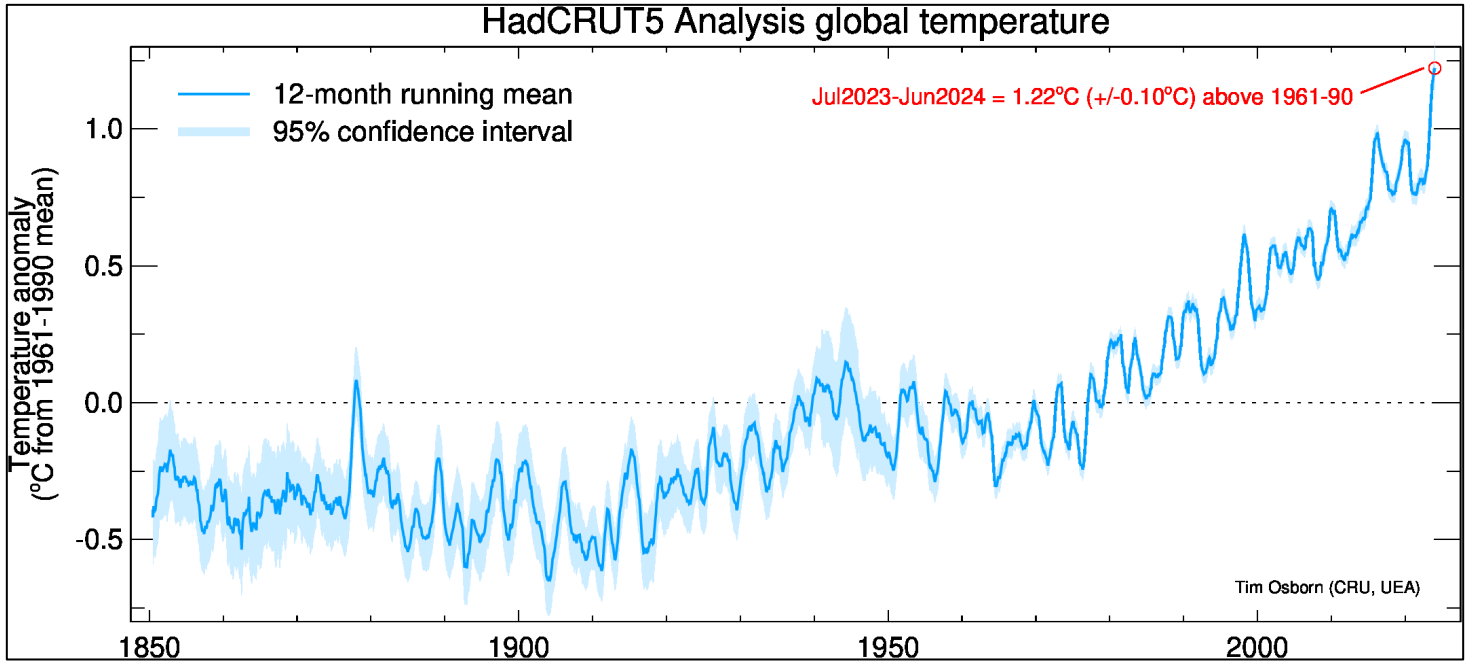
The Realities of Climate and Energy

Steven E. Koonin, NYU/Hoover

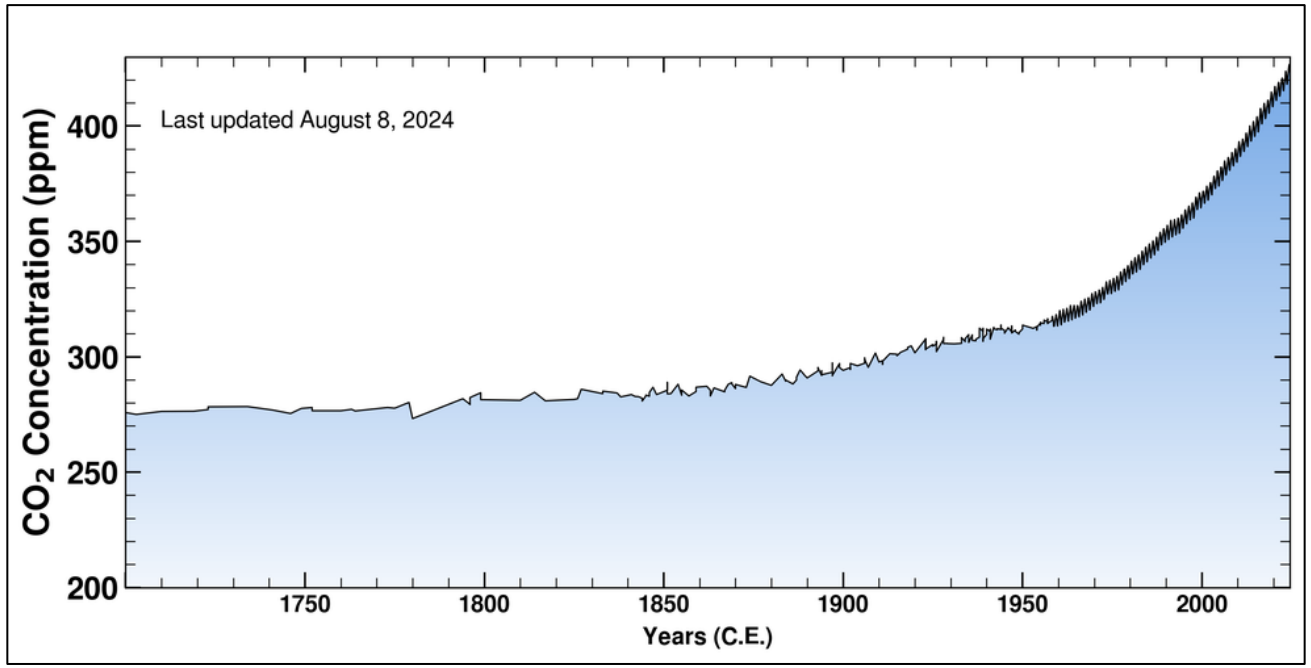
Mid-Coast Forum on Foreign Relations

August 13, 2024

koonin@stanford.edu
https://steven-koonin.medium.com/

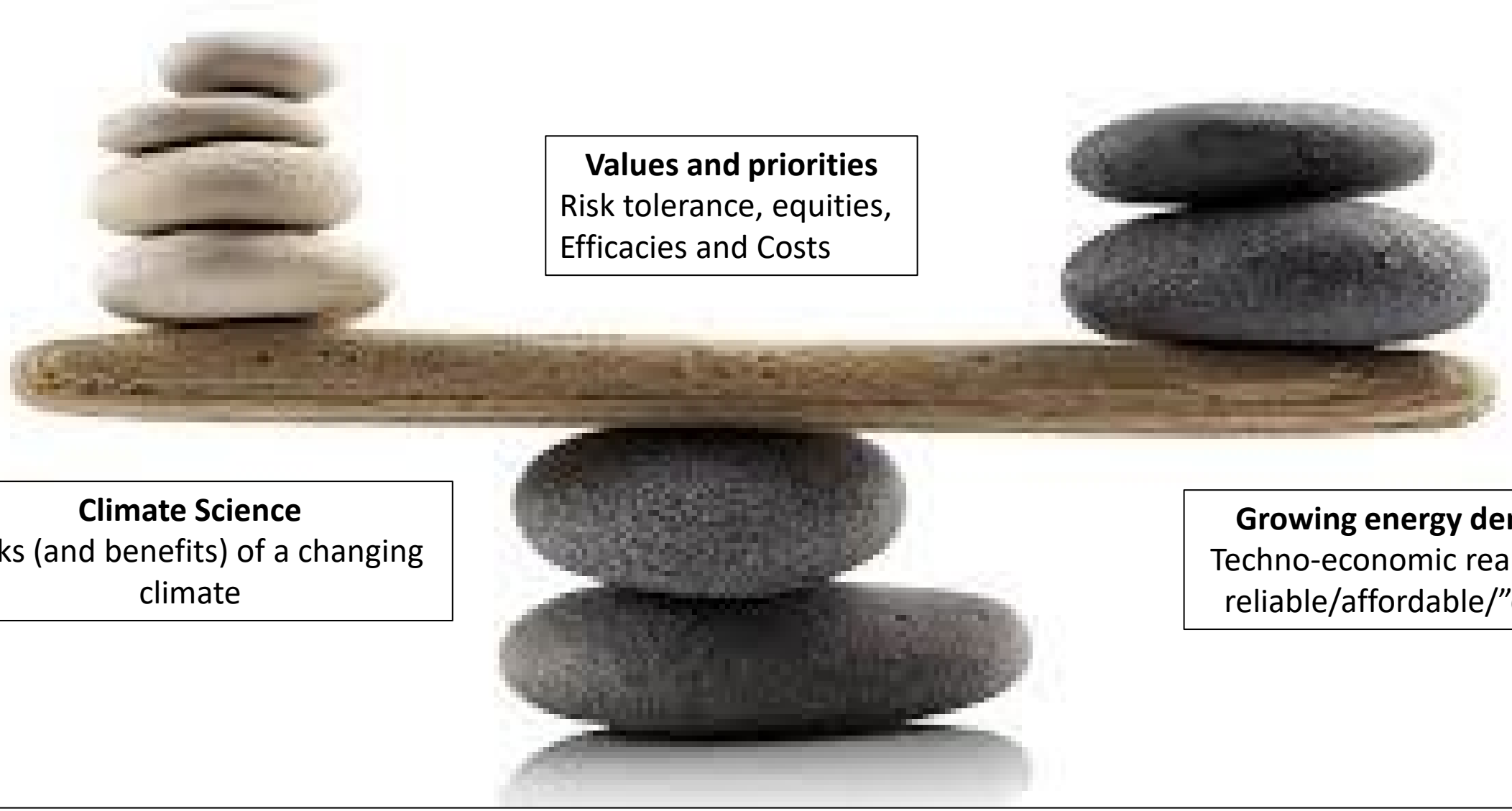


https://crudata.uea.ac.uk/~timo/diag/tempdiag.htm



https://keelingcurve.ucsd.edu/

Responses must strike a balance



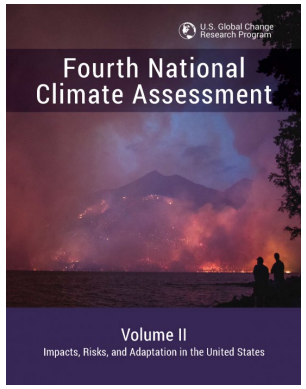
Values and priorities
Risk tolerance, equities, Efficacies and Costs

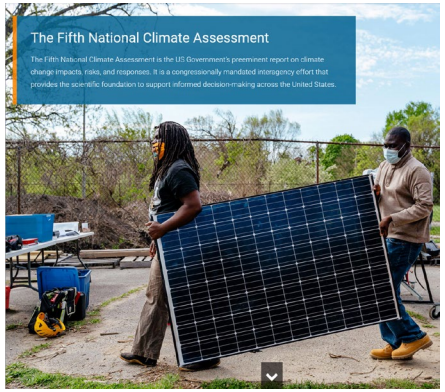
Climate Science
Risks (and benefits) of a changing climate

Growing energy demand
Techno-economic realities of reliable/affordable/”clean”

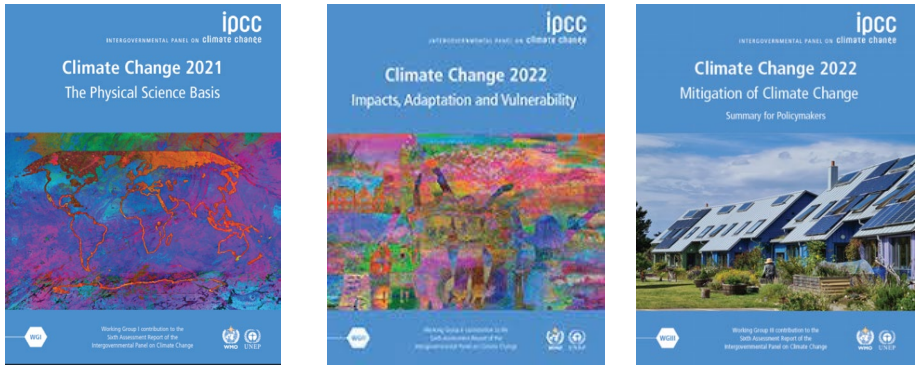
Assessment reports define the science
(vice “The Science”)

UN IPCC Fifth Assessment Report (AR5, 2014)





US Climate Science Special Report (CSSR, 2017)
US Fourth National Climate Assessment Vol II (2018)
NCA5 in 2023



UN IPCC Sixth Assessment Report (AR6, 2021-22)

