State of the Climate: Recent Developments

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NOAA's National Climatic Data Center

NCDC

NCDC Climate Monitoring Branch

http://www.ncdc.noaa.gov/climate-monitoring

- NCDC moved 1940s
  - Asheville, NC
- CMB est. 1998
  - Provides regular "State of the Climate" reports
  - Mission: "monitor and assess the state of the climate"
  - We deal in data – the *observed* climate. This approach complements, informs and draws from larger climate science (the *understood* climate)

About Me

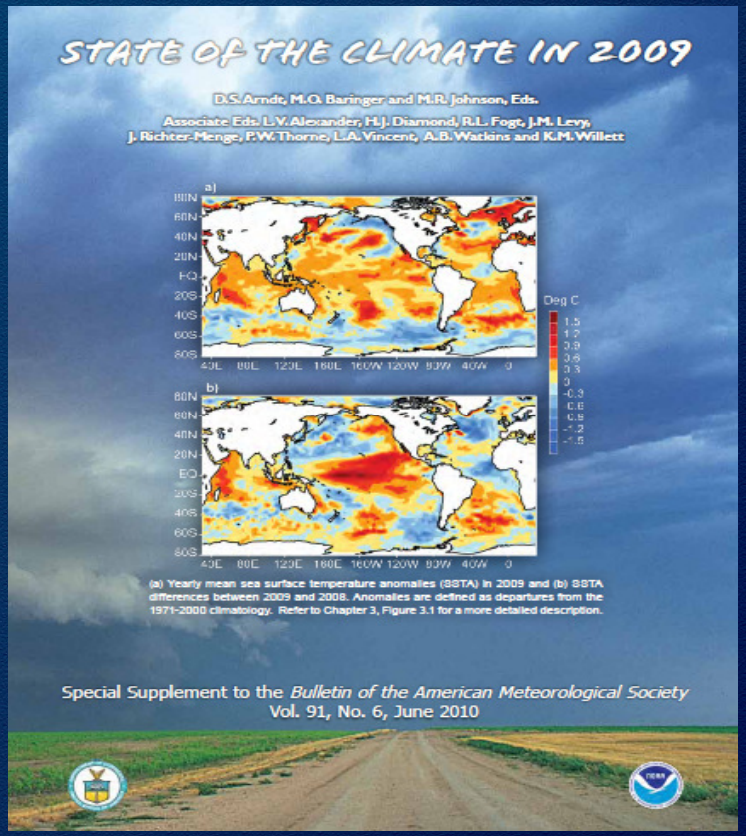
- I'm a meteorologist by training & education
  - I learned about weather systems, jet streams, storms, tornadoes, etc.
  - Then I got into drought … then local climate … then big-picture climate
- My meteorology background is just a tiny part of the climate system
  - Emblematic of the climate-is-bigger-than-any-one-discipline/problem/issue/opportunity
  - My doctoral work in adult education is becoming more relevant, too, which is really fun!

(global and decadal)

STATE OF THE CLIMATE: LARGER SCALES

State of the Climate

- Much of the following taken from “State of the Climate in 2009”.
- “Annual physical” of the climate system

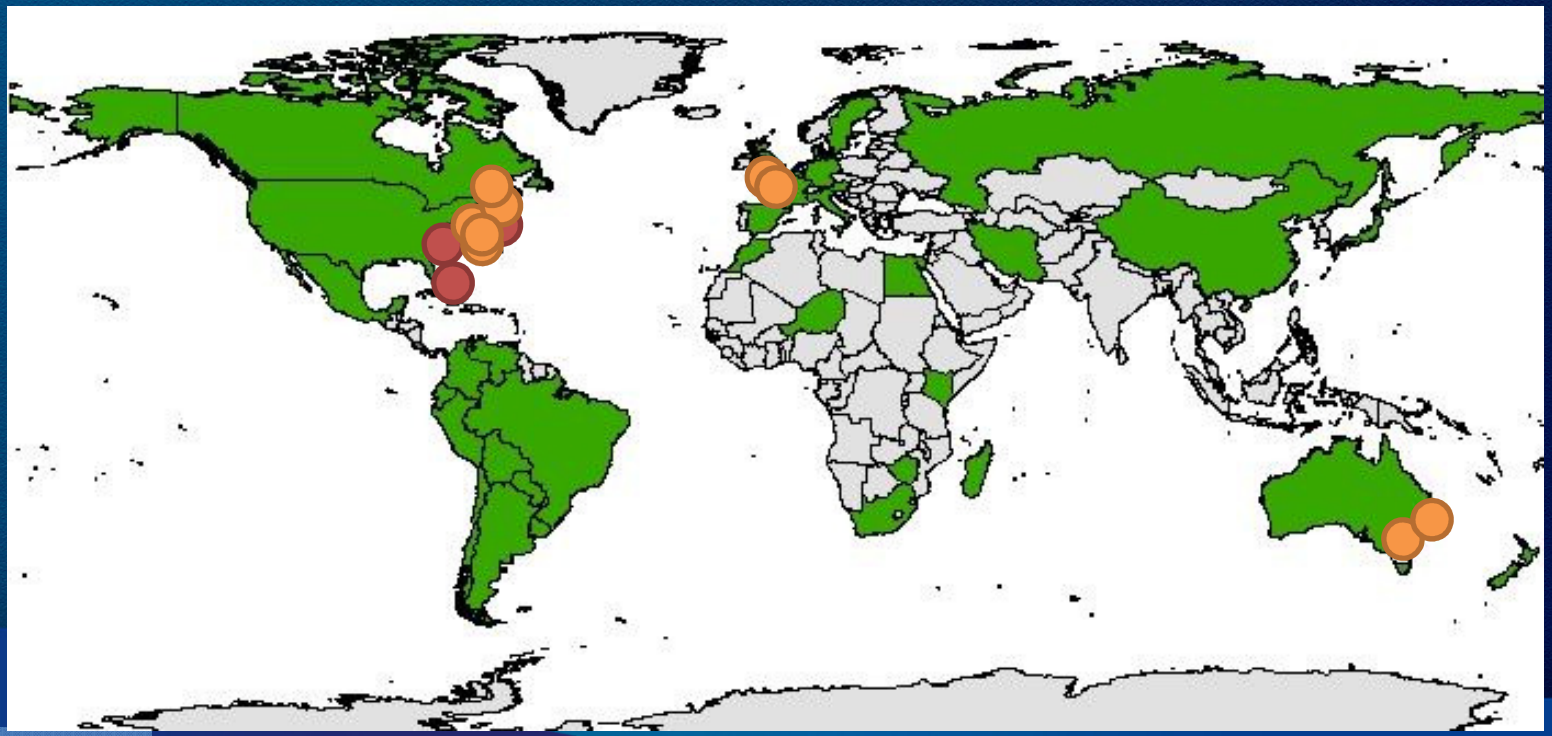


http://www.ncdc.noaa.gov/bams-state-of-the-climate/2009.php

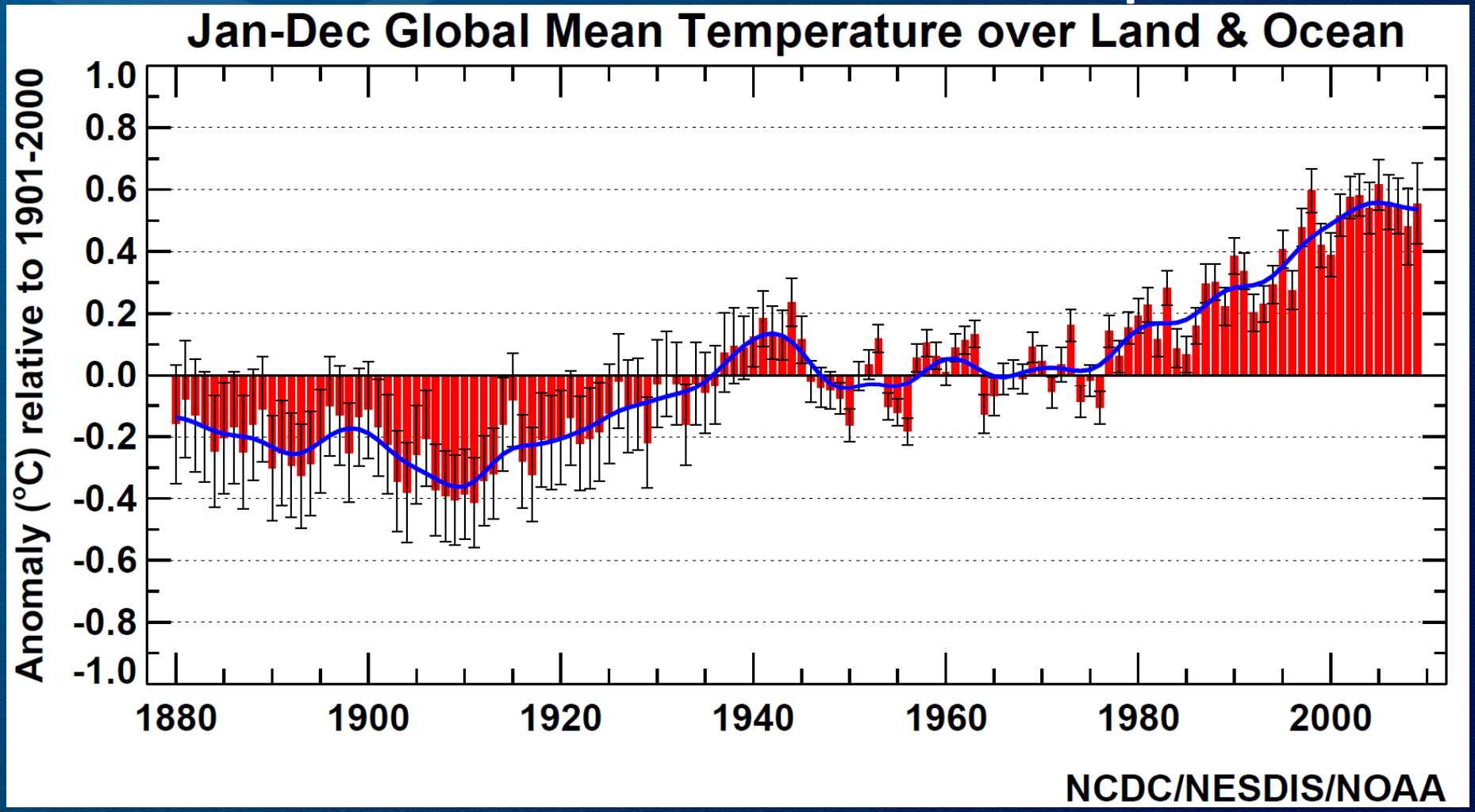
Click on “Key Climate Indicators”

