Temperature and Precipitation Changes in Far West Texas: Models vs. Observations

John W. Nielsen-Gammon

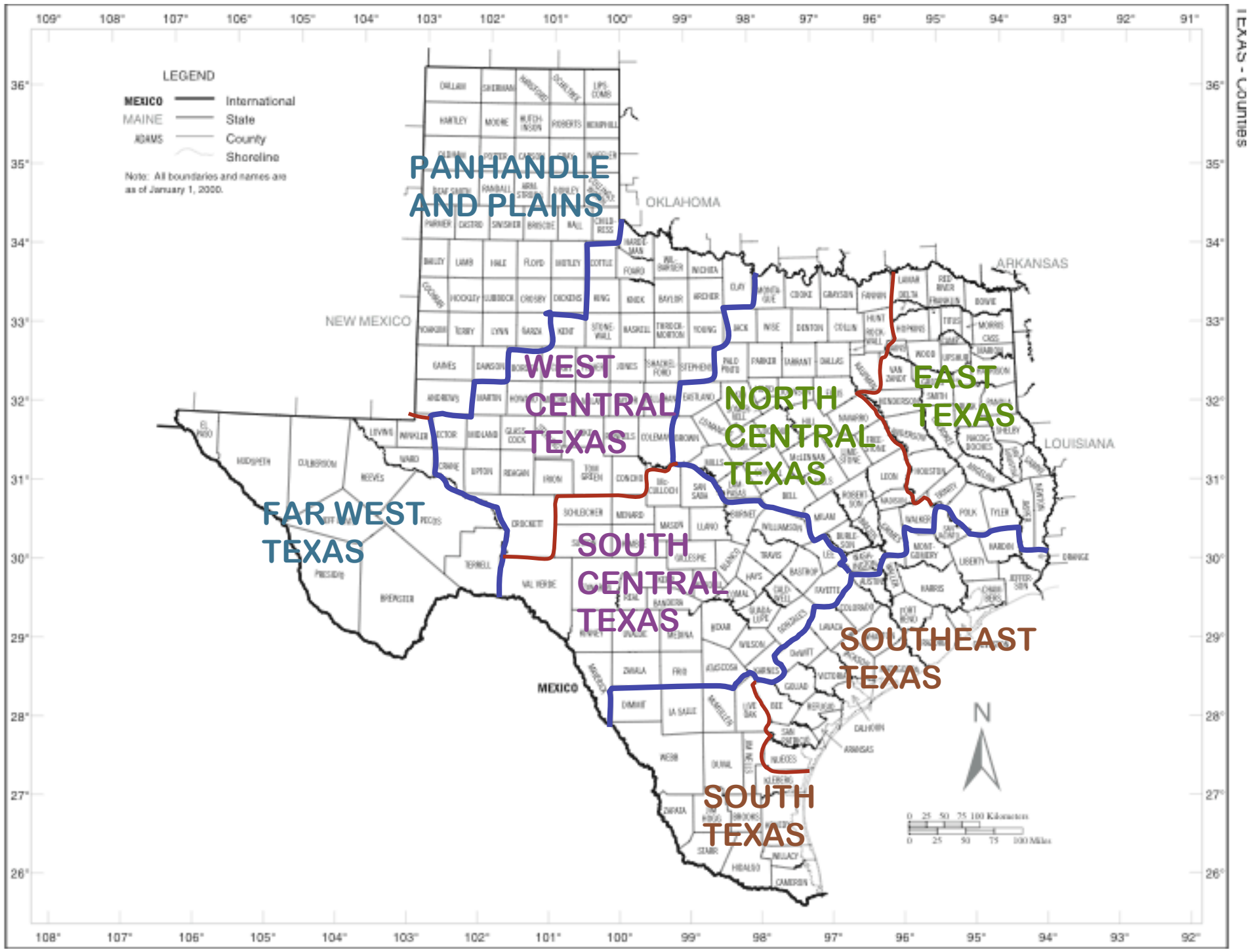
Texas State Climatologist

Future vs. Past

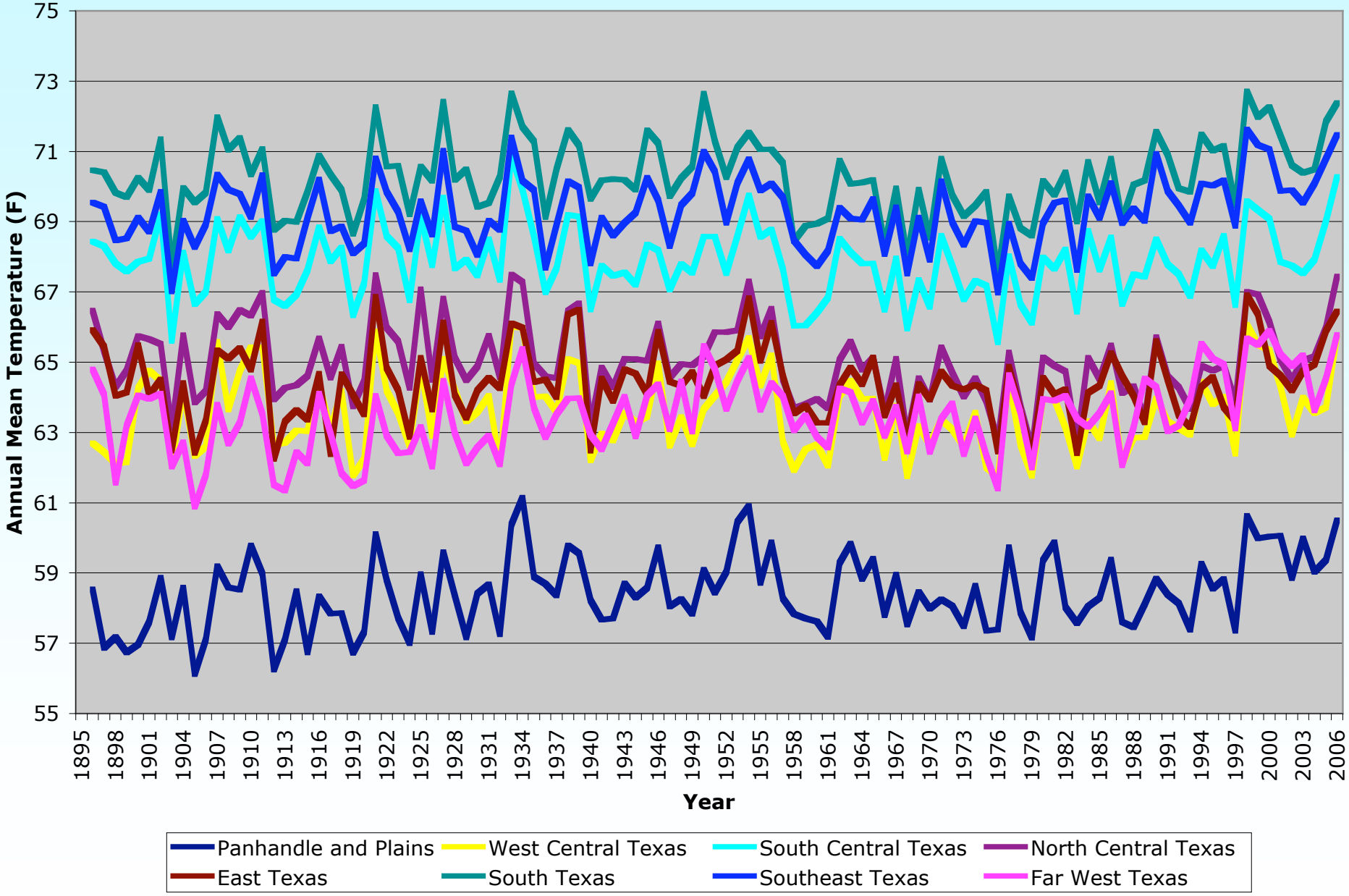
- Temperature outlook in Texas from greenhouse gases: warmer
- Precipitation outlook in Texas from greenhouse gases: probably drier
- Are these expectations consistent with what's been happening over the past century?

