

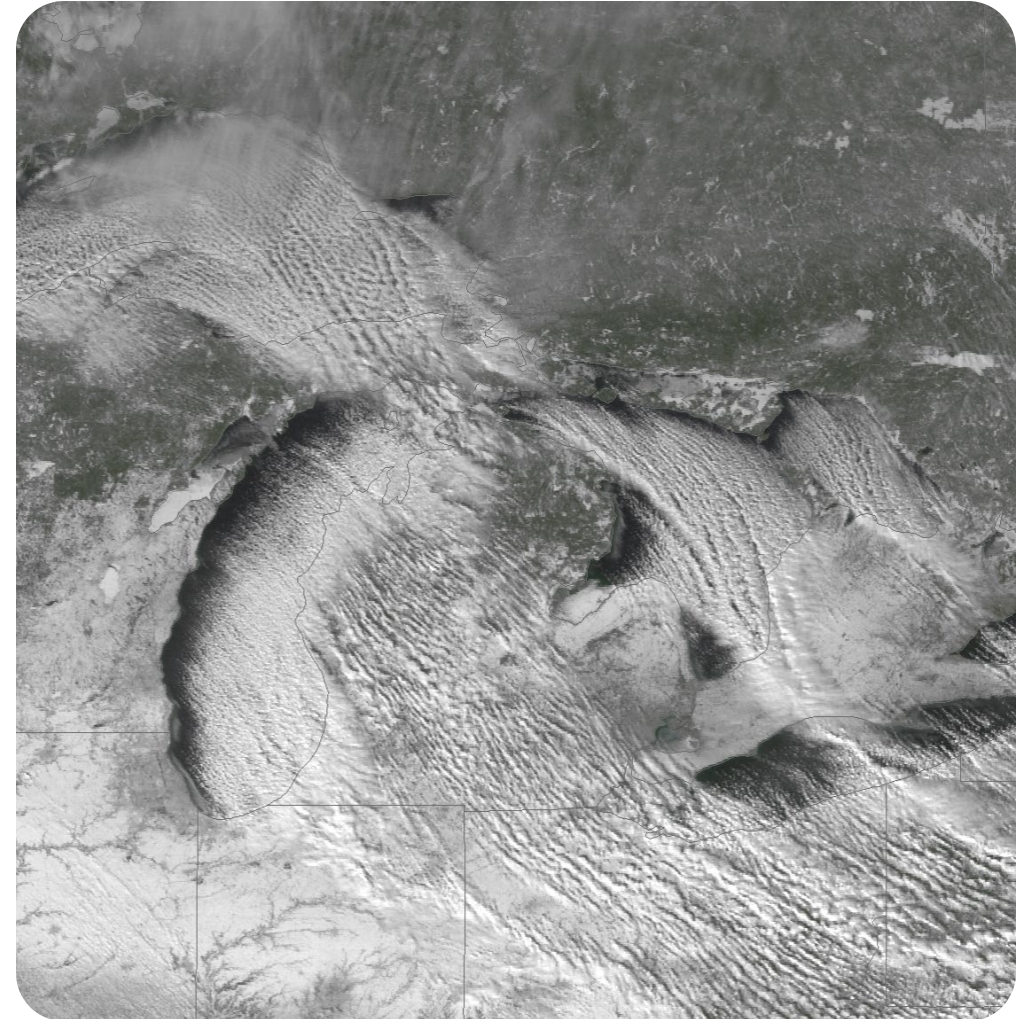
NWS Winter Outlook & Resources

MTU CTT Winter Operations Conference
October 20, 2026

U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service

Discussion

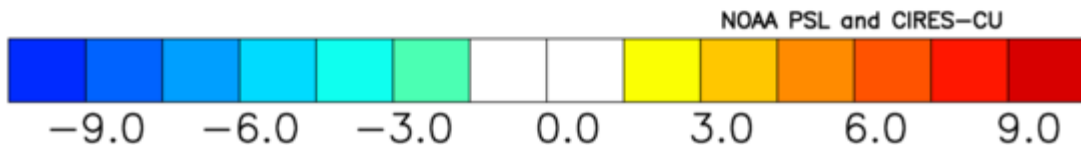
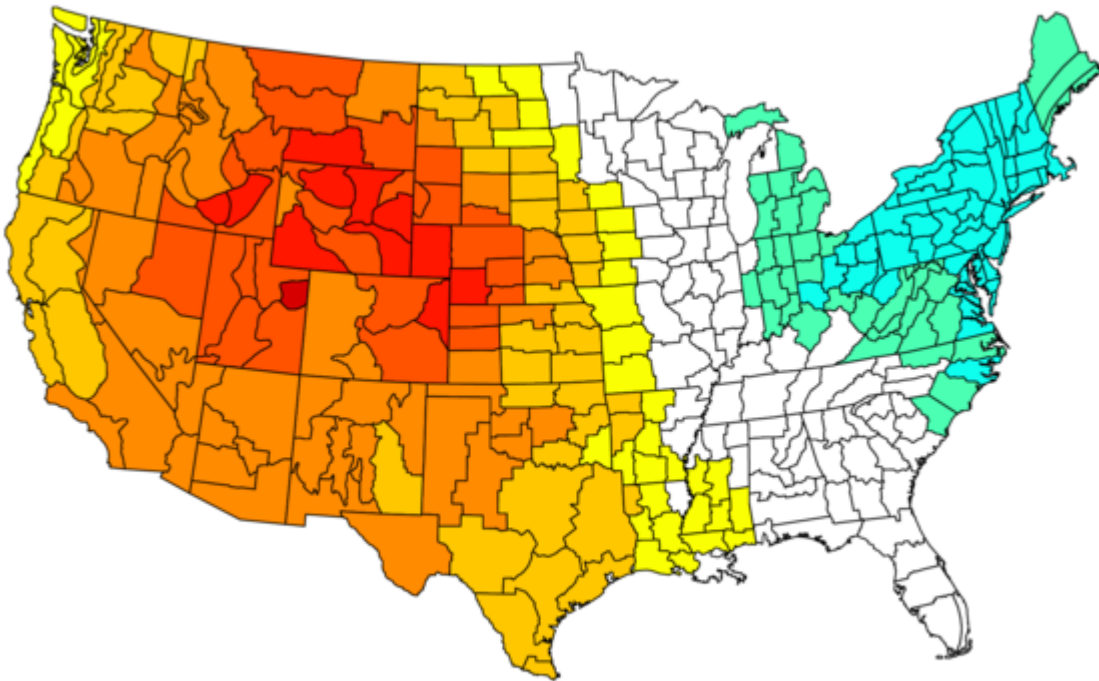
- 01 Looking Back at Last Winter
- 02 What Goes Into a Winter Outlook?
- 03 Winter Trends Across Michigan
- 04 Winter 2026-2027 Outlook
- 05 NWS Resources



Looking Back at Last Winter

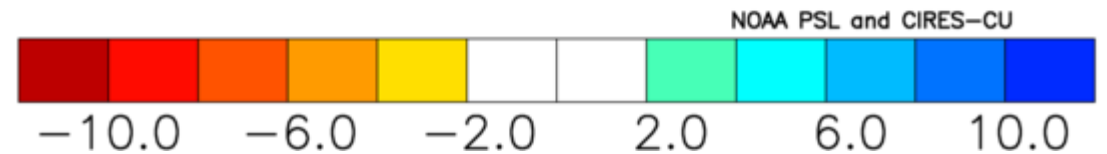
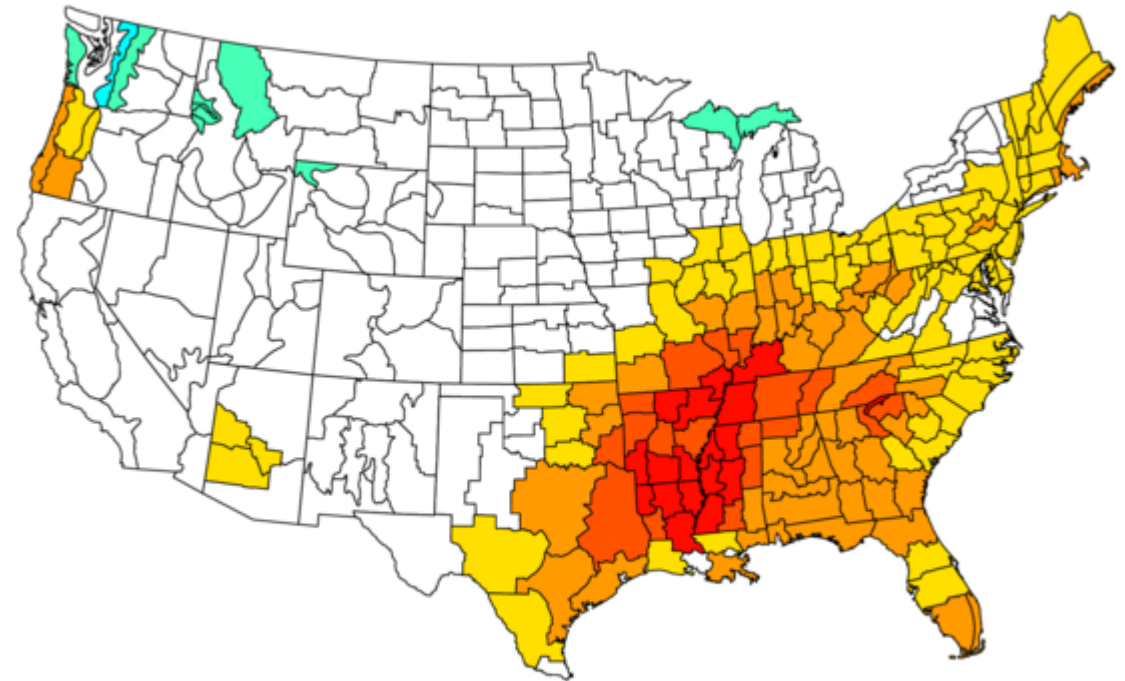
Temperatures Compared to Average

NOAA/NCEI Climate Division Temperature Anomalies (F)
Dec to Feb 2025–26
Versus 1991–2020 Longterm Average

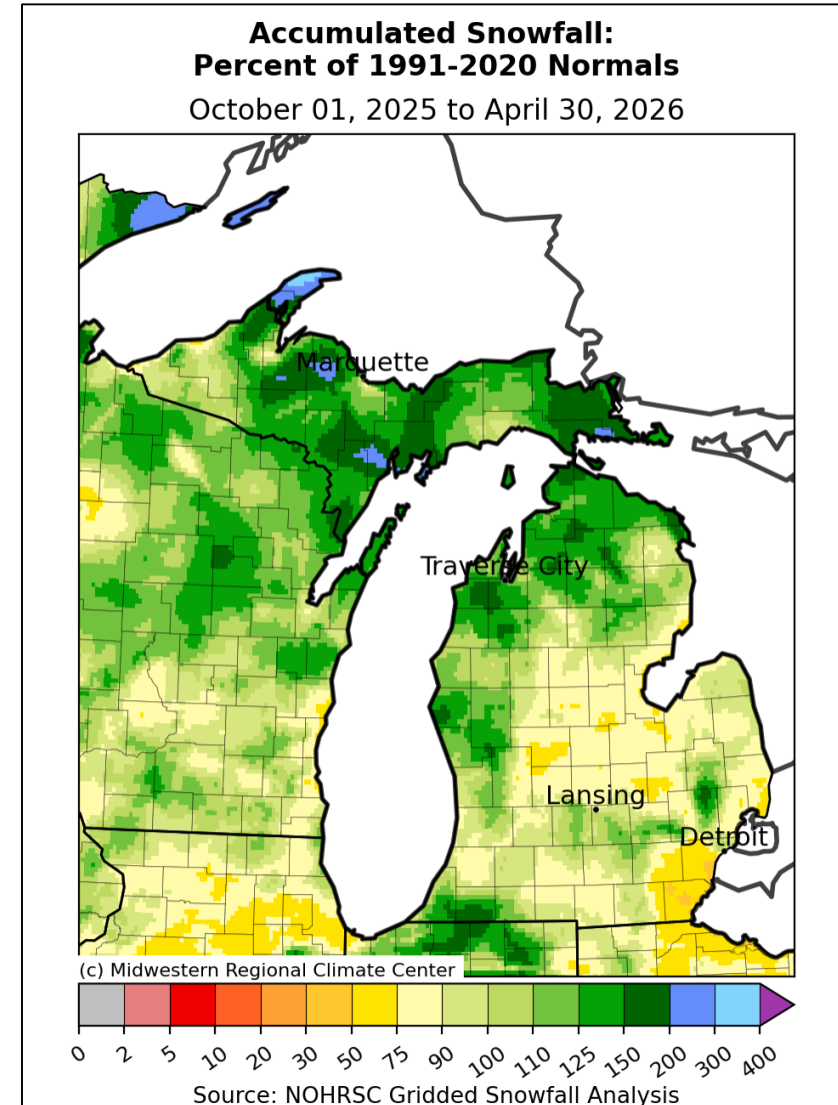
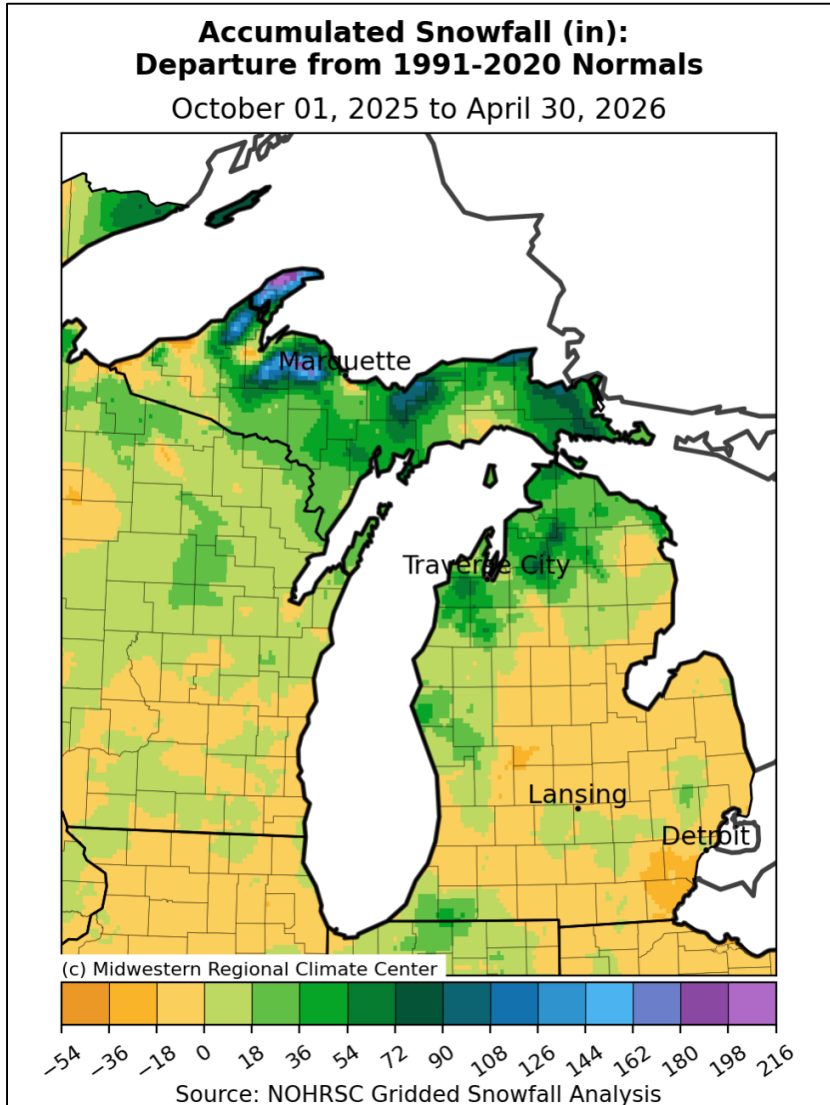


