



Misconceptions about Global Warming and Climate Change

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Definitions

- Global warming describes an average temperature increase of the Earth over time
- Climate change describes how weather patterns will be affected around the globe
 - Changes in climate averages or in extremes of temperature and precipitation
 - Location specific

Misconception #1

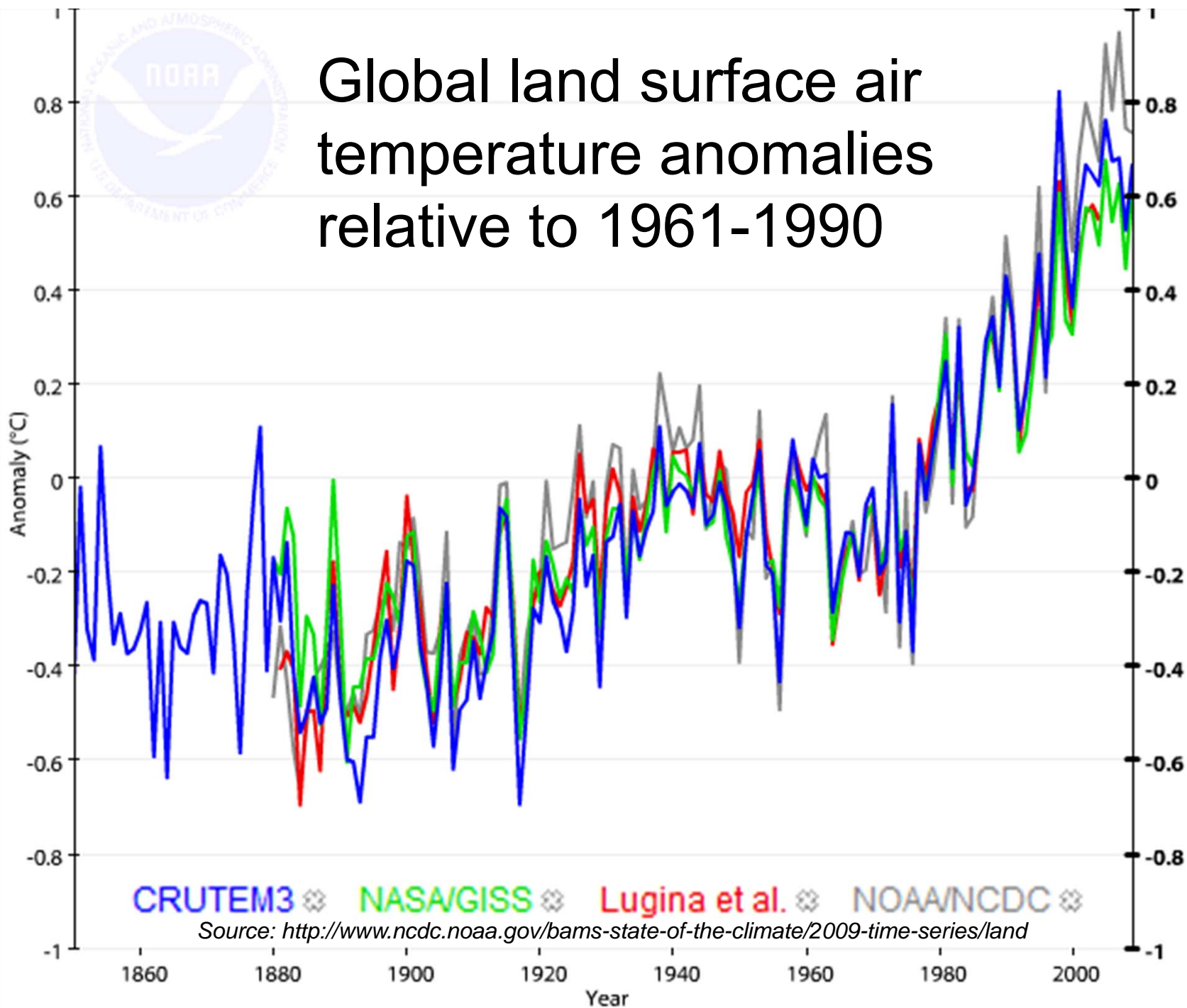
“There is no consensus!”

Reality: peer-reviewed literature is in consensus on the increase in global average temperatures and relative causes





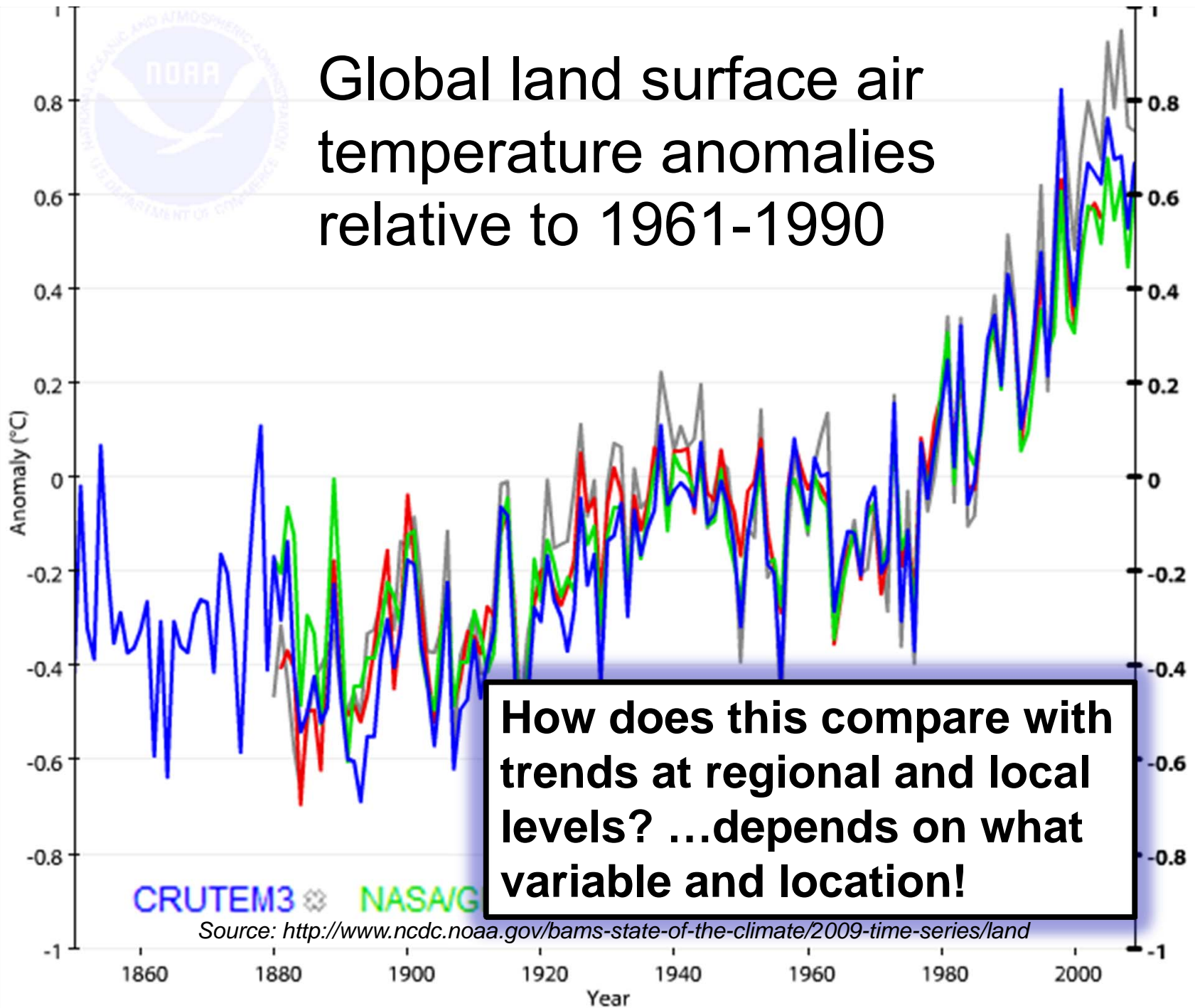
Global land surface air temperature anomalies relative to 1961-1990



Source: <http://www.ncdc.noaa.gov/bams-state-of-the-climate/2009-time-series/land>