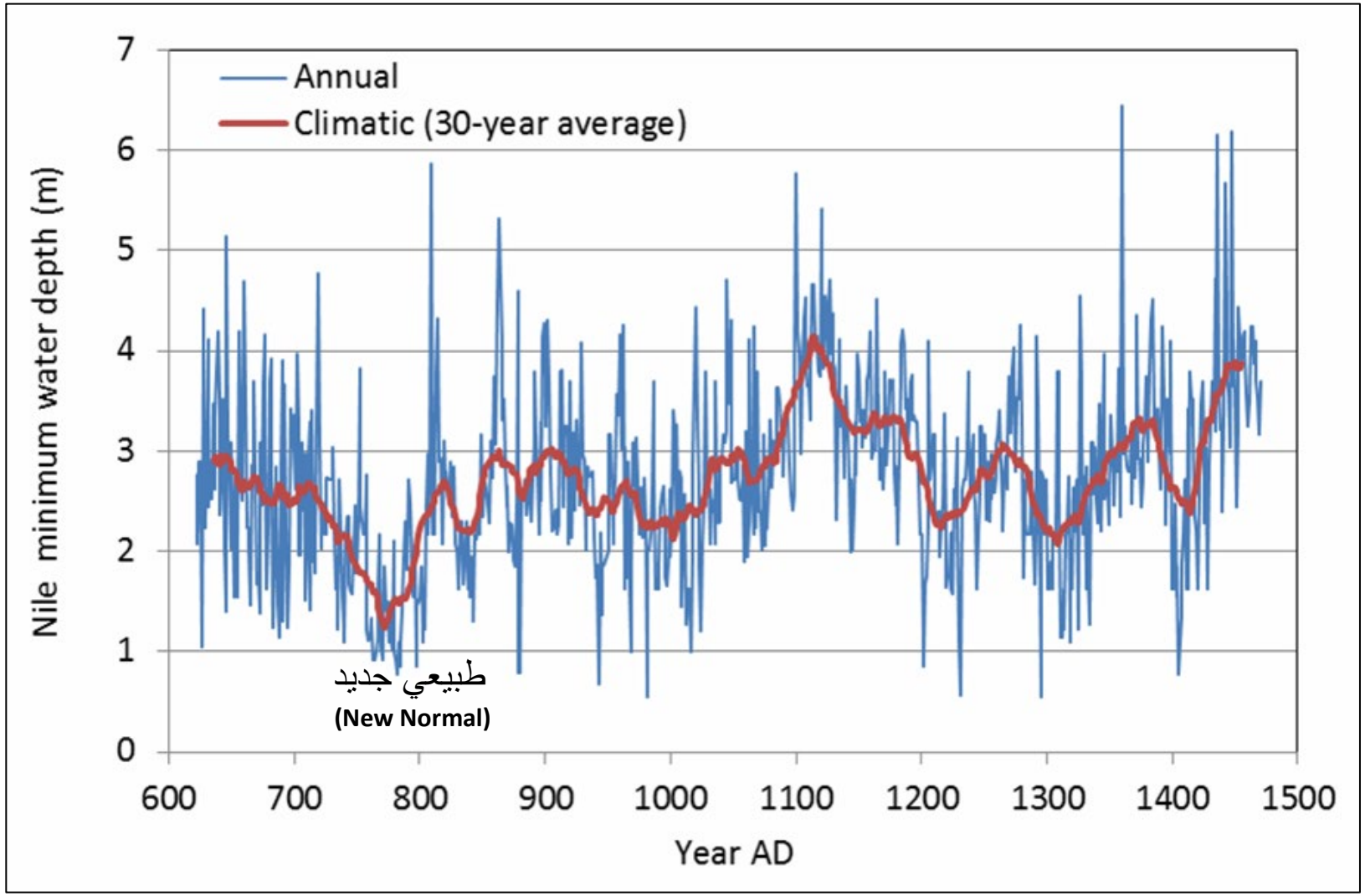
The reports say important (and surprising) things

Most people have not read these reports

Climate plays out over decades

Annual Nile minima at the Roda Nilometer

Drains 10% of Africa (~1/3 CONUS)

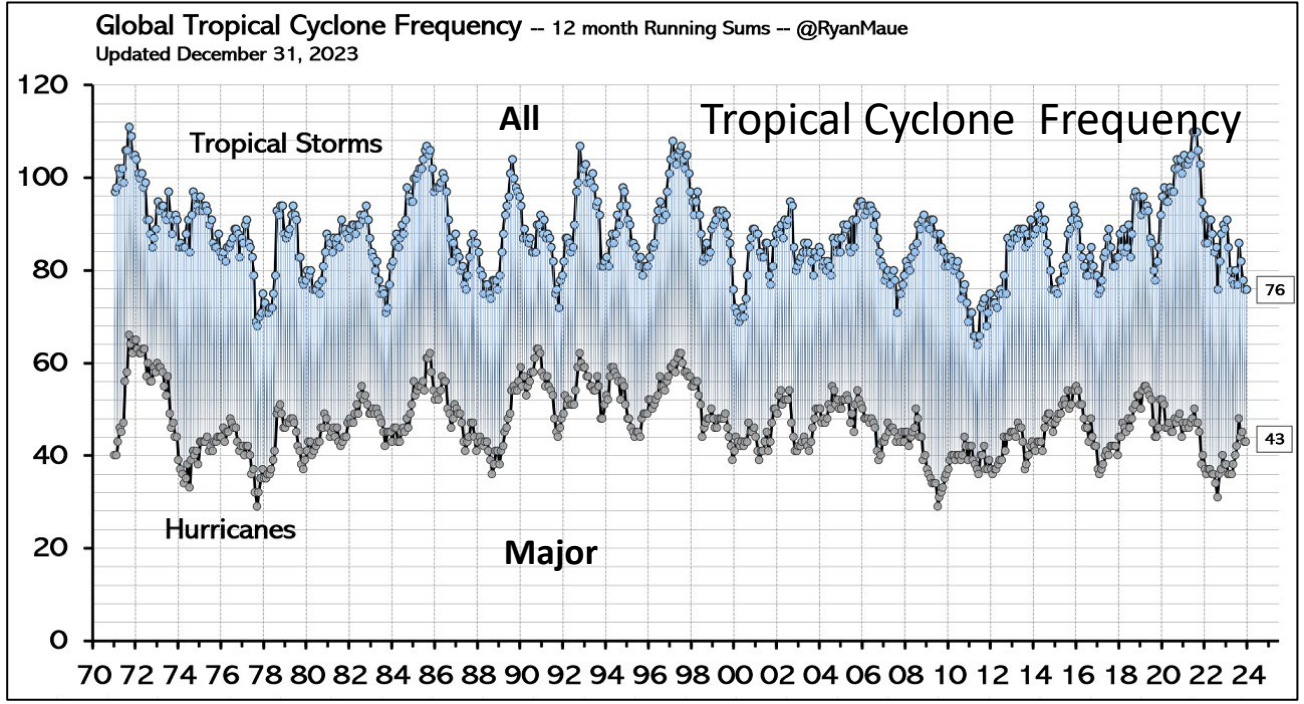


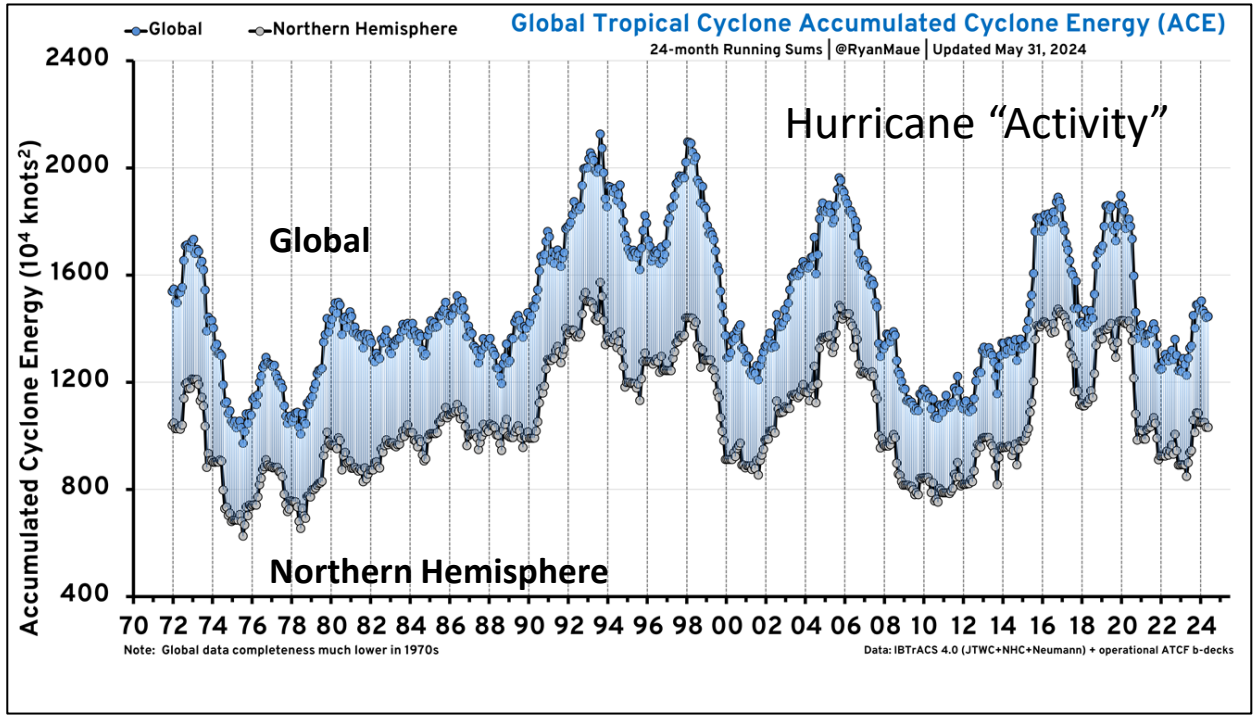
Most climate observables show no trend

IPCC AR6 WG1 Table 12.12

High confidence of decrease	Medium confidence of decrease	Low confidence in direction of change	Medium confidence of increase	High confidence of increase

Climatic Impact-driver Type	Climatic Impact-driver Category	Already Emerged in Historical Period
Heat and Cold	Mean air temperature	1
	Extreme heat	2
	Cold spell	4
	Frost	
Wet and Dry	Mean precipitation	
	River flood	
	Heavy precipitation and pluvial flood	
	Landslide	
	Aridity	
	Hydrological drought	
	Agricultural and ecological drought	
	Fire weather	
Wind	Mean wind speed	
	Severe wind storm	
	Tropical cyclone	
	Sand and dust storm	
Snow and Ice	Snow, glacier and ice sheet	
	Permafrost	
	Lake, river and sea ice	11
	Heavy snowfall and ice storm	
	Hail	
	Snow avalanche	
Coastal	Relative sea level	
	Coastal flood	
	Coastal erosion	
Open Ocean	Mean ocean temperature	
	Marine heatwave	
	Ocean acidity	
	Ocean salinity	13
	Dissolved oxygen	14
Other	Air pollution weather	
	Atmospheric CO_2 at surface	
	Radiation at surface	





Very little is happening with Hurricanes

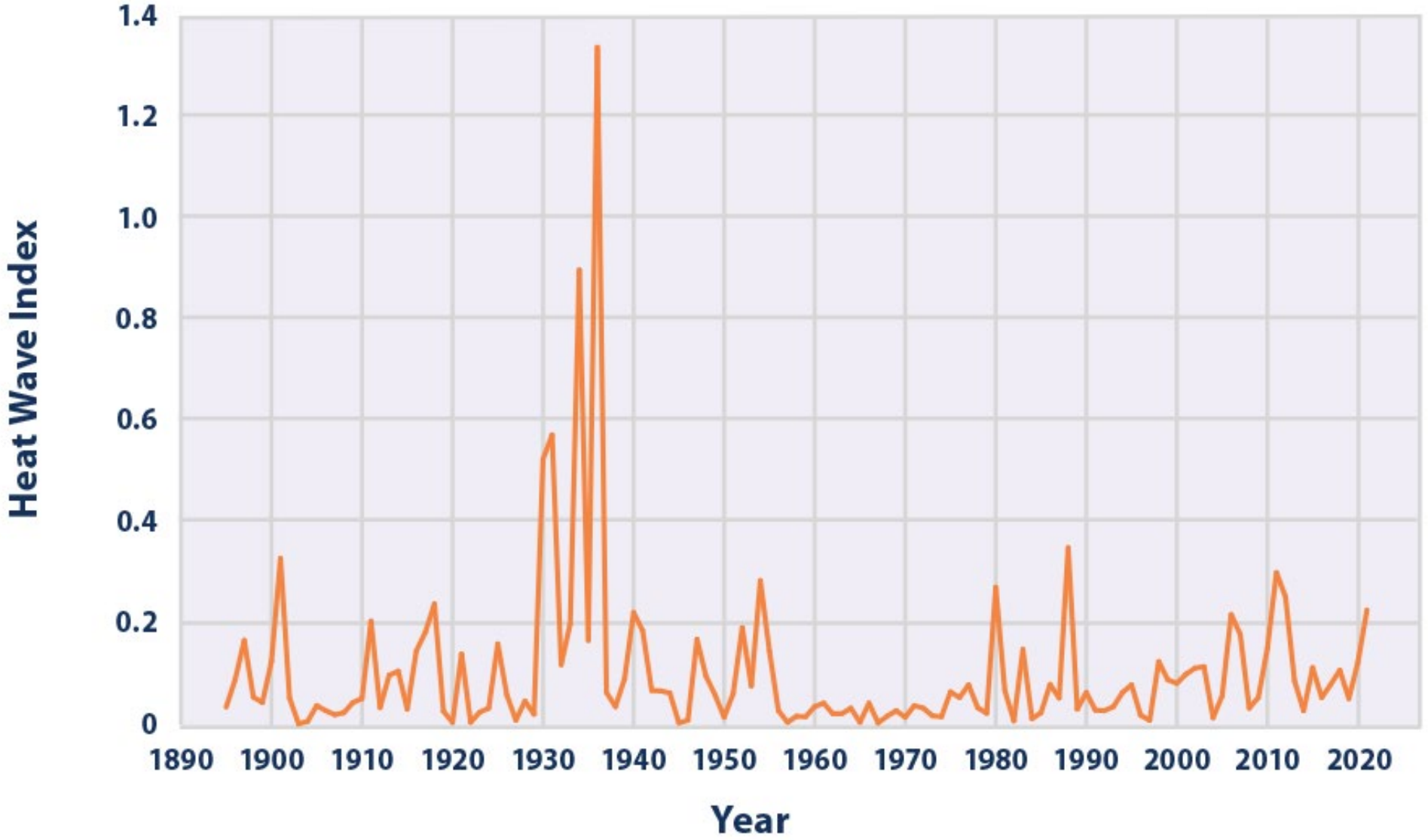
http://climatlas.com/tropical/

*… there is **still low confidence that any reported long-term** (multidecadal to centennial) **increases in TC activity are robust** …* – CSSR, p 258

