Maryland Climate Bulletin
October 2024

Prepared by
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DEPARTMENT OF
ATMOSPHERIC &
OCEANIC SCIENCE
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Maryland
State
Climatologist
Office

Summary

Statewide averages indicate that October 2024 was warmer and drier than normal (i.e., 1991-2020 averages). Monthly mean temperatures were between 51 and 62°F; maximum temperatures were in the 63–74°F range and minimum temperatures were between 36 and 50°F. Monthly total precipitation was in the 0.2–2.8 inches range.

Maryland Regional Features (Figures 1-6, C1, and D1)

- The mean temperature was warmer than normal over nearly all the state, particularly over the southern Charles, Saint Mary's, and southern Calvert counties (above 2.1°F) and portions of Montgomery, Prince George's, Howard, Frederick, Carroll, and Baltimore counties (1.5–1.8°F). Slightly colder than normal conditions appeared over northern Anne Arundel County.

- The maximum temperature was warmer than normal over the entire state, especially over Garrett County (4.2–5.7°F) and the southern tips of Saint Mary's, Calvert, and Dorchester counties (4.2–4.5°F).

- The minimum temperature was colder than normal over much of the state, particularly over eastern Dorchester, northern Wicomico and Worcester counties (–2.7 to –2.4°F), Washington, southern Baltimore, and northern Anne Arundel and Howard counties (–2.1 to –2.4°F), and southern Garrett County (–2.1°F). Above-normal temperatures appeared over western Charles Couty (1.2°F) and parts of Charles, Saint Mary's counties, and western Montgomery County (around 0.9°F).

- Precipitation was below normal in the entire state, especially over Baltimore, Harford, and Cecil counties, southern Saint Mary's, and Calvert counties, and Caroline, Dorchester, Wicomico, Somerset, and Worcester counties (3.6 to 3.9 inches deficit). These counties, the whole Eastern Shore, and western Montgomery County received just 10% of their climatological rainfall for the month; the rest of the Piedmont and most of the Upper Coastal Plain received not more than 20% of their climatological rainfall. Counties in western Maryland had between 50 and 70% of their climatological precipitation.

- The extension of the state under drought conditions covered 87% of the state at the end of October, a 6% increase with respect to September. Extreme drought conditions remained in the southern half of Garrett County, and moderate to severe drought conditions developed over the Coastal Plains and Harford and Cecil counties. The creeks and rivers in these regions had below-normal and much below-normal streamflow. Moderate drought conditions remained in portions of Allegany and Washington counties. Counties in the central and western Piedmont had normal to abnormally dry conditions with still normal streamflow in their streams and rivers.

Maryland Climate Divisions (Figures 7-8, B1, and B2)

- All climate divisions were warmer and drier than normal. The Lower Southern, Climate Division 3, had the warmest anomaly (2.2°F above normal), while the Southeastern Shore, Climate Division 1, had the driest anomaly (3.91 inches below normal).

- Statewide temperature was warmer than normal (1.3°F) for the eleventh month since December 2023; anomalies in October 2024 were much larger than in September and August. Statewide precipitation was below normal (3.26 inches) for the sixth time since April.

Extreme daily heat and precipitation, and growing degree days (Figures 9-11)

- Statewide maximum and minimum daily temperatures indicated that the number of days with extreme temperatures was larger than normal, although not the number of waves/spells by the end of October. There were 2 more hot days (maximum temperature warmer than 86°F; 50 vs. 48) than normal but 2 fewer heat waves (2 vs. 9); 12 more warm days (maximum temperature warmer than 80°F; 113 vs. 101) than normal but 2 fewer warm day spells (9 vs. 11); and 13 more warm nights (minimum temperature warmer than 68°F; 40 vs. 27) than normal but the same number of warm night spells (6).

- Statewide daily total precipitation showed that the number of days with extreme precipitation (at least 0.64 inches; the 95th percentile in 1951-2000) was fewer than normal by 1 day (15 vs. 14) by the end of October. The number of dry spells (consecutive days with daily precipitation of no more than 0.04 inches) was less than normal by 9 dry spells (31 vs. 40) by the end of the month. However, the mean duration of the dry spells was larger than normal by 2 days (6 vs. 4), and the longest duration of the spells was larger than normal by 8 days (24 vs. 16); the longest dry spell started October 8.

- The cumulative calendar year (until October 31) growing degree days have been greater than normal since the start of March. Modified growing degree days (base 86/50°F) reached 3578°FDD, and growing degree days (base 50°F) reached 3451°FDD by the end of October. The modified growing days were 583°FDD above normal, while the growing degree days were 556°FDD above normal.

Historical Context (Figure 12, Tables A1 and A2)

- Statewide mean, maximum, and minimum temperatures in October 2024 (58.3, 71.0, 45.5°F) were above their long-term (1895-2023) mean but far from their historical records of 63.3, 74.4, and 53.8°F set in 2007, 2007 and 2021, respectively. However, the maximum temperature was within 10% of the highest recorded values. Statewide

precipitation (0.53 inches) in October was below the long-term mean within 5% of the smallest values and close to the record of 0.15 inches in 1963.

- Maximum temperatures showed that October 2024 was the third hottest for Worcester County, the fourth hottest for Dorchester, Somerset, and Wicomico counties, the seventh for Saint Mary's County, the eighth for Caroline and Cecil counties, and the tenth for Harford County, and statewide.

- Precipitation indicated that October 2024 was among the sixth driest for 19 of the 23 counties and the fourth driest statewide. This month was the driest for Dorchester, Wicomico, and Worcester counties; the second driest for Caroline, Cecil, Queen Anne's, Saint Mary's, Somerset; the third driest for Calvert, Harford, Kent and Talbot counties; the fourth for Baltimore and Charles, counties; the fifth driest for Anne Arundel, Carroll, Frederick, Howard, and Montgomery counties; the sixth for Prince George's County, and the seventh for Washington County.

Century-Plus Trends, 1895-2024 (Figures 13, 14)

- Statewide mean temperature and heating degree−days in October showed a significant warming trend (1.7°F/century) and a decreasing heating trend (–48.8°FDD/century). Statewide precipitation had a non-significant wetting trend (0.64 in/century).

- Regionally, October temperatures showed significant warming trends almost everywhere in the state to the east and south of the Blue Ridge. The largest trend is in Baltimore City and southwestern Baltimore County (2.4°F/century), as it has been since March. Trends above 1.6°F/century are evident in central Piedmont and Lower Coastal Plain counties.

- Regionally, October precipitation displayed significant wetting trends over most of the state. In particular, over Baltimore City, south-central Baltimore, and Howard counties (1.1 in/century), along the counties of the Upper Coastal Plain and Piedmont, and Garrett and Allegany counties (around 0.8 in/century).

Contents

1.   Introduction

The Maryland Climate Bulletin is issued by the Maryland State Climatologist Office (MDSCO), which resides in the Department of Atmospheric and Oceanic Science at the University of Maryland, College Park. It documents the surface climate conditions observed across the state in a calendar month and is issued in the second week of the following month.

Maryland's geography is challenging, with the Allegheny and Blue Ridge mountains to the west, the Piedmont Plateau in the center, the Chesapeake Bay, and the Atlantic Coastal Plain to the east. The range of physiographic features and the state's eastern placement within the expansive North American continent contribute to a comparatively wide range of climatic conditions.

The bulletin seeks to document and characterize monthly surface climate conditions in the state, placing them in the context of regional and continental climate variability and change to help Marylanders interpret and understand recent climate conditions.

The monthly surface climate conditions for October 2024 are presented via maps of key variables, such as average surface air temperature, maximum surface air temperature, minimum surface air temperature, total precipitation, and their anomalies (i.e., departures from normal); they are complemented by drought conditions for the state, as given by the U.S. Drought Monitor, and streamflow anomalies as given by the U.S. Geological Survey Water Watch in Section 3. Statewide and climate division averages for the month are compared against each other via scatter plots in Section 4. Extreme daily heat and precipitation, as well as growing degree days, are presented from the analysis of daily statewide averaged temperatures and precipitation in Section 5. The monthly statewide averages are placed in the context of the historical record via box and whisker plots in Section 6. Century-plus trends in statewide air temperature, heating degree days, precipitation, and state maps of air temperature and precipitation are presented in Section 7. Ancillary statewide, climate division and county-level information is provided via tables and plots in Appendices A-B; climatology and variability maps are in Appendices C-D, including the percent of normal precipitation and normalized anomalies for the month.

2.   Data & Methods

Surface air temperatures, total precipitation, and degree-days data in this report are from the following sources:

- NOAA Monthly U.S. Climate *Gridded* Dataset at 5-km horizontal resolution (NClimGrid – Vose et al. 2014). It is available in a preliminary status at https://www.ncei.noaa.gov/data/nclimgrid-monthly/access/
  Data was downloaded on 11/15/2024.

- NOAA Monthly U.S. Climate *Divisional* Dataset (NClimDiv – Vose et al. 2014). It is available in a preliminary status (v1.0.0-20241106) at: https://www.ncei.noaa.gov/pub/data/cirs/climdiv/ Data was downloaded on 11/11/2024.

- NOAA area averages of daily temperatures and precipitation dataset (nClimGrid−Daily −Durre et al. 2022). It is available in a preliminary status, v1.0.0, at: https://www.ncei.noaa.gov/products/land-based-station/nclimgrid-daily Data was downloaded on 11/11/2024.

Drought conditions are from the U.S. Drought Monitor website: https://droughtmonitor.unl.edu/Maps/MapArchive.aspx

Streamflow conditions are from the U.S. Geological Survey Water Watch website: https://waterwatch.usgs.gov/index.php

Some definitions:

About climate and climatology. Weather and climate are closely related, but they are not the same. Weather represents the state of the atmosphere (temperature, precipitation, etc.) at any given time. On the other hand, climate refers to the time average of the weather elements when the average is over long periods. If the average period is long enough, we can start to characterize the climate of a particular region.

It is customary to follow the World Meteorological Organization (WMO) recommendation and use 30 years for the average. The 30-year averaged weather data is traditionally known as Climate Normal (Kunkel and Court 1990), which is updated every ten years (WMO 2017). Establishing a climate normal or climatology is important as it allows one to compare a specific day, month, season, or even another normal period with the current normal. Such comparisons characterize anomalous weather and climate conditions, climate variability and change, and help define extreme weather and climate events (Arguez et al. 2012). The current climate normal, or just the climatology, is defined for 1991–2020.

About the anomalies: Anomalies for a given month (e.g., October 2024) are the departures of the monthly value from the corresponding month's 30-year average (i.e., from the average of 30 Octobers) during 1991-2020. When the observed monthly value exceeds its climatological value, it is referred to as above normal (e.g., warmer than normal or wetter than normal) or a positive anomaly. In contrast, when this value is smaller than its climatological value, it is referred to as below normal (e.g., colder than normal or drier than normal) or negative anomaly.

About variability. The monthly standard deviation of a climate variable measures its dispersion relative to its monthly mean and assesses its year-to-year, or interannual, variability. Anomalies

are sometimes compared against that variability to identify extremes in the climate record. When the anomalies are divided by the standard deviation, they are named standardized anomalies.

About hot days, warm days, and warm nights. Extreme heat, detrimental to crops without irrigation and population lacking air conditioning, is tracked by the count of hot days, warm days and nights, and their consecutive occurrence (e.g., Tschurr et al. 2020, Barriopedro et al. 2023). A hot day is defined as one when the maximum temperature is greater than 86°F, a warm day is when the maximum temperature is greater than 80°F while a warm night is when the minimum temperature is greater than 68°F. When these conditions persist for two or more days, they are called heat waves for the hot days and warm spells for the warm days and nights. These threshold values correspond to the 89th and 75th percentiles of statewide daily maximum temperature and the 95th percentile of statewide daily minimum temperature for the period 1951-2000.

