Climate and the Economy

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Breakfast with the Economists

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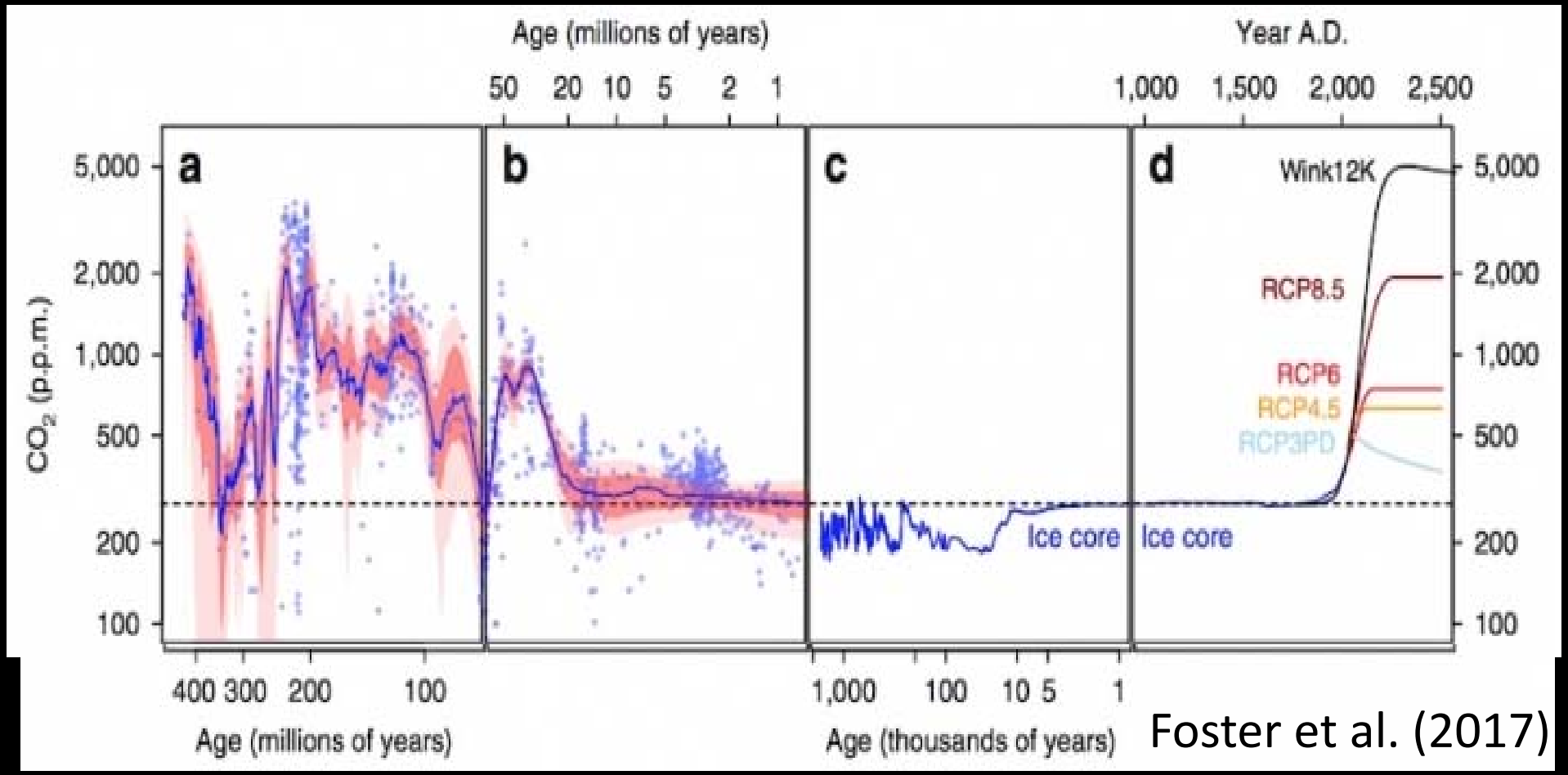
How Climate Is Affecting Weather

By 2050, carbon dioxide could reach levels unseen in 50 million years.

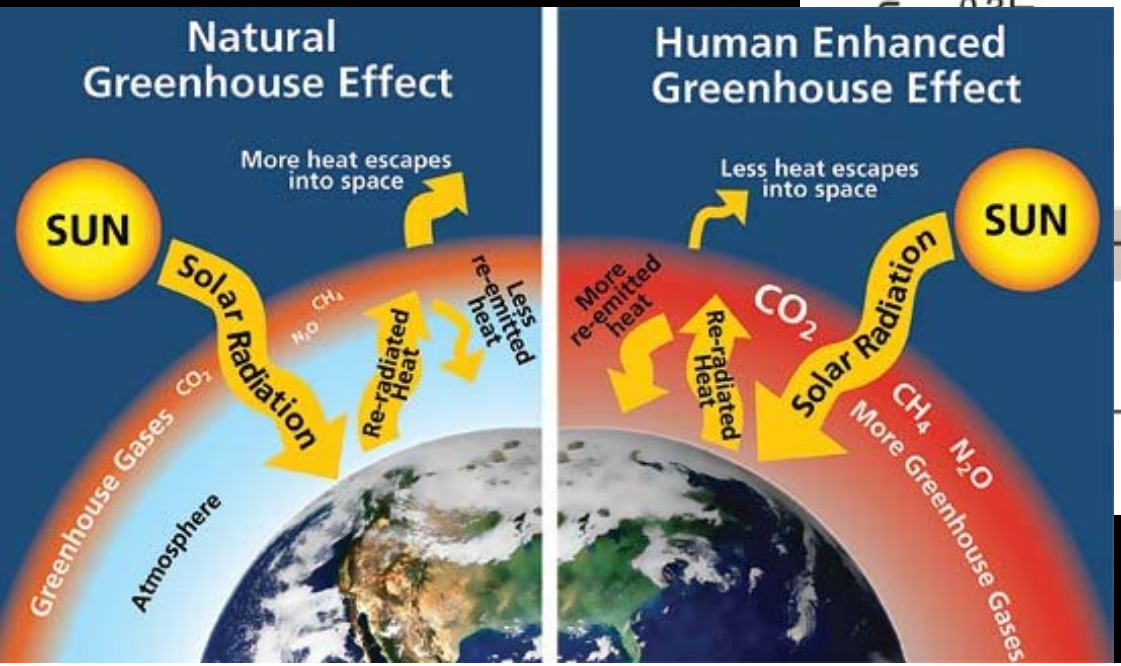


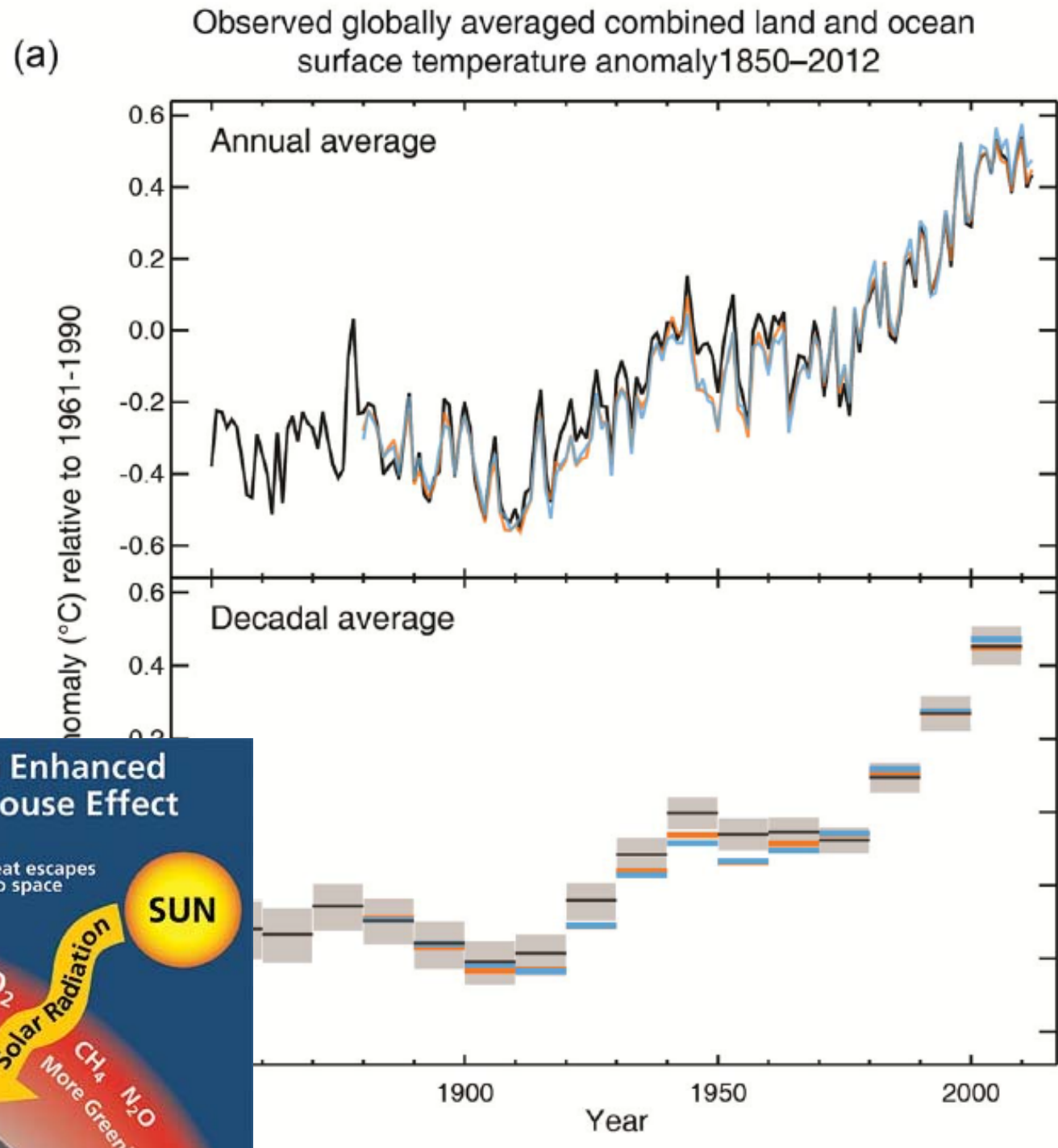
Foster et al. (2017)

And by the 2200s, it could reach levels unseen in more than 200 million years!

Carbon dioxide traps heat that would otherwise go to space, like adding blankets to the planet.

