



Walter Orr Roberts Memorial Public Lecture

If You Can't Predict the Weather Beyond 10 Days Then You Can't Predict the Climate and Other Myths

Ben Kirtman

University of Miami - RSMAS

UNIVERSITY
OF MIAMI

ROSENSTIEL
SCHOOL of MARINE &
ATMOSPHERIC SCIENCE



GLOBAL
WARMING IS
A COMPLETE
MYTH! SO
JUST KEEP
ON WALKING...



...BUT STAY
AWAY FROM
THE EDGE



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Myths or Misconceptions?

- **Can't Predict Weather -> Can't Predict Climate**
 - **Scientific Basis for Climate Prediction**
- **All Variations Can Be Explained by Natural Variability**
 - Quantifying Natural Variability vs. Anthropogenic Change
- **Global Warming is Caused by the Sun**
- **Models Aren't Very Good at Predicting the Future**
 - Quantifying Prediction Skill
- **Every Year Should be Warmer Than the Previous Year**

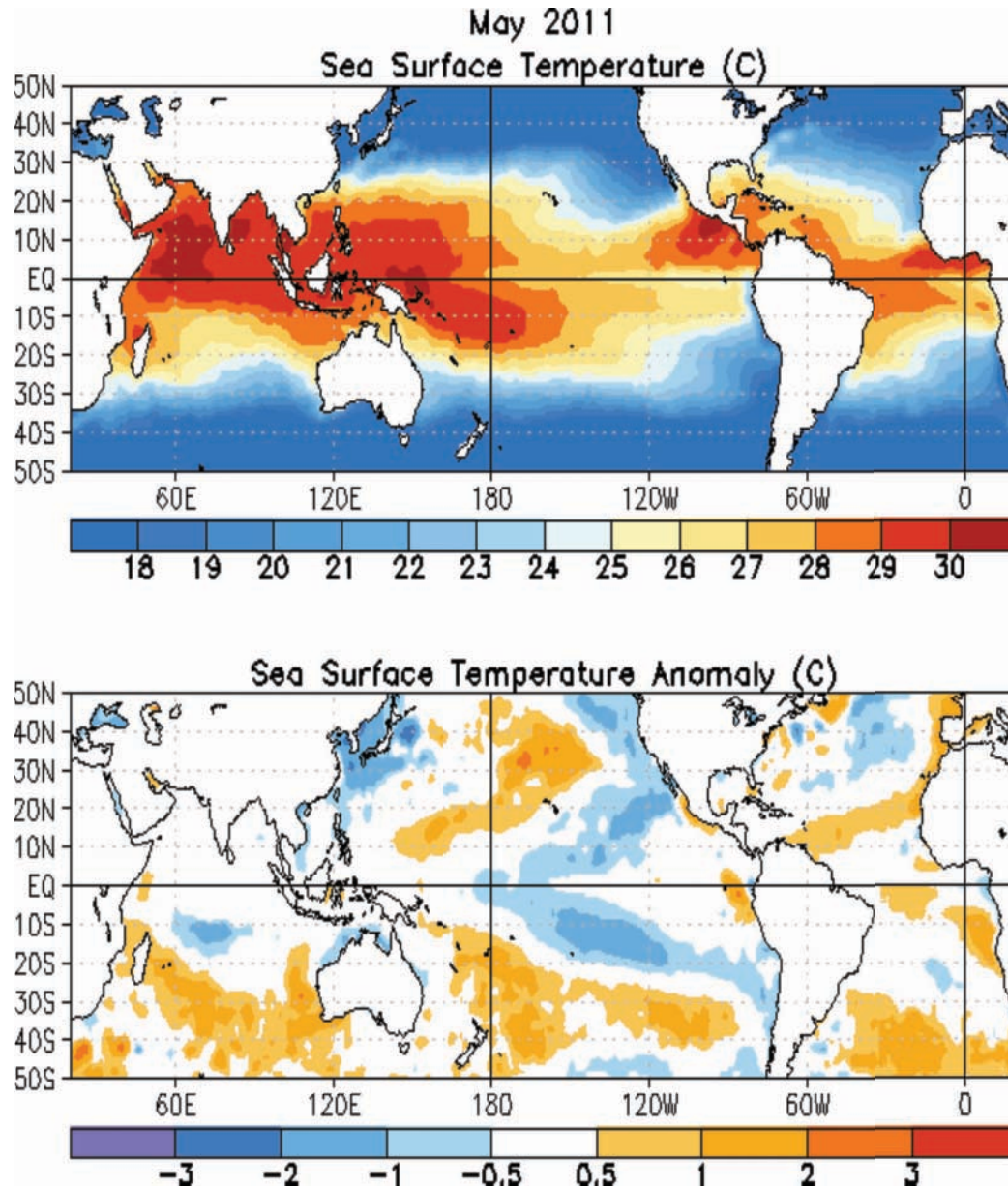
Themes

- **Scientific Basis For Climate Prediction**
- **Prediction on Time Scales from Seasons to Decades**
 - Including all the Sources of Predictability
 - Living with Uncertainty
- **Models Aren't Perfect, But Are Useful**
- **Some Emphasis on US Rainfall**

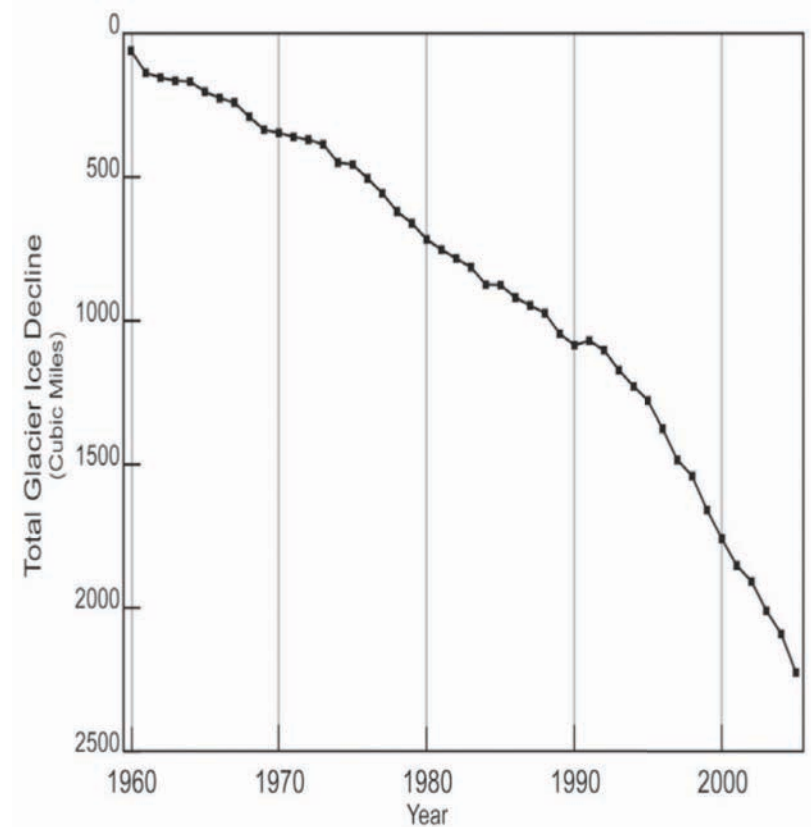
Scientific Basis for Climate Prediction

- **Weather vs. Climate**
 - Climate = The Statistics of Weather
 - Language: Anomalies, Trend
- **Slowly Evolving “Boundary” Conditions**
 - Ex: El Niño and La Niña, Pacific Decadal Variability, Atlantic Multi-Decadal Variability
- **Variations in External Forcing**
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How do we know that the climate is changing?



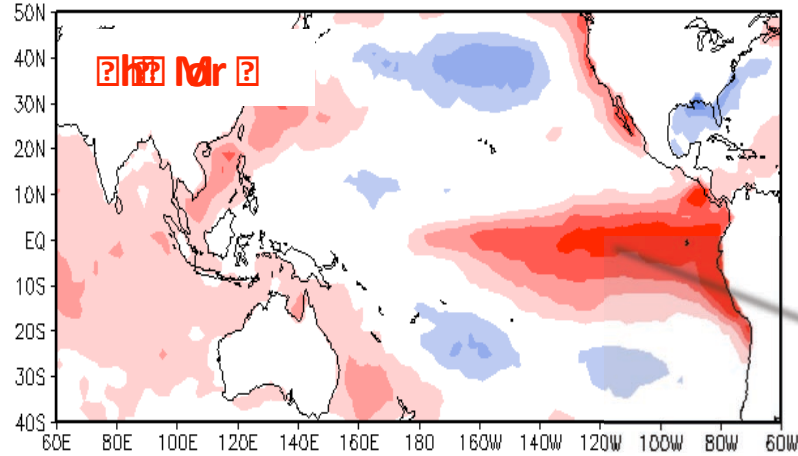
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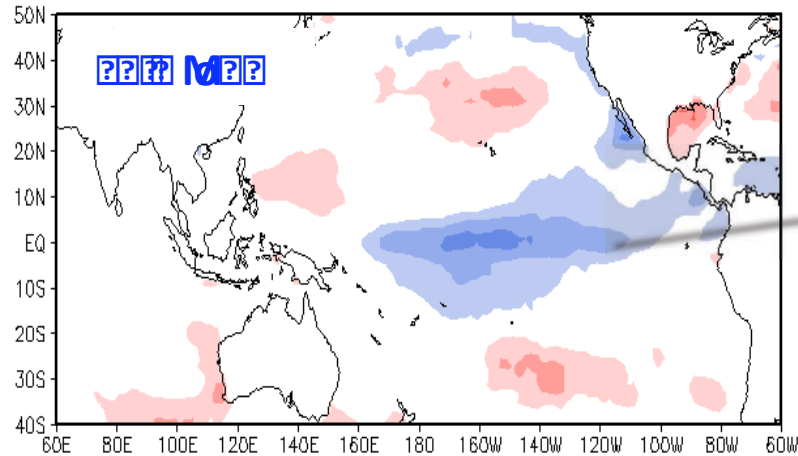
Meier et al.²⁷

As temperatures have risen, glaciers around the world have shrunk. The graph shows the cumulative decline in glacier ice worldwide.

