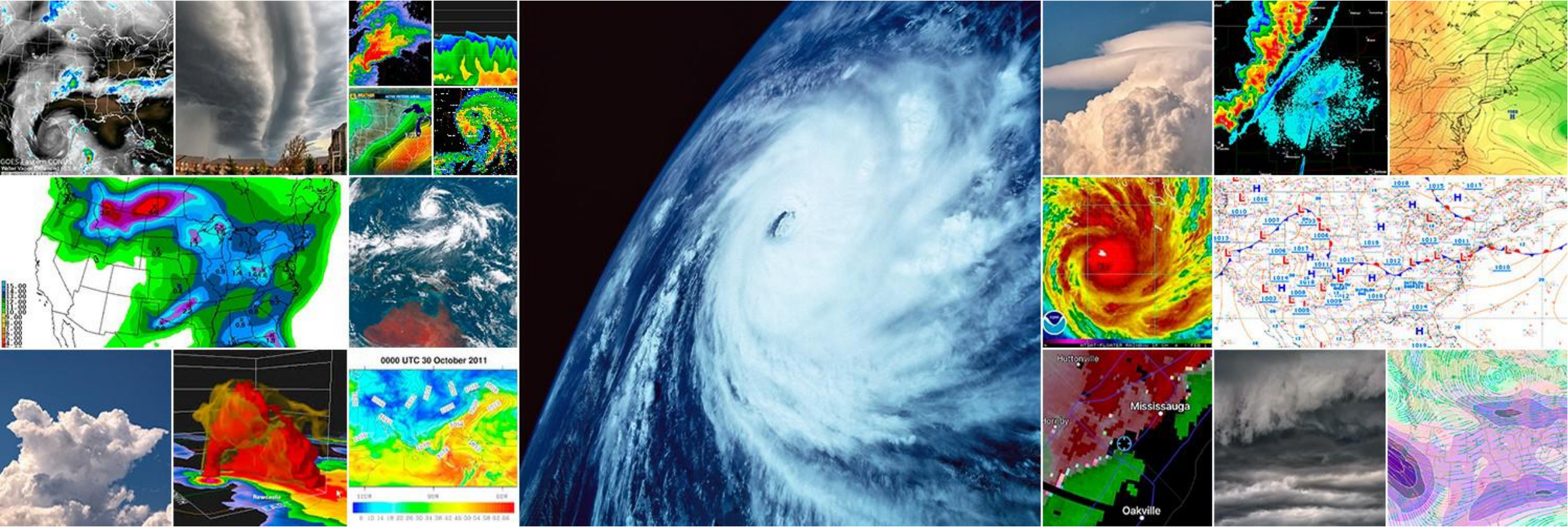


Weather Drivers for Ontario

A Look at Some Trends and Outlooks



Land Improvement Contractors of Ontario (LICO) Wed 22 Jan 2025 9am - 10am (EST)

Presenter: Ron Bianchi Meteorologist

GFS Stratospheric Polar Vortex Structure

Valid: 19 Jan 2025-12Z (19 Jan 2025-00Z, FH012)

Potential Temperature [K]

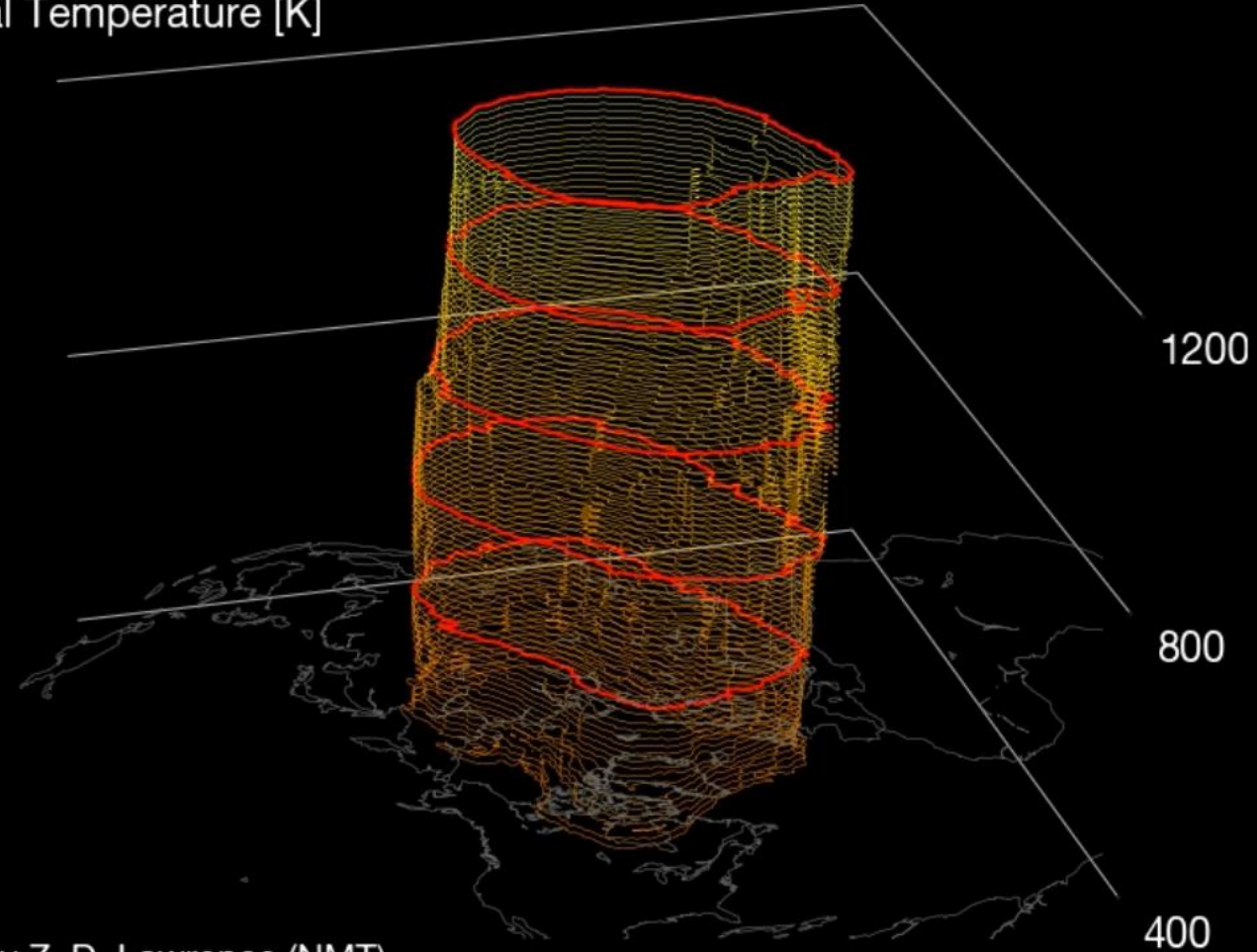
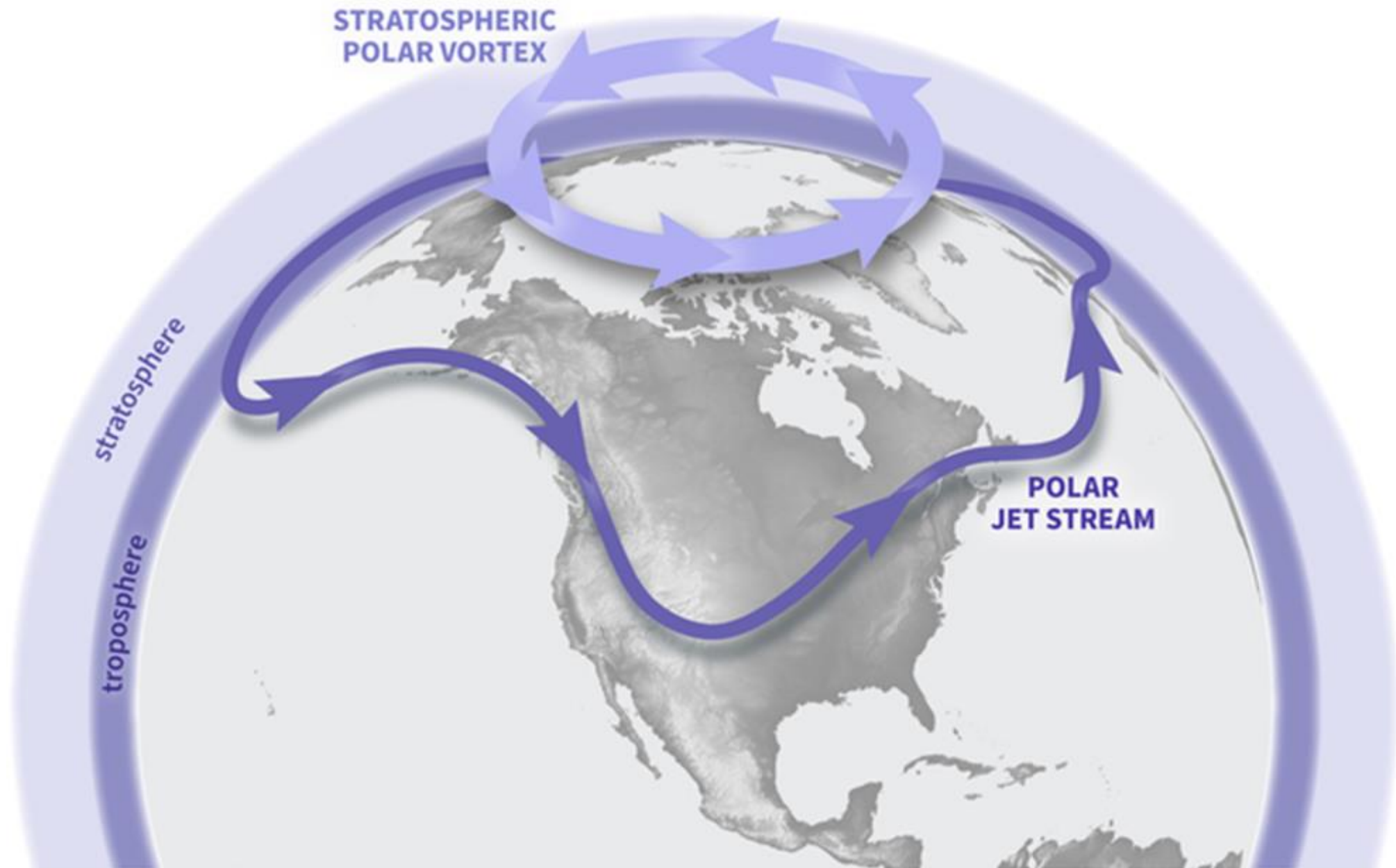


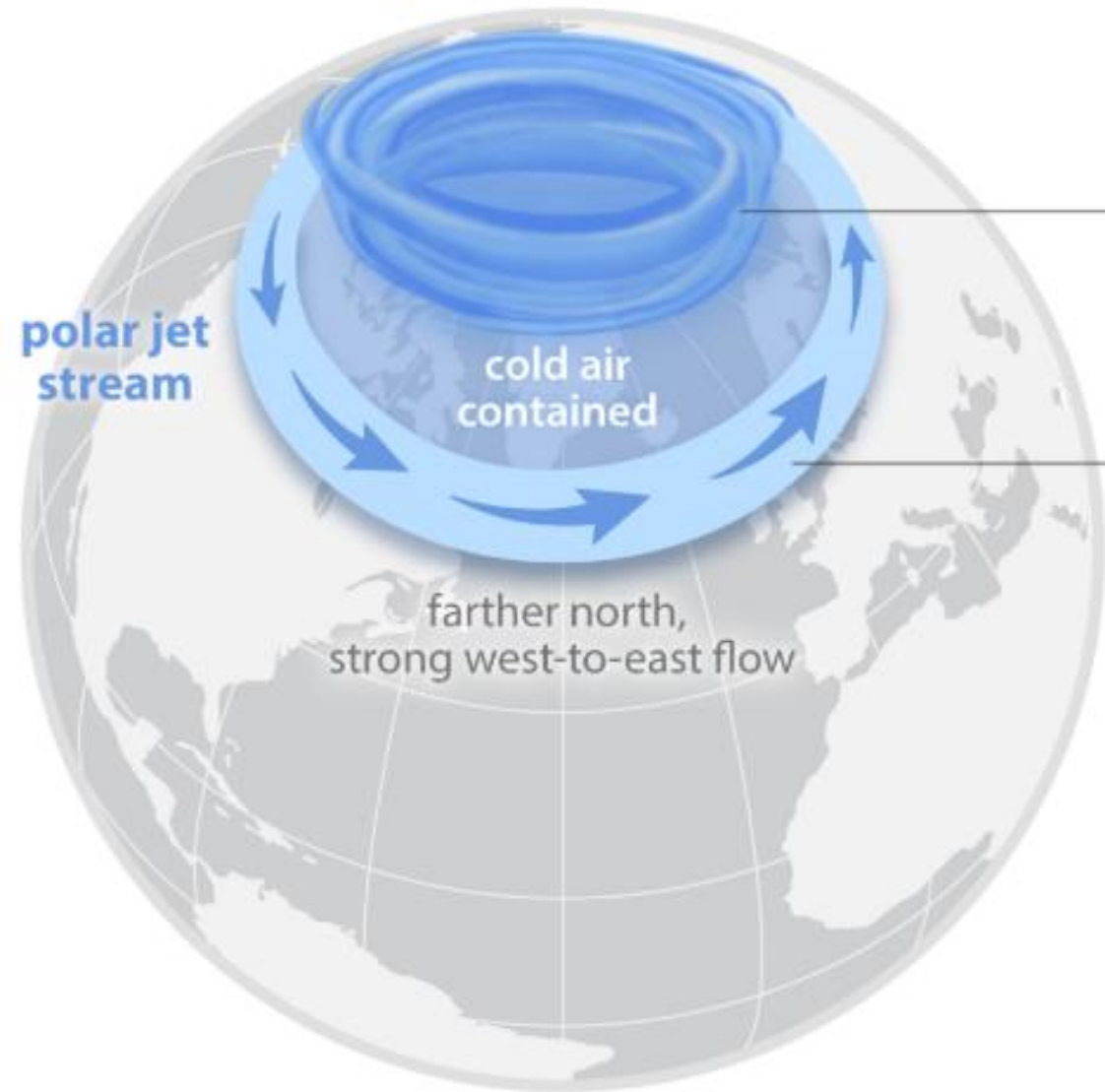
Figure by Z. D. Lawrence (NMT)
stratobserve.com

Data source: GFS, http://nomads.ncep.noaa.gov:9090/dods/gfs_0p50/

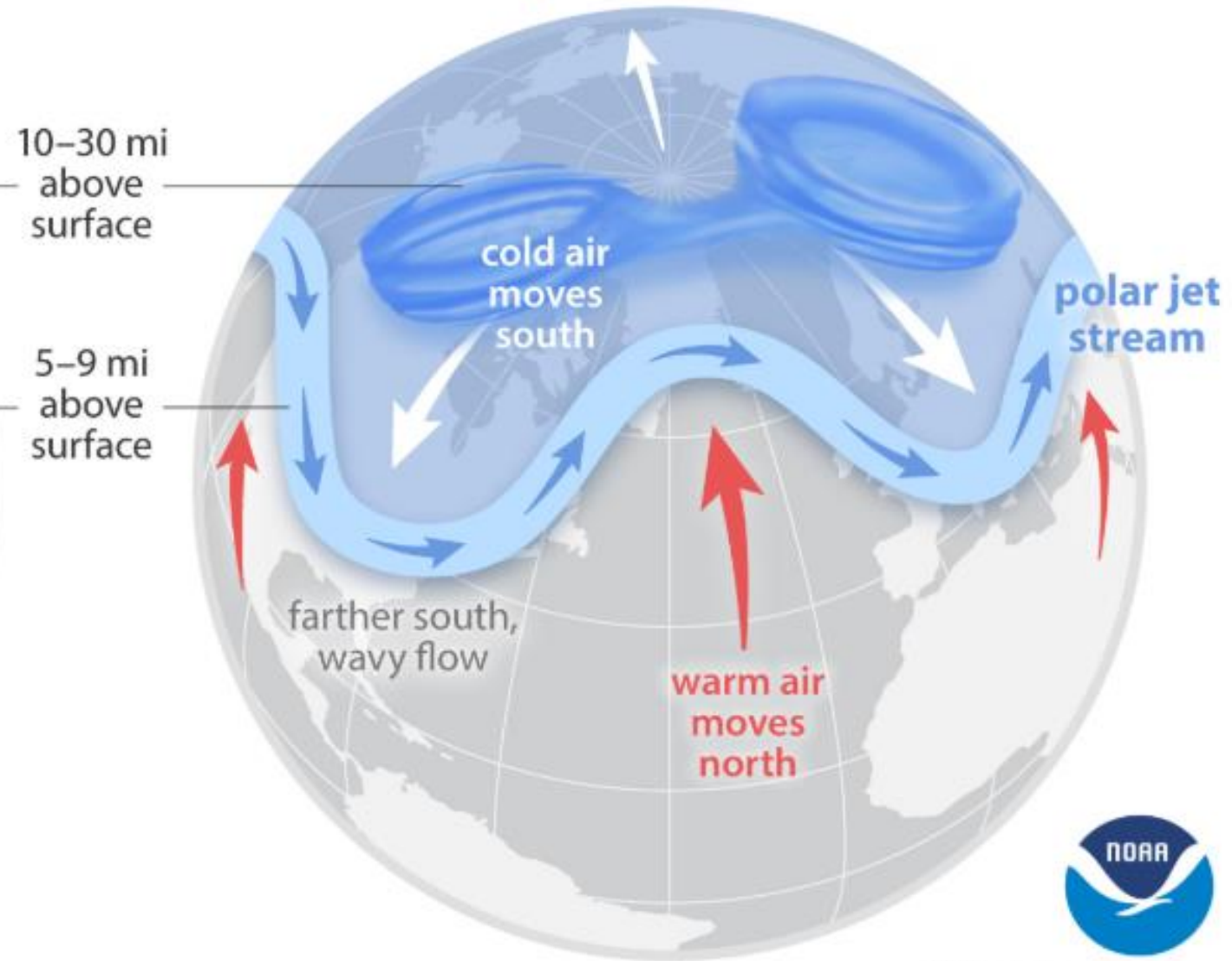
Tropospheric polar jet stream versus stratospheric polar vortex



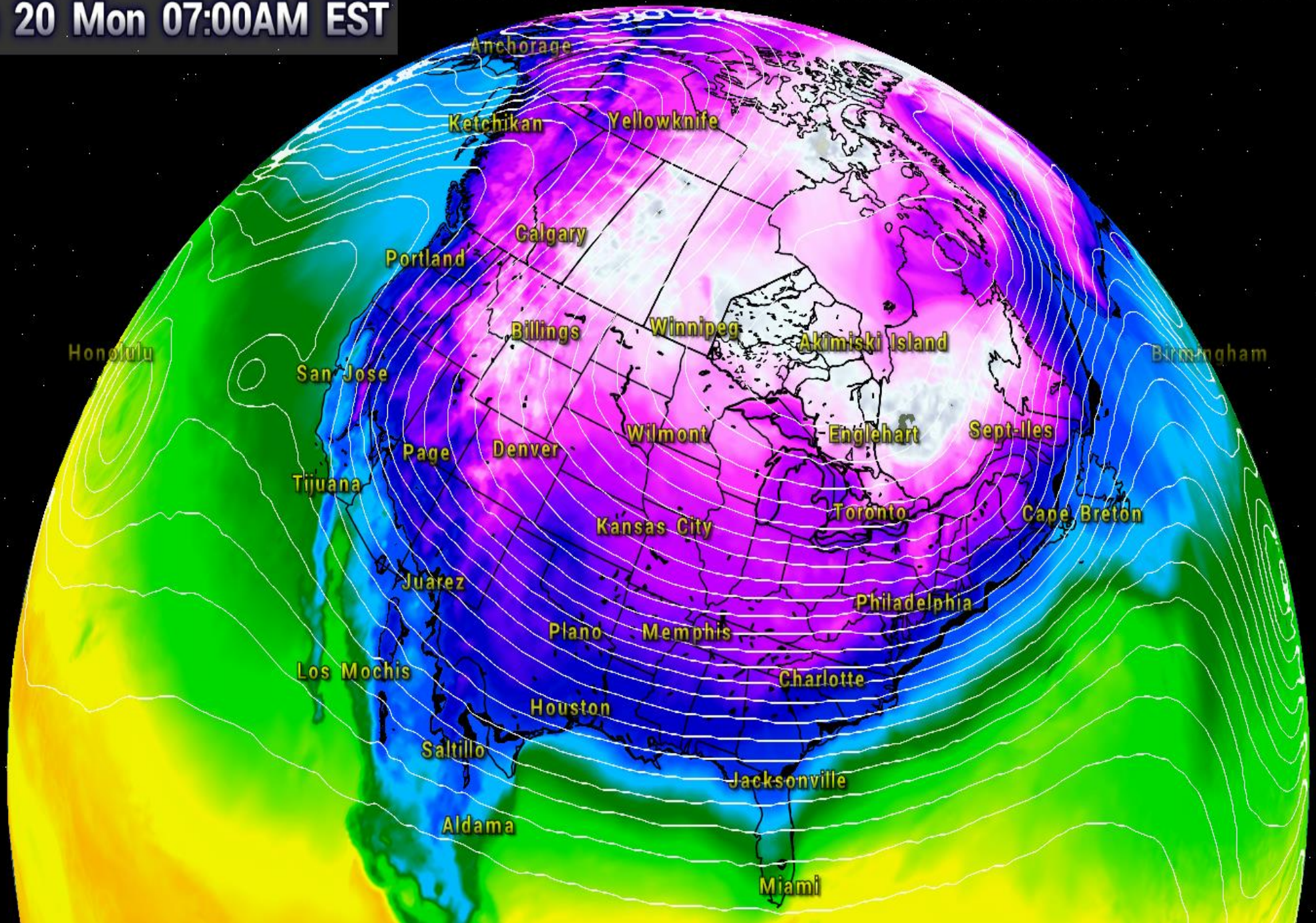
stable polar vortex

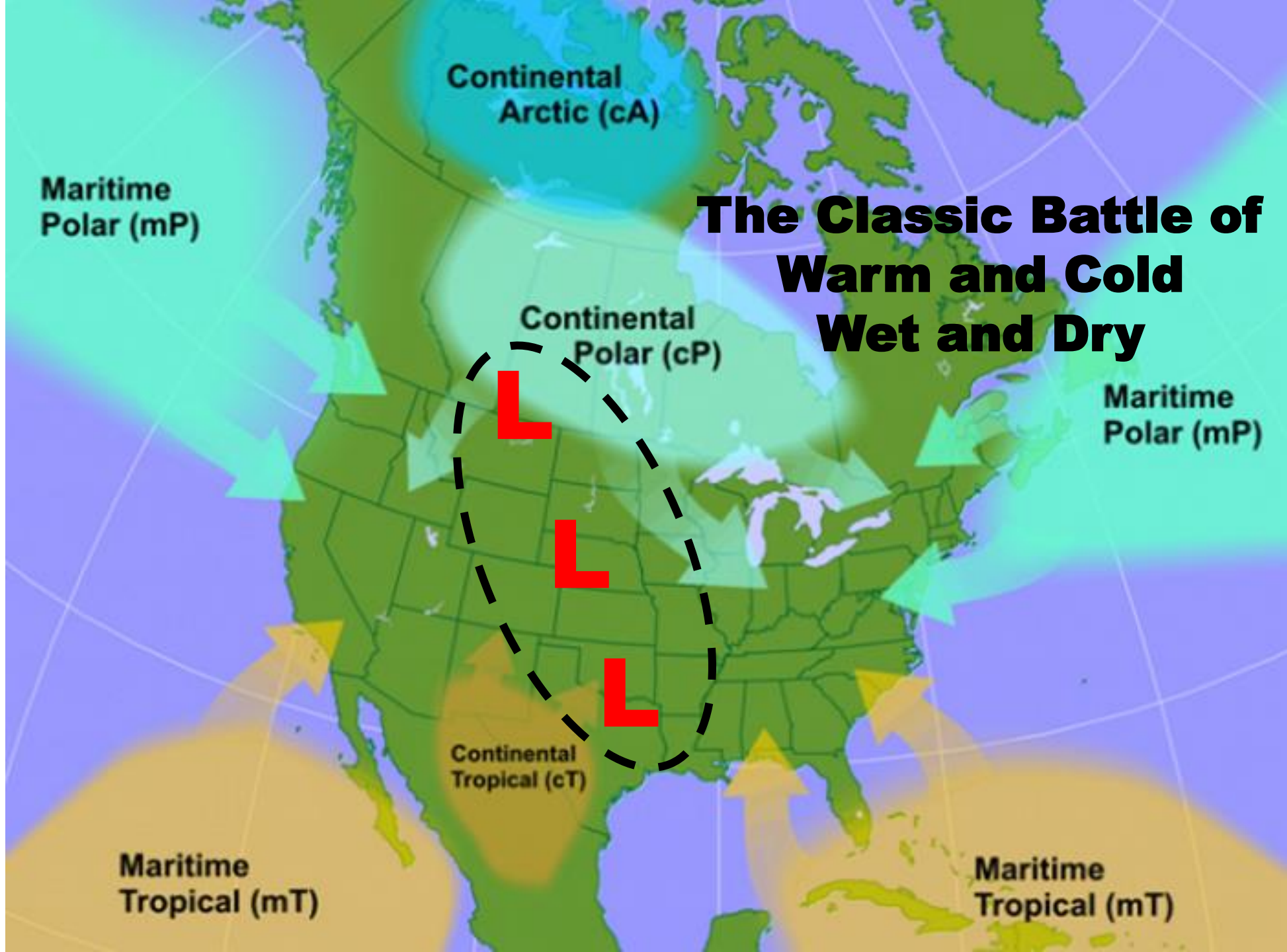


disrupted polar vortex



Model: Jan 20 Mon 07:00AM EST





The Classic Battle of Warm and Cold Wet and Dry

Maritime Polar (mP)

