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Maryland Climate Bulletin
February 2022

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DEPARTMENT OF ATMOSPHERIC & OCEANIC SCIENCE

Maryland State Climatologist Office

Summary

February 2022 was largely warmer and drier than normal, especially along the western and eastern shores. While warm anomalies in mean and minimum temperatures were a fraction of the year-to-year variability, anomalies in maximum temperatures reached and surpassed the year-to-year variability. Below normal precipitation in turn reached values comparable to the precipitation year-to-year variability especially in the southern tips of the western and eastern shores. This region was identified by the U.S. Drought monitor as an anomalously dry region. Only the northern most counties over the Appalachian Mountains and Northeast had colder and wetter than normal conditions. February 2022 brought a last flip in the climatic conditions observed during the 2021-2022 winter as January 2022 was wetter and colder than normal, and December 2021 was largely warmer and drier than normal but more than February 2022 was.

Contents

1. Introduction

This bulletin is issued by the Maryland State Climate Office once per month in order to indicate in a brief format the most recent monthly surface climatic conditions in the state. Maryland is a state of great geographic diversity with miles of streams and rivers, beaches, coastal flatlands and wetlands, hills, valleys and mountains. This range of physiographic features, together with the land and water distribution and the placement of the state within the continental U.S., contribute to a comparatively wide range of climatic conditions thus the importance of their monitoring. This bulletin is addressed to all Marylanders so they can stay current with the latest climate conditions impacting their lives.

The monthly surface climate conditions for February 2022 are presented via maps of a set of variables such as mean surface air temperature, maximum surface air temperature, minimum surface air temperature, total precipitation, and their anomalies, that are complemented with drought conditions for the state, as given by the U.S. Drought Monitor (Sections 3). Then statewide and climate division averages for the month are contrasted against each other via scatter plots (Section 4). Ancillary information at statewide, climate divisions and county levels are given via tables and plots, and via maps in Appendices A-C.

2. Data

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

- NOAA Monthly U.S. Climate Gridded Dataset at 5km horizontal resolution (NClimGrid – Vose et al. 2014), which are given in a *preliminary* status, and available at:

  https://www.ncei.noaa.gov/pub/data/nidis/indices/nclimgrid-monthly/base-files/

- NOAA Monthly U.S. Climate Divisional Dataset (NClimDiv – Vose et al. 2014), which are given in a *preliminary* status, and are available at:

  https://www.ncdc.noaa.gov/cag/statewide/time-series

The drought conditions map is from the U.S. Drought Monitor site and available at:

https://droughtmonitor.unl.edu/Maps/MapArchive.aspx

Some useful notes are the following.

About the anomalies. Anomalies for a given month (i.e. February 2022) are the difference of the monthly values with respect to the long-term mean of the 30 months (i.e. Februaries) in the period 1991-2020; this 30-year mean is known as the climate normal, or just the climatology for short. When a value exceeds its climatological value, it is usually referred as an above normal (e.g., warmer than normal or wetter than normal) anomaly, or positive anomaly, while when the

value is smaller than its climatological value, it is referred as a below normal (e.g., colder than normal or dryer than normal) anomaly, or negative anomaly.

About NOAA's Climate Divisions. The term "climate division" refers to one of the 8 divisions in the state that represent climatically homogeneous regions, as determined by NOAA:

https://www.ncei.noaa.gov/access/monitoring/dyk/us-climate-divisions

These regions are the following:

- 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, and Montgomery, as well as 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.