The Climate Record

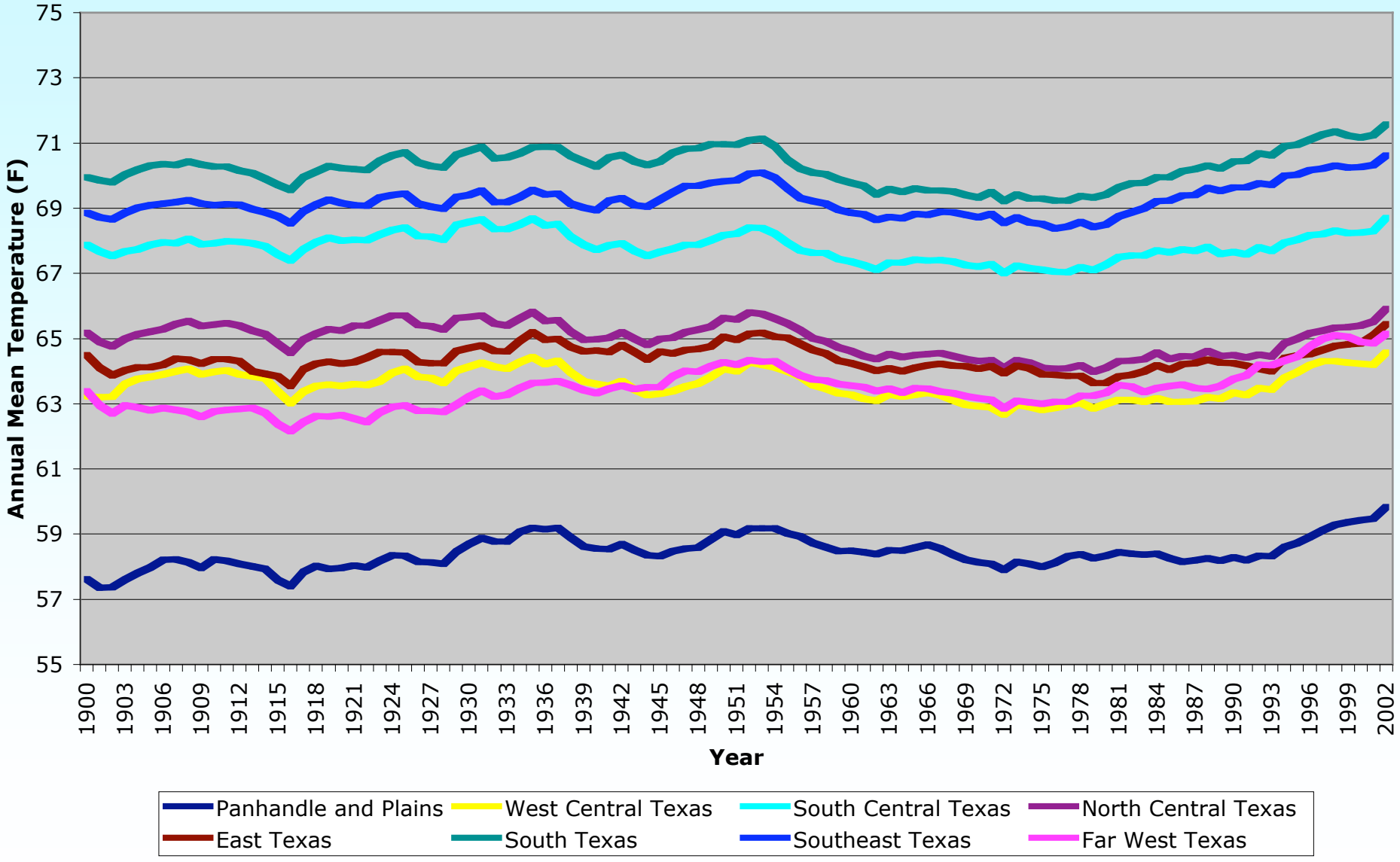
- United States Historical Climatology Network, Versions 1 and 2
  - 44-49 stations with long-term, relatively stable climate records
  - Corrections for obs time (temperature) and objectively-identified inhomogeneities
  - TAMU statistical interpolation to extend to denser COOP network
  - Conventional climate division data has issues


LEGEND
MEXICO International
MAINE State
ADAMS County
Shoreline
Note: All boundaries and names are as of January 1, 2000.
PANHANDLE AND PLAINS
WEST CENTRAL TEXAS
NORTH CENTRAL TEXAS
EAST TEXAS
FAR WEST TEXAS
SOUTH CENTRAL TEXAS
SOUTHEAST TEXAS
SOUTH TEXAS
OKLAHOMA
ARKANSAS
LOUISIANA
NEW MEXICO
MEXICO
N

