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Maryland Climate Bulletin
Spring 2023

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DEPARTMENT OF
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OCEANIC SCIENCE
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Maryland
State
Climatologist
Office

Summary

Spring 2023 was warmer and much drier than normal (i.e., 1991-2020 averages), after it started with a warmer and drier March, followed by a wetter and much warmer April, and ended with a colder and drier than normal May. Seasonal mean temperatures were in the 46 to 57°F range; maximum temperatures were between 58 to 69°F; minimum temperatures were in the 34 to 57°F range. Seasonal accumulated total precipitation was in the 5 to 11.5 inches range.

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

- Mean temperature was warmer than normal almost everywhere, notably in the north-central counties of the Piedmont Province (above 1.0°F) and portions of Charles, Saint Mary's, Calvert, Talbot, Caroline, Dorchester, Wicomico, Somerset, and Worcester counties (above 1.2°F).

- Maximum temperature was warmer than normal everywhere, by at least 1.0°F, especially over Howard, northern Anne Arundel, and Baltimore counties, including Baltimore City (above 2.0°F), western Garrett County, and portions of Saint Mary's, Calvert, Talbot, Dorchester, and Wicomico counties (above 2.2 °F).

- Minimum temperature was warmer than normal in portions of Montgomery, Saint Mary's, Calvert, Talbot, and Dorchester counties (above 1.0°F), but it was colder than normal in Garrett, Allegany, and Washington counties.

- Precipitation was below normal over the whole state, especially over the north-central counties of the Piedmont Province and portions of Charles and Kent counties (above 5.0 in).

- The partial water year (October 2022-May 2023) also showed below-normal conditions everywhere, especially over Montgomery, Frederick, Howard, and Baltimore counties, including Baltimore City (below −180 in) and western Charles County. These regions had around 75% of the climatological amounts at this time of the water year.

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

- All eight climate divisions were warmer and drier than normal, particularly the North Central, Northwestern Shore, Upper Southern, and Lower Southern divisions, by at least 1°F and −3.5 in.

- Statewide warm and dry anomalies have persisted since last fall, but the drying in spring 2023 was the largest (−4 in).

Historical Context (Figure 8, Tables A1 and A2)

- Spring 2023's mean, maximum, and minimum statewide temperatures (54.8, 66.3, and 43.4°F) were above the long-term (1895-2022) average and among 25% of the recorded warmest springs. Statewide accumulated total precipitation (11.01 in) was below the long-term average and ranked 9th among the driest springs since 1895. Maximum temperatures in nine counties, and Baltimore City, were among the ten warmest on record.

Century-Plus (1895-2023) Trends (Figures 9, 10)

- Statewide mean temperature in spring showed a significant 1.9°F/century warming trend, and the heating degree-days a significant −162.57°F degree-days decreasing trend. On the other hand, statewide accumulated total precipitation in spring showed a non-significant increasing trend (0.88 in/century), and the partial water year had a significant increasing trend of 2.31 in/century.
- Regionally, mean temperature in spring showed a significant warming trend everywhere in the state. It varies from ~0.6°F/century over Garrett County to above 2.0°F on the eastern shore and along the Montgomery−Frederick and Carroll−Howard county boundaries, extending into western Harford County, with maximum values over Baltimore City (2.8°F/century).
- Regionally, accumulated total precipitation in spring showed significant increasing trends. Increasing trends larger than 1.0 in/century were found to the west of Washington County, with a maximum of 1.8 in/century over Allegany County, and to the east over the north-central counties of the Piedmont with a maximum of 1.8 in/century over Baltimore and Harford 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, 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 statewide, and climate division and county-wise, 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 spring 2023 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 is provided via tables and plots in Appendices A-B; climatology and variability maps are in Appendices C-E.

2. Data

Surface air temperatures, total precipitation, and heating 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), which is available in a preliminary status at: https://www.ncei.noaa.gov/data/nclimgrid-monthly/access/
  Data was downloaded on 6/10/2023.

- NOAA Monthly U.S. Climate *Divisional* Dataset (NClimDiv – Vose et al. 2014), which is available in a preliminary status (v1.0.0-20230606) at: https://www.ncei.noaa.gov/pub/data/cirs/climdiv/
  Data was downloaded on 6/10/2023.

Water year data is calculated from the monthly total precipitation.

Some definitions:

About the seasons: Seasons are defined following the common three-month meteorological definitions as follows. 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 the anomalies: Anomalies for a given season (e.g., spring 2023) are the departures of the seasonal value from the corresponding season's 30-year average (i.e., from the average of 30 springs) during 1991-2020; the 30-year average (or mean) is the climate normal, or just the 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 dryer than normal) or negative anomaly.

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. Spring 2023 Maps

A. Mean Temperatures

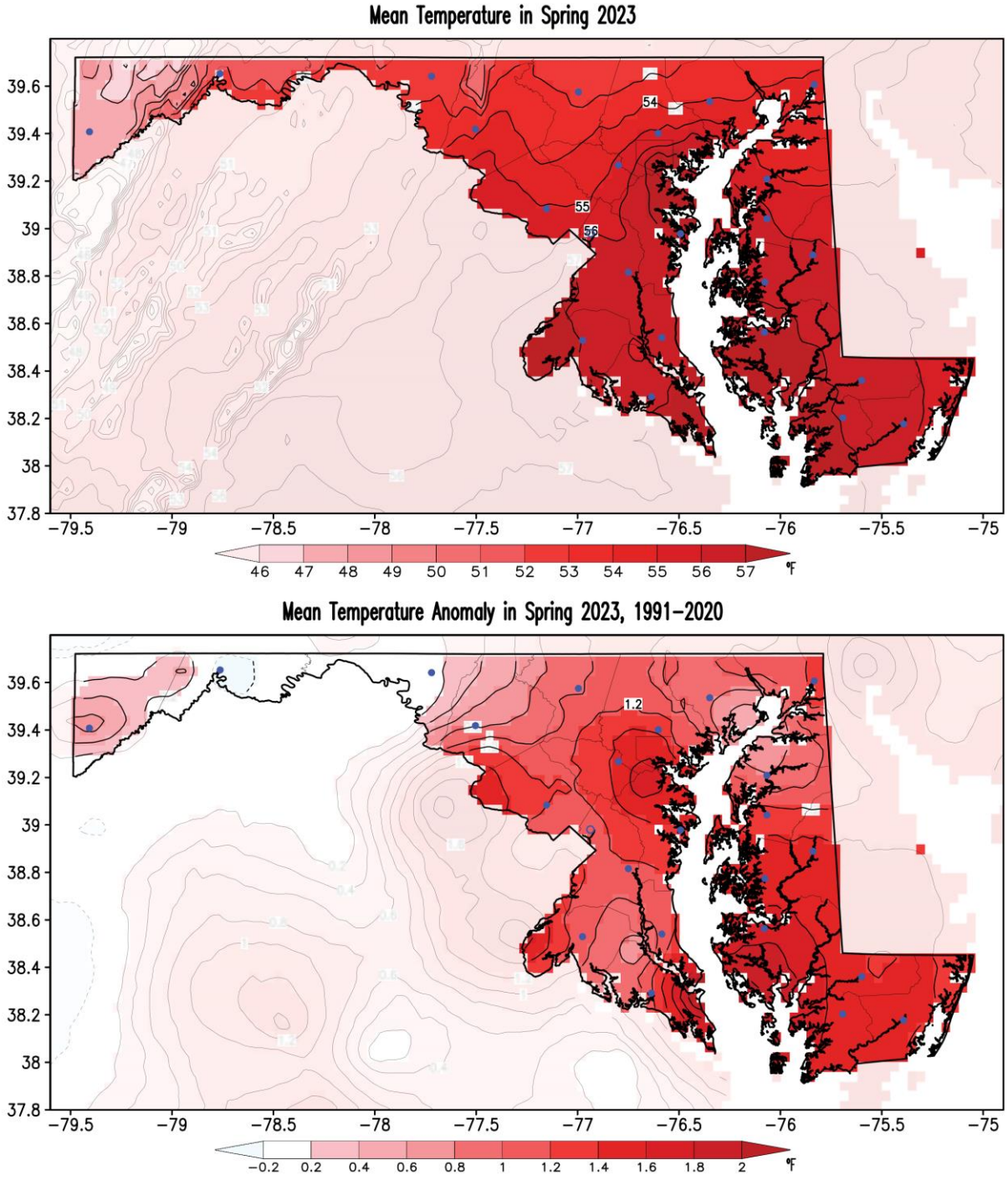

Figure 1. Seasonal mean surface air temperature (top panel) and its anomaly with respect to the 1991-2020 climatology (bottom panel) for spring 2023. Temperatures are in °F following the color bar. Blue/red shading in the anomaly map marks colder/warmer than normal conditions. Note shading outside the state has been washed out to facilitate focusing on Maryland. Filled blue circles mark the county seats.