Continental Arctic (cA)

Continental Polar (cP)

Maritime Polar (mP)

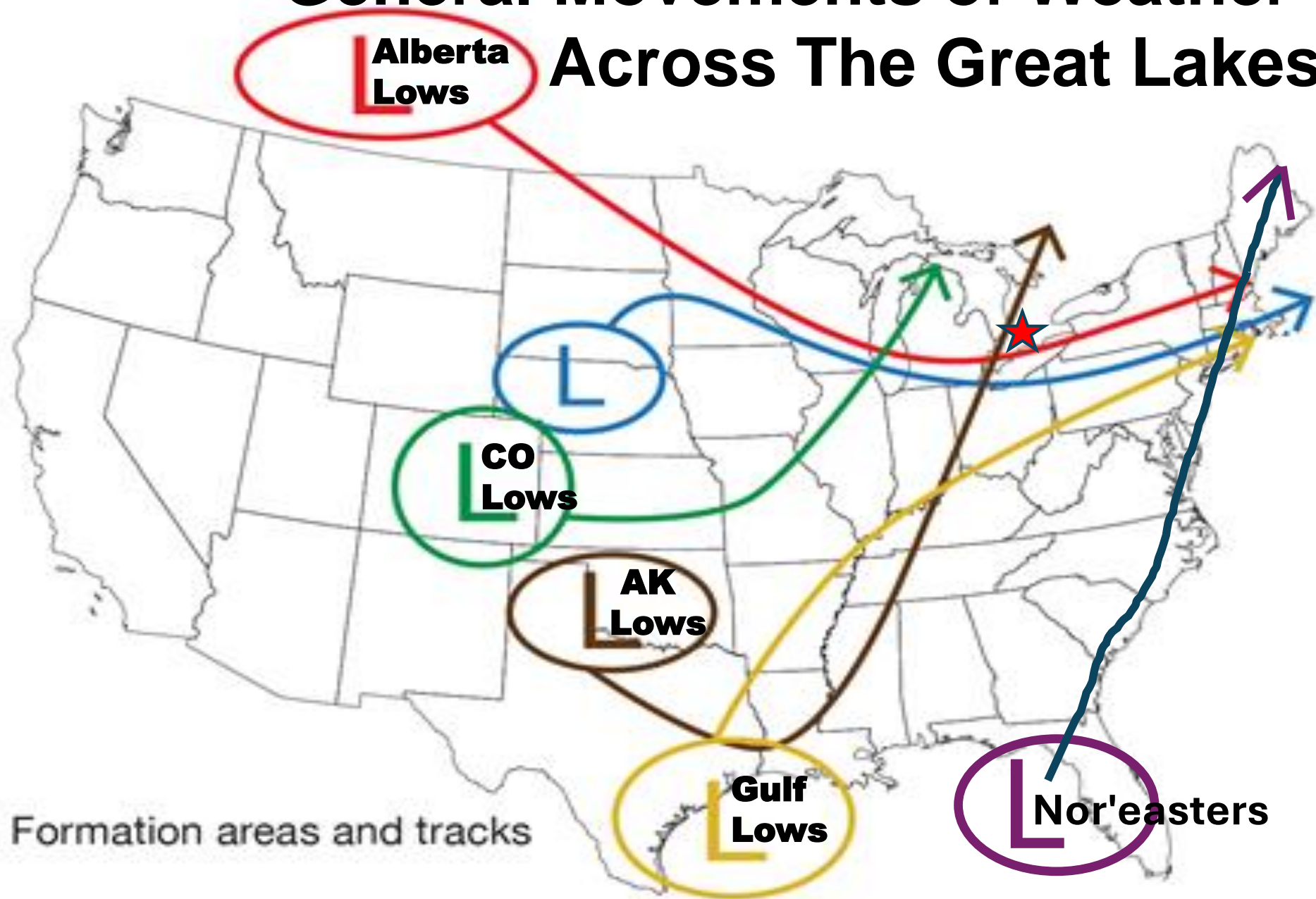
Continental Tropical (cT)

Maritime Tropical (mT)

Maritime Tropical (mT)

General Movements of Weather Systems

Across The Great Lakes



Alberta Lows

CO Lows

AK Lows

Gulf Lows

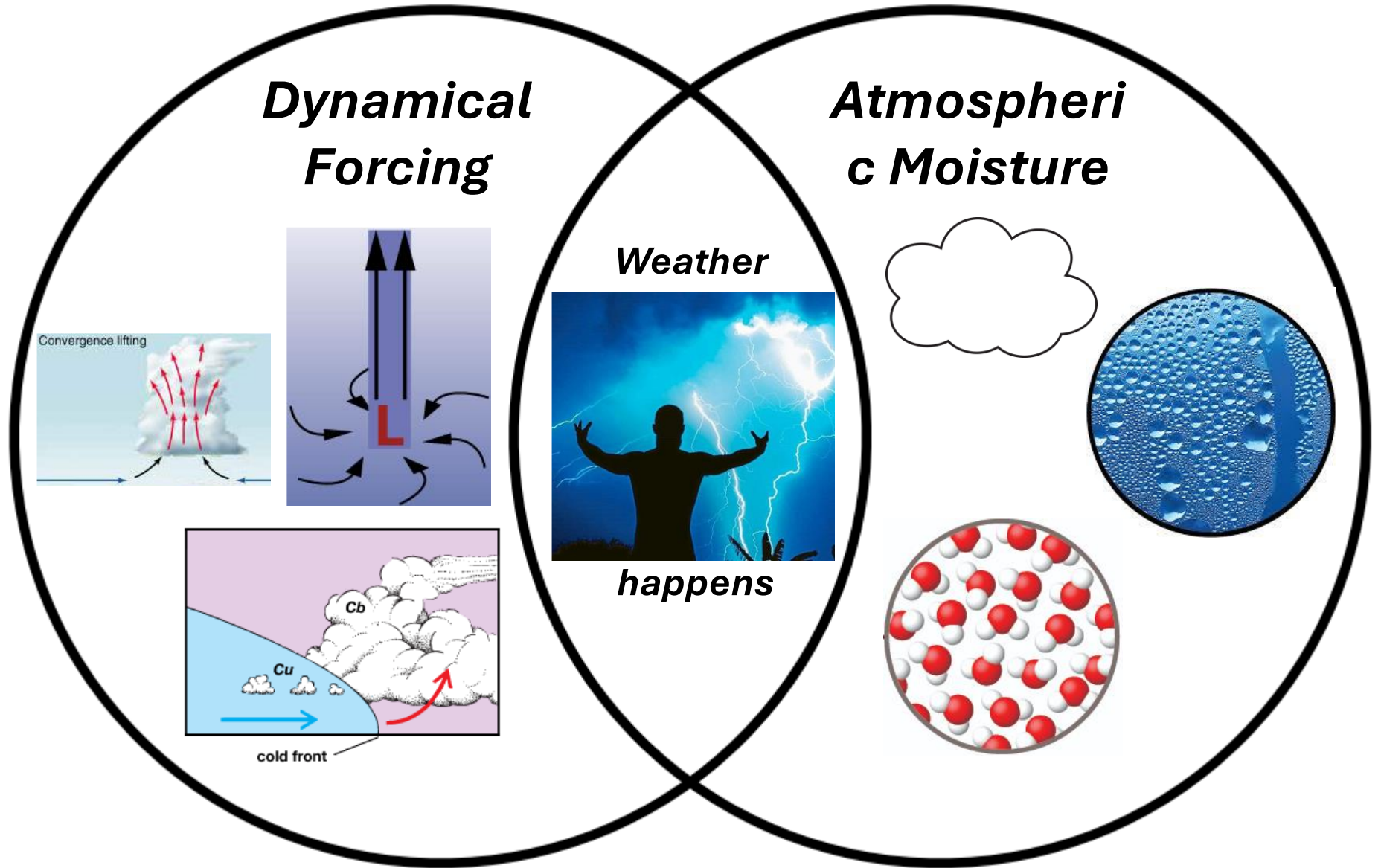
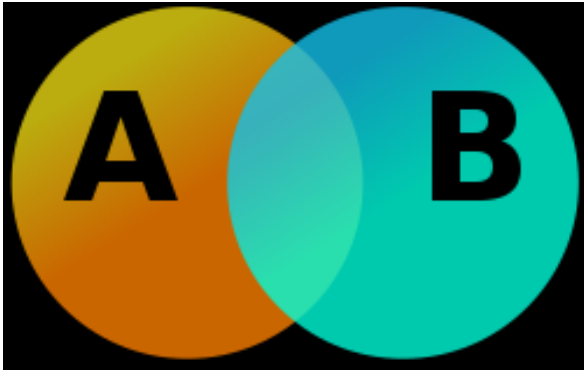
Nor'easters

Formation areas and tracks

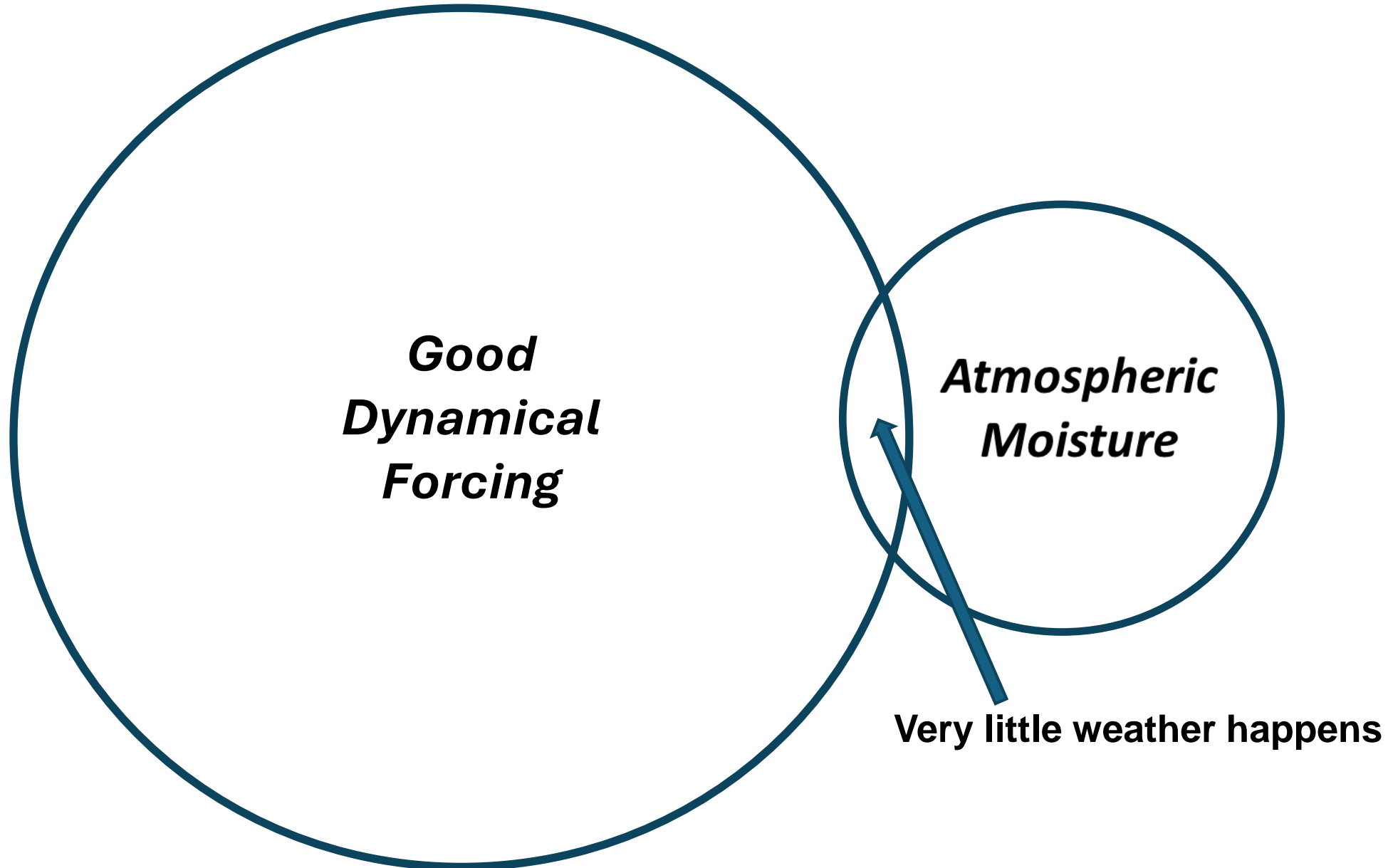
Weather – It is really this simple?



John Venn

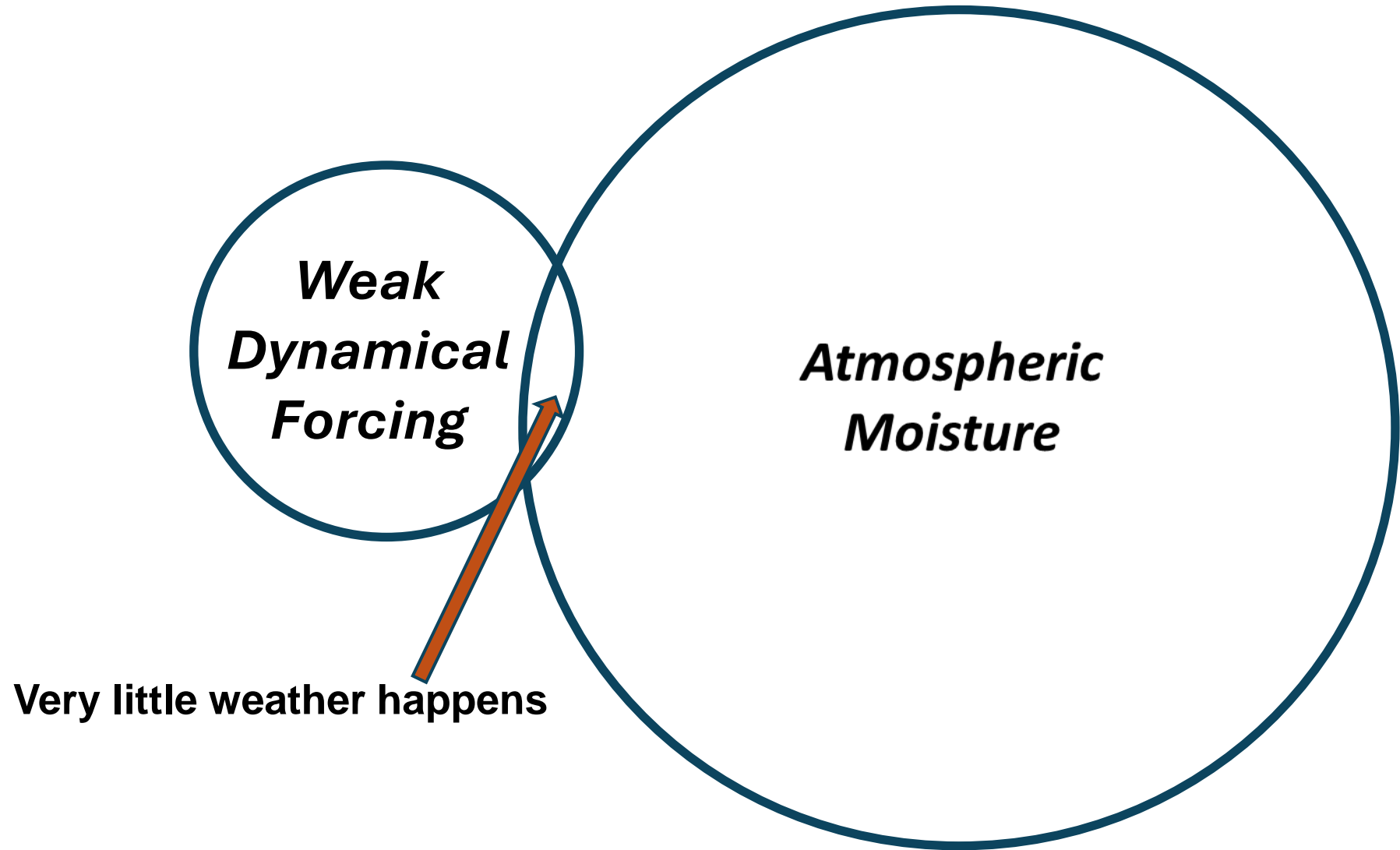


***Good Upward Forcing + Very Little Moisture =
Very Little Weather Happens***

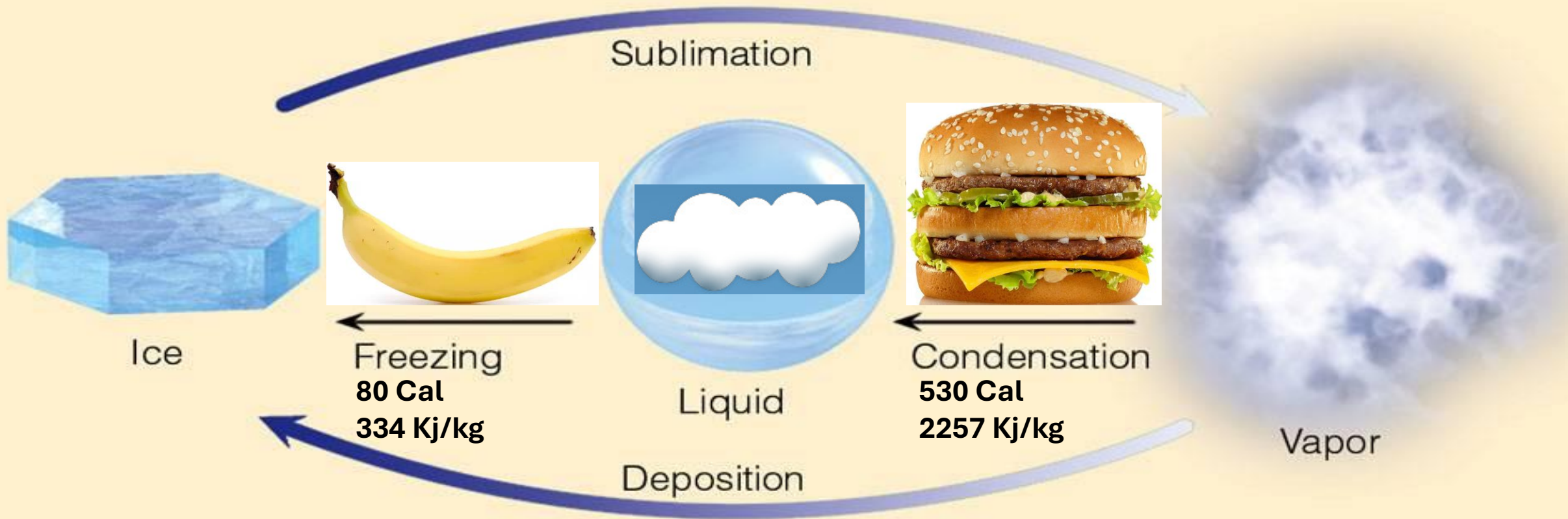


Weak Upward Forcing + Lots of Moisture =

Very Little Weather Happens

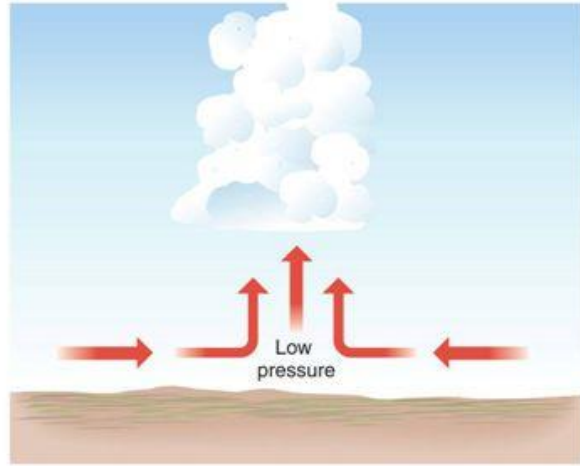
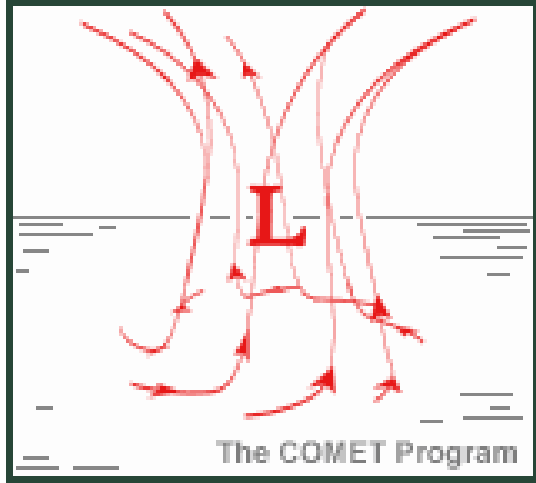


HEAT ENERGY TAKEN FROM ENVIRONMENT



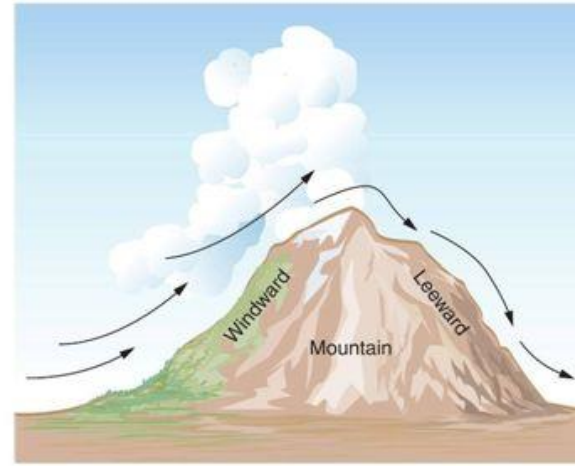
HEAT ENERGY RELEASED TO ENVIRONMENT

Atmospheric Lifting Mechanisms



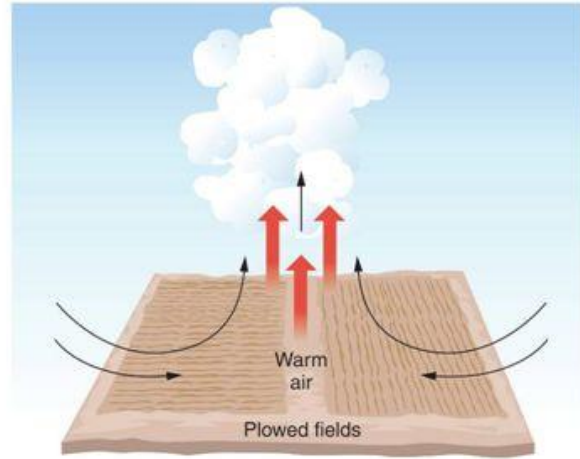
(a) Convergent

Copyright © 2006 Pearson Prentice Hall, Inc.



