Monitoring Wisconsin's Weather and Climate

2008 Wisconsin Fertilizer, Aglime, & Pest Management Conference Program
15 January 2008

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Asst. State Climatologist

Dept. of Atmospheric & Oceanic Sciences
University of Wisconsin-Madison

Outline

- Who & Where We Are
- What we Do
- Looking into the Past
- Long term Climate shifts
- Looking Ahead-- Forecasts

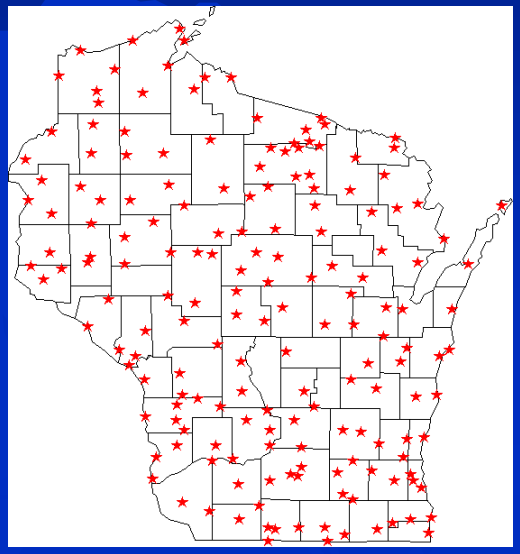
Who & Where We Are

WHERE WE ARE

1225 W. Dayton St., Madison

http://www.aos.wisc.edu/~sco

Views of State Climatology Office



Background

- US Weather Bureau State Climatologist at UW from 1940's to 1973
- SCO affiliation with UW Extension & The Wisconsin Geological & Natural History Survey 1974-1999
- Current affiliation with Dept. of Atmospheric & Oceanic Sciences, UW-Madison

What We Do

Wisconsin State Climatology Office

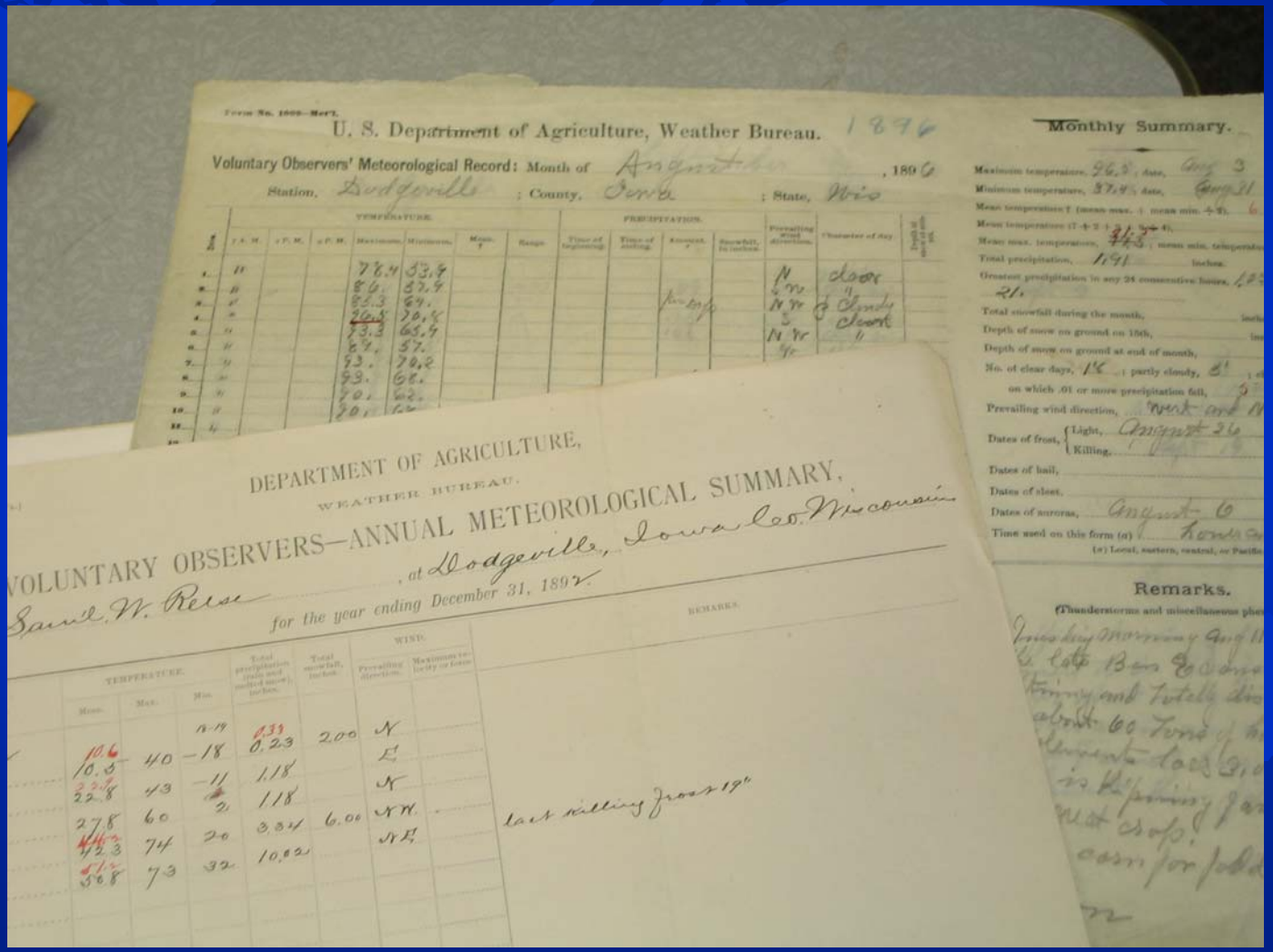
Information Gateway
to
Regional Climate Variability & Change

Data, Interpretation, Collaborative Research & Advice
for
Scientists, Government, & Public

Outreach Service of Atmospheric & Oceanic Sciences
University of Wisconsin-Madison

Maintaining the Records

19th Century Weather Data



A Data Source

- Surface weather observations
  - First Order Stations
    - Hourly
    - Summary of Day
    - Monthly Data
  - Coop Stations
  - Hourly Precipitation Stations
- Upper Air observations
- Radar Observations
- Storm Data

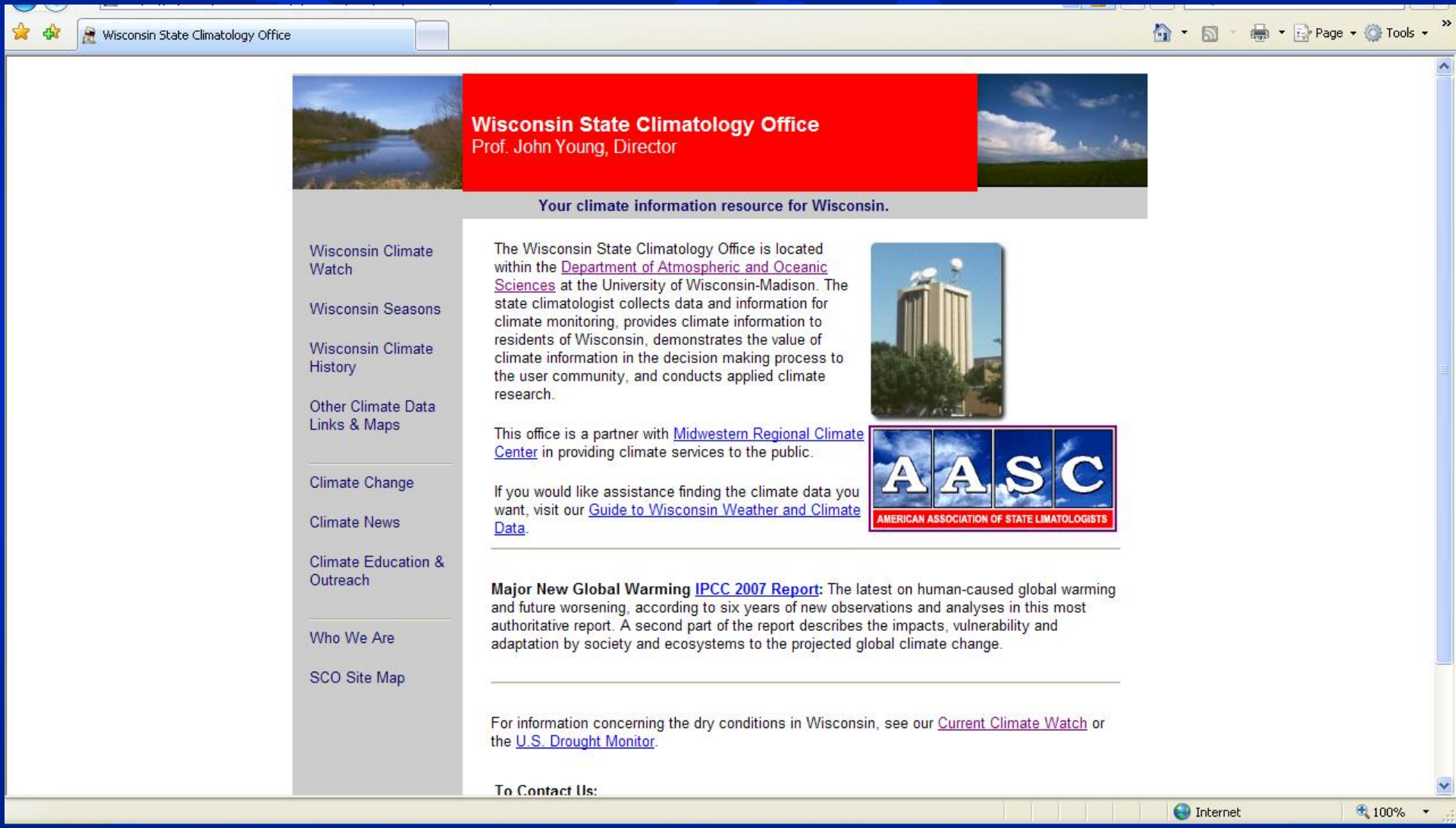
So what was the Wind Chill at Ice Bowl I ?

- On 31 Dec 1967 at Green Bay:
  - Noon air temperature: -14°F
  - Winds: NW at 14 mph
  - Wind-chill temp: - 37°F
  - Final Score:
    Packers 21-Cowboys 17
- On 20 Jan 2008 at Green Bay:
  - Normal high: 20°F
  - Lowest high: -7°F
  - Forecast high: +8°F

Source: packers.com

The Wisconsin State Climatology Office Web Page

http://www.aos.wisc.edu/~sco



http://www.aos.wisc.edu/~sco/clim-history/index.html

Wisconsin State Climatology Office - Windows Internet Explorer

http://www.aos.wisc.edu/~sco/clim-history/index.html

NOAA's National Weather Se... | Wisconsin State Climatolo...

Wisconsin State Climatology Office
Prof. John Young, Director

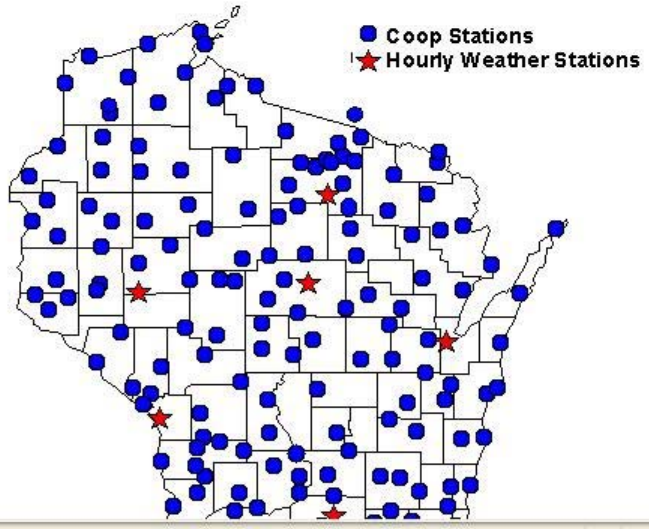
Your climate information resource for Wisconsin.

- Wisconsin Climate Watch
- Wisconsin Seasons
- Wisconsin Climate History
  - -Statewide
  - -By Division
  - -Seven Cities
  - -By Location
- Other Climate Data Links & Maps
- Climate Change
- Climate News
- Climate Education & Outreach
- Who We Are
- SCO Site Map

