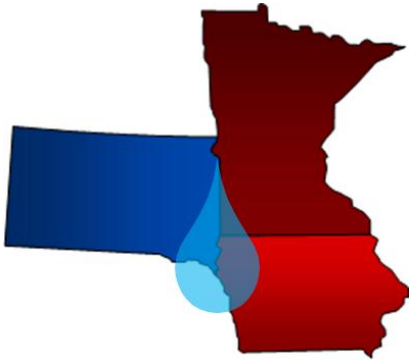
A Presentation of the 2012 Drainage Research Forum

November 20, 2012
Farmamerica, Waseca MN



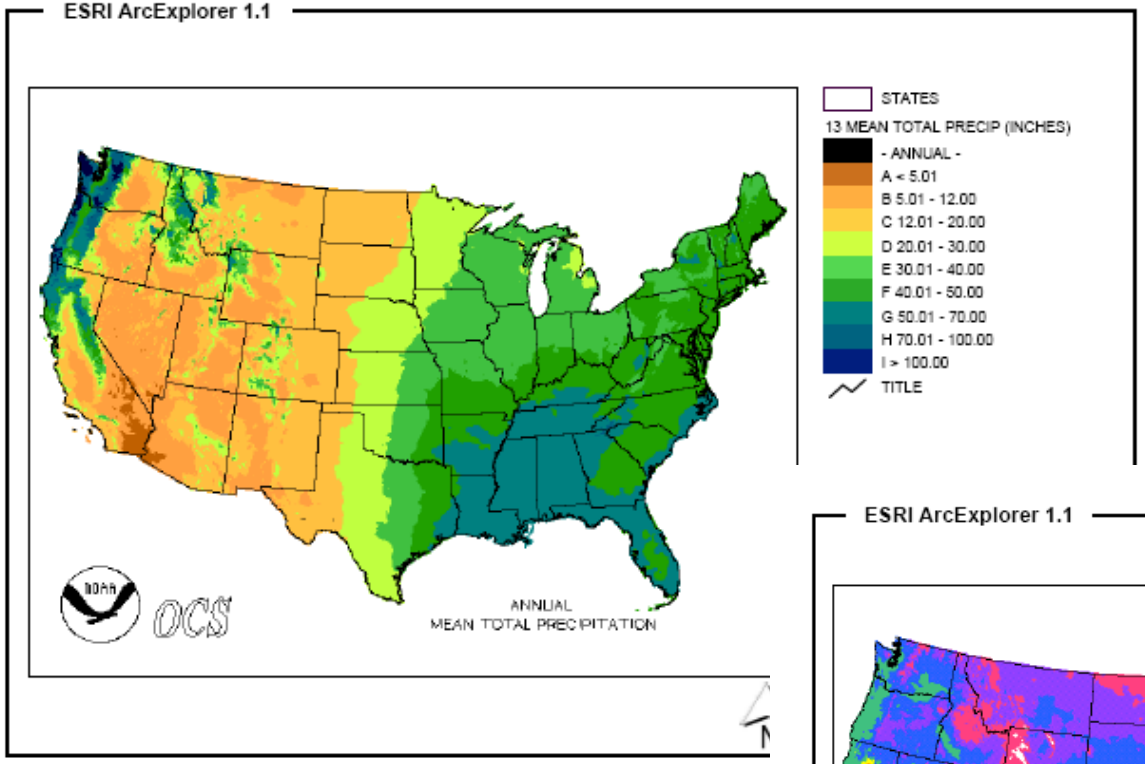
IOWA STATE UNIVERSITY
University Extension

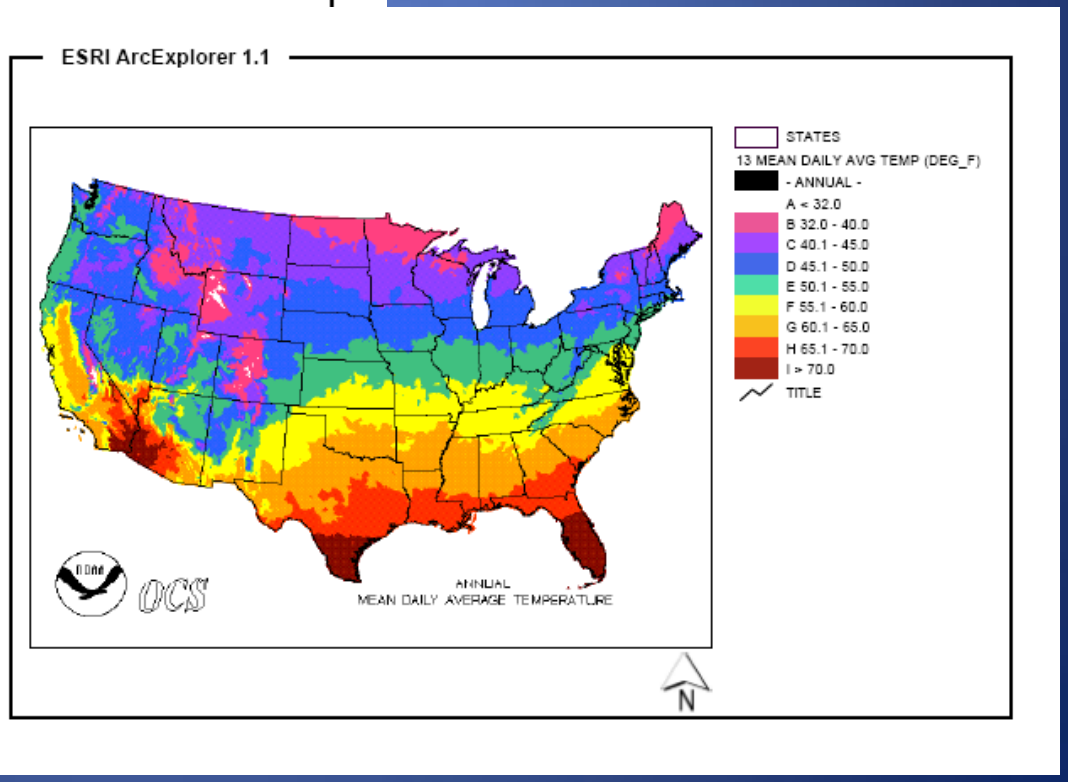
SDSU Extension

Climate Variability and Extremes: Historic and Recent trends

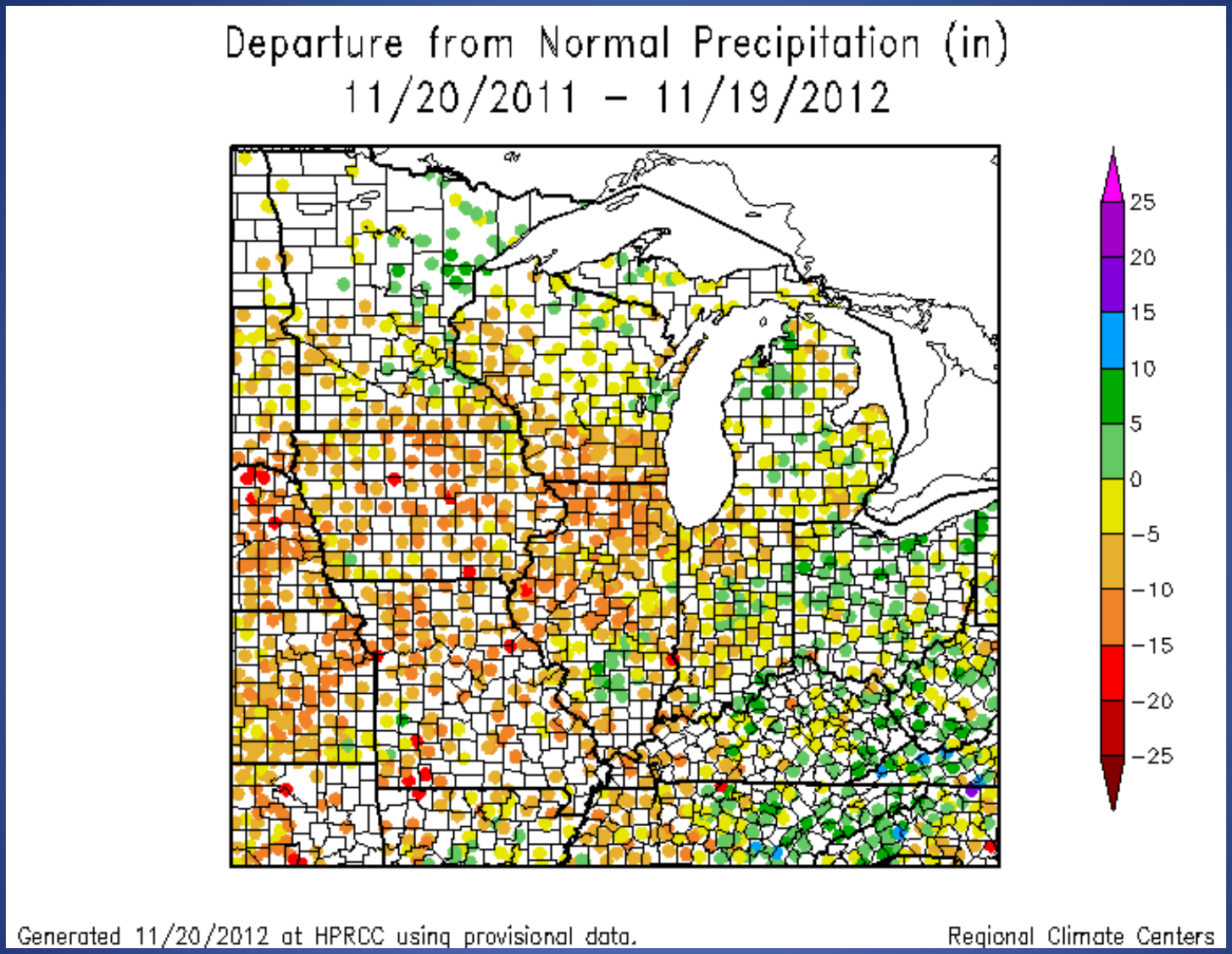
Dr. Dennis Todey
South Dakota State Climatologist
CES/AES/ABE
Past-President - American Association State Climatologists

Great Plains Climatology 1971-2000: Precipitation and Temperature





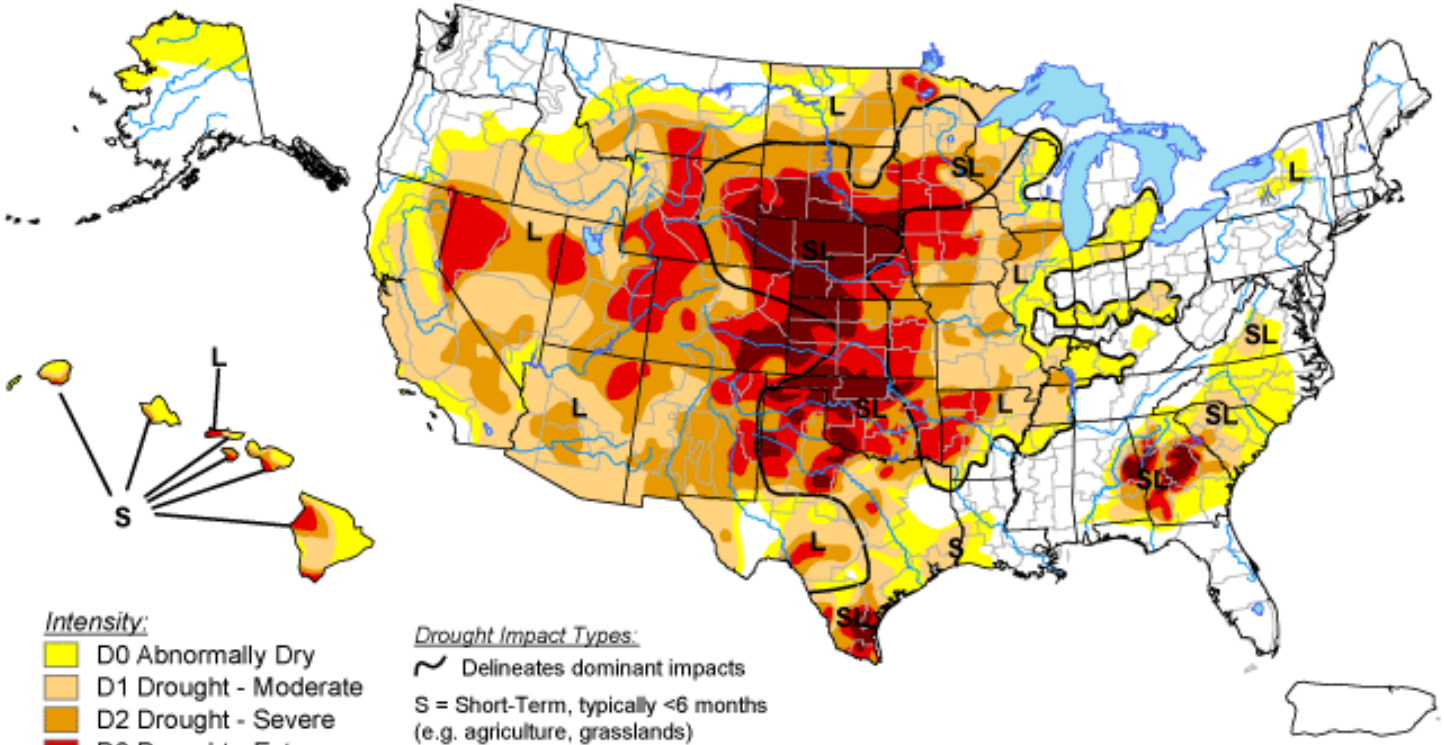
SOUTH DAKOTA Climate and Weather



SOUTH DAKOTA Climate and Weather

U.S. Drought Monitor

November 13, 2012
Valid 7 a.m. EST



Intensity:
- D0 Abnormally Dry
- D1 Drought - Moderate
- D2 Drought - Severe
- D3 Drought - Extreme
- D4 Drought - Exceptional

Drought Impact Types:
Delineates dominant impacts
S = Short-Term, typically <6 months (e.g. agriculture, grasslands)
L = Long-Term, typically >6 months (e.g. hydrology, ecology)

