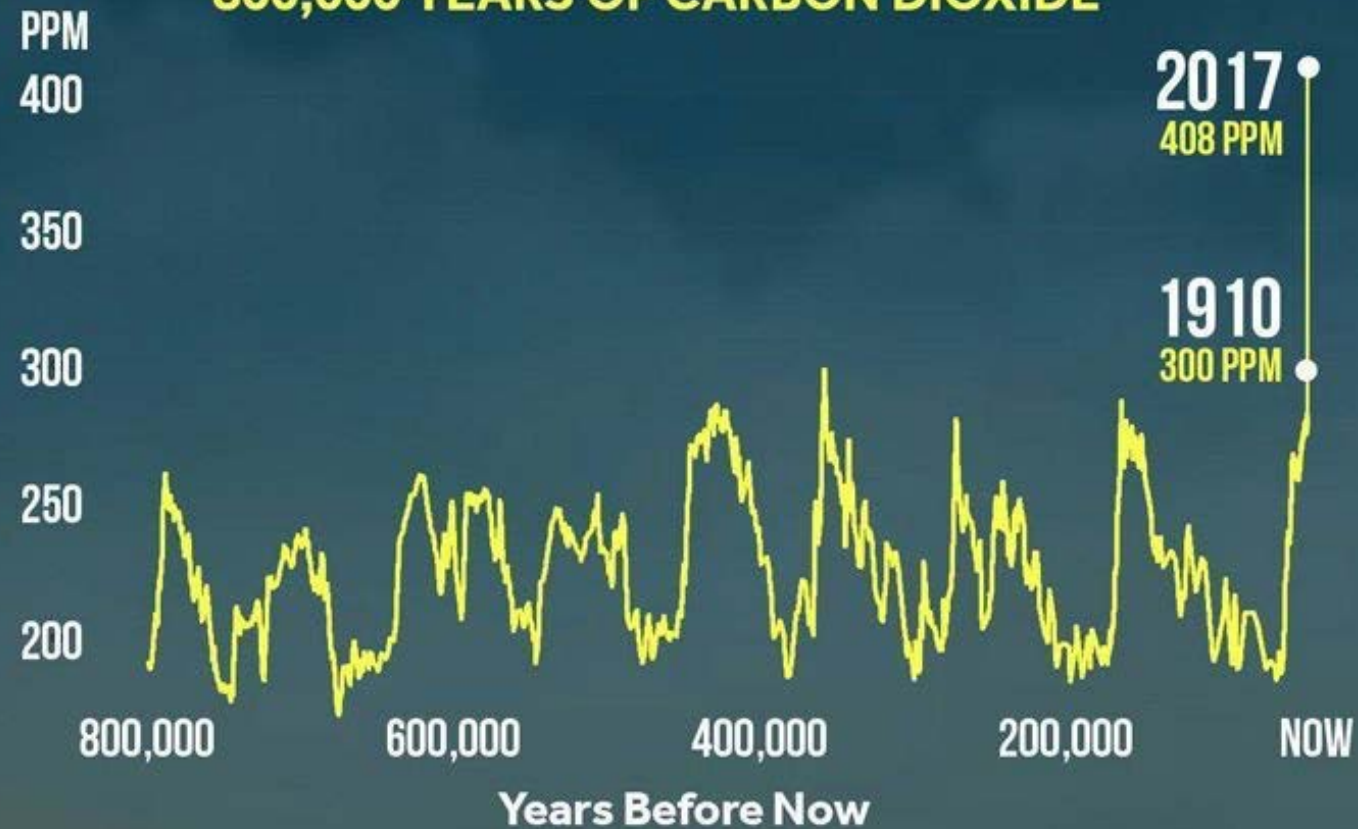


WHAT WE KNOW

Well-established science on climate change

CHANGING OUR ATMOSPHERE

800,000 YEARS OF CARBON DIOXIDE



Source: Luthi et al (2008) (cdiac.ornl.gov) & Keeling et al (Scripps.ucsd.edu)

CLIMATE  CENTRAL

THE CLIMATE IS CHANGING

NASA GLOBAL CLIMATE CHANGE
Vital Signs of the Planet

FACTS ARTICLES SOLUTIONS EXPLORE RESOURCES NASA SCIENCE

FEATURES

Human Influence on Global Droughts Goes Back 100 Years

Human activities were affecting global drought risk as far back as the early 20th century, according to a NASA study. (Image credit: USDA)

[FULL STORY](#)