BAMS SotC Authors & Editors

- 305 authors from 43 Nations
- Argentina, Australia, Austria, Belgium, Bolivia, Brazil, Canada, Chile, China, Colombia, Comoros, Costa Rica, Cuba, Denmark, Ecuador, Egypt, France, Germany, Iran, Italy, Jamaica, Japan, Kenya, Madagascar, Mauritius, Mexico, Morocco, New Zealand, Niger, Paraguay, Peru, Russia, Seychelles, Solomon Islands, South Africa, Spain, Sweden, Taiwan, United Kingdom, United States, Uruguay, Venezuela, Zimbabwe



Global Scale: Historical Perspective



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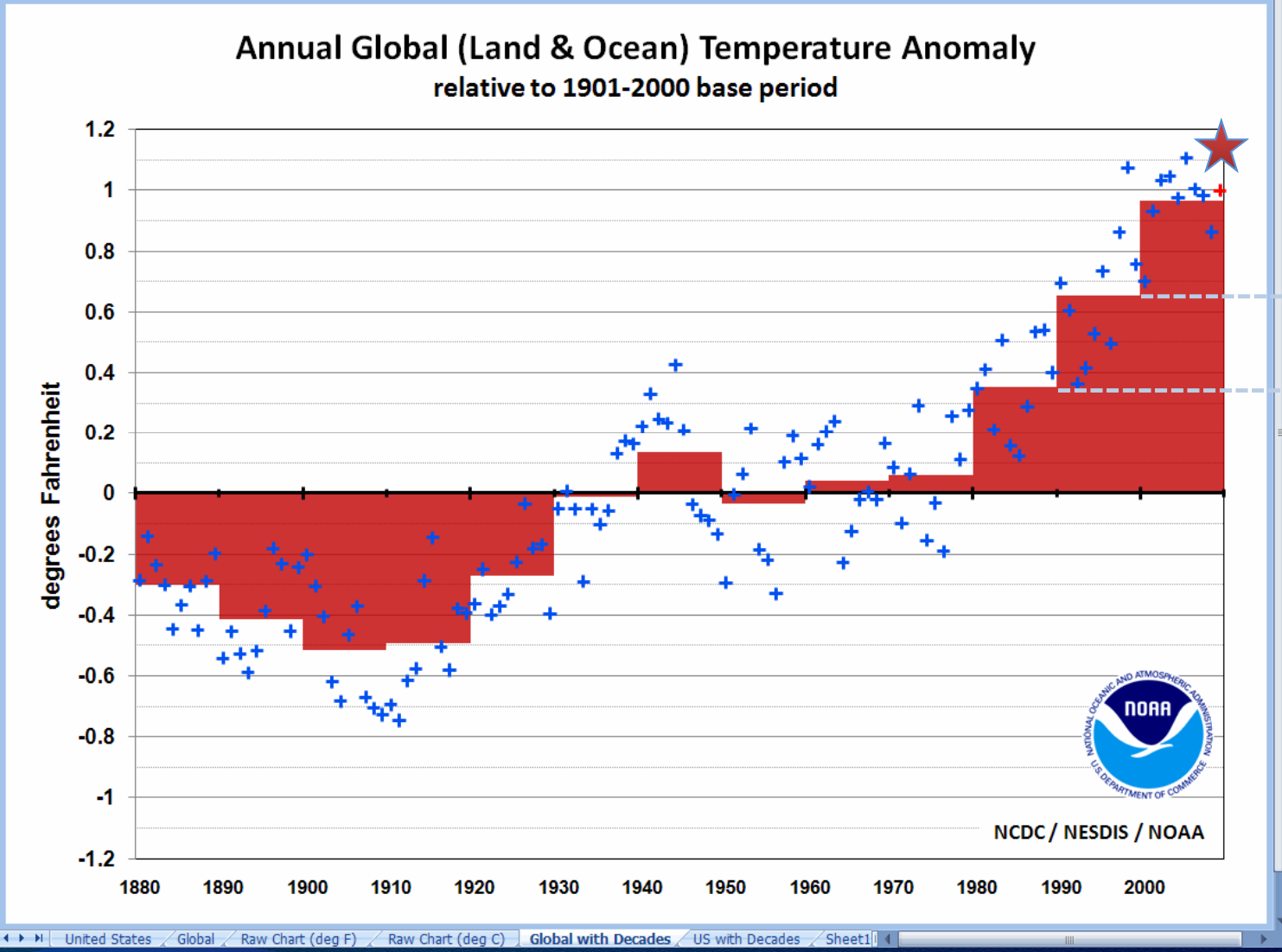
1880-2009 Global Temperature



2010 through September

1990s warmest decade at the time. Every year of 2000s warmer than 1990s average.

1980s warmest decade at the time. Every year of 1990s warmer than 1980s average.

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Essential Climate Variables

Atmosphere: Surface	Atmosphere: Upper-Air	Atmosphere: Composition	Ocean: Surface	Ocean: Subsurface	Terrestrial
Air Temperature	Earth Rad'n Budget	Carbon Dioxide	Temperature	Temperature	Soil Moisture
Precipitation	Temperature	Methane	Salinity	Salinity	Snow Cover
Air Pressure	Wind Speed & Dir	Ozone	Sea Level	Current	Permafrost + Seasonally Frozen
Sfc Rad'n Budget	Water Vapor	Nitrous Oxide	Sea State	Nutrients	Glaciers + Ice Caps
Wind Speed & Dir	Cloud Properties	CFCs	Sea Ice	Carbon	River Discharge
Water Vapor		Hydro CFCs	Current	Ocean Tracers	Water Use
		Hydrofluorocarbs	Ocean Color	Phytoplankton	Ground Water
		Sulfur Hexafluorides	CO_2 Partial Pressure		Lake Levels
		Perfluorocarbons			Albedo
		Aerosol Properties			Land Cover
					Percent Absorbed Photosynthetically Active Radiation
					Leaf Area Index
					Biomass
					Fire Disturbance

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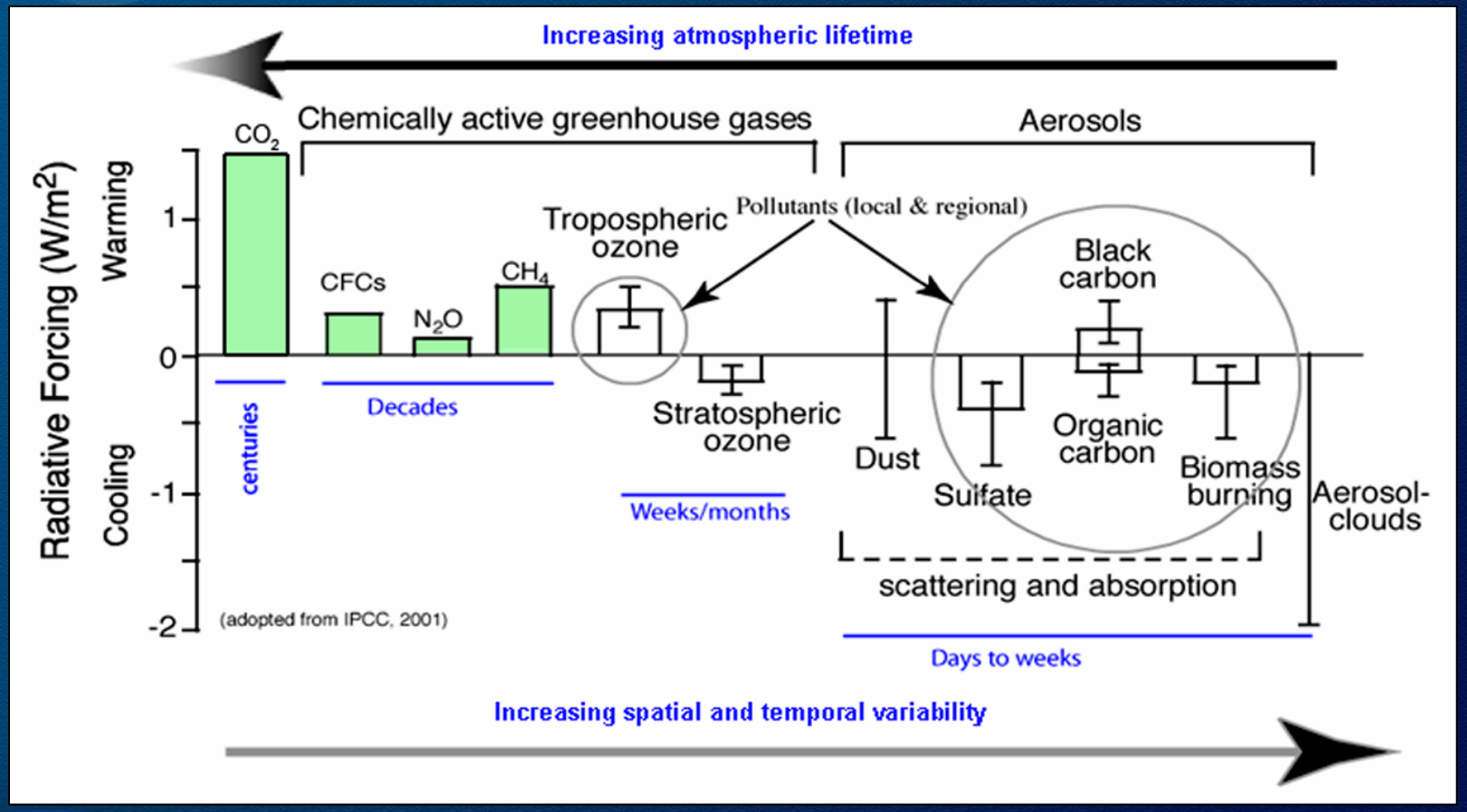
Why CO_2?

