2007/2008 Winter Climate Summary

ISSUED BY THE NATIONAL WEATHER SERVICE
GRAND RAPIDS MI

By William Marino

Our Winter Forecast issued last fall…

The National Weather Service 2007-2008 winter forecast for Southwest Lower Michigan has an enhanced probability for above normal temperatures and precipitation. Snowfall has an enhanced probability for being above normal inland of Route 31, while lake shore areas show an enhanced probability for below normal snowfall.

What actually happened…

The winter of 2007/2008 over Southwest Lower Michigan fit the forecast in all respects, except snowfall was above normal across the entire area instead of just near the lake shore.

This winter will be remembered most for the frequent snowstorms, which were punctuated by snow-melting warm-ups five times. Not only was it warmer than normal, but also snowier and wetter than normal.

Precipitation was well above normal across all of Southwest Lower Michigan. Mean areal precipitation was computed by taking the mean of every climate station in the region. Comparing the mean from this winter to past winters (Fig. 2), this was the second wettest winter on record. Some locations either set new records for total precipitation or got within the top 10 wettest winters on record. Muskegon's 11.99 inches of total precipitation was the wettest on record. Grand Rapids saw 10.95 inches of precipitation, making it the third wettest.

A significant amount of the precipitation was not rainfall, but the melted water equivalent of the snowfall. There were two lake effect snow storms that required warnings, which is an unusually small number for Southwest Lower Michigan. There were twelve synoptic snowstorms (an unusually large number), which helped to raise the water level of Lake Michigan. This is an unusual occurrence for the winter months.

Many locations set winter season snowfall records in spite of generally warmer than normal temperatures. Even though there were five warm-ups between the numerous snowstorms, snow was on the ground most of the winter over most of the area.

2007/2008 Winter Data December through February	GRAND RAPIDS	MUSKEGON	LANSING
Average High Temperature:	32.3°	32.2°	31.4°
Departure from Normal	+0.4°	-0.1°	-0.6°
Average Low Temperature:	19.8°	20.5°	18.5°
Departure from Normal	+1.7°	+1.2°	+2.2°
Average Mean Temperature:	26.0°	26.4°	25.0°
Departure from Normal	+1.0°	+0.6°	+0.8°
Average Precipitation:	10.95”	11.99”	7.91”
Departure from Normal	+4.68”	+5.55”	+2.68”
Snowfall:	94.9”	101.7”	59.5”
Departure from Normal	+42.8”	+19.7”	+21.7”

Table 1. Primary Climate temperature and precipitation measurements for the winter of 2007/2008

Temperatures

Average winter temperatures were near to above normal across all of Southwest Lower Michigan. Inland areas near and north of Route 10 had the highest departures from normal (Fig. 6). Those areas near and north of Route 10 were typically over one degree above normal. Areas south of Route 10 generally were between normal and one degree above normal. Baldwin, which is in Lake County, near Route 10, was nearly 2 degrees warmer than normal this past winter. Grand Rapids, Lansing and Muskegon were all within the same general range (Table 1).

January was the only month of the winter that was significantly warmer than normal. From the 5th through the 13th, the daily mean temperature averaged around 18 degrees above normal. On the 7th, most of southwest Michigan had high temperatures in the 60s. The last time highs were in the 60s in January for most of Southwest Lower Michigan was back in the mid 1990s. It was during that time that most areas south of Route 10 totally lost their snow cover. Once cold air moved into the area on the 19th, the remainder of the winter (January 19th through February 29th) averaged three degrees below normal. The coldest period of the winter occurred from the 10th through the 23rd of February, when temperatures averaged around 16 degrees, or about 9 degrees below normal. Thanks to that cold spell, February was the coldest month.

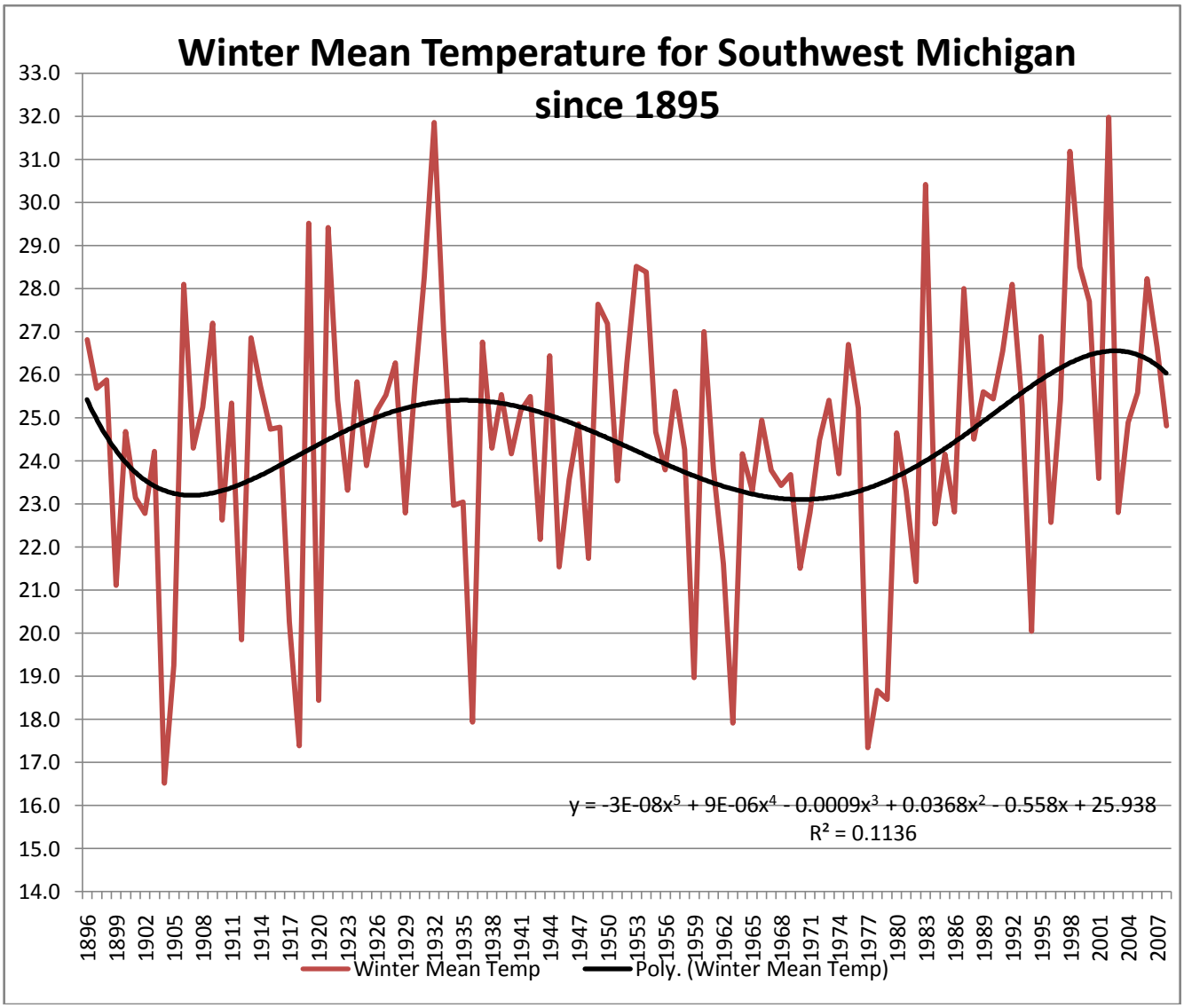

Fig. 1. Mean Temperature from 1895 through 2007 averaged from all available climate sites in Southwest Lower Michigan.

