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# Maryland Climate Bulletin
# Fall 2024

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# Summary

Fall 2024 was warmer and drier than normal (i.e., 1991-2020 averages) in Maryland (statewide), with warmer and drier than normal September, October, and November. Seasonal mean temperatures were in the 52 to 62°F range, maximum temperatures were between 62 and 72°F, and minimum temperatures were in the 40 to 52°F range. Seasonal accumulated total precipitation was between 3 and 9.5 inches.

*Maryland Regional Features* (Figures 1-5, C1, and E1)

- The mean temperature was warmer than normal everywhere in the state, particularly over Garrett County (up to 2.8°F), and Prince George's, Anne Arundel, Charles, Calvert, Saint Mary's, Kent, Queen Anne's, Talbot, and western Dorchester counties (2.0–2.4°F).

- The maximum temperature was warmer than normal too in the entire state, especially over Garrett County (3.3–4.2°F), Calvert, and portions of Saint Mary's and Charles counties (around 3.0°F).

- The minimum temperature was warmer than normal over most of the state, notably over Charles County (1.8–2.4°F) and western portions of Montgomery and Prince George's counties (around 1.8°F). Slightly below-normal temperatures appeared over Wicomico, Somerset, and Worcester counties.

- Precipitation was below normal over the whole state, particularly over Cecil County and portions of Harford, Kent, Queen Anne's, and Wicomico counties (8 inches deficit), and counties of the Coastal Plains on both sides of the Bay (6−7 inches deficit). The regions with maximum deficit had around 25−30% of their climatological fall precipitation, while those on both sides of the Bay received no more than 50%. Western Maryland over Allegany and Garrett counties received 55–85% of their climatological precipitation.

- The partial water year 2025 (October − November 2024) started below normal over the entire state, especially over eastern Wicomico and northern Worcester counties (5.5 inches deficit), northern Harford and Cecil counties (5 inches deficit), and counties of the Piedmont and Coastal Plains (4–4.5 inches deficit). Among these regions, the southern Eastern Shore had 25–30% of their climatological water amount, and the rest had between 35 and 40% of theirs.

*Maryland Climate Divisions* (Figures 6-7, B1, and B2)

- All eight climate divisions were warmer and drier than normal in the fall. Climate division 8, the Allegheny Plateau, had the largest mean temperature departure from normal (2.5°F), while climate divisions 1 and 7, Southeastern Shore and Appalachian Mountains, had the smallest (1.2°F). Climate Division 8 had the smallest departure from normal precipitation (−2.05 in), while Climate Division 1 had the largest departure from

normal (−7.58 in). Climate Division 1 was the only one with below–normal minimum temperature (–0.2°F).

- Seasonally, statewide mean temperature anomalies have remained warmer than normal since spring, with the largest anomalies in spring (3.0°F); however, they have remained warmer than normal since fall 2023. Statewide precipitation anomalies changed from above normal in spring (1.25 in) to below normal in summer (1.92 inches deficit) and fall (6.26 inches deficit).

*Historical Context* (Figure 8, Tables A1 and A2)

- Fall 2024's statewide mean, maximum, and minimum temperatures (59.0, 69.9, and 48.1°F) were above the long-term (1895-2023) averages, with the mean and maximum temperatures within 10% of their highest recorded values for the season. These temperatures were more than one degree apart from their warmest records of 60.4, 71,7, and 50.4°F established in 1931, 1931, and 2018, respectively. Fall's statewide precipitation (5.05 in) was below the long-term average and within 5% of the smallest values on record; it was close to the driest record of 3.51 inches in 1930.
- Mean temperatures showed that fall 2024 was the eleventh warmest fall statewide and among the ten warmest in 14 counties. It was the fifth warmest fall for Calvert, Charles, Garrett, Prince George's, and Saint Mary's counties.
- Maximum temperatures indicated that fall 2024 was the fifth warmest fall statewide and among the ten warmest for 20 counties. It was the fifth warmest fall for Caroline, Charles, Howard, and Talbot counties, the fourth warmest for Cecil, Harford, Kent, Prince George's, Queen Anne's, and Saint Mary's counties, and the third warmest for Calvert, Dorchester, Somerset, Wicomico, and Worcester counties.
- Minimum temperatures showed that fall 2024 was the sixteenth warmest fall statewide, the tenth warmest for Charles, Prince George's, and Saint Mary's counties, and the ninth for Calvert County.
- Precipitation revealed that fall 2024 was the sixth driest fall statewide and among the ten driest for 17 counties. It was the fifth driest fall for Washington County, the fourth for Dorchester and Harford counties, the third driest for Somerset, Wicomico, and Worcester, the second driest for Caroline and Queen Anne's counties, and the driest for Cecil and Kent counties.

*Century-Plus Trends, 1895-2024* (Figures 9, 10)

- Statewide mean temperature, heating degree days, precipitation, and partial water year (October to November) in fall showed significant trends: a warming trend (1.8°F/century), a decreasing heating trend (−144.3°FDD/century), a wetting trend (2.20 in/century), and an increasing water year trend (1.39 in/century), respectively.

- Regionally, fall temperatures showed significant warming trends everywhere in the state. The largest trend is over southwestern Baltimore County, including Baltimore City (2.6°F/century). Large trends (above 2.0°F/century) are also evident in Piedmont, western Charles, Prince George's counties, and the eastern half of the Eastern Shore.
- Regionally, fall precipitation displayed significant wetting trends over the entire state. The largest trends are over central Baltimore County (3.0 in/century). Slightly smaller trends (2.4−2.8 in/century) are found in the rest of the Piedmont and Charles, Calvert, and Saint Mary's counties.

# 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. This is the seasonal version of the bulletin.

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 eastern placement of the state within the expansive North American continent contribute to a comparatively wide range of climatic conditions.

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

The seasonal surface climate conditions for fall 2024 are presented via maps of key variables, such as average surface air temperature, maximum surface air temperature, minimum surface air temperature, accumulated total precipitation, and their anomalies (i.e., departures from normal); they are complemented by partial water year conditions for the state (Section 3). Statewide and climate division averages for the season are compared against each other via scatter plots (Section 4). The seasonal statewide averages are placed in the context of the historical record via box and whisker plots in Section 5. Century-plus trends in statewide air temperature, heating degree-days, accumulated total precipitation, partial water year, and state maps of air temperature and accumulated total precipitation are presented in Section 6. Ancillary statewide, climate division, and county-level information are provided via tables and plots in Appendices A-B; climatology and variability maps are in Appendices C-E.

# 2. Data & Methods

Surface air temperatures, total precipitation, and cooling 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 12/12/2024.

- NOAA Monthly U.S. Climate *Divisional* Dataset (NClimDiv – Vose et al., 2014). It is available in a preliminary status (v1.0.0) at: https://www.ncei.noaa.gov/pub/data/cirs/climdiv/
  Data was downloaded on 12/9/2024.

Some definitions:

*About the seasons*: Seasons are defined following the common three-month meteorological definitions. Spring includes March, April, and May; summer includes June, July, and August; fall includes September, October, and November; and winter includes December, January, and February. Seasonal temperatures are obtained as the mean of the temperatures in the three months, while seasonal precipitation and degree days are obtained as the sum of their values in the three months (which in turn were obtained as the sum of their daily values).

*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 season (e.g., fall 2024) are the departures of the seasonal value from the corresponding climatology; in this case, the 1991-2020 climatology. When the observed seasonal 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 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, which is considered tolerable for human comfort (CPC, 2023).

*About the water year*. The water year is the sum of total precipitation from the 1st of October to the 30th of September of the next year and is labeled by the year in which the measurements end; so, the water year 2025 started in October 2024 and will end in September 2025. Total precipitation in the complete water year reflects winter snow accumulation and summer rainfall. Precipitation that falls during a water year reflects how much water will contribute to actual stream flow and groundwater inputs for that year. This issue presents only the partial water year from October to November from the total monthly precipitation data.