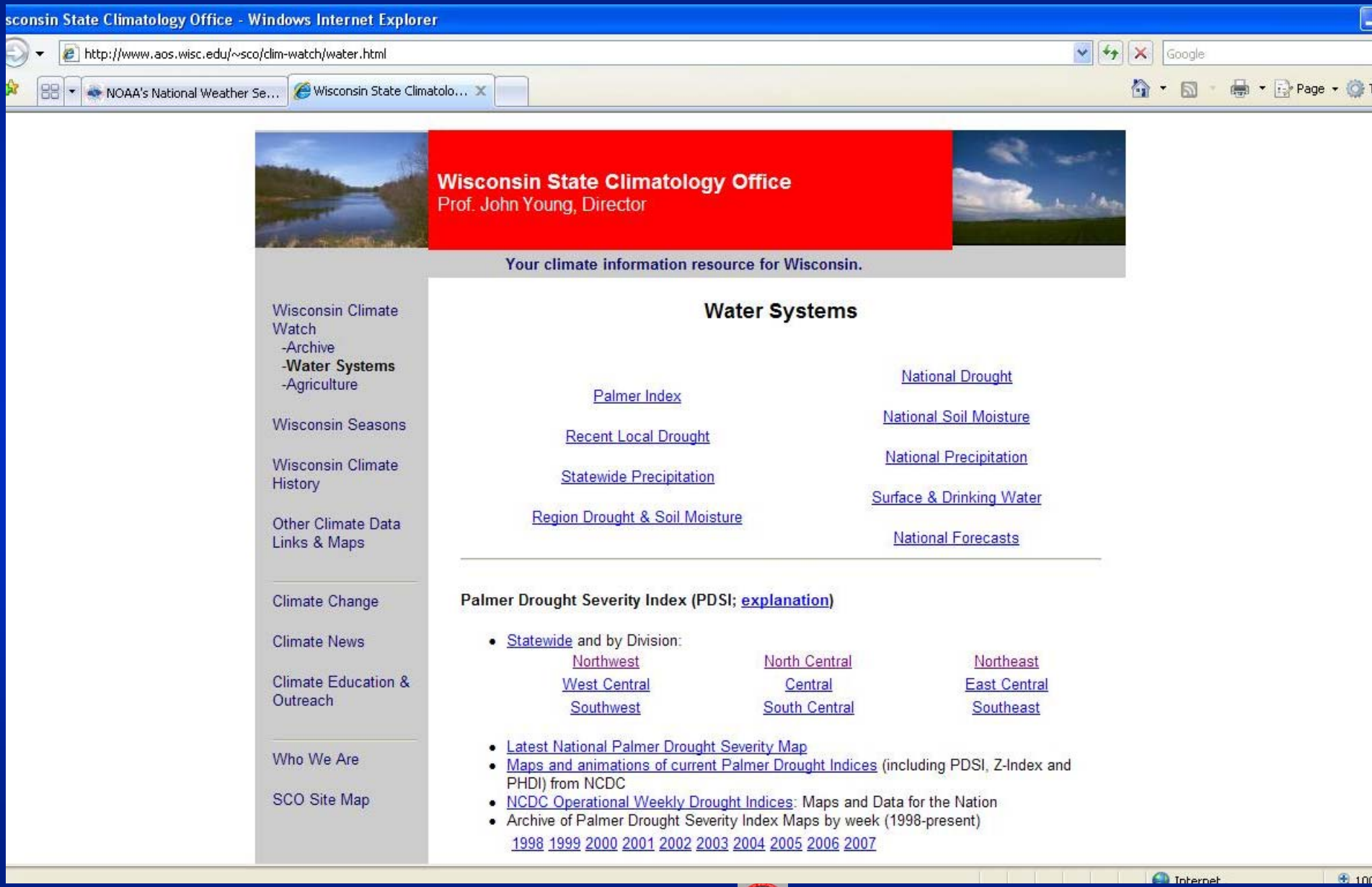
Wisconsin Climate History

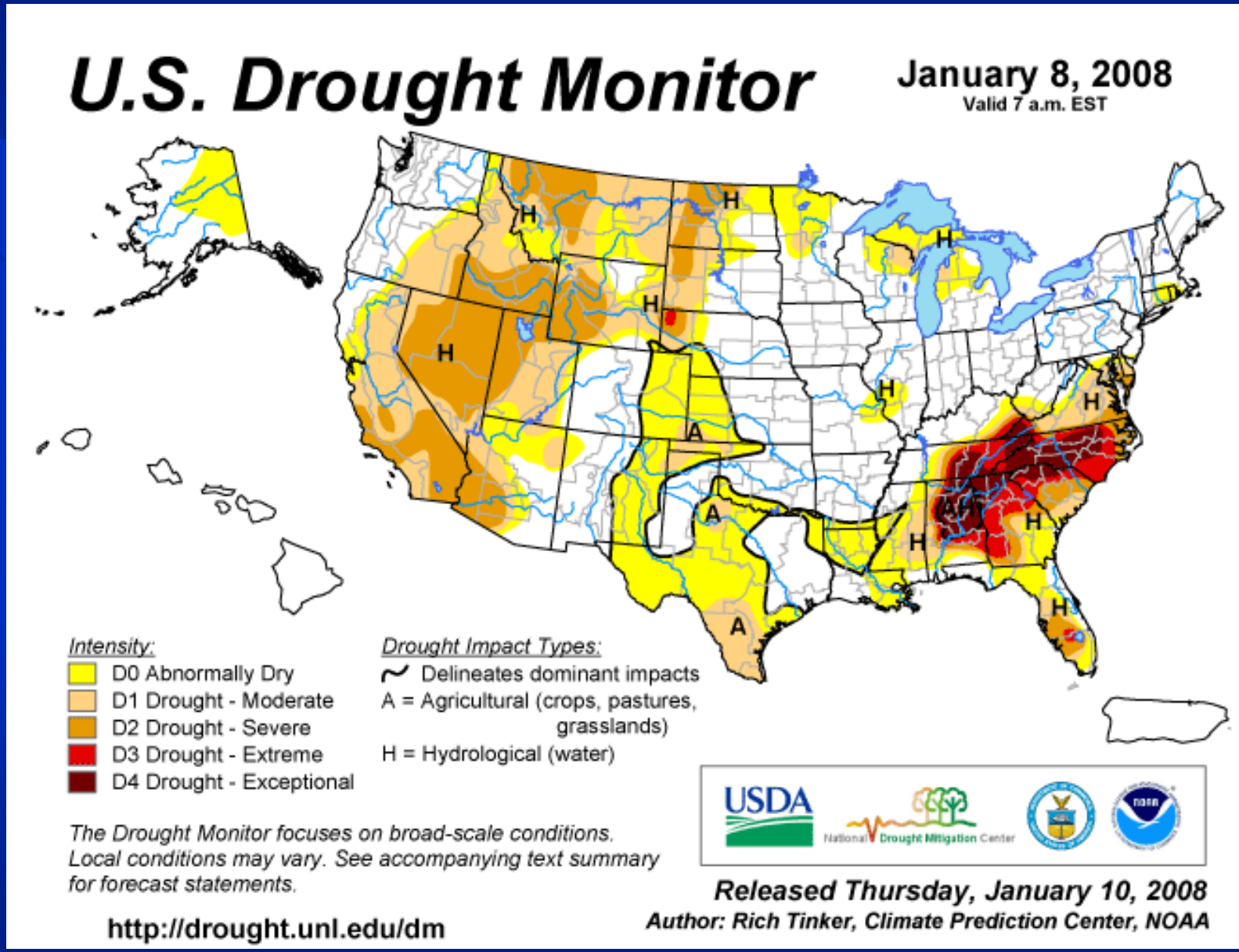
Statewide Climate | Seven Cities Climate

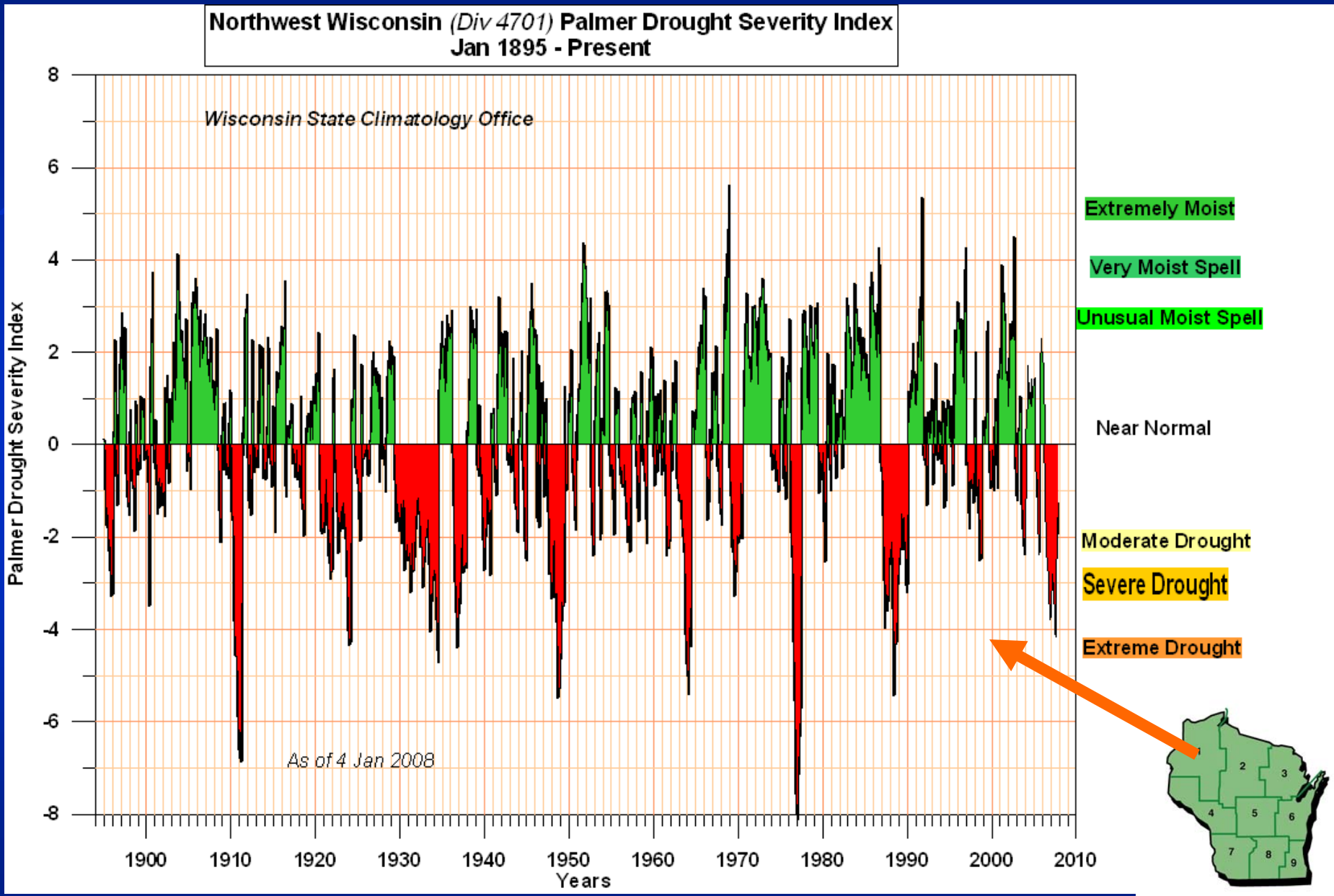
WI Climate by Division | Climate Summaries by Location



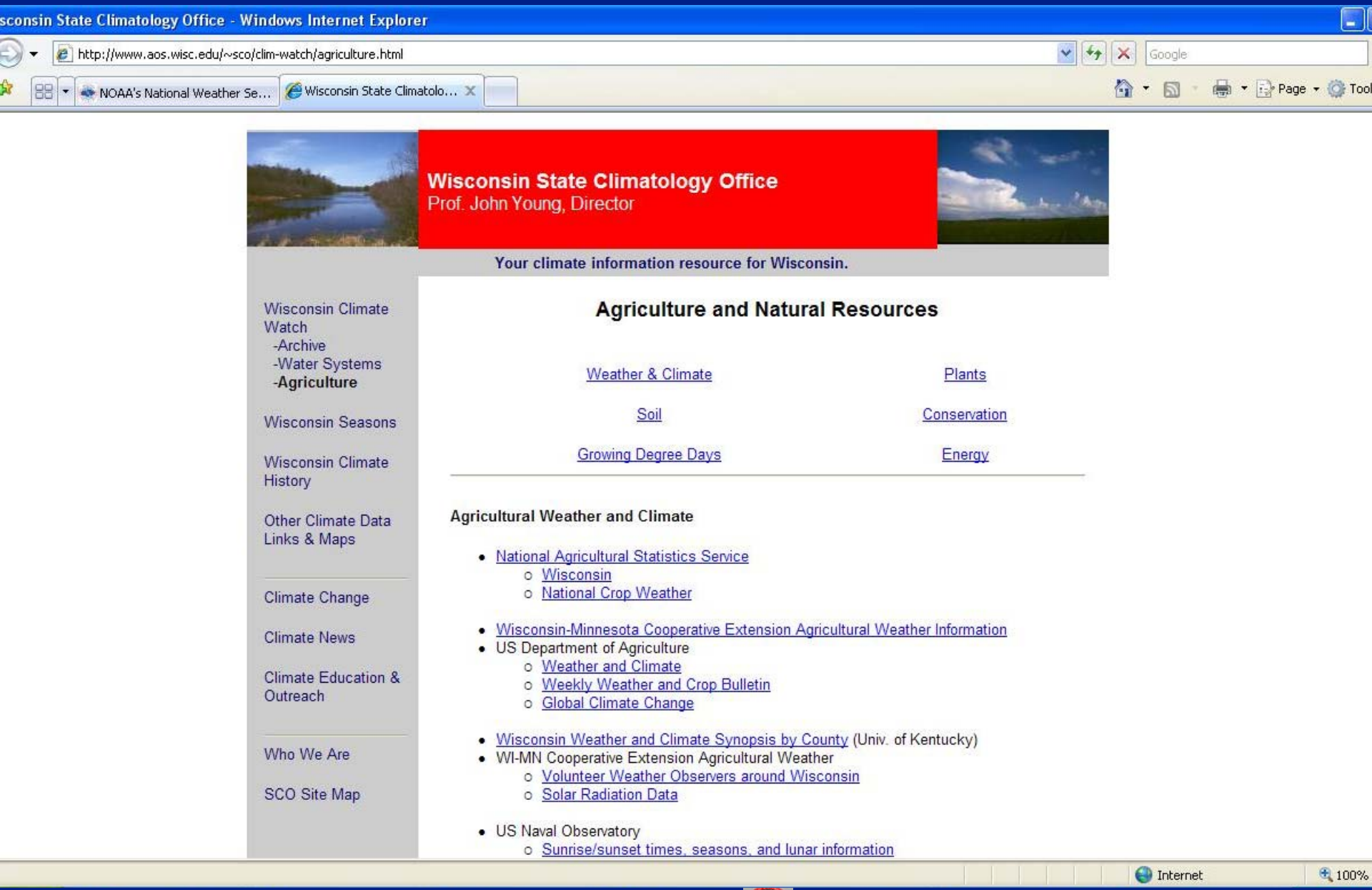
http://www.aos.wisc.edu/~sco/clim-watch/water.html



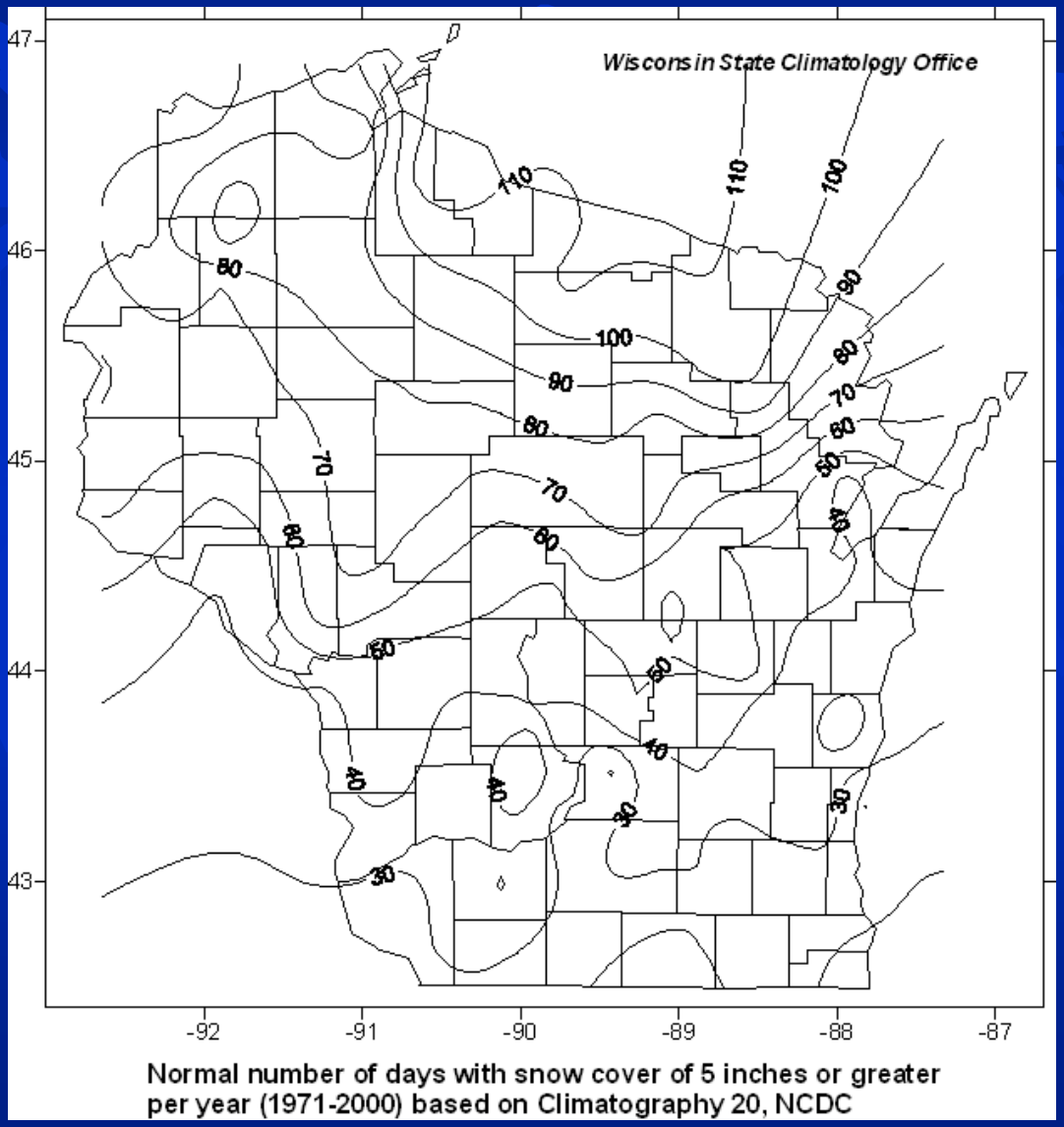

U.S. Drought Monitor
January 8, 2008
Valid 7 a.m. EST
Intensity:
D0 Abnormally Dry
D1 Drought - Moderate
D2 Drought - Severe
D3 Drought - Extreme
D4 Drought - Exceptional
Drought Impact Types:
Delineates dominant impacts
A = Agricultural (crops, pastures, grasslands)
H = Hydrological (water)
The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.
http://drought.unl.edu/dm
USDA
National Drought Mitigation Center
Released Thursday, January 10, 2008
Author: Rich Tinker, Climate Prediction Center, NOAA


Northwest Wisconsin (Div 4701) Palmer Drought Severity Index
Jan 1895 - Present
Wisconsin State Climatology Office
Palmer Drought Severity Index
8
6
4
2
0
-2
-4
-6
-8
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010
Years
As of 4 Jan 2008
Extremely Moist
Very Moist Spell
Unusual Moist Spell
Near Normal
Moderate Drought
Severe Drought
Extreme Drought
1
2
3
4
5
6
7
8
9

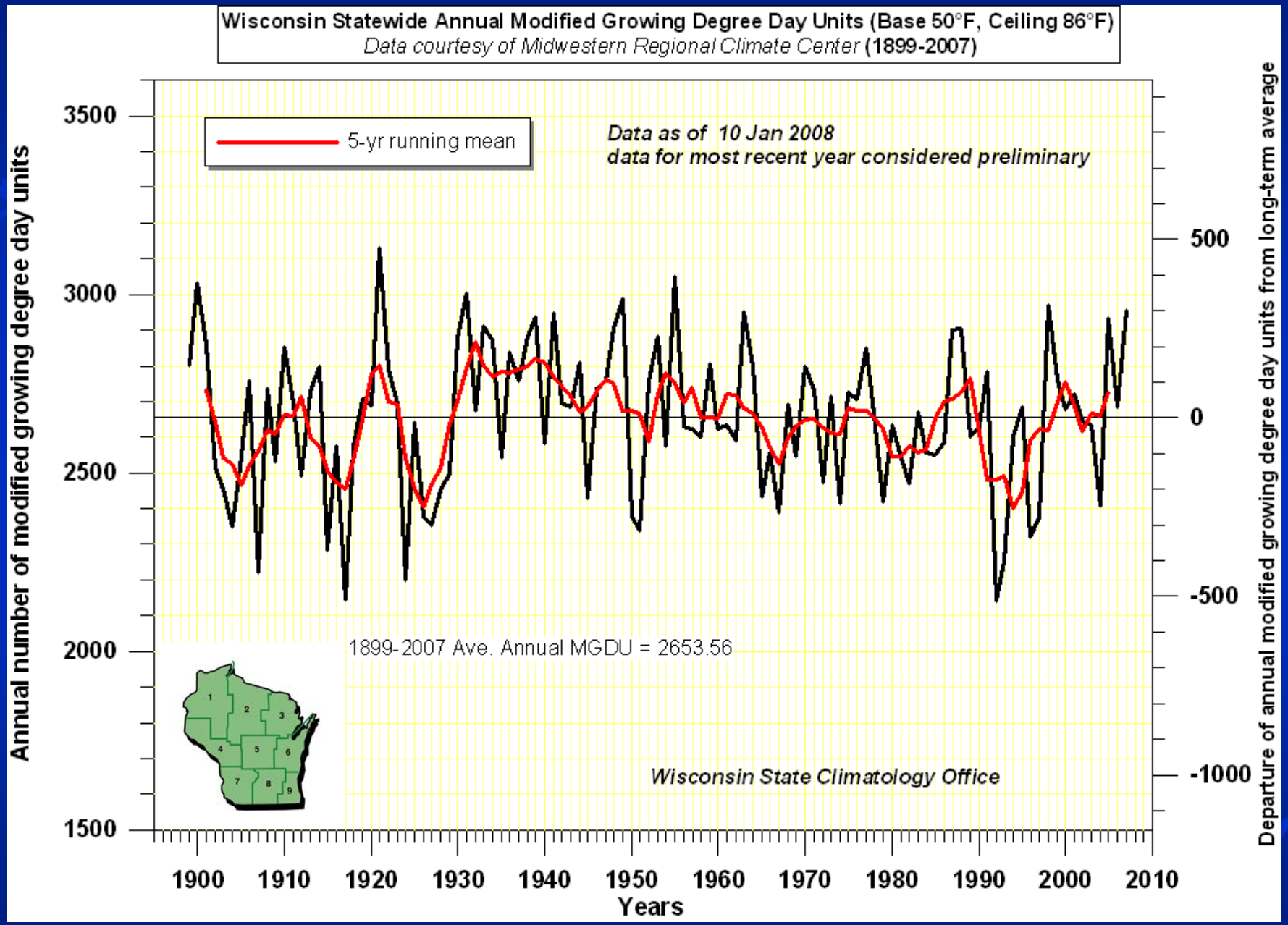
http://www.aos.wisc.edu/~sco/clim-watch/agriculture.html



