

Review – October 2023

Temperature

Despite a seasonal drop in temperatures over the month, October was warmer than average for most of the state. Average temperatures ranged from 50-60°F, with the northeast and far northwest seeing the coolest conditions (Fig. 1a). Temperature departures varied across Ohio, with some small areas near Canton as well as western Ohio seeing no significant departure, while areas across the eastern portion of the state saw departures of up to 4°F above average. Overall, the state generally experienced warmer temperatures than usual for the month (Fig. 1b). At the county level, every county in Ohio ranked at least in the warmer third of the historical record, with the far northeastern counties ranking within the warmest tenth of the record for October (Fig. 2).

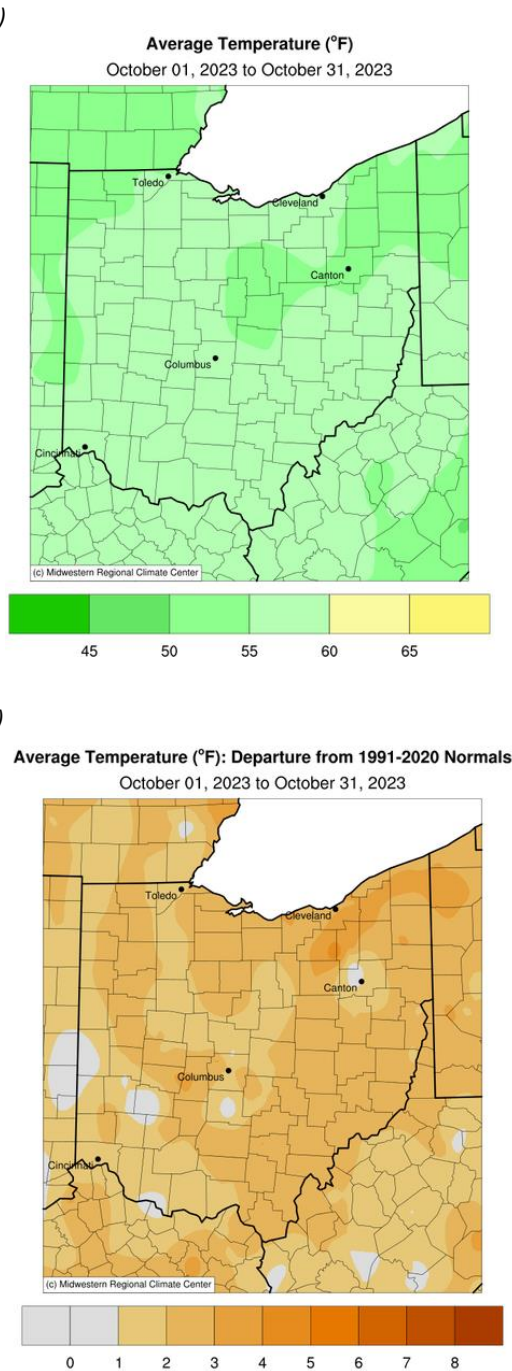


Figure 1a: Average temperature and 1b: Departure from Normal for the month of October 2023. Data courtesy of the Midwestern Regional Climate Center (<http://mrcc.purdue.edu>).

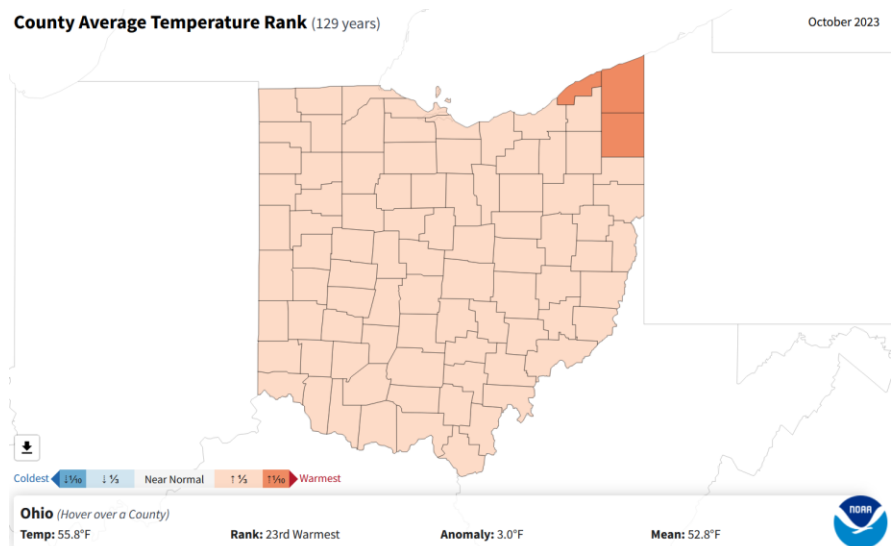


Figure 2: State of Ohio average temperature ranks by county for October 2023. Courtesy of the National Centers for Environmental Information (<https://www.ncdc.noaa.gov/sotc/>).

