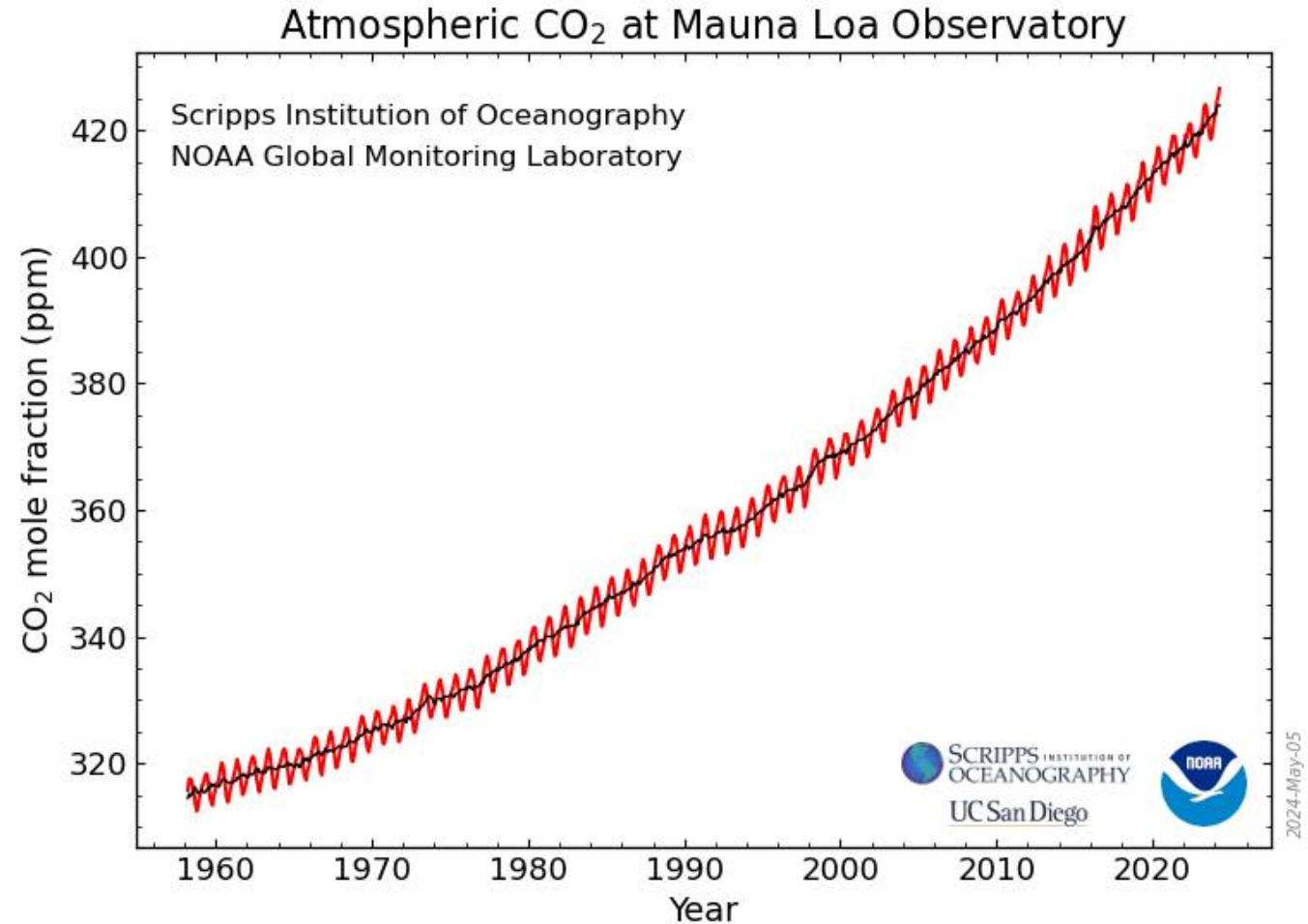
Dr. Keith Seitter

Distinguished Visiting Professor at the College of the Holy Cross

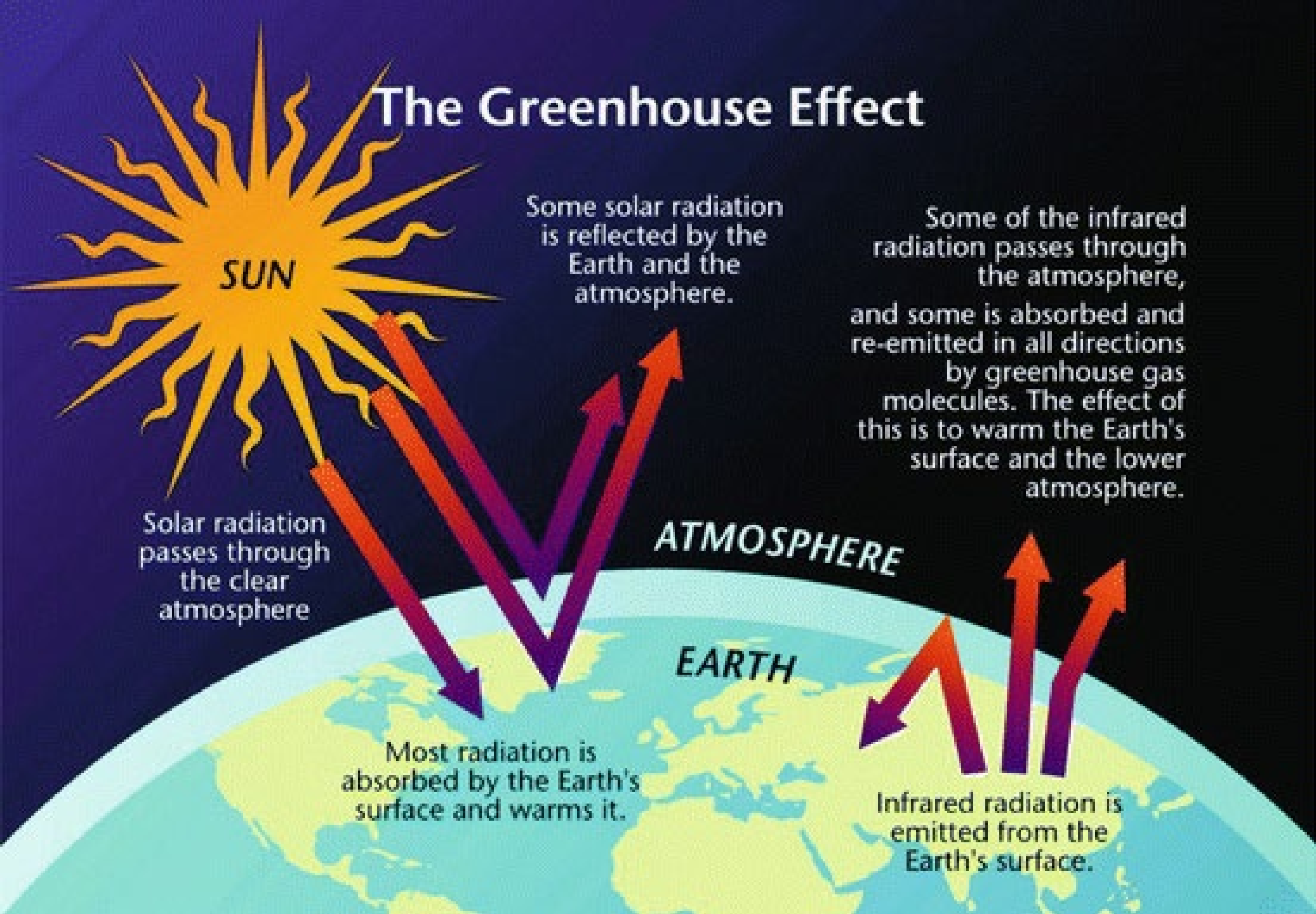
Executive Director Emeritus of the American Meteorological Society