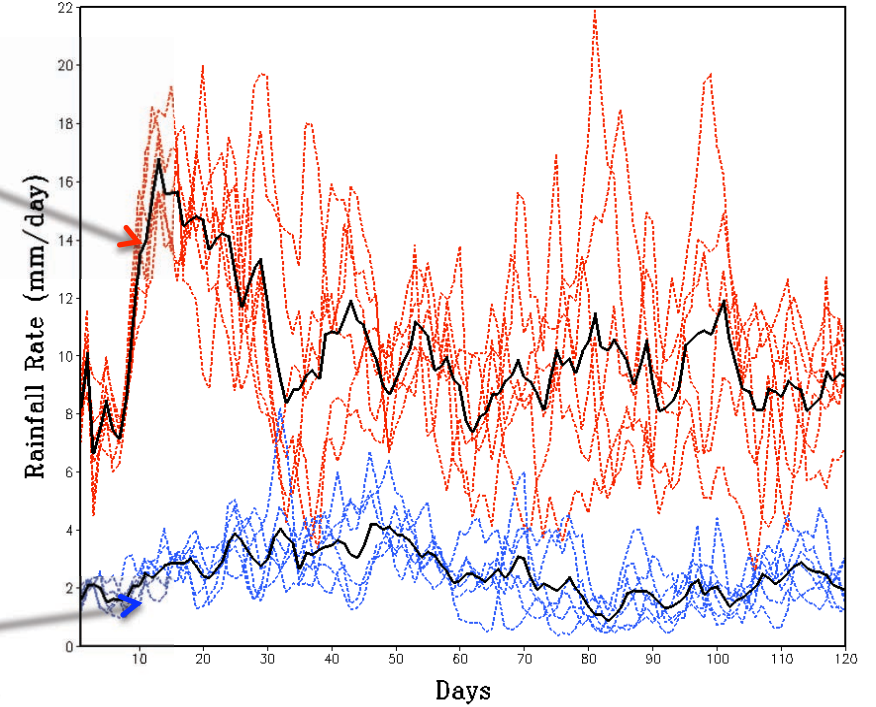
SST Anomaly JFMA1998



SST Anomaly JFMA1989

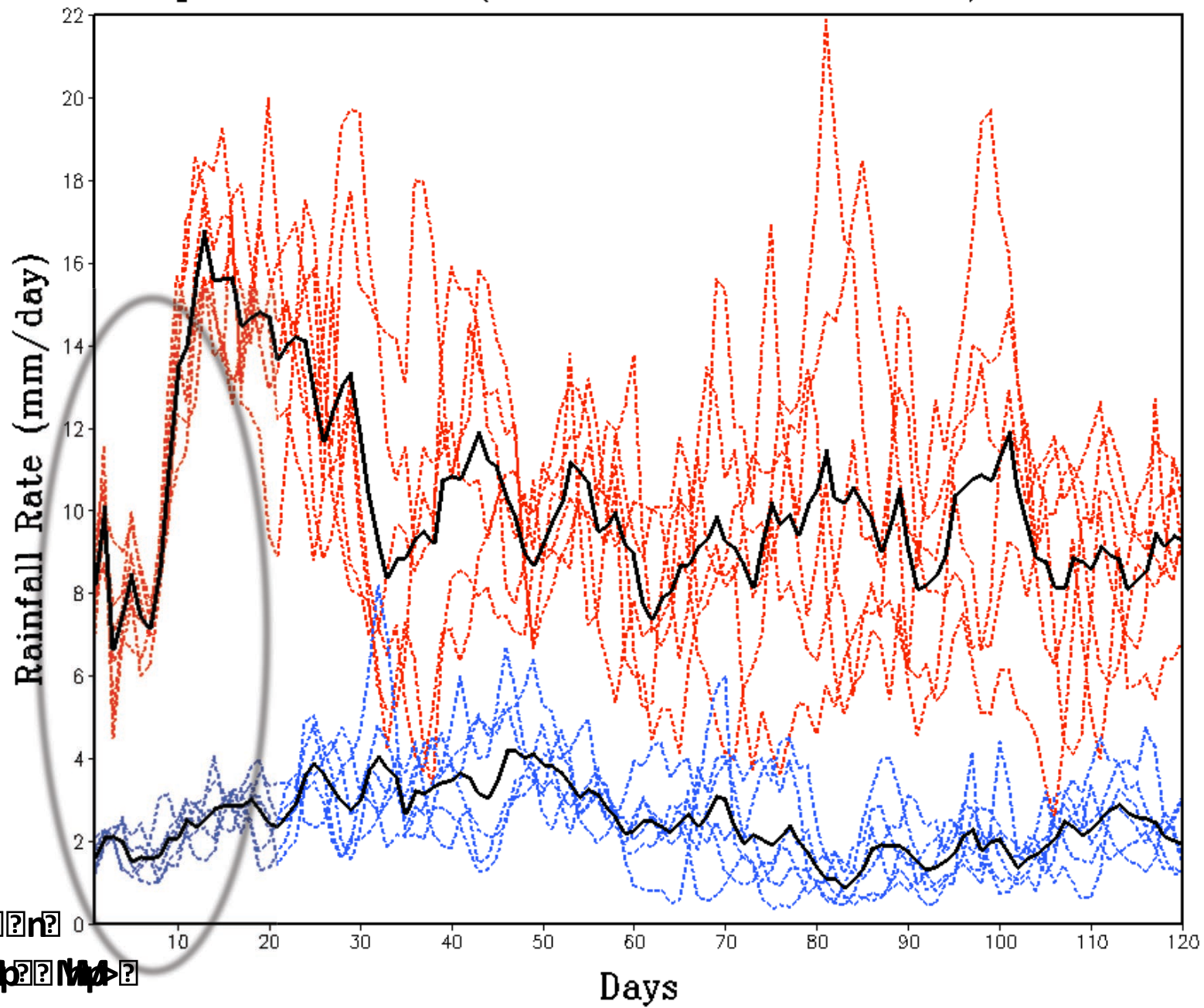


Tropical Pacific (10S-10N, 120W-160W) Rainfall

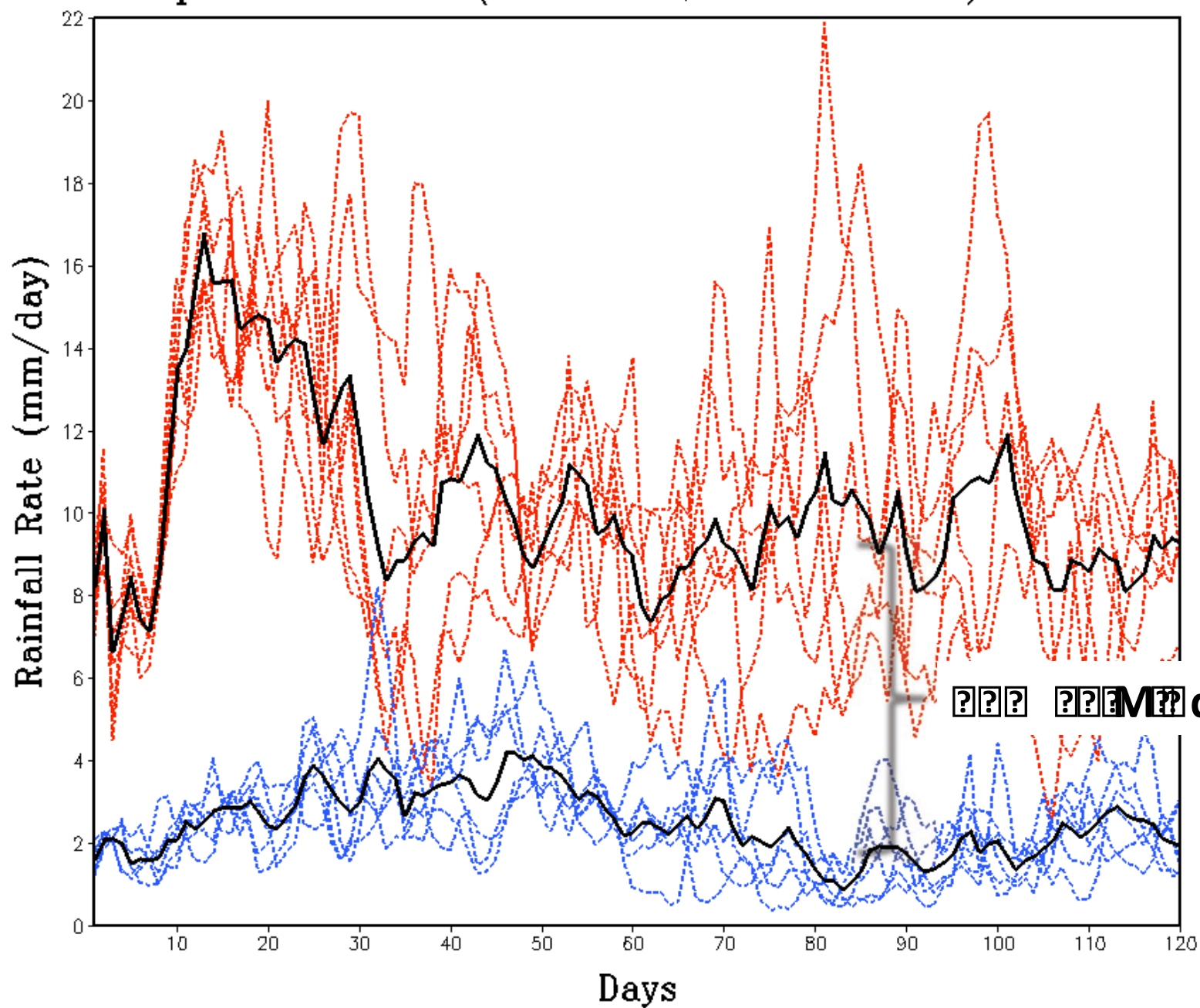


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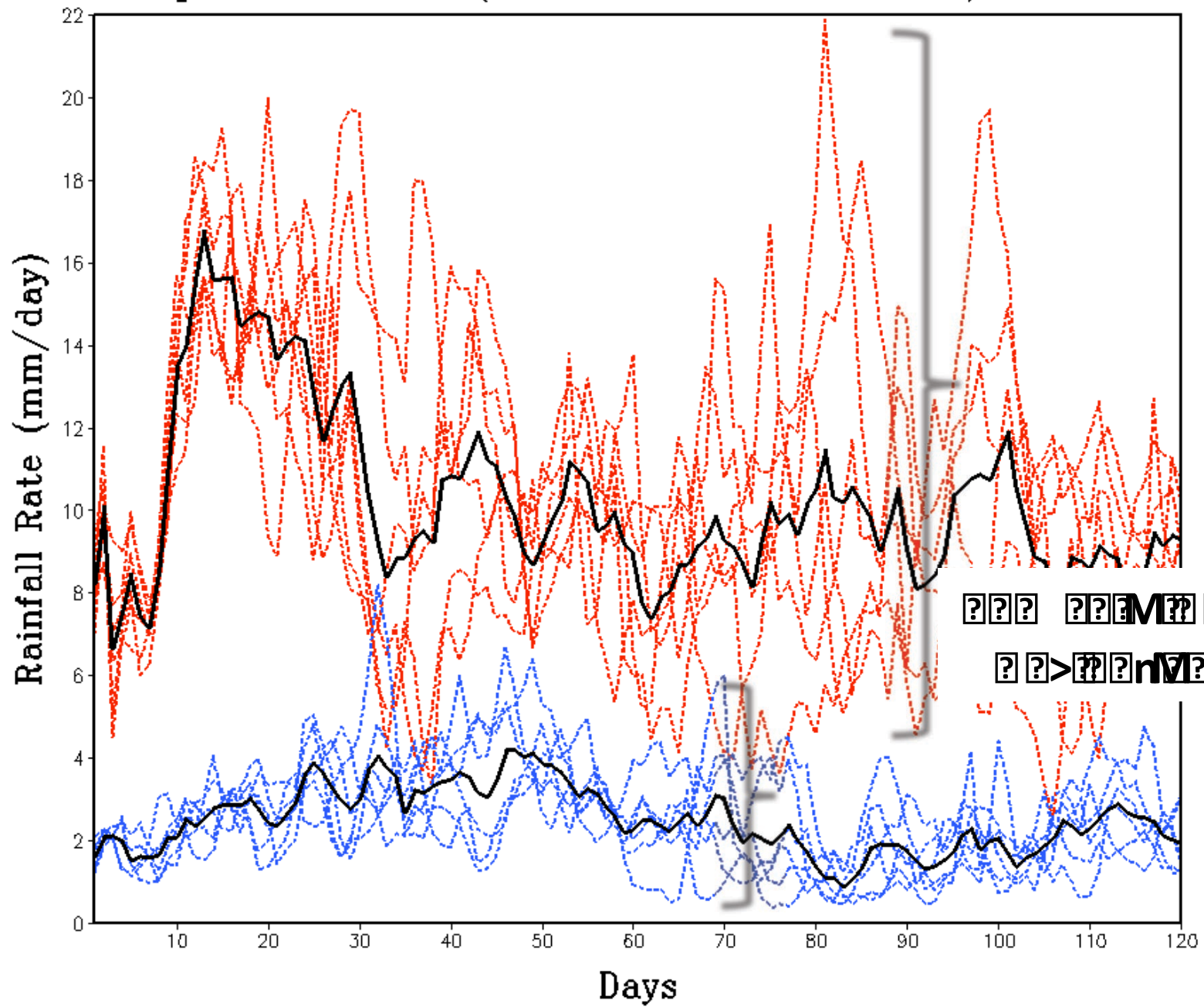
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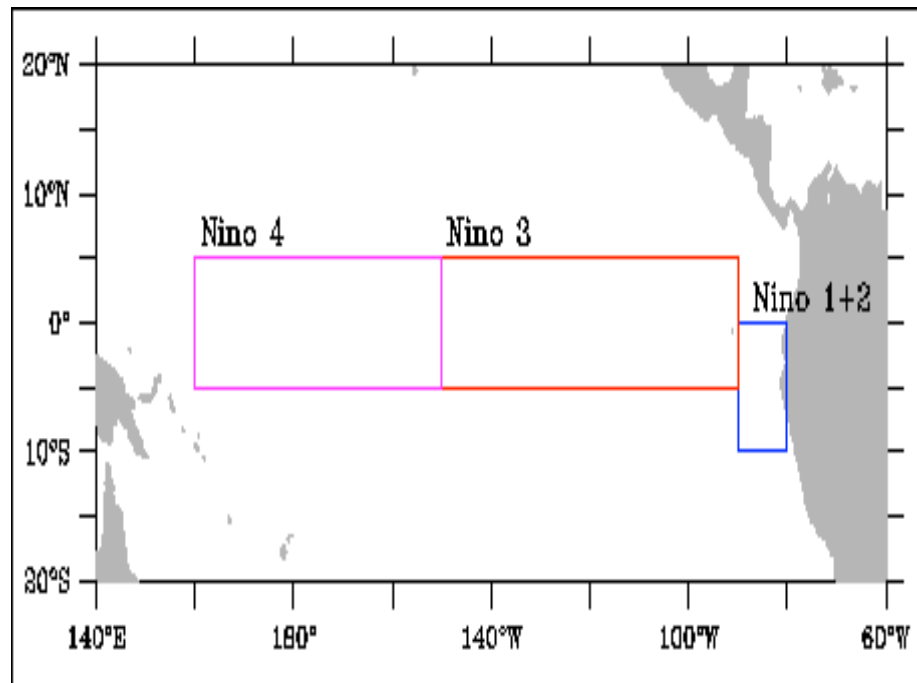