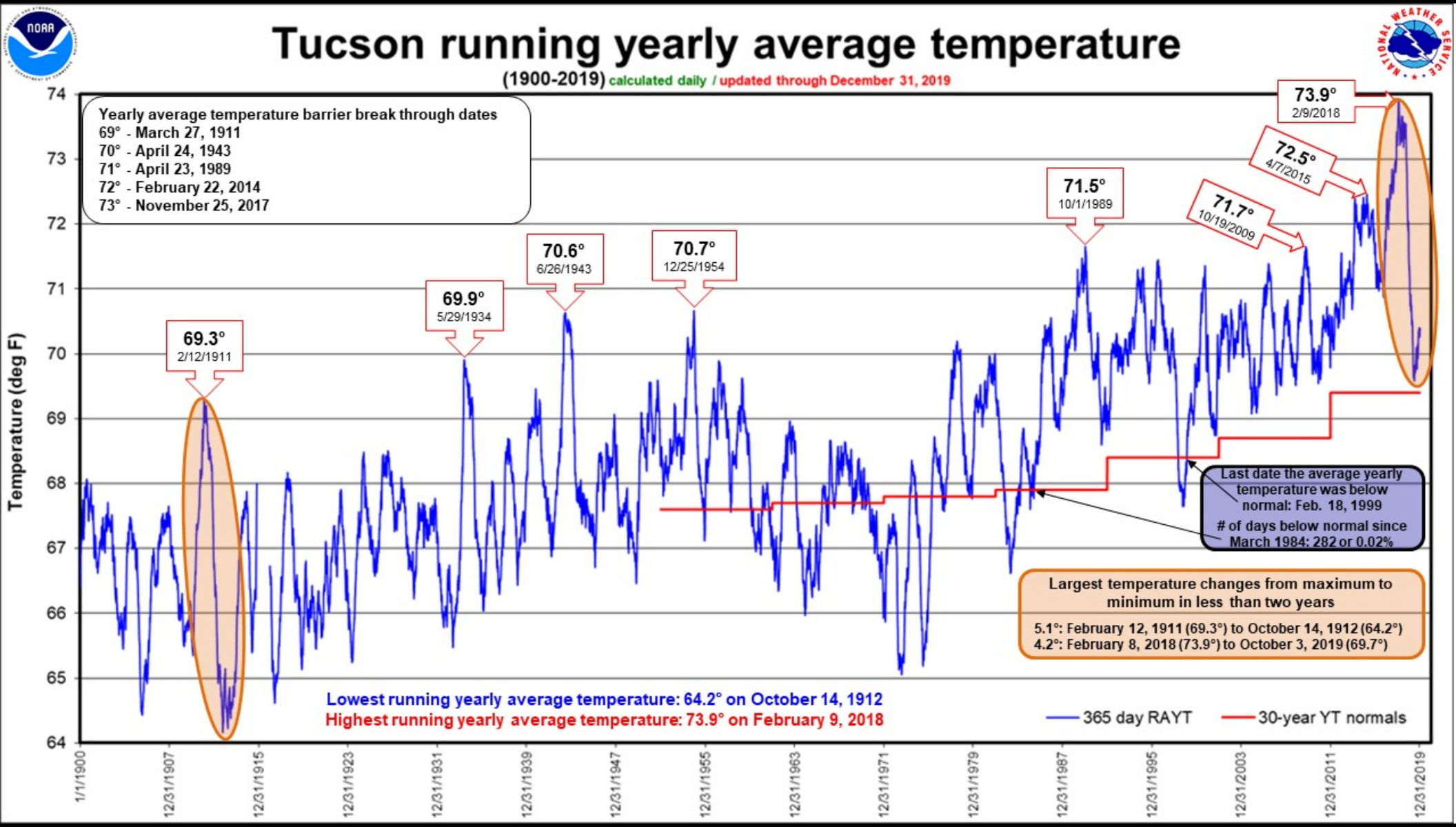
When more heat is trapped, the planet warms.





IPCC AR5 (2013)

We see the effects of global warming locally.



1900 1950 2019

https://twitter.com/NWSTucson/status/1221994449170878470

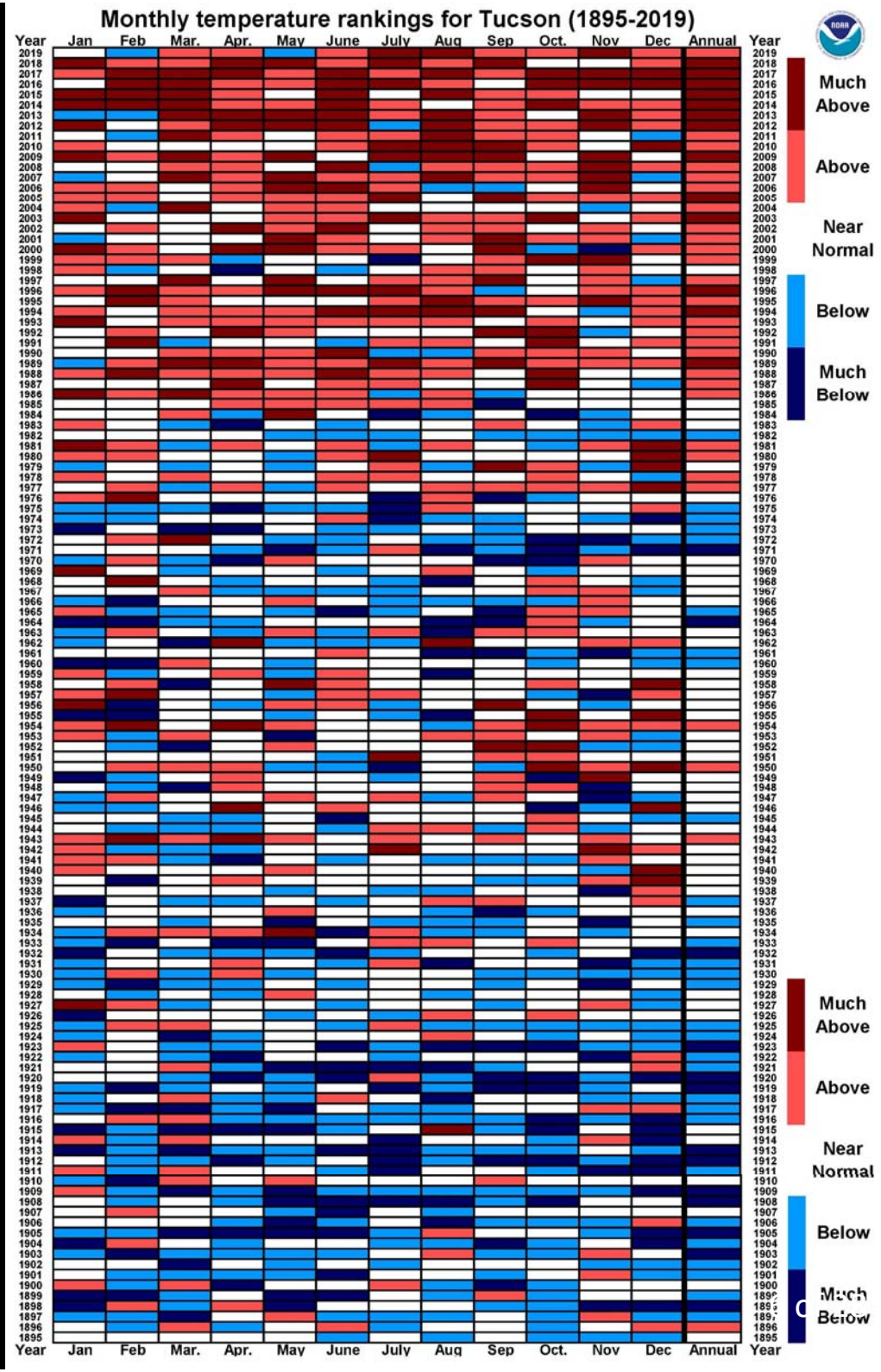
2019

Weather happens: some months will be unusually cool and some will be unusually hot. But many more are now unusually hot.