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

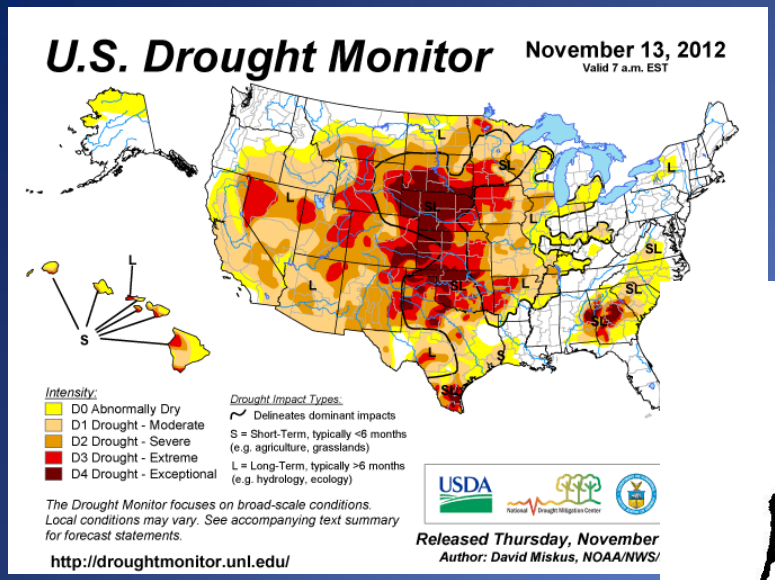
http://droughtmonitor.unl.edu/

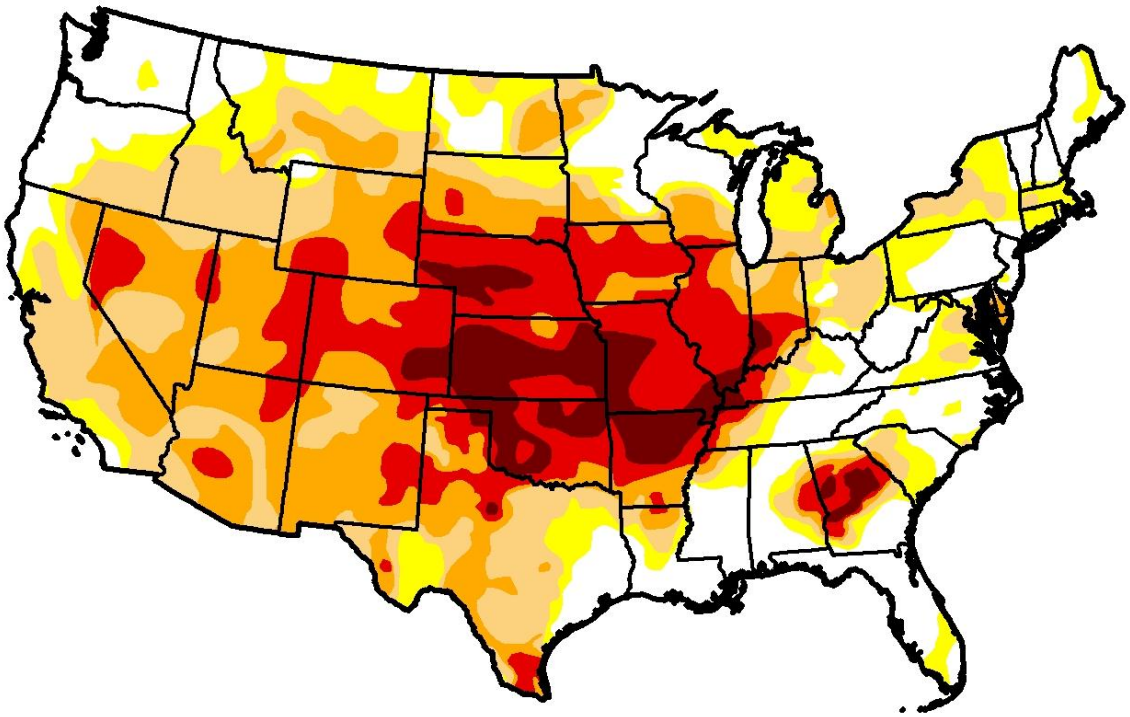
USDA
National Drought Mitigation Center

Released Thursday, November 15, 2012
Author: David Miskus, NOAA/NWS/NCEP/CPC

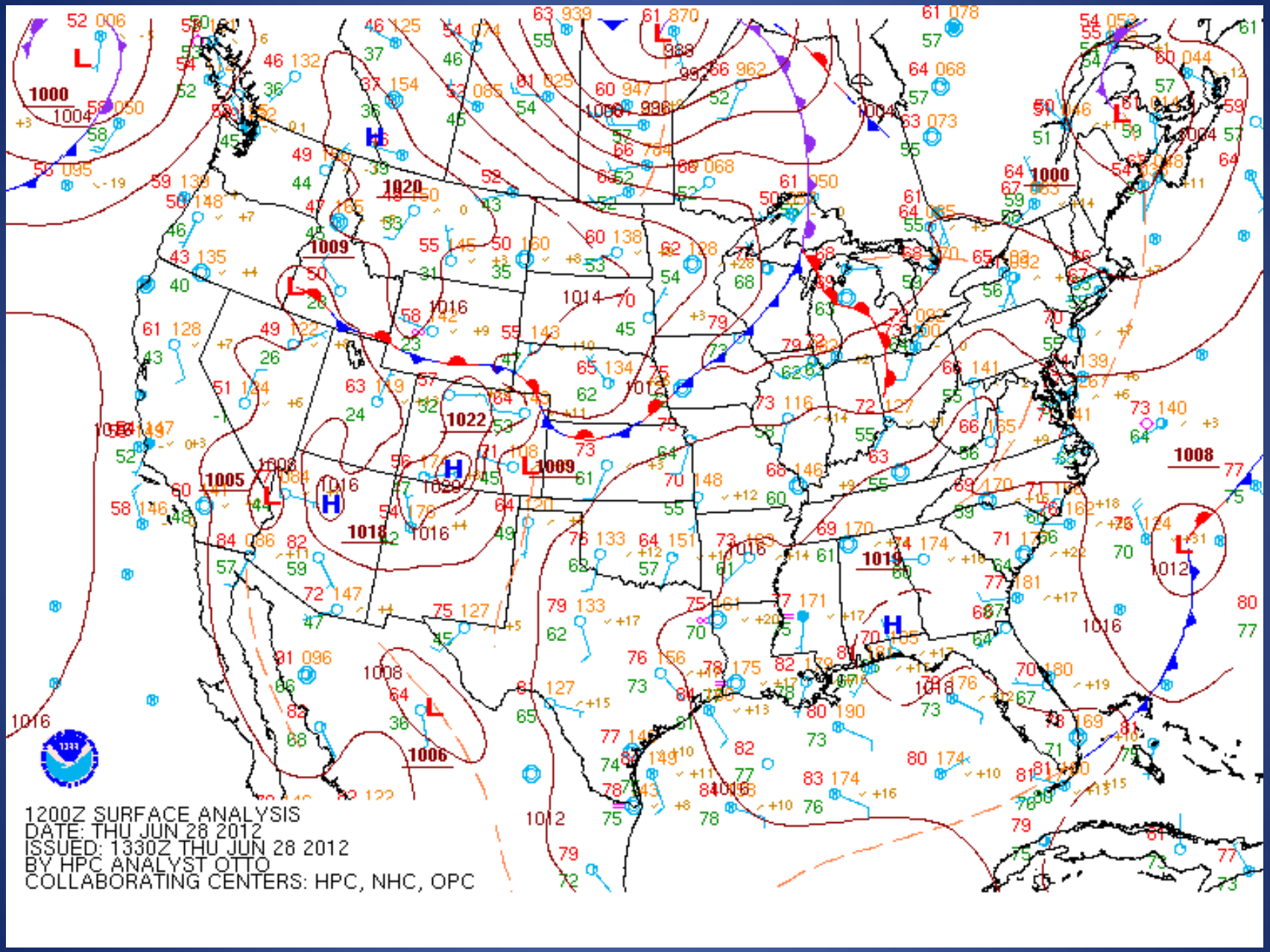
SOUTH DAKOTA Climate and Weather

21 August 2012 Drought Monitor





SOUTH DAKOTA
Climate and Weath


1200Z SURFACE ANALYSIS
DATE: THU JUN 28 2012
ISSUED: 1330Z THU JUN 28 2012
BY HPC ANALYST OTTO
COLLABORATING CENTERS: HPC, NHC, OPC

TRENDS - PRECIPITATION

SOUTH DAKOTA
Climate and Weather

Climate data

- Measurements from National Weather Service Cooperative Observer Program
- Data since the late 1800s.
- More types of precipitation observation now
- Official is still NWS can

SOUTH DAKOTA Climate and Weather

Climate data

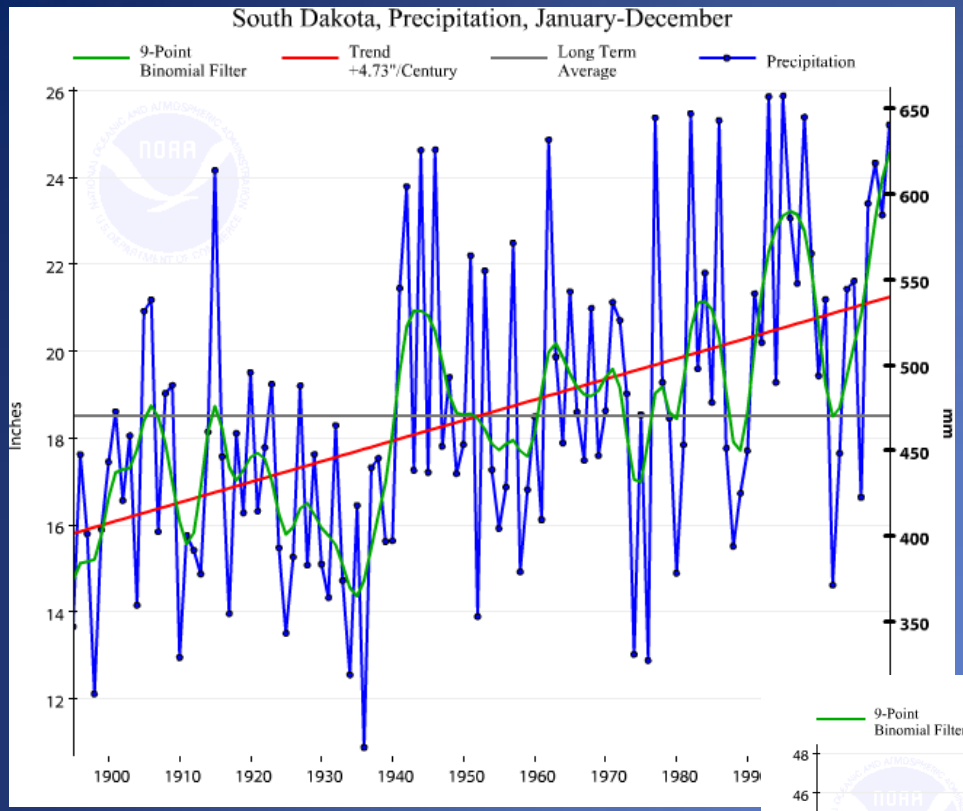
- Overall precipitation increasing since the 1930s
- Irregular trend
- Time of year a large component – different times of year
- More occurring in heavier rain events

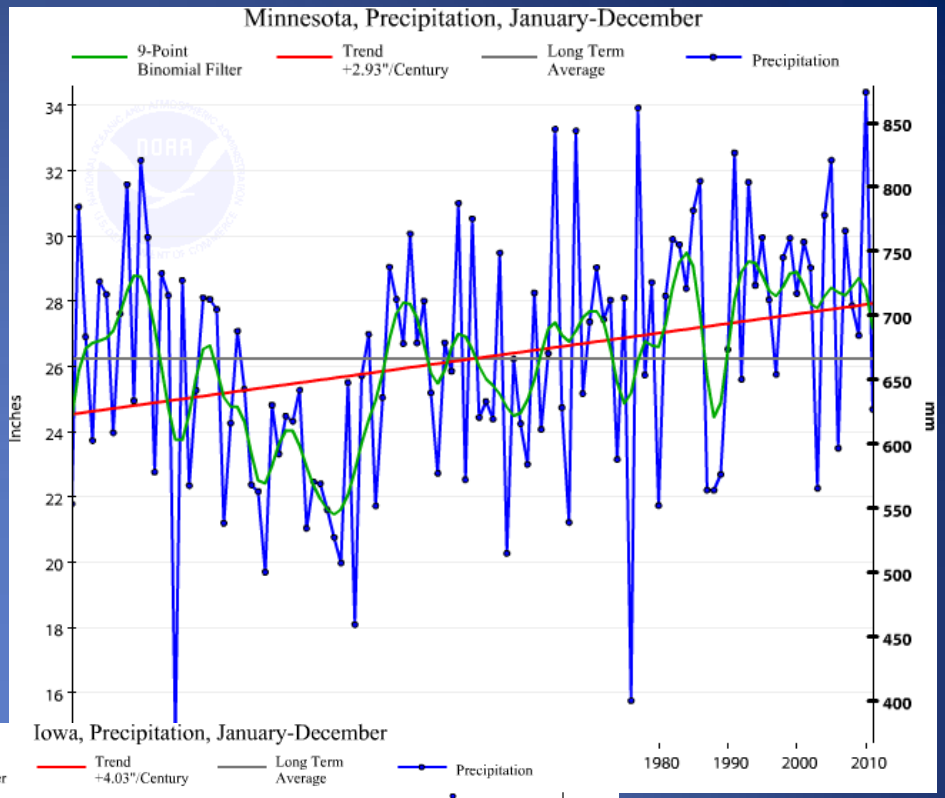
SOUTH DAKOTA
Climate and Weather

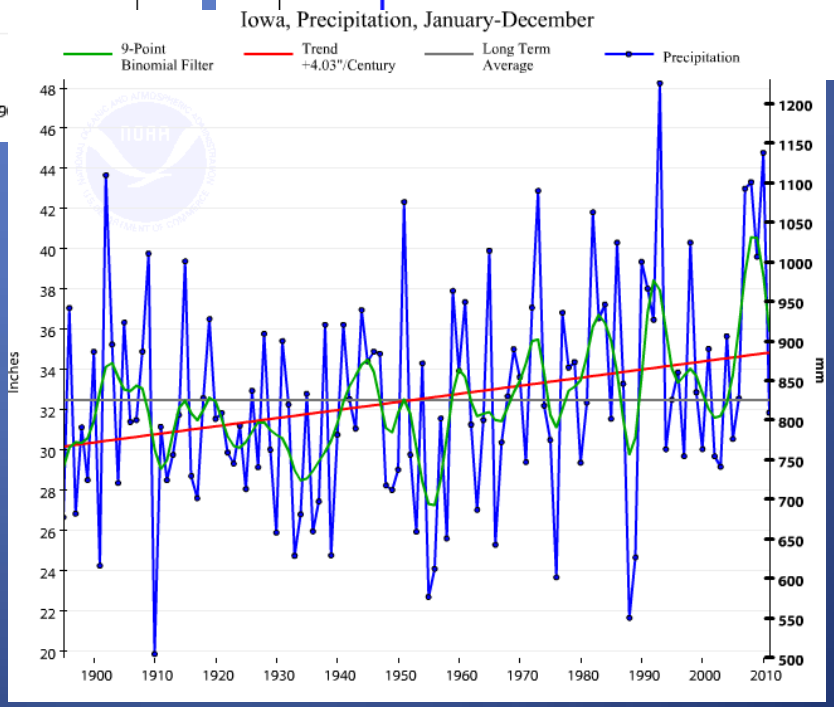
Climate data

- Climate division data sets and statewide data
- Averages of stations in the entity
- Overcomes missing data
- Not as local

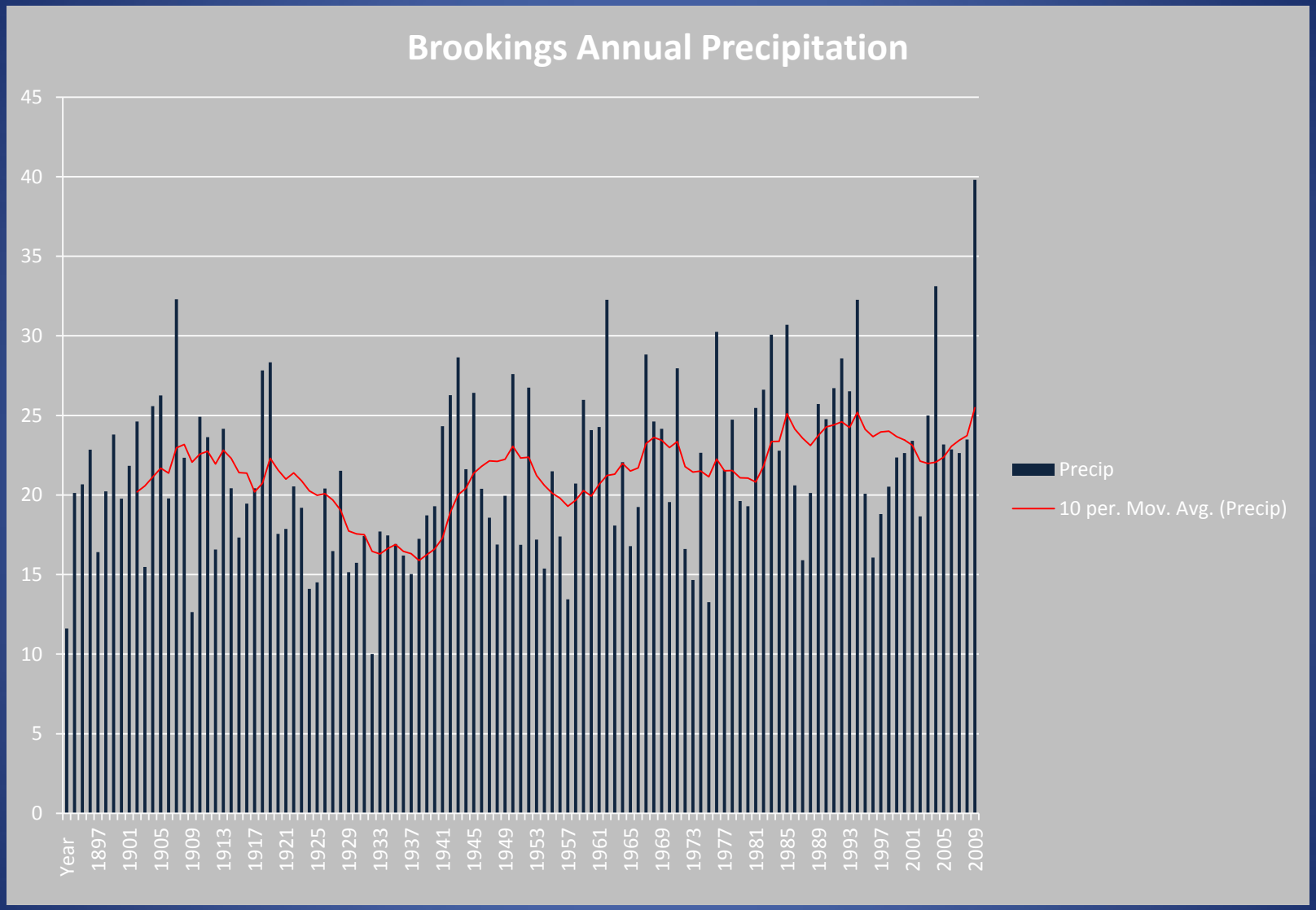
SOUTH DAKOTA
Climate and Weather



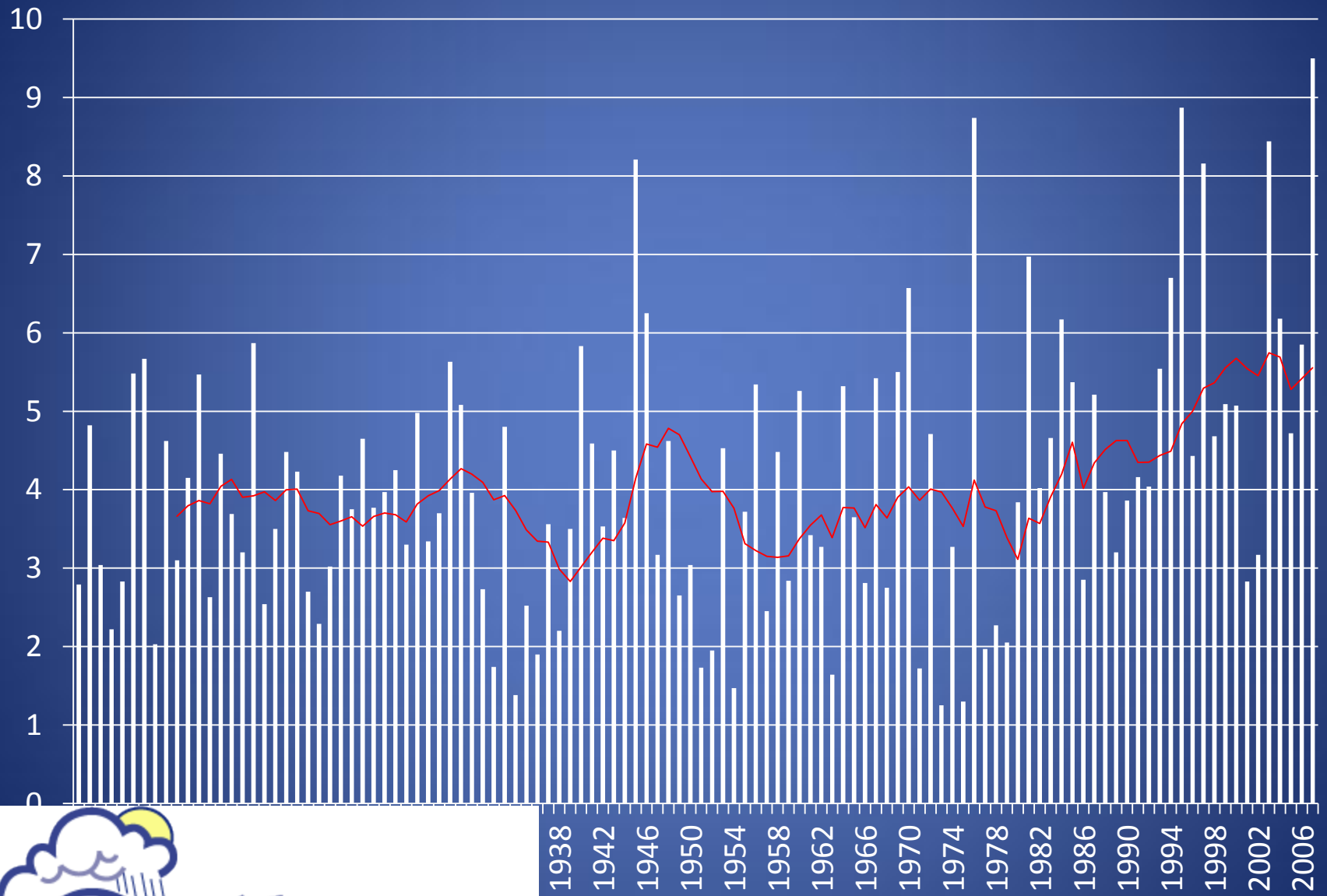




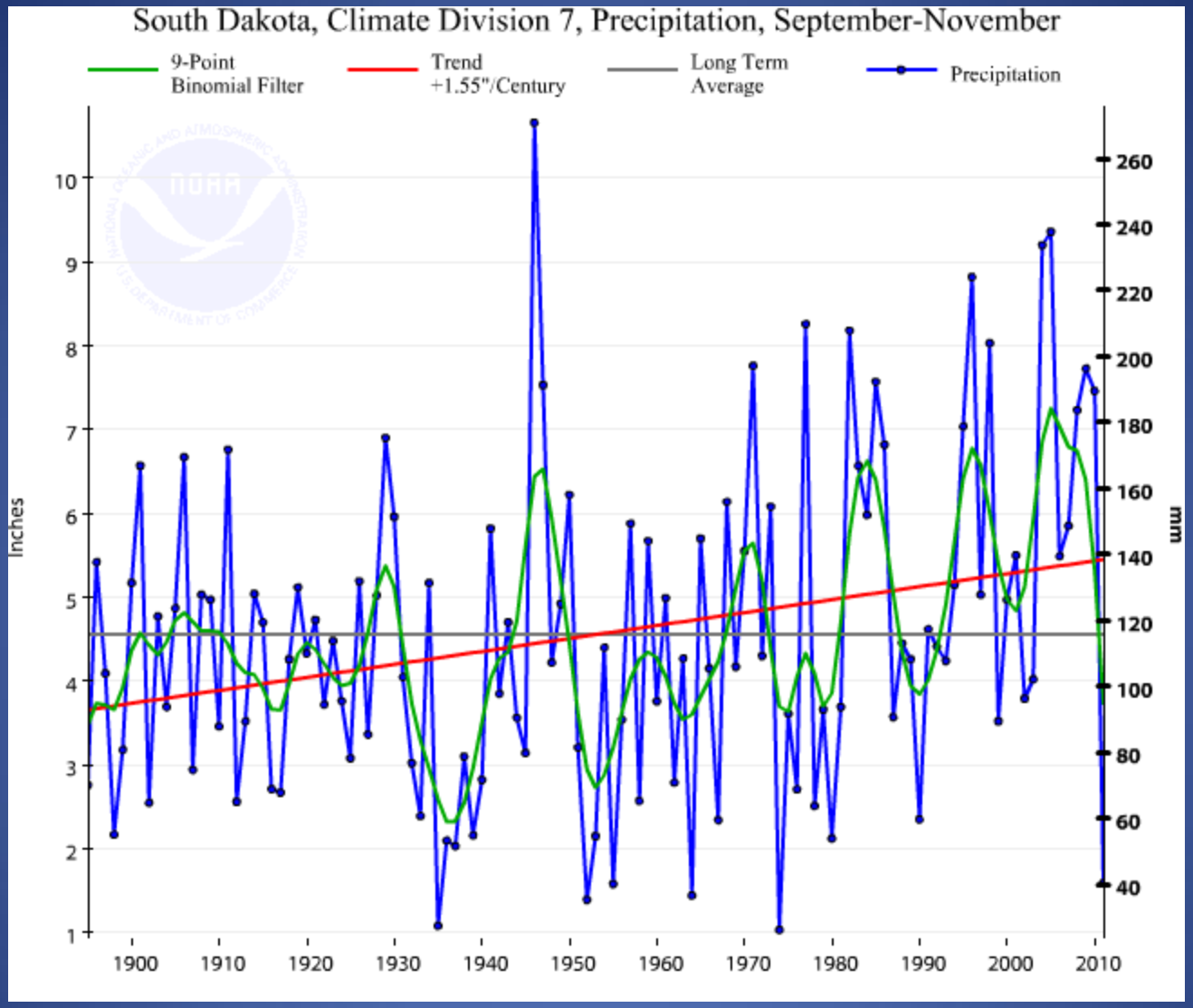
SOUTH DAKOTA Climate and Weather


Brookings Annual Precipitation
45
40
35
30
25
20
15
10
5
0
Year
1897
1901
1905
1909
1913
1917
1921
1925
1929
1933
1937
1941
1945
1949
1953
1957
1961
1965
1969
1973
1977
1981
1985
1989
1993
1997
2001
2005
2009
Precip
10 per. Mov. Avg. (Precip)