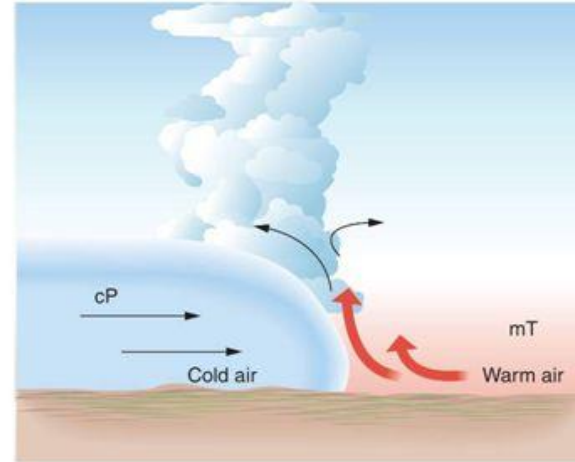
(c) Orographic (barrier)

Copyright © 2006 Pearson Prentice Hall, Inc.



(b) Convective (local heating)

Copyright © 2006 Pearson Prentice Hall, Inc.



(d) Frontal (e.g. cold front)

Copyright © 2006 Pearson Prentice Hall, Inc.

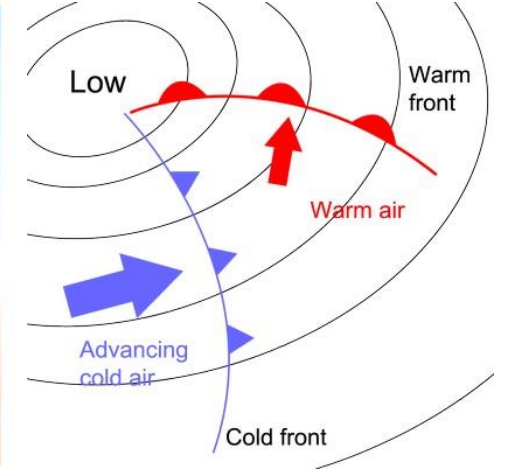


Figure 8.6

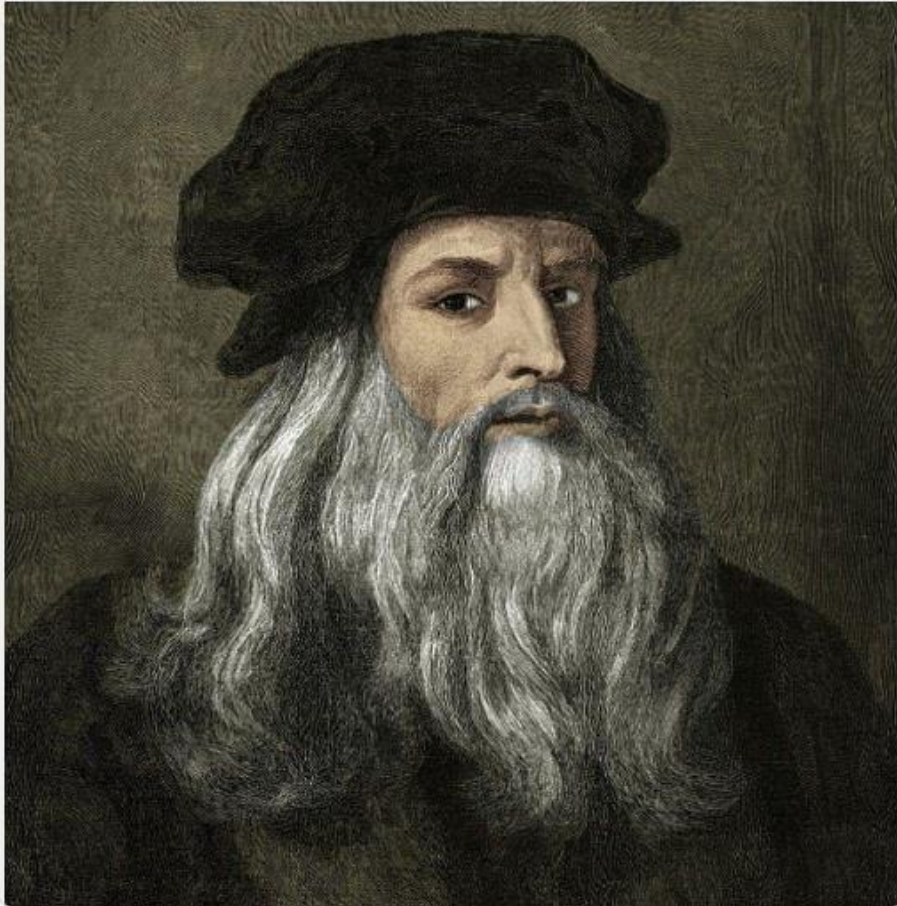
Moisture + Lift = Clouds...more clouds.....



Physics In History @PhysInHistory · Dec 15, 2024

"Study the science of art. Study the art of Science. Develop your senses
- especially learn how to see. Realize that everything connects to
everything else."

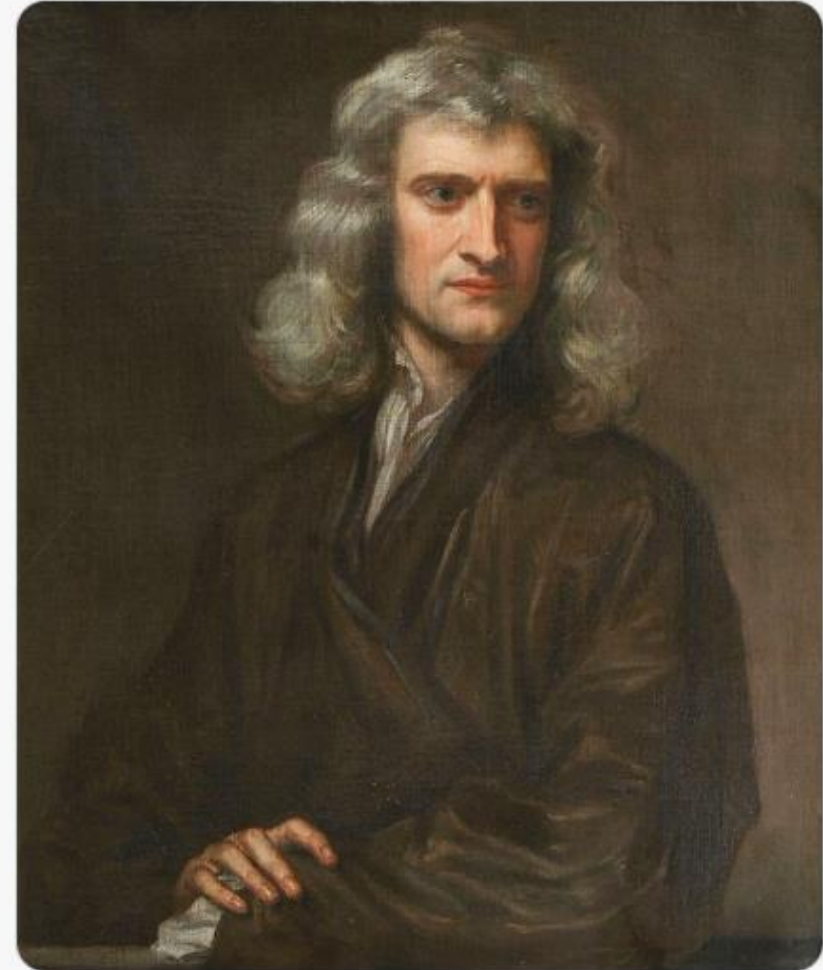
- Leonardo da Vinci (1452 - 1519)

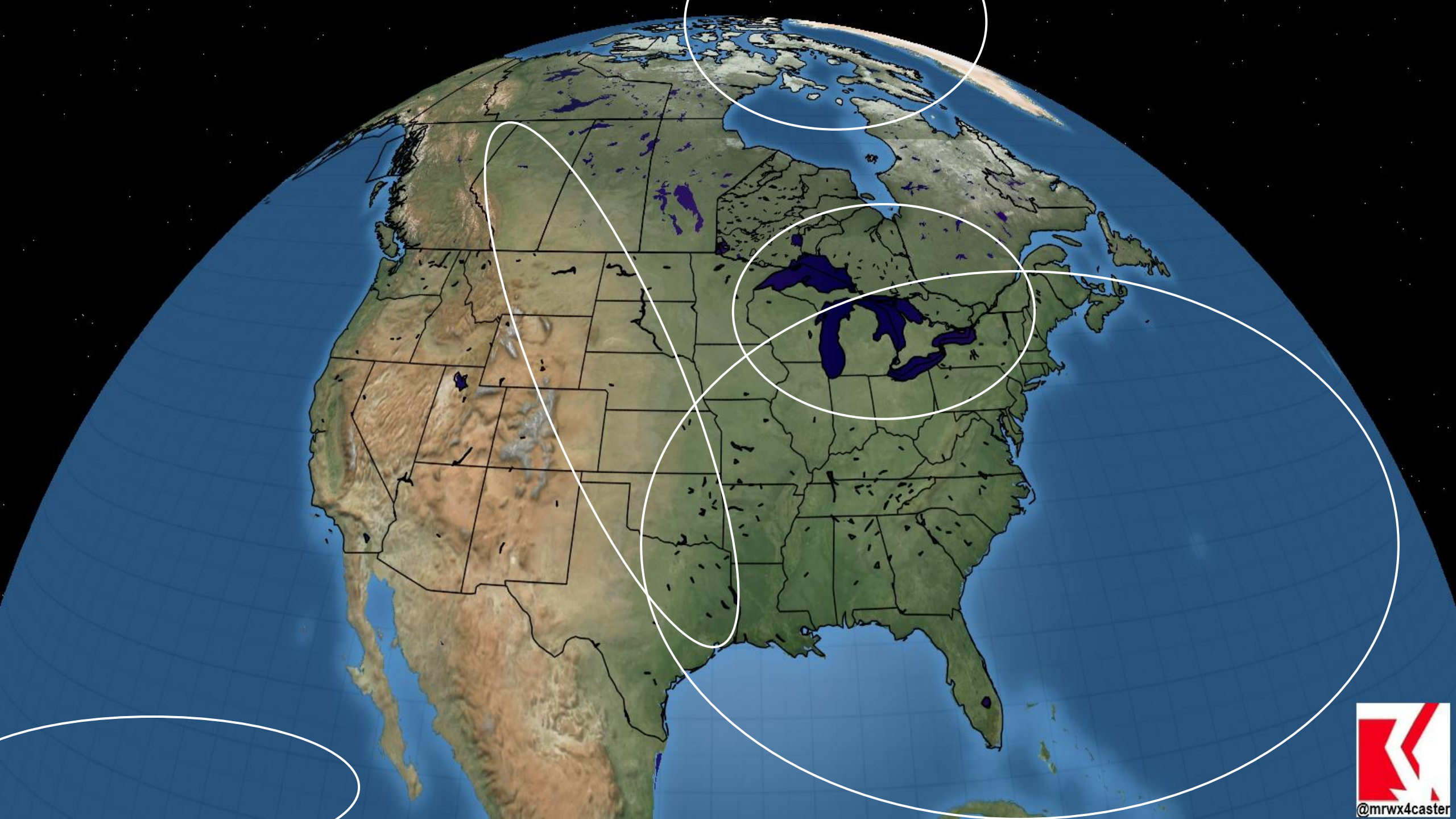


Physics In History @PhysInHistory · Dec 30, 2024

"What we know is a drop, what we don't know is an ocean."

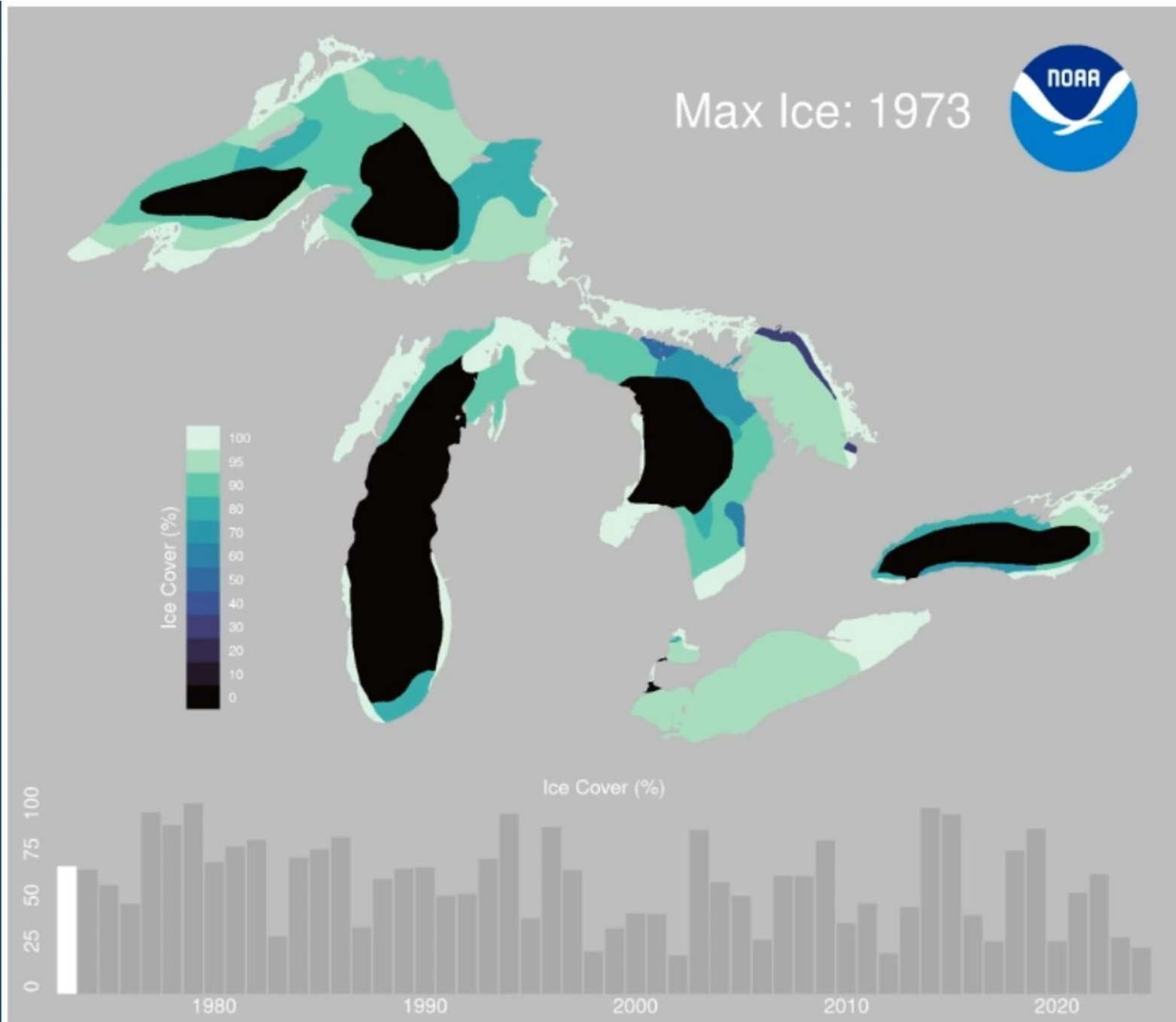
- Isaac Newton





@mrwx4caster

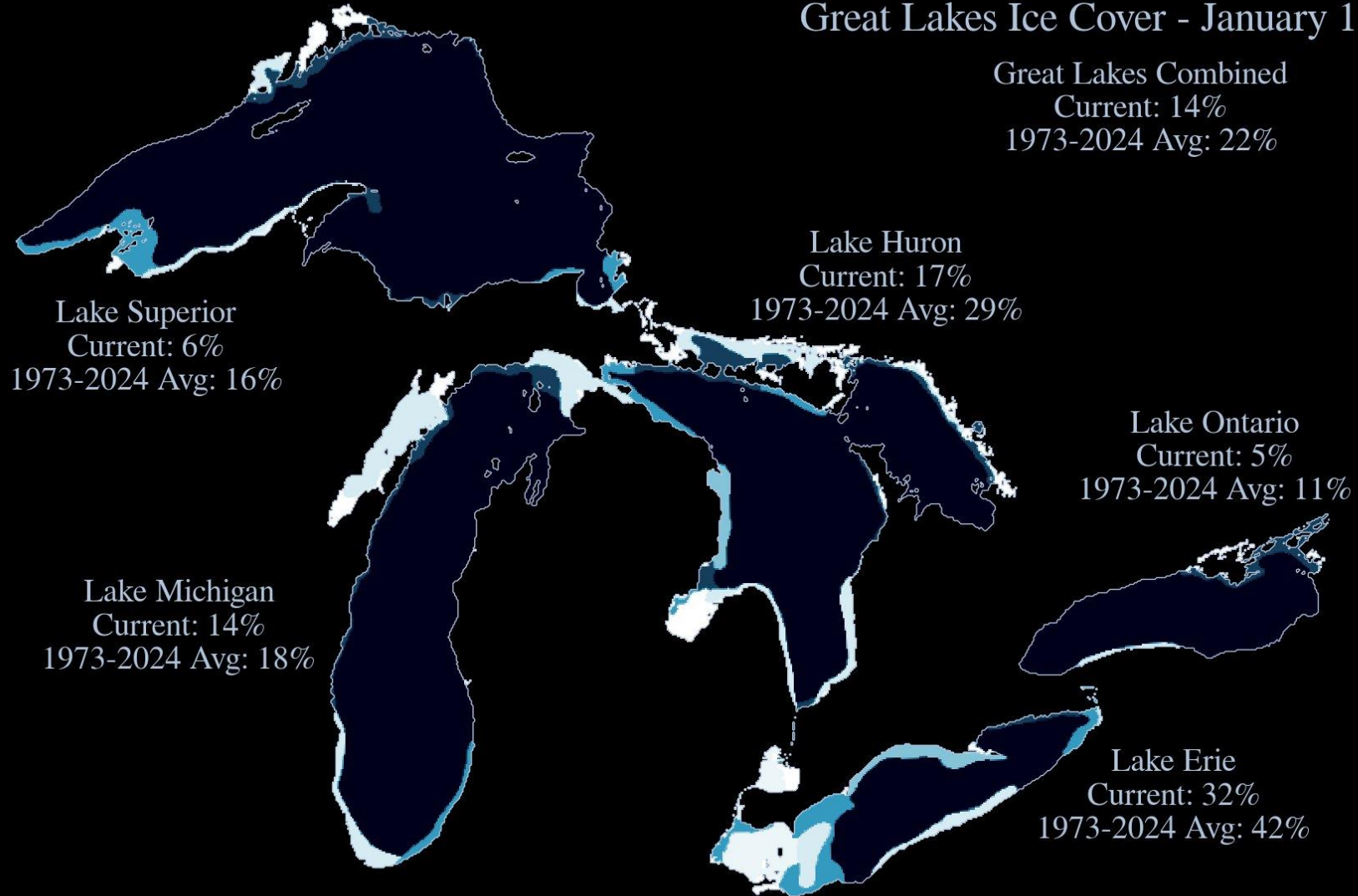
Annual Max Ice Cover Animation 1973-2024