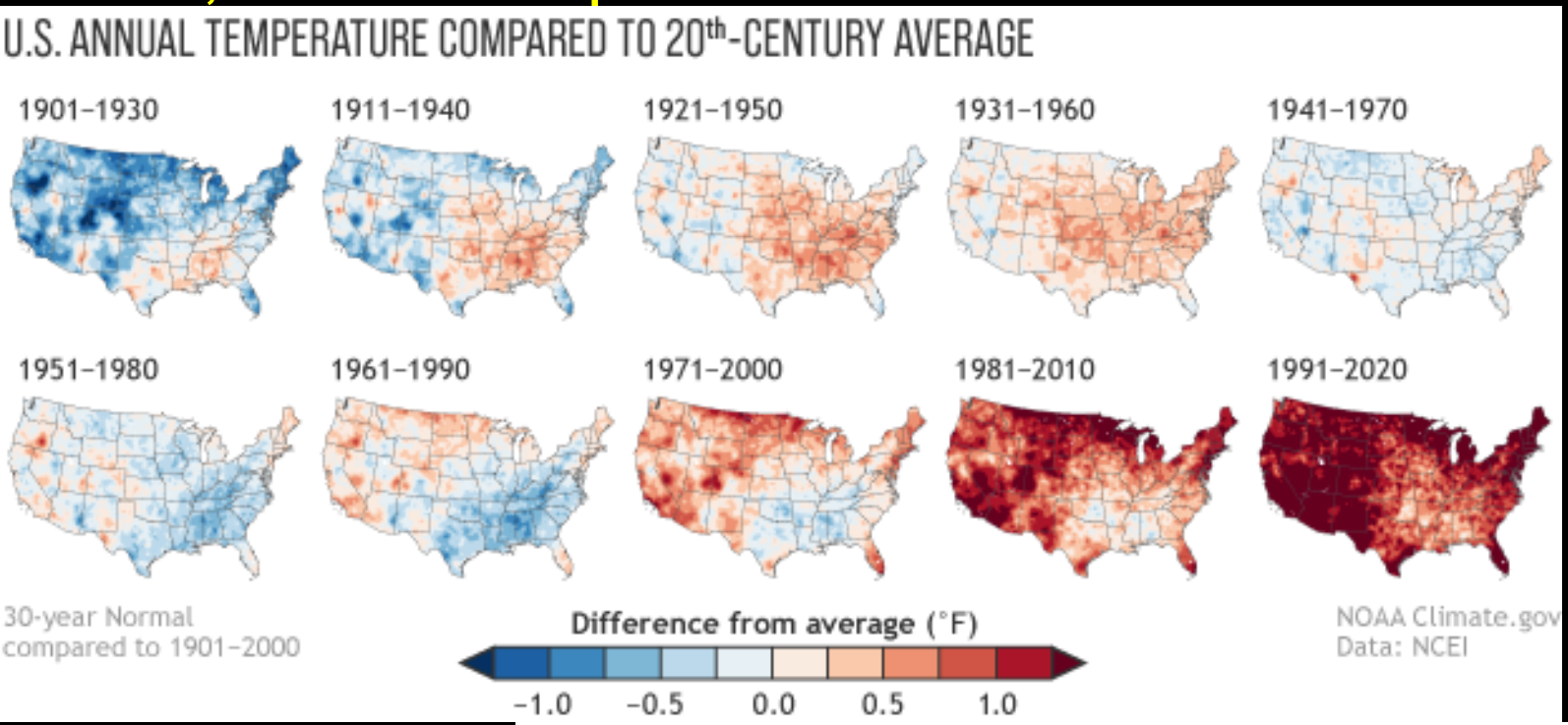
1950

https://twitter.com/NWSTucson/status/1221944644884848 64

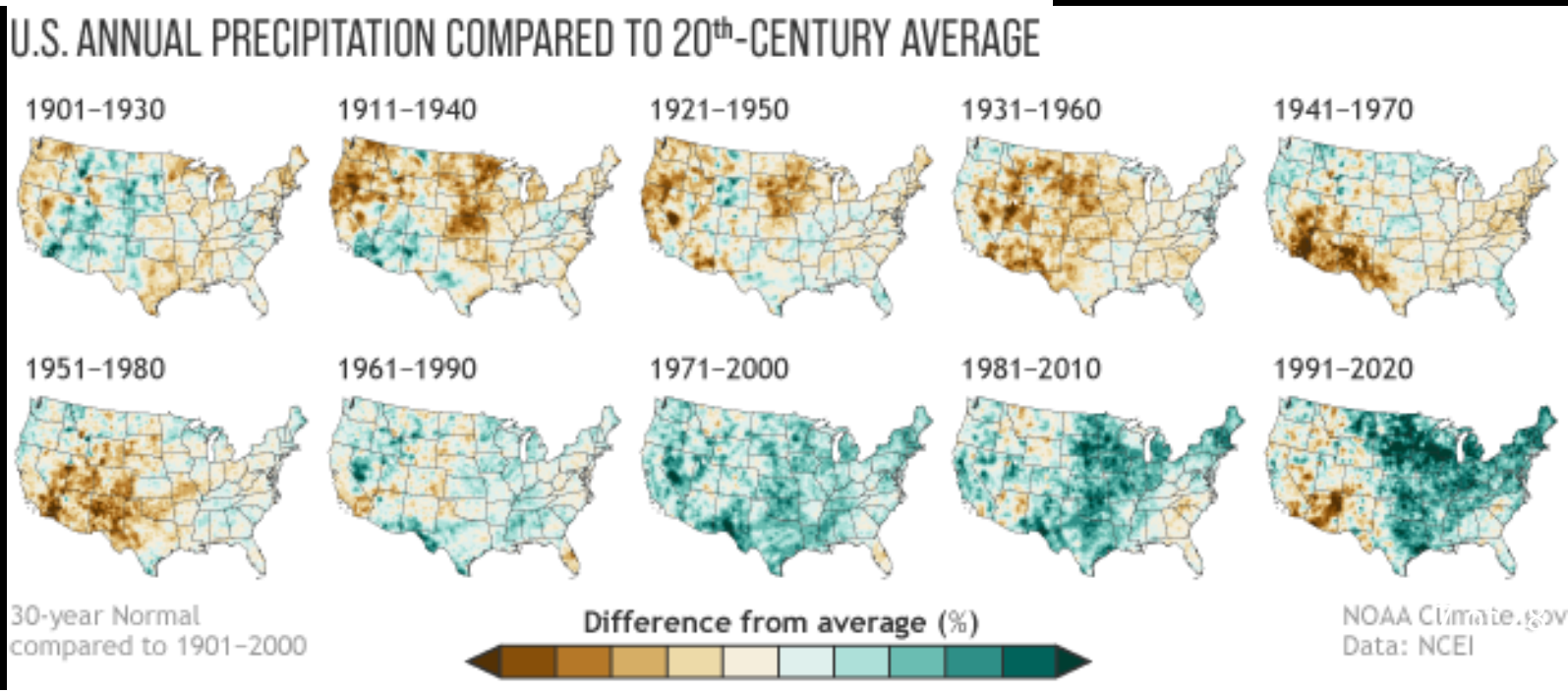
1900



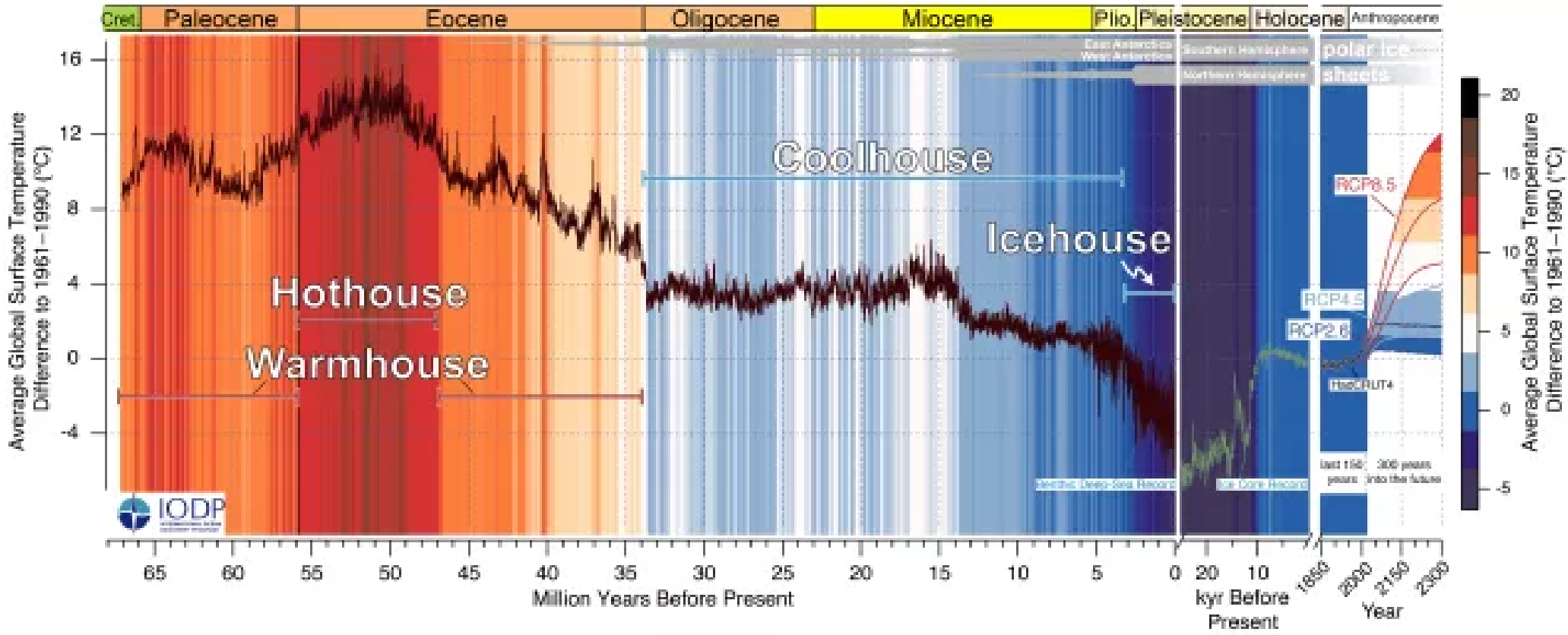
The baseline climates for locations across the U.S. are trending hotter, with some places wetter and some drier.



https://climate.gov/news-features/understanding-climate/climate-change-and-1991-2020-us-climate-normals

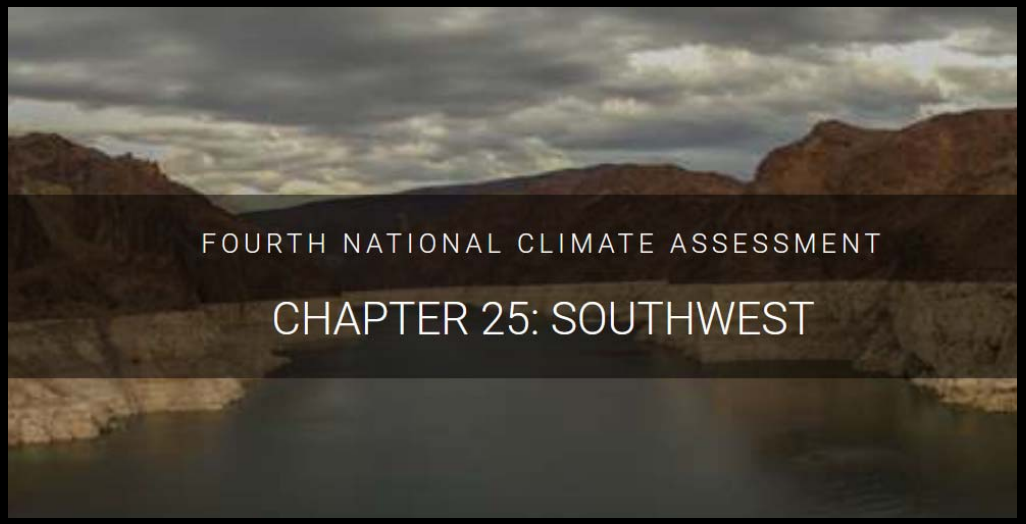


If we do nothing, the warming to come will look something like an ice age, but sped up and in reverse. And it could take us to temperatures last reached 50 million years ago.

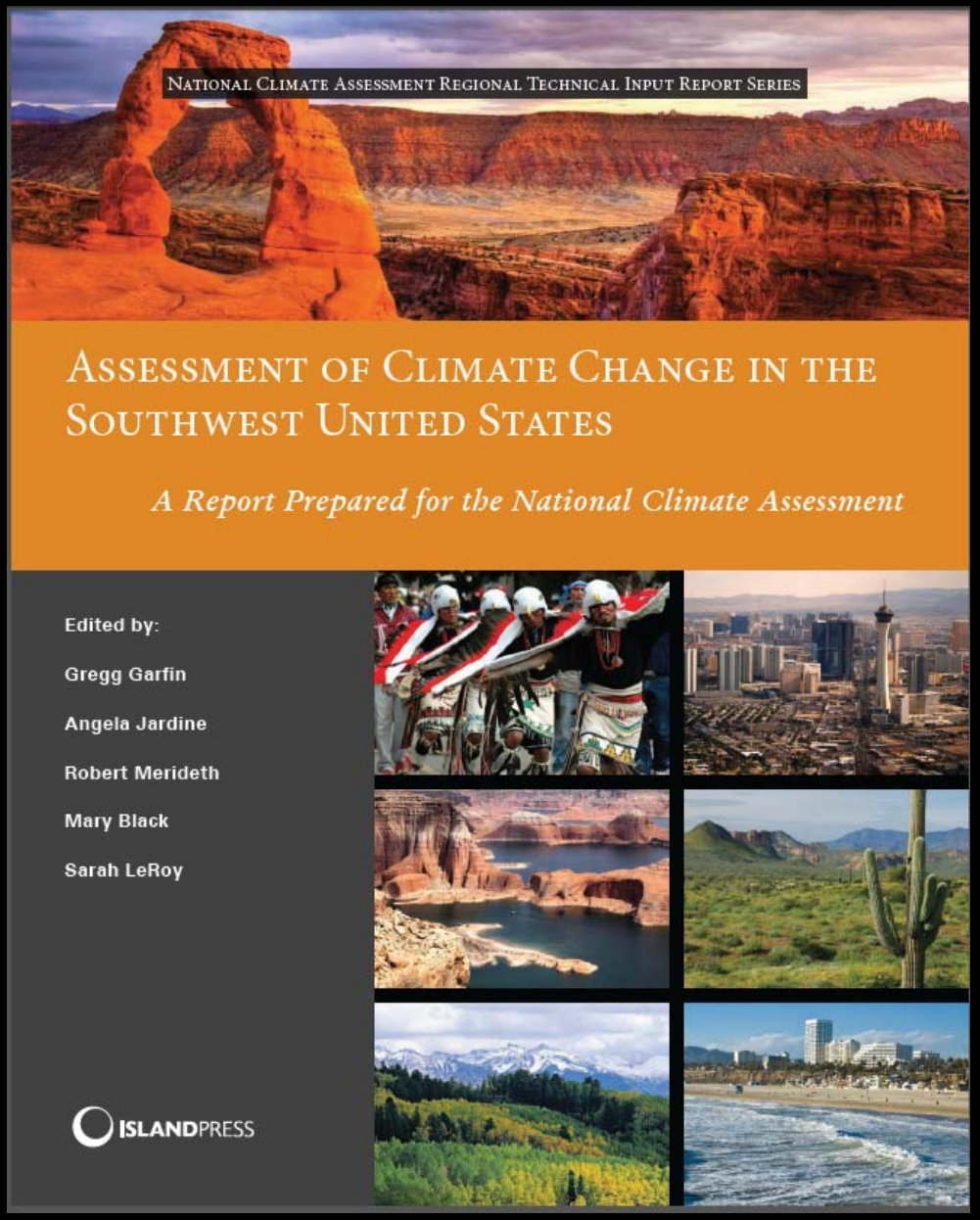


Westerhold et al. (2020), https://www.livescience.com/oldest-climate-record-ever-cenozoic-era.html