South Dakota - Northeast District Fall Precipitation

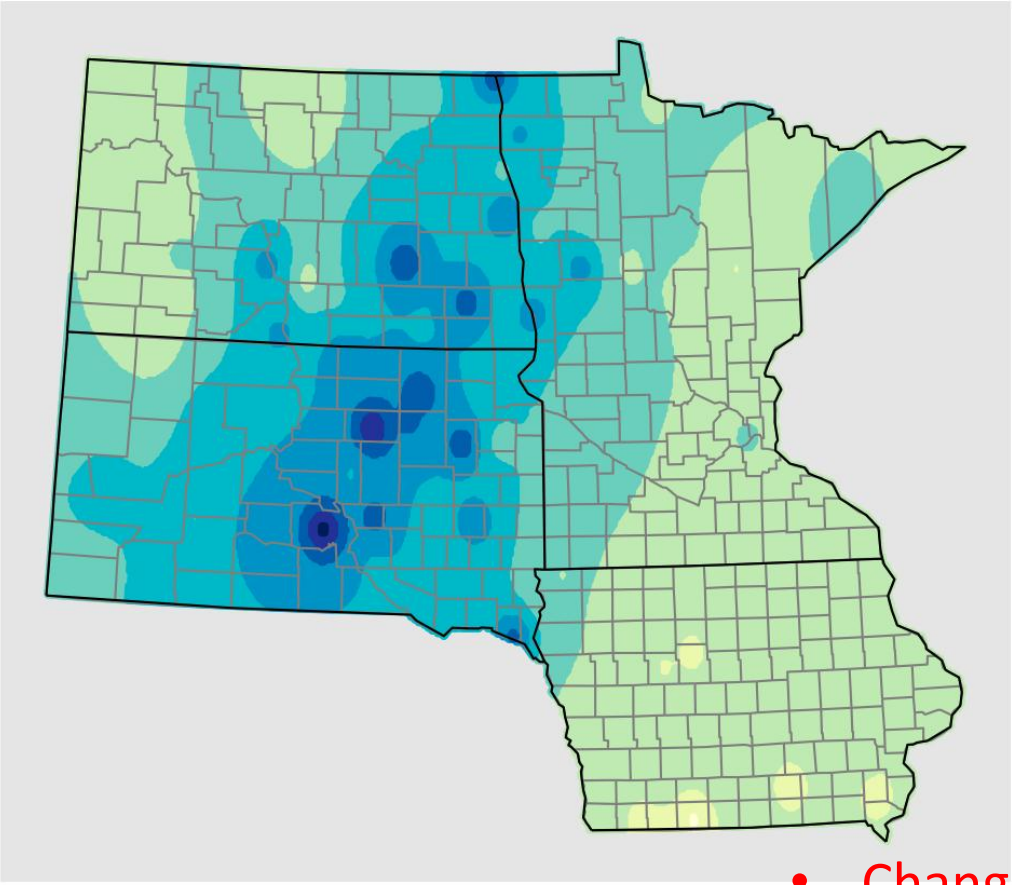


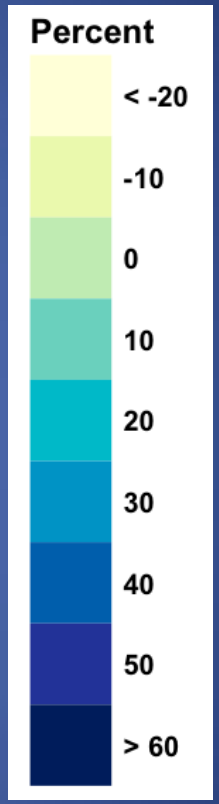
SOUTH DAKOTA Climate and Weather



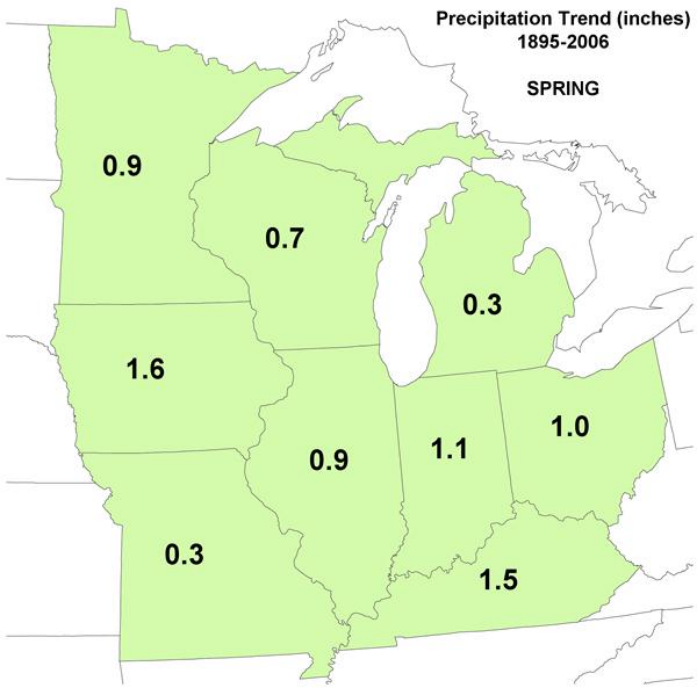
SOUTH DAKOTA Climate and Weather

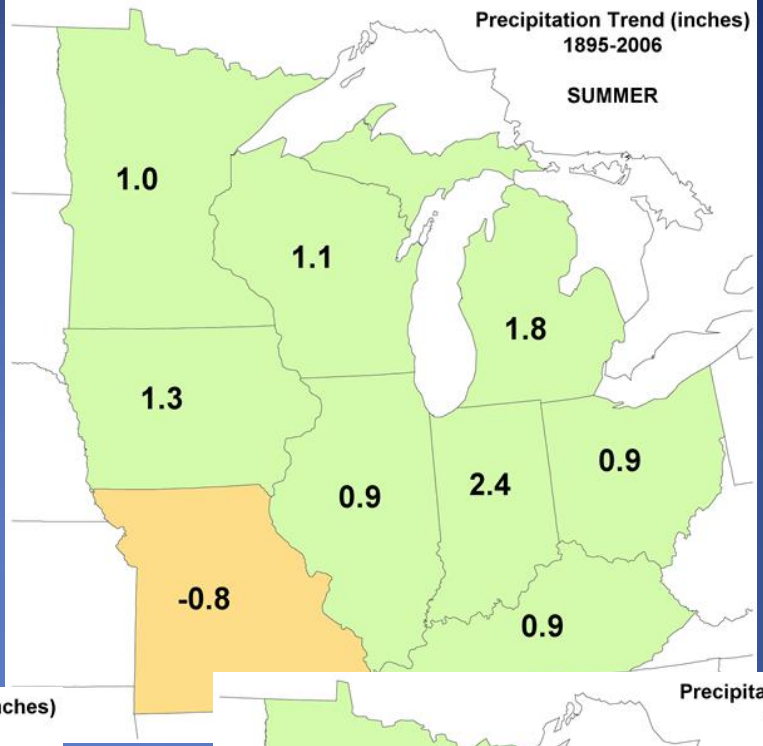
Large increases in fall precip. across the eastern Dakotas

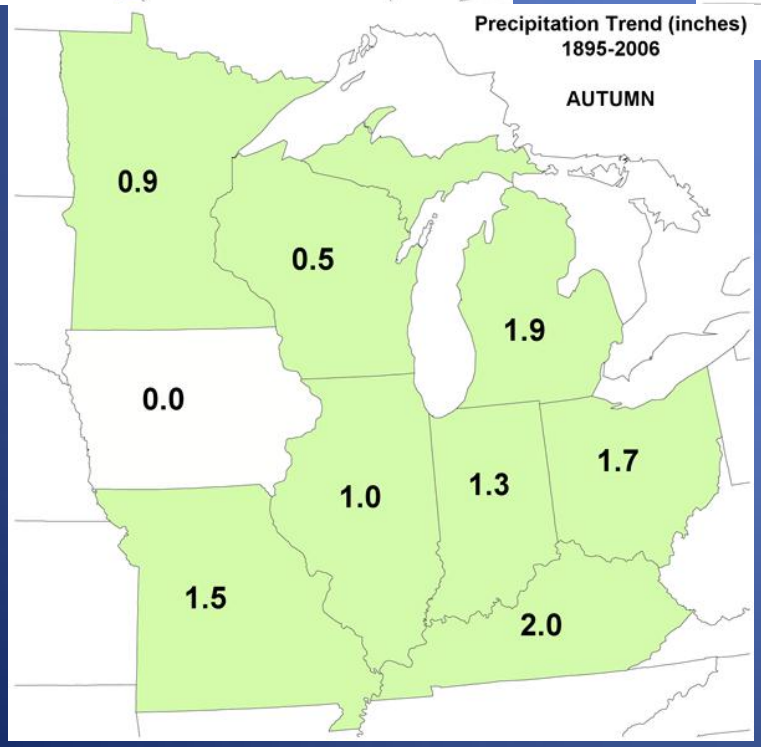


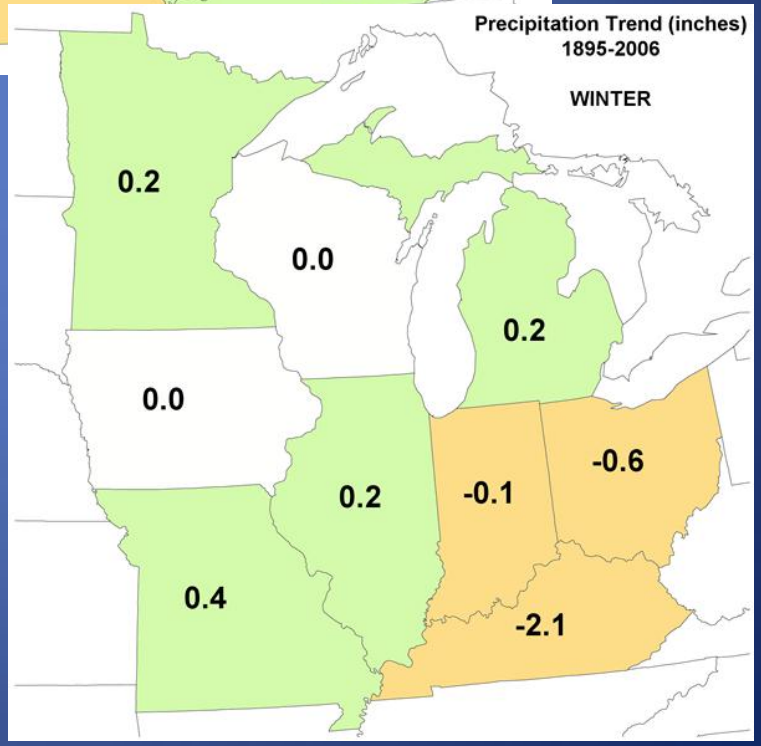


- Change in fall (SON) precipitation (%)
- 1991-2009 as compared to 1961-1990

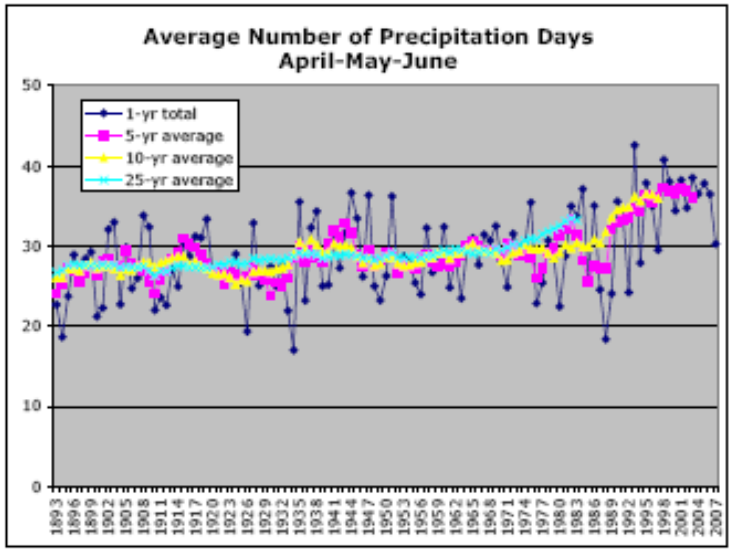

Precipitation Trend (inches)
1895-2006
SPRING
0.9
0.7
0.3
1.6
0.9
1.1
1.0
0.3
1.5

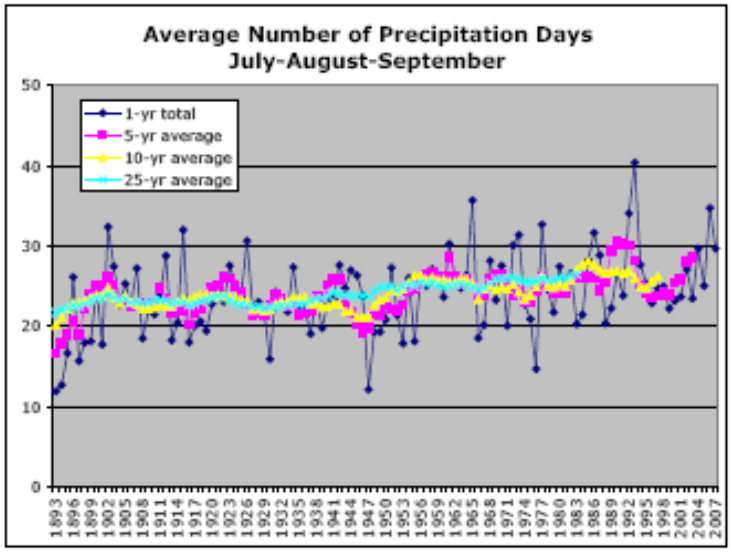

Precipitation Trend (inches)
1895-2006
SUMMER
1.0
1.1
1.8
1.3
0.9
2.4
0.9
-0.8
0.9

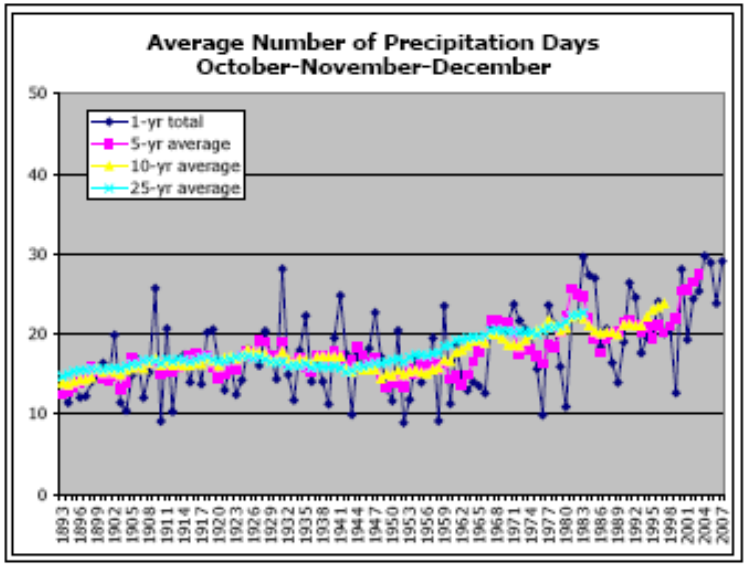

Precipitation Trend (inches)
1895-2006
AUTUMN
0.9
0.5
1.9
0.0
1.0
1.3
1.7
1.5
2.0

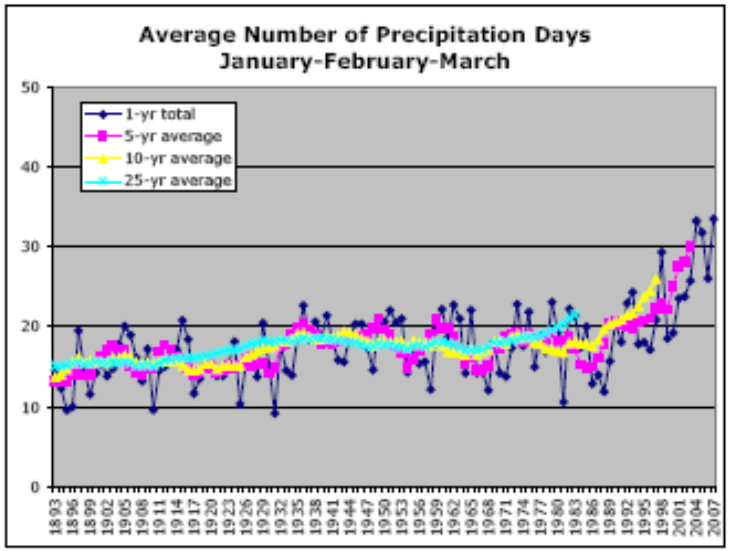

Precipitation Trend (inches)
1895-2006
WINTER
0.2
0.0
0.2
0.0
0.2
-0.1
-0.6
0.4
-2.1