3. February 2022 Maps

A. Mean Temperature

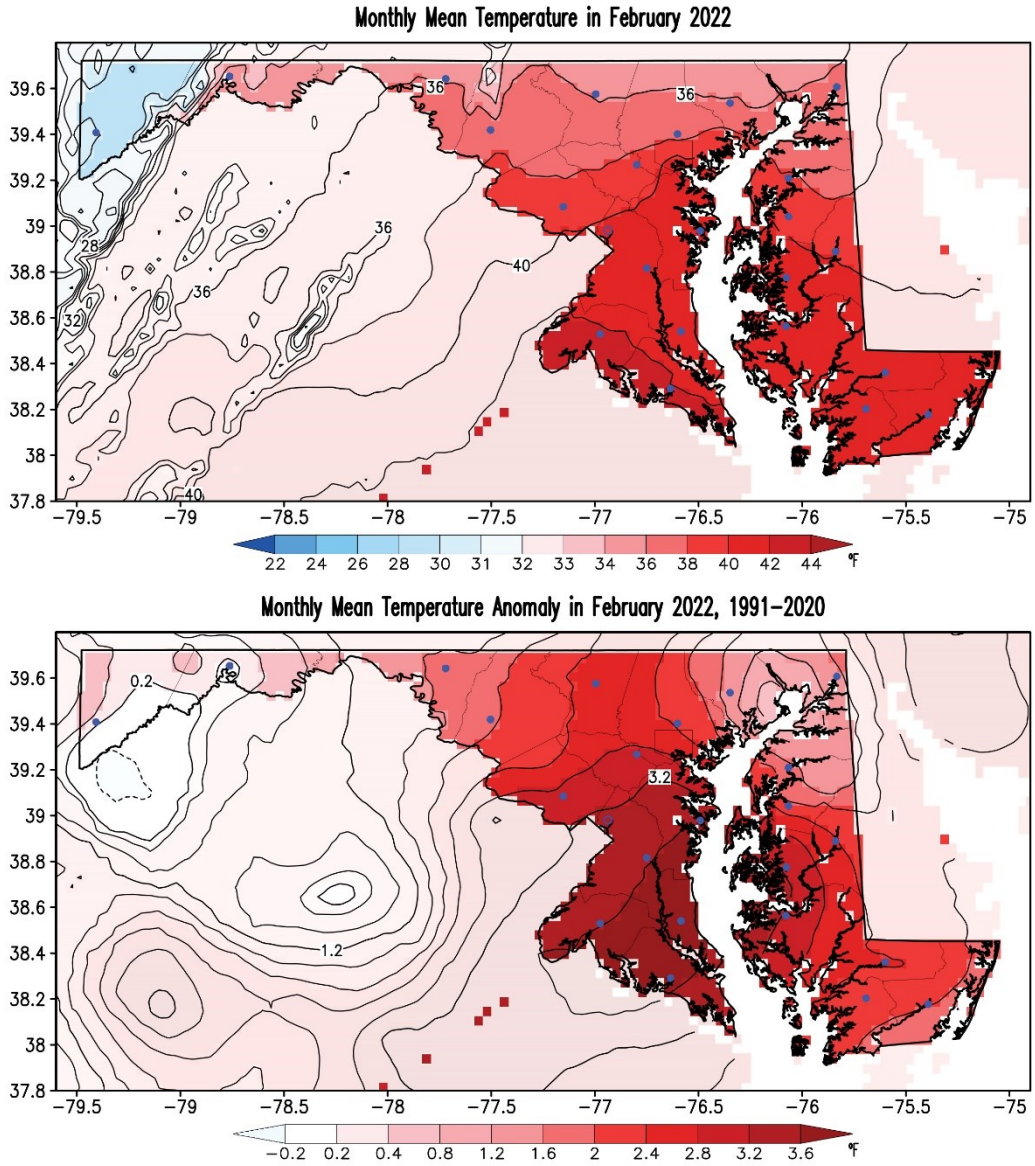

Figure 1. Mean surface air temperature (top panel) and its anomaly with respect to the 1991-2020 climatology (bottom panel) in February 2022. Temperatures are given in °F according to the color bars. Red shading in the anomaly map shows above normal conditions. Note that shading outside the state has been washed out for clarity purposes. Filled blue circles mark the county seats.

Monthly mean temperatures in February 2022 presented a common structure with a warm south and a cold northwest. Temperatures along the coastal plains of the eastern and western shore were warner (~40-42°F) than over the Piedmont (~36-40°F) and the mountainous western Maryland (~28-36°F) where Garrett County experienced mean below freezing temperatures. However, the mean temperatures over the whole extent of the state were warmer than the climatology, especially over southern portions of the western and eastern shores with a focus over Calvert and St. Mary's and Dorchester counties (+3.6°F). Maximum anomalies did not surpass the regional year-to-year variability though.