For projections for the Southwest, see:



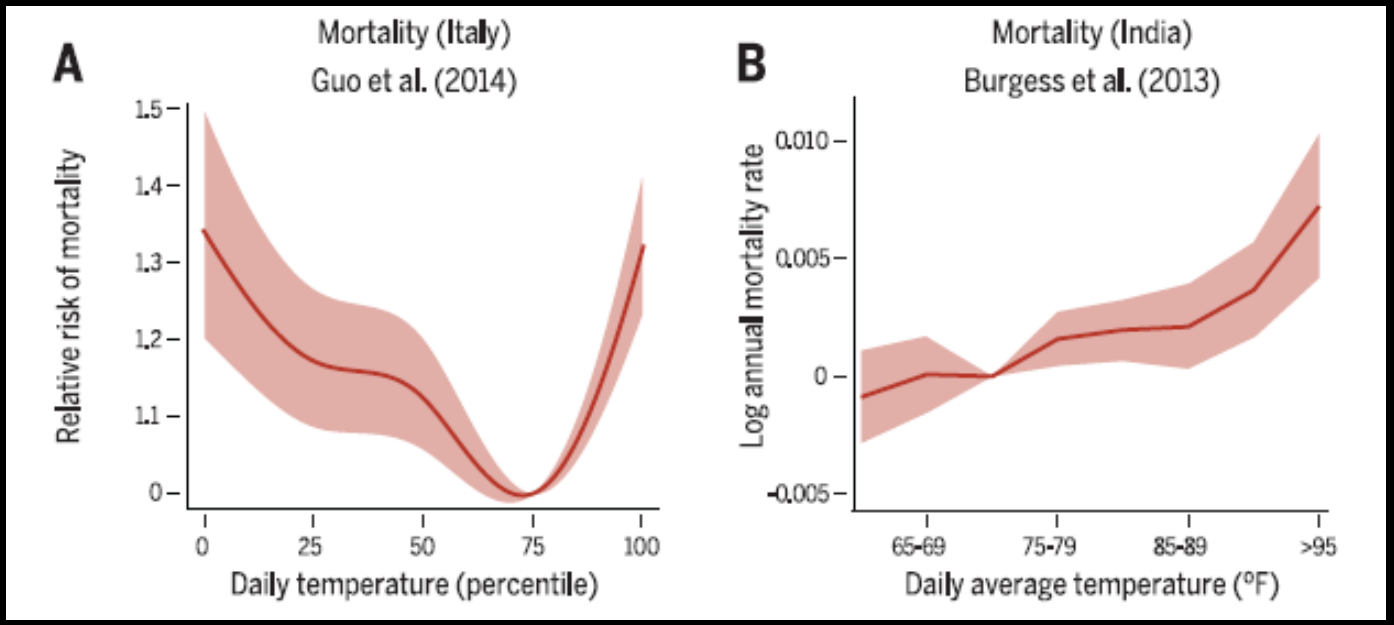
https://nca2018.globalchange.gov/chapter/25/

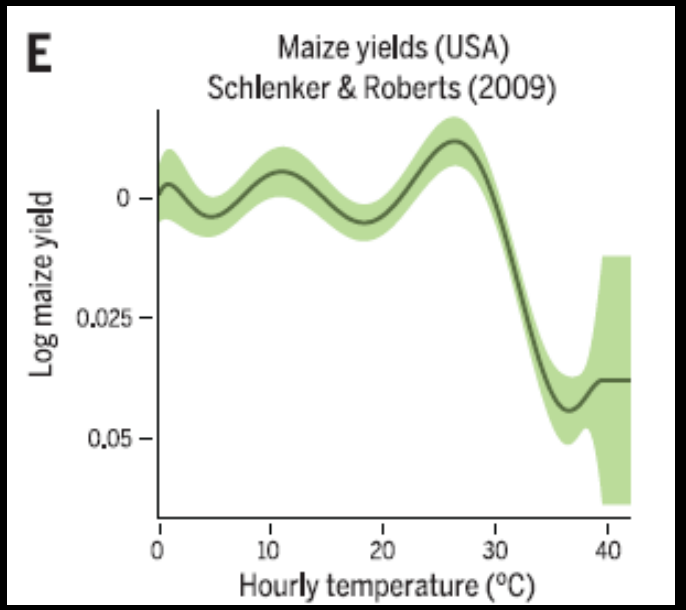


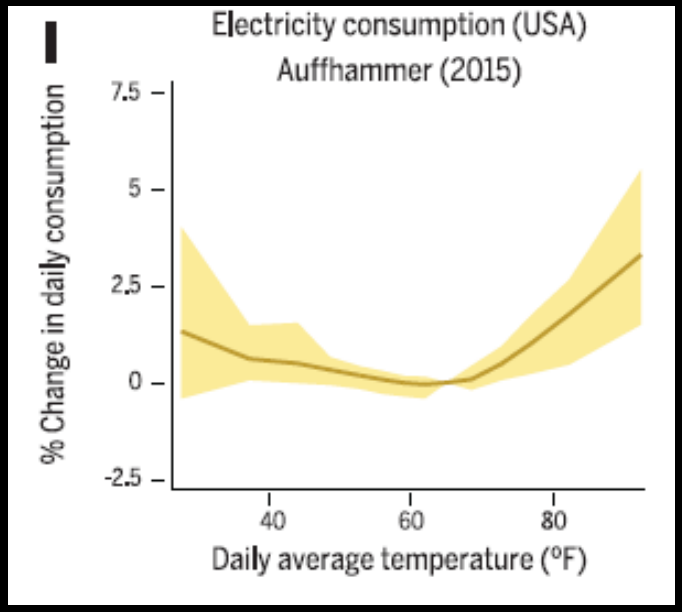
https://www.swcarr.arizona.edu/

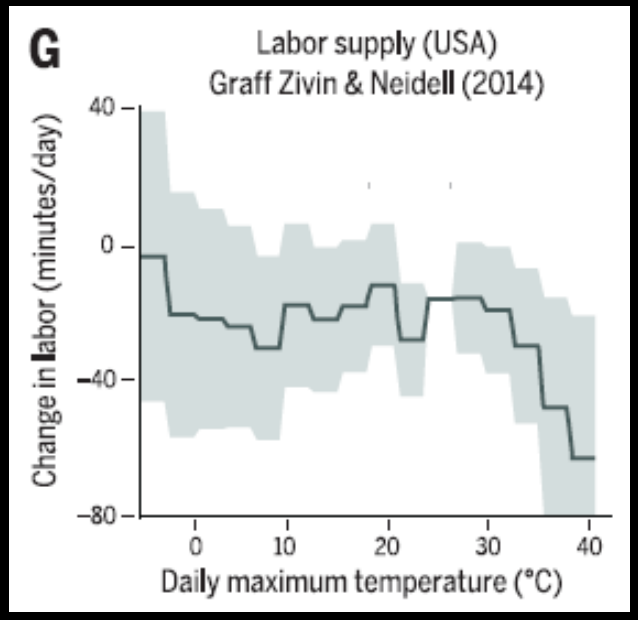
How Weather Matters for the Economy

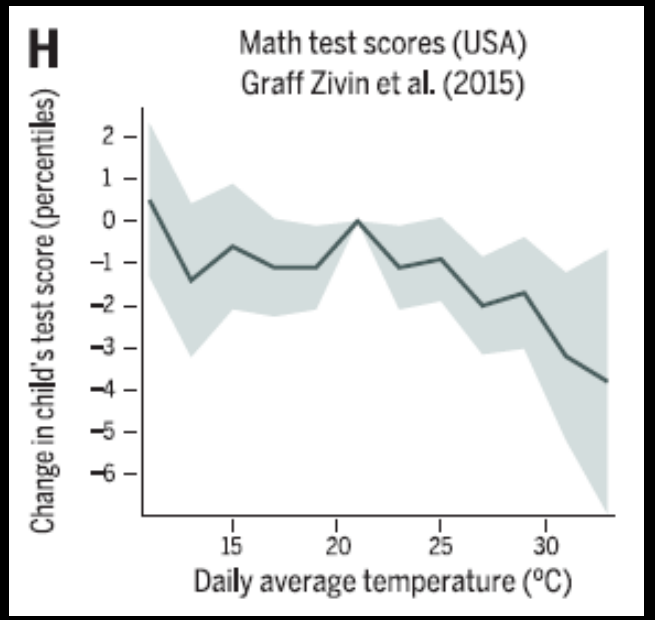
Temperature matters for many outcomes.