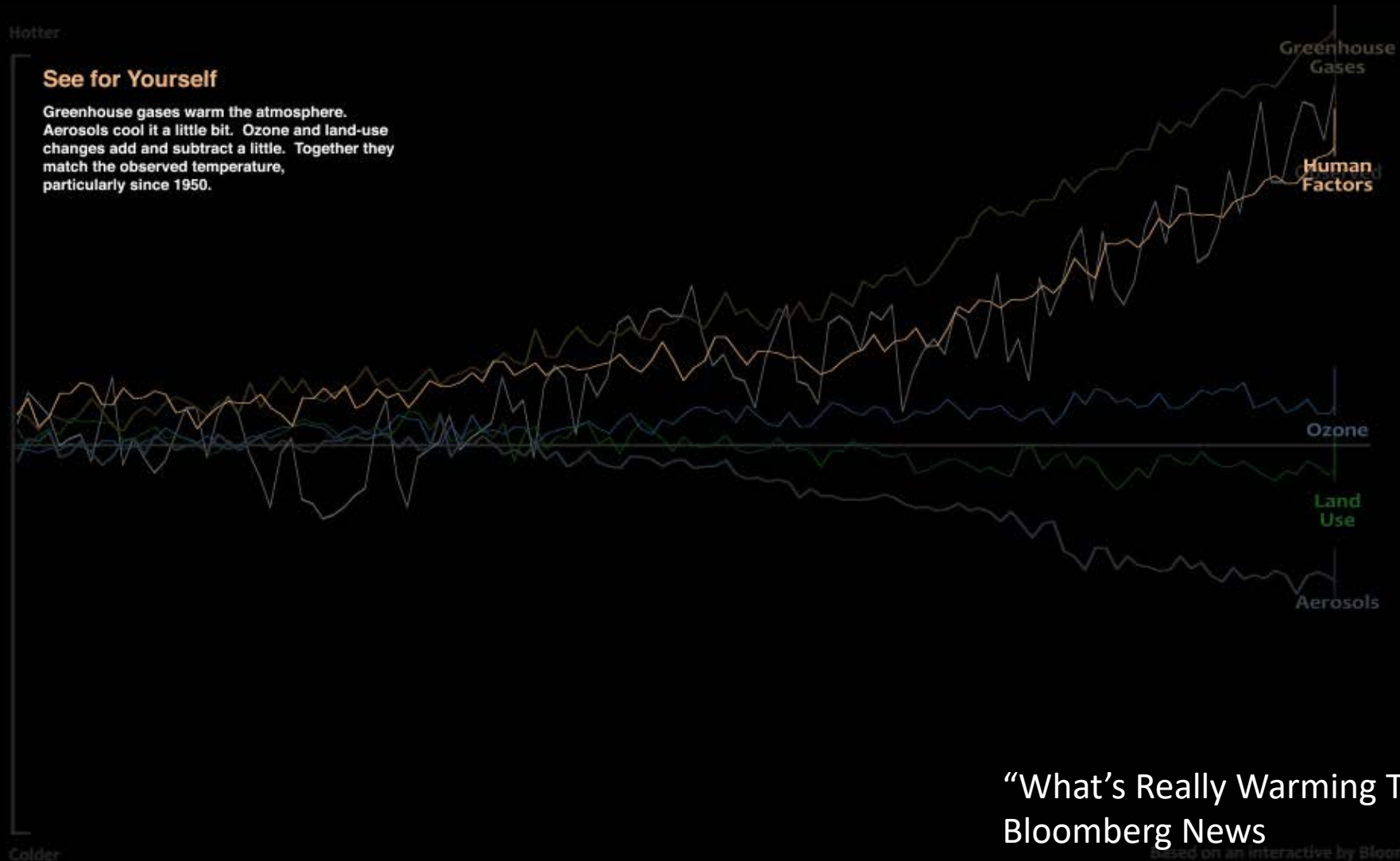
CARBON DIOXIDE
↑ 410 parts per million

GLOBAL TEMPERATURE
↑ 1.9 °F since 1880

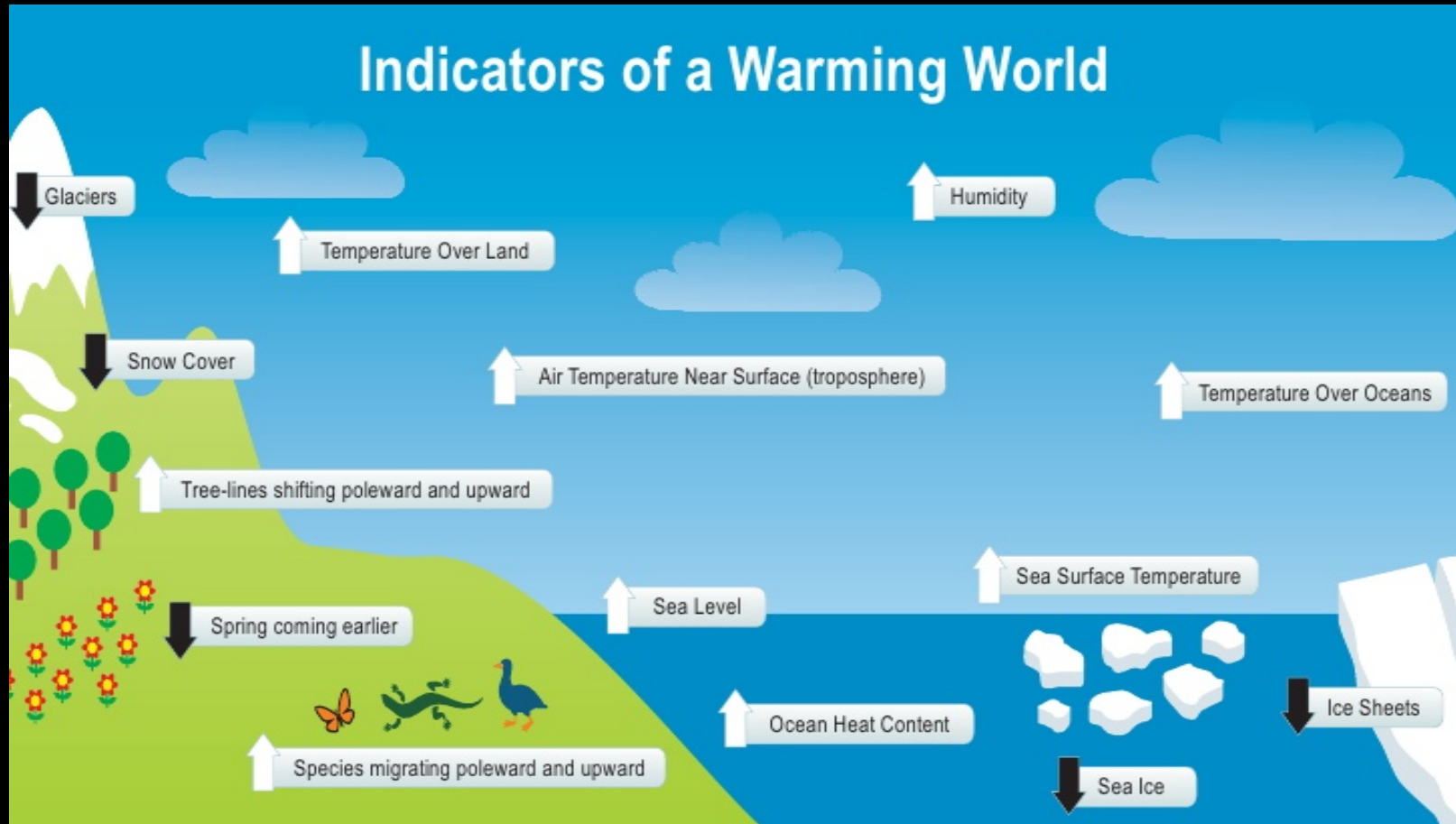
ARCTIC ICE MINIMUM
↓ 12.8 percent per decade

