

Weather Forecasting



Patrick Bak
NWS Gaylord MI



2023 Winter Operations Conference

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What Will We Talk About Today?

- Winter precipitation forecast challenges
- Finding snow information on NWS Gaylord's website, including probabilistic information
- First Look at Winter 2023-24 potential

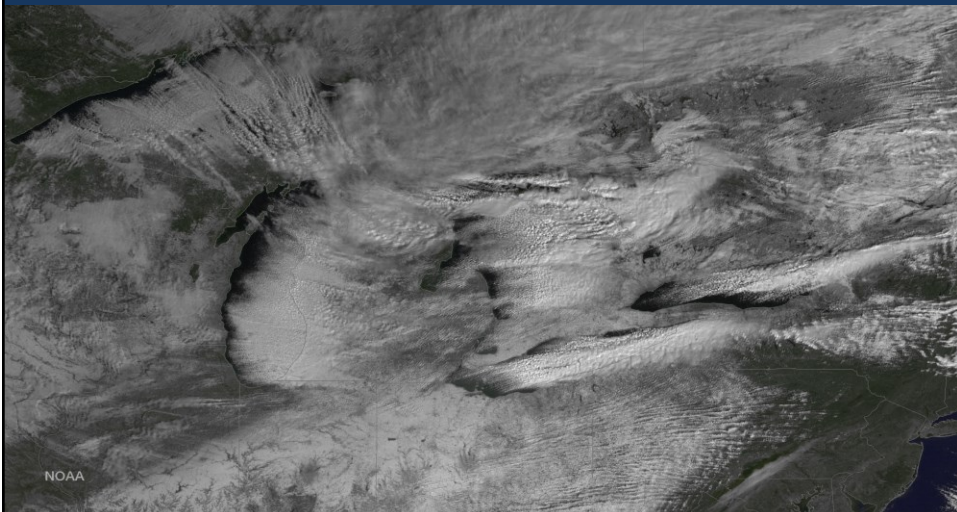
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Winter Forecast Challenges in the Great Lakes

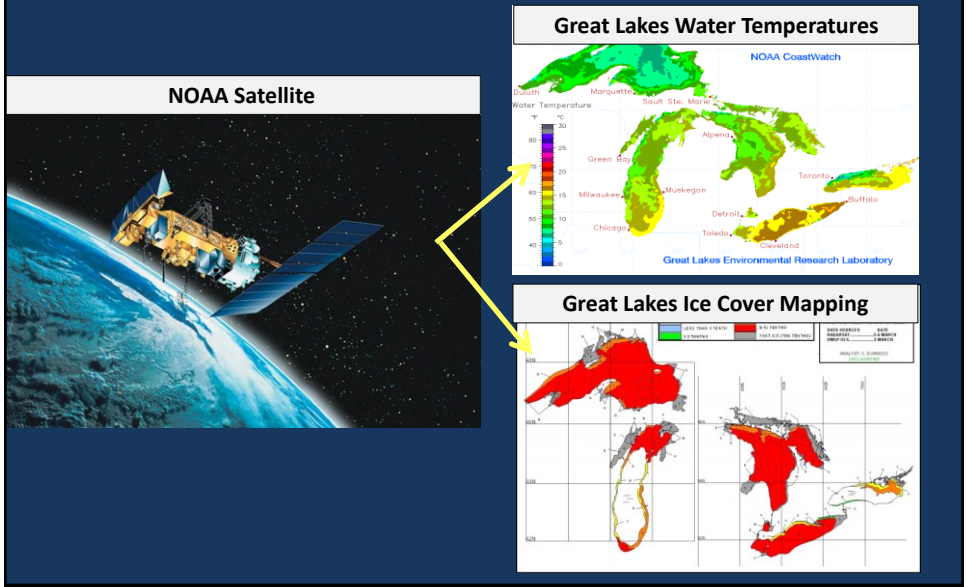


Winter Challenge #1: Limited Marine Observations

Few Ships/No Buoys/Cloudy Conditions

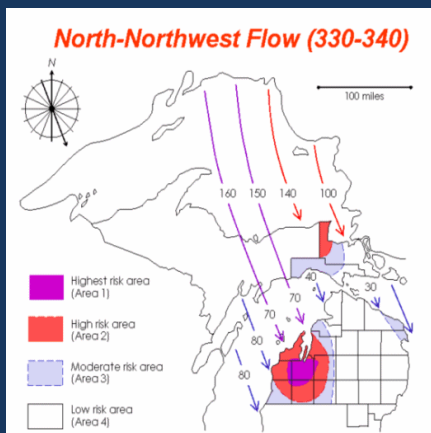


Why are cloudy days a problem?

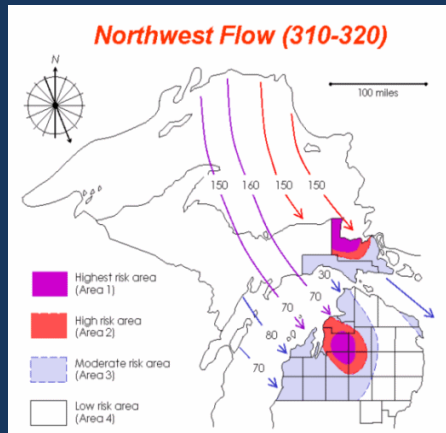


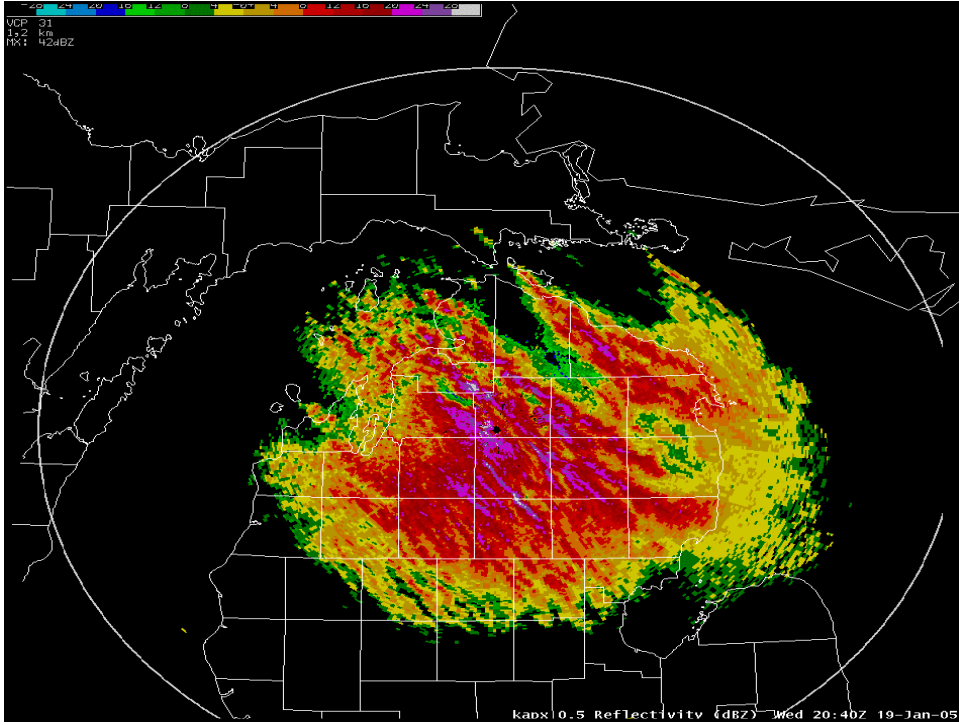
Challenge #2: Slight variations in wind direction have big impacts on snowfall