Precipitation Compared to Average

NOAA/NCEI Climate Division Precipitation Anomalies (in)
Dec to Feb 2025–26
Versus 1991–2020 Longterm Average



Looking Back at Last Winter



Looking Back at Last Winter

Seasonal Snowfall Accumulations

366" Herman (2nd highest on record)
360" Calumet
277" Marquette NWS (2nd highest on record)
240" Paradise
189" Sault Ste Marie (3rd highest on record)
171" Petoskey
166" Gaylord NWS

147" Kalkaska
113" Hart
109" Muskegon
85" Battle Creek
75" Grand Rapids NWS
42" Lansing
40" Detroit

Looking Back at Last Winter

Maximum Recorded Snow Depth

5' 8" Herman
5' 5" Calumet
4' 3" Marquette NWS
3' 6" Paradise
3' 0" Sault Ste Marie
2' 11" Petoskey
1' 8" Gaylord NWS

1' 8" Hart
1' 3" Muskegon
1' 0" Grand Rapids NWS
10" Battle Creek
9" Lansing
9" Detroit

Looking Back at Last Winter



I-196 Pileup, Ottawa County

January 19



NWS Marquette

March 17



NWS Marquette

March 17

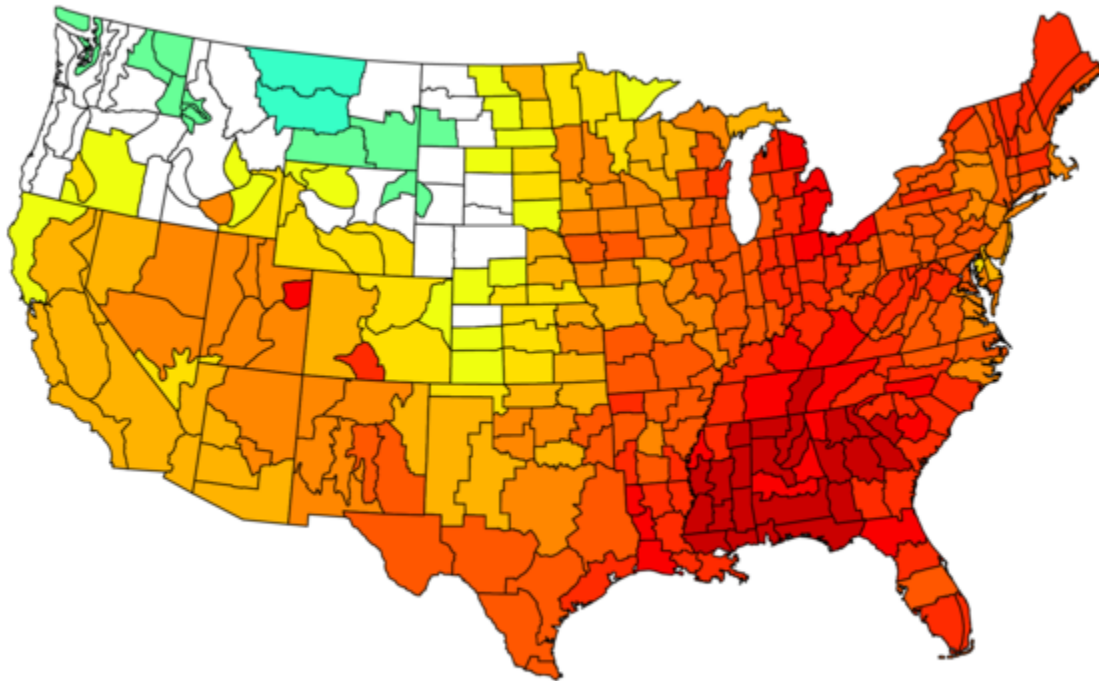
What Goes Into a Winter Outlook?

1. Long term temperature and precipitation trends (ie. 10 to 30 years) are considered
2. Pacific Ocean temperature trends along the equator (El Niño, La Niña, or neither)
3. Analogs that match current pattern with the results of the same pattern in the past
4. Shorter term influences on global patterns (detectable about 2 -4 weeks out)
5. Global computer model forecasts

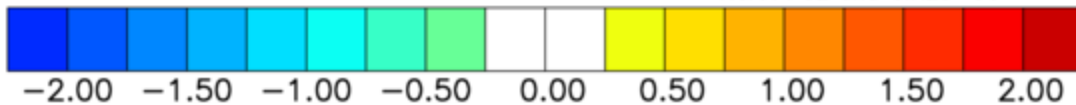
10-Year Winter Trends Across The U.S.

10 Year Temperature Trends Compared to Average

NOAA/NCEI Climate Division Composite Temperature Anomalies (F)
Dec to Feb 2016–17 to 2025–26
Versus 1991–2020 Longterm Average

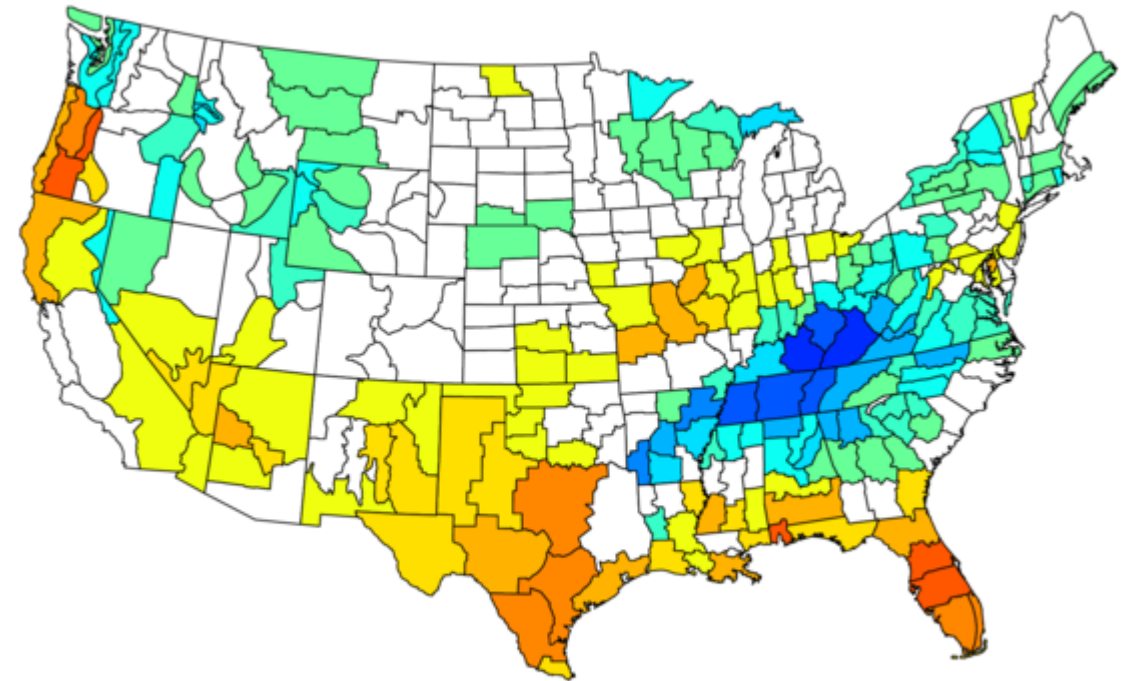


NOAA PSL and CIRES-CU

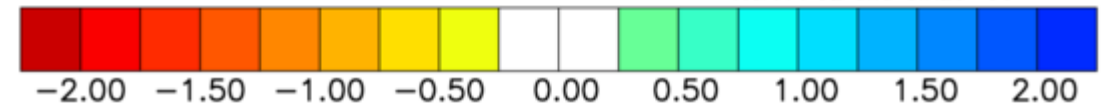


10 Year Precipitation Trends Compared to Average

NOAA/NCEI Climate Division Composite Precipitation Anomalies (in)
Dec to Feb 2016–17 to 2025–26
Versus 1991–2020 Longterm Average

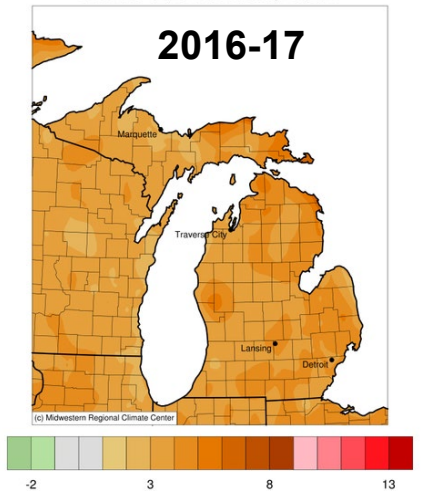


NOAA PSL and CIRES-CU

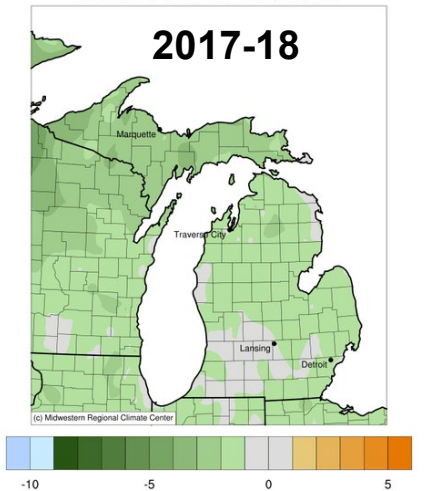


Michigan's Last 10 Winters: Temperature Results

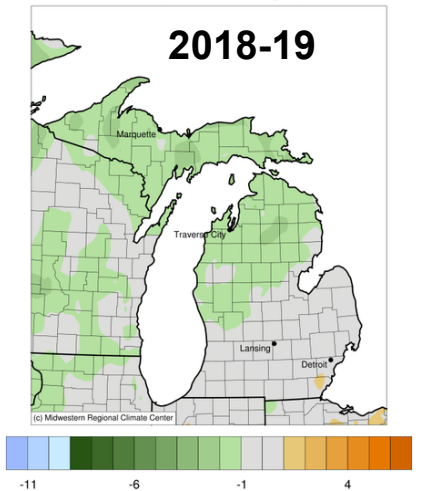
Average Temperature (°F): Departure from 1991-2020 Normals
December 01, 2016 to February 28, 2017



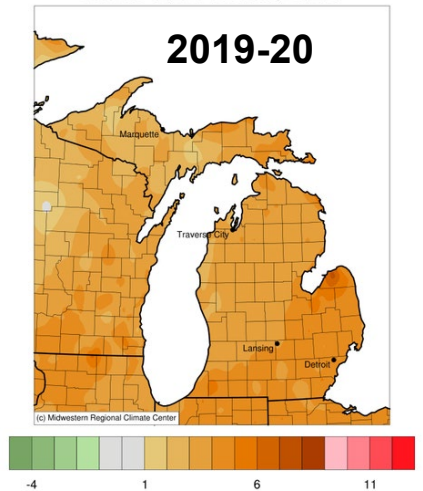
Average Temperature (°F): Departure from 1991-2020 Normals
December 01, 2017 to February 28, 2018



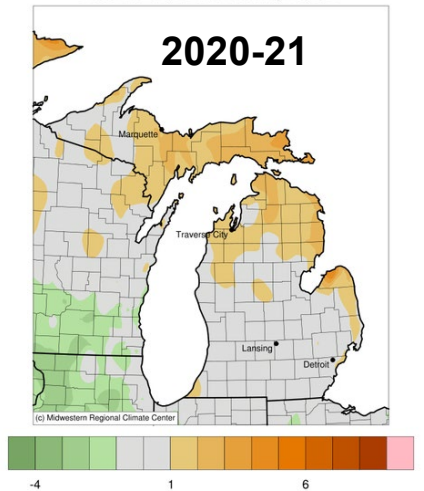
Average Temperature (°F): Departure from 1991-2020 Normals
December 01, 2018 to February 28, 2019