CO_2 is **the GHG** among greenhouse gases because:
There's a lot of it, it's increasing over time, and it lasts a long time



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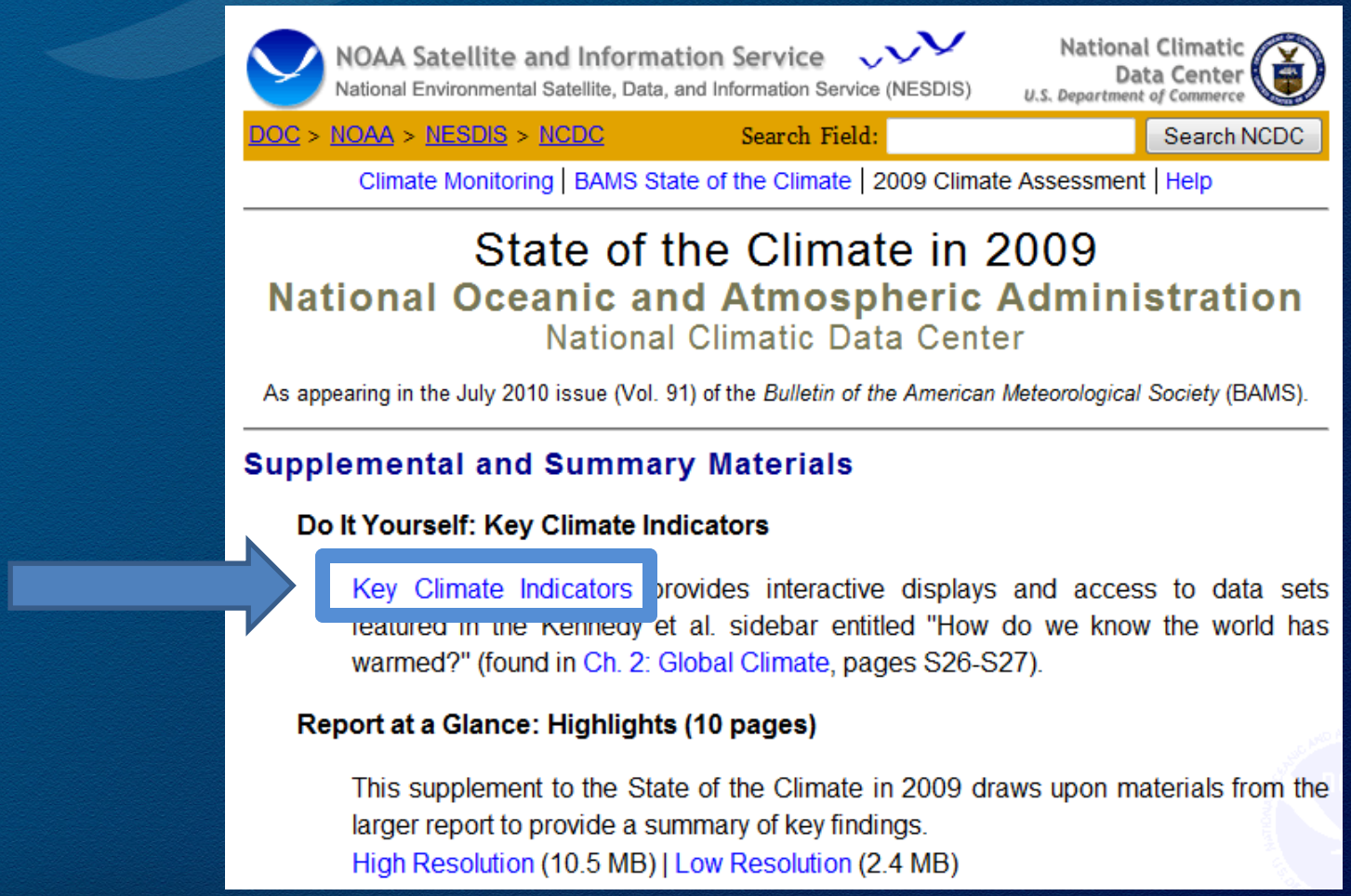
Ravishankara (2006)

Multiple Climate Indicators



NOAA Satellite and Information Service
National Environmental Satellite, Data, and Information Service (NESDIS)

National Climatic Data Center
U.S. Department of Commerce

DOC > NOAA > NESDIS > NCDC Search Field: Search NCDC

Climate Monitoring | BAMS State of the Climate | 2009 Climate Assessment | Help

State of the Climate in 2009
National Oceanic and Atmospheric Administration
National Climatic Data Center

As appearing in the July 2010 issue (Vol. 91) of the *Bulletin of the American Meteorological Society* (BAMS).

Supplemental and Summary Materials

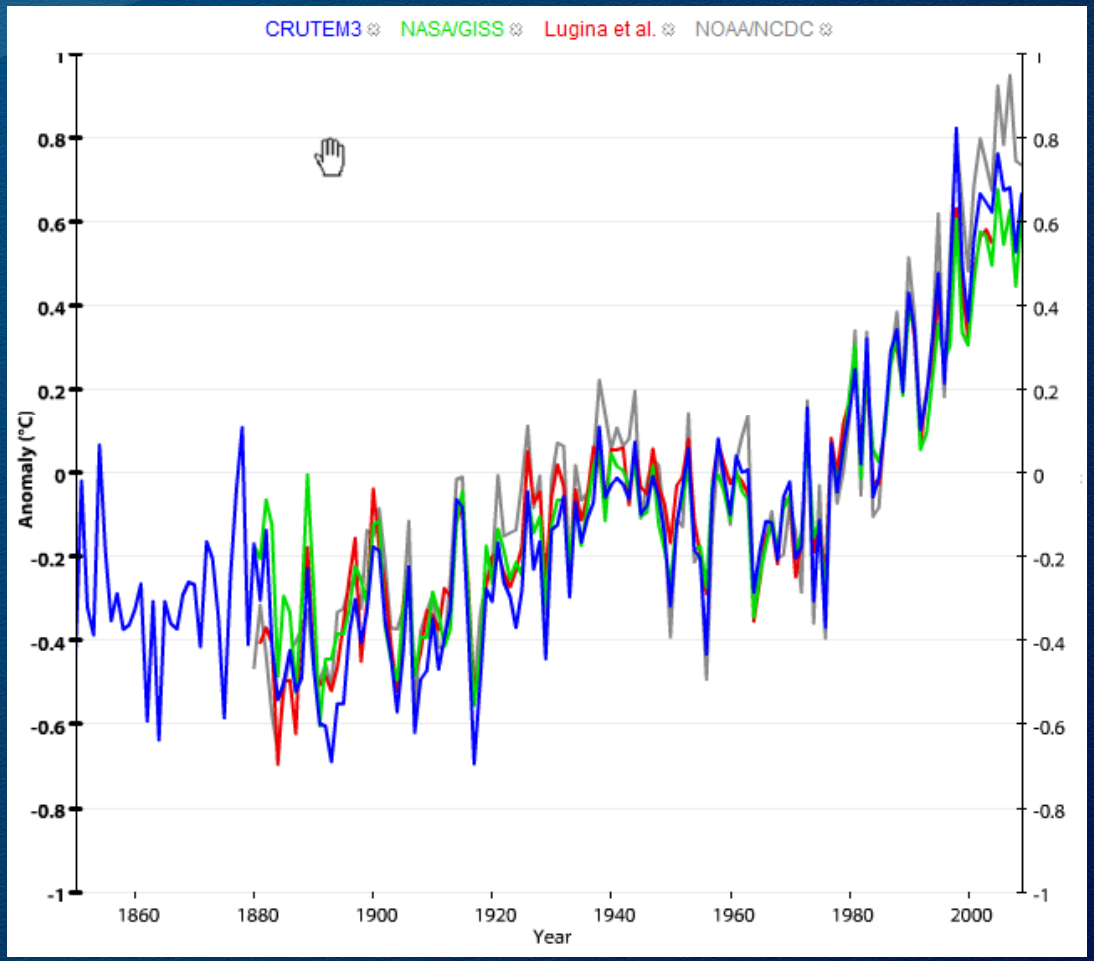
Do It Yourself: Key Climate Indicators

Key Climate Indicators provides interactive displays and access to data sets featured in the Kennedy et al. sidebar entitled "How do we know the world has warmed?" (found in Ch. 2: Global Climate, pages S26-S27).

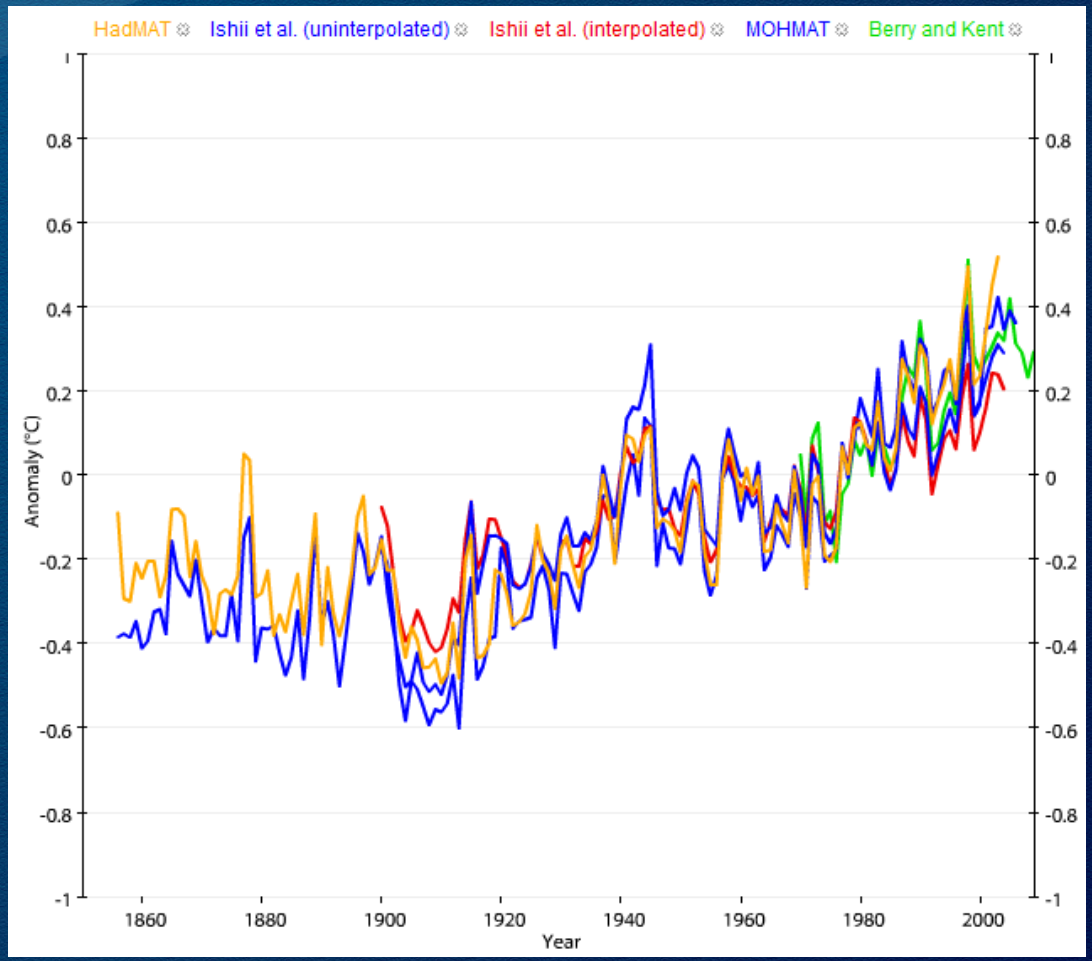
Report at a Glance: Highlights (10 pages)