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Precipitation

While October was generally wetter than the previous month in Ohio, the total accumulation varied widely across the state. Overall, northern Ohio recorded the most precipitation due to the lake effect, with accumulations of 3-4 inches being the most common. For the rest of the state, precipitation was much more irregular, with a general range of 1.5-3 inches of accumulation recorded in the month (Fig. 3b). Departures from the record were similarly varied, with areas near the corners of the state seeing around 0-2 inches above normal, and the central block of Ohio seeing around 0-1 inches below normal (Fig. 3b). At the county level, most of the north, east, and some of the southwestern counties ranked in the wettest third of the record, with the rest of the state ranking near normal for October (Fig. 4).

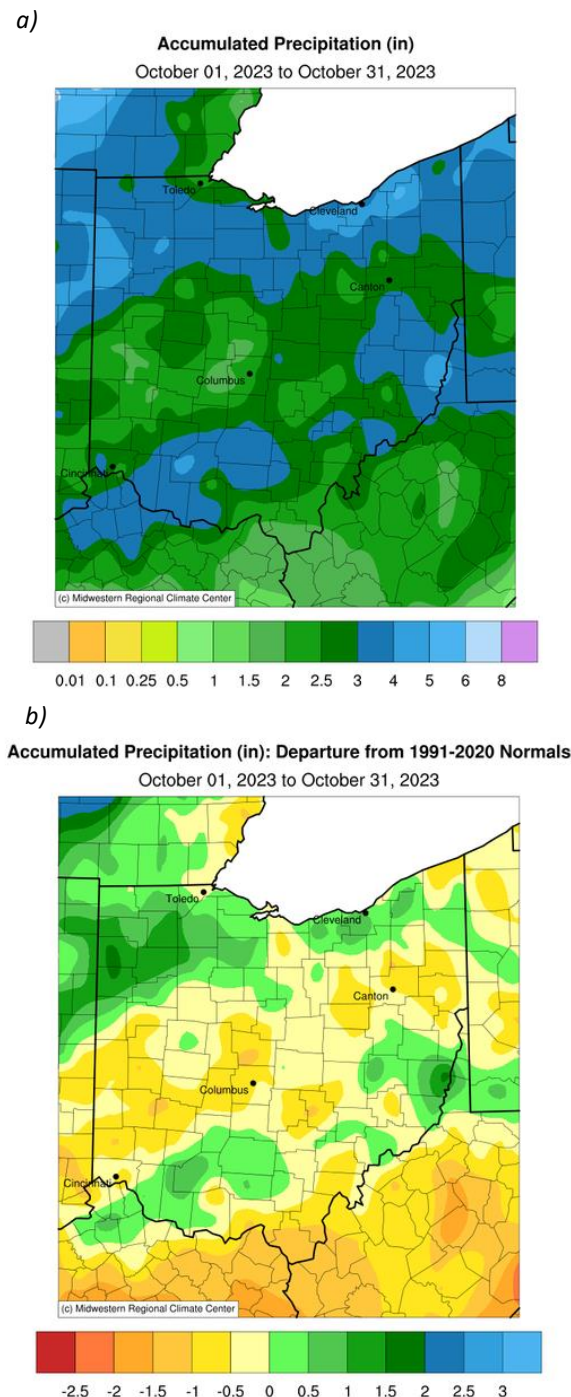


Figure 3a: Accumulated precipitation and 3b: Departures from Normal for the month of October 2023. Data courtesy of the Midwestern Regional Climate Center (<http://mrcc.purdue.edu>).