Source:
<https://www.glerl.noaa.gov/>

Great Lakes Ice Cover - January 19, 2025

Great Lakes Combined
Current: 14%
1973-2024 Avg: 22%



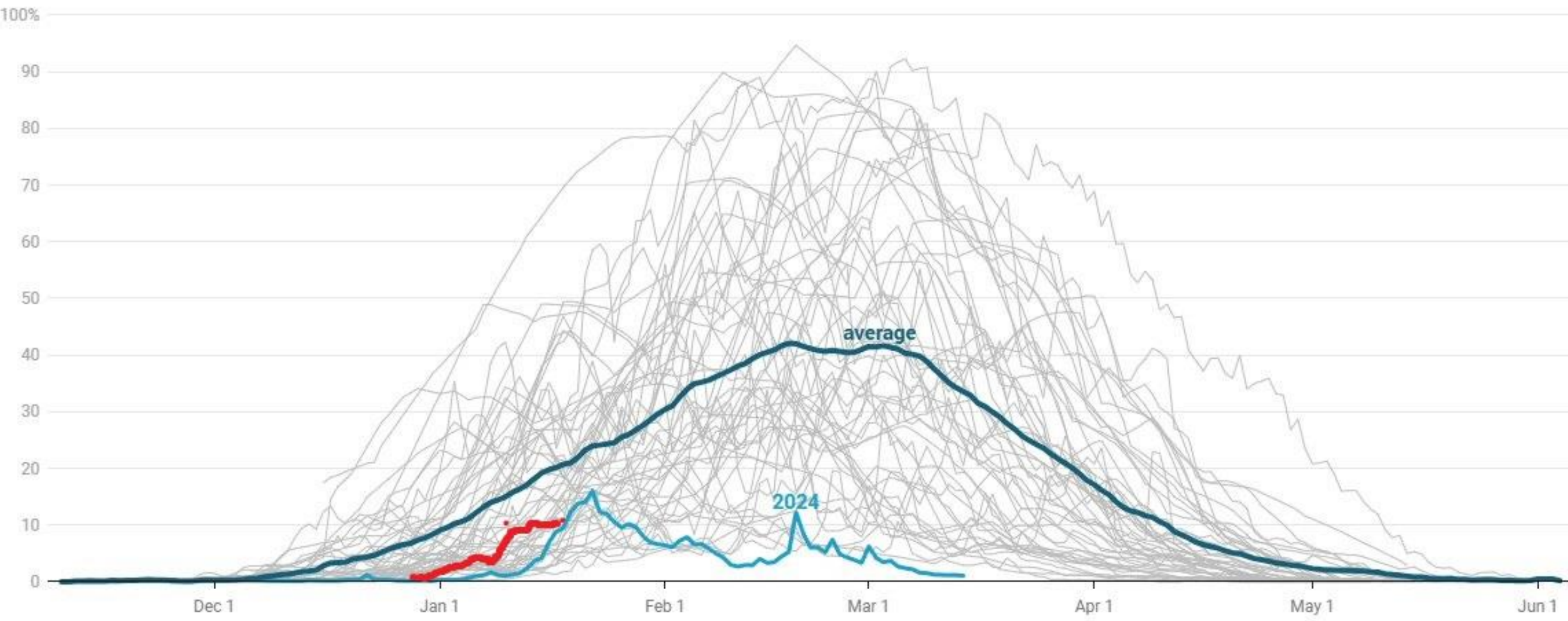
Ice data reprocessed from the NOAA Great Lakes Ice Atlas (1973-2002) and the North American Ice Service Great Lakes Ice Charts (2003-2025)

<https://glicetracker.github.io>

Great Lakes ice coverage for every year since 1973

2023-2024 season through March 14

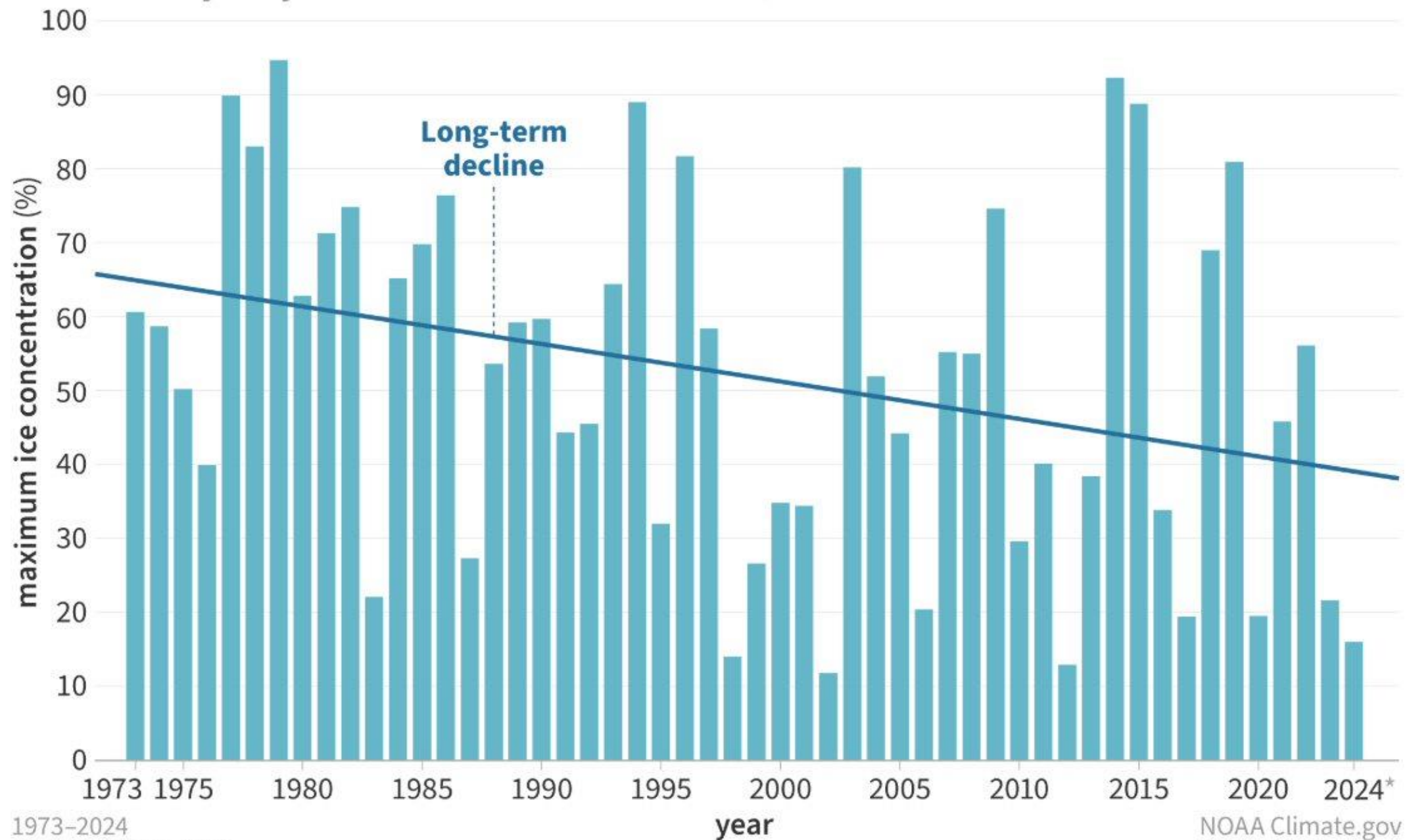
— average — 2024 — 1973 — 1974 — 1975 — 1976 — 1977 — 1978 — 1979 — 1980 — 1981 — 1982 — 1983 — 1984 — 1985 — 1986 — 1987 — 1988 — 1989 — 1990 — 1991 — 1992 — 1993 — 1994 — 1995 — 1996 — 1997 — 1998 — 1999 — 2000 — 2001 — 2002 — 2003 — 2004 — 2005 — 2006 — 2007 — 2008 — 2009 — 2010 — 2011 — 2012 — 2013 — 2014 — 2015 — 2016 — 2017 — 2018 — 2019 — 2020 — 2021 — 2022 — 2023



Last updated March 14, 2024.

Chart: NOAA Climate.gov • Source: GLERL • Embed • Download image • Created with Datawrapper

Great Lakes yearly maximum ice concentration (1973-2024)



1973-2024
as of March 15, 2024

NOAA Climate.gov
Data: GLERL

Warming Great Lakes could lead to stronger snow storms, climate scientists say

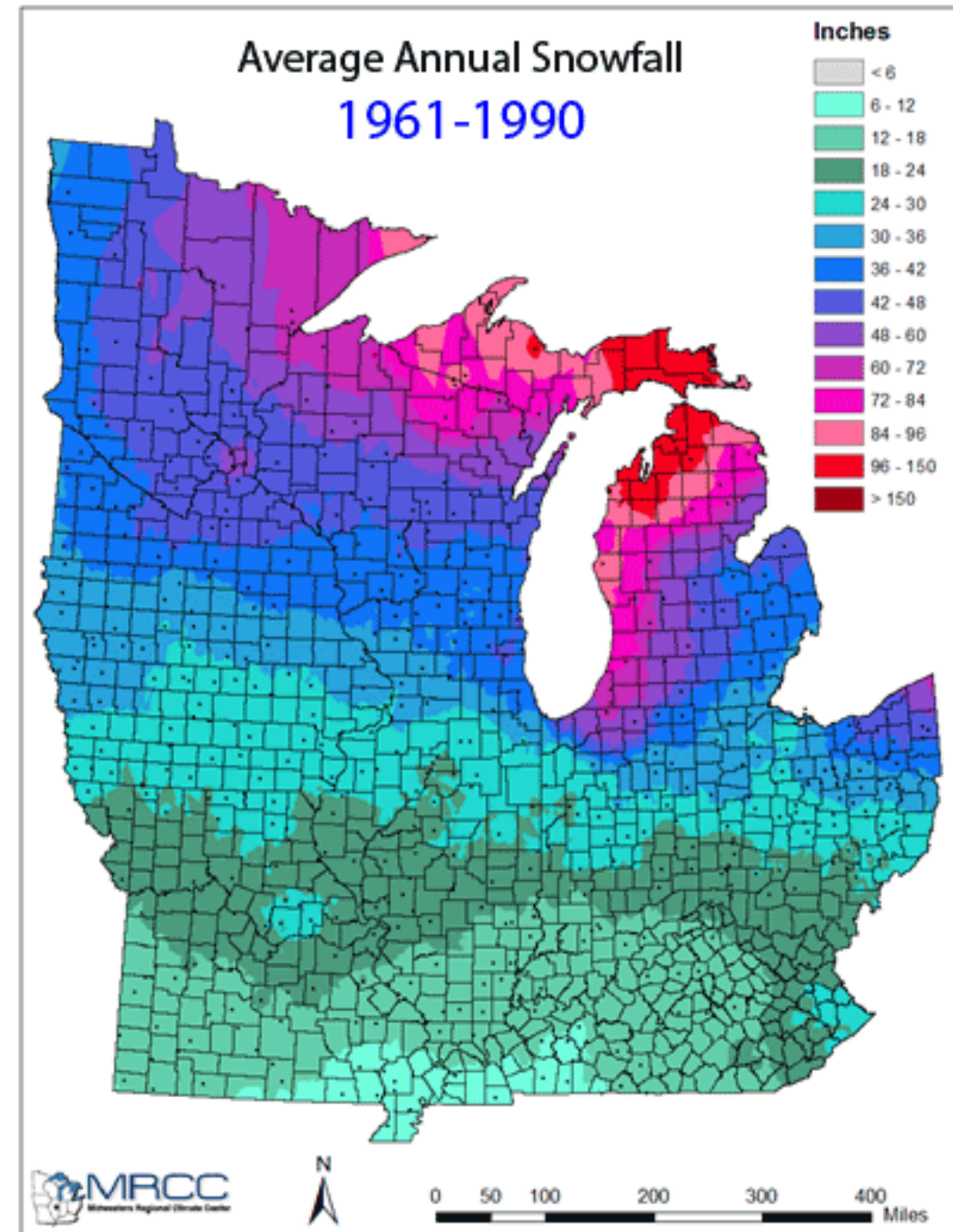
In 2024, 4 of 5 Great Lakes had warmest average surface temperatures in 3 decades

The Canadian Press · Posted: Jan 03, 2025 4:02 PM EST | Last Updated: January 3



Gravenhurst, Ont., was under a state of emergency in early December after intense snow squalls battered parts of the province. (Submitted by Dustin Soares)

Preliminary work indicate that by 2040-2050 lake-effect snow events would decrease significantly near the southern lower lakes Great Lakes because of **fewer below freezing days**. However, it seems likely that lake-effect snow conditions may become more favorable in the near future 2030's -2040's as lake temperatures rise while winter air temperatures remain cold enough to produce snow.



GREAT LAKES SURFACE ENVIRONMENTAL ANALYSIS (GLSEA)



Analysis Date: JD 019 01/19/2024

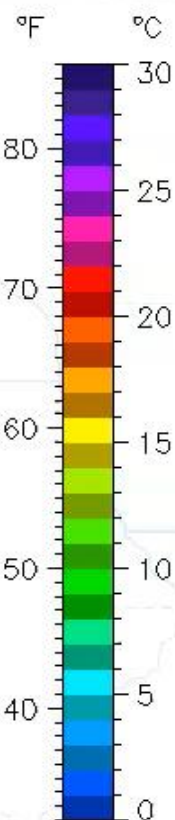
Percent Pixels with Data within +/-10 Days: 89.4%

Date of last ice analysis: 1/19/2024

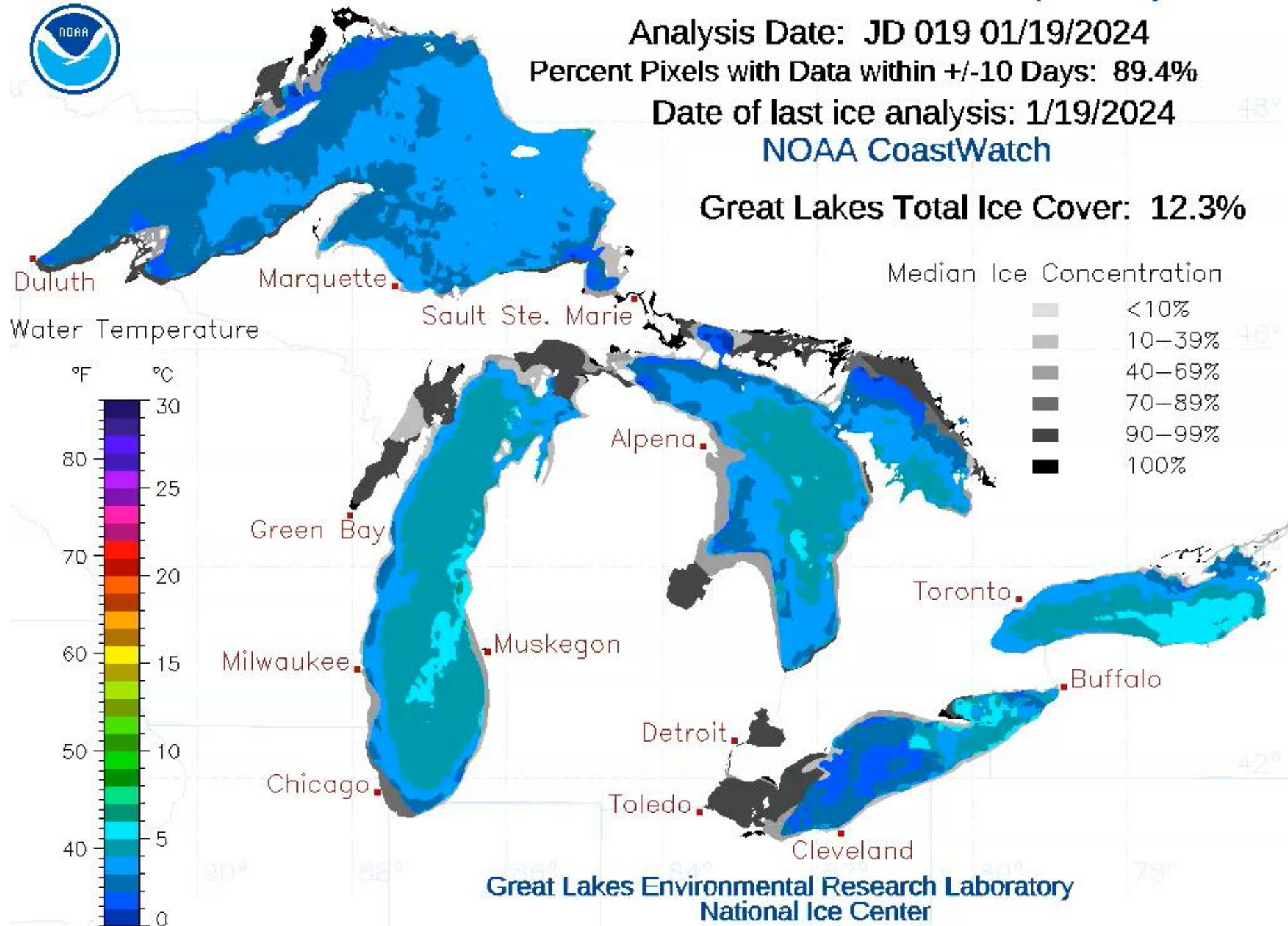
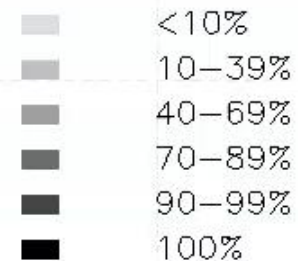
NOAA CoastWatch

Great Lakes Total Ice Cover: 12.3%

Water Temperature



Median Ice Concentration



Great Lakes Environmental Research Laboratory
National Ice Center

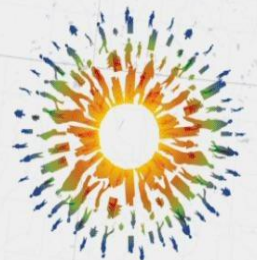
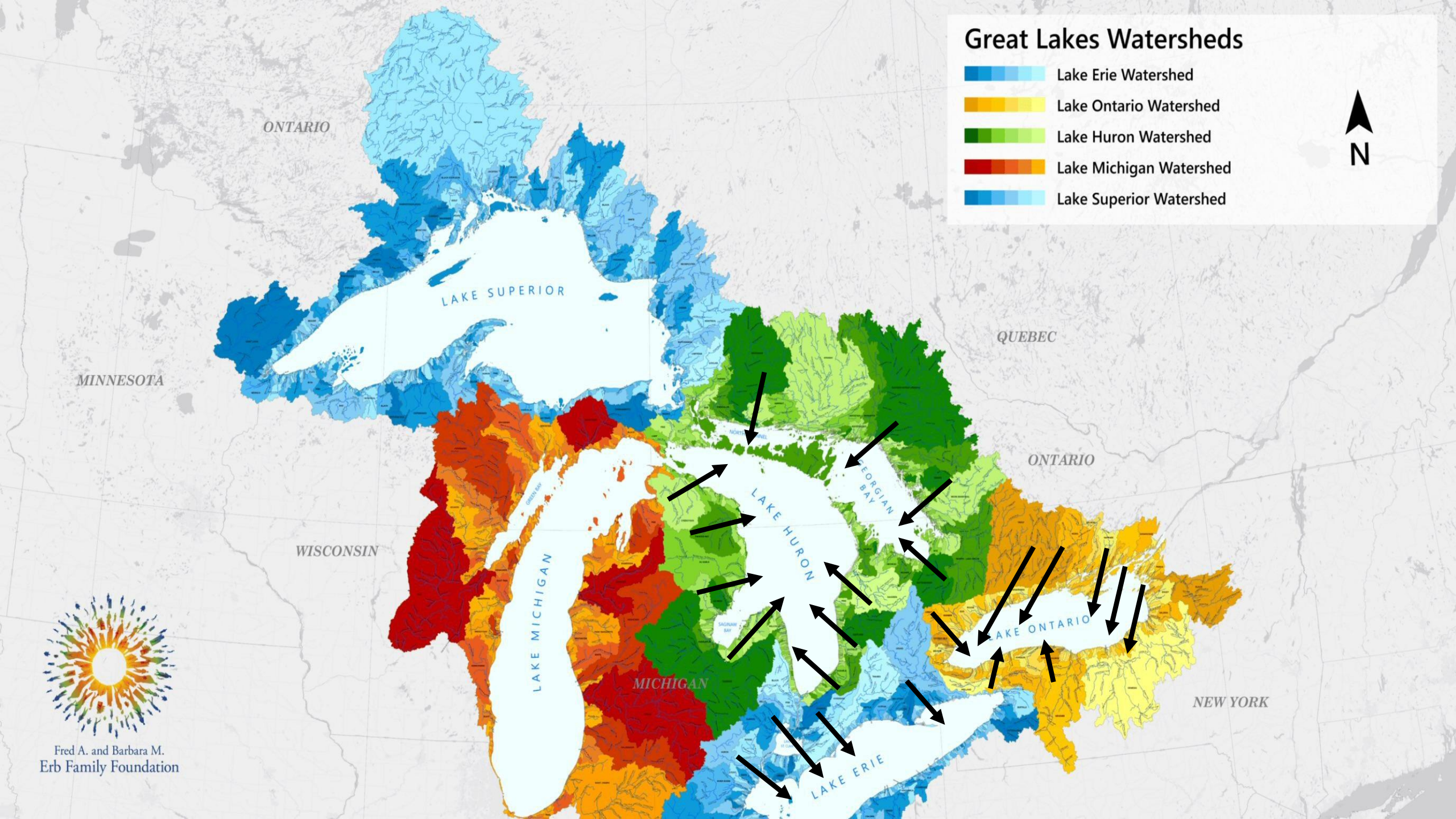
Year-to-date (YTD) average surface temperatures by lake (in degrees Fahrenheit)

January 1 through December 5, 2024

Lake	2024 YTD	YTD long-term average	Difference from average (°F)	Previous or current record (year)
Michigan	53.5*	50.4	3.1	53.1 (2012)
Huron	51.7*	48.8	2.9	51.3 (2012)
Erie	56.5*	53.6	2.9	55.9 (2016)
Ontario	54.7*	51.5	3.2	54.5 (2012)
Superior	47.3	44.3	3.0	47.7 (2012)

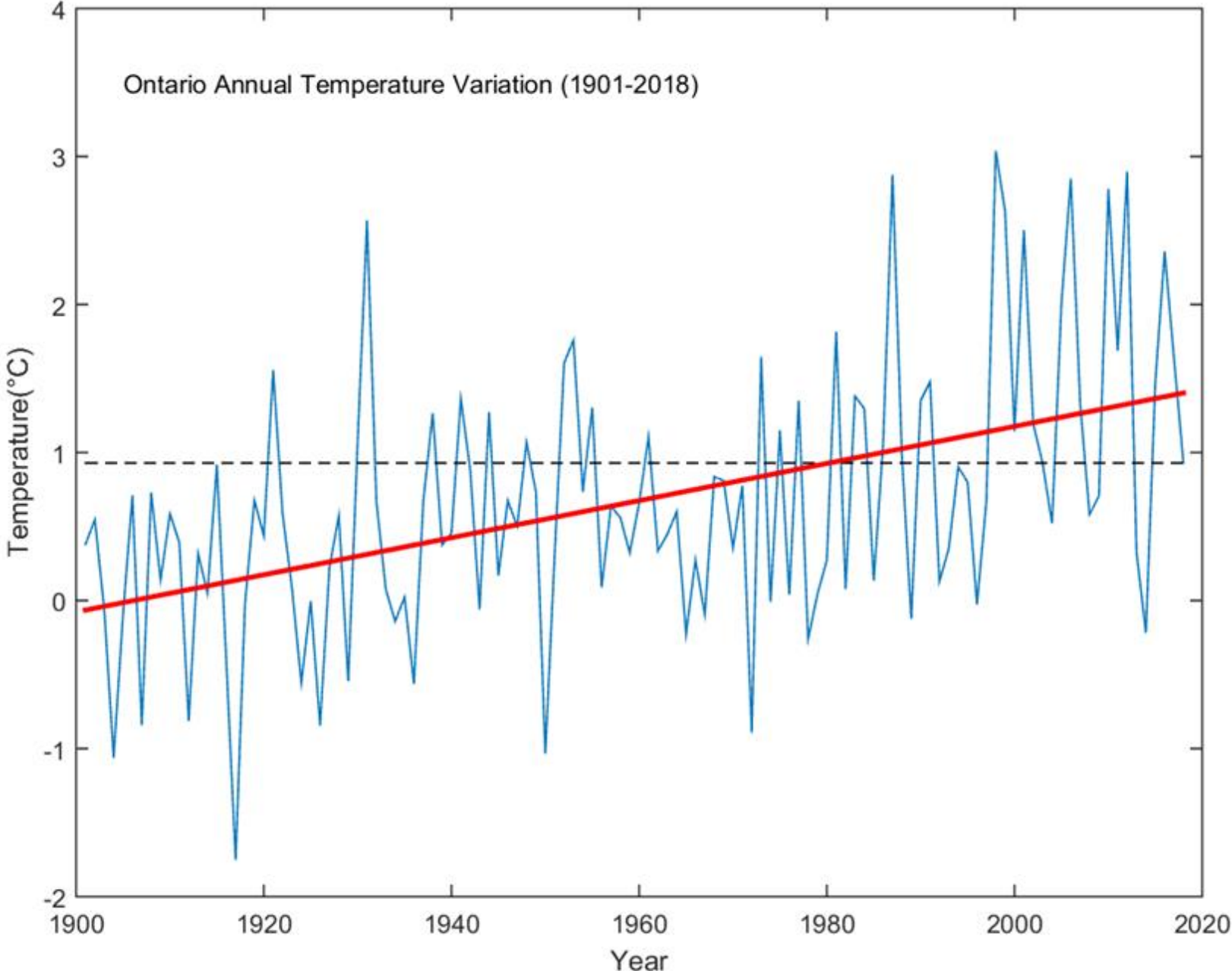
Great Lakes Watersheds

-  Lake Erie Watershed
-  Lake Ontario Watershed
-  Lake Huron Watershed
-  Lake Michigan Watershed
-  Lake Superior Watershed