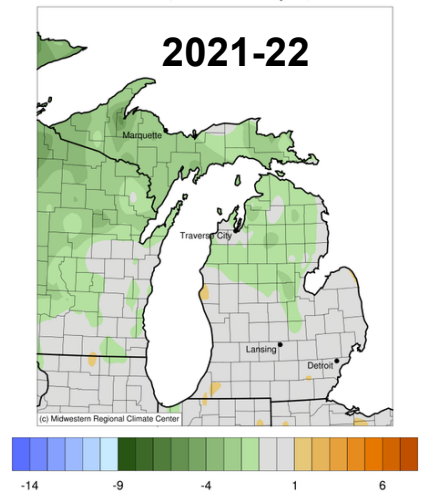
Average Temperature (°F): Departure from 1991-2020 Normals
December 01, 2019 to February 28, 2020



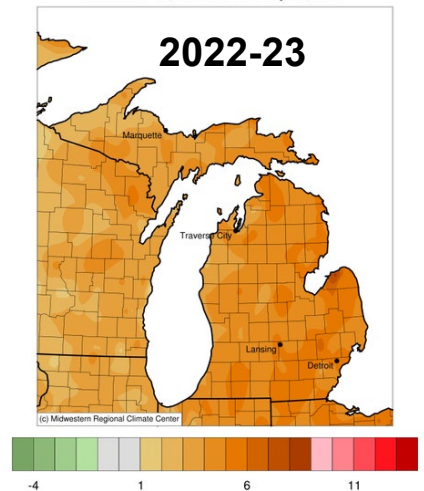
Average Temperature (°F): Departure from 1991-2020 Normals
December 01, 2020 to February 28, 2021



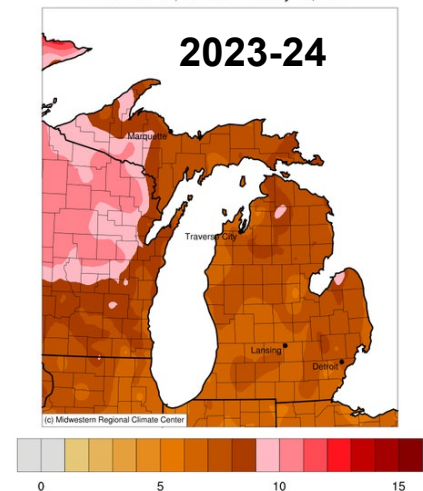
Average Temperature (°F): Departure from 1991-2020 Normals
December 01, 2021 to February 28, 2022



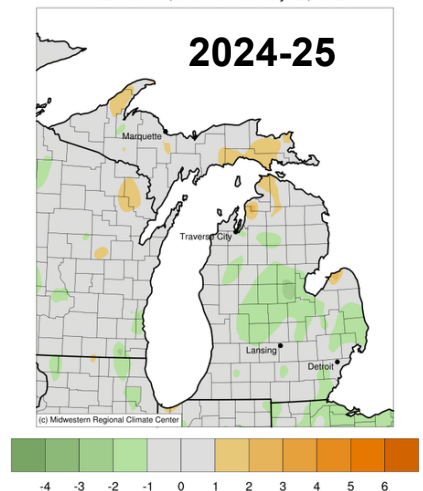
Average Temperature (°F): Departure from 1991-2020 Normals
December 01, 2022 to February 28, 2023



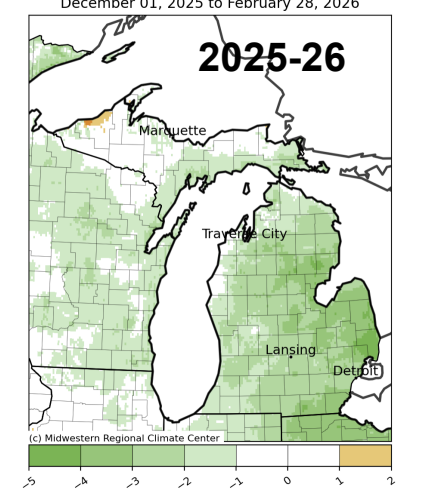
Average Temperature (°F): Departure from 1991-2020 Normals
December 01, 2023 to February 29, 2024



Average Temperature (°F): Departure from 1991-2020 Normals
December 01, 2024 to February 28, 2025

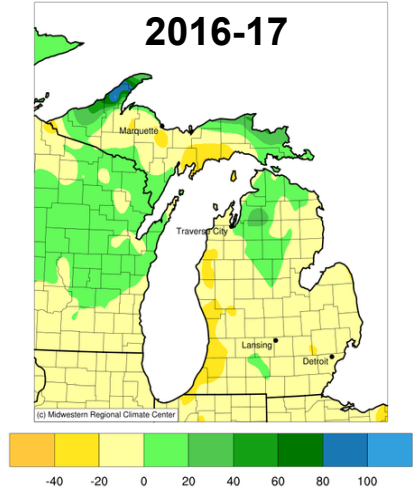


Average Temperature (°F): Departure from 1991-2020 Normals
December 01, 2025 to February 28, 2026

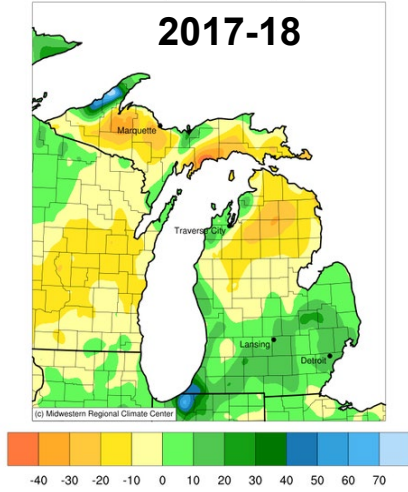


Michigan's Last 10 Winters: Snowfall Results

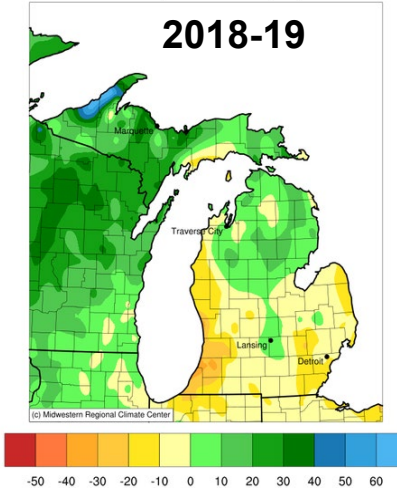
Accumulated Snowfall (in): Departure from 1991-2020 Normals
December 01, 2016 to February 28, 2017



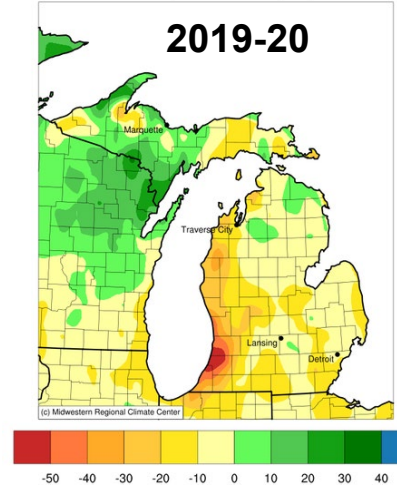
Accumulated Snowfall (in): Departure from 1991-2020 Normals
December 01, 2017 to February 28, 2018



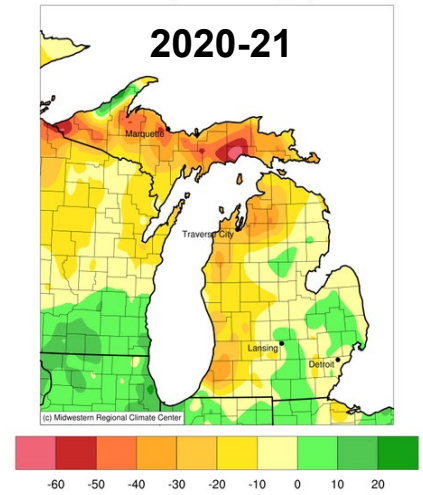
Accumulated Snowfall (in): Departure from 1991-2020 Normals
December 01, 2018 to February 28, 2019



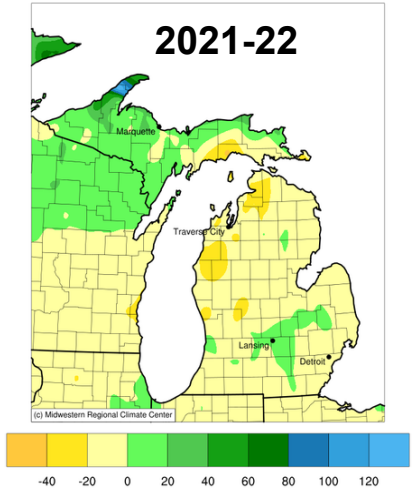
Accumulated Snowfall (in): Departure from 1991-2020 Normals
December 01, 2019 to February 29, 2020



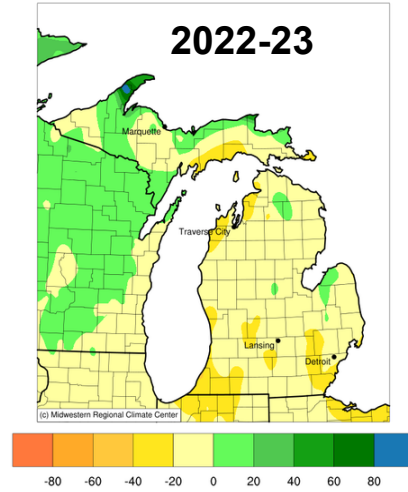
Accumulated Snowfall (in): Departure from 1991-2020 Normals
December 01, 2020 to February 28, 2021



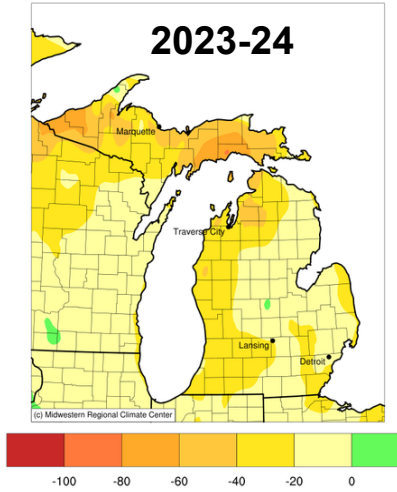
Accumulated Snowfall (in): Departure from 1991-2020 Normals
December 01, 2021 to February 28, 2022



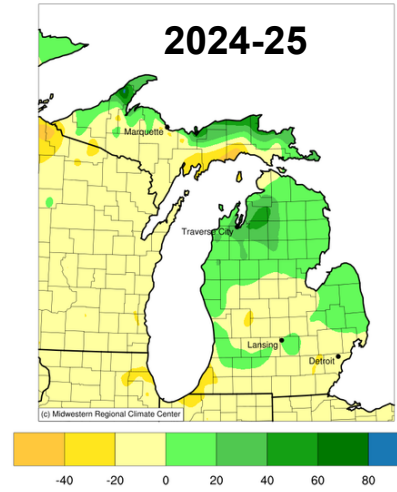
Accumulated Snowfall (in): Departure from 1991-2020 Normals
December 01, 2022 to February 28, 2023



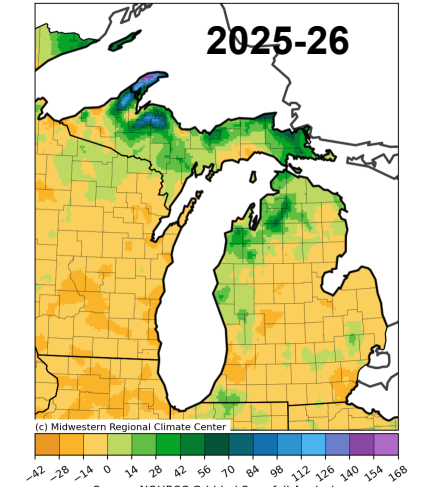
Accumulated Snowfall (in): Departure from 1991-2020 Normals
December 01, 2023 to February 29, 2024



Accumulated Snowfall (in): Departure from 1991-2020 Normals
December 01, 2024 to February 28, 2025