B. Maximum Temperatures

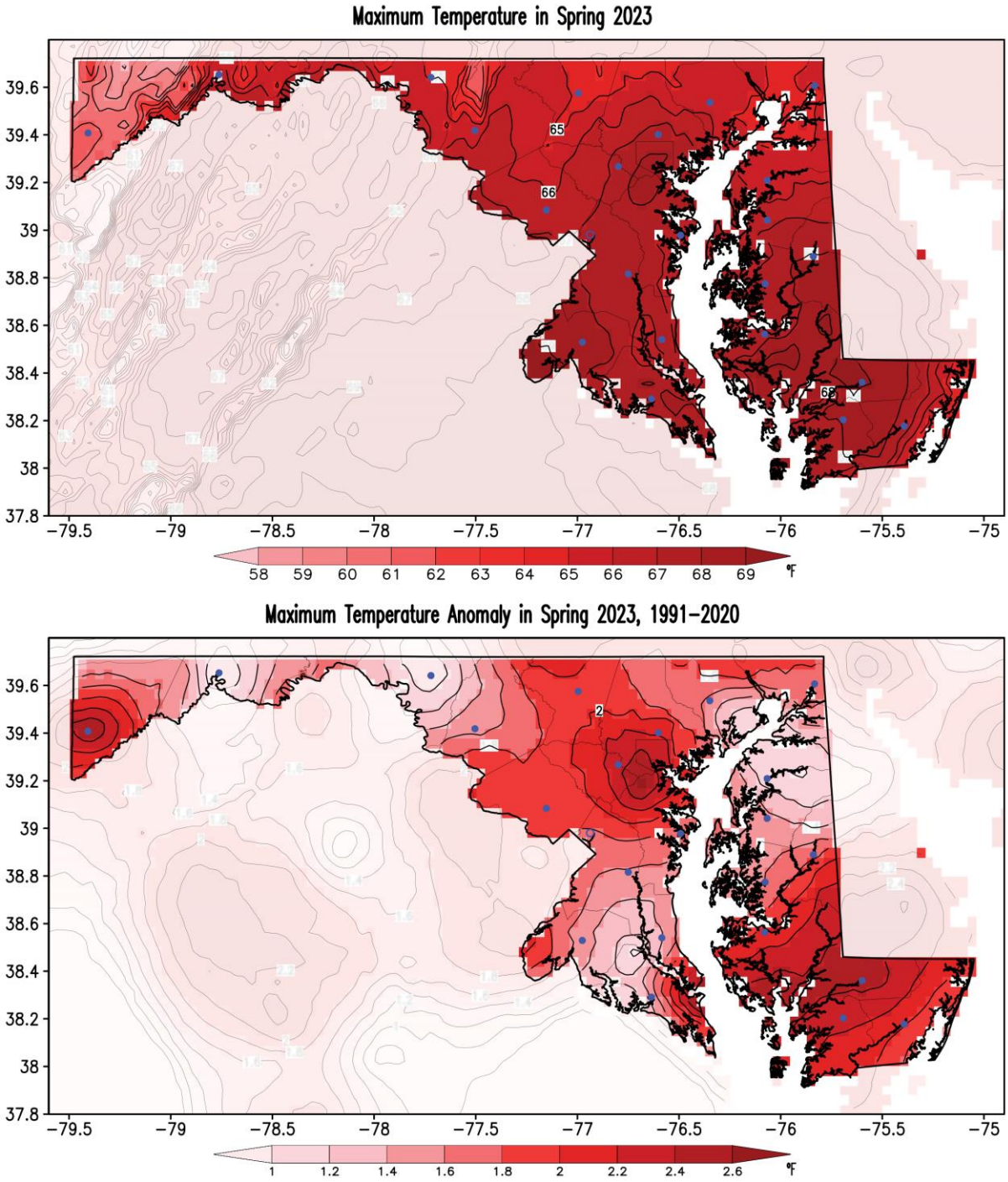

Figure 2. Seasonal maximum surface air temperature (top panel) and its anomaly with respect to the 1991-2020 climatology (bottom panel) for spring 2023. Temperatures are in °F following the color bar. Red shading in the anomaly map marks warmer than normal conditions. Note shading outside the state has been washed out to facilitate focusing on Maryland. Filled blue circles mark the county seats.

C. Minimum Temperatures

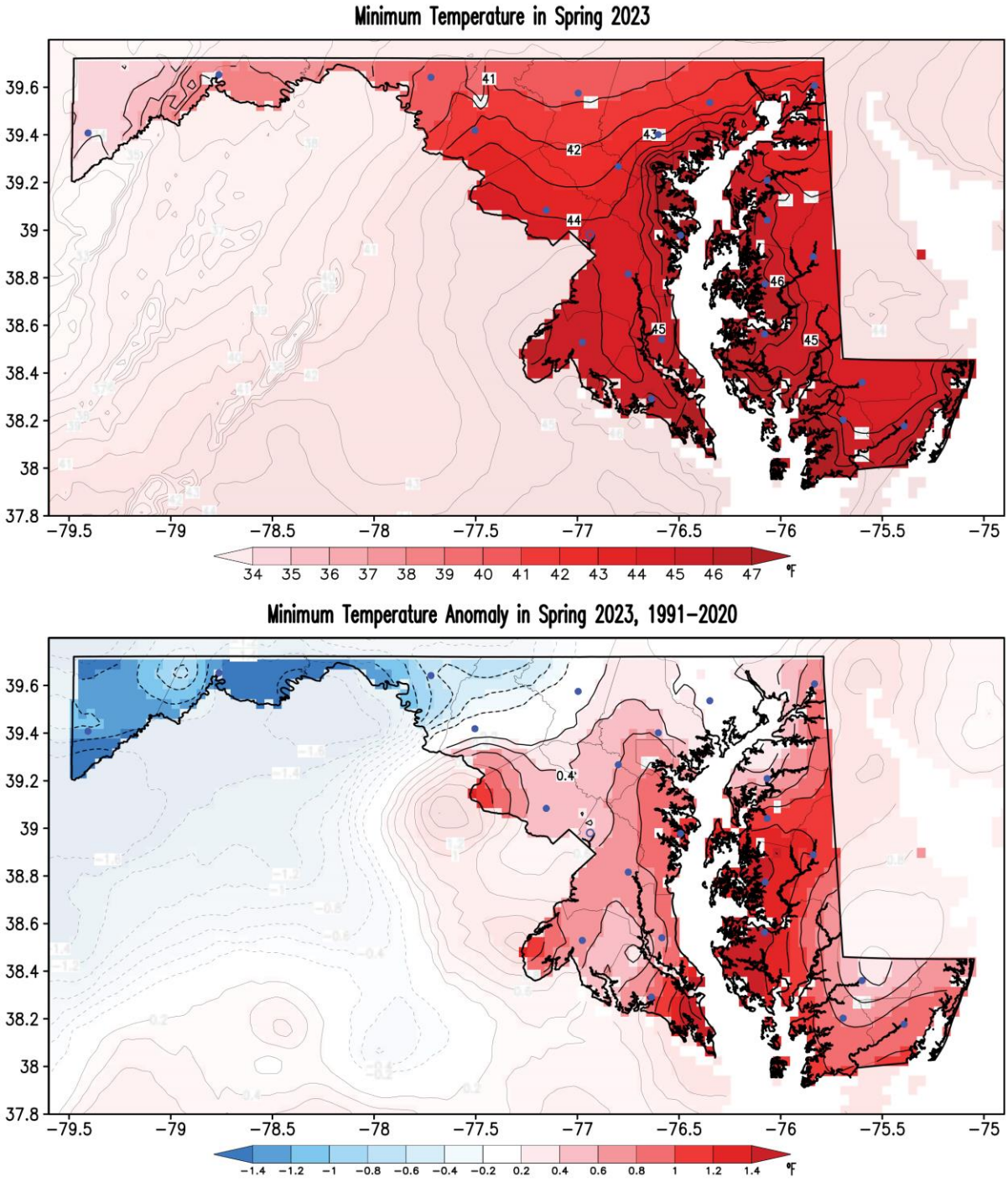

Figure 3. Seasonal minimum surface air temperature (top panel) and its anomaly with respect to the 1991-2020 climatology (bottom panel) for spring 2023. Temperatures are in °F following the color bar. Blue/red shading in the anomaly map marks colder/warmer than normal conditions. Note shading outside the state has been washed out to facilitate focusing on Maryland. Filled blue circles mark the county seats.