B. Maximum Temperature

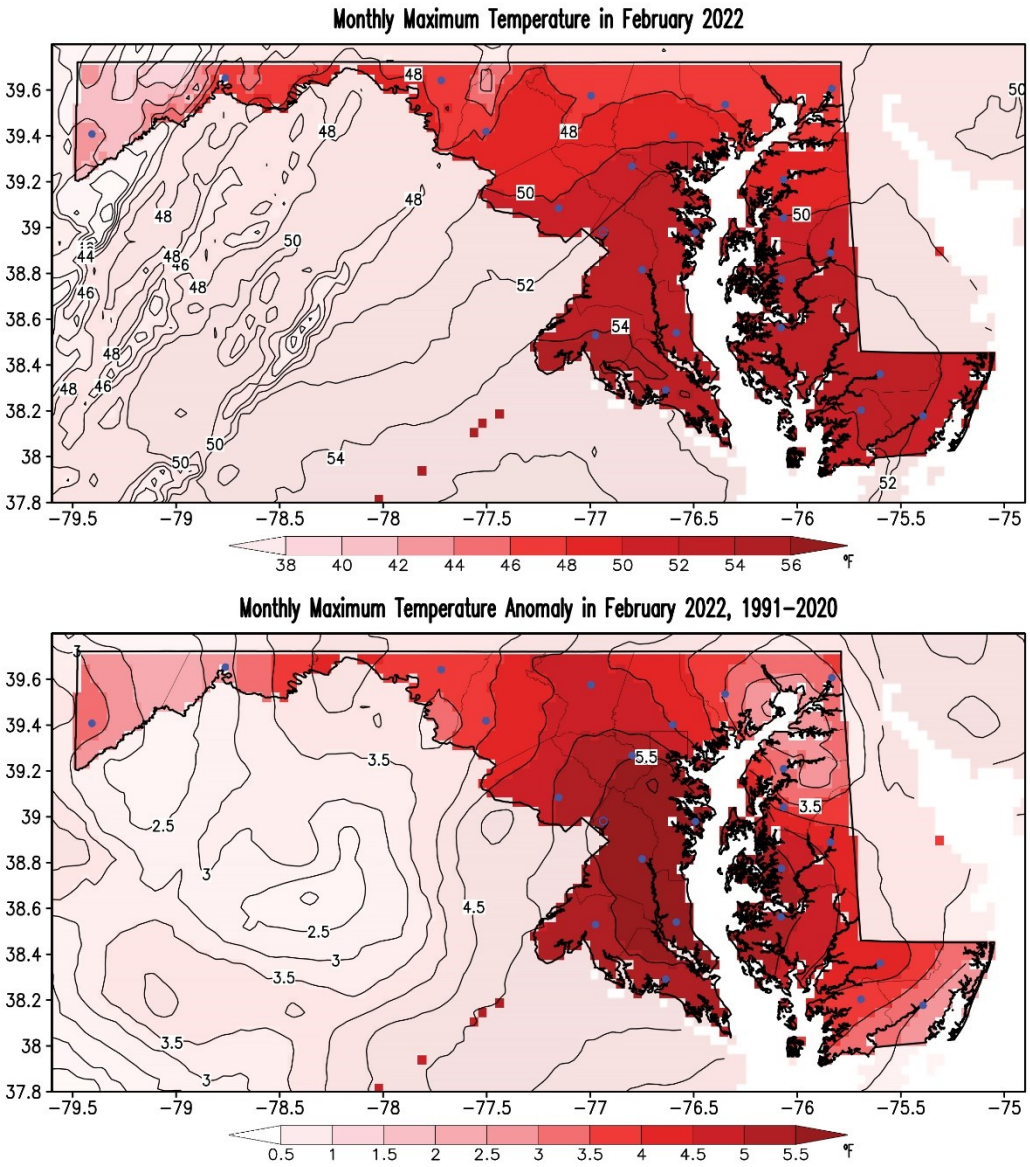

Figure 2. Maximum surface air temperature (top panel) and its anomaly with respect to the 1991-2020 climatology (bottom panel) in February 2022. Temperatures are given in °F according to the color bars. Red shading in the anomaly map shows above normal conditions. Note that shading outside the state has been washed out for clarity purposes. Filled blue circles mark the county seats.

Monthly mean maximum temperatures in February 2022 followed the same structure than the mean temperatures with maximum values over the coastal plains (~52-54°F) and minimum values over western Maryland (~40-44°F). Maximum temperatures over the whole state were also warmer than the climatology with maximum anomalies over the southern coastal plains with a focus on Calvert, St. Mary's, Anne Arundel and Prince George's counties (+5.5°F). Maximum anomalies surpassed the year-to-year variability.

C. Minimum Temperatures

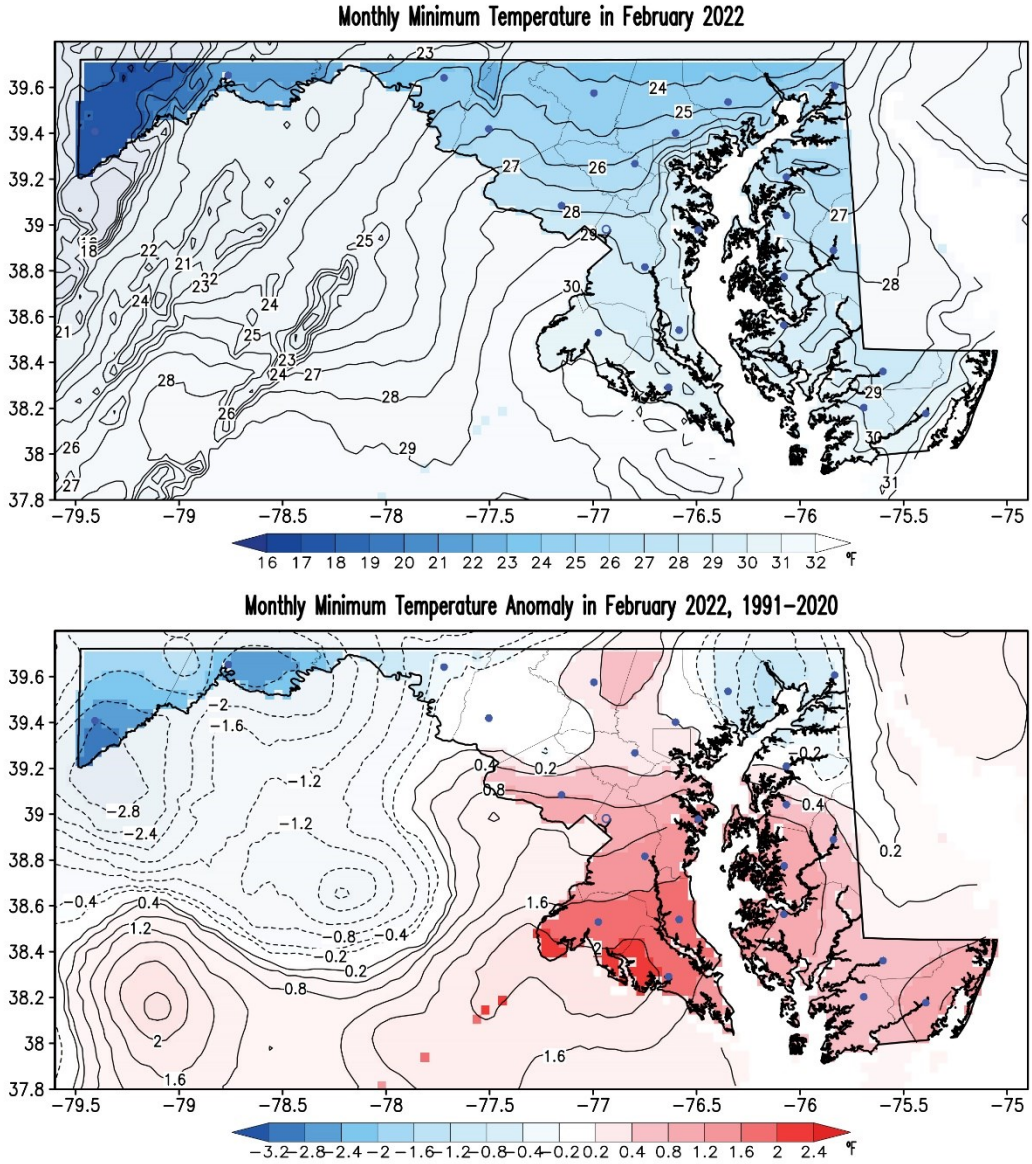

Figure 3. Minimum surface air temperature (top panel) and its anomaly with respect to the 1991-2020 climatology (bottom panel) in February 2022. Temperatures are given in °F according to the color bars. Blue/red shading in the anomaly map shows below/above normal conditions. Note that shading outside the state has been washed out for clarity purposes. Filled blue circles mark the county seats.