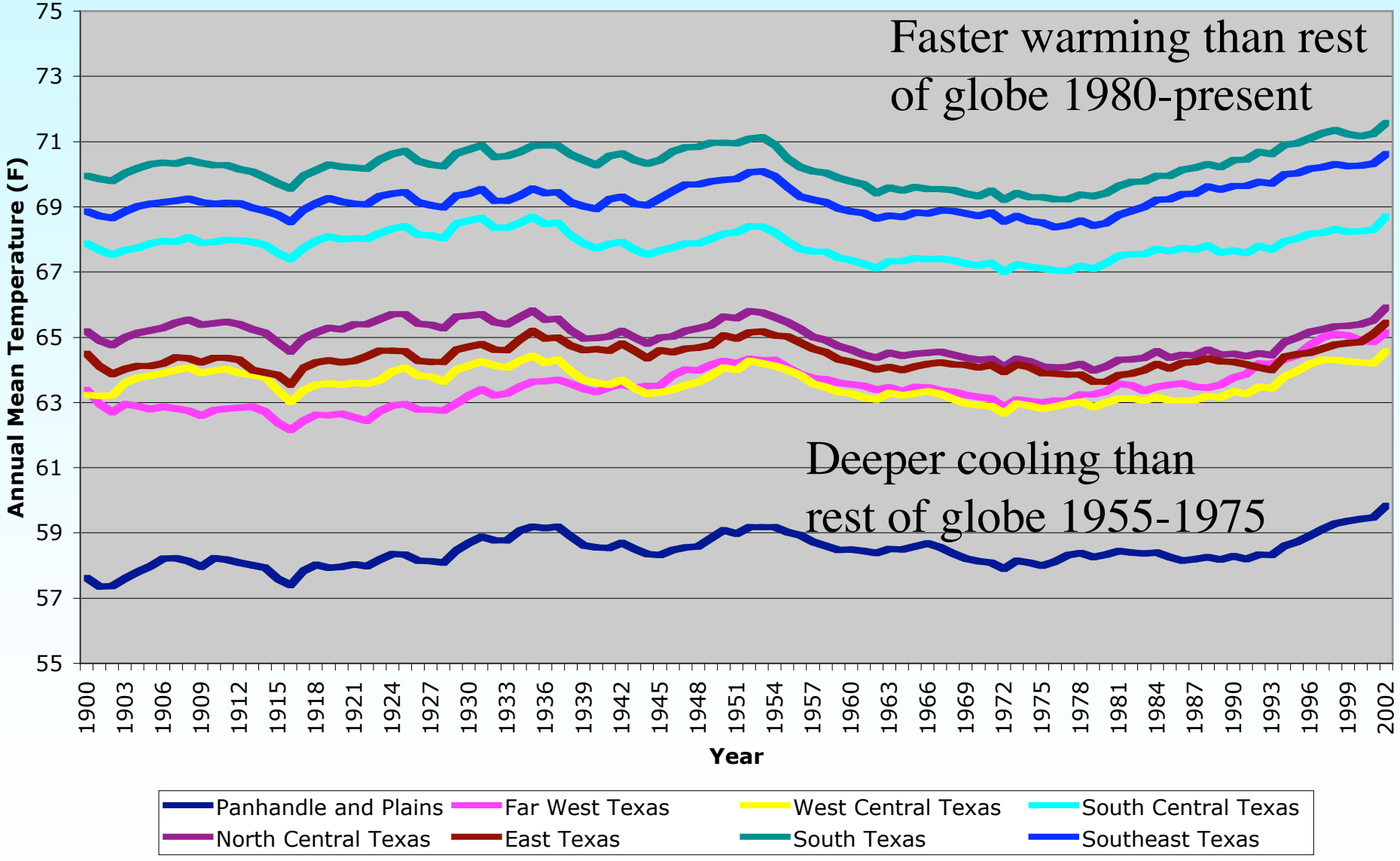
Average Temperature of HCN Stations Within Texas Areas



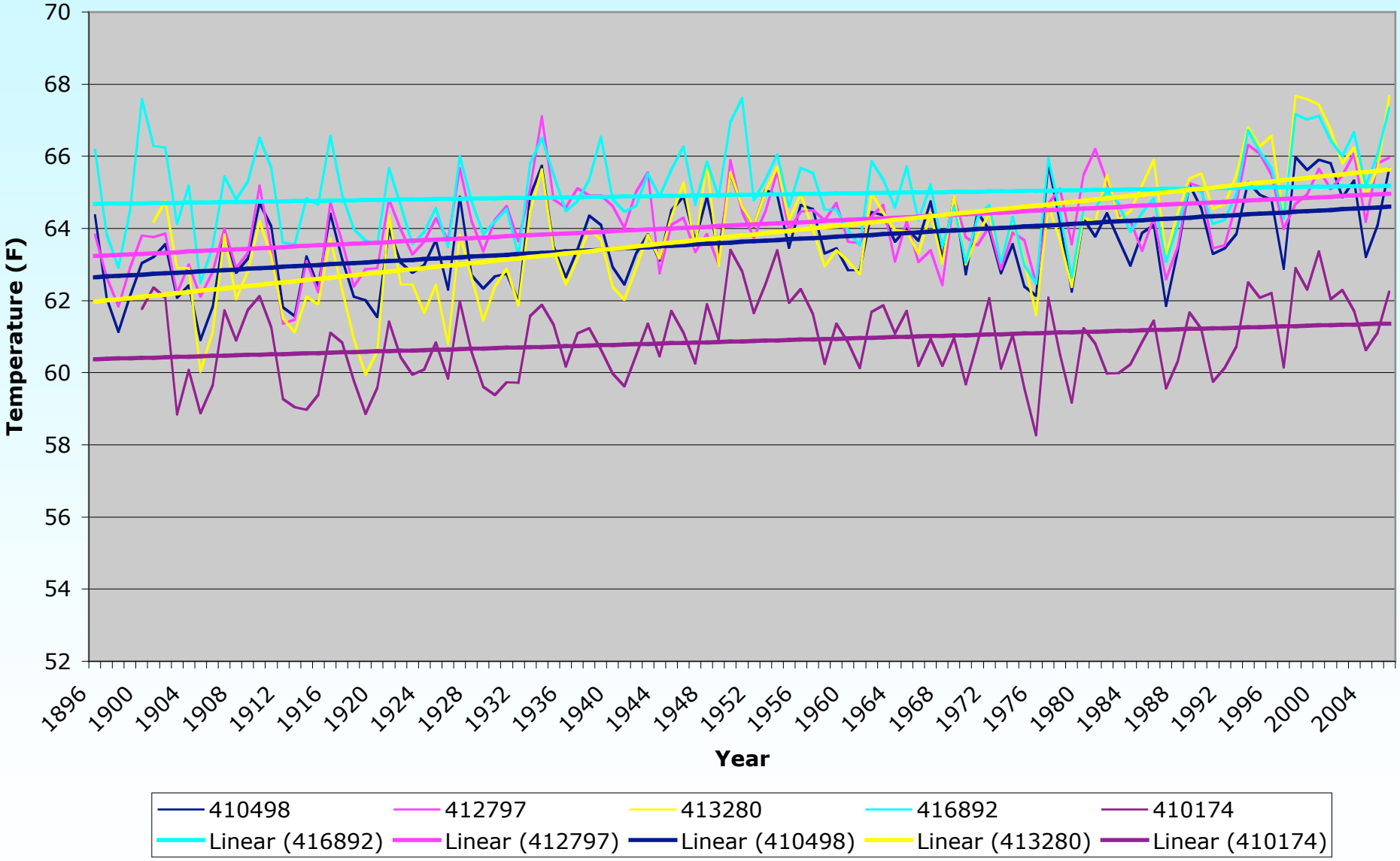
Smoothed Temperatures of HCN Stations Within Texas Areas