North-Northwest Flow



Northwest Flow

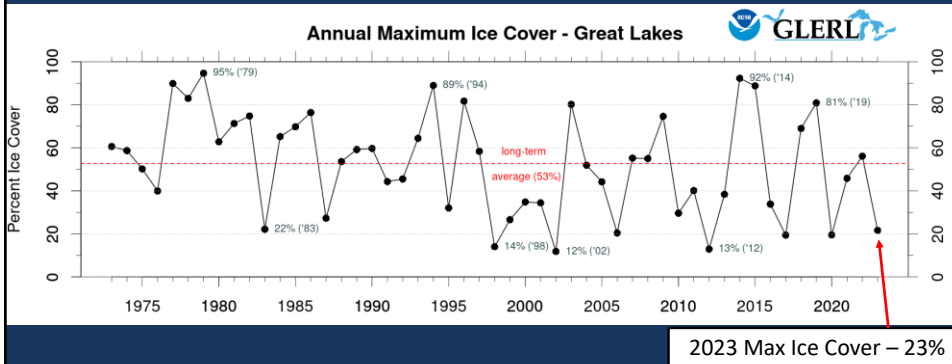




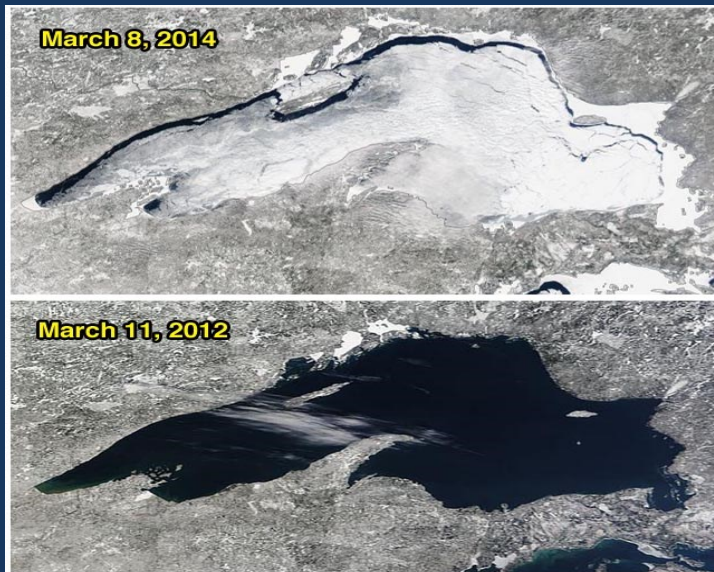
Challenge #3 Great Lakes Ice Cover



Ice cover varies from year to year

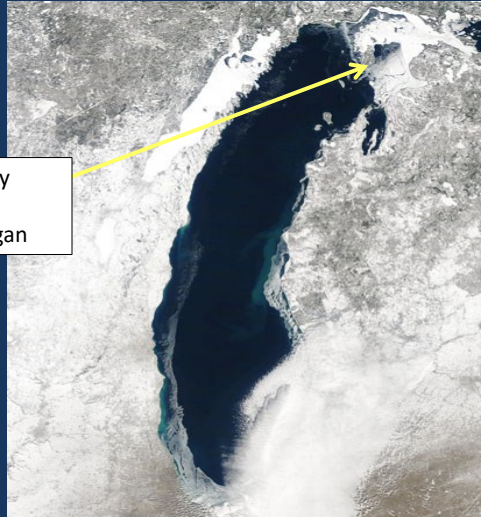


March ice cover differences on Lake Superior 2012 versus 2014

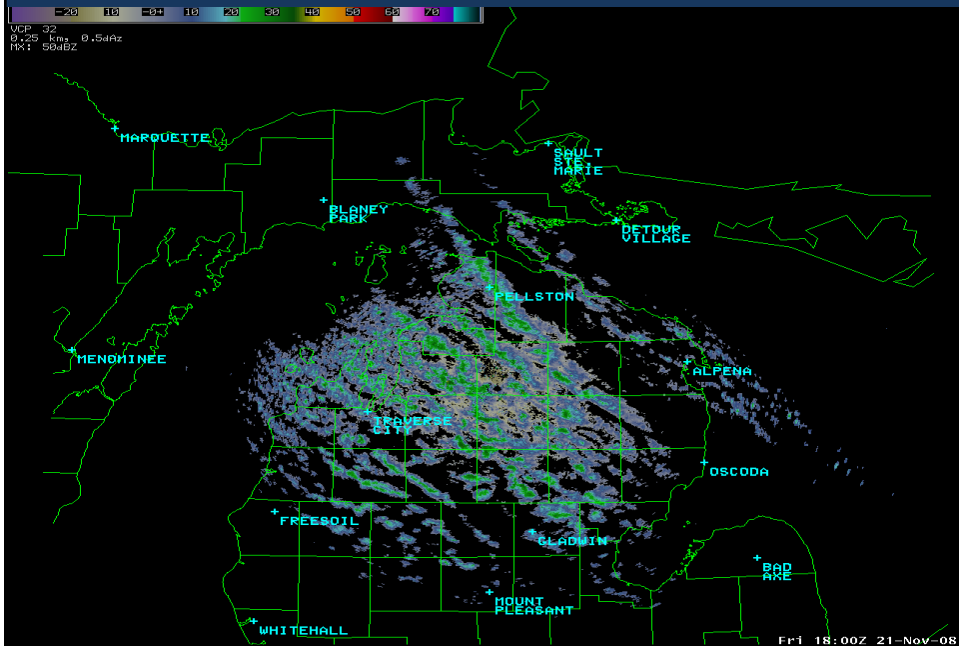


Small Amounts of Ice can make a big difference in Lake Effect Snow

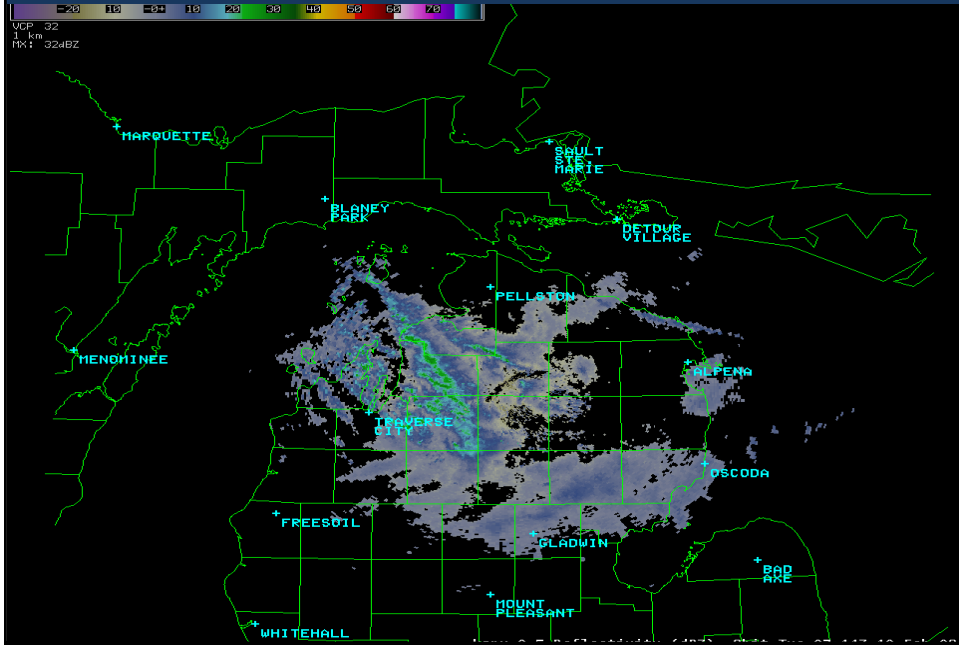
Notice just a relatively small area of ice in Northern Lake Michigan