***There is low confidence in most reported long-term (multidecadal to centennial) trends** in TC frequency- or intensity-based metrics*
– IPCC AR6 11.7.1.2

Heat Wave Index (CONUS)

https://www.epa.gov/climate-indicators/climate-change-indicators-heat-waves



Past New England Heat Waves

New England Historical Society

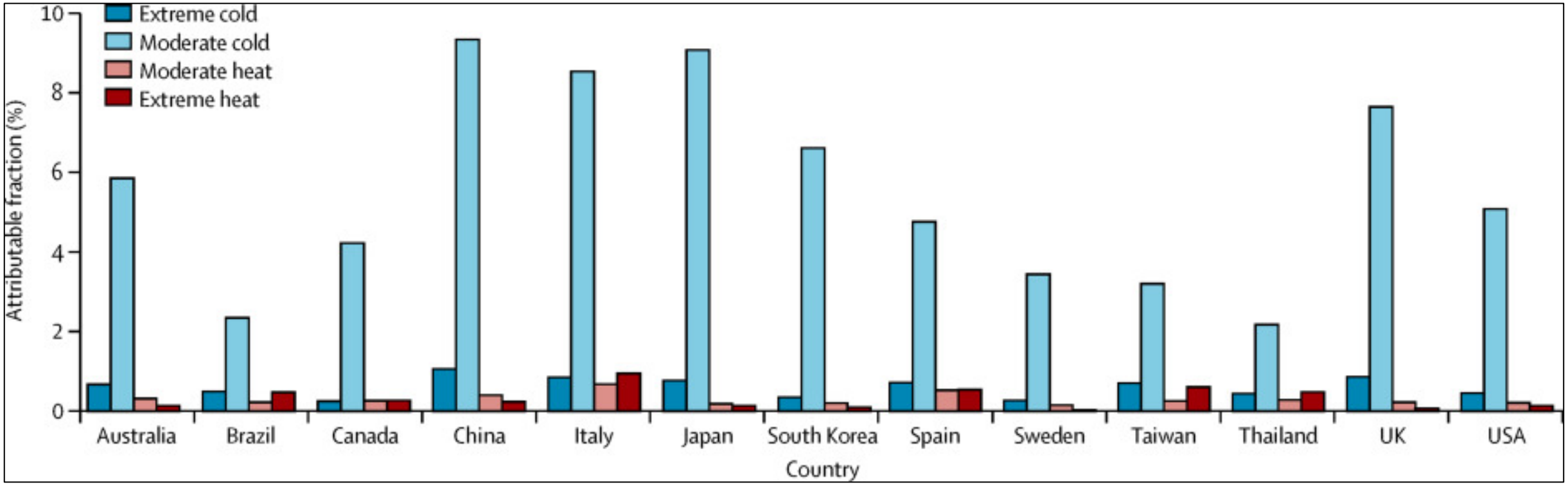
A **July 1911** heat wave killed thousands of New Englanders and sent many over the brink of madness. … On July 4, temperatures hit **103 in Portland, 104 in Boston (a record that still stands), 105 in Vernon, Vt., and 106 in Nashua, N.H. and Bangor, Maine.**

Historic Ipswich

On May 10, 1896 most of the Eastern US was over 90 degrees. New Bedford, Massachusetts was 96 degrees, which was 43 degrees warmer than the previous day's forecast high, but the worst was yet to come. A heat wave during **July and August, 1896** was at that time the worst weather-related tragedy in American history. By the time it ended in mid-August, 1500 deaths from the Midwest to New York to New England had been recorded

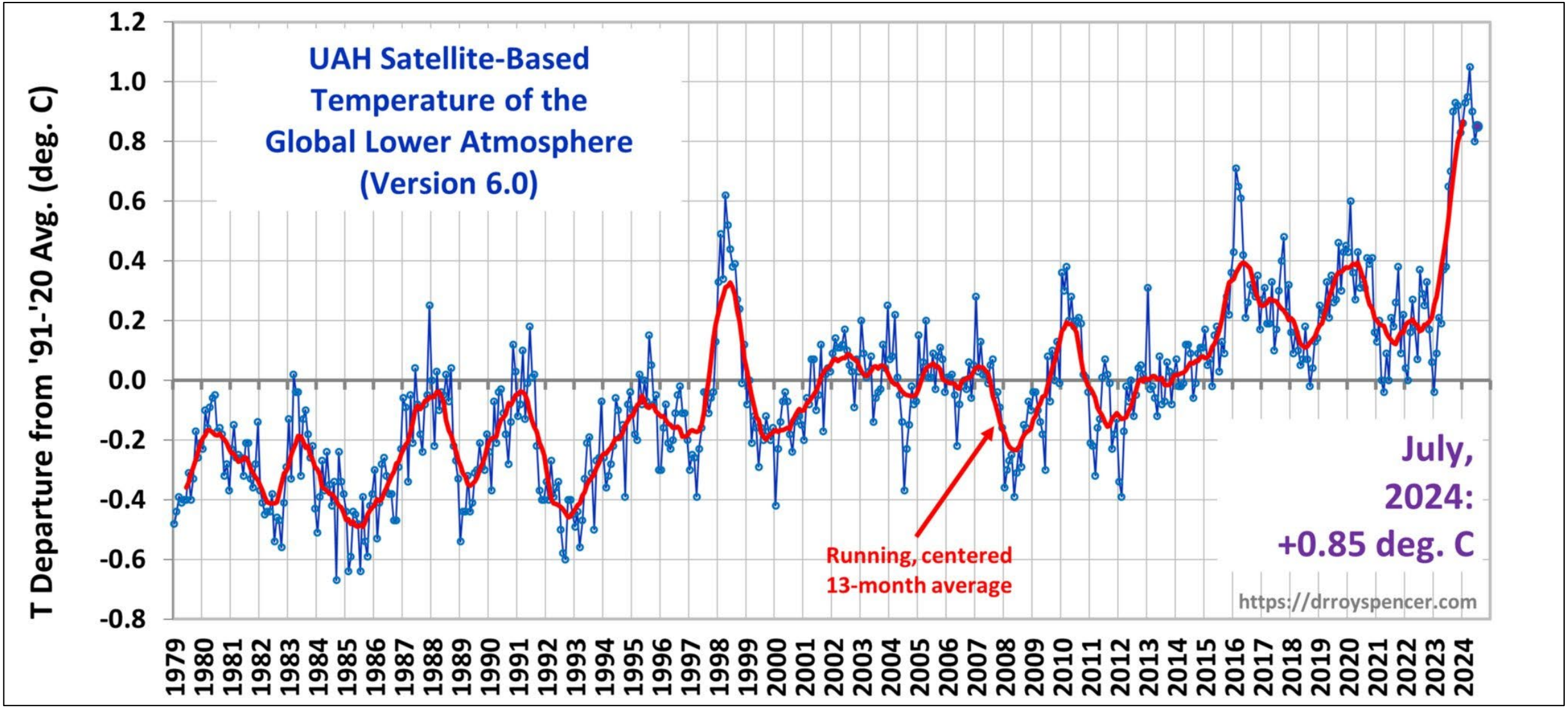
“Cold” is far deadlier than “heat”

Fraction of all-cause mortality attributable to moderate and extreme hot and cold temperature by country