Smoothed Temperatures of HCN Stations Within Texas Areas



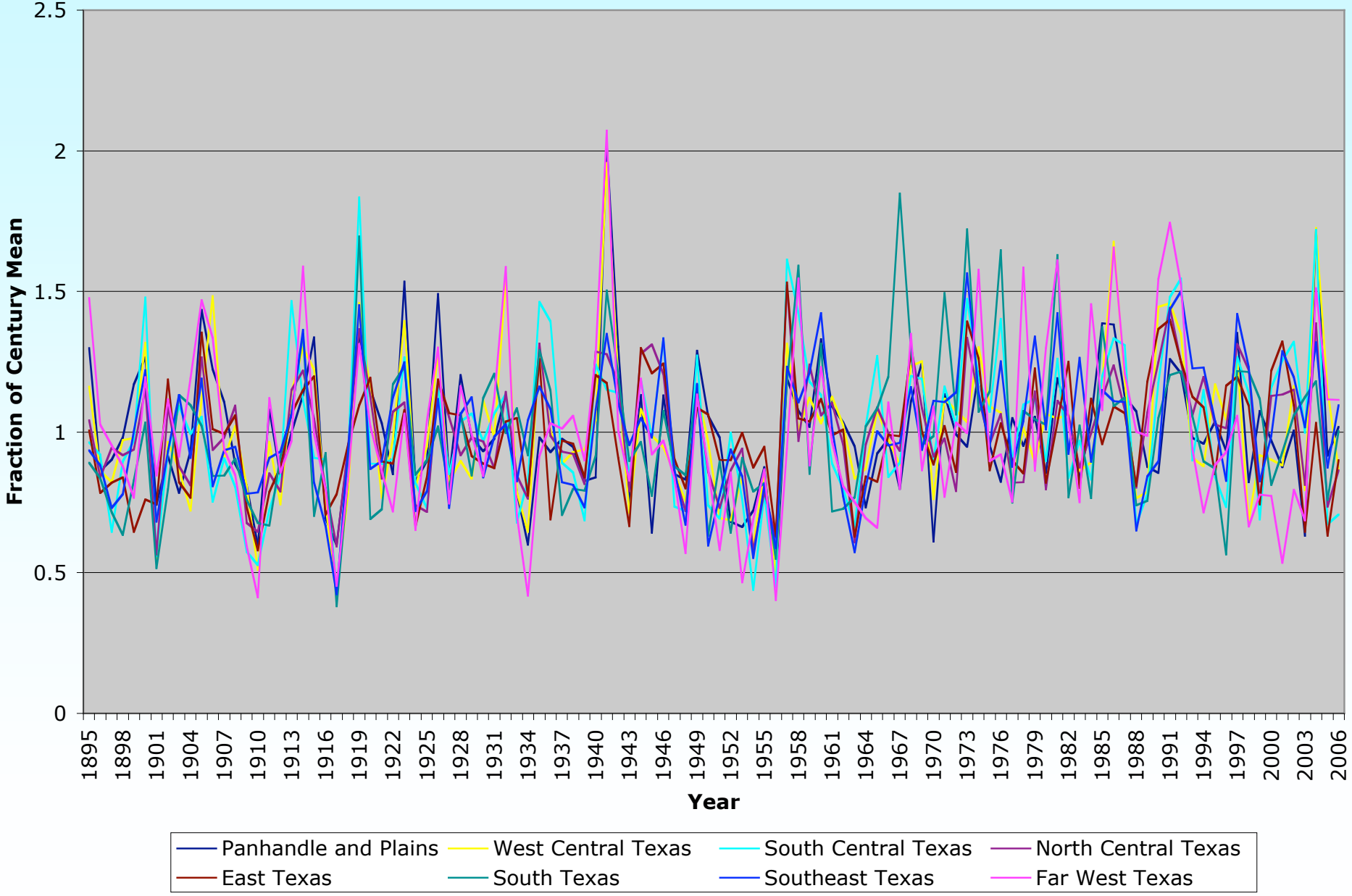
Far West Texas Temperatures -- Individual Stations



Attribution Studies

- Based on atmospheric models driven by observed sea surface temperatures
- Temperature variations during last half of 20th Century largely due to sea surface temperature changes (overall, patterns)
- Natural vs. anthropogenic fraction unknown