To give a better representation of climate trends in Southwest Lower Michigan, data from all climate stations in the area were averaged for this winter and previous winters. The resulting mean temperatures plotted in Fig. 1 show there has been a warming trend since the 1970s. The mean winter temperature for all of Southwest Lower Michigan increased from 23.1 degrees for the winter of 1970/1971 to 26.5 degrees in winter of 2001/2002. After the winter of 2001/2002, winters started to cool. The winter of 2007/2008 for all of Southwest Lower Michigan was the coolest winter since the winter of 2002/2003 across the area. In the past ten years, only two winters were colder than the winter of 2007/2008.

Precipitation

Taking an average of all climate stations in Southwest Lower Michigan, the mean areal precipitation has continued to increase since the early 1990s (Fig. 2). The mean for the winter of 2007/2008 was 3.23 inches, which is 1.25 inches above the 1971 to 2000 normal of 1.98 inches. That makes this the second wettest winter on record, behind the 3.63 inches that fell in the winter of 1949/1950.

Measurable precipitation occurred frequently. At Grand Rapids, there were 59 days (or 65 percent of the total days in the winter season) with measurable precipitation, which set a new record. The normal number of measurable precipitation days at Grand Rapids is 41, which is 45 percent of the maximum possible.

Storm steering winds were unusually strong just south of the Great Lakes region (yellow area in Fig. 5), which likely contributed to the wet pattern. Precipitation departures from normal over the United States (dark green areas in Fig. 9) occurred on the north side of the area where the upper level jet stream was anomalously strong. This pattern put Michigan on the colder north side of more storm systems, resulting in snowfall well above normal (Fig. 12).

Water levels on the Great Lakes responded to the combination of this relatively cold and very wet winter compared to the last ten years. As can be seen on Figs. 3 and 4, the water level of Lakes Michigan and Huron does seem rather responsive to the total winter precipitation across the region. While it is true that the level of Lakes Michigan and Huron are near record lows, the combination of near record precipitation and temperatures that were cool enough to create more ice than has been seen in a few years on Lake Michigan helped allow water levels to rise at a time when they typically would fall (Fig. 3). It is hypothesized that a high proportion of synoptic storms this winter helped to transport moisture to the Great Lakes region from the Gulf of Mexico. Lake effect snow, on the other hand, depletes moisture from the Great Lakes - so the relative lack of lake effect precipitation helped cause a net gain in lake levels.

Looking at the seasonal departure from the mean for precipitation (Fig. 8), it can be seen that the winter of 2007/2008 was wetter than normal across all of Lower Michigan with the wettest areas in the southern sections. That is likely related to the storm track being south of Lower Michigan (Fig. 5). Even though southern sections were the wettest, northern areas of Southwest Lower Michigan were wetter than normal. For example, Baldwin was 3.38 inches above normal for their total winter

precipitation. It was not until the first week of March (after winter was over) when the jet stream changed position (not shown) and the precipitation frequency decreased significantly.

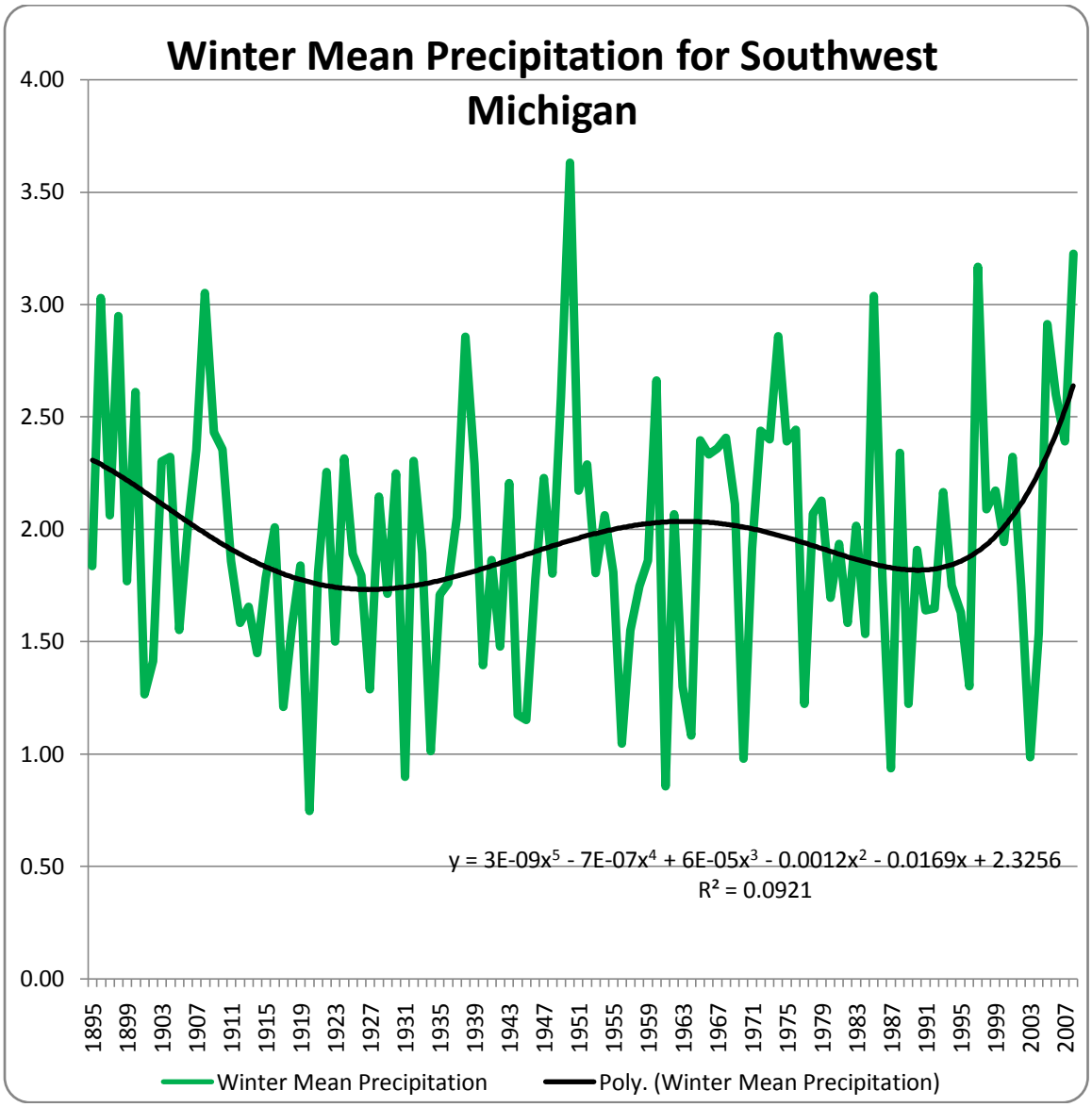

Fig. 2. As in Fig 1, except for winter precipitation.