https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(14)62114-0/fulltext

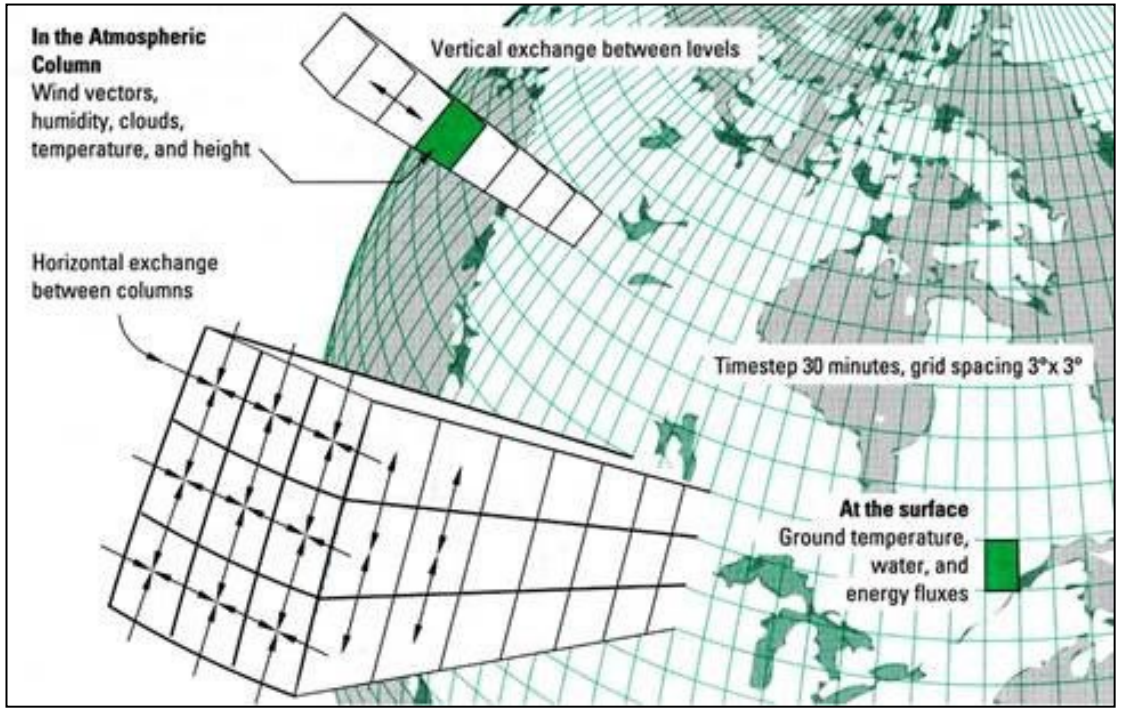
Recent unusual heat

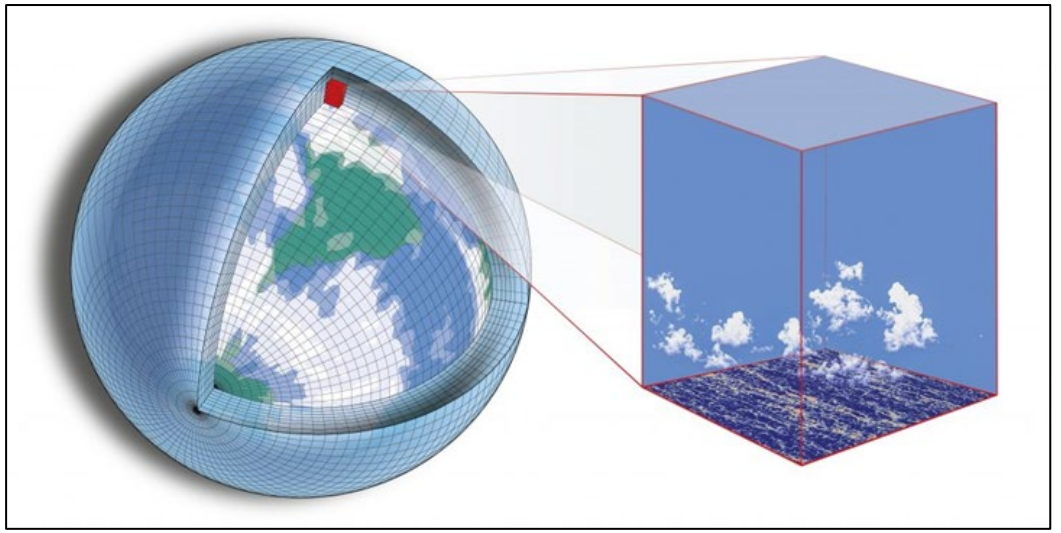


https://www.drroyspencer.com/

Projections of future climates are not fit for purpose

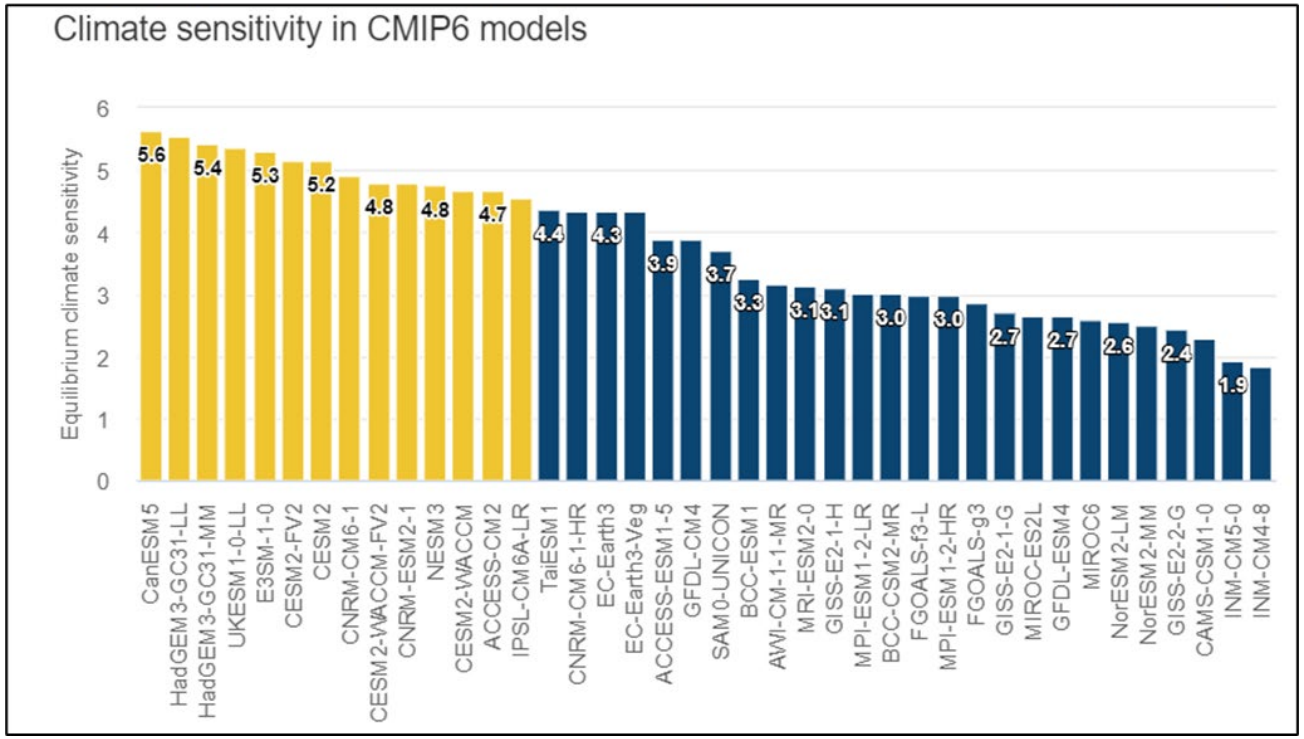
- T. Palmer and B. Stevens, PNAS (2019)



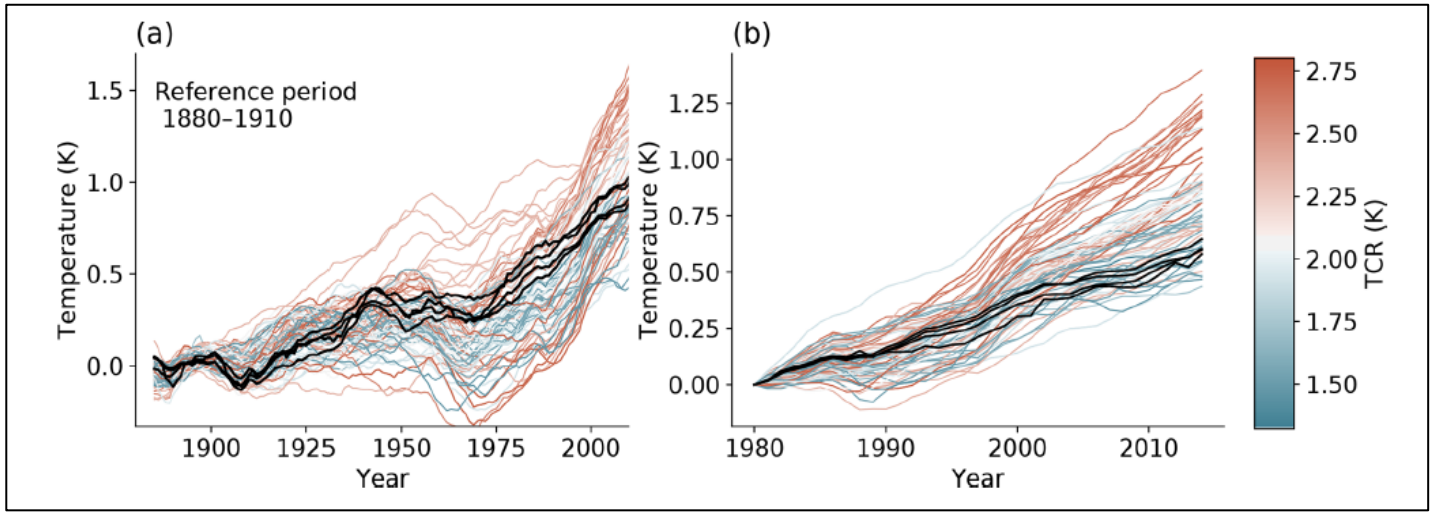


Deficiencies of the latest generation of models

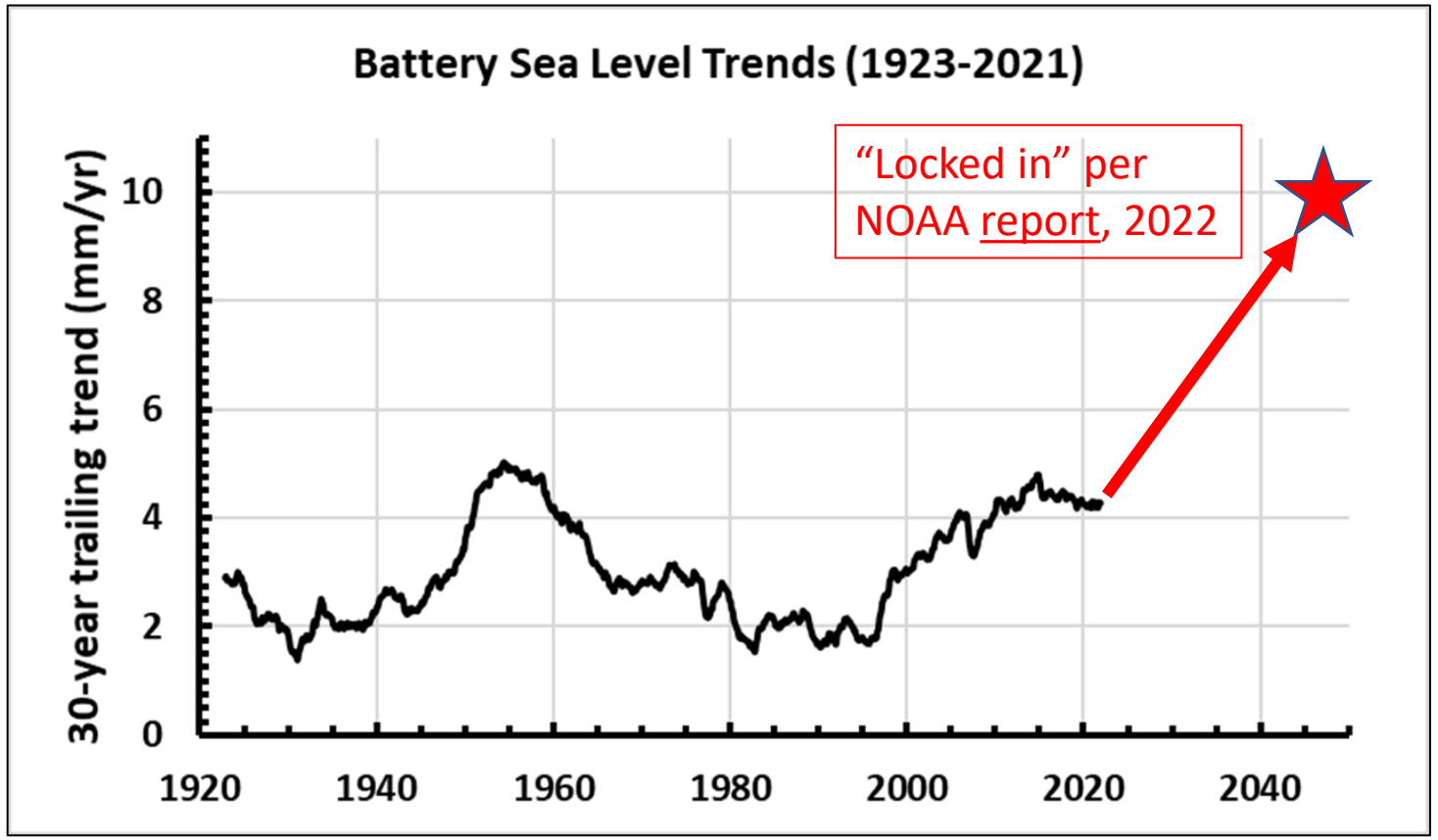
https://www.carbonbrief.org/cmip6-the-next-generation-of-climate-models-explained