Iowa precipitation days



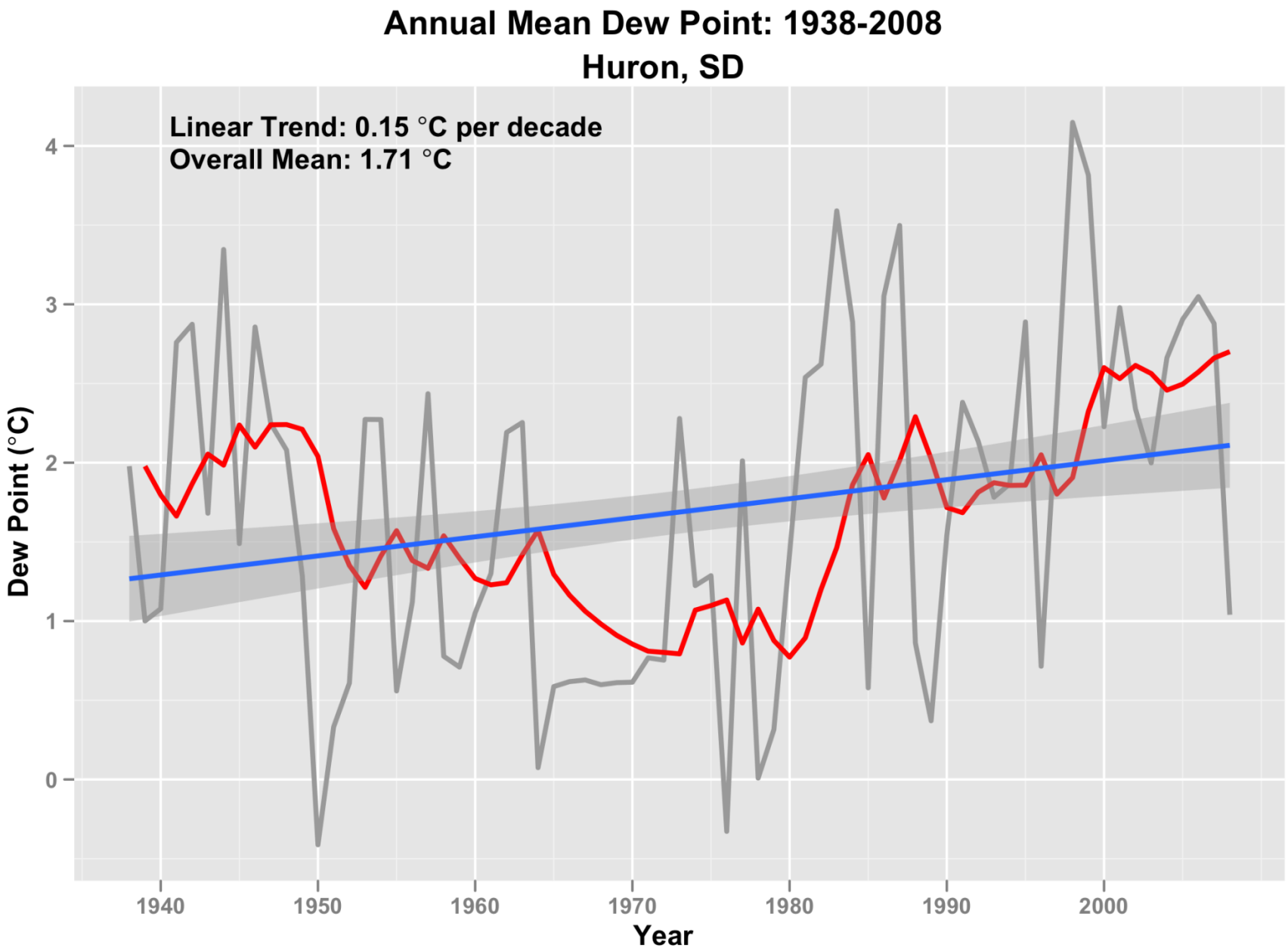


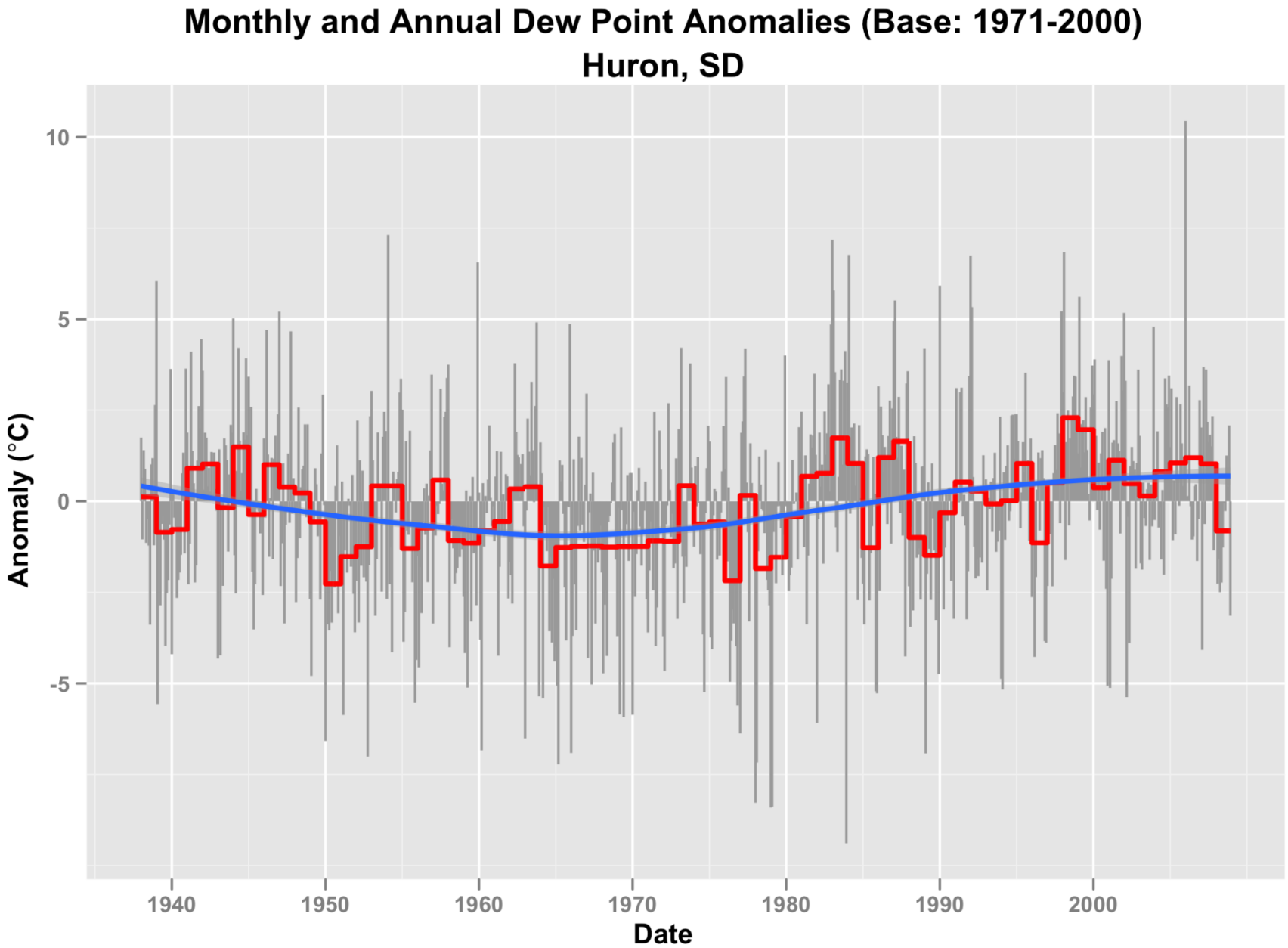


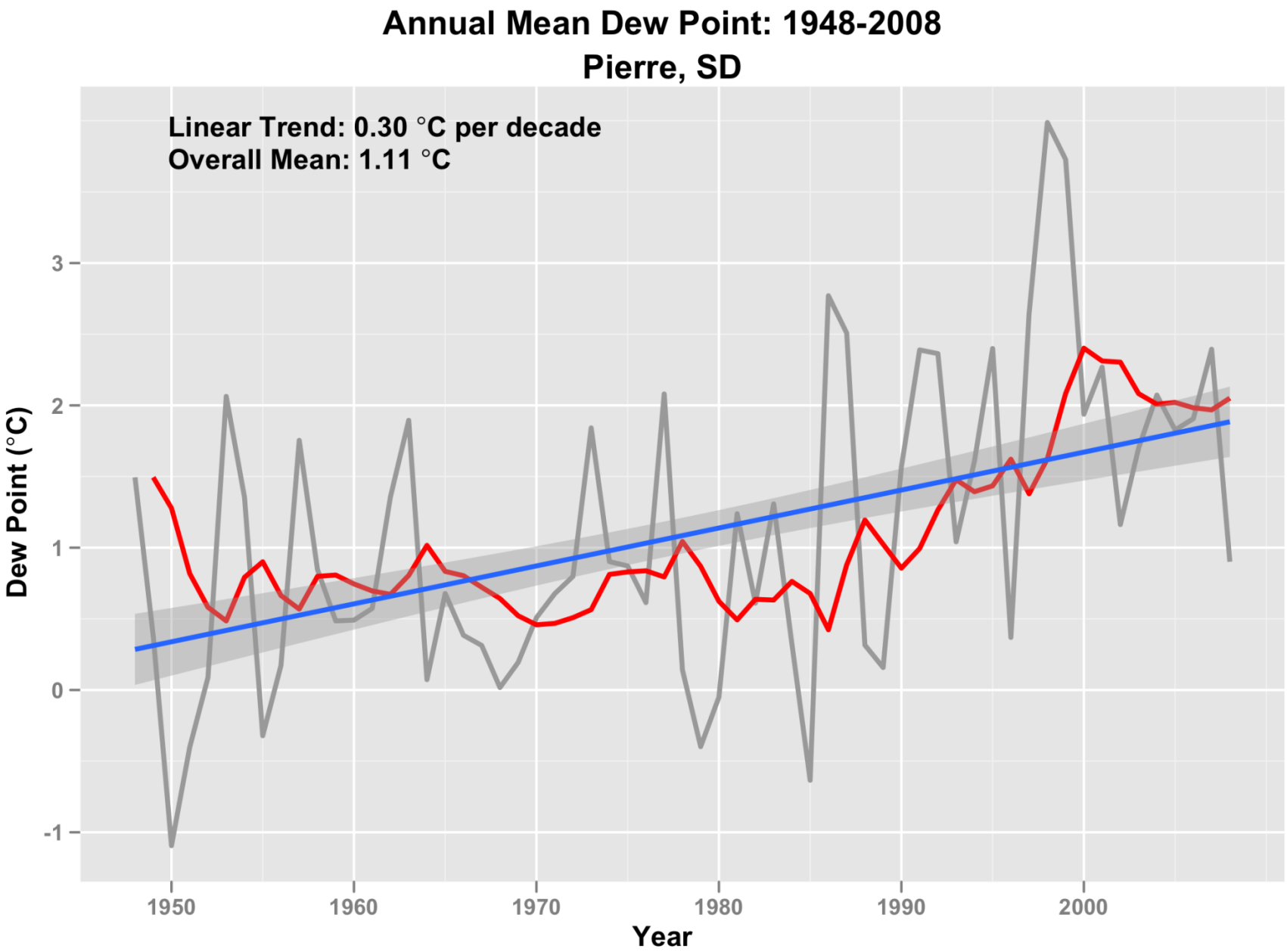


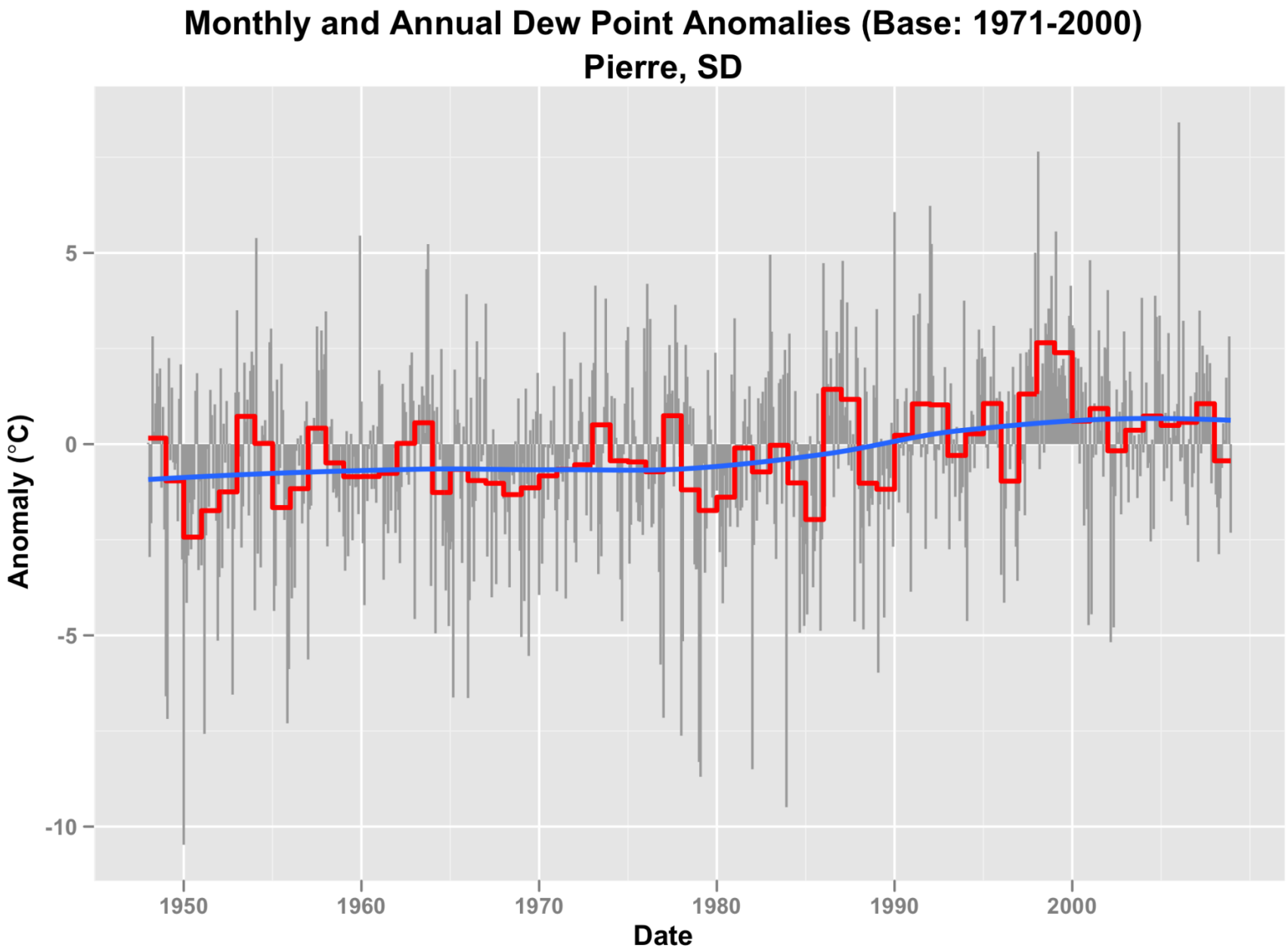
TRENDS – DEW POINT

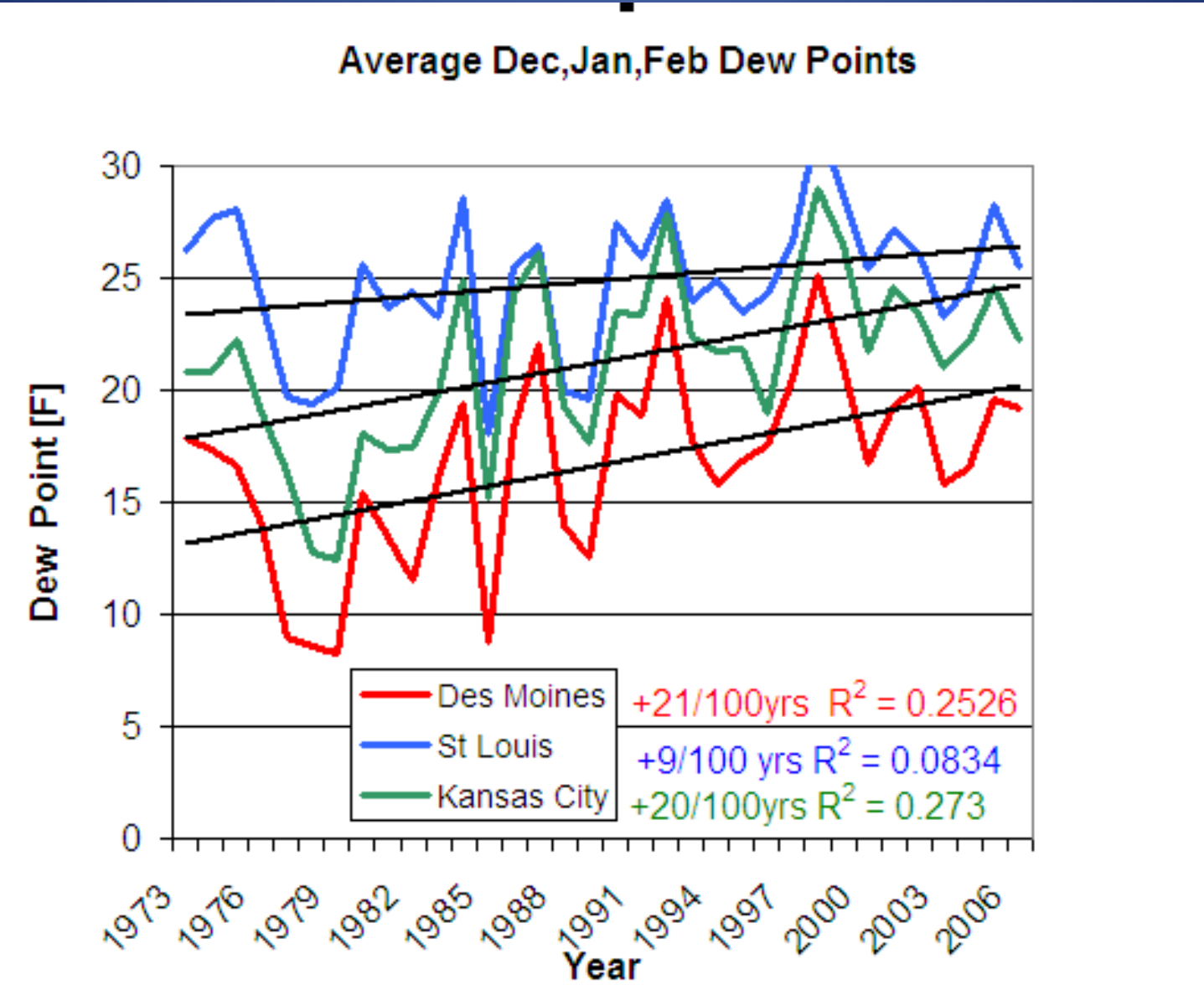
SOUTH DAKOTA
Climate and Weather

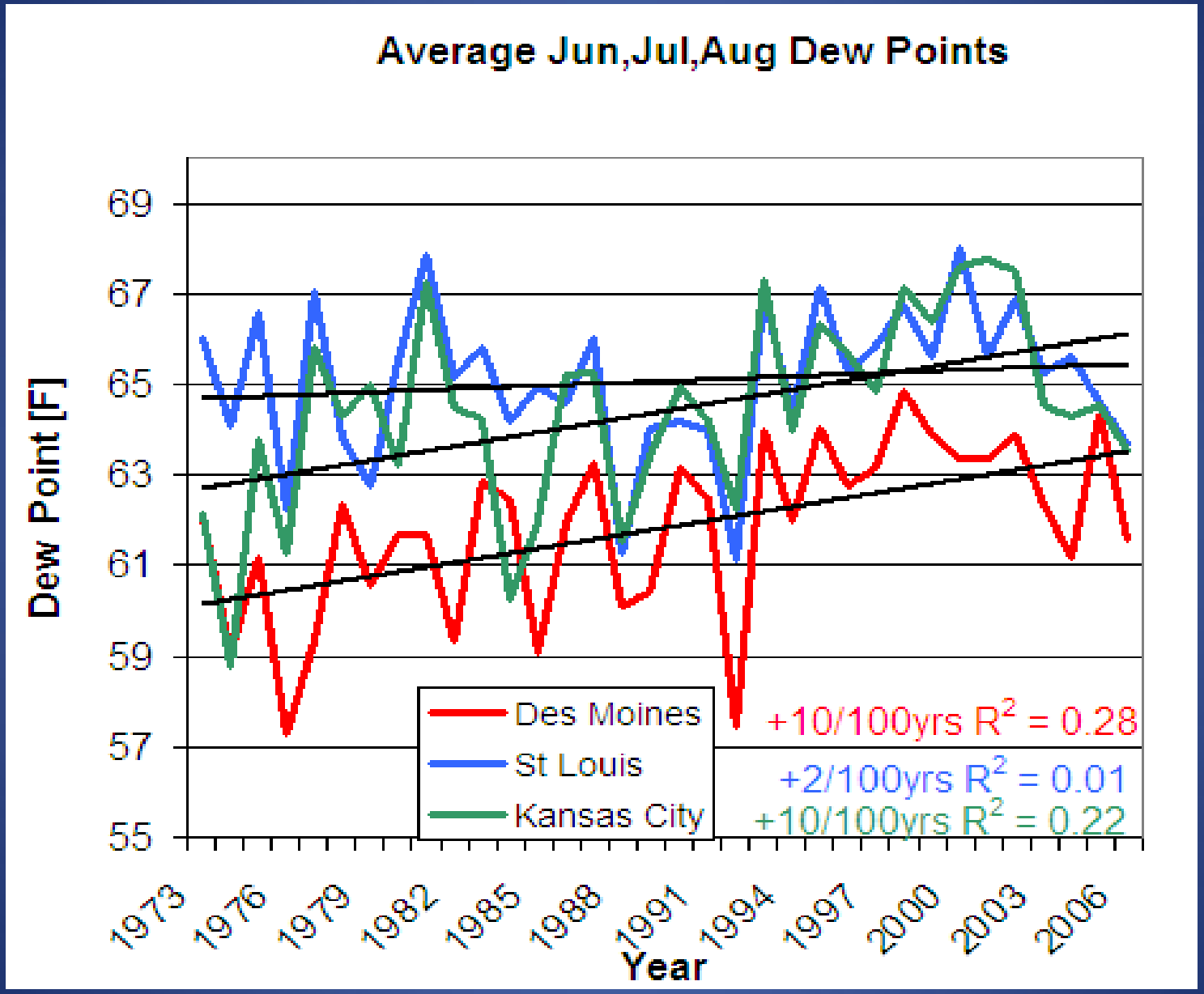

Annual Mean Dew Point: 1938-2008
Huron, SD
Linear Trend: 0.15 °C per decade
Overall Mean: 1.71 °C
Dew Point (°C)
4
3
2
1
0
1940
1950
1960
1970
1980
1990
2000
Year


Monthly and Annual Dew Point Anomalies (Base: 1971-2000)
Huron, SD
Anomaly (°C)
10
5
0
-5
1940
1950
1960
1970
1980
1990
2000
Date


Annual Mean Dew Point: 1948-2008
Pierre, SD
Linear Trend: 0.30 °C per decade
Overall Mean: 1.11 °C
Dew Point (°C)
3
2
1
0
-1
1950
1960
1970
1980
1990
2000
Year


Monthly and Annual Dew Point Anomalies (Base: 1971-2000)
Pierre, SD
Anomaly (°C)
5
0
-5
-10
1950
1960
1970
1980
1990
2000
Date


Average Dec,Jan,Feb Dew Points
Dew Point [F]
30
25
20
15
10
5
0
1973
1976
1979
1982
1985
1988
1991
1994
1997
2000
2003
2006
Year
Des Moines
St Louis
Kansas City
+21/100yrs R2 = 0.2526
+9/100 yrs R2 = 0.0834
+20/100yrs R2 = 0.273


Average Jun,Jul,Aug Dew Points