About degree days. Degree days are the difference between the daily mean temperature (high temperature plus low temperature divided by two) and a predefined base temperature; because energy demand is cumulative, degree-day totals are usually calculated on a daily, monthly, seasonal, and annual basis.

- *Heating and cooling degree days.* These are used to get a general idea of how much energy is required to warm or cool buildings. The base temperature used for this purpose is 65°F, considered tolerable for human comfort (CPC, 2023).

- *Growing degree days.* These estimate the growth and development of plants and insects through the calendar year or during the growing season under the idea that development will only occur if the temperature exceeds some minimum development threshold temperature or, in other words, if enough warmth is accumulated. Because the actual development will differ for different plants and insects, and the presence of weeds and precipitation can influence the development, a base temperature of 50°F is generally considered acceptable for all plants and insects (OSU 2024). However, this base temperature is best suited for the development of specific crops like corn, sweet corn, soybeans, tomatoes, and a few others.

  - *Modified growing degree days.* The modified growing degree days are obtained if base temperatures are established for the daily maximum and minimum temperatures before calculating the daily mean temperature. When the base temperature for the daily maximum temperature is set to 86°F, and the base temperature for the daily minimum temperature is set to 50°F, the growing degree days are specific to corn development as no appreciable growth is detected with temperatures lower than 50°F or greater than 86°F.

About extreme precipitation. This is defined as the yearly number of days with statewide averaged daily total precipitation equal to or greater than 0.64 inches. This threshold value represents the 95th percentile of statewide averaged daily total precipitation for 1951-2000.

About the dry day spells. A dry day is defined as a day with precipitation below 0.04 inches. These conditions are named dry spells if they persist for two or more days. The number of dry spells and their duration are particularly important during the vegetation period (Tschurr et al., 2020).

About NOAA's Climate Divisions. The term "climate division" refers to one of the eight divisions in the state that represent climatically homogeneous regions, as determined by NOAA: https://www.ncei.noaa.gov/access/monitoring/dyk/us-climate-divisions

The eight climate divisions in Maryland are:

- Climate Division 1: Southeastern Shore. It includes the counties of Somerset, Wicomico, and Worcester.
- Climate Division 2: Central Eastern Shore. It includes the counties of Caroline, Dorchester, and Talbot.
- Climate Division 3: Lower Southern. It includes the counties of Calvert, Charles, and St. Mary's.
- Climate Division 4: Upper Southern. It includes the counties of Anne Arundel and Prince George's.
- Climate Division 5: Northeastern Shore. It includes the counties of Kent and Queen Anne's.
- Climate Division 6: North Central. It includes the counties of Baltimore, Carroll, Cecil, Frederick, Harford, Howard, Montgomery, and the city of Baltimore.
- Climate Division 7: Appalachian Mountains. It includes the counties of Allegany and Washington.
- Climate Division 8: Allegheny Plateau. It includes Garrett County.

Note that these Climate Divisions do not correspond with the *Physiographic Provinces* in the state, as the former follow county lines. Climate Division 8 follows the *Appalachian Plateau Province*, Climate Division 7 follows the *Ridge and Valley Province*; however, Climate Division 6 includes the *Blue Ridge and the Piedmont Plateau provinces,* Climate Divisions 3, 4, and a portion of 6 include the *Upper Coastal Plain Province*, and Climate Divisions 1, 2, 5, and a portion of 6 include the *Lower Coastal Plain (or Atlantic Continental Shelf) Province*.
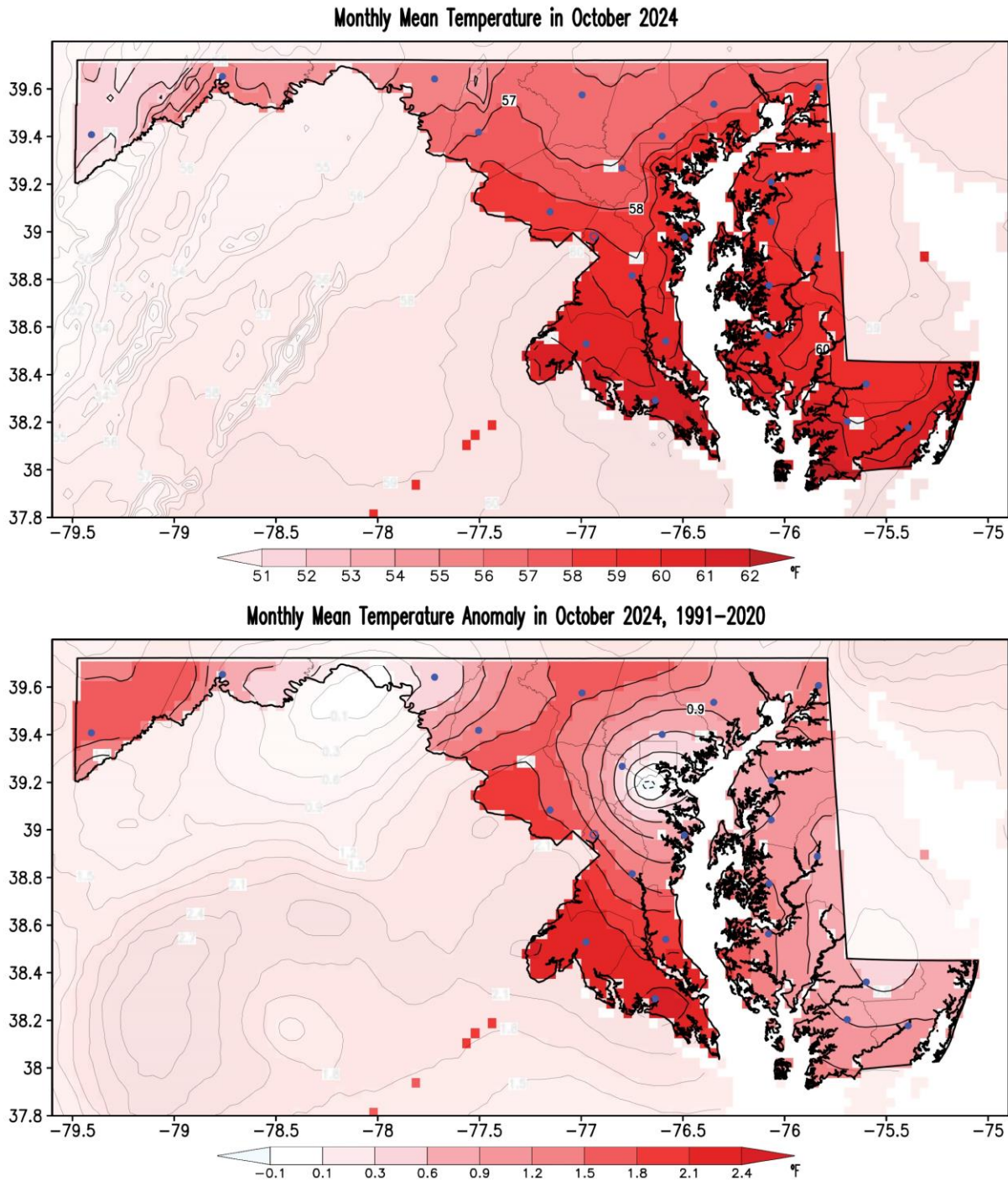
3. October 2024 Maps

A. Mean Temperatures

Figure 1. Monthly mean surface air temperature (top panel) and its anomaly with respect to the 1991-2020 climatology (bottom panel) for October 2024. Temperatures are in °F following the color bar. Blue/red shading in the anomaly map marks colder/warmer than normal conditions. Note shading outside the state has been washed out to facilitate focusing on Maryland. Filled blue circles mark the county seats.
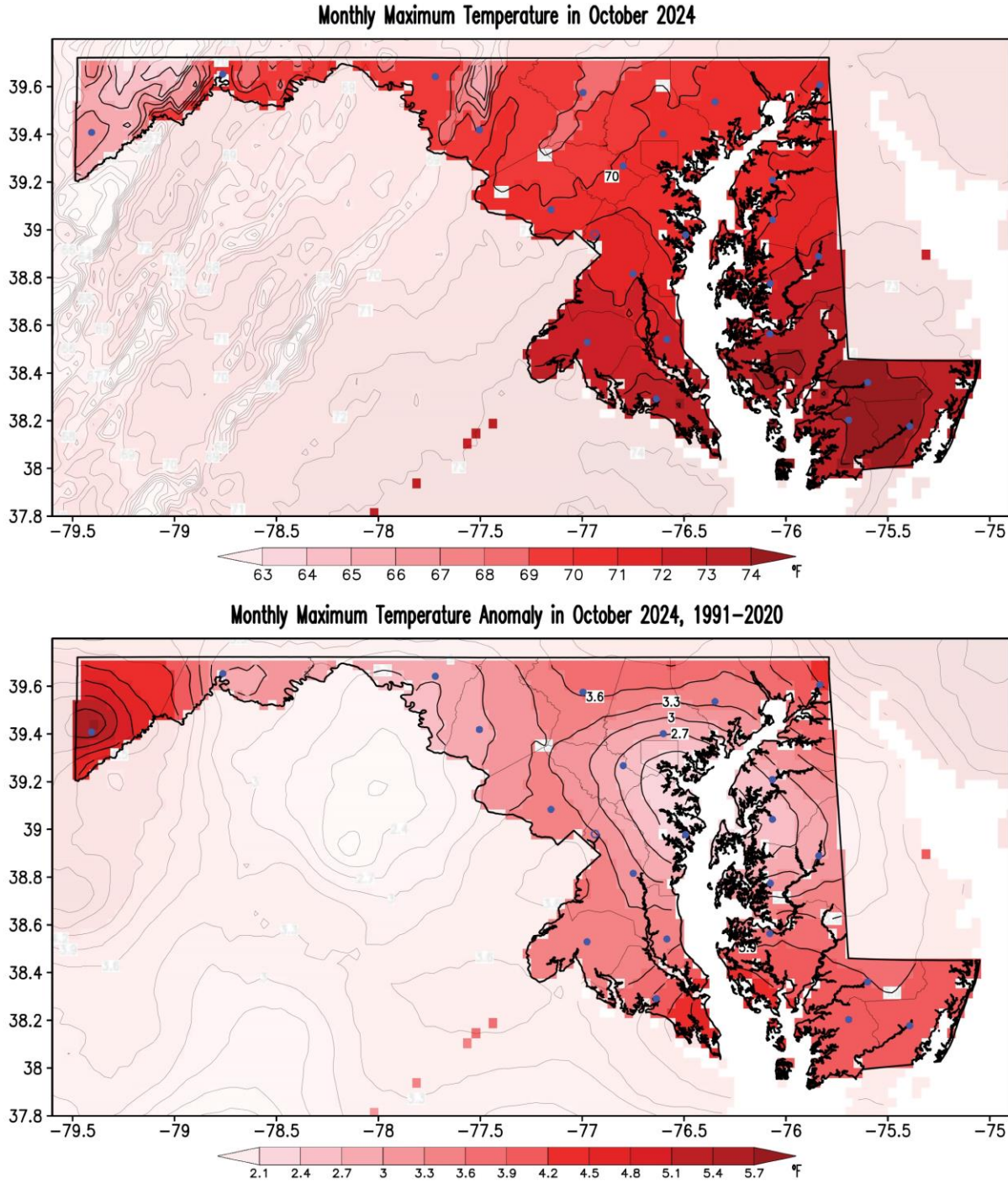
B.   Maximum Temperatures