This supplement to the State of the Climate in 2009 draws upon materials from the larger report to provide a summary of key findings.
High Resolution (10.5 MB) | Low Resolution (2.4 MB)

Globally: Temperature over Land



Globally: Temperature over Oceans



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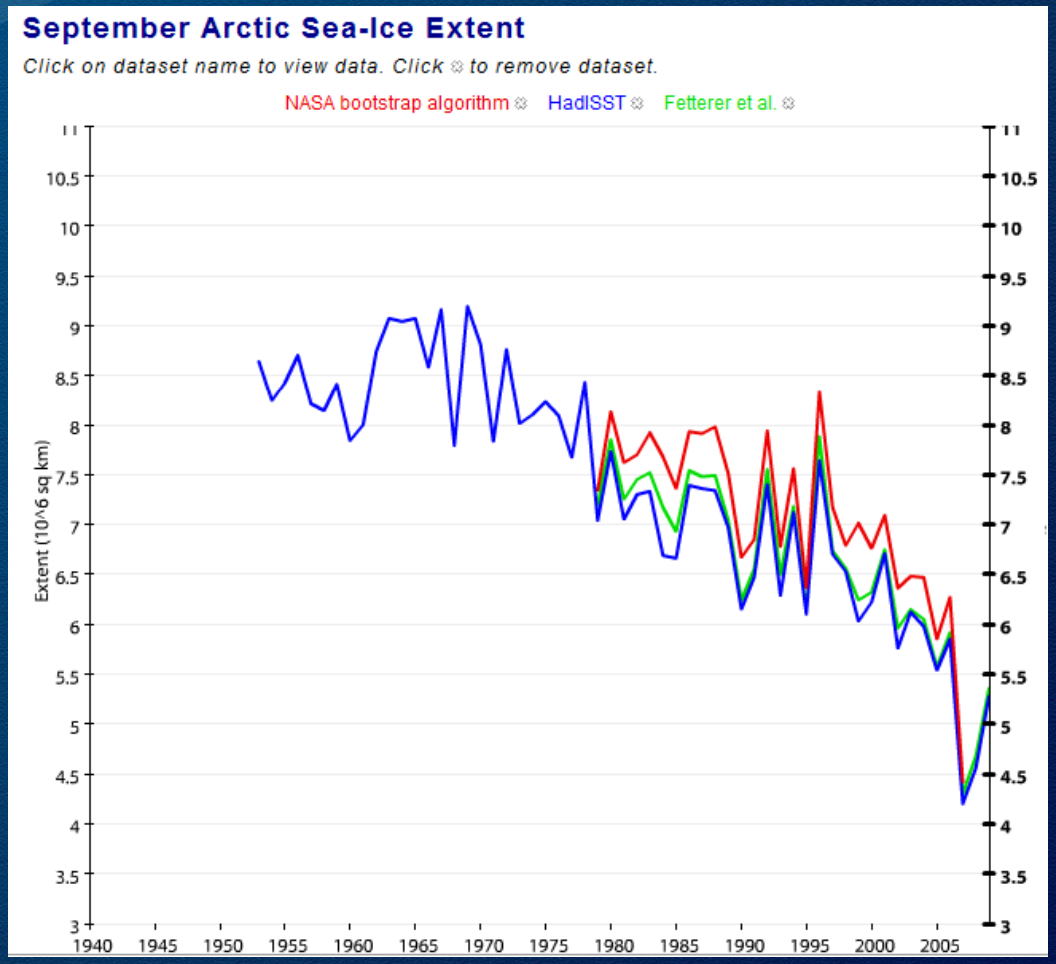
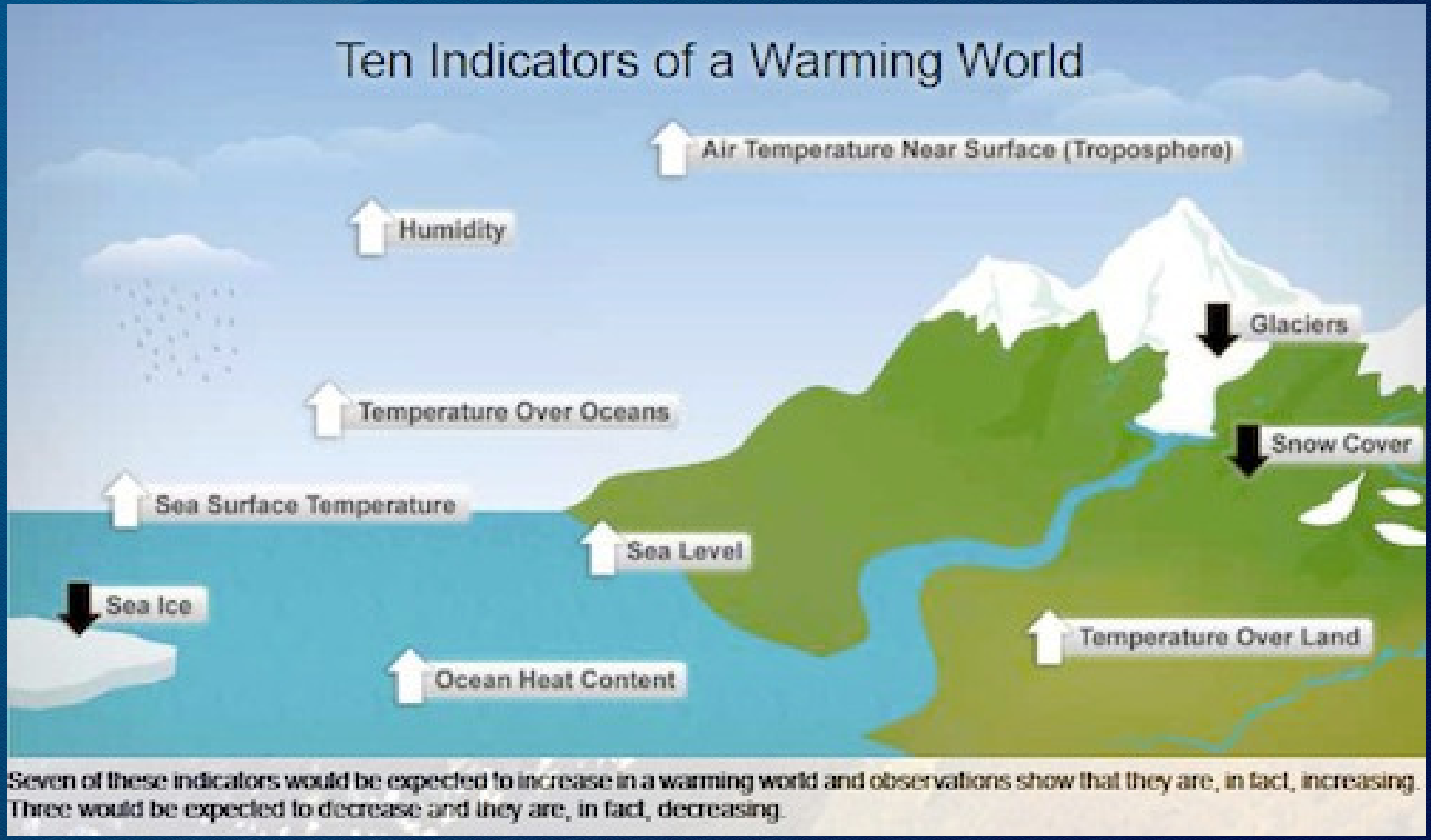
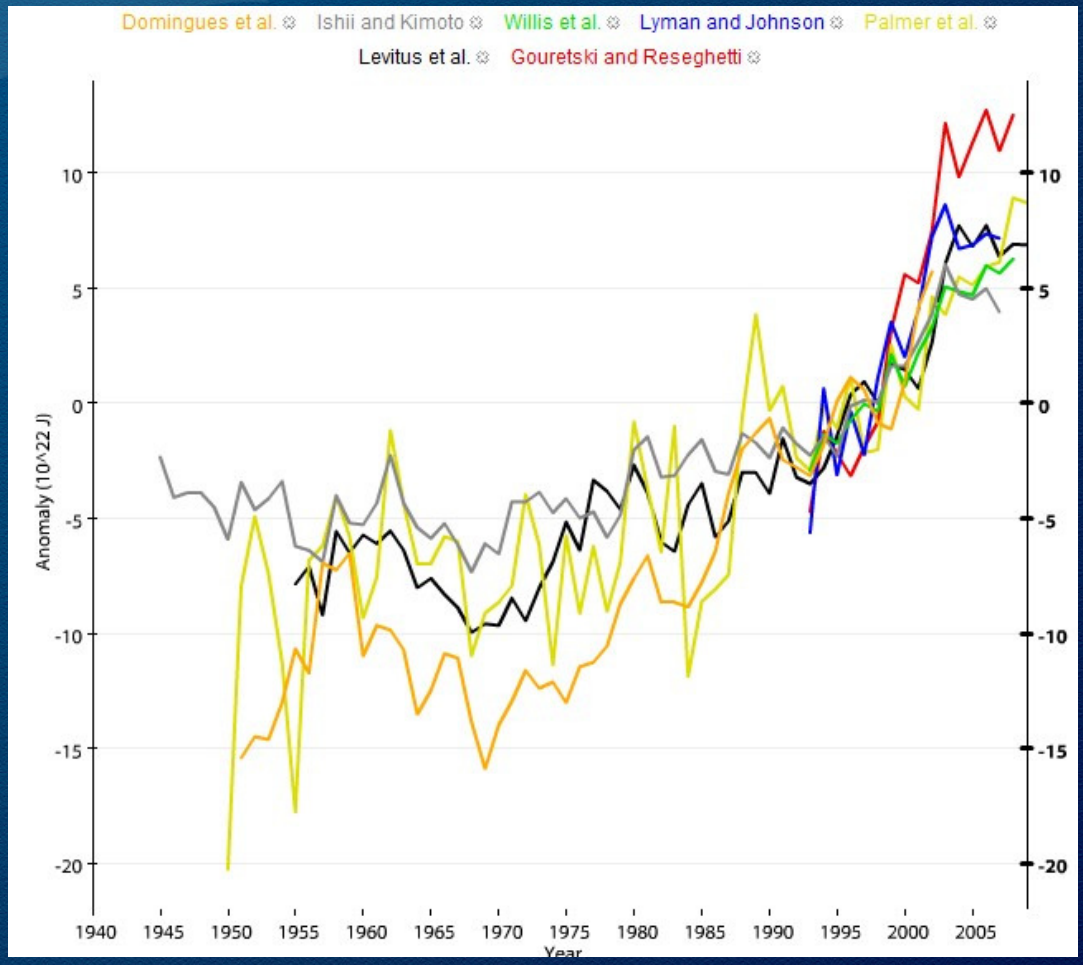
Northern Hemisphere Sea Ice