Dew Point [F]
69
67
65
63
61
59
57
55
1973
1976
1979
1982
1985
1988
1991
1994
1997
2000
2003
2006
Year
Des Moines
St Louis
Kansas City
+10/100yrs R2 = 0.28
+2/100yrs R2 = 0.01
+10/100yrs R2 = 0.22

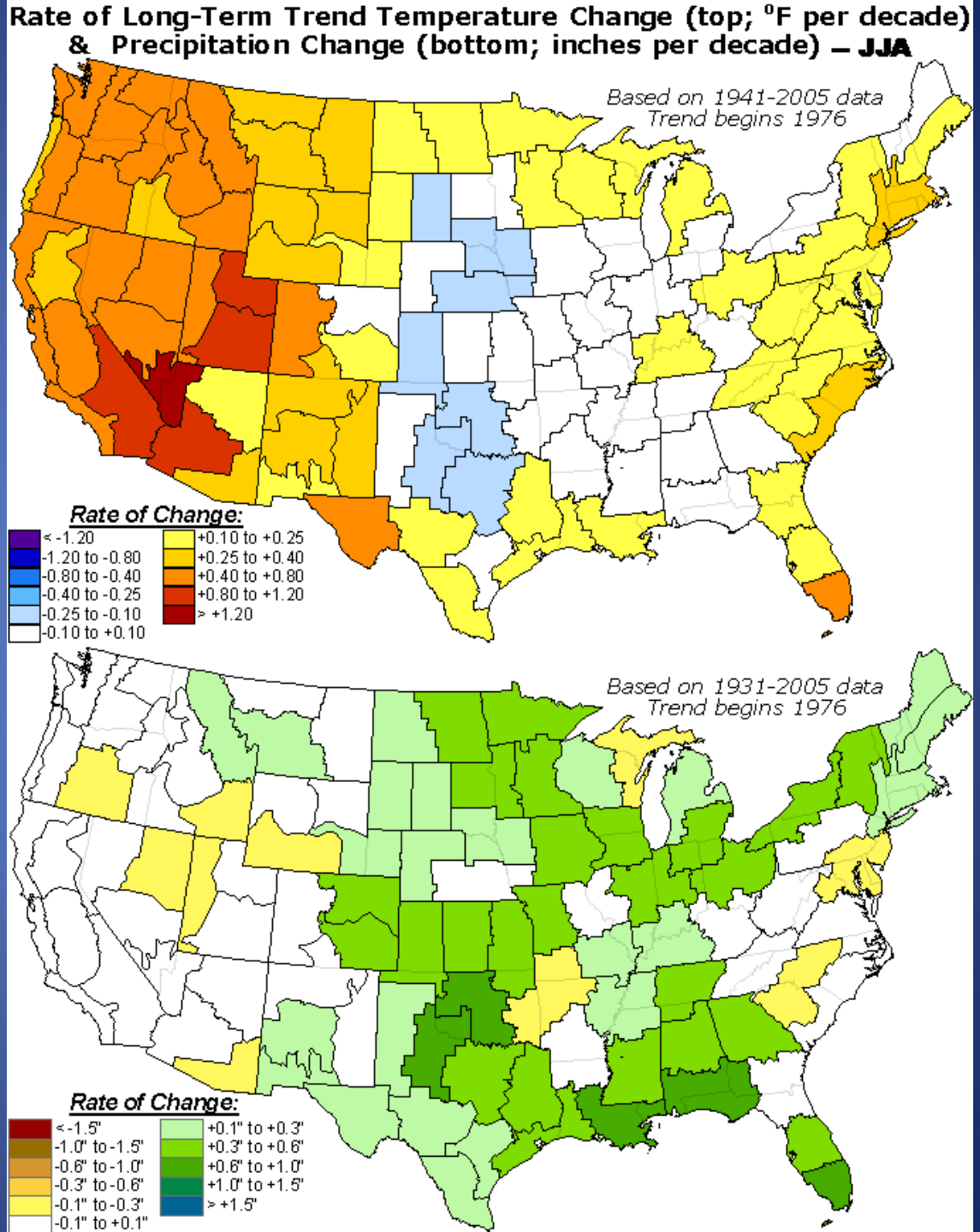
Most stations showed a significant increasing trend in dew point

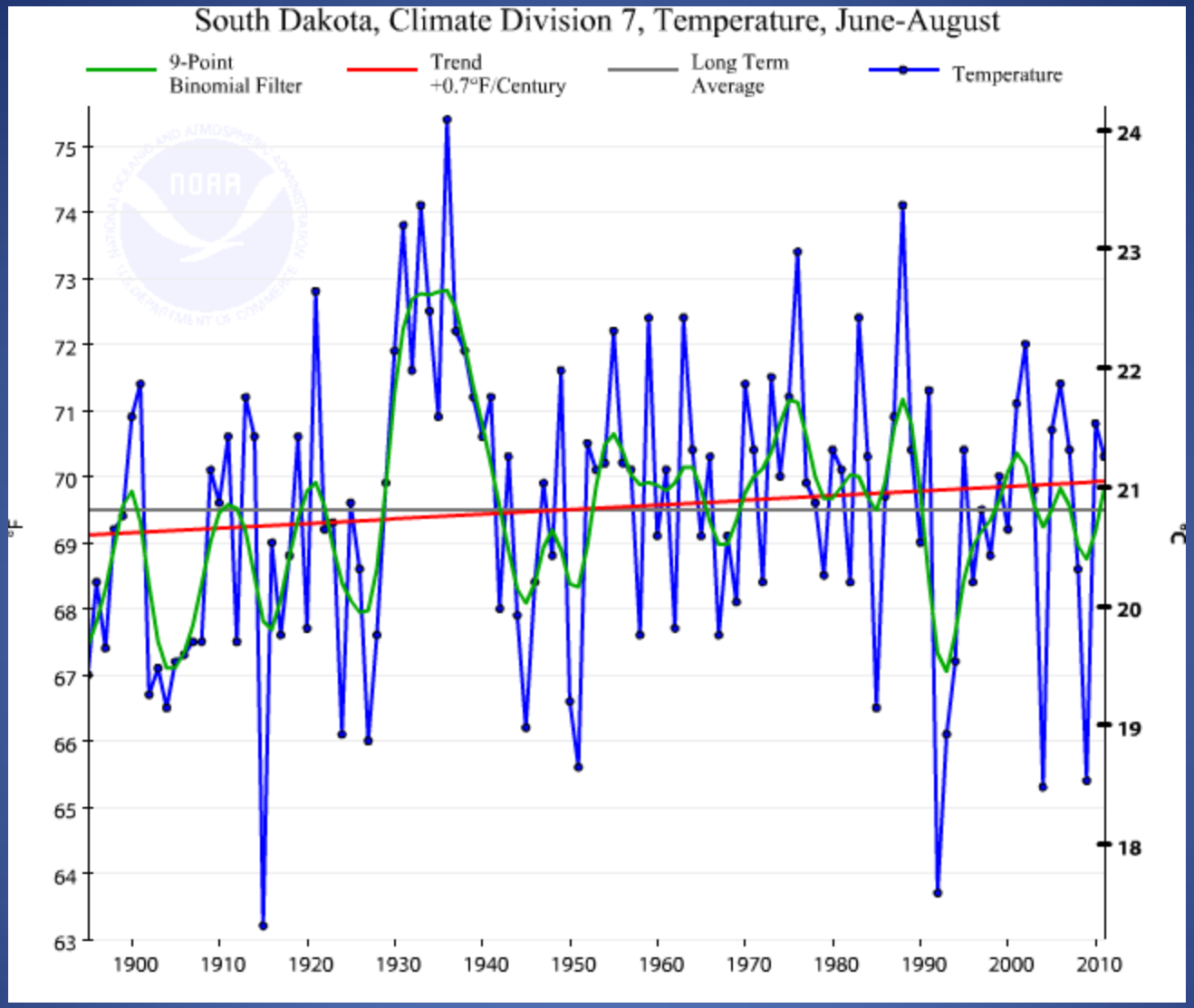
Station	Period	Trend (° C/10 yrs)	Kendall's τ	S	Adj. p-value
Aberdeen	1965–2008	0.34	0.130	1532	0.0030
Ellsworth AFB	1959–2008	0.29	0.138	2096	0.0045
Huron	1959–2008	0.32	0.138	2101	0.0017
Pierre	1959–2008	0.33	0.155	2361	0.0003
Rapid City	1959–2008	0.31	0.148	2250	0.0006
Sioux Falls	1973–2008	0.29	0.096	752	0.0514
Watertown	1973–2008	0.14	0.046	360	0.3038

TEMPERATURE

SOUTH DAKOTA
Climate and Weather

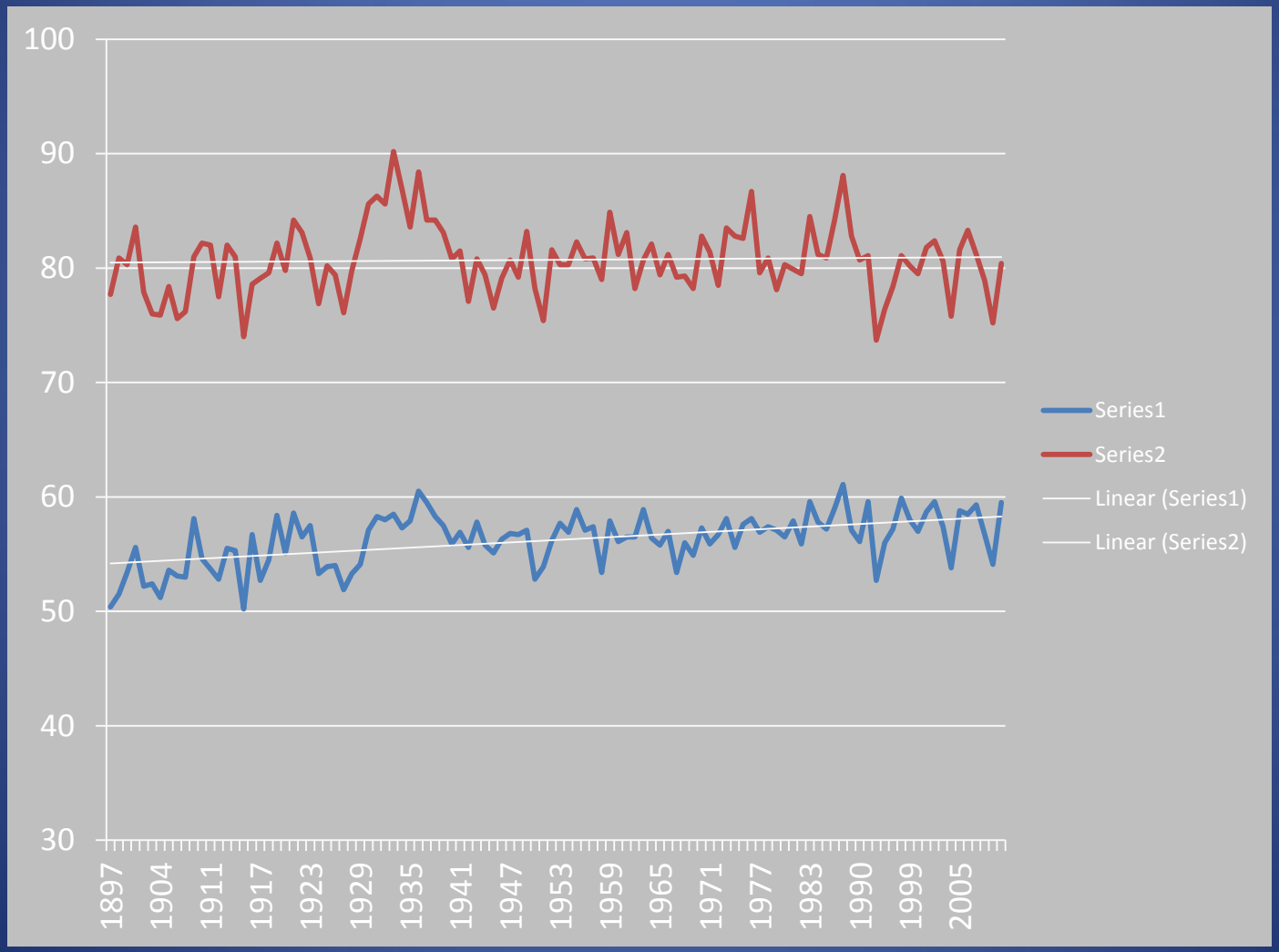
Jun. – Aug. trends



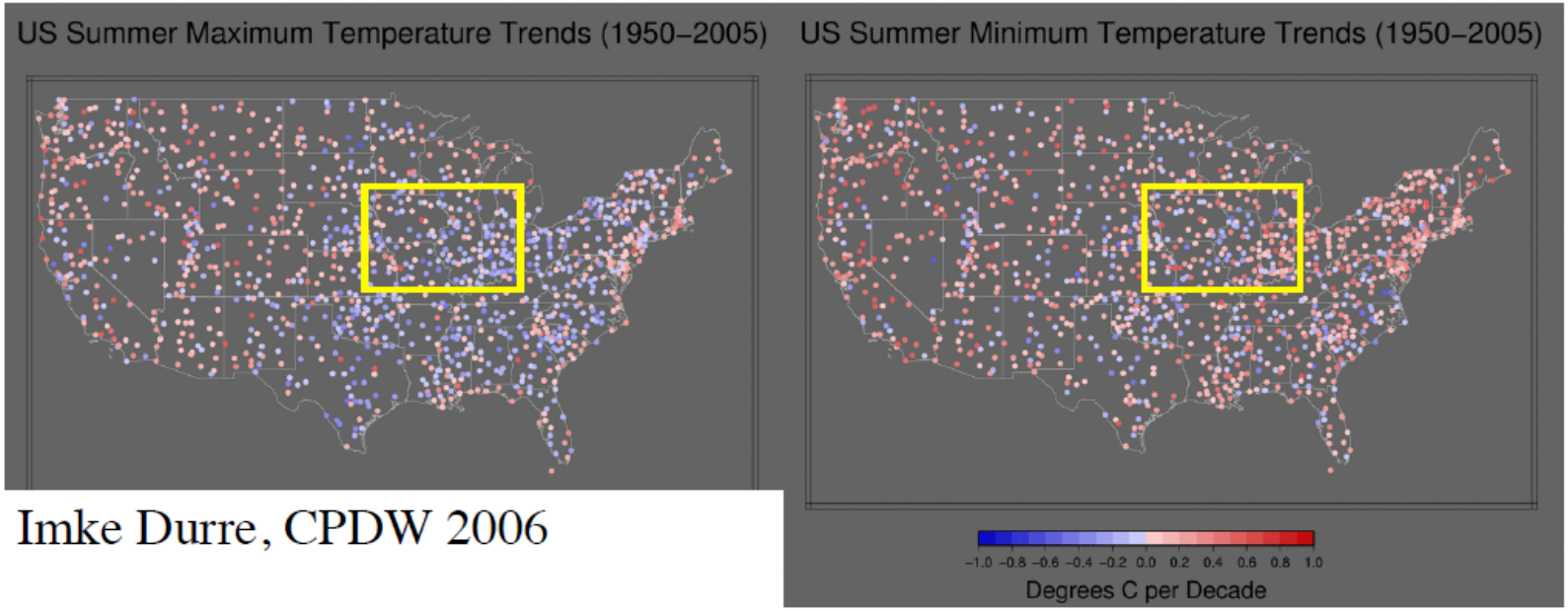


SOUTH DAKOTA Climate and Weather

Watertown summer temperatures 1897-2010



Maximum and Minimum Temperature Trends Offset Each Other



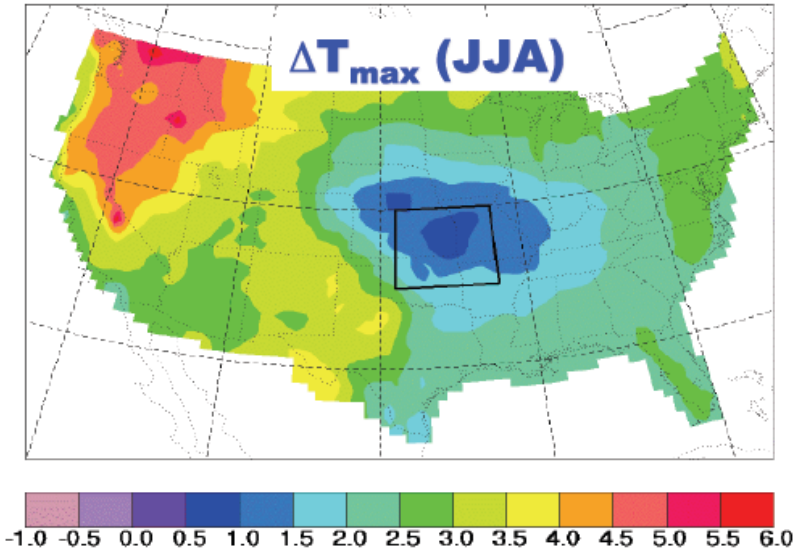
Imke Durre, CPDW 2006

An increase in minimum temperature and a decrease in maximum temperature results in little change in a verage temperature.