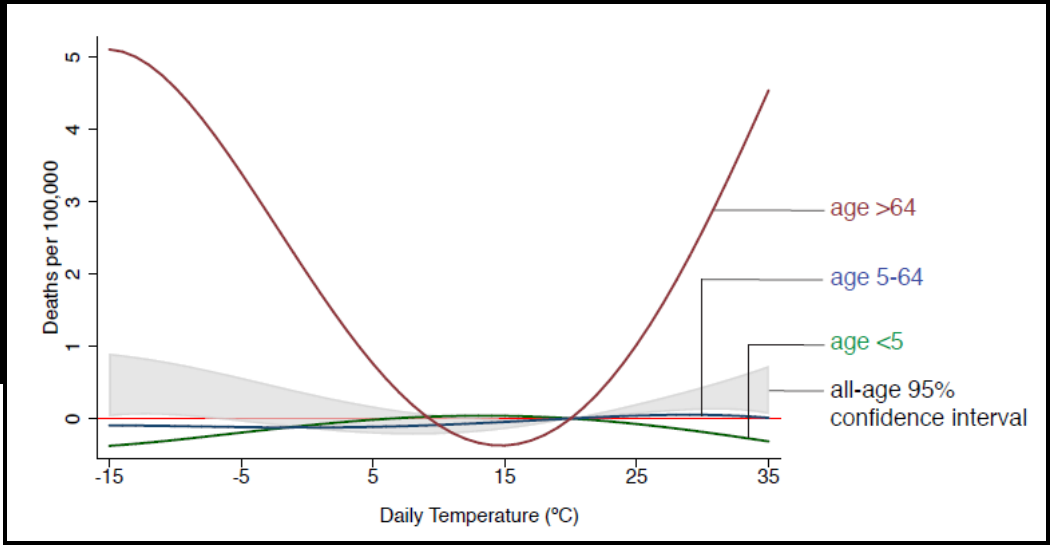




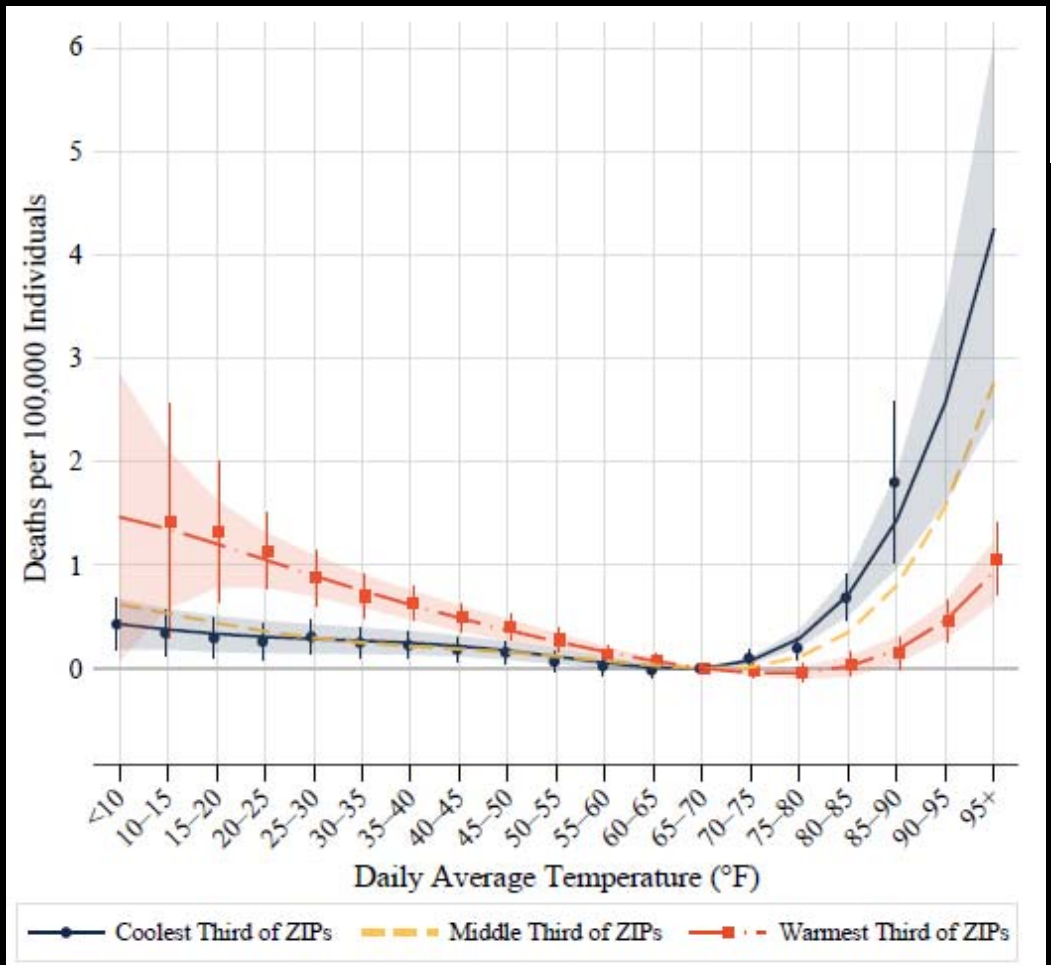
via Carleton and Hsiang (2016)

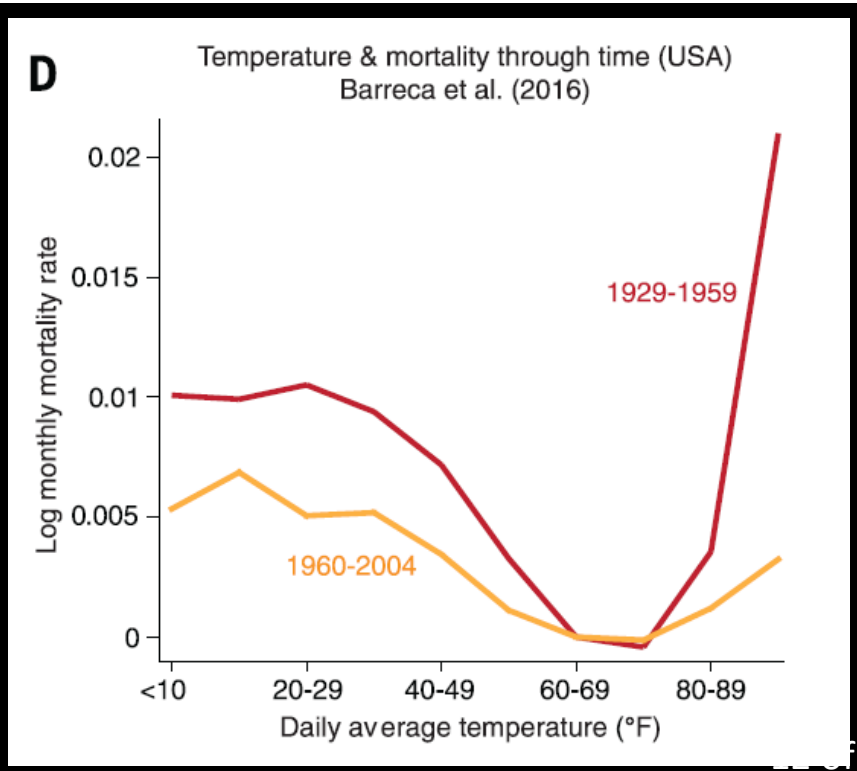
Heat mortality is concentrated mainly among the elderly, but it has fallen over time and people in hotter places handle heat better.

Carleton et al. 2020



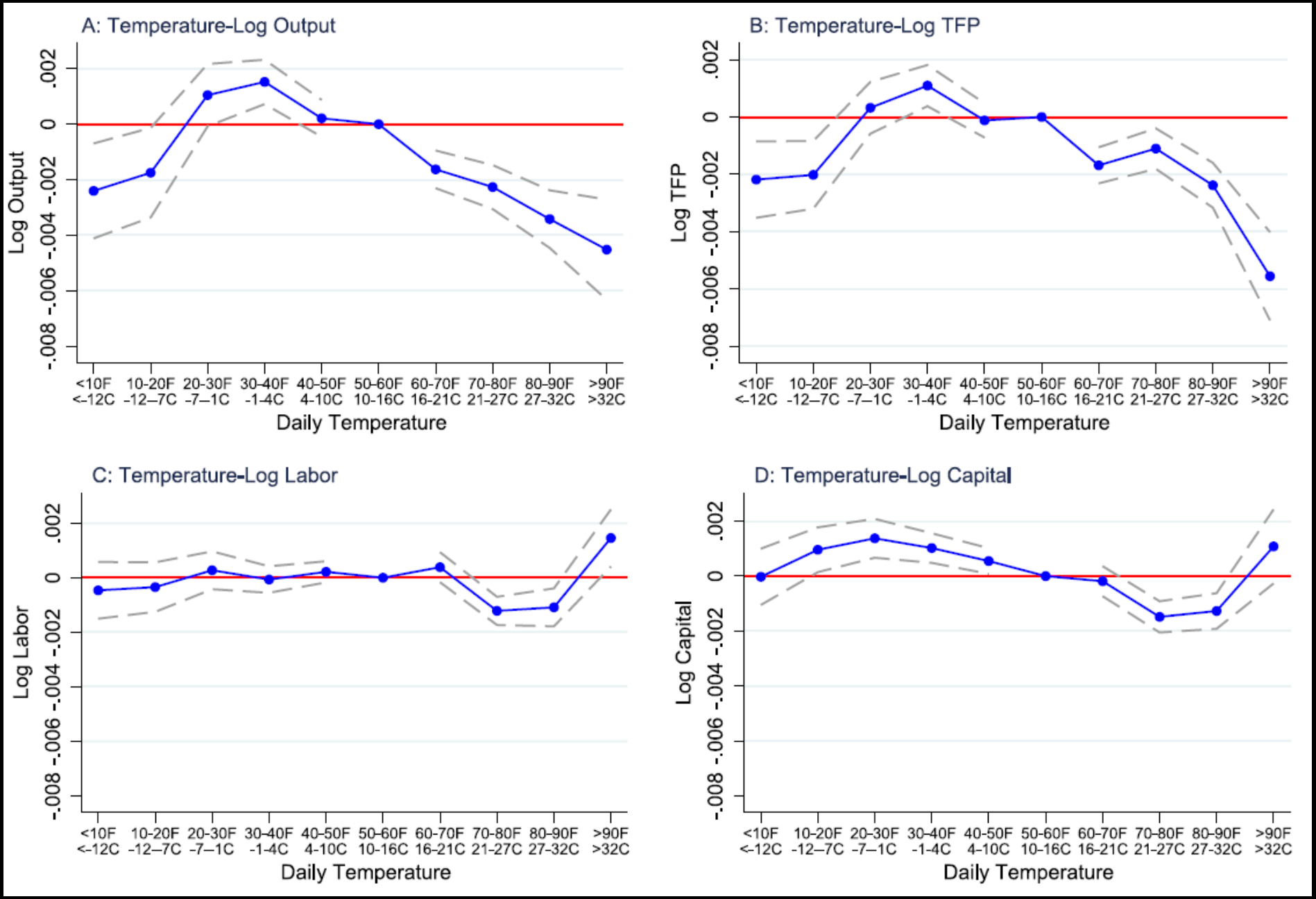
Heutel et al. (2021)





via Carleton and Hsiang (2016)

Productivity among Chinese manufacturing plants appears to fall in hotter weather.



Zhang et al. 2018

U.S. states' output appears to fall in hotter weather, with many industries exposed.