Global-scale evidence: a warming world



Global Ocean Heat Content
(upper layers)



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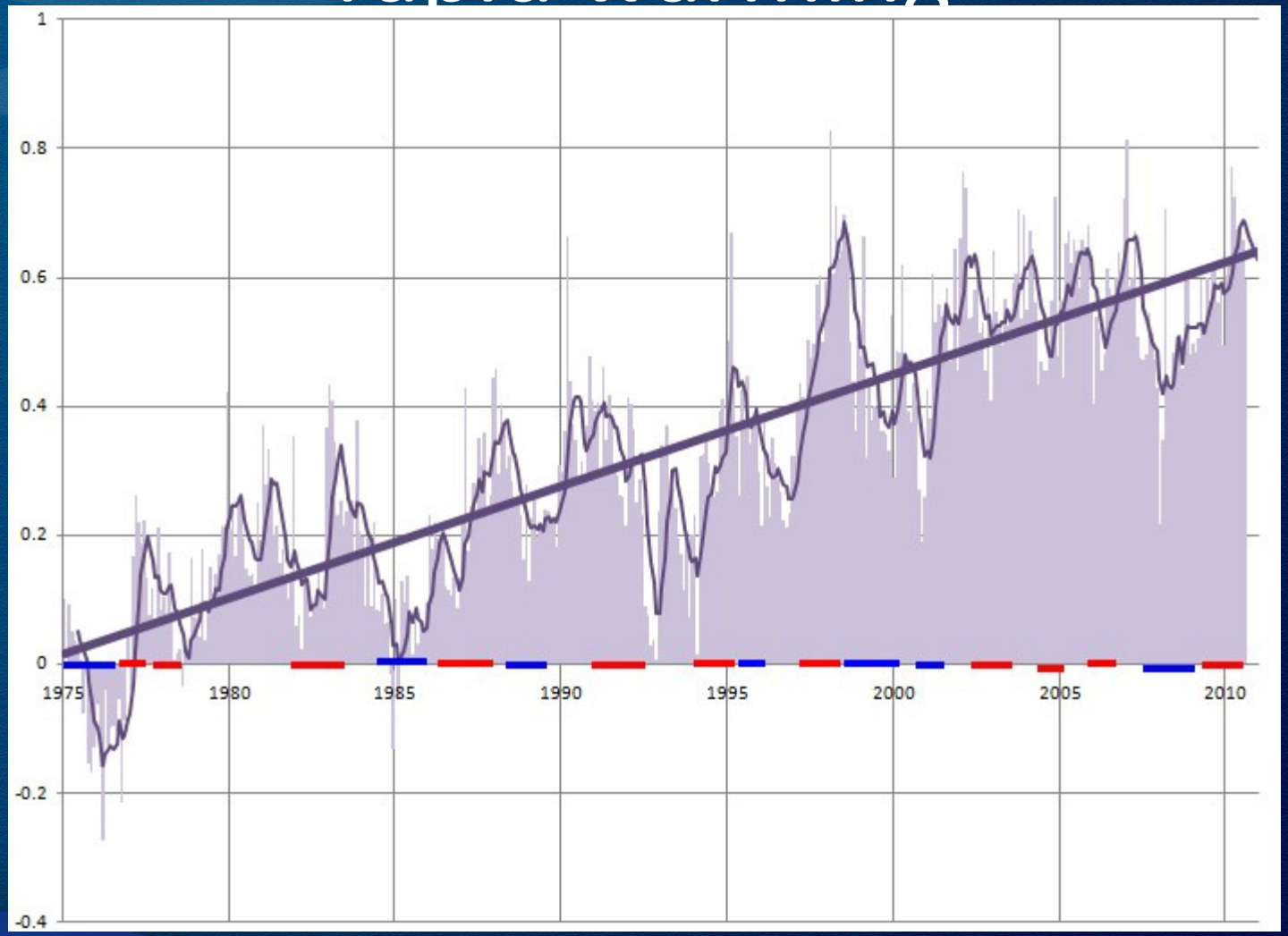
[sub-]continental and seasonal

STATE OF THE CLIMATE: SMALLER SCALES

Zooming in on the last ~30 years of rapid warming



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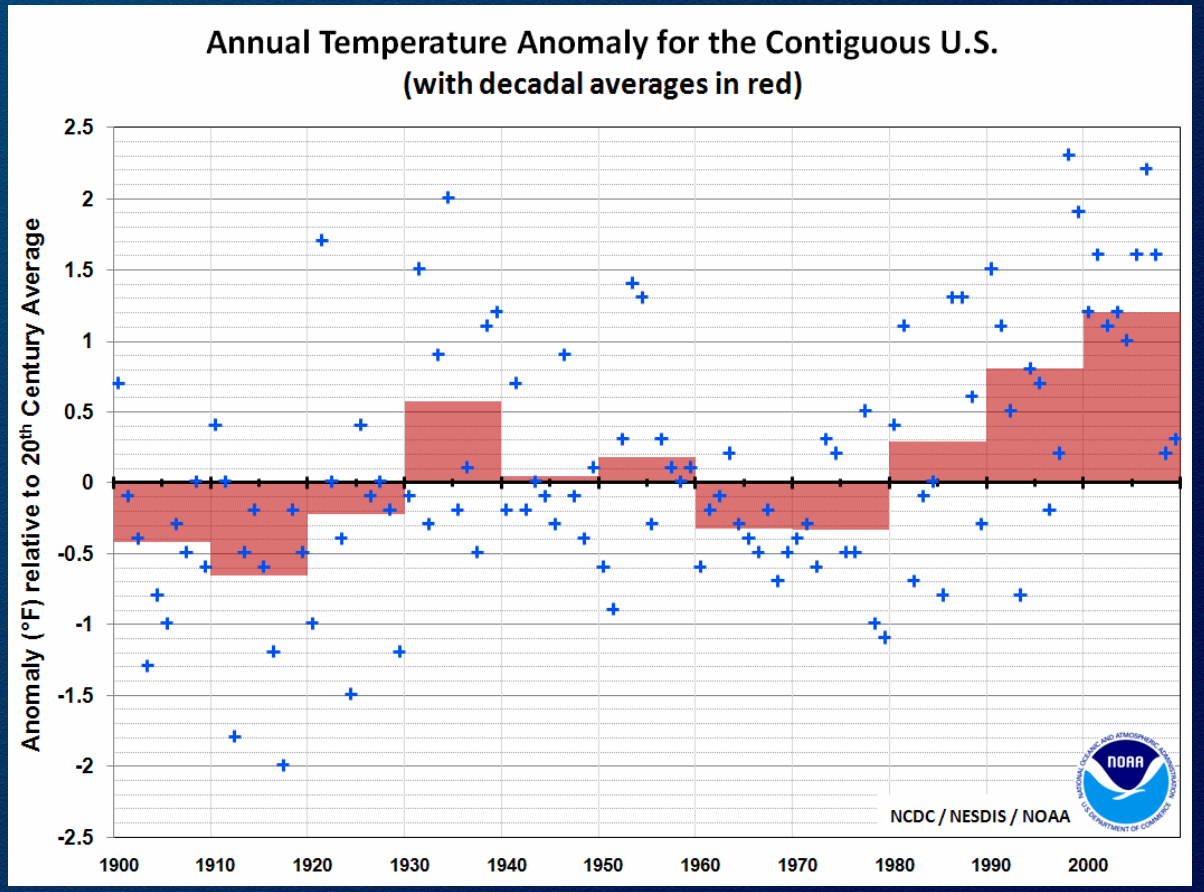
U.S. Temperature since 1895

- More variability: "Noisier" than global trace (the US is just 2% of the world)
- Happens to be warming at the same rate as the rest of the globe since 1895



Relationship between weather & climate

Literature Review: Stallone et al. (1976)

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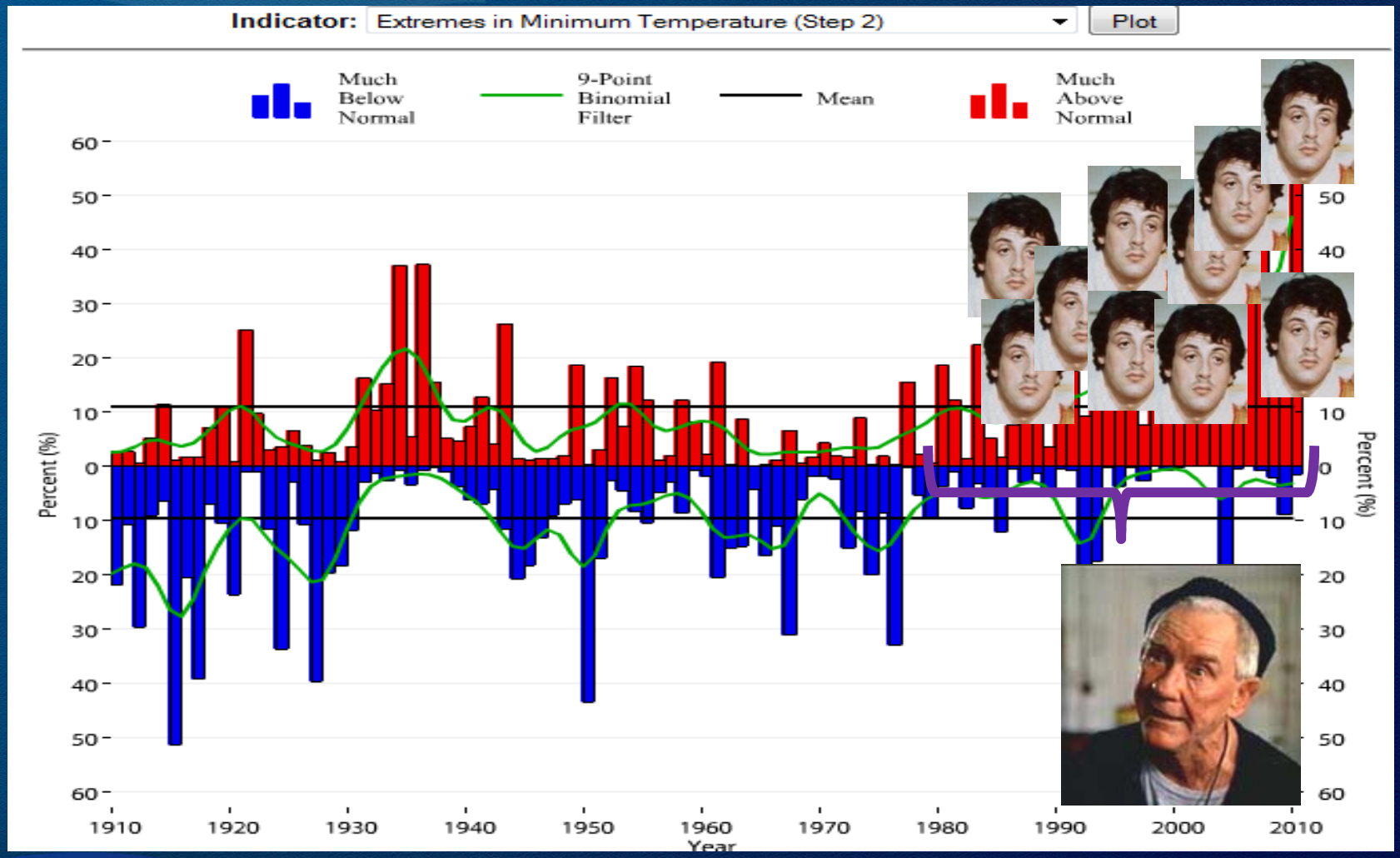
US Climate Extremes