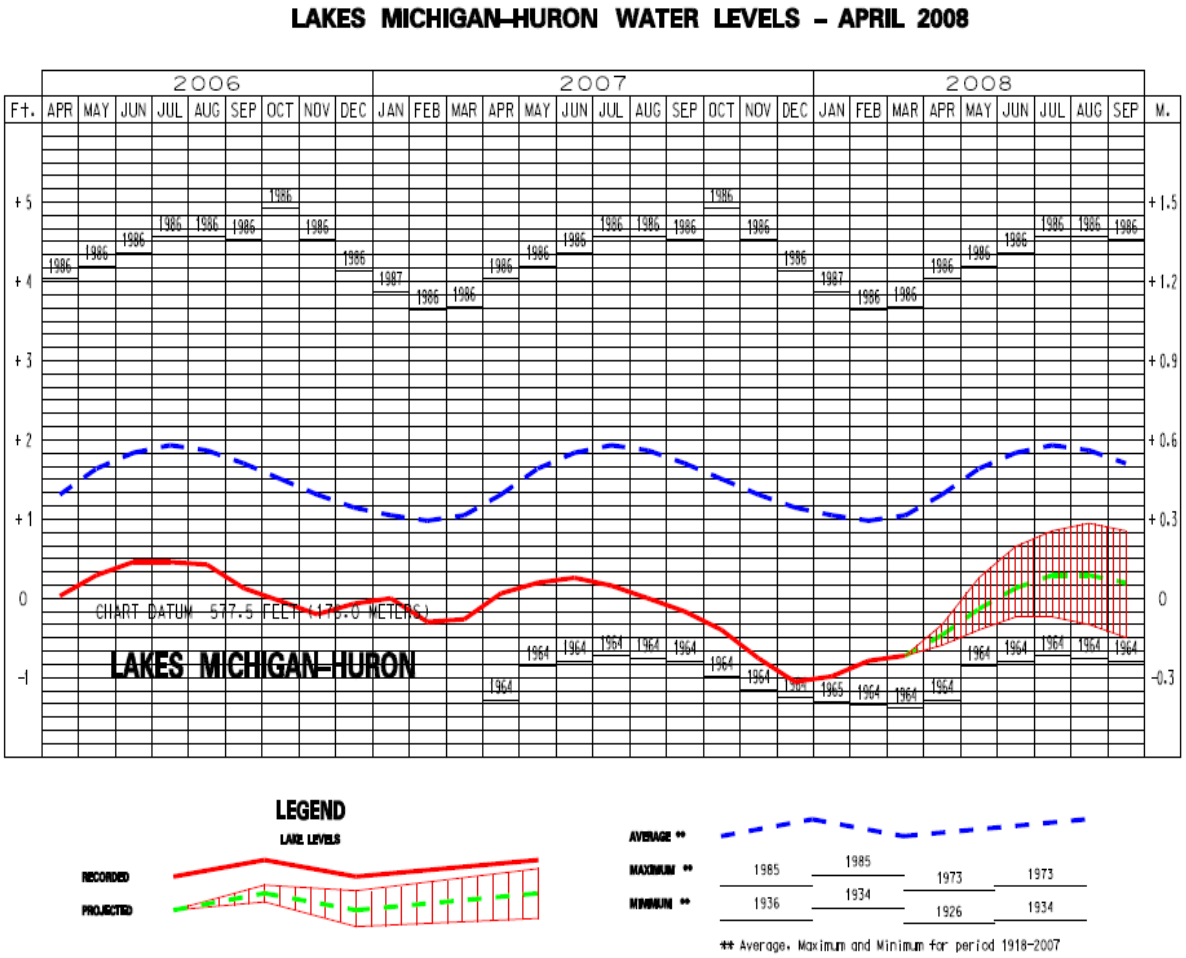

Fig. 3. Lake Michigan-Huron Water Levels from 2006 through 2008 in April. This chart is from the Army Corps of Engineers