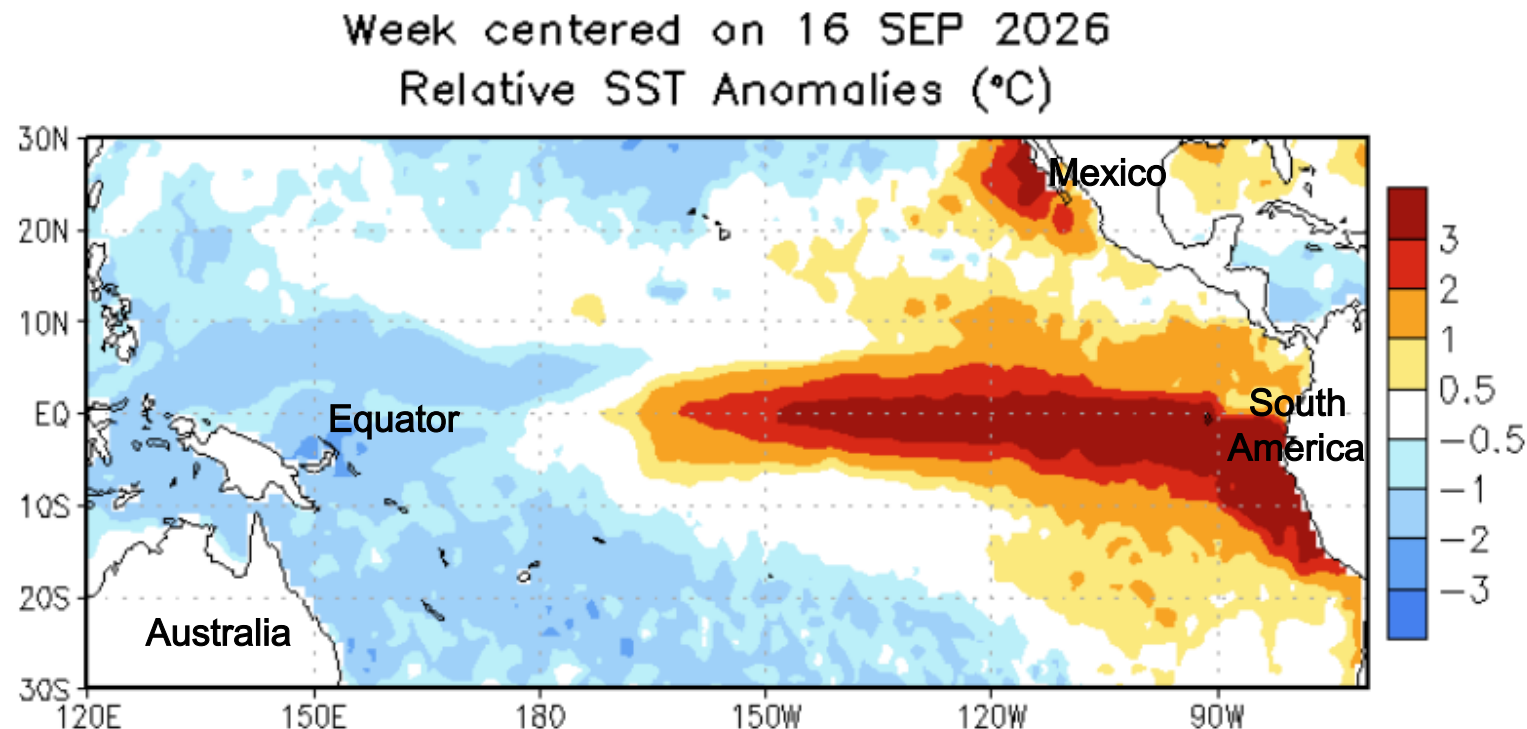
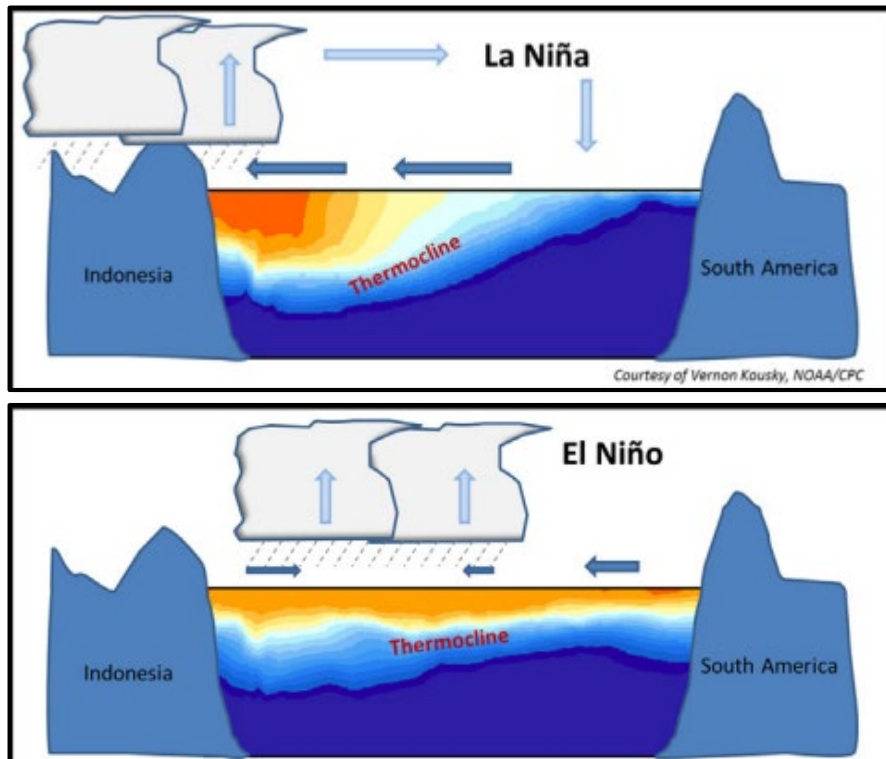


Accumulated Snowfall (in):
Departure from 1991-2020 Normals
December 01, 2025 to February 28, 2026



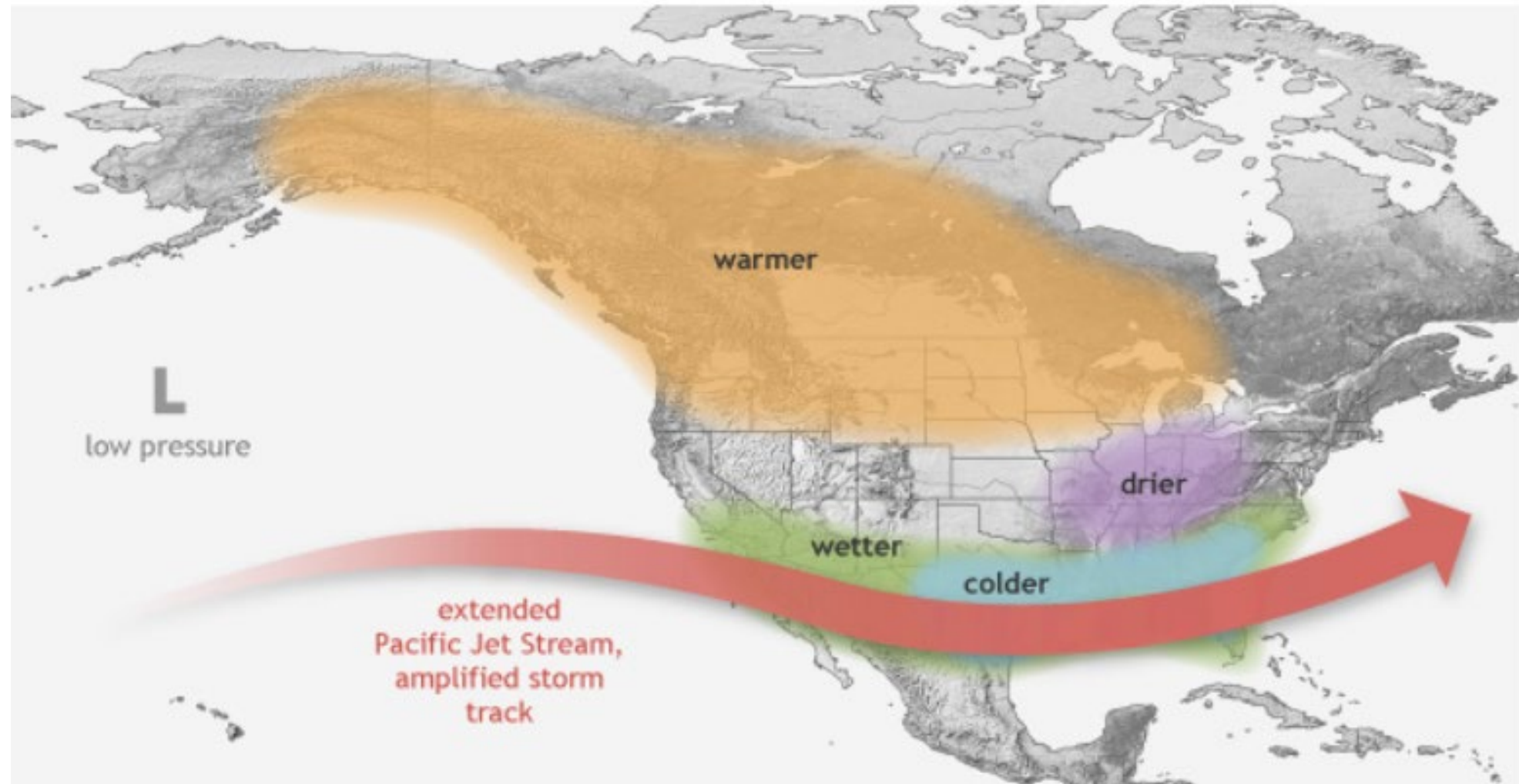
El Niño: What is It?

Warmer than normal water over a large portion of the Pacific Ocean, focused along the Equator. Tropical rains form further east than normal, influencing the jet stream over North America and our winter pattern.



A Typical Baseline El Niño Winter Pattern

WINTER EL NIÑO PATTERN



El Niño vs Other Winter Influences

01

Key Thought #1

El Niño controls the baseline pattern over an entire season.

02

Key Thought #2

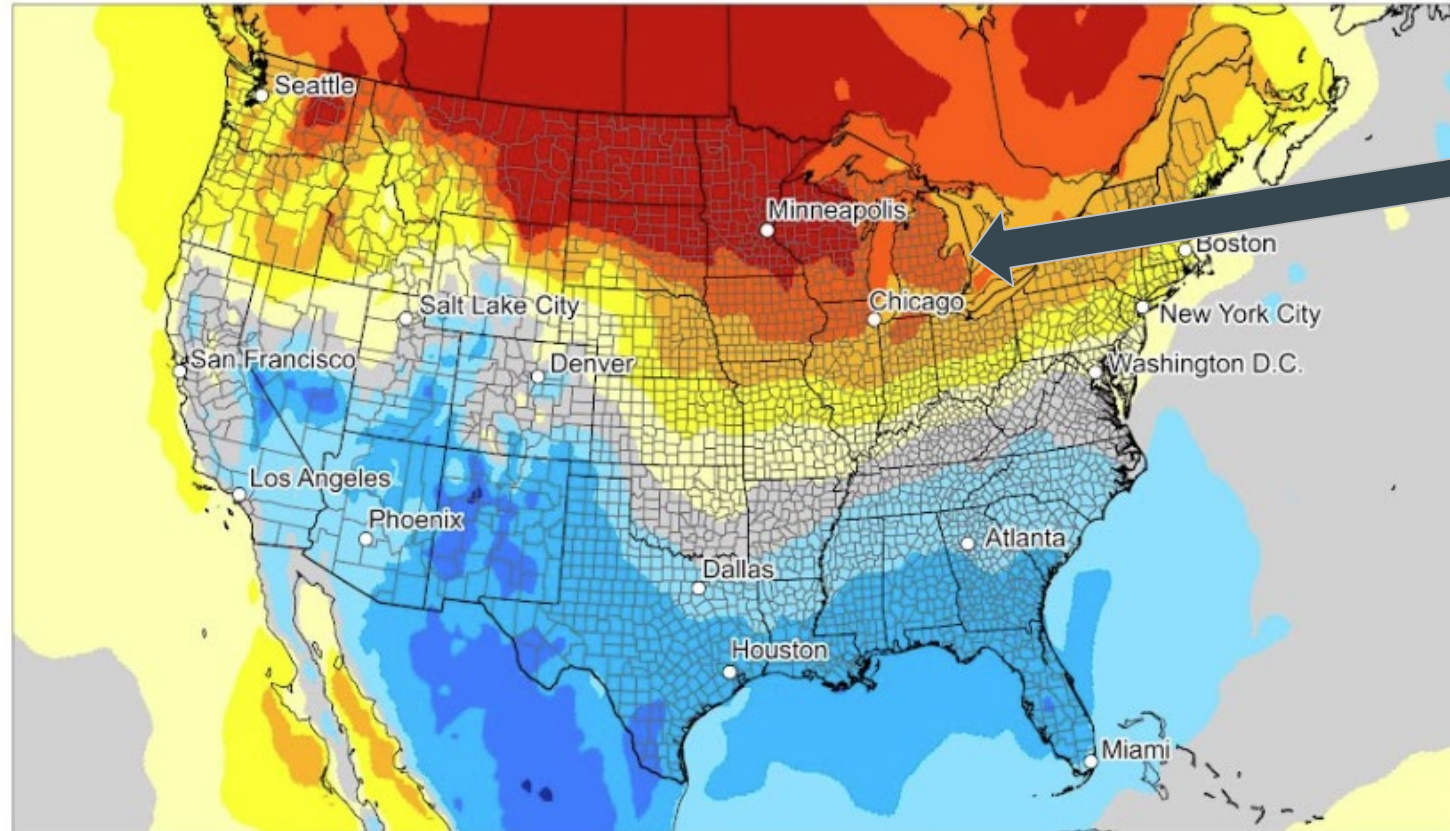
Other global influences that occur on shorter (i.e., weekly) timescales can either **enhance** or **counteract** typical El Niño outcomes.

03

Key Thought #3

A record El Niño event may produce outcomes that don't fit expectations, since we haven't been here before

Strong El Niño Temperature Outcomes



~2 to 3 degrees
warmer than
normal

Source: ERA5 Reanalysis

Composite of 11 years since 1950.

