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Maryland Climate Bulletin
September 2024

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DEPARTMENT OF ATMOSPHERIC & OCEANIC SCIENCE
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Maryland State Climatologist Office

Summary

Statewide averages indicate that September 2024 was slightly warmer than normal and much drier than normal (i.e., 1991-2020 averages). Monthly mean temperatures were in the 61−71°F range; maximum temperatures were between 70 and 80°F, and minimum temperatures were in the 50 and 64°F range. Monthly total precipitation was between 0.6 and 3.9 inches.

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

- The mean temperature had areas of warmer and colder-than-normal temperatures throughout the state. It was warmer than normal over Garrett County (above 1°F), large areas of the coastal plains, and eastern and western Piedmont. Slightly colder than normal conditions appeared over northern Prince George's and Anne Arundel counties, southern Montgomery and Howard counties (−0.4°F), and Allegany and Worcester counties.

- The maximum temperature was colder than normal over most of the state, especially in Allegany County (−1.8°F) and Washington and western Montgomery counties (−1.5°F). Warmer than normal temperatures were present only over western Garrett County (above 2.1°F) and northern Harford and Cecil counties.

- The minimum temperature was warmer than normal everywhere in the state, particularly over western Frederick and Montgomery counties (around 2.2−2.4°F), southern Saint Mary's and Calvert counties (around 2.0−2.2°F), and Allegany and Garrett counties (around 1.8−2.0°F).

- Precipitation was below normal over the entire state, especially in Harford, Cecil, and Kent counties (3.5 inches deficit), which received only between 20 to 30% of their normal monthly rainfall. The rest of the eastern shore received between 30 and 50% of their normal monthly rainfall, and portions of Charles, Saint Mary's, and Calvert counties had around 50%.

- The extent of the state affected by drought increased this month from around 67% at the start of September to around 81% at the start of October. The below-normal rainfall of this month contributed to the worsening of drought conditions in the state. The anomalously low rainfall in Cecil and Kent counties may be behind the appearance of the moderate drought conditions that developed there. Extreme drought conditions expanded in Garrett County, severe drought conditions remained in Garrett and Allegany counties, and moderate drought conditions did in portions of Allegany and Washington counties. Abnormally dry conditions appeared over the eastern and western portions of the Piedmont. Streams and rivers had below-normal to much-below-normal streamflow in the severe to extreme drought areas in Garrett County and below-normal over Cecil County.

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

- Except for the Upper Southern Climate Division 4, which had a cold anomaly (0.1°F below normal), the other climate divisions were warmer than normal. The Allegany

Plateau, Climate Division 8, had the warmest anomaly (1.1°F above normal). On the other hand, all the eight climate divisions were drier than normal. The Northeastern Shore, Climate Division 5, had the driest anomaly (2.80 inches below normal).

- Statewide temperature was warmer than normal (0.2°F) for the tenth month since December 2023, although it was smaller than in August (0.4°F) and much smaller than in July (2.2°F). Statewide precipitation, after being above normal in August for the first time since April, went back to below normal in September (1.99 inches below normal).

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

- Statewide maximum and minimum daily temperatures indicated that the current number of days with extreme temperatures is larger than normal, although not the number of waves/spells. There were 3 more hot days (maximum temperature warmer than 86°F) than normal but 2 fewer heatwaves (7 vs. 9) than normal; 12 more warm days (maximum temperature warmer than 80°F) than normal but 2 fewer warm day spells (9 vs. 11), and 12 more warm nights (minimum temperature warmer than 68°F) than normal but 1 fewer warm night spells (5 vs. 6).

- Statewide daily total precipitation showed that the current number of days with extreme precipitation (at least 0.64 inches; the 95th percentile in 1951-2000) is larger than normal by 1 day (15 vs. 14). Still, the number of dry spells (consecutive days with daily precipitation of no more than 0.04 inches) is fewer than normal by 8 dry spells (29 vs. 37).

- The cumulative calendar year (until September 30) growing degree days have been greater than normal since the start of March. Modified growing degree days (base 86/50°F) reached 3811°FDD, and growing degree days (base 50°F) reached 3747°FDD by the end of September. The modified growing days were 234°FDD above normal, while the growing degree days were 295°FDD above normal, similar to the August anomalies.

Historical Context (Figure 12, Tables A1 and A2)

- Statewide mean and minimum temperatures in September 2024 (68.5, 59.2°F) were above their long-term (1895-2023) mean, while the maximum temperature (77.8°F) was barely below; these temperatures were far from their historical records of 72.7, 65.6, and 84.9°F set in 2018, 2018 and 1930 respectively. The minimum temperature was within 25% of the largest values on record. Statewide precipitation (2.36 inches) was below the long-term mean and within 25% of the smallest values on record but still far from the record of 0.54 inches in 1941.

- Precipitation indicated that September 2024 was the sixth driest for Cecil County, the tenth for Caroline County, and the eleventh for Kent County.

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

- Statewide mean temperature and precipitation in September showed significant trends: a warming trend (1.2°F/century) and a wetting trend (0.97 in/century).

- Regionally, September 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 (2.2°F/century), as it has been since March. Trends above 1.4°F/century are evident in the counties of central Piedmont.

- Regionally, September precipitation displayed significant wetting trends over most of the state, except for portions of Anne Arundel, Talbot, Caroline, Dorchester, and Wicomico counties. The largest significant wetting trends appeared over parts of the Blue Ridge (1.5 in/century), northern Piedmont (above 1.2 in/century), and southern Saint Mary's and Calvert counties (above 1.0 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 September 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, cooling 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 and total precipitation data in this report are from the following sources; this time, however, monthly data for September 2024 was calculated in-house from daily data cited below and appended to the monthly data downloaded for the previous Bulletin:

- 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 9/11/2024.

- NOAA Monthly U.S. Climate *Divisional* Dataset (NClimDiv – Vose et al. 2014). It is available in a preliminary status (v1.0.0-20240906) at:
  https://www.ncei.noaa.gov/pub/data/cirs/climdiv/
  Data was downloaded on 9/10/2024.

- 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 10/21/2024.

- NOAA daily gridded fields for temperatures and precipitation data set (nClimGrid–Daily, Durre et al. 2022). It is available in a preliminary status, v1.0.0, at:
  https://www.ncei.noaa.gov/data/nclimgrid-daily/access/grids/2024
  Data for 1–30 September 2024 was downloaded on 10/25/2024.

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., September 2024) are the departures of the monthly value from the corresponding month's 30-year average (i.e., from the average of 30 Septembers) 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.

- *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 the longest dry spell 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. September 2024 Maps

A. Mean Temperatures

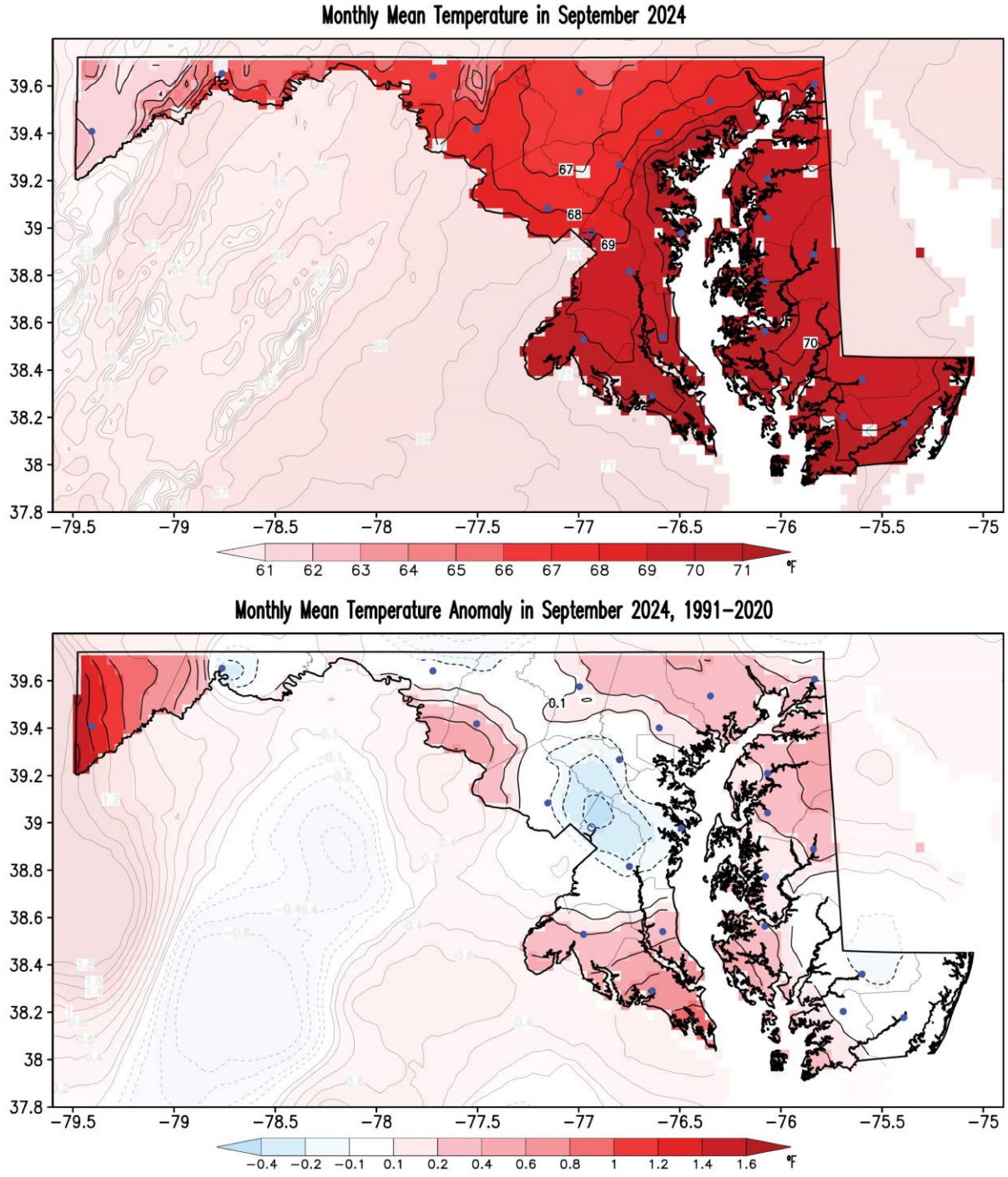

Figure 1. Monthly mean surface air temperature (top panel) and its anomaly with respect to the 1991-2020 climatology (bottom panel) for September 2024. Temperatures are in °F following the color bar. Blue/red shading in the anomaly map marks colder/warmer than normal conditions. Note shading outside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