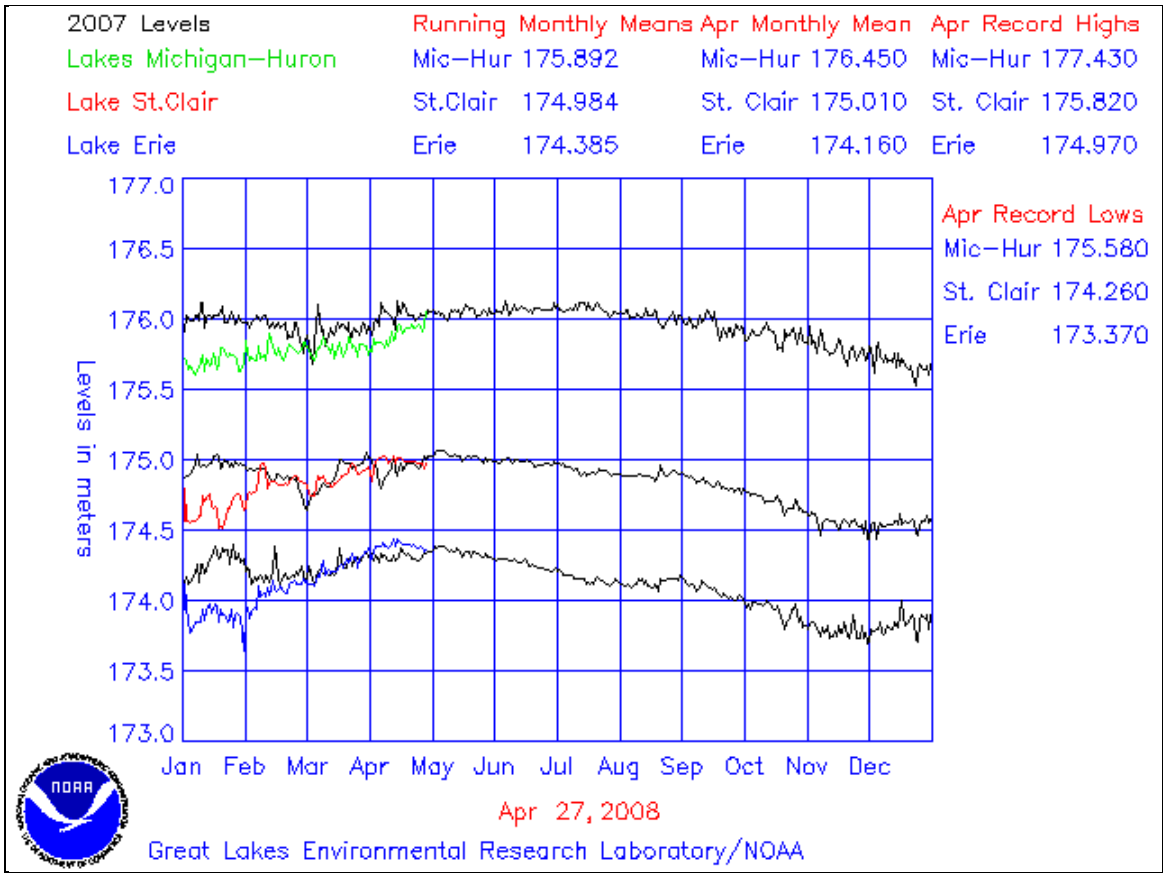

Fig. 4. Great Lakes Water Levels since January 2007

Snowfall

Snowfall was heavy across Southwest Lower Michigan (Figs. 10 through 12). Grand Rapids had the second snowiest season on record with 107 inches of snowfall. The 132.0 inches in 1951/1952 remains the record seasonal snowfall. Muskegon was not close to setting a record, but with 110 inches of snow, it was the first time Muskegon recorded above normal snowfall since the 1995/1996 season. Many other locations had impressive snow totals that were well above normal (Table 2).

Winter storms occurred with unusually great frequency and strength. The twelve synoptic storms that required warnings this past season set an all-time record for Southwest Lower Michigan since the Grand Rapids National Weather Service began issuing warnings. The previous record was eight storms set in the 1999/2000 season. The long term average is six synoptic snow storms per winter season. Eight of the storms that occurred this winter season impacted more than a quarter of the Grand Rapids County Warning Area with warning criteria snowfall. This tied the record for Southwest Lower Michigan, which was first set during the 2006/2007 season.

A notable aspect to the 2007/2008 winter is the very large proportion of synoptic snowstorms to lake effect snow events. There were only two purely lake effect events that produced warning criteria snowfall. Only the 2001/2002 season had fewer with one purely lake effect snowstorm. In a typical season, there are two synoptic storms for each lake effect events; however, the 2007/2008 season has a ratio of 6:1, which is the greatest ratio on record for synoptic to lake effect events.

Location	Total Season Snowfall	Normal Snowfall	Departure from Normal
Muskegon	110.3	105.4	+4.9
Grand Rapids	107.0	71.2	+35.8
Lansing	69.5	53.8	+15.7
Grandville	141.7	NA	NA
Hart	126.9	76.3	+50.6
Bloomingdale	114.0	73.3	+40.7
Hastings	94.0	48.7	+45.3
Kalamazoo	94.6	77.7	+16.9
South Haven	92.3	47.5	+44.8
Freemont	87.8	NA	NA
Big Rapids	87.3	54.9	+32.4
Hesperia	83.1	71.3	+11.8
Ionia	74.2	43.7	+30.5
White Cloud	77.7	67.7	+10.0
Baldwin	70.7	70.6	+0.1
Grand Ledge	61.9	41.3	+12.2