*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. Fall 2024 Maps

## A. Mean Temperatures

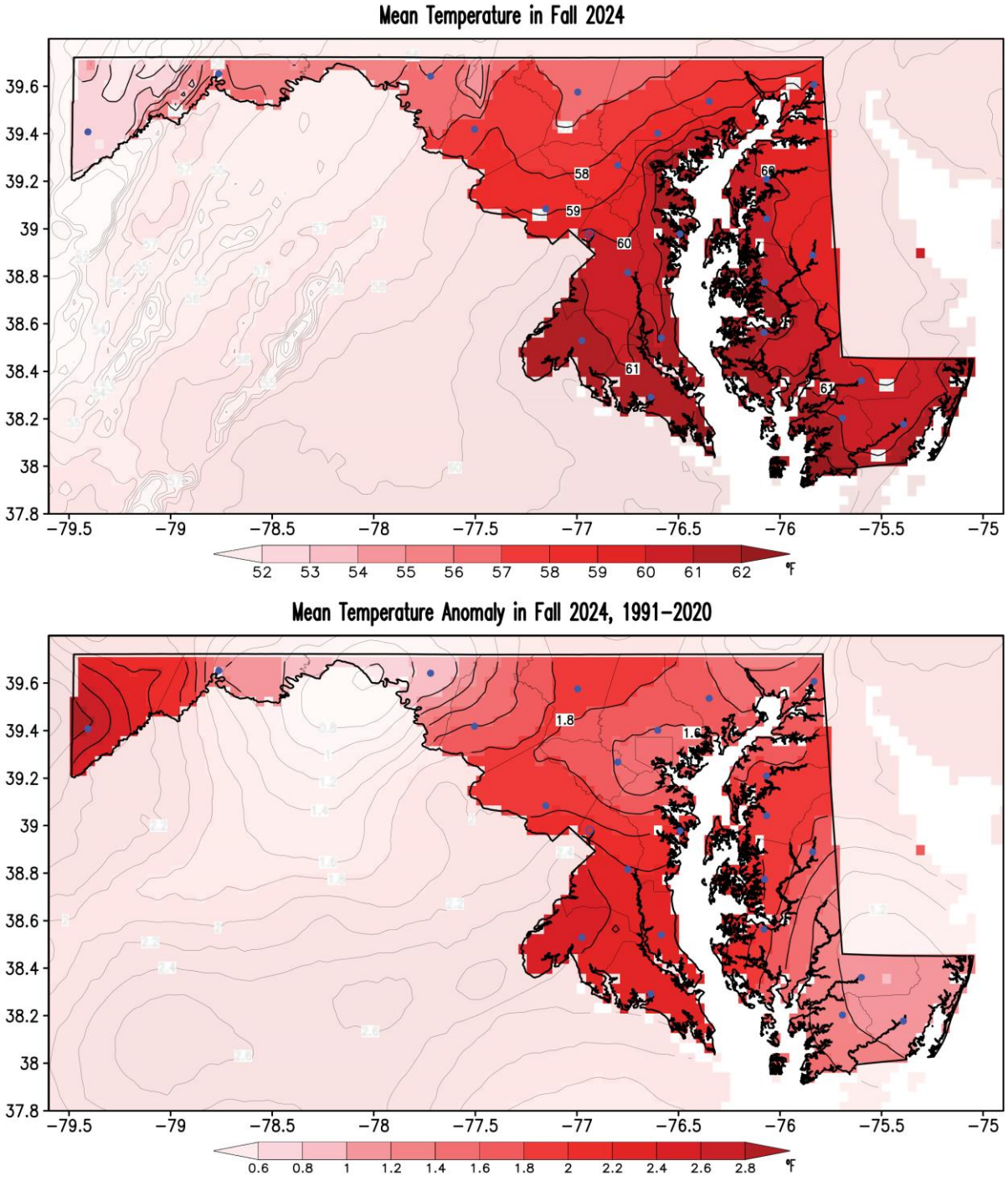


**Figure 1.** Seasonal mean surface air temperature (top panel) and its anomaly with respect to the 1991-2020 climatology (bottom panel) for fall 2024. Temperatures are in °F following the color bar. Red shading in the anomaly map marks warmer than normal conditions. Note shading outside the state has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

B. Maximum Temperatures

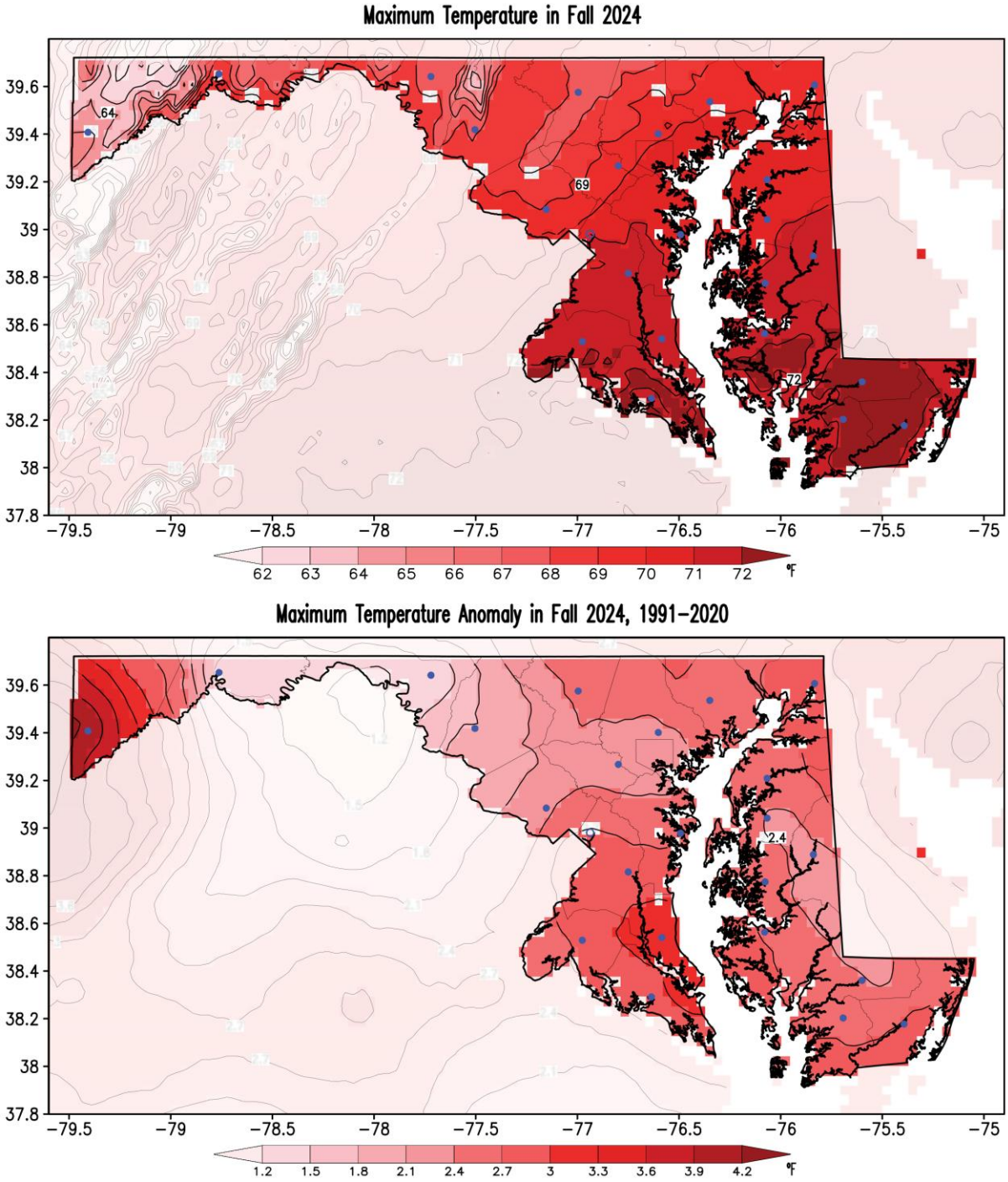


**Figure 2.** Seasonal maximum surface air temperature (top panel) and its anomaly with respect to the 1991-2020 climatology (bottom panel) for fall 2024. Temperatures are in °F following the color bar. Red shading in the anomaly map marks warmer than normal conditions. Note shading outside the state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

C. Minimum Temperatures

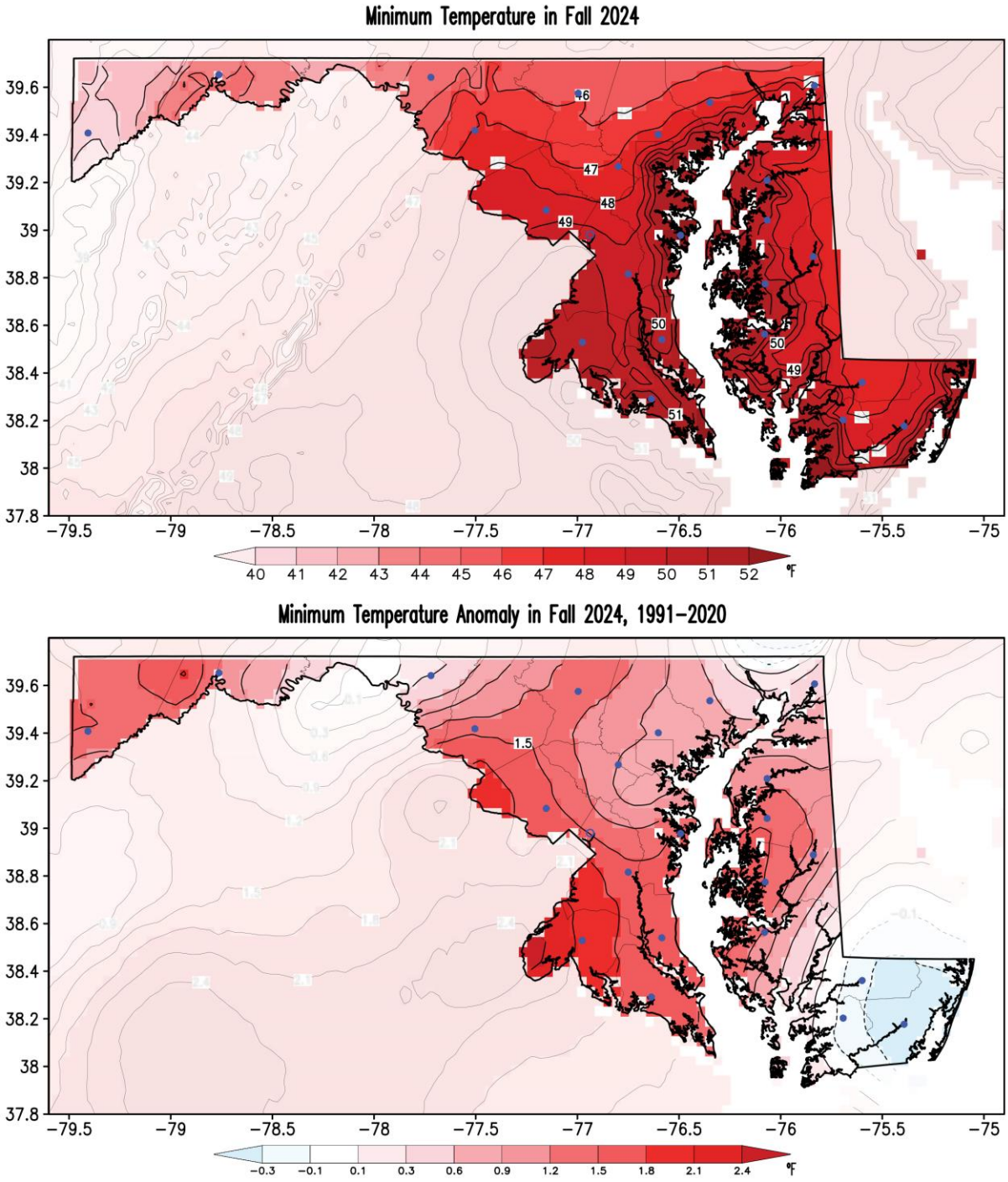


**Figure 3.** Seasonal minimum surface air temperature (top panel) and its anomaly with respect to the 1991-2020 climatology (bottom panel) for fall 2024. Temperatures are in °F following the color bar. Blue/red shading in the anomaly map marks colder/warmer than normal conditions. Note shading outside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