Climate: A statistical description (both mean and variability) of the atmosphere–ocean–land–cryosphere system over a few decades.

Global climate is governed by the balance of incoming and outgoing energy in the Earth system, which depends strongly on the composition of the atmosphere. So, changes in the atmospheric composition can affect climate, leading to climate change.



The Greenhouse Effect



SUN

Some solar radiation is reflected by the Earth and the atmosphere.

Some of the infrared radiation passes through the atmosphere, and some is absorbed and re-emitted in all directions by greenhouse gas molecules. The effect of this is to warm the Earth's surface and the lower atmosphere.

Solar radiation passes through the clear atmosphere

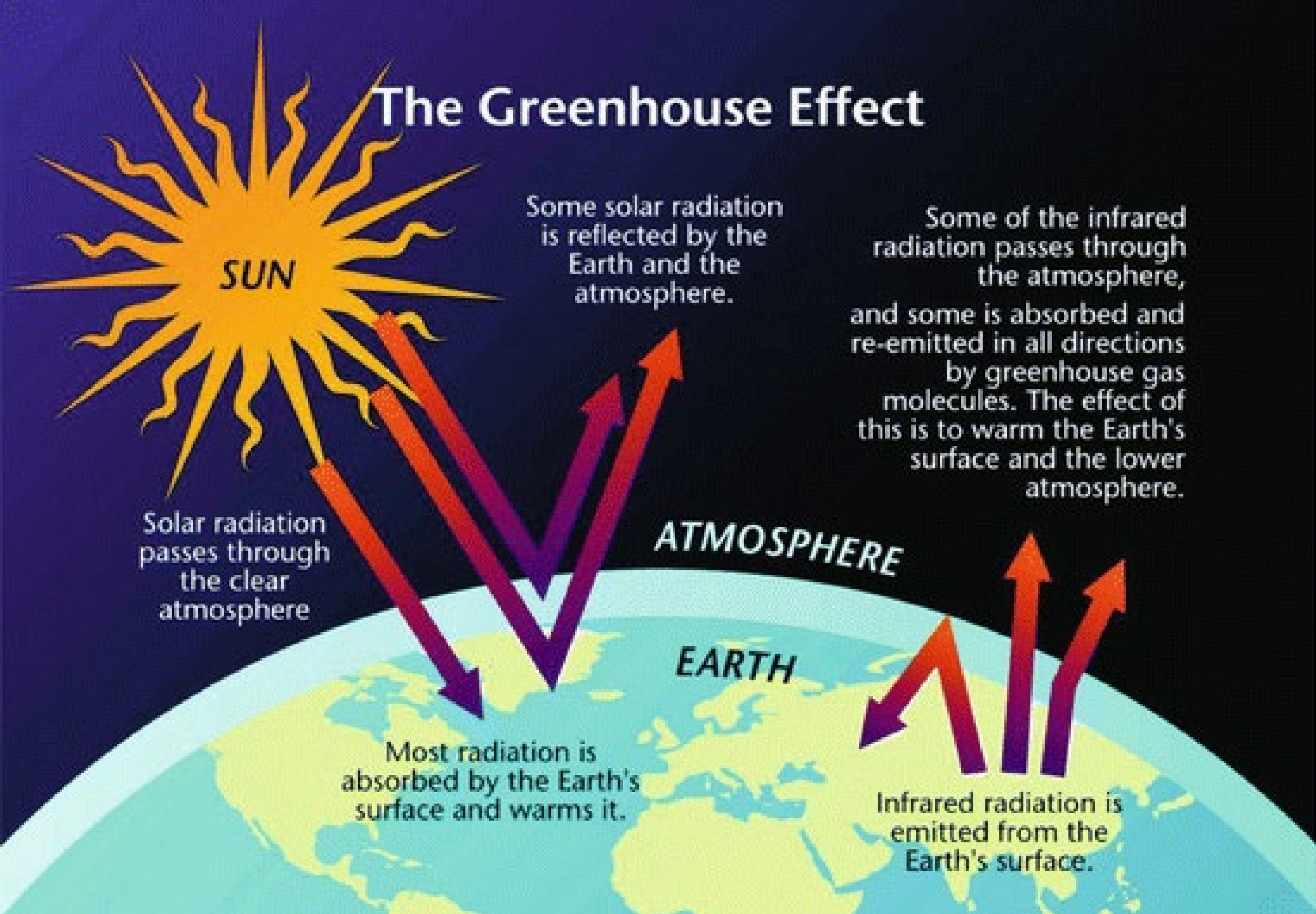
ATMOSPHERE

EARTH

Most radiation is absorbed by the Earth's surface and warms it.

Infrared radiation is emitted from the Earth's surface.