Table 2. Selected Location Seasonal Snowfalls

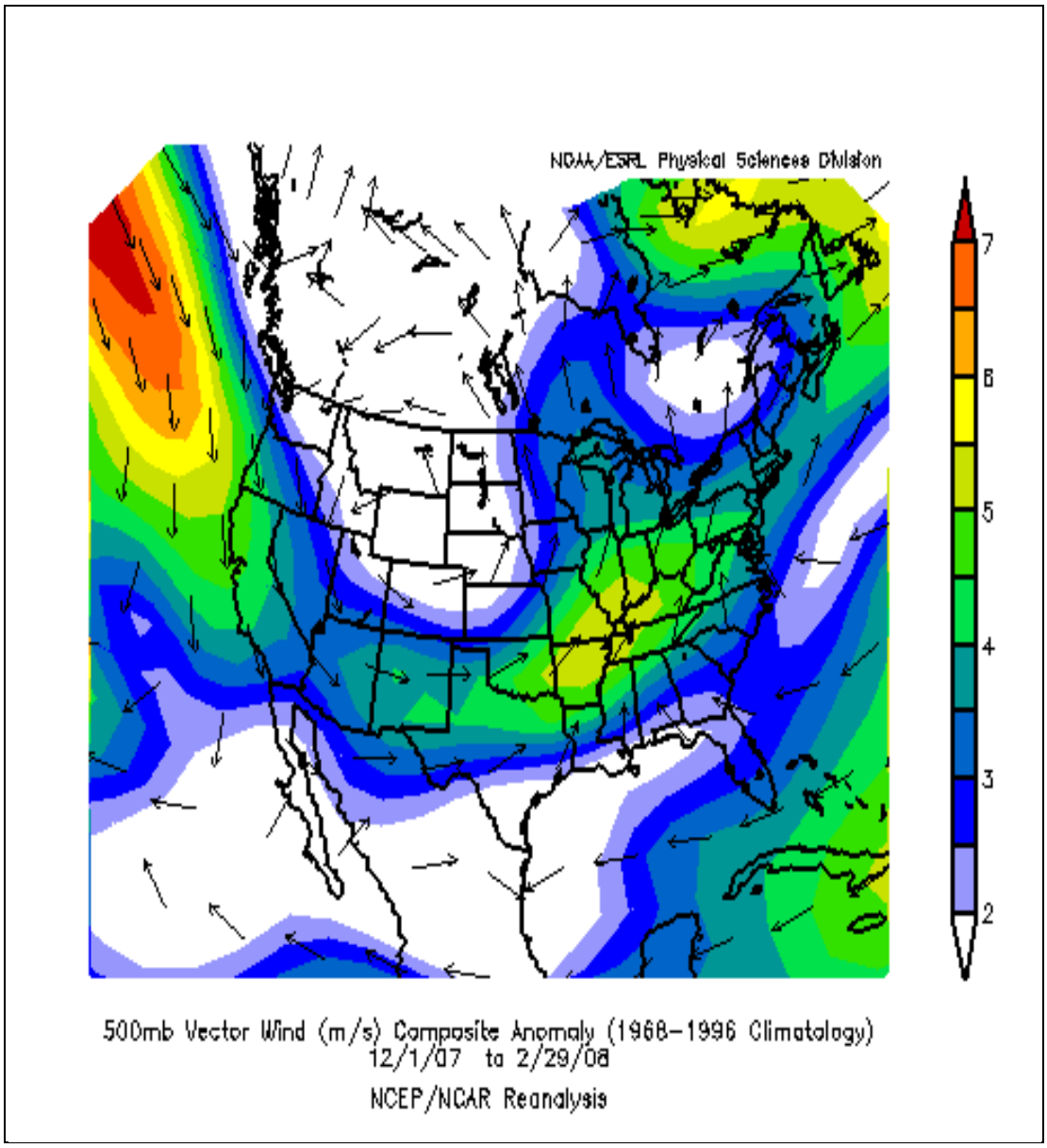

Fig. 5. Mean Winter Steering Level Wind Anomaly

Winter Anomalies Charts 2007/2008

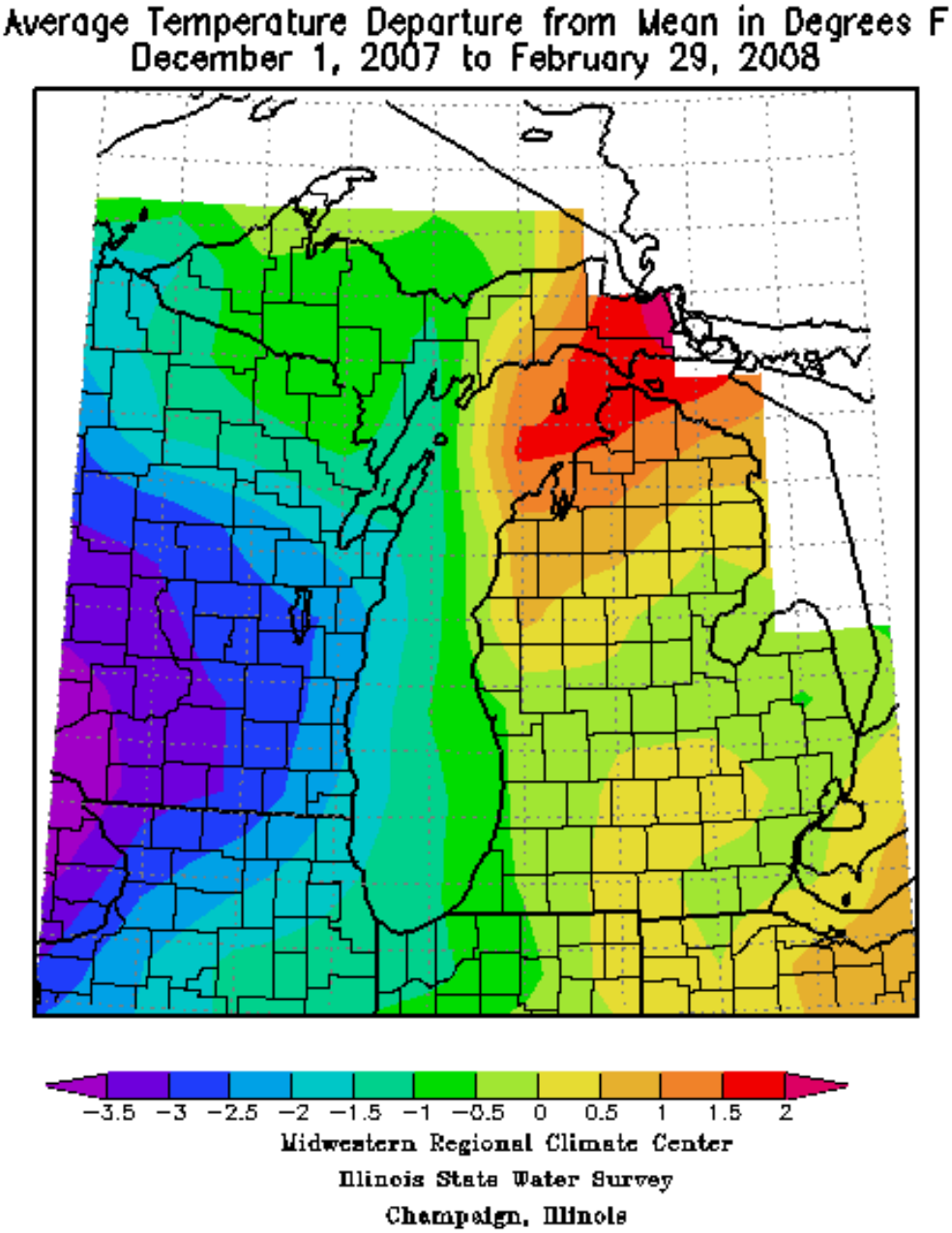

Fig. 6. Temperature departure from normal (degrees F) for the winter of 2007-2008.