D. Precipitation

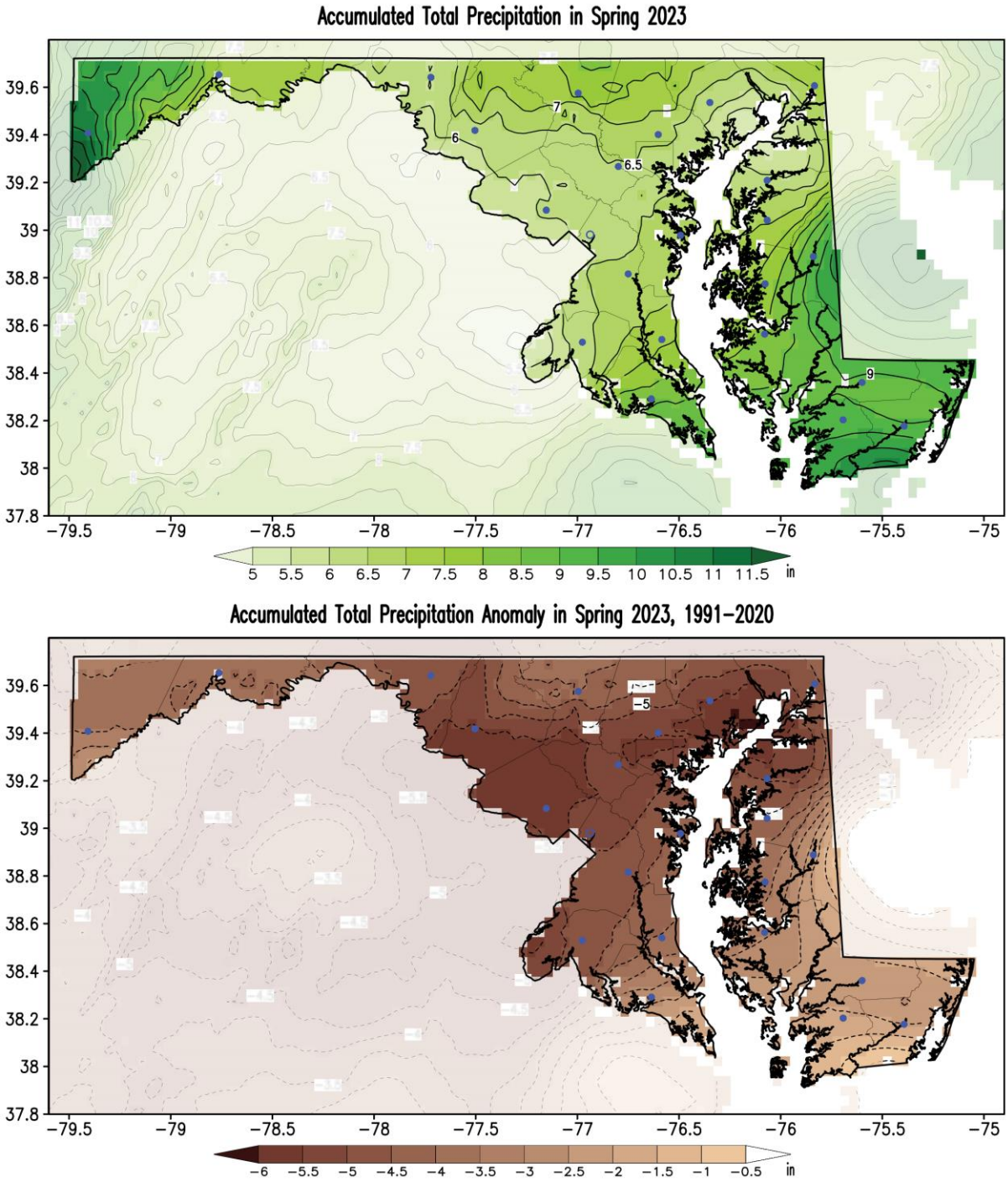

Figure 4. Seasonal accumulated total precipitation (top panel) and its anomaly with respect to the 1991-2020 climatology (bottom panel) for spring 2023. Precipitation is in inches following the color bar. Brown shading in the anomaly map marks drier than normal conditions. Note shading outside the state has been washed out to facilitate focusing on Maryland. Filled blue circles mark the county seats.

E. Partial Water Year (October 2022 – May 2023)

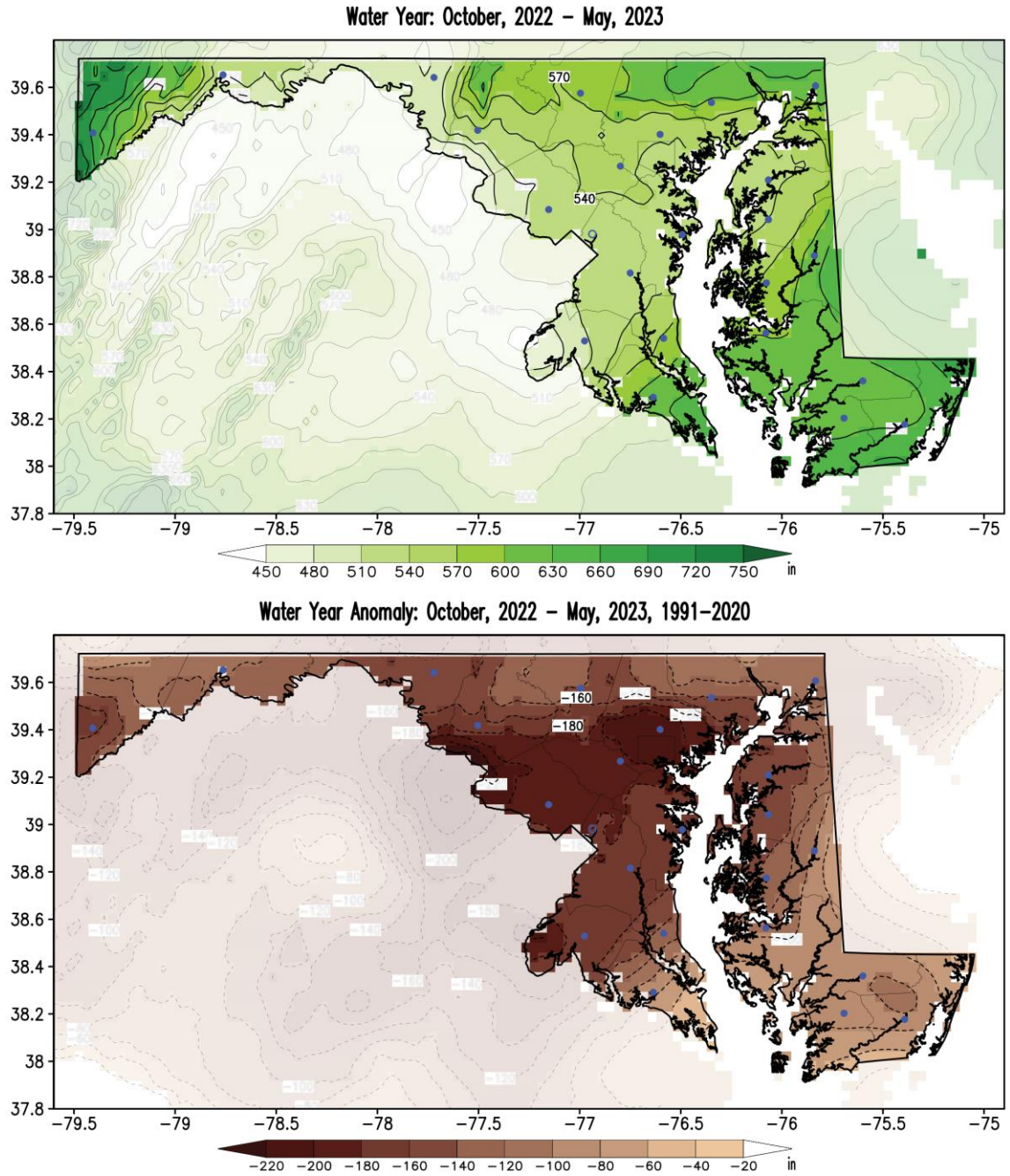

Figure 5. Partial water year until the end of spring 2023 (top panel), and its anomaly with respect to the 1991-2020 climatology (bottom panel). Water year is in inches following the color bar. Brown shading in the anomaly map marks drier than normal conditions. The current maps display the partial conditions from October 2022 to May 2023. 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; 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. Note shading outside the state has been washed out to facilitate focusing on Maryland. Filled blue circles mark the county seats.