Monthly Maximum Temperature in October 2024

Monthly Maximum Temperature Anomaly in October 2024, 1991–2020

Figure 2. Monthly maximum surface air temperature (top panel) and its anomaly with respect to the 1991-2020 climatology (bottom panel) for October 2024. Temperatures are in °F following the color bar. Red shading in the anomaly map marks warmer than normal conditions. Note shading outside the state has been washed out to facilitate focusing on Maryland. Filled blue circles mark the county seats.
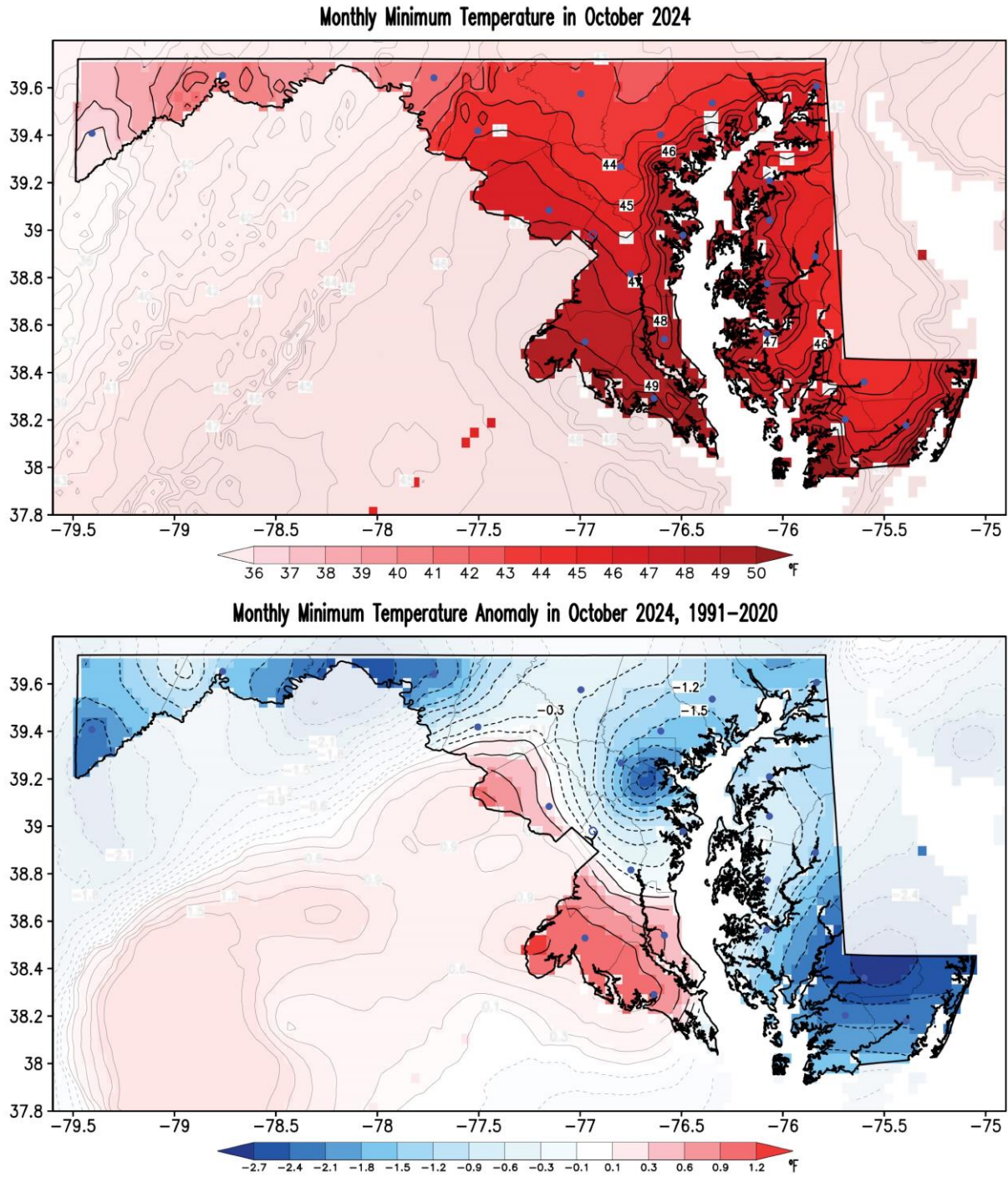
C.   Minimum Temperatures

Figure 3. Monthly minimum surface air temperature (top panel) and its anomaly with respect to the 1991-2020 climatology (bottom panel) for October 2024. Temperatures are in °F following the color bar. Blue/red shading in the anomaly map marks colder/warmer than normal conditions. Note shading outside the state has been washed out to facilitate focusing on Maryland. Filled blue circles mark the county seats.
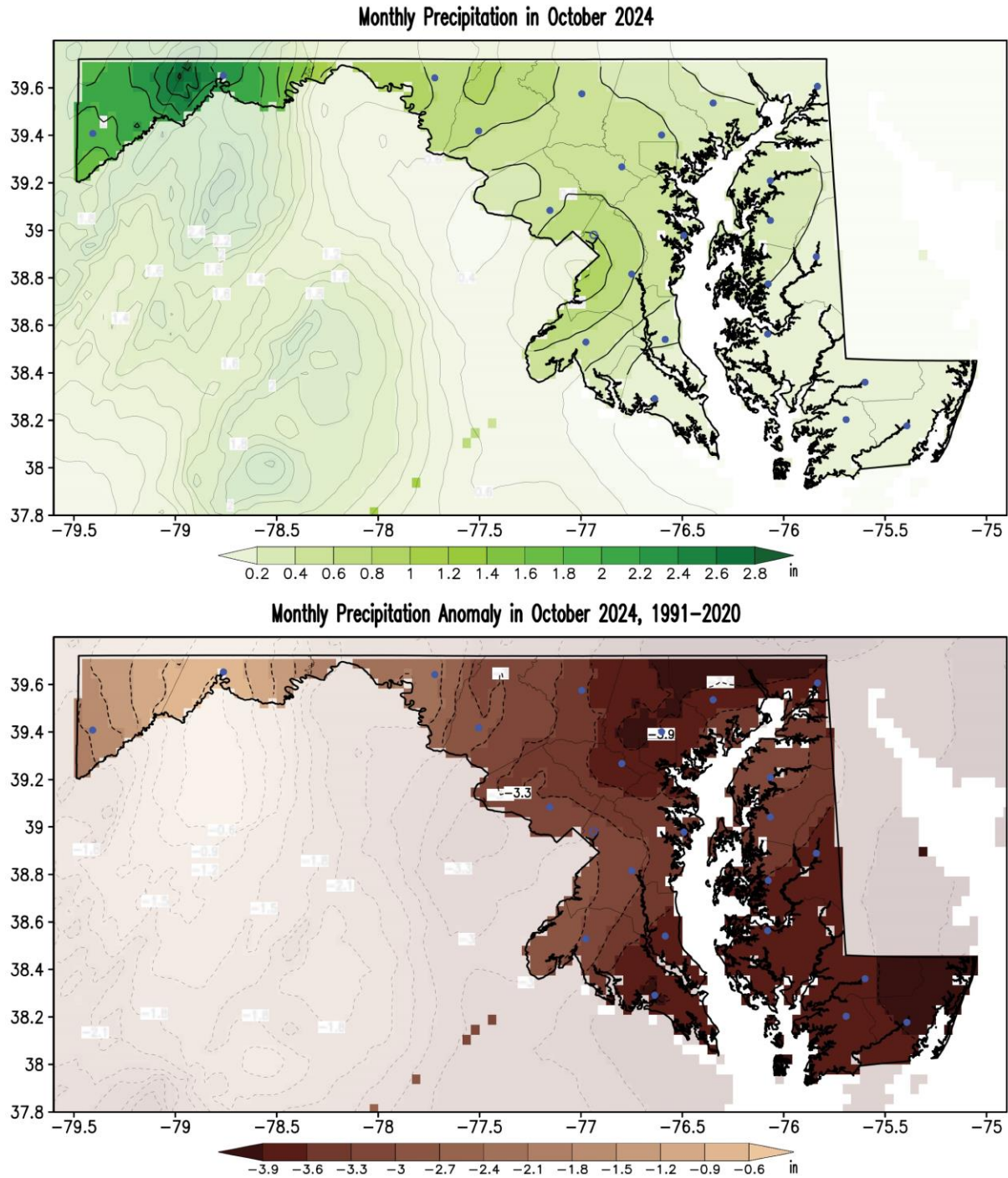
D.   Precipitation

Figure 4. Monthly total precipitation (top panel) and its anomaly with respect to the 1991-2020 climatology (bottom panel) for October 2024. Precipitation is in inches following the color bar. Brown shading in the anomaly map marks drier than normal conditions. Note shading outside the state has been washed out to facilitate focusing on Maryland. Filled blue circles mark the county seats.

E.   Drought

U.S. Drought Monitor
Maryland

October 29, 2024
(Released Thursday, Oct. 31, 2024)
Valid 8 a.m. EDT
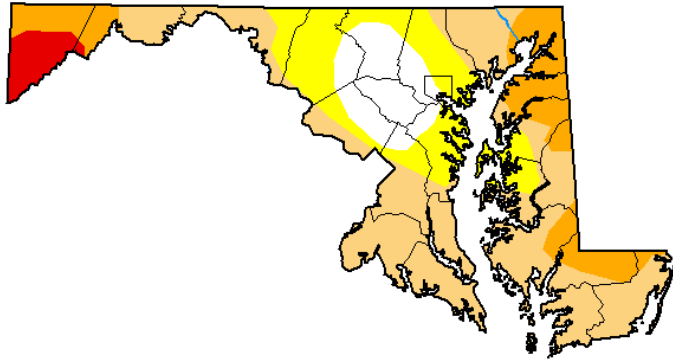
Drought Conditions (Percent Area)

	None	D0	D1	D2	D3	D4
Current	12.59	20.56	46.15	16.63	4.07	0.00
Last Week 10-22-2024	12.59	51.02	21.96	10.36	4.07	0.00
3 Months Ago 07-30-2024	32.74	27.50	16.32	14.92	8.52	0.00
Start of Calendar Year 01-02-2024	70.35	29.65	0.00	0.00	0.00	0.00
Start of Water Year 10-01-2024	18.77	59.58	11.76	5.82	4.07	0.00
One Year Ago 10-31-2023	48.31	48.35	2.86	0.47	0.00	0.00

Intensity:

None		D2 Severe Drought
D0 Abnormally Dry		D3 Extreme Drought
D1 Moderate Drought		D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions.
Local conditions may vary. For more information on the
Drought Monitor, go to https://droughtmonitor.unl.edu/About.aspx