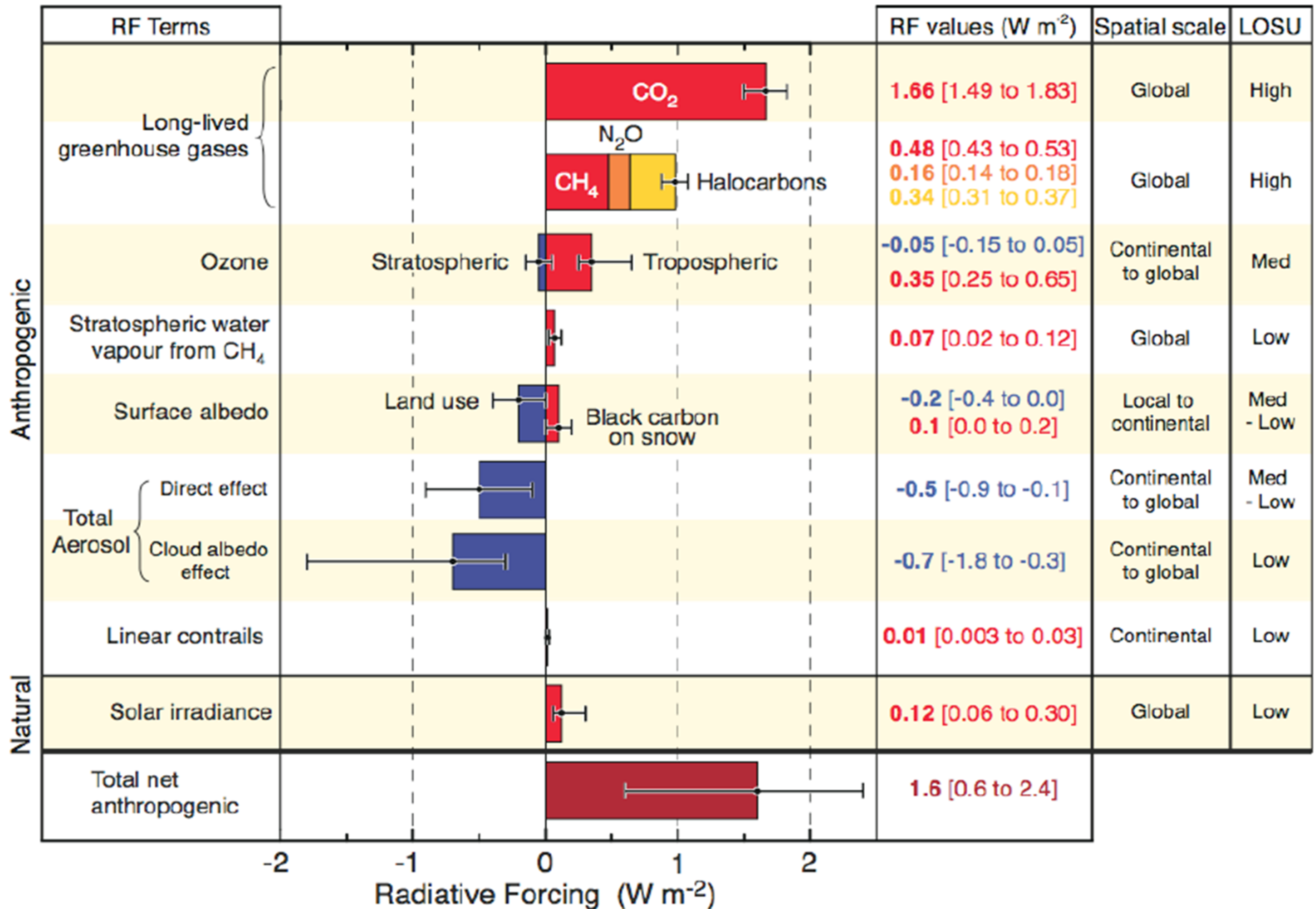


Global land surface air temperature anomalies relative to 1961-1990



How does this compare with trends at regional and local levels? ...depends on what variable and location!

Radiative Forcing Components



Misconception #2

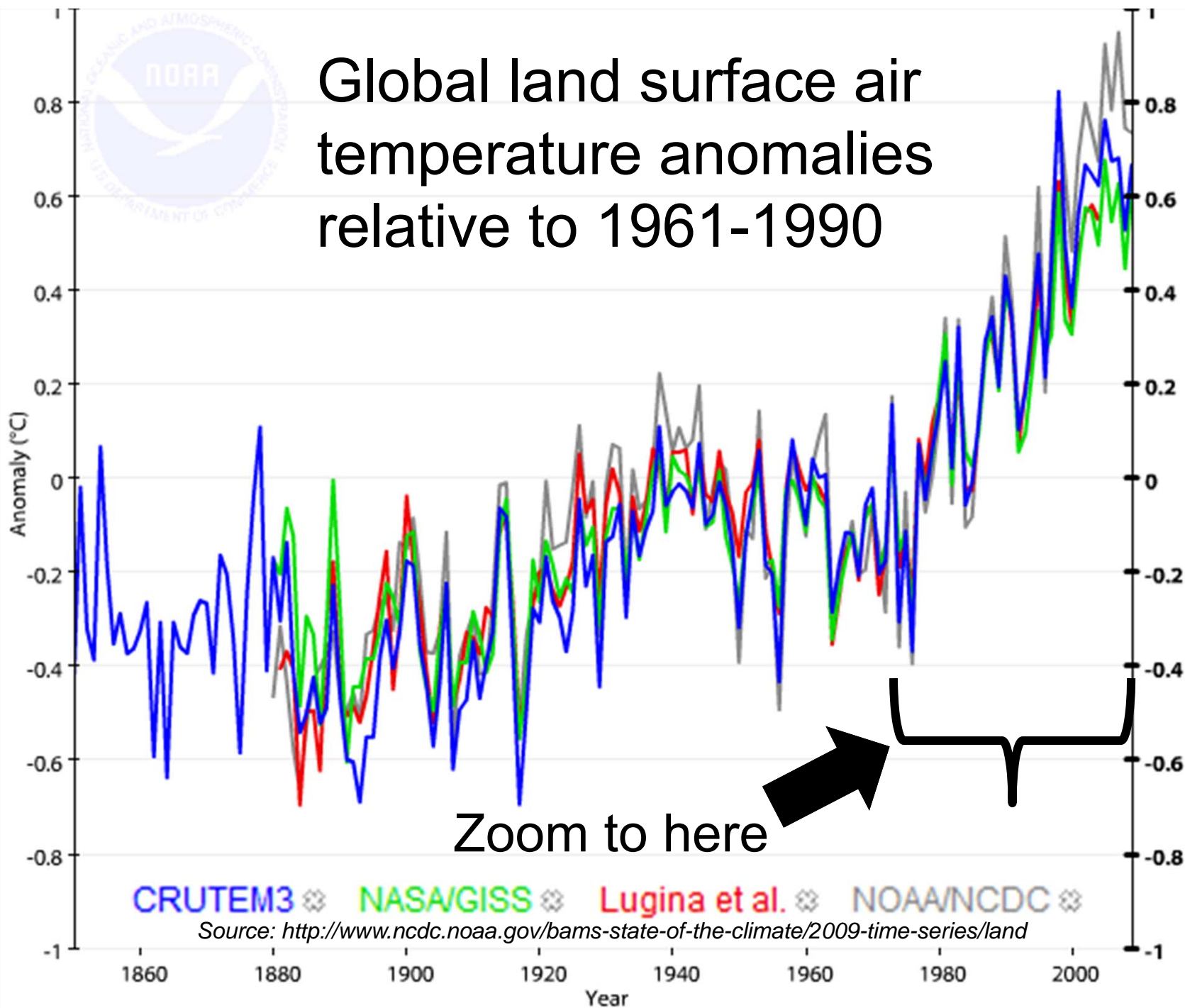
“There has been cooling since 1998 so global warming is over!”