D. Precipitation

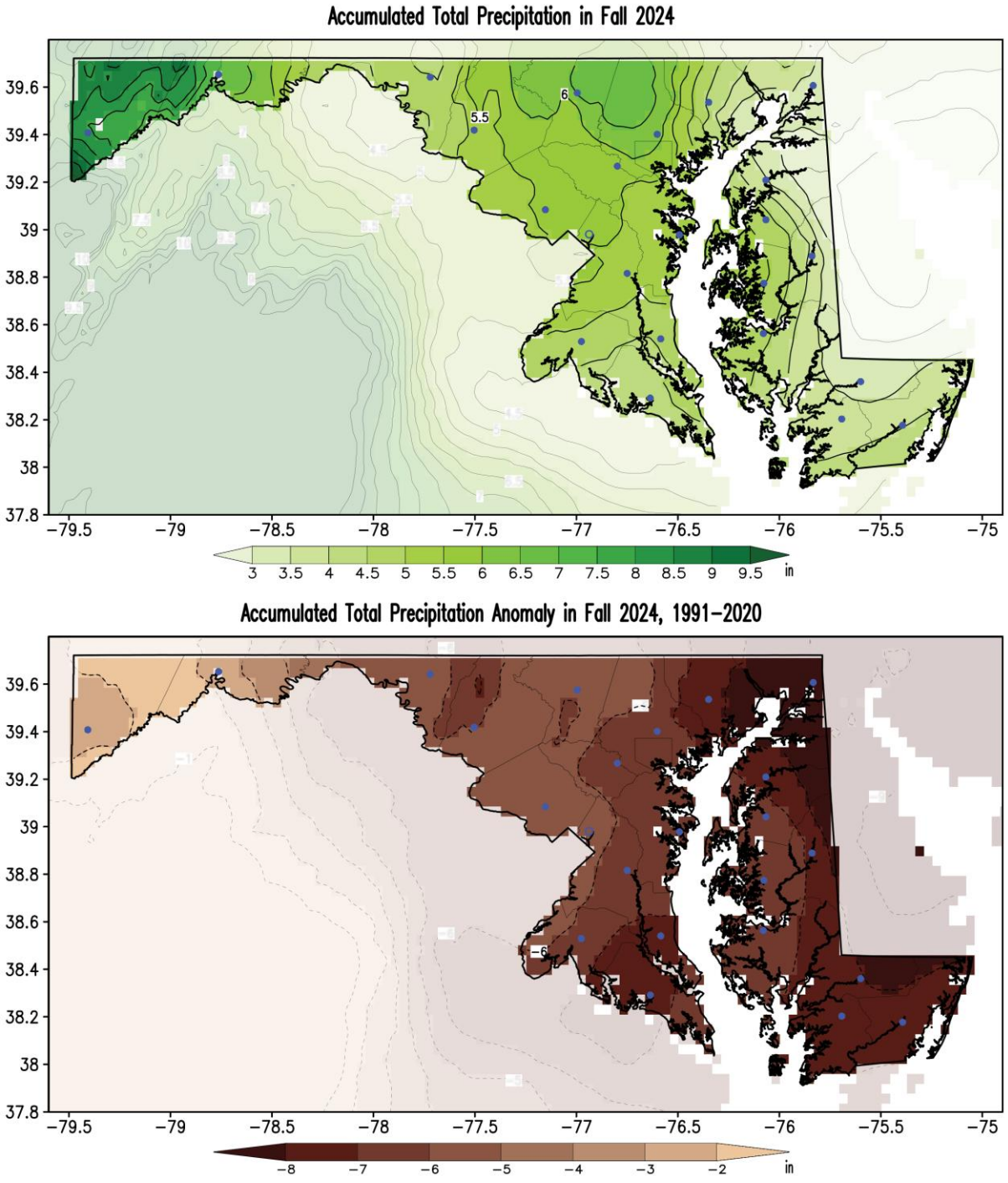


**Figure 4.** Seasonal accumulated total precipitation (top panel) and its anomaly with respect to the 1991-2020 climatology (bottom panel) for fall 2024. Precipitation is in inches following the color bar. Brown shading in the anomaly map marks drier than normal conditions. Note shading outside the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

E. Partial Water Year (October – November, 2024)

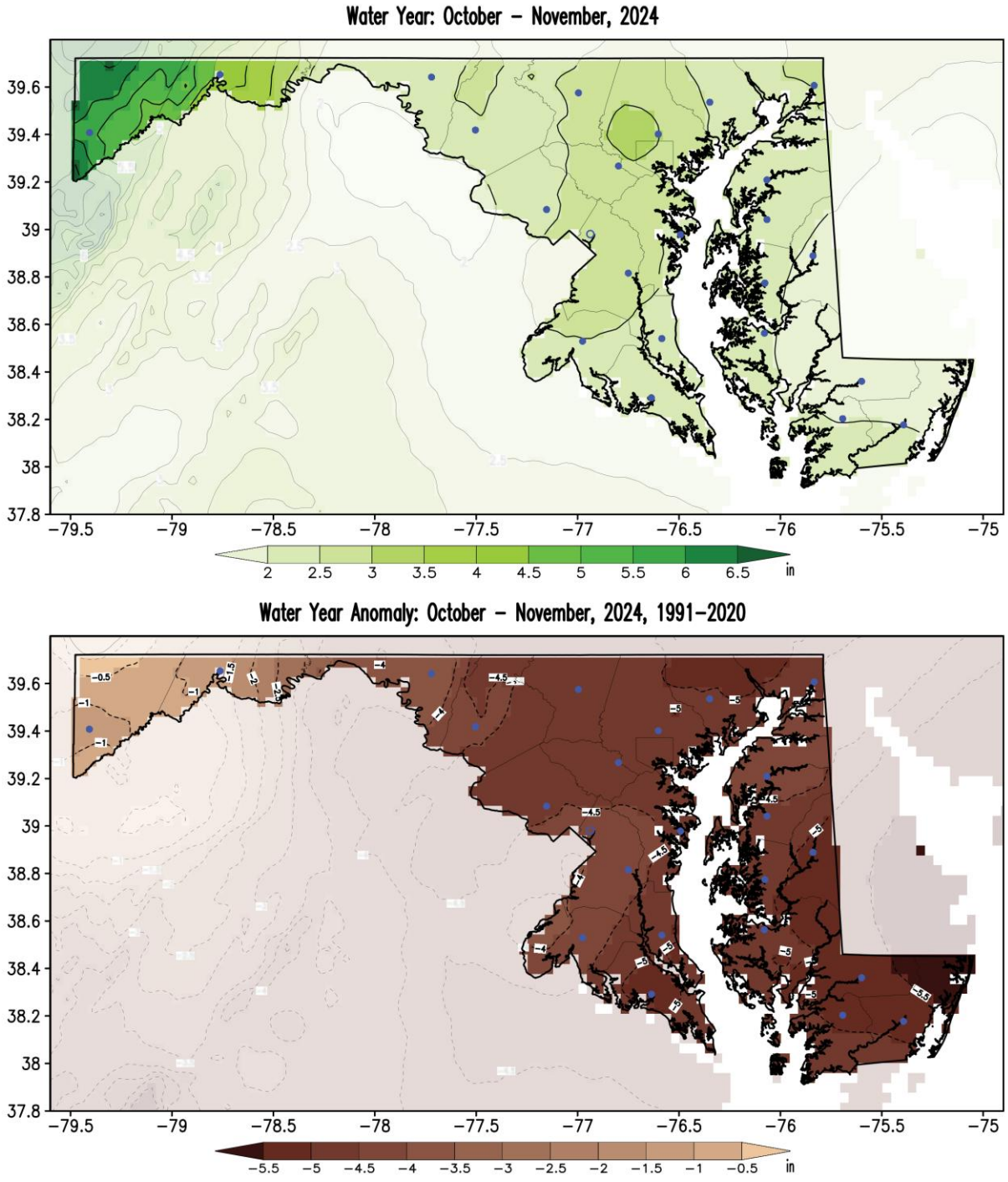


**Figure 5.** Partial water year until November 2024 (top panel), and its anomaly with respect to the 1991-2020 climatology (bottom panel). Water year is in inches following the color bar. Brown shading in the anomaly map marks drier than normal conditions. The current maps display the partial conditions from October to November 2024. Note shading outside the state has been washed out to facilitate focusing on Maryland. Filled blue circles mark the county seats.