"Warming Hole"

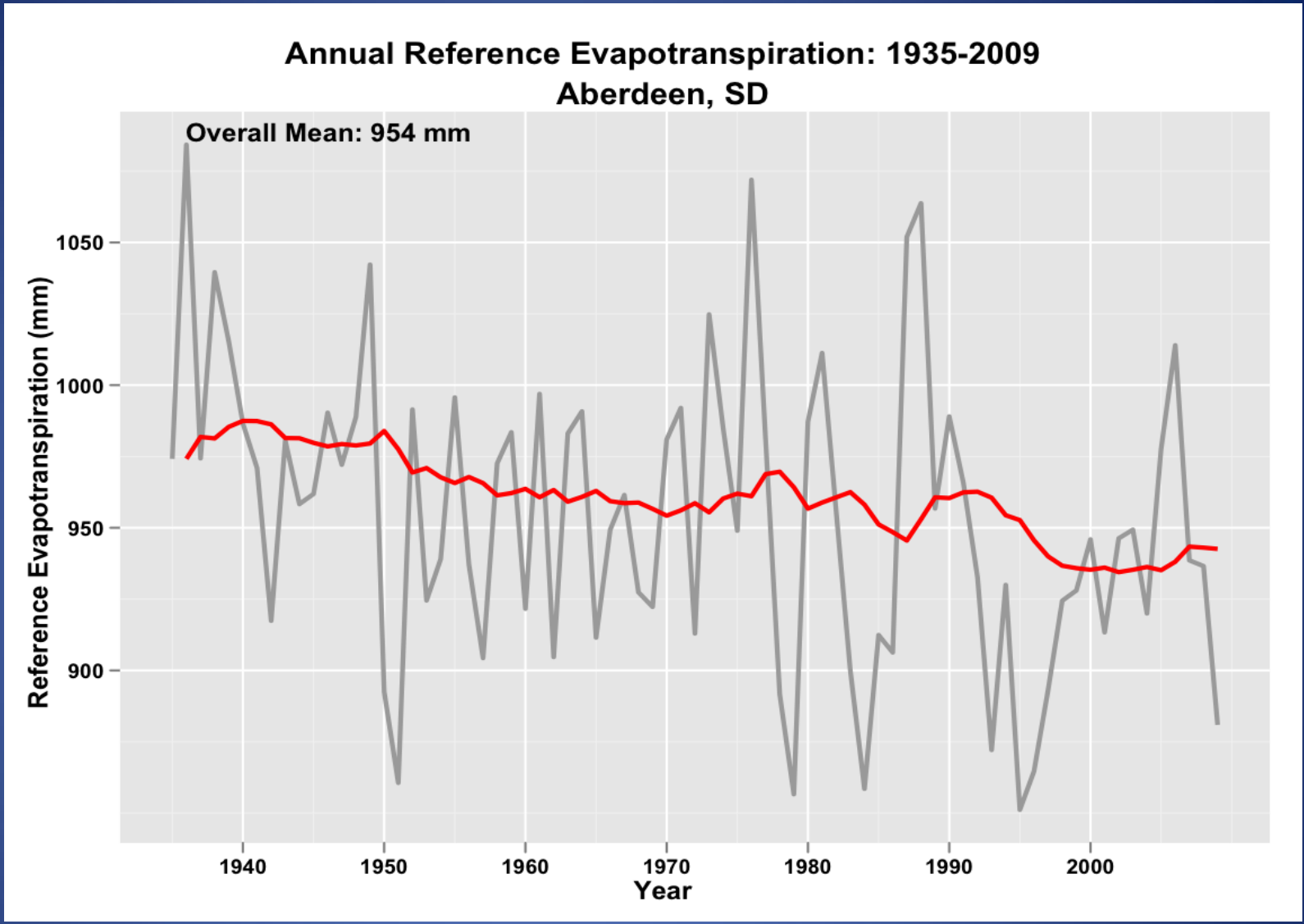
Global models poorly simulate Midwest temperature trend (Kunkel et al 2006).

Regional model simulated Midwest trends and used to examine future change considering greenhouse gas increases alone.**



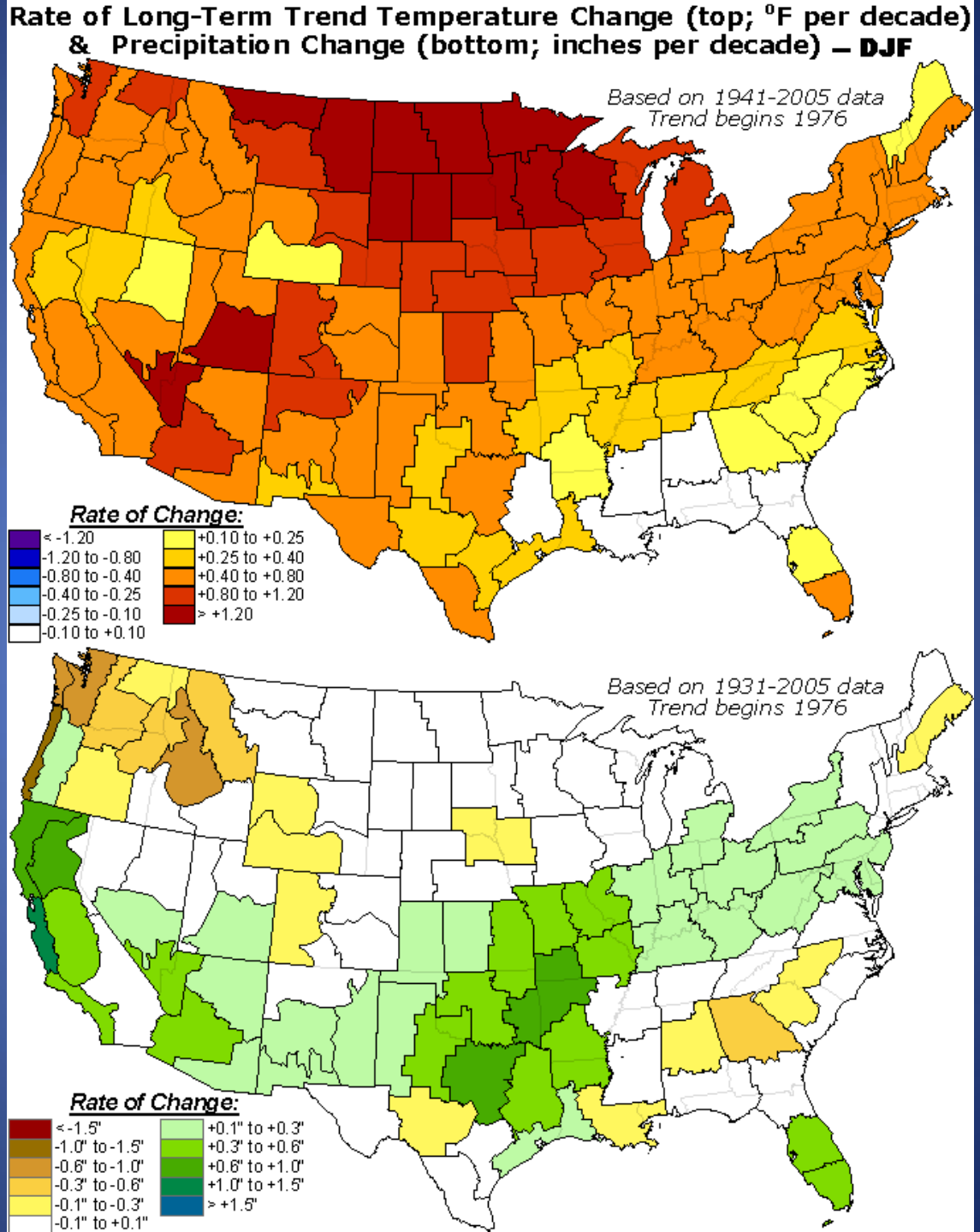
Conclusion: Lack of Midwest warming can be consistent with global warming mechanism.

**Pan, Z., R. W. Arritt, E. S. Takle, W. J. Gutowski, Jr., C. J. Anderson, and M. Segal, 2004: Altered hydrologic feedback in a warming climate introduces a "warming hole". Geophys. Res. Lett.31, L17109, doi: 10.1029/2004GL020528.

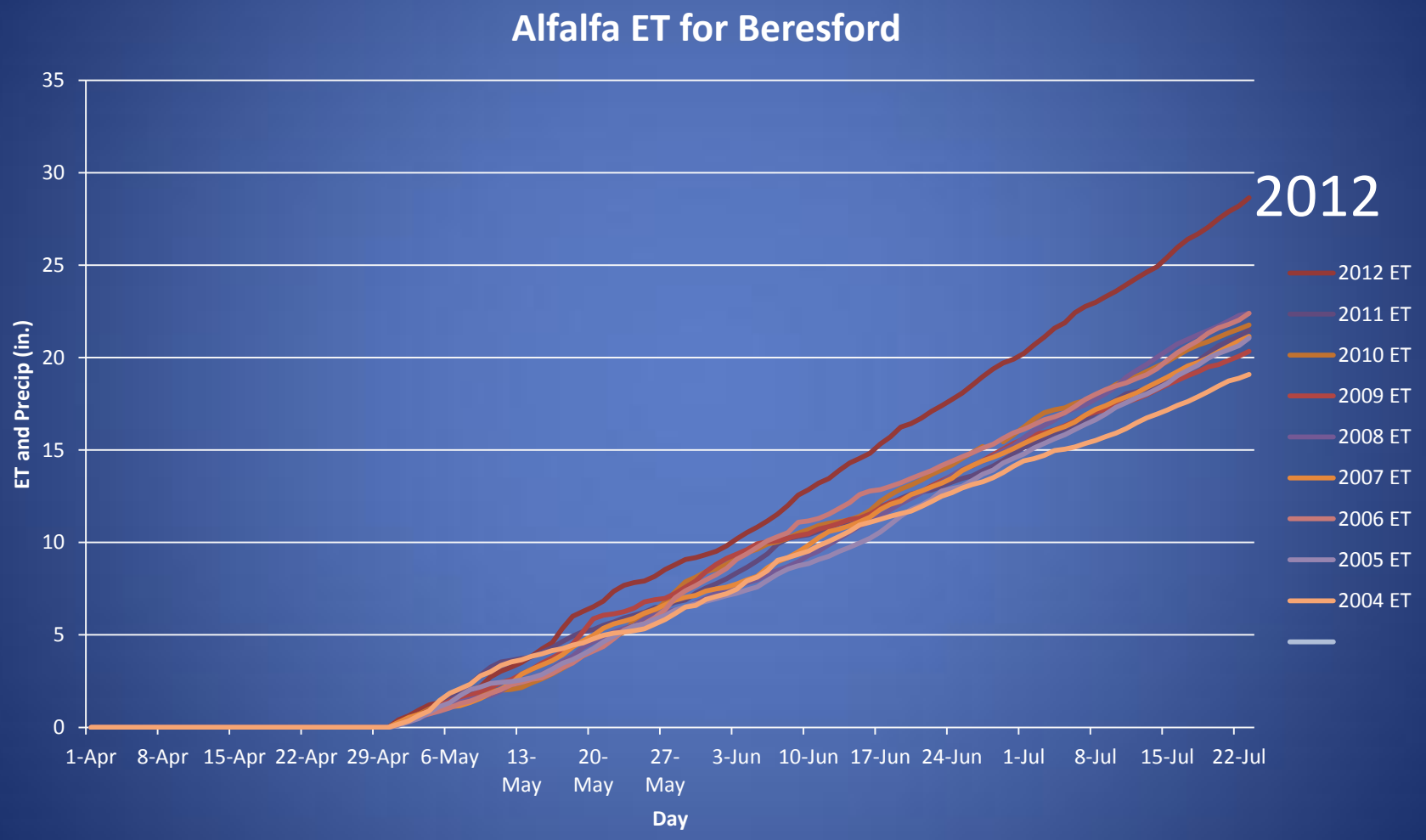


ET – Evapotranspiration, a combination of surface evaporation and transpiration from a crop
Calculated based on temperature index

Dec-Feb trends



Atmospheric Demand



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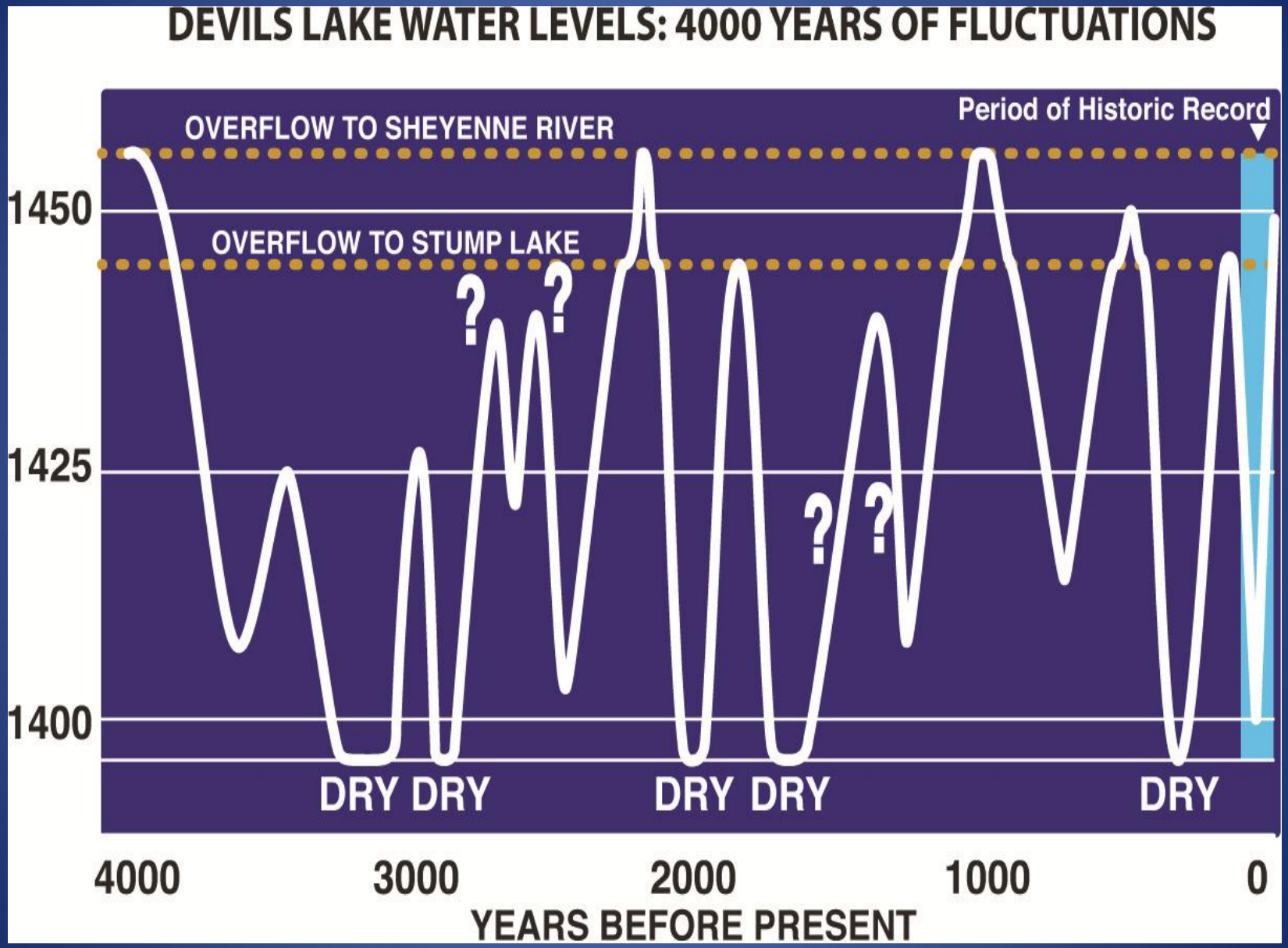
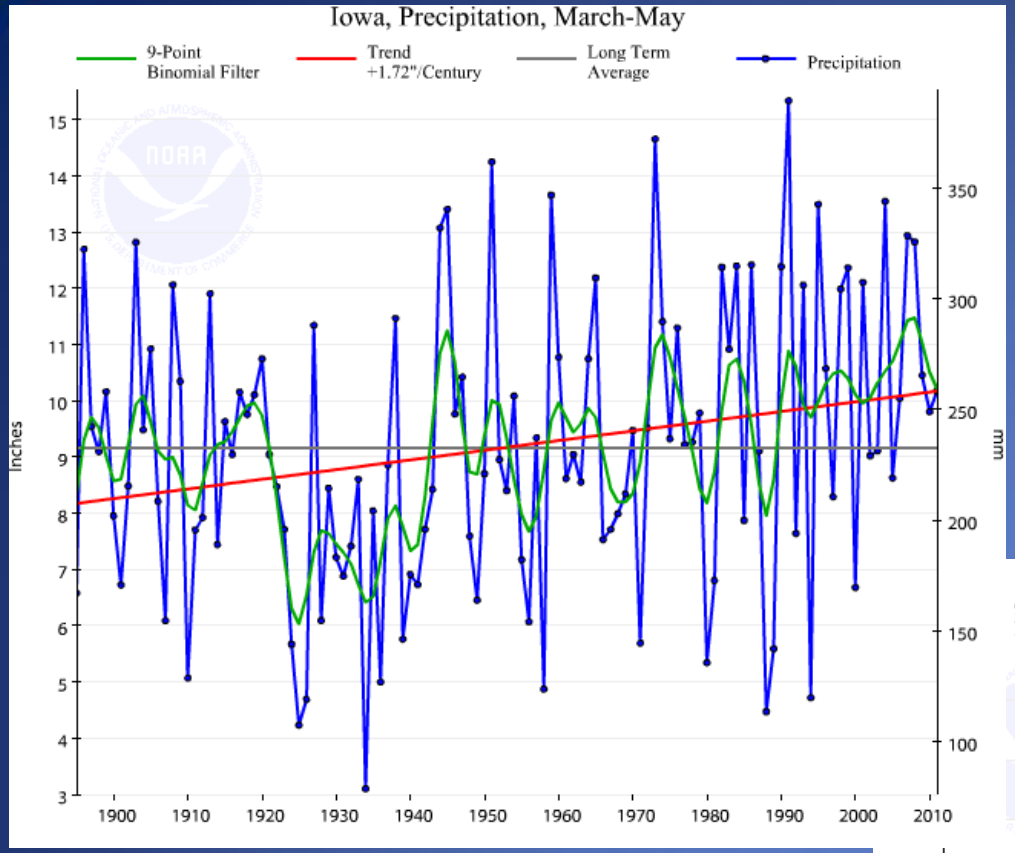
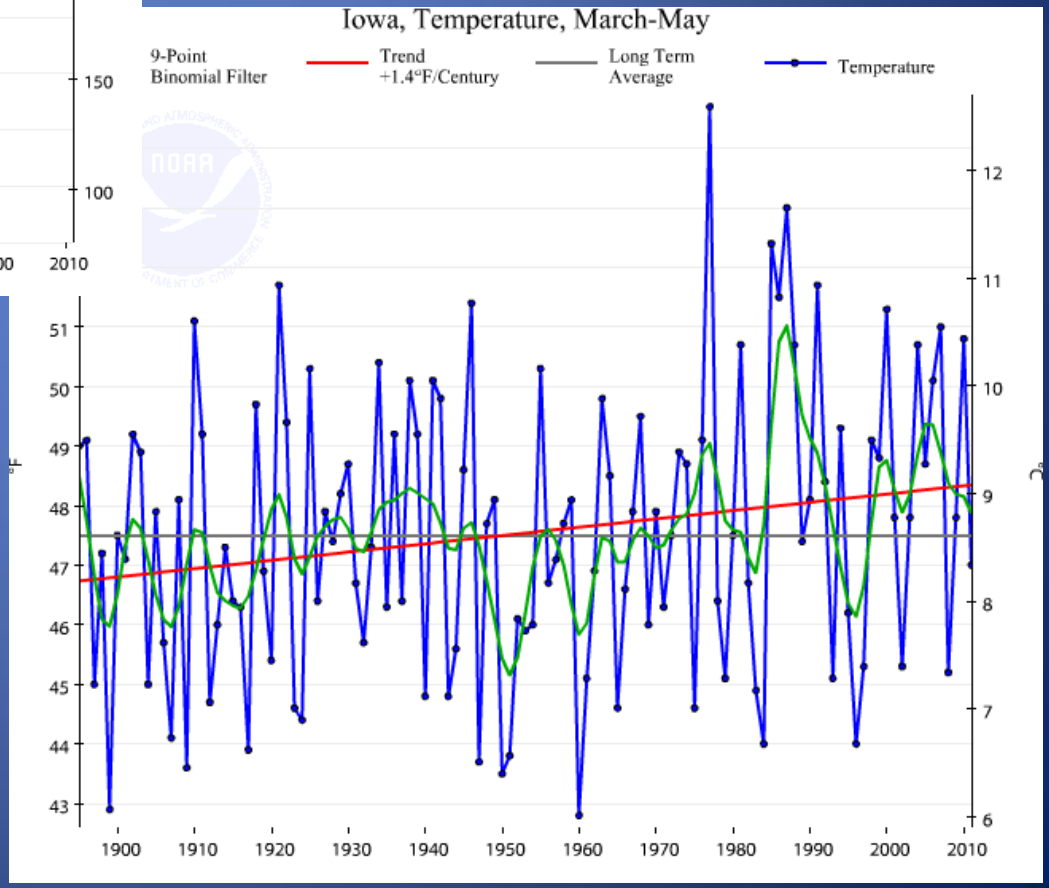
TEMPERATURE