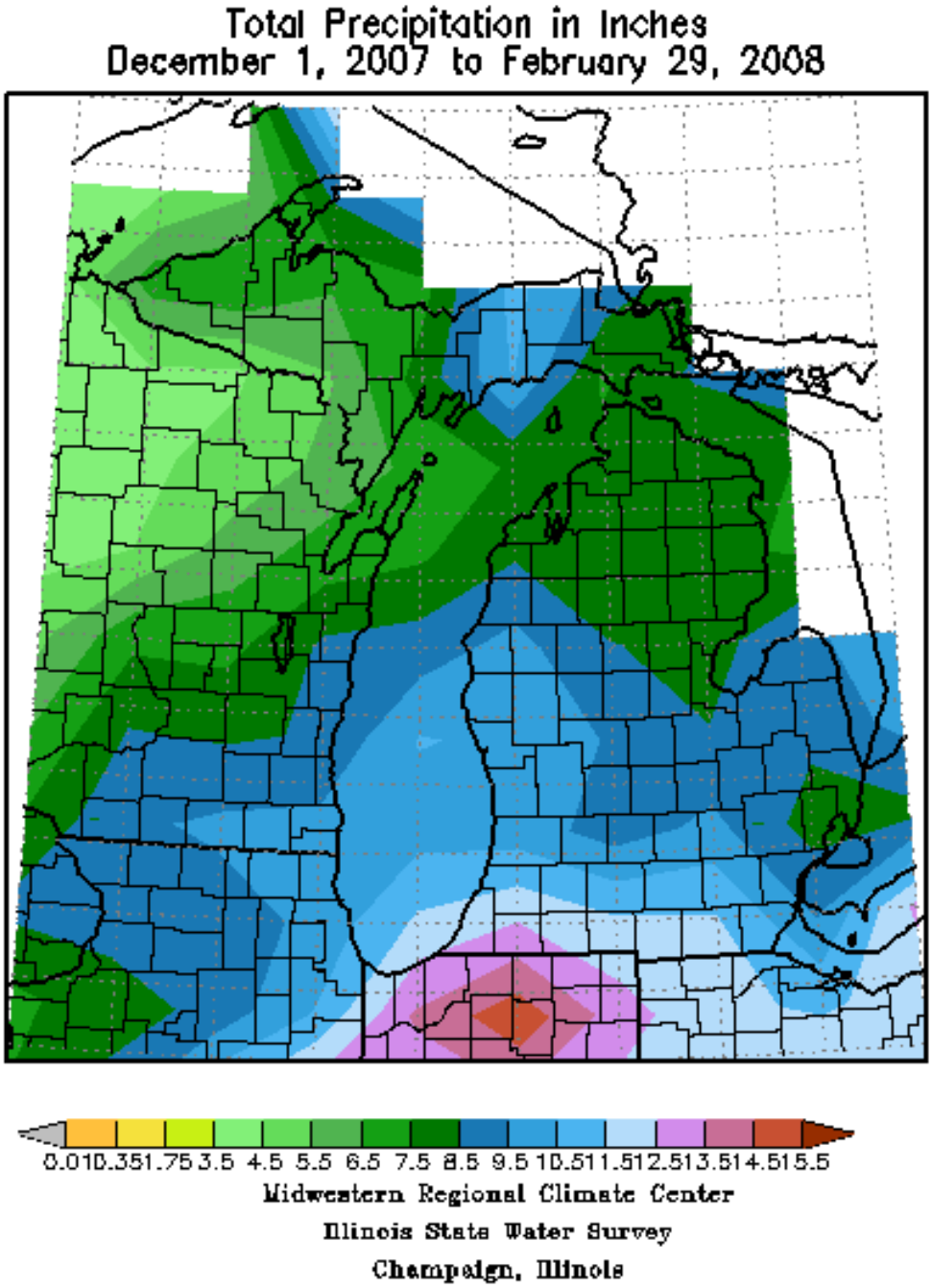

Fig. 7. Total Precipitation for the winter of 2007/2008

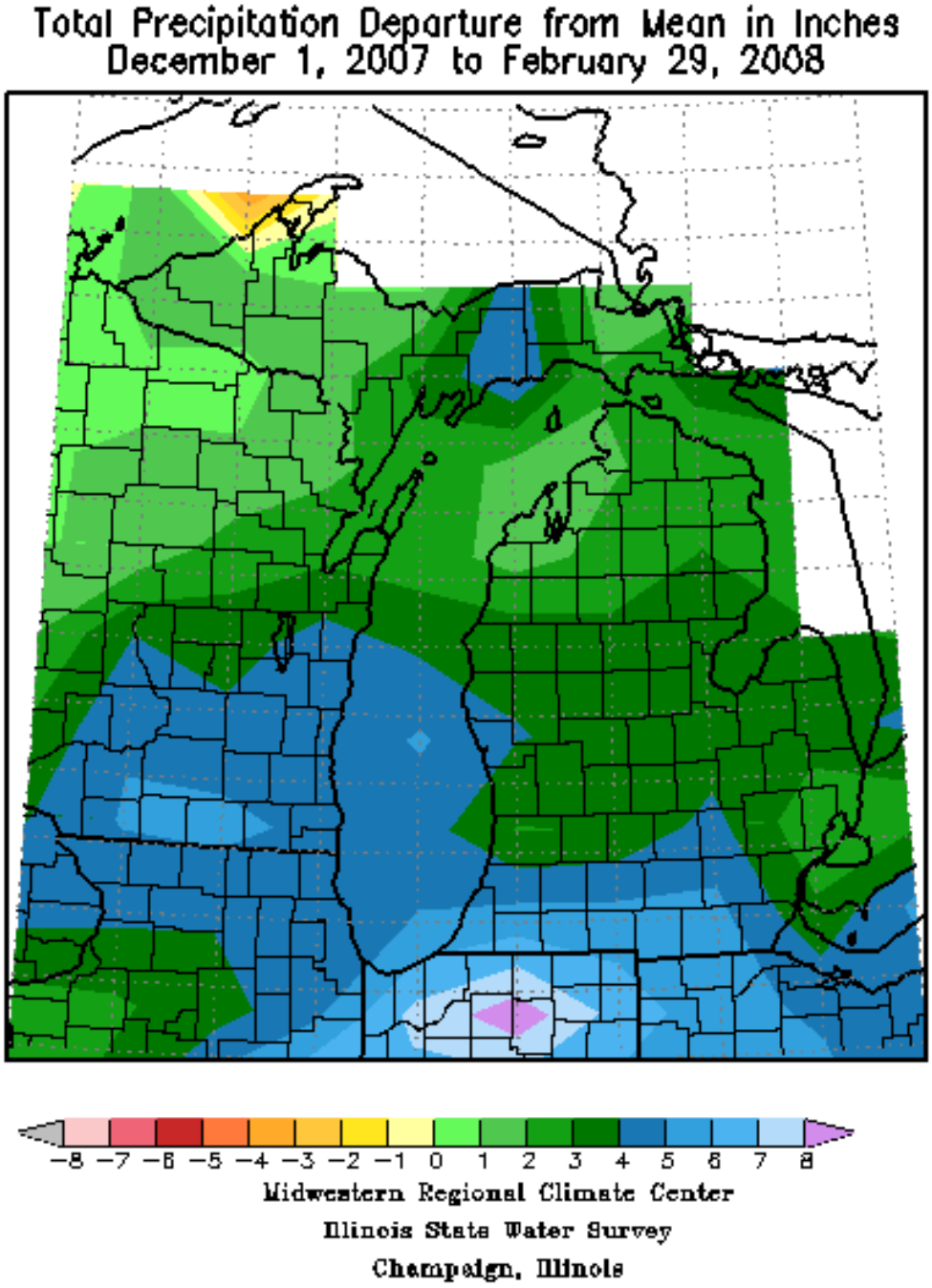

Fig. 8. Total Precipitation Departure from the Mean in inches for the winter of 2007-2008.