# 4. Fall and Spring – Fall 2024 Climate Divisions Averages

A. Fall 2024 Scatter Plots

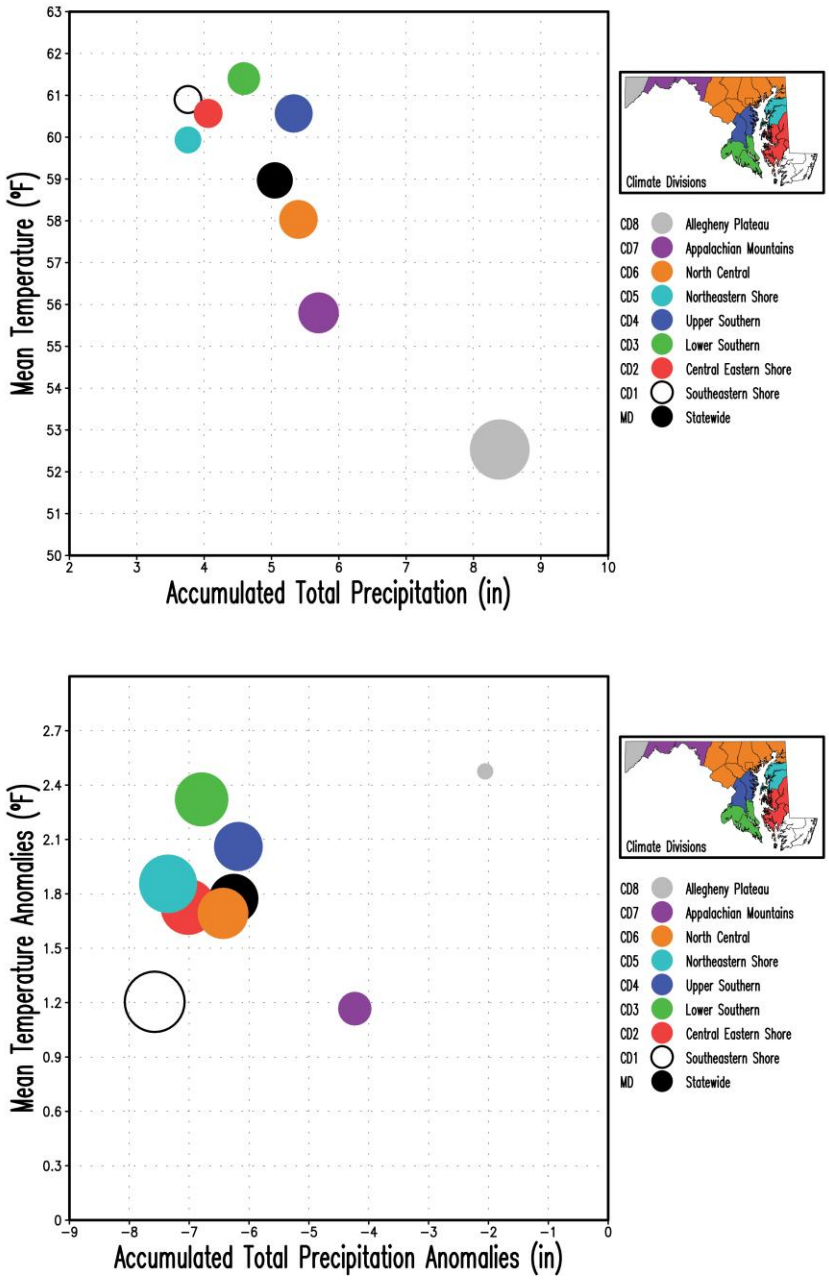


**Figure 6.** Scatter plots of Maryland (statewide) and Climate Divisions (CD#) seasonal mean surface air temperature vs. accumulated total precipitation for fall 2024. The upper panel shows the mean temperature and total precipitation, and the bottom panel displays their anomalies with respect to the 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 (8.39 inches in CD8, top panel) and by the maximum precipitation anomaly (|−7.58| 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. Spring to Fall 2024 Scatter Plots

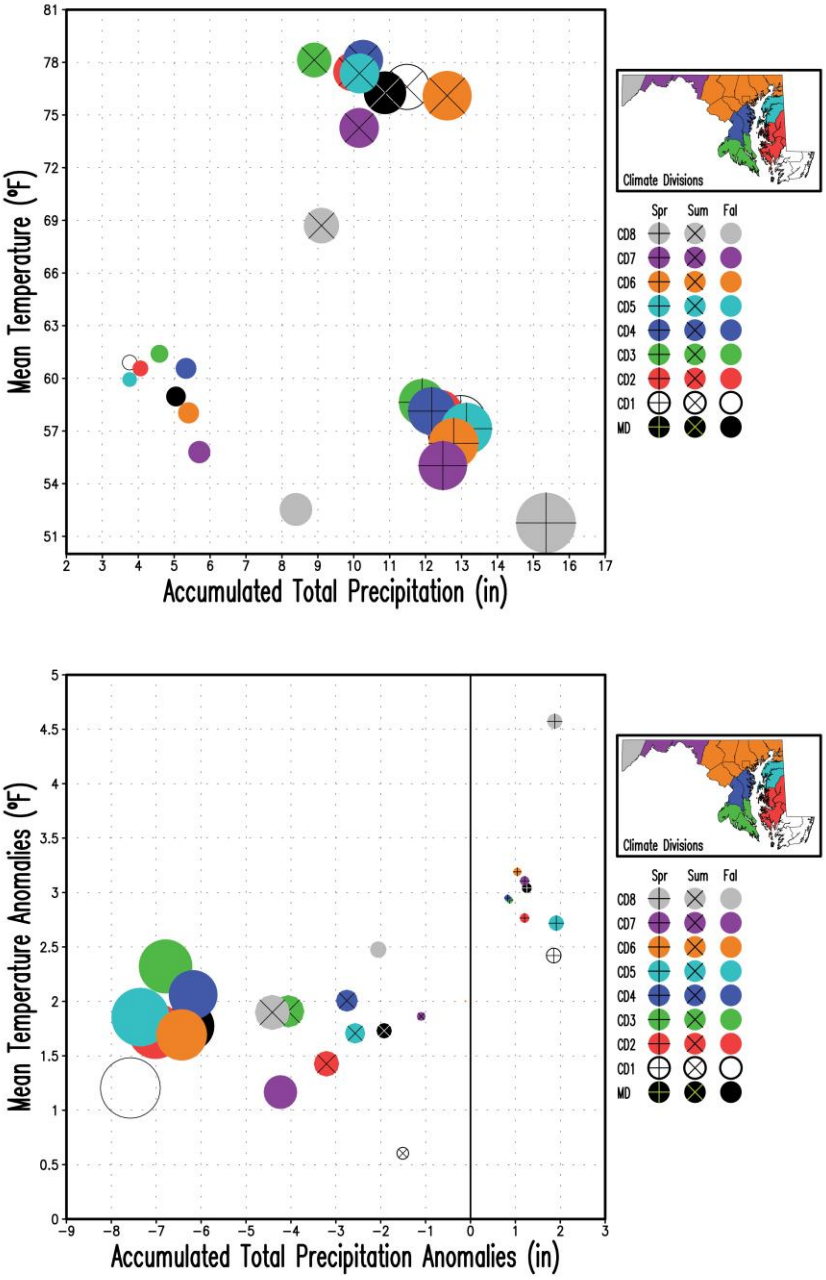


**Figure 7**. Scatter plots of Maryland (statewide) and Climate Divisions (CD#) seasonal mean surface air temperature vs. accumulated total precipitation for spring, summer and fall 2024. The upper panel shows the mean temperature and total precipitation, and the bottom panel displays their anomalies 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 (15.35 inches in CD8 in spring, top panel) and by the maximum precipitation anomaly (|–7.58| inches in CD1 in fall, bottom panel) among the nine regions and three months. Fall is displayed with filled circles only, while summer and spring are displayed with superposed multiplication and addition signs, respectively.

# 5. Fall 2024 Statewide Averages in the Historical Record

## A. Box and Whisker Plots

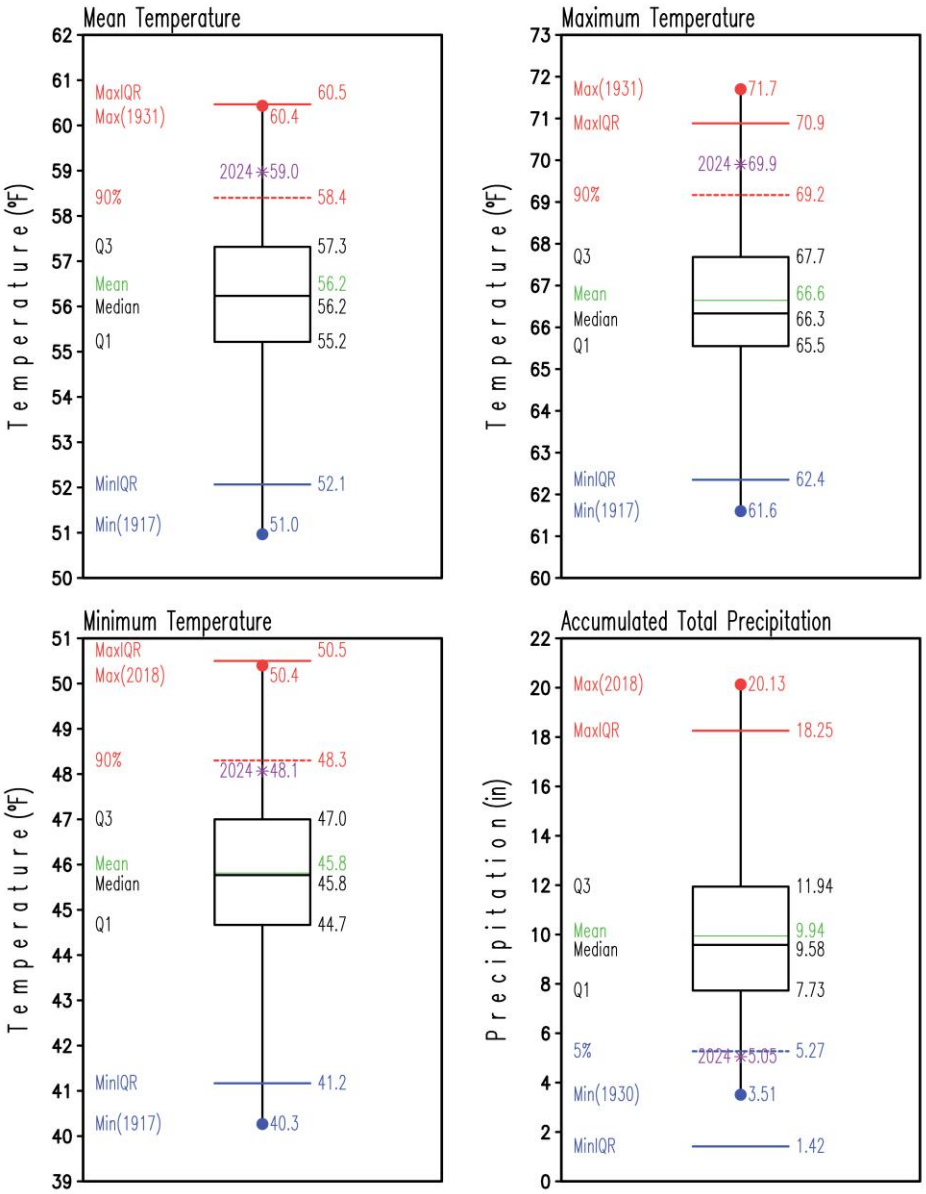


**Figure 8.** Box and Whisker plots of Maryland (statewide) seasonal mean (upper left), maximum (upper right), minimum (lower left) surface air temperatures, and accumulated total precipitation (lower right) for fall for the period 1895-2023. The label and asterisk in purple represent conditions for fall 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 smaller and larger values are the lower and upper horizontal black lines of the box, respectively. The threshold indicating the upper 10% temperature values is marked by the dashed red line, and that for the lower 5% precipitation is marked by the dashed blue line. 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.