Number of days of 5 or more inch snow cover



Normal number of days with snow cover of 5 inches or greater per year (1971-2000) based on Climatography 20, NCDC


Wisconsin Statewide Annual Modified Growing Degree Day Units (Base 50°F, Ceiling 86°F)
Data courtesy of Midwestern Regional Climate Center (1899-2007)
5-yr running mean
Data as of 10 Jan 2008
data for most recent year considered preliminary
1899-2007 Ave. Annual MGDU = 2653.56
Wisconsin State Climatology Office
Annual number of modified growing degree day units
Departure of annual modified growing degree day units from long-term average
3500
3000
2500
2000
1500
500
0
-500
-1000
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010
Years

Looking into the Past

http://www.aos.wisc.edu/~sco/clim-history/index.html

Wisconsin State Climatology Office - Windows Internet Explorer

http://www.aos.wisc.edu/~sco/clim-history/index.html

NOAA's National Weather Se... | Wisconsin State Climatolo...

Page | Tools

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Prof. John Young, Director

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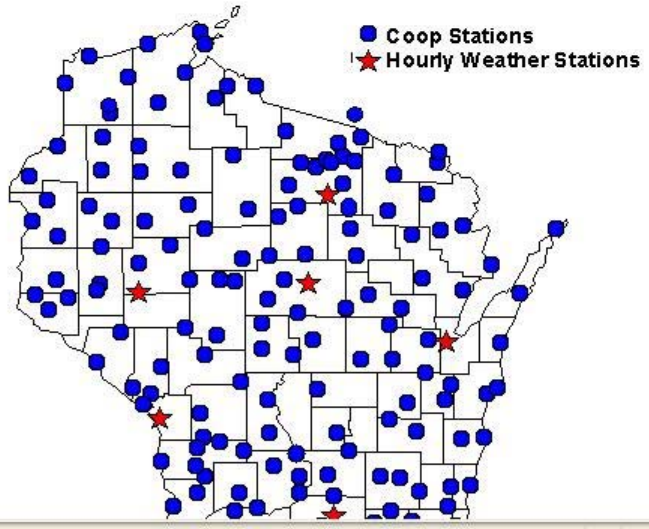
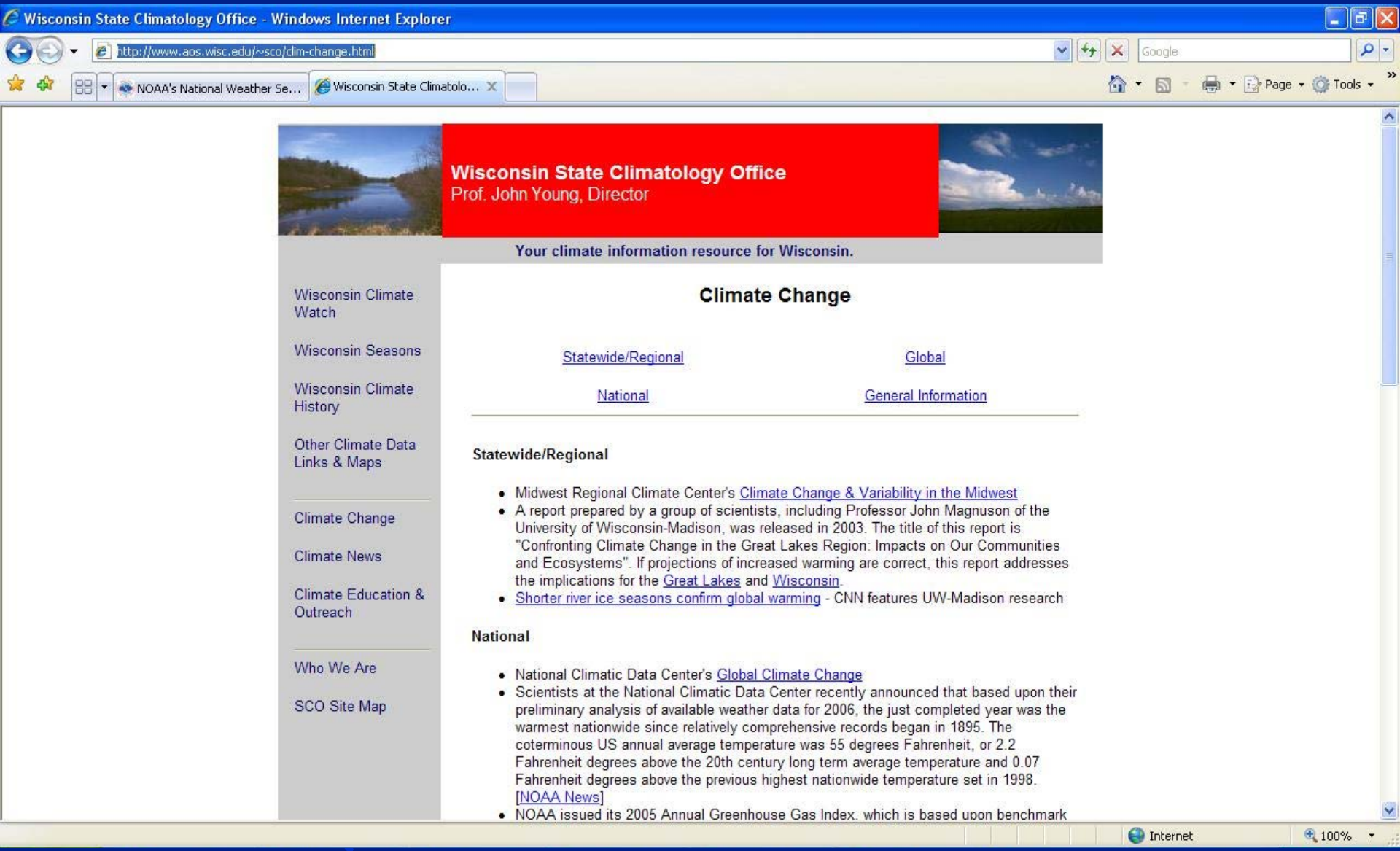


Internet | 100%


Wisconsin State Climatology Office - Windows Internet Explorer
http://www.aos.wisc.edu/~sco/clim-change.html
NOAA's National Weather Se...
Wisconsin State Climatolo...
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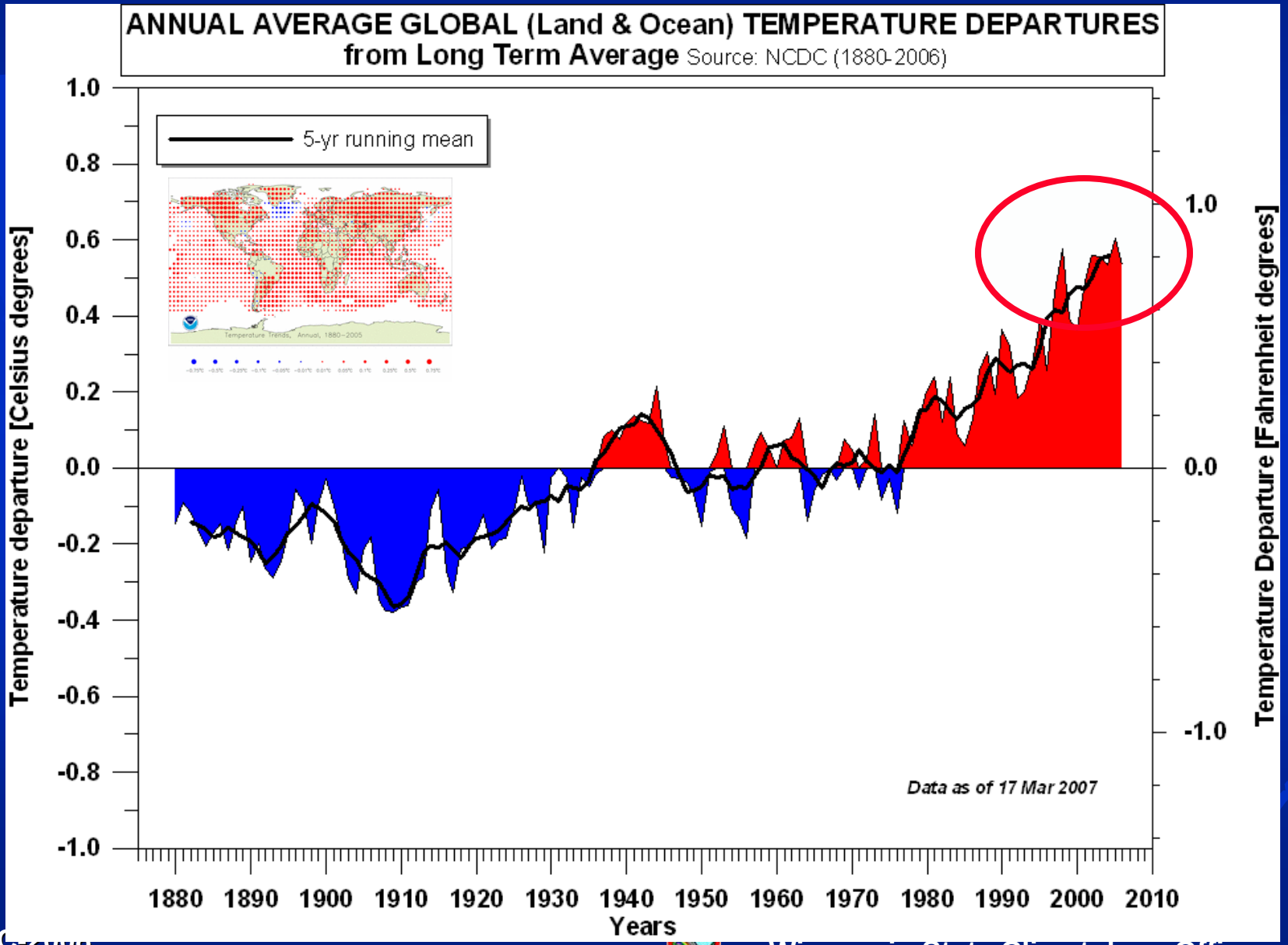
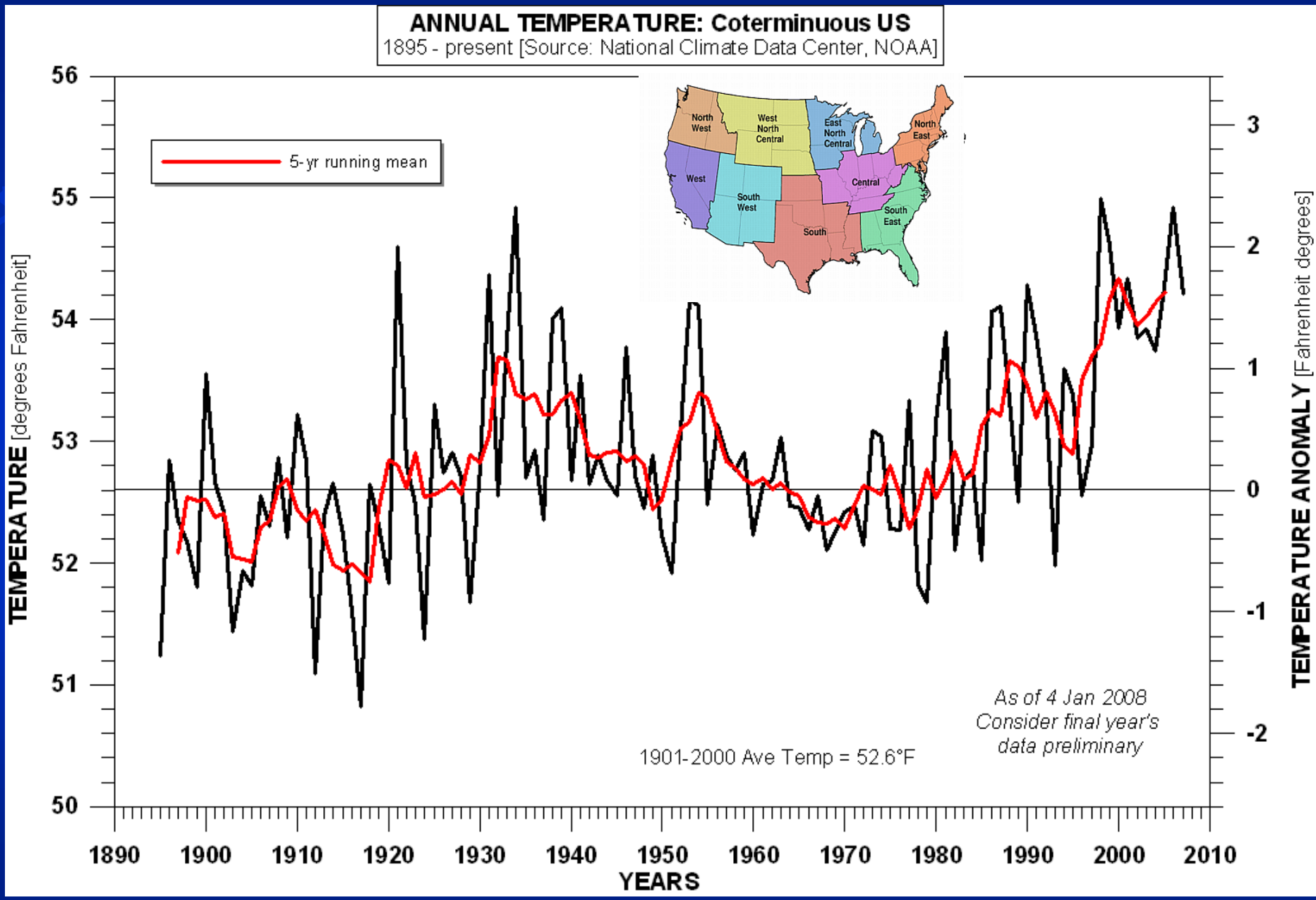
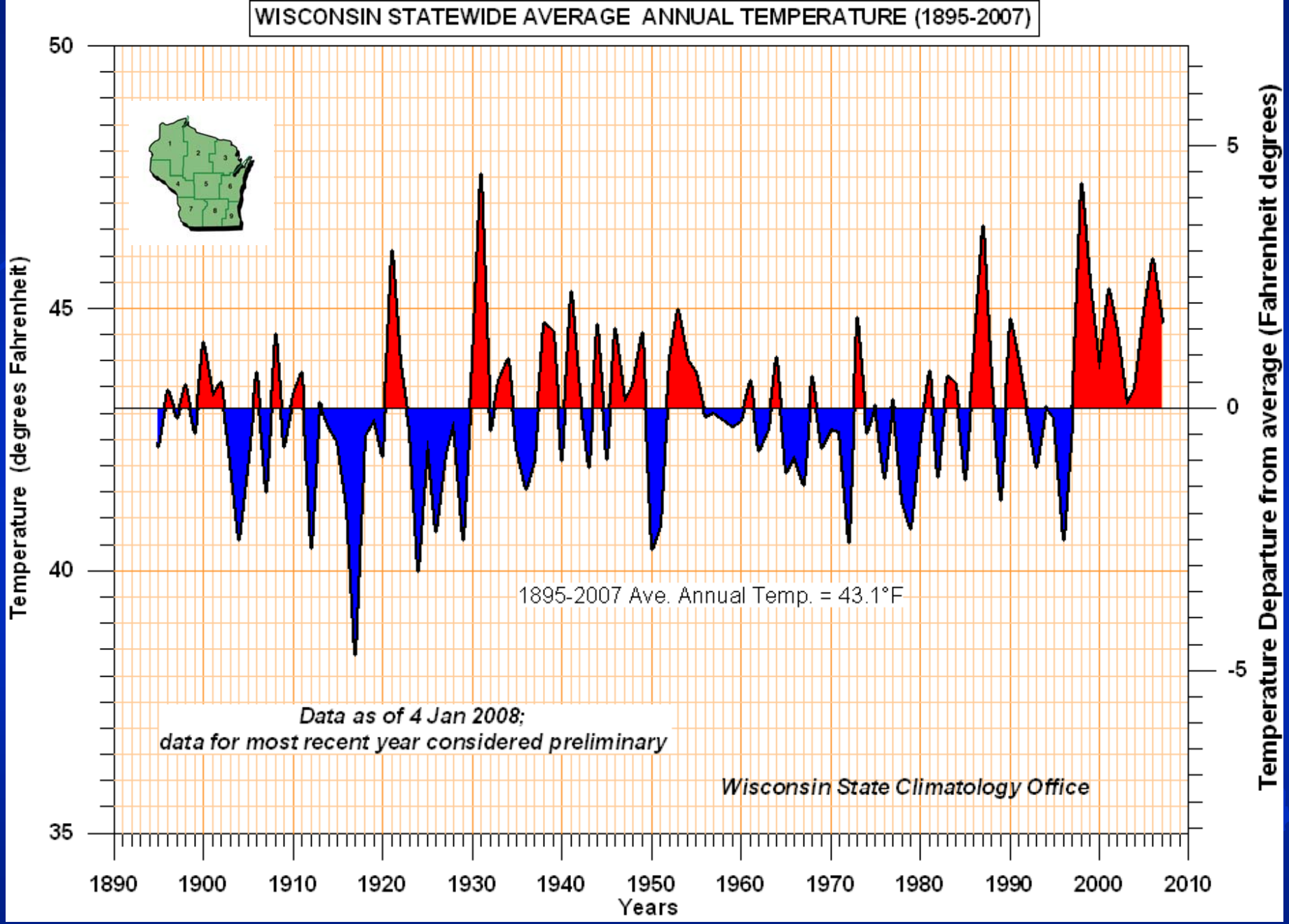
Climate Change
Statewide/Regional
Global
National
General Information
Statewide/Regional
Midwest Regional Climate Center's Climate Change & Variability in the Midwest
A report prepared by a group of scientists, including Professor John Magnuson of the University of Wisconsin-Madison, was released in 2003. The title of this report is "Confronting Climate Change in the Great Lakes Region: Impacts on Our Communities and Ecosystems". If projections of increased warming are correct, this report addresses the implications for the Great Lakes and Wisconsin.
Shorter river ice seasons confirm global warming - CNN features UW-Madison research
National
National Climatic Data Center's Global Climate Change
Scientists at the National Climatic Data Center recently announced that based upon their preliminary analysis of available weather data for 2006, the just completed year was the warmest nationwide since relatively comprehensive records began in 1895. The coterminous US annual average temperature was 55 degrees Fahrenheit, or 2.2 Fahrenheit degrees above the 20th century long term average temperature and 0.07 Fahrenheit degrees above the previous highest nationwide temperature set in 1998. [NOAA News]
NOAA issued its 2005 Annual Greenhouse Gas Index, which is based upon benchmark
Internet
100%