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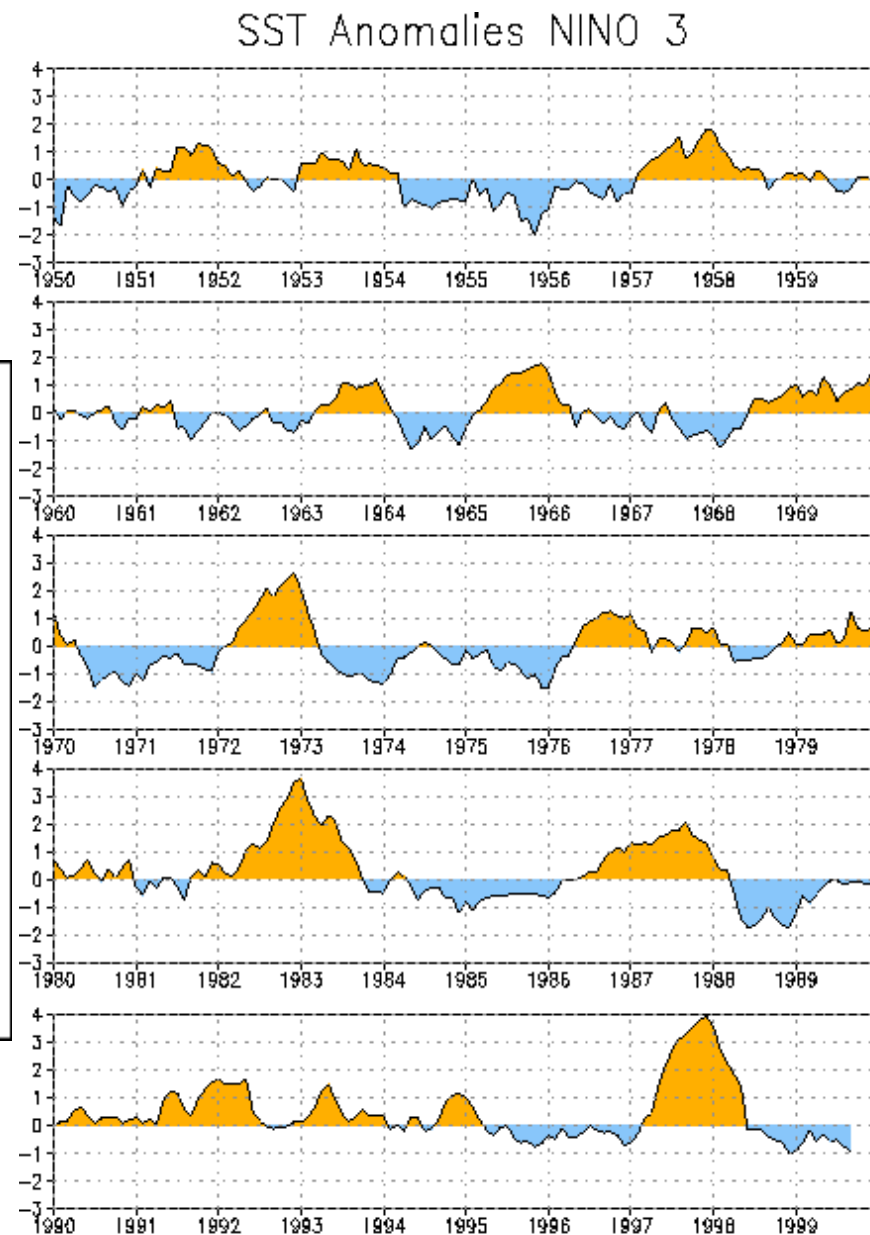
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The “Nino3” SST index

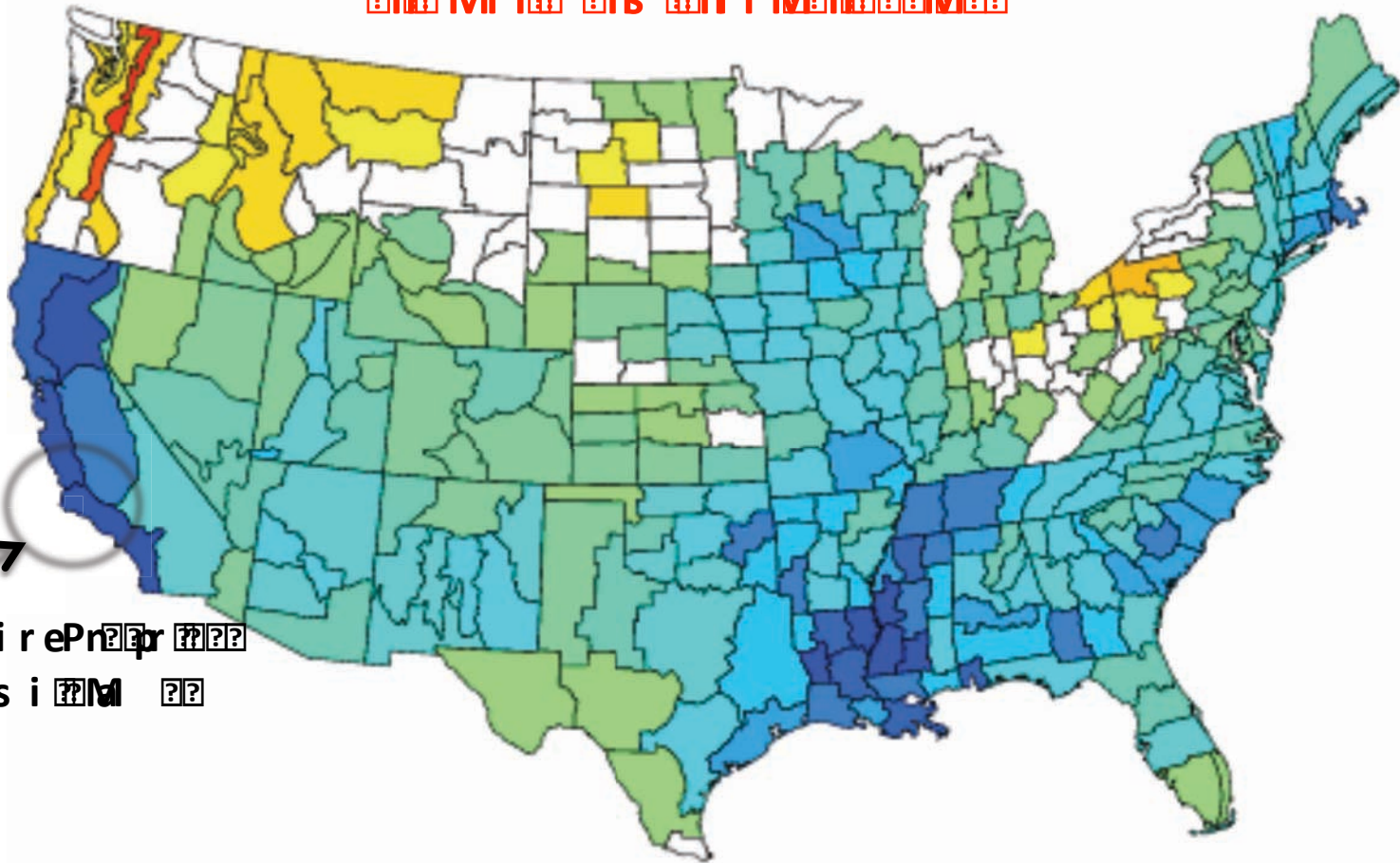


Note that El Nino events do not occur regularly



Composite Precipitation Anomalies (inches) Jul to Jun 1972-73, 1982-83, 1991-92, 1997-98 Versus 1950-1995 Longterm Average

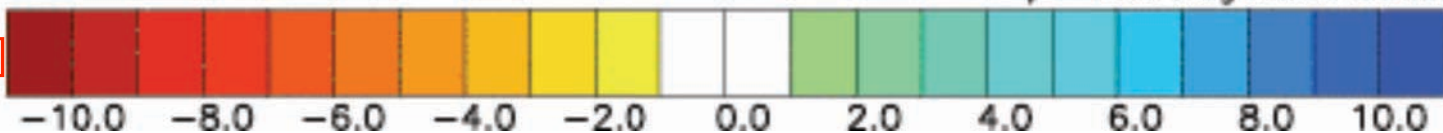
Mr fns rri VhVhVhVhVh



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Mr fPs i M

NOAA-CIRES/Climate Diagnostics Center

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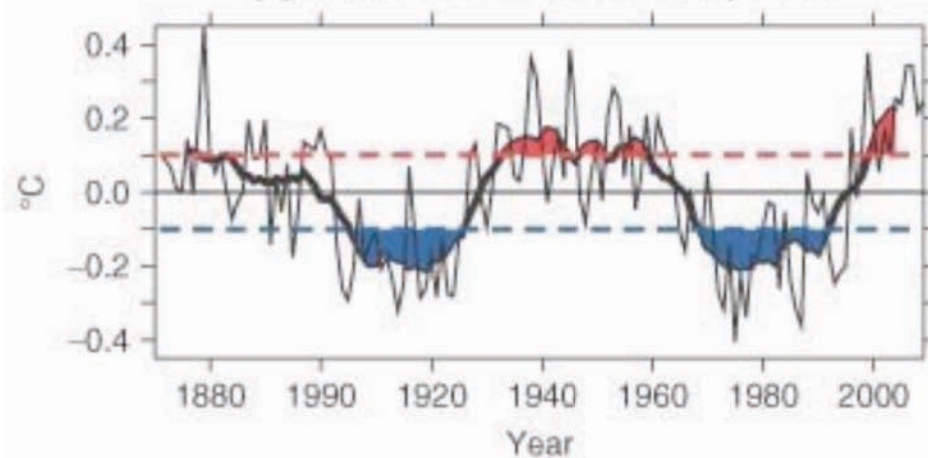


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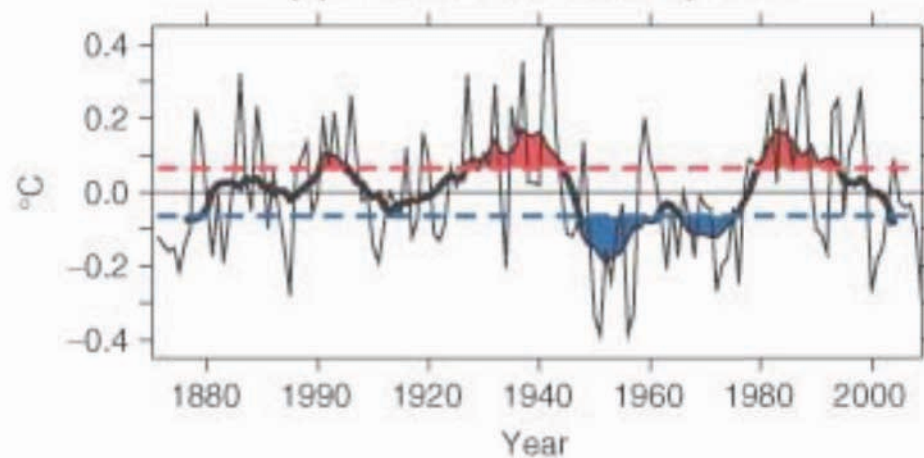
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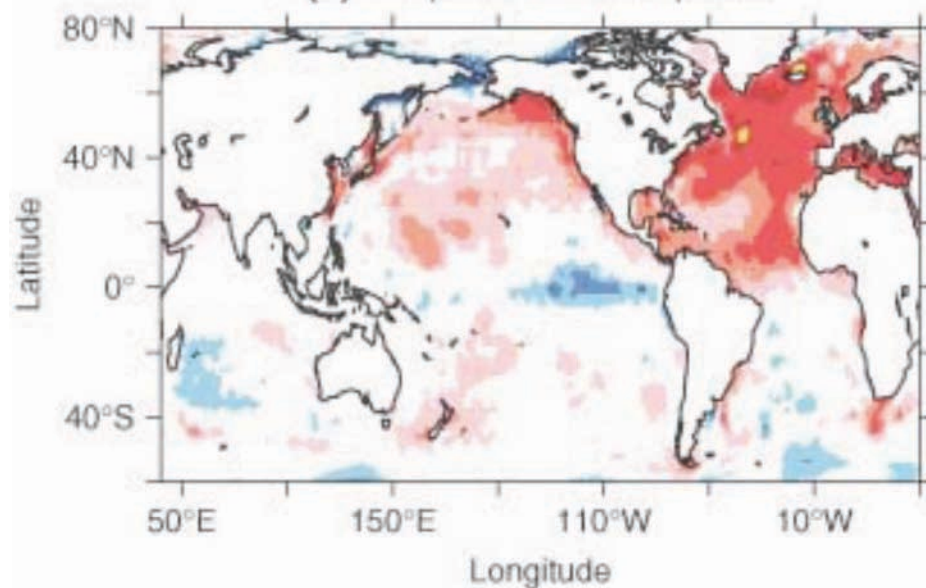
(a) Atlantic multidecadal variability index



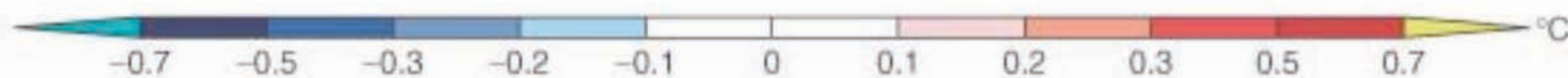
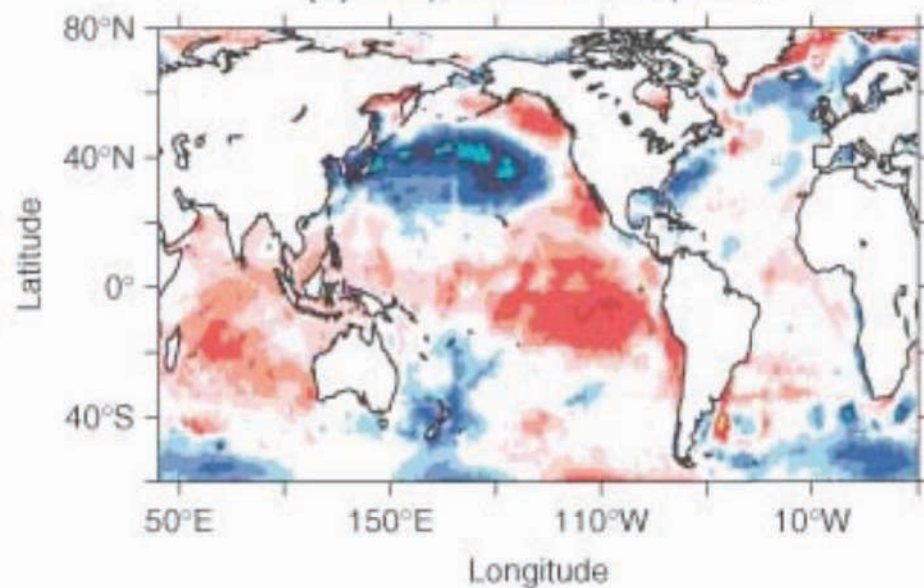
(c) Pacific decadal variability index