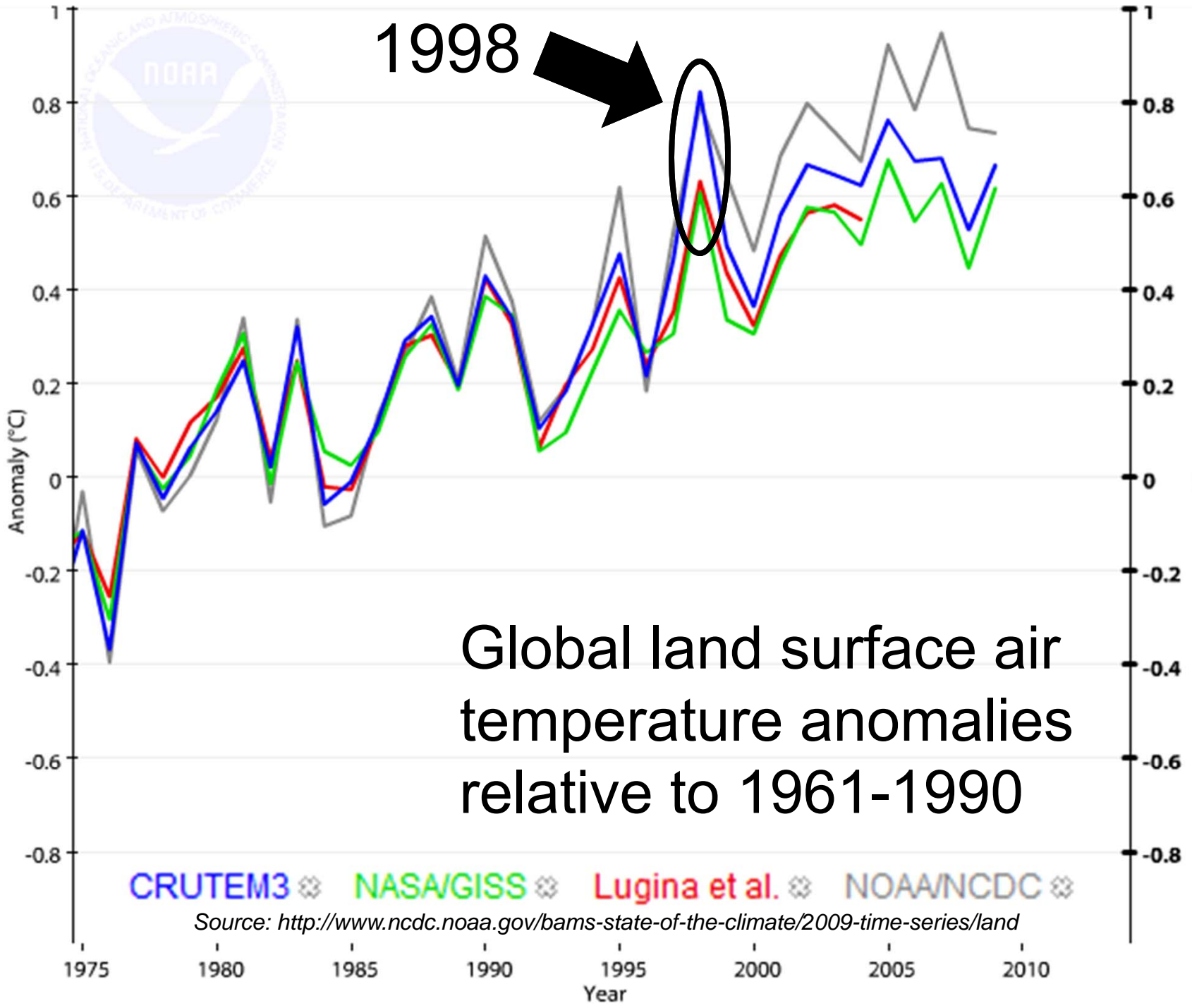
Reality: best to look at longest period of record available when examining trends





Global land surface air temperature anomalies relative to 1961-1990





Global land surface air temperature anomalies relative to 1961-1990

CRUTEM3 ✎ NASA/GISS ✎ Lugina et al. ✎ NOAA/NCDC ✎

Source: <http://www.ncdc.noaa.gov/bams-state-of-the-climate/2009-time-series/land>

Misconception #3

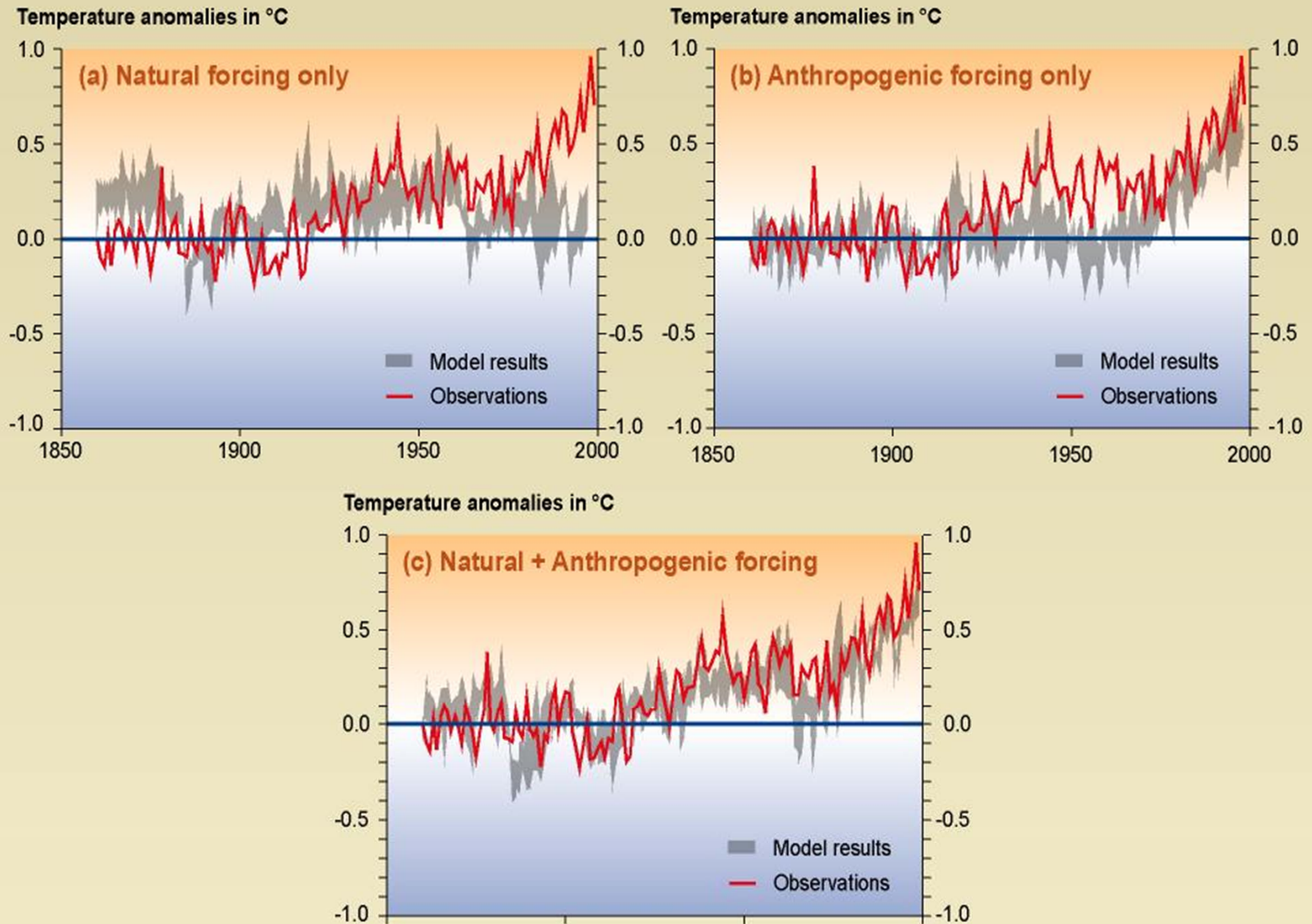
“Only natural processes are contributing to the warming, not humans!” OR

“Only humans are contributing to the warming, not natural processes!”