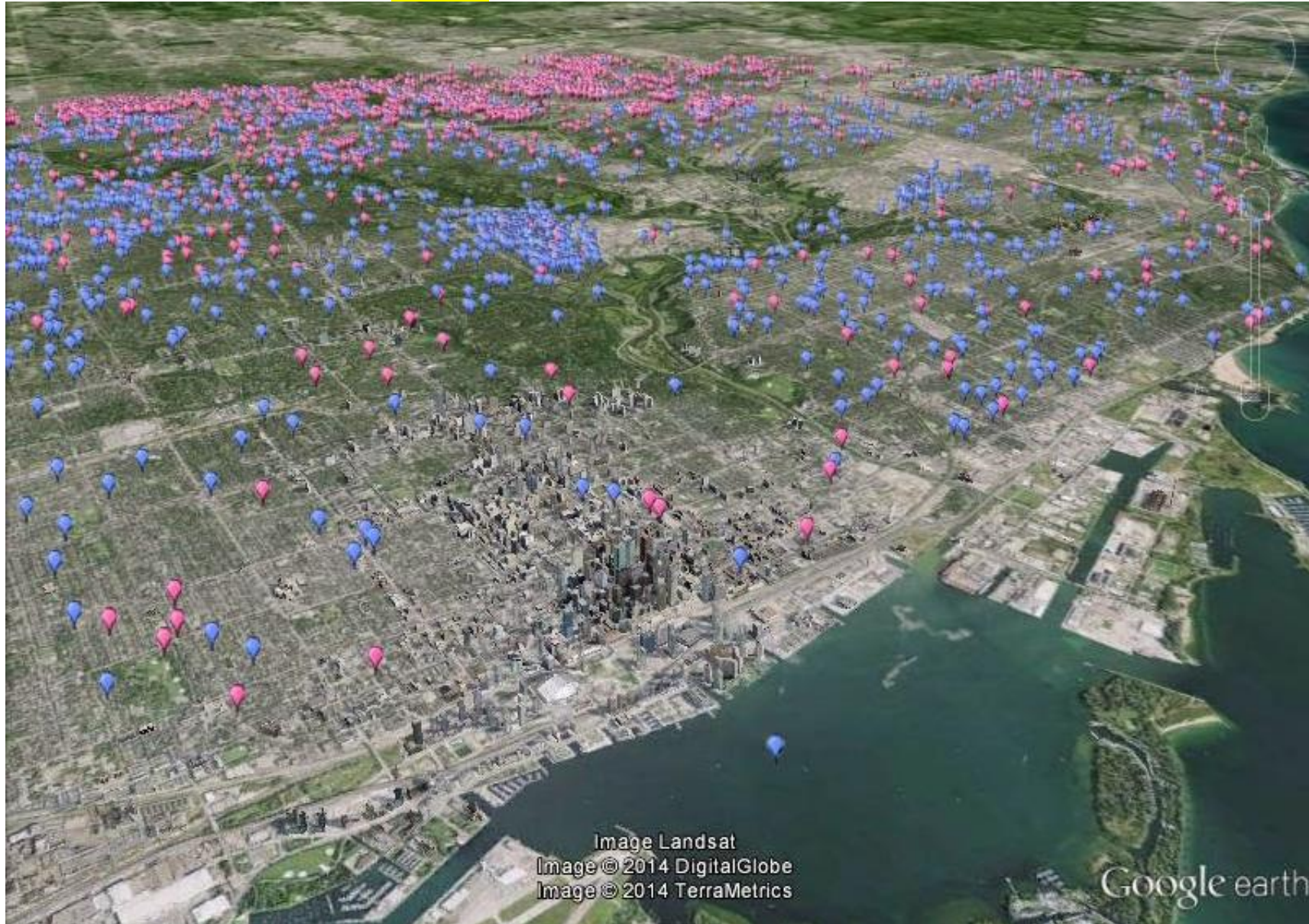


Fred A. and Barbara M.
Erb Family Foundation

From 1901 to 2018 - Ontario's average annual temperature increased by 1.3°C



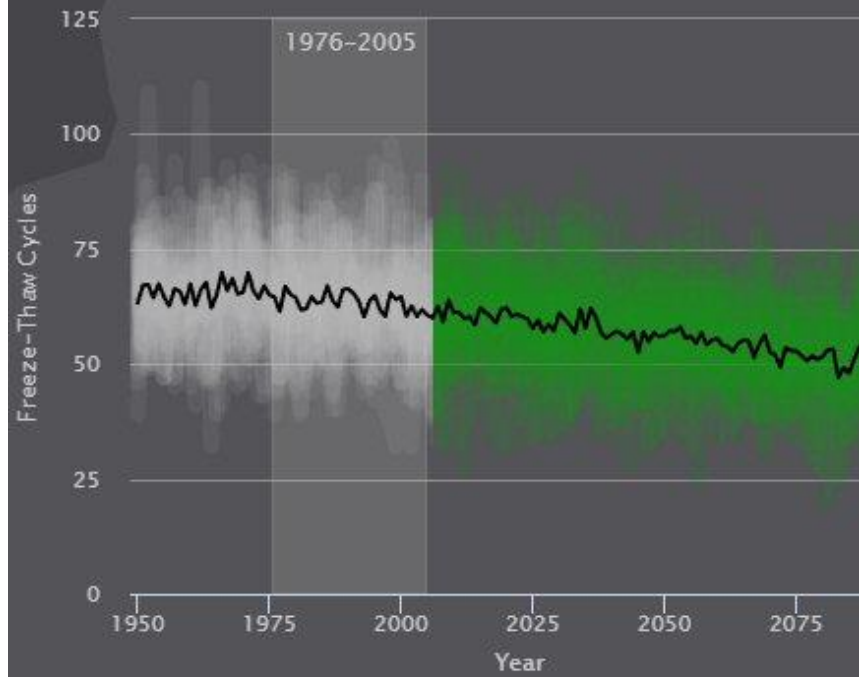
According to the Insurance Bureau of Canada, the Greater Toronto Area has had **SIX** -“100 Year Storms” since 2005.



Municipality
LONDON

Projected change in mean
Freeze-Thaw Cycles
Low Carbon → Less climate change

1976-2005
63.4



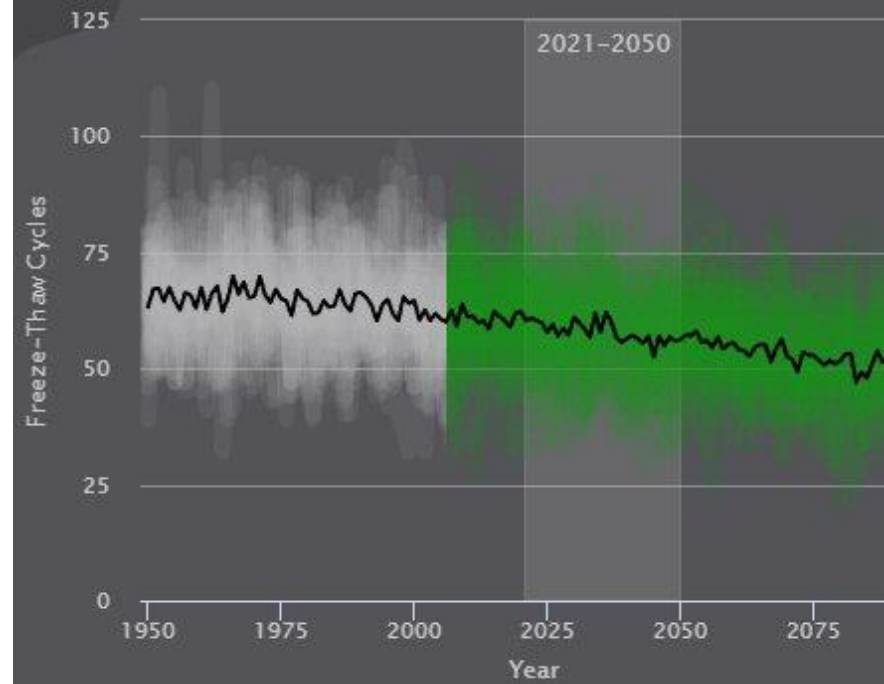
— Ensemble mean — Historical Values
— 1950-2005 — 2006-2095

Municipality
LONDON

Projected change in mean
Freeze-Thaw Cycles
Low Carbon → Less climate change

1976-2005 → 2021-2050
63.4 → 57.9

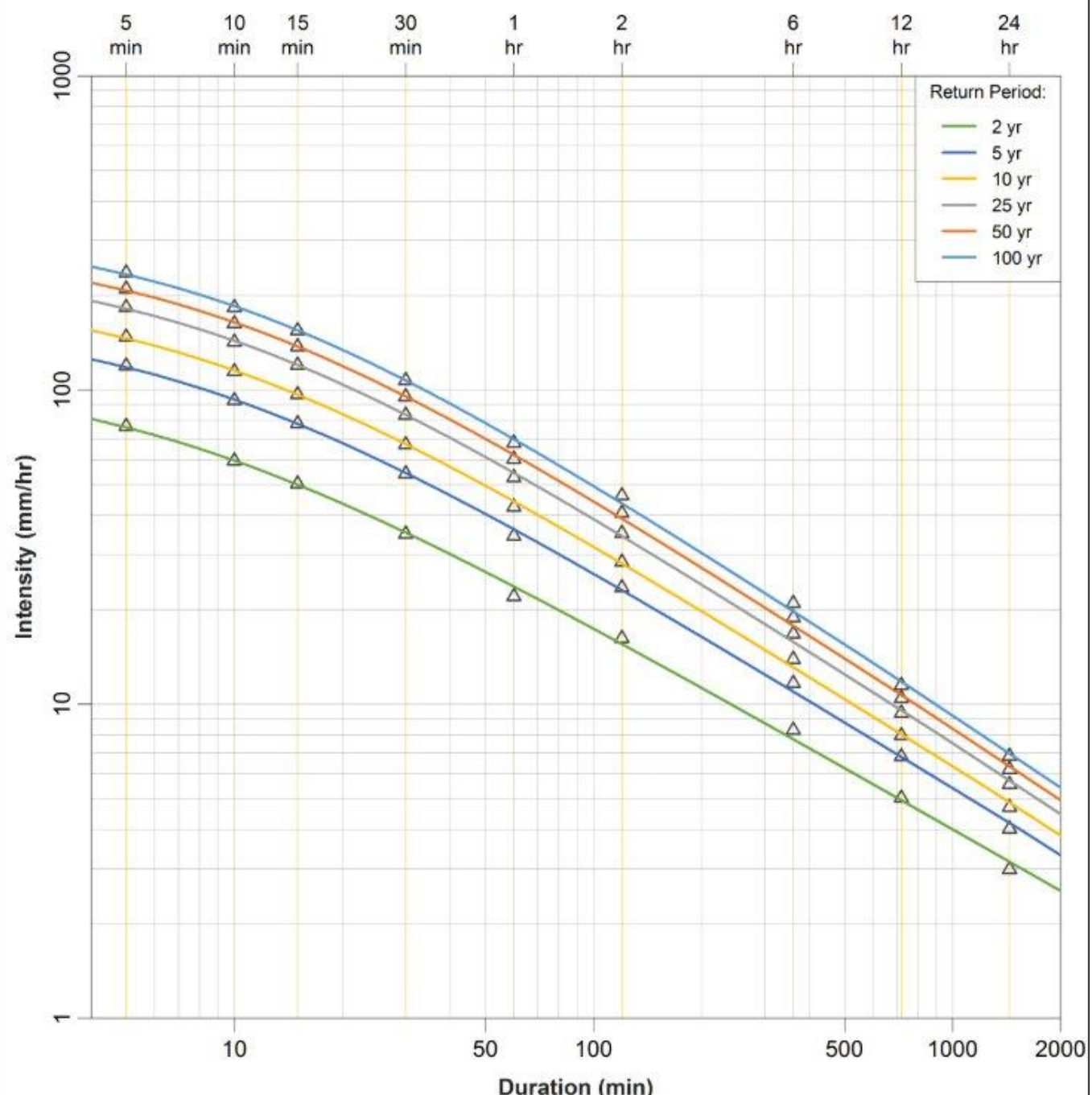
Down ▾
-5.5





Building design for the future

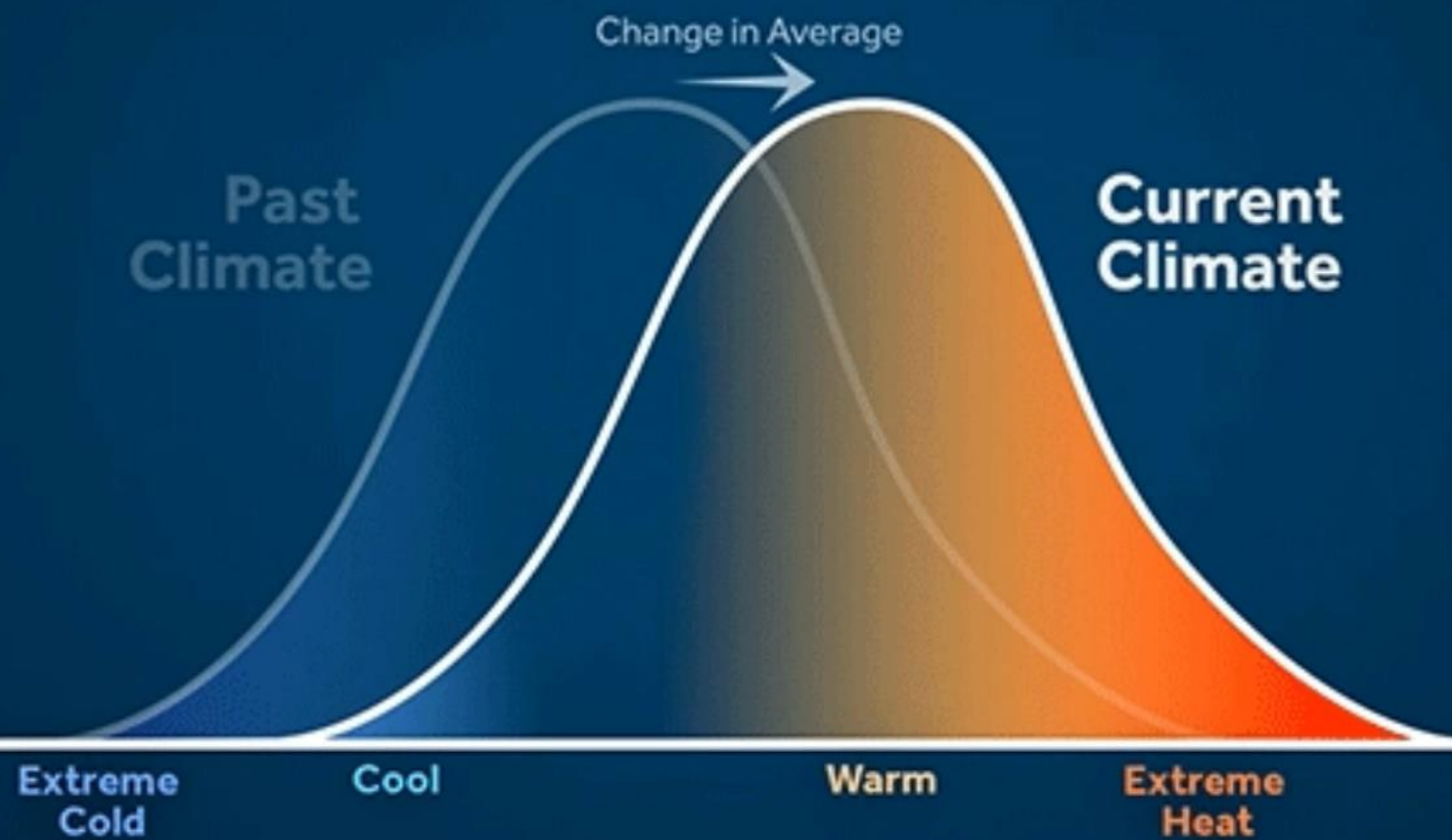
IDF Curves for [43.0685, 278.8143]: 2015-2045, 50%



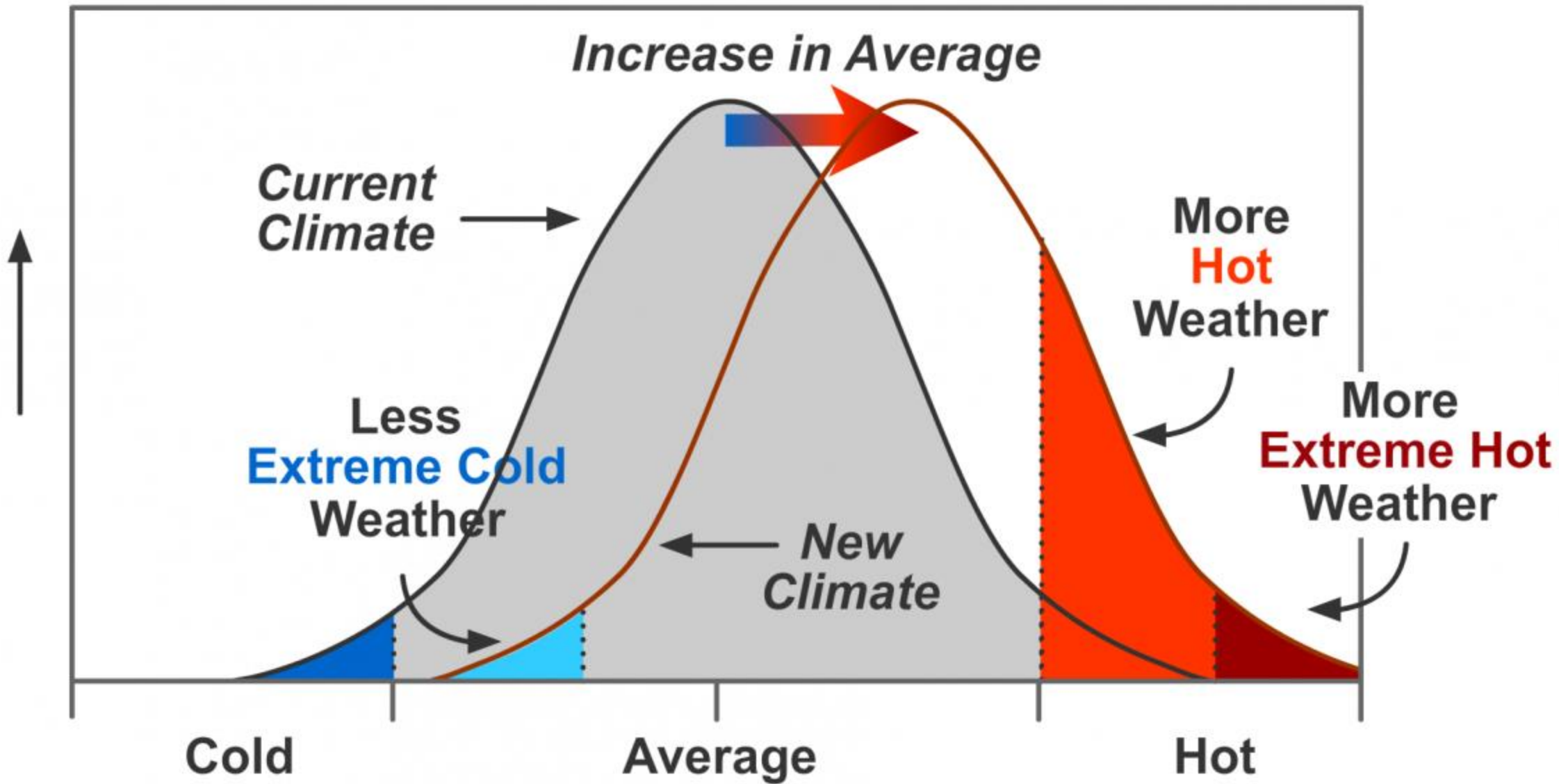
A close-up, blurred image of a speedometer. The needle is pointing towards a red zone on the right side of the scale. The text "Shift in timing of future events" is overlaid in white. The speedometer has markings for "4", "5", and "10000 rpm".