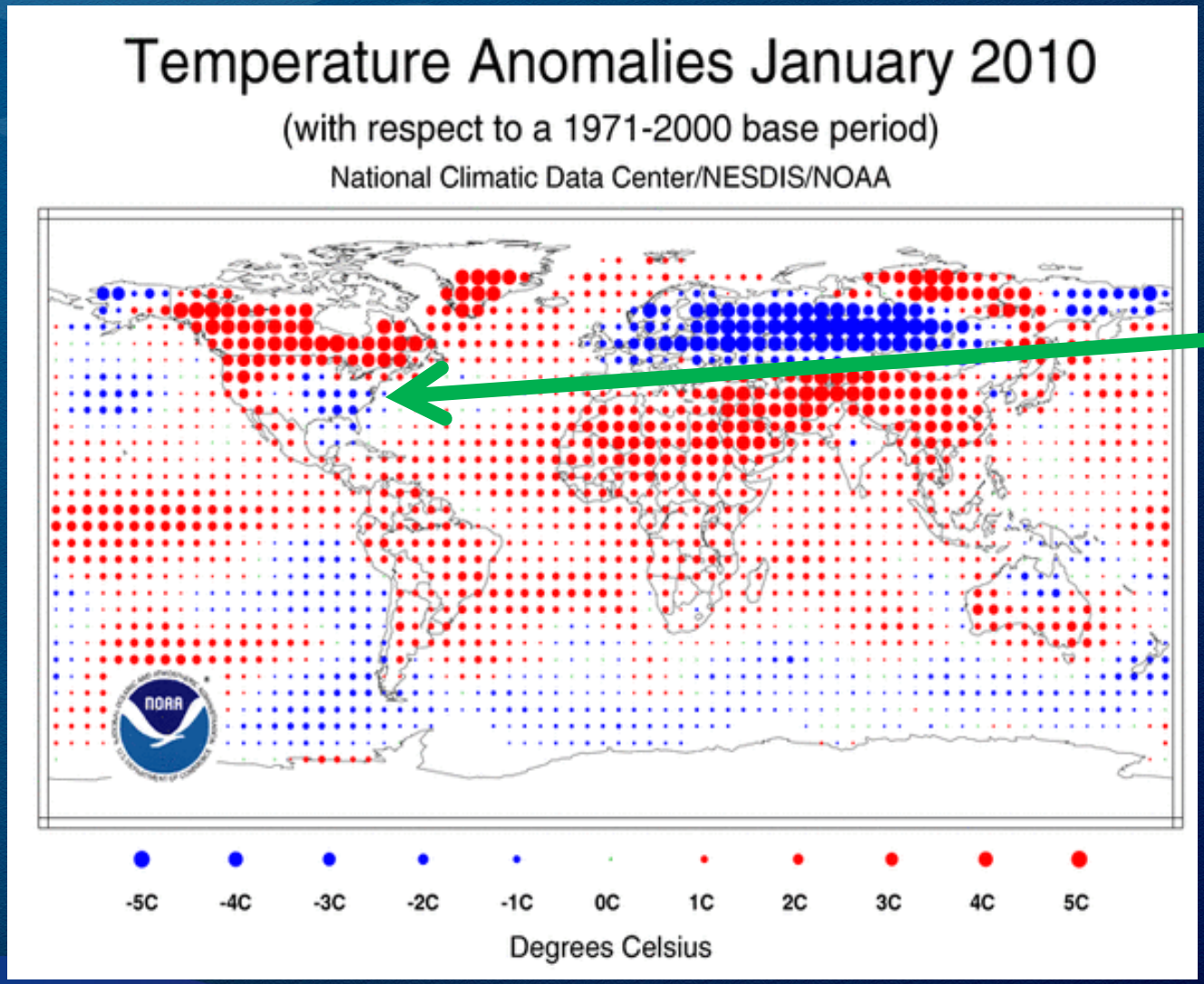
summer minimum temperatures



State Climate Extremes so far in 2010

- Feb 2010: all-time WV monthly snowfall at a station (Bayard, WV)
- Mar 2010: Wettest Mar for NJ, MA, RI
- Apr 2010: Warmest Apr for IL, NJ, CT, RI, ME
- Spring 2010: Warmest spring for MI, NJ, NY, CT, RI, MA, VT, NH, ME
- Jun 2010: Warmest Jun for NC, DE, NJ; Wettest Jun for MI
- First Half 2010: Warmest on record for ME, VT, NH, RI
- Jul 2010: Warmest Jul for DE, RI
- Summer 2010: Warmest summer for AL, GA, TN, SC, NC, VA, MD, DE, NJ, RI; Wettest summer for WI
- Sep 2010: Driest on record for WY
- Sep 2010: Largest hailstone observed in Kansas (7.75" diameter)
- Mar-Sep 2010 ("warm season"): warmest on record for LA, FL, SC, NC, TN, KY, IN, OH, VA, WV, MD, DE, NJ, CT, RI, NH, VT, ME.

January Deep Freeze



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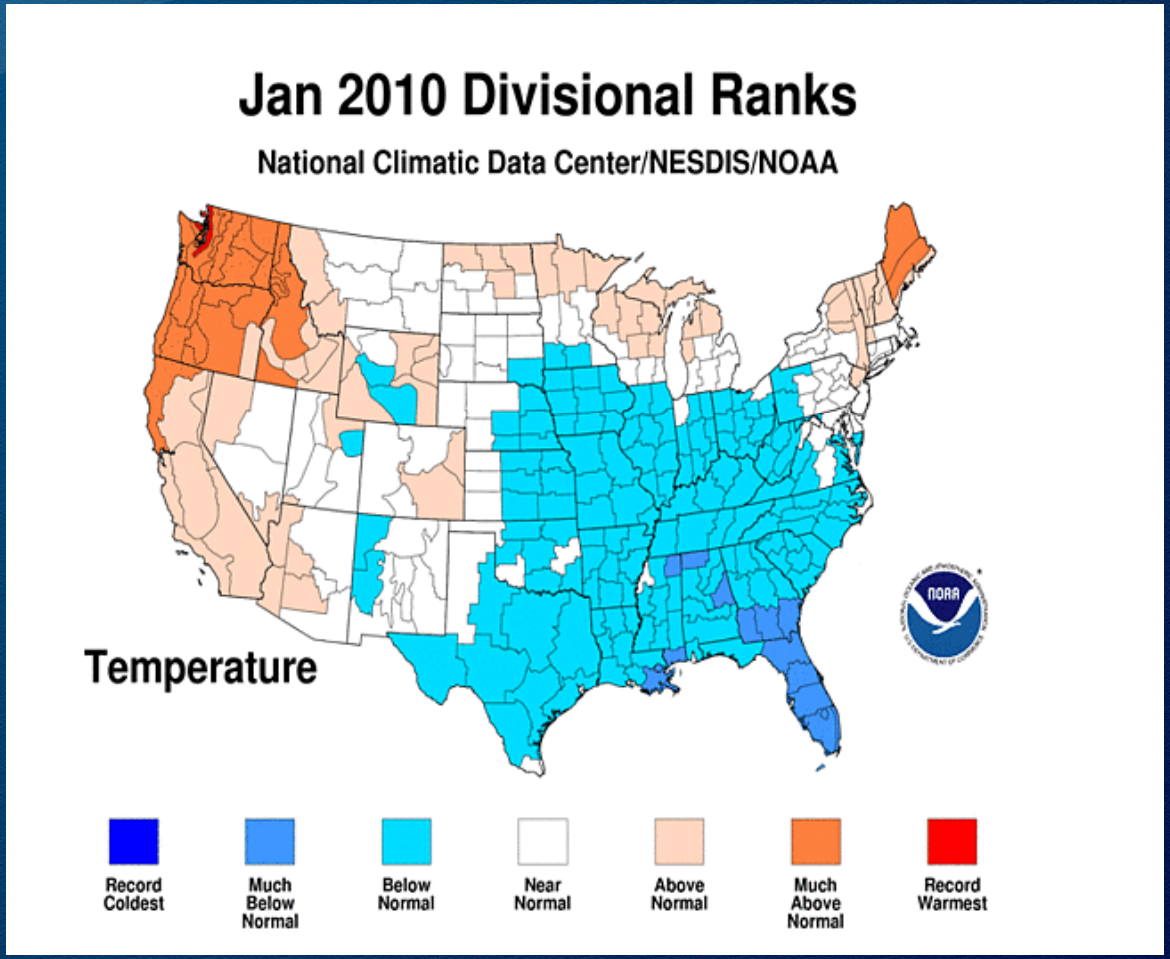
January Deep (but not wide) Freeze



The "Coldest Winter on Record"?