Annual Texas Precipitation



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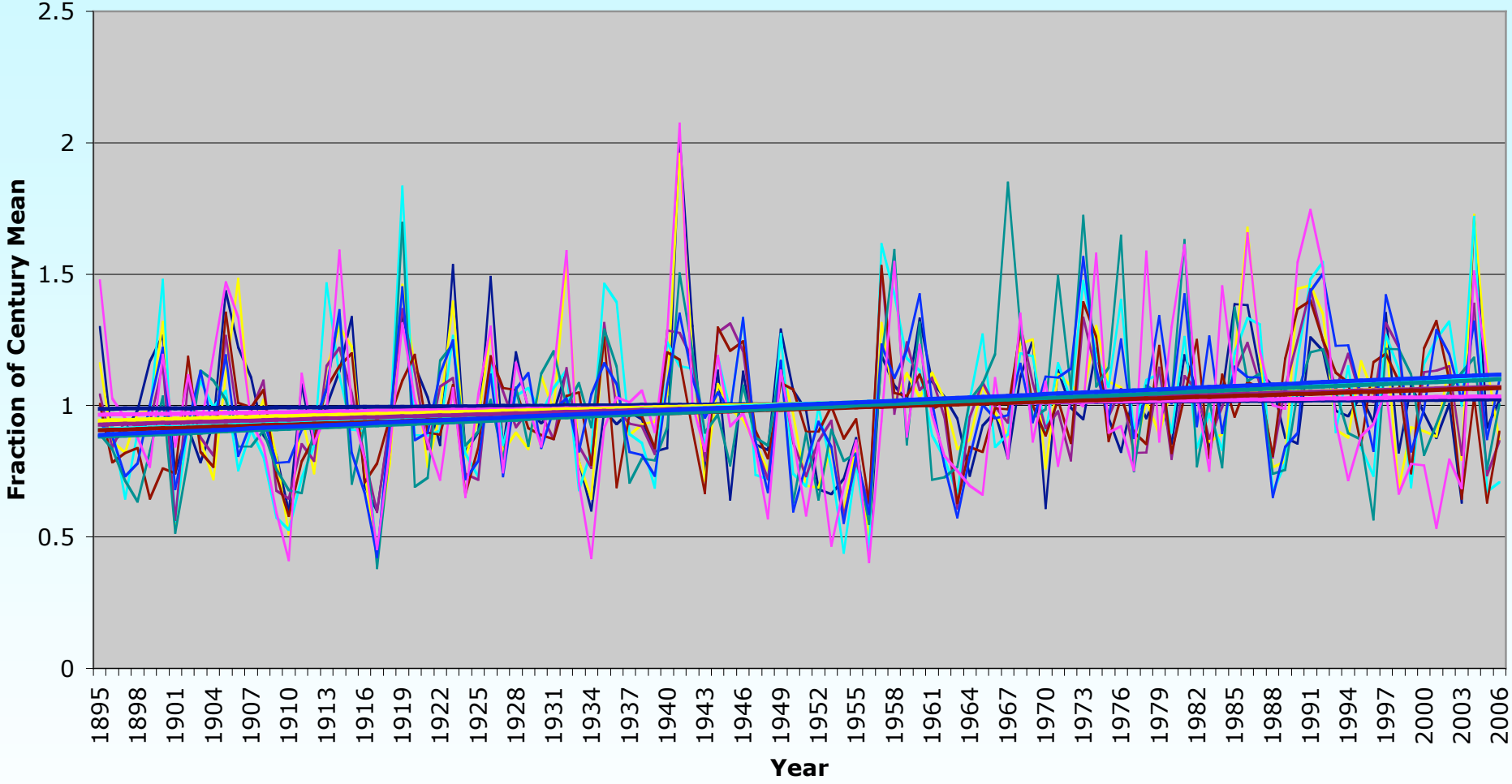
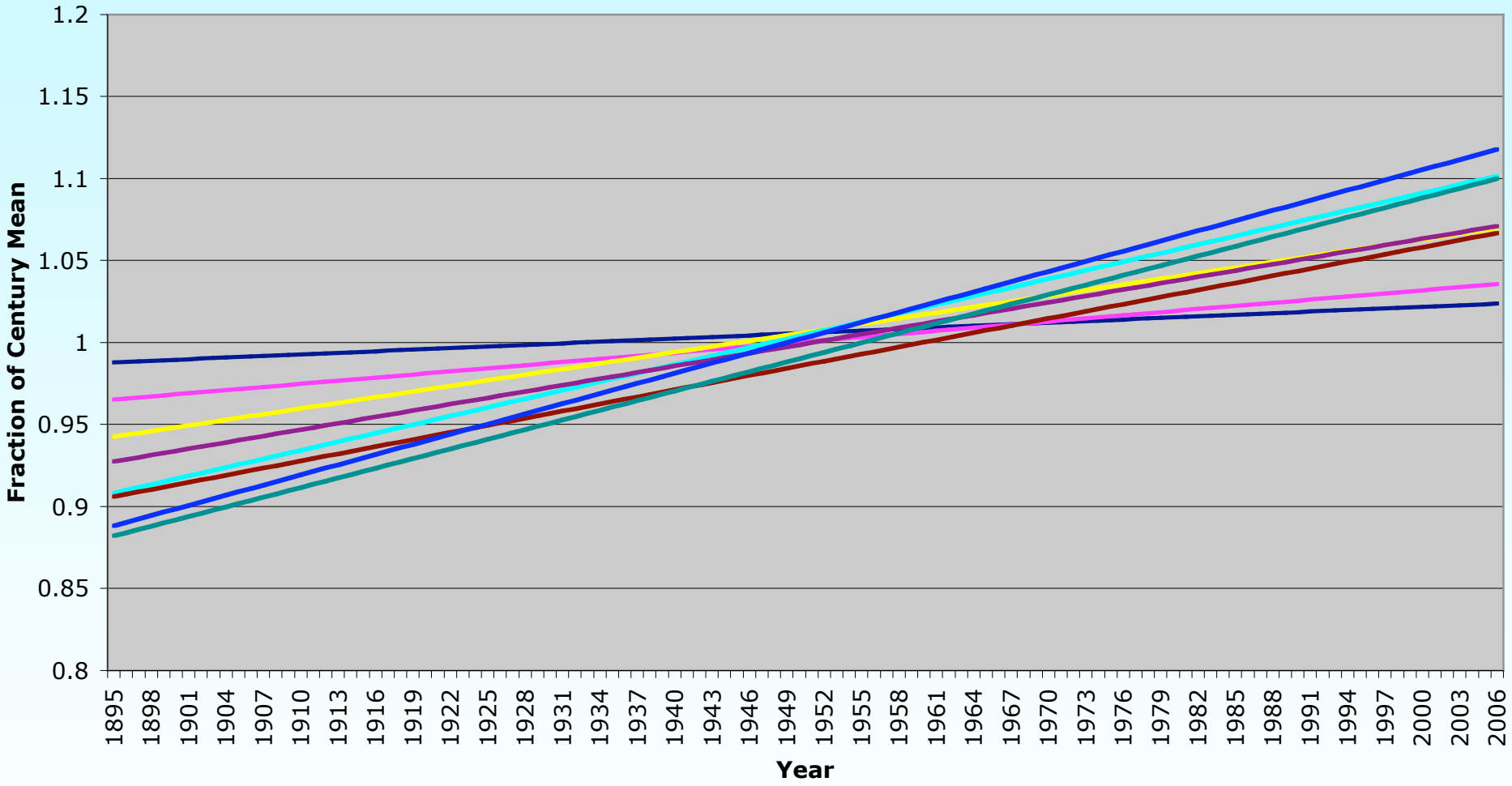
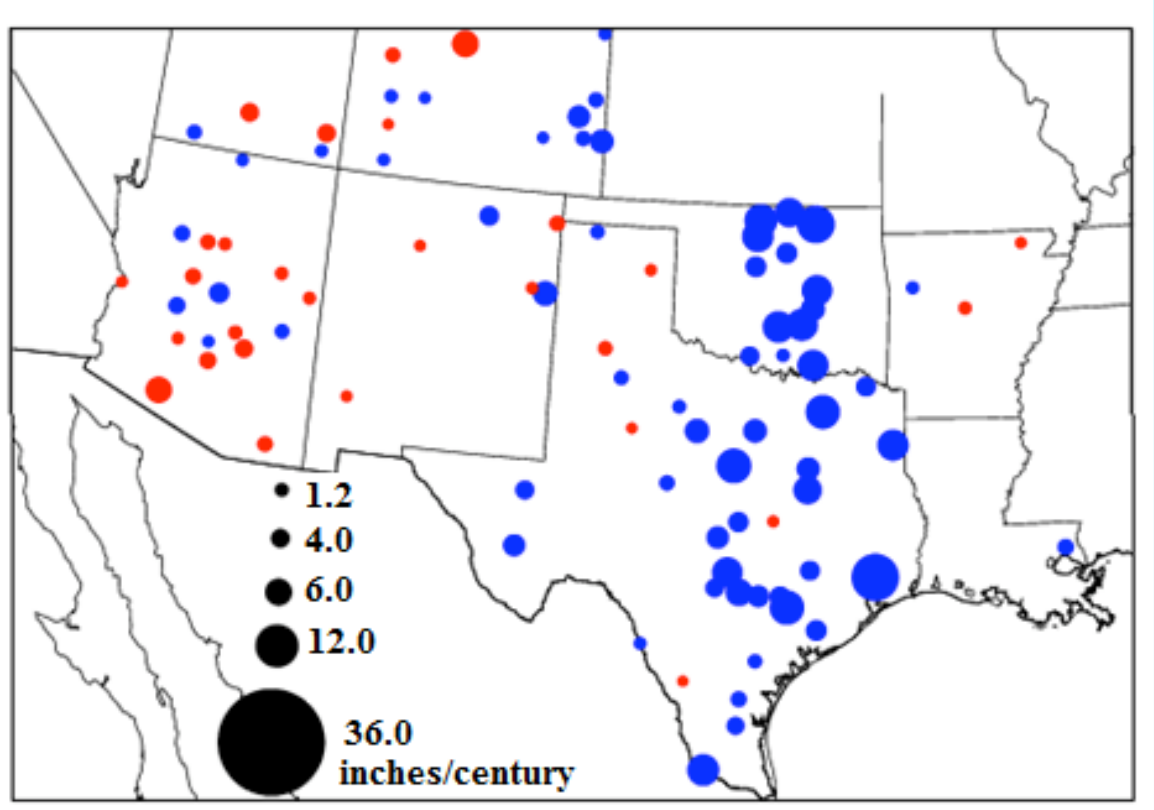