Shift in timing of future events

SMALL CHANGE IN AVERAGE **BIG CHANGE IN EXTREMES**

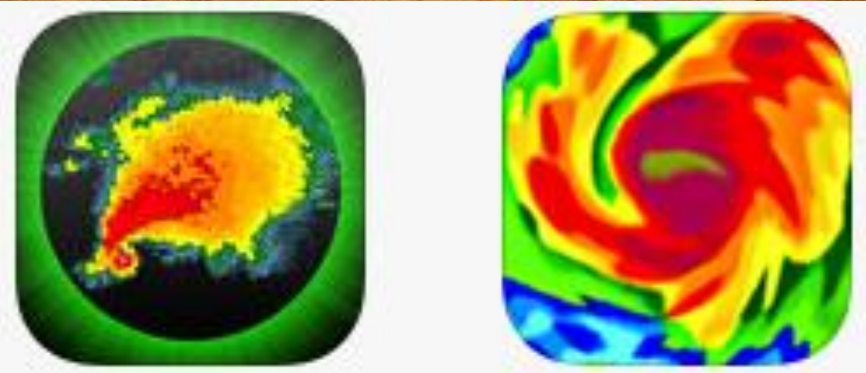


Probability of Occurrence

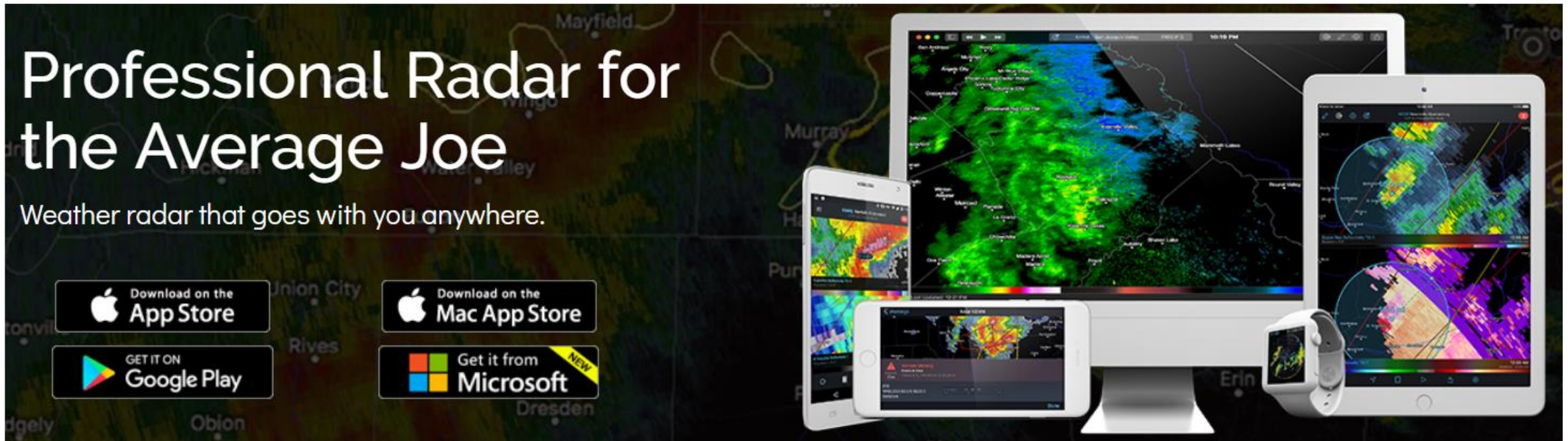




Tools



Met Tools - Radar



Professional Radar for the Average Joe

Weather radar that goes with you anywhere.

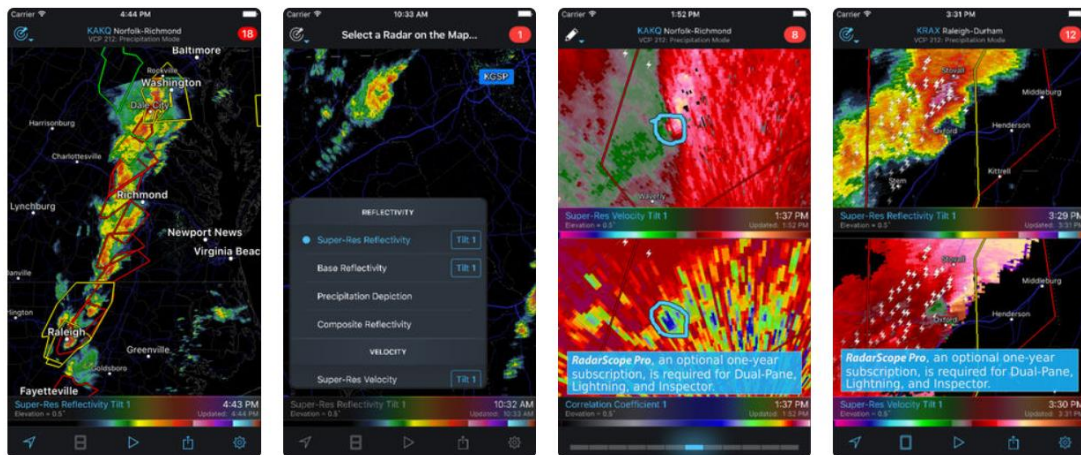
Download on the App Store

Download on the Mac App Store

GET IT ON Google Play

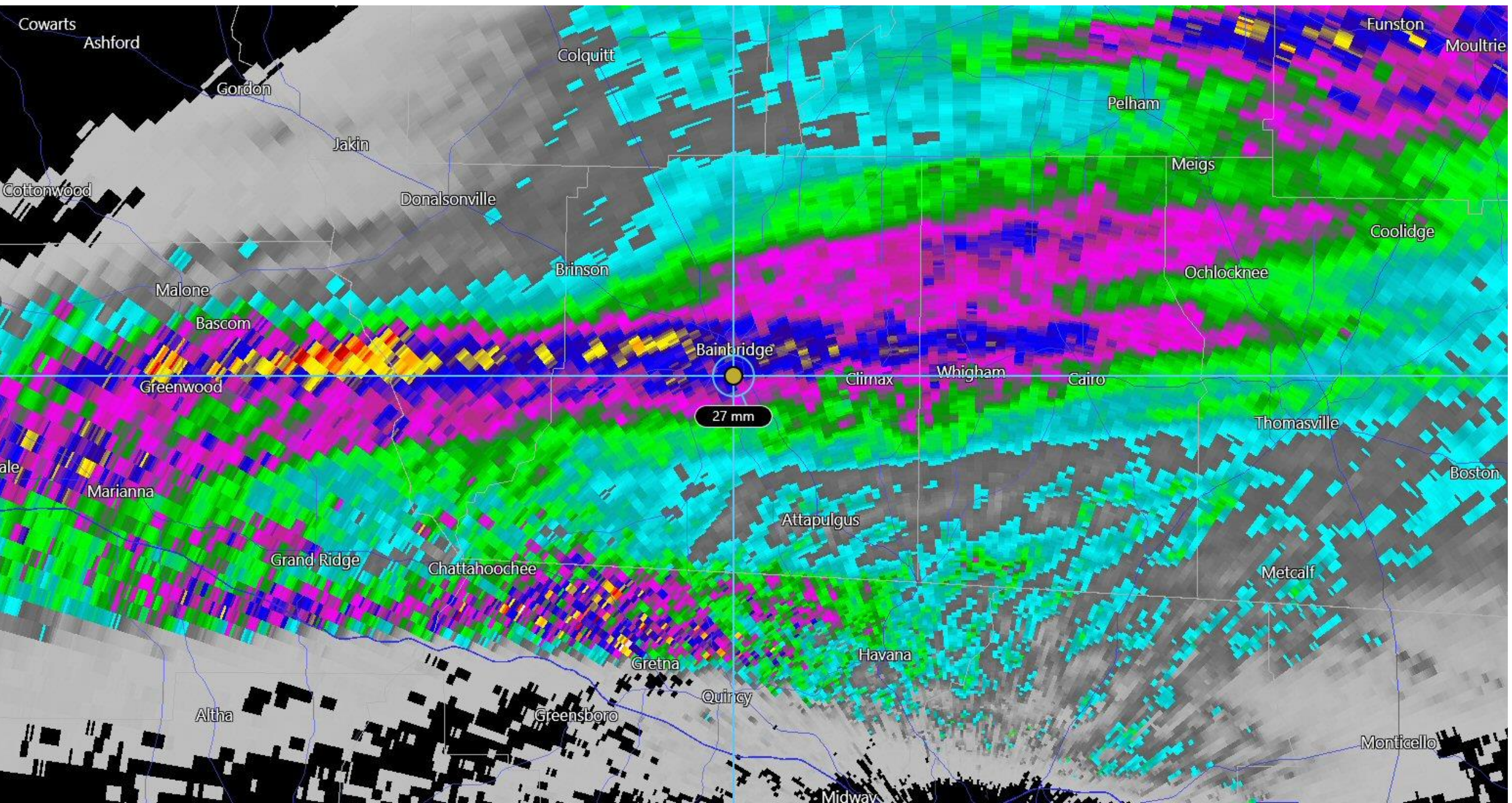
Get it from Microsoft

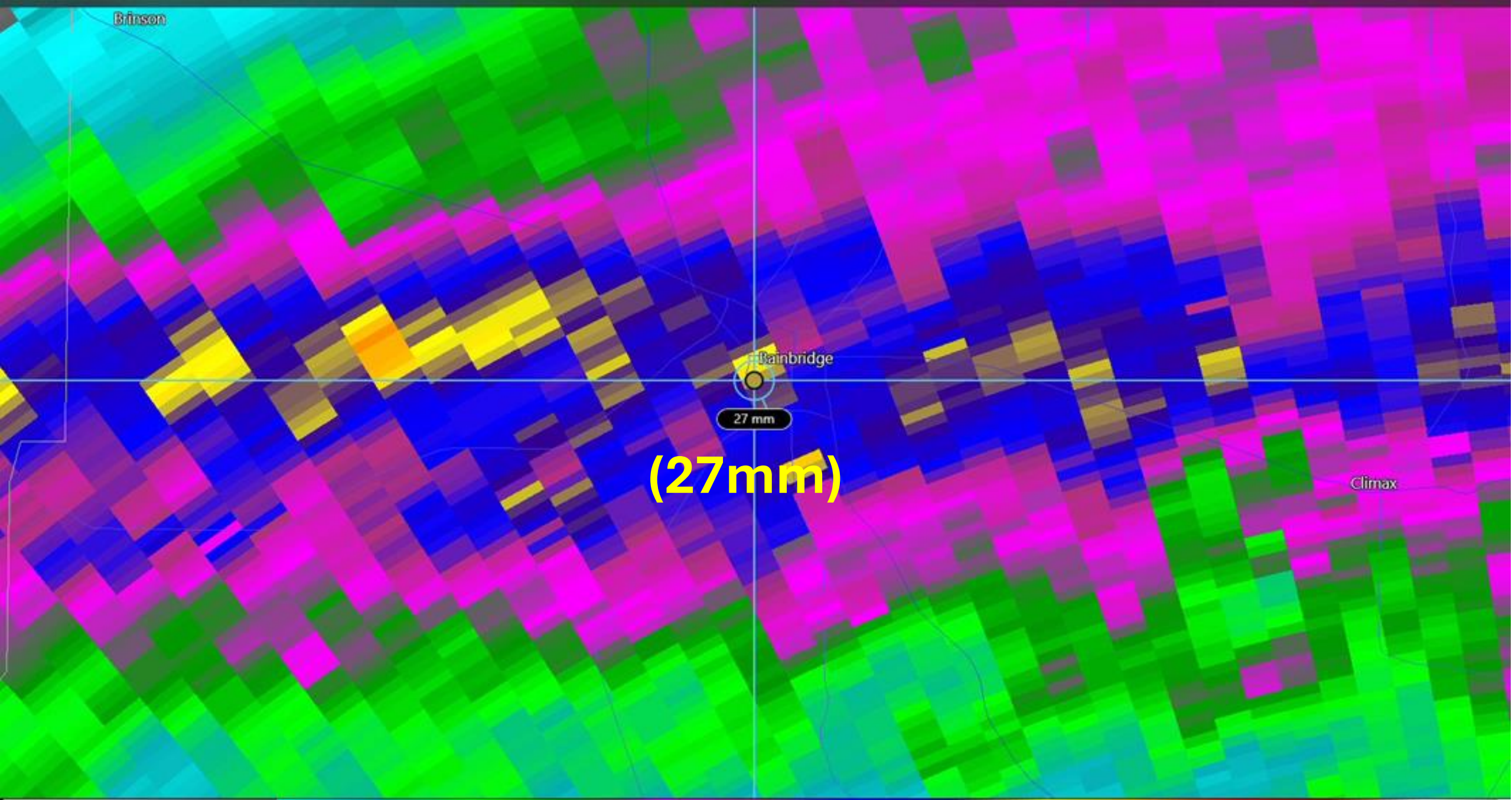
The advertisement features a central desktop monitor displaying a large radar map with green and yellow intensity levels. To the left, a smartphone and a tablet show the same radar interface. To the right, another tablet displays a different radar view with purple and blue colors. A smartwatch is also visible in the foreground. The background is a dark map with various city names like Mayfield, Murray, and Union City.



<https://radarscope.io/>
\$13 US One time







Brinson


Bainbridge

27 mm

(27mm)

Climax

Multi-Radar Multi-Sensor (MRMS) Operational Product Viewer



MRMS

multi-radar multi-sensor

Operational Product Viewer

2025 Jan 21 10:00 UTC

00:	01:	02:	03:	04:	05:
06:	07:	08:	09:	10:	11:
12:	13:	14:	15:	16:	17:
18:	19:	20:	21:	22:	23:

Current Time Auto Update

Product Type

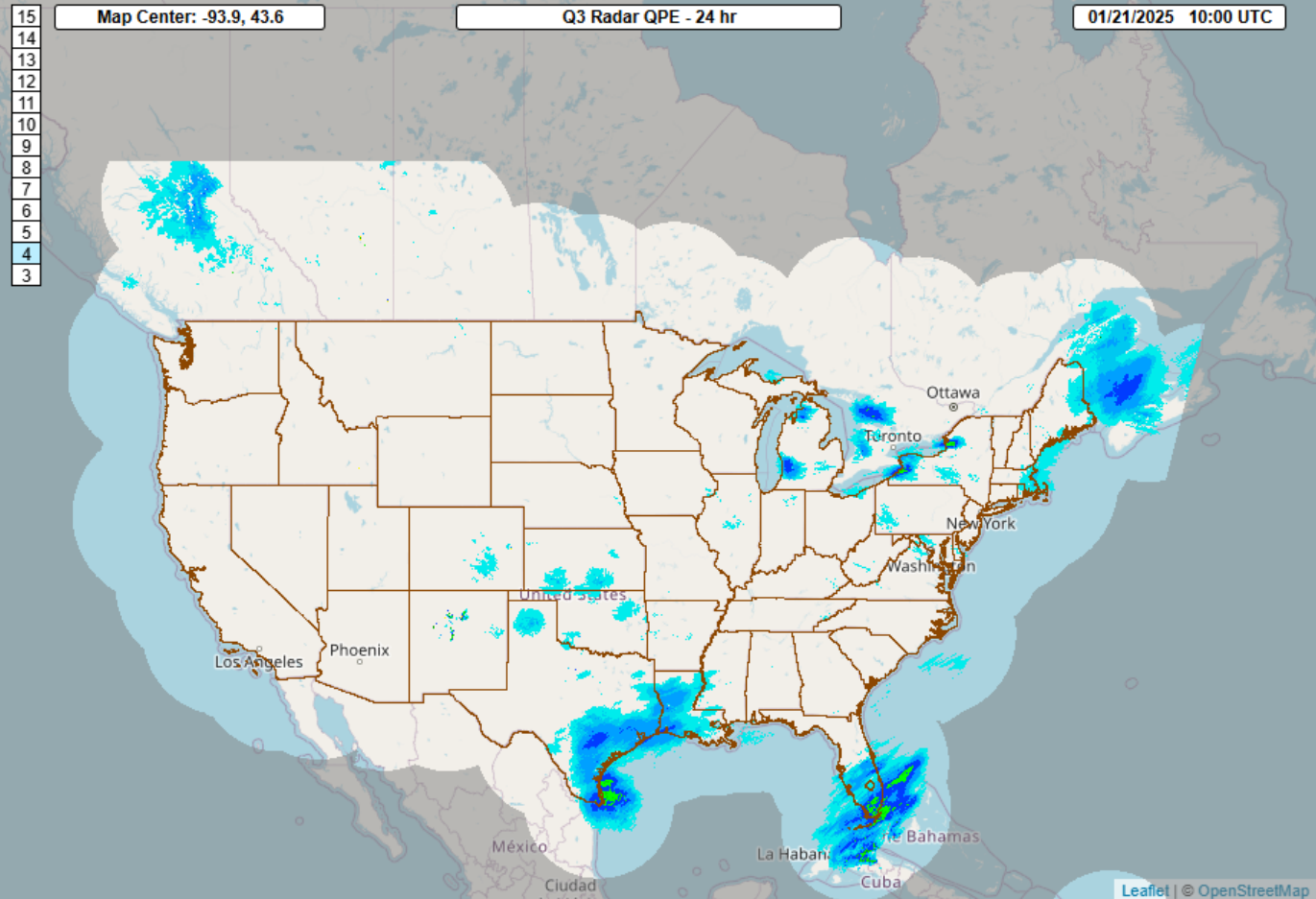
Base Reflectivity
Composite Reflectivity
Seamless Hybrid Scan
Refl At Lowest Altitude
Layer Reflectivity
Echo Top
Layer Thickness
3D Mosaic Levels
ZDR - 3D Mosaic
RhoHV - 3D Mosaic
Radar Quality Index
Rotation
Hail/Lightning
Gauge Influence Index
FLASH
Q3 Radar Only
Q3 Multi-Sensor
Vertically Integrated Water
Precipitation Flag/Bright Band
Model

Rate
15 min
1 hr
3 hr
6 hr
12 hr
24 hr
48 hr
72 hr

Map Center: -93.9, 43.6

Q3 Radar QPE - 24 hr

01/21/2025 10:00 UTC



in

24.0
20.0
18.0
16.0
14.0
12.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.5
2.0
1.5
1.0
0.75
0.50
0.25
0.10
0.05
0.01

Opacity 0% 100%

Rate Scale

QPE Scale

Loop Image

Reset Region

Enable Mouse Wheel

Overlays

Base Map Layer

mPING Legend

Product Readout

Overlay mPING Reports

<https://mrms.nssl.noaa.gov/>



2025 Jan 21 10:42 UTC ◀ 2 min ▶

◀ 4 min

◀ 10 min

◀ 30 min

◀ 1 hr

◀ 6 hr

◀ 1 dy

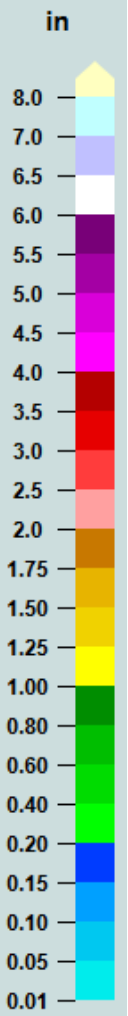
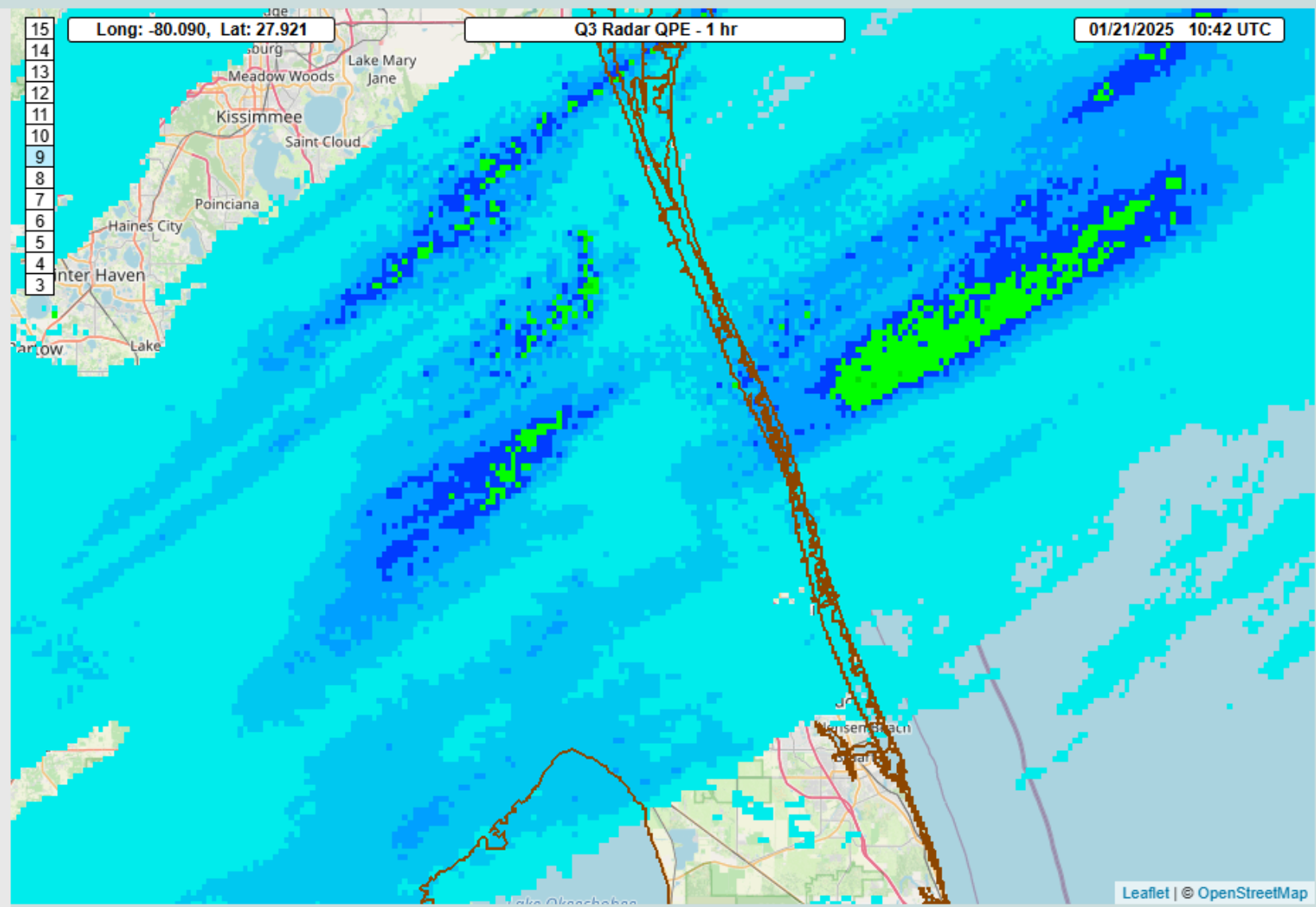
:00	:02	:04	:06	:08	:10
:12	:14	:16	:18	:20	:22
:24	:26	:28	:30	:32	:34
:36	:38	:40	:42	:44	:46
:48	:50	:52	:54	:56	:58

Current Time Auto Update

Product Type

- Base Reflectivity
- Composite Reflectivity
- Seamless Hybrid Scan
- Refl At Lowest Altitude
- Layer Reflectivity
- Echo Top
- Layer Thickness
- 3D Mosaic Levels
- ZDR - 3D Mosaic
- RhoHV - 3D Mosaic
- Radar Quality Index
- Rotation
- Hail/Lightning
- Gauge Influence Index
- FLASH
- Q3 Radar Only**
- Q3 Multi-Sensor
- Vertically Integrated Water
- Precipitation Flag/Bright Band
- Model

- Rate
- 15 min
 - 1 hr**
 - 3 hr
 - 6 hr
 - 12 hr
 - 24 hr
 - 48 hr
 - 72 hr



Opacity 0% 100% [Permalink](#)