ICE SHEETS
↓ 413 Gigatonnes per year

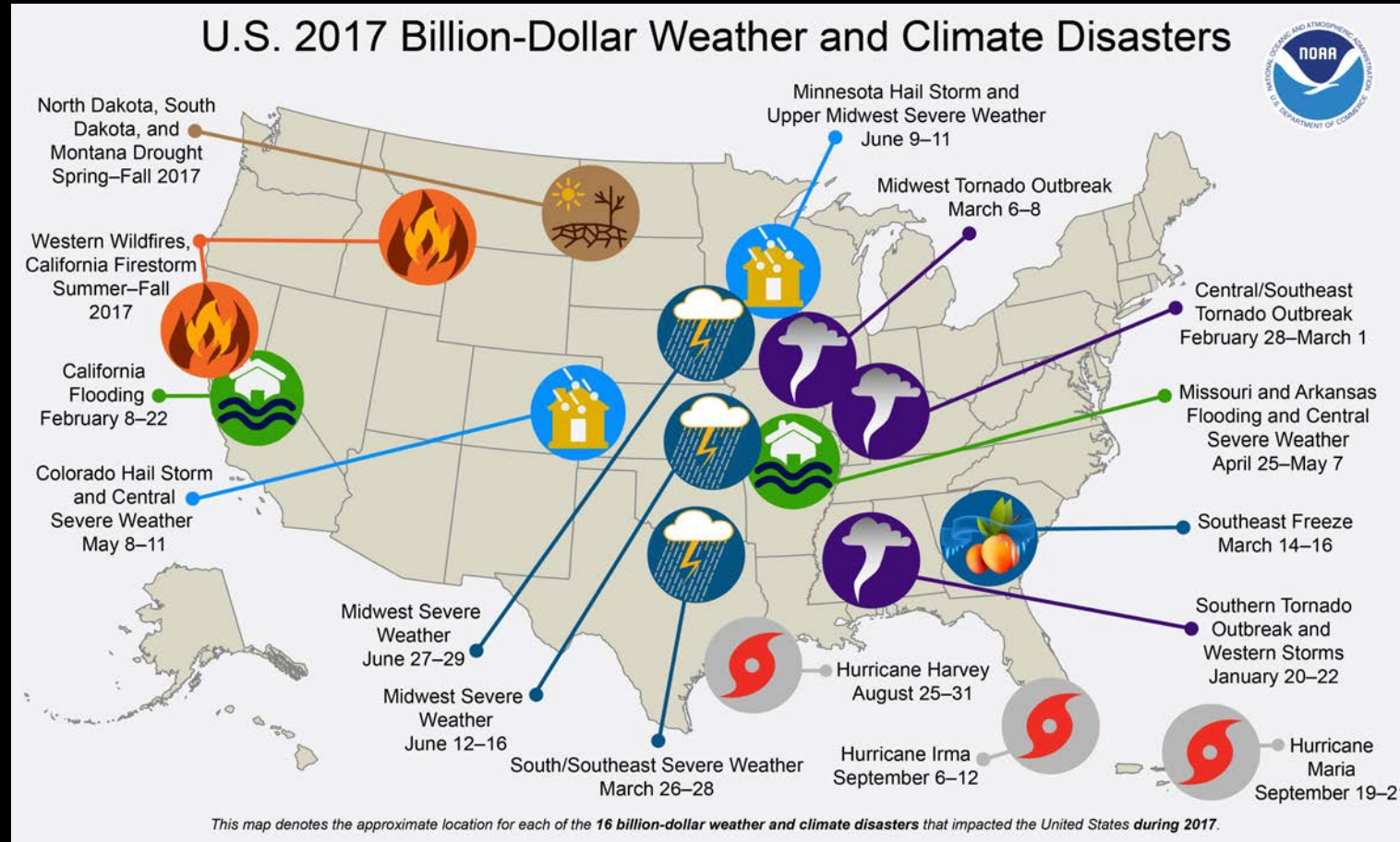
HUMAN ACTIVITIES ARE RESPONSIBLE



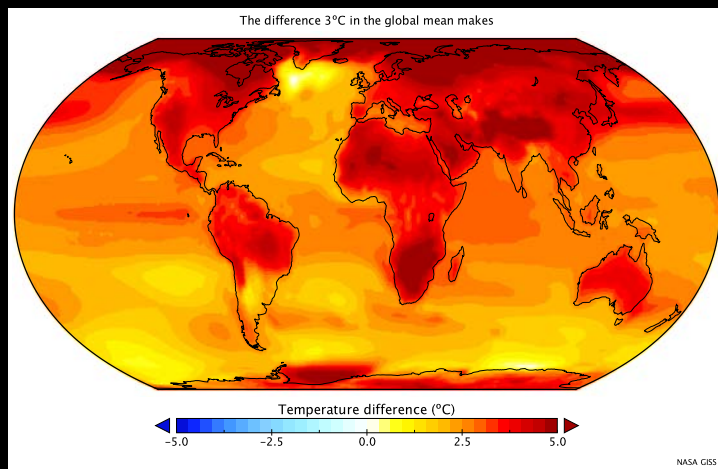
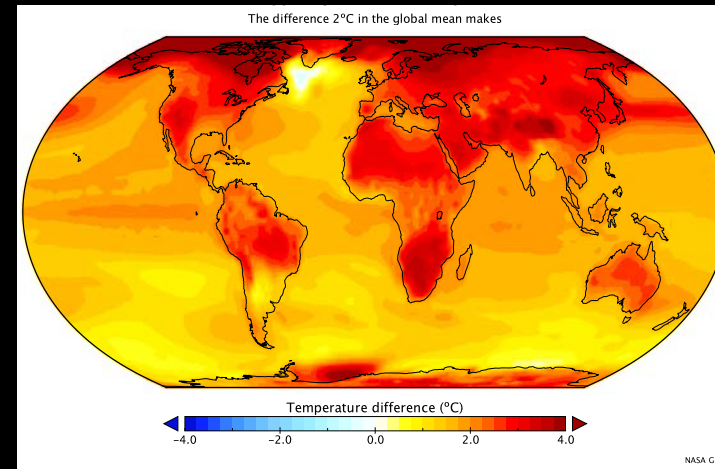
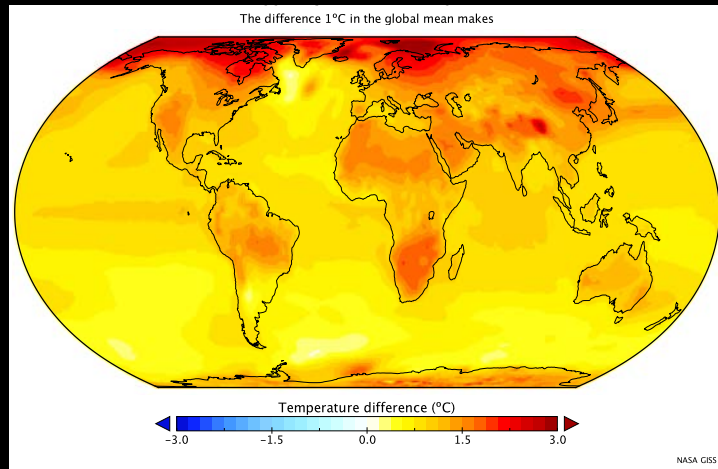
CLIMATE CHANGE: MORE THAN WARMING



SOME EXTREME EVENTS ARE WORSENING



IMPACTS SCALE WITH TEMPERATURE

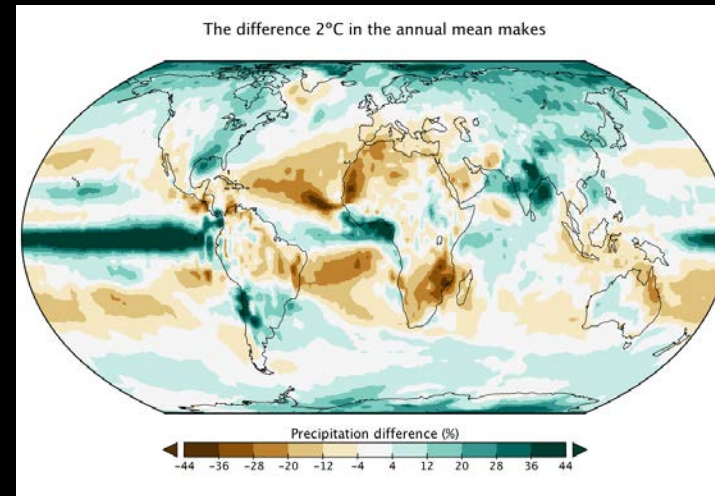
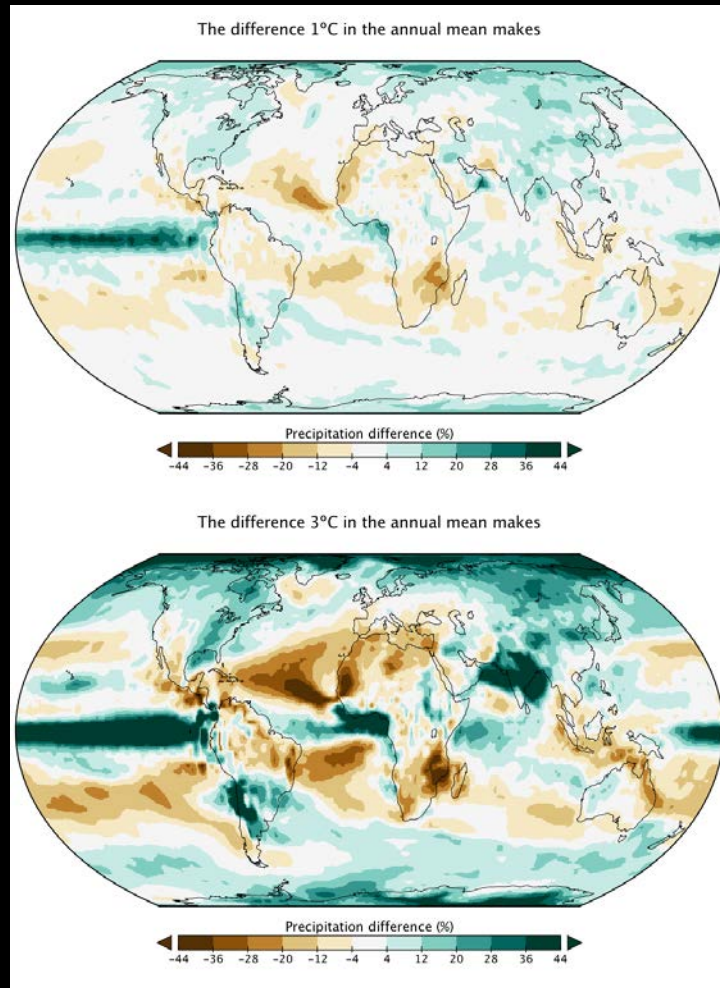


Surface Air Temperature (°C)

The difference between 2, 3, and 4°C above pre-industrial and 1°C (~ present day).

Decadal snapshots taken from 6 simulations from RCP85 scenarios.

IMPACTS SCALE WITH TEMPERATURE

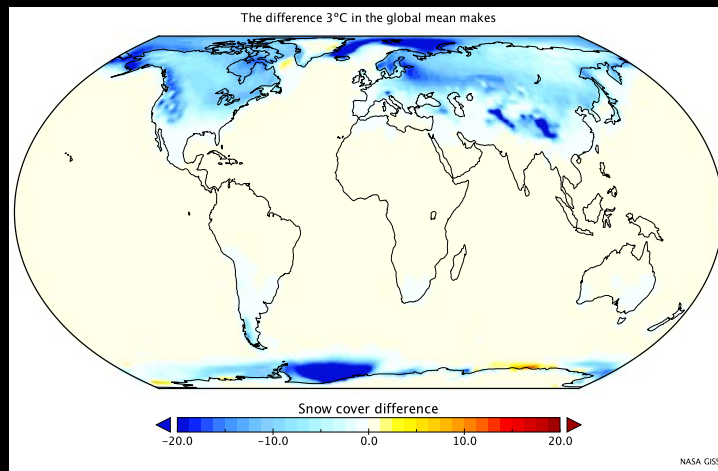
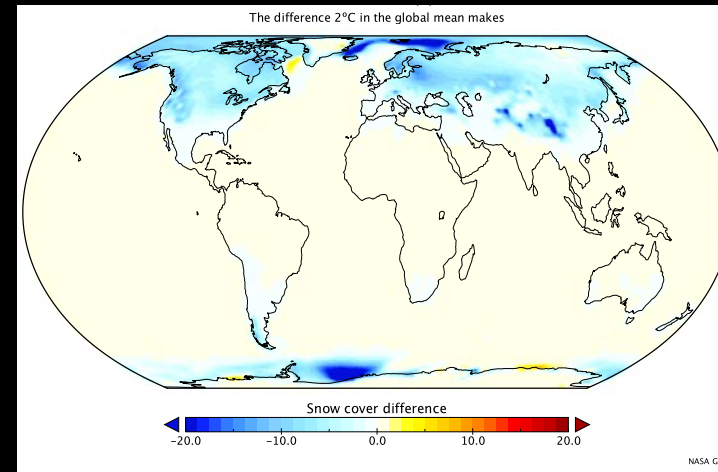
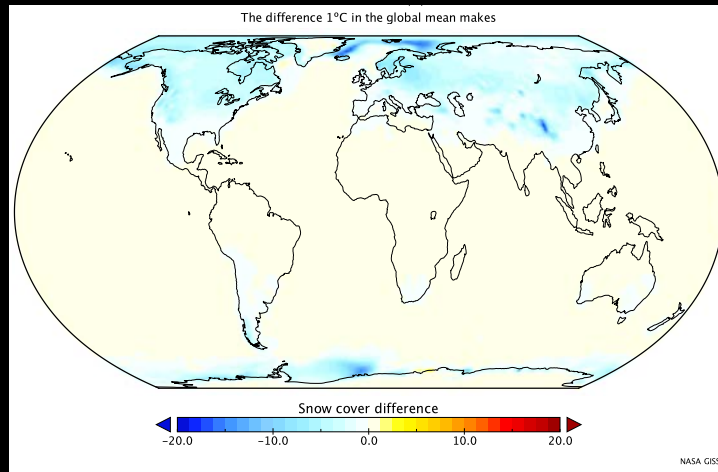