Long-term Climate Shifts

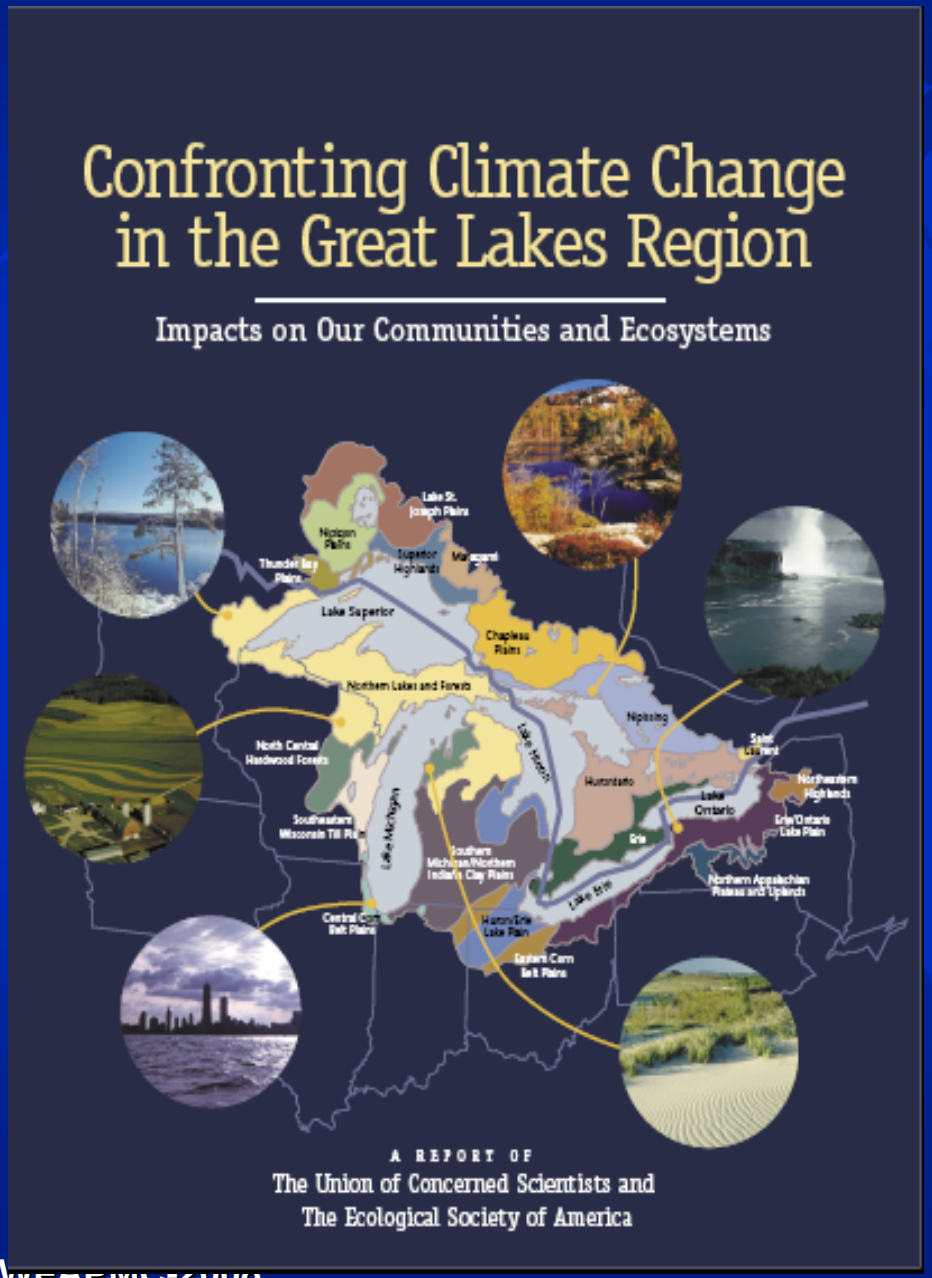
ANNUAL GLOBAL AVERAGE TEMPERATURE
for Instrumental Period of Record




ANNUAL TEMPERATURE: Coterminuous US
1895 - present [Source: National Climate Data Center, NOAA]
5-yr running mean
North West
West North Central
East North Central
North East
West
South West
Central
South East
South
TEMPERATURE [degrees Fahrenheit]
TEMPERATURE ANOMALY [Fahrenheit degrees]
56
55
54
53
52
51
50
3
2
1
0
-1
-2
1890
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010
YEARS
1901-2000 Ave Temp = 52.6°F
As of 4 Jan 2008
Consider final year's
data preliminary


WISCONSIN STATEWIDE AVERAGE ANNUAL TEMPERATURE (1895-2007)
Temperature (degrees Fahrenheit)
Temperature Departure from average (Fahrenheit degrees)
50
45
40
35
5
0
-5
1890
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010
Years
1895-2007 Ave. Annual Temp. = 43.1°F
Data as of 4 Jan 2008;
data for most recent year considered preliminary
Wisconsin State Climatology Office

http://www.ucsusa.org/greatlakes/glchallengereport.html

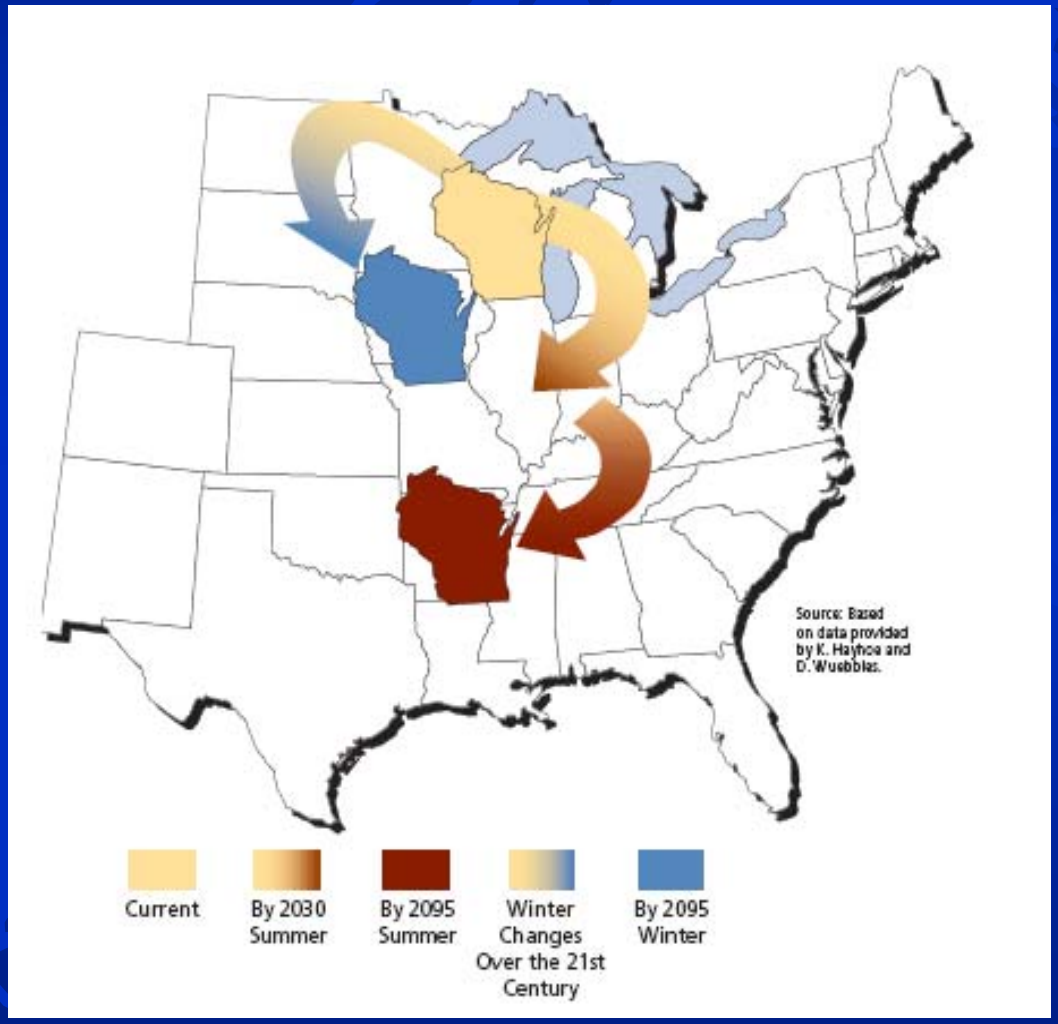


Great Lakes basin currently experiencing:

- **Shorter winters**
- **Decreased lake ice cover duration**
- **Increasing annual average temperatures**
- **More frequent heat events**
- **More drought**
- **More common heavy precipitation events (rain & snow)**

Climate Projections

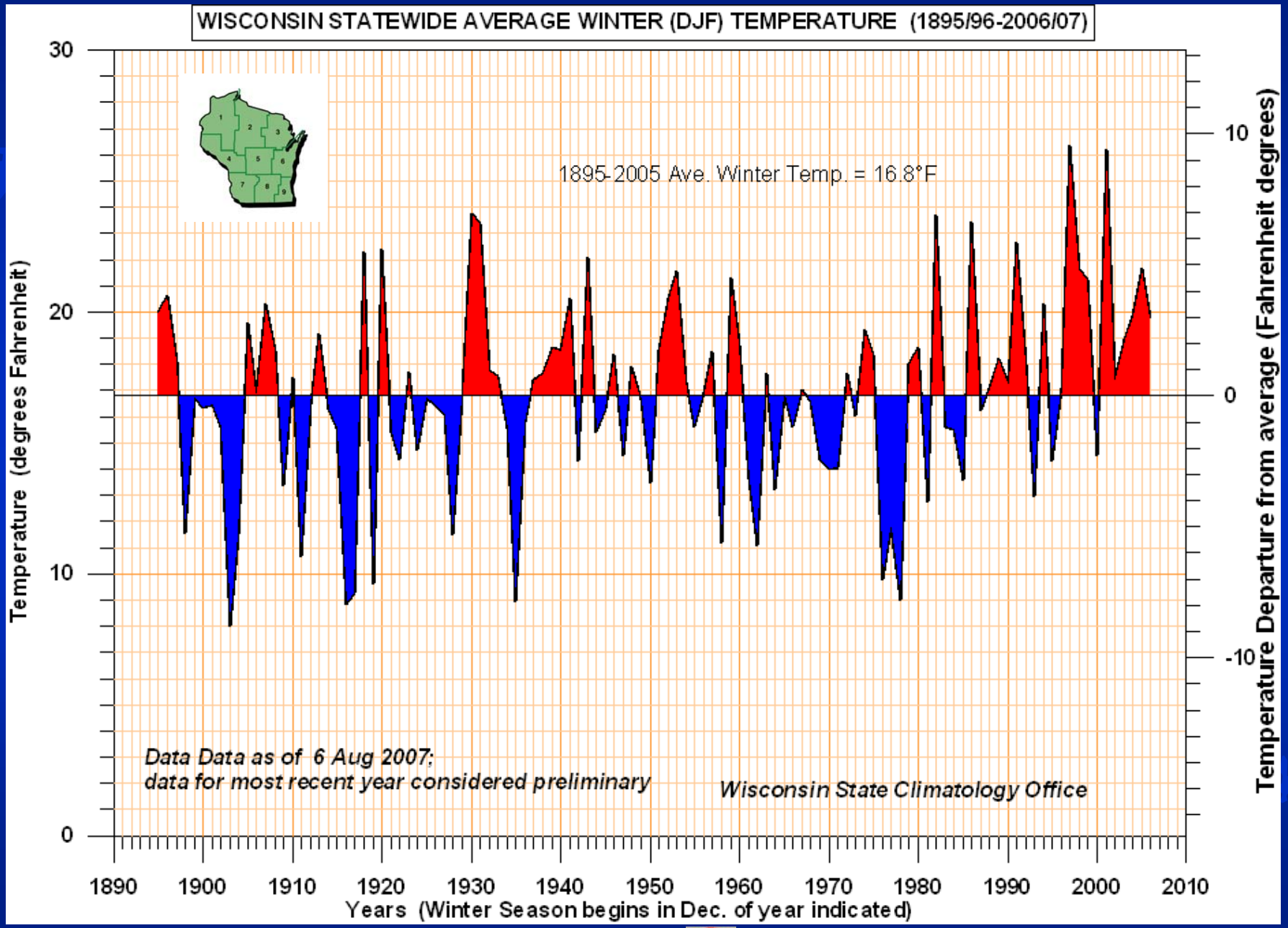
(From *Confronting Climate Change in the Great Lakes Region*, *Wisconsin*)



Projected Climate Changes in Wisconsin

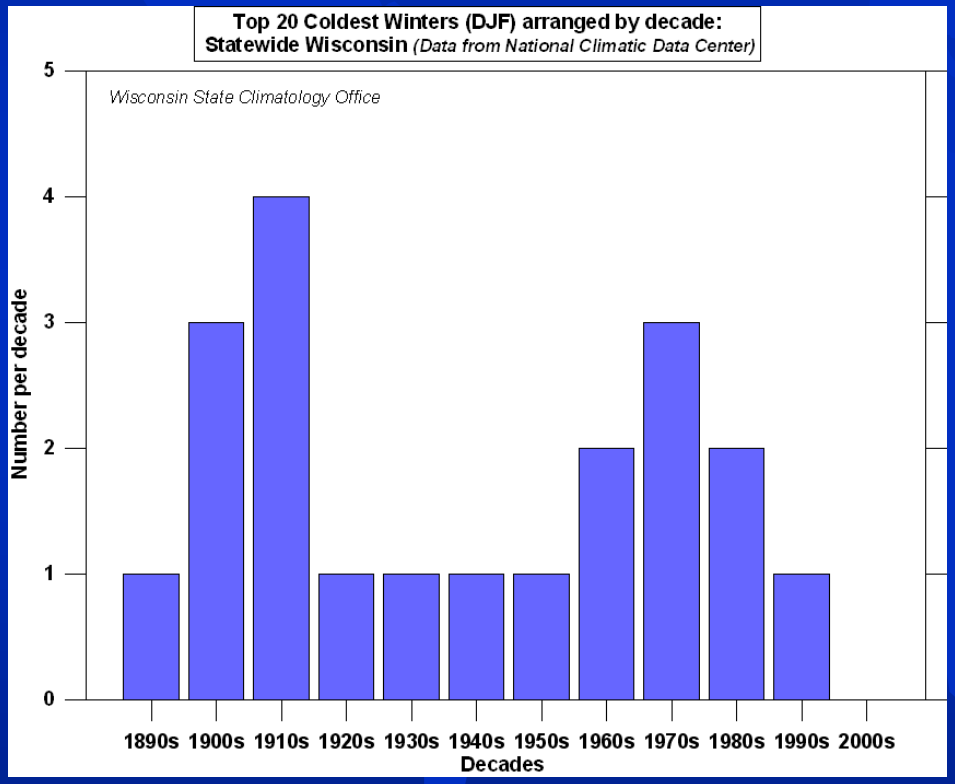
(From *Confronting Climate Change in the Great Lakes Region*, *Wisconsin*)