B. Maximum Temperatures

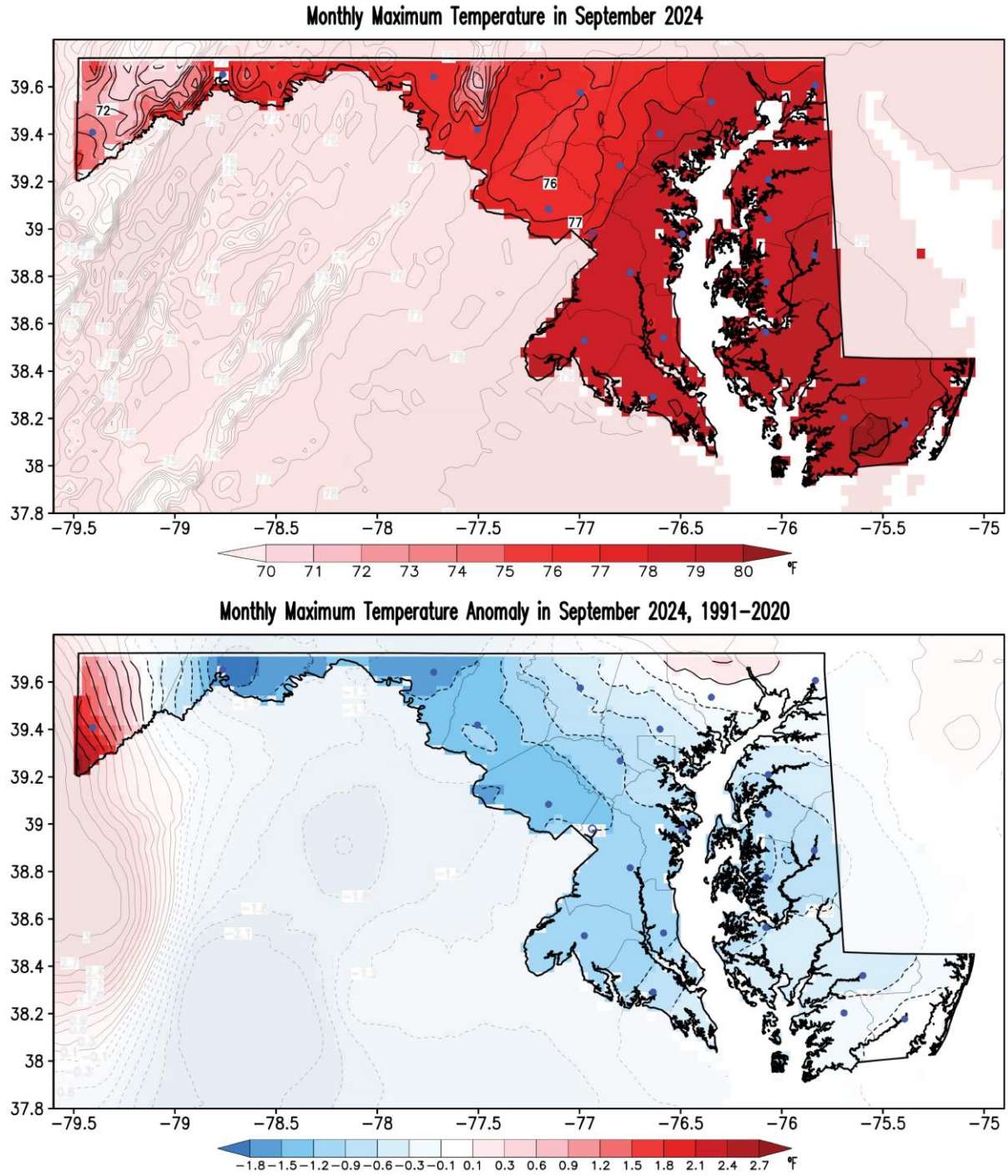

Figure 2. Monthly maximum surface air temperature (top panel) and its anomaly with respect to the 1991-2020 climatology (bottom panel) for September 2024. Temperatures are in °F following the color bar. Blue/red shading in the anomaly map marks colder/warmer than normal conditions. Note shading outside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

C. Minimum Temperatures

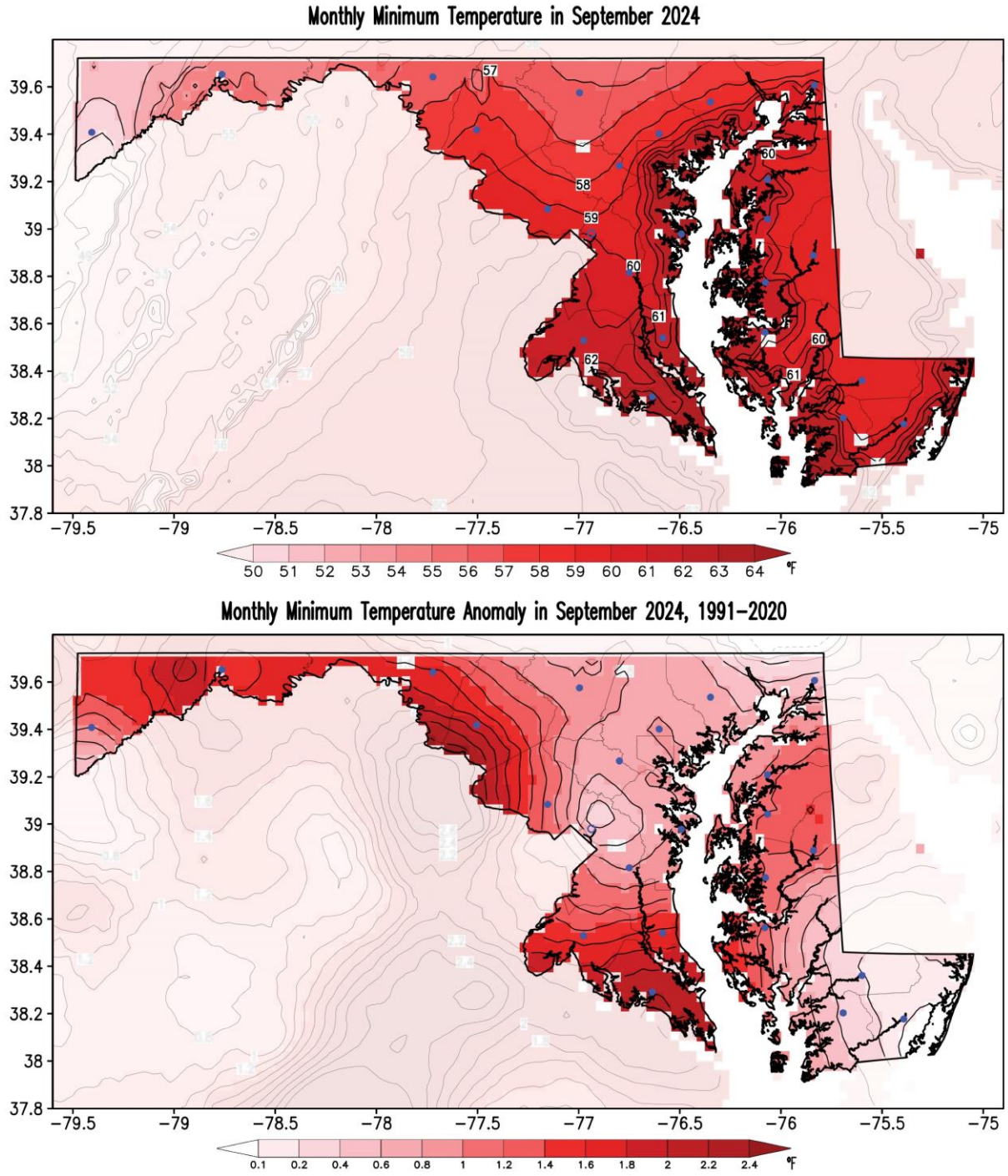

Figure 3. Monthly minimum surface air temperature (top panel) and its anomaly with respect to the 1991-2020 climatology (bottom panel) for September 2024. Temperatures are in °F following the color bar. Red shading in the anomaly map marks warmer than normal conditions. Note shading outside the state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