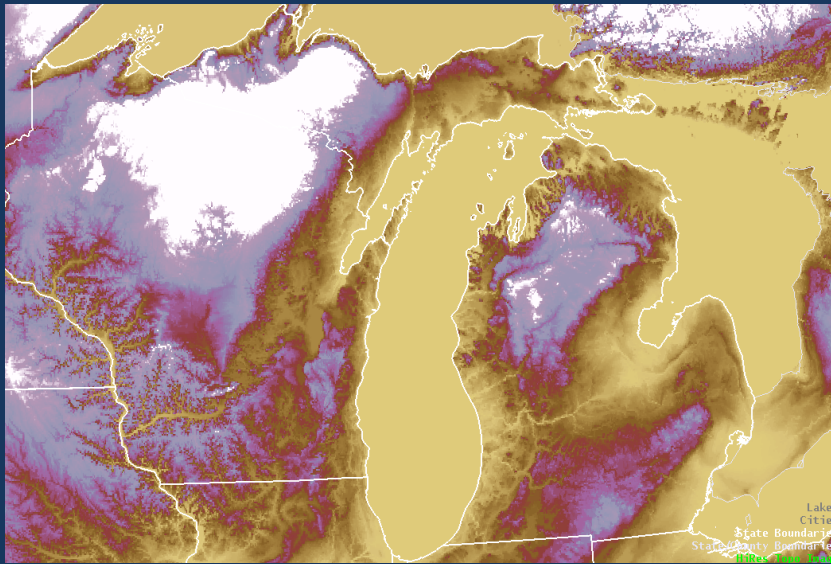
Northwest winds - No Ice cover



Northwest winds - Ice cover

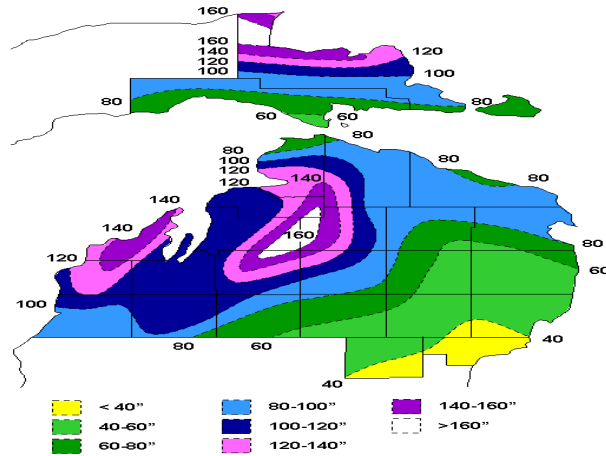


Challenge #4 Elevation



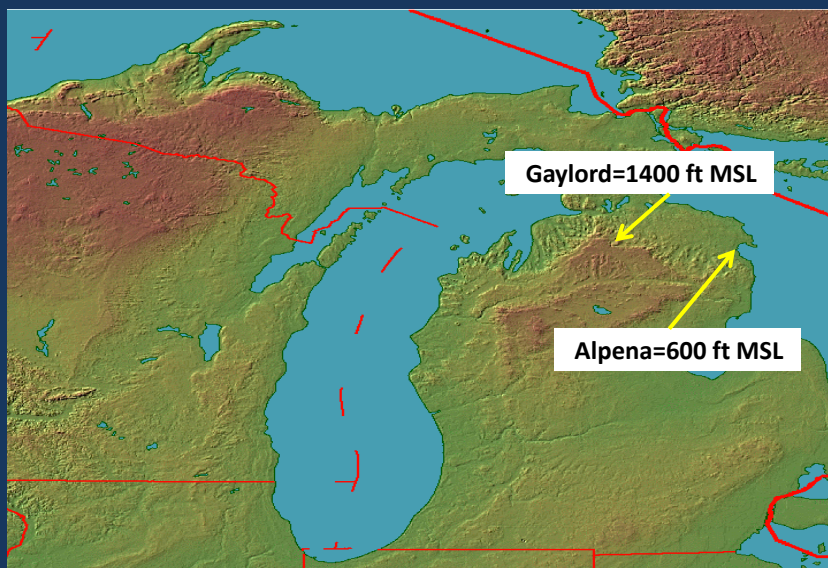
Seasonally = 8 to 12 inches more snowfall for every 100 foot change in elevation

Mean Annual Snowfall NWS Gaylord Forecast Area

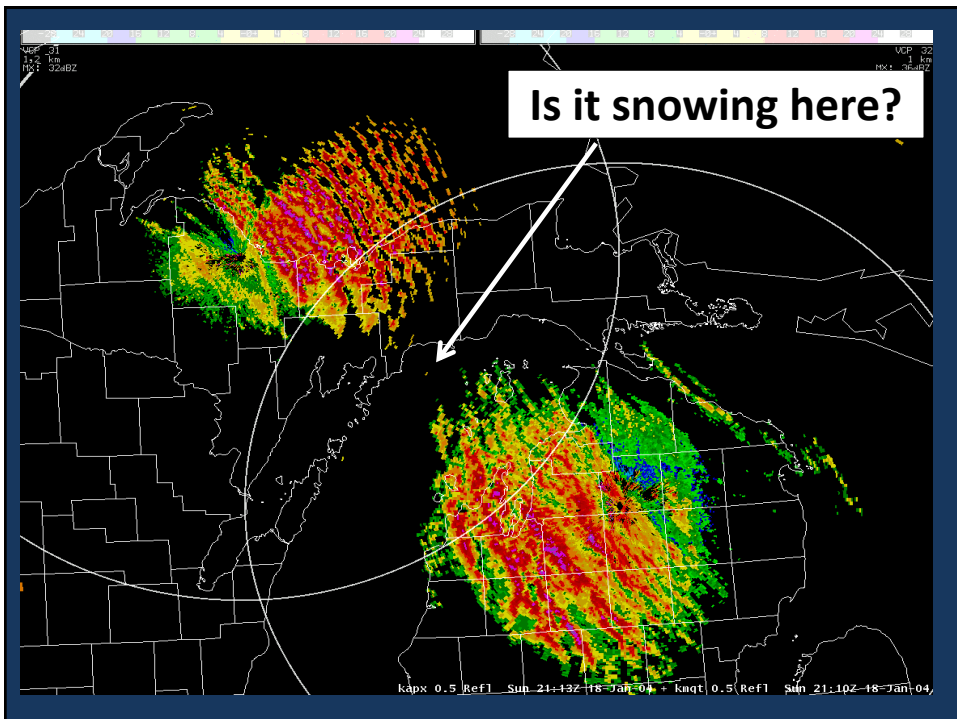
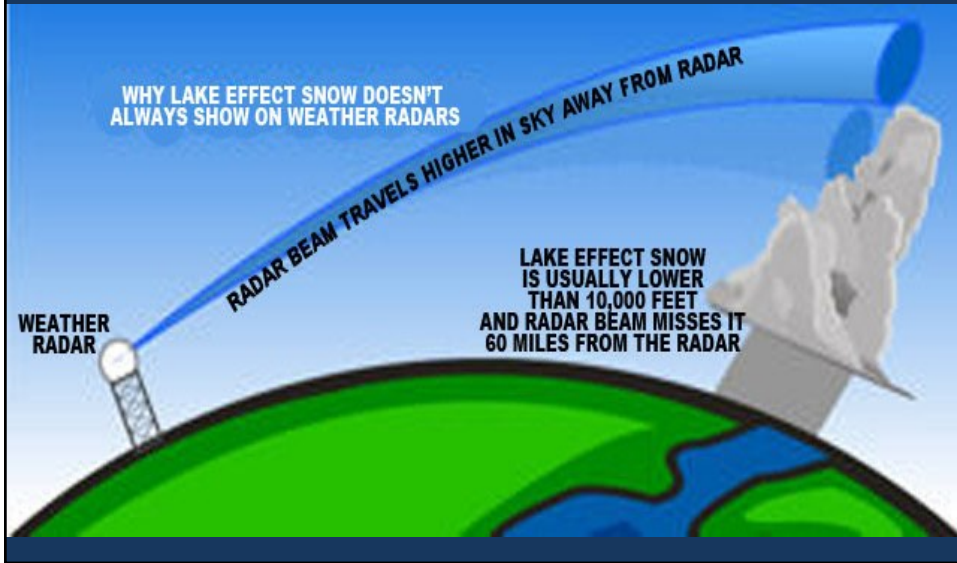