Rate Scale

QPE Scale

Loop Image

Enable Mouse Wheel

Product Readout

Overlay mPING Reports ▼

HRRR

RAP

NAM

NAMNST

GEM-RDPS

GEM-GDPS

ECMWF

GFS

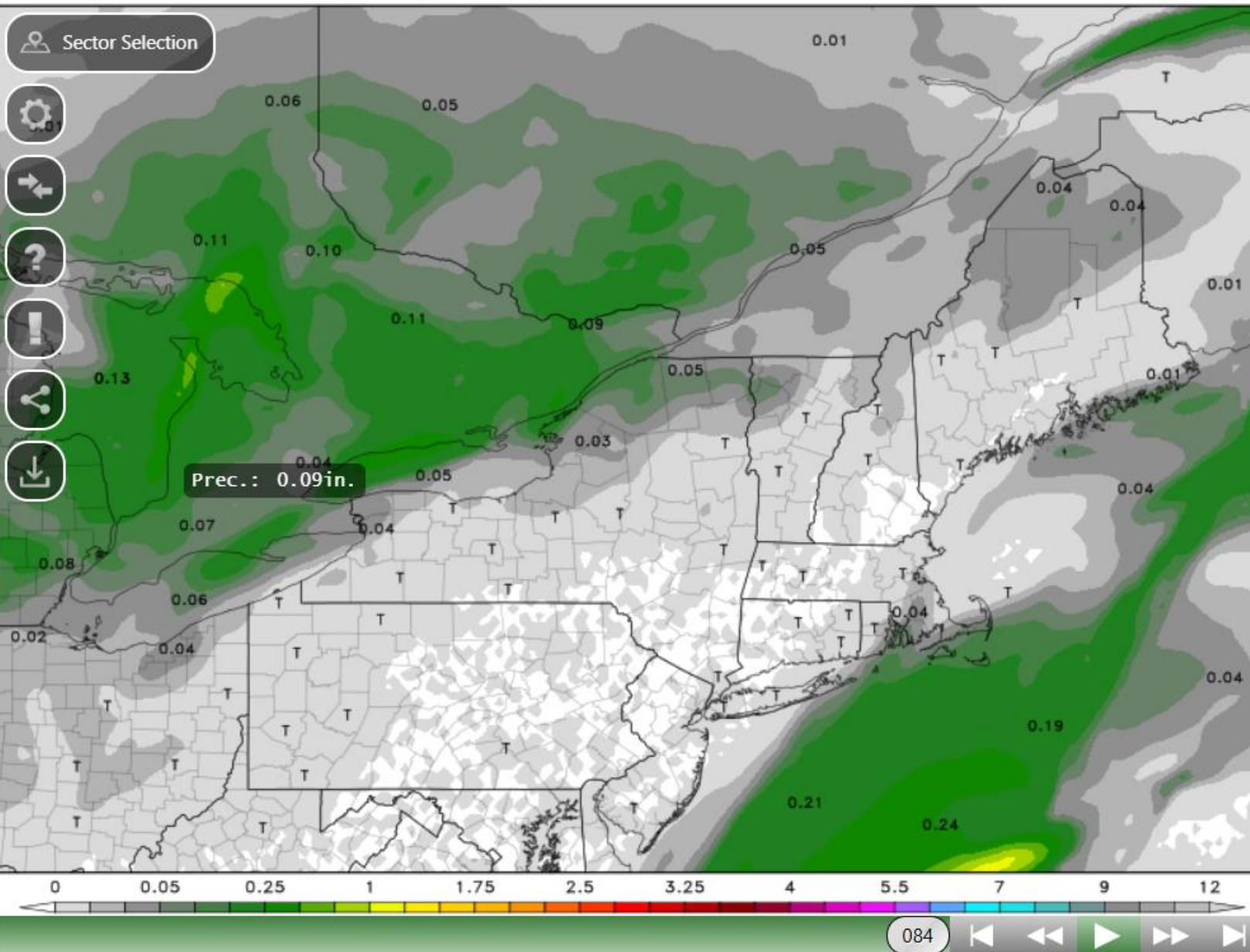
CFSv2

SREF

GEFS

24h Precipitation Accumulation (in.) | College of DuPage NEXLAB

12Z RDPS | F084 Valid: 00Z FRI JAN 24 2025



Forecast sounding data unavailable for this model

Cursor readout data available via mouseover

<https://www.tropicaltidbits.com/>

Numerical Model Prediction

CMC

Global

Ensemble

Hurricane

Mesoscale

Climate

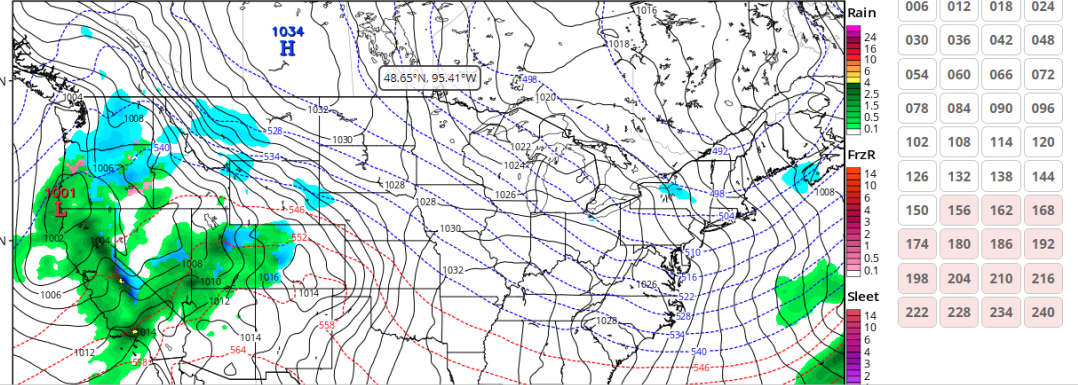
12z Wednesday, Mar 06

GEM 6-hour Averaged Precip Rate (mm/hr), MSLP (hPa), & 1000-500mb Thick (dam)

Init: 12z Mar 06 2019 Forecast Hour: [6] valid at 18z Wed, Mar 06 2019

TROPICALTIDBITS.COM

Forecast Hour: 6



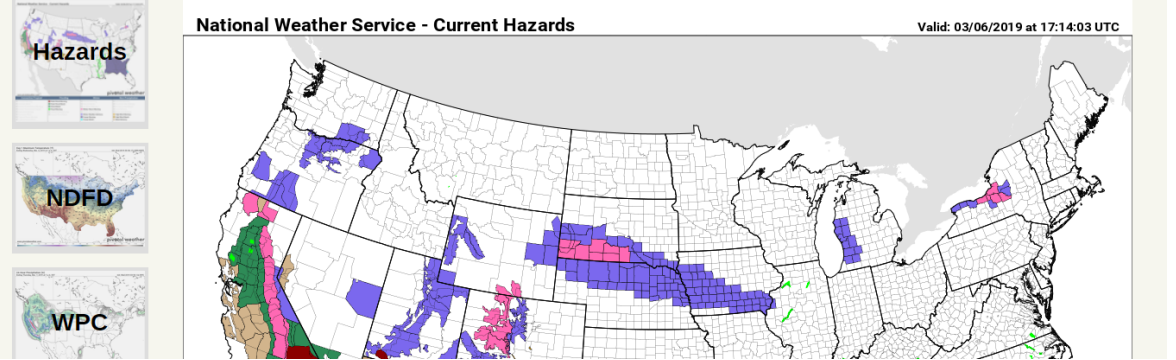
<https://www.pivotalweather.com/>

INTRODUCING CUSTOM MAP SOLUTIONS

BY PIVOTAL WEATHER

Learn More >

Continental US Central US Mid-Atlantic Midwest US North Central US Northeast US Northwest US Ohio Valley South Central US Southeast US Southwest US



College of DuPage Next Generation Weather Lab WPN StormReady

Home Academics Weather Analysis Tools Storm Chasing Program Local Weather FAQs

Analysis Data Satellite and Radar Numerical Models Text Products Links

Conditions: Dewpoint 8°F / 14°F Wind: SW at 6 mph Severe T-Storm Warning Tornado Warning

Students learn to do hand analysis of raw data

College of DuPage Meteorology Program

The College of DuPage experience is nothing like any other meteorology program in the nation. Here, you can begin learning real meteorology right away and have more courses to choose from than anywhere else. Whether you are interested in forecasting, severe weather, or more traditional atmospheric sciences, COD will allow students of all ages a chance to delve into how the atmosphere works from the start of their academic career. Students wishing to obtain a four year degree will be able to transfer to another school as a junior with a wealth of experiences and a top-quality education. Others who wish to learn more about meteorology in relation to other careers will find the weather offerings at COD challenging and fascinating.

College of DuPage Meteorology Program

General Courses Severe Weather Forecasting Climate AMS Club Web Alert

ESAS 1110 Introduction to Meteorology

A first look at various aspects of meteorology, including solar radiation, global circulation, environmental issues, winds, stability, precipitation processes, weather systems, and severe weather. Basic physical principles, meteorological terminology, societal impacts, and weather analysis will be explored.

Notes and Syllabus by Paul Sivratka

ESAS 2110 Intermediate Meteorology

A quantitative first look at the science of meteorology. Physical concepts will be examined using algebraic methods to prepare students for material using higher mathematics. Operational, physical, and dynamical meteorology will be discussed to give students an overall understanding of atmospheric science. Equations of motion, thermodynamics, and the primitive equations will be among the topics

<https://weather.cod.edu/#>

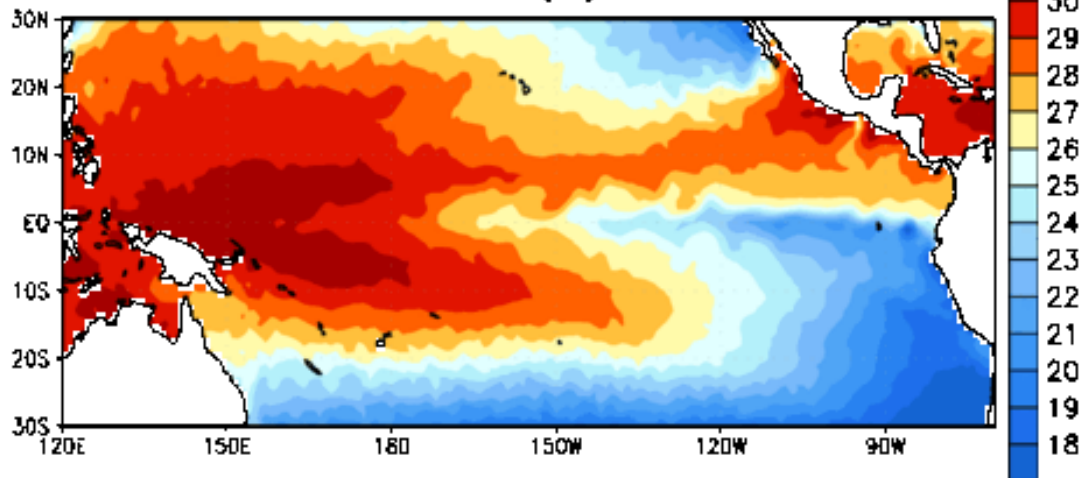
So...Let's take a look at the Rest of the Winter into Spring



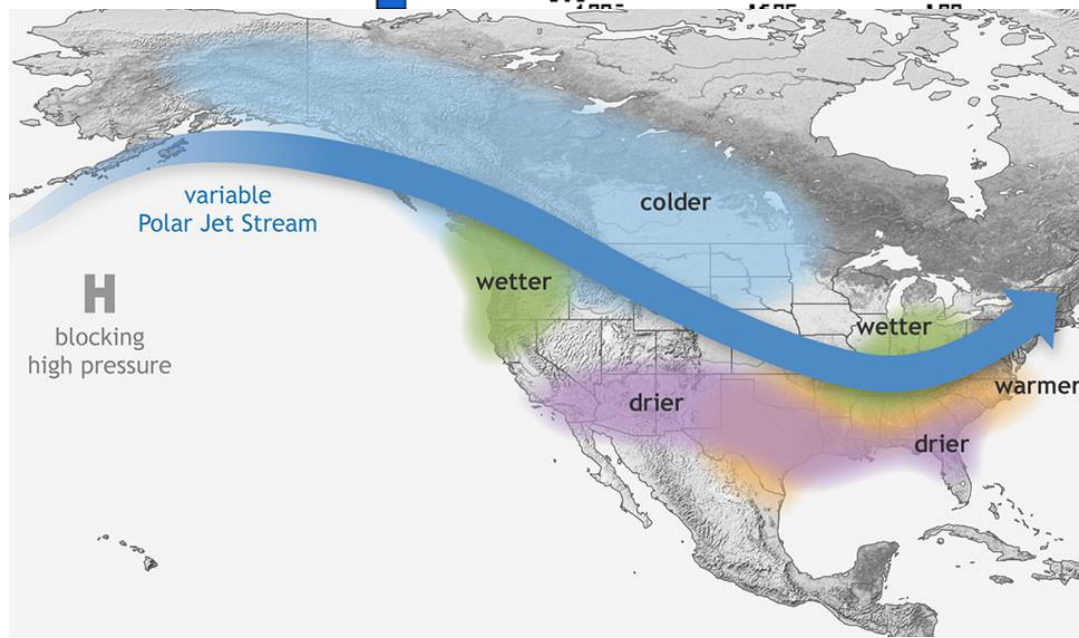
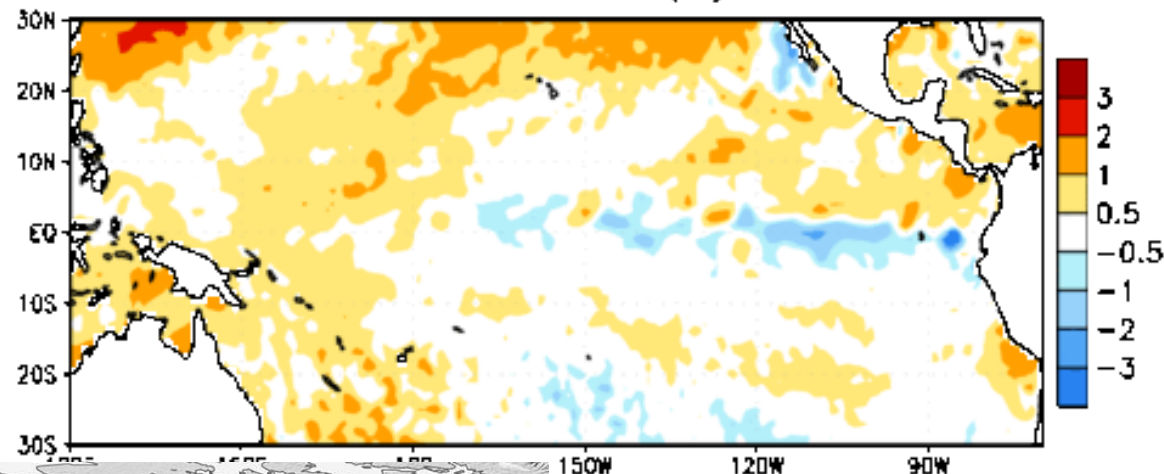
La Niña conditions are present

La Niña conditions are expected to persist through February-April 2025 (59% chance), with a transition to ENSO-neutral likely during March-May 2025 (60% chance).

Week centered on 30 OCT 2024
SST (°C)

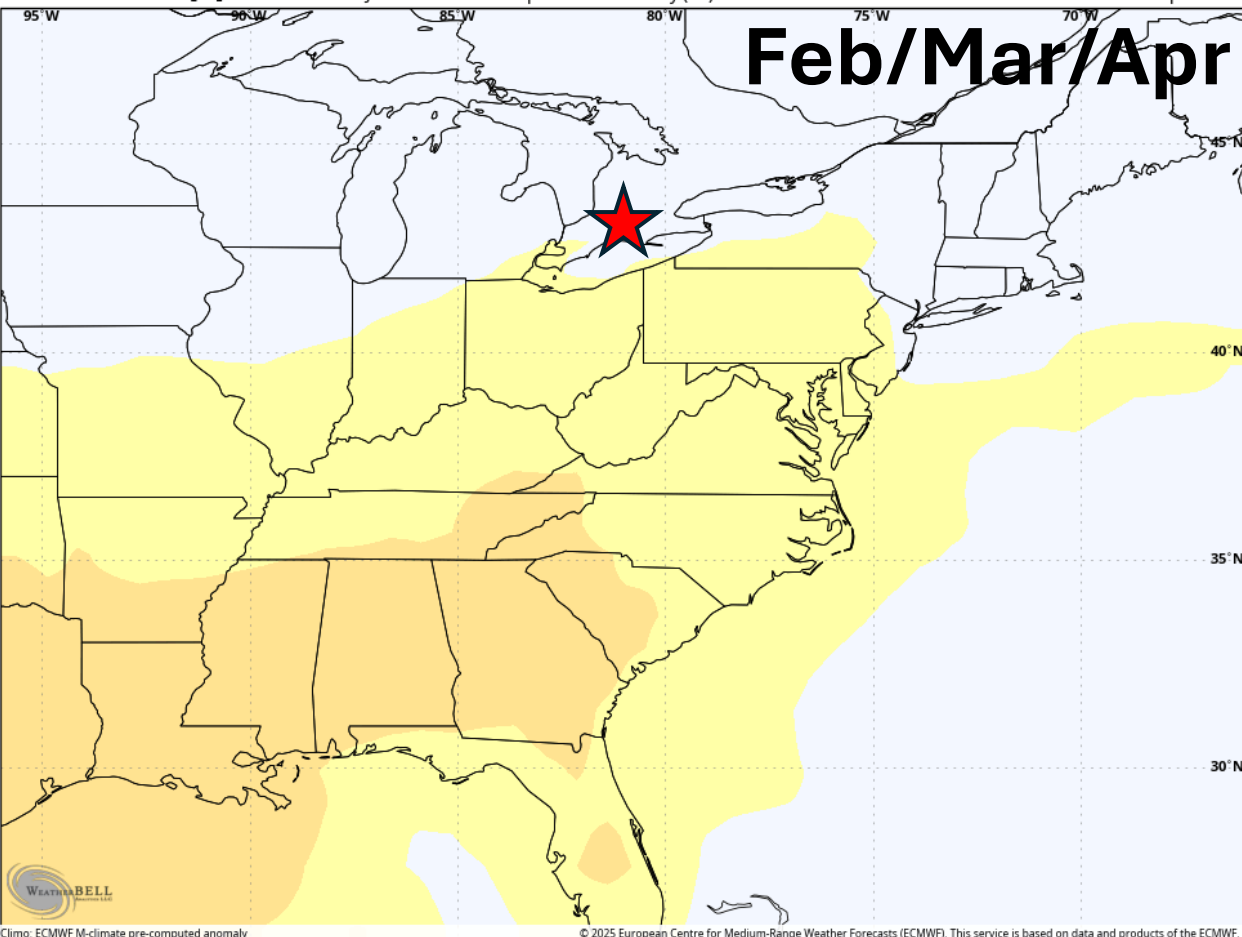


Week centered on 30 OCT 2024
SST Anomalies (°C)



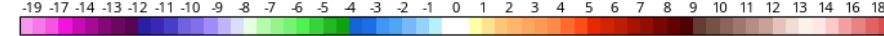
ECMWF Seasonal [M] 0.75° Init 00z 1 Jan 2025 • 2m Temperature Anomaly (°C) Valid: Feb/Mar/Apr 2025

Feb/Mar/Apr



Climo: ECMWF M-climate pre-computed anomaly © 2025 European Centre for Medium-Range Weather Forecasts (ECMWF). This service is based on data and products of the ECMWF.

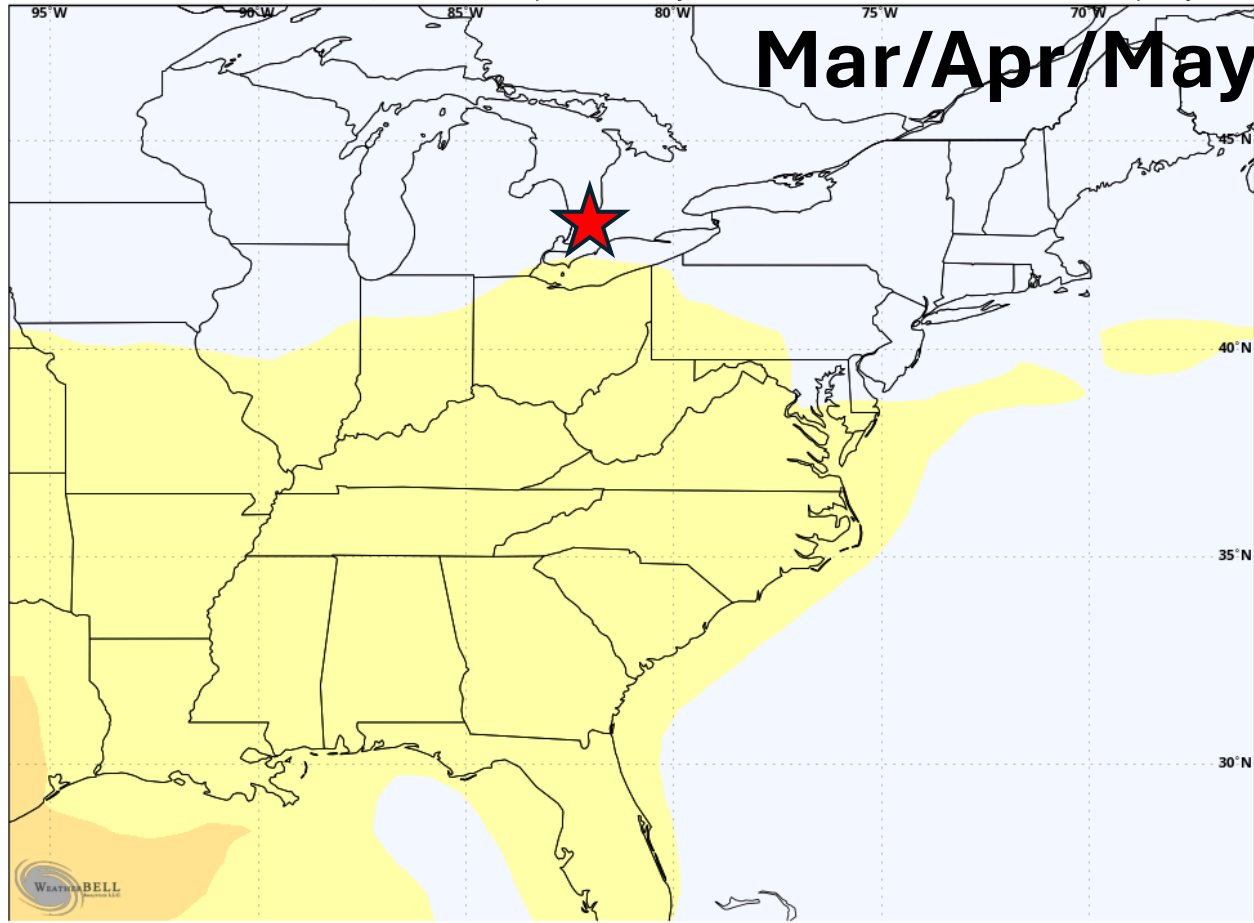
Max: 1.5 • Min: -0.2



EURO Temperatures

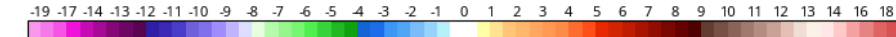
ECMWF Seasonal [M] 0.75° Init 00z 1 Jan 2025 • 2m Temperature Anomaly (°C) Valid: Mar/Apr/May 2025