D. Precipitation

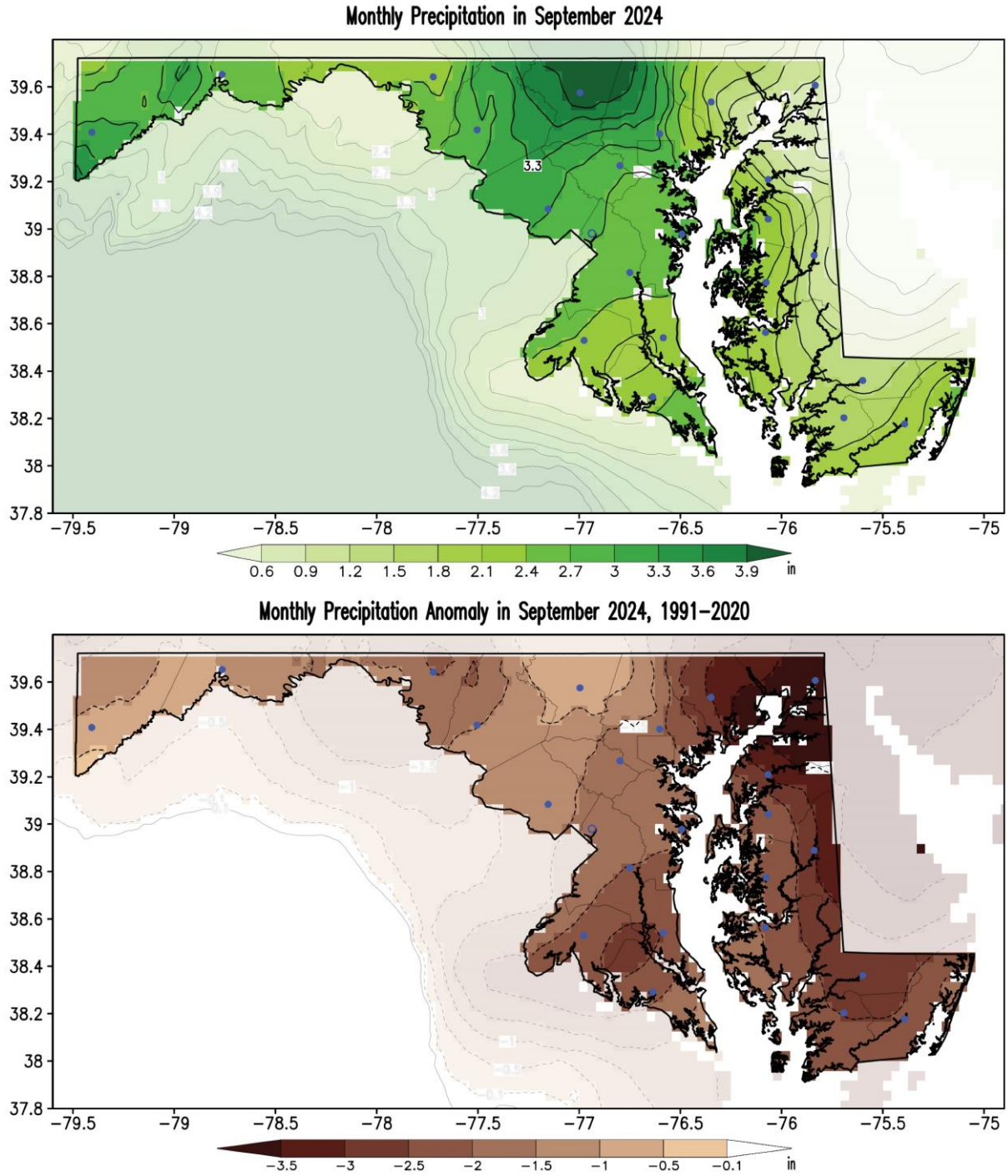

Figure 4. Monthly total precipitation (top panel) and its anomaly with respect to the 1991-2020 climatology (bottom panel) for September 2024. Precipitation is in inches following the color bar. Brown shading in the anomaly map marks drier than normal conditions. Note shading outside the state has been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

E. Drought

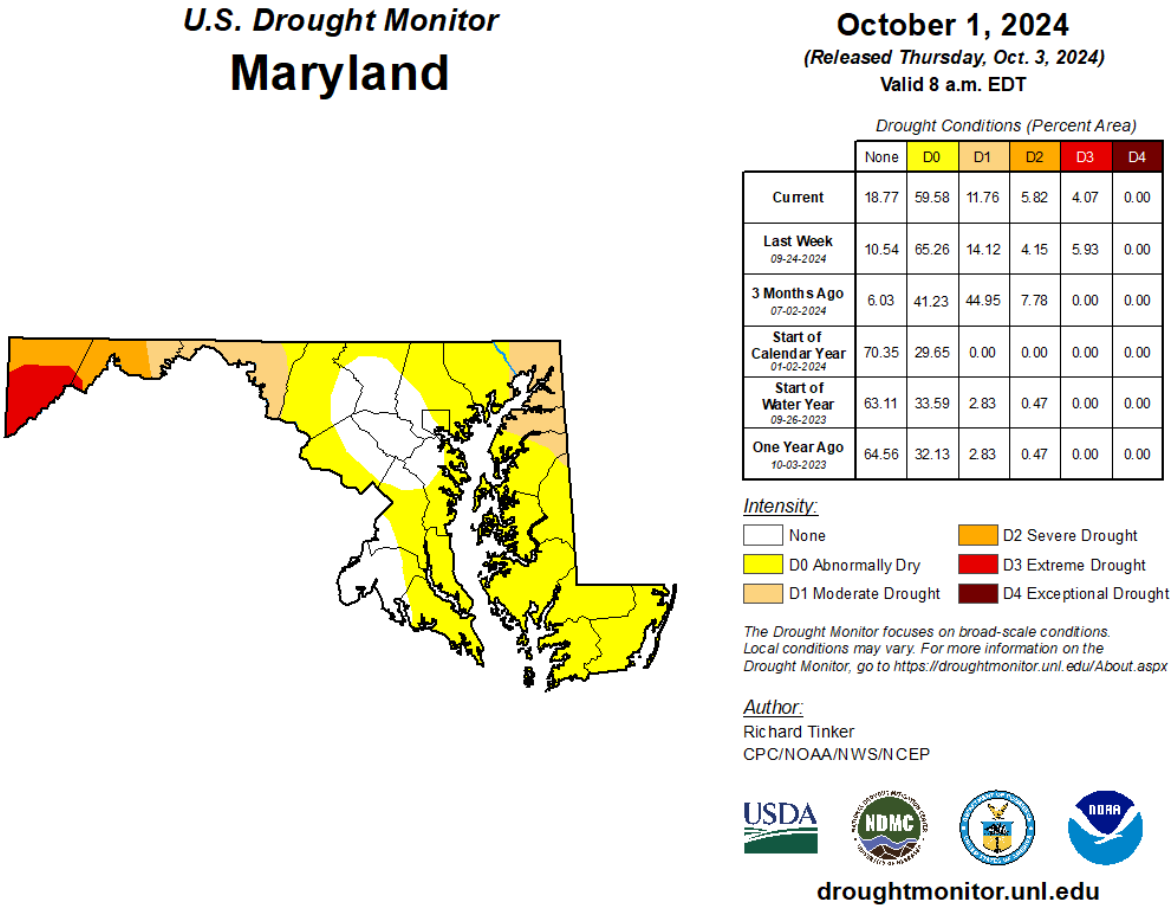

Figure 5. Drought conditions as reported by the U.S. Drought Monitor on October 1, 2024. At this time, drought conditions have expanded to around 81% of the state. Extreme drought conditions over Garrett County now cover the southern half of the county. The extent of the abnormally dry conditions increased again and now covers, in addition of the coastal plains, large portion of the Piedmont. Moderate drought conditions appeared over Cecil and Kent counties. 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

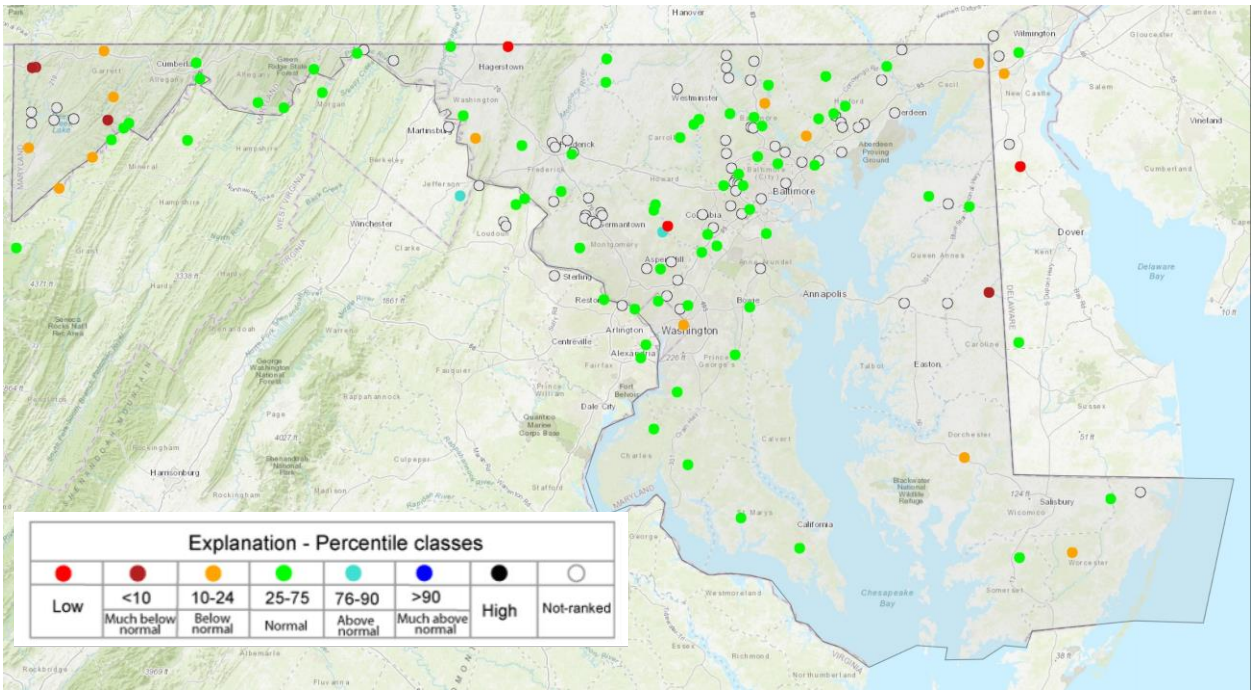

Figure 6. Monthly averaged streamflow class anomalies as reported by the U.S. Geological Survey (USGS) Water Watch for September 2024. Orange to red-filled circles denote below-normal to much below-normal streamflow conditions, cyan to black-filled circles denote above-normal to much above-normal streamflow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