(b) Composite AMV SST pattern



(d) Composite PDV SST pattern

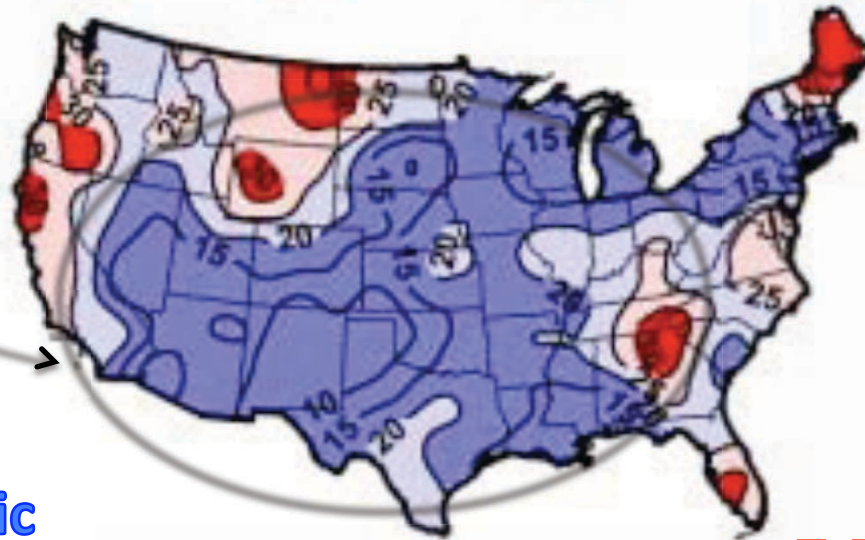


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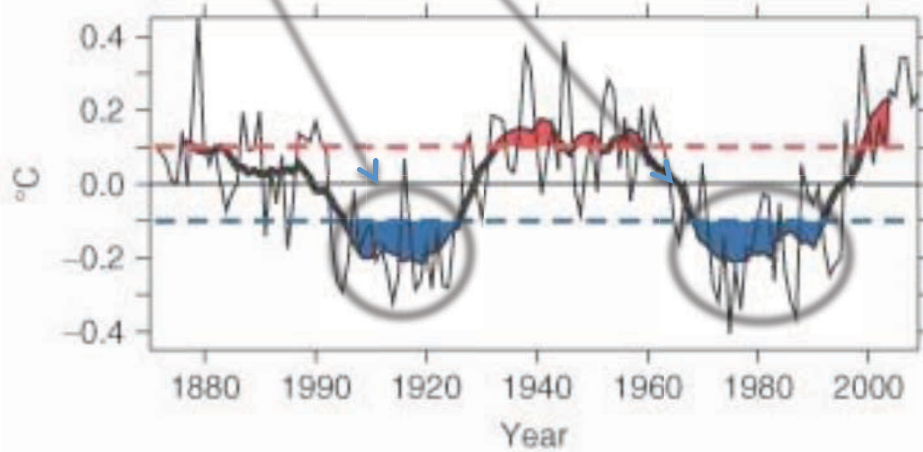
+PDO -AMO



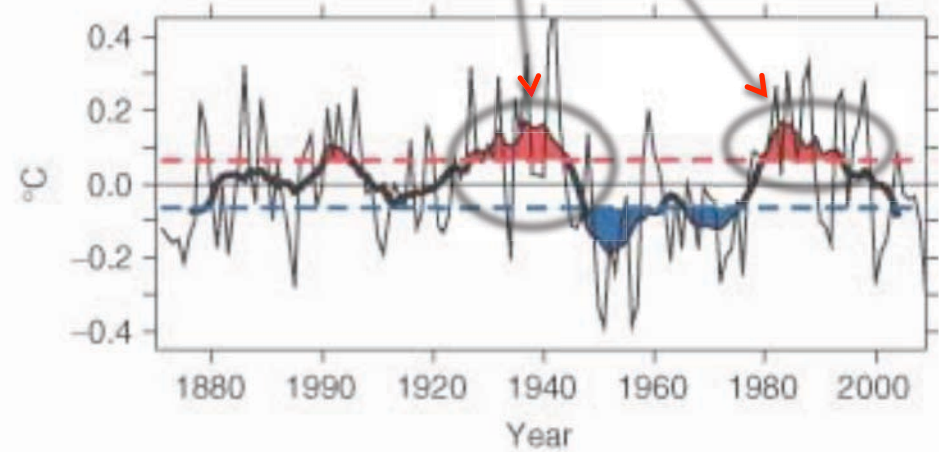
Cold North Atlantic

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(a) Atlantic multidecadal variability index



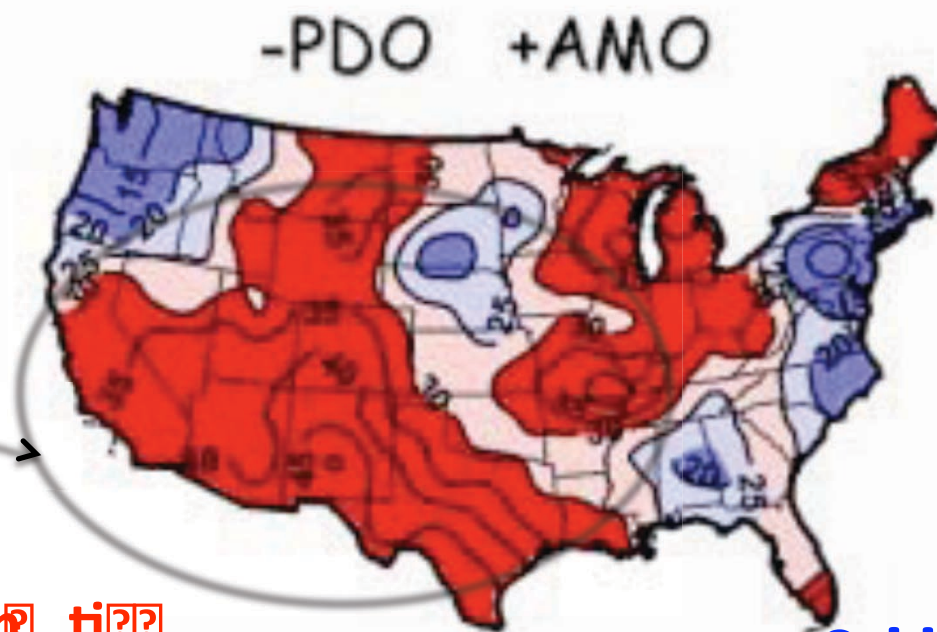
(c) Pacific decadal variability index



What is the relationship between the

AMO and the

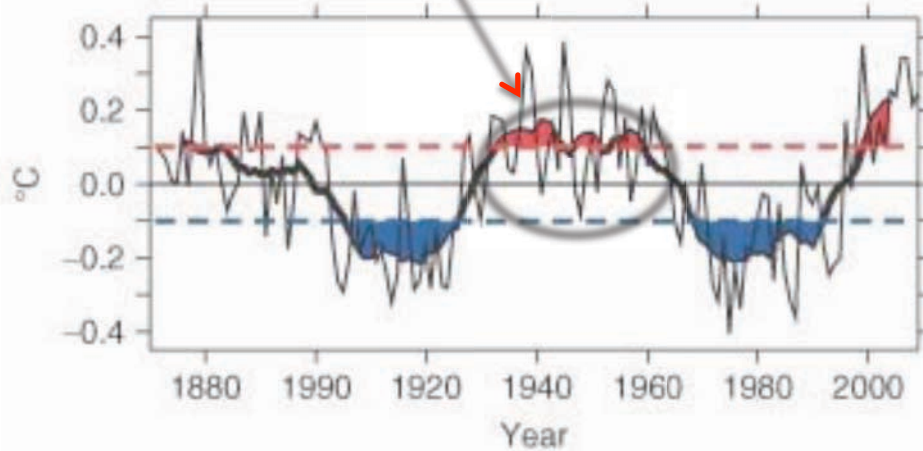
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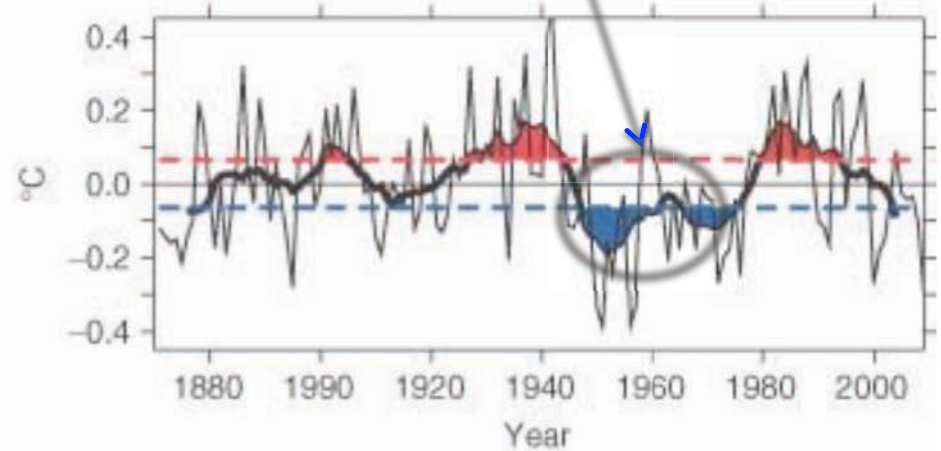
What is the relationship between the

Cold Tropical Pacific

(a) Atlantic multidecadal variability index



(c) Pacific decadal variability index



Scientific Basis for Climate Prediction

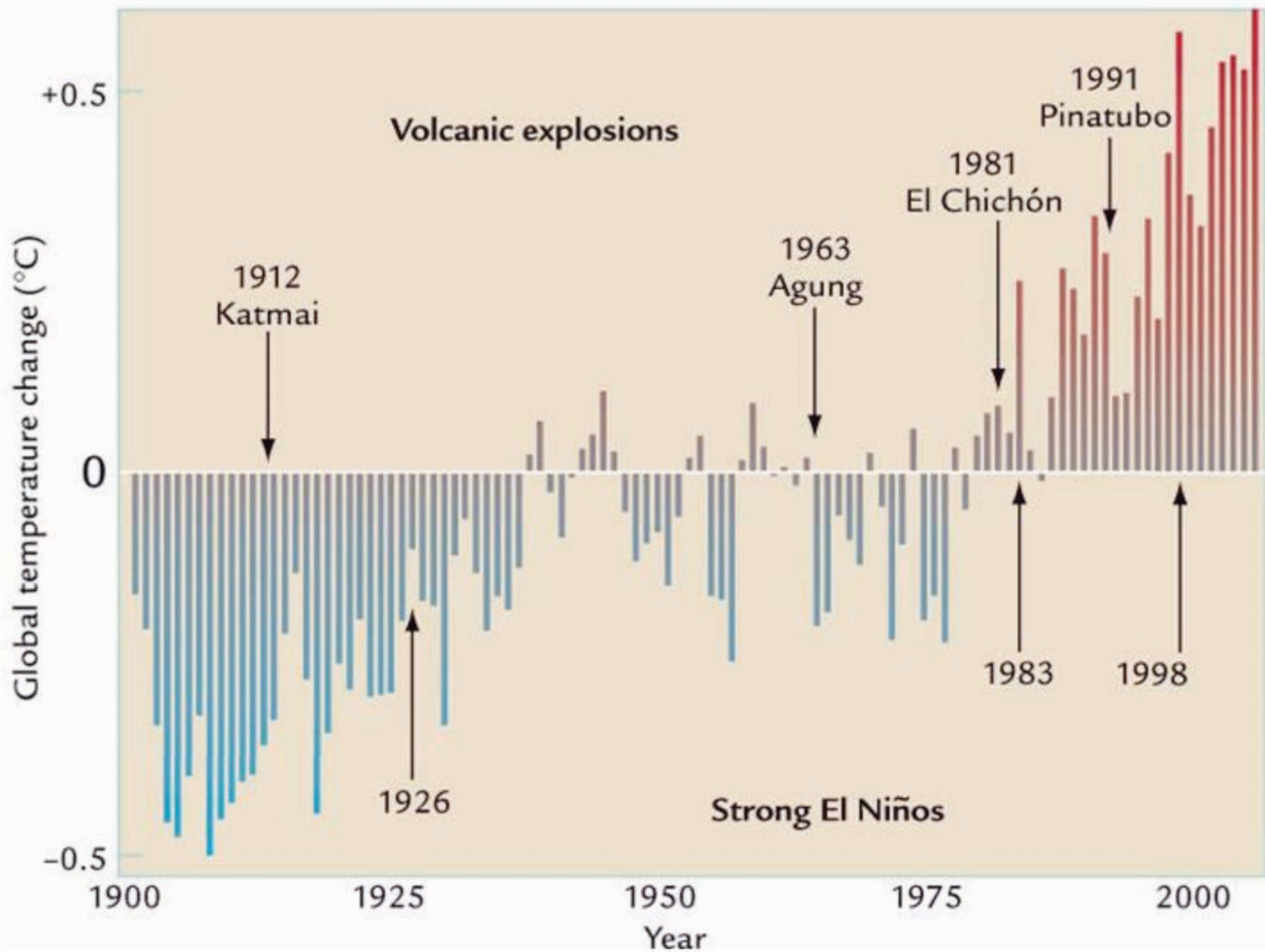
- **Slowly Evolving “Boundary” Conditions or the Natural Variability of the Climate System**
 - Ex: El Niño and La Niña, Pacific Decadal Variability, Atlantic Multi-Decadal Variability
- **Point: For Prediction We Need to Include All the Natural Modes of Variability**