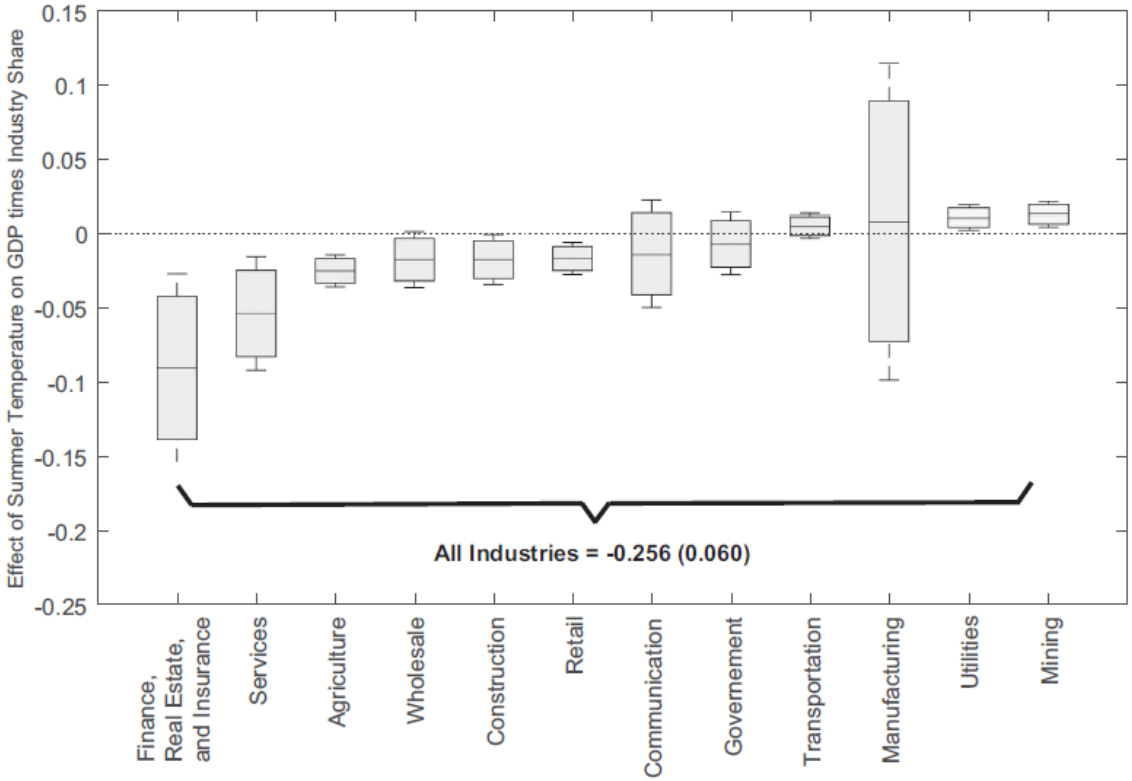
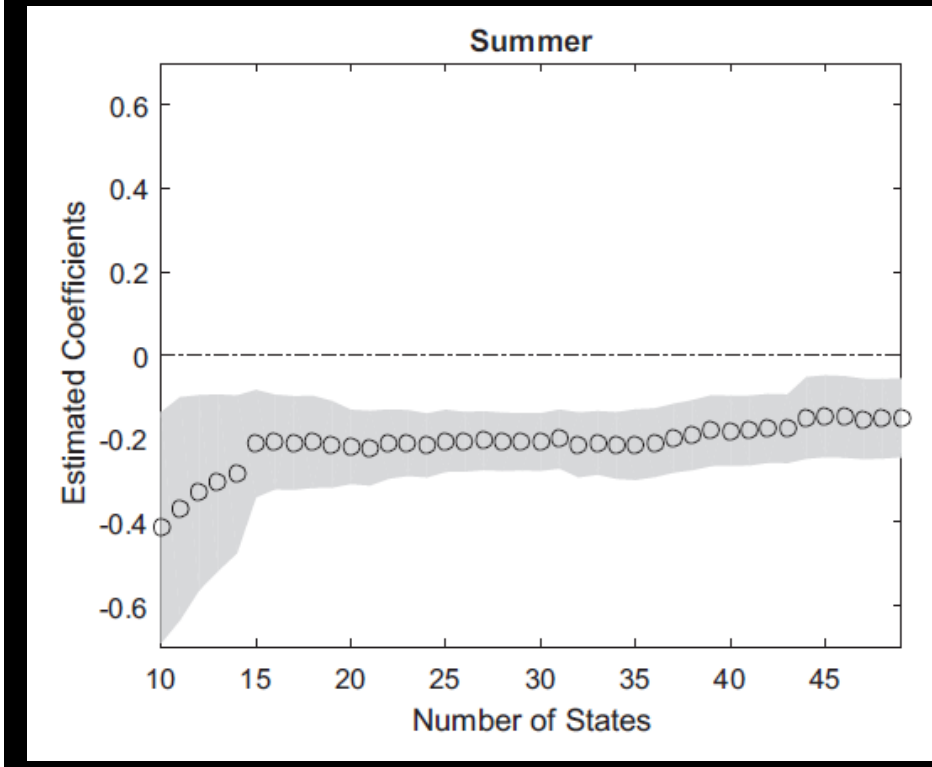


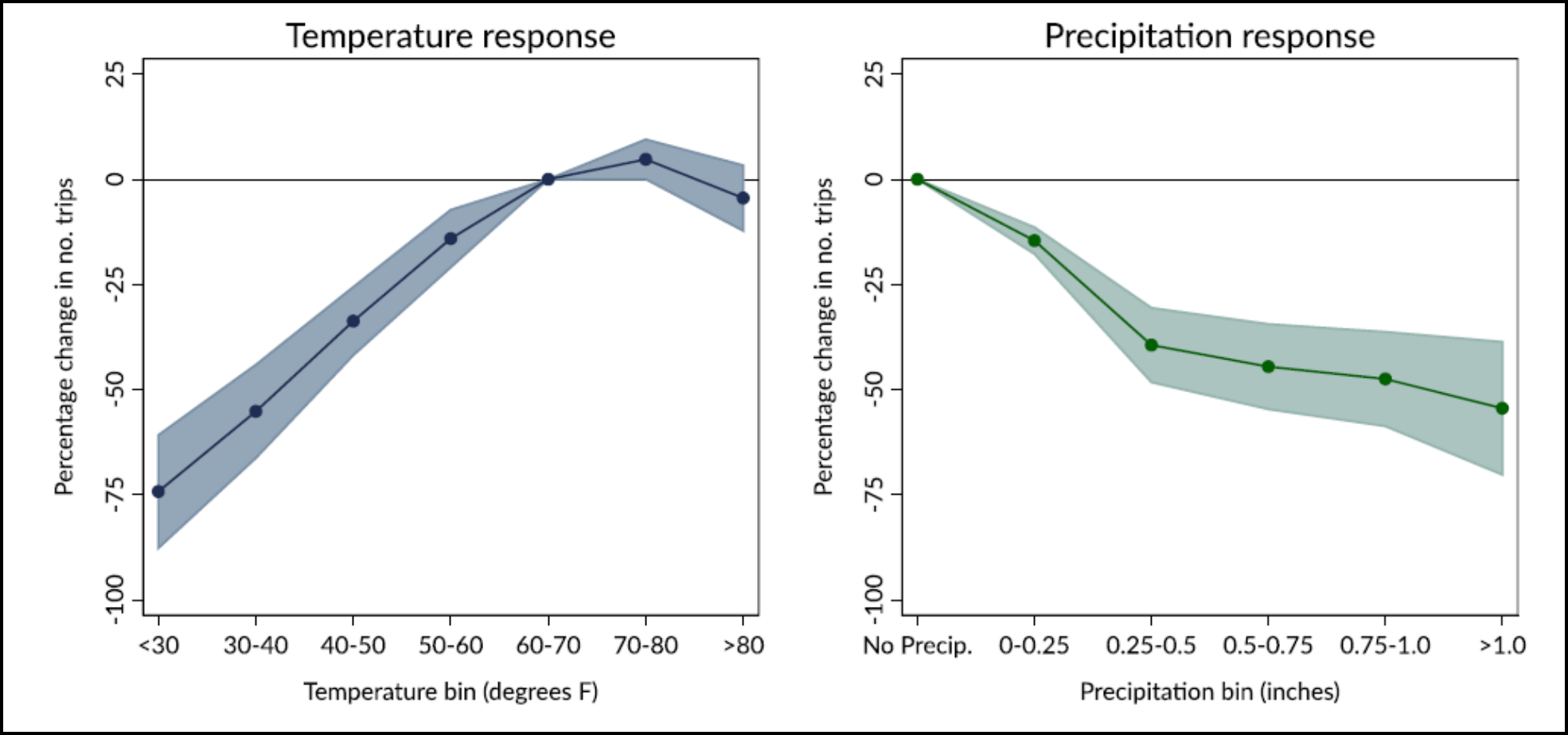
FIG. 1. Decomposition of the Summer Temperature Effect in the Cross Section of Industries.



Colacito et al. 2019

In work that I can't share yet, I show that seasonal climate risk also affects sectors throughout the economy and is priced in financial markets.

On the other hand, cycling data (from bikeshare programs) suggest that people do more outdoor recreation when it is warmer and drier.



Chan and Wichman 2020

What does this imply for long-run climate change?

People react to short-run changes in weather differently from permanent changes in climate: "Adaptation"

- Reactions to having lived with hotter weather year after year: "Ex-post adaptation"
- Reactions to expecting future years to also be hot: "Ex-ante adaptation"

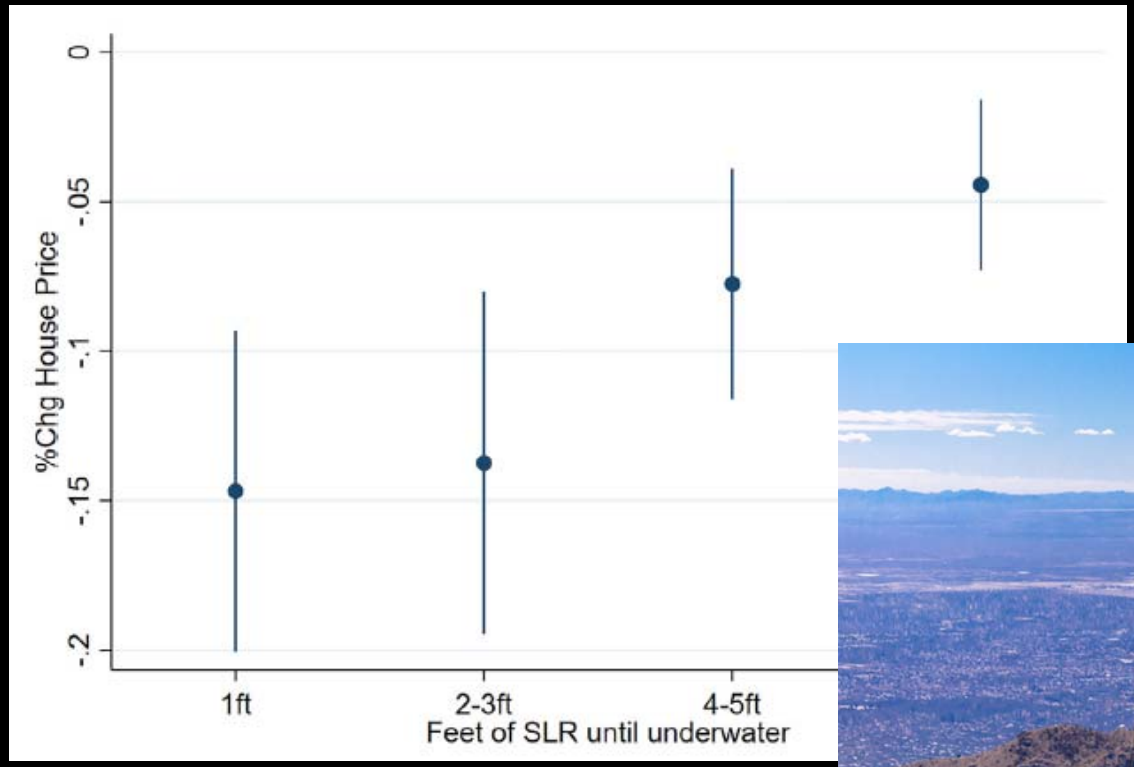
In recent work, I showed how to measure these adaptation responses.