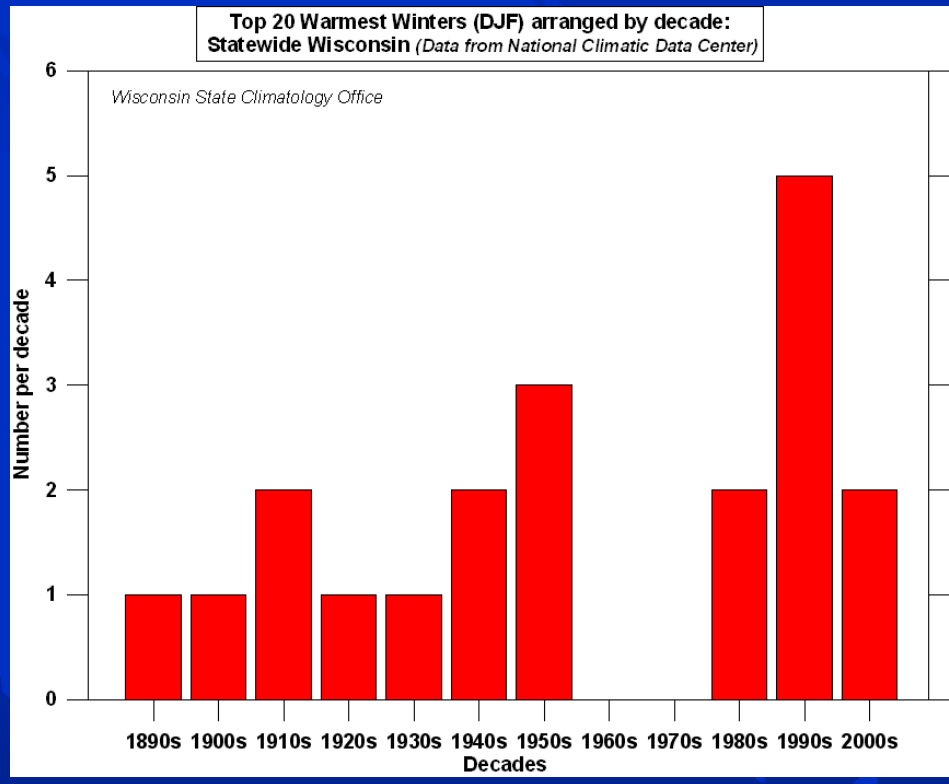
- **A 5-10°F rise in winter and a 8-17°F rise in summer temperatures by 2100.**


WISCONSIN STATEWIDE AVERAGE WINTER (DJF) TEMPERATURE (1895/96-2006/07)
1895-2005 Ave. Winter Temp. = 16.8°F
Temperature (degrees Fahrenheit)
Temperature Departure from average (Fahrenheit degrees)
30
20
10
0
10
0
-10
1890
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010
Years (Winter Season begins in Dec. of year indicated)
Data Data as of 6 Aug 2007;
data for most recent year considered preliminary
Wisconsin State Climatology Office

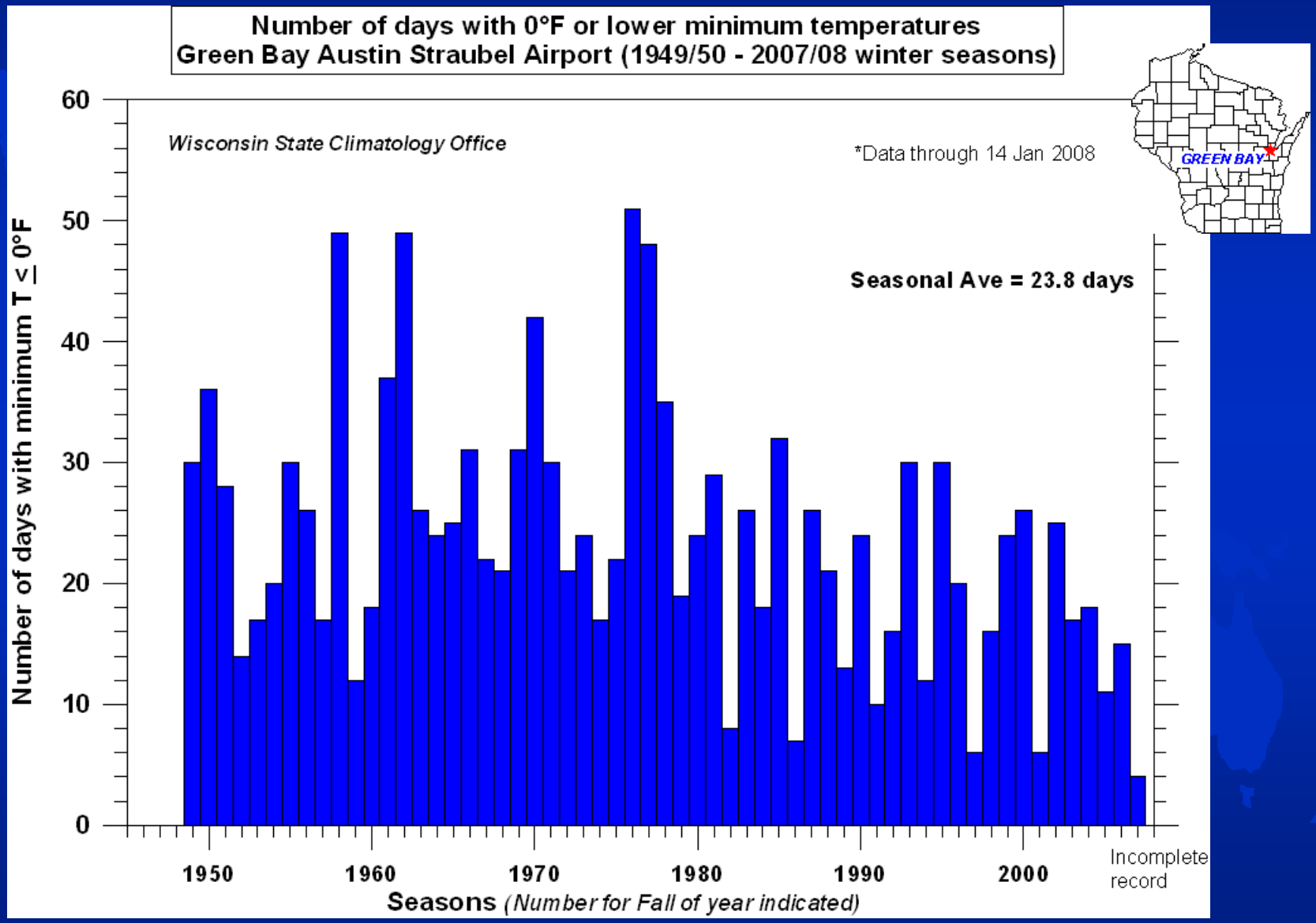
Extremes in Statewide Winter Temperatures

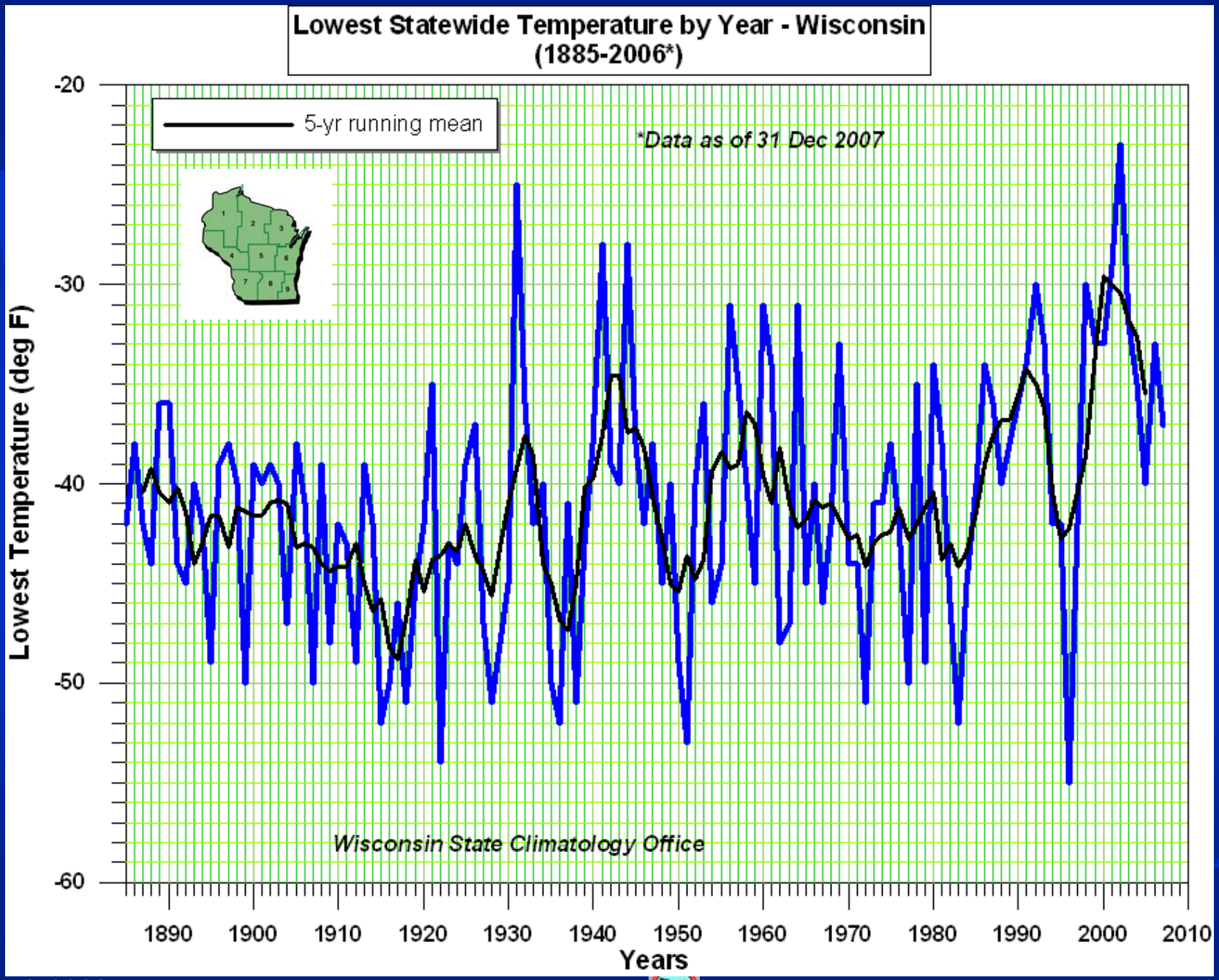
Coldest & Warmest 20 Winters (1895- present)

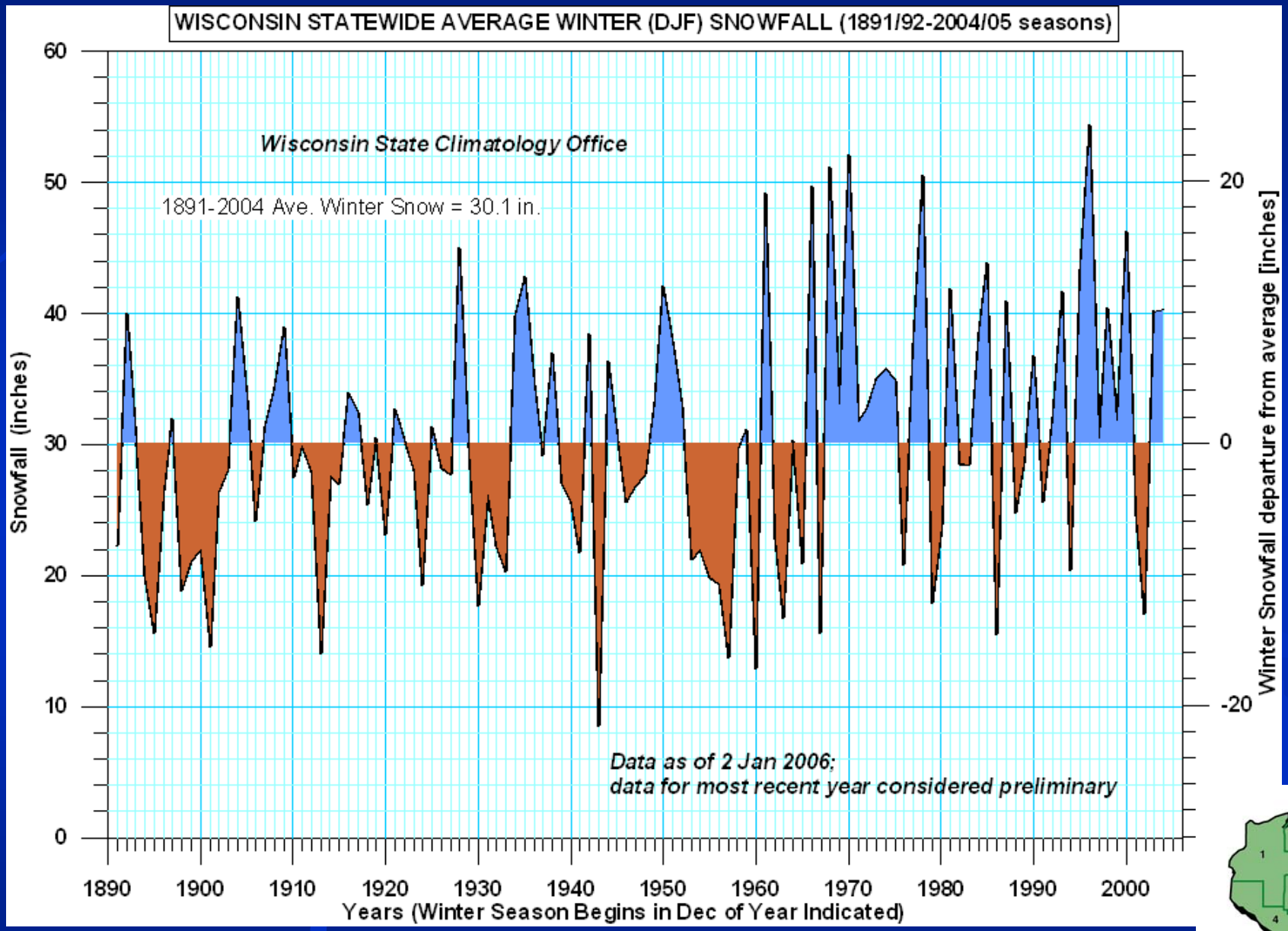




Trends in Winter Cold Extremes




Lowest Statewide Temperature by Year - Wisconsin
(1885-2006*)
5-yr running mean
*Data as of 31 Dec 2007
Wisconsin State Climatology Office
Lowest Temperature (deg F)
-20
-30
-40
-50
-60
1890
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010
Years