SOUTH DAKOTA
Climate and Weather

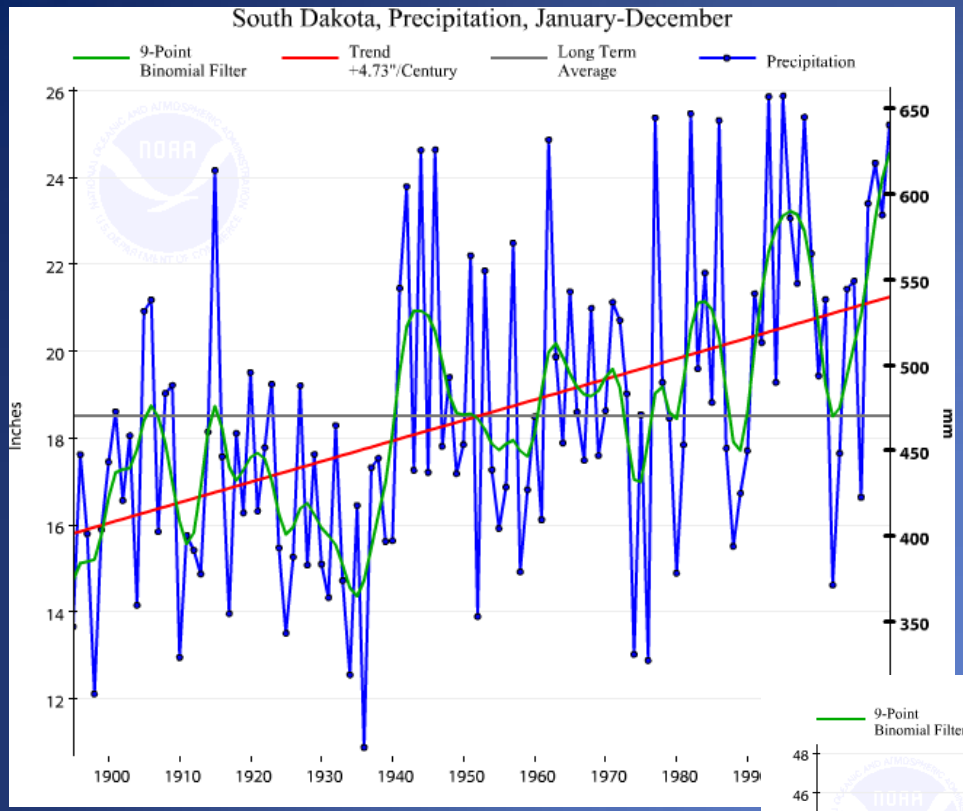

DEVILS LAKE WATER LEVELS: 4000 YEARS OF FLUCTUATIONS
Period of Historic Record
OVERFLOW TO SHEYENNE RIVER
OVERFLOW TO STUMP LAKE
1450
1425
1400
?
?
?
?
DRY DRY
DRY DRY
DRY
4000
3000
2000
1000
0
YEARS BEFORE PRESENT

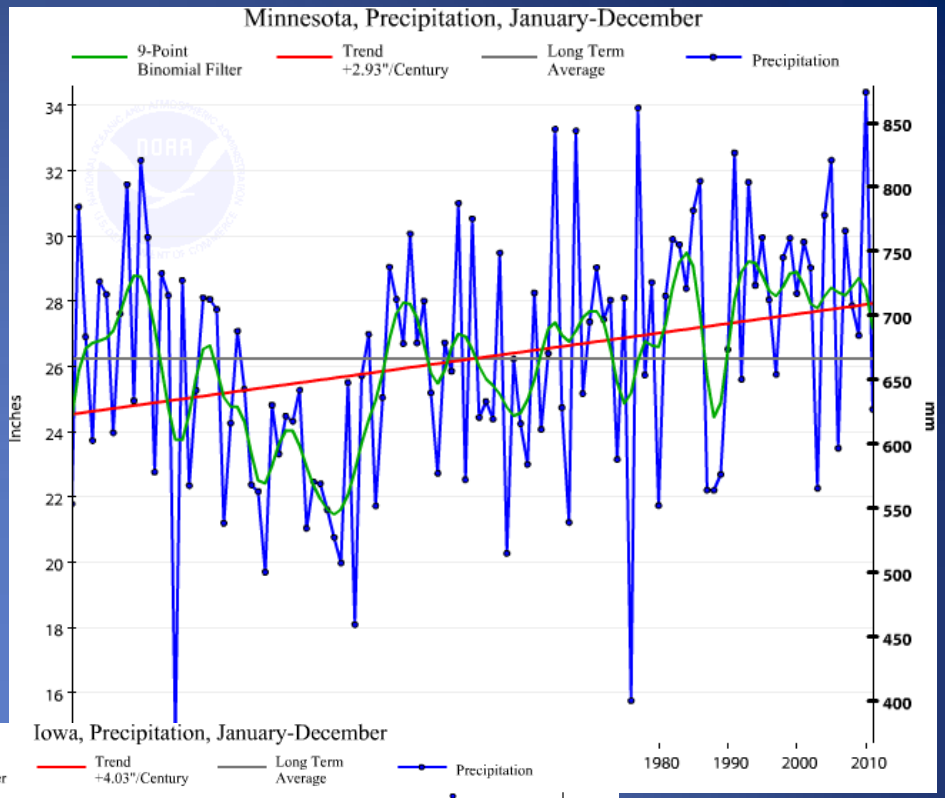

Iowa, Precipitation, March-May
9-Point Binomial Filter
Trend +1.72"/Century
Long Term Average
Precipitation
Inches
mm
15
14
13
12
11
10
9
8
7
6
5
4
3
350
300
250
200
150
100
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010

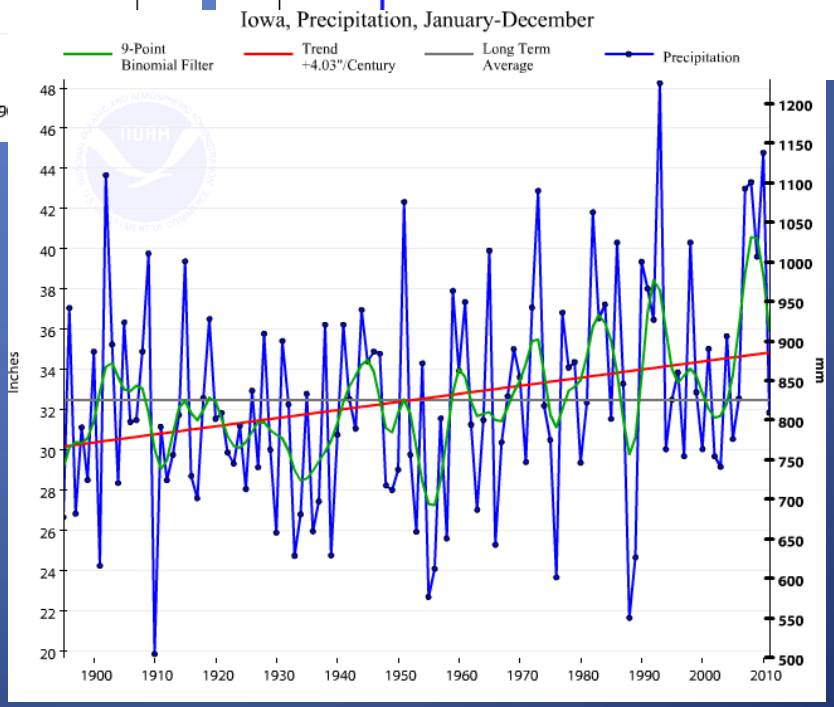

Iowa, Temperature, March-May
9-Point Binomial Filter
Trend +1.4°F/Century
Long Term Average
Temperature
°F
°C
51
50
49
48
47
46
45
44
43
12
11
10
9
8
7
6
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010

VARIABILITY

SOUTH DAKOTA
Climate and Weather







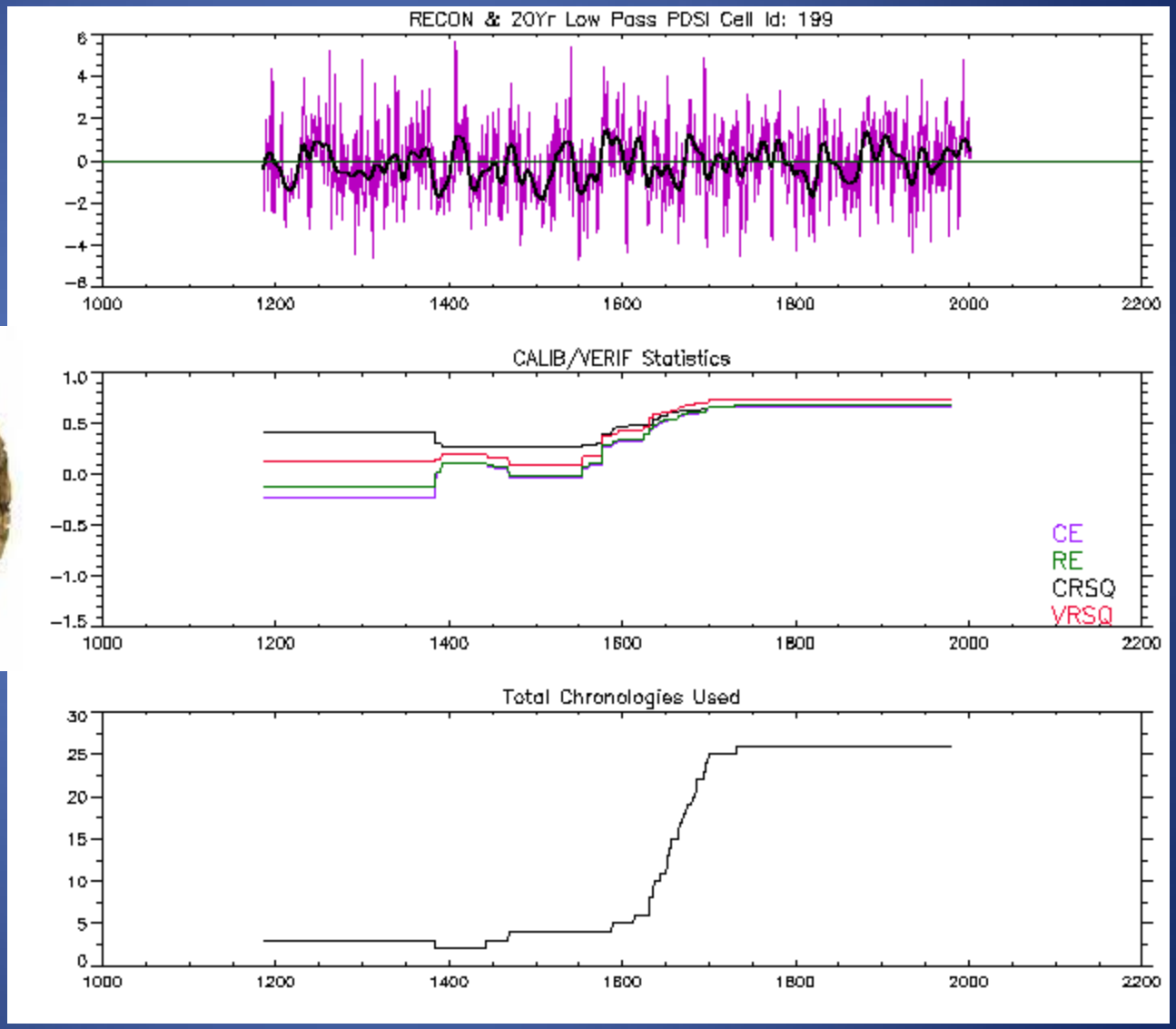
SOUTH DAKOTA Climate and Weather

Records of wetness

- Instrumented – best
- Proxies – longer, but not as accurate
  - Tree rings
  - Lake cores (salinity)

Tree ring reconstructions

Northeast
Iowa



http://www.ncdc.noaa.gov/paleo/newpdsi.html

Other information

- Increasing interest in tiling – SDSU, NDSU and UM and cooperative extension doing programming
- Enlarging lakes/sloughs
- Soil moisture information would be helpful – need to develop more capability for this
- Leading to prevent plant issues - RMA

Summary

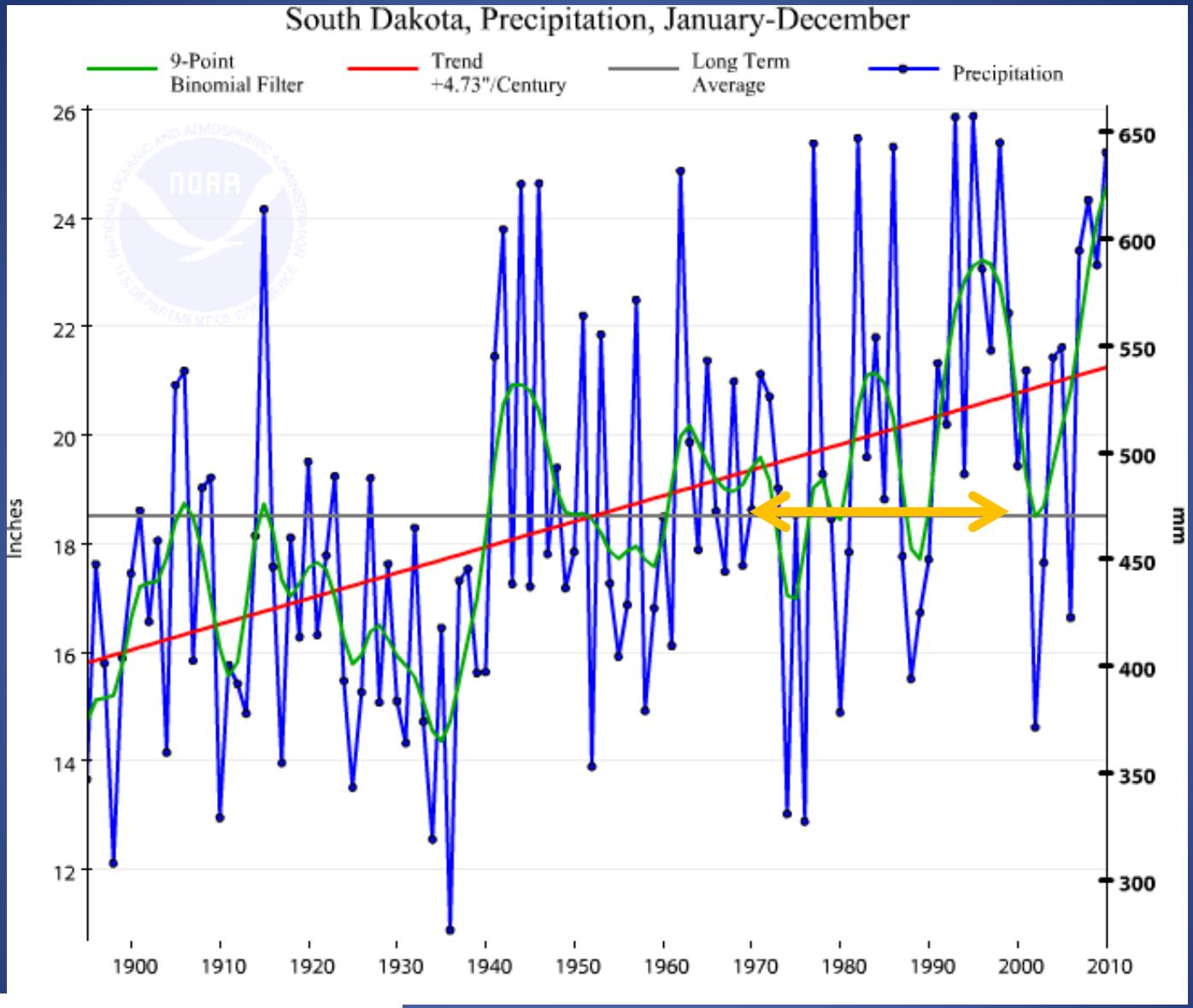
- More precipitation overall – especially fall
- More heavy precipitation events
- Increasing dew point
- General warming (more winter – less summer)
- Longer growing season (~ 1-2 days/decade)