Scientific Basis for Climate Prediction

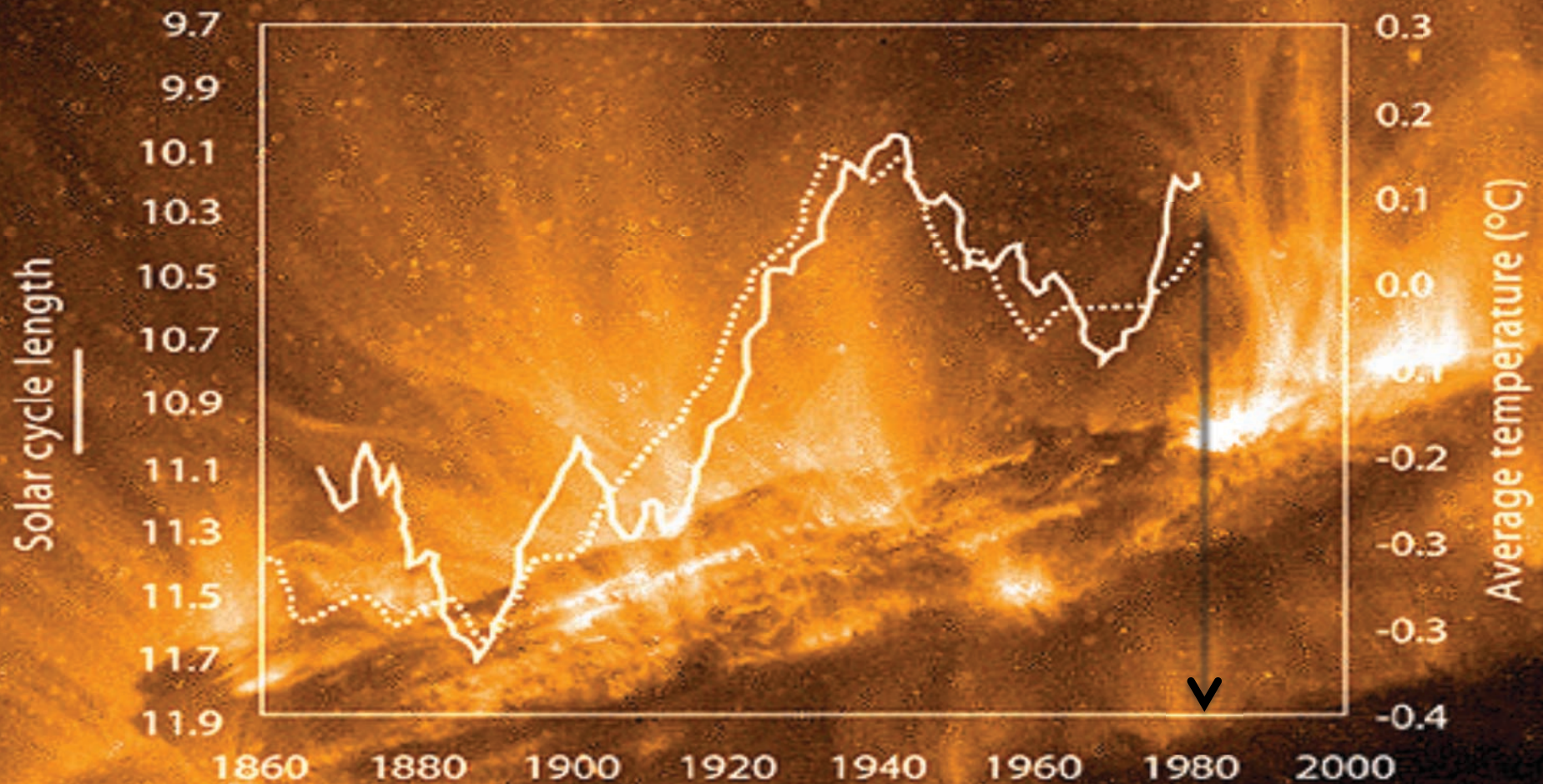
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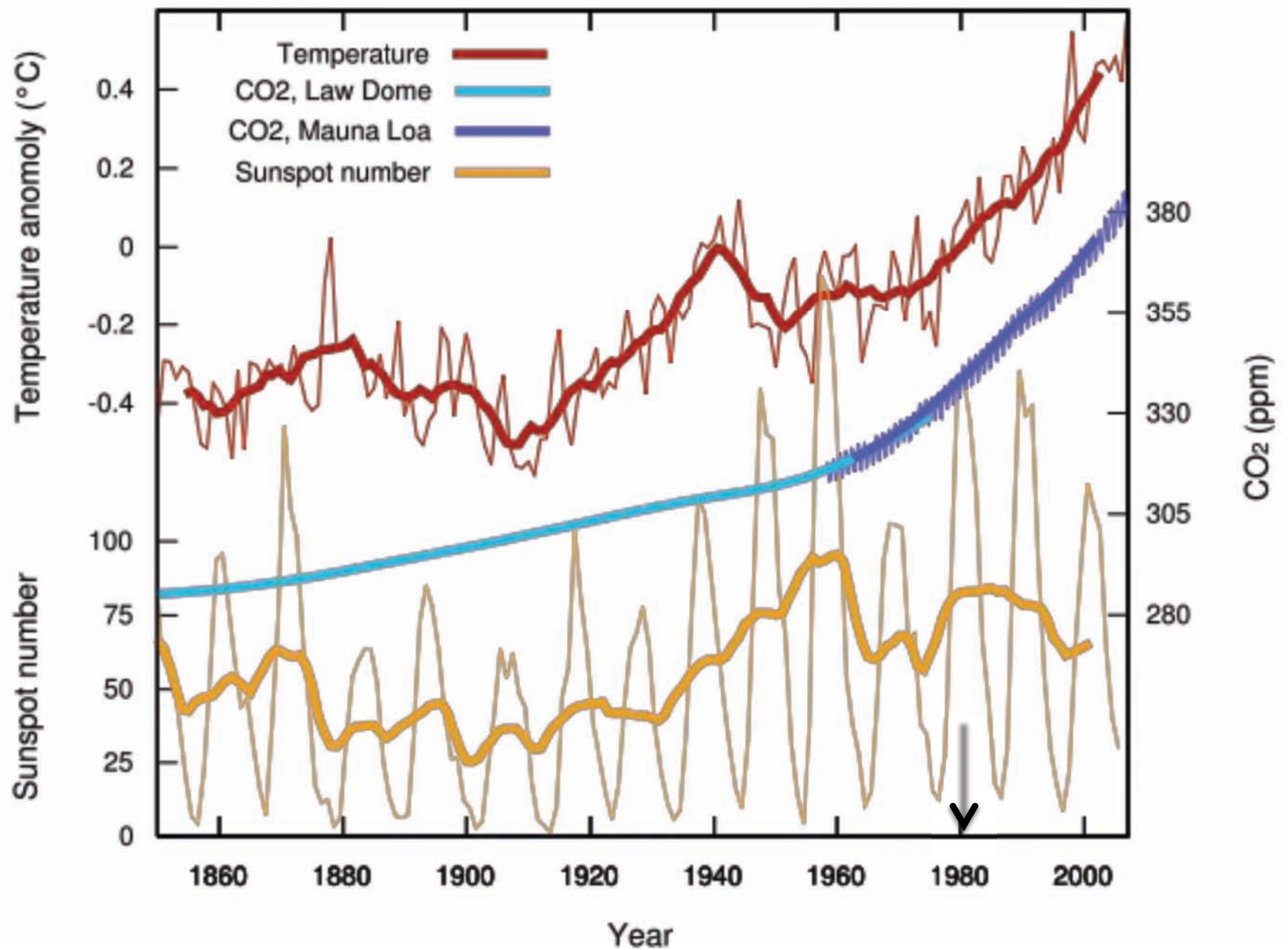
Average Northern Hemisphere Temperature



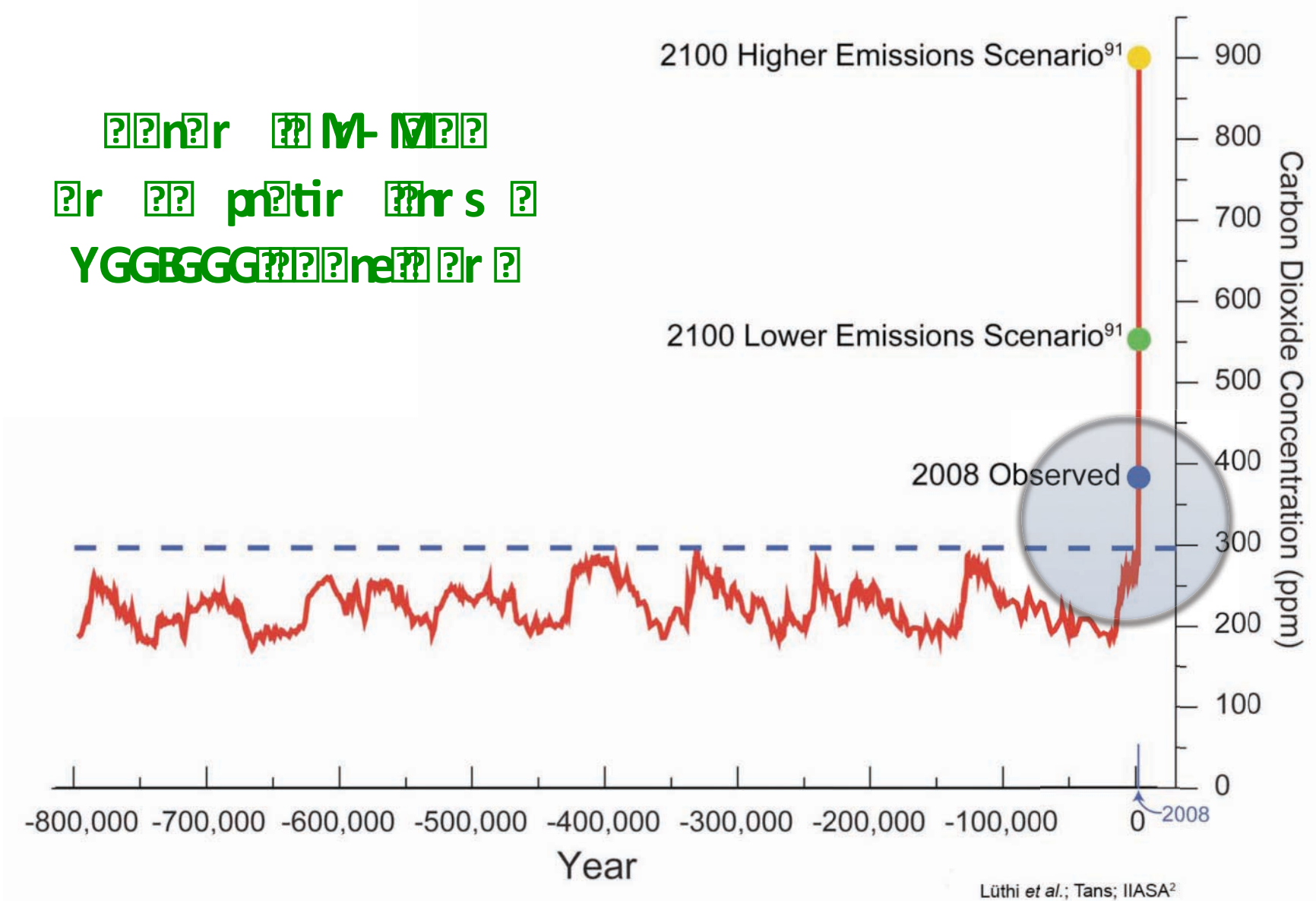
**GLOBAL WARMING: IT'S THE SUN,
STUPID!**

Background image: Coronal loops on the surface of the Sun. NASA.