I find that adaptation actually increases long-run costs in U.S. agriculture, as when we adapt by using scarce resources.

I project that climate change will largely eliminate profits from the average acre of current eastern U.S. farmland by 2100.

And the work on seasonal climate risk I mentioned implies adaptation is either costly or limited.

This area is still emerging, but there is some evidence that housing markets already capitalize future sea level rise.



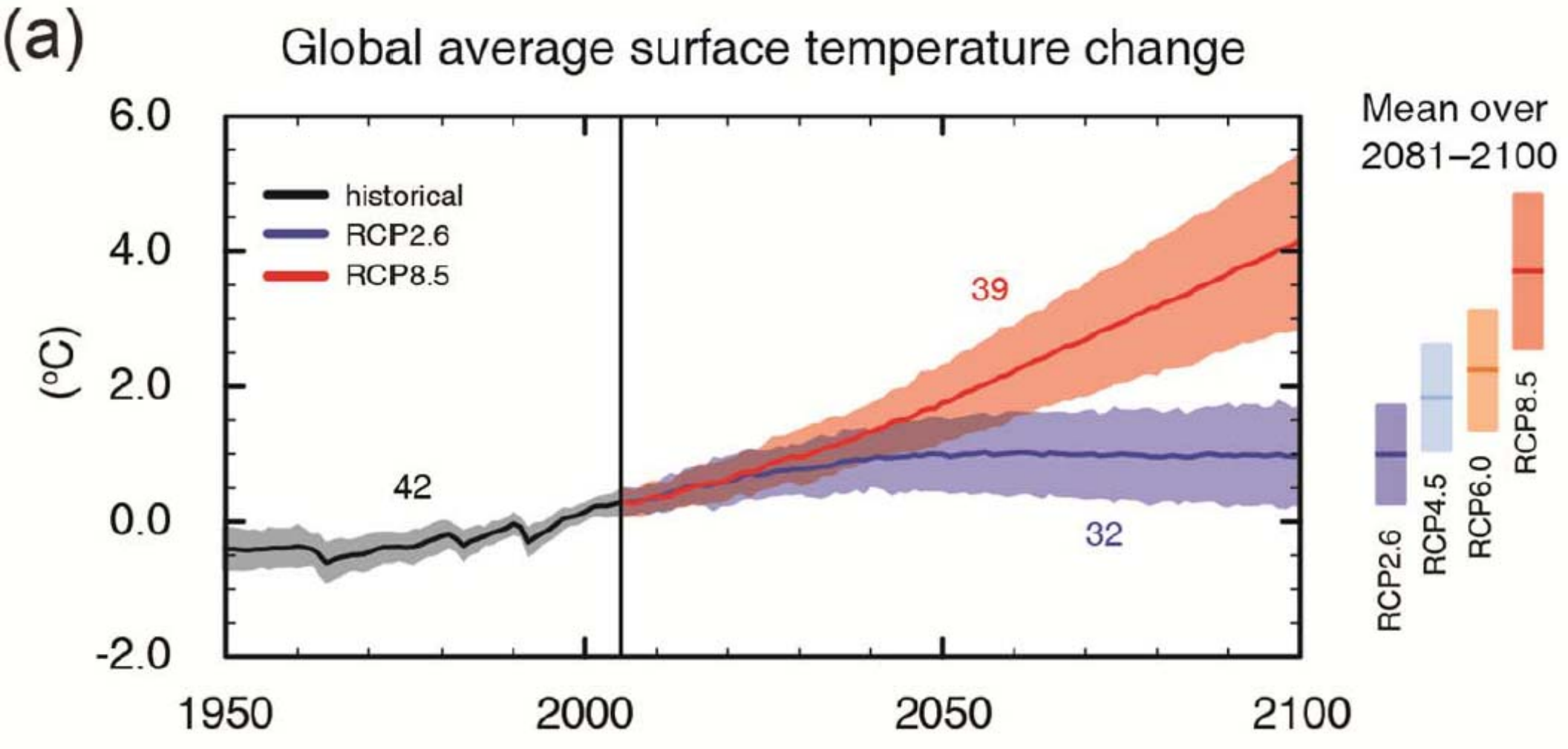
Bernstein et al. 2019

Maybe not the most pressing challenge facing Arizona…

But for local implications, consider how migration patterns might change over the century.

The Economic Challenge

We still have choices: If the world stopped emitting any greenhouse gases today, we would still see some more warming, but if we keep emitting at the current rate, we will see a lot more warming.



IPCC AR5 (2013)

Prices work when they convey the correct information about the value of resources and the cost of producing them.

When prices work, we get the "right" amounts of things without anyone ever having to calculate them.

Prices direct resources to where they are most useful.

Emitting carbon dioxide imposes costs that are not reflected in its price ("externalities"). We therefore get too much of it.

Ultimately we need to price carbon emissions to reflect their costs.

Fuels with a lot of carbon would get more expensive (coal).

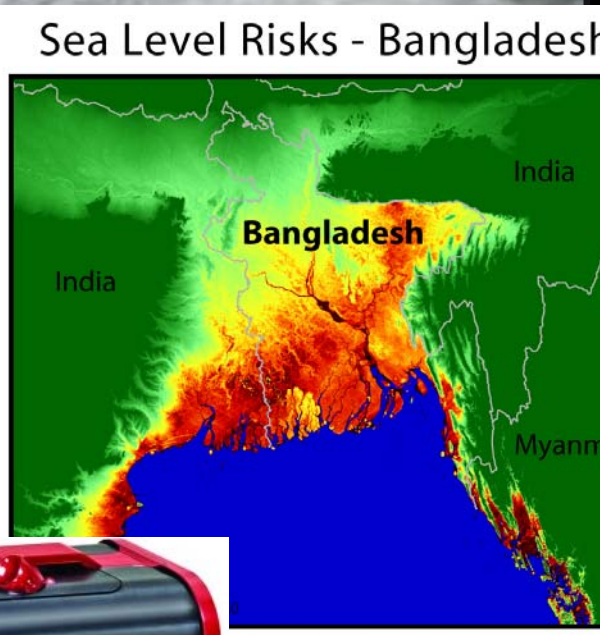
The market would favor fuels that emit less carbon. For instance, natural gas would have an edge over coal. So would renewables and nuclear.

Electric vehicles would look more attractive if their electricity is lower-carbon than gasoline.

Raising the price of carbon-intensive energy would also lead people to use less fuel: we would buy more efficient appliances and cars.

Firms start to invest more in new, cleaner technologies and in technologies to remove carbon from the air.

What is the correct price for emissions?



Our knowledge of the damages from climate change is staggeringly incomplete.

Plausible assumptions give emission prices anywhere from 5-500 $/t$CO_2$.

There is much we know we don't know.

And much we don't even know to ask about.

And much we may never know: many consequences may be impossible to value in a data-driven way.

So take economists' recommendations regarding the strength of policy with a hill of salt.

We can price some of this uncertainty.

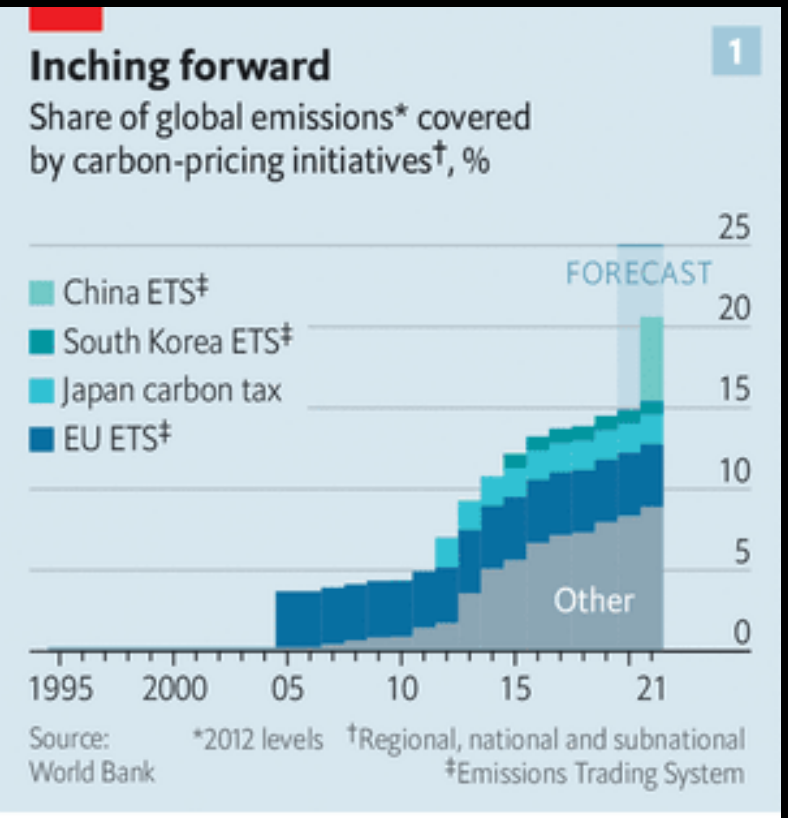
I showed that accounting for uncertainty substantially increases the cost of emissions because reducing emissions looks like insurance.

Table 1: The year 2014 social cost of carbon and its components, all in $/tCO$_2$.