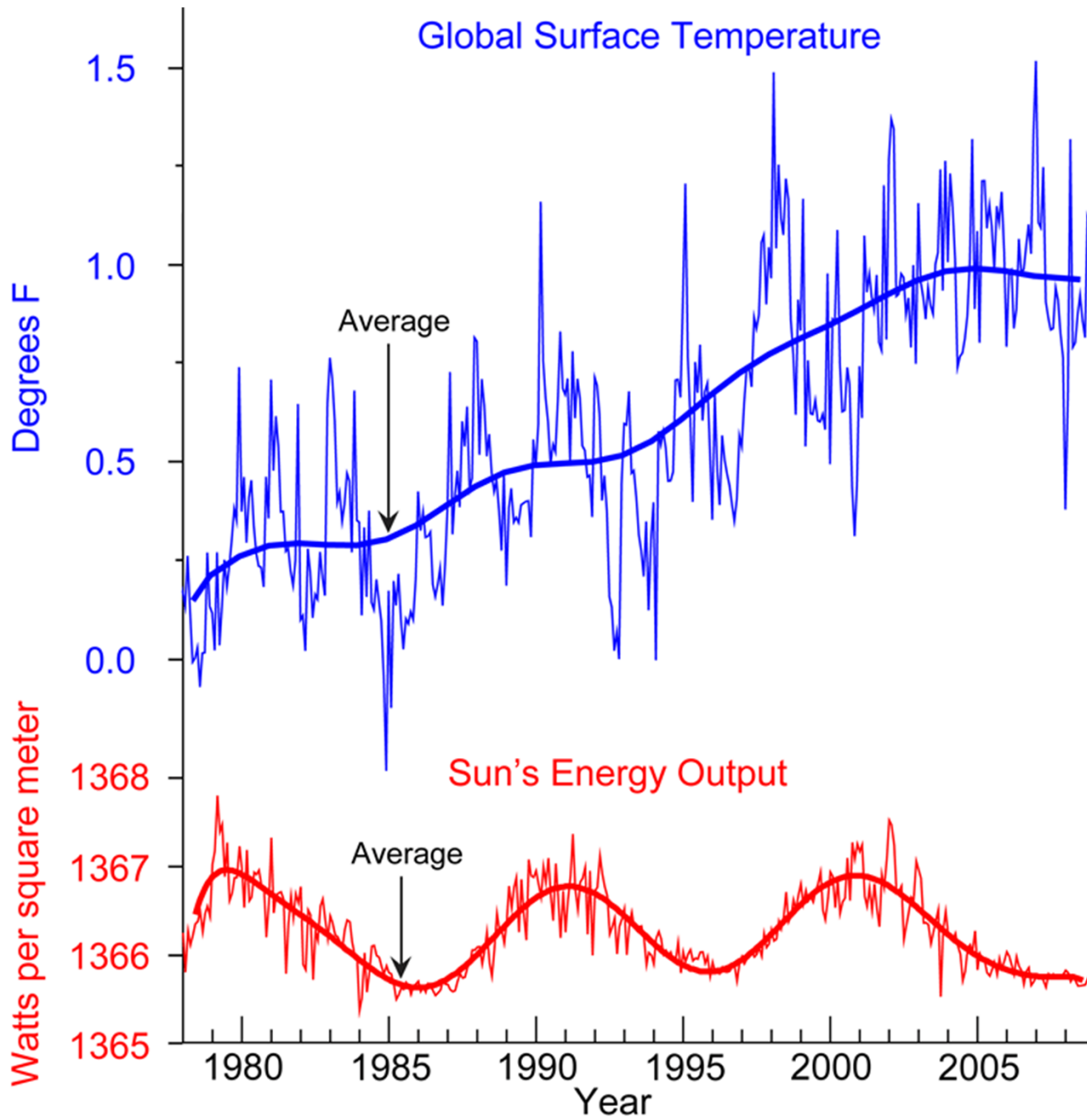
Reality: *both* are driving warming trend!



Comparison between modeled and observations of temperature rise since the year 1860



Source: IPCC Third Assessment Report



Source: <http://www.ncdc.noaa.gov/indicators/index.html>

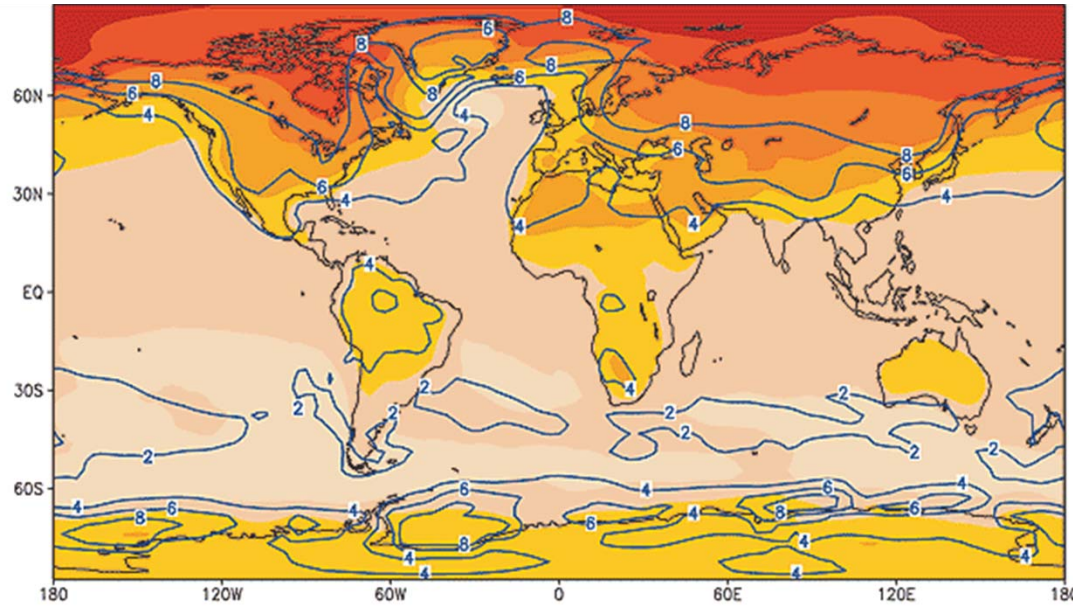
Misconception #4

“Everywhere in the world will warm equally”

Reality: location specific



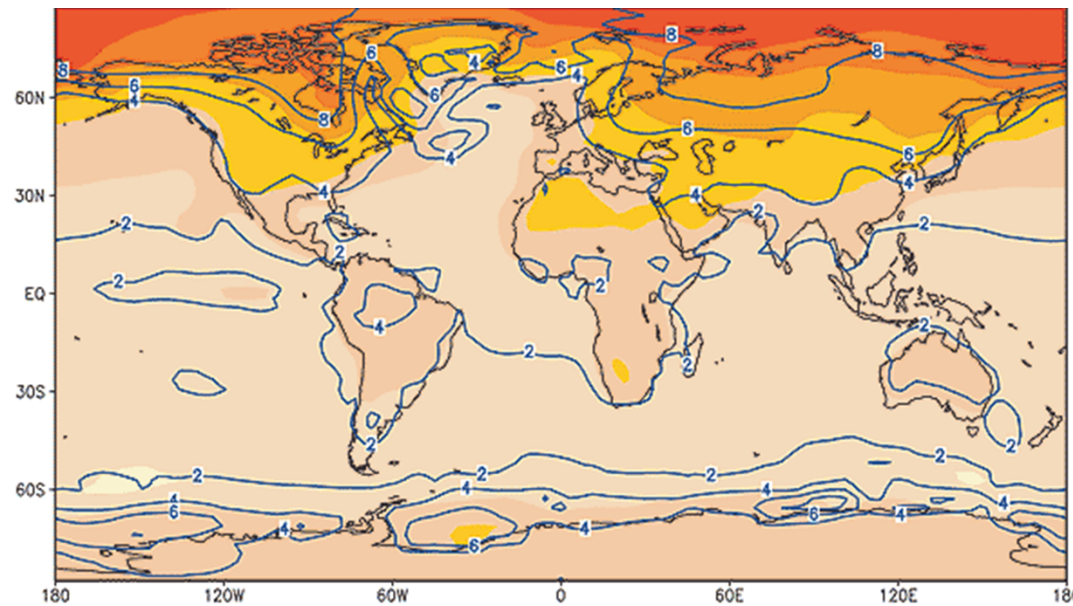
Annual mean change of temperature (shading) & range (isolines) in °C for SRES scenario A2 and B2



A2



Source: IPCC Third Assessment Report



B2



Both show period 2071 to 2100 relative to the period 1961 to 1990 and were performed by OAGCMs