4. September and JAS 2024 Climate Divisions Averages

A. September 2024 Scatter Plots

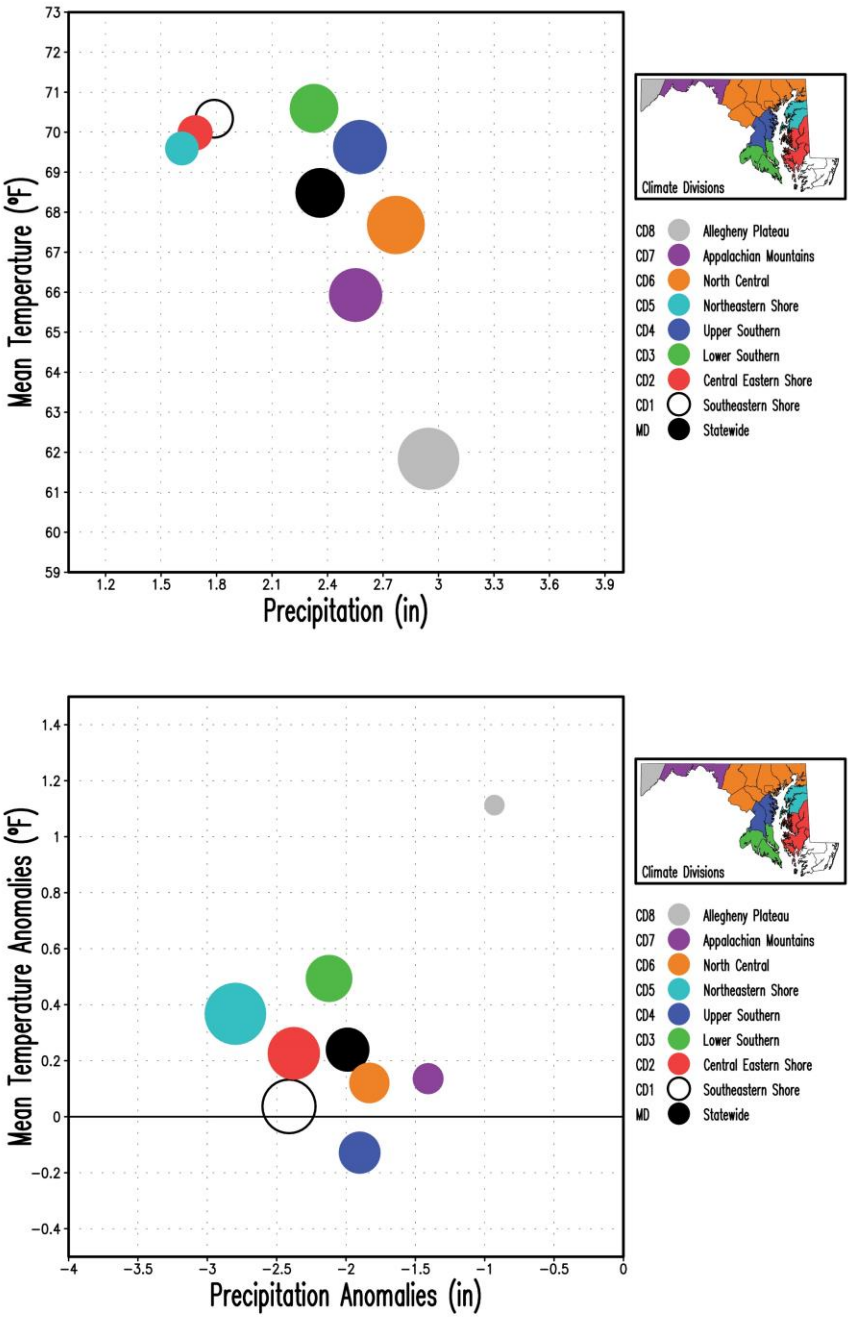

Figure 7. Scatter plots of Maryland (statewide) and Climate Divisions (CD#) monthly mean surface air temperature vs. total precipitation for September 2024. The upper panel shows the mean temperature and total precipitation, and the bottom panel displays their anomalies with respect to the 1991-2020 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 (2.95 inches in CD8, top panel) and by the maximum precipitation anomaly (|-2.80| inches in CD5, 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. July – September 2024 Scatter Plots

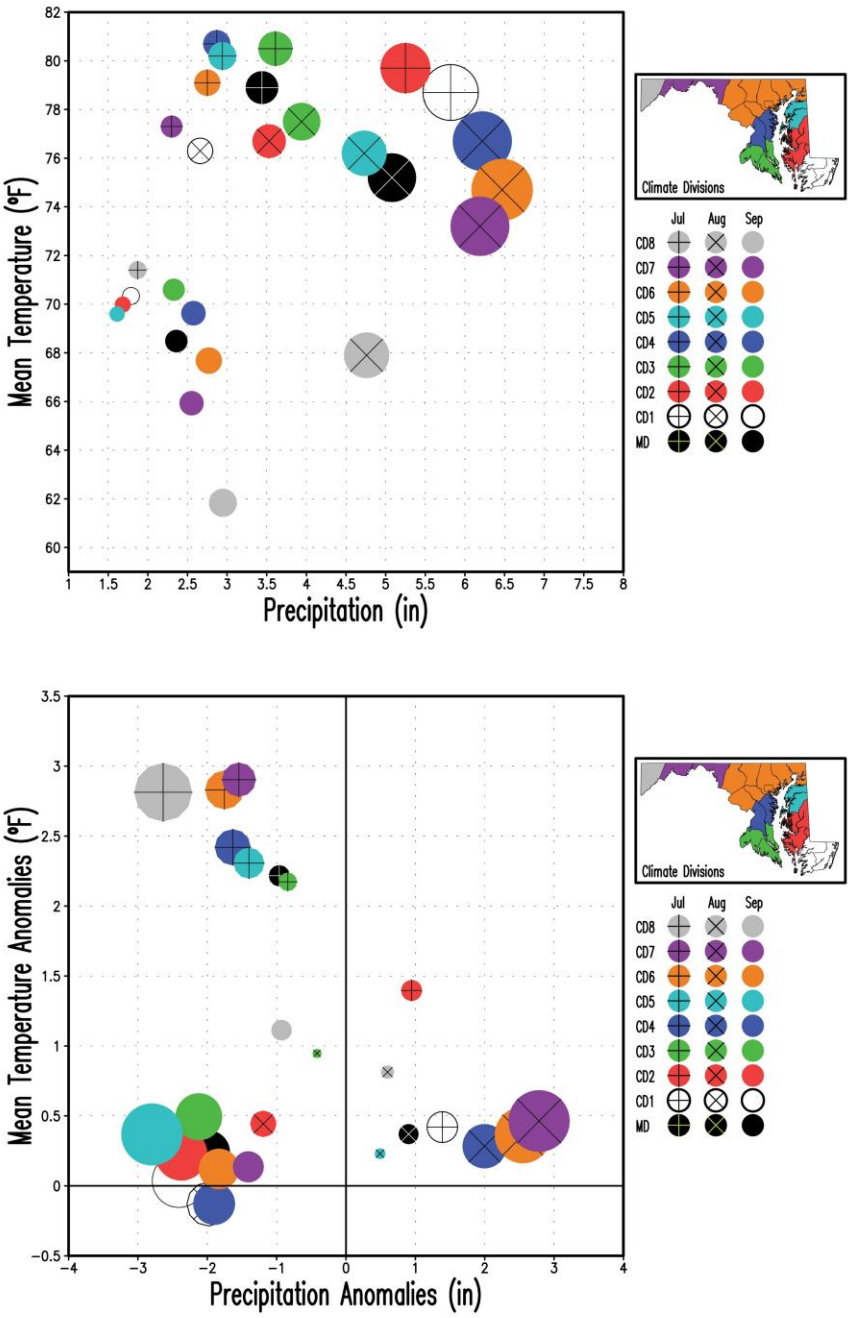

Figure 8. Scatter plots of Maryland (statewide) and Climate Divisions (CD#) monthly mean surface air temperature vs. total precipitation for July, August, and September 2024. The upper panel shows the mean temperature and total precipitation, and the bottom panel displays their anomalies with respect 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 (6.47 inches in CD6 in August, top panel) and by the maximum precipitation anomaly (|−2.80| inches in CD5 in September, bottom panel) among the nine regions and three months. September is displayed with filled circles only, while August and July are displayed with superposed multiplication and addition signs, respectively.

5. Extremes and Growing Degree Days

A. Hot Days, Warm Days and Warm Nights

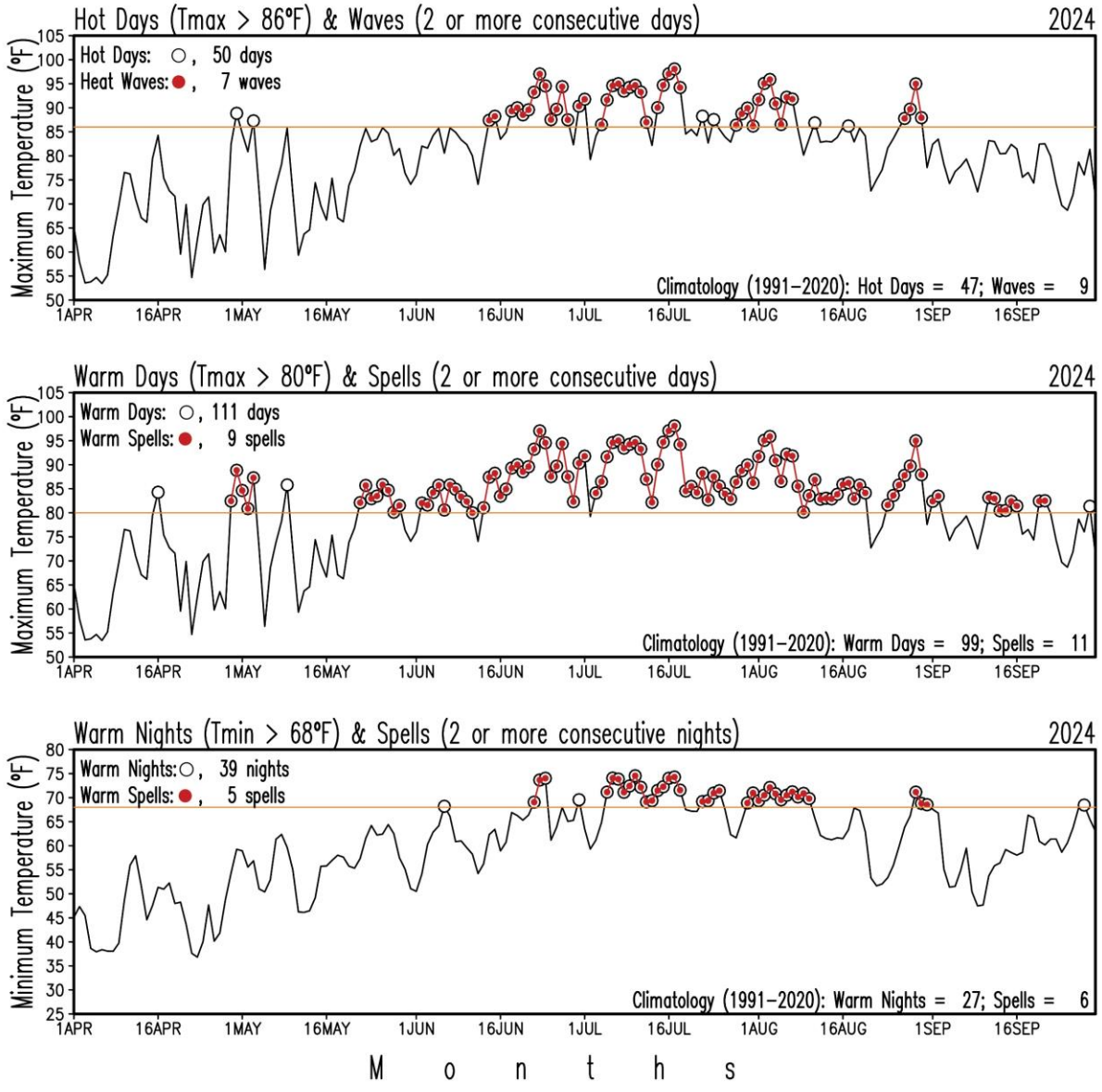

Figure 9. Maryland (statewide) number of hot days, warm days, warm nights, and their consecutive occurrence for the period January 1 - September 30, 2024. The upper panel shows hot days in open circles and heat waves in red-filled circles from statewide daily maximum temperatures. The middle panel shows warm days in open circles and warm day spells in red-filled circles from statewide daily maximum temperatures. The bottom 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 at the MDSCO website.