Temperature, CO₂, and Sunspots

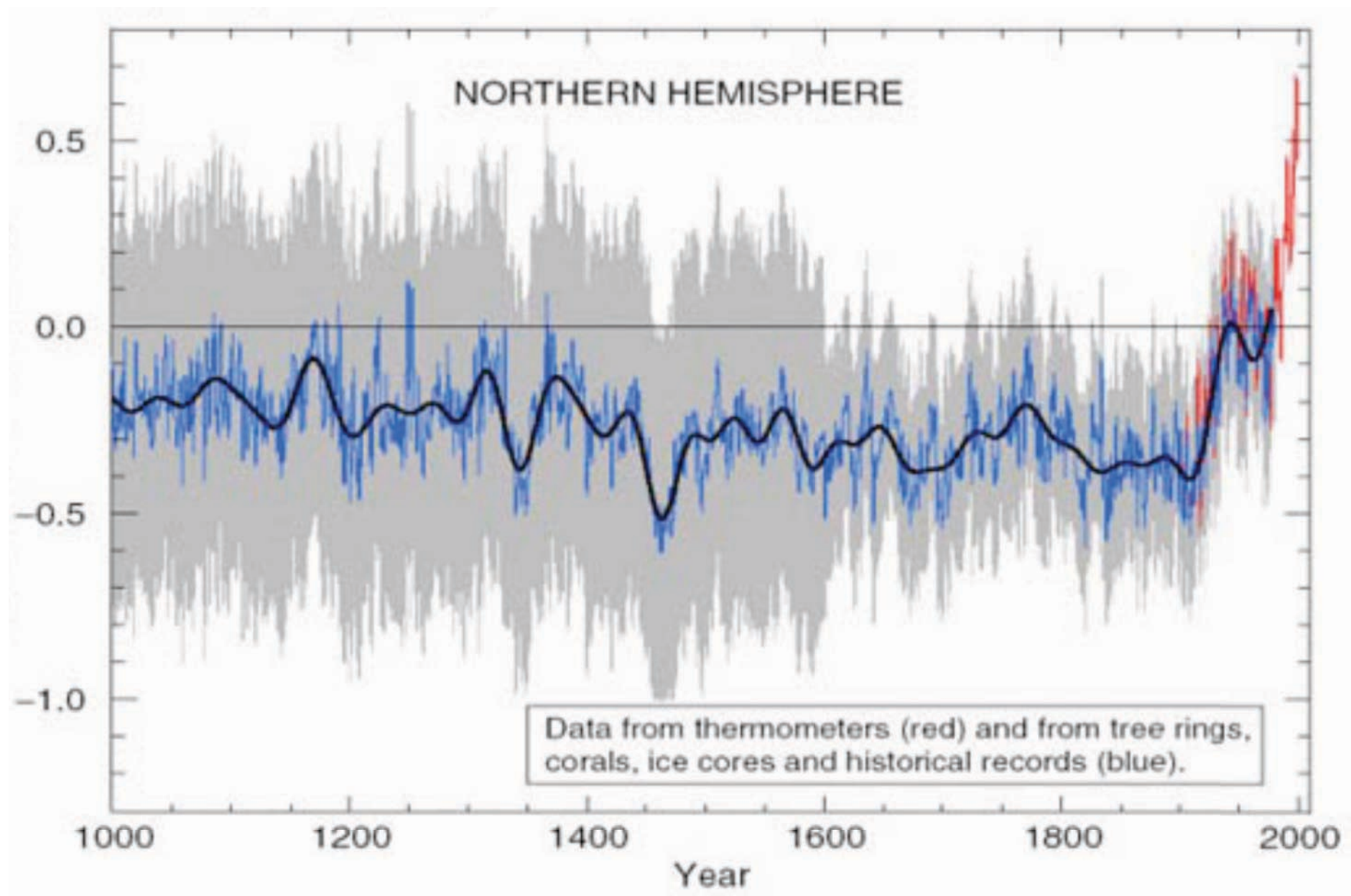


Carbon dioxide concentration
has increased rapidly since
1950

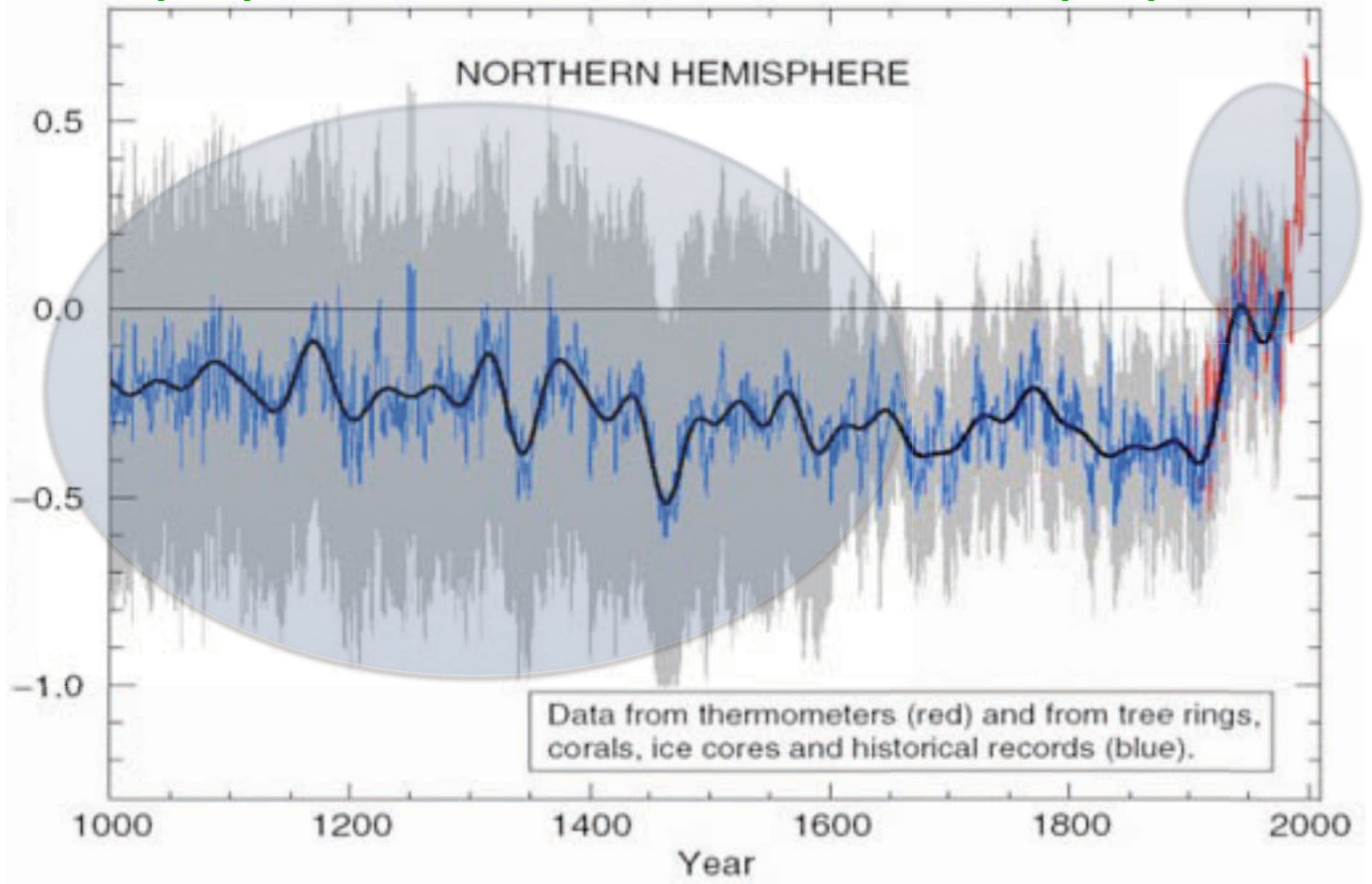


To Understand the Past or to Make a Climate Prediction of the Future

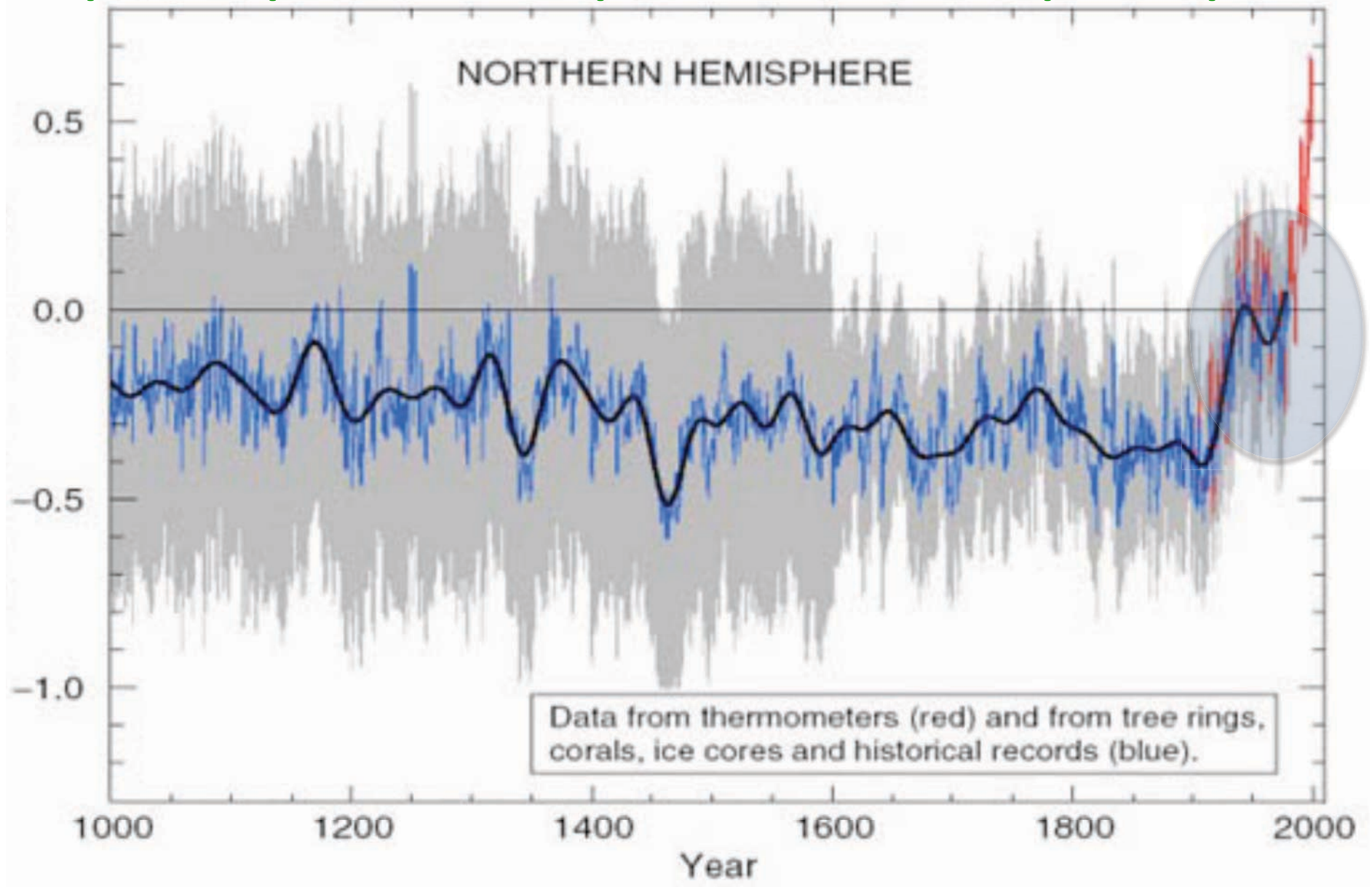
- **Need to Include Natural Variability**
 - Ex: El Niño and La Niña, Pacific Decadal Variability, Atlantic Multi-Decadal Variability
- **Need to Include/Predict the Variations in External Forcing**
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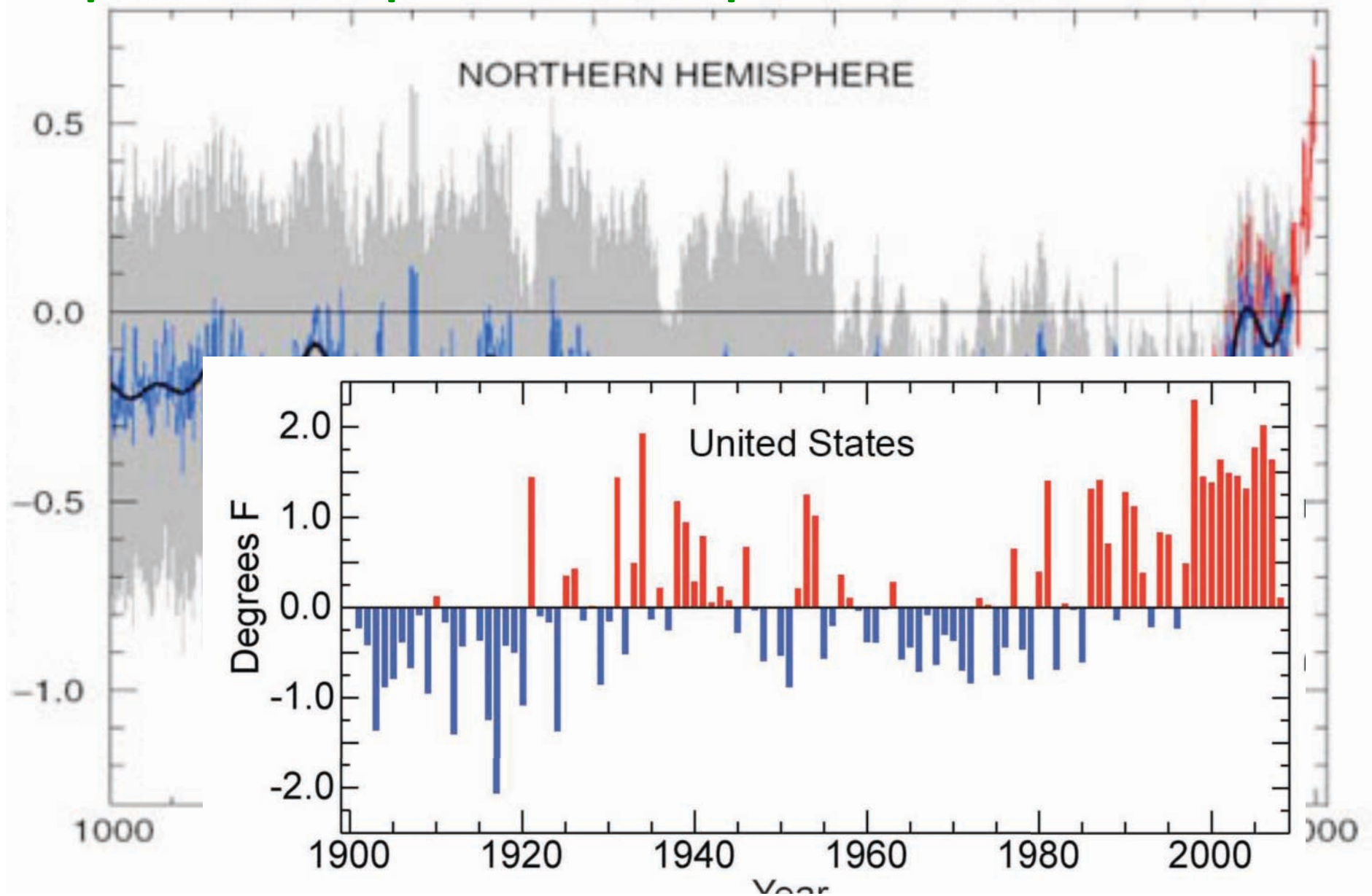
What is the evidence for global warming?