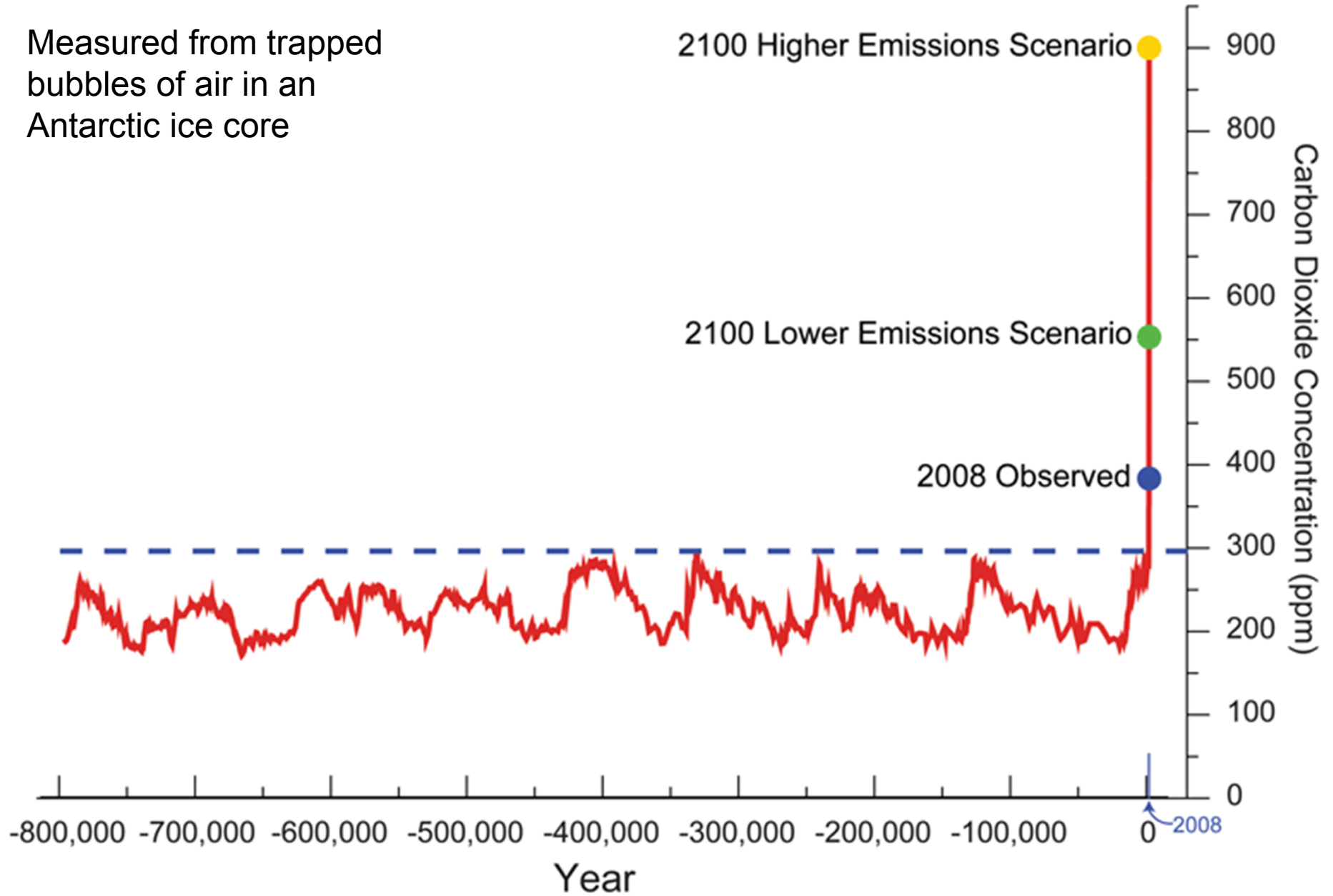
Misconception #5

“Carbon dioxide has natural fluctuations”

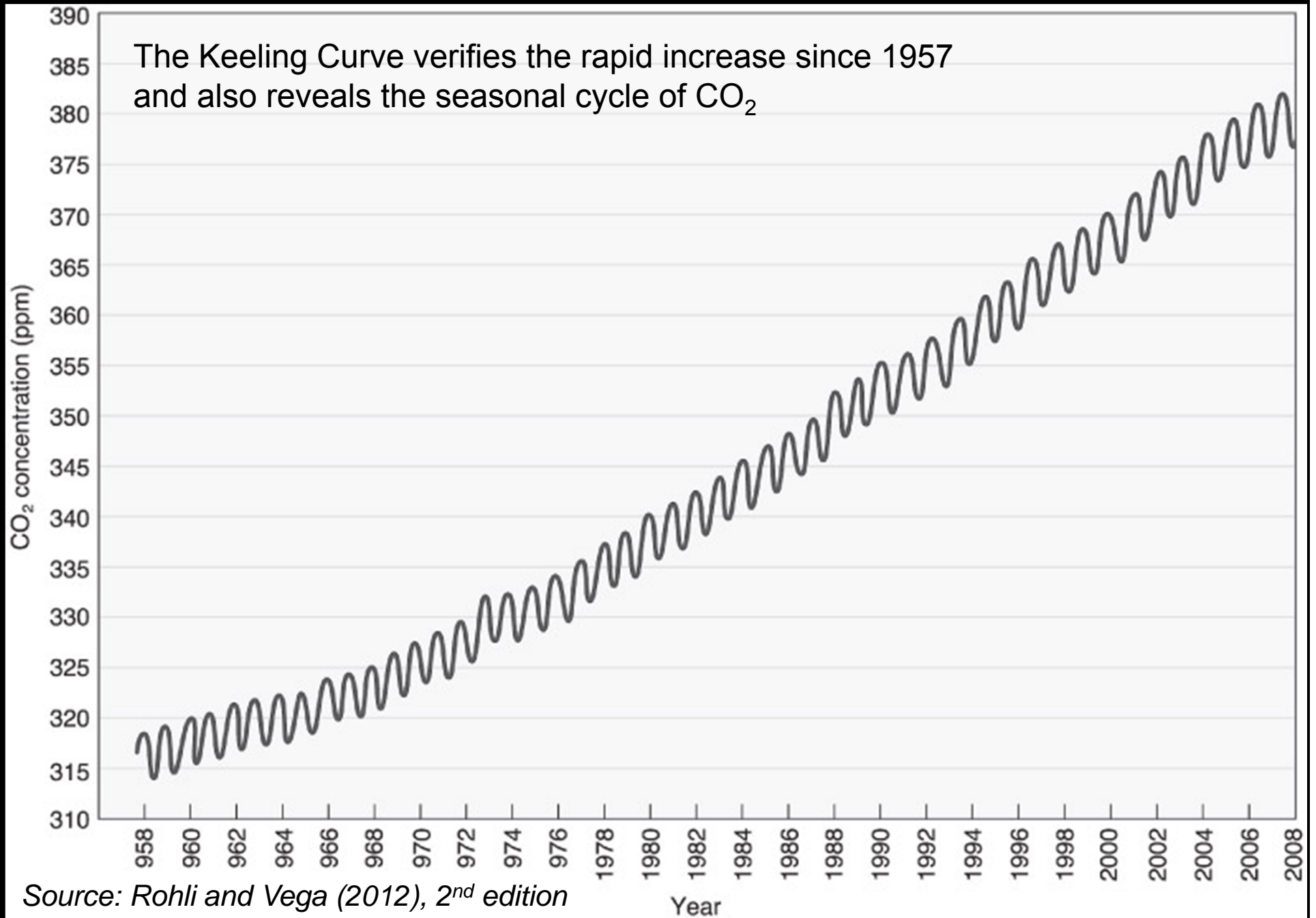
Reality: true, but humans also contribute