B. Extreme Precipitation and Dry Spells

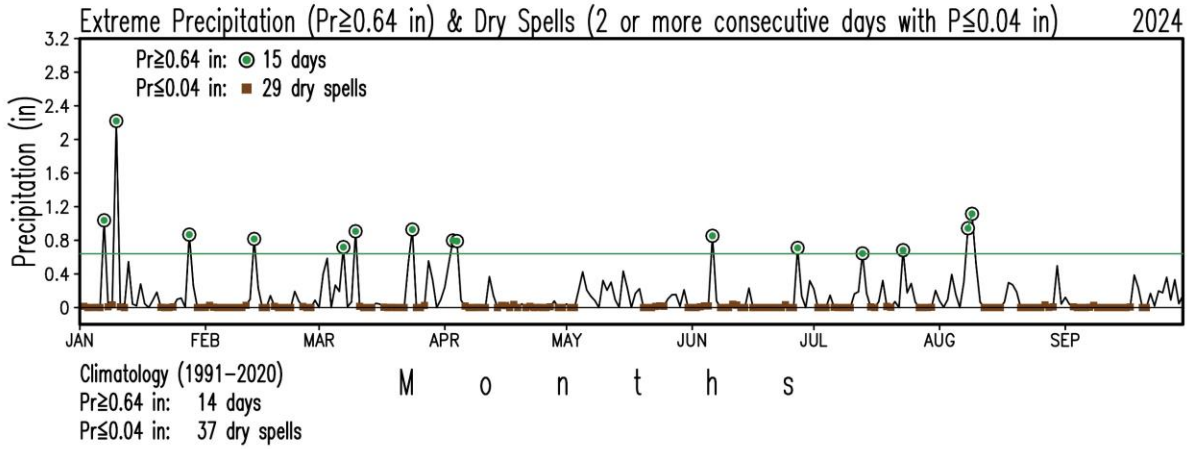

Figure 10. Maryland (statewide) number of days with extreme precipitation and dry day spells for the period January 1 - September 30, 2024. Extreme precipitation days (precipitation equal to or larger than 0.64 in) are identified by the green-filled circles. Dry spells (consecutive days with daily total 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 at the MDSCO website.

C. Modified Growing Degree Days

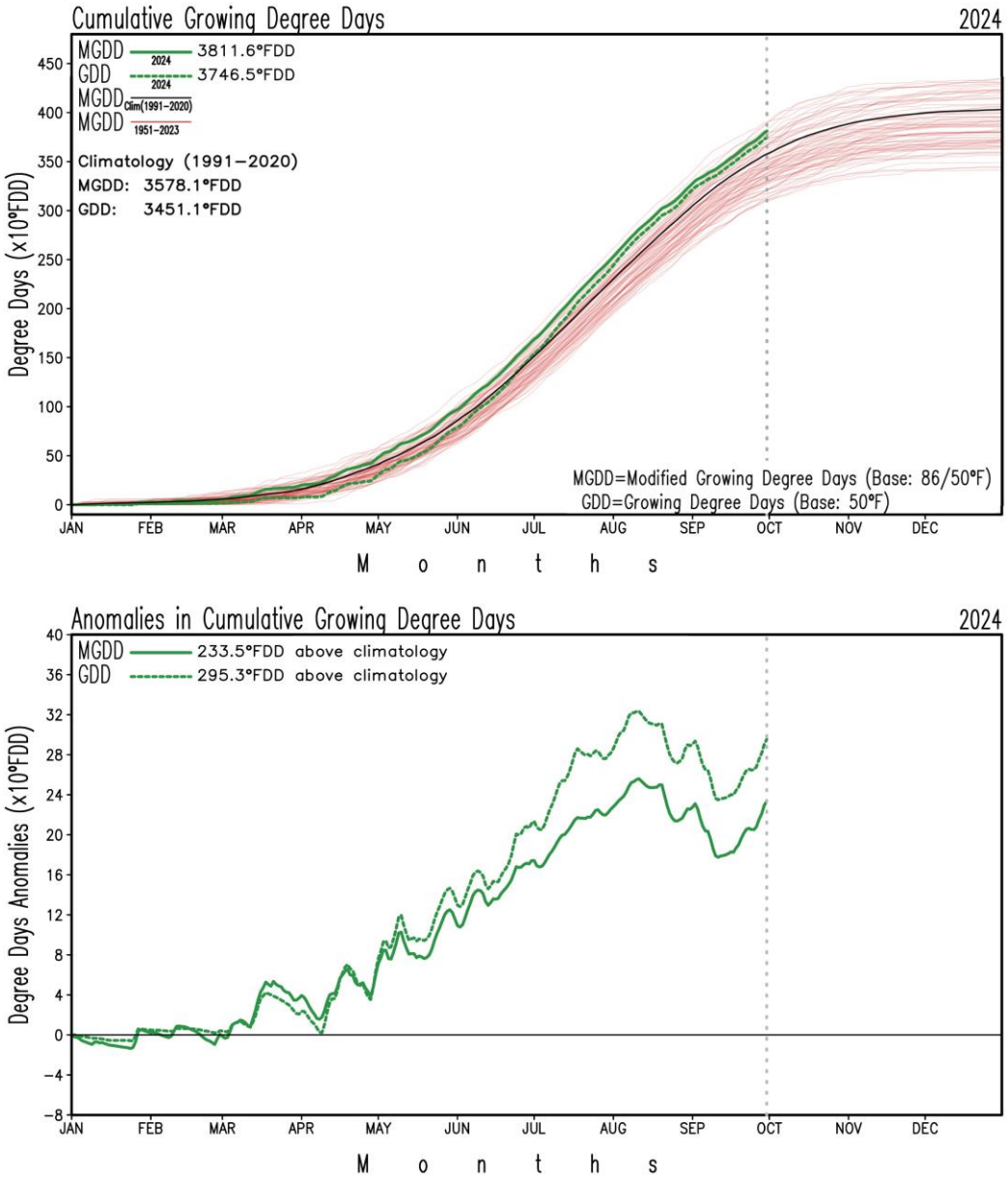

Figure 11. Maryland (statewide) cumulative growing degree days (upper panel) and its anomalies with respect to the 1991-2020 climatology (bottom panel) during the calendar year period January 1 to September 30, 2024. The cumulative modified growing degree days are displayed with the continuous green 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 at the MDSCO website.

6. September 2024 Statewide Averages in the Historical Record

A. Box and Whisker Plots

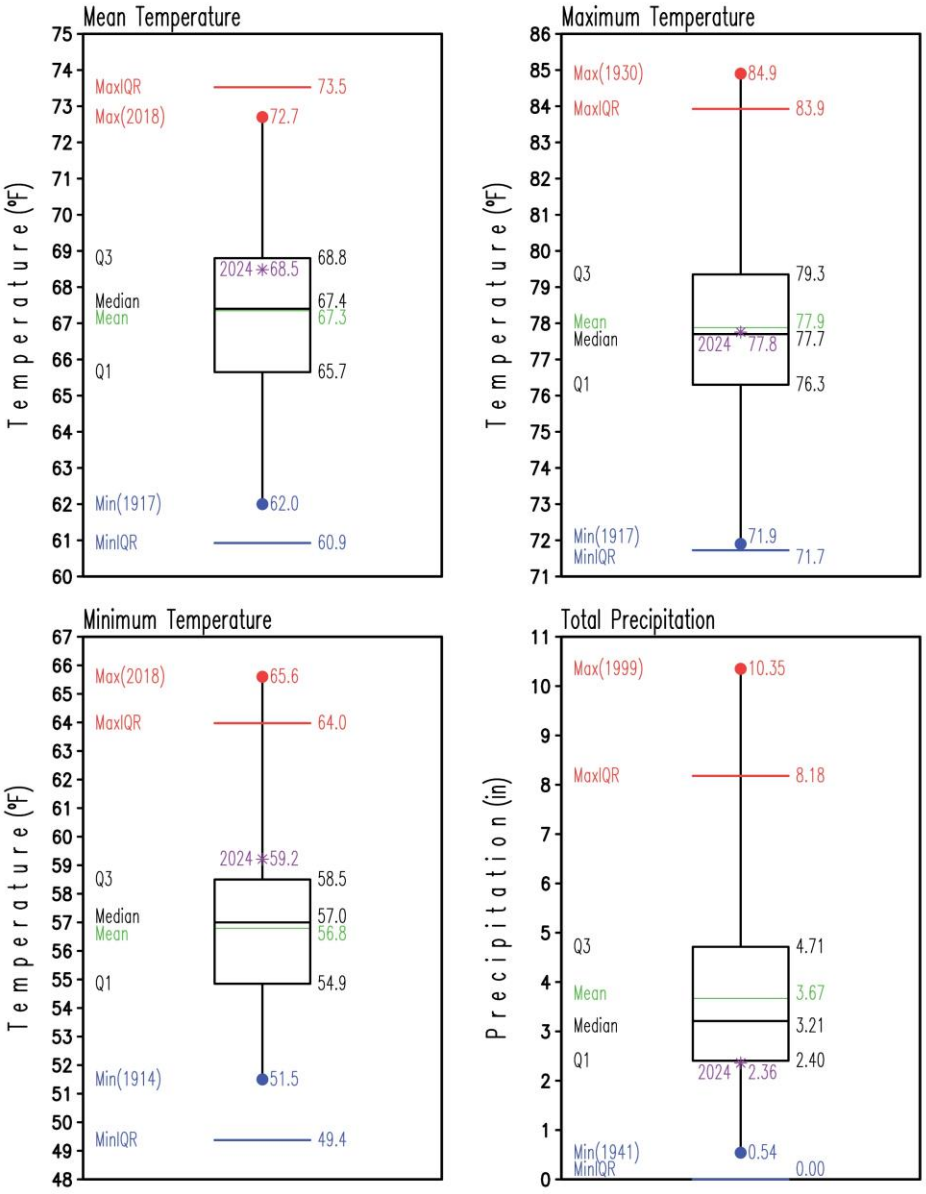

Figure 12. Box and Whisker plots of Maryland (statewide) monthly mean (upper left), maximum (upper right), minimum (lower left) surface air temperatures, and total precipitation (lower right) for September for the period 1895-2023. The label and asterisk in purple represent conditions for September 2024. 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 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 September Trends