Nijsse *et al.* (2020); 34 CMIP6 models

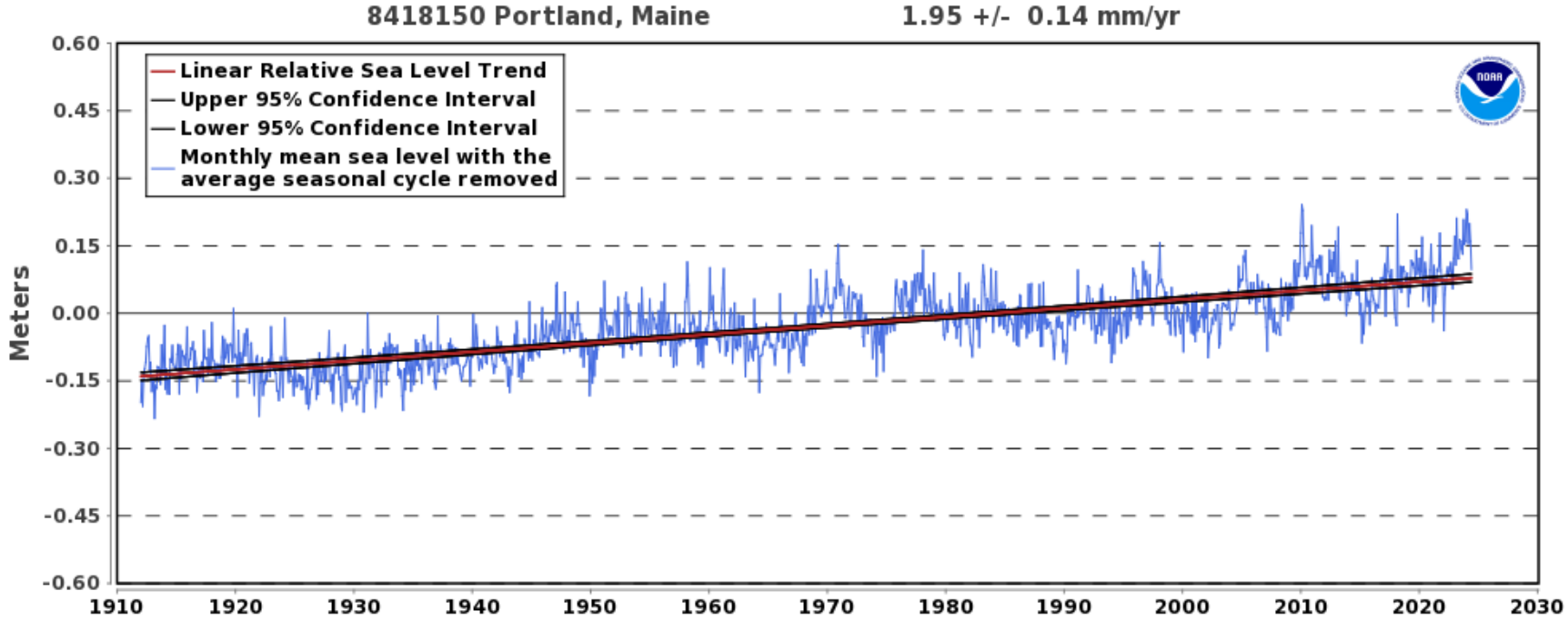


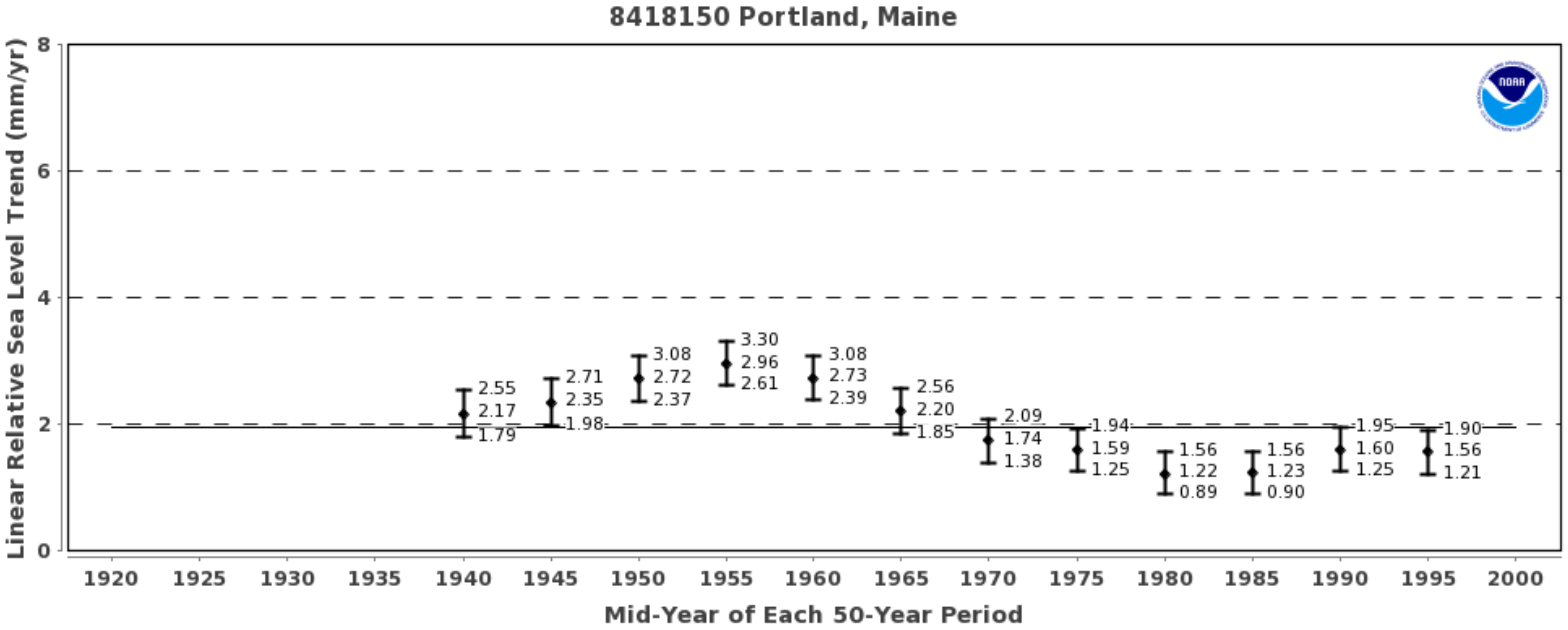
Sea Level Projections are extraordinary



Sea level data at Portland, ME

https://tidesandcurrents.noaa.gov/sltrends/sltrends_station.shtml?id=8418150



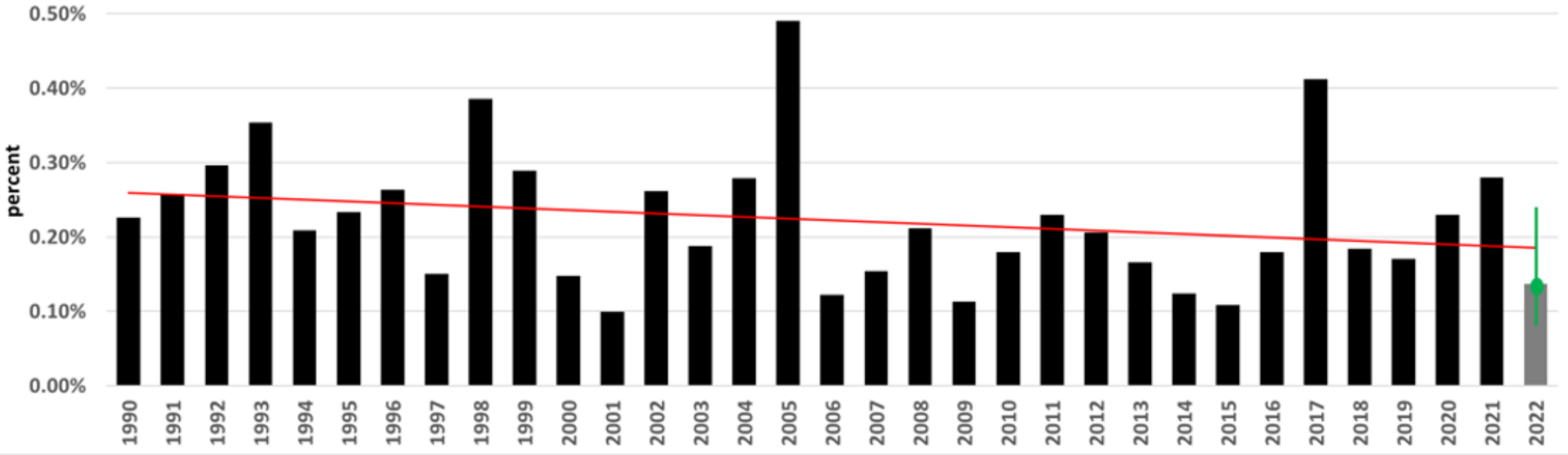


Humanity has prospered since 1900 despite 1.3C warming

Indicator	Change	Unit	"1900"	"Today"
Global temperature	1.3 warmer	degrees C	-0.5 (1905)	+0.8 (2022)
Population	5X larger	Billions	1.65 (1900)	8.0 (2022)
Life expectancy	130% longer	Years	32 (1900)	72.6 (2019)
Literacy fraction	4X larger	percent	21.4 (1900)	86.25 (2016)
GDP per capita	6.8X larger	$2011	2,241 (1920)	15,212 (2018)
Extreme poverty	>7X smaller	Percent (<$1/day)	70 (1900)	<10 (2015)
Weather death rate	50X smaller	per million	241 (1920)	5 (2008)

Global Weather Losses as Percent of Global GDP: 1990-2022

Note: 2022 is estimated based on 1st half results



Sources:
Munich Re, World Bank, Aon

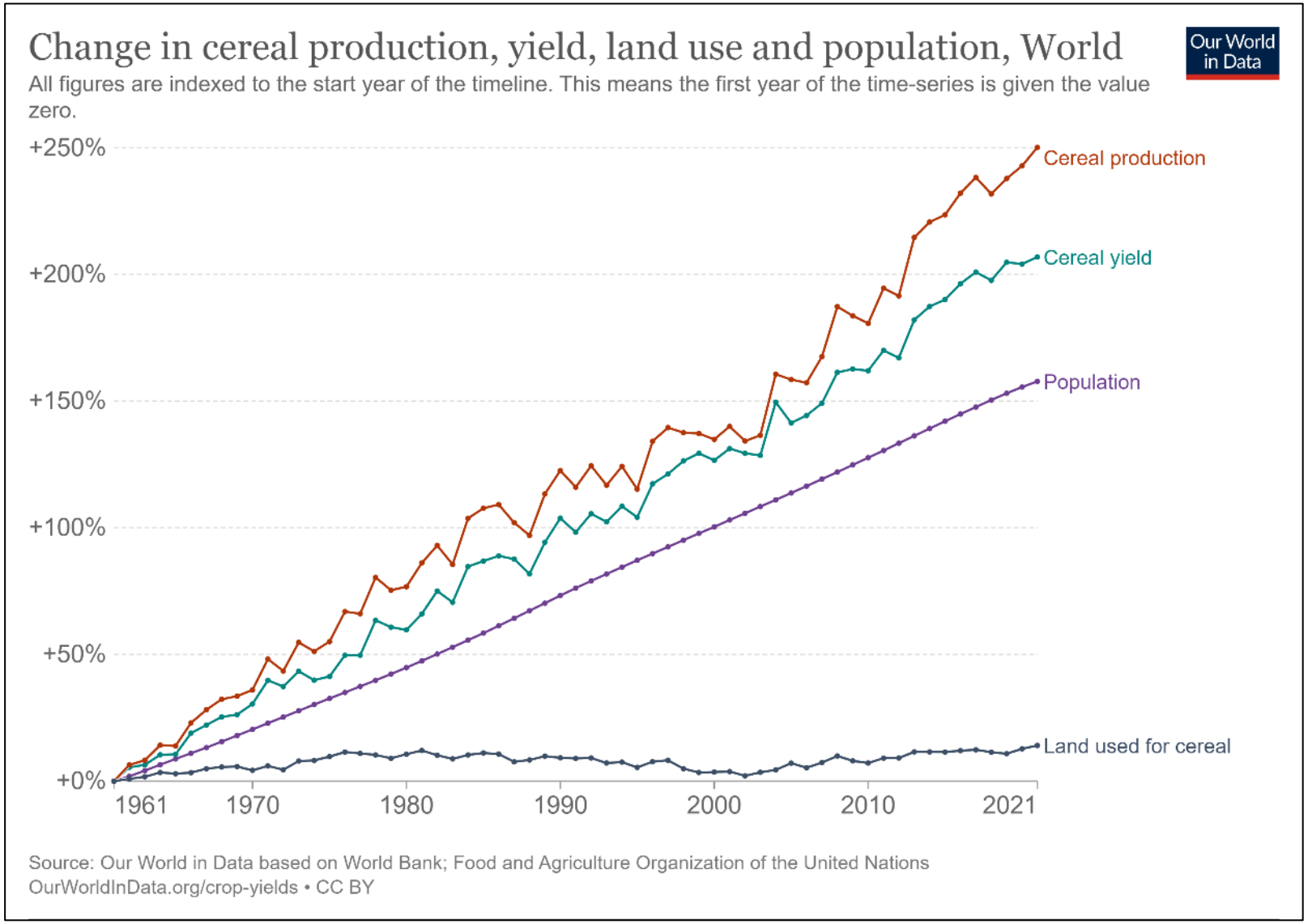
Updated from: Pielke 2019. Tracking progress on the economic costs of disasters under the indicators of the sustainable development goals. *Environmental Hazards* 18:1-6.

Note: 2022 is estimated based on 1H 2022 results reported by Aon, adjusted based on (a) historical relationship of loss estimates of Aon to Munich Re & (b) relationship of 1H to full year results. Green represents ~90% range of relationship of 1H to full year losses.

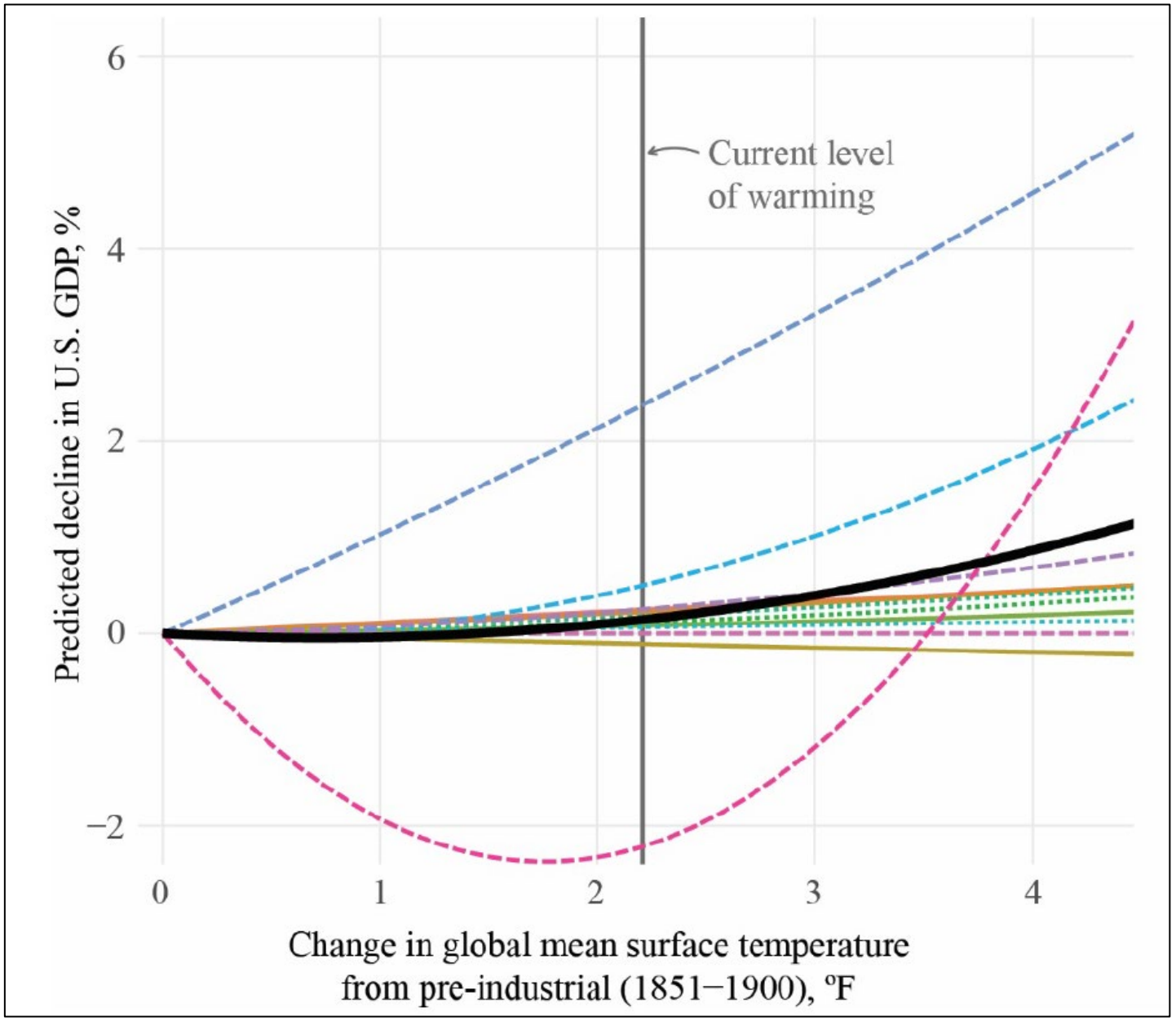
https://rogerpielkejr.substack.com/p/weather-and-climate-disaster-losses