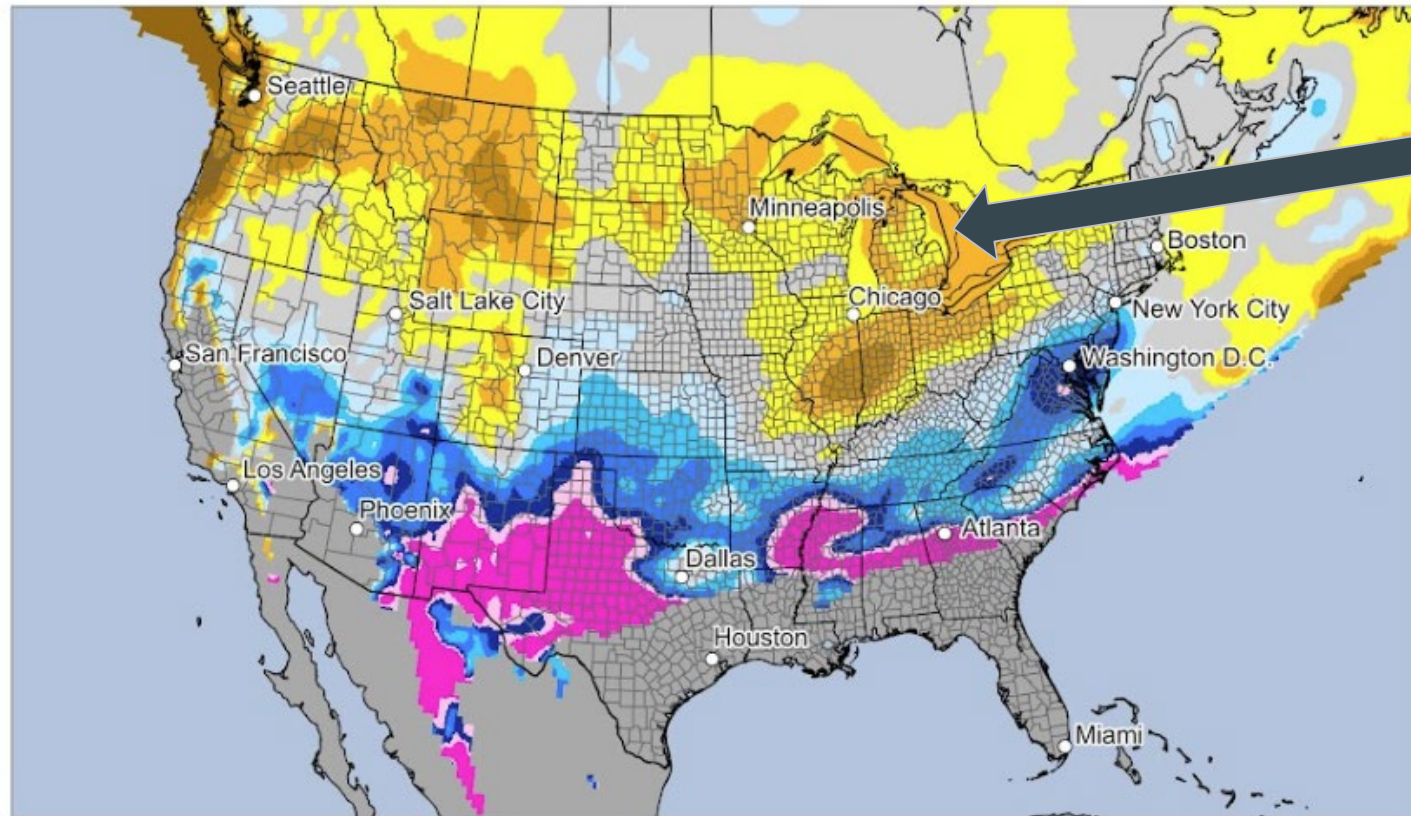
Map by: Brian Brettschneider

Years: 1958, 1966, 1973, 1983, 1988, 1992, 1998, 2003, 2010, 2016, 2024



Departure From (Detrended) Average (F) Since 1950

Strong El Niño Snowfall Outcomes



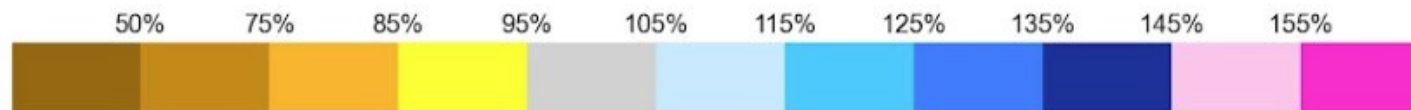
~75% of normal
snowfall

Source: ERA5 Reanalysis

Composite of 11 years since 1950.

Map by: Brian Brettschneider

Years: 1958, 1966, 1973, 1983, 1988, 1992, 1998, 2003, 2010, 2016, 2024



Percent of (Detrended) Average(Since 1950)

Strong El Niño Stats By City: Southern Lower MI

Lansing

Avg Max Temp	35.0° +2.5° vs Baseline
Avg Temp	28.0° +2.9° vs Baseline
Avg Min Temp	21.1° +3.3° vs Baseline
Avg Precip	5.20" -0.32" vs Baseline
Avg Snow	24.1" -9.9" vs Baseline

Grand Rapids

Avg Max Temp	35.1° +2.5° vs Baseline
Avg Temp	28.6° +2.8° vs Baseline
Avg Min Temp	22.1° +3.1° vs Baseline
Avg Precip	6.34" -0.26" vs Baseline
Avg Snow	38.4" -16.9" vs Baseline

Muskegon

Avg Max Temp	35.0° +2.2° vs Baseline
Avg Temp	29.1° +2.3° vs Baseline
Avg Min Temp	23.2° +2.4° vs Baseline
Avg Precip	6.31" -0.51" vs Baseline
Avg Snow	49.6" -22.7" vs Baseline

Strong El Niño Stats By City: Northern Lower / UP

Petoskey

Avg Max Temp	32.5° +2.7° vs Baseline
Avg Temp	26.4° +2.9° vs Baseline
Avg Min Temp	20.2° +3.2° vs Baseline
Avg Precip	5.41" -0.80" vs Baseline
Avg Snow	57.8" -28.4" vs Baseline

Sault Ste Marie

Avg Max Temp	27.6° +2.4° vs Baseline
Avg Temp	20.5° +3.0° vs Baseline
Avg Min Temp	13.5° +3.6° vs Baseline
Avg Precip	6.45" -0.28" vs Baseline
Avg Snow	60.2" -21.4" vs Baseline

Marquette

Avg Max Temp	27.1° +3.2° vs Baseline
Avg Temp	19.7° +3.8° vs Baseline
Avg Min Temp	12.2° +4.4° vs Baseline
Avg Precip	5.86" -1.13" vs Baseline
Avg Snow	77.9" -28.5" vs Baseline

Strong El Niño Snow Records: Grand Rapids



Don't Discount the Potential For Winter Storms!

All 11 strong El Niños have produced 1 or more daily snowfall records:

- 17 daily records set for 6" or more of snow
- All but one El Niño produced a winter storm featuring 6" or more of snow

Forecasting at Different Scales

Seasonal Forecasts Provide Average Seasonal Expectations
"What's My Baseline For This Winter?"



Weekly to Monthly Forecasts Indicate Pattern Changes Coming
"How Are Things Trending 2 Weeks from Now?"



Daily Forecasts Better Describe Winter Storm & Cold Potential
"How Much Snow Could We Get from That Storm System?"

Facts About Seasonal Forecasts

- Seasonal forecasts do not predict the frequency/intensity of winter storms
- They provide 3-month probabilities with respect to average winter weather
- Significant day to day or week to week pattern changes do not show up
- These forecasts do not show temperature or precipitation extremes
- They generally are more accurate during stronger El Niños and La Niñas

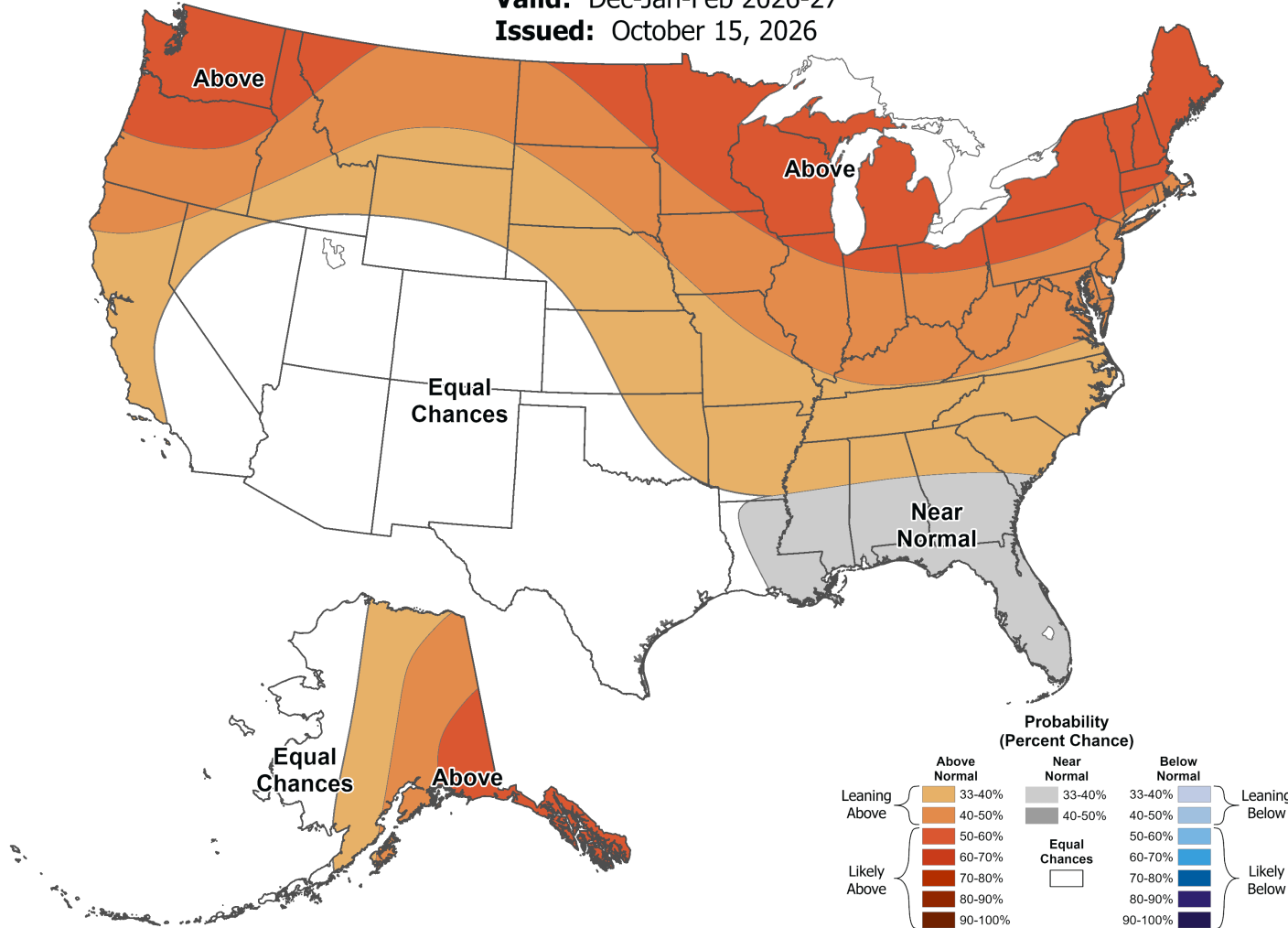
Winter Temperature Forecast



Seasonal Temperature Outlook

Valid: Dec-Jan-Feb 2026-27

Issued: October 15, 2026



Likely Warmer Than Normal

Based on prior strong El Niños as well as model forecasts

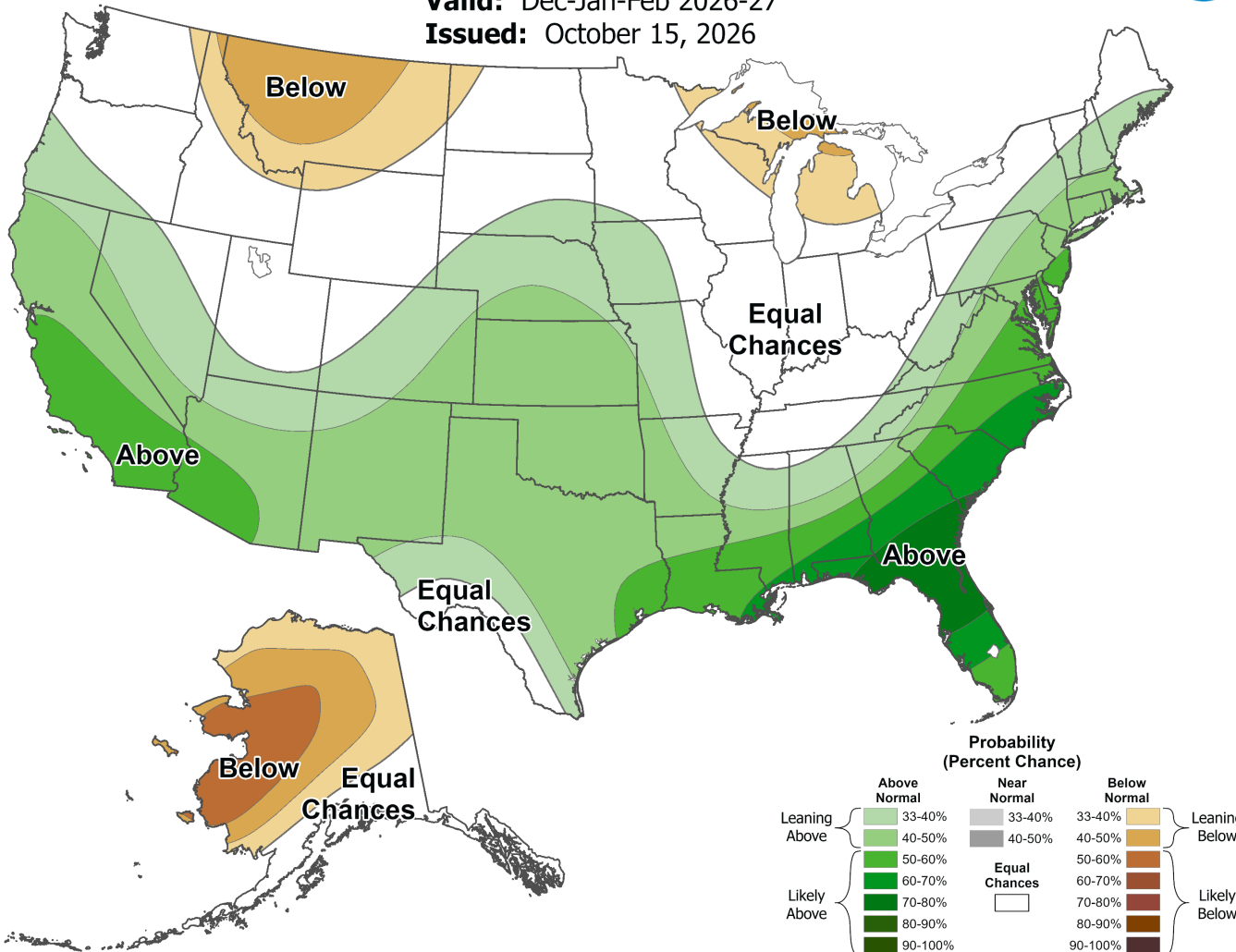
Frequently Above Freezing

Especially Lower MI, where freeze & thaw cycles may be common

Lake Effect Pattern Reduced

Above normal temperatures reduce lake effect snow totals

Issued: October 15, 2026



Warmer temperatures raise the likelihood for mixed precipitation

More Details About This Winter

Temperature Forecast *(2-3 Degrees Warmer Than Normal)*

Average highs: 35°-39°

Average lows: 22°-26°

Snowfall Forecast *(1 to 2 ft Less Snow Than Normal)*

Muskegon

Dec-Feb: 29"-52"