Author:
Brian Fuchs
National Drought Mitigation Center

droughtmonitor.unl.edu

Figure 5. Drought conditions as reported by the U.S. Drought Monitor on October 29, 2024. At this time, around 87% of the state is under some drought category, a 6% more than at the end of September. While the extent of the extreme drought in Garrett County remains the same, the extent of the severe drought and moderate drought have increased over the coastal plains. Yellow shading indicates abnormally dry regions, light orange shading shows regions under a moderate drought, darker orange marks regions under severe drought, and red shading indicates extreme drought according to the drought intensity key. Numbers in the table indicate the percentage of the state covered under the particular drought conditions at the time (in the left column). Areas shown in yellow (Abnormally Dry) indicate land that is going into or coming out of drought. Light orange areas (Moderate Drought) highlight land that may experience low water supply and damage to crops and pastures. Orange areas (Severe Drought) show land with water shortages and an increased likelihood of crop and pasture losses. Red areas (Extreme Drought) highlight land that may experience widespread water shortages and major losses of crops and pastures, with forests susceptible to fire. Current conditions can be monitored from the U. S. Drought Monitor website.
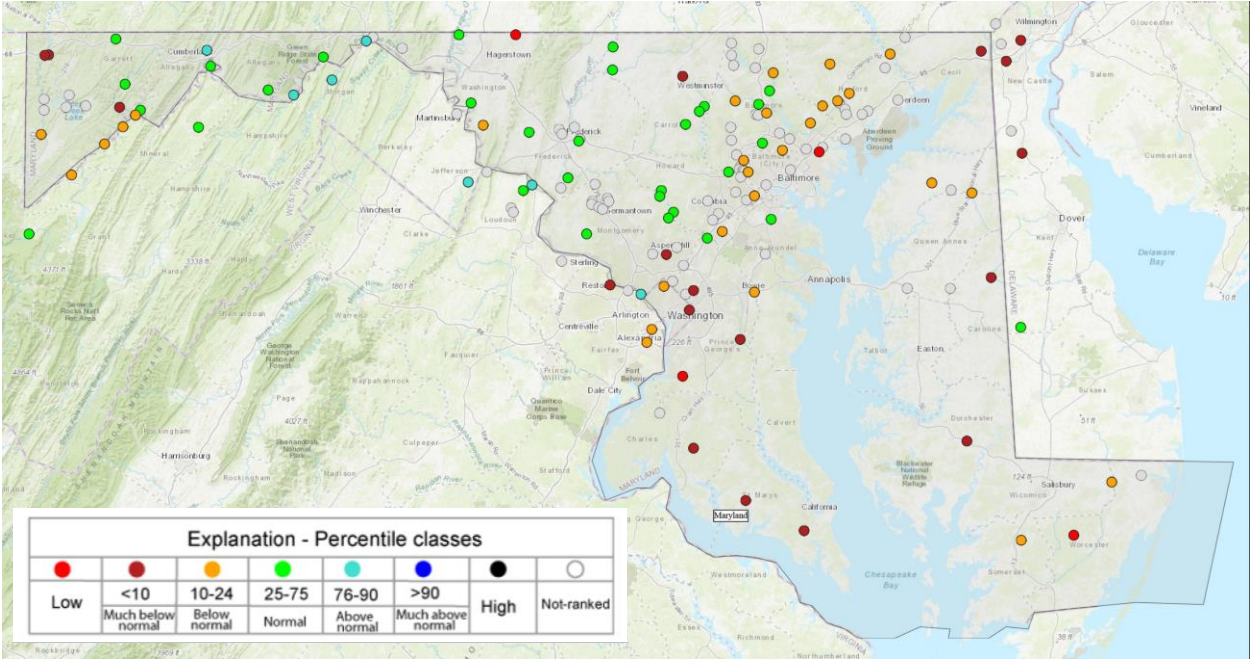
F.   Streamflow

Figure 6. Monthly averaged streamflow class anomalies as reported by the U.S. Geological Survey (USGS) Water Watch for October 2024. Orange to red-filled circles denote below-normal streamflow conditions, cyan to black-filled circles denote above-normal streamflow conditions, and green-filled circles represent normal streamflow conditions. Streams and rivers had below-normal streamflow in the severe to extreme drought areas in Garrett County and along both sides of the Bay. Current conditions can be monitored from the U. S. Geological Survey website.

4. October and ASO 2024 Climate Divisions Averages
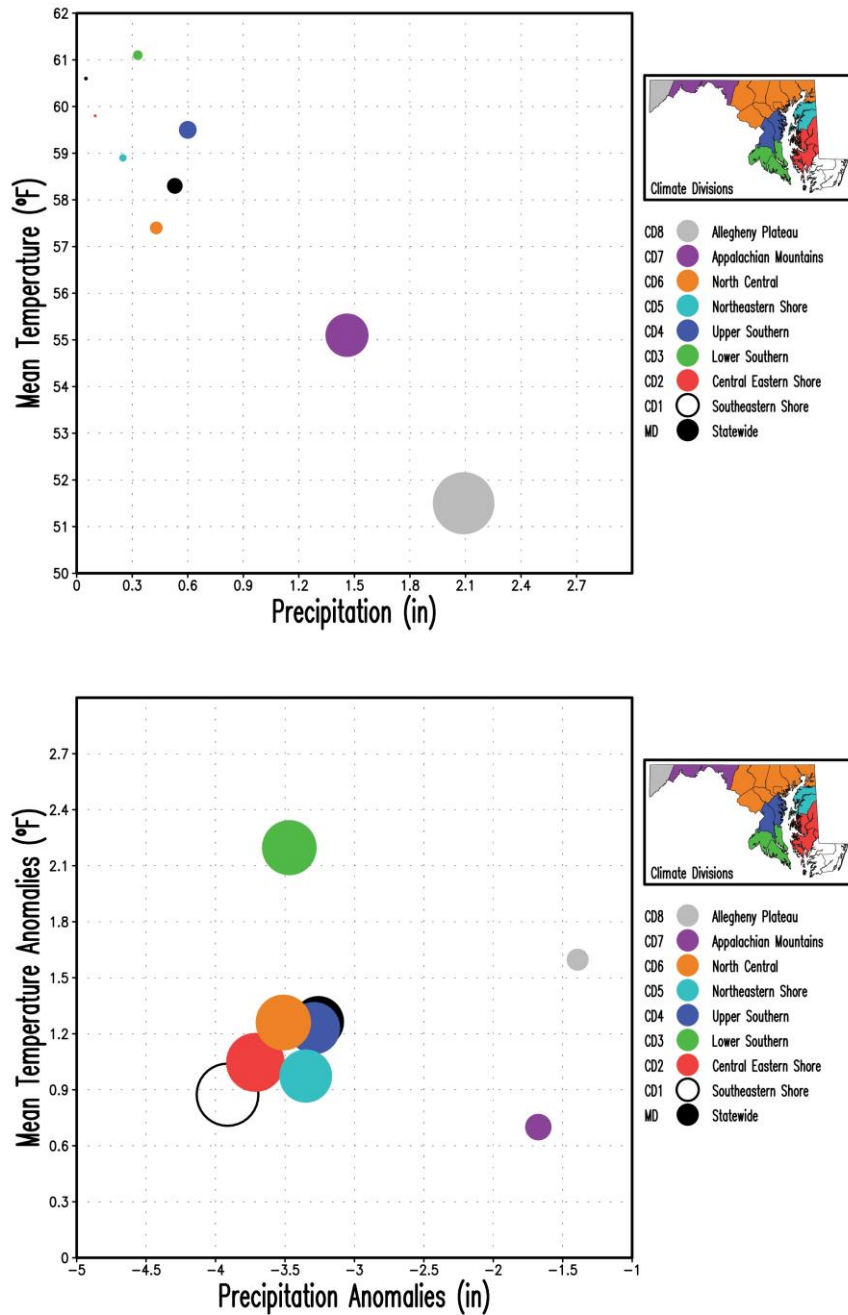
A. October 2024 Scatter Plots

Figure 7. Scatter plots of Maryland (statewide) and Climate Divisions (CD#) monthly mean surface air temperature vs. total precipitation for October 2024. The upper panel shows the mean temperature and total precipitation, and the bottom panel displays their anomalies with respect to the 1991-2020 climatology. Temperatures are in °F and precipitation is in inches. The size of the circles is proportional to the total precipitation scaled down by the maximum precipitation (2.09 inches in CD8, top panel) and by the maximum precipitation anomaly (|−3.91| inches in CD1, bottom panel) among the nine regions. Note that the color of the filled circles corresponds to the color in the Climate Divisions according to the inset map.
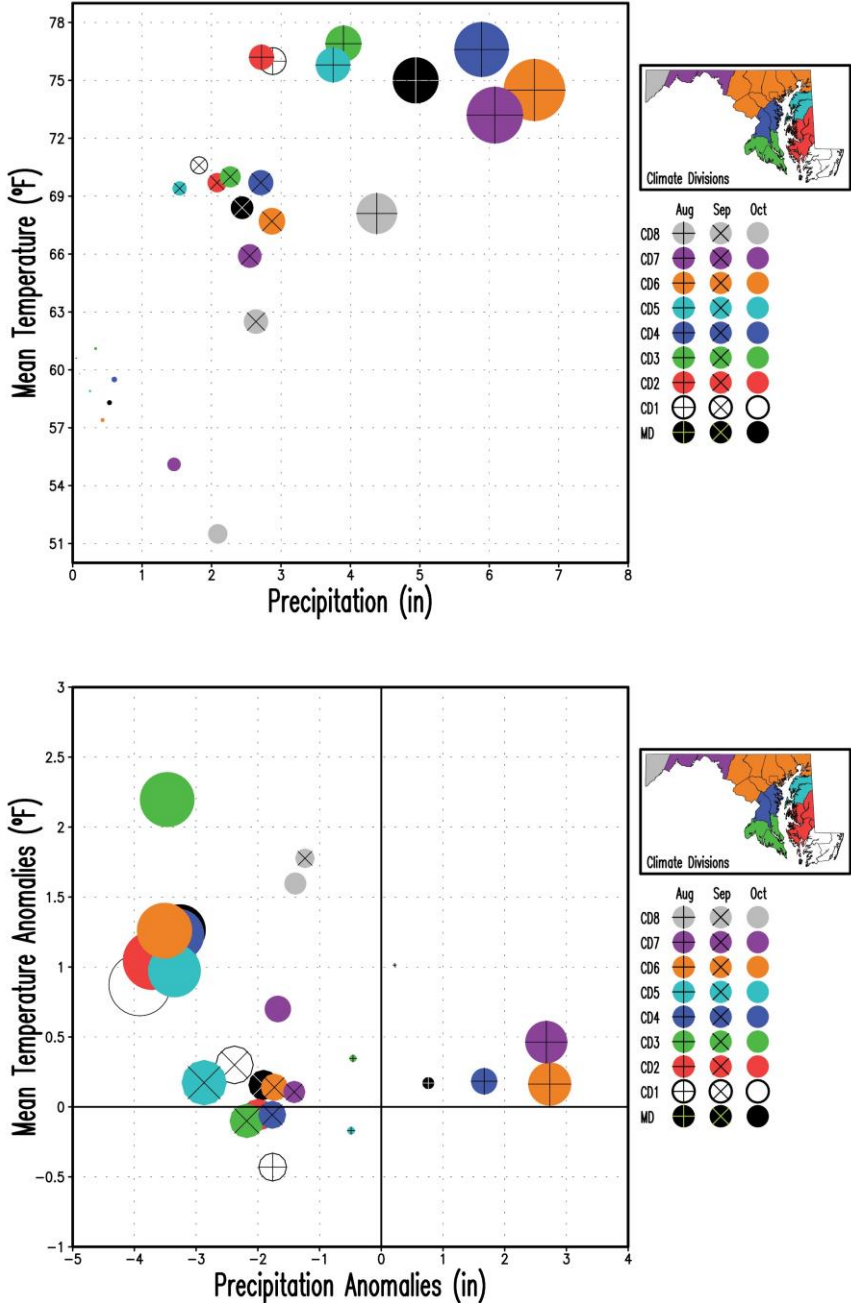
B.   August – October 2024 Scatter Plots

Figure 8. Scatter plots of Maryland (statewide) and Climate Divisions (CD#) monthly mean surface air temperature vs. total precipitation for August, September and October 2024. The upper panel shows the mean temperature and total precipitation, and the bottom panel displays their anomalies with respect to the 1991-2020 climatology. Temperatures are in °F, and precipitation is in inches. The size of the circles is proportional to the total precipitation scaled down by the maximum precipitation (6.65 inches in CD6 in August, top panel) and by the maximum precipitation anomaly (|−3.91| inches in CD1 in October, bottom panel) among the nine regions and three months. October is displayed with filled circles only, while September and August are displayed with superposed multiplication and addition signs, respectively.