Monthly mean minimum temperatures in February 2022 were at the freezing mark or below throughout the state, reaching the lowest values over western Maryland (~18-23°F) and the highest values over the coastal plains along the coasts of the Chesapeake Bay (~30°F). Minimum temperatures however, no exceeded the climatological values of February everywhere in the state as it was the case for the mean and maximum temperatures. While minimum temperature anomalies were largely above normal over the coastal plains, with maximum values over Charles and St. Mary's counties (+2°F), they were below normal over northeastern and western Maryland with minimum values over Allegany and Garrett counties (-2.4°F and below). In both cases, maximum (positive or negative) anomalies were less than half of the year-to-year variability.

D. Precipitation

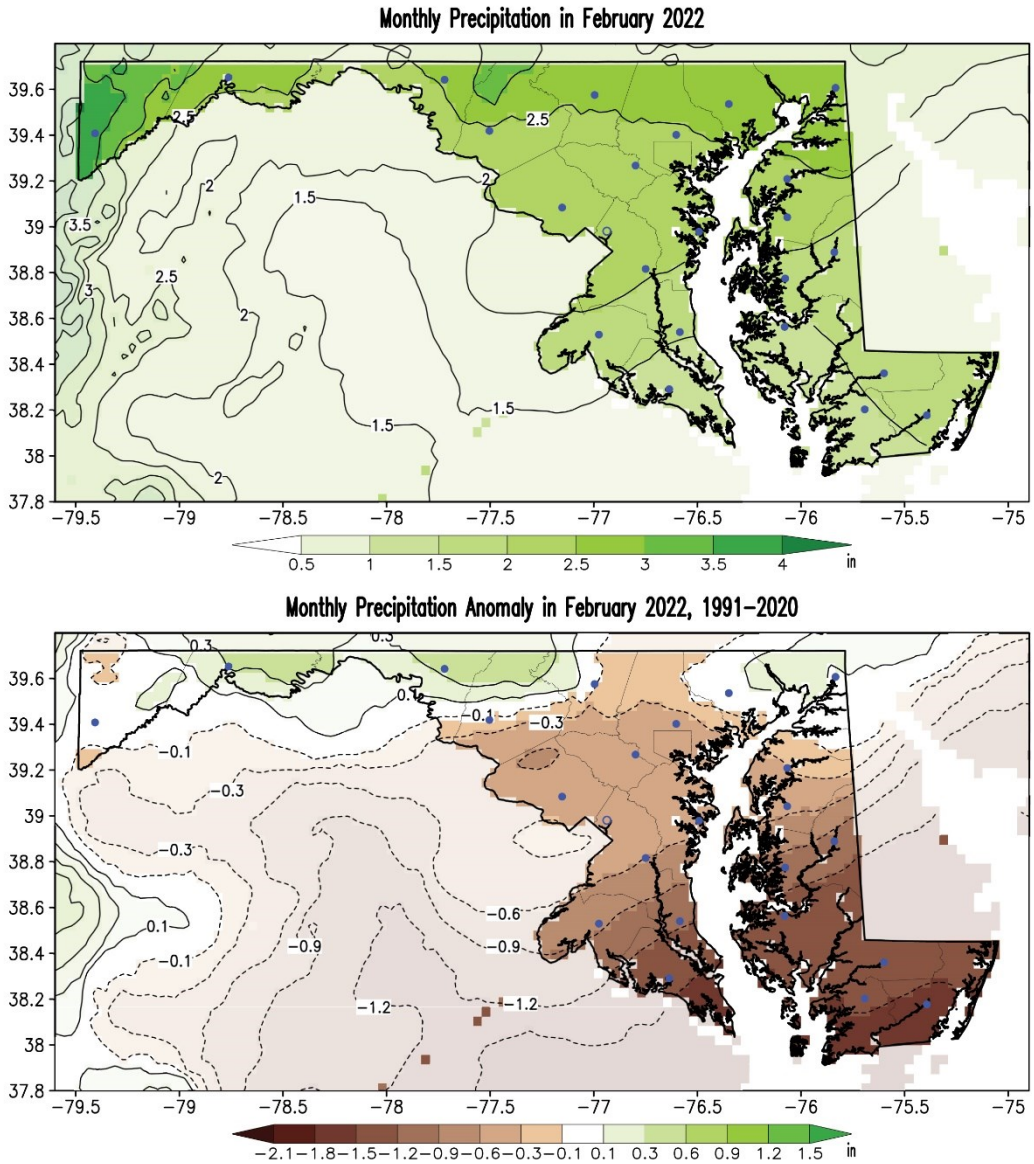

Figure 4. Precipitation (top panel) and its anomaly with respect to the 1991-2020 climatology (bottom panel) in February 2022. Precipitation units are given as inches according to the color bars. Brown/green shading in the anomaly map shows below/above normal conditions. Note that shading outside the state has been washed out for clarity purposes. Filled blue circles mark the county seats.