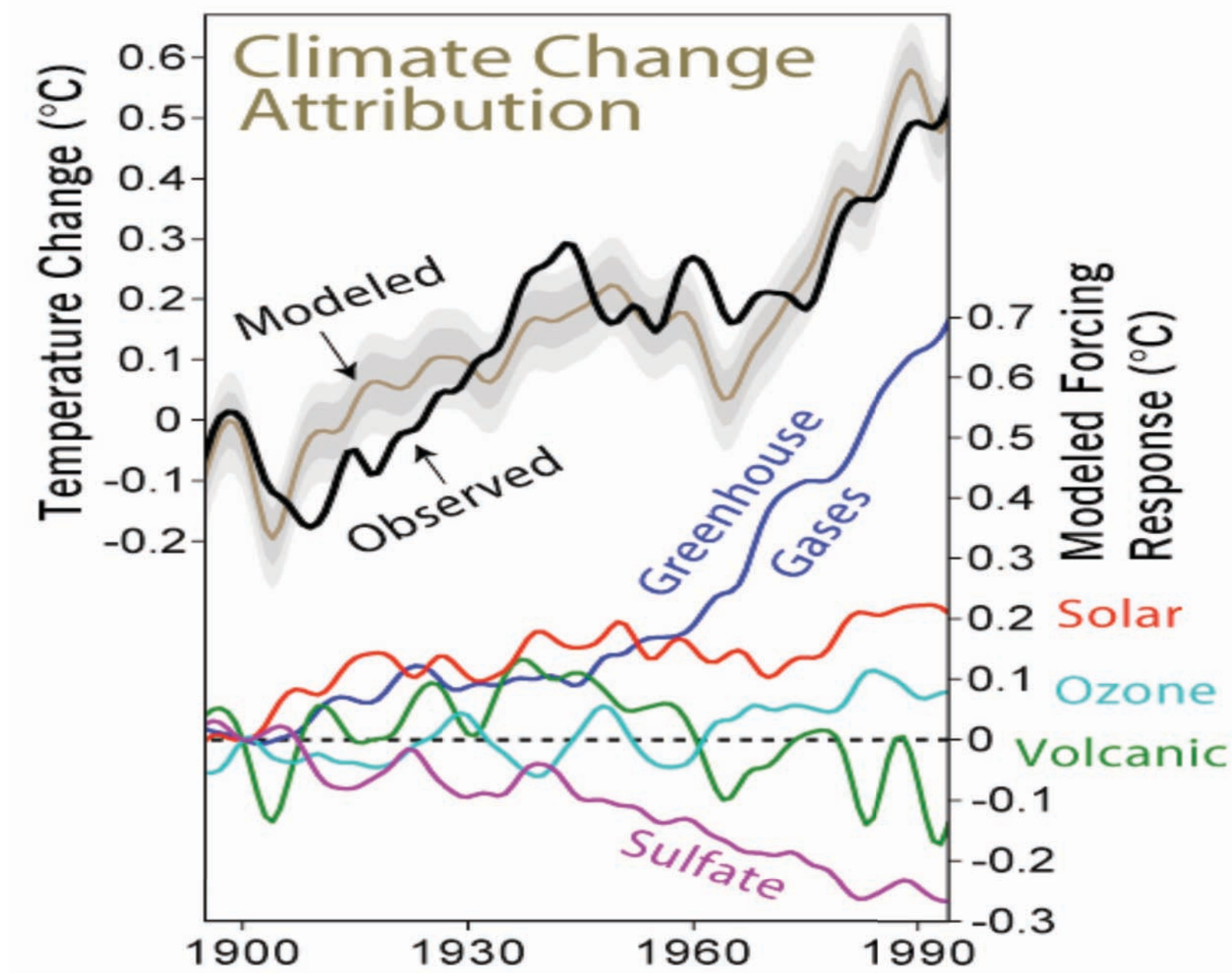
Pre-1850 - Northern Hemisphere temperature reconstruction



Pre-Industrial Northern Hemisphere temperature trends in the pre-industrial period



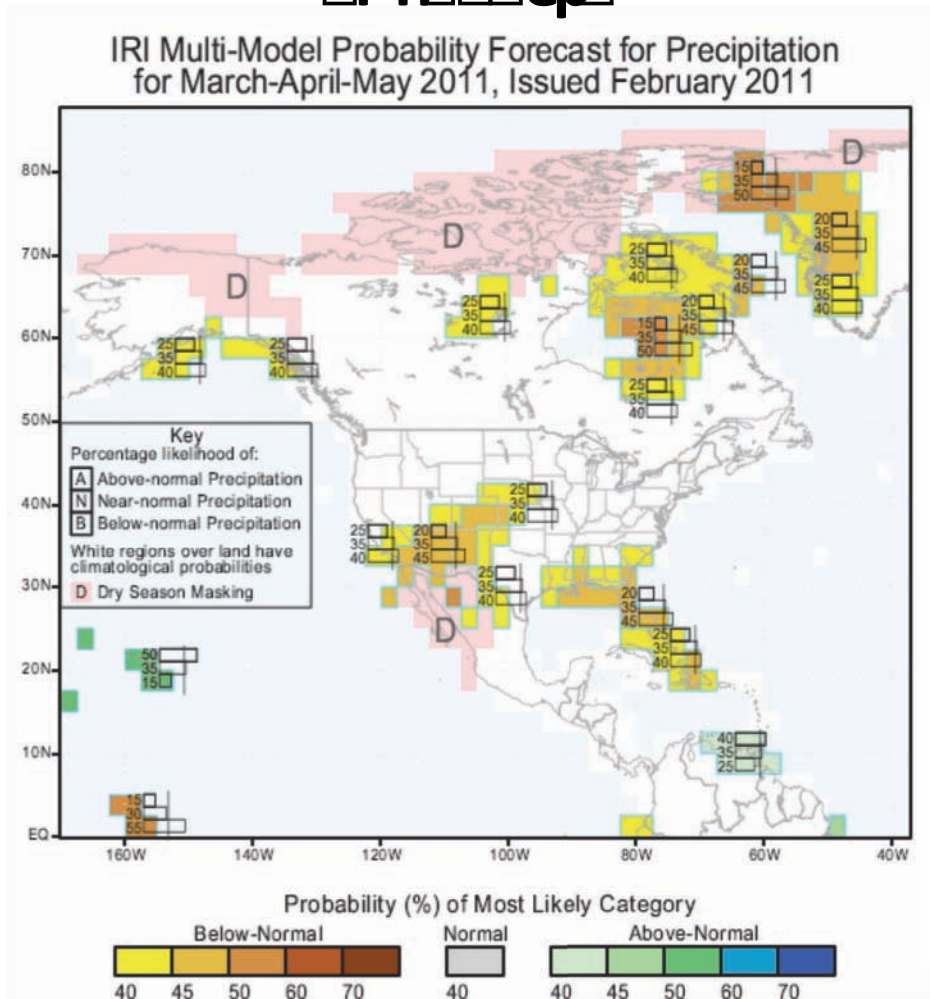
Modeling the response of the climate system to various forcings



To Understand the Past or to Make a Climate Prediction of the Future

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- **May Need to Predict Variations in External Forcing**
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- **Need to Recognize Predictions/Projection Will Have Uncertainty**
 - Sometimes Predictions/Projections will “Bust”

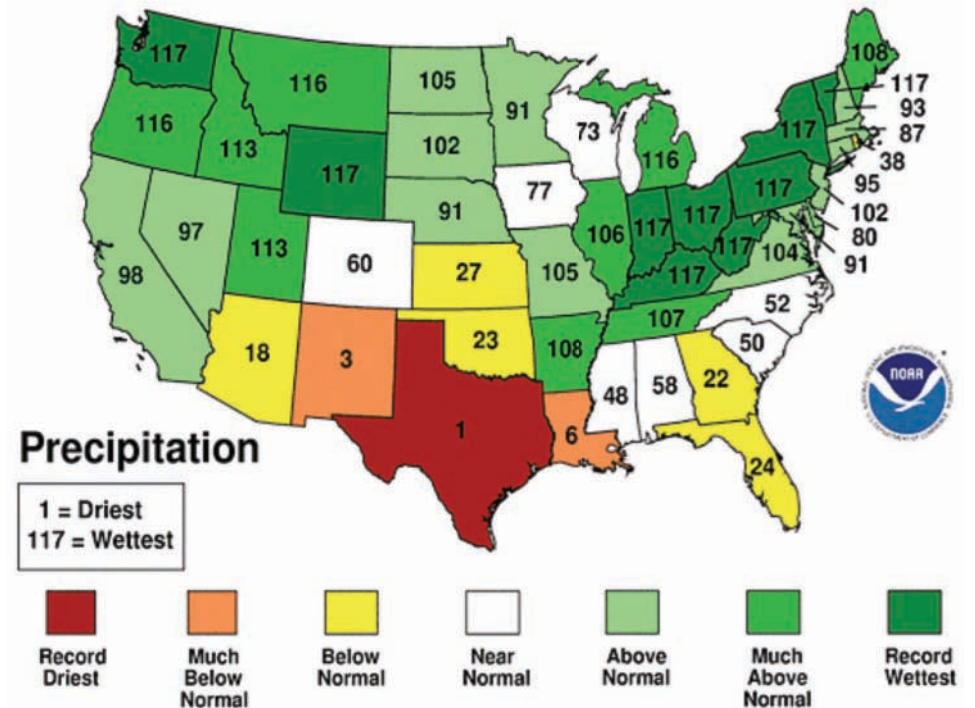
Pre-Seasonal



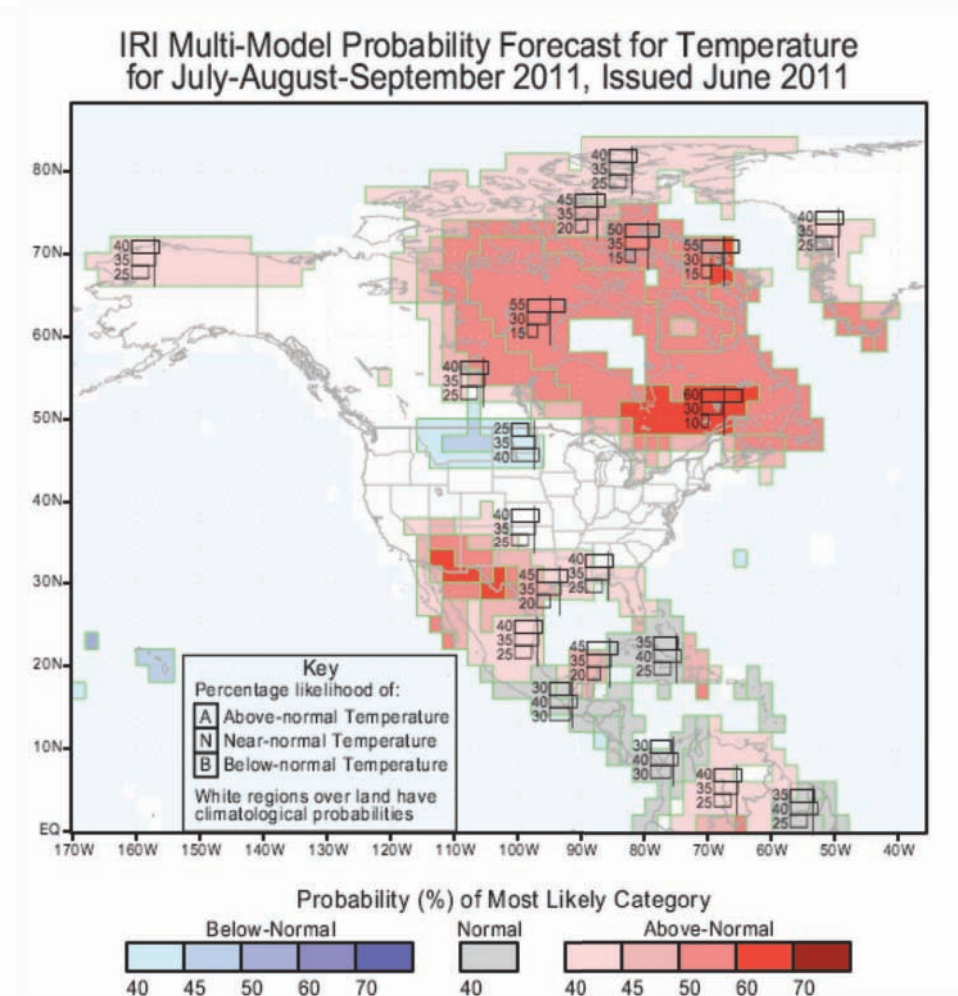
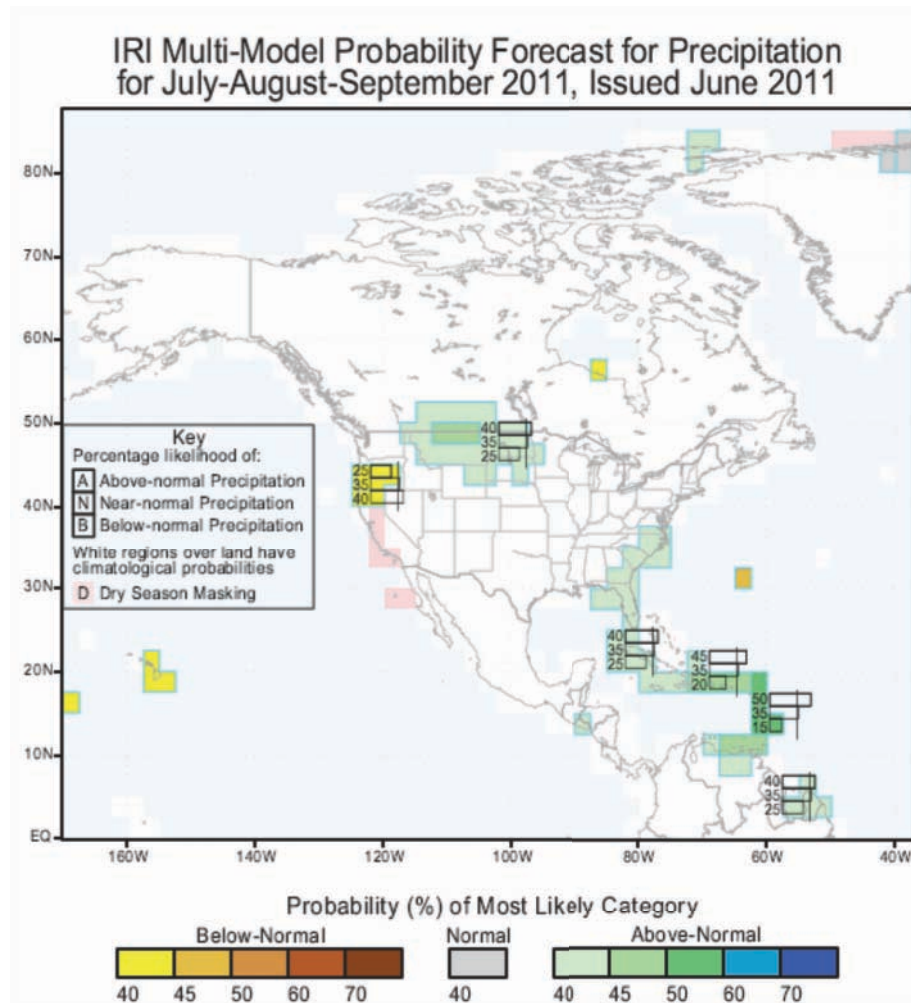
Seasonal