5.   Extremes and Growing Degree Days

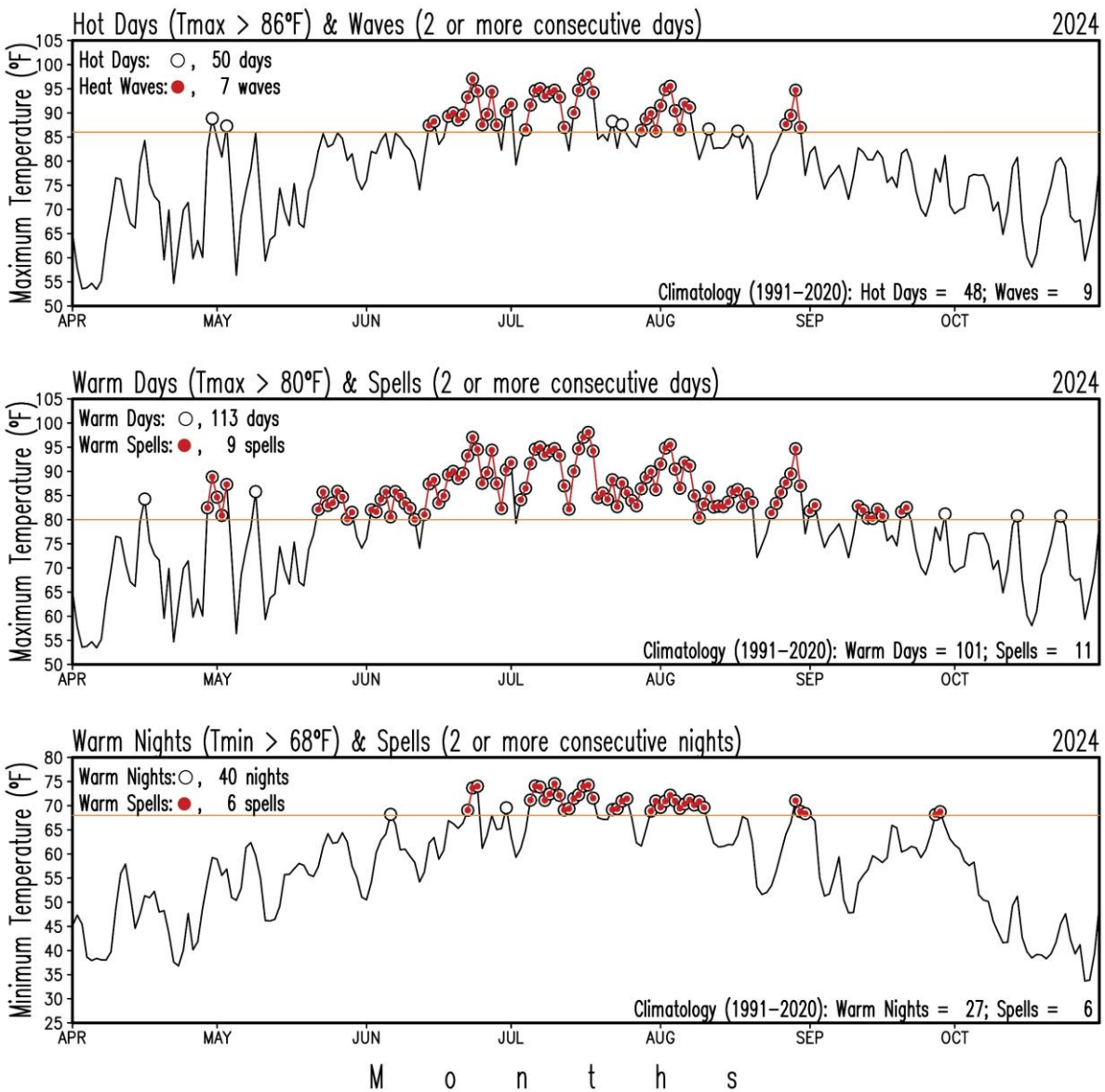## A.   Hot Days, Warm Days, and Warm Nights

Figure 9. Maryland (statewide) number of hot days, warm days, warm nights, and their consecutive occurrence for the period January 1 - October 31, 2024. The upper panel shows hot days in open circles and heat waves in red-filled circles from statewide daily maximum temperatures. The middle panel shows warm days in open circles and warm day spells in red-filled circles from statewide daily maximum temperatures. Lower panel shows warm nights in open circles and warm night spells in red-filled circles from statewide daily minimum temperatures. The orange line in each panel marks the threshold temperatures of 86°F, 80°F and 68°F for each case. Figures at the county and climate division level and summary tables can be found on the MDSCO website.

B.   Extreme Precipitation and Dry Spells
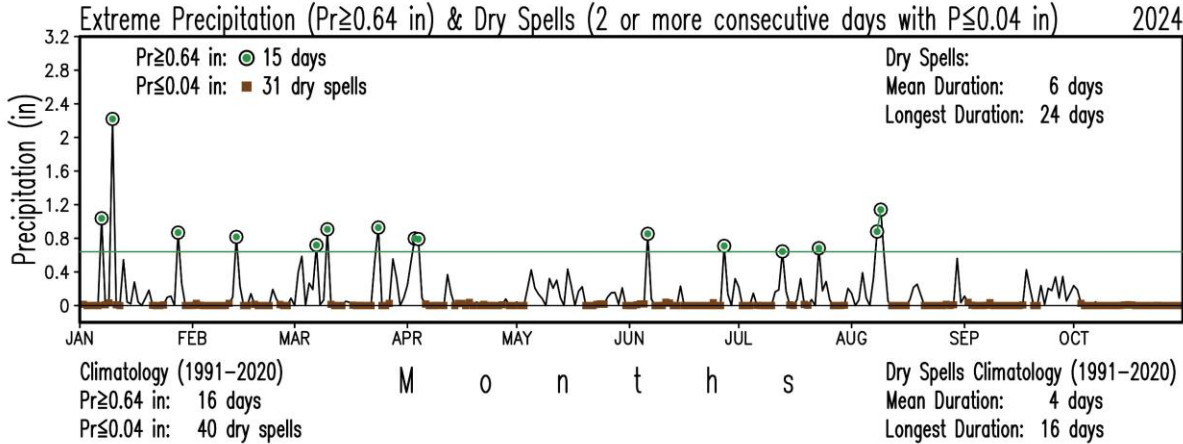
Figure 10. Maryland (statewide) number of days with extreme precipitation and dry day spells for the period January 1 - October 31, 2024. Extreme precipitation days (precipitation equal to or larger than 0.64 in) are identified by the green-filled circles. Dry spells (consecutive days with daily total precipitation less than or equal to 0.04 in) are shown by brown-filled squares. Both extremes are identified from the statewide area-averaged total daily precipitation. Figures at the county and climate division level and summary tables can be found on the MDSCO website.

C. Modified Growing Degree Days
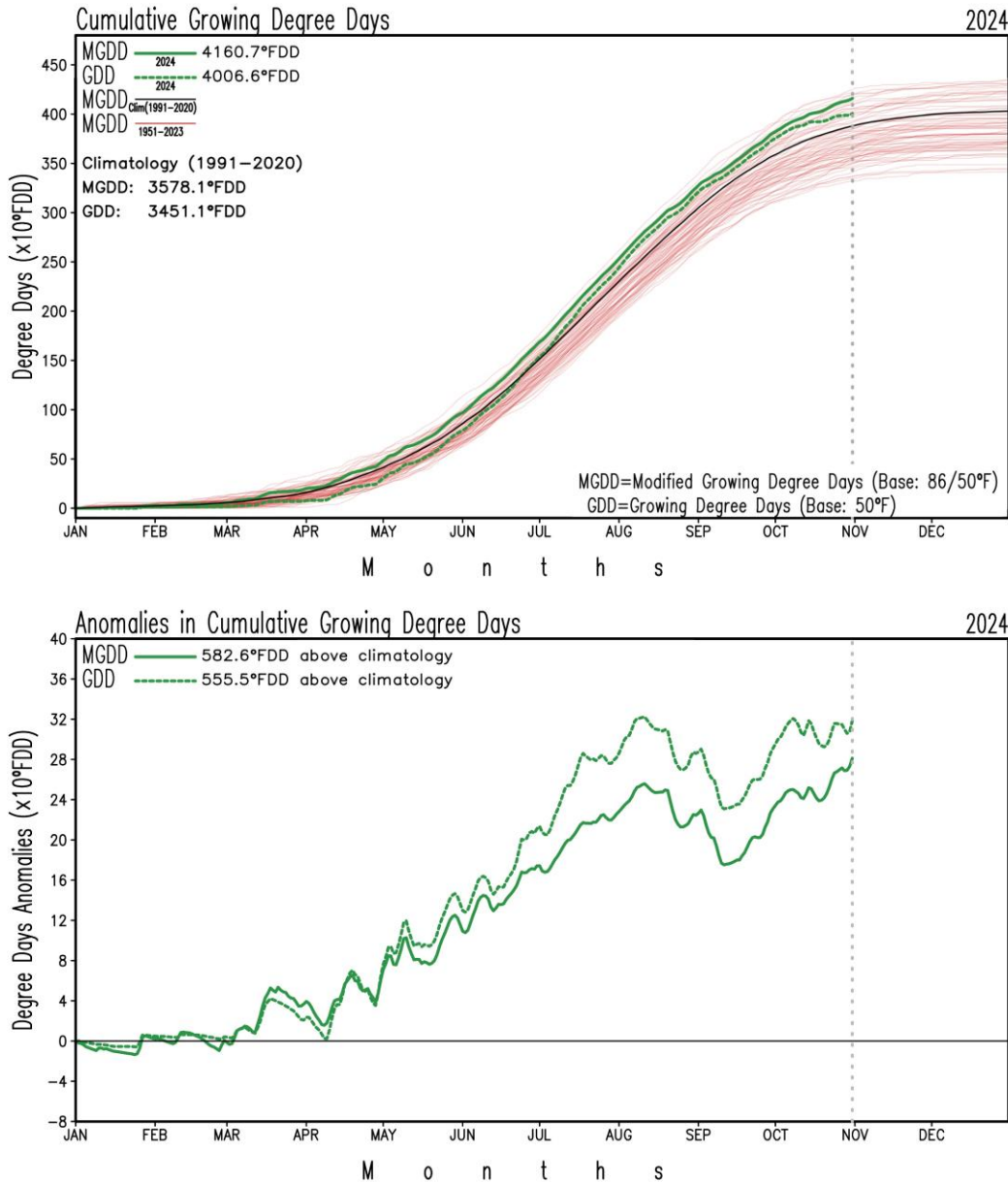
Figure 11. Maryland (statewide) cumulative growing degree days (upper panel) and its anomalies with respect to the 1991-2020 climatology (bottom panel) during the calendar year period January 1 to October 31, 2024. The cumulative modified growing degree days are displayed with the continuous green line, while the growing degree days are shown with the dashed green line; the black line in the upper panel shows the 1991- 2020 climatological cumulative modified growing degree days, and the thin red lines display the cumulative modified growing degree days every year from 1951 to 2023. Figures at the county and climate division level and summary tables can be found on the MDSCO website.