4. Spring and Fall 2022–Spring 2023 Climate Divisions Averages

A. Spring 2023 Scatter Plots

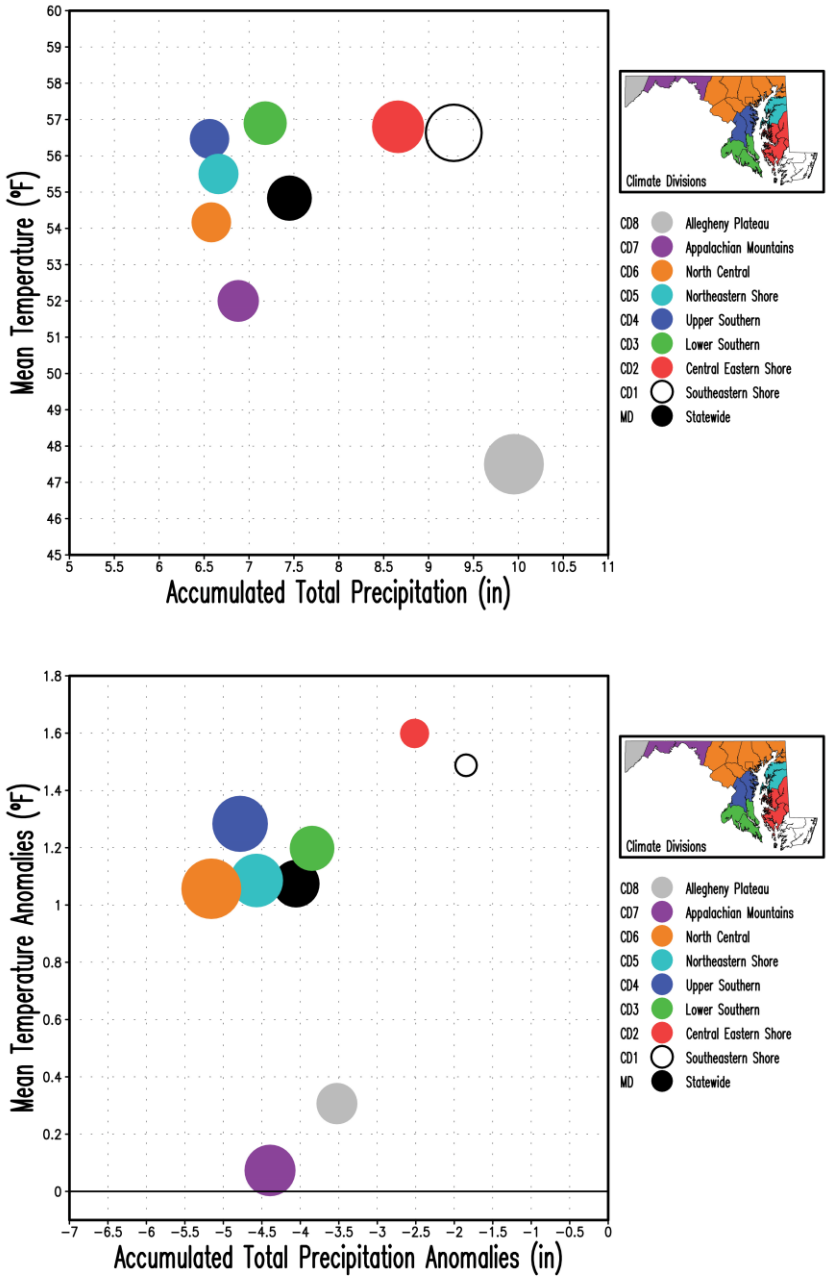

Figure 6. Scatter plots of Maryland (statewide) and Climate Divisions (CD#) seasonal mean surface air temperature vs. accumulated total precipitation for spring 2023. The upper panel shows the mean temperature and total precipitation, and the bottom panel displays their anomalies with respect to the 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 (9.95 inches in CD8, top panel) and by the maximum precipitation anomaly (|-5.16| inches in CD6, 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. Fall 2022 – Winter, Spring 2023 Scatter Plots

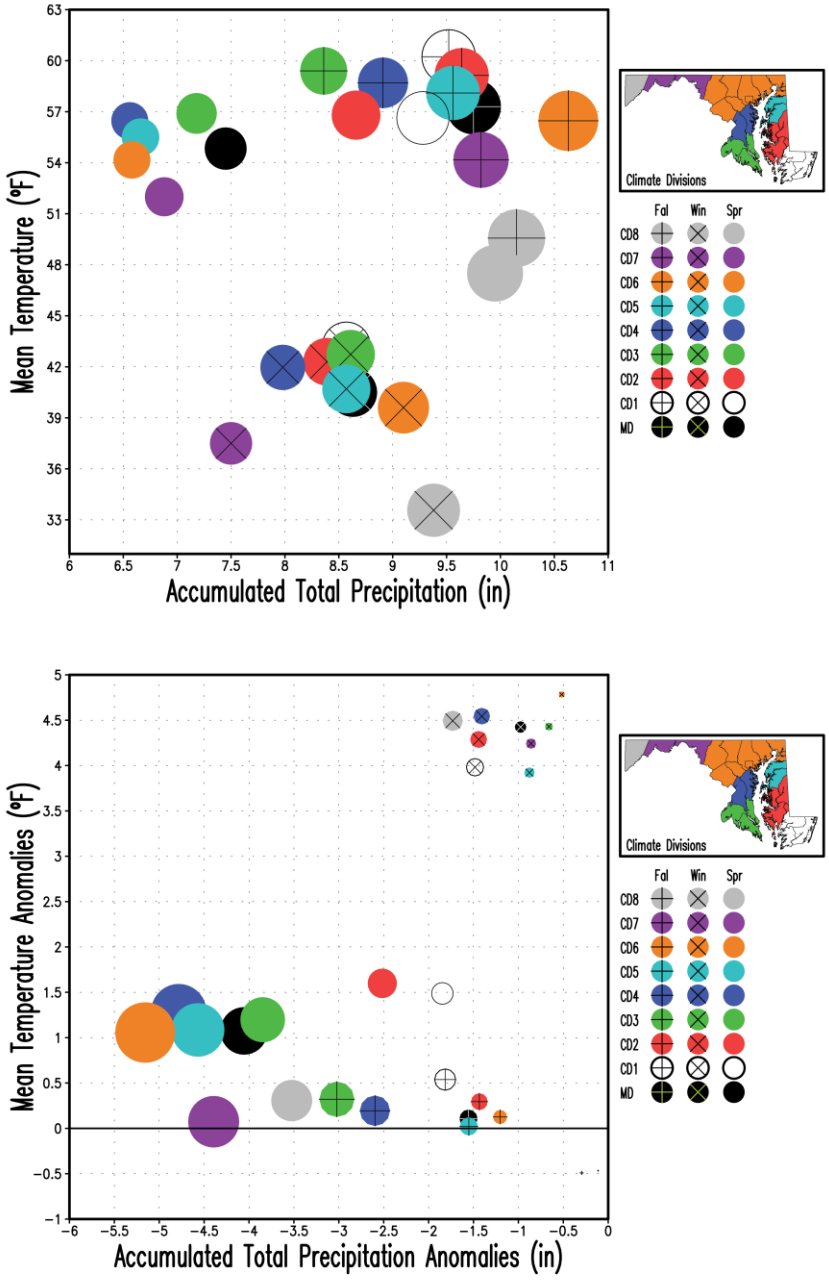

Figure 7. Scatter plots of Maryland (statewide) and Climate Divisions (CD#) seasonal mean surface air temperature vs. accumulated total precipitation for fall 2022, winter, and spring 2023. The upper panel shows the mean temperature and total precipitation, and the bottom panel displays their anomalies 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 (10.63 inches in CD6 in fall, top panel) and by the maximum precipitation anomaly (|-5.16| inches in CD6 in spring, bottom panel) among the nine regions and three months. Spring is displayed with filled circles only, while winter and fall are displayed with superposed multiplication and addition signs, respectively.