March-May 2011 Statewide Ranks

National Climatic Data Center/NESDIS/NOAA



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Figure 1: Time series of normalized anomalies of the global average surface temperature (GAST) and the global average surface temperature (GAST) for the period 1960–2020. The figure shows two panels: (a) GAST and (b) GAST. The y-axis represents the normalized anomaly (Norm anom) ranging from -3 to 3. The x-axis represents the year from 1960 to 2020. The black line represents the GAST, and the colored lines represent the GAST for different regions: North America (blue), Europe (green), Asia (yellow), Africa (orange), and Australia (red). The shaded gray area represents the confidence interval.

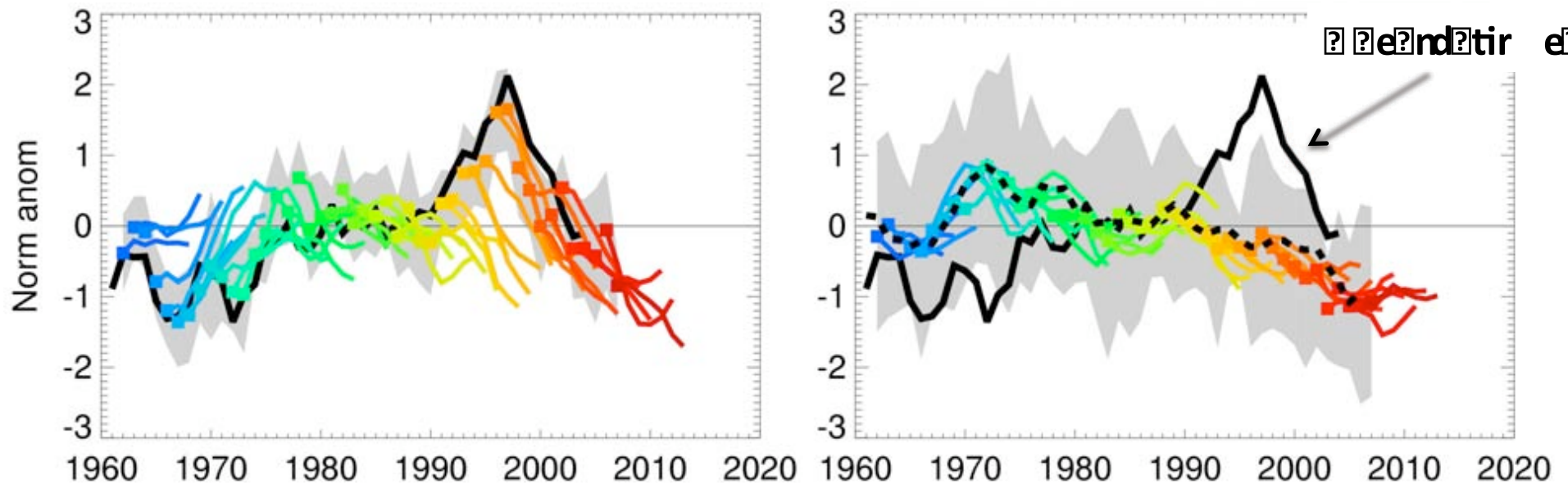


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• The GAST is a measure of the global average surface temperature (GAST) and is a key indicator of climate change. The GAST is calculated as the average of the surface temperatures of the Earth's surface, weighted by the area of each region. The GAST is a measure of the global average surface temperature (GAST) and is a key indicator of climate change.

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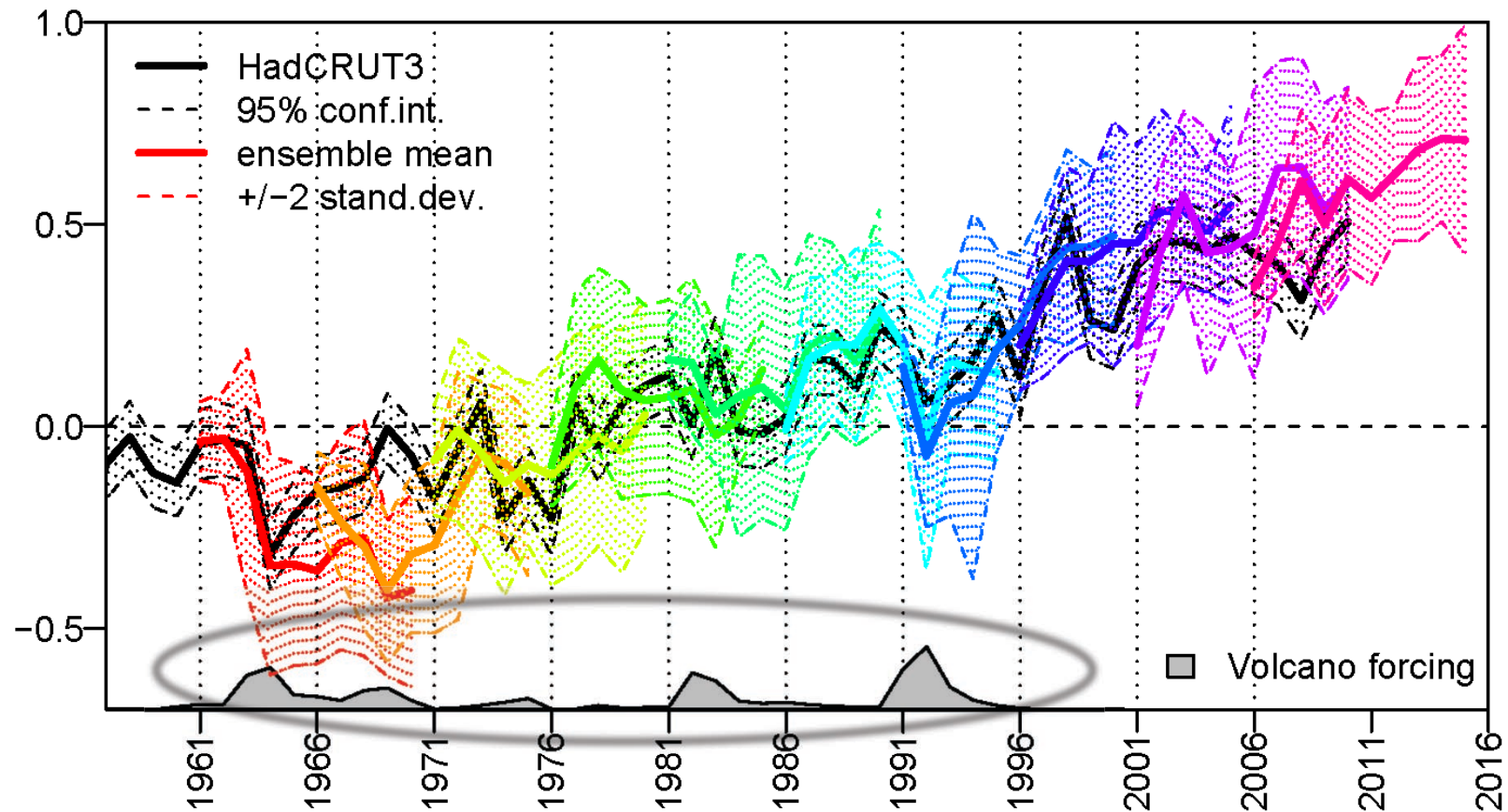
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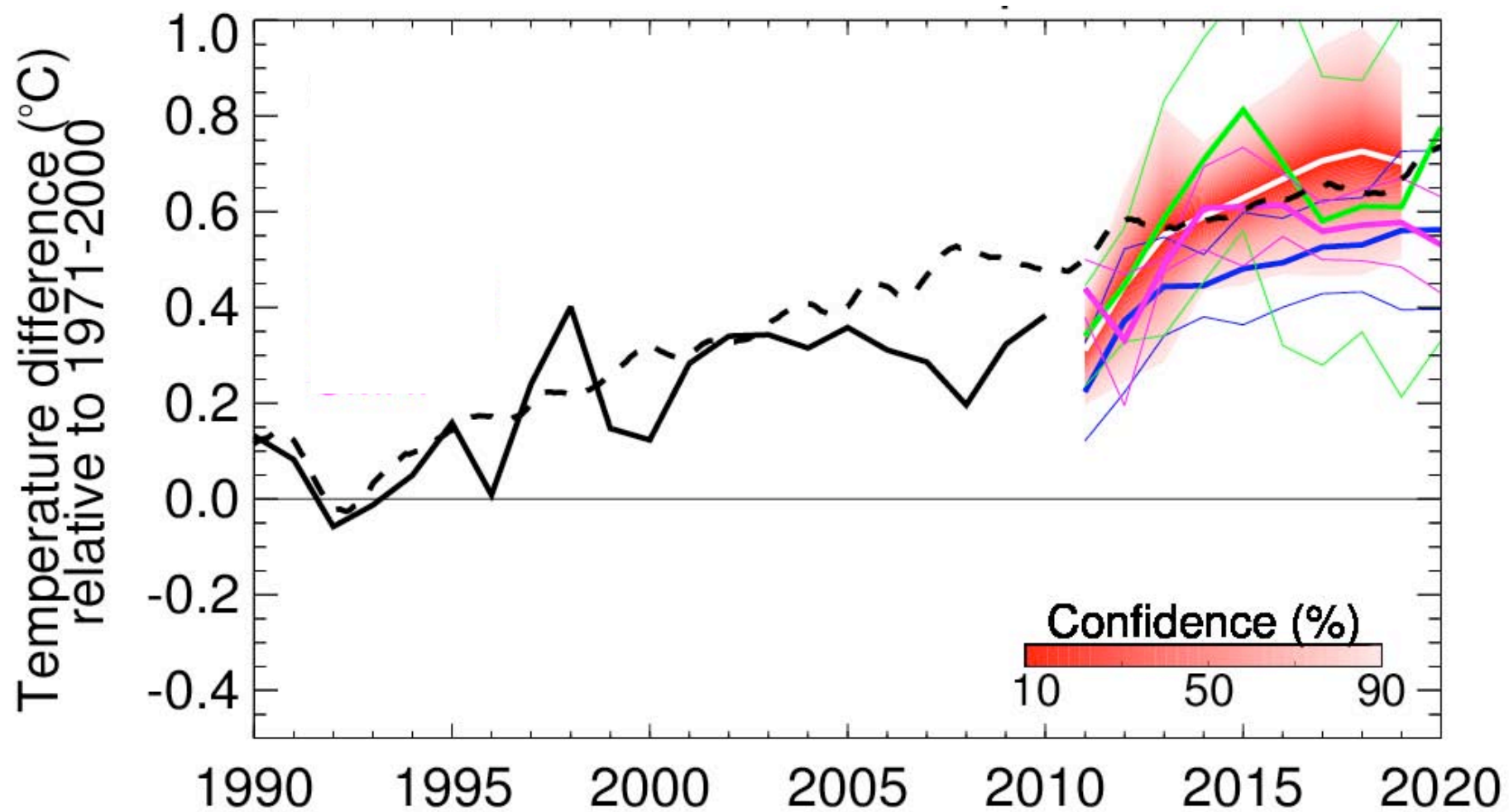
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ANN SCREEN TEMPERATURE GLOBAL (K) annual means



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Global Mean Temperature



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