A. Statewide Mean Temperature, and Precipitation

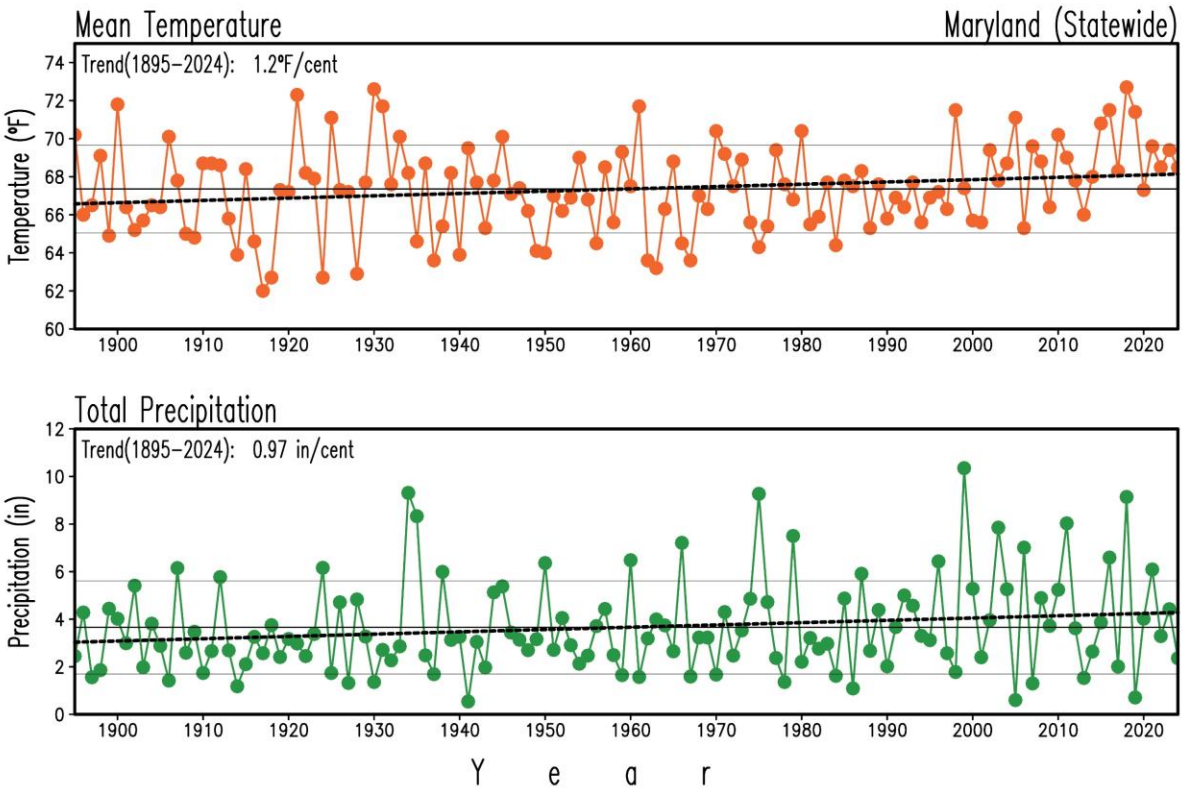

Figure 13. Maryland (statewide) mean surface air temperature, and precipitation in September for the period 1895-2024. Temperature is in °F, and precipitation is in inches. The thin, continuous black lines in each panel display the long-term means (67.4°F and 3.66 in, 1895-2024), and the double thin, continuous gray lines indicate the standard deviation (2.3°F and 1.96 in) above/below the long-term mean. The thick dashed black lines show the long-term linear trend. The warming temperature trend (1.2°F/century) and the precipitation wetting trend (0.97 in/century) are statistically significant at the 95% level (*Student's t-test* −Santer et al. 2000).

B. Temperature and Precipitation Maps

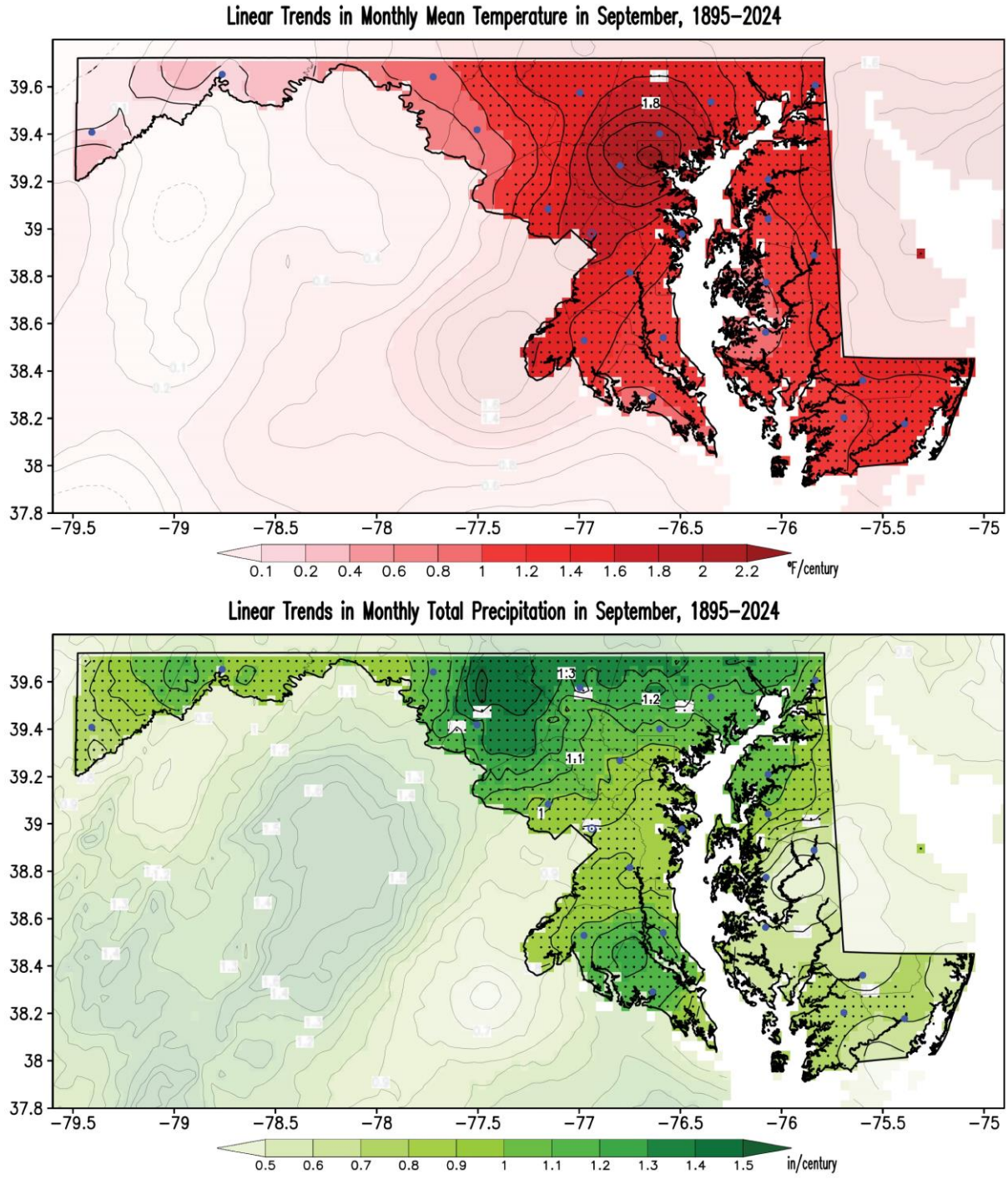

Figure 14. Linear trends in surface air mean temperature and precipitation in September for the period 1895-2024. Temperatures are in °F/century, and precipitation is in inches/century following the color bars. Red shading in the temperature map marks warming trends. Green shading in the precipitation 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. September 2024 Data Tables: Statewide, Climate Divisions, and Counties

A. Mean Temperature and Precipitation

Region	Mean Air Temperature (°F)	Rank (#)
Statewide	68.5	90
Climate Division 1	70.3	86
Climate Division 2	70.0	94
Climate Division 3	70.6	95
Climate Division 4	69.6	86
Climate Division 5	69.6	95
Climate Division 6	67.7	91
Climate Division 7	65.9	85
Climate Division 8	61.8	95
Allegany	65.4	79
Anne Arundel	70.0	85
Baltimore	68.0	94
Baltimore City	69.9	93
Calvert	70.3	94
Caroline	69.3	95
Carroll	66.4	87
Cecil	68.7	93
Charles	70.3	91
Dorchester	70.3	93
Fredrick	66.9	85
Garrett	61.8	95
Harford	68.5	94
Howard	67.3	88
Kent	69.7	94
Montgomery	67.8	87
Prince George's	69.3	86
Queen Anne's	69.6	93
Saint Mary's	70.9	100
Somerset	70.9	87
Talbot	70.1	93
Washington	66.5	85
Wicomico	69.8	85
Worcester	70.3	83