Panhandle and Plains
West Central Texas
South Central Texas
North Central Texas
East Texas
South Texas
Southeast Texas
Far West Texas
Linear (Panhandle and Plains)
Linear (Far West Texas)
Linear (West Central Texas)
Linear (South Central Texas)
Linear (North Central Texas)
Linear (East Texas)
Linear (South Texas)
Linear (Southeast Texas)

Annual Texas Precipitation



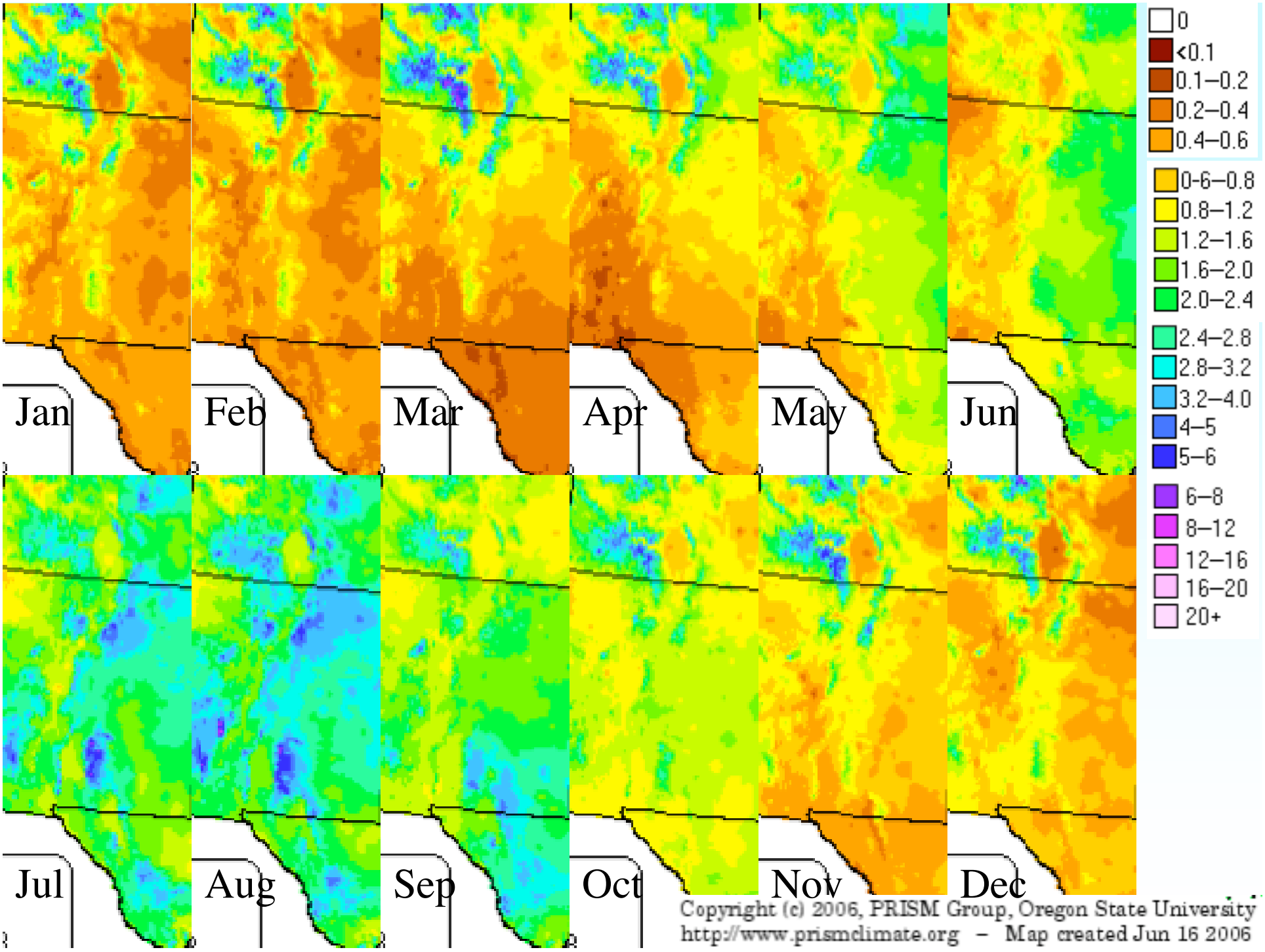
Precipitation trends at century-long USHCN stations



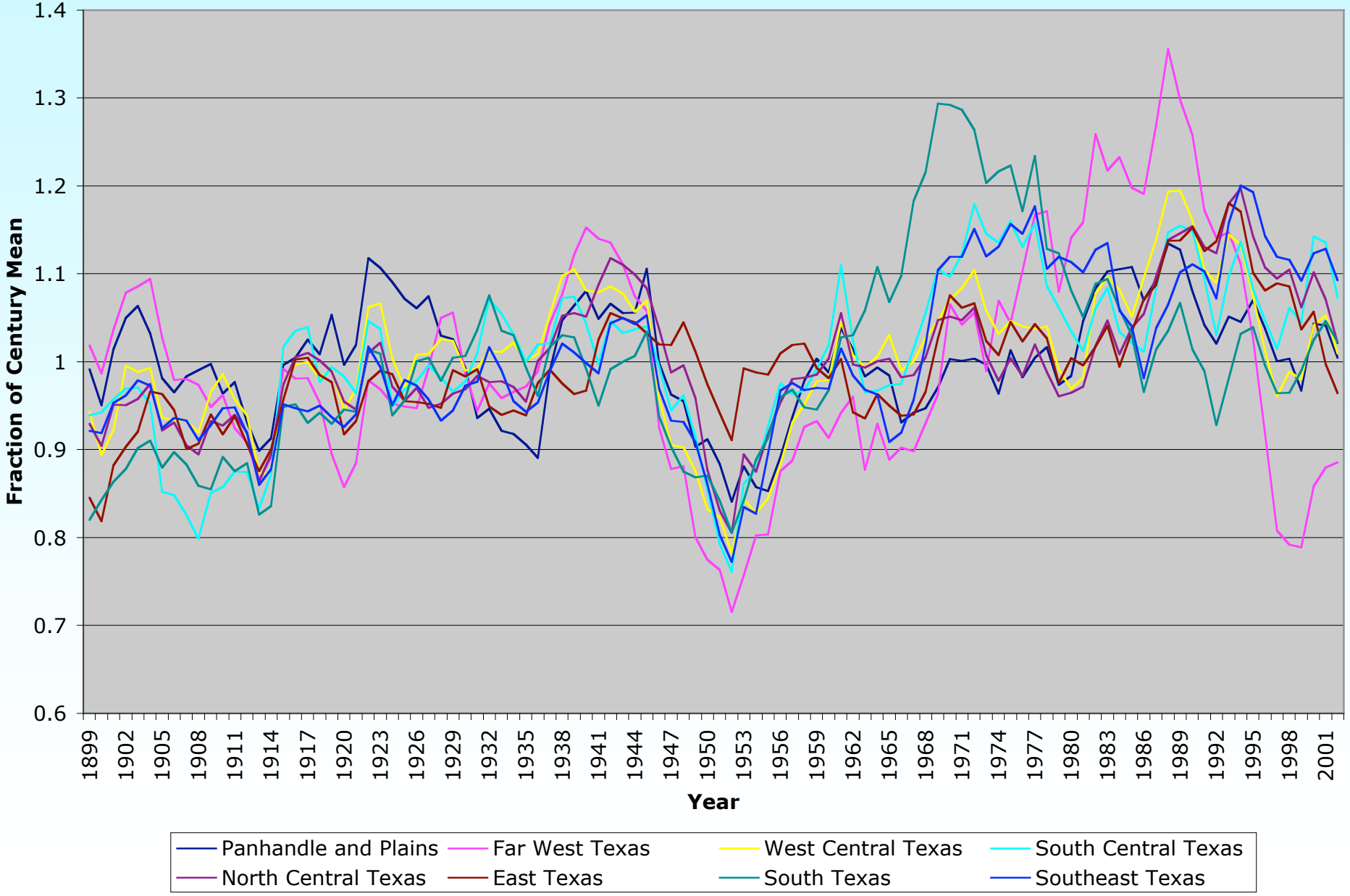
Blue: Increasing Precipitation
Red: Decreasing Precipitation