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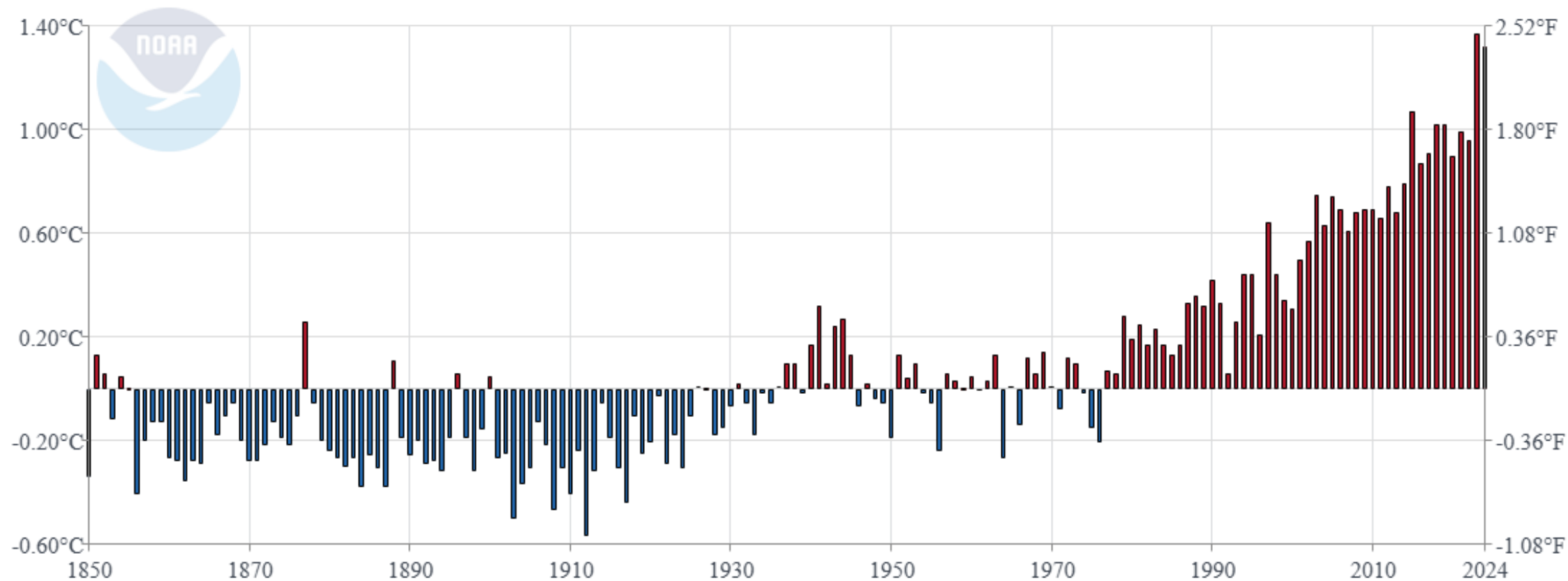
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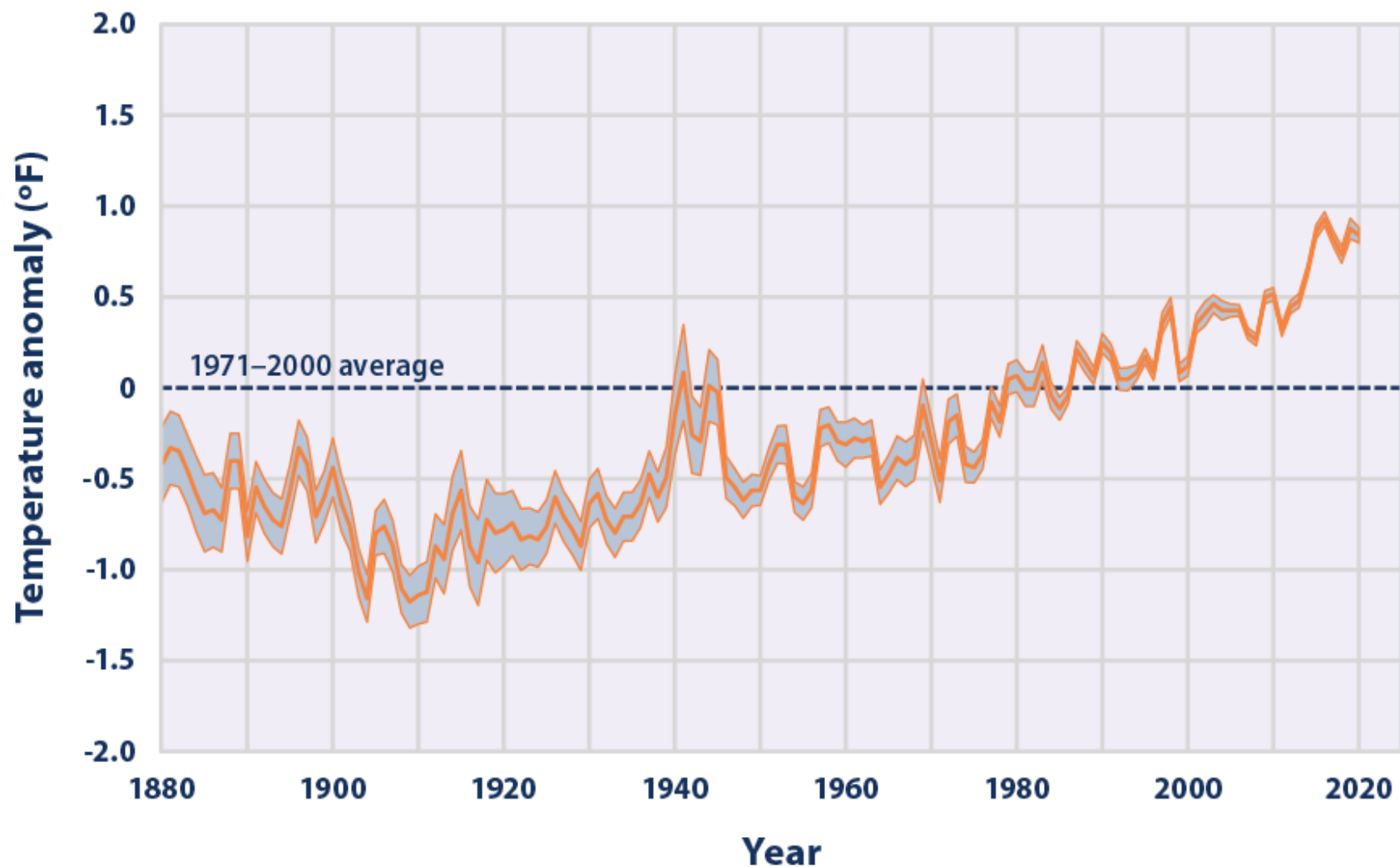
Carbon dioxide, Methane, Water vapor, ... (a few other gases)