6. October 2024 Statewide Averages in the Historical Record
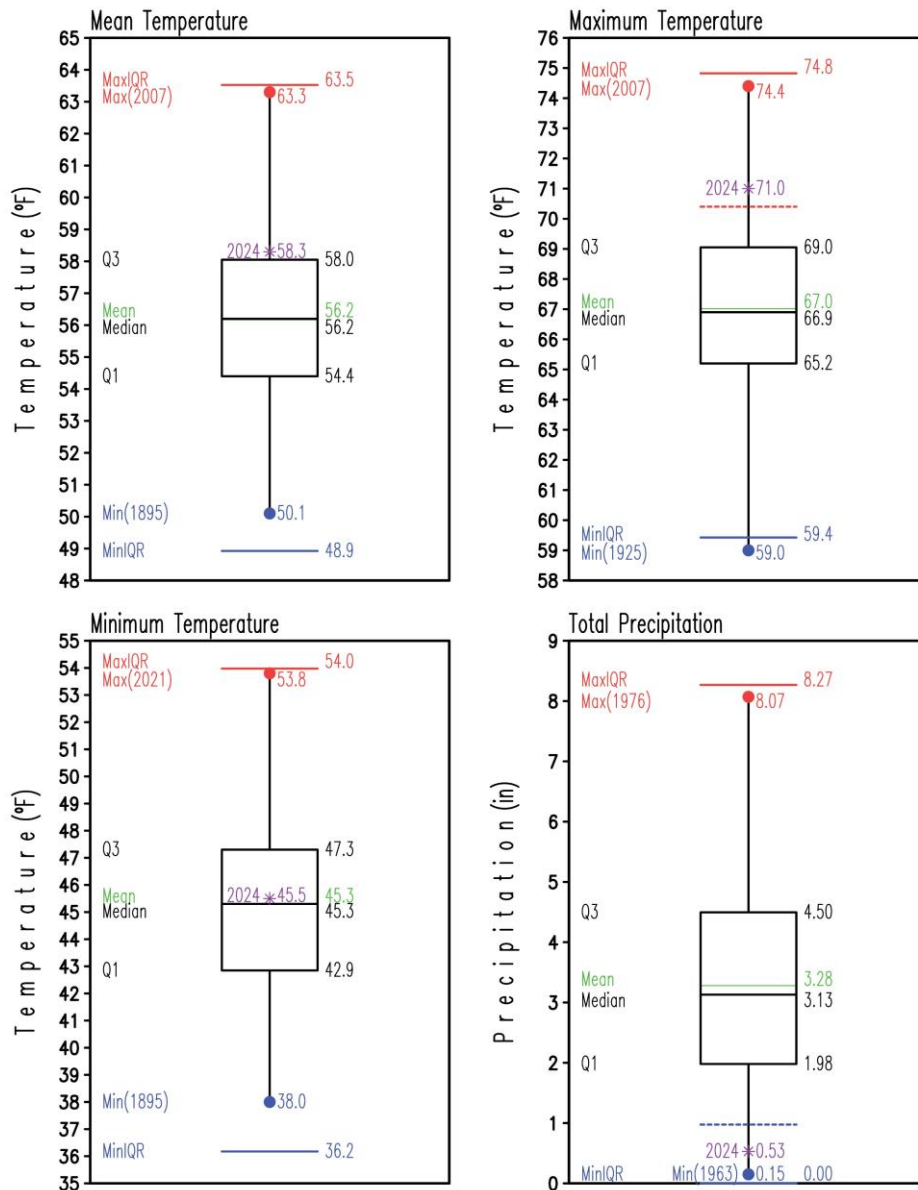
A. Box and Whisker Plots

Figure 12. Box and Whisker plots of Maryland (statewide) monthly mean (upper left), maximum (upper right), minimum (lower left) surface air temperatures, and total precipitation (lower right) for October for the period 1895-2023. The label and asterisk in purple represent conditions for October 2024. Statistics for the period 1895-2023 are labeled at the left side of each box and whisker plot and their values at their right. Temperatures are in °F, and precipitation is in inches. The mean is the green line within the box, while the median is the black line within the box. The lower (Q1) and upper (Q3) quartiles, indicating the values of the variable that separate 25% of the smallest and largest values, are the lower and upper horizontal black lines of the box, respectively. The thresholds indicating the upper 10% values in maximum temperature and the lower 5% values in precipitation are marked by the dashed red and blue lines respectively. The blue and red dots mark the minimum and maximum values in the period at the end of the whiskers; the year of occurrence is shown in parenthesis. The blue and red horizontal lines represent extreme values defined by Q1-1.5×(Q3-Q1) and Q3+1.5×(Q3-Q1), respectively.

7. 1895-2024 October Trends

A. Statewide Mean Temperature, Heating Degree-Days, and Precipitation
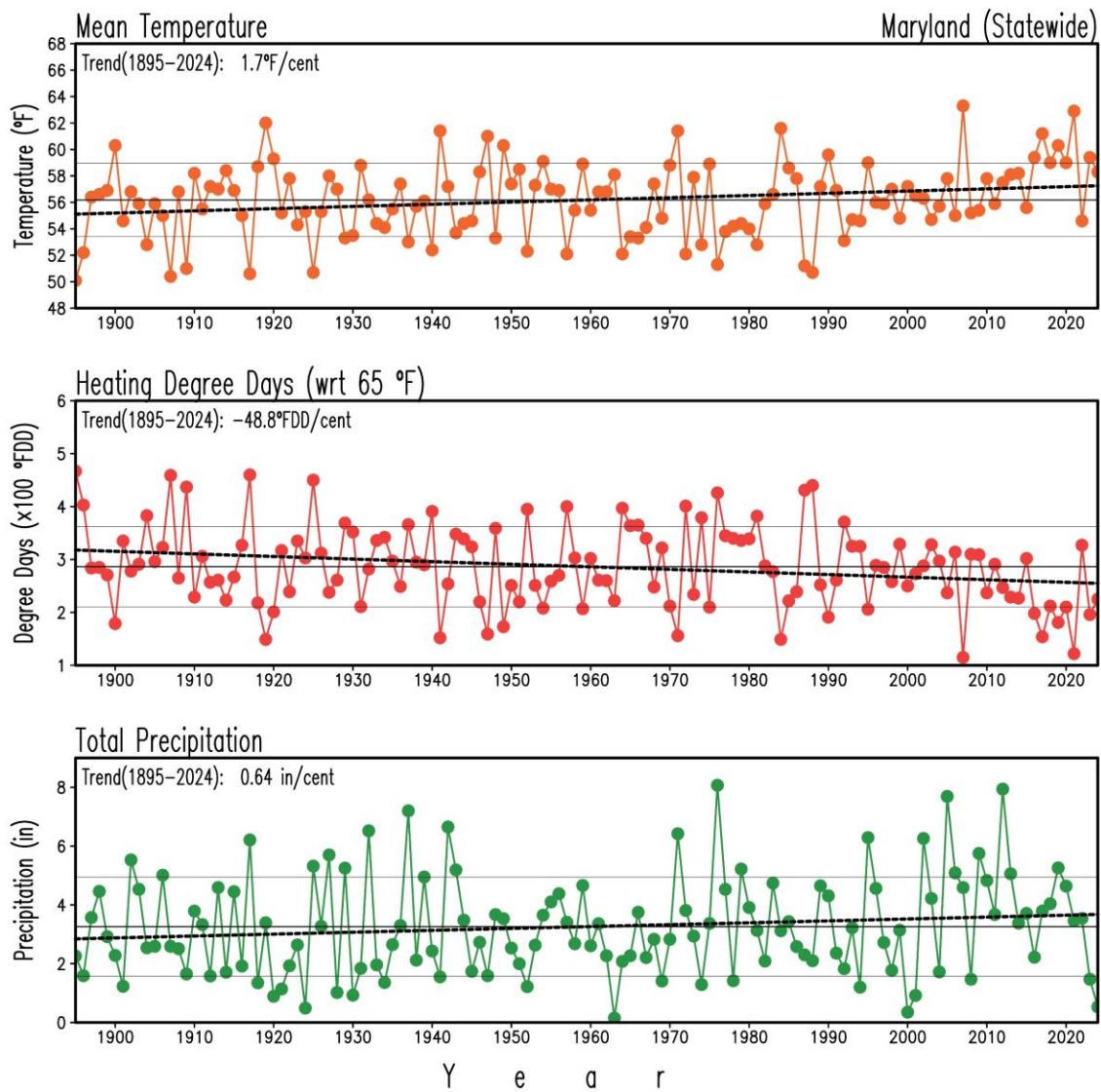
Figure 13. Maryland (statewide) mean surface air temperature, heating degree days, and precipitation in October for the period 1895-2024. Temperature is in °F, heating degree-days is in °F degree-days (°FDD), and precipitation is in inches. The thin, continuous black lines in each panel display the long-term means (56.2°F, 286.4°FDD and 3.26 in, 1895-2024), and the double thin, continuous gray lines indicate the standard deviation (2.8°F, 76.0°FDD and 1.68 in) above/below the long-term mean. The thick dashed black lines show the long-term linear trend. The warming temperature trend (1.7°F/century) and the decreasing heating degree-days trend (−48.8°FDD/century) are statistically significant at the 95% level (*Student's t-test* −Santer et al. 2000) but no the precipitation increasing trend (0.64 in/century).

B.   Temperature and Precipitation Maps
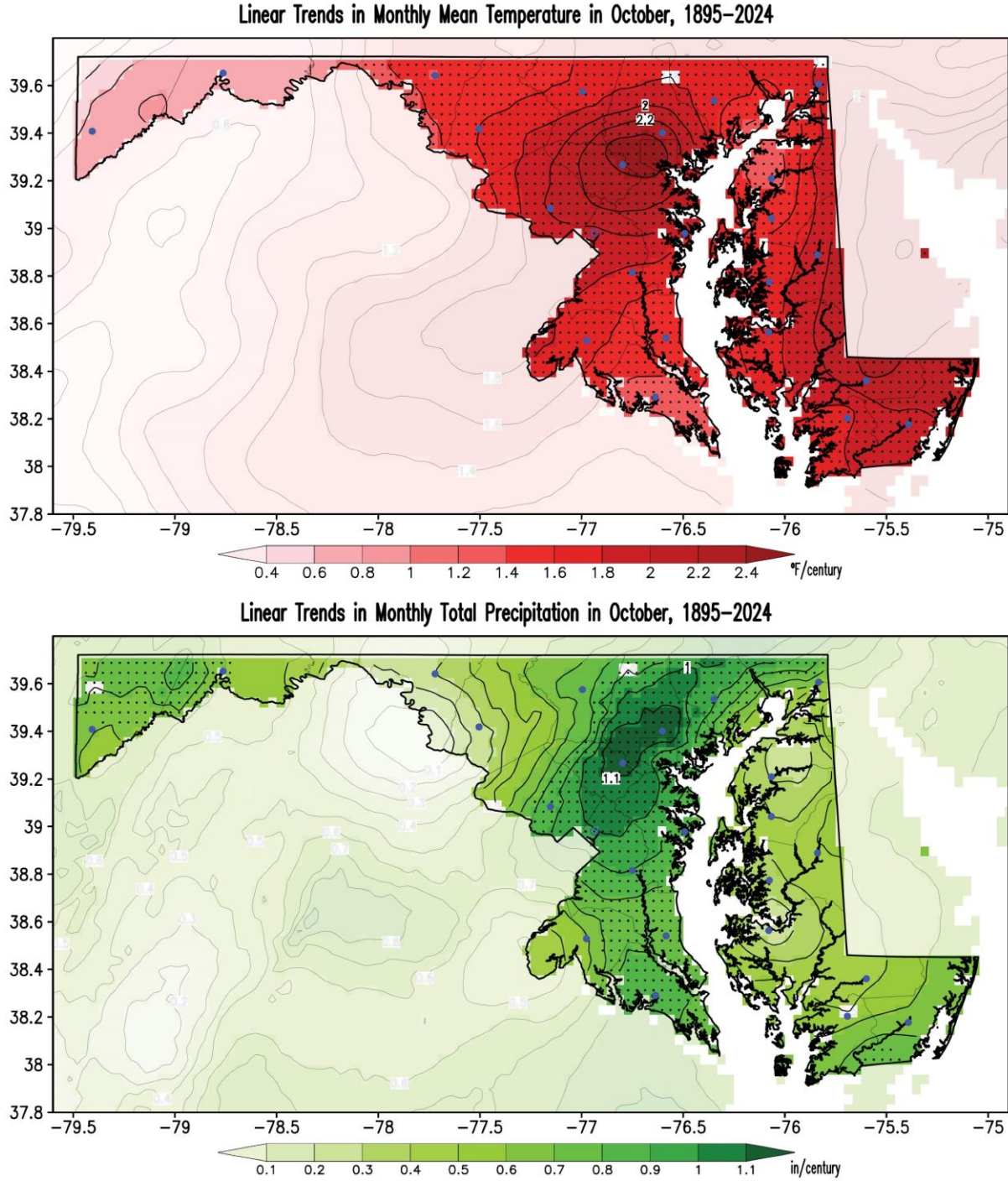
Figure 14. Linear trends in surface air mean temperature and precipitation in October for the period 1895-2024. Temperatures are in °F/century, and precipitation is in inches/century following the color bars. Red shading in the temperature map marks warming trends. Green shading in the precipitation map shows wetting trends. Stippling in the maps shows regions where trends are statistically significant at the 95% level (*Student's t-test* −Santer et al. 2000). Note that shading outside the state has been washed out to facilitate focusing on Maryland. Filled blue circles mark the county seats.