Climate Features, Upper Rio Grande Basin

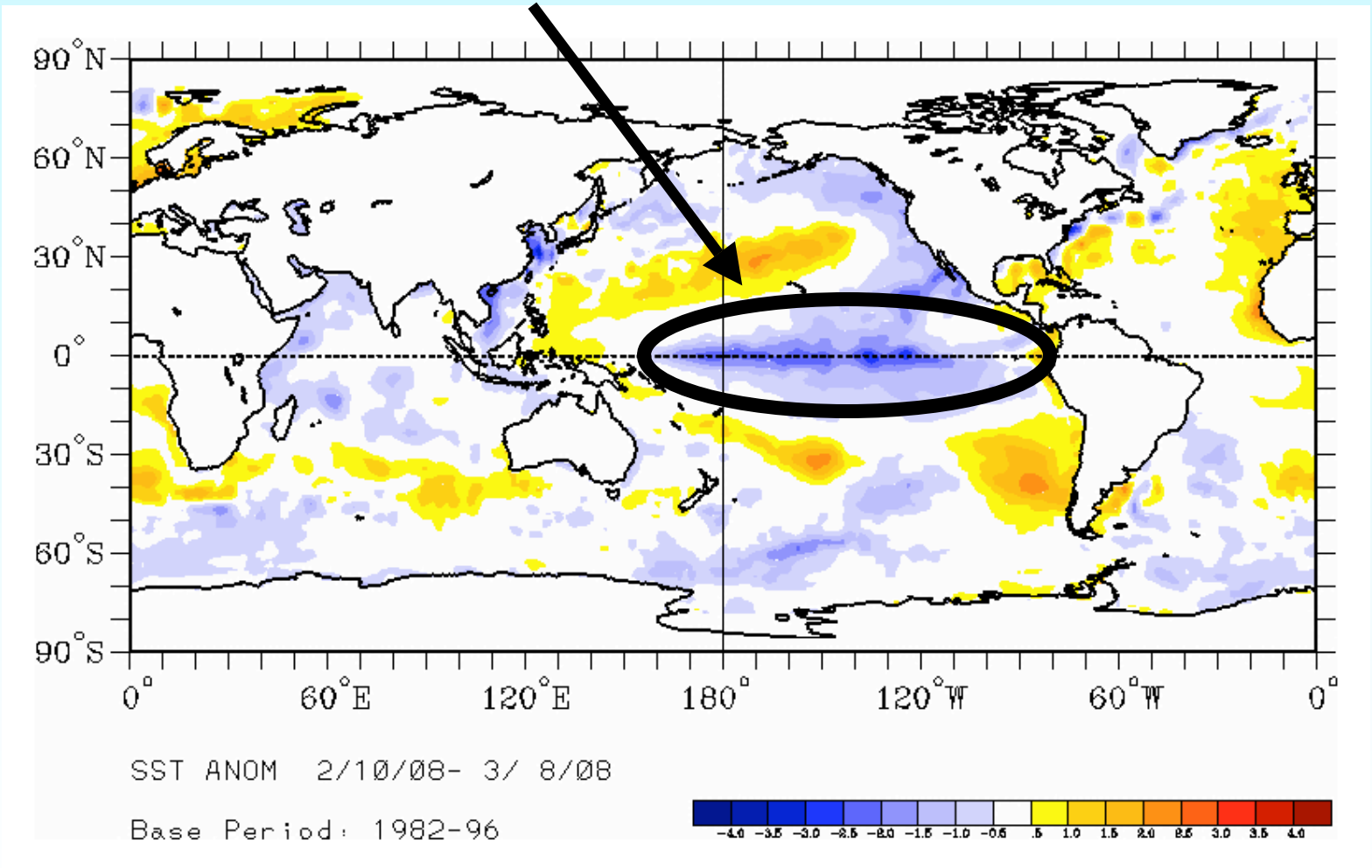
- Wintertime orographically-enhanced precipitation
  - Snow dumped on mountains
- Southwest Monsoon
  - Summertime thunderstorms