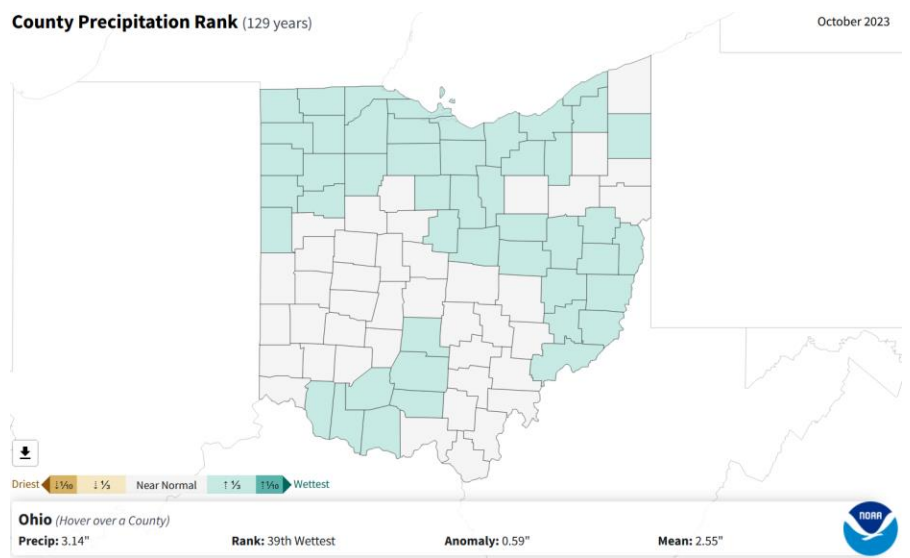
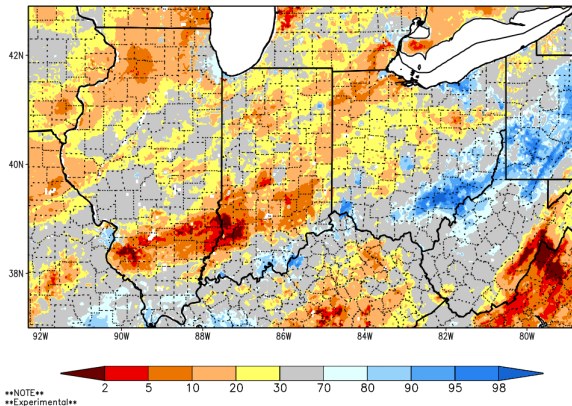


Figure 4: State of Ohio precipitation ranks by county for October 2023. Courtesy of the National Centers for Environmental Information (<https://www.ncdc.noaa.gov/sotc/>).

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a) SPoRT-LIS 0–40 cm Soil Moisture percentile valid 31 Oct 2023



b) SPoRT-LIS 0–200 cm Soil Moisture percentile valid 31 Oct 2023

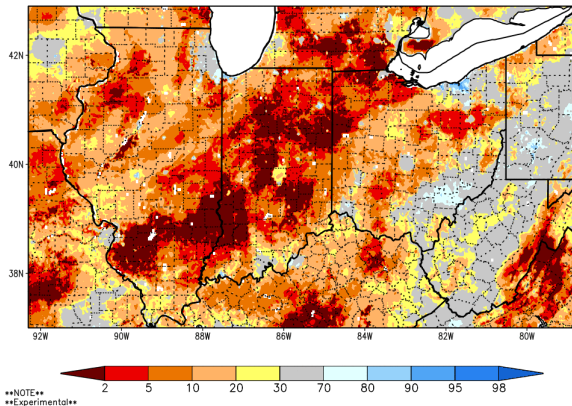


Figure 5a: 0–40 cm and 5b: 0–200 cm soil moisture percentile across the region at the end of October. Courtesy of NASA SPoRTLIS (https://weather.msfc.nasa.gov/sport/case_studies/lis_IN.html).

Soil and Energy

As frequent precipitation resumed in October, soil dryness was largely alleviated throughout Ohio. While the 0–40cm level appears to be nearly free of all soil dryness, this is mostly due to a series of significant precipitation events at the end of October that resulted in wetter soil near the surface (Fig. 5a). Nevertheless, such precipitation events are indicative of improvements in the state’s soil moisture conditions. Additionally, the 0–200cm level shows a reduction in the severity of soil dryness throughout the state, though moderate dryness still remains (Fig. 5b).

While the continued progression through Autumn has brought an overall decrease in temperatures, Ohio’s degree days conform to the warmer-than-average conditions seen in October. Heating Degree Days (HDDs) were fewer than normal in the month, with the eastern half of the state seeing the greatest departures. Conversely, Cooling Degree Days (CDDs) were greater than normal, though the total number of CDDs has dwindled into the lower double-digits as we move towards winter (Fig. 6).