Appendix A. October 2024 Data Tables: Statewide, Climate Divisions, and Counties

A. Mean Temperature and Precipitation

Region	Mean Air Temperature (°F)	Rank (#)	Region	Total Precipitation (in)	Rank (#)
Statewide	58.3	102	Statewide	0.53	4
Climate Division 1	60.6	101	Climate Division 1	0.05	1
Climate Division 2	59.8	101	Climate Division 2	0.10	2
Climate Division 3	61.1	113	Climate Division 3	0.33	3
Climate Division 4	59.5	100	Climate Division 4	0.60	5
Climate Division 5	58.9	100	Climate Division 5	0.25	3
Climate Division 6	57.4	101	Climate Division 6	0.43	4
Climate Division 7	55.1	86	Climate Division 7	1.46	32
Climate Division 8	51.5	99	Climate Division 8	2.09	41
Allegany	54.7	86	Allegany	2.14	54
Anne Arundel	59.4	93	Anne Arundel	0.47	5
Baltimore	57.2	95	Baltimore	0.39	4
Baltimore City	58.6	88	Baltimore City	0.44	5
Calvert	60.8	107	Calvert	0.25	3
Caroline	58.8	100	Caroline	0.11	2
Carroll	56.4	102	Carroll	0.51	5
Cecil	58.1	101	Cecil	0.12	2
Charles	60.9	116	Charles	0.50	4
Dorchester	60.4	104	Dorchester	0.07	1
Fredrick	56.8	100	Fredrick	0.63	5
Garrett	51.5	98	Garrett	2.09	41
Harford	57.7	99	Harford	0.22	3
Howard	57.2	99	Howard	0.48	5
Kent	58.9	95	Kent	0.26	3
Montgomery	58.3	108	Montgomery	0.49	5
Prince George's	59.6	106	Prince George's	0.70	6
Queen Anne's	59.0	100	Queen Anne's	0.26	2
Saint Mary's	61.5	112	Saint Mary's	0.13	2
Somerset	61.1	100	Somerset	0.08	2
Talbot	60.1	102	Talbot	0.20	3
Washington	55.4	86	Washington	0.83	7
Wicomico	59.8	98	Wicomico	0.03	1
Worcester	60.8	100	Worcester	0.05	1

Table A1. Monthly mean surface air temperature (left) and total precipitation (right) at Maryland (statewide), climate division, and county levels for October 2024. Temperatures are in °F, and precipitation is in inches. The rank is the order that the variable for October 2024 occupies among the 130 Octobers after the 130 values have been arranged from the lowest to the highest in the *standard competition ranking method*. The closer to 130 the rank is, the larger (i.e., the warmer/wetter) the value of the surface variable is in the record; similarly, the closer to 1 the rank is, the smaller (i.e., the colder/drier) the value of the surface variable is in the record.

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B.   Maximum and Minimum Temperatures

Region	Maximum Air Temperature (°F)	Rank (#)	Region	Minimum Air Temperature (°F)	Rank (#)
Statewide	71.0	121	Statewide	45.5	67
Climate Division 1	74.0	127	Climate Division 1	47.2	51
Climate Division 2	72.9	125	Climate Division 2	46.7	61
Climate Division 3	72.9	121	Climate Division 3	49.4	94
Climate Division 4	71.4	114	Climate Division 4	47.6	78
Climate Division 5	71.2	116	Climate Division 5	46.5	66
Climate Division 6	69.9	119	Climate Division 6	44.8	71
Climate Division 7	69.2	109	Climate Division 7	41.0	58
Climate Division 8	65.4	117	Climate Division 8	37.5	61
Allegany	69.1	107	Allegany	40.4	59
Anne Arundel	71.0	113	Anne Arundel	47.8	70
Baltimore	70.1	116	Baltimore	44.4	64
Baltimore City	70.6	112	Baltimore City	46.5	57
Calvert	72.4	120	Calvert	49.2	86
Caroline	72.4	123	Caroline	45.3	62
Carroll	69.2	116	Carroll	43.5	79
Cecil	70.9	123	Cecil	45.4	60
Charles	72.7	120	Charles	49.1	100
Dorchester	73.6	127	Dorchester	47.1	55
Fredrick	69.2	116	Fredrick	44.5	75
Garrett	65.4	117	Garrett	37.5	59
Harford	70.4	121	Harford	44.9	60
Howard	69.9	117	Howard	44.4	74
Kent	71.0	117	Kent	46.8	64
Montgomery	70.2	118	Montgomery	46.4	91
Prince George's	71.8	116	Prince George's	47.3	88
Queen Anne's	71.2	116	Queen Anne's	46.7	66
Saint Mary's	73.3	124	Saint Mary's	49.8	84
Somerset	74.0	127	Somerset	48.3	54
Talbot	72.0	119	Talbot	48.1	68
Washington	69.3	110	Washington	41.6	57
Wicomico	74.0	127	Wicomico	45.6	49
Worcester	73.9	128	Worcester	47.6	50

Table A2. Monthly maximum (left) and minimum (right) surface air temperatures at Maryland (statewide), climate division, and county levels for October 2024. Temperatures are in °F. The rank is the order that the variable for October 2024 occupies among the 130 Octobers after the 130 values have been arranged from the lowest to the highest using the *standard competition ranking method*. The closer to 130 the rank is, the larger (i.e., the warmer) the value of the surface variable is in the record; similarly, the closer to 1 the rank is, the smaller (i.e., the colder) the value of the surface variable is in the record.

Appendix B. October 2024 Bar Graphs: Statewide, Climate Divisions, and Counties
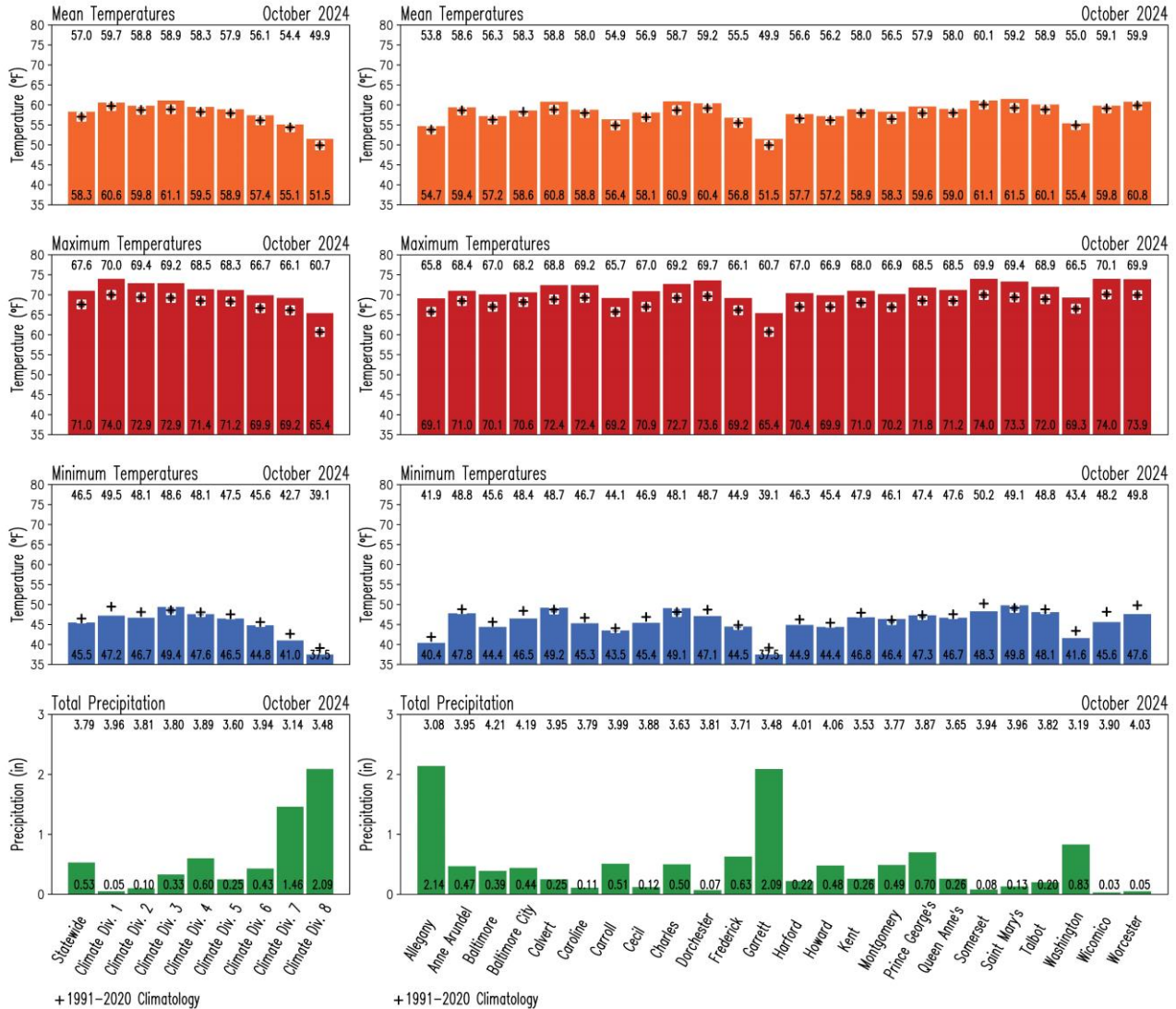
A.   Temperatures and Precipitation

Figure B1. Monthly surface variables in Maryland for October 2024. Color bars represent the variables as follows: mean surface air temperature (orange), maximum surface air temperature (red), minimum surface air temperature (blue), and total precipitation (green) at statewide and climate division (left column), and county (right column) levels. Temperatures are in °F, and precipitation is in inches. The numbers at the base of the bars indicate the magnitude of the variable for October 2024. For comparison, the corresponding 1991-2020 climatological values for October are displayed as black addition signs, and their magnitudes are shown at the top of the panels.
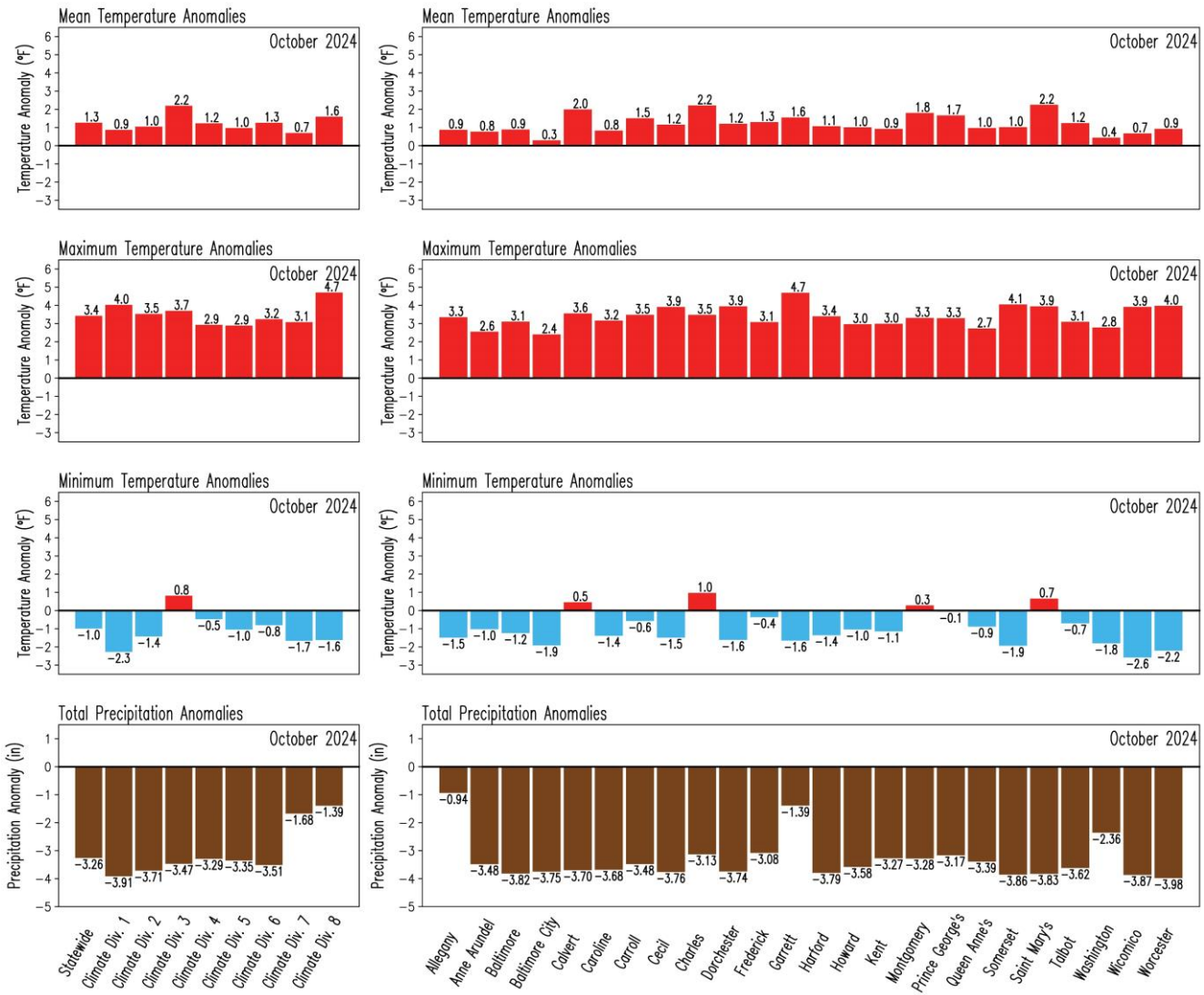
B.   Temperatures and Precipitation Anomalies