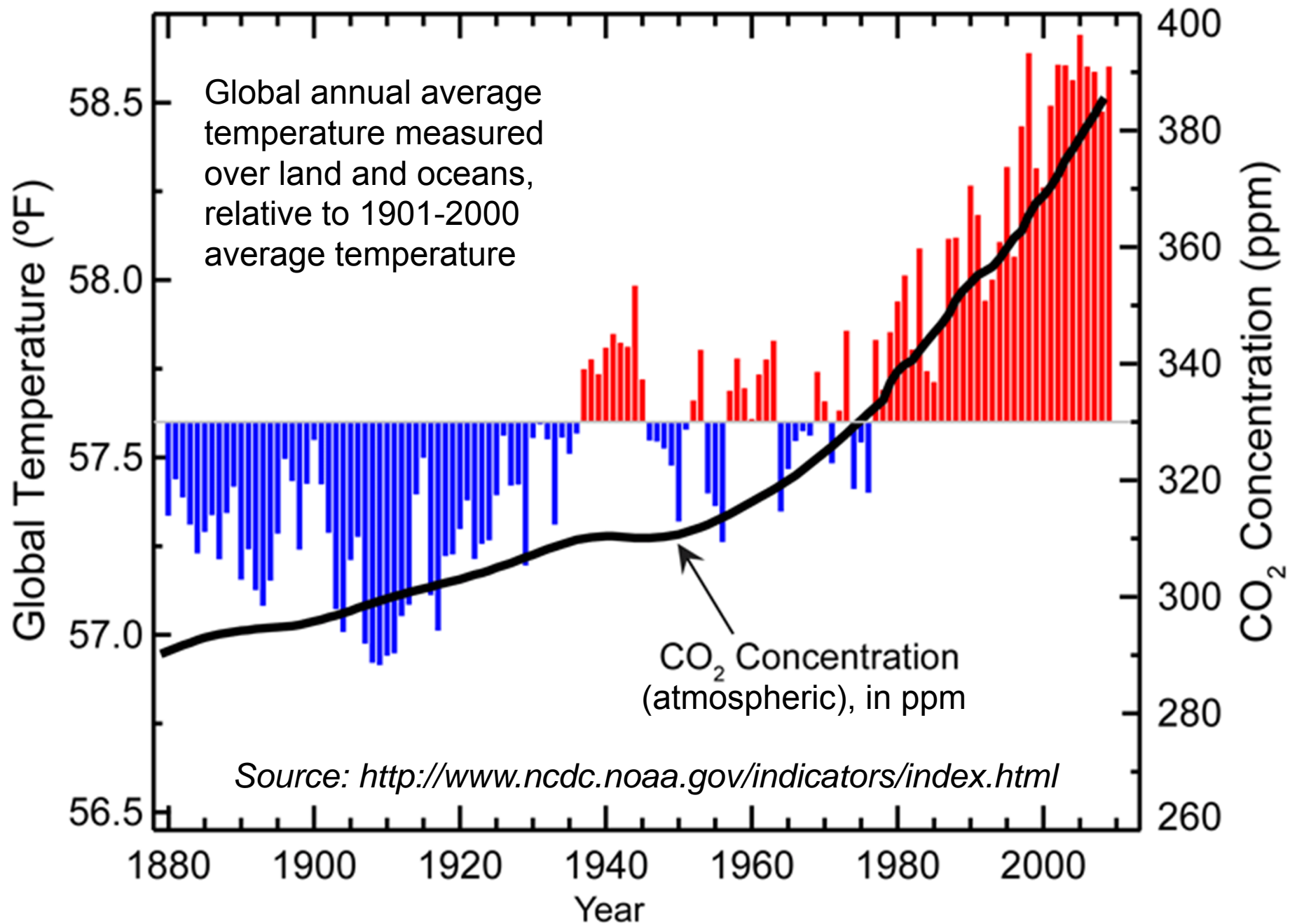
Measured from trapped bubbles of air in an Antarctic ice core



Source: <http://www.ncdc.noaa.gov/indicators/index.html>



Global Temperature and Carbon Dioxide



Misconception #6

“Shouldn’t we pay more attention to water vapor since it the most abundant greenhouse gas in the atmosphere?”

Reality: short shelf life and humans have very small effect on water vapor content of the atmosphere*



Misconception #7

“Why is methane a concern when atmospheric concentrations are only about 1.8ppm?”

Reality: about 20 times more effective at absorbing radiation than CO₂



Misconception #8

“The greenhouse effect is bad!”

Reality: keeps surface of the Earth approximately 60F warmer than Earth with no GHGs but GHGs impact our climate system



Misconception #9

“Human influence is only due to increased GHG concentrations”

Reality: also due to land use / land cover changes e.g., urbanization-- converting forests to housing developments, from cropland to forests in SE US, etc.

→ Local scale attribution is difficult!



Misconception #10

“ _____ is proof that no global warming does not exist!”

OR

“ _____ is proof of global warming!”

Reality: no single event can be attributed to global warming



Misconception #10

“ The extremely cold winter is proof that no global warming does not exist!”

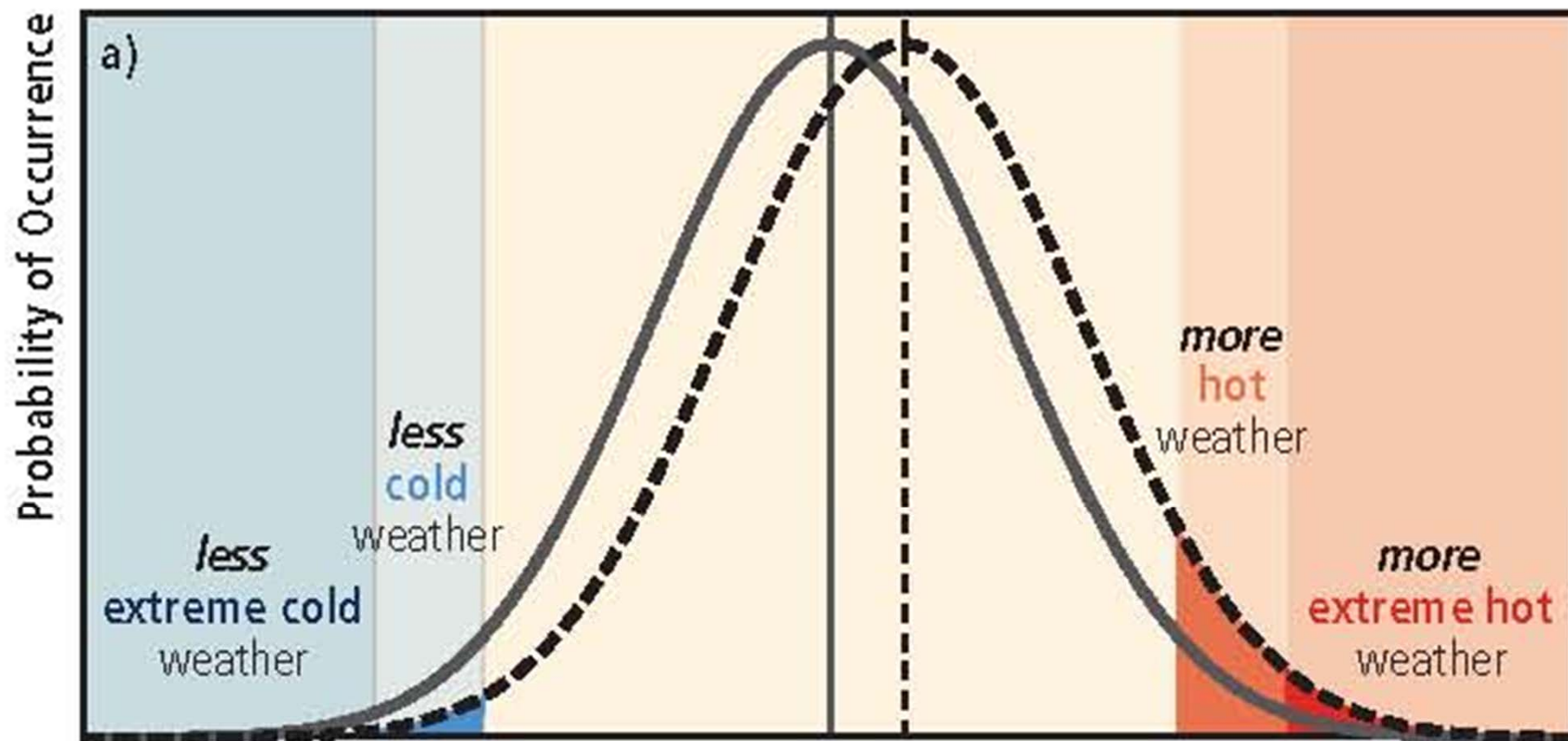
OR

“ The 2011 tornado in Raleigh is proof of global warming!”