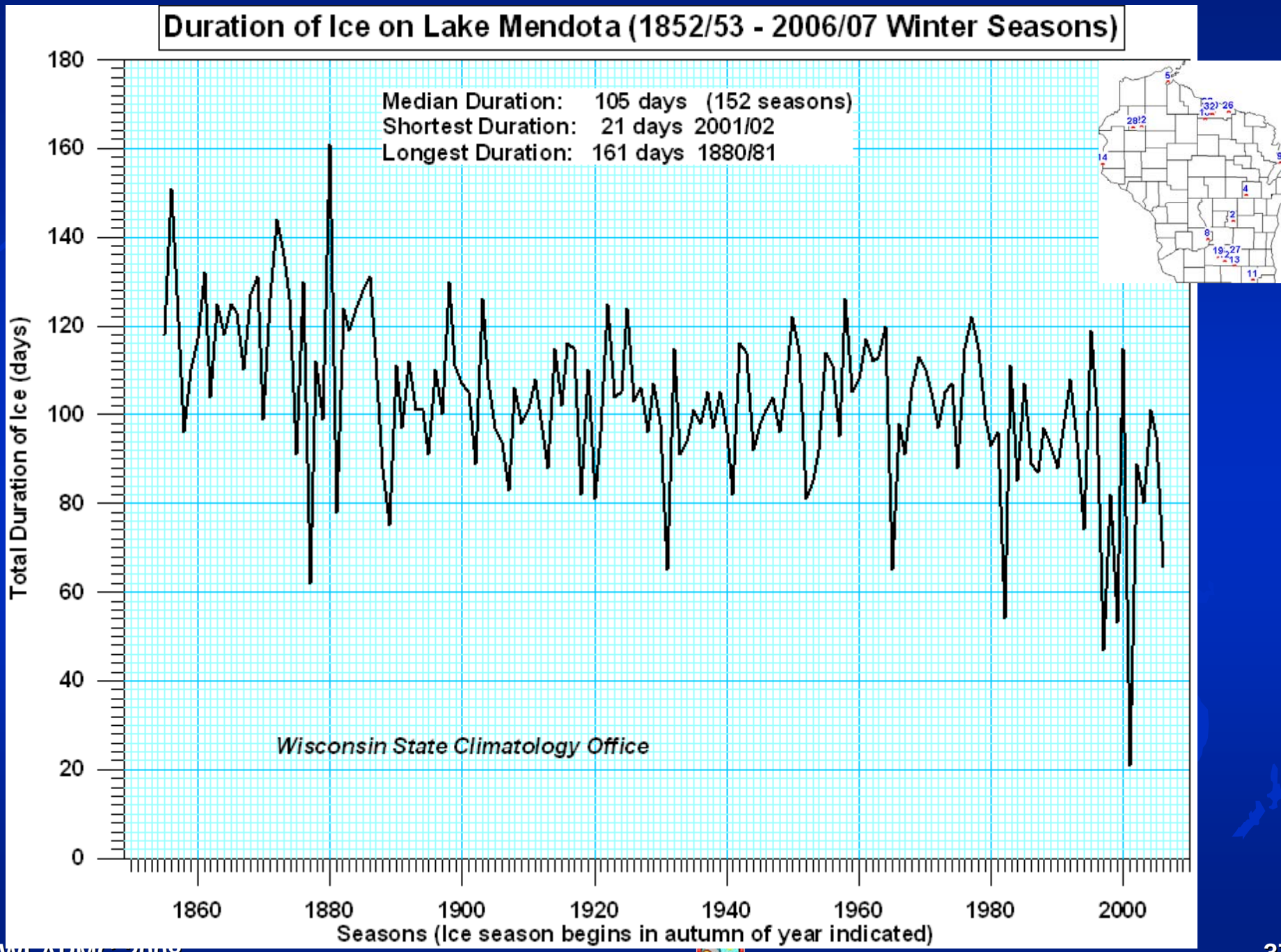

WISCONSIN STATEWIDE AVERAGE WINTER (DJF) SNOWFALL (1891/92-2004/05 seasons)
Wisconsin State Climatology Office
1891-2004 Ave. Winter Snow = 30.1 in.
Data as of 2 Jan 2006;
data for most recent year considered preliminary
Snowfall (inches)
Winter Snowfall departure from average [inches]
Years (Winter Season Begins in Dec of Year Indicated)
0
10
20
30
40
50
60
-20
0
20
1890
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000


1
2
3
4
5
6
7
8
9

Projected Climate Changes in Wisconsin

(From *Confronting Climate Change in the Great Lakes Region*, *Wisconsin*)

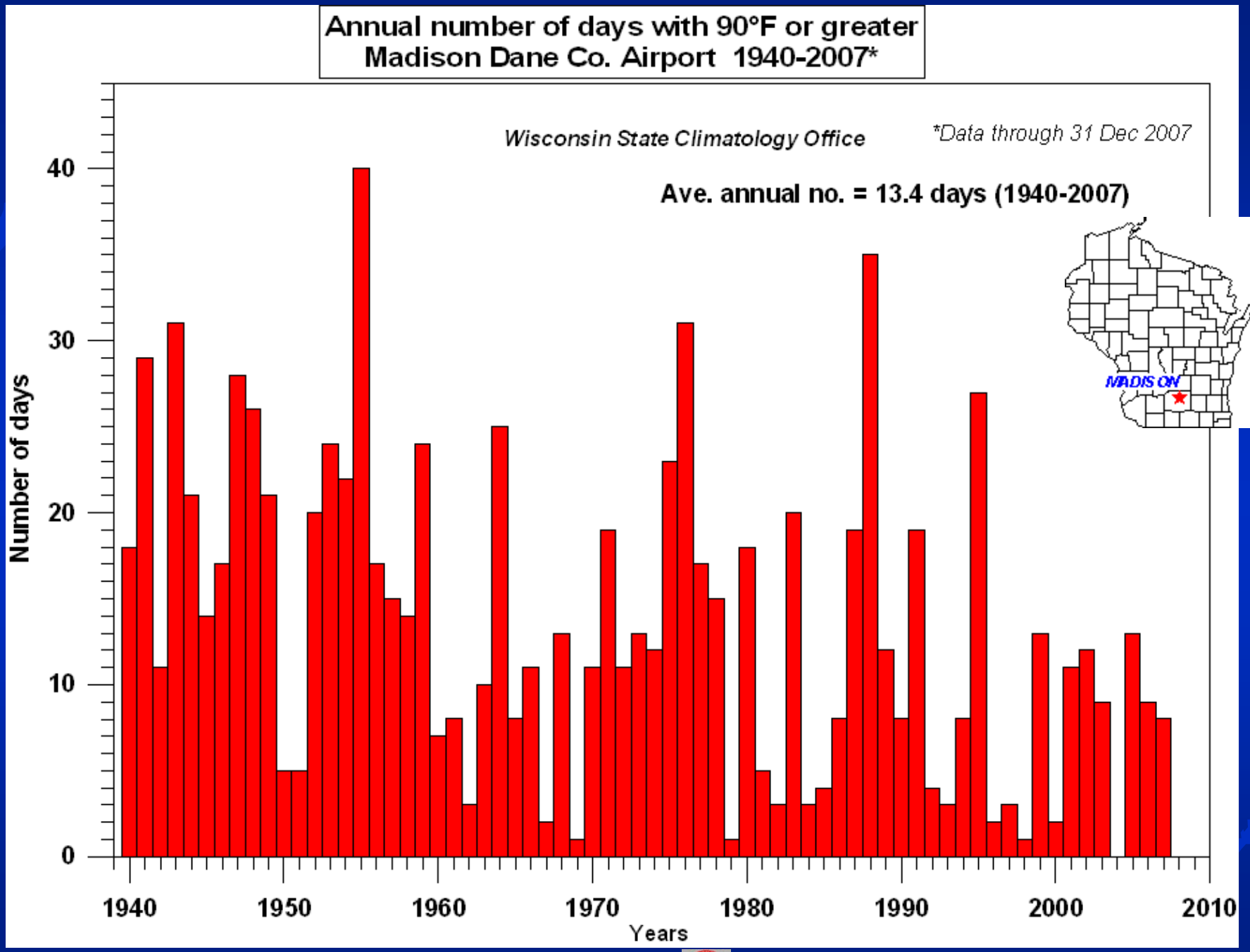
- **Declines in ice cover on Great Lakes and inland lakes are expected to continue.**

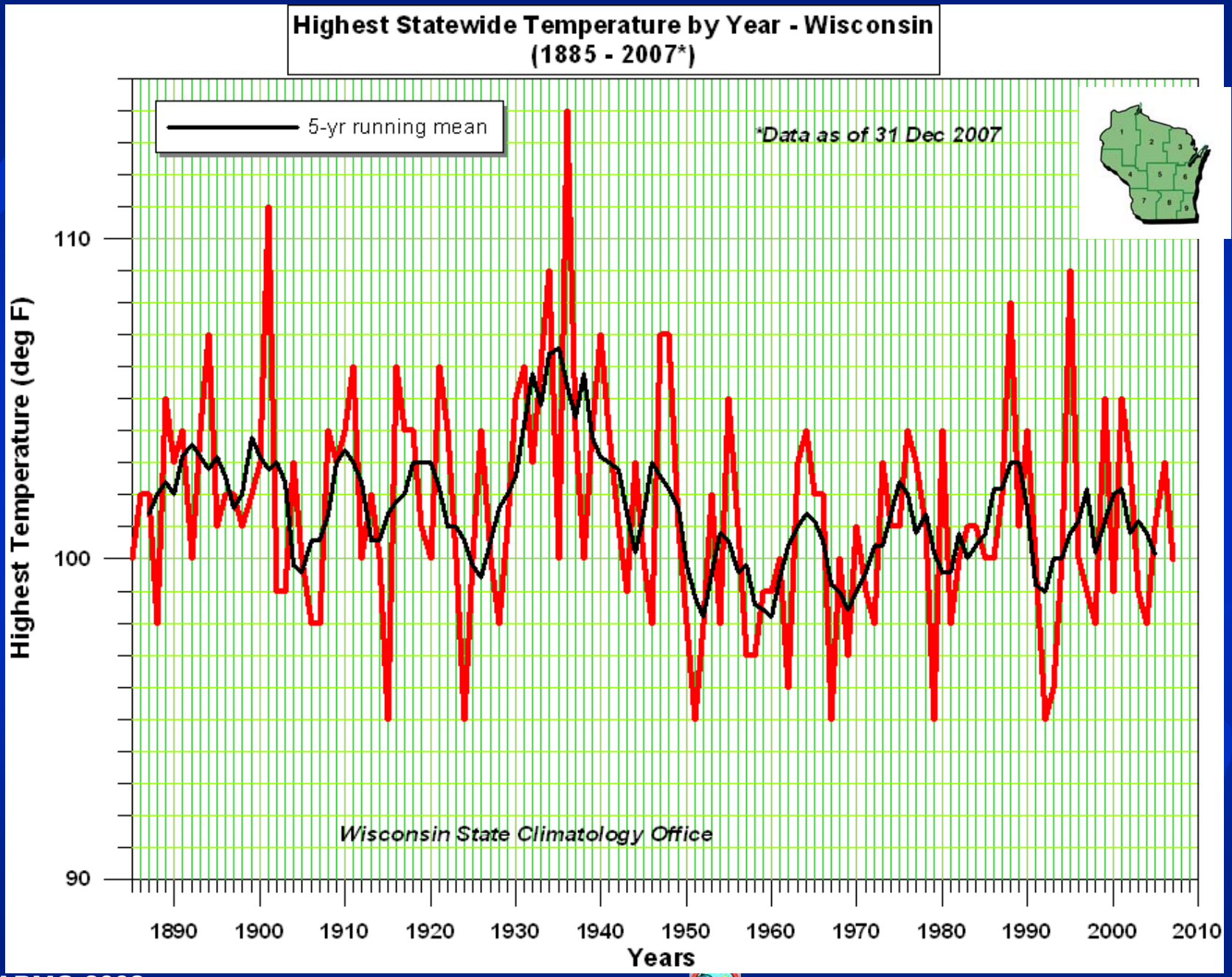

Duration of Ice on Lake Mendota (1852/53 - 2006/07 Winter Seasons)
Median Duration: 105 days (152 seasons)
Shortest Duration: 21 days 2001/02
Longest Duration: 161 days 1880/81
Total Duration of Ice (days)
180
160
140
120
100
80
60
40
20
0
1860
1880
1900
1920
1940
1960
1980
2000
Seasons (Ice season begins in autumn of year indicated)
Wisconsin State Climatology Office

Projected Climate Changes in Wisconsin

(From *Confronting Climate Change in the Great Lakes Region*, *Wisconsin*)

- Extreme heat will be more common, and frequency of heavy rainstorms will increase and could be 50-100% higher than today.

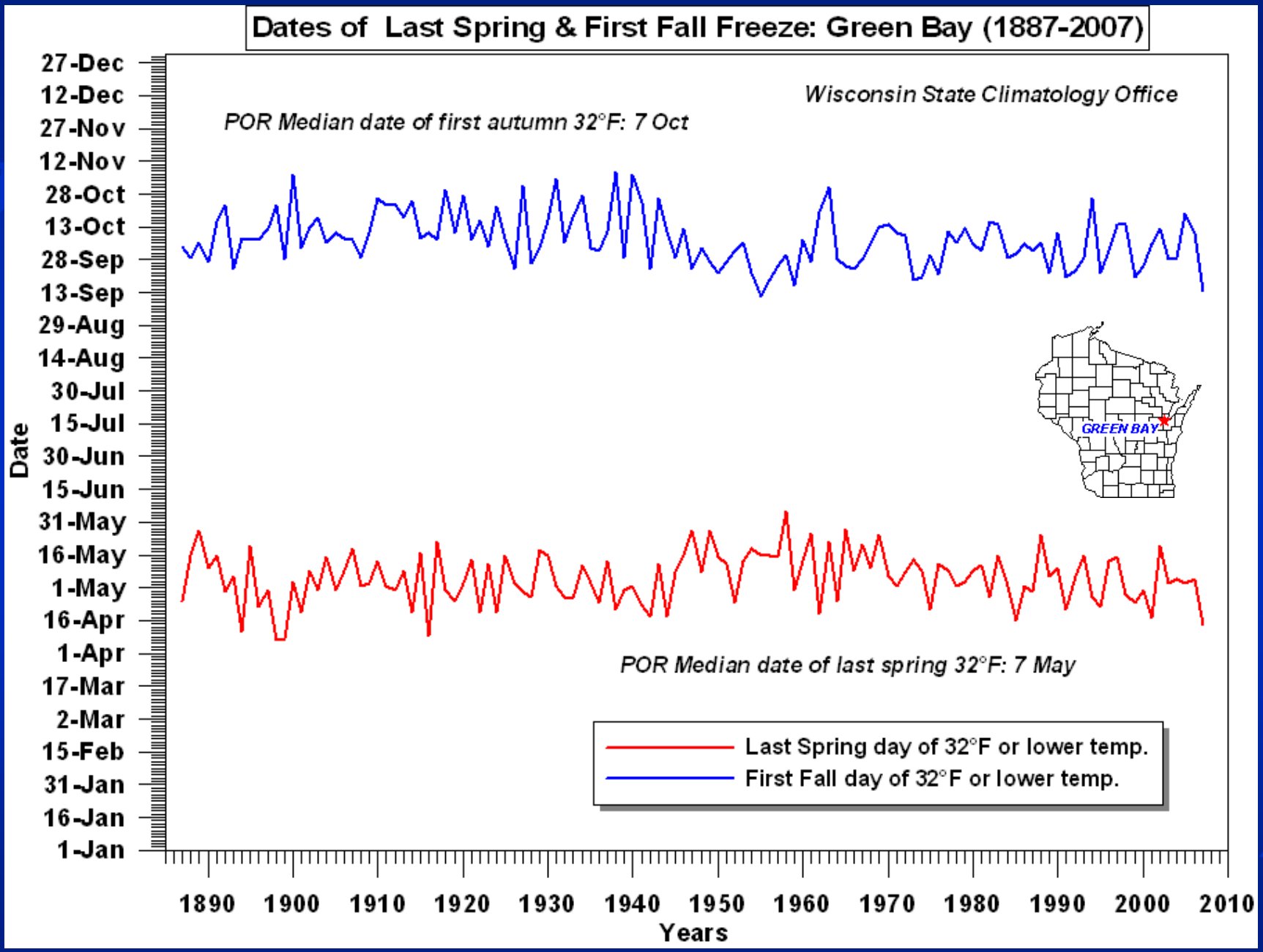

Annual number of days with 90°F or greater
Madison Dane Co. Airport 1940-2007*
Wisconsin State Climatology Office
*Data through 31 Dec 2007
Ave. annual no. = 13.4 days (1940-2007)
MADISON
Number of days
0
10
20
30
40
1940
1950
1960
1970
1980
1990
2000
2010
Years

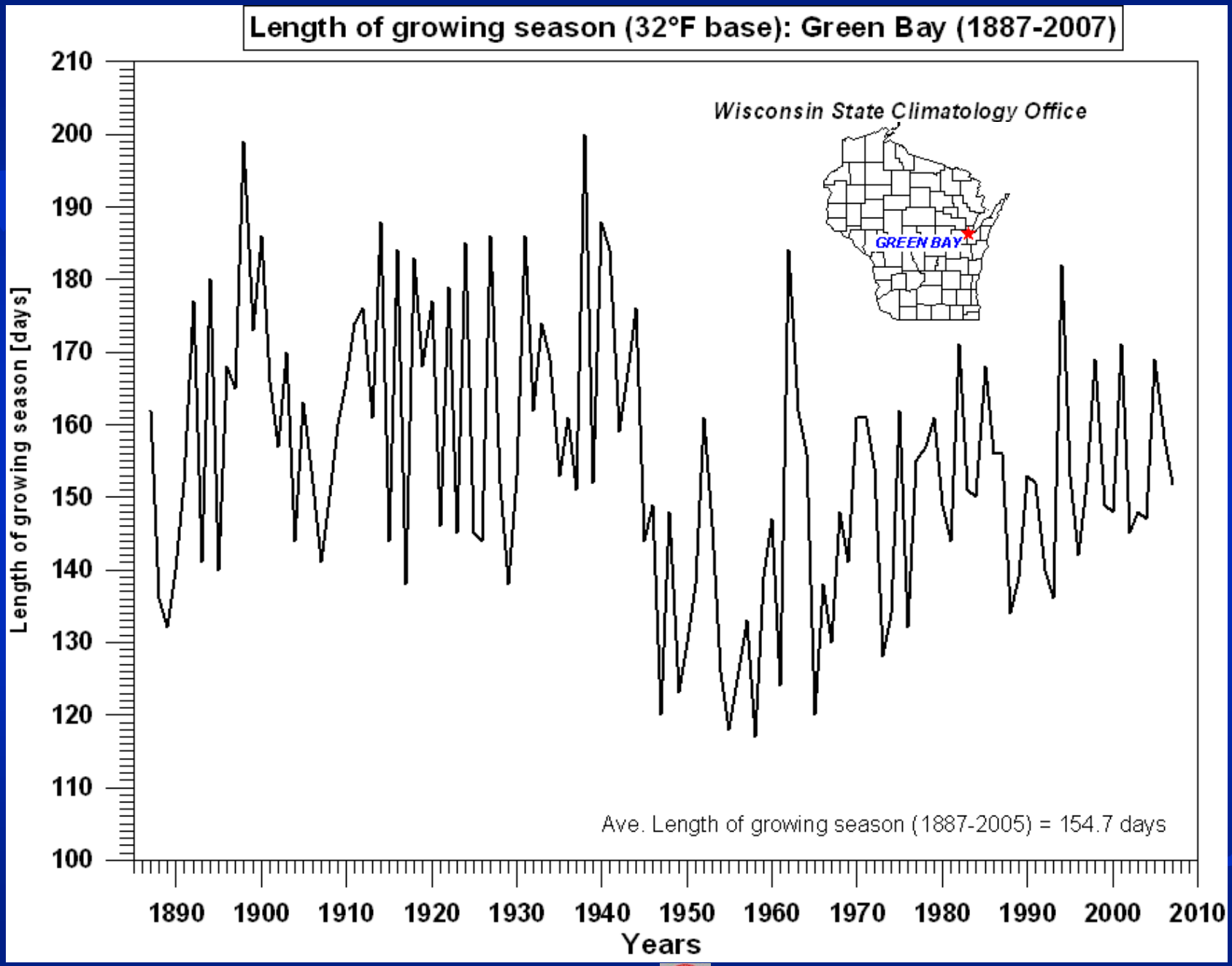

Highest Statewide Temperature by Year - Wisconsin
(1885 - 2007*)
5-yr running mean
*Data as of 31 Dec 2007
Highest Temperature (deg F)
110
100
90
Wisconsin State Climatology Office
1890
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010
Years

Projected Climate Changes in Wisconsin

(From *Confronting Climate Change in the Great Lakes Region*, *Wisconsin*)

- Growing season could be 4-7 weeks longer.