Global Land and Ocean Average Temperature Anomalies

October



Average Global Sea Surface Temperature, 1880–2020



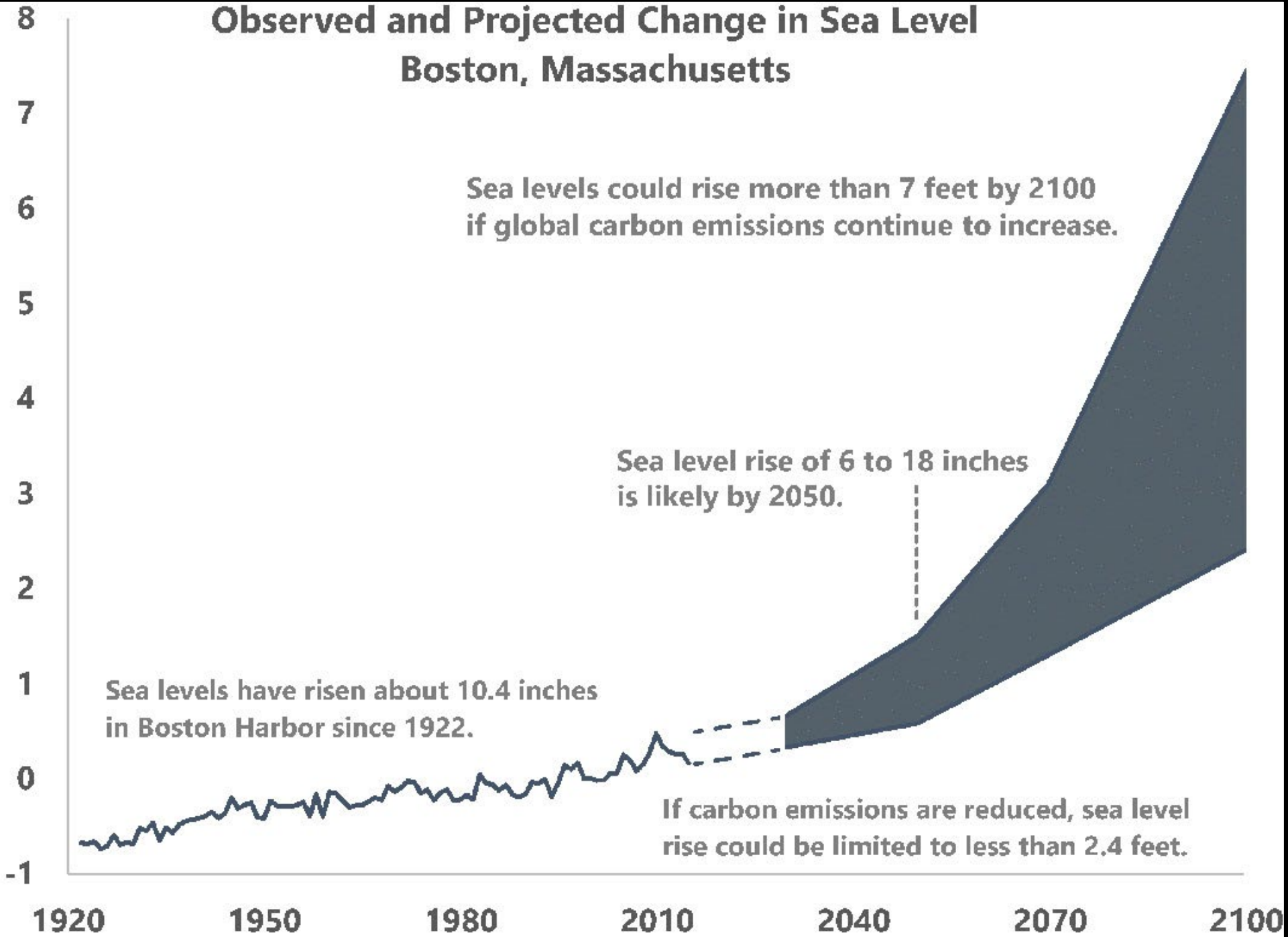
Data source: NOAA (National Oceanic and Atmospheric Administration). 2021. Extended reconstructed sea surface temperature (ERSST.v5). Accessed February 2021.

www.ncdc.noaa.gov/data-access/marineocean-data/extended-reconstructed-sea-surface-temperature-ersst.

For more information, visit U.S. EPA's "Climate Change Indicators in the United States" at www.epa.gov/climate-indicators.

Observed and Projected Change in Sea Level Boston, Massachusetts

Change in Sea Level Relative to 2000 (ft)