Reality: no single event can be attributed to global warming

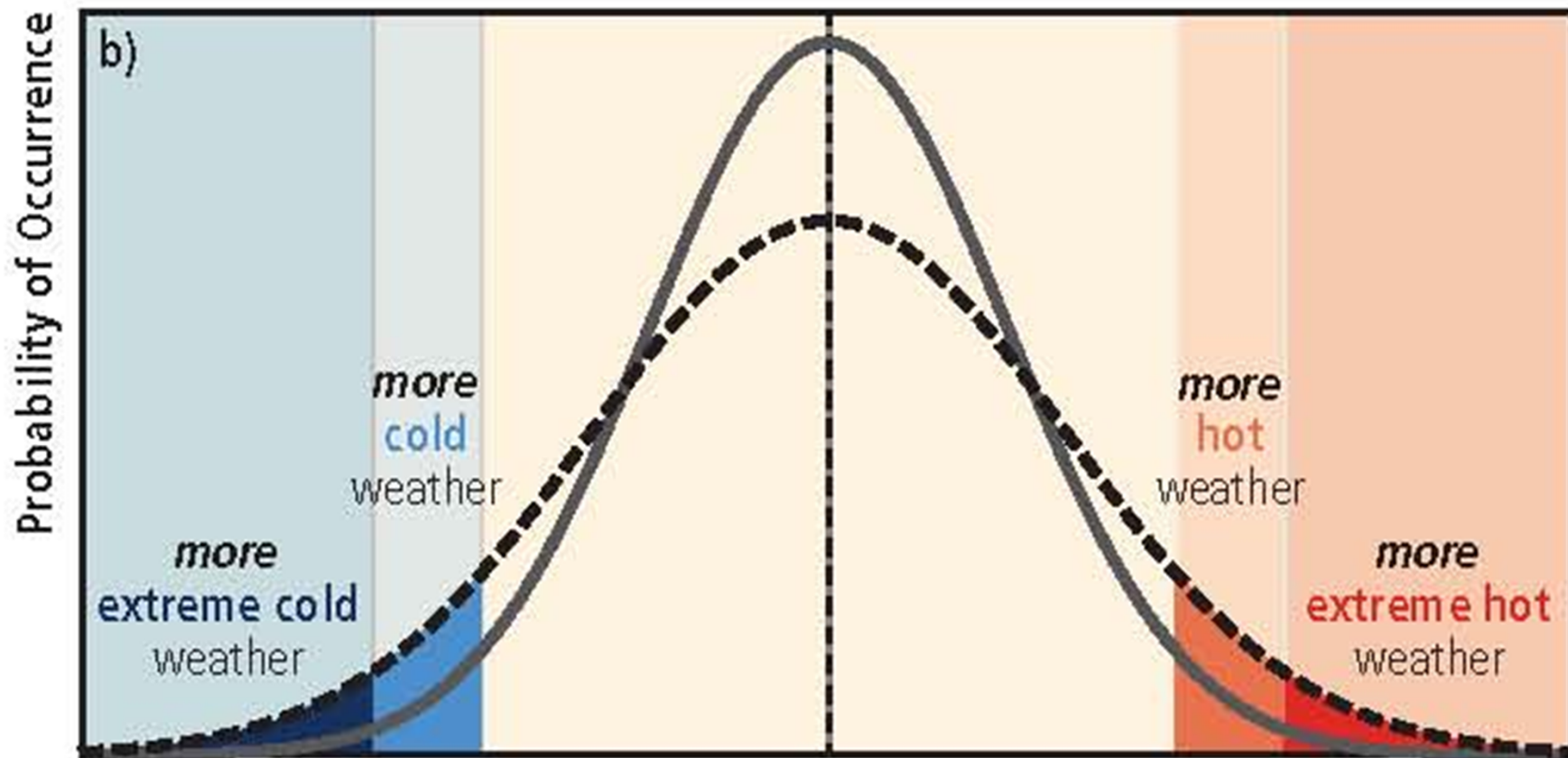


Shifted Mean



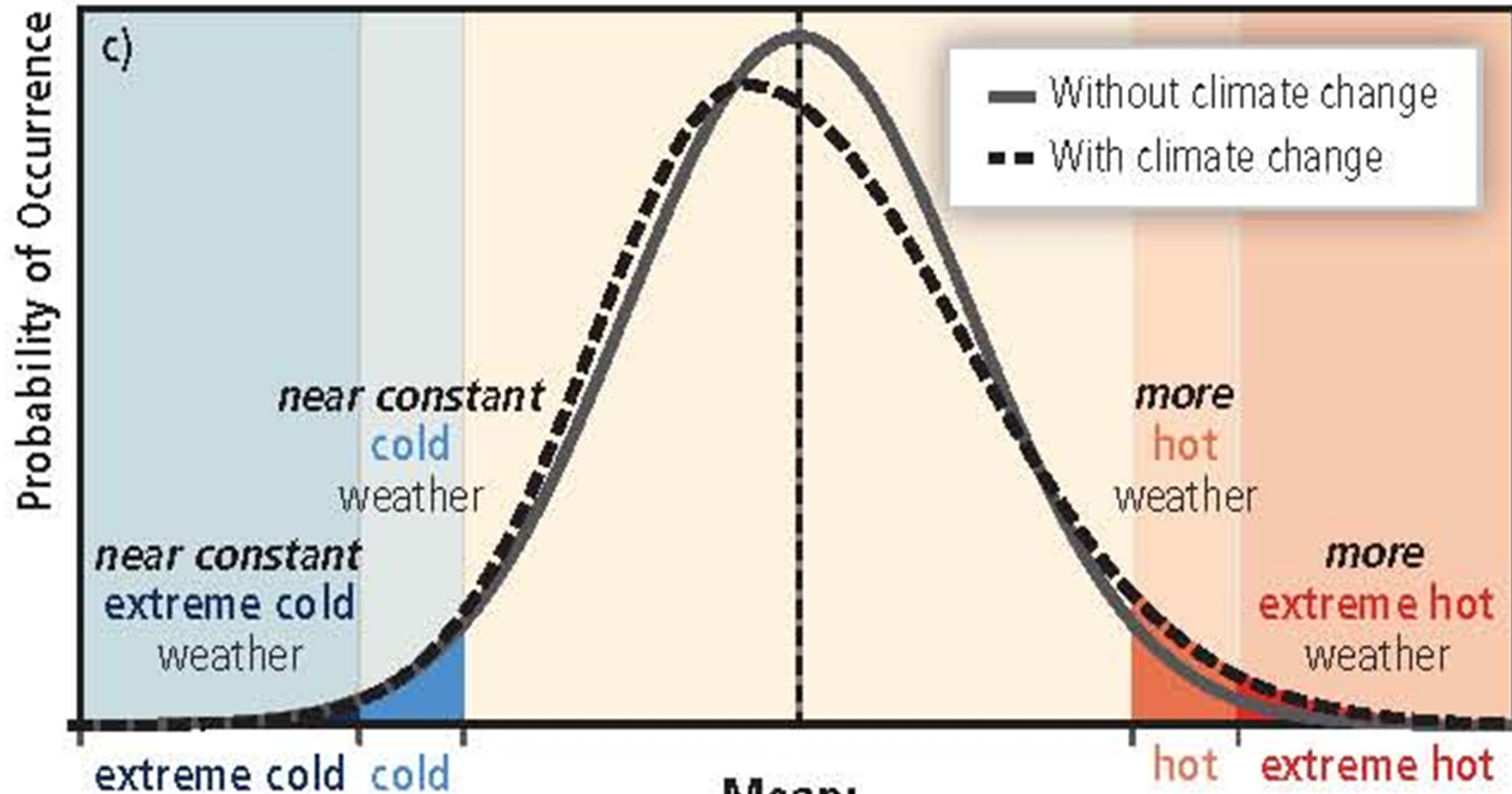
Source: 2012 IPCC Special Report

Increased Variability



Source: 2012 IPCC Special Report

Changed Symmetry

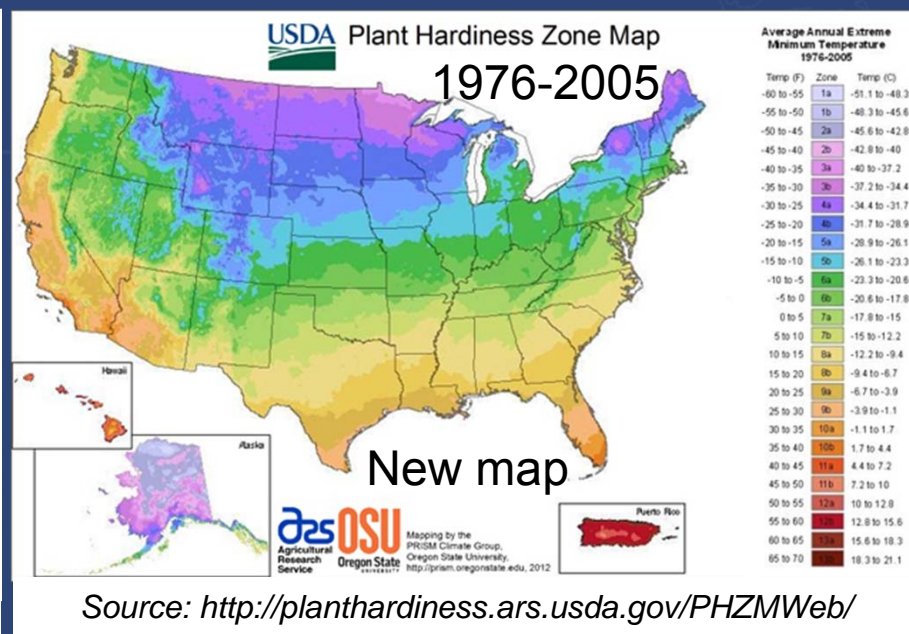
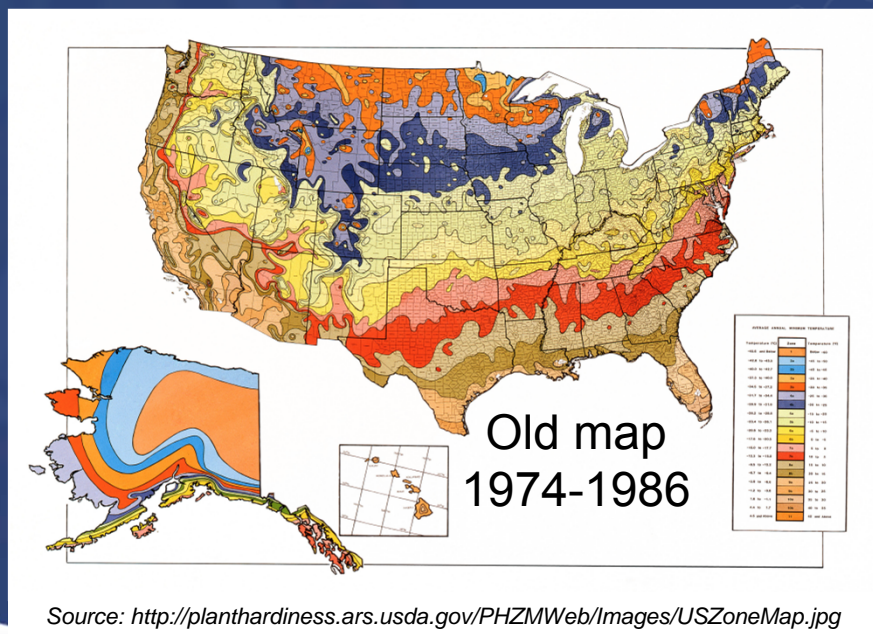


Mean:
without and with weather change

Source: 2012 IPCC Special Report

Misconception #11

“USDA Plant Hardiness Zone Maps are evidence of changing climate”



Reality: yes and no!



Misconception #12

“You can’t get an accurate weather forecast for next week so how can you get the climate correct a hundred years from now?”

Reality: Weather model \neq climate model
...although recent improvements to both!



The Development of Climate models, Past, Present and Future



Source: IPCC Third Assessment Report

Misconception #13

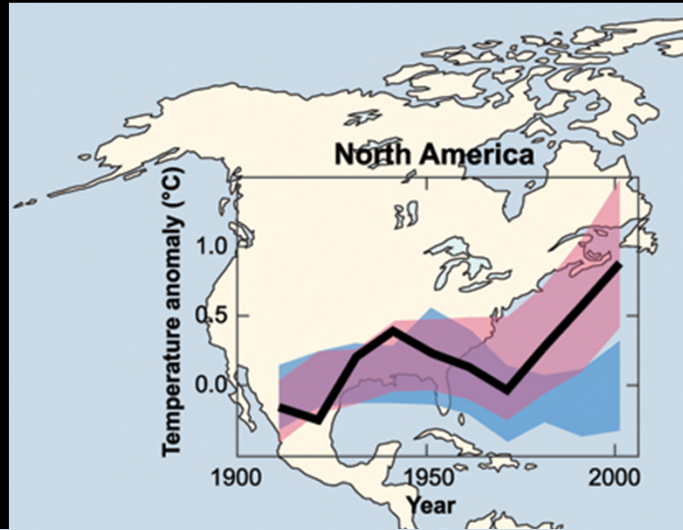
“Climate models have lots of uncertainty and can’t be trusted!”

Reality: GCM’s will never be perfect **but** capable of reproducing past and present climate states at large spatial scales

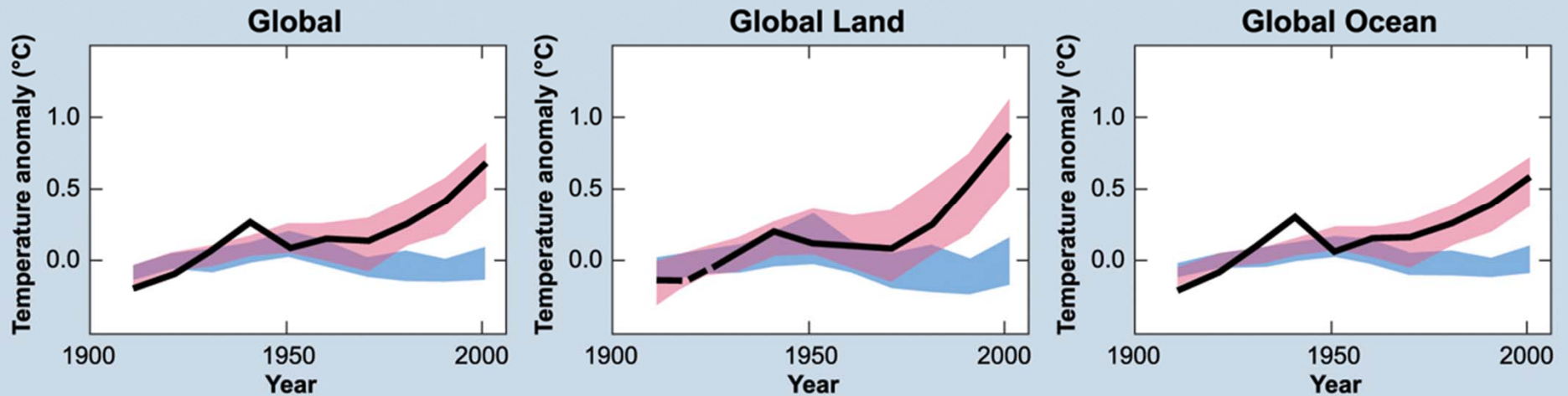
→ more confidence for modeling future state at large spatial scales (continental, global)






Global and continental temperature change simulated by climate models



Source: IPCC Fourth Assessment Report



 models using only natural forcings (solar activity and volcanoes)
 models using both natural and anthropogenic forcings

 observations

Note: Anomalies relative to 1901-1950 averages



Are we missing the point?

- Need to shift focus to Earth's response to warming, or impacts
 - *For example...*
 - average global temperature is 3 degrees warmer in 2100*
 - vs.*
 - coastal areas facing SLR, pine species shifts, frequency of SPB outbreaks, etc.*

What if there is no climate change?

- Southern US still experiences disasters!
 - Droughts, tornadoes, ice storms, hurricanes...
- Vulnerability due to increasing populations





What do physical climate scientists argue about?

- Sensitivity of the climate system
- Tipping point
- Attribution
 - How much warming due to local land-use change vs. due to global increase in CO₂?
- Localized changes (hurricanes, extreme events)
- Impacts
- Cost-benefit of action steps

Discussion Questions

- Have we reached a tipping point?
- How would one determine the contribution of global warming to any event? e.g. tornado outbreak, drought, seasonal snowfall totals
- How might your PINEMAP research, extension, and education help address these?