5. Spring 2023 Statewide Averages in the Historical Record

A. Box and Whisker Plots

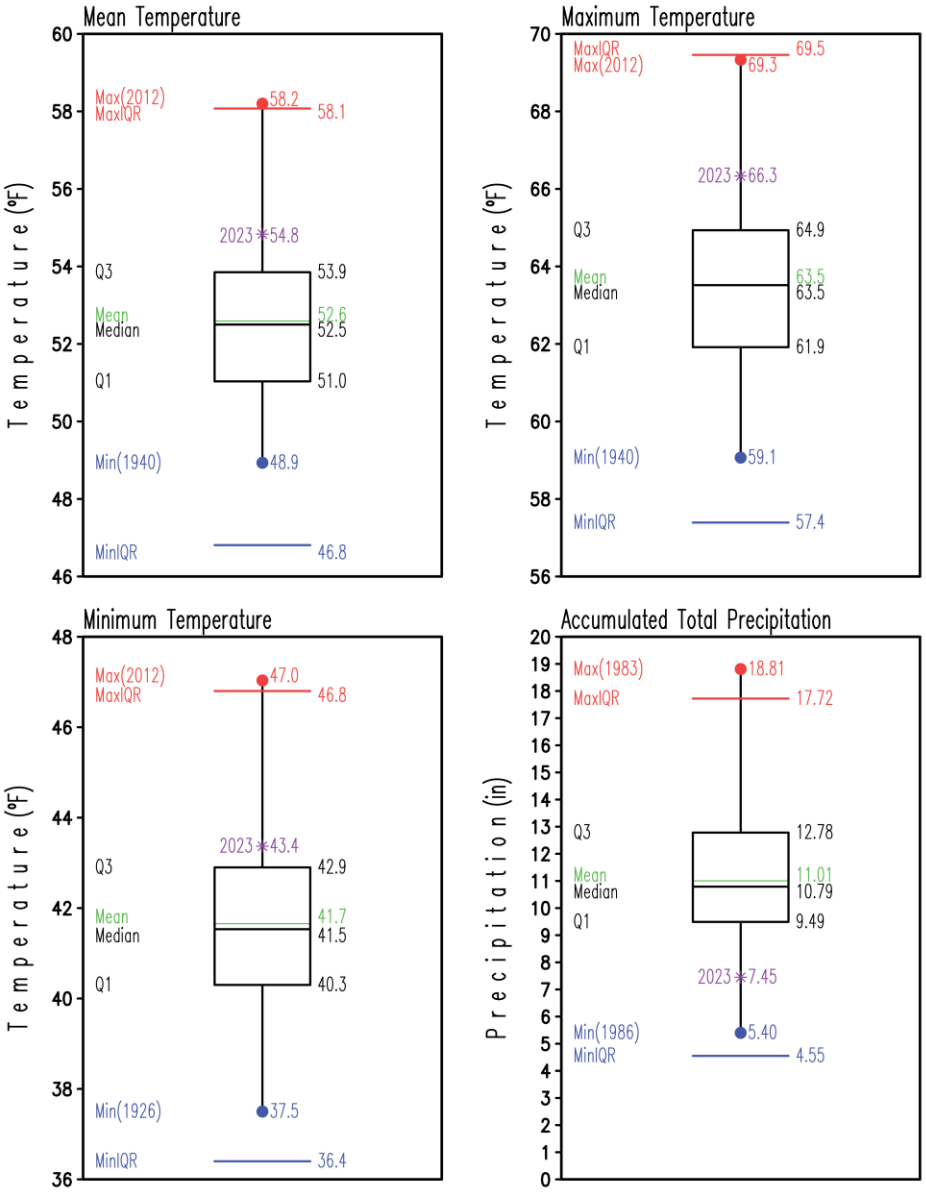

Figure 8. Box and Whisker plots of Maryland (statewide) seasonal mean (upper left), maximum (upper right), minimum (lower left) surface air temperatures, and accumulated total precipitation (lower right) for spring for the period 1895-2022. The label and asterisk in purple represent conditions for spring 2023. Statistics for the period 1895-2022 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 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. 1895-2023 Trends

A. Statewide Mean Temperature, Heating Degree-Days, Accumulated Total Precipitation, and Partial (Oct-May) Water Year

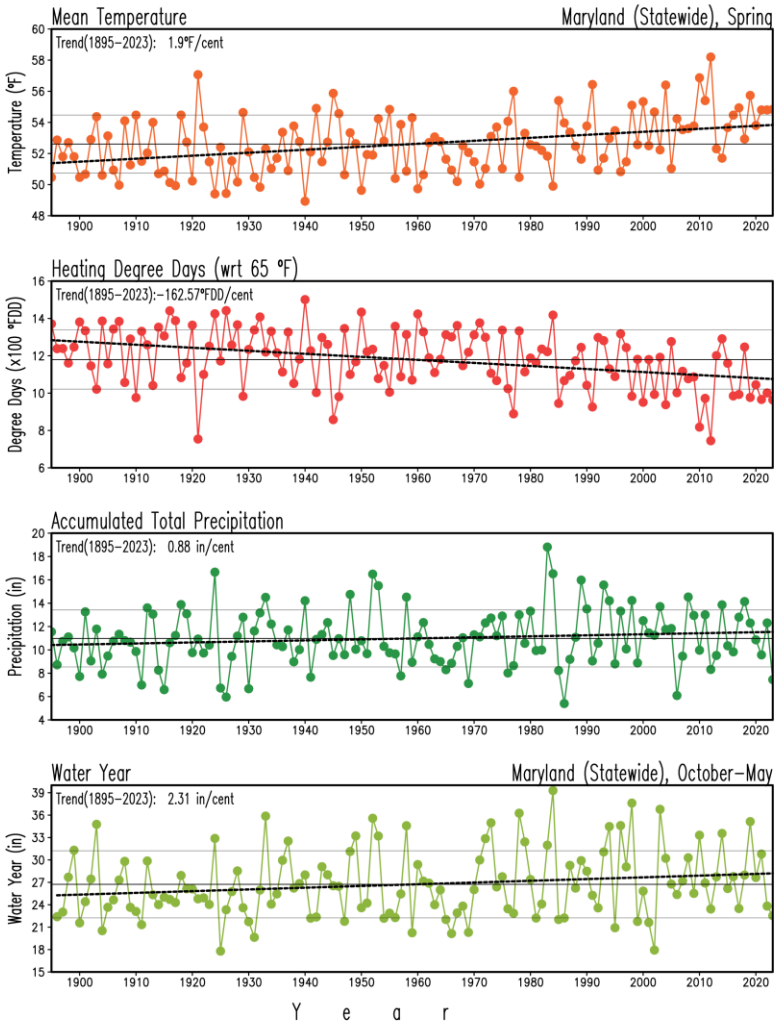

Figure 9. Maryland (statewide) mean surface air temperature, heating degree-days, accumulated total precipitation in spring, and partial (October-May) water year for the period 1895-2023. Temperature is in °F, heating degree-days is in °F degree-days (°FDD), and precipitation is in inches. The thin, continuous black lines in each panel display the long-term means (52.6°F, 1179.67°FDD, 10.98 in, and 26.73 in, 1895-2023), and the double thin, continuous gray lines indicate the standard deviation (1.9°F, 157.68°FDD, 2.44 in, and 4.49 in) above/below the long-term mean. The thick dashed black lines show the long-term linear trend. Degree-days are the difference between the daily mean temperature (high temperature plus low temperature divided by two) and 65°F. It gives a general idea of how much energy is required to heat buildings; because energy demand is cumulative, degree-day totals for a season are the sum of each individual day's degree-day total (CPC, 2023). The warming temperature trend (1.9°F/century), the decreasing heating degree-days (−162.57°FDD/century) trend, and the increasing water year (2.31 in/century) trend are statistically significant at the 95% level (*Student's t-test* −Santer et al. 2000), but not the increasing precipitation (0.88 in/century) trend.