Season: 43"-63"

Grand Rapids

Dec-Feb: 32"-49"

Season: 51"-66"

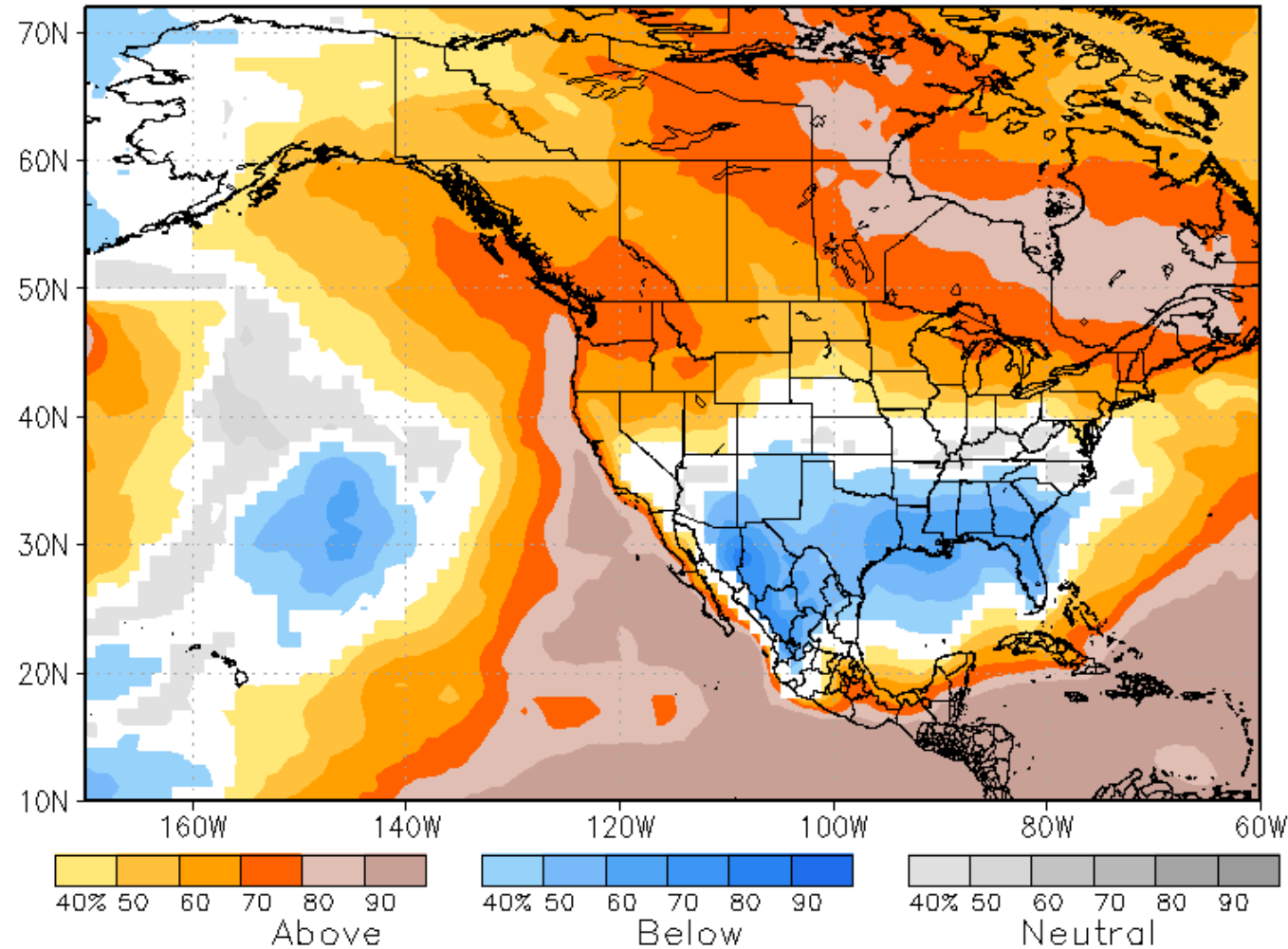
Lansing

Dec-Feb: 20"-30"

Season: 30"-40"

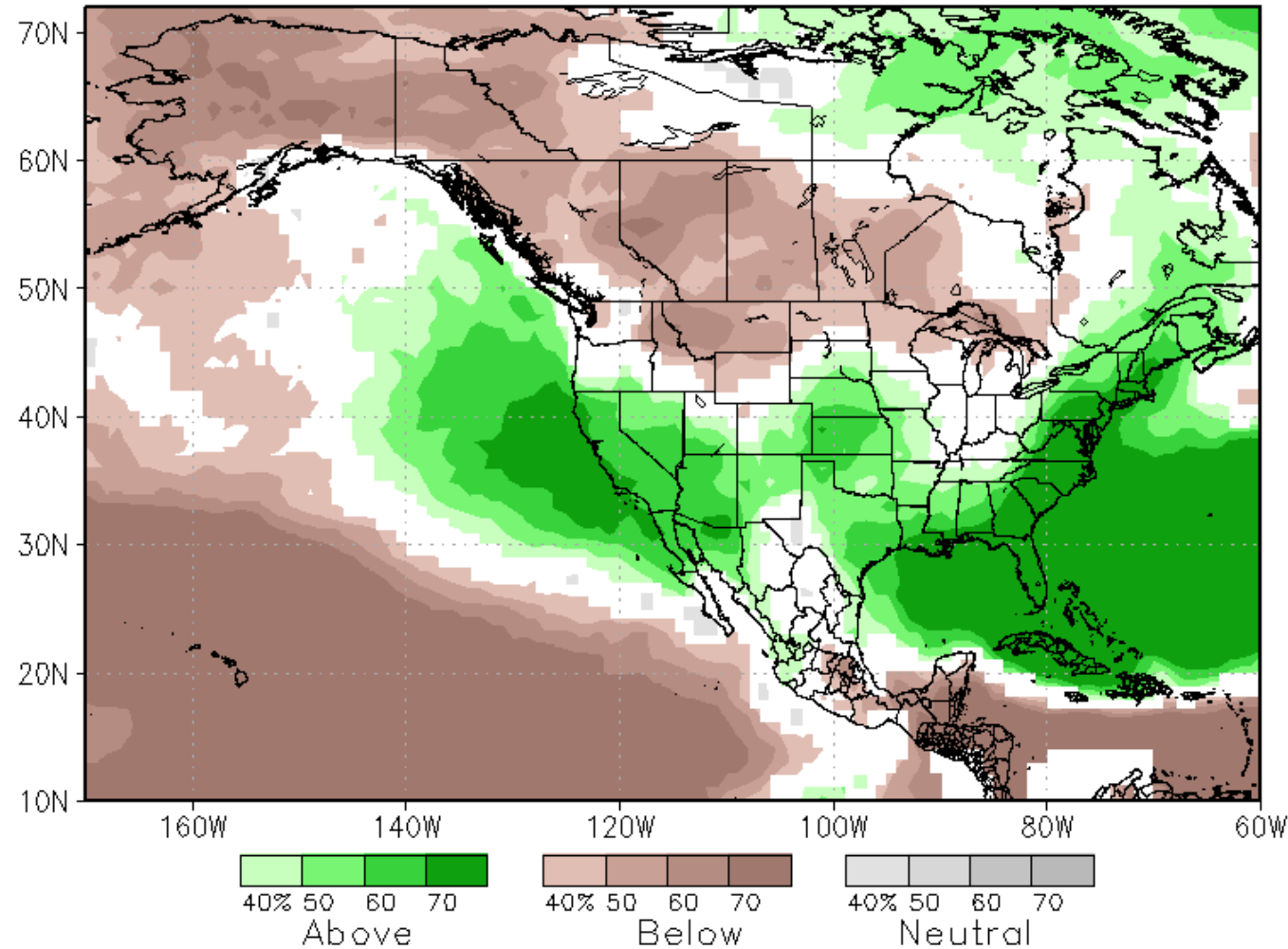
Model Forecasts

Temperature Probabilities



Model Forecasts

Precipitation Probabilities



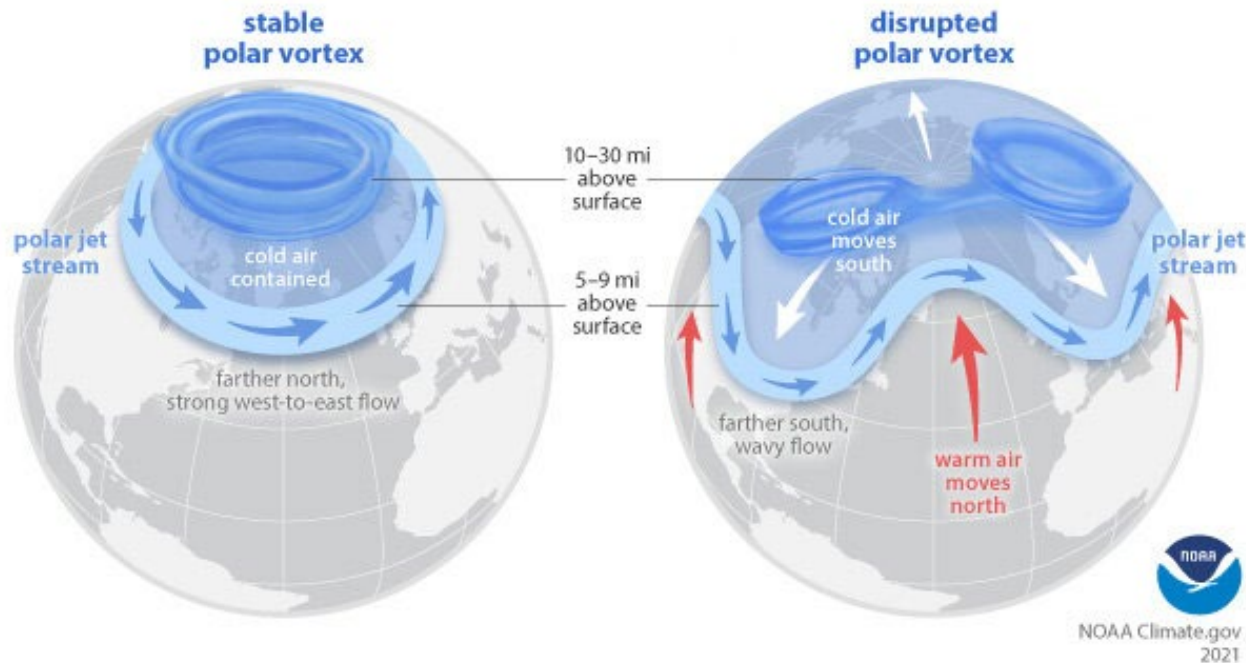
The Polar Vortex: Less Common Than You Think

Understanding the polar vortex

The Arctic polar vortex is a strong band of winds in the stratosphere, surrounding the North Pole 10–30 miles above the surface.

The polar vortex is far above and typically does not interact with the polar jet stream, the flow of winds in the troposphere 5–9 miles above the surface. But when the polar vortex is especially strong and stable, the jet stream stays farther north and has fewer “kinks.” This keeps cold air contained over the Arctic and the mid-latitudes warmer than usual.

Every other year or so, the Arctic polar vortex dramatically weakens. The vortex can be pushed off the pole or split into two. Sometimes the polar jet stream mirrors this stratospheric upheaval, becoming weaker or wavy. At the surface, cold air is pushed southward to the mid-latitudes, and warm air is drawn up into the Arctic.



Exists in the Arctic Circle

Can descend and impact us once or twice every few years

Can Be Forecasted ~2 Weeks Ahead

Some skill is shown within 2 weeks of an event that impacts North America

Don't Blame All Cold Weather on it

It rarely is responsible for our cold. Other factors are usually at play.