Region	Total Precipitation (in)	Rank (#)
Statewide	2.36	31
Climate Division 1	1.79	24
Climate Division 2	1.68	20
Climate Division 3	2.33	43
Climate Division 4	2.58	47
Climate Division 5	1.61	16
Climate Division 6	2.77	51
Climate Division 7	2.55	54
Climate Division 8	2.95	61
Allegany	2.68	62
Anne Arundel	2.58	49
Baltimore	3.07	59
Baltimore City	2.91	55
Calvert	2.28	41
Caroline	1.18	10
Carroll	3.79	76
Cecil	0.97	6
Charles	2.31	50
Dorchester	1.77	22
Fredrick	3.17	66
Garrett	2.95	61
Harford	1.69	21
Howard	2.93	57
Kent	1.36	11
Montgomery	3.05	60
Prince George's	2.55	51
Queen Anne's	1.80	24
Saint Mary's	2.33	42
Somerset	1.79	25
Talbot	2.09	25
Washington	2.43	51
Wicomico	1.51	18
Worcester	1.98	29

Table A1. Monthly mean surface air temperature (left) and total precipitation (right) at Maryland (statewide), climate division, and county levels for September 2024. Temperatures are in °F, and precipitation is in inches. The rank is the order that the variable for September 2024 occupies among the 130 Septembers 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.

B. Maximum and Minimum Temperatures

Region	Maximum Air Temperature (°F)	Rank (#)
Statewide	77.8	67
Climate Division 1	79.5	85
Climate Division 2	79.2	69
Climate Division 3	78.7	65
Climate Division 4	78.4	57
Climate Division 5	78.7	64
Climate Division 6	77.2	66
Climate Division 7	76.2	43
Climate Division 8	72.4	76
Allegany	76.1	44
Anne Arundel	78.4	58
Baltimore	77.8	72
Baltimore City	78.8	72
Calvert	78.3	59
Caroline	79.2	70
Carroll	76.4	65
Cecil	78.2	80
Charles	78.7	62
Dorchester	79.4	71
Fredrick	76.2	57
Garrett	72.5	75
Harford	78.3	80
Howard	76.9	62
Kent	78.6	69
Montgomery	76.6	55
Prince George's	78.3	58
Queen Anne's	78.7	62
Saint Mary's	78.8	67
Somerset	79.6	84
Talbot	78.7	64
Washington	76.4	41
Wicomico	79.6	78
Worcester	79.4	86

Region	Minimum Air Temperature (°F)	Rank (#)
Statewide	59.2	108
Climate Division 1	61.1	92
Climate Division 2	60.8	105
Climate Division 3	62.5	114
Climate Division 4	60.9	103
Climate Division 5	60.5	111
Climate Division 6	58.2	106
Climate Division 7	55.6	109
Climate Division 8	51.2	103
Allegany	54.7	102
Anne Arundel	61.6	104
Baltimore	58.2	106
Baltimore City	61.0	105
Calvert	62.2	112
Caroline	59.4	108
Carroll	56.4	106
Cecil	59.2	102
Charles	61.9	114
Dorchester	61.2	104
Fredrick	57.6	109
Garrett	51.2	103
Harford	58.7	104
Howard	57.8	104
Kent	60.7	107
Montgomery	59.0	111
Prince George's	60.3	105
Queen Anne's	60.4	110
Saint Mary's	63.1	116
Somerset	62.1	94
Talbot	61.5	108
Washington	56.5	109
Wicomico	60.0	93
Worcester	61.2	89

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

A. Temperatures and Precipitation

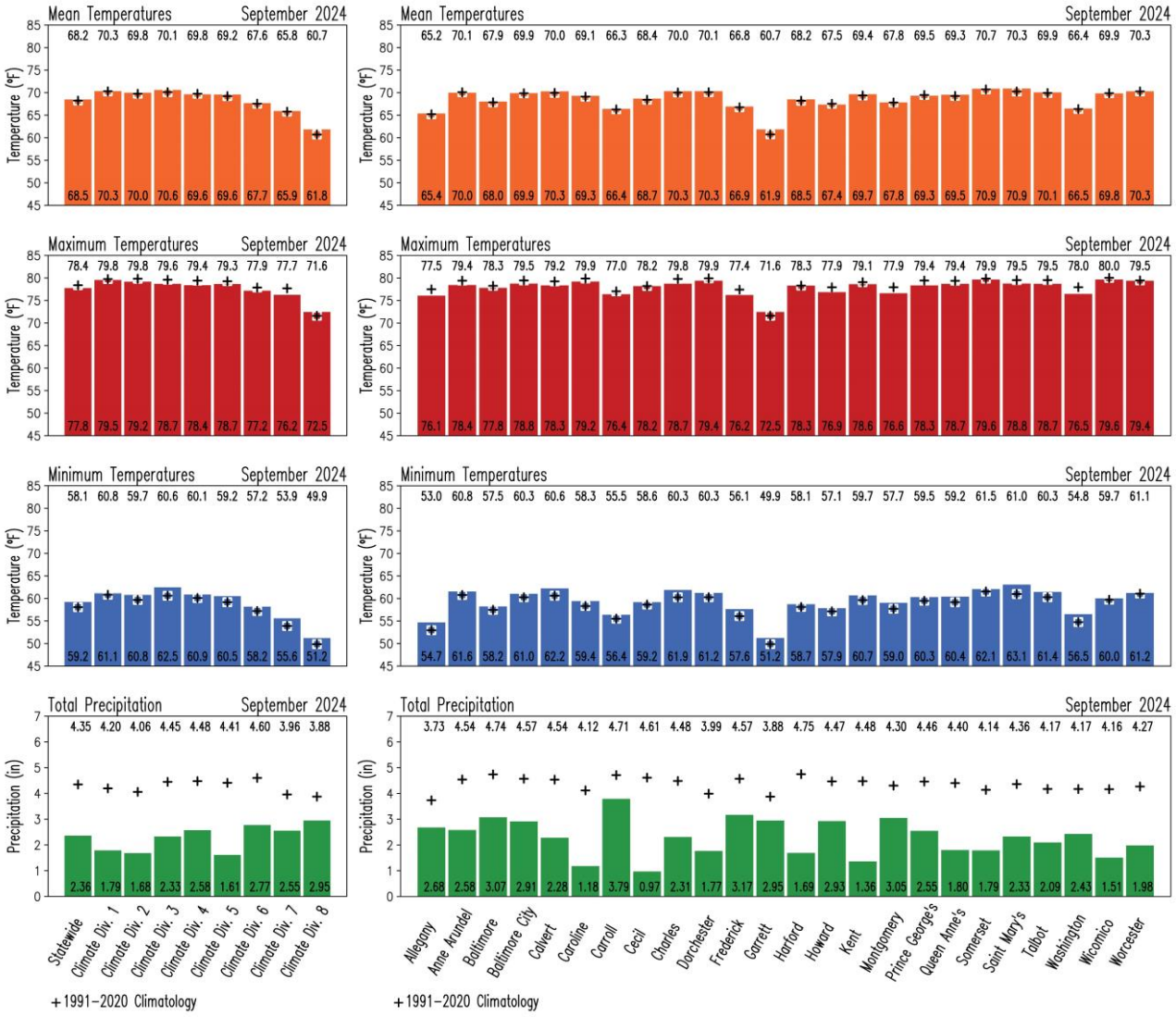

Figure B1. Monthly surface variables in Maryland for September 2024. Color bars represent the variables as follows: mean surface air temperature (orange), maximum surface air temperature (red), minimum surface air temperature (blue) and total precipitation (green) at statewide and climate division (left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