- December 2009, compared to 130 Decembers on record since 1880:

Latitude Belt	Land + Ocean	Land	Ocean
NH: 0-90N	19th warmest	54th warmest	2nd warmest
NH Polar: 60-90N	90th warmest (41st coldest)	92nd warmest (39th coldest)	18th warmest
NH Mid-Lat: 30-60N	59th warmest	78th warmest (53rd coldest)	18th warmest
NH Tropics: 0-30N	Warmest on record	2nd warmest	2nd warmest

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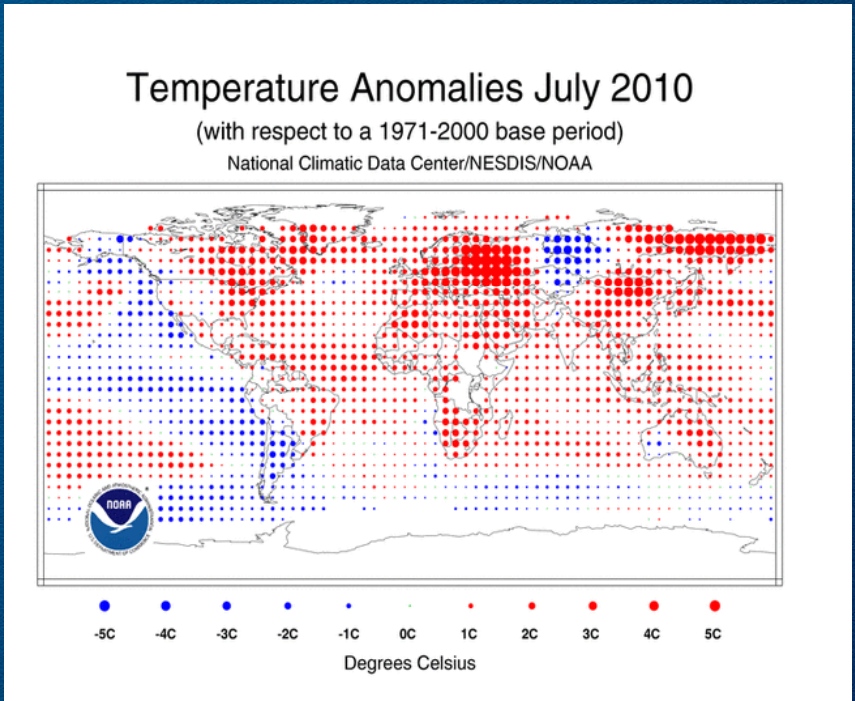
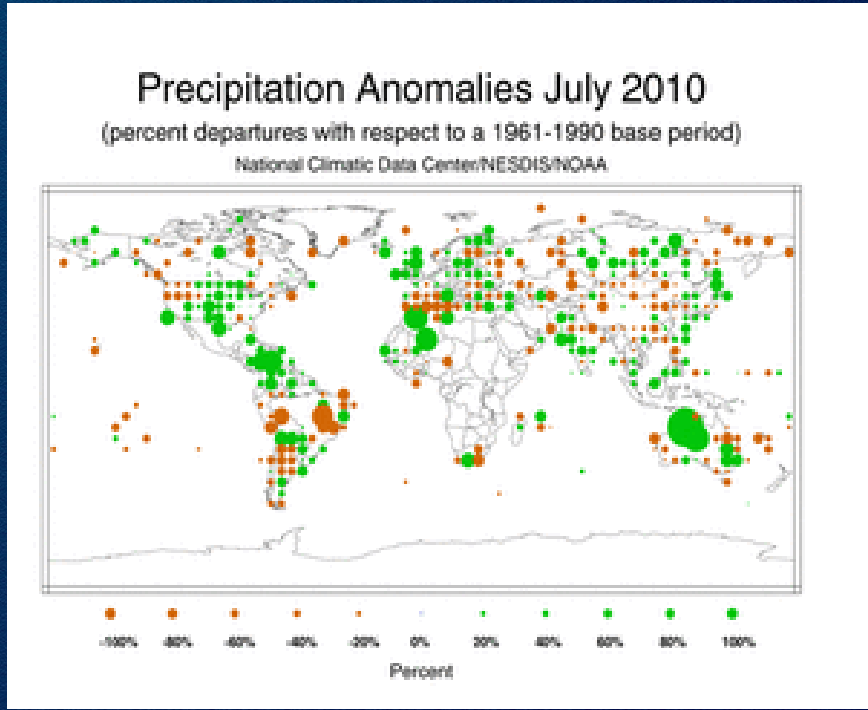
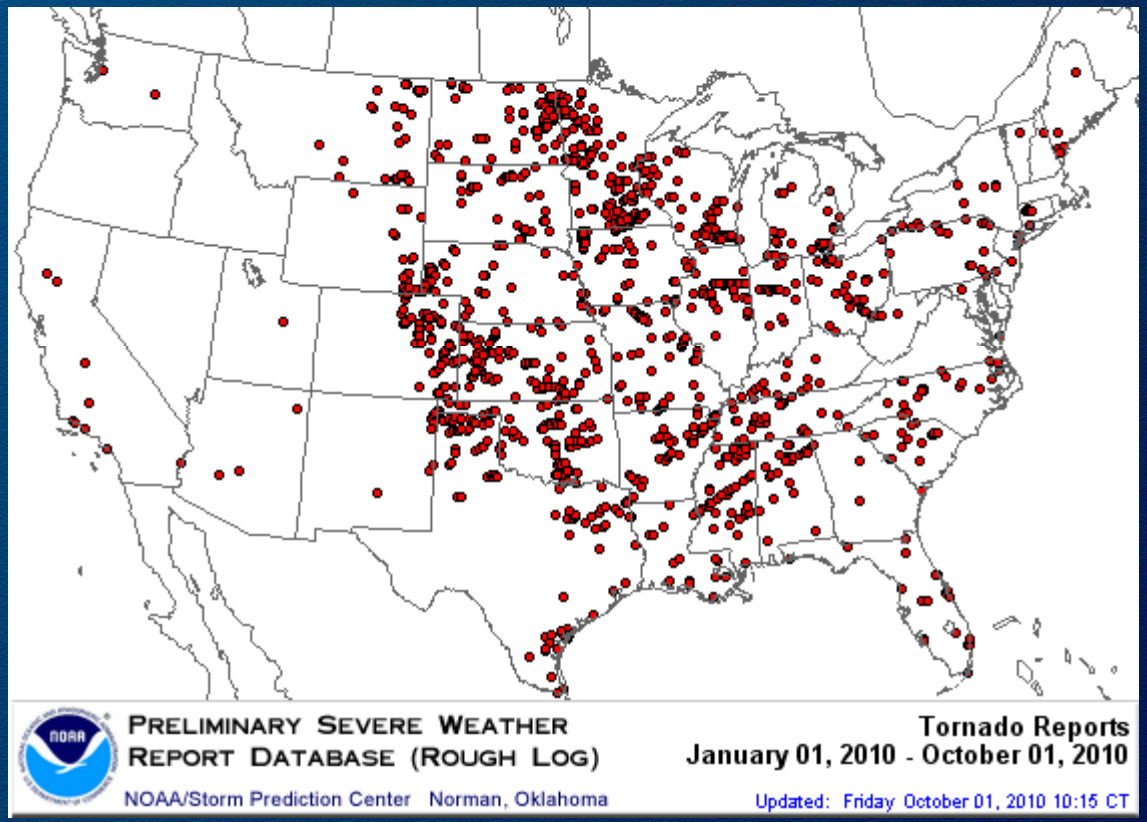
July Asian Catastrophes





Tornadoes in the US: 2010



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July 23, 2010: Vivian, SD

Image courtesy Aberdeen, SD WFO

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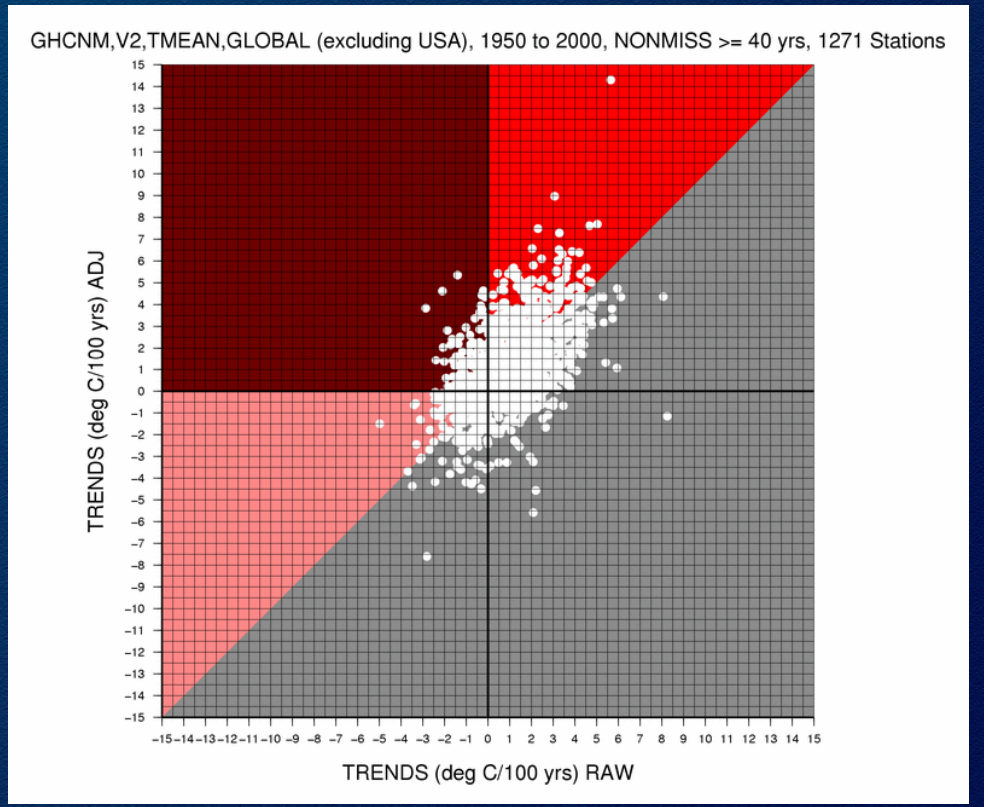
THANK YOU FOR YOUR TIME

Climate Data: Fallacy #1

- Fallacy: Homogeneity Adjustment inflates global temperature trends
- Truth: Adjusted trends are as often smaller than raw trends
- Comparing trends between raw and adjusted data shows an even split for the globe as a whole
  - 51%: Increase in trend when adjusted
  - 49%: Decrease in trend when adjusted