# 6. 1895-2024 Trends

## A. Statewide Mean Temperature, Heating Degree-Days, Accumulated Total Precipitation, and Partial (October-November) Water Year

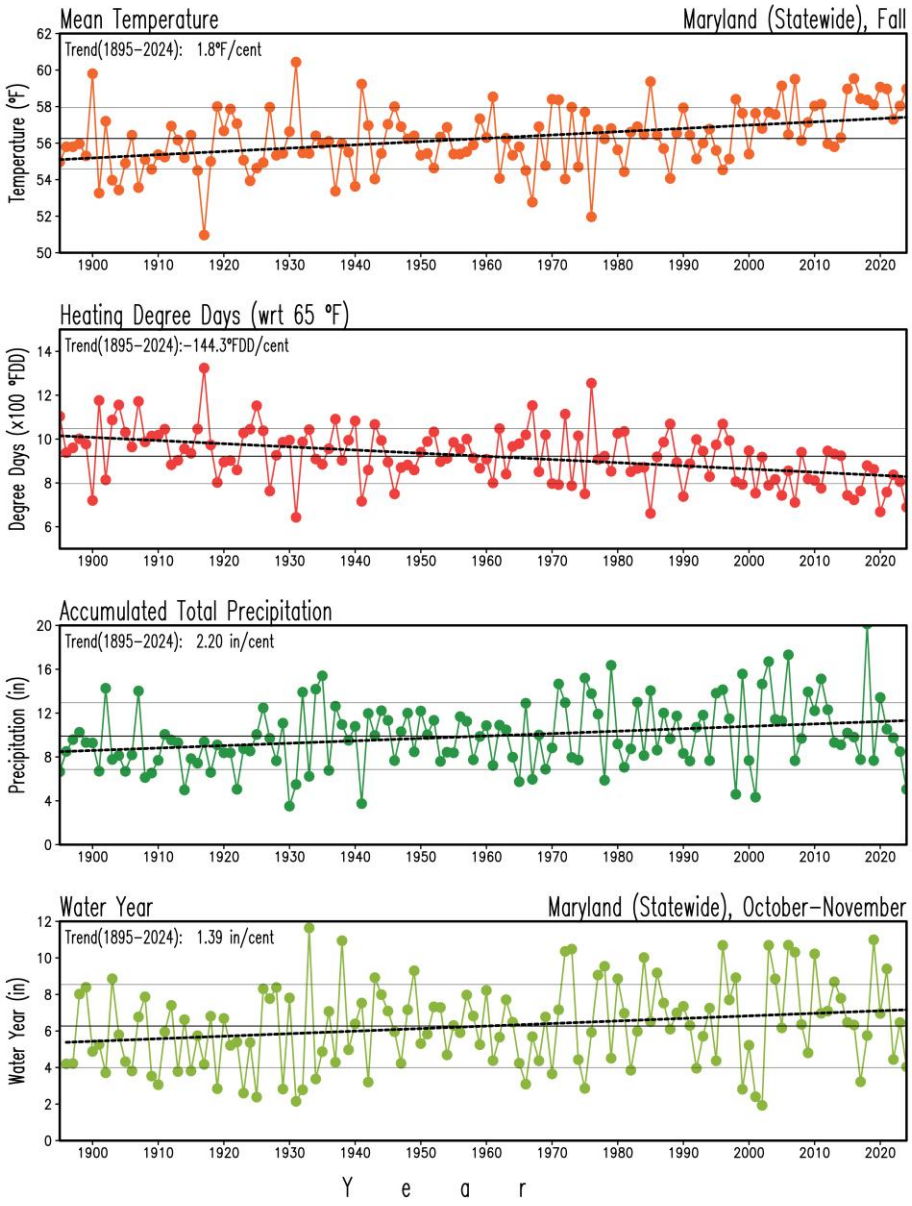


**Figure 9.** Maryland (statewide) mean surface air temperature, heating degree-days, accumulated total precipitation in fall, and partial (October-November) water year for the period 1895-2024. Temperature is in °F, heating degree-days is in °F degree-days (°FDD), and precipitation is in inches. The thin, continuous black lines in each panel display the long-term means (56.3°F, 921.9°FDD, 9.90 in, and 6.27 in, 1895-2024), and the double thin, continuous gray lines indicate the standard deviation (1.7°F, 125.4°FDD, 3.04 in, and 2.27 in) above/below the long-term mean. The thick dashed black lines show the long-term linear trend. The warming temperature trend (1.8°F/century), the decreasing heating degree-days trend (–144.3°FDD/century), the wetting precipitation trend (2.20 in/century), and the increasing water year trend (1.39 in/century) are statistically significant at the 95% level (*Student's t-test* –Santer et al. 2000).

B. Temperature and Precipitation Maps

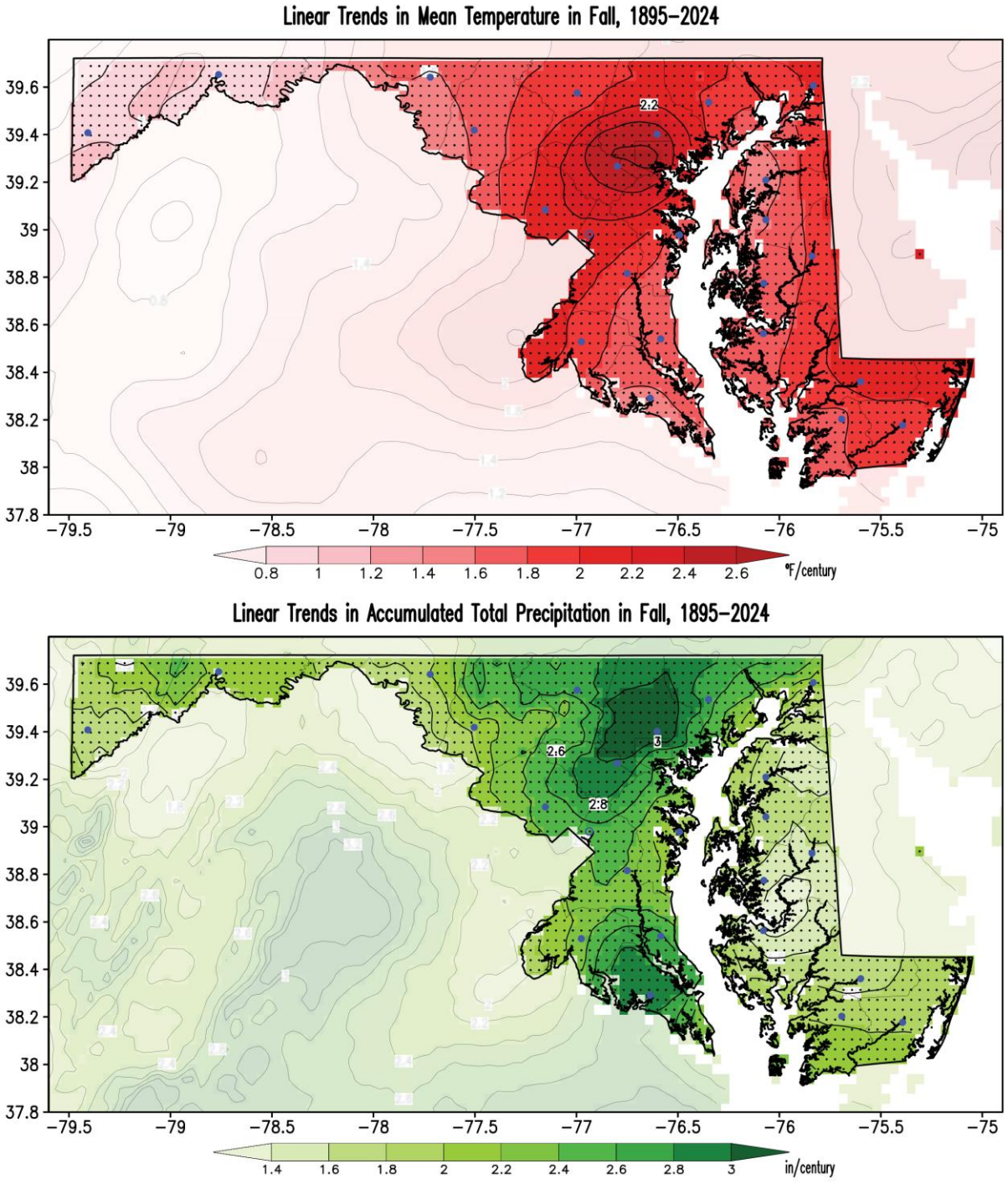


**Figure 10.** Linear trends in fall surface air mean temperature and accumulated total precipitation for the period 1895-2024. Temperatures are in °F/century, and precipitation is in inches/century following the color bars. Red shading in the temperature map marks warming trends. Green shading in the 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. Fall 2024 Tables: Statewide, Climate Divisions, and Counties