During winter storms, temperatures generally drop about 1 degree Fahrenheit for every 300-400 foot rise in elevation

This can easily make the difference between rain and snow

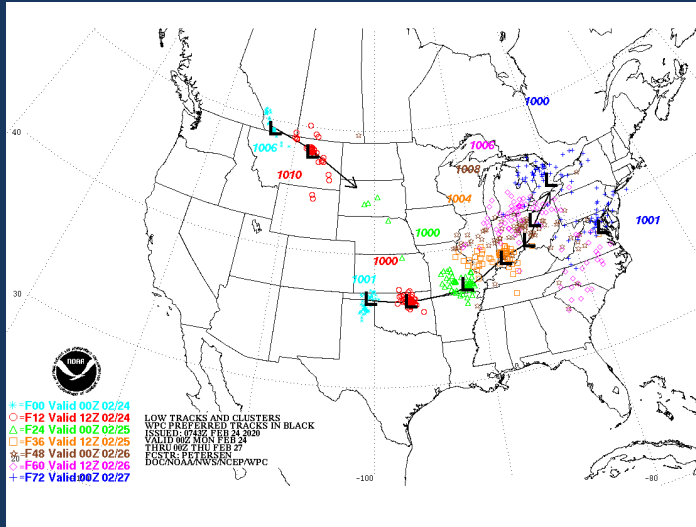


Challenge #5 Radar Limitations



Challenge #6

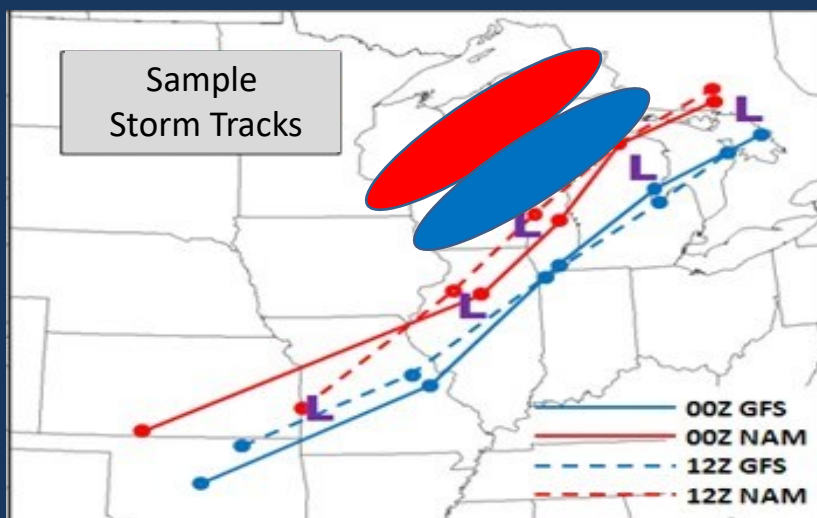
Varying computer model solutions



This is a problem both summer and winter, all across the United States. Differences in computer model solutions - which have a large impact on the forecast.

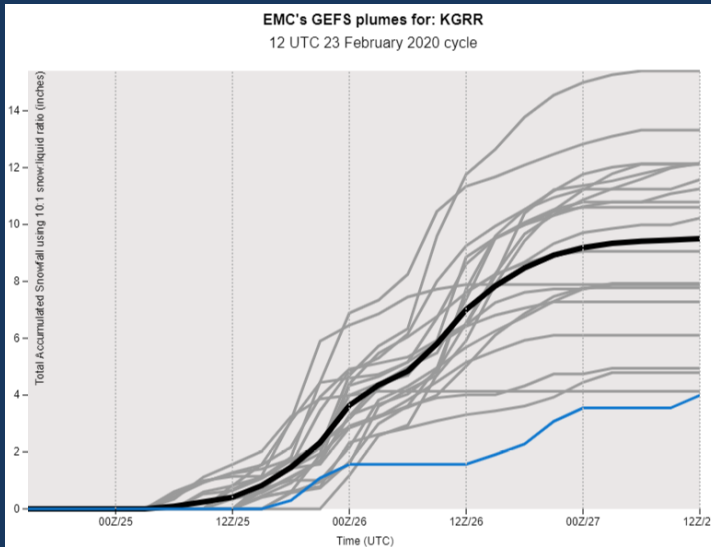
Why is storm track important?

Heaviest snow normally falls 150 to 200 miles to the left of the surface low track



Challenge #6

Varying computer model solutions

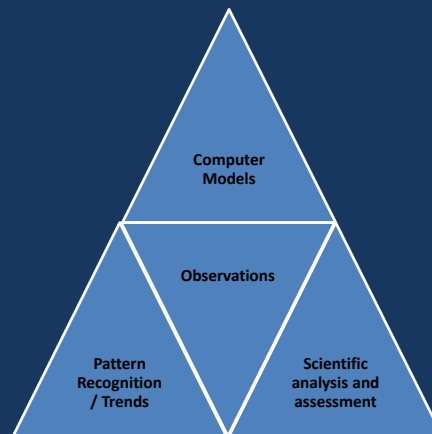


Snowfall forecasting is a challenge, not simply due to differences in storm track, but also with other weather parameters that can significantly impact snowfall totals

With all of these challenges...How do meteorologists put the forecast together?