Monthly total precipitation in February 2022 was not much. Precipitation was maximum over the mountainous western and northern Maryland, reaching maximum values over Garrett County (3.5 in) and minimum values in the southern counties of St. Mary's, Dorchester, and Somerset (1.5 in). This month's precipitation was smaller than normal in large parts of the state including the Coastal Plains and the Piedmont regions (-1.8 in), and larger than normal over the Allegany, Washington and Cecil counties (+0.3 in). The largest negative anomalies in the southern tips of the western and eastern shores were comparable to the year-to-year variability.

E. Drought

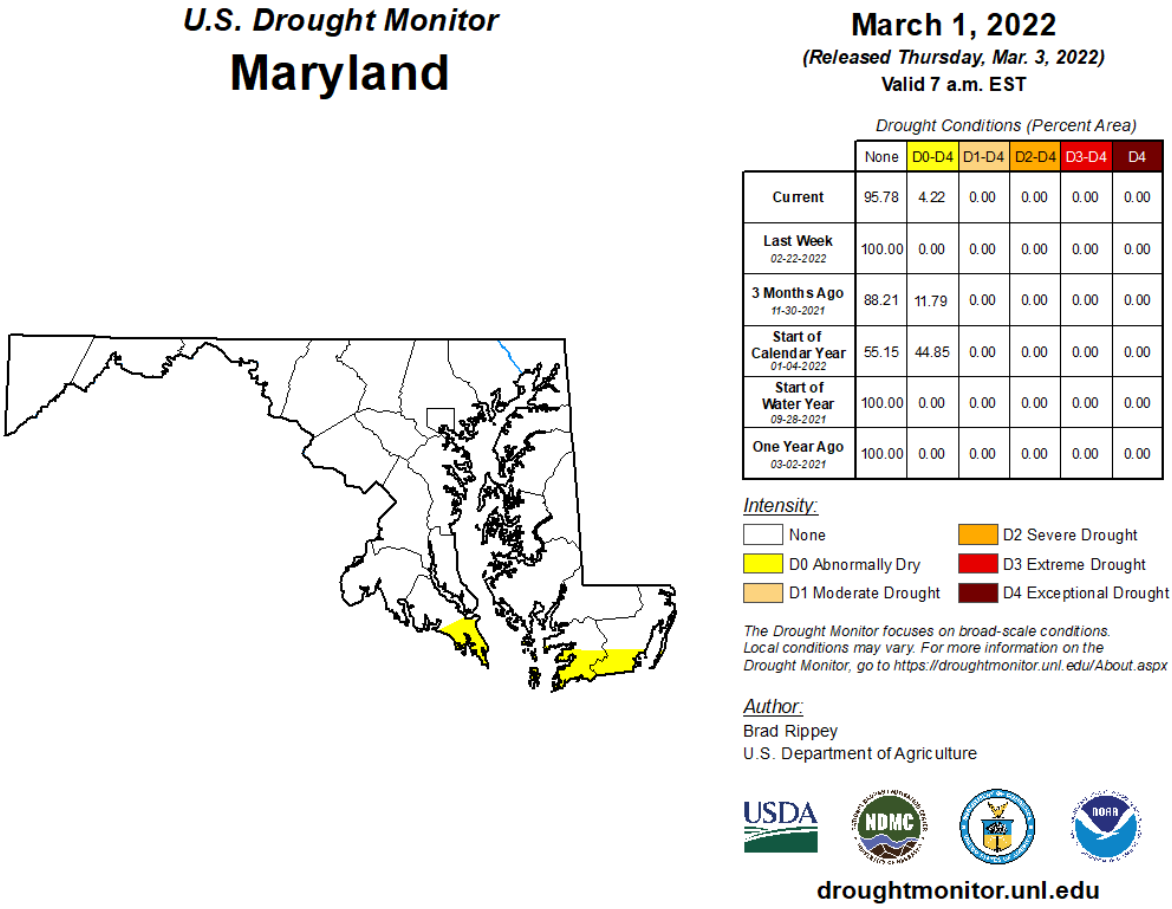

Figure 5. Drought conditions as reported by the U.S. Drought Monitor on March 1, 2022.

Drought conditions do not develop overnight and the anomalously low precipitation in February 2022 are only captured in the southern tips of St. Mary's, Somerset and Worcester counties by the drought monitor. These southernmost regions had a deficit of 1.5 in in February 2022, and the monitor label them as anomalously dry regions where surface water levels decline, and fire danger is elevated.