A. Mean Temperature and Precipitation

| Region | Mean Air Temperature (°F) | Rank (#) |
|---|---|---|
| **Statewide** | 59.0 | 120 |
| **Climate Division 1** | 60.9 | 117 |
| **Climate Division 2** | 60.6 | 121 |
| **Climate Division 3** | 61.4 | 127 |
| **Climate Division 4** | 60.6 | 125 |
| **Climate Division 5** | 59.9 | 124 |
| **Climate Division 6** | 58.0 | 120 |
| **Climate Division 7** | 55.8 | 113 |
| **Climate Division 8** | 52.5 | 126 |
| **Allegany** | 55.5 | 113 |
| **Anne Arundel** | 60.7 | 122 |
| **Baltimore** | 58.2 | 120 |
| **Baltimore City** | 60.0 | 119 |
| **Calvert** | 61.3 | 126 |
| **Caroline** | 59.8 | 122 |
| **Carroll** | 56.9 | 121 |
| **Cecil** | 58.7 | 122 |
| **Charles** | 61.3 | 126 |
| **Dorchester** | 60.9 | 120 |
| **Fredrick** | 57.3 | 120 |
| **Garrett** | 52.5 | 126 |
| **Harford** | 58.4 | 120 |
| **Howard** | 58.1 | 121 |
| **Kent** | 60.0 | 123 |
| **Montgomery** | 58.7 | 124 |
| **Prince George's** | 60.5 | 126 |
| **Queen Anne's** | 60.1 | 123 |
| **Saint Mary's** | 61.6 | 126 |
| **Somerset** | 61.3 | 118 |
| **Talbot** | 60.9 | 124 |
| **Washington** | 56.1 | 113 |
| **Wicomico** | 60.3 | 118 |
| **Worcester** | 61.0 | 116 |

| Region | Acc. Total Precipitation (in) | Rank (#) |
|---|---|---|
| **Statewide** | 1.68 | 6 |
| **Climate Division 1** | 1.25 | 3 |
| **Climate Division 2** | 1.35 | 3 |
| **Climate Division 3** | 1.53 | 6 |
| **Climate Division 4** | 1.78 | 11 |
| **Climate Division 5** | 1.25 | 2 |
| **Climate Division 6** | 1.80 | 7 |
| **Climate Division 7** | 1.90 | 14 |
| **Climate Division 8** | 2.80 | 47 |
| **Allegany** | 2.27 | 41 |
| **Anne Arundel** | 1.77 | 10 |
| **Baltimore** | 2.03 | 11 |
| **Baltimore City** | 1.96 | 11 |
| **Calvert** | 1.57 | 7 |
| **Caroline** | 1.20 | 2 |
| **Carroll** | 2.09 | 12 |
| **Cecil** | 1.14 | 1 |
| **Charles** | 1.57 | 9 |
| **Dorchester** | 1.39 | 4 |
| **Fredrick** | 1.85 | 8 |
| **Garrett** | 2.79 | 47 |
| **Harford** | 1.47 | 4 |
| **Howard** | 1.92 | 11 |
| **Kent** | 1.18 | 1 |
| **Montgomery** | 1.84 | 8 |
| **Prince George's** | 1.78 | 12 |
| **Queen Anne's** | 1.34 | 2 |
| **Saint Mary's** | 1.45 | 7 |
| **Somerset** | 1.30 | 3 |
| **Talbot** | 1.64 | 6 |
| **Washington** | 1.56 | 5 |
| **Wicomico** | 1.14 | 3 |
| **Worcester** | 1.30 | 3 |

**Table A1.** Seasonal mean surface air temperature (left) and accumulated total precipitation (right) in Maryland (statewide), climate division, and county levels for fall 2024. Temperatures are in °F, and precipitation is in inches. The rank is the order that the variable for fall 2024 occupies among the 130 falls since 1895 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, the larger (i.e., 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.

B. Maximum and Minimum Temperatures

| Region | Maximum Air Temperature (°F) | Rank (#) |
|---|---|---|
| **Statewide** | 69.9 | 126 |
| **Climate Division 1** | 72.1 | 128 |
| **Climate Division 2** | 71.6 | 126 |
| **Climate Division 3** | 71.9 | 127 |
| **Climate Division 4** | 71.1 | 127 |
| **Climate Division 5** | 70.7 | 127 |
| **Climate Division 6** | 68.9 | 123 |
| **Climate Division 7** | 67.5 | 109 |
| **Climate Division 8** | 63.9 | 124 |
| **Allegany** | 67.3 | 108 |
| **Anne Arundel** | 70.9 | 125 |
| **Baltimore** | 69.3 | 124 |
| **Baltimore City** | 70.4 | 122 |
| **Calvert** | 71.7 | 128 |
| **Caroline** | 71.3 | 126 |
| **Carroll** | 68.0 | 123 |
| **Cecil** | 69.7 | 127 |
| **Charles** | 71.9 | 126 |
| **Dorchester** | 71.9 | 128 |
| **Fredrick** | 67.9 | 119 |
| **Garrett** | 63.9 | 124 |
| **Harford** | 69.5 | 127 |
| **Howard** | 69.1 | 126 |
| **Kent** | 70.5 | 127 |
| **Montgomery** | 69.0 | 122 |
| **Prince George's** | 71.2 | 127 |
| **Queen Anne's** | 70.8 | 127 |
| **Saint Mary's** | 72.0 | 127 |
| **Somerset** | 72.2 | 128 |
| **Talbot** | 71.1 | 126 |
| **Washington** | 67.7 | 111 |
| **Wicomico** | 72.1 | 128 |
| **Worcester** | 72.1 | 128 |

| Region | Minimum Air Temperature (°F) | Rank (#) |
|---|---|---|
| **Statewide** | 48.1 | 115 |
| **Climate Division 1** | 49.7 | 92 |
| **Climate Division 2** | 49.6 | 114 |
| **Climate Division 3** | 50.9 | 122 |
| **Climate Division 4** | 50.1 | 119 |
| **Climate Division 5** | 49.1 | 118 |
| **Climate Division 6** | 47.2 | 113 |
| **Climate Division 7** | 44.1 | 111 |
| **Climate Division 8** | 41.1 | 117 |
| **Allegany** | 43.6 | 112 |
| **Anne Arundel** | 50.5 | 117 |
| **Baltimore** | 47.2 | 113 |
| **Baltimore City** | 49.7 | 112 |
| **Calvert** | 50.9 | 122 |
| **Caroline** | 48.2 | 116 |
| **Carroll** | 45.9 | 115 |
| **Cecil** | 47.8 | 108 |
| **Charles** | 50.8 | 121 |
| **Dorchester** | 49.9 | 110 |
| **Fredrick** | 46.6 | 117 |
| **Garrett** | 41.1 | 117 |
| **Harford** | 47.4 | 111 |
| **Howard** | 47.2 | 115 |
| **Kent** | 49.4 | 117 |
| **Montgomery** | 48.3 | 119 |
| **Prince George's** | 49.6 | 121 |
| **Queen Anne's** | 49.3 | 118 |
| **Saint Mary's** | 51.2 | 121 |
| **Somerset** | 50.5 | 96 |
| **Talbot** | 50.6 | 119 |
| **Washington** | 44.6 | 107 |
| **Wicomico** | 48.5 | 95 |
| **Worcester** | 49.8 | 85 |

**Table A2**. Seasonal maximum (left) and minimum (right) surface air temperatures in Maryland (statewide), climate division, and county levels for fall 2024. Temperatures are in °F. The rank is the order that the variable for fall 2024 occupies among the 130 falls since 1895 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, 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. Fall 2024 Bar Graphs: Statewide, Climate Divisions, and Counties