Agricultural impact of climate change

https://ourworldindata.org/grapher/index-of-cereal-production-yield-and-land-use



Estimated US Economic Impacts of Warming

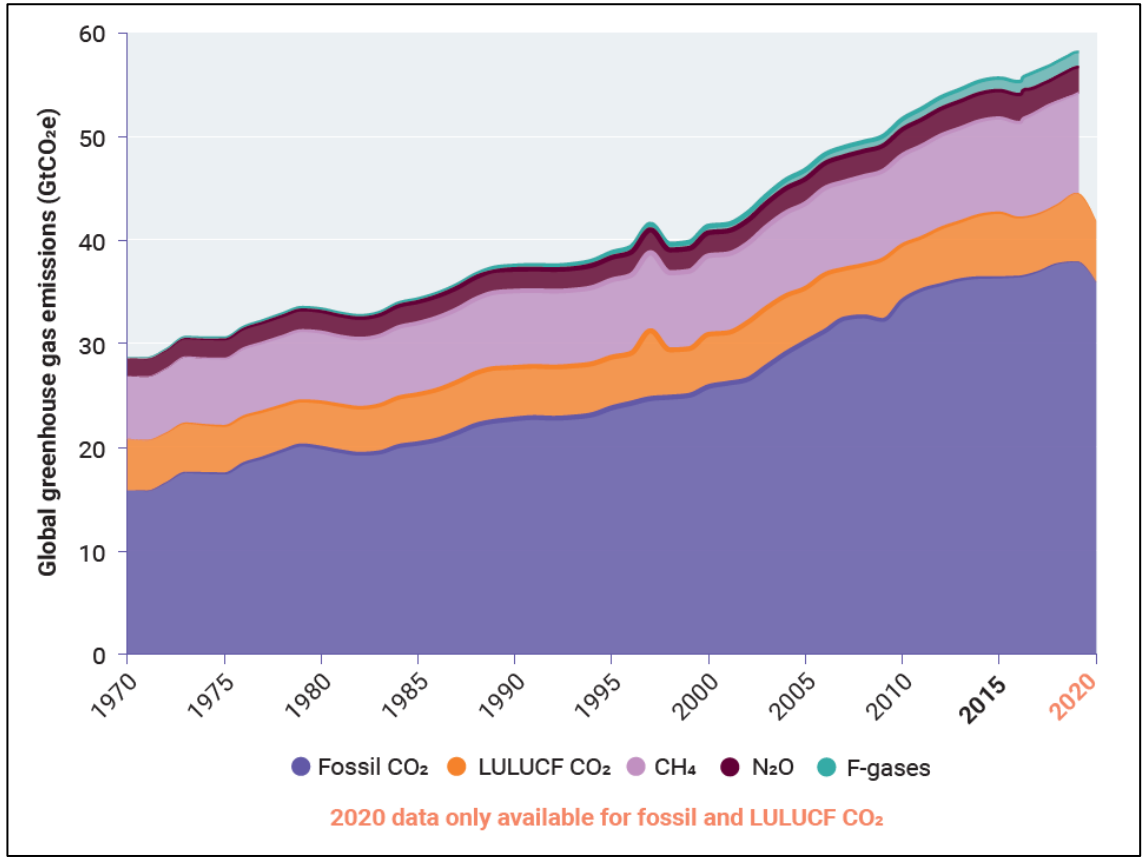


Estimates of global warming's impact on the US GDP. The black line is the aggregate of the various peer-reviewed estimates shown.

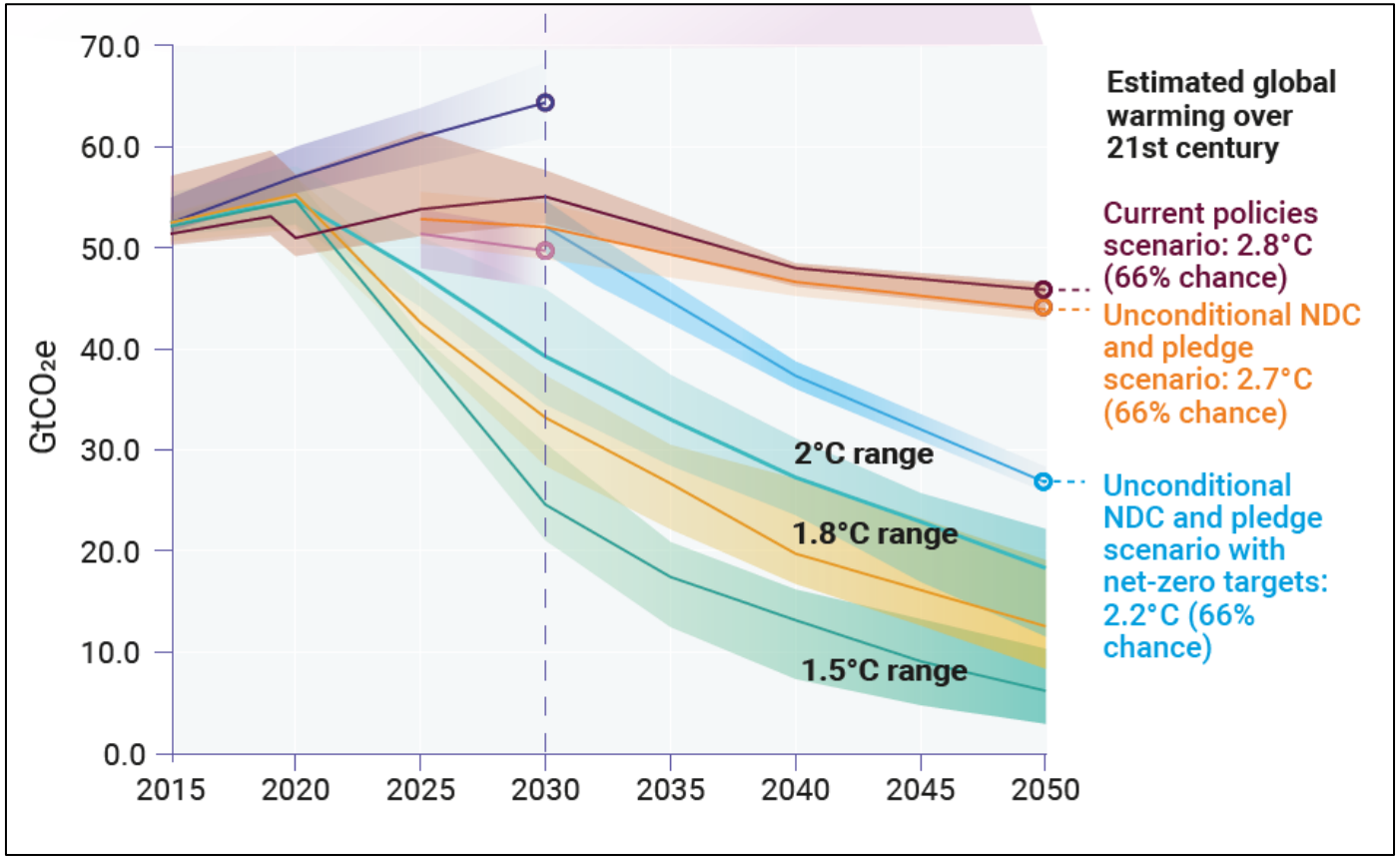
https://www.**whitehouse**.gov/cea/written-materials/2023/03/14/methodologies-and-considerations-for-integrating-the-physical-and-transition-risks-of-climate-change-into-macroeconomic-forecasting-for-the-presidents-budget/

Response to a changing climate

Net Zero by 2050
“to avoid the worst effects of climate change”