4. Statewide and Climate Divisions Precipitation and Mean Temperature

A. February 2022 in the Historical 1895-2022 Record: Statewide

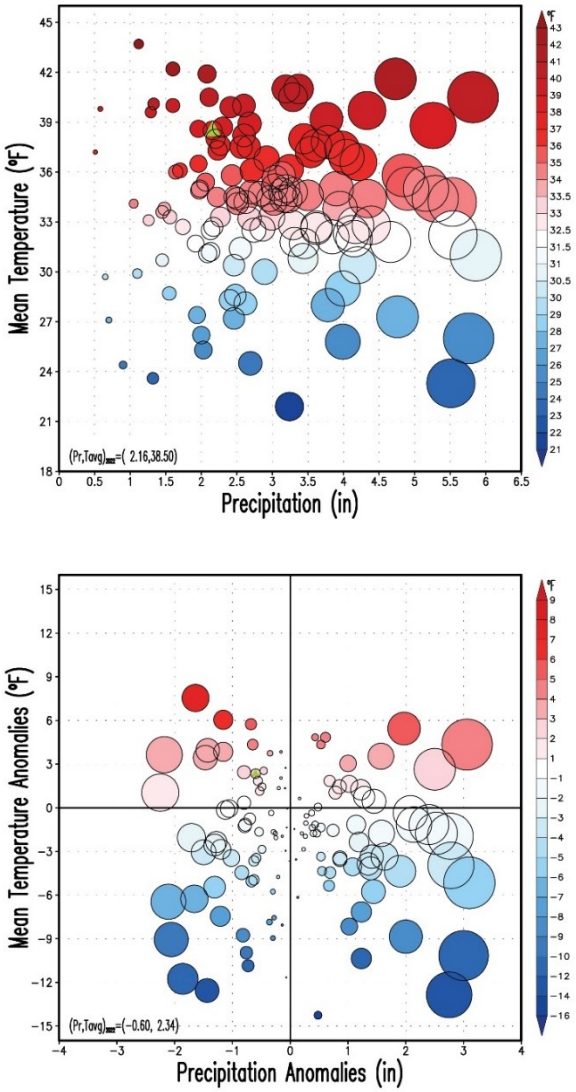

Figure 6. Scatter plot of averaged Maryland statewide mean surface air temperature vs total precipitation for the period 1895-2022. Upper panel shows the February mean temperature and total precipitation, and bottom panel displays their anomalies with respect to the 1991-2020 climatology. The size of the circles is proportional to the total precipitation scaled down by the maximum precipitation on record (5.86 in in 2003, top panel) and by the maximum precipitation anomaly (3.10 in in 2003, bottom panel). The blue/red shading of the circles denotes temperatures below/above 32°F in the top panel and below/above climatology in the bottom anomaly panel. February 2022 is marked by the yellow/green filled triangle.

The statewide total precipitation and mean temperature of 2.16 in and 38.5°F cannot be considered extreme conditions when put in context of the historical record of 128 years (Table 1 and 4). The statewide anomalies of -0.60 in, 2.34 °F indicate a dry and warm anomalous February 2022.

B. February 2022: Statewide and Climate Divisions

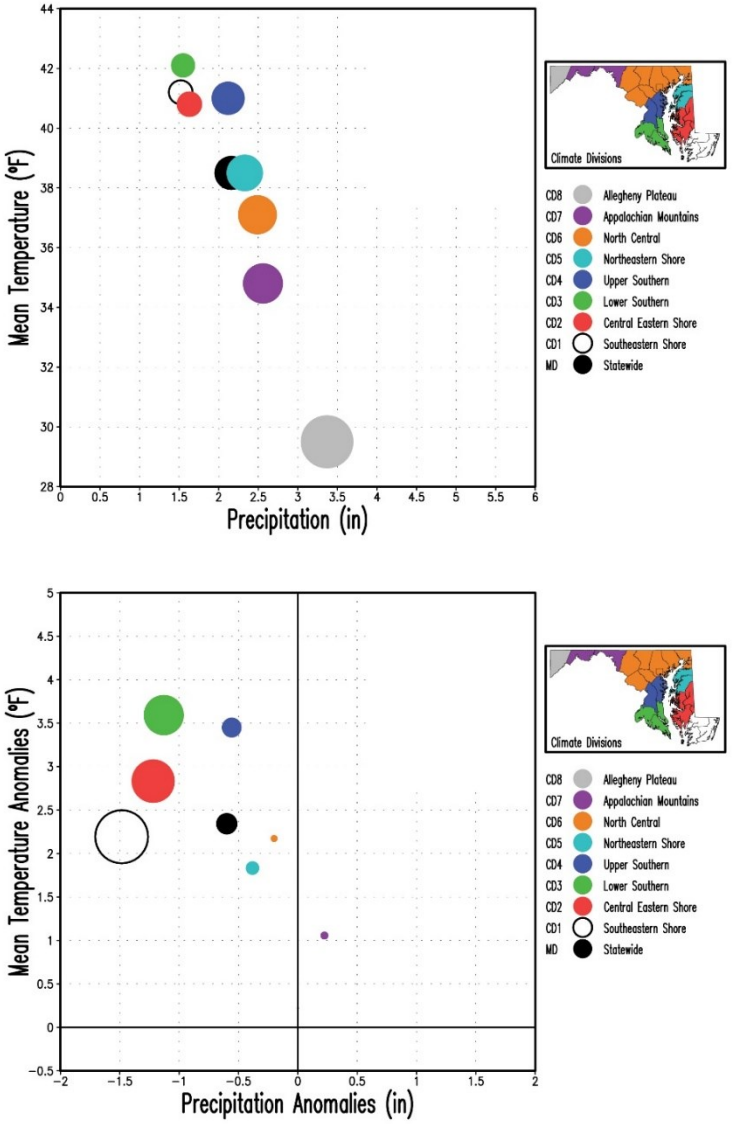

Figure 7. Scatter plot of averaged Maryland statewide and Climate Divisions (CD#) mean surface air temperature vs total precipitation for February 2022. Upper panel shows the mean temperature and total precipitation, and bottom panel displays their anomalies with respect to the 1991-2020 climatology. The size of the circles is proportional to the total precipitation scaled down by the maximum precipitation (3.37 in in CD8, top panel) and by the maximum precipitation anomaly (|-1.48| in 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.