B. Temperature and Precipitation Maps

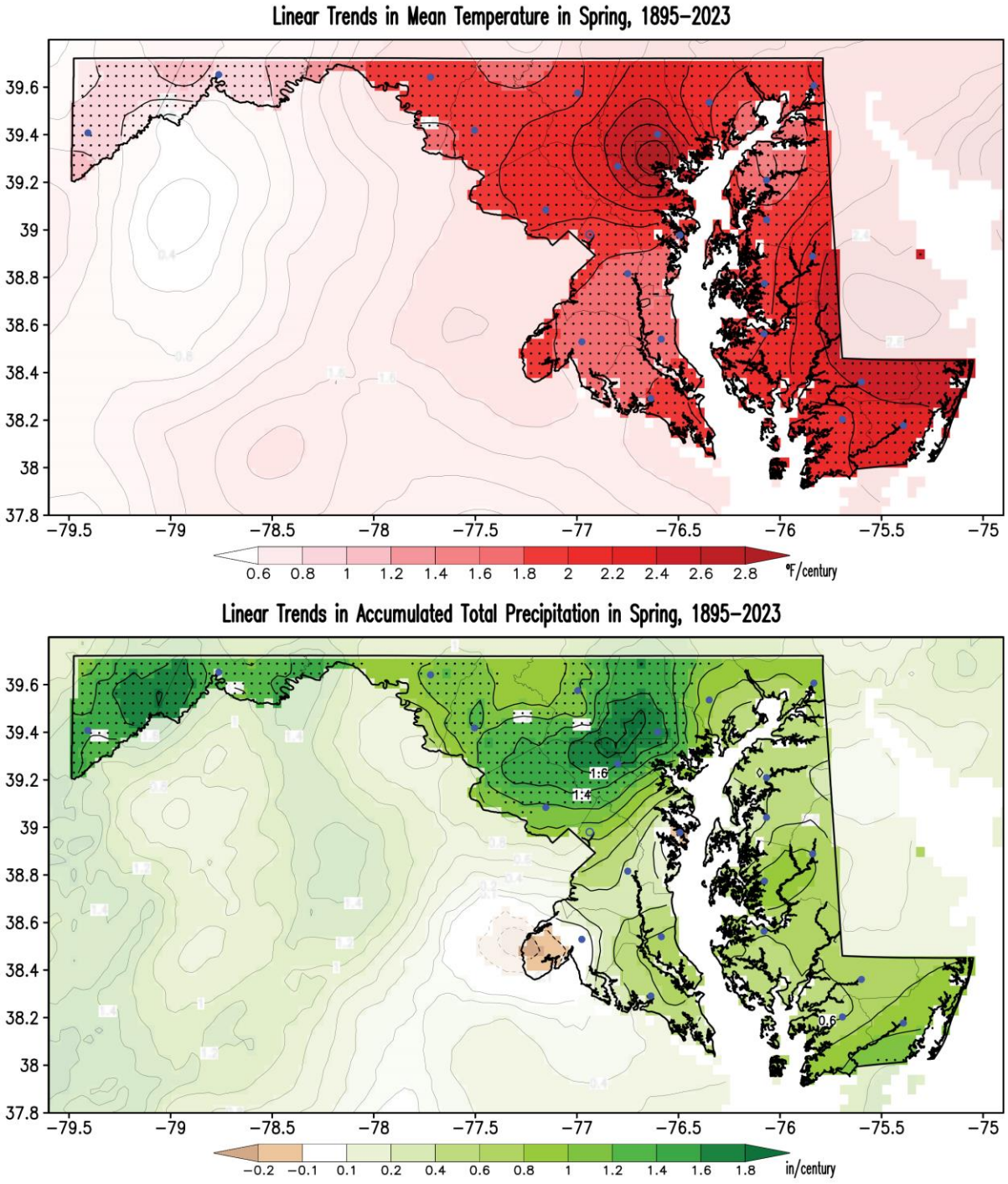

Figure 10. Linear trends in spring surface air mean temperature and accumulated total precipitation for the period 1895-2023. Temperatures are in °F/century, and precipitation is in inches/century following the color bars. Red shading in the temperature map marks warming trends. Brown/green shading in the precipitation map shows drying/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. Spring 2023 Tables: Statewide, Climate Divisions, and Counties

A. Mean Temperature and Precipitation

Region	Mean Air Temperature (°F)	Rank (#)
Statewide	54.8	114
Climate Division 1	56.6	118
Climate Division 2	56.8	118
Climate Division 3	56.9	116
Climate Division 4	56.5	118
Climate Division 5	55.5	116
Climate Division 6	54.2	115
Climate Division 7	52.0	91
Climate Division 8	47.5	93
Allegany	51.3	87
Anne Arundel	56.7	118
Baltimore	54.5	115
Baltimore City	56.6	119
Calvert	56.5	114
Caroline	56.2	119
Carroll	53.0	113
Cecil	54.2	113
Charles	57.0	113
Dorchester	57.2	122
Fredrick	53.5	108
Garrett	47.5	90
Harford	54.0	107
Howard	54.7	117
Kent	55.2	111
Montgomery	55.0	117
Prince George's	56.2	114
Queen Anne's	55.8	117
Saint Mary's	56.9	114
Somerset	57.3	119
Talbot	56.8	117
Washington	52.6	99
Wicomico	56.7	119
Worcester	56.2	117

Region	Acc. Total Precipitation (in)	Rank (#)
Statewide	7.45	9
Climate Division 1	9.28	40
Climate Division 2	8.66	23
Climate Division 3	7.18	10
Climate Division 4	6.56	8
Climate Division 5	6.66	7
Climate Division 6	6.58	5
Climate Division 7	6.88	8
Climate Division 8	9.95	23
Allegany	7.50	21
Anne Arundel	6.59	9
Baltimore	6.91	7
Baltimore City	6.41	7
Calvert	7.48	12
Caroline	9.03	26
Carroll	7.20	8
Cecil	6.60	5
Charles	6.26	6
Dorchester	8.53	21
Fredrick	6.61	5
Garrett	9.94	23
Harford	6.29	4
Howard	6.36	6
Kent	6.14	5
Montgomery	5.97	4
Prince George's	6.51	8
Queen Anne's	6.89	9
Saint Mary's	8.28	23
Somerset	9.49	47
Talbot	7.74	14
Washington	6.30	4
Wicomico	8.98	31
Worcester	9.34	46

Table A1. Seasonal mean surface air temperature (left) and accumulated total precipitation (right) at Maryland (statewide), climate division, and county levels for spring 2023. Temperatures are in °F, and precipitation is in inches. The rank is the order that the variable for spring 2023 occupies among the 129 springs after the 129 values have been arranged from the lowest to the highest in the *standard competition ranking method*. The closer to 129 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	66.3	118
Climate Division 1	67.6	122
Climate Division 2	68.0	120
Climate Division 3	68.0	116
Climate Division 4	67.5	119
Climate Division 5	66.2	107
Climate Division 6	65.8	118
Climate Division 7	65.0	110
Climate Division 8	60.3	111
Allegany	64.7	106
Anne Arundel	67.5	119
Baltimore	66.3	117
Baltimore City	67.9	121
Calvert	67.2	114
Caroline	67.9	119
Carroll	65.1	116
Cecil	65.0	112
Charles	68.4	116
Dorchester	68.4	123
Fredrick	65.3	117
Garrett	60.3	111
Harford	65.4	109
Howard	66.6	122
Kent	65.7	106
Montgomery	66.4	120
Prince George's	67.6	116
Queen Anne's	66.5	109
Saint Mary's	67.6	116
Somerset	67.9	121
Talbot	67.3	117
Washington	65.3	110
Wicomico	68.6	123
Worcester	66.7	120

Region	Minimum Air Temperature (°F)	Rank (#)
Statewide	43.4	107
Climate Division 1	45.7	110
Climate Division 2	45.6	117
Climate Division 3	45.9	112
Climate Division 4	45.4	114
Climate Division 5	44.7	117
Climate Division 6	42.6	106
Climate Division 7	39.0	65
Climate Division 8	34.7	57
Allegany	37.9	53
Anne Arundel	45.9	117
Baltimore	42.7	111
Baltimore City	45.4	115
Calvert	45.8	111
Caroline	44.5	118
Carroll	40.9	103
Cecil	43.5	110
Charles	45.6	110
Dorchester	46.1	117
Fredrick	41.7	95
Garrett	34.7	57
Harford	42.7	105
Howard	42.7	109
Kent	44.7	115
Montgomery	43.7	111
Prince George's	44.8	110
Queen Anne's	45.0	118
Saint Mary's	46.2	113
Somerset	46.5	113
Talbot	46.3	117
Washington	40.0	78
Wicomico	44.8	110
Worcester	45.7	111

Table A2. Seasonal maximum (left) and minimum (right) surface air temperatures at Maryland (statewide), climate division, and county levels for spring 2023. Temperatures are in °F. The rank is the order that the variable for spring 2023 occupies among the 129 springs after the 129 values have been arranged from the lowest to the highest using the *standard competition ranking method*. The closer to 129 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. Spring 2023 Bar Graphs: Statewide, Climate Divisions, and Counties