## A. Temperatures and Precipitation

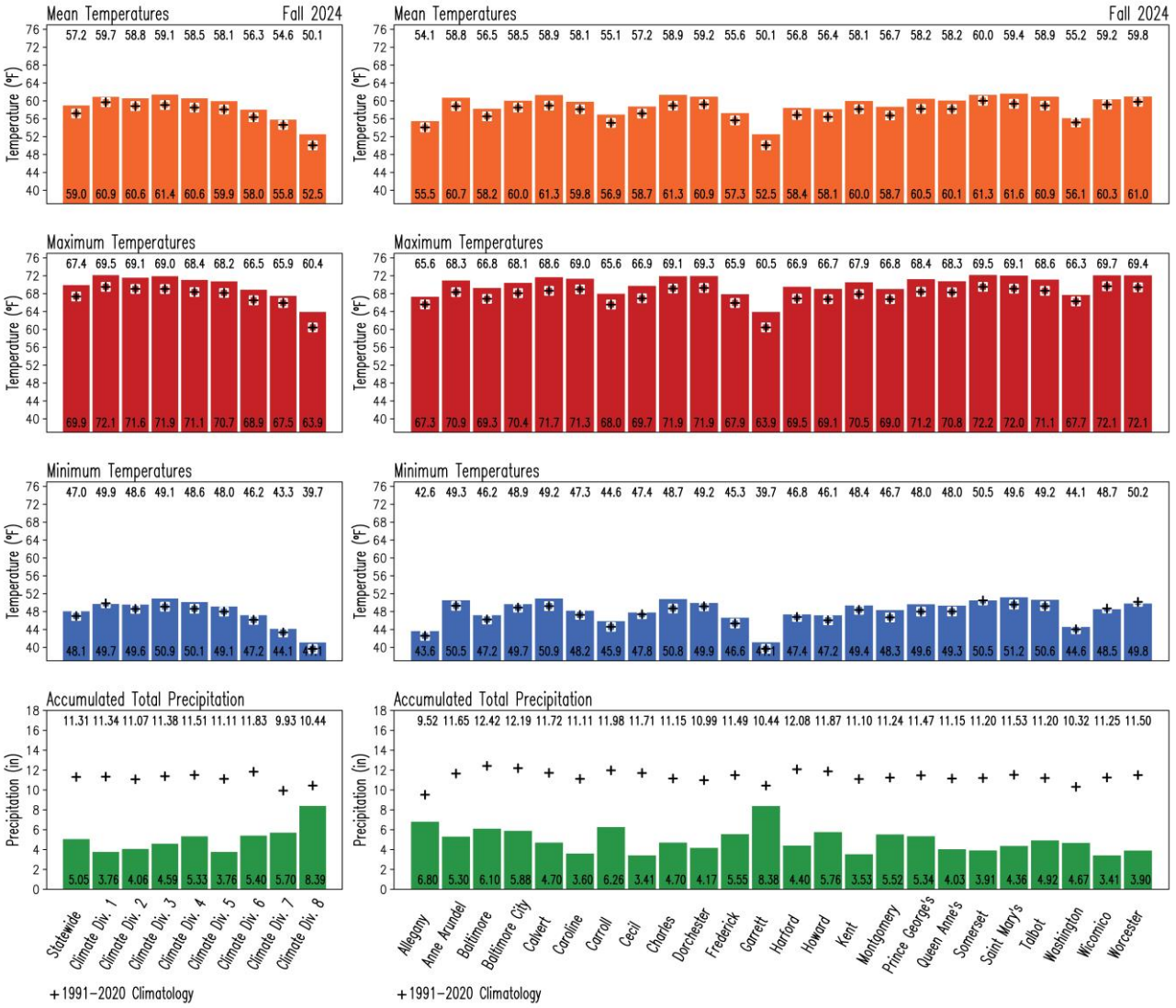


**Figure B1.** Seasonal surface variables in Maryland for fall 2024. Color bars represent the variables as follows: mean surface air temperature (orange), maximum surface air temperature (red), minimum surface air temperature (blue) and accumulated total precipitation (green) at statewide and climate division (left column), and at 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 fall 2024. For comparison, the corresponding 1991-2020 climatological values for fall are displayed as black addition signs, and their magnitudes are shown at the top of the panels.

## B. Temperature and Precipitation Anomalies

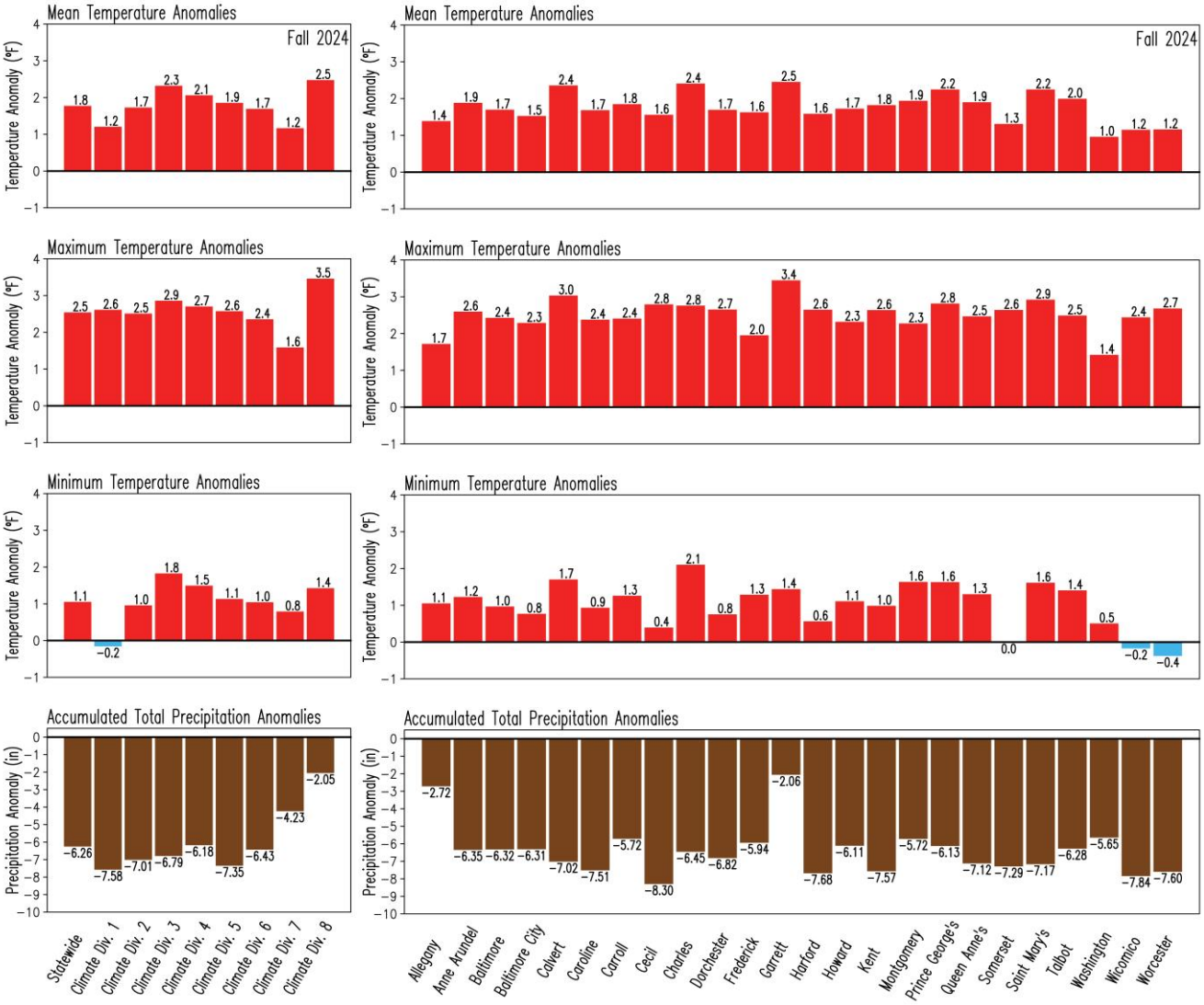


**Figure B2.** Anomalies of the seasonal surface variables in Maryland for fall 2024. Anomalies are with respect to the 1991-2020 climatology. The red/blue color represents warmer/colder than normal anomalies for mean surface air temperature (upper row), maximum surface air temperature (second row from top), and minimum surface air temperature (third row from top), while the brown color indicates drier than normal anomalies in accumulated total precipitation (bottom row) at statewide and climate division (left column), and at 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 fall 2024.

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

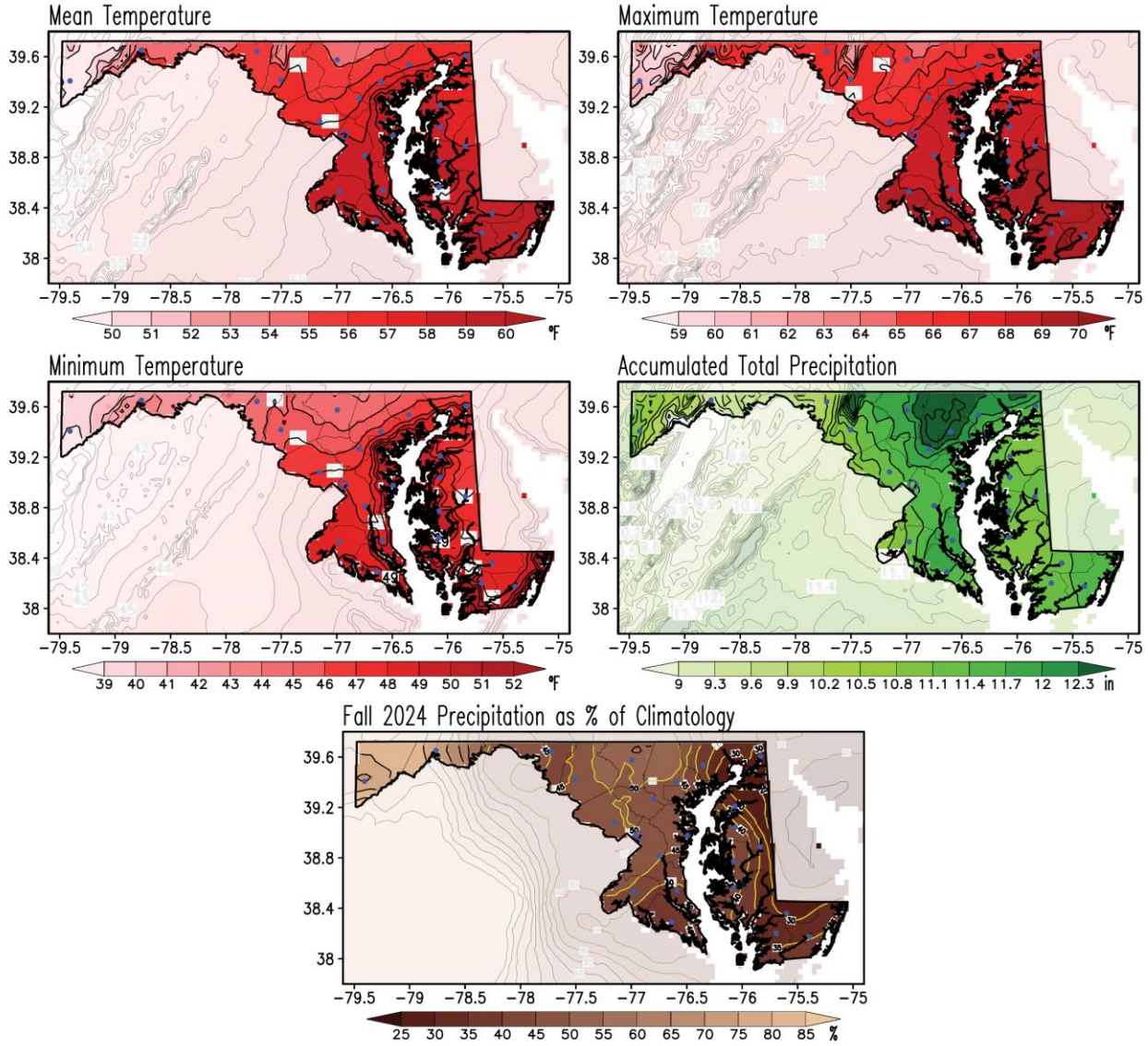


**Figure C1.** Fall climatology of the seasonal mean, maximum and minimum surface air temperatures, and accumulated total precipitation for the period 1991-2020 (upper and middle rows), and precipitation in fall 2024 as a percentage of climatology (bottom row). Temperatures are in °F, and precipitation is in inches according to the color bars. This is the current climate normal against which the fall 2024 conditions are compared to obtain the fall 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, and yellow isolines are for percentages equal to or less than 50%. Note that shading outside the state has been washed out to facilitate focusing on Maryland. Filled blue circles mark the county seats.