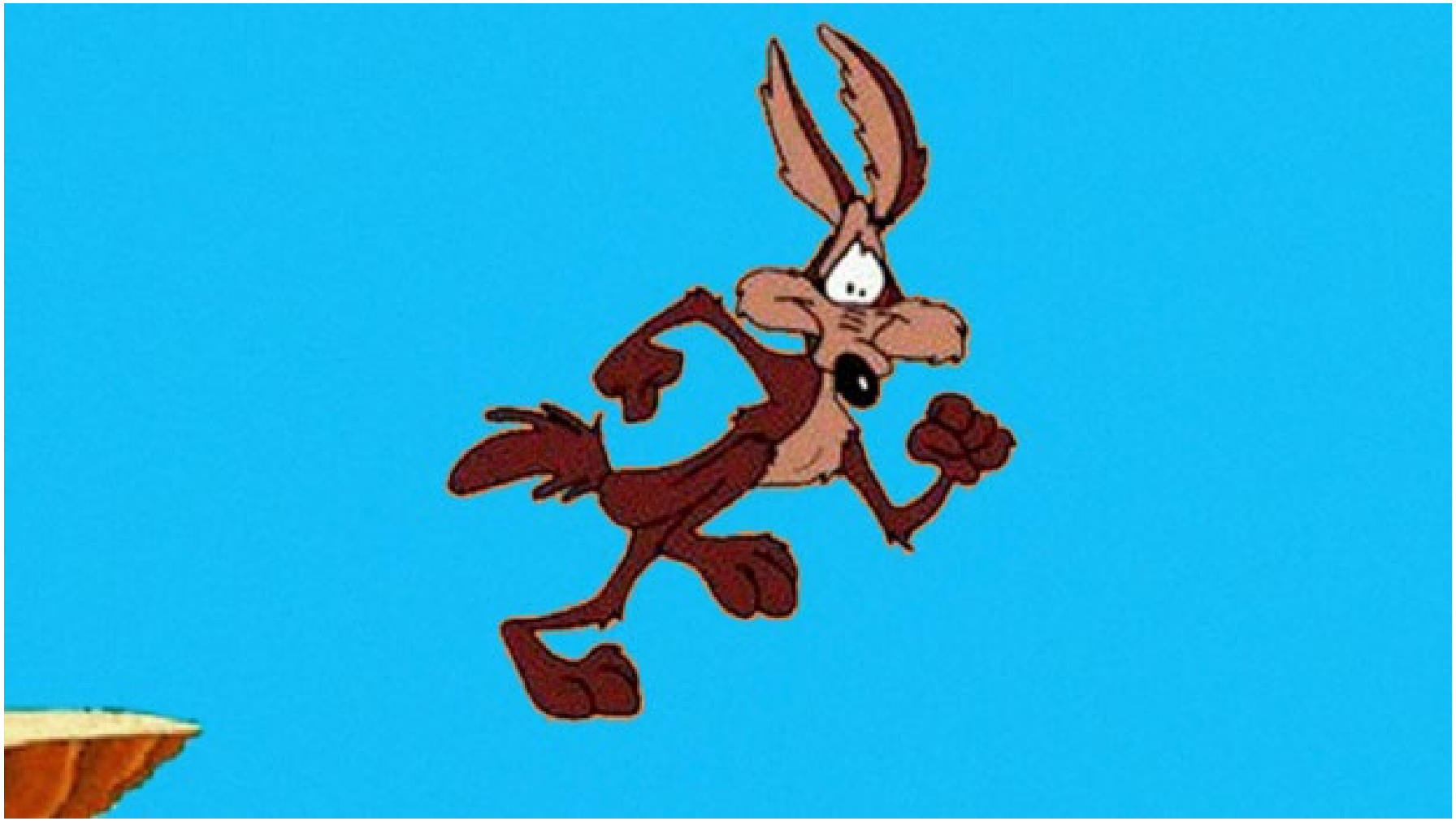


[UN EGR21](), Figure ES.1

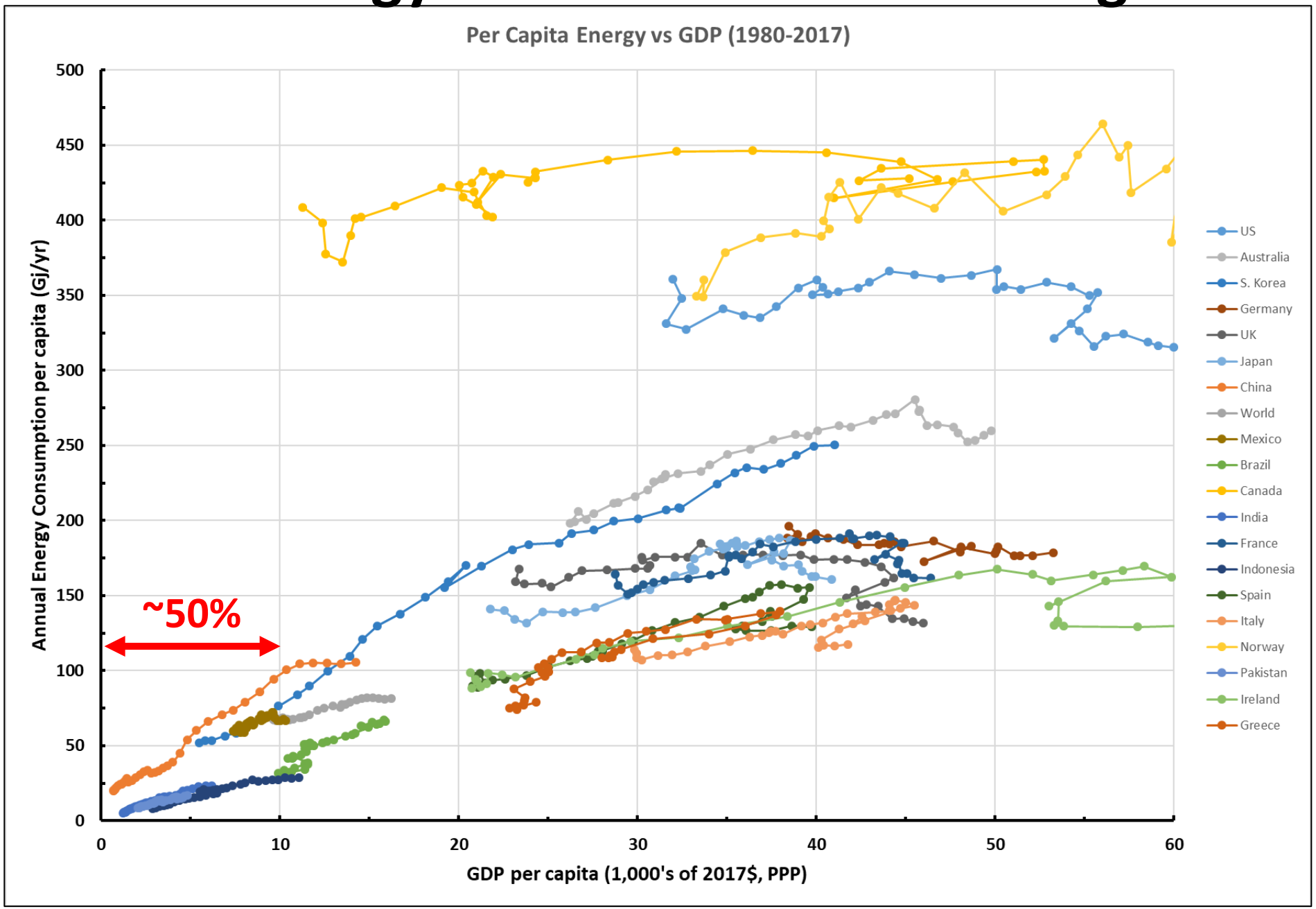


[UN EGR21](), Figure ES.6

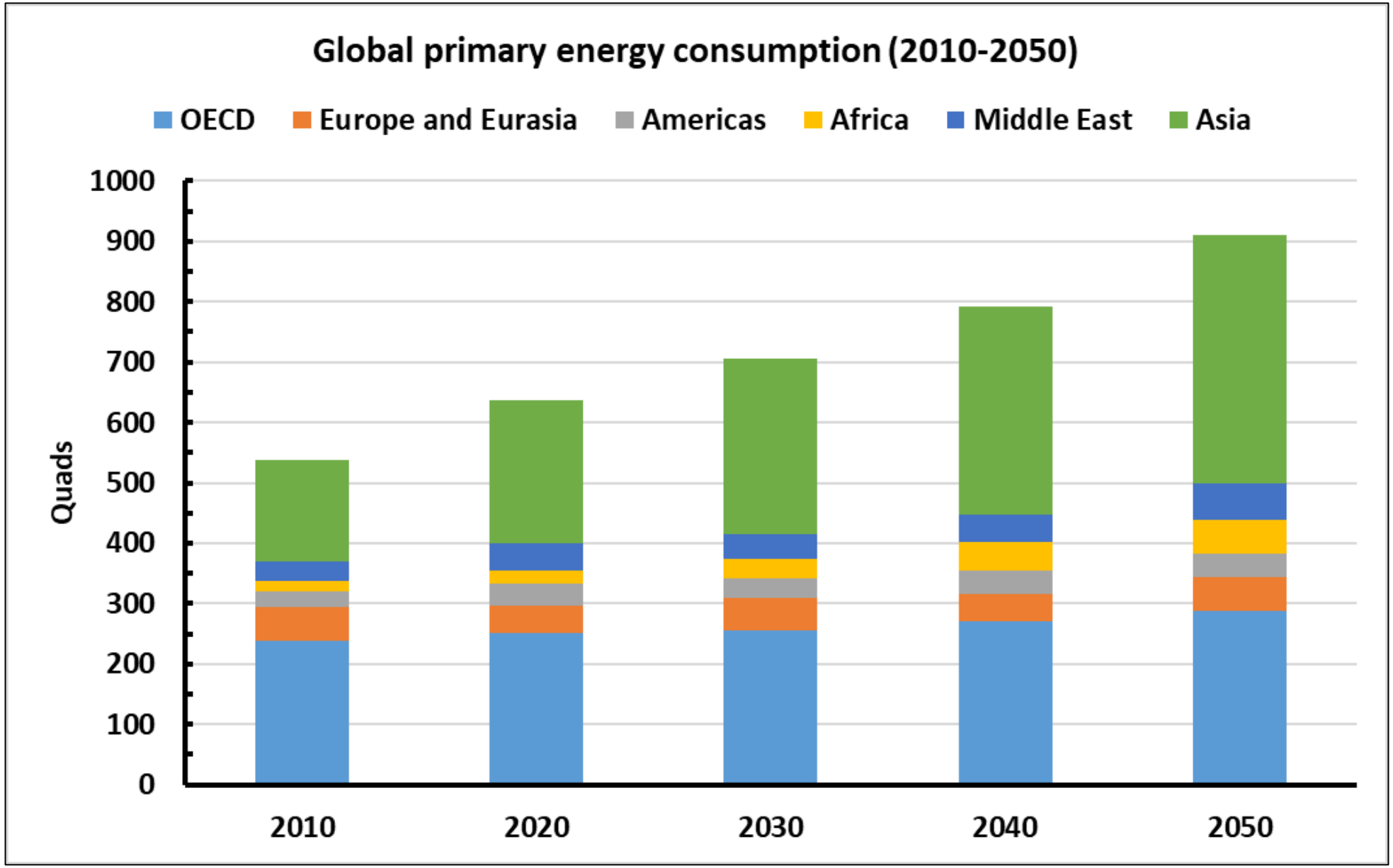
The energy transition today



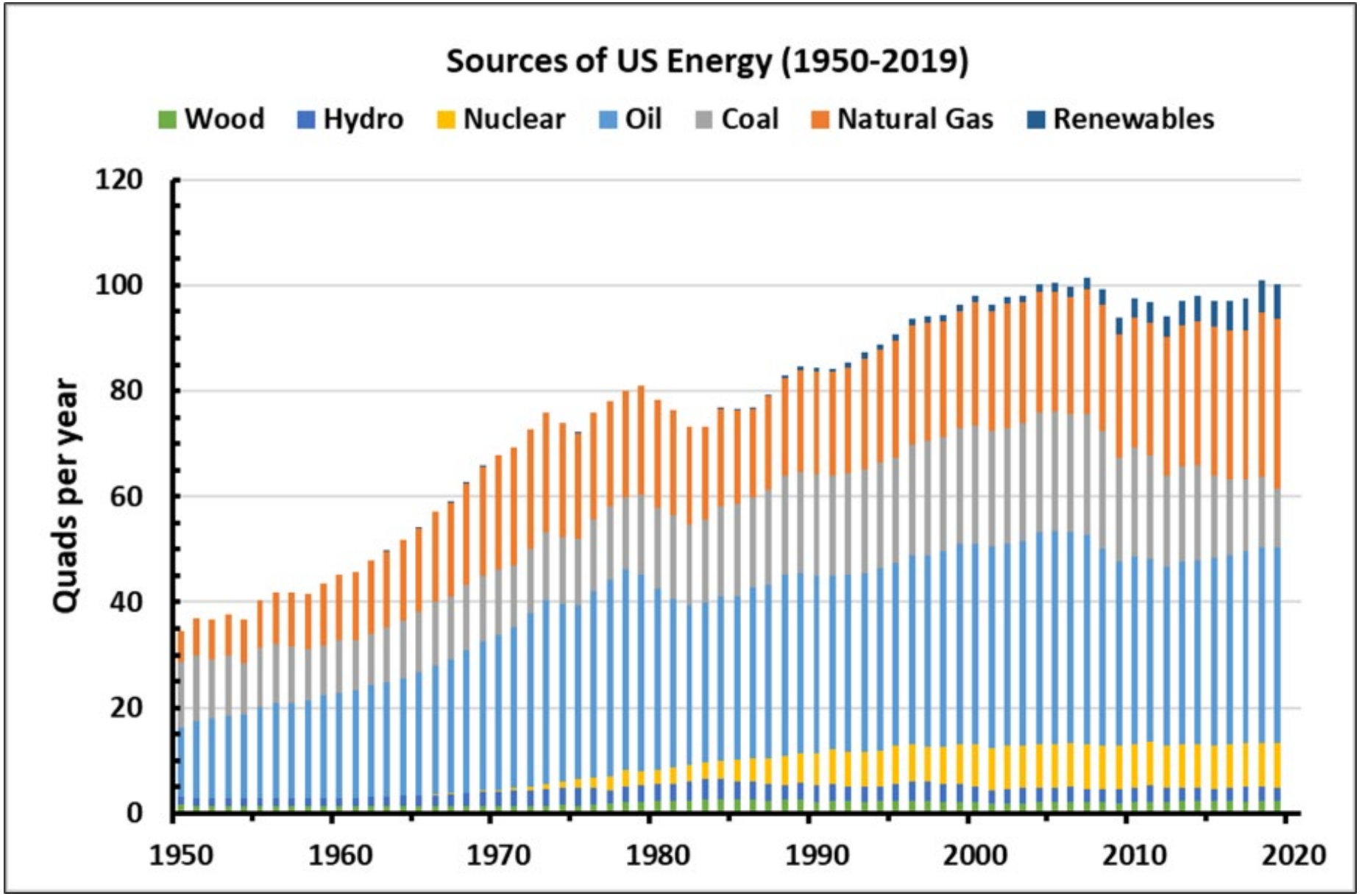
Energy is essential to well-being



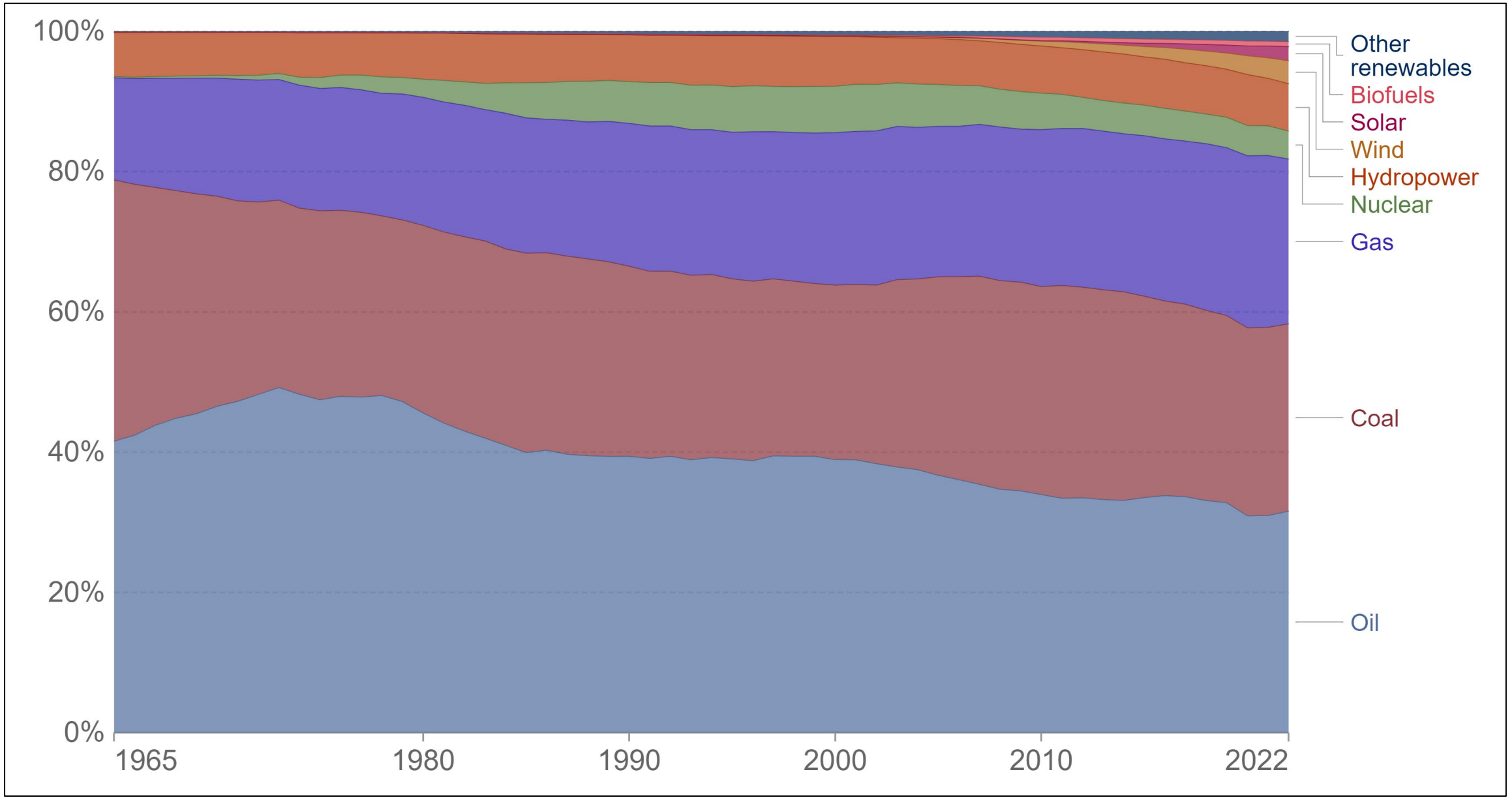
Projected global energy consumption



Energy systems evolve over decades

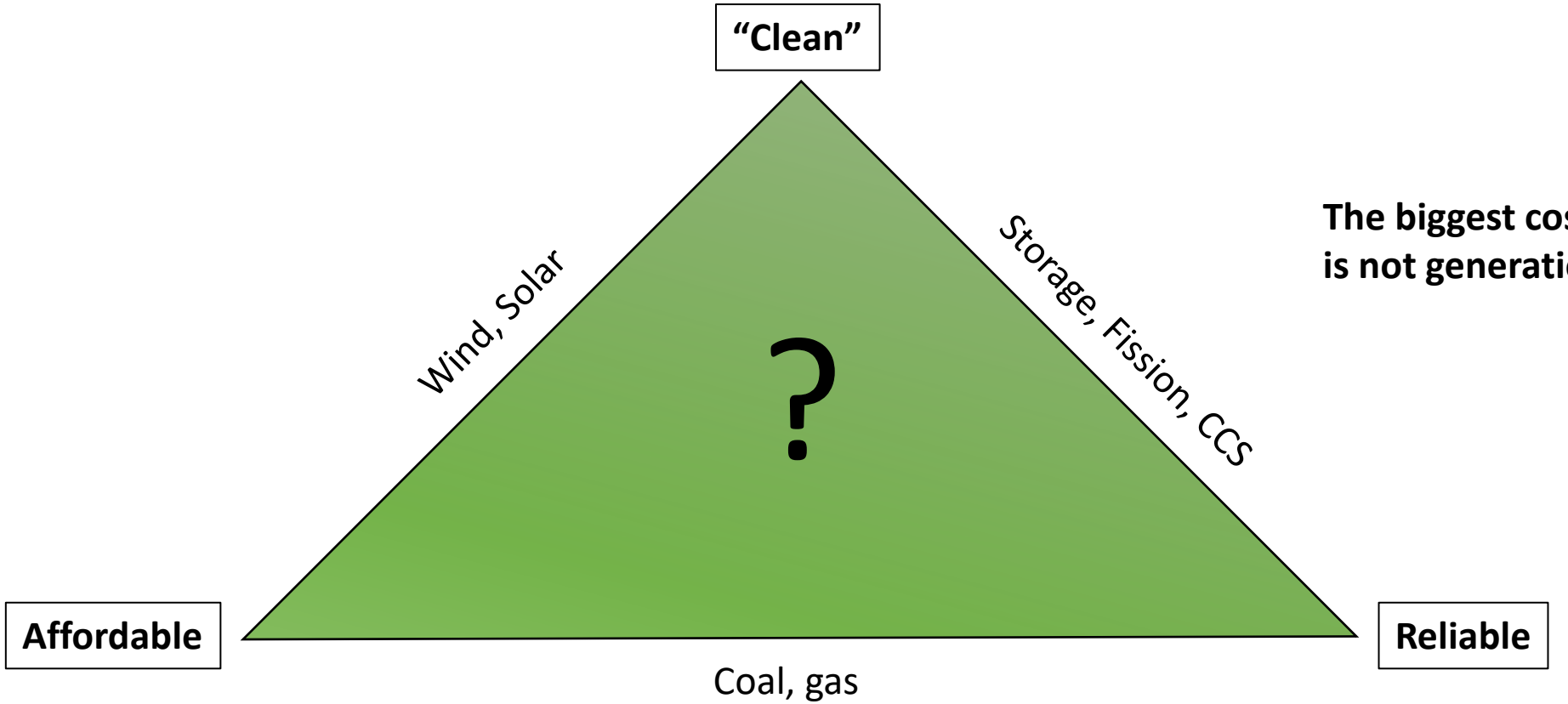


Global energy consumption by source



https://ourworldindata.org/grapher/energy-consumption-by-source-and-country

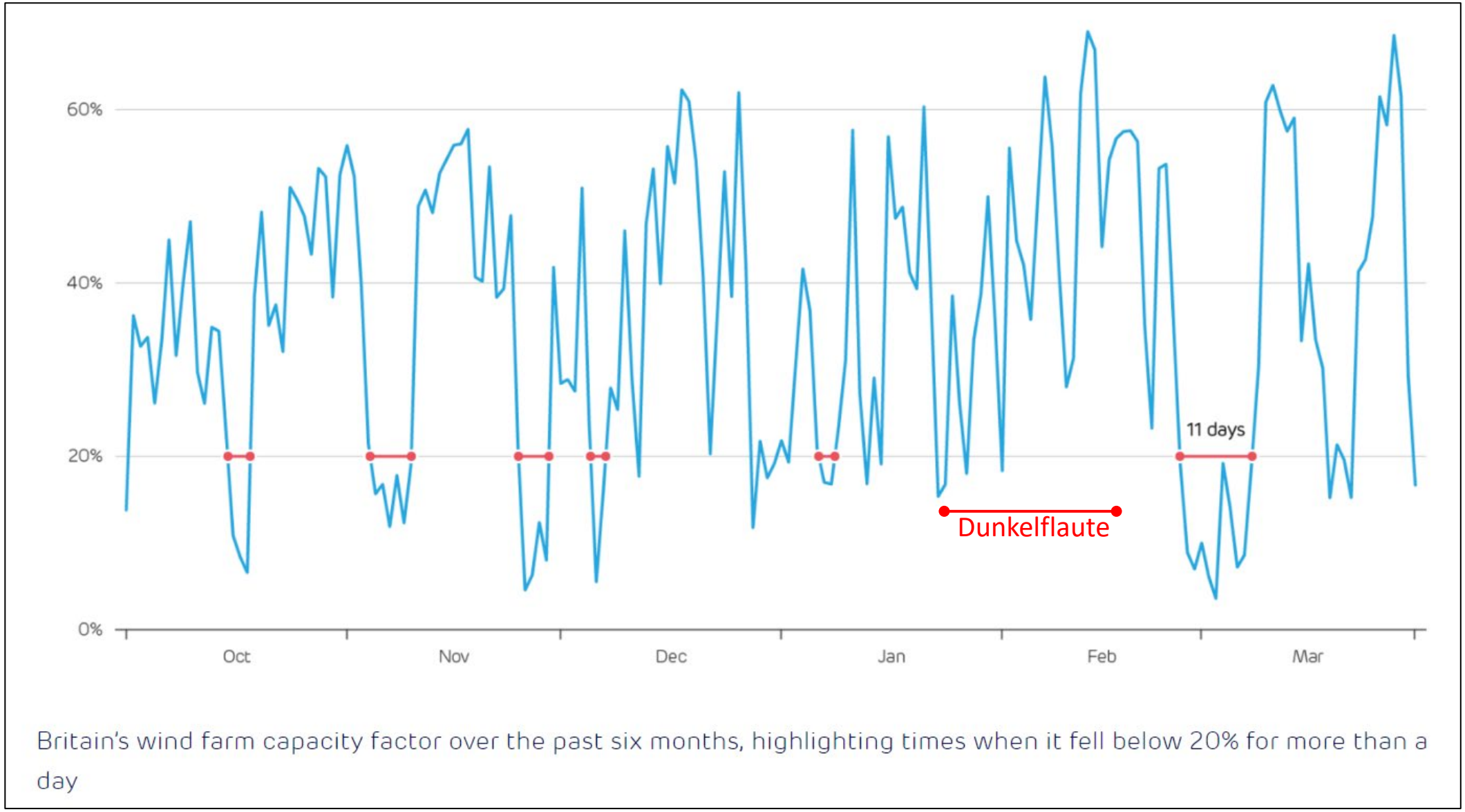
The Electrical Grid's Troubled Triangle



The biggest cost of a green grid is not generation, but reliability.

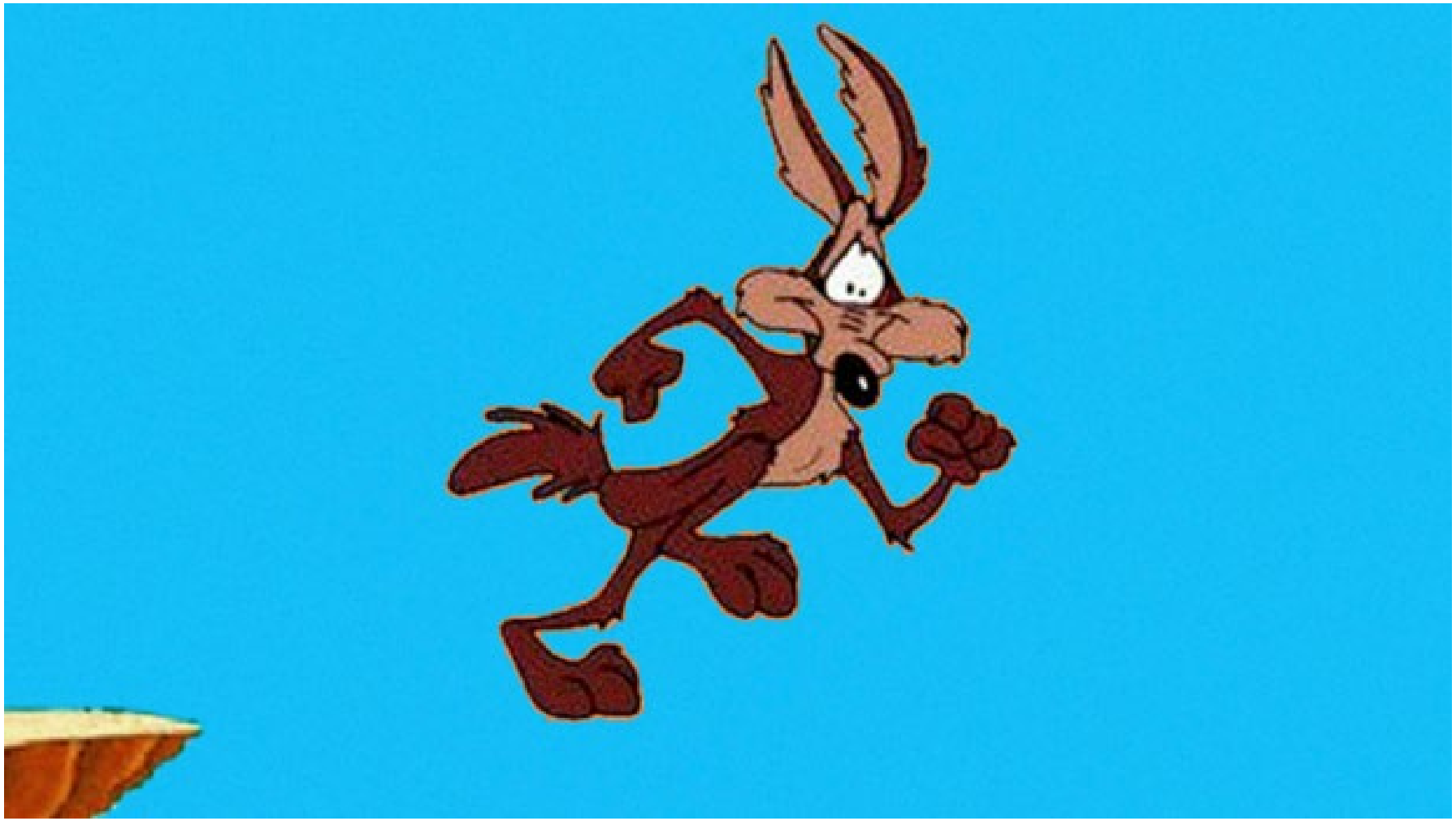
Daily wind generation in the UK (2020-21)

https://reports.electricinsights.co.uk/q1-2021/when-the-wind-goes-gas-fills-in-the-gap/



Britain's wind farm capacity factor over the past six months, highlighting times when it fell below 20% for more than a day

Whither the energy transition?



Koonin's recommended course forward

- **Cancel the "climate crisis", but acknowledge the task/challenge of reducing human influences**
- **Better observations and understanding of the climate**
- **Do not constrain the Developing World's energy supply**
- **A greater focus on adaptation and resilience (framework, costs)**
- **Develop and demonstrate emissions-lite technology**
- **Formulate "graceful" decarbonization pathways**

Comments? Questions?

Steven.Koonin@nyu.edu

https://steven-koonin.medium.com/