Precipitation (% change)

The difference between 2, 3, and 4°C above pre-industrial and 1°C (~ present day).

Decadal snapshots taken from 6 simulations from RCP85 scenarios.

IMPACTS SCALE WITH TEMPERATURE

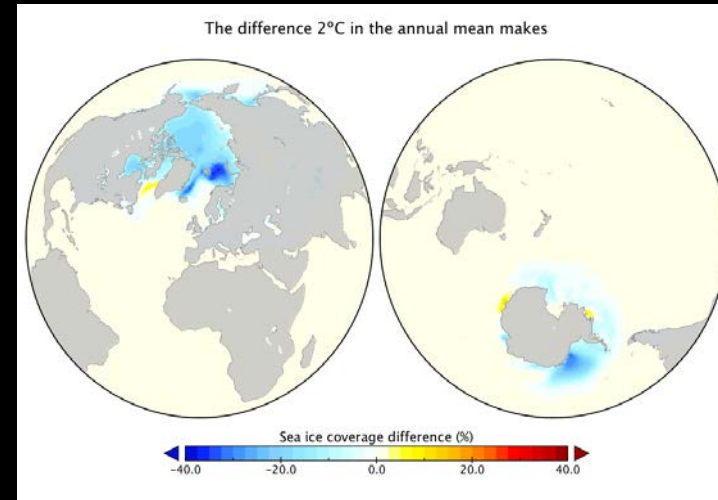
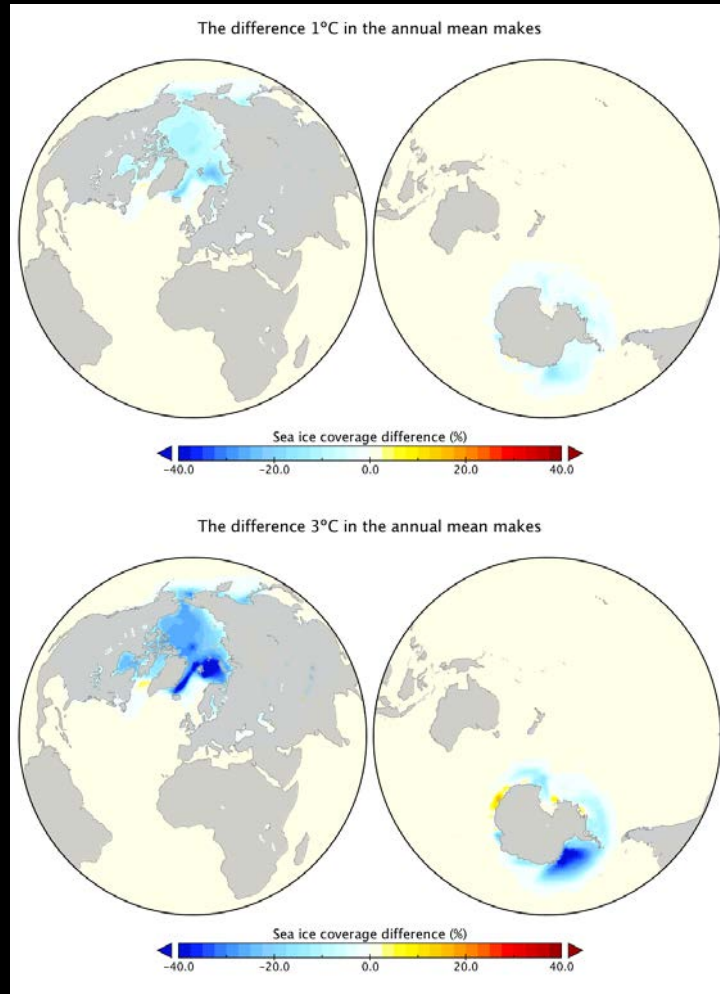


Snow cover (%)

The difference between 2, 3, and 4°C above pre-industrial and 1°C (~ present day).

Decadal snapshots taken from 6 simulations from RCP85 scenarios.

IMPACTS SCALE WITH TEMPERATURE

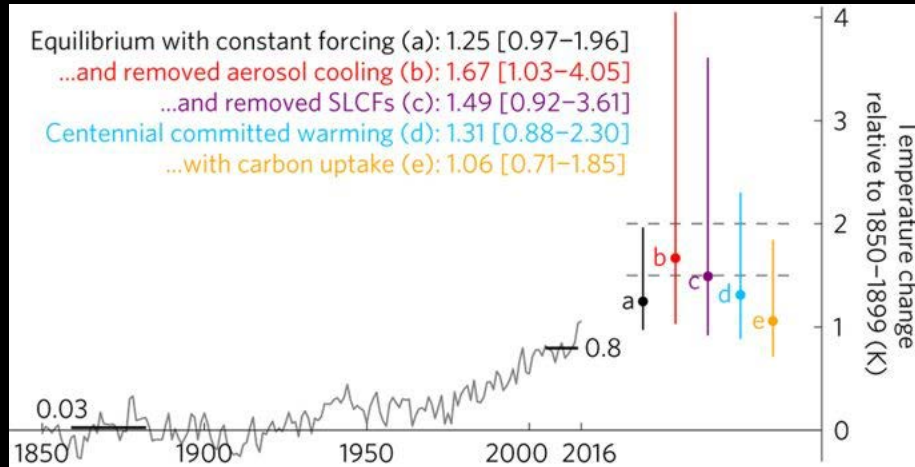


Sea ice cover (%)

The difference between 2, 3, and 4°C above pre-industrial and 1°C (~ present day).

Decadal snapshots taken from 6 simulations from RCP85 scenarios.