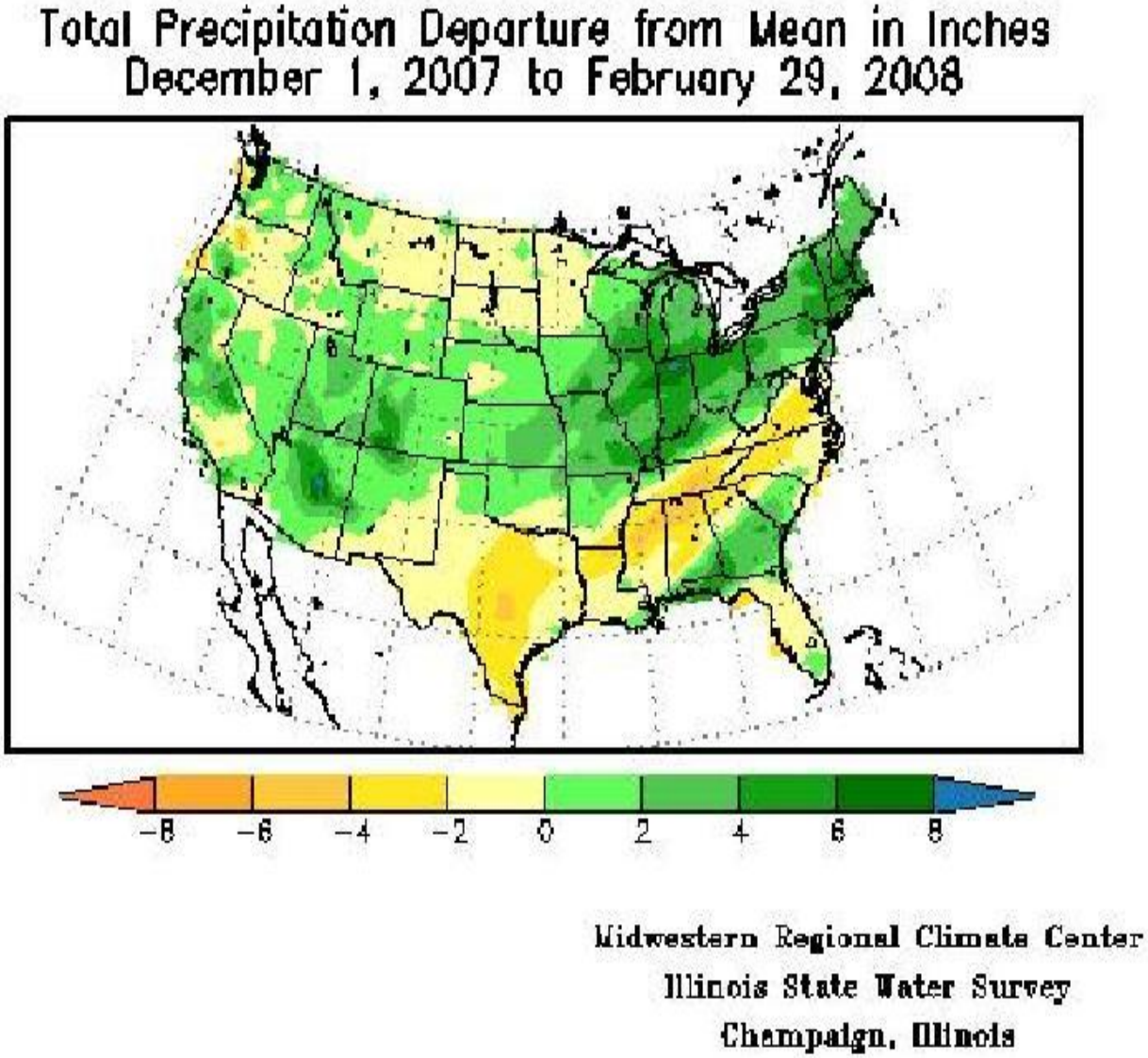

Fig. 9. Precipitation Departure from Mean for the winter of 2007/2008

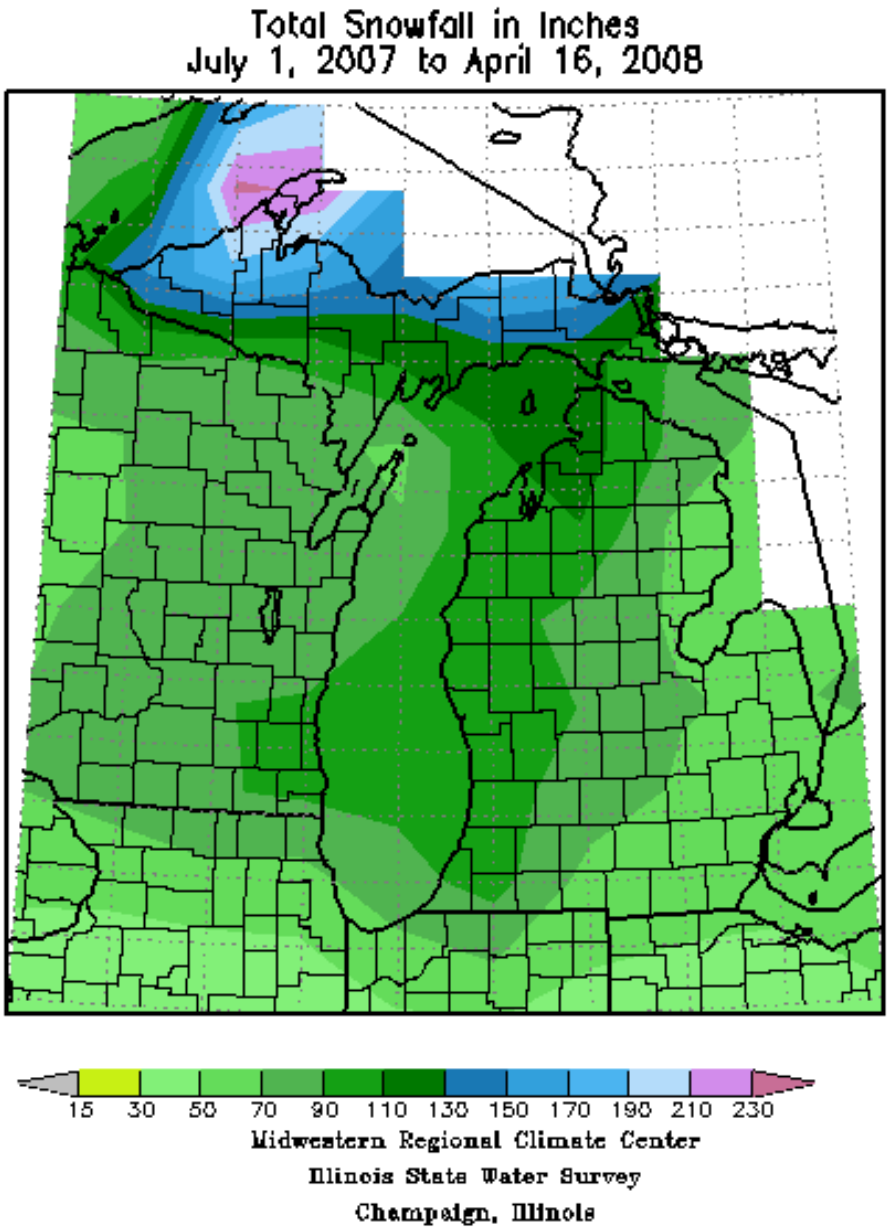

Fig. 10. Total Snowfall for the 2007/2008 Season from July 1st through April 15th.