The farther to the north in the state, the wetter and colder was February 2022 (e.g., CD8, CD7, CD6 vs the other CDs). However, as mentioned in the anomaly maps, the whole state was warmer than normal and almost the whole state had below normal precipitation, except for the Appalachian Mountain region (CD7).

C. December 2021 to February 2022: Statewide and Climate Divisions

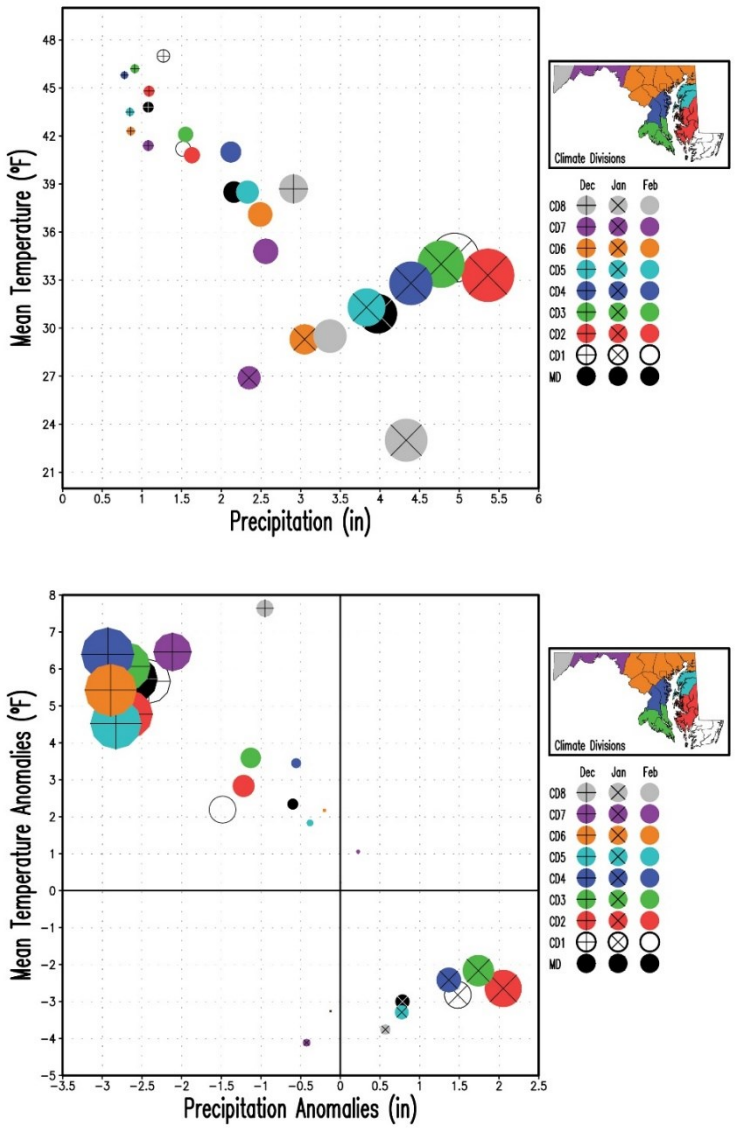

Figure 8. Scatter plot of averaged Maryland statewide and Climate Divisions (CD#) mean surface air temperature vs total precipitation for December 2021, January 2022 and February 2022. Upper panel shows the mean temperature and total precipitation, and bottom panel displays their anomalies with respect to the 1991-2020 climatology. The size of the circles is proportional to the total precipitation scaled down by the maximum precipitation (5.36 in in CD2 in January 2022, top panel) and by the maximum precipitation anomaly (|-2.93| in in CD4 in December 2021, bottom panel) among the nine regions. Note that February 2022 is displayed with filled circles only, while January 2022 and December 2021 are displayed with superposed multiplication and addition signs respectively.

When putting February 2022 in context of the previous two months it was warmer and drier than January 2022 and colder and wetter (or less dry) than December 2021. However, December 2021 was the warmest and driest of the three months. Among these three months, January 2022 was the most anomalously cold and wet.

Appendix A. Tables

Region	Mean Temperature (°F) 1991-2020 Climatology	Mean Temperature (°F) February 2022	Rank
MD Statewide	36.2	38.6	108
CD8: Allegheny Plateau	29.3	29.5	88
CD7: Appalachian Mountains	33.7	34.6	95
CD6: North Central	34.9	37.1	107
CD5: Northeastern Shore	36.7	38.5	106
CD4: Upper Southern	37.6	41.0	113
CD3: Lower Southern	38.5	41.9	114
CD2: Central Eastern Shore	38.0	41.2	114
CD1: Southeastern Shore	39.0	41.9	112

Table 1. Statewide and Climate Divisions mean temperature in February. Climatological value for the period 1991-2020 is in the second column, value in February 2022 is in the third column and its rank in the historical record of 128 years (1895-2022) is in the fourth column.

Region	Maximum Temperature (°F) 1991-2020 Climatology	Maximum Temperature (°F) February 2022	Rank
MD Statewide	45.7	49.9	115
CD8: Allegheny Plateau	38.5	41.2	103
CD7: Appalachian Mountains	43.4	46.5	108
CD6: North Central	44.2	48.5	115
CD5: Northeastern Shore	46.1	49.6	114
CD4: Upper Southern	47.0	52.7	123
CD3: Lower Southern	48.4	53.4	119
CD2: Central Eastern Shore	47.6	52.4	120
CD1: Southeastern Shore	48.5	52.1	114

Table 2. Statewide and Climate Divisions maximum temperature in February. Climatological value for the period 1991-2020 is in the second column, value in February 2022 is in the third column and its rank in the historical record of 128 years (1895-2022) is in the fourth column.