Creating a Forecast: Like putting a puzzle together

- Current observations
- Various computer models
- Pattern recognition
- Forecaster expert analysis and assessment



Finding Snow Info On NWS Gaylord Website

The screenshot shows the NWS Gaylord website interface. At the top, there is a navigation bar with links for HOME, FORECAST, PAST WEATHER, SAFETY, INFORMATION, EDUCATION, NEWS, SEARCH, and ABOUT. Below this, there are sections for local forecasts, news headlines, and a main forecast area for Gaylord, MI. On the right side, there is a 'Local Programs' menu with various options. The 'Snow' option is highlighted in orange, and a red arrow points to it from the text 'Select "Snow"' located below the menu.

Three Days of 12 Hour Snowfall Forecast Available

The screenshot shows the NWS Gaylord website interface, specifically the 'Snowfall Information' section. A red arrow points to the 'Snowfall Forecast' tab in the navigation bar. Below the navigation bar, there are several maps and charts showing snowfall forecasts for Gaylord, MI. The maps are titled 'Snowfall Forecast' and show the forecast for the next 12 hours. The maps are arranged in a grid, with the top-left map showing the forecast for the next 12 hours through 10:00 PM EDT, and the other maps showing forecasts for different times of the day.

Three Days of Expected Snow Ratio Data Available

NATIONAL WEATHER SERVICE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Local forecast by "City, ST, or ZIP code"
Enter location: Go

News Headlines

- Cold and Damp into Next Week
- Frost Advisories and Freeze Warnings discontinued for 2022 Growing Season

Snowfall Information
Weather data > Gaylord, MI > Snowfall information

Current Hazards | Current Conditions | Radar | Forecasts | Rivers and Lakes | Climate and Past Weather | Local Programs

Current Snowfall Information | Snowfall Forecast | Previous Years' Snowfall | **Ratios and Other Info** | Outlook | Probabilistic Fcst

Snow Ratio and Other Snowfall Information

Red Shading (Wet Snow) Ratio of 1-11" of Snow to 1" Liquid
Green Shading (Normal Snow) Ratio of 11-20" of Snow to 1" Liquid
Blue Shading (Dry Snow) Ratio of 20+" of Snow to 1" Liquid

Snow Ratio Forecast Gaylord, MI
Valid Thu 08/04M through Thu 08/09M EDT

Snow Ratio Forecast Gaylord, MI
Valid Thu 08/09M through Fri 08/09M EDT

Snow Ratio Forecast Gaylord, MI
Valid Fri 08/10M through Sat 08/10M EDT

Snow Ratio Forecast Gaylord, MI
Valid Sat 08/11M through Sun 08/11M EDT

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Experimental Probabilistic Forecasts

NATIONAL WEATHER SERVICE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

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Enter location: Go

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Weather data > Gaylord, MI > Snowfall information

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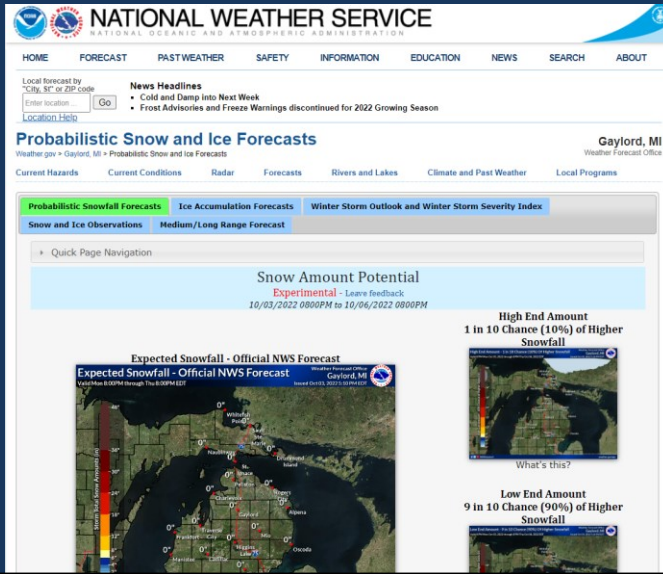
Probabilistic Snow and Ice Forecasts (separate page)

Percent Chance of 4" Snow or More Gaylord, MI
Valid 07/09M through 07/10M EDT

Percent Chance of 8" Snow or More Gaylord, MI
Valid 07/09M through 07/10M EDT

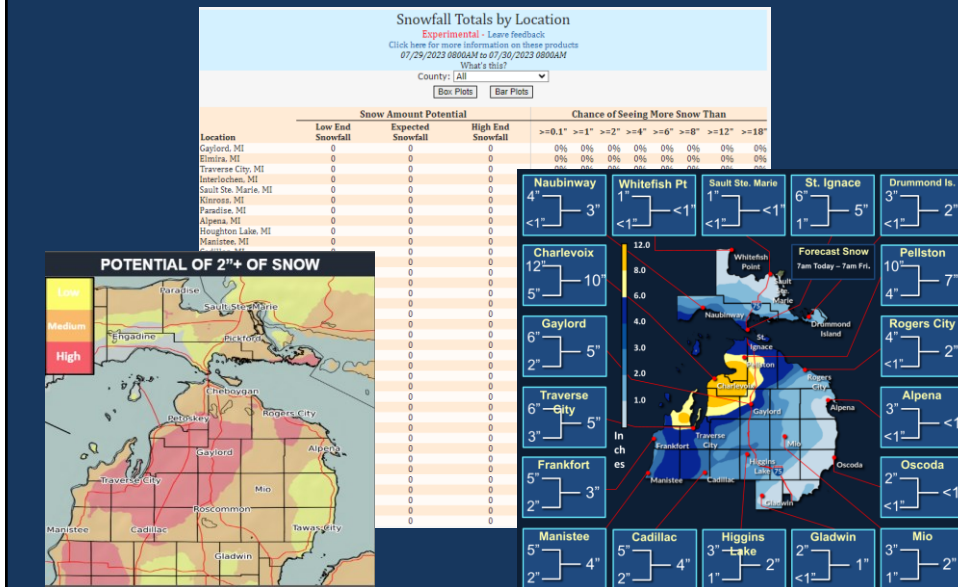
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Experimental Probabilistic Forecasts



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Experimental Probabilistic Forecasts



Winter Storm Severity Index (WSSI)

<https://www.wpc.ncep.noaa.gov/wwd/wssi/wssi.php?id=APX>

Winter Storm Severity Index (WSSI)

The WSSI does not depict official warnings and should always be used in context with official NWS forecasts and warnings. For a users guide and more information about the WSSI, please select from the dropdown menu below [Click Me for Additional Information](#)

NEW Rolling 24 HR WSSI Display located here
Probabilistic WSSI (PWSSI) Display Located here

Overall Impact | Snow Amount | Snow Load | Ice Accumulation | Flash Freeze | Blowing Snow | Ground Blizzard

Overall Impact: Maximum impact from any of the components.