Dates of Last Spring & First Fall Freeze: Green Bay (1887-2007)
Wisconsin State Climatology Office
POR Median date of first autumn 32°F: 7 Oct
POR Median date of last spring 32°F: 7 May
GREEN BAY
Last Spring day of 32°F or lower temp.
First Fall day of 32°F or lower temp.
Date
27-Dec
12-Dec
27-Nov
12-Nov
28-Oct
13-Oct
28-Sep
13-Sep
29-Aug
14-Aug
30-Jul
15-Jul
30-Jun
15-Jun
31-May
16-May
1-May
16-Apr
1-Apr
17-Mar
2-Mar
15-Feb
31-Jan
16-Jan
1-Jan
1890
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010
Years


Length of growing season (32°F base): Green Bay (1887-2007)
Wisconsin State Climatology Office
GREEN BAY
Length of growing season [days]
210
200
190
180
170
160
150
140
130
120
110
100
1890
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010
Years
Ave. Length of growing season (1887-2005) = 154.7 days

Projected Climate Changes in Wisconsin

(From *Confronting Climate Change in the Great Lakes Region*, *Wisconsin*)

- An overall drier climate but:
  - winter precipitation is expected to increase by as much as 25% and summer precipitation is expected to decrease as much as 20%.
  - Wisconsin may see drier soils and more summer droughts.

Annual number of days with 1 inch or more liquid-equivalent precipitation
Milwaukee Mitchell Airport 1928-2007*

Wisconsin State Climatology Office

**Data through Dec 2007*

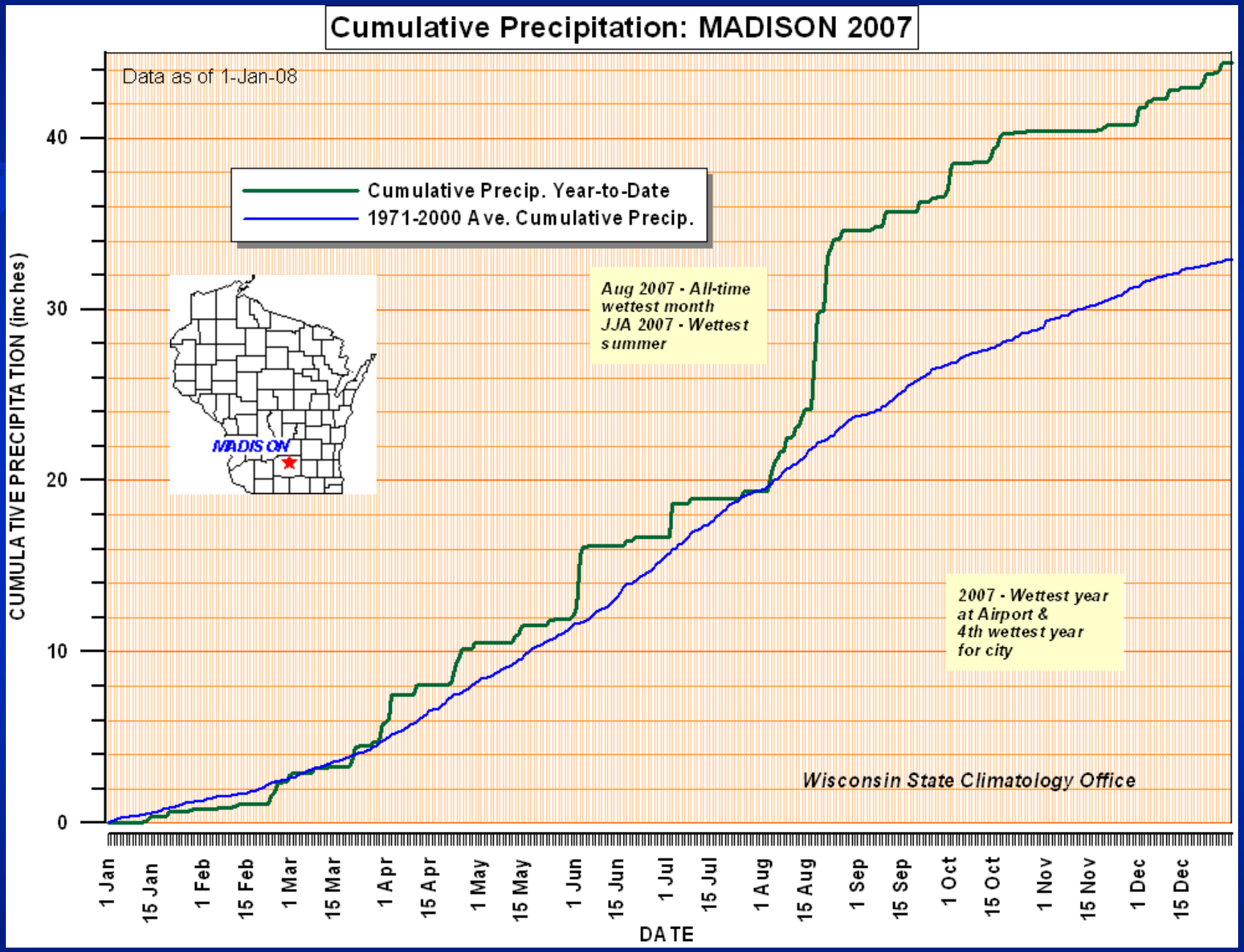
Ave. annual no. = 5.8 days (1928-2005)

Number of days

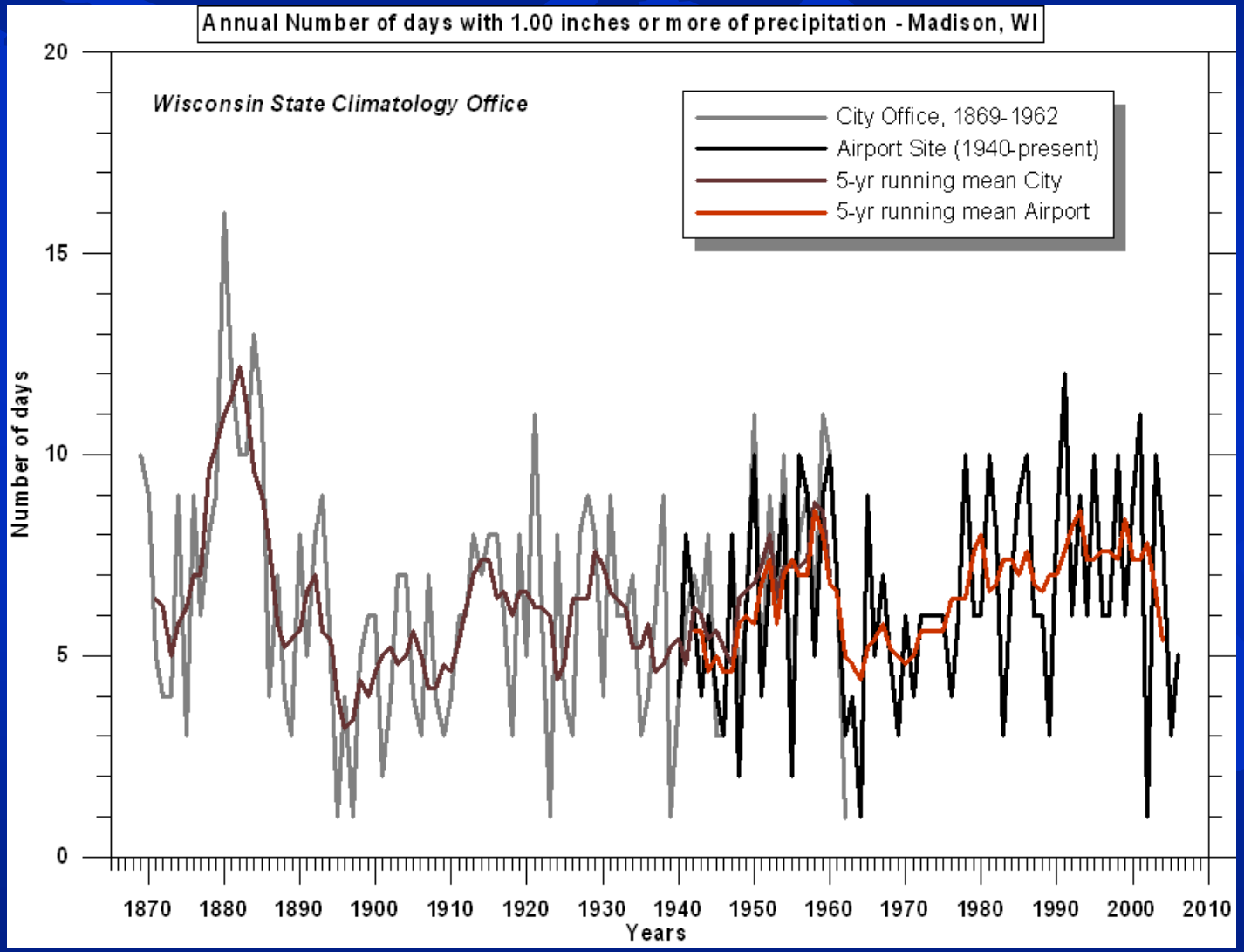
15
10
5
0

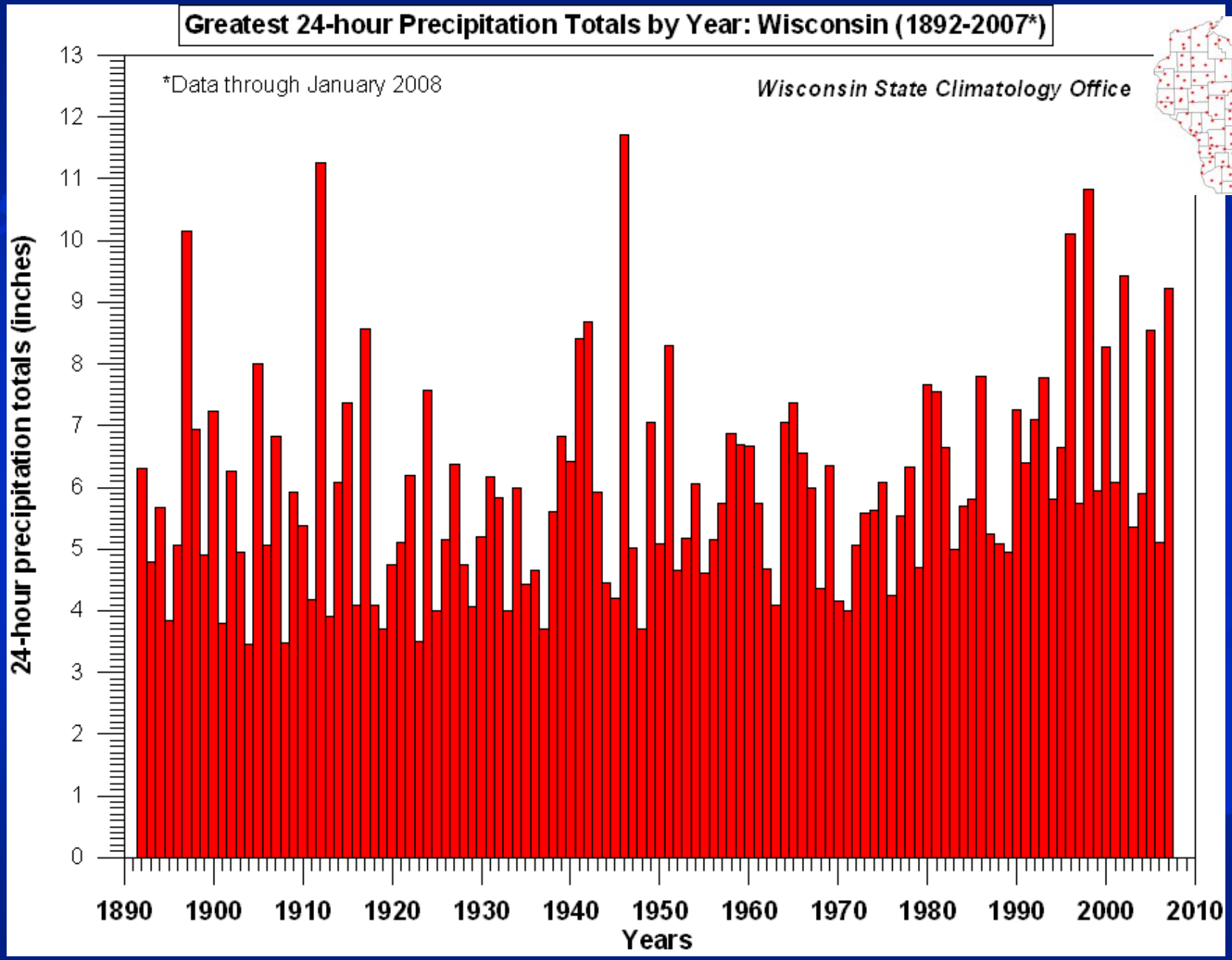
1930 1940 1950 1960 1970 1980 1990 2000 2010