Figure B2. Anomalies of the monthly surface variables in Maryland for October 2024. Anomalies are with respect to the 1991-2020 climatology. Red/blue color represents positive/negative (warmer/colder than normal) anomalies for mean surface air temperature (upper row), maximum surface air temperature (second row from top), and minimum surface air temperature (third row from top), while brown color indicates negative drier than normal) anomalies in total precipitation (bottom row) at statewide and climate division (left column) and county (right column) levels. Temperatures are in °F, and precipitation is in inches. The numbers outside the bars indicate the magnitude of the anomaly for October 2024.

Appendix C. October 1991-2020 Climatology Maps and October 2024 Precipitation as Percentage of Climatology
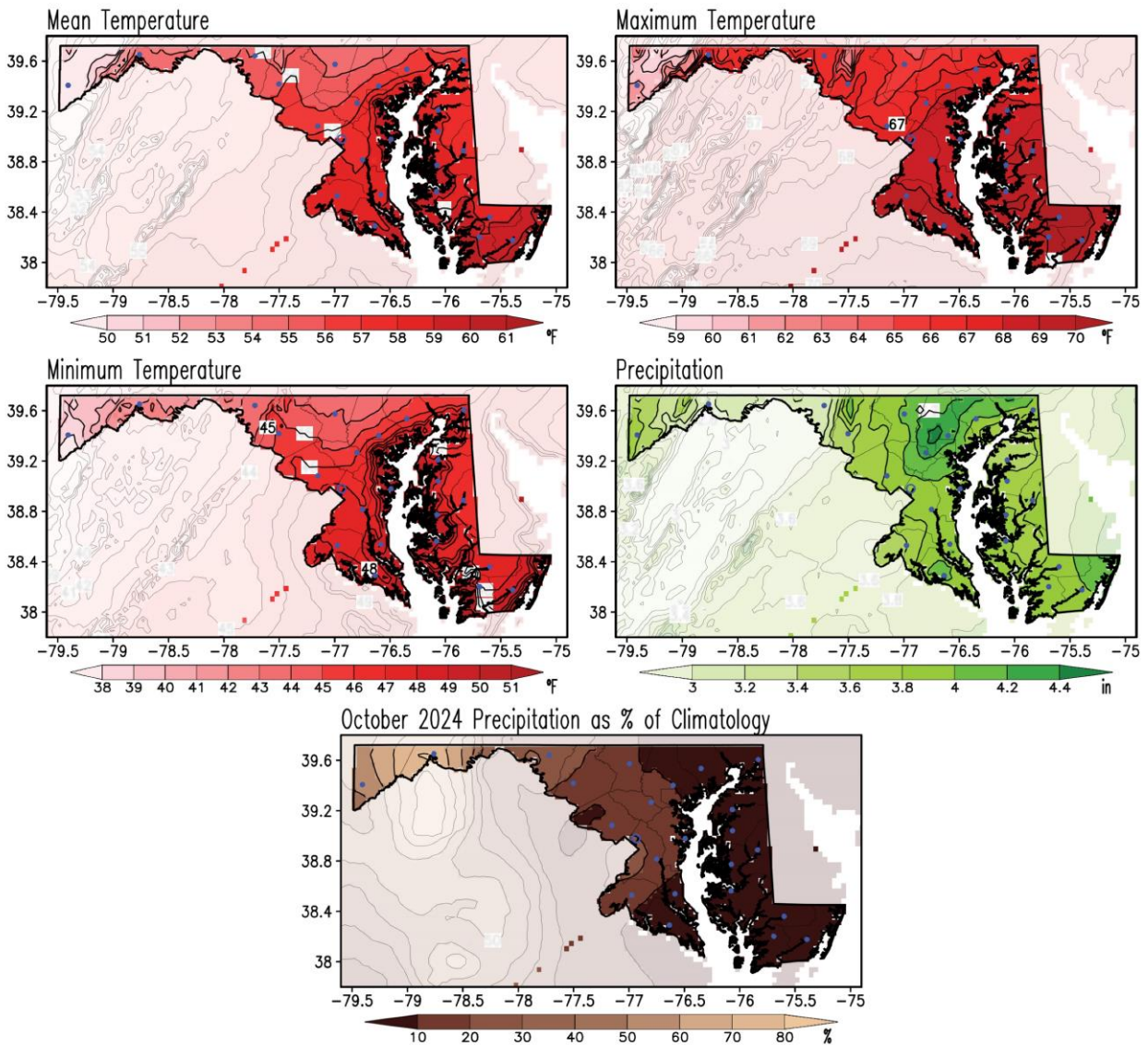

Figure C1. October climatology of the monthly mean, maximum and minimum surface air temperatures, and total precipitation for the period 1991-2020 (upper and middle rows), and precipitation in October 2024 as a percentage of climatology (bottom row). Temperatures are in °F, and precipitation is in inches according to the color bars. This is the current climate normal against which the October 2024 conditions are compared to obtain the October 2024 anomalies (from Figure 1 to 4). The precipitation as a percentage is obtained by dividing the total precipitation (from Figure 4) by the climatology (from the middle right panel) and multiplying that ratio by 100 so units are in percent of climatology (%); brown shading in this map shows drier than normal conditions. Note that shading outside the state has been washed out to facilitate focusing on Maryland. Filled blue circles mark the county seats.

Appendix D. October Standard Deviation and October 2024 Standardized Anomalies Maps
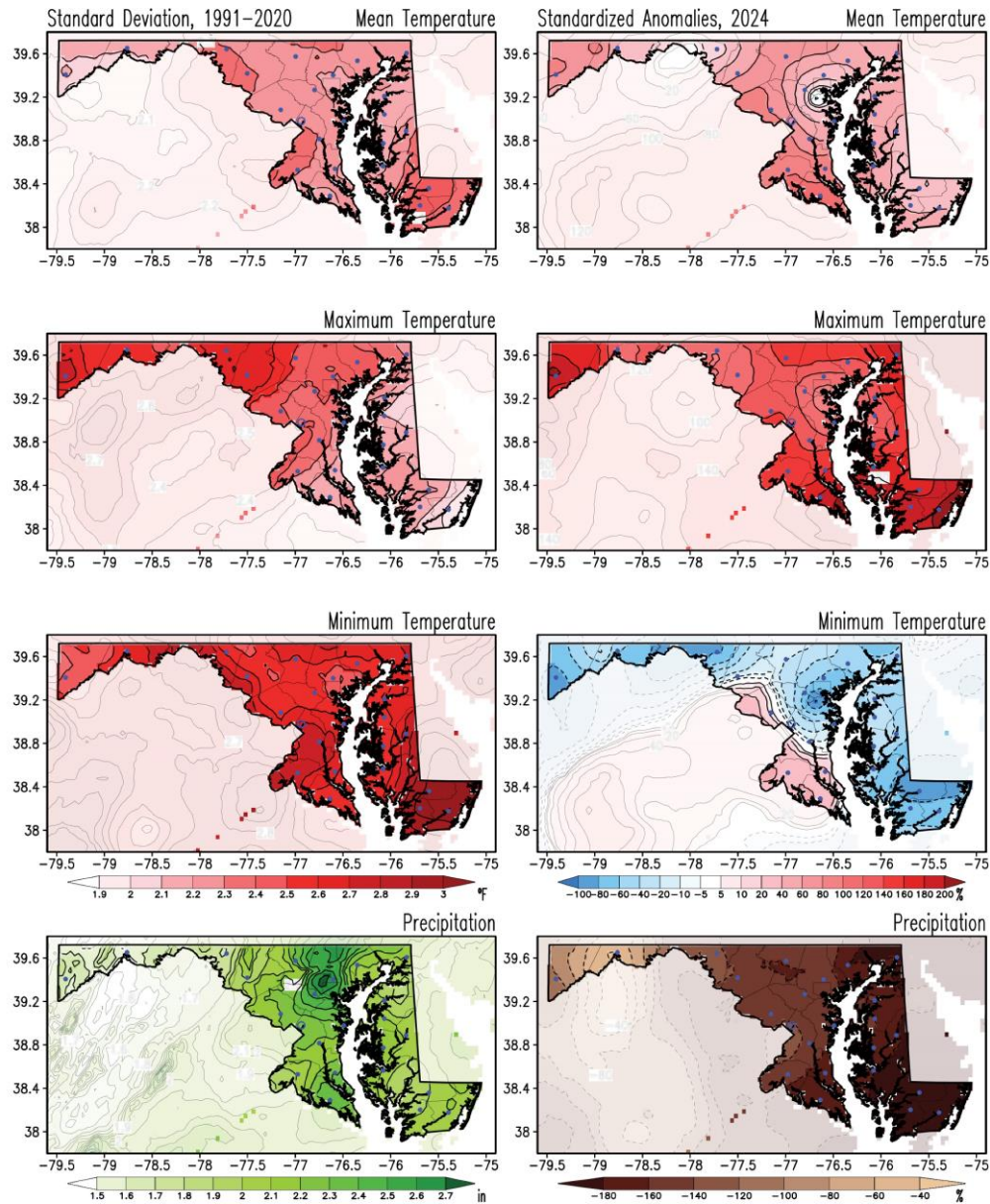

Figure D1. Standard deviation for October and standardized anomalies of temperatures and precipitation for October 2024. Standard deviations for monthly mean, maximum, and minimum surface air temperatures and total precipitation were obtained for the 1991-2020 period (left column). Anomalies for October 2024 (right column) are obtained as a percentage of the standard deviations. The standard deviations in temperatures are in °F, and those in precipitation are in inches according to the color bars. Blue/red shading in the anomaly temperature maps marks colder/warmer than normal conditions; brown shading in the anomaly precipitation map marks drier than normal conditions. The standardized anomalies are obtained by dividing the raw anomalies (from Figures 1 to 4) by the standard deviation (from left column panels) and multiplying that ratio by 100; hence, units are in percent (%). Note that shading outside the state has been washed out to facilitate focusing on Maryland. Filled blue circles mark the county seats.

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