Days 1-3 | Day 1 | Day 2 | Day 3

Select Zoom Area: [APX] Gaylord Print Map

Winter Storm Severity Index - Effective From Wed, Oct 11, 2023 01 PM ET Through Sat, Oct 14, 2023 08 AM ET
Last Updated: Wednesday October 11, 2023 01:19 PM ET

Potential Winter Storm Impacts

- Winter Weather Area**
 - Expect Winter Weather.
 - Winter driving conditions. Drive carefully.
- Minor Impacts**
 - Expect a few inconveniences to daily life.
 - Winter driving conditions. Use caution while driving.
- Moderate Impacts**
 - Expect disruptions to daily life.
 - Expectation driving conditions. Use extra caution while driving.
 - Choppy and disorient to infrastructure may occur.
- Major Impacts**
 - Expect considerable disruptions to daily life.
 - Expectation driving conditions. Travel is not advised.
 - Choppy and disorient to infrastructure may occur.
 - Choppy and disorient to infrastructure may occur.
 - Life saving actions may be needed.
- Extreme Impacts**
 - Expect substantial disruptions to daily life.
 - Expectation driving conditions. Travel is not advised.
 - Choppy and disorient to infrastructure may occur.
 - Choppy and disorient to infrastructure may occur.
 - Life saving actions may be needed.

Download Latest WSSI in GIS Format:
Download Data in KMZ
Download Data in SHP
REST Service Links

NEW WSSI Static Image Archive:
WSSI Static Image Archive Data

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Finding Hourly Weather Graphs

NATIONAL WEATHER SERVICE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

HOME FORECAST PAST WEATHER SAFETY INFORMATION EDUCATION NEWS SEARCH ABOUT

Local forecast by "City, ST" or ZIP code
Enter location
[Location Help](#)

News Headlines

- Cold and Damp into Next Week
- Frost Advisories and Freeze Warnings discontinued for 2022 Growing Season

MY FORECAST
Gaylord, Otsego County
Airport MI

NWS Forecast Office Gaylord, MI
[Weather.gov](#) > Gaylord, MI

Gaylord, 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.

Mostly Cloudy
47°F
8°C [Get Detailed info](#)

This Afternoon
60%
Showers Likely
High: 48°F

Tonight
50% → 80%
Scattered Showers then Showers
Low: 30°F
[change location](#)

Click on your desired location

Watches, Warnings & Advisories
Small Craft Advisory
Hazardous Weather Outlook

Last Map Update: Thu, Oct. 13, 2022 at 1:01:27 pm EDT

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Finding Hourly Weather Graphs

NATIONAL WEATHER SERVICE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

HOME FORECAST PAST WEATHER SAFETY INFORMATION EDUCATION NEWS SEARCH ABOUT

Go

News Headlines

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- Frost Advisories and Freeze Warnings discontinued for 2022 Growing Season

[Additional Headlines](#)

Hazardous Weather Conditions

- Hazardous Weather Outlook

En Español [Share](#) [Facebook](#) [Twitter](#) [LinkedIn](#) [YouTube](#) [Pinterest](#)

Click on Hourly Weather Forecast

Current conditions at **Gaylord Regional Airport (KGLR)**
Lat: 45.027°N Lon: 84.959°W Elev: 132ft

Mostly Cloudy
47°F
8°C

Humidity 71%
Wind Speed N @ 6 mph
Barometer 29.56 in (999.4 mb)
Dewpoint 38°F (3°C)
Visibility 10.00 mi
Wind Chill 44°F (7°C)
Last update 13 Oct 12:53 pm EDT

More Information:
[Local Forecast Office](#)
[More Local Info](#)
[3 Day History](#)
[Mobile Weather](#)
[Hourly Weather Forecast](#)

Extended Forecast for Gaylord MI

This Afternoon	Tonight	Friday	Friday Night	Saturday	Saturday Night	Sunday	Sunday Night	Monday
60%	70%	60% 60%	60% 70%	70% 40%	40%	90% 60%		
Showers Likely	Showers Likely	Rain/Snow then Showers Likely	Showers Likely then Rain/Snow Likely	Showers Likely then Chance Showers	Chance Showers	Chance Showers then Showers Likely	Showers Likely then Rain/Snow Likely	Rain/Snow
High: 48 °F	Low: 30 °F	High: 44 °F	Low: 33 °F	High: 47 °F	Low: 33 °F	High: 47 °F	Low: 32 °F	High: 41 °F

Hourly Weather Graphs

Point Forecast: Gaylord MI
45°30N 84°56W (Elev: 137 ft) Last Update: 12:27 pm EDT Oct 13, 2022

Hourly Weather Forecast Graph

Weather Elements: Temperature (°F) Dewpoint (°F) Wind Chill (°F) Surface Wind (mph) Sky Cover (%) Precipitation Potential (%) Relative Humidity (%) Rain Thunder Snow Freezing Rain Sleet Fog

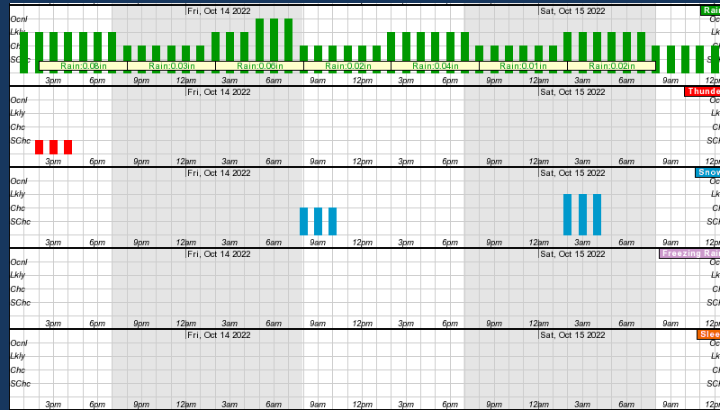
Fire Weather: Mixing Height (x100ft) Haines Index Trans. Wind (mph) 20th Wind (mph) Vent Rate (x1000 mph-ft)

Aviation Weather: Ceiling Height Visibility Thunder Potential

48-Hour Period Starting: 1pm Thu, Oct 13 2022 Submit Back 2 Days Forward 2 Days

The graph displays multiple data series over a 48-hour period. The top panel shows Temperature (°F) in red, Dewpoint (°F) in blue, and Wind Chill (°F) in green. The middle panel shows Surface Wind (mph) in purple. The bottom panel shows Sky Cover (%) in light blue, Precipitation Potential (%) in dark blue, and Precipitation (inches) in green bars. The x-axis represents time in 3-hour increments from 1pm on Oct 13 to 12am on Oct 14.