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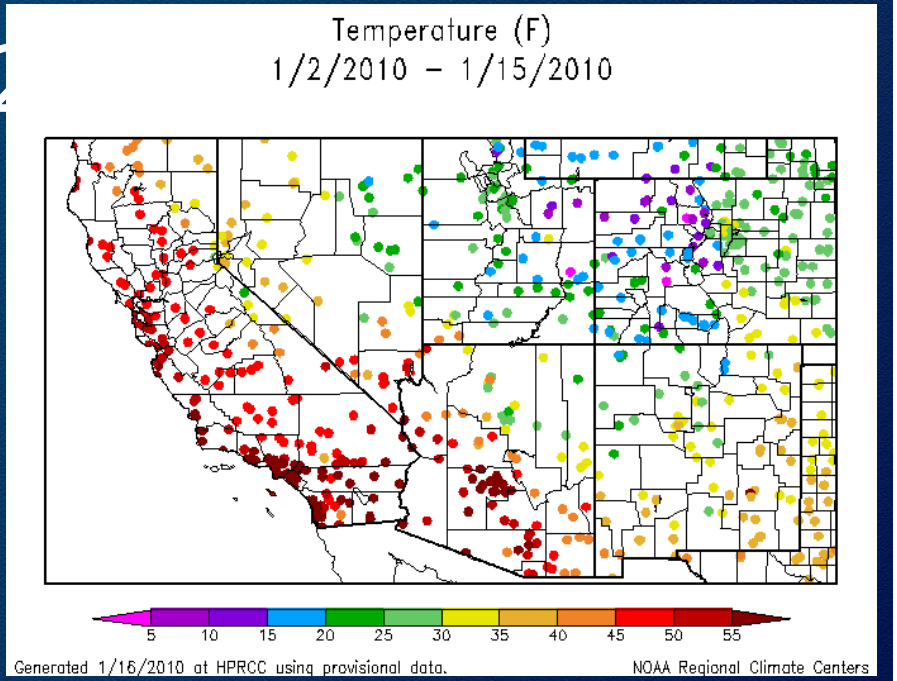
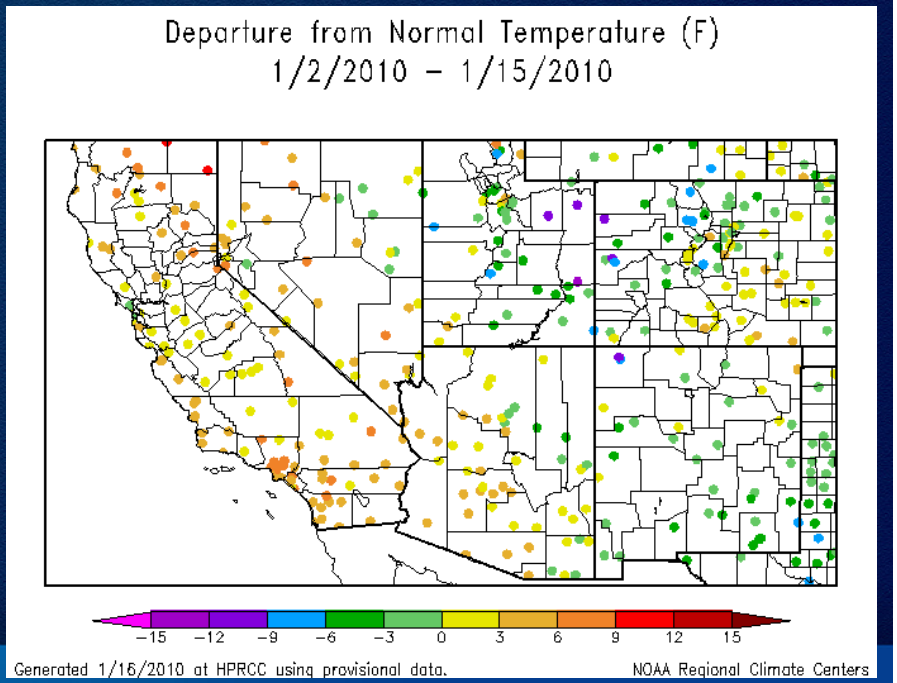
This and the following two slides were presented by Jay Lawrimore at the AMS Meeting in Atlanta

Climate Data Fallacy #2

- Fallacy: The loss of stations in colder climates creates artificial warming
- Truth: Absolute temperatures are not used to calculate the global temperature
  - Global temperature calculations are made using local temperature anomalies – *departures* from climatological average
  - Anomalies in colder climates are often warmer (larger positive) than in warmer climates; i.e., poleward stations actually show more warming.





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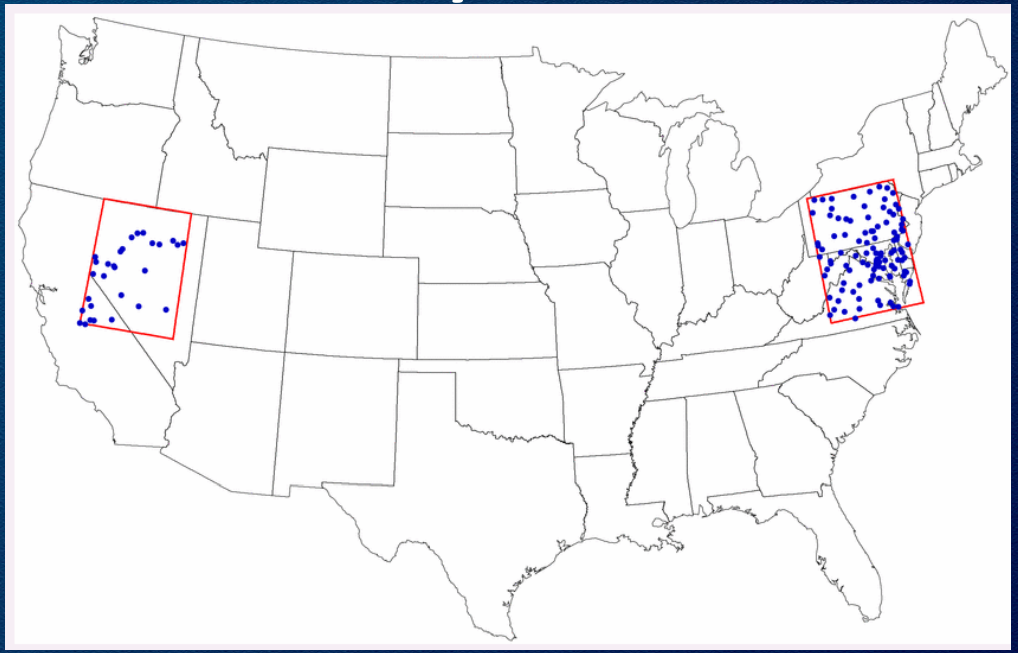
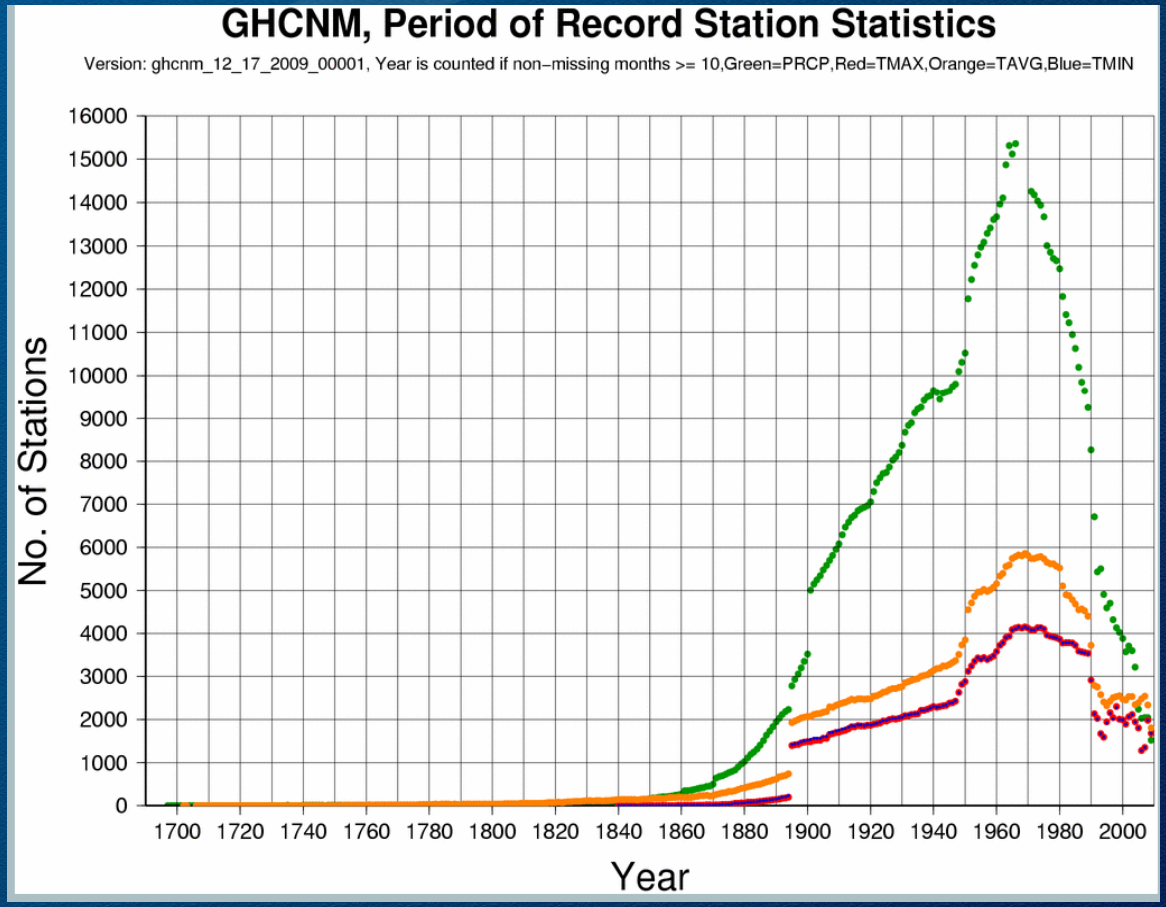
Climate Data Fallacy #3

- Fallacy: Grid box averaging corrupts global average
- Truth: Provides equal weight to heavily and lightly populated areas



  - Station temperature anomalies are averaged within 5x5 degree areas before the global average is calculated
  - As a result: the global temperature is <u>not</u> disproportionally weighted to heavily populated areas

Climate Change Data: Fallacy #4 (NEW!)



- Fallacy: NOAA has "deleted" stations since the 1990s
- Truth: In the late 1990s, NOAA found, rescued and added thousands of stations from the 50s-80s.
- Greatest coverage during 1960s and 1970s
- ~1200-1500 stations are routinely updated.
  - Monthly Updates via Global Telecommunication System
- Available since 1997 as GHCN Version 2.0

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