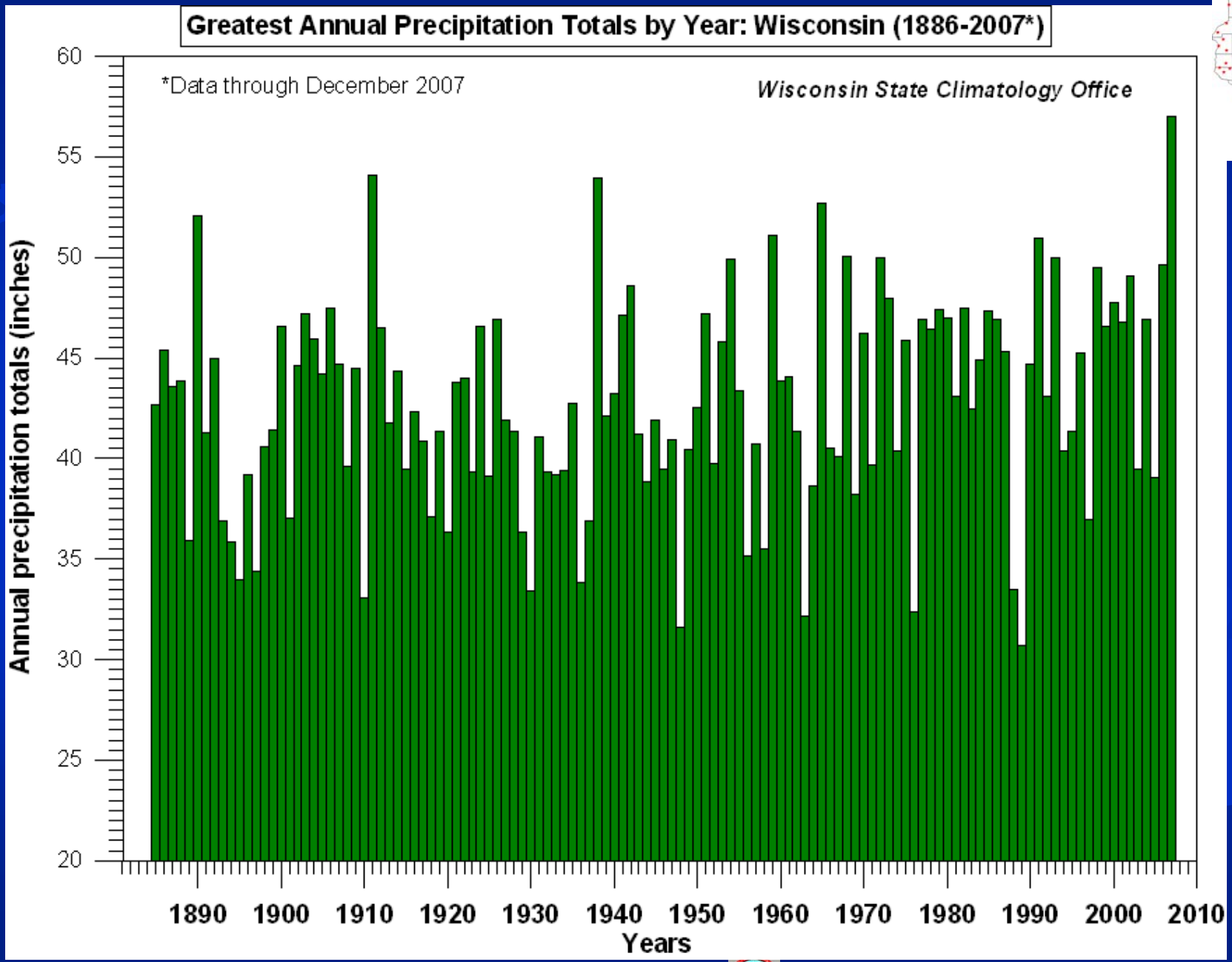
Years


Cumulative Precipitation: MADISON 2007
Data as of 1-Jan-08
Cumulative Precip. Year-to-Date
1971-2000 Ave. Cumulative Precip.
MADISON
Aug 2007 - All-time wettest month
JJA 2007 - Wettest summer
2007 - Wettest year at Airport & 4th wettest year for city
Wisconsin State Climatology Office
CUMULATIVE PRECIPITATION (inches)
0
10
20
30
40
1 Jan
15 Jan
1 Feb
15 Feb
1 Mar
15 Mar
1 Apr
15 Apr
1 May
15 May
1 Jun
15 Jun
1 Jul
15 Jul
1 Aug
15 Aug
1 Sep
15 Sep
1 Oct
15 Oct
1 Nov
15 Nov
1 Dec
15 Dec
DATE

Trends in Precipitation Extremes



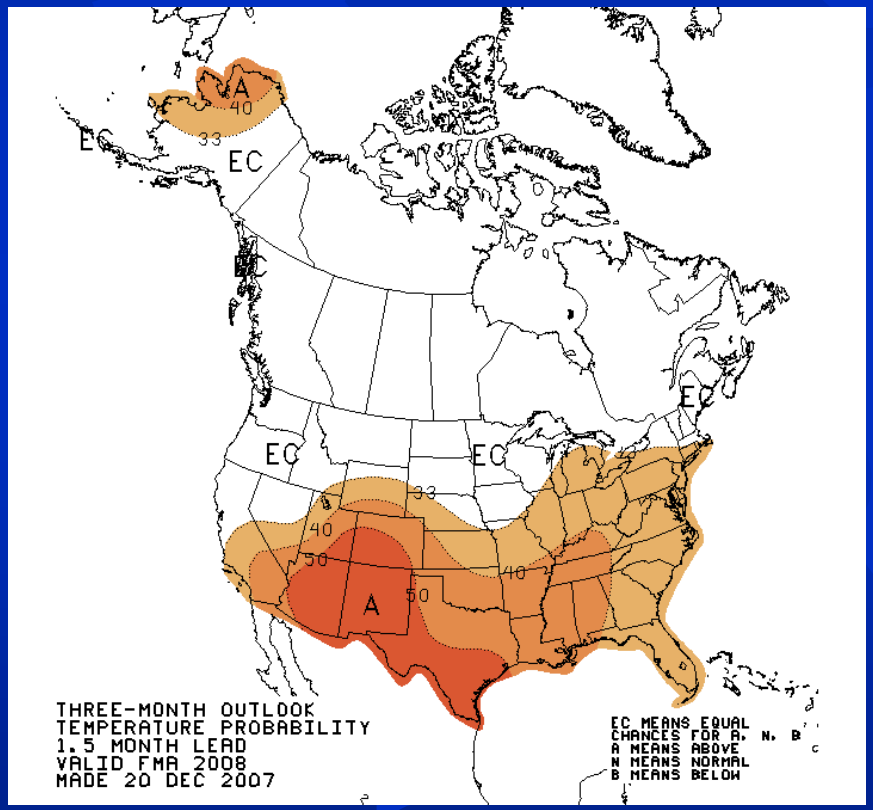

Greatest 24-hour Precipitation Totals by Year: Wisconsin (1892-2007*)
*Data through January 2008
Wisconsin State Climatology Office
24-hour precipitation totals (inches)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
1890
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010
Years

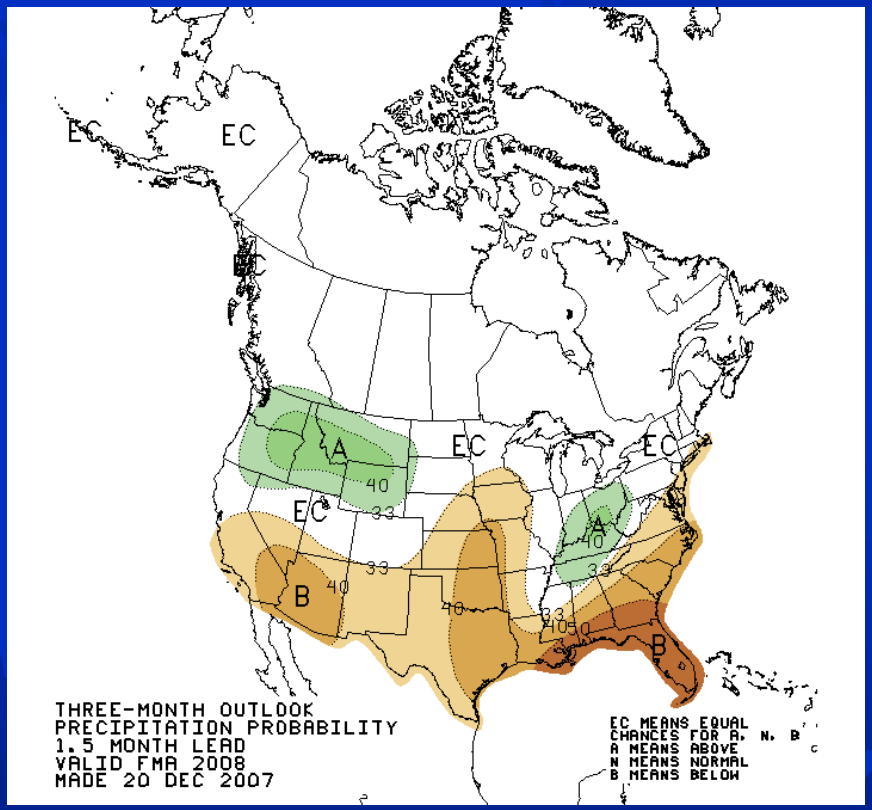

Greatest Annual Precipitation Totals by Year: Wisconsin (1886-2007*)
*Data through December 2007
Wisconsin State Climatology Office
Annual precipitation totals (inches)
60
55
50
45
40
35
30
25
20
1890
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010
Years

Looking Ahead - Forecasts

Outlook for February 2008

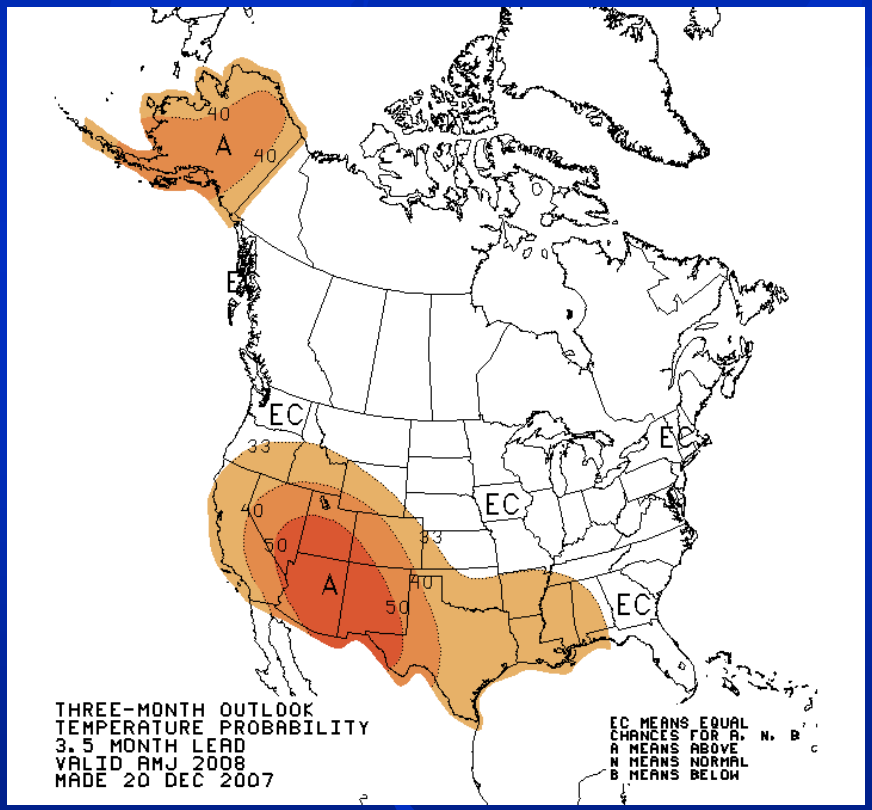
from Climate Prediction Center

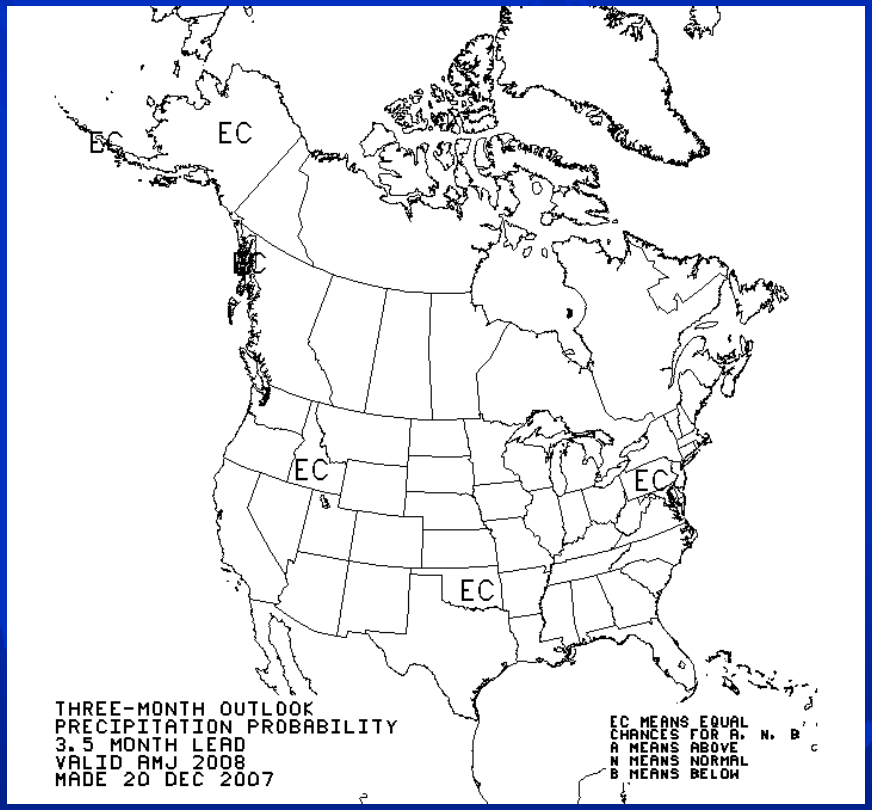


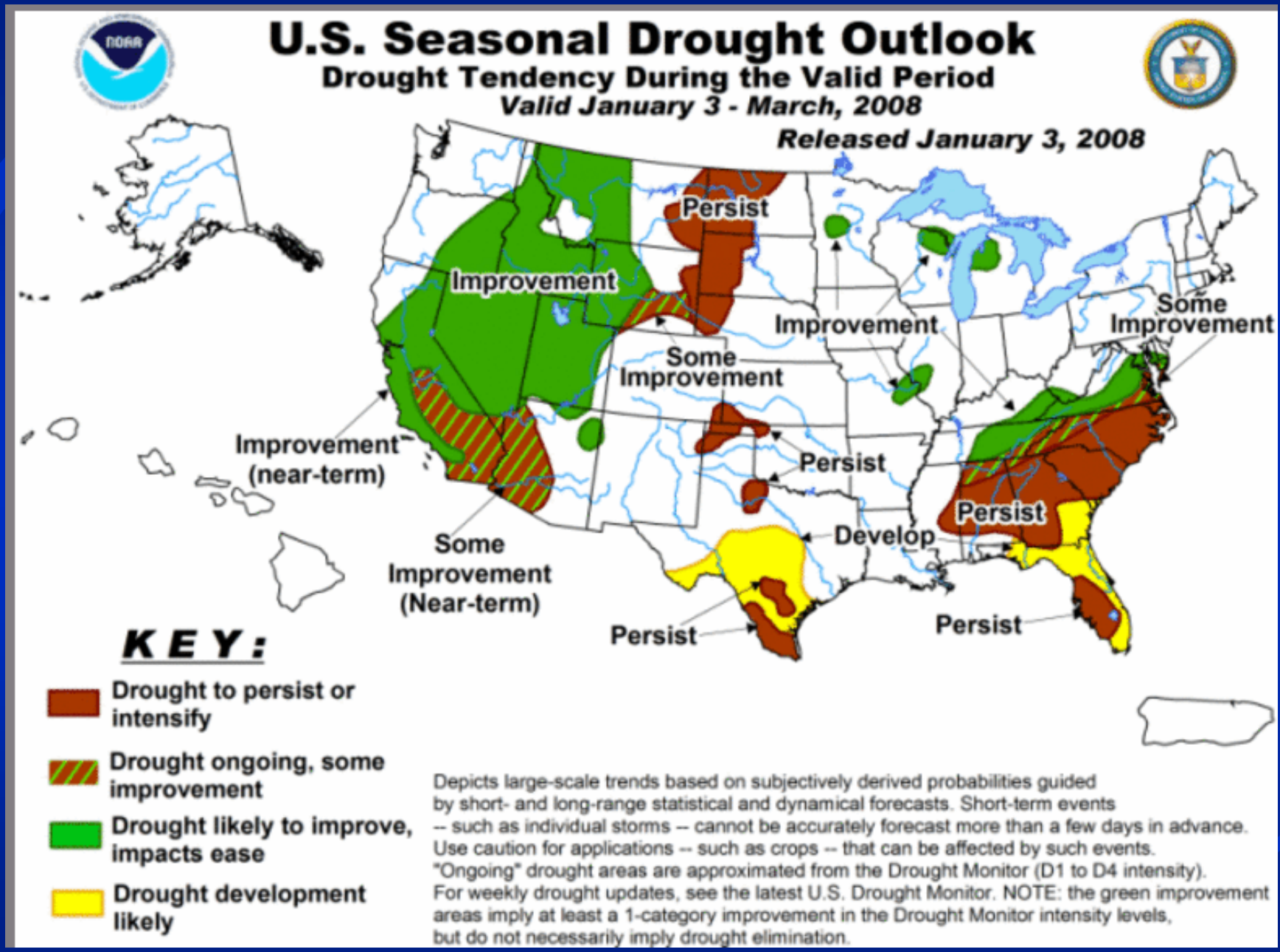


Outlook for April-June 2008

from Climate Prediction Center






U.S. Seasonal Drought Outlook
Drought Tendency During the Valid Period
Valid January 3 - March, 2008
Released January 3, 2008
Persist
Improvement
Improvement
Some Improvement
Some Improvement
Improvement (near-term)
Persist
Persist
Develop
Some Improvement (Near-term)
Persist
Persist
KEY:
Drought to persist or intensify
Drought ongoing, some improvement
Drought likely to improve, impacts ease
Drought development likely
Depicts large-scale trends based on subjectively derived probabilities guided by short- and long-range statistical and dynamical forecasts. Short-term events -- such as individual storms -- cannot be accurately forecast more than a few days in advance. Use caution for applications -- such as crops -- that can be affected by such events. "Ongoing" drought areas are approximated from the Drought Monitor (D1 to D4 intensity). For weekly drought updates, see the latest U.S. Drought Monitor. NOTE: the green improvement areas imply at least a 1-category improvement in the Drought Monitor intensity levels, but do not necessarily imply drought elimination.

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