Hourly Weather Graphs



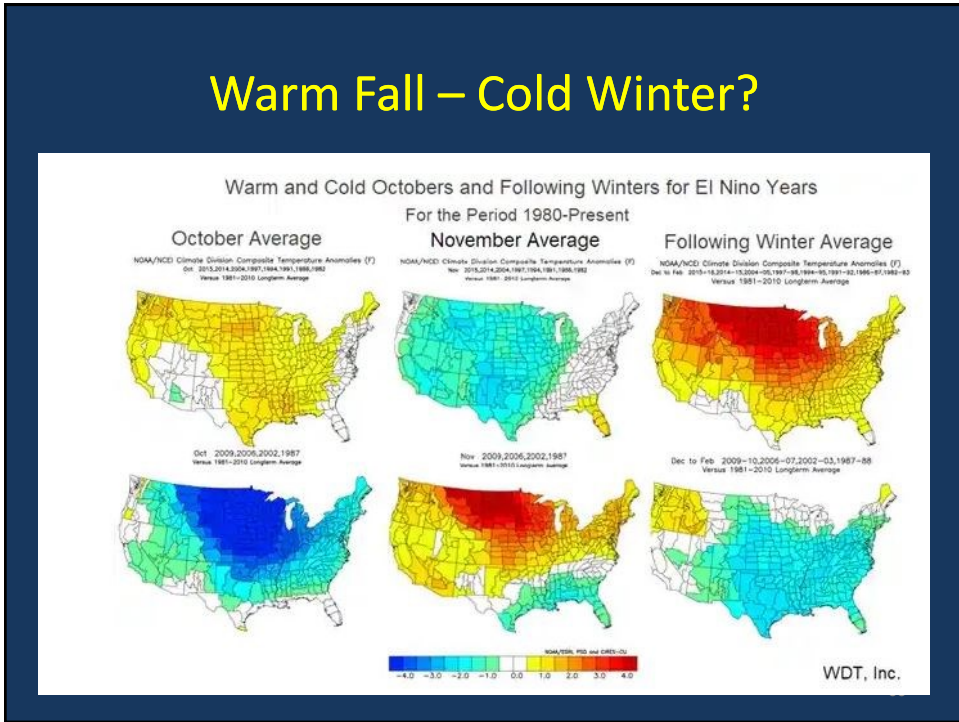
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What Might Winter 2023-2024 Look Like?

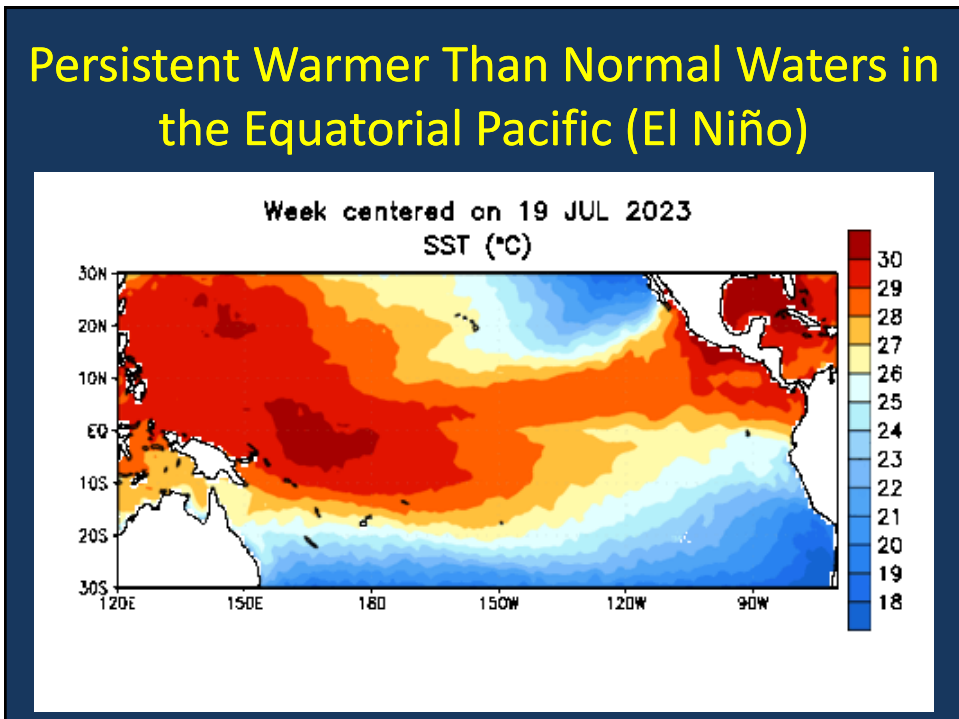
- Official NOAA Winter Outlook will be released by the end of the month
- Odds are that a El Niño pattern (warmer than normal water in the equatorial Pacific) will be in place through the winter (last three winters were a La Niña)
- Winter Outlooks are often based on El Niño/La Niña cycle, but many other less predictable patterns impact seasonal weather.