Climate Division	Heating Degree Days	Normal	Departure	Cooling Degree Days	Normal	Departure
1	352	392	-40	25	9	16
2	326	380	-54	27	11	17
3	349	414	-65	15	7	8
4	328	364	-37	26	12	14
5	313	357	-44	22	13	9
6	333	397	-64	18	9	8
7	321	380	-59	19	9	10
8	301	331	-30	21	15	6
9	272	322	-50	21	14	7
10	296	357	-62	18	11	7
Statewide	318	367	-50	21	11	10



Figure 6: (Left) October 2023 heating & cooling degree days. (Right) Corresponding Ohio Climate Divisions. Data courtesy of the Midwestern Regional Climate Center (<http://mrcc.purdue.edu>).

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Notable Events

While October was an exceptionally calm month in terms of impactful weather events in Ohio, it did feature some interesting meteorological phenomena. Most notable was the world record-breaking October 7-8 Lake Erie waterspout outbreak, in which more than 180 waterspouts were spotted mostly along the coast of northeastern Ohio. While no damages or injuries were reported, the event made national headlines as the most waterspouts ever recorded during a single event. Although impressive, this isn't a surprise, as the United States accounts for more than 40% of all waterspout sightings across the world.

Waterspouts form in a similar way to tornadoes, in that they result from the upward movement of air in an environment where winds change direction with height, causing the upward-moving air to spin. In fact, they are so similar that when a waterspout moves onto land, it is reclassified as a tornado. Waterspouts are usually seen when the surface water temperature of a large body of water is much higher than the air above it, which causes the air around it to rise. This was seen on October 7, when Lake Erie's surface temperature exceeded 70°F, more than 20°F warmer than the air above it (Fig. 7). As such, forecasters were able to predict the potential for waterspout formation in advance, reducing the impact on human activities across the Great Lakes (Fig. 8).

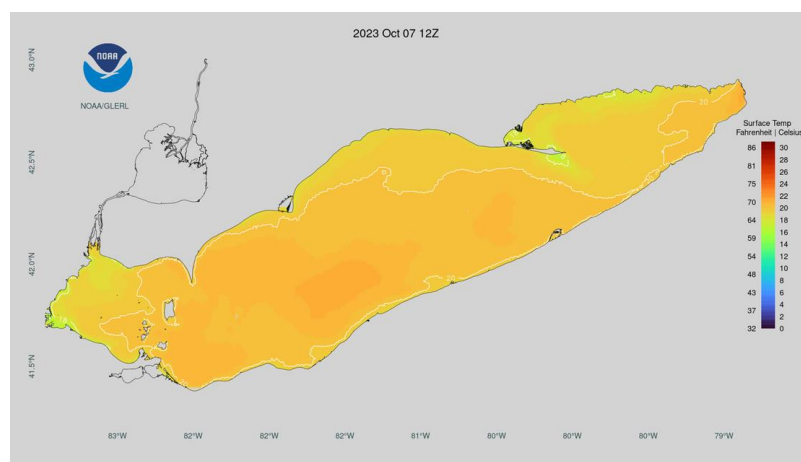


Figure 7: Map of Lake Erie showing the surface water temperature at 7:00 am EDT on October 7, 2023. Data courtesy of NOAA's Lake Erie Experimental FVCOM NOWCAST/FORECAST (<https://www.glerl.noaa.gov/res/glcfs/ncast.php?lake=eri>)

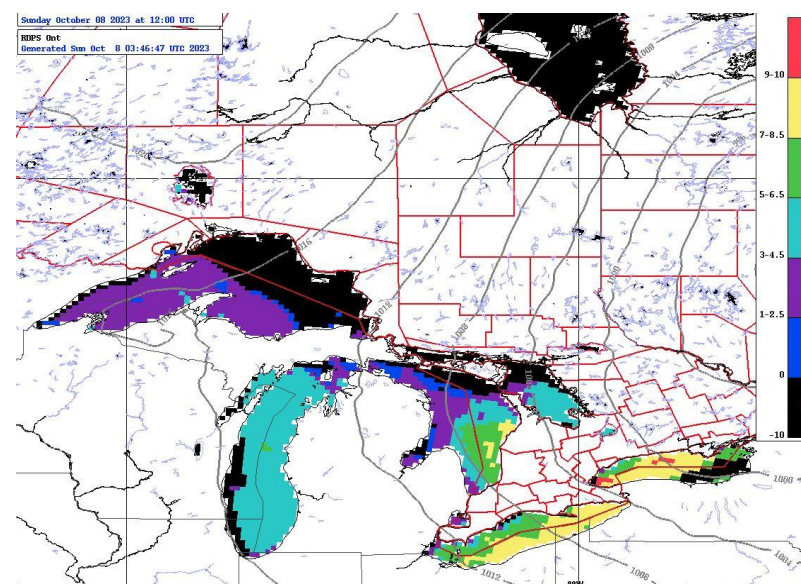
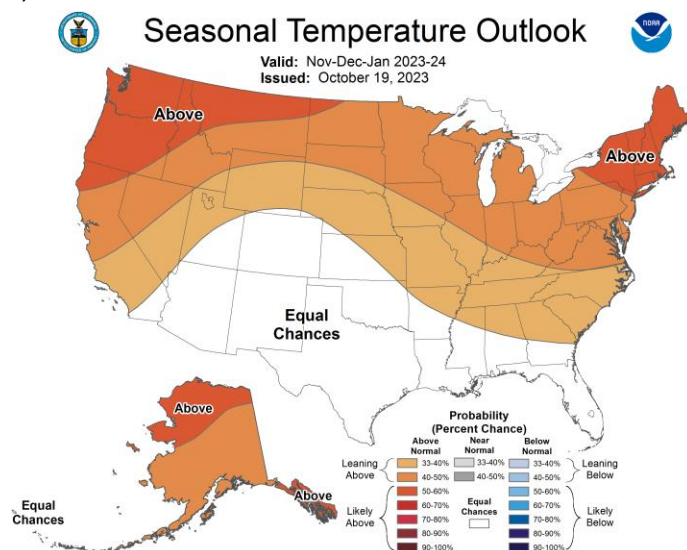