NWS Resources to Help You

NWS in Michigan



NWS Marquette (weather.gov/mqt)
906-475-5213



NWS Gaylord (weather.gov/apx)
989-732-9306



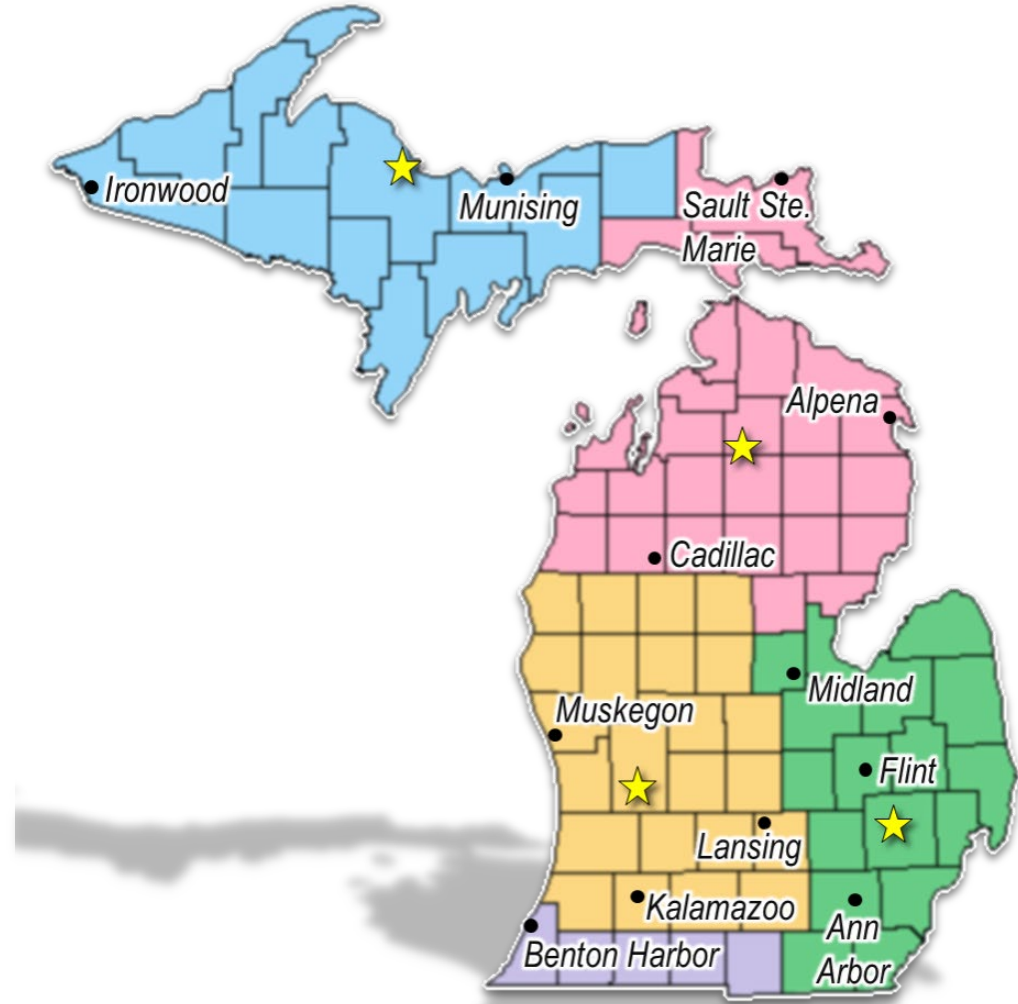
NWS Grand Rapids (weather.gov/grr)
616-956-5922



NWS Detroit (weather.gov/dtx)
248-625-4139



NWS Northern Indiana (weather.gov/iwx)
574-834-1183

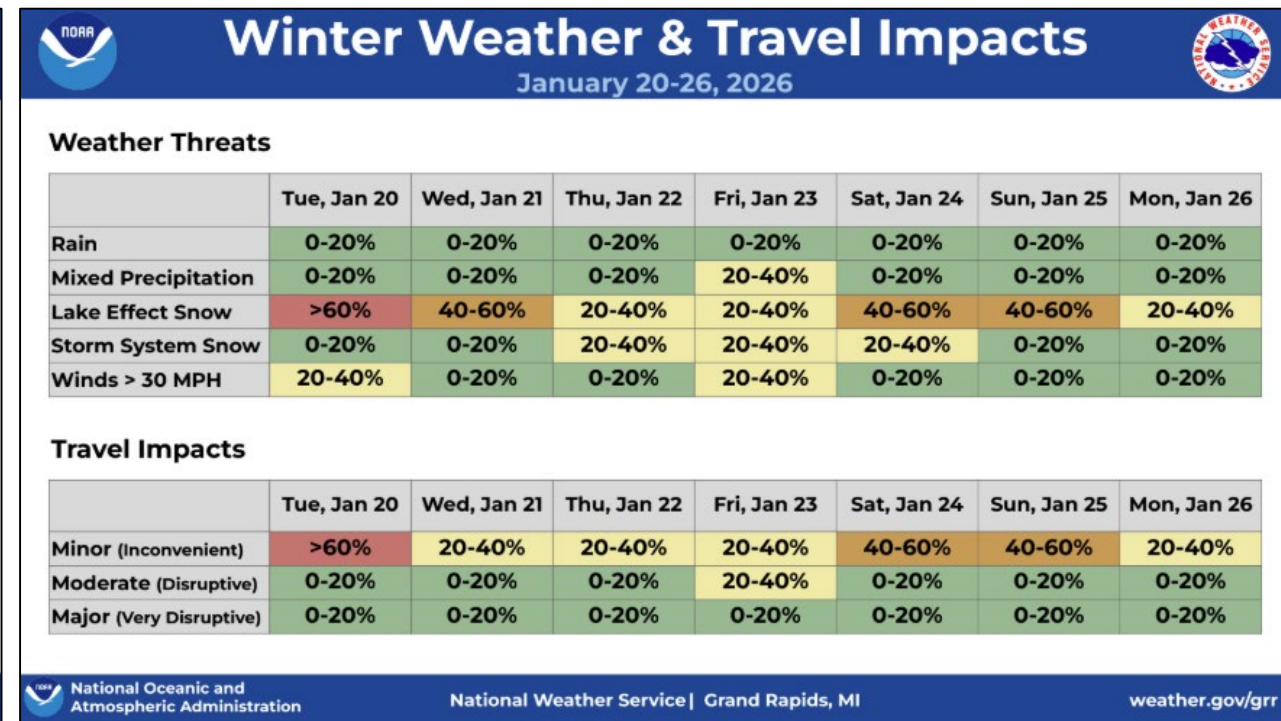
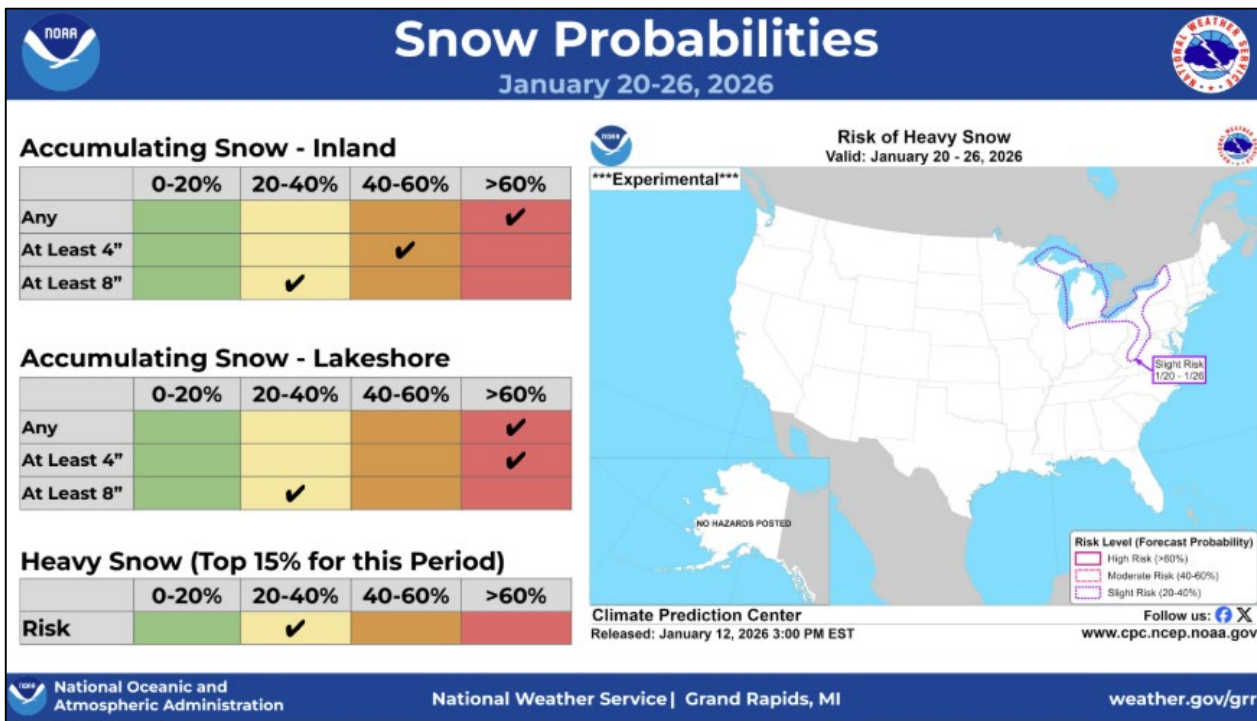


Know What's Behind Your Weather Forecast

ENTITY	DATA SOURCES	HUMAN vs AUTOMATION	PRIMARY USERS
AccuWeather	NWS, ECMWF, surface sensors, satellite	Hybrid. Automated hyper -local forecasts.	Public
Apple	NWS, ECMWF, UK Met, Environment Canada, etc	Automated. No human oversight.	Public
DTN	Global models, proprietary surface data network	Hybrid. AI + human involvement.	Industry
Media (Local TV)	Provided via WSI, Baron Weather, etc.	Hybrid. Automated hyper -local forecasts	Public, Industry
Michigan Storm Chasers	Publicly available global and mesoscale models	Hybrid. Human + model based graphics.	Public
National Weather Service	National Blend of Models (NBM)	Hybrid. Forecasters assess NBM output.	Local/State/Federal Govt

NWS Extended Outlooks

Forecast from 8 to 14 Days Out



NWS Webinars and Weather Messages



Saturday, November 29 - Sunday, November 30				
Sat am		Sat mid-late eve		Sun am
Start		Peak		End
Event Type				
	Storm System		Lake Effect	Both
Snow Character	Dry	 Normal	Wet	Very Wet
Peak Rates (In / Hour)	0.10-0.25	0.25-0.50	 0.50-1.00	1.00-2.00
Blowing Snow	 None	Open Areas	Widespread	Blizzard
Max Gusts (MPH)	<15	 15-25	25-35	>35
Direction	 Start		 Peak	
			 End	

NWS Website & Beta Version

**NATIONAL WEATHER SERVICE**
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

HOMEFORECASTPAST WEATHERSAFETYINFORMATIONEDUCATIONNEWSSEARCHABOUT

Local forecast by
"City, St" or ZIP code

[Location Help](#)

**Hurricane and Storm Surge Watches Issued for the Northern Gulf Coast for Strengthening Tropical Storm Isaia**
Tropical Storm Isaia is forecast to track toward the central Gulf Coast while strengthening into a hurricane on Thursday. There is an increasing risk of damaging hurricane-force winds and life-threatening storm surge impacts along portions of the northern Gulf Coast Friday into Saturday. Isaia will bring heavy rainfall to the central Gulf Coast and much of the Southeast Friday into the weekend. [Read More >](#)

MY FORECAST
Grand Rapids MI

71°F
22°C [Get Detailed Info](#)
This Afternoon

Sunny
High: 71°F
Tonight

Mostly Clear
Low: 51°F

NWS Forecast Office Grand Rapids, MI
[Weather.gov](#) > Grand Rapids, MI
Grand Rapids, MI
Weather Forecast Office
Current Hazards Current Conditions Radar Forecasts Rivers and Lakes Climate and Past Weather Local Programs
Click a location below for detailed forecast.