9-yr Smoothed Texas Precipitation

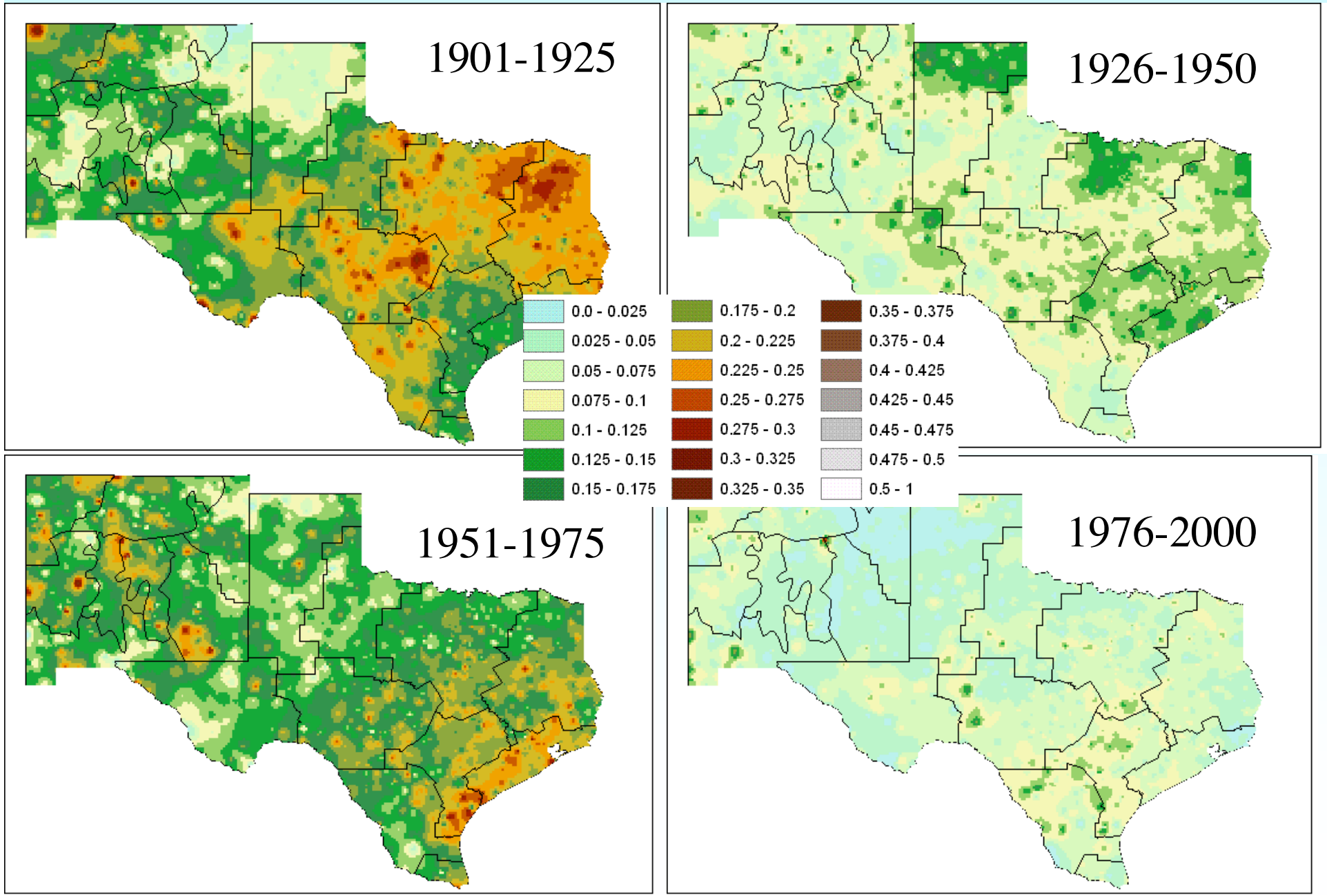


La Niña

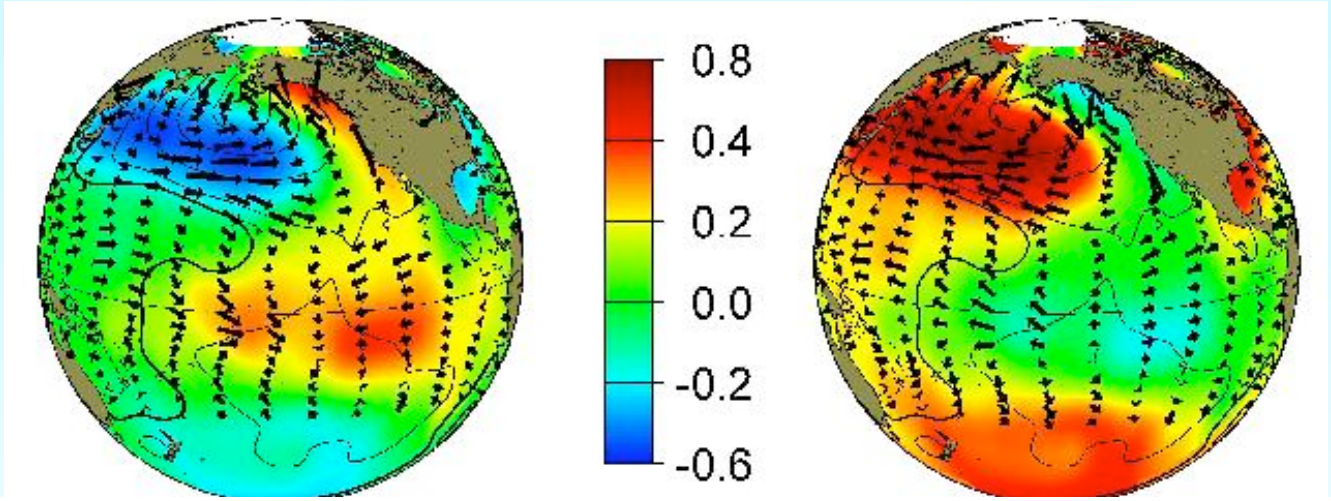


Late Winter 2008 Sea Surface Temperature Anomalies

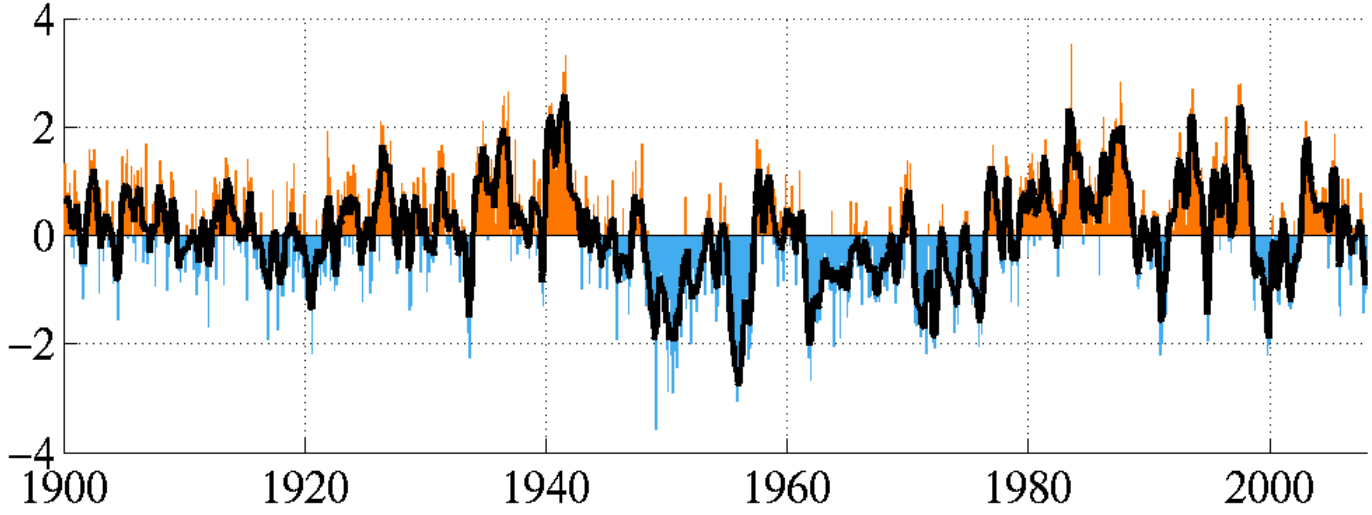
Fraction of months in drought, based on 12-month total precipitation



Pacific Decadal Oscillation



monthly values for the PDO index: 1900–January 2008



Negative values of PDO enhance effect of La Niña

Final Remarks

- Temperature likely to go up
  - Rate of increase faster than global mean since 1980
  - Important driver of future water demand
- Future precipitation change unknown
  - We've gotten used to a wet climate regime
  - Climate models: leaning toward less rainfall
  - Historical trends: leaning toward more rainfall
- Natural vs. anthropogenic
  - Natural variability is large
  - Man is tipping the scales
- *n-g@tamu.edu*