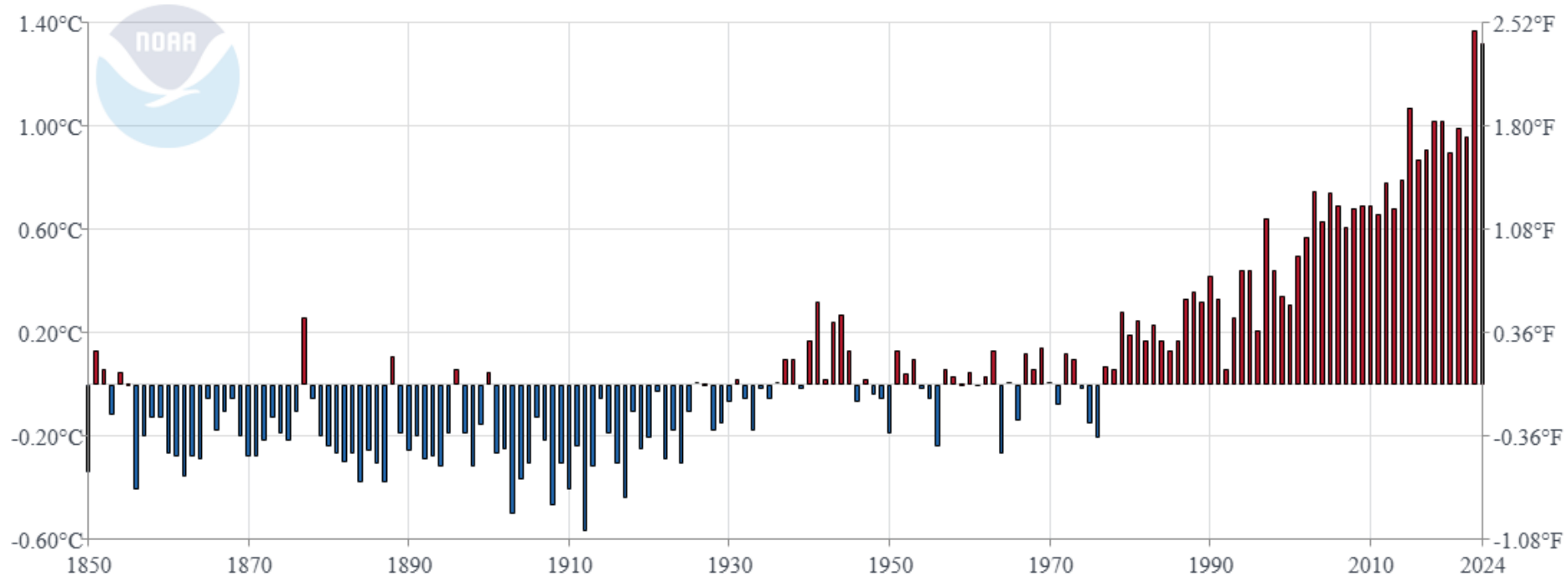




Boston with sea level six feet higher than current levels [blue under water, green vulnerable]

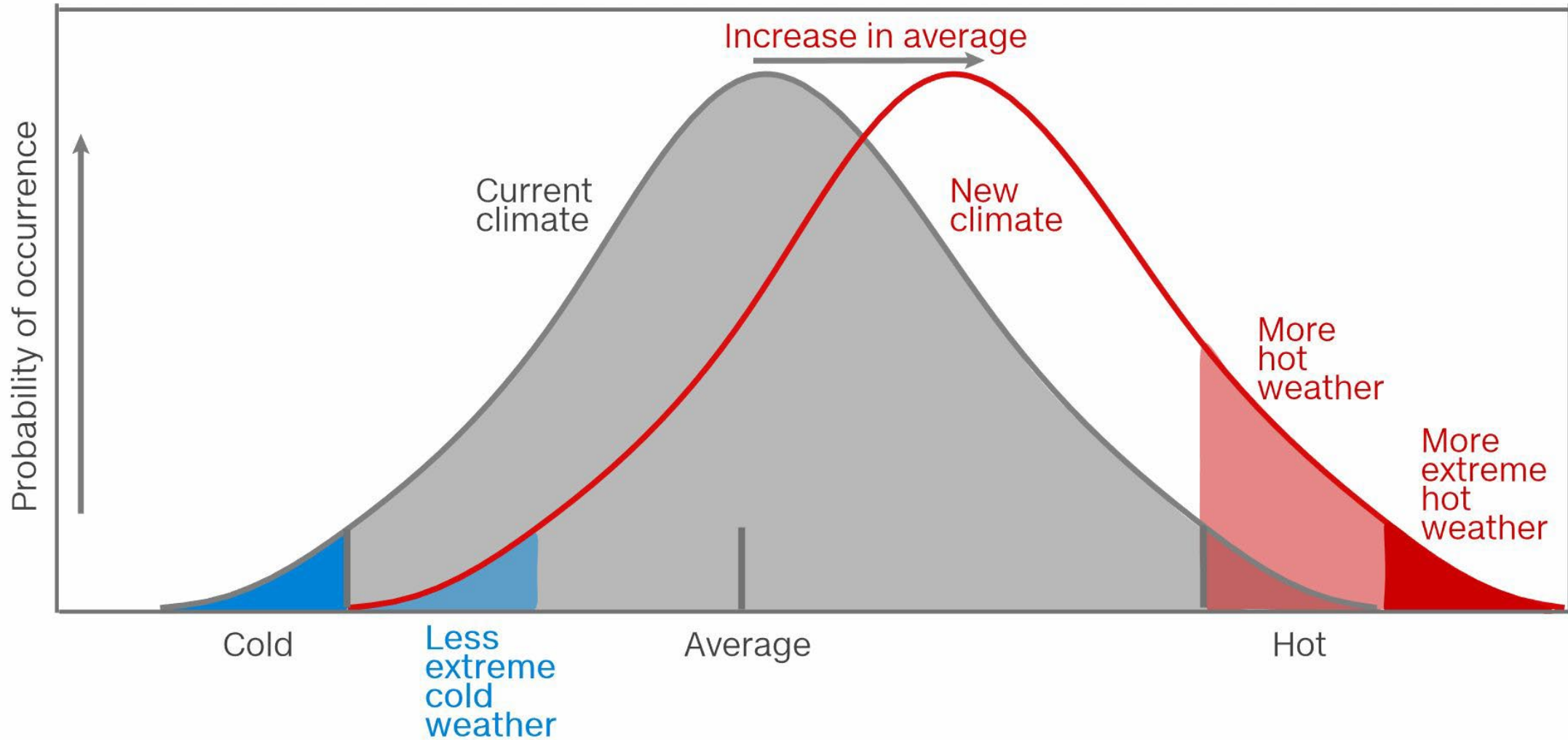
Global Land and Ocean Average Temperature Anomalies