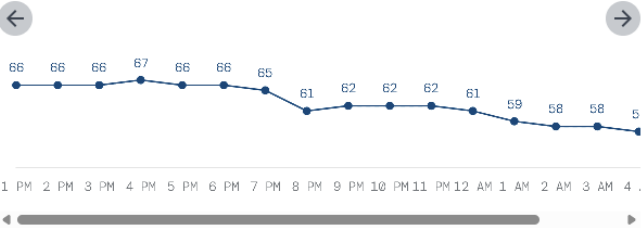
Last Map Update: Wed, Oct 7, 2026 at 1:18:23 pm EDT
[Watches, Warnings & Advisories](#)
[Small Craft Advisory](#)
[Hazardous Weather Outlook](#)


**beta.weather.gov**
National Weather Service
 UNDER DEVELOPMENT

Forecast ▾ About ▾

☆ **Muskegon, MI**
Today 7 Days Maps Analysis

Current Conditions
66°F FEELS LIKE 66°F
 Clear
WIND calm
HUMIDITY 73%
DEWPOINT 57°F
VISIBILITY 10 miles
PRESSURE 29.8 in (1009 mb)
OBSERVATION STATION
Muskegon, Muskegon County Airport (KMGK)
Distance to location: 4 miles
Elevation: 627 feet
LAST UPDATED
Wednesday, 10:50 AM EDT

Today's Forecast
Today, Oct 7 HIGH 68°F LOW 53°F
DAY (6AM-6PM) NIGHT (6PM-6AM)
 Sunny  Mostly clear
5% chance of precipitation

1 PM 2 PM 3 PM 4 PM 5 PM 6 PM 7 PM 8 PM 9 PM 10 PM 11 PM 12 AM 1 AM 2 AM 3 AM 4 AM
Temperature Feels like
 Sunrise 7:50 AM  Sunset 7:17 PM 

NWS Forecast Points Page weather.gov/forecastpoints

Hourly Table

Day of week:											Tuesday 10/13							
Time:	2PM	3PM	4PM	5PM	6PM	7PM	8PM	9PM	10PM	11PM	12AM	1AM	2AM	3AM	4AM	5AM	6AM	
Weather:																		
Temperature (°F):	70	71	71	70	68	65	63	61	60	59	58	58	57	56	56	55	54	
Wind Speed (mph):	8	8	8	8	7	6	5	5	6	6	6	6	6	6	7	7	7	
Wind Gust (mph):	18	20	20	20	17	14	12	12	13	14	14	13	13	14	15	16	16	
Wind Direction (°):	270	270	270	270	270	270	270	260	250	240	230	210	200	210	240	250	240	
Wind Direction:	➔	➔	➔	➔	➔	➔	➔	➔	↗	↗	↗	↗	↗	↗	↗	↗	↗	
Prob. of Precip. (%):	8	8	8	8	8	8	20	20	20	20	20	20	36	36	36	36	36	
Prob. of Thunder (%):	5	5	5	5	5	5	5	5	5	5	5	5	2	2	2	2	2	
Precip. Amount (in.):																		
Snow (in.):																		
Ice (in.):																		
Dew Point (°F):	60	60	59	59	59	58	58	57	57	56	55	55	54	53	53	52	51	
RH (%):	71	68	66	68	73	78	84	87	90	90	90	90	90	90	90	90	90	
Sky Cover (%):	55	55	55	55	55	55	55	55	55	55	55	55	54	54	54	54	54	

Fort Wayne

i

NWS Winter Pages

Marquette

<https://www.weather.gov/mqt/winter>

Gaylord

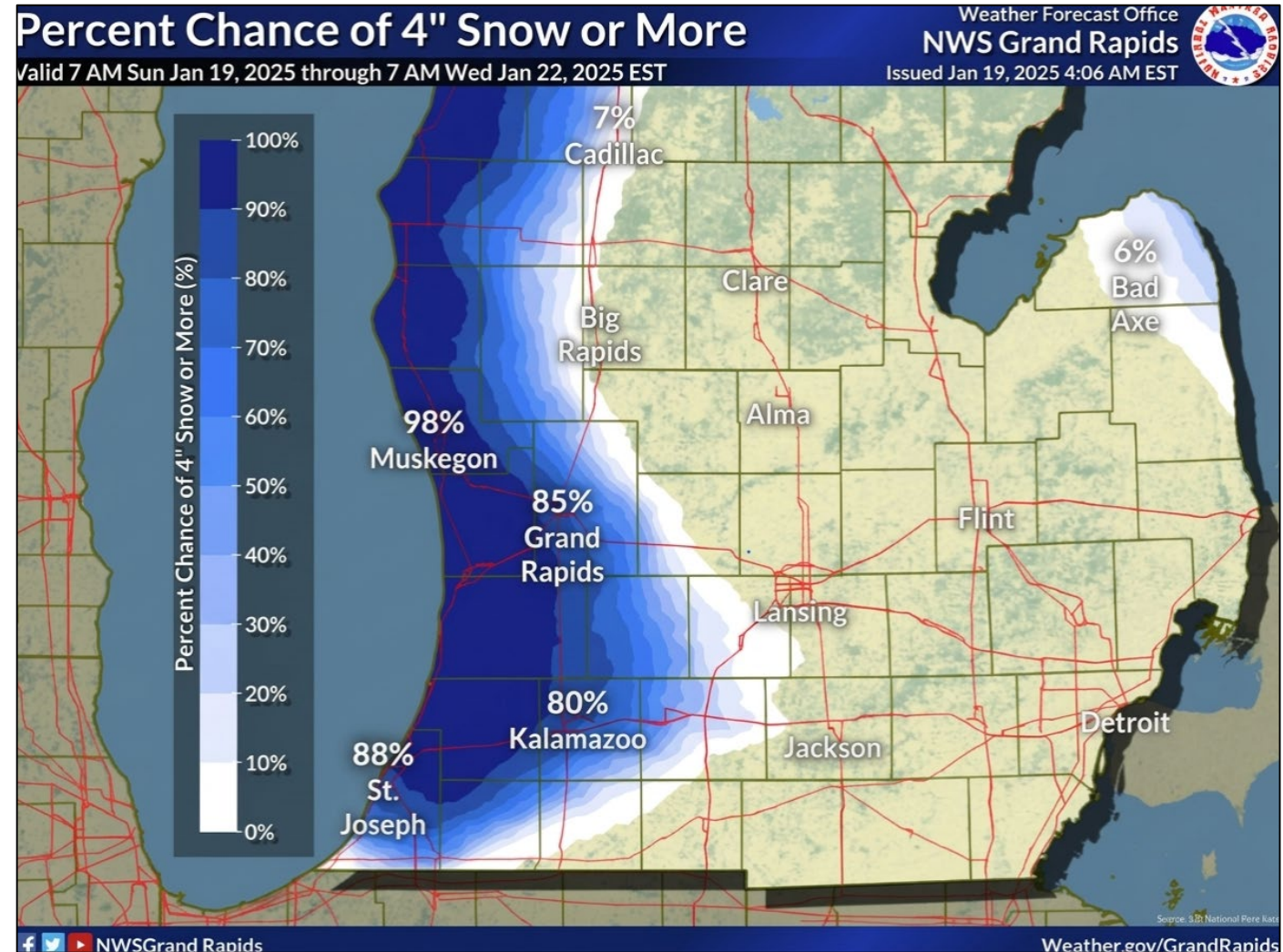
<https://www.weather.gov/apx/winter>

Grand Rapids

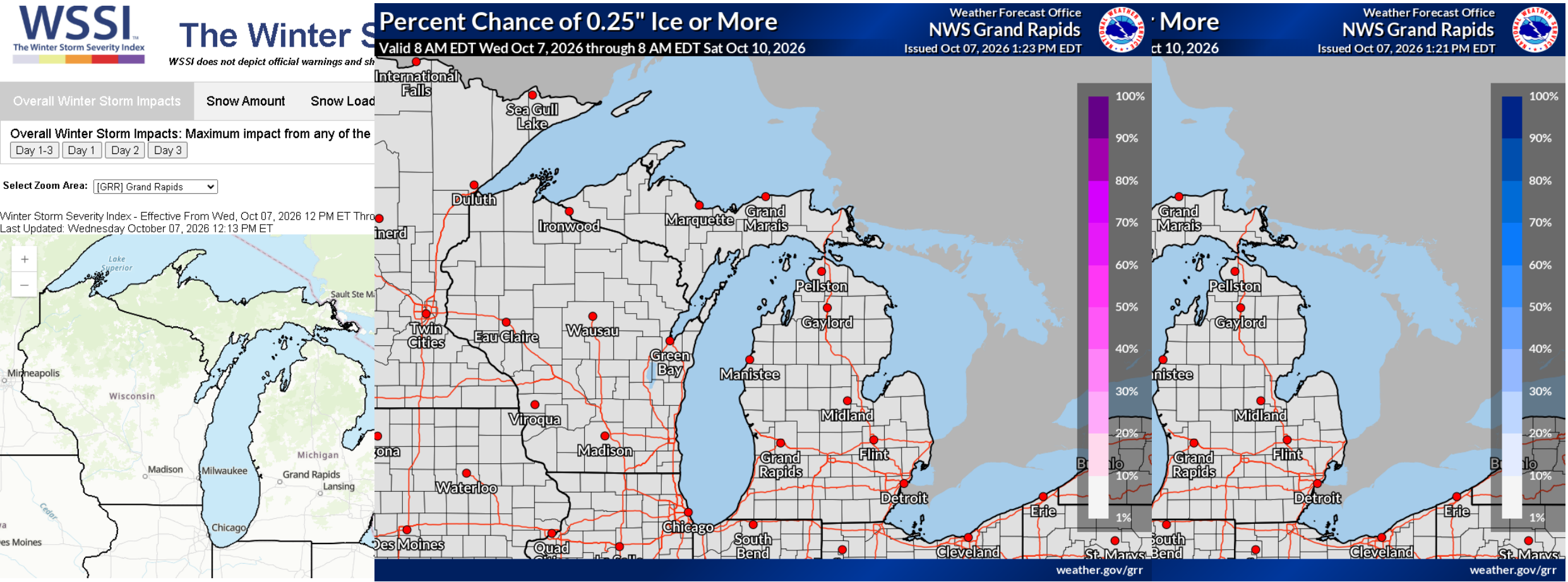
<https://www.weather.gov/grr/winter>

Detroit

<https://www.weather.gov/dtx/winter>



NWS Winter Pages



NWS Transportation Page (SW Michigan Only)

Grand Rapids

<https://www.weather.gov/grr/transportation>

Custom Forecast

Hourly Probabilities

Snowfall Thresholds

Ice Thresholds

Winter Storm Severity

Outlooks

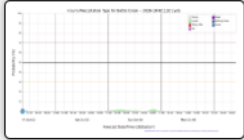
Hourly Probabilities

This page features experimental, model-based forecasts of hourly precipitation type, snowfall character, and snowfall rates. The cycle times listed on the images represent when the computer model ran and are listed in Zulu (Z) time according to the Coordinated Universal Time system used globally. More information about Z time is available [here](#). Images are updated to this webpage by 3am/9am/3pm/9pm EST (4am/10am/4pm/10pm EDT). They are produced for the following locations at this time:

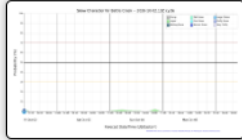
- Battle Creek
- Big Rapids
- Grand Rapids
- Holland
- Jackson
- Kalamazoo
- Lansing
- Ludington
- Mount Pleasant
- Muskegon
- South Haven

Click on an image below to enlarge.

Battle Creek



Precipitation Type

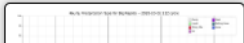


Snow Character

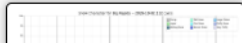


Snowfall Rate

Big Rapids



Precipitation Type



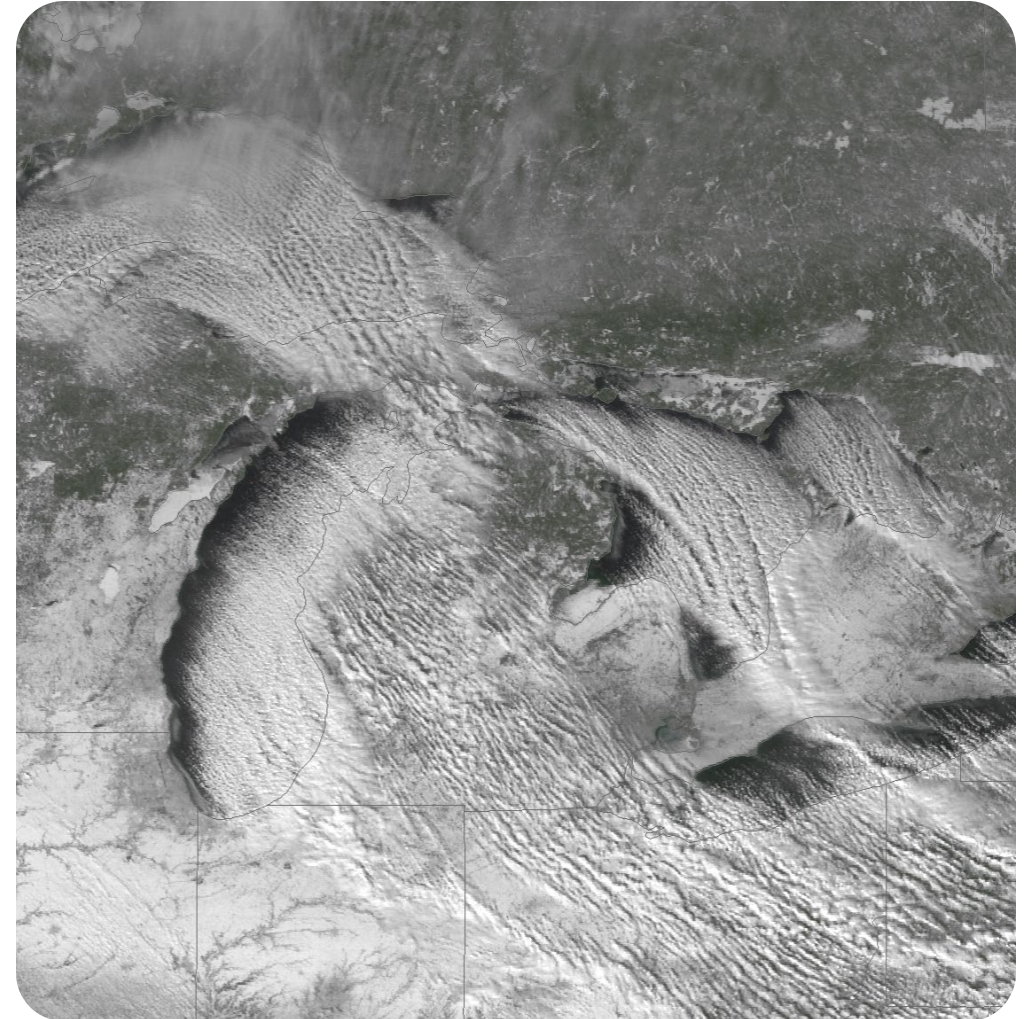
Snow Character



Snowfall Rate

Summary

- 01 Last Winter: Colder/Snowier Than Normal
- 02 5 Main Factors Go Into a Winter Outlook
- 03 10-Year Winter Trends Show Warming
- 04 This Winter: Warmer Than Normal
- 05 Use NWS Resources to Your Advantage



Thank You!

Brandon Hoving, PEM

NWS Meteorologist - Grand Rapids, MI
Transportation Sector Program Manager

brandon.hoving@noaa.gov