A. Temperatures and Precipitation

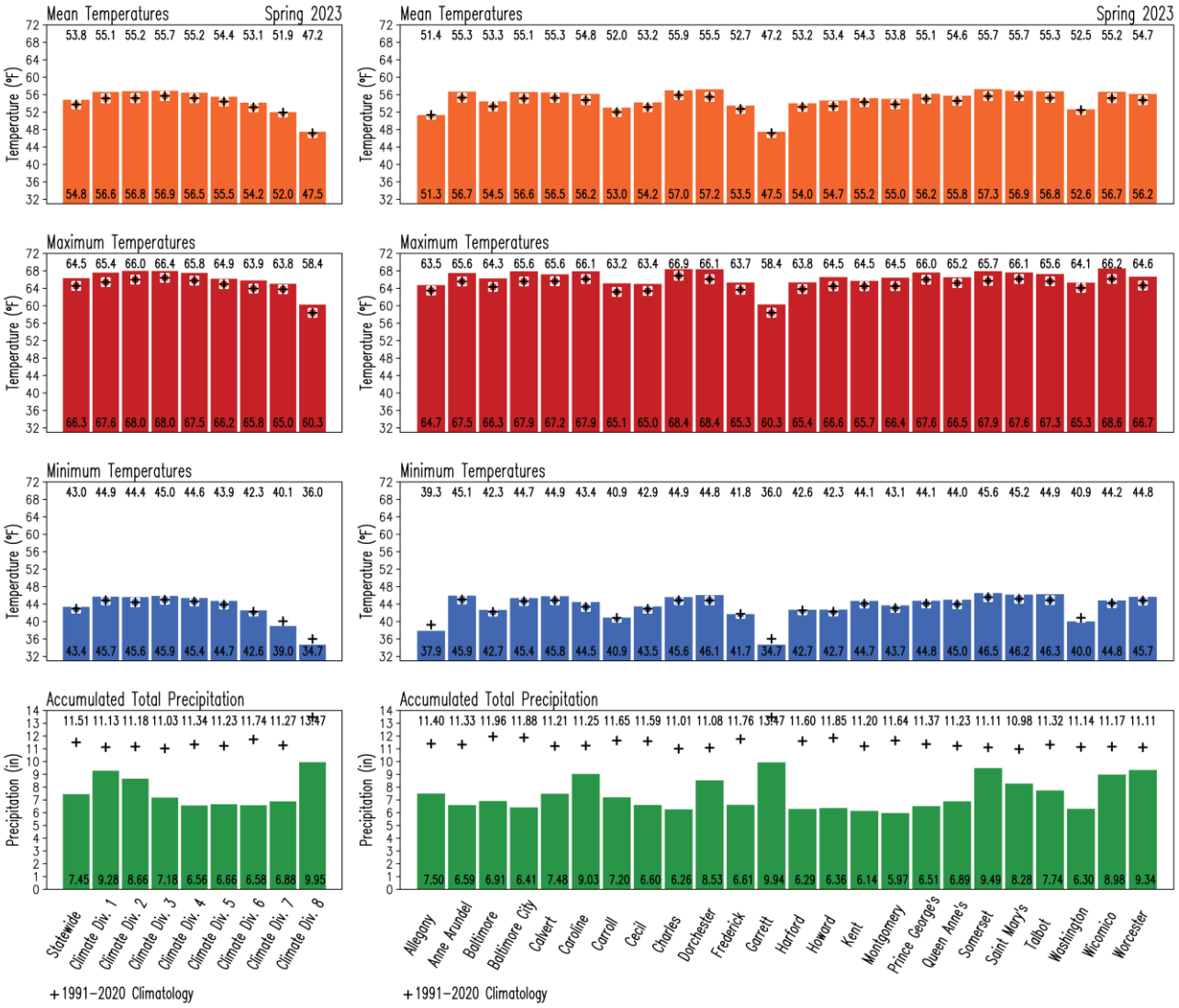

Figure B1. Seasonal surface variables in Maryland for spring 2023. Color bars represent the variables as follows: mean surface air temperature (orange), maximum surface air temperature (red), minimum surface air temperature (blue) and accumulated total precipitation (green) at statewide and climate division (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 spring 2023. For comparison, the corresponding 1991-2020 climatological values for winter are displayed as black addition signs, and their magnitudes are shown at the top of the panels.

B. Temperature and Precipitation Anomalies

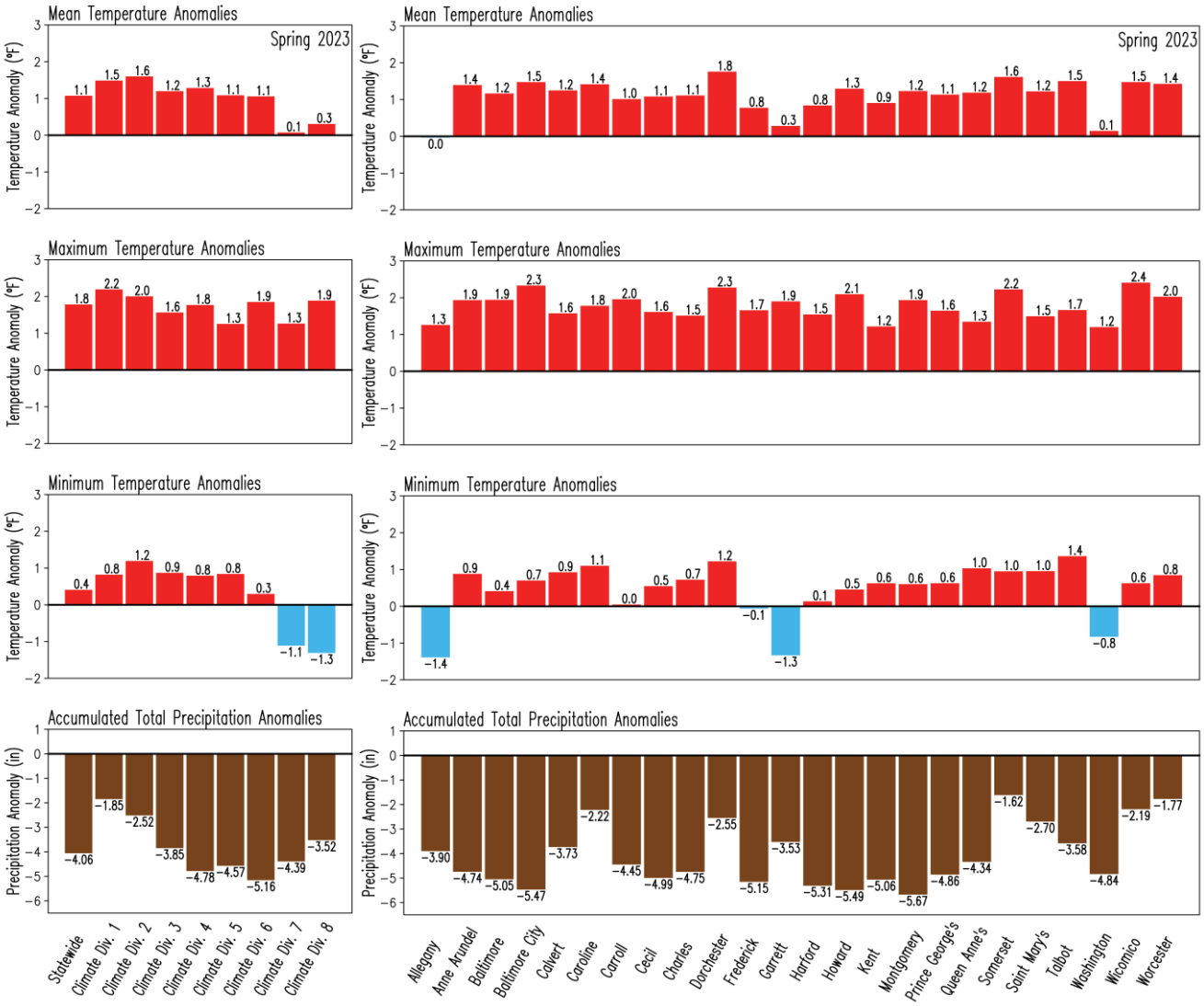

Figure B2. Anomalies of the seasonal surface variables in Maryland for spring 2023. Anomalies are with respect to the 1991-2020 climatology. Blue/red color represents negative/positive anomalies for mean surface air temperature (upper row), maximum surface air temperature (second row from top), and minimum surface air temperature (third row from top) while brown color indicates negative 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 of the bars indicate the magnitude of the anomaly for spring 2023.

Appendix C. Spring 1991-2020 Climatology Maps

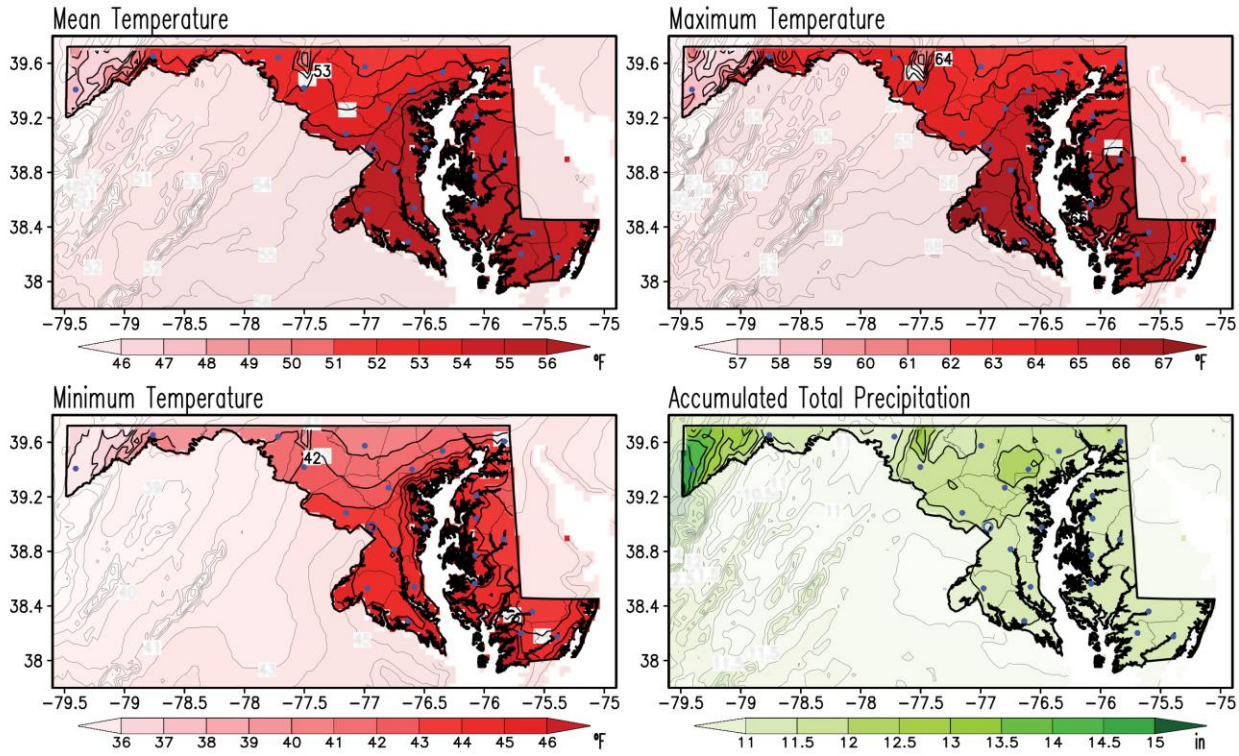

Figure C1. Spring climatology of the seasonal mean, maximum and minimum surface air temperatures, and accumulated total precipitation for the period 1991-2020. Temperatures are in °F, and precipitation is in inches according to the color bars. This is the current climate normal against which the spring 2023 conditions are compared to obtain the spring 2023 anomalies. Note that shading outside the state has been washed out to facilitate focusing on Maryland. Filled blue circles mark the county seats.