B. Temperatures and Precipitation Anomalies

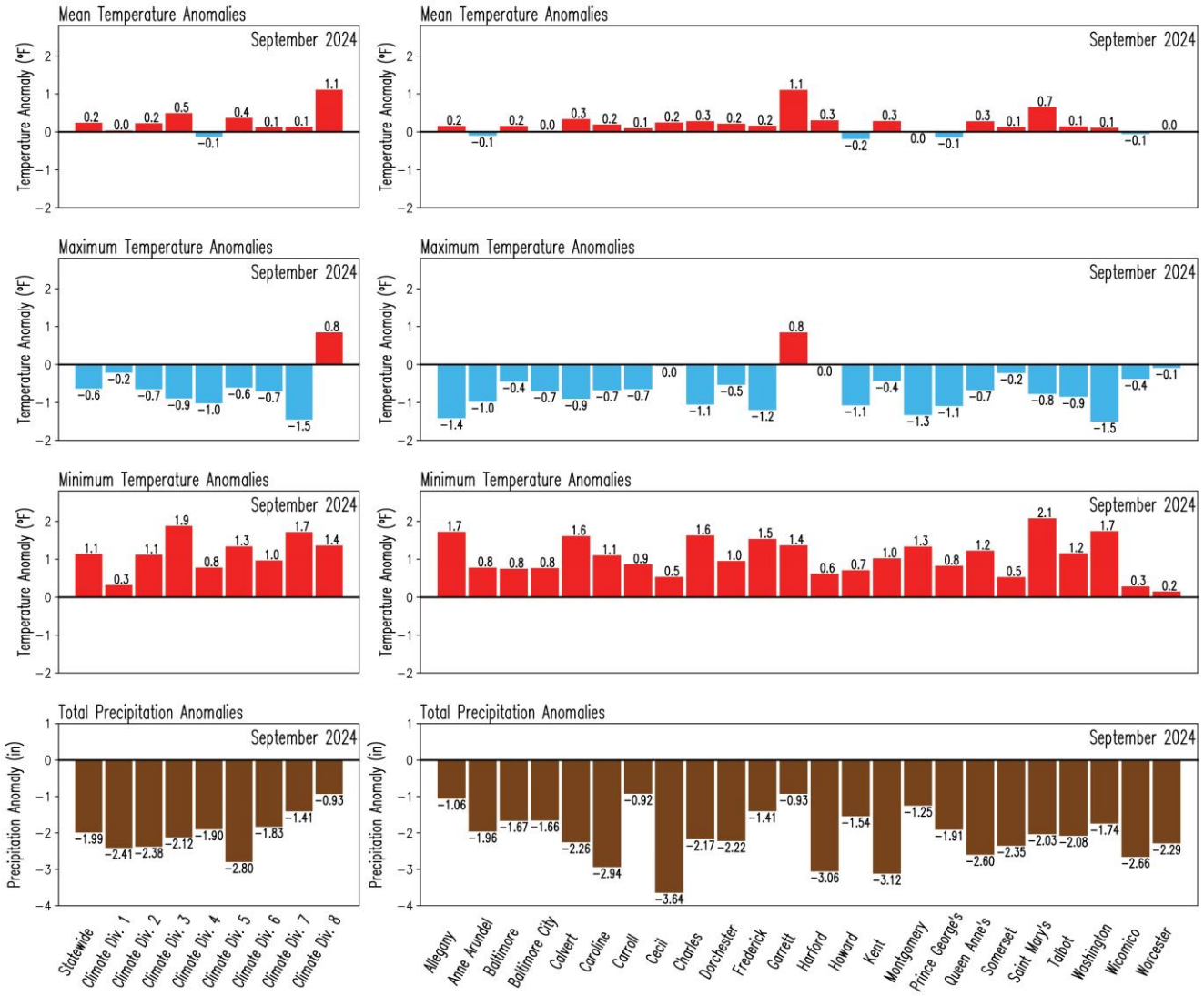

Figure B2. Anomalies of the monthly surface variables in Maryland for September 2024. Anomalies are with respect to the 1991-2020 climatology. Red/blue color represents positive/negative (warmer/colder than normal) anomalies for mean surface air temperature (upper row), maximum surface air temperature (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 at county (right column) levels. Temperatures are in °F, and precipitation is in inches. The numbers outside of the bars indicate the magnitude of the anomaly for September 2024.

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

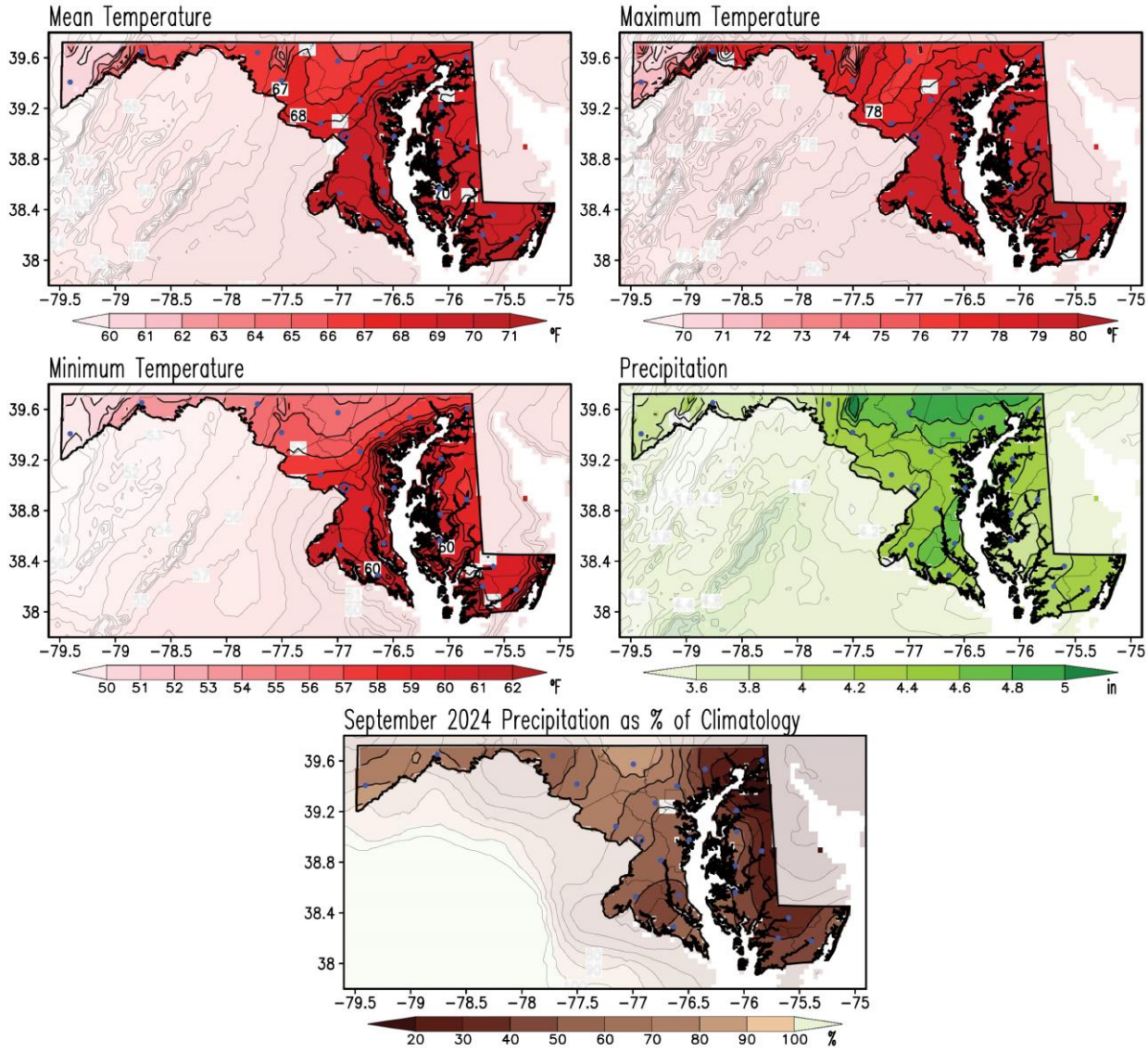

Figure C1. September climatology of the monthly mean, maximum and minimum surface air temperatures, and total precipitation for the period 1991-2020 (upper and middle rows), and precipitation in September 2024 as a percentage of climatology (bottom row). Temperatures are in °F, and precipitation is in inches according to the color bars. This is the current climate normal against which the September 2024 conditions are compared to obtain the September 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. September Standard Deviation and September 2024 Standardized Anomalies Maps

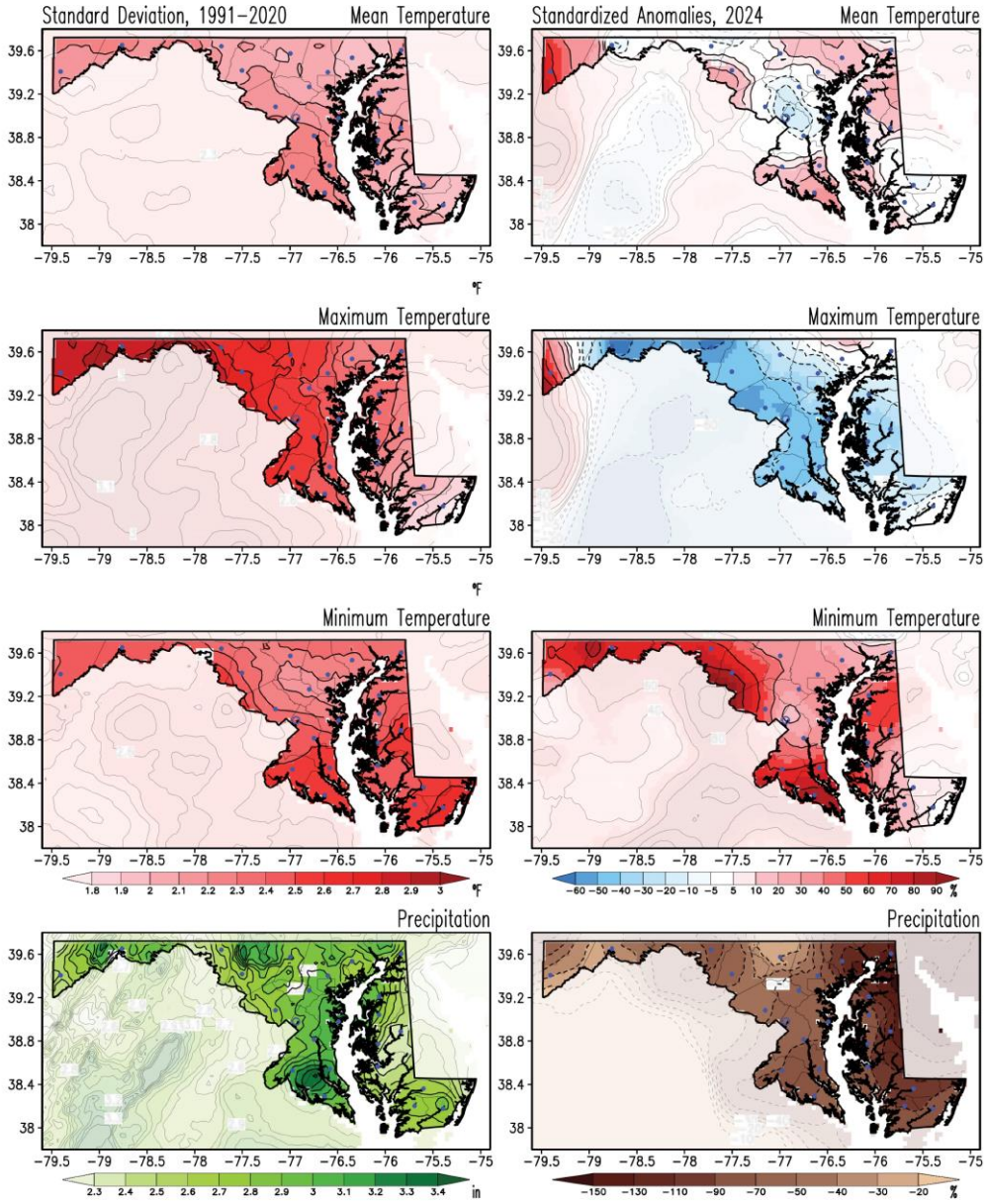

Figure D1. Standard deviation for September and standardized anomalies of temperatures and precipitation for September 2024. Standard deviations for monthly mean, maximum, and minimum surface air temperatures and total precipitation were obtained for the 1991-2020 period (left column). Anomalies for September 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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