WE ARE COMMITTED TO MORE WARMING



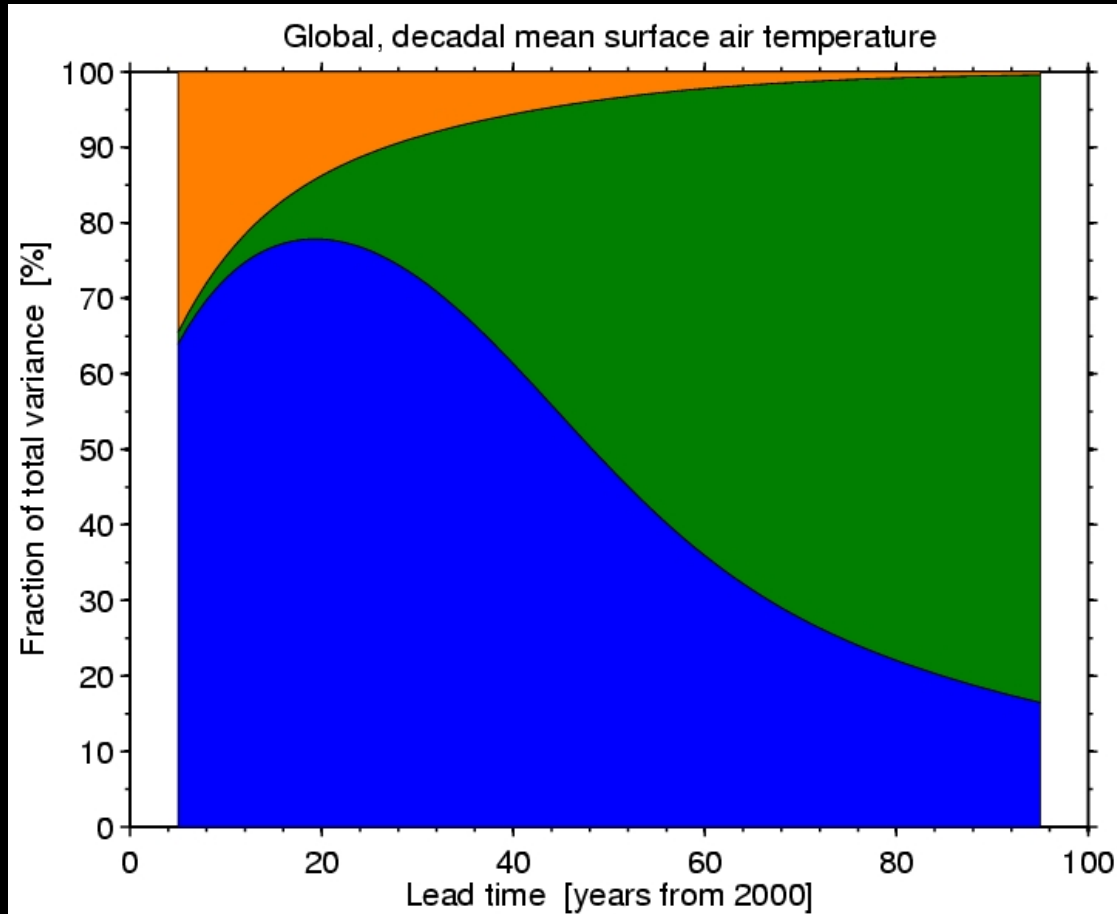
Mauritsen and Pincus 2017

- CO₂ stays in the atmosphere for centuries
- The deep ocean takes millennia to come into equilibrium
- If we ceased all fossil fuel emissions instantaneously, the planet will continue to warm
- There is a 13% **chance we have already exceeded the 1.5C limit.**

WHAT WE DON'T KNOW

What prevents us from knowing *exactly* what will happen?