October

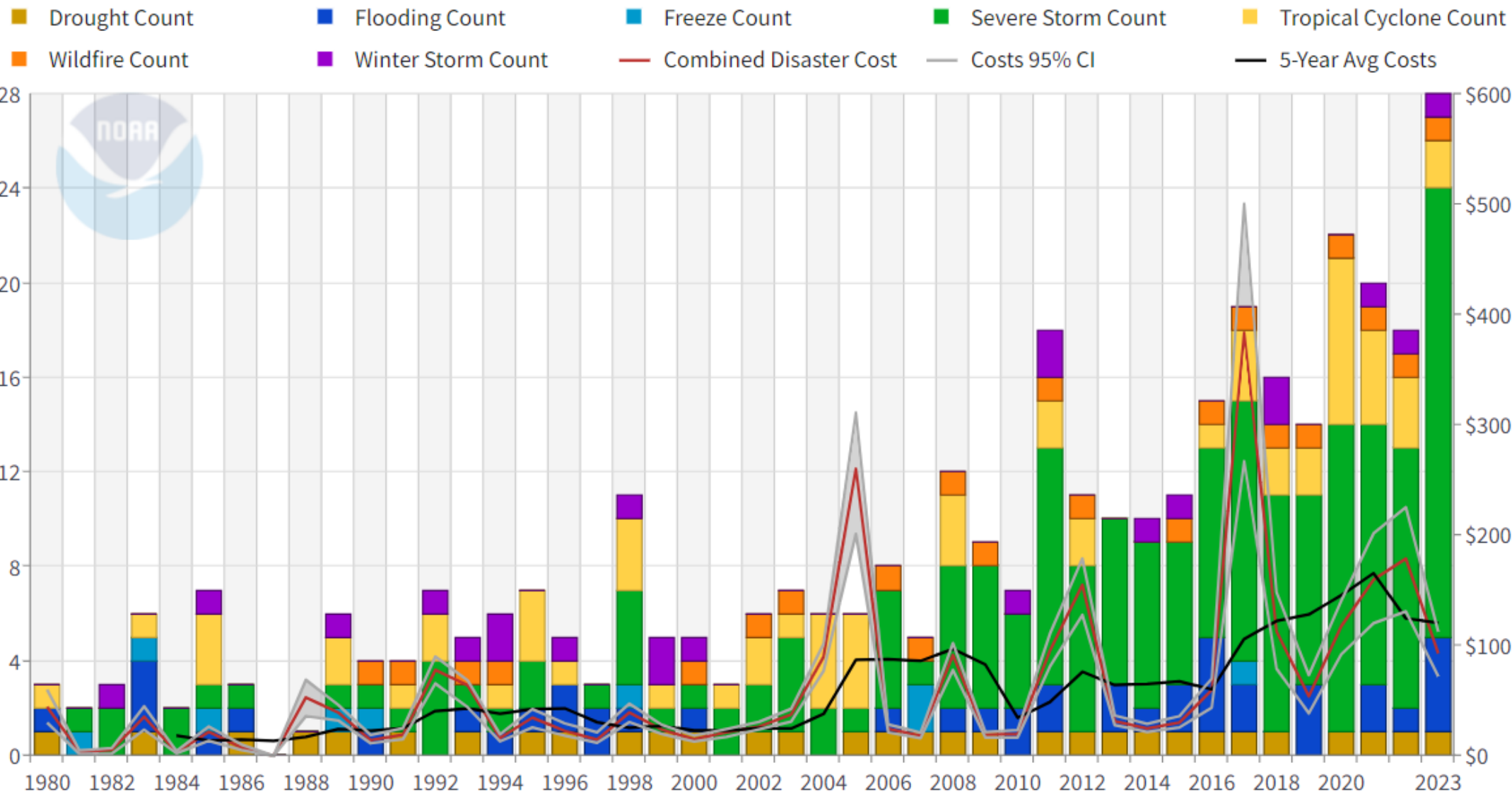


One can view weather as an “expression” of climate, and our changing climate expresses itself through changes in our weather.

Climate change and extreme weather



United States Billion-Dollar Disaster Events 1980-2023 (CPI-Adjusted)



Days over 95°F in July



ClimateCentral.org

Projections based on regional estimates



abc NEWS

RECORD HEAT WAVE

FORECAST HIGHS

Las Vegas

113	113	114	115
Tue	Wed	Thu	Fri

Death Valley

123	121	121	125
Tue	Wed	Thu	Fri

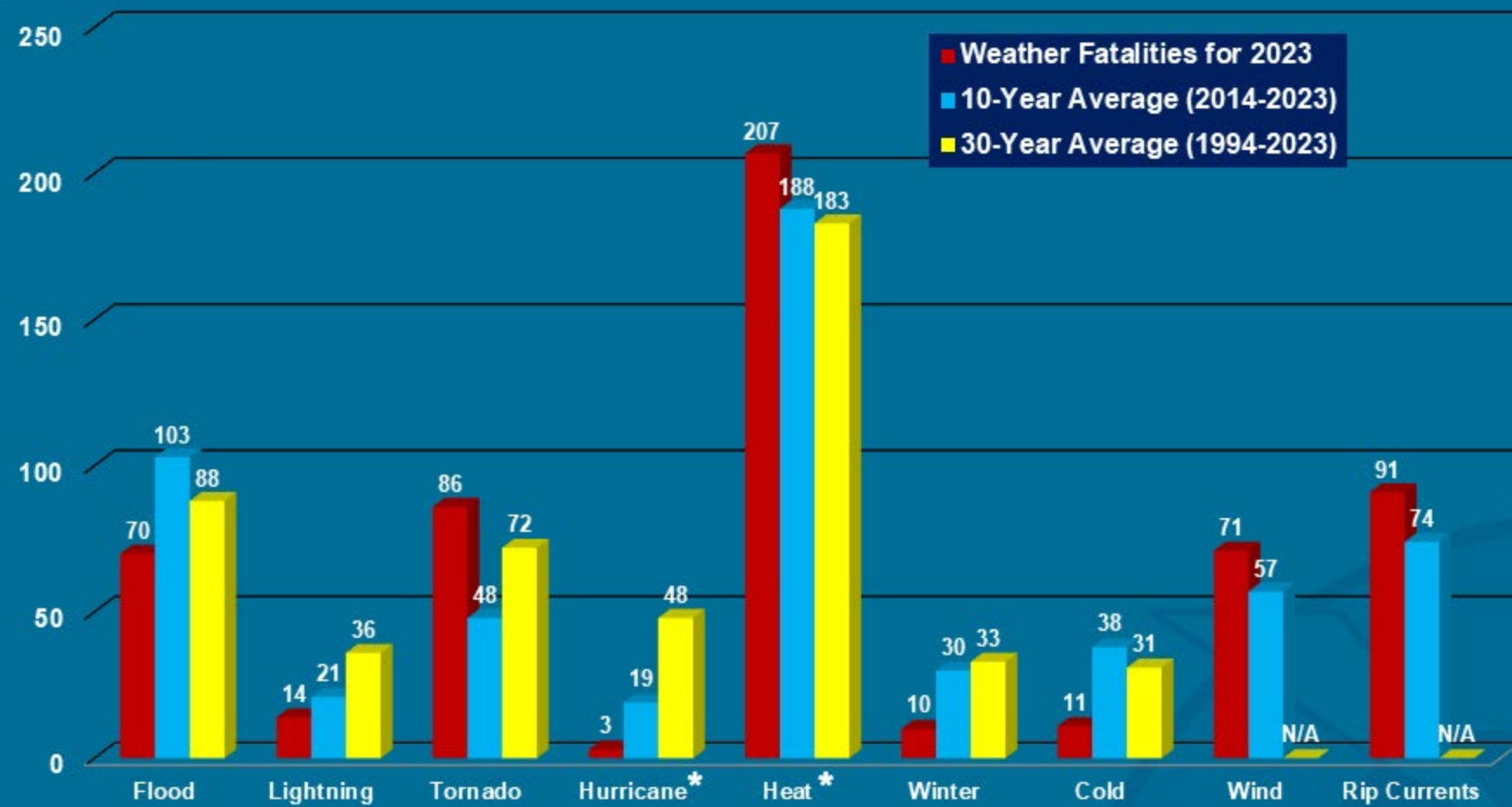
Phoenix

117	117	117	118
Tue	Wed	Thu	Fri

Phoenix, Arizona recorded the longest streak of consecutive 100-degree days with 113 days from May 27 to September 16, 2024