# Appendix D: The Water Year 1991-2020 Climatology, and October – November 2024 as Percentage of Climatology

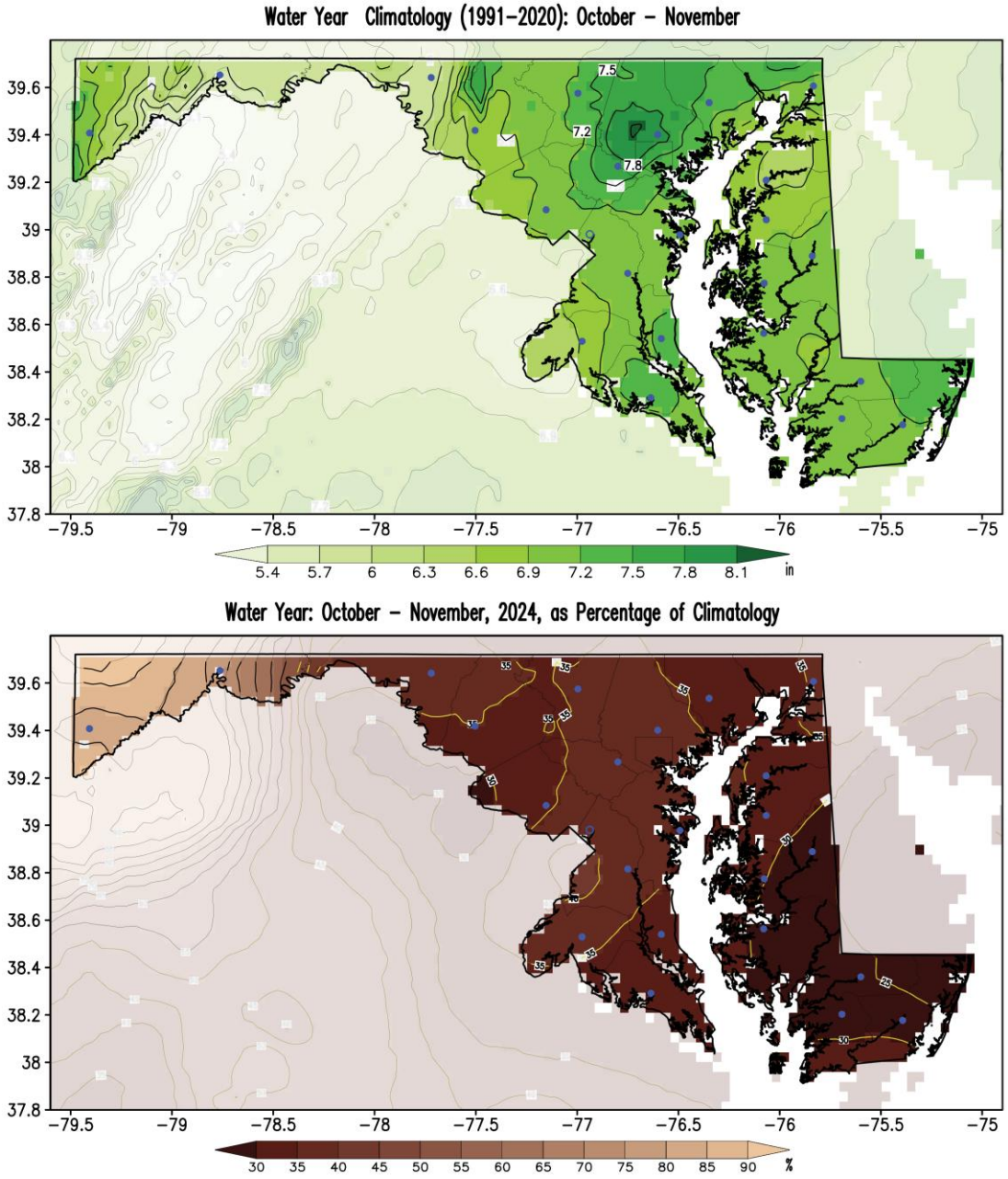


**Figure D1.** Climatology of the partial water year (October – November, top panel), and current partial water year (October – November 2024) as a percentage of the climatology (bottom panel). Climatology is for the period 1991-2020. The water year climatology is in inches following the color bar. The current water year as a percentage of climatology is obtained by dividing the current water year (Figure 5 upper panel) by the climatology (upper panel) and multiplying the ratio by 100; hence, units are in percent (%). Brown shading in the percentage map highlights regions where the current water year is drier than normal, and yellow isolines show percentages equal to or less than 50%. Note that shading outside the state has been washed out to facilitate focusing on Maryland. Filled blue circles mark the county seats.

# Appendix E. Fall Standard Deviation and Fall 2024 Standardized Anomalies Maps

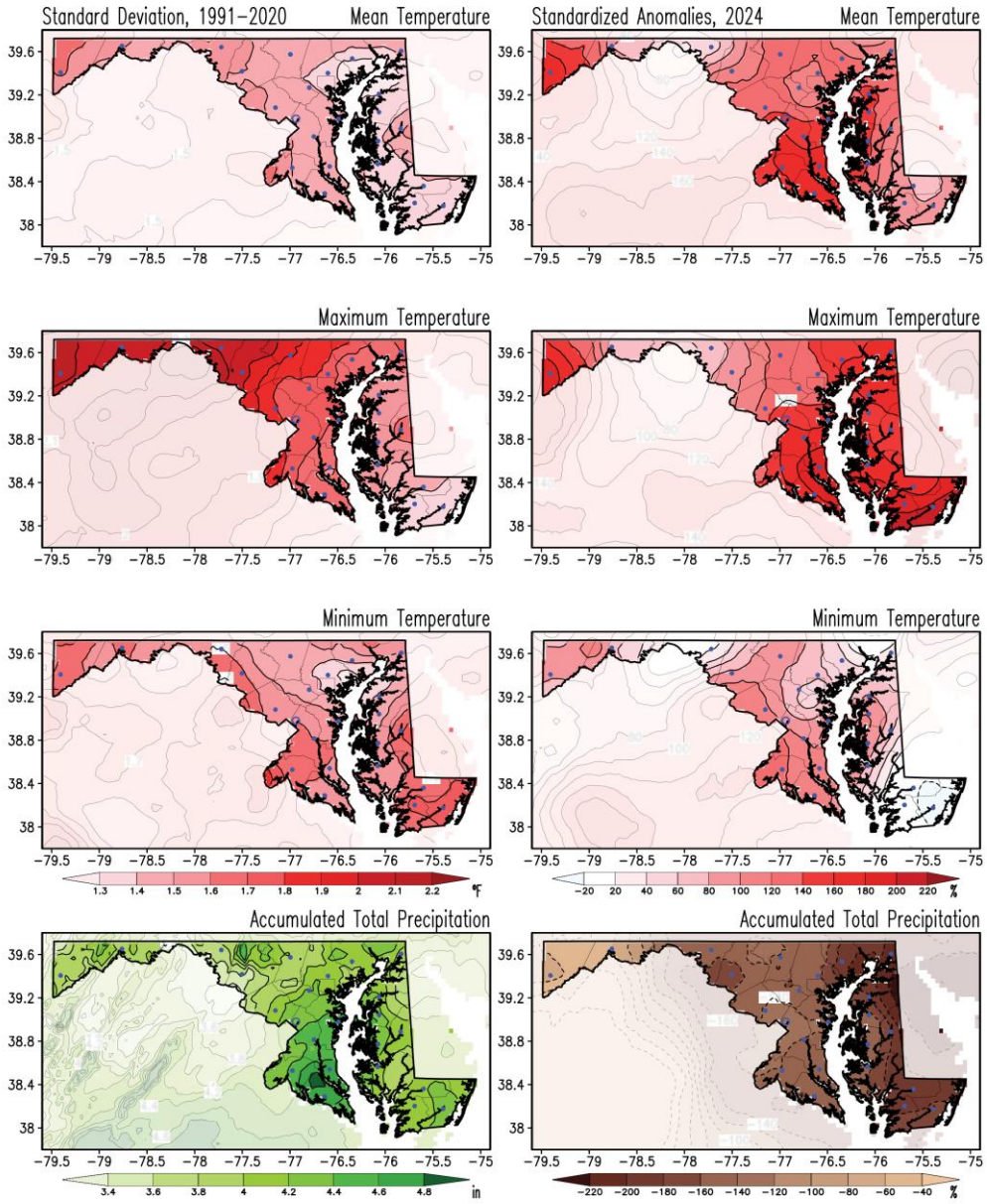


**Figure E1.** Standard deviation for fall and standardized anomalies of temperatures and precipitation for fall 2024. Standard deviations for seasonal mean, maximum, and minimum surface air temperatures and accumulated total precipitation were obtained for the 1991-2020 period (left column). Anomalies for fall 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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