SOURCES OF UNCERTAINTY

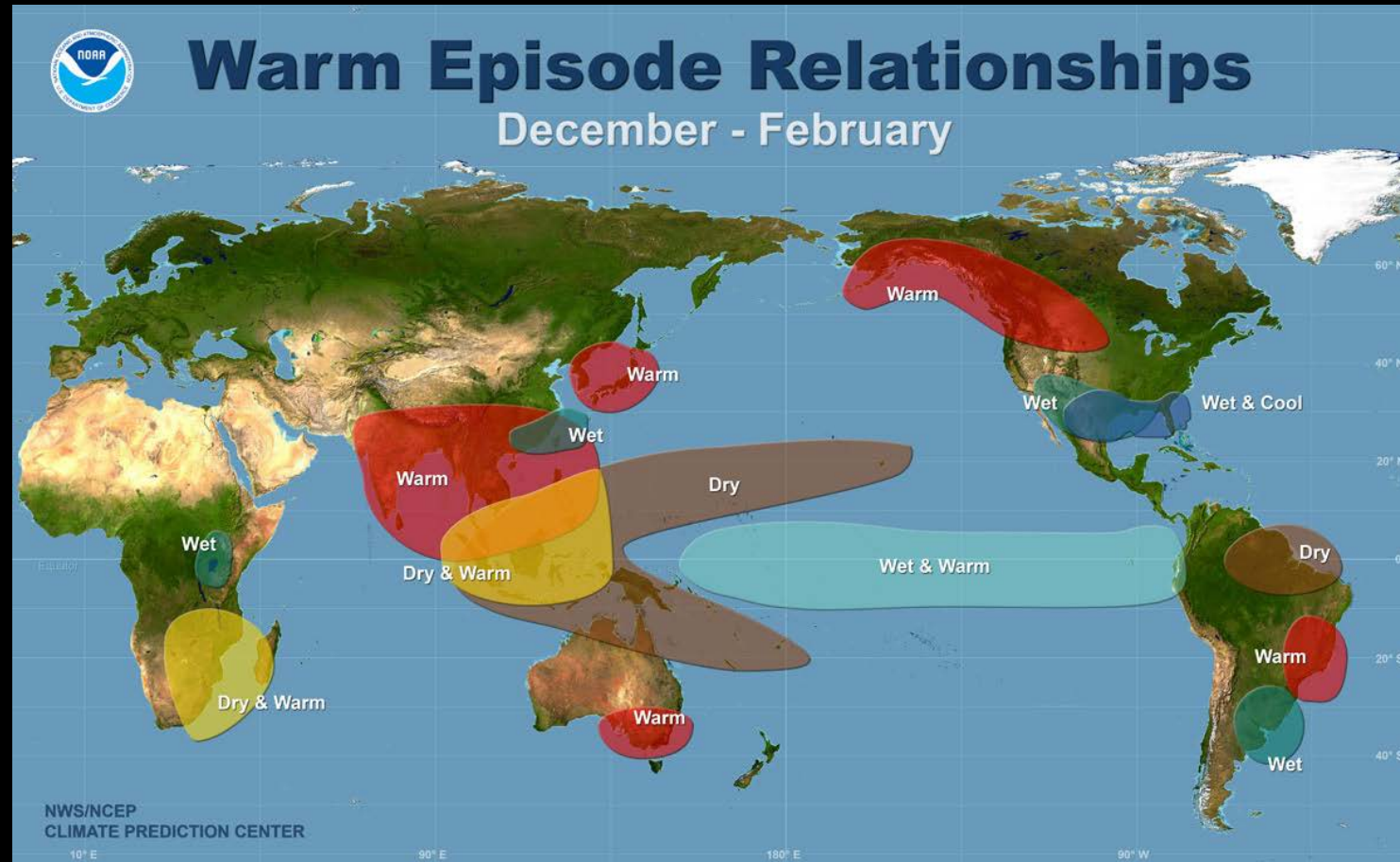


INTERNAL VARIABILITY

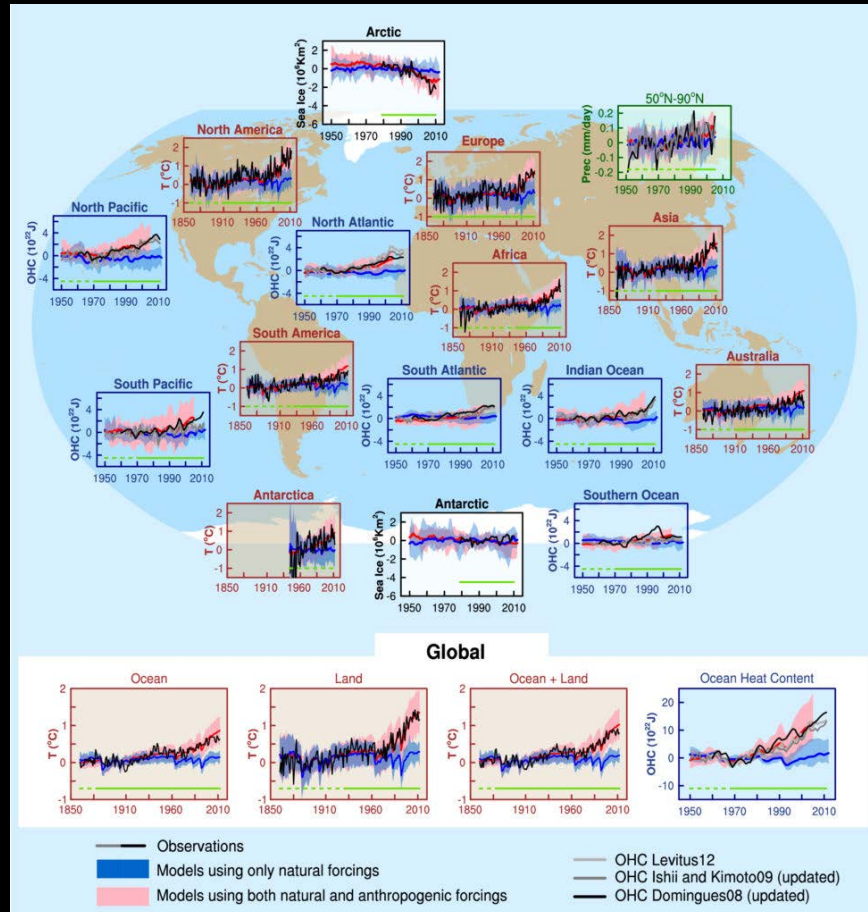
SCENARIO UNCERTAINTY

MODEL UNCERTAINTY

INTERNAL CLIMATE VARIABILITY

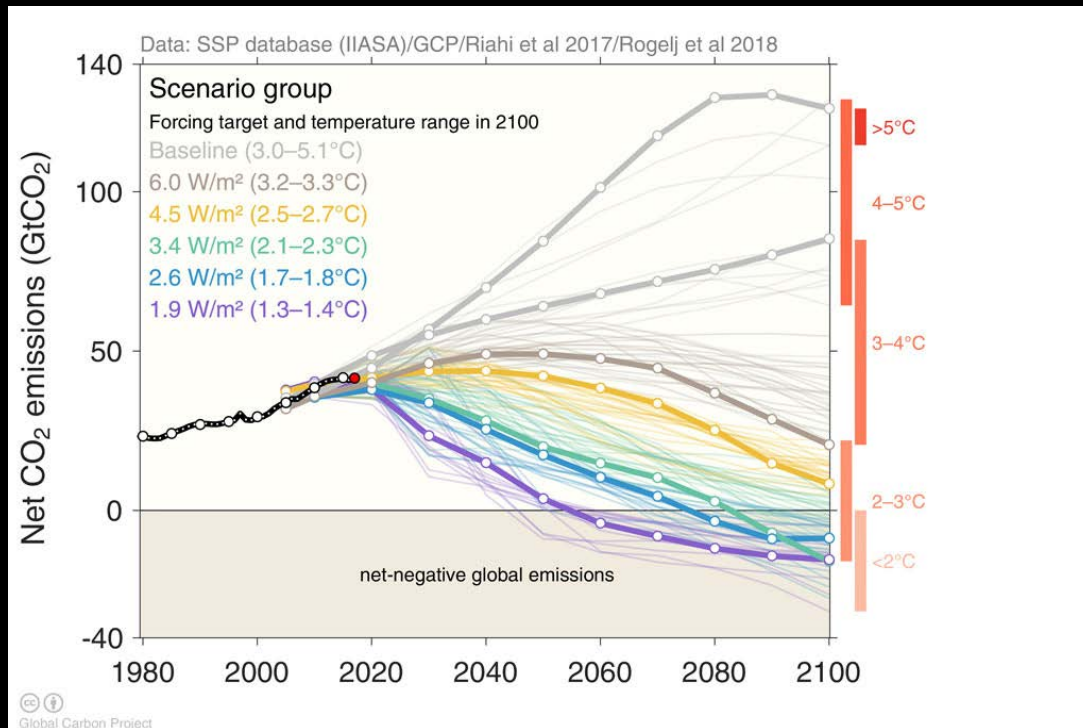


INTERNAL VARIABILITY IS LARGE ON REGIONAL SCALES



- The temperature is increasing almost everywhere
- On the global scale, the warming **signal** has emerged from the **noise** of internal variability
- On some regional scales, no clear attribution (yet) to human activities