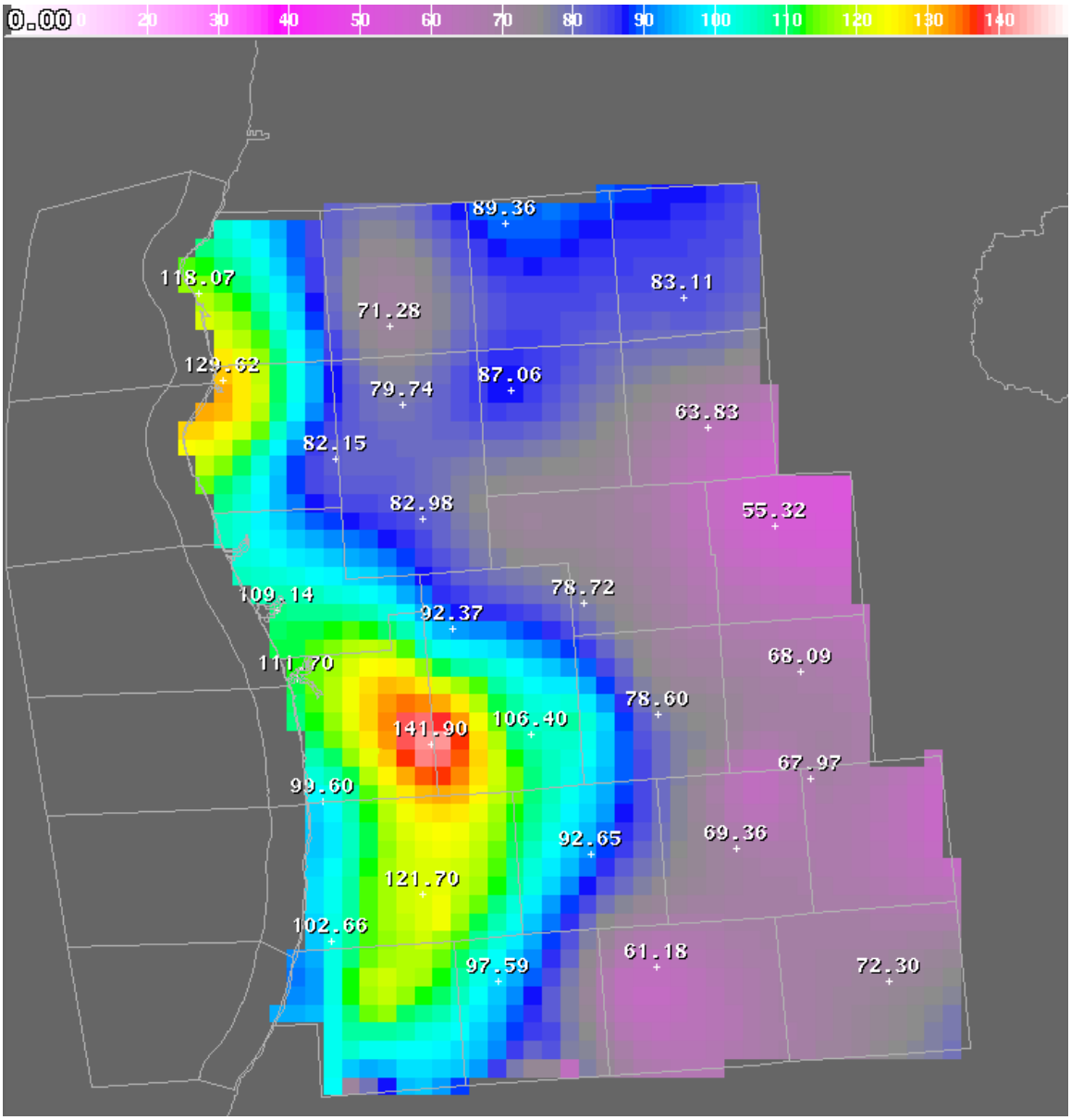

Fig. 11. The total seasonal snowfall across Southwest Michigan. The total is from July 1st through April 15th. Any snowfall after the 15th of April is not reflected in this map.

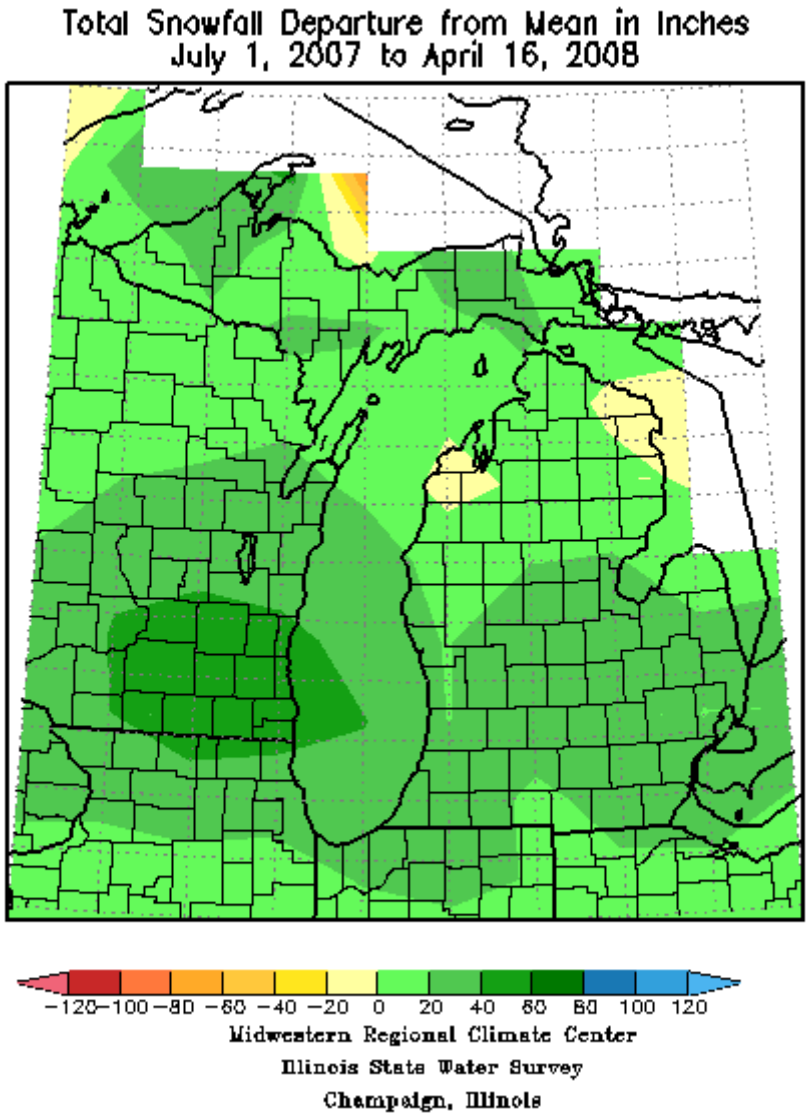

Fig. 12. Total Snowfall Departure from Normal for the Winter of 2007-2008 (through April 15th).

Web References:

Climate Diagnostics Center:
http://www.cdc.noaa.gov/

Midwest Climate Center:
http://sisyphus.sws.uiuc.edu/cliwatch/watch.htm

National Weather Service:
http://www.weather.gov/

Grand Rapids National Weather Service Climate Page:
Grand Rapids NWS Climate Page
(http://www.weather.gov/climate/index.php?wfo=grr)

Atmospheric Blocking:
http://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/block.shtml

North Atlantic Oscillation / Pacific - North American pattern (NAO/PNA):
http://www.cpc.ncep.noaa.gov/www_images/telecalc_header.gif

Daily Madden-Julian Oscillation Indices:
http://www.cpc.ncep.noaa.gov/products/precip/CWlink/daily_mjo_index/mjo_index.html

500-hPa heights and anomalies from the NCEP Global Data Assimilation System (GDAS)
http://www.cpc.ncep.noaa.gov/products/intraseasonal/z500_nh_anim.shtml

Drought Monitor:
http://www.drought.unl.edu/dm/monitor.html