SOUTH DAKOTA
Climate and Weather

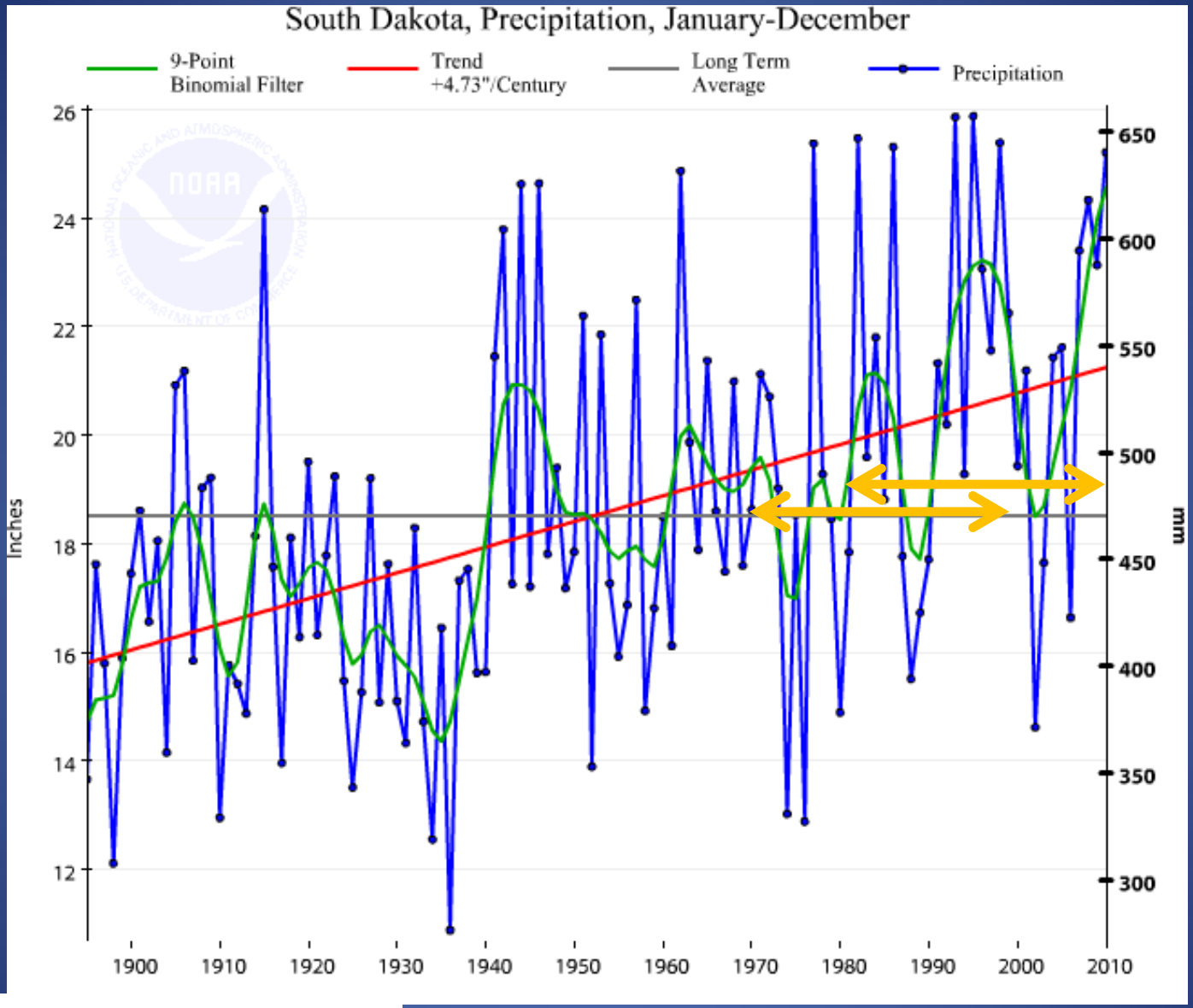
Change in normals

- Update every 10 years
- In July rolled out 1981-2010 data
- Updated from 1971-2000 data
- Changes – temperature, precipitation

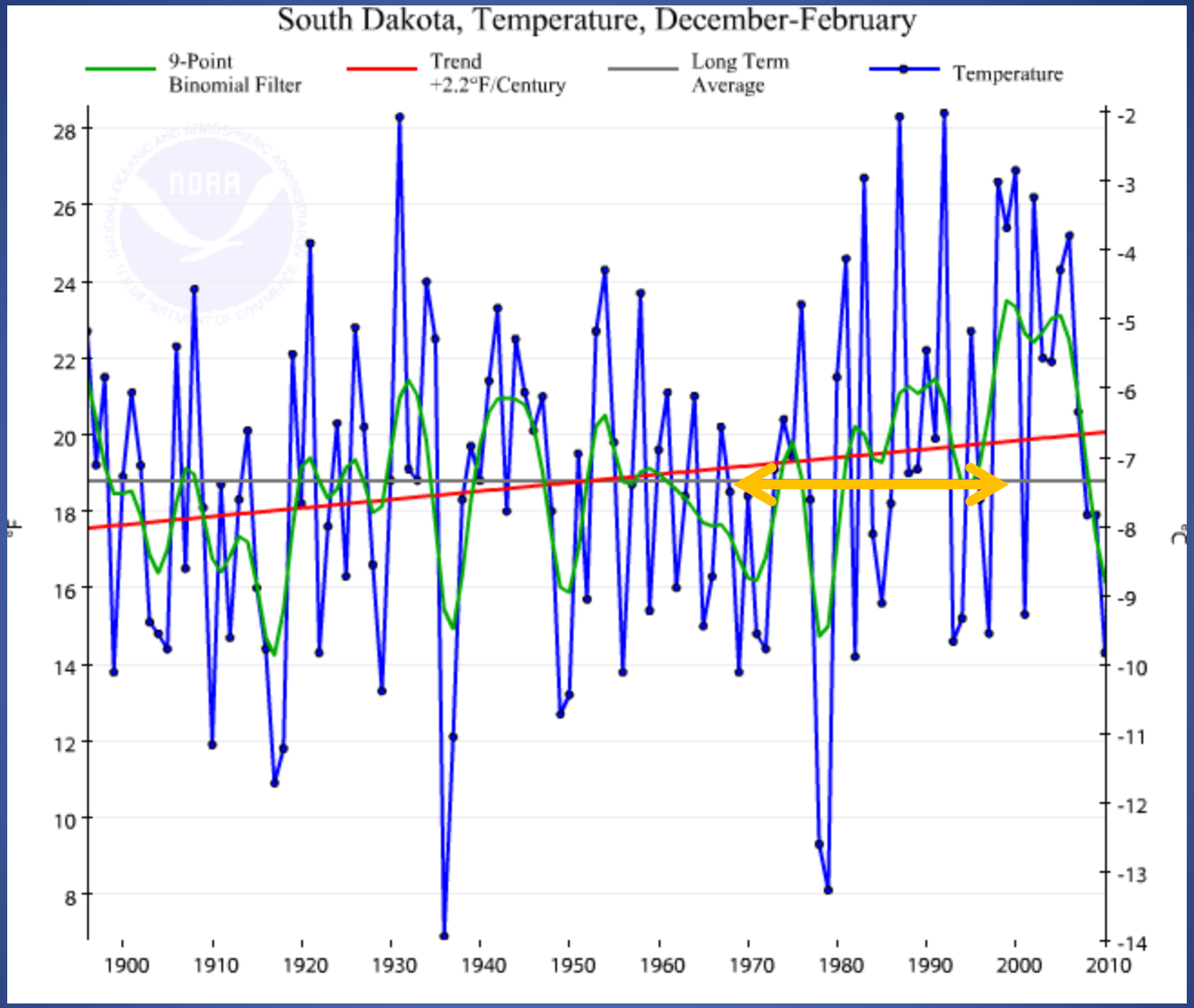
SOUTH DAKOTA
Climate and Weather



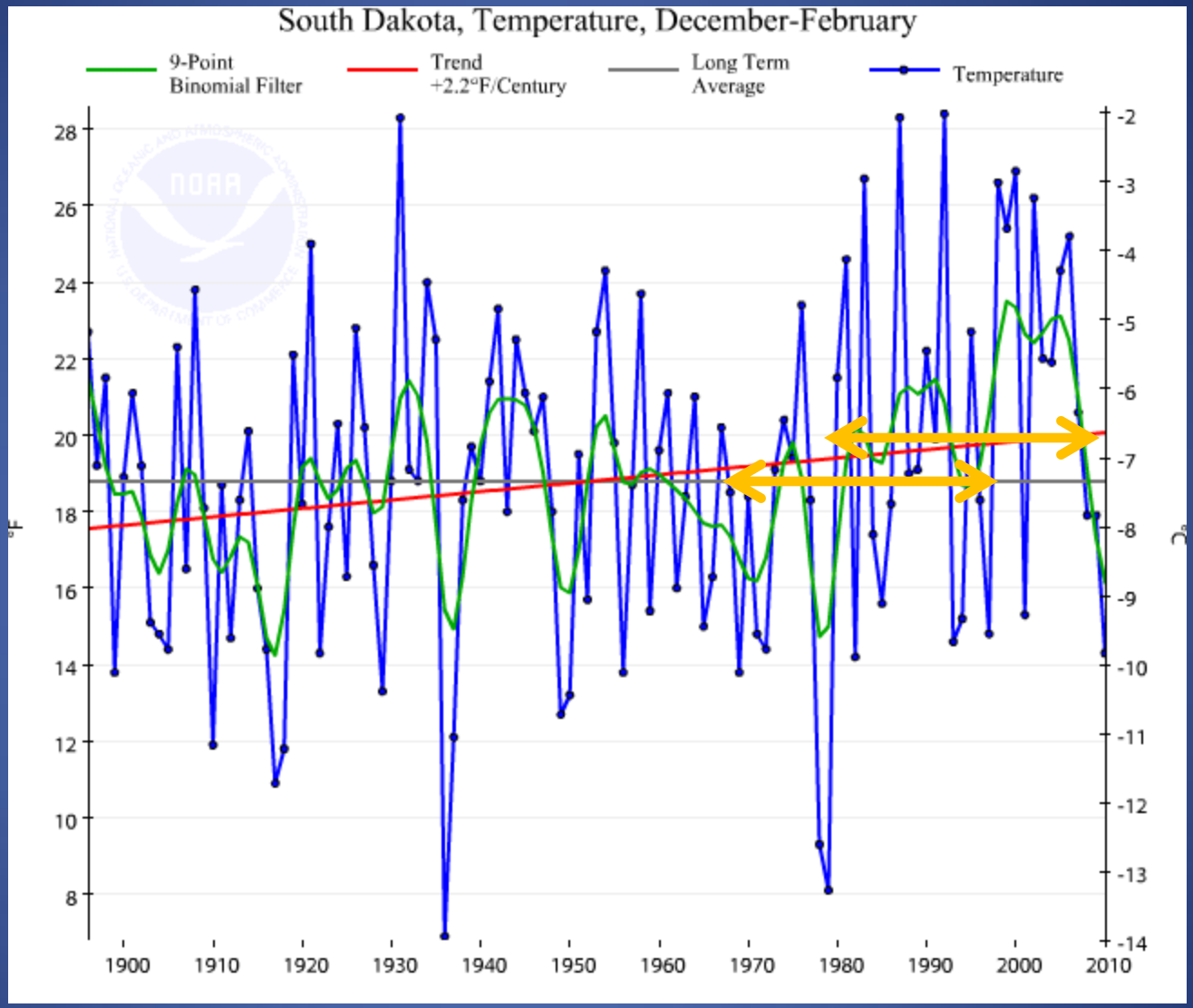
SOUTH DAKOTA Climate and Weather



SOUTH DAKOTA Climate and Weather



SOUTH DAKOTA Climate and Weather



SOUTH DAKOTA Climate and Weather

Drought and Climate Webinars

- Organized by NOAA Central Region's Doug Kluck
- Focusing on Plains drought and climate outlook
- 1-3 presenters each time
- Open Q&A
- **Next webinar: November 15, 1-2 PM CDT**
- **To register, go to:** https://www1.gotomeeting.com/register/355412680

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Community Collaborative Rain, Hail & Snow Network

"Because every drop counts"

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Welcome to CoCoRaHS! "Volunteers working together to measure precipitation across the nation."

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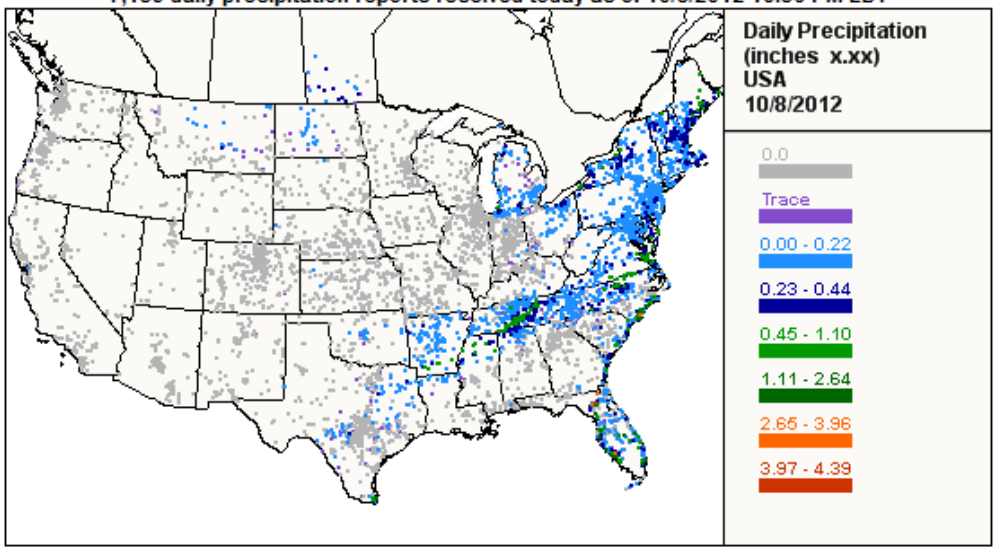
Measuring Reference Evapotranspiration ET_o

"The 'up' side of the water cycle"

7,159 daily precipitation reports received today as of 10/8/2012 10:56 PM EDT



JOIN CoCoRaHS

Things to know about...

Rain

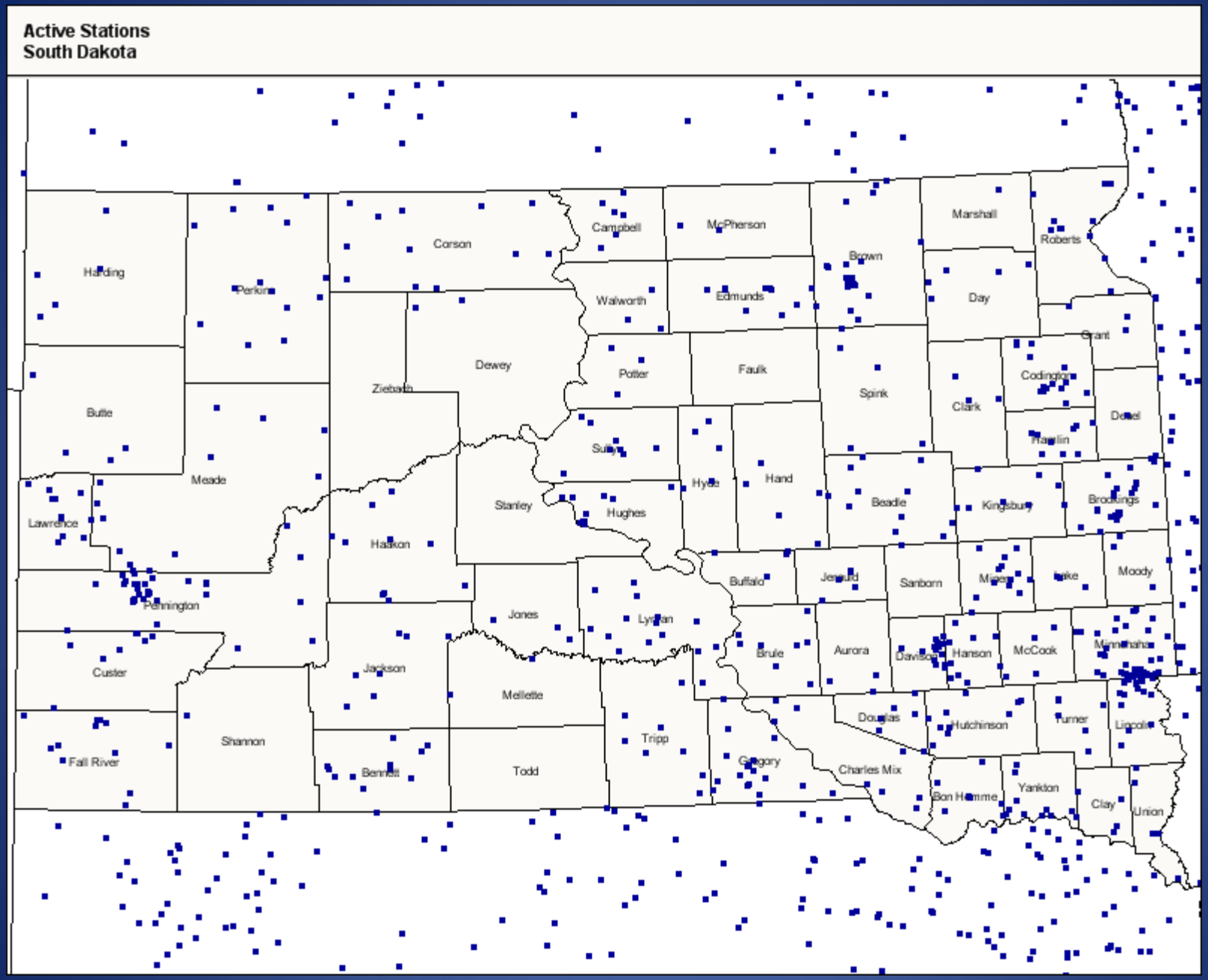
Hail

Snow

CoCoRaHS WxTalk Webinar Series

Purchase an official CoCoRaHS 4" Rain Gauge

"The official CoCoRaHS Rain Gauge supplier"



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How is this used?

- NWS Summary precip reports
- SCO-NWS comments on Drought Monitor (better DM resolution) - Farm Bill
- Flood reports – better spot forecasts
- Better radar interpretation
- Better climate monitoring

Climate is what you expect.

Weather is what you get.

SOUTH DAKOTA
Climate and Weather

Comments/Questions/Complaints?

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605 688-5141

http://climate.sdstate.edu

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