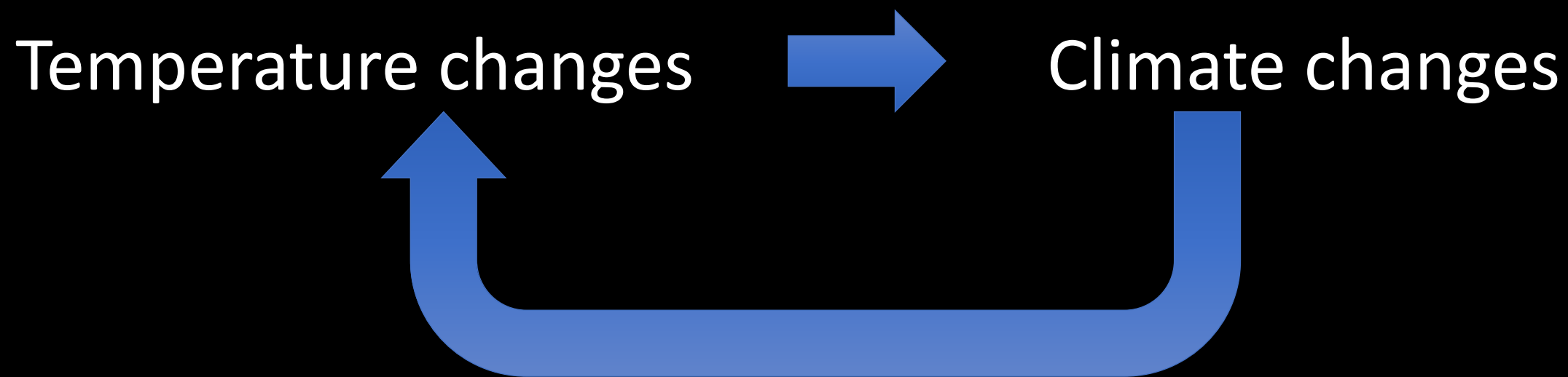
SCENARIO UNCERTAINTY

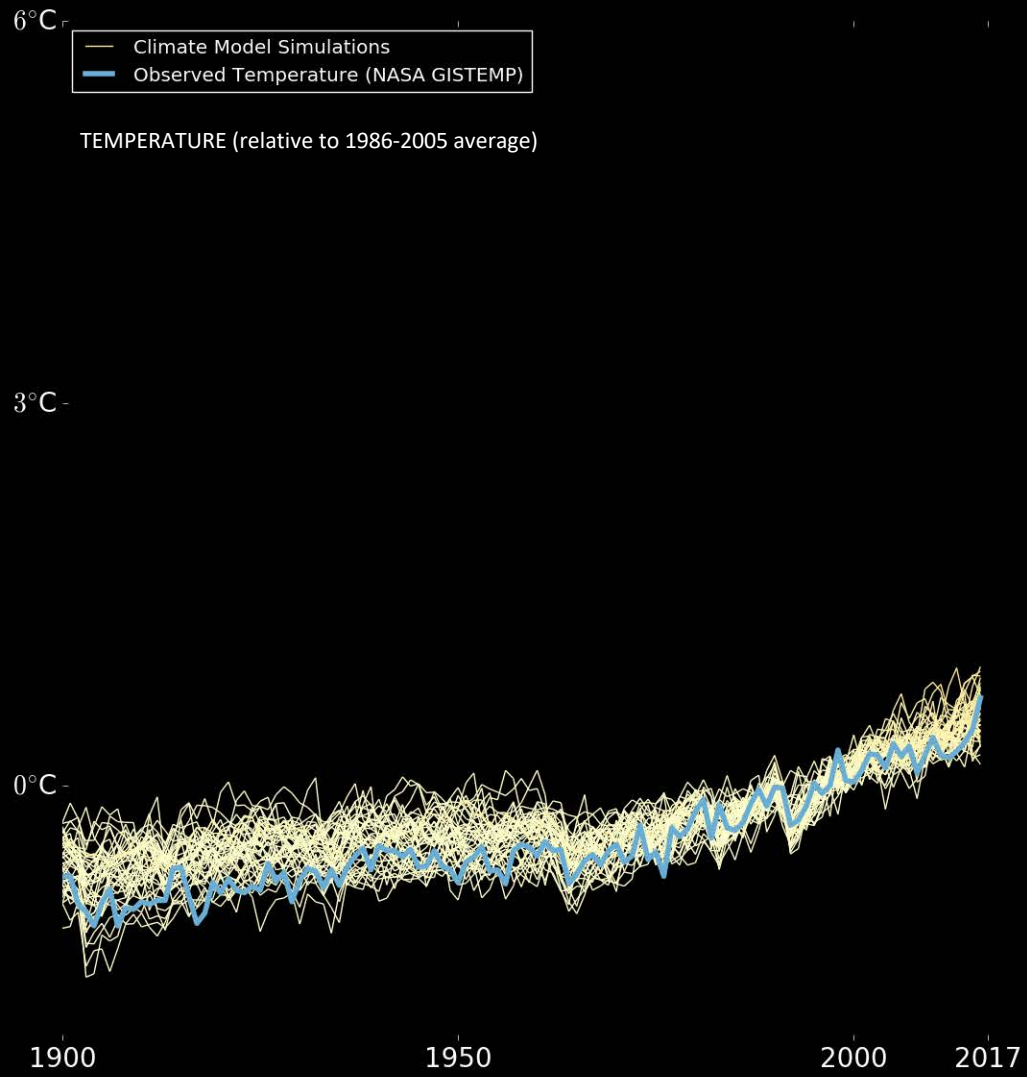


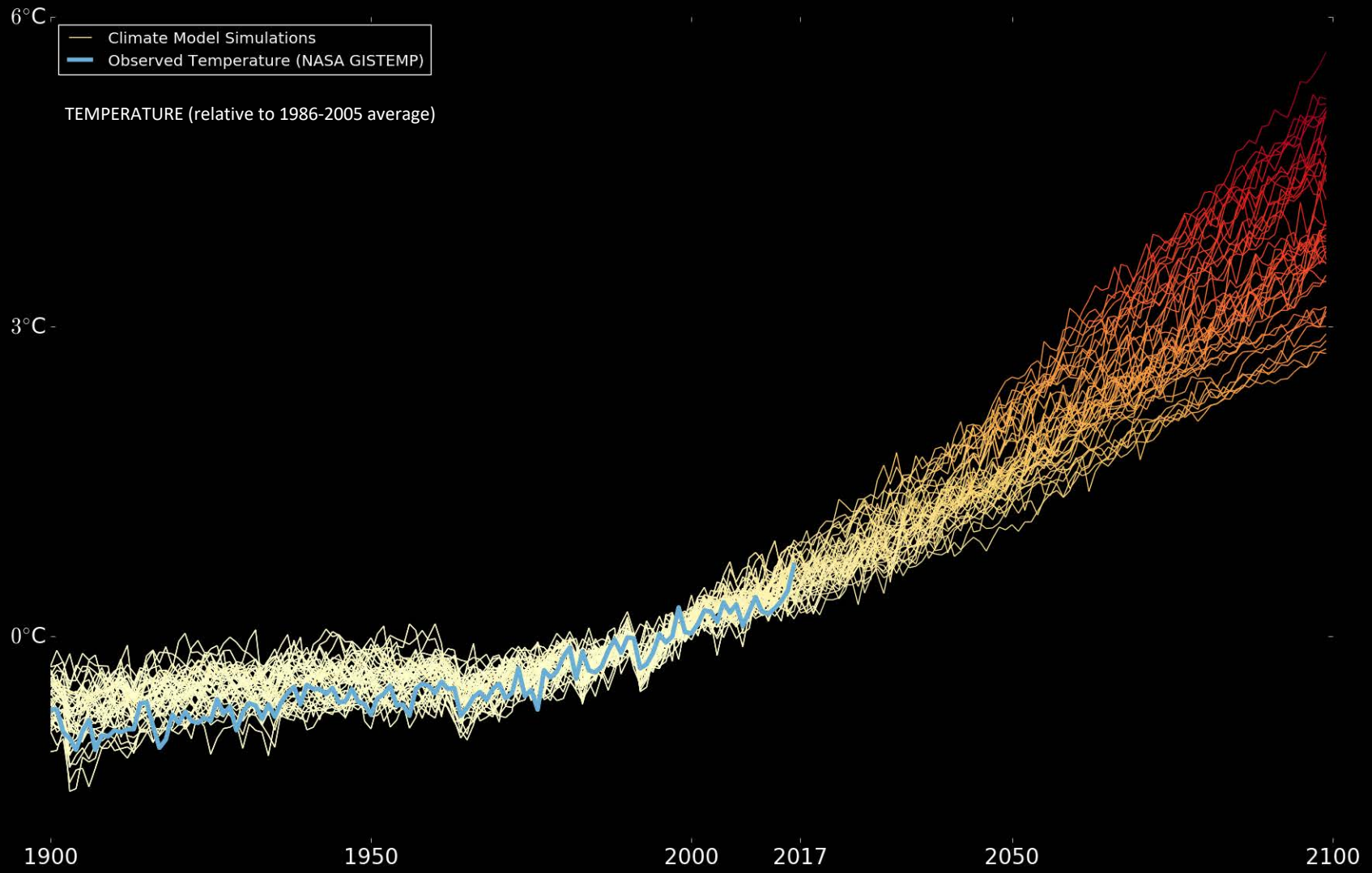
- Possible future narratives:

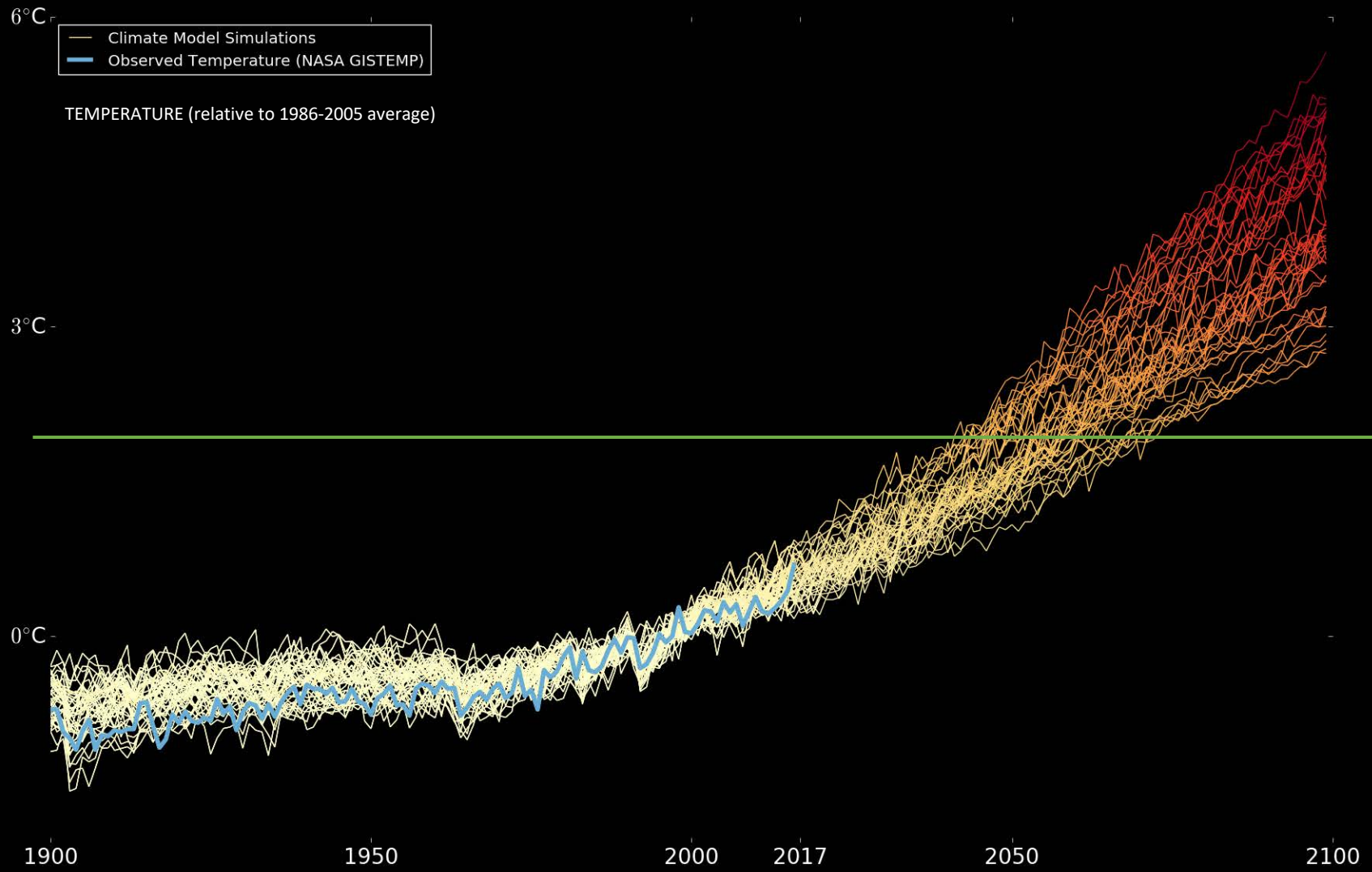
- 1. Sustainability
- 2. Middle of the Road
- 3. Regional Rivalry
- 4. Inequality
- 5. Fossil-fueled Development