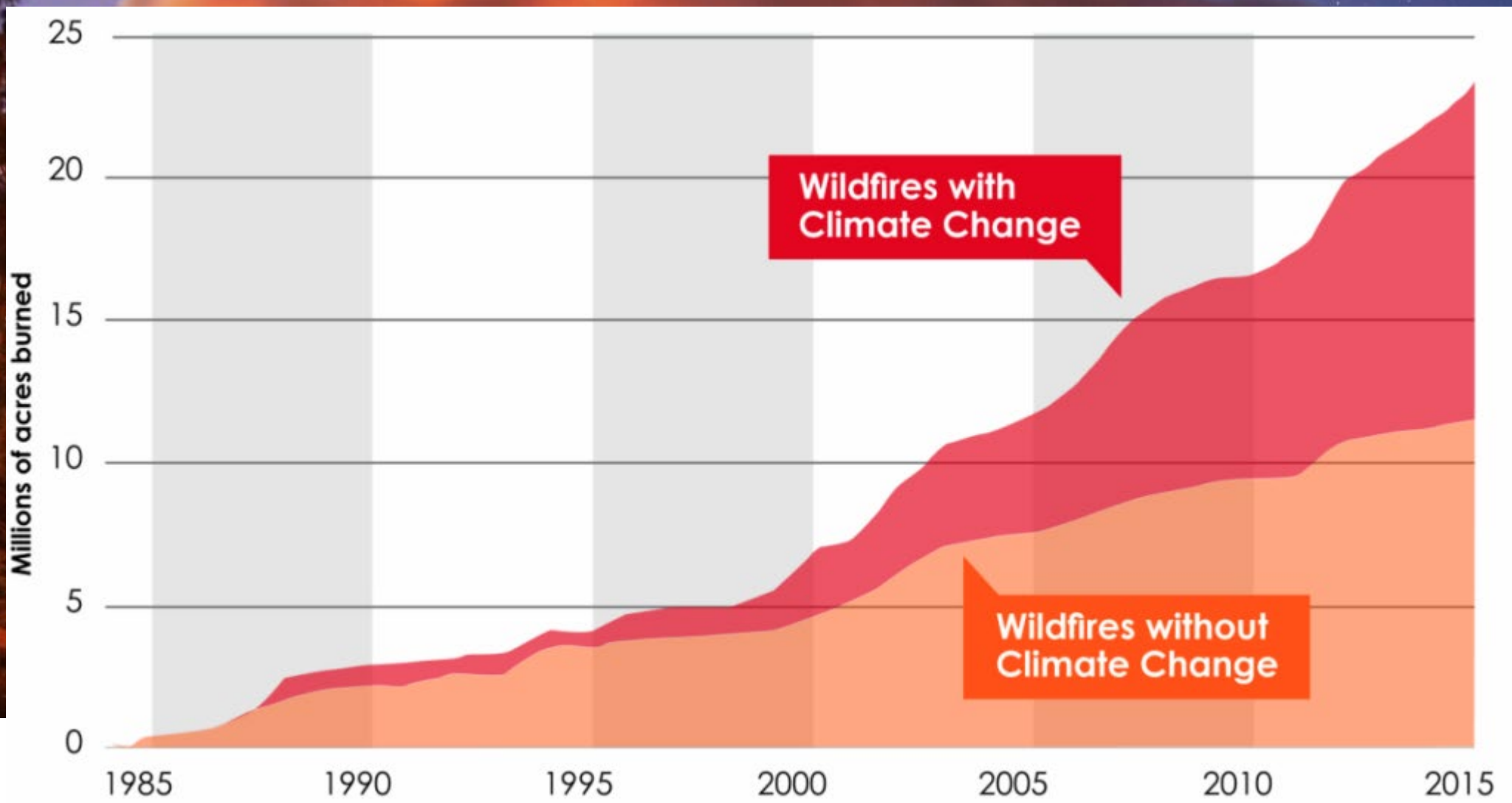


Weather Fatalities 2023



**Due to an inherent delay in the reporting of official heat fatalities in some jurisdictions, this number will likely rise in subsequent updates.
The fatalities, injuries, and damage estimates found under Hurricane/Tropical Cyclone events are attributed only to the wind.