Weather and climate are closely related, but they are not the same. Weather represents the state of the atmosphere (temperature, precipitation, humidity, wind, sunshine, cloudiness, 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 averaging 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).

Appendix D: The Water Year 1991-2020 Climatology, and October 2022 – May 2023 as Percentage of Climatology

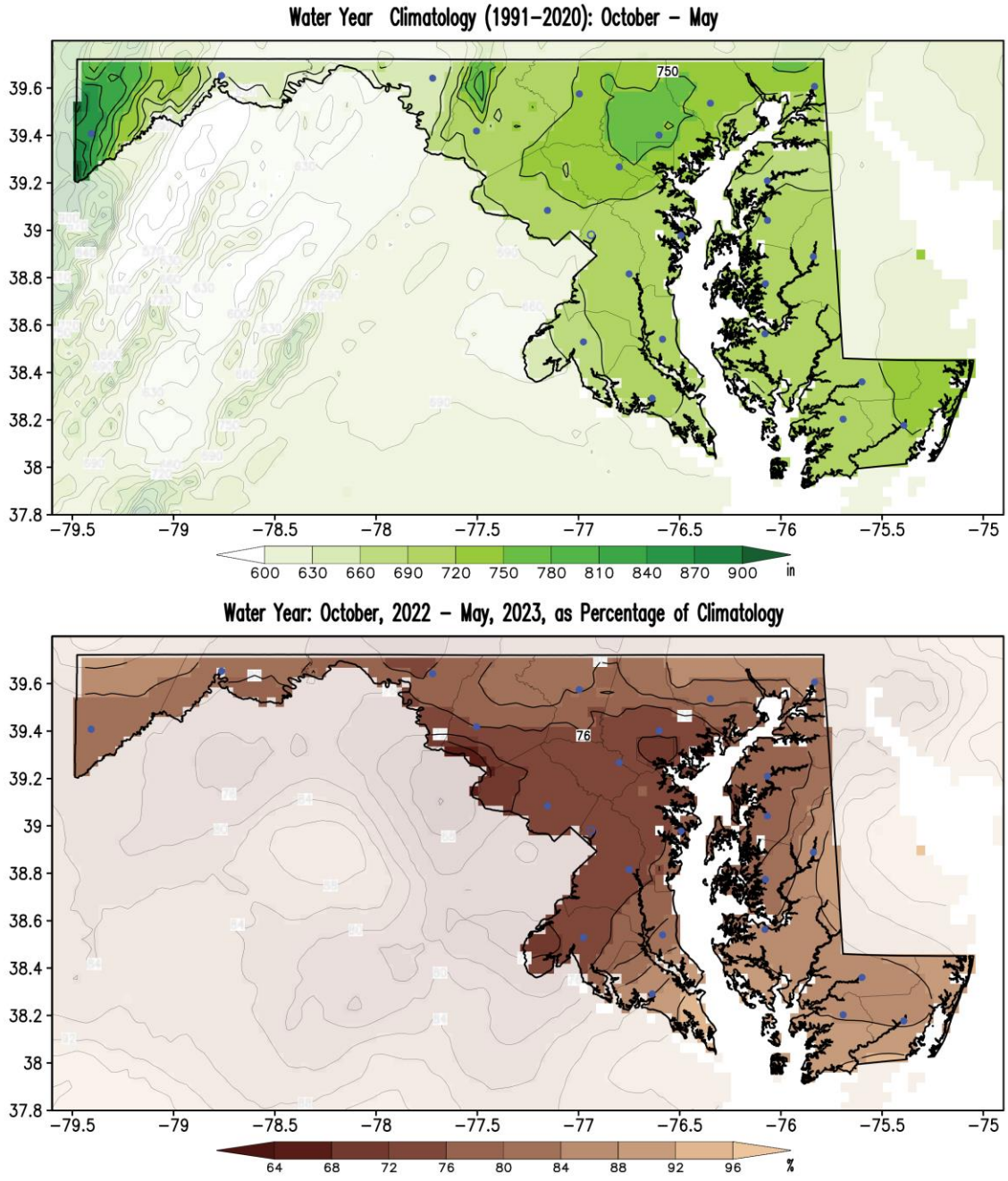

Figure D1. Climatology of the partial water year (October-May, top panel), and current partial water year (October 2022 – May 2023) as a percentage of the climatology (bottom panel). Climatology is for the period 1991-2020. The water year climatology is in inches following the color bar. The current 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 smaller than normal. Note that shading outside the state has been washed out to facilitate focusing on Maryland. Filled blue circles mark the county seats.

Appendix E. Spring Standard Deviation and Spring 2023 Standardized Anomalies Maps

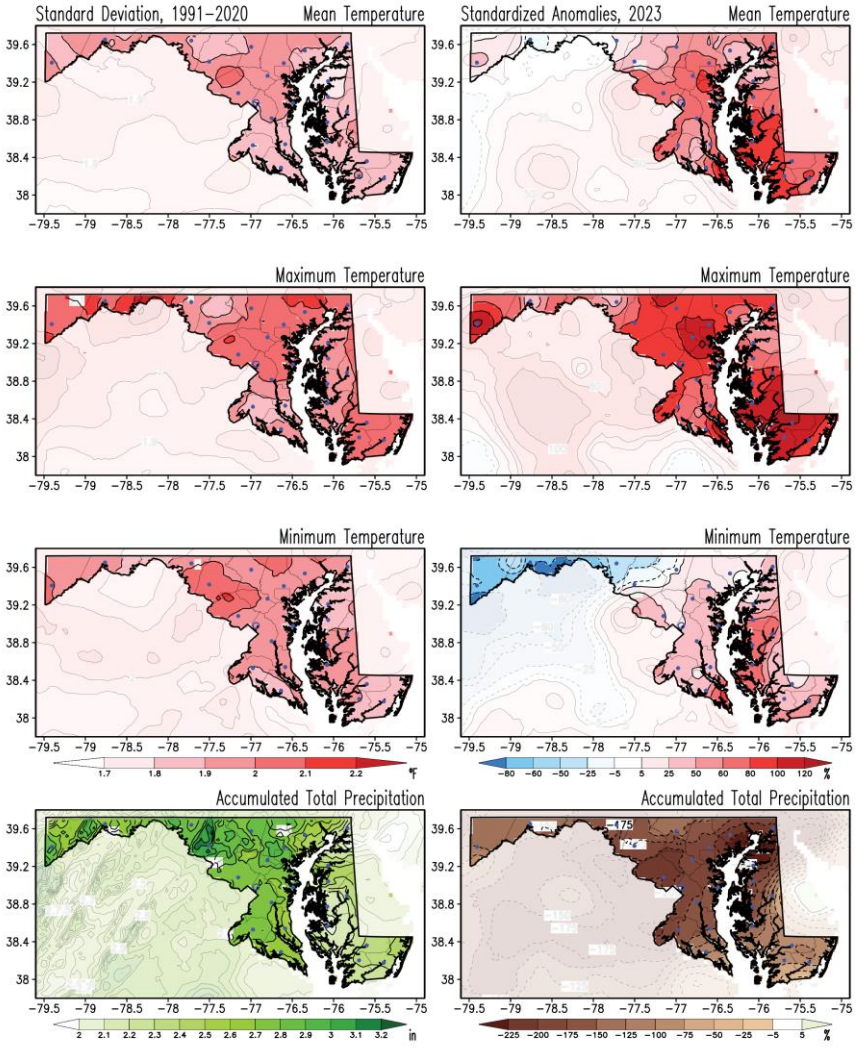

Figure E1. Standard deviation for spring and standardized anomalies of temperatures and precipitation for spring 2023. Standard deviations for seasonal mean, maximum, and minimum surface air temperatures and accumulated total precipitation were obtained for the 1991-2020 period (left column). Anomalies for spring 2023 (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.

The standard deviation measures a climate variable's 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*.

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