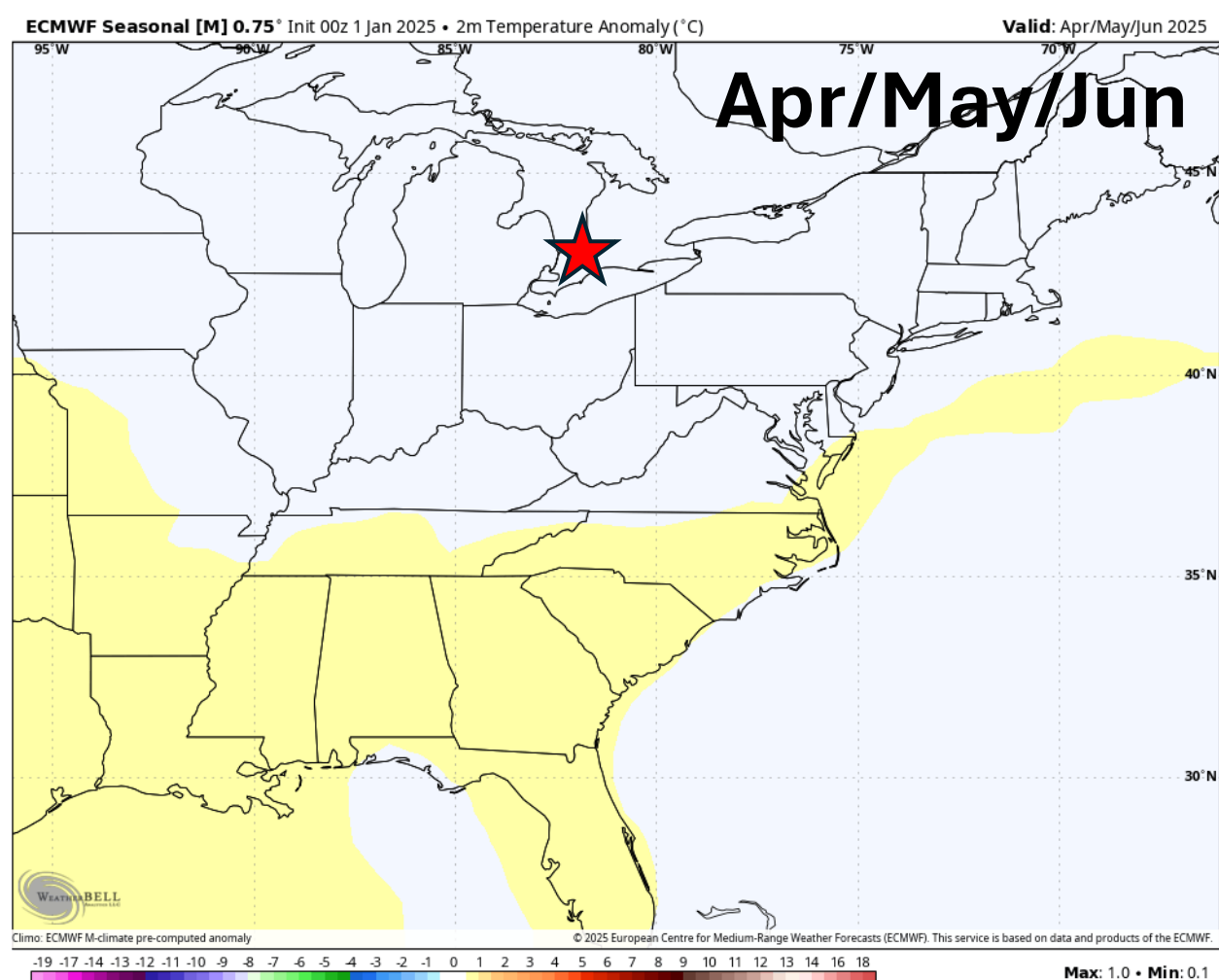
Mar/Apr/May



Climo: ECMWF M-climate pre-computed anomaly © 2025 European Centre for Medium-Range Weather Forecasts (ECMWF). This service is based on data and products of the ECMWF.

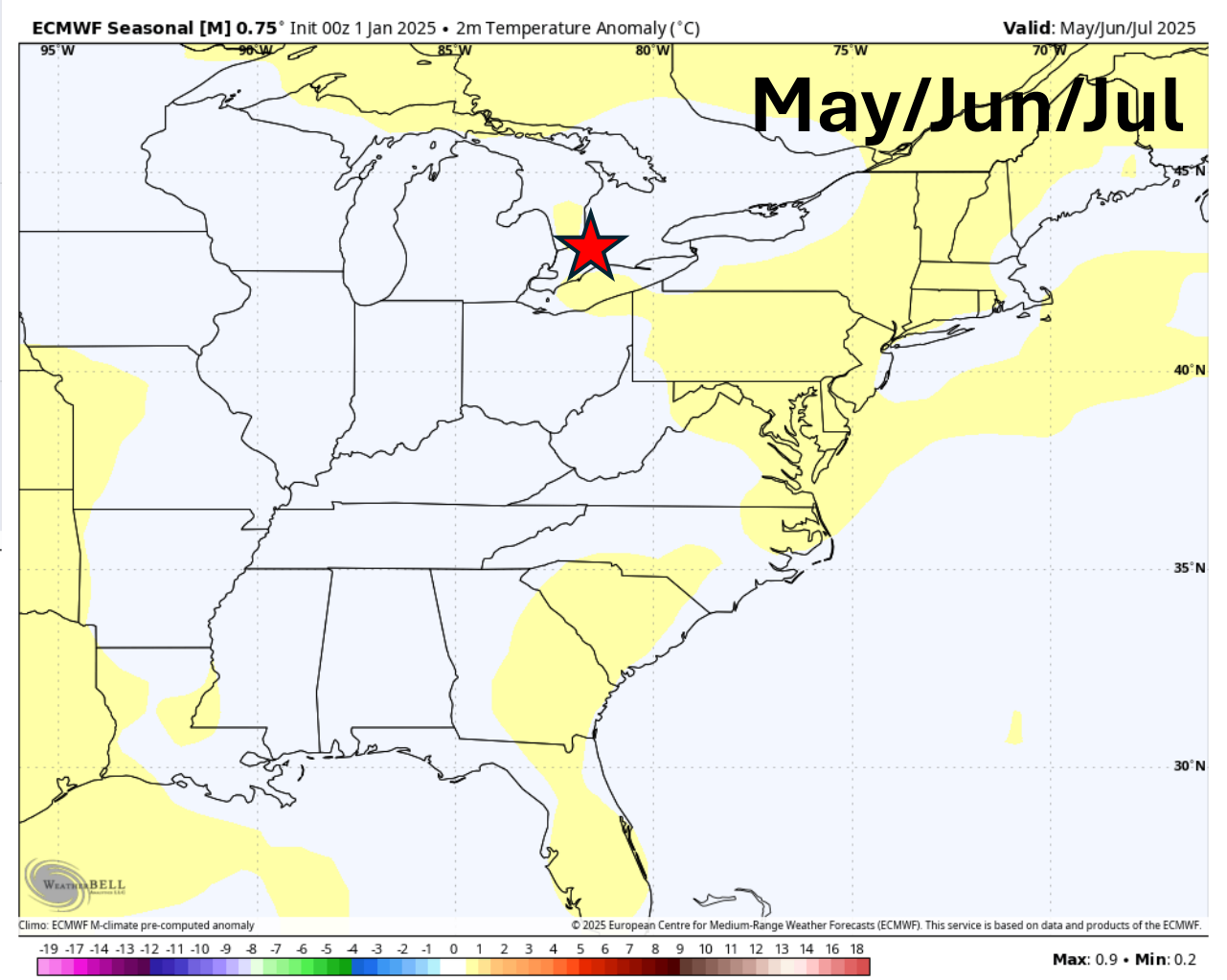
Max: 1.2 • Min: -0.1

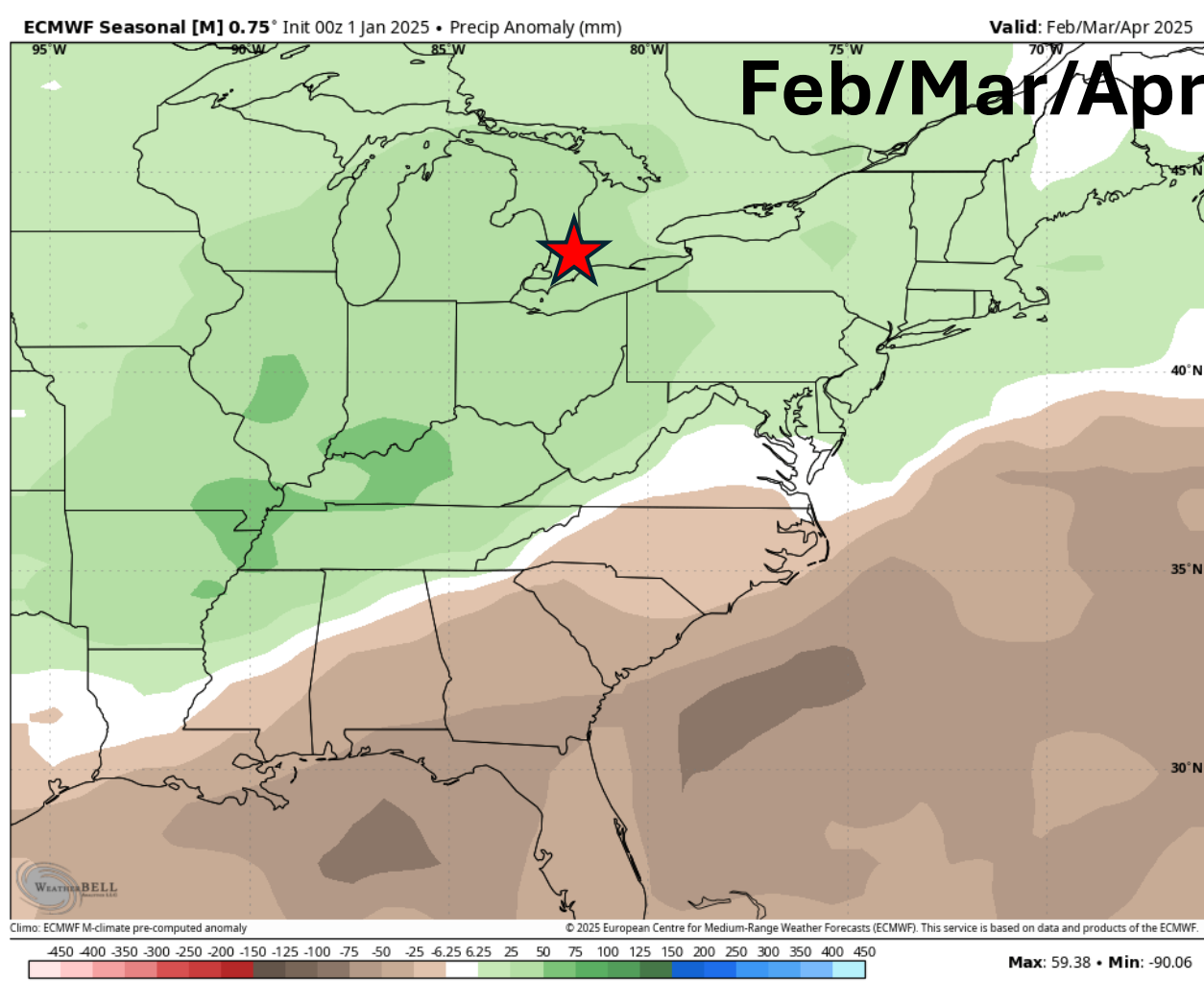




EURO

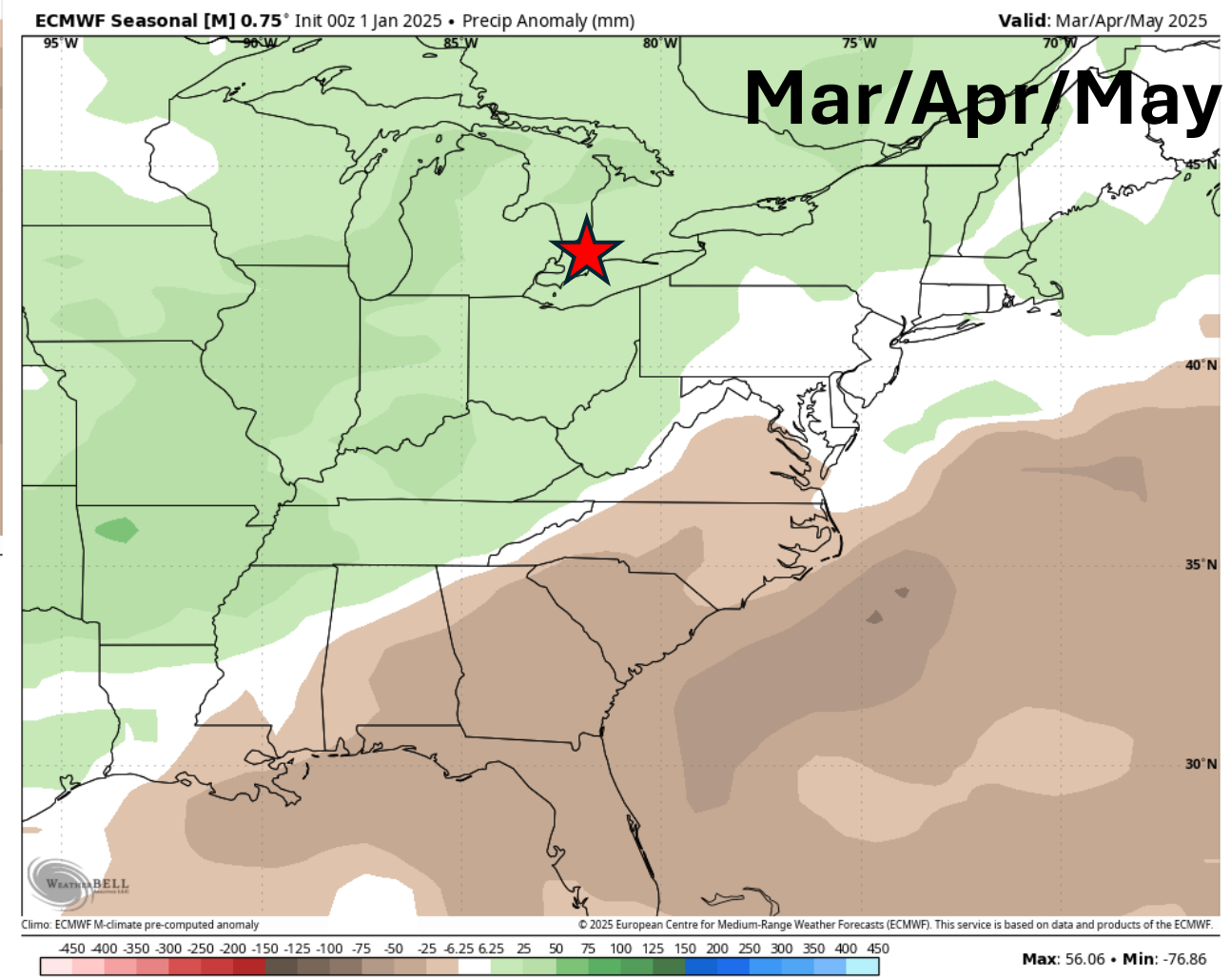
Temperatures



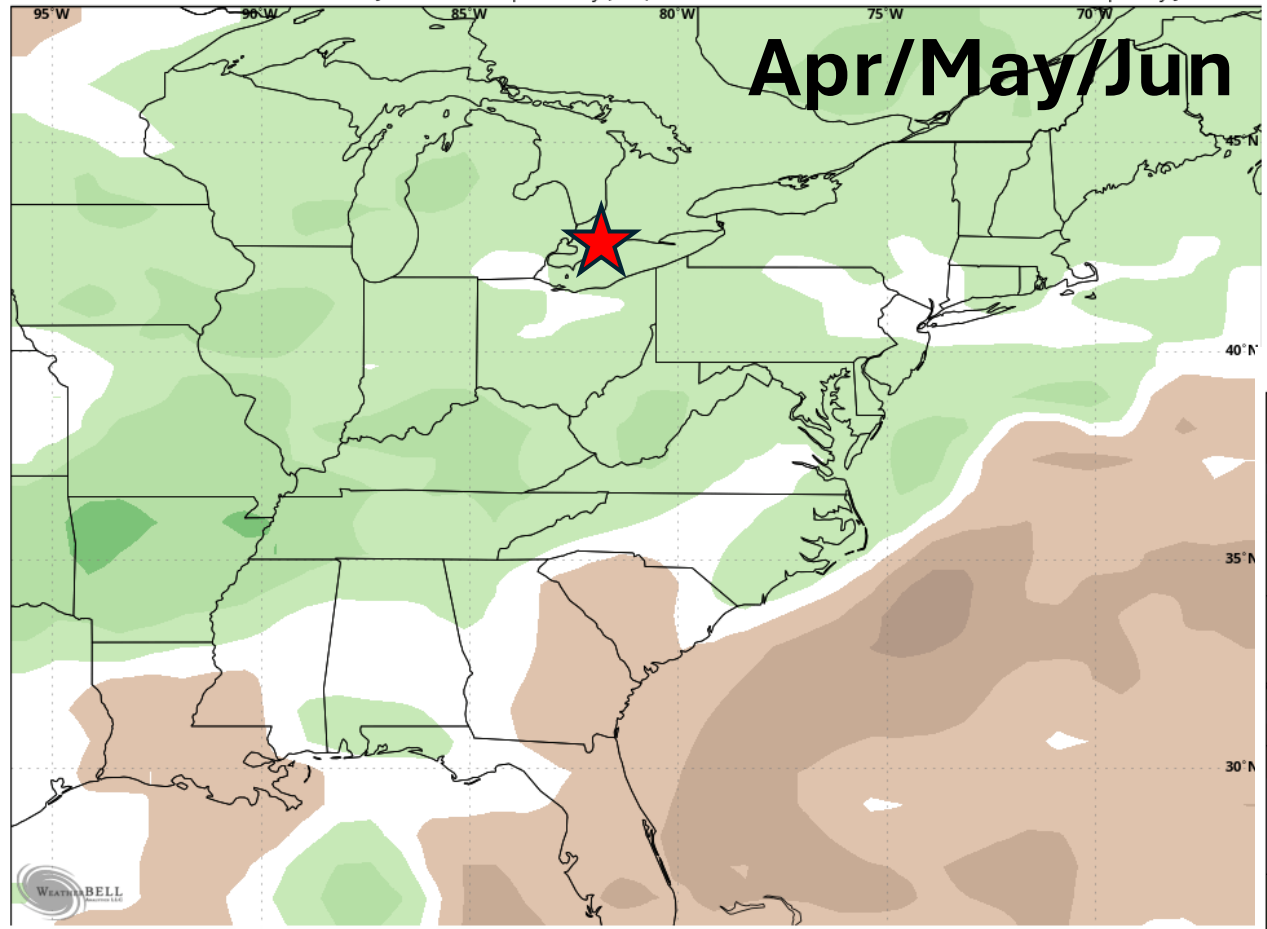


EURO

Precipitation

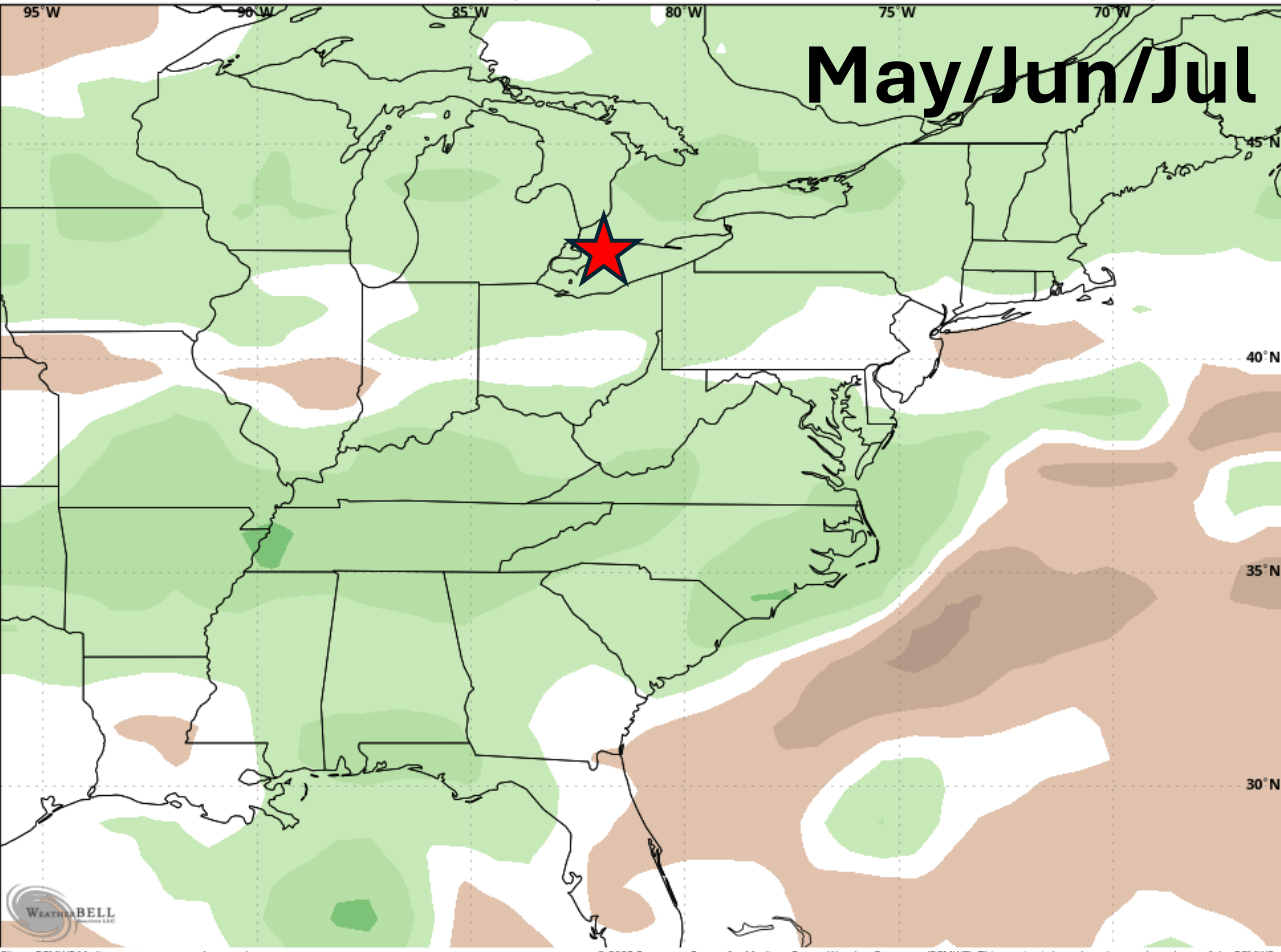


Apr/May/June



EURO Precipitation

May/June/July





Any Questions?



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