PHYSICAL UNCERTAINTY





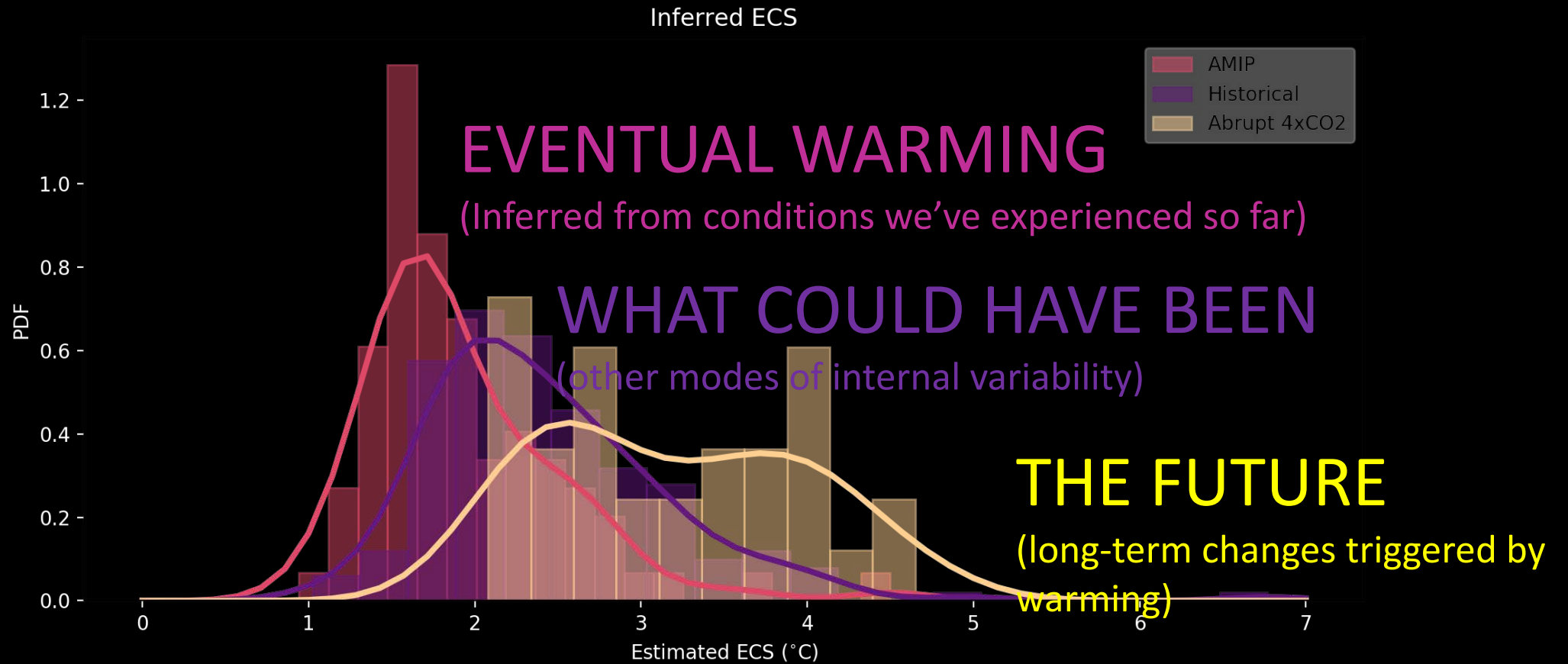




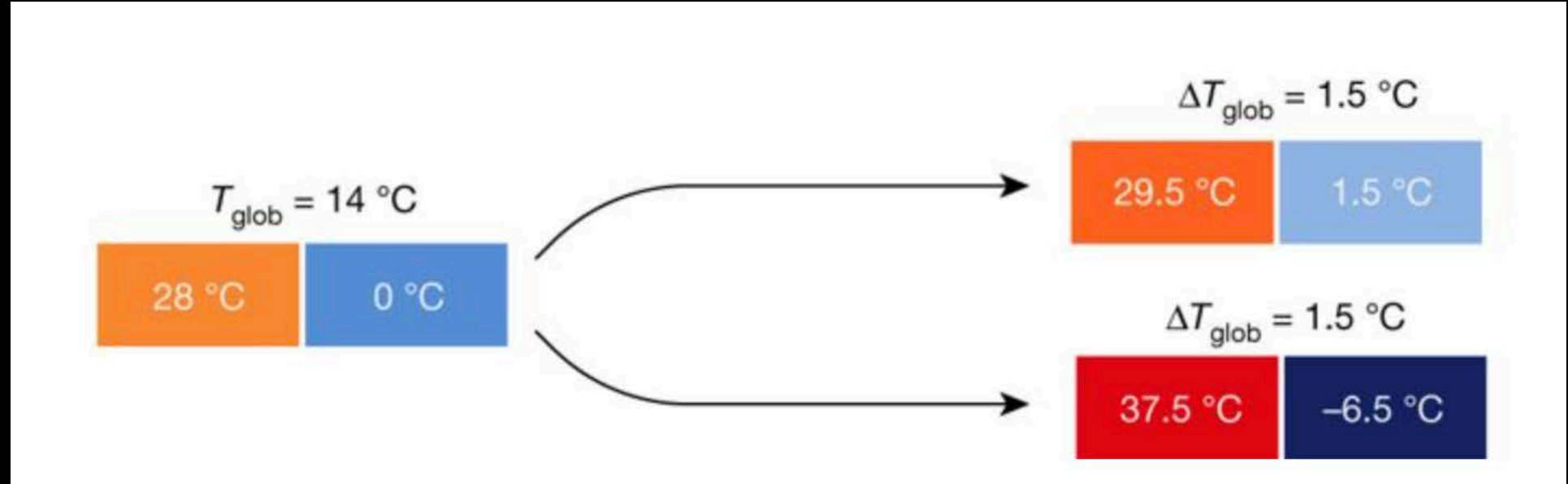
WHAT WE'RE LEARNING

Recent advances in the field

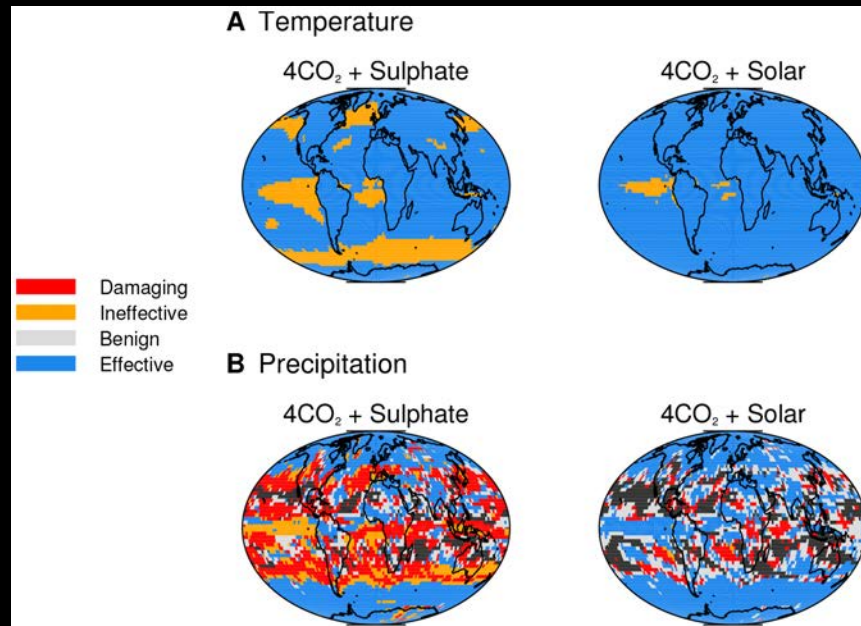
IT WILL GET WARMER



THERE ARE MANY POSSIBLE CLIMATES



BEWARE GEOENGINEERING



- Proposed solar radiation management schemes may lower the global average temperature
- Effects on precipitation much more uncertain and potentially damaging
- Ethics, governance, attribution, implementation are all issues

1.5C

of warming

VS

2C

of warming

Heatwaves

Up to
 1.1 months

Up to
 1.5 months

Freshwater

*availability in the Mediterranean**

 9%

17% 

Heavy rainfall

*increase in intensity**

 5%

7% 

Crop yields

*in tropical regions**

 Wheat production down
9% 

Wheat production down
16% 

 Maize production down
3% 

Maize production down
6% 

 Soy production up
6% 

Soy production up
7% 

 Rice production up
6% 

Rice production up
6% 

Sea level rise

by 2100 relative to 2000

 40cm

50cm 

Coral bleaching

from 2050 onwards

 90%
of reefs at risk

98% 
of reefs at risk

You may have heard that we have 12 years to fix everything. This is well-meaning nonsense, but it's still nonsense. We have both no time and more time. Climate change isn't a cliff we fall off, but a slope we slide down. And, true, we've chosen to throw ourselves headlong down the hill at breakneck speed. But we can always choose to begin the long, slow, brutal climb back up. If we must argue about what the view will be like when we get there, let's at least agree to turn around first.