	Channel				
Source of Uncertainty	Deterministic	Precautionary	Damage Scaling	Growth Insurance	Total
200-year horizon					
Consumption Volatility	300.8	9.6	-7.9	0.11	302.7
Warming Parameter	294.6	5.3	-4.3	2.6	298.2
Damage Parameter	295.8	30.7	-25.1	49.4	354.6
All Three Factors	290.9	40.9	-33.4	58.7	362.0

Lemoine 2021

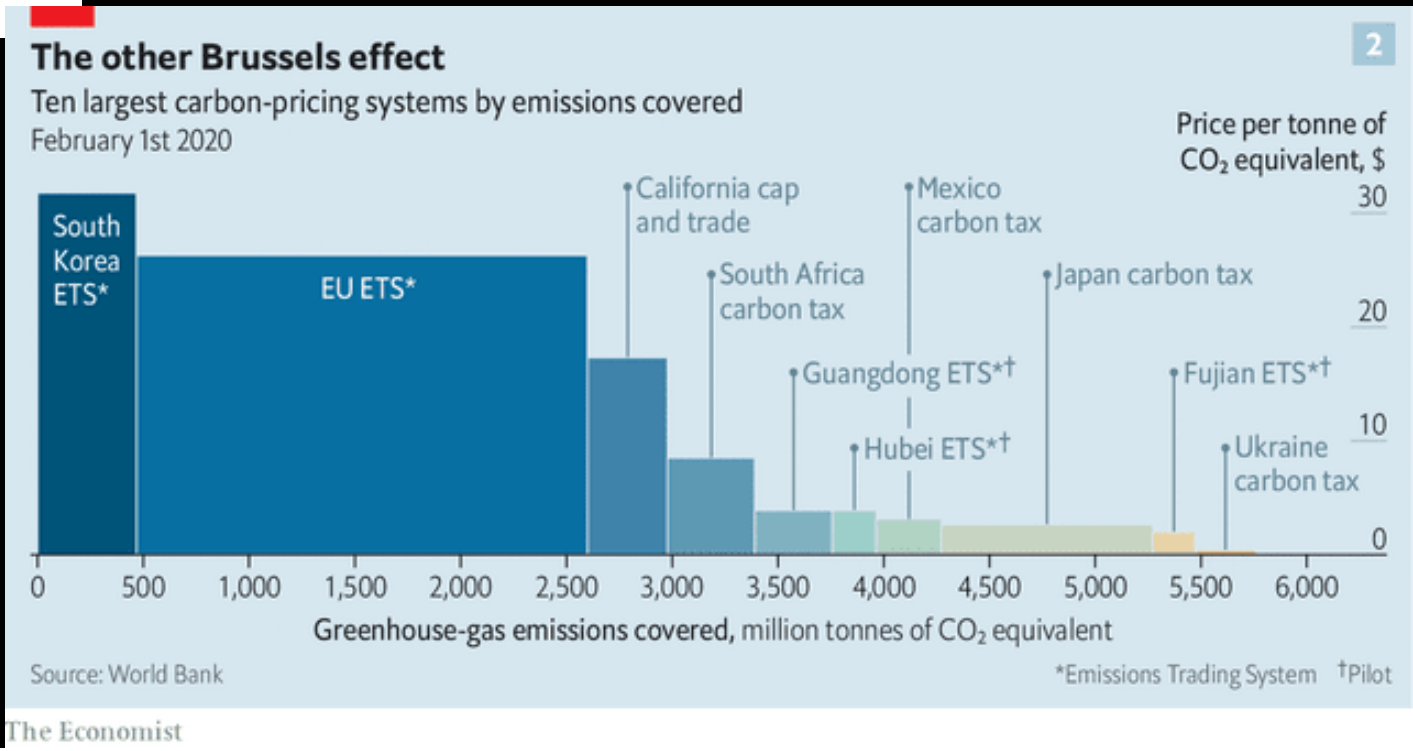
The U.S. government is currently recalculating the carbon price it uses for cost-benefit analyses of new regulations. It may borrow from this approach to pricing uncertainty.



An emission price can be implemented through a tax or through “cap-and-trade”.

More and more of the world’s emissions are covered, but we are well short of what is needed to avoid 1.5 or 2 degrees of warming.

https://www.economist.com/briefing/2020/05/23/the-world-urgently-needs-to-expand-its-use-of-carbon-prices



The Economic Project of the 21st Century

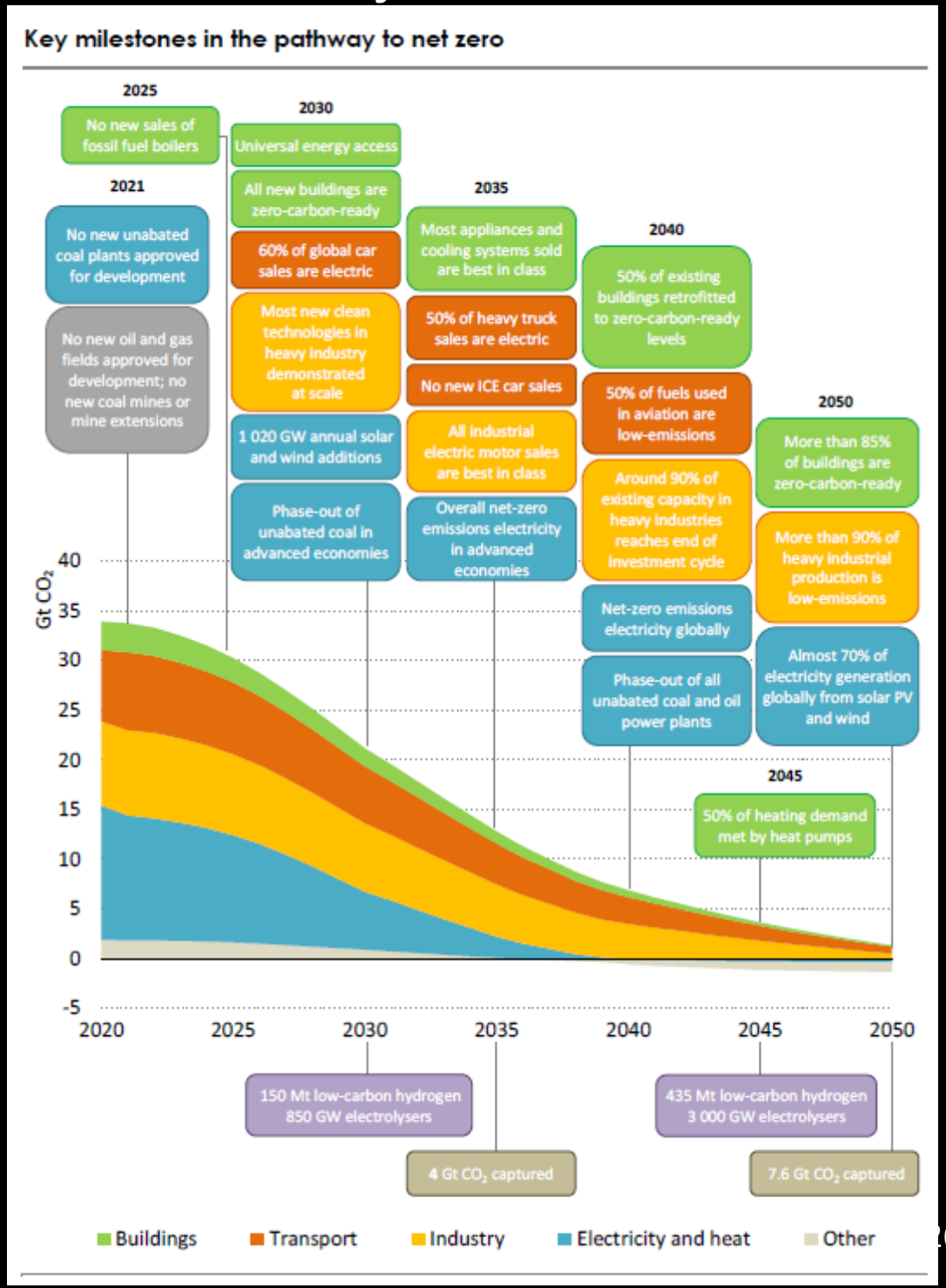
Limiting warming to 1.5 or 2 degrees Celsius is an ambitious project that requires:

1) Avoiding new investment in fossil fuel supply,

2) Making large investments in other energy infrastructure,

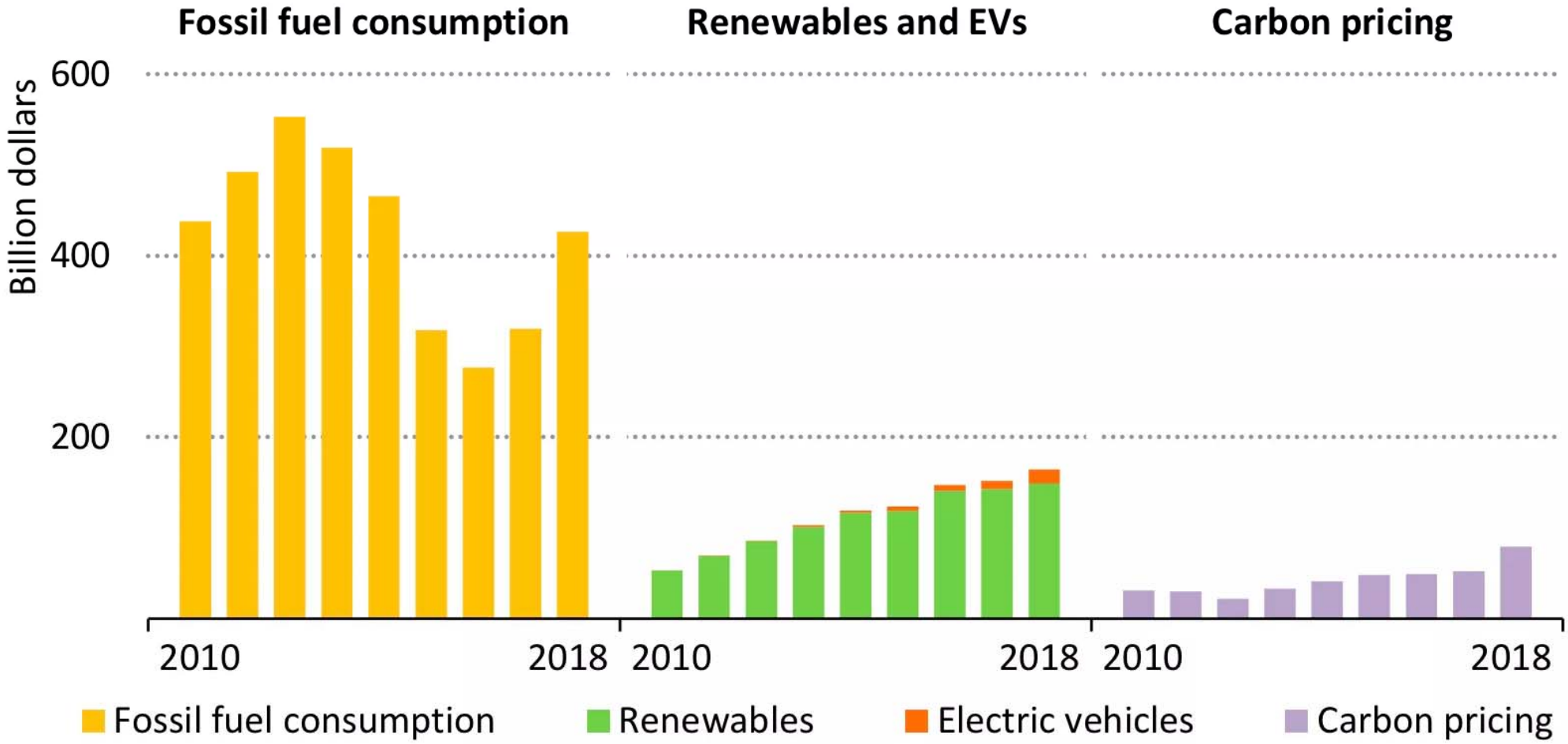
3) Getting all large countries on board.

International Energy Agency 2021
https://www.iea.org/reports/net-zero-by-2050



However, the world currently subsidizes fossil fuels on net, which worsens the externality.

Figure 1.20 ▷ **Estimated value of subsidies to fossil fuel consumption, renewables and electric vehicles, and carbon pricing, 2010-2018**



IEA World Energy Outlook 2019

Outlook

Limiting climate change is feasible – and new technologies make it appear way cheaper than it looked even 10 years ago.

The next decade-plus will determine how much more climate change we have to live with.

Domestic and international politics is moving towards action, much more so than even 10 years ago.

Domestic policy appears less tilted towards emission prices than 10 years ago, in part because those may need to go through Congress.