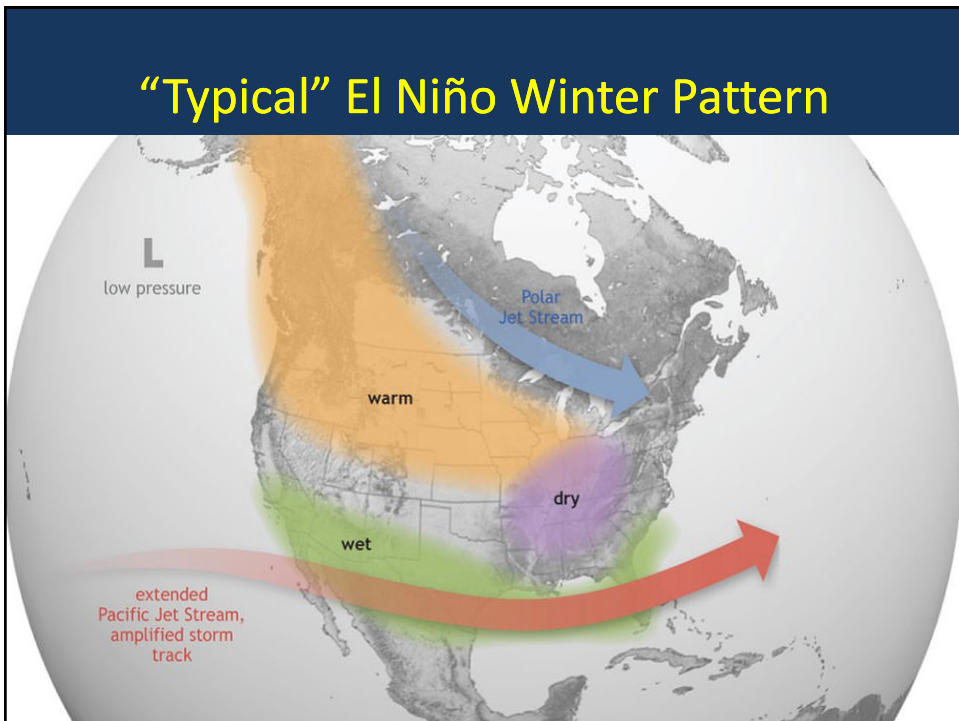
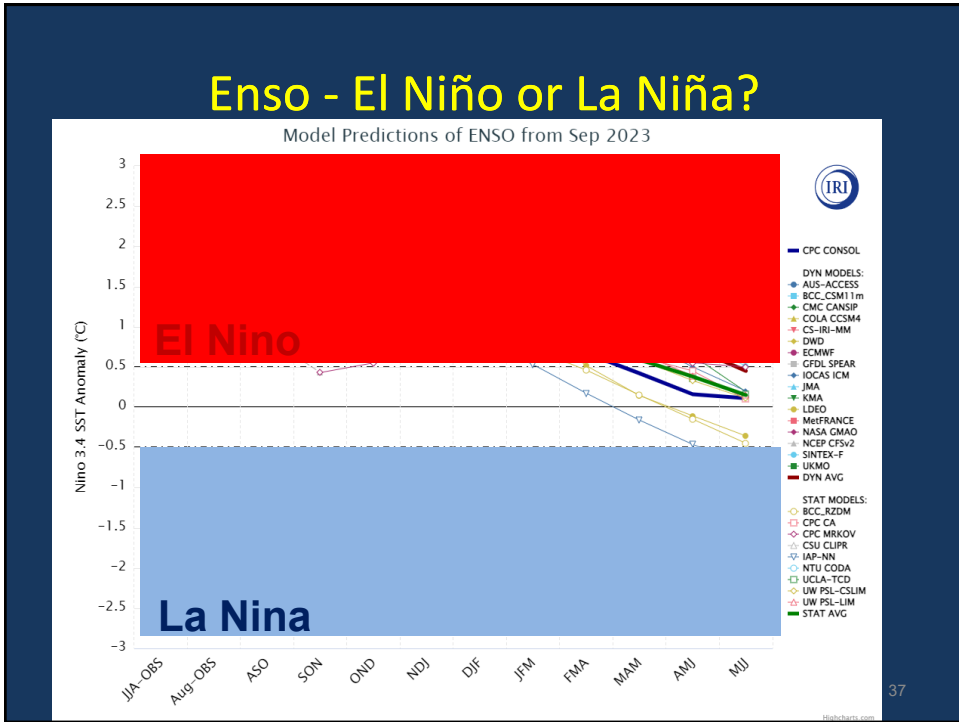
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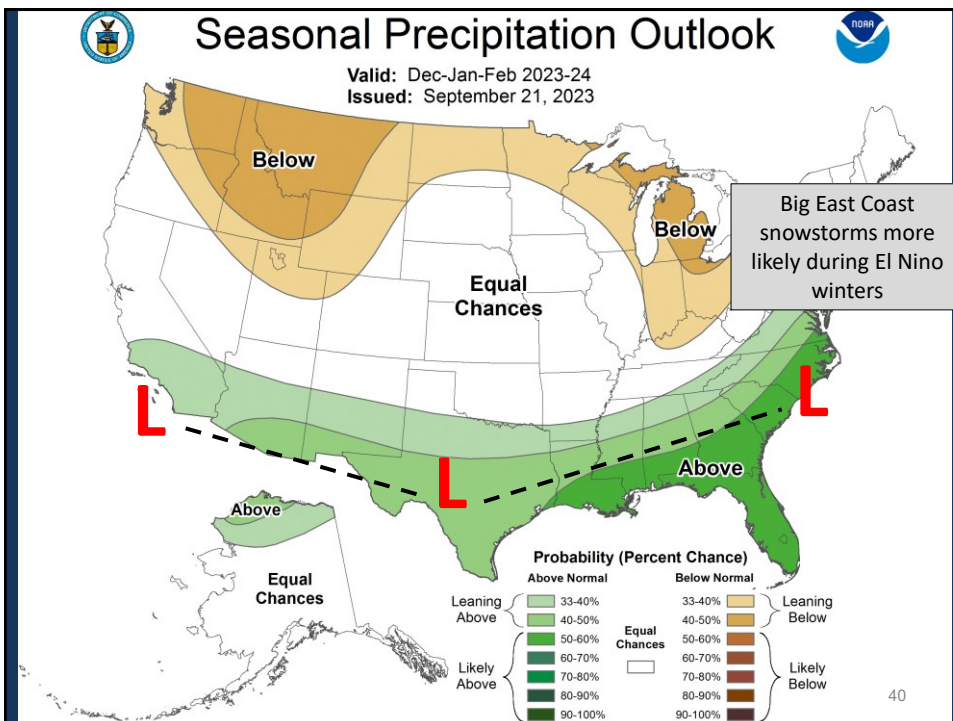
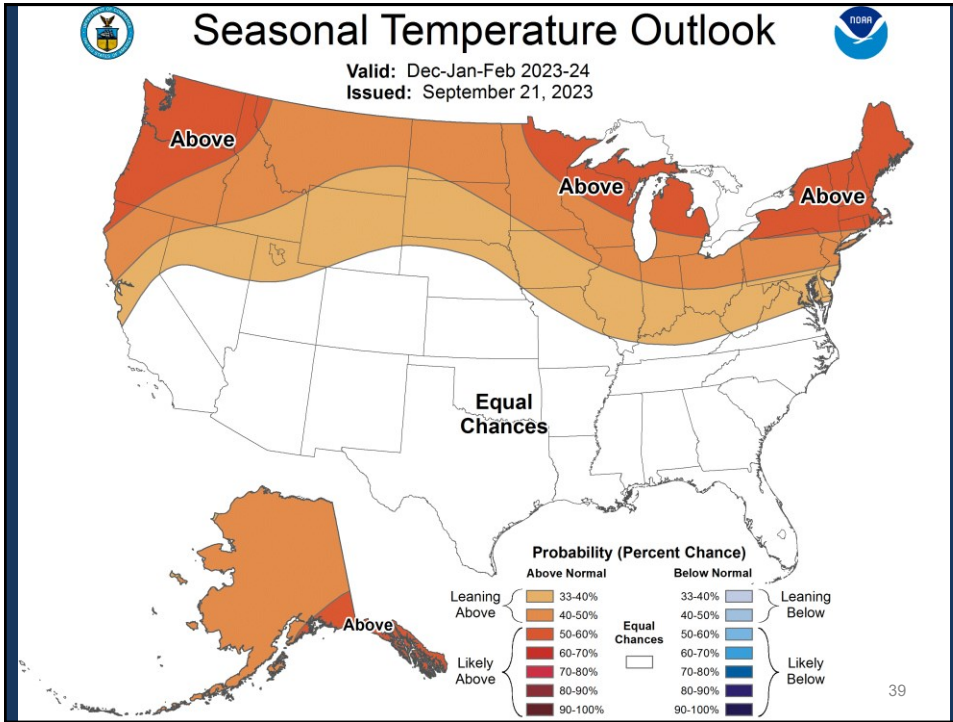
Warm Fall – Cold Winter?



Persistent Warmer Than Normal Waters in the Equatorial Pacific (El Niño)

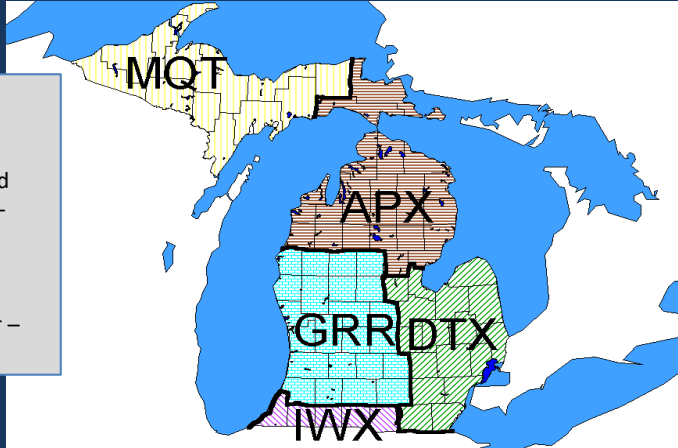






NWS Office Responsibility in Michigan

- NWS Marquette -
weather.gov/MQT
- NWS Gaylord –
weather.gov/Gaylord
- NWS Grand Rapids –
weather.gov/GRR
- NWS Detroit –
weather.gov/DTX
- NWS North Webster –
weather.gov/IWX



Contact your local office for more specific local information
or to be added to their weather notification list

Questions or want more information?

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Warning Coordination Meteorologist
NWS Gaylord

989-731-3384 Ext 726

pat.bak@noaa.gov

www.weather.gov/gaylord