Figure 8: Map of the Great Lakes showing waterspout potential at 7:00 am EDT on October 8, 2023. Warmer colors represent higher potential. Data courtesy of the International Centre for Waterspout Research (<https://www.icwr.ca/waterspout-forecast.php>)

Forecast: November 2023 – January 2024

a)



b)

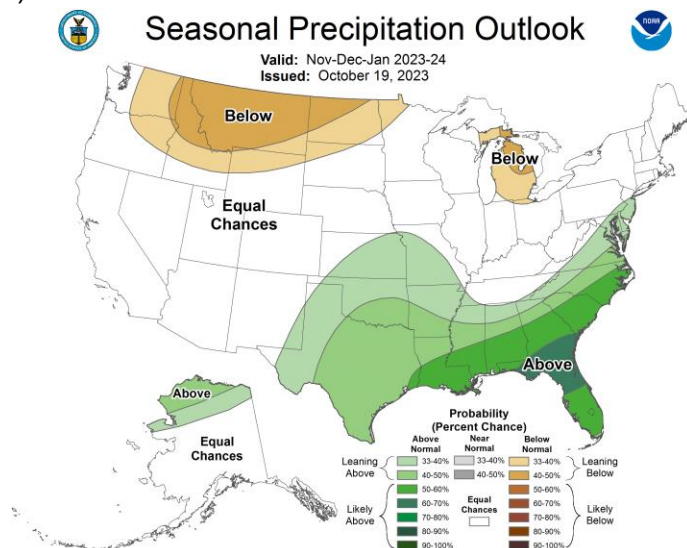


Figure 9a: Nationwide Seasonal Temperature and 9b: Precipitation Outlook for November 2023-January 2024. Courtesy of the Climate Prediction Center (<https://www.cpc.ncep.noaa.gov/>).

Authors:

Jacob L. Fields
Atmospheric Sciences Undergraduate
Student Assistant: Climate Services
Byrd Polar and Climate Research Center
The Ohio State University
fields.609@osu.edu

Geddy R. Davis
Meteorologist/Atmospheric Scientist
Program Coordinator: Climate Services
Byrd Polar and Climate Research Center
The Ohio State University
davis.5694@osu.edu

Aaron B. Wilson
State Climate Office of Ohio
Byrd Polar and Climate Research Center
OSU Extension
The Ohio State University
wilson.1010@osu.edu

Looking Ahead

The CPC's 3-month outlooks indicate a warmer-than-average end to the year for Ohio, with little insight into the state's precipitation. Regarding temperatures, Ohio is predicted with moderate confidence to lean above normal in the coming months, possibly limiting the occurrence of frozen precipitation through early winter (Fig. 9a). Meanwhile, Ohio has equal chances of seeing above- or below-normal precipitation in the coming months (Fig. 9b). Although uncertain, this prediction comes with the U.S Drought Monitor's forecast of both the improvement and removal of drought conditions in many areas of the eastern U.S. by the end of the forecast period, including Ohio. This trend has already begun as Ohio saw the alleviation of drought at the end of October, with only about a third of the state seeing abnormally dry conditions, down from 96.7% of the state at the end of September.

Note: these outlooks do not provide the quantity of above or below normal conditions, just the likelihood of occurrence (i.e., the probability).