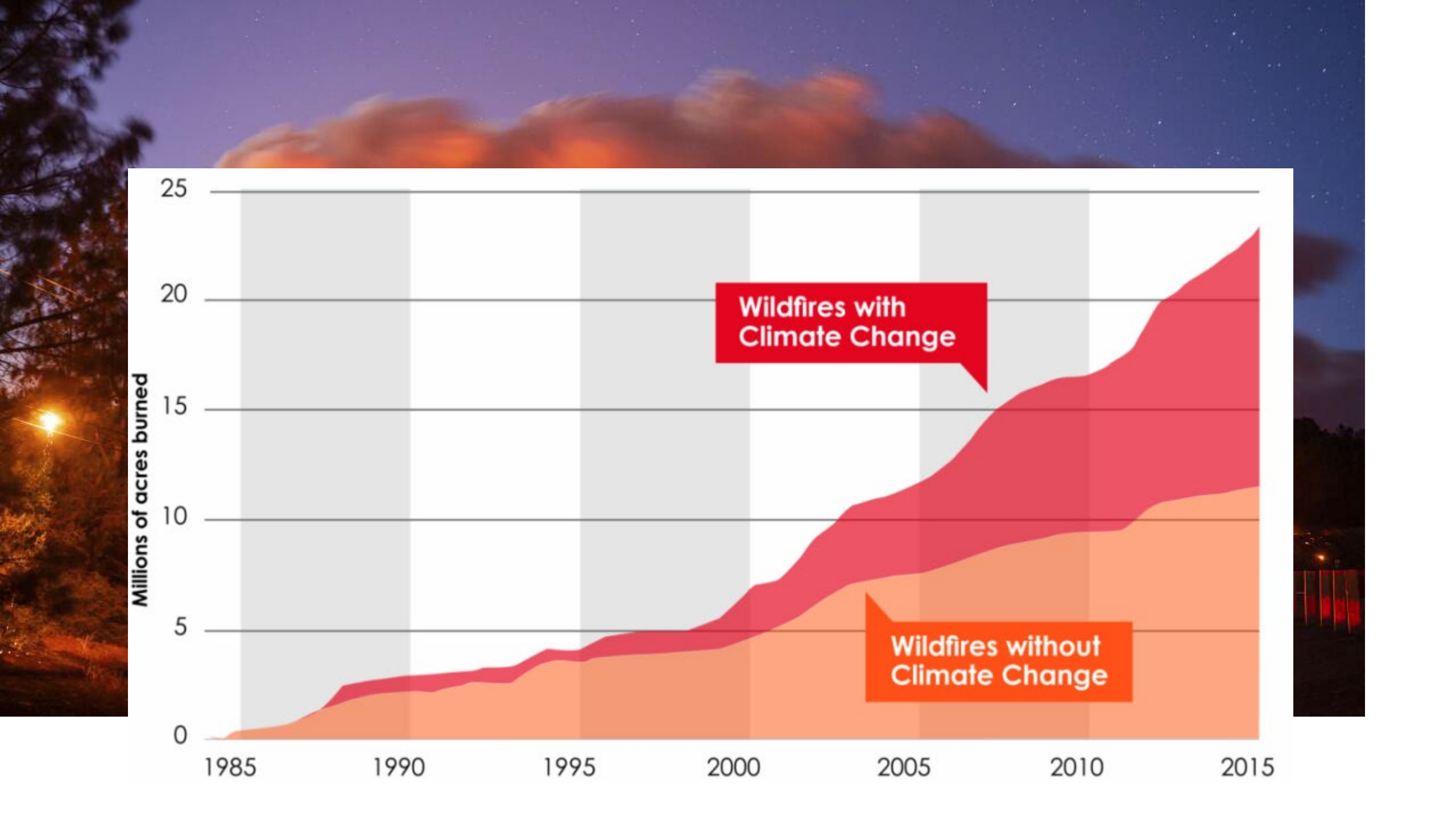




Millions of acres burned

Wildfires with Climate Change

Wildfires without Climate Change

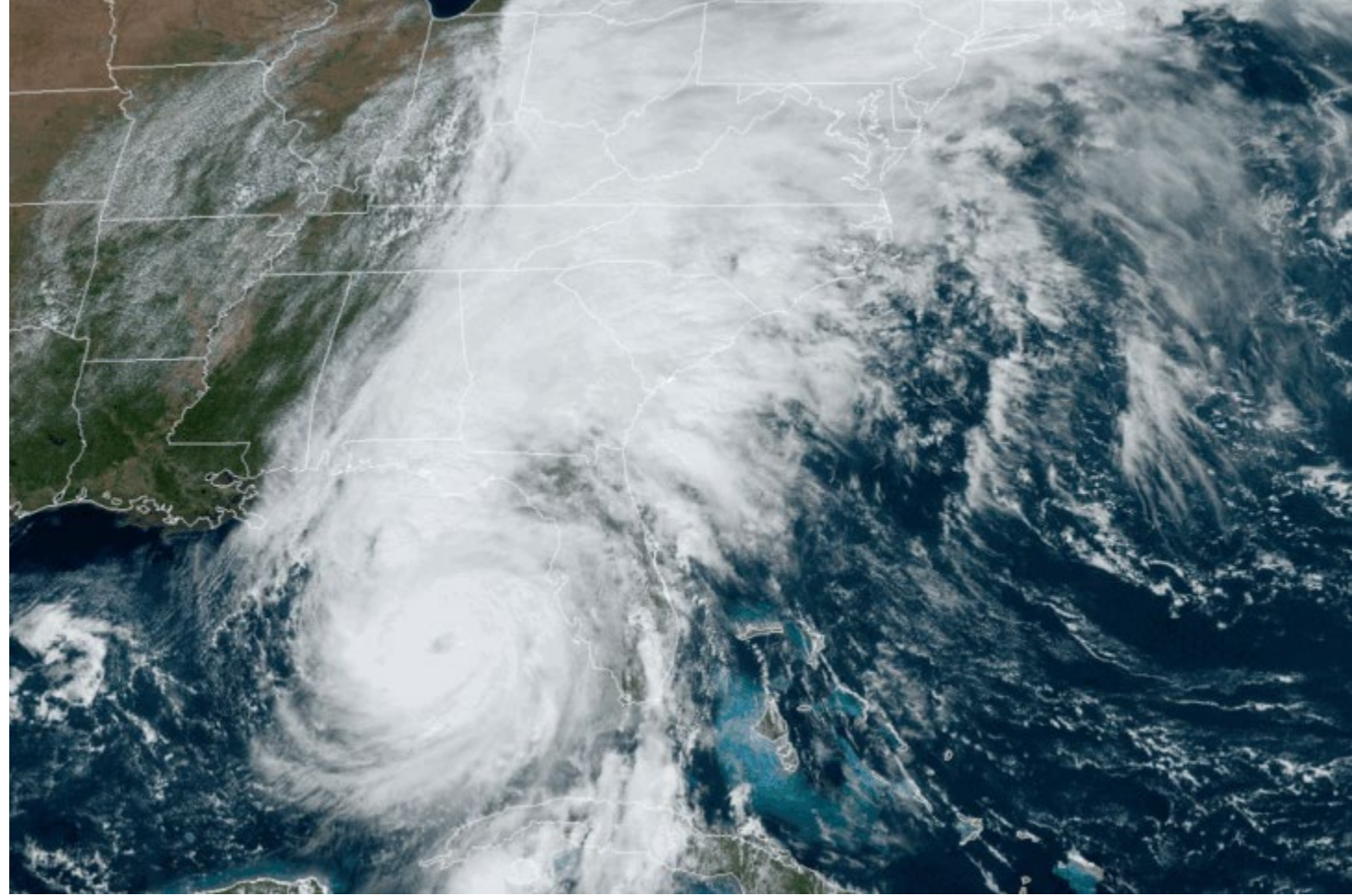


There are many other impacts resulting from our changing climate, such as more intense hurricanes due to warmer ocean waters providing more energy to them, and increased flooding due to warmer air holding more water vapor.



Hurricane Helene, 26-27 September 2024

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Hurricane Helene, 26-27 September 2024

But those can be discussions for another time.