Region	Minimum Temperature (°F) 1991-2020 Climatology	Minimum Temperature (°F) February 2022	Rank
MD Statewide	26.7	27.3	93
CD8: Allegheny Plateau	20.1	17.8	57
CD7: Appalachian Mountains	24.1	22.8	72
CD6: North Central	25.6	25.7	86
CD5: Northeastern Shore	27.2	27.4	89
CD4: Upper Southern	28.1	29.3	103
CD3: Lower Southern	28.6	30.5	107
CD2: Central Eastern Shore	28.3	30.0	107
CD1: Southeastern Shore	29.5	31.6	110

Table 3. Statewide and Climate Divisions minimum temperature in February. Climatological value for the period 1991-2020 is in the second column, value in February 2022 is in the third column and its rank in the historical record of 128 years (1895-2022) is in the fourth column.

Region	Precipitation (in) 1991-2020 Climatology	Precipitation (in) February 2022	Rank
MD Statewide	2.76	2.15	37
CD8: Allegheny Plateau	3.37	3.37	79
CD7: Appalachian Mountains	2.34	2.56	75
CD6: North Central	2.69	2.49	55
CD5: Northeastern Shore	2.71	2.32	47
CD4: Upper Southern	2.68	2.13	41
CD3: Lower Southern	2.68	1.52	22
CD2: Central Eastern Shore	2.85	1.60	17
CD1: Southeastern Shore	3.00	1.44	14

Table 4. Statewide and Climate Divisions total precipitation in February. Climatological value for the period 1991-2020 is in the second column, value in February 2022 is in the third column and its rank in the historical record of 128 years (1895-2022) is in the fourth column.

Appendix B. February 1991-2020 Climatology Maps

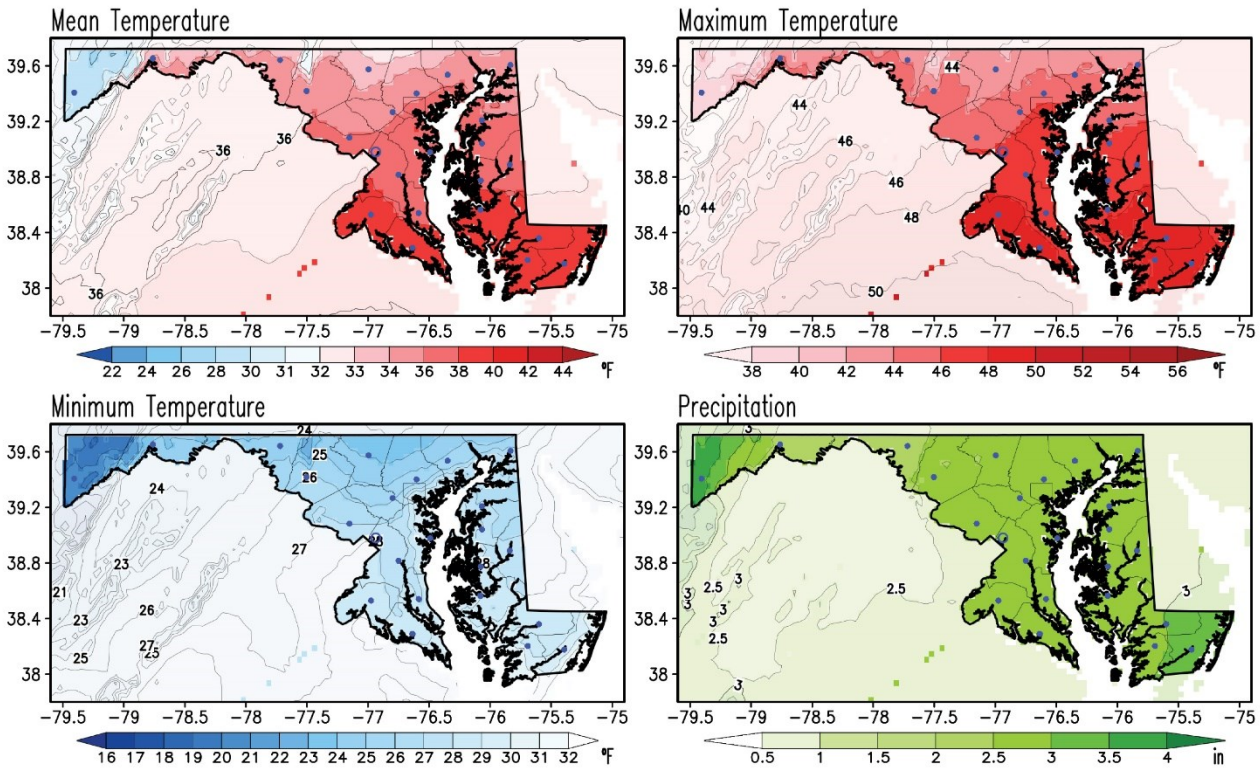

Figure 9. February climatology of the mean, maximum and minimum temperatures and precipitation for the period 1991-2020. Temperatures are given in °F and precipitation is in inches according to the color bars. This is the current climate normal against the February 2022 are compared with to obtain the February 2022 anomalies. Note that shading outside the state has been washed out for clarity purposes. 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.) and ocean (sea-level, sea surface temperature, etc.) at any given time, while 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 a 30-year period 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). The establishment of a climate normal or climatology is important as it allows one to compare a specific day, month, season, or even another period normal 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 C. February Standard Deviation and February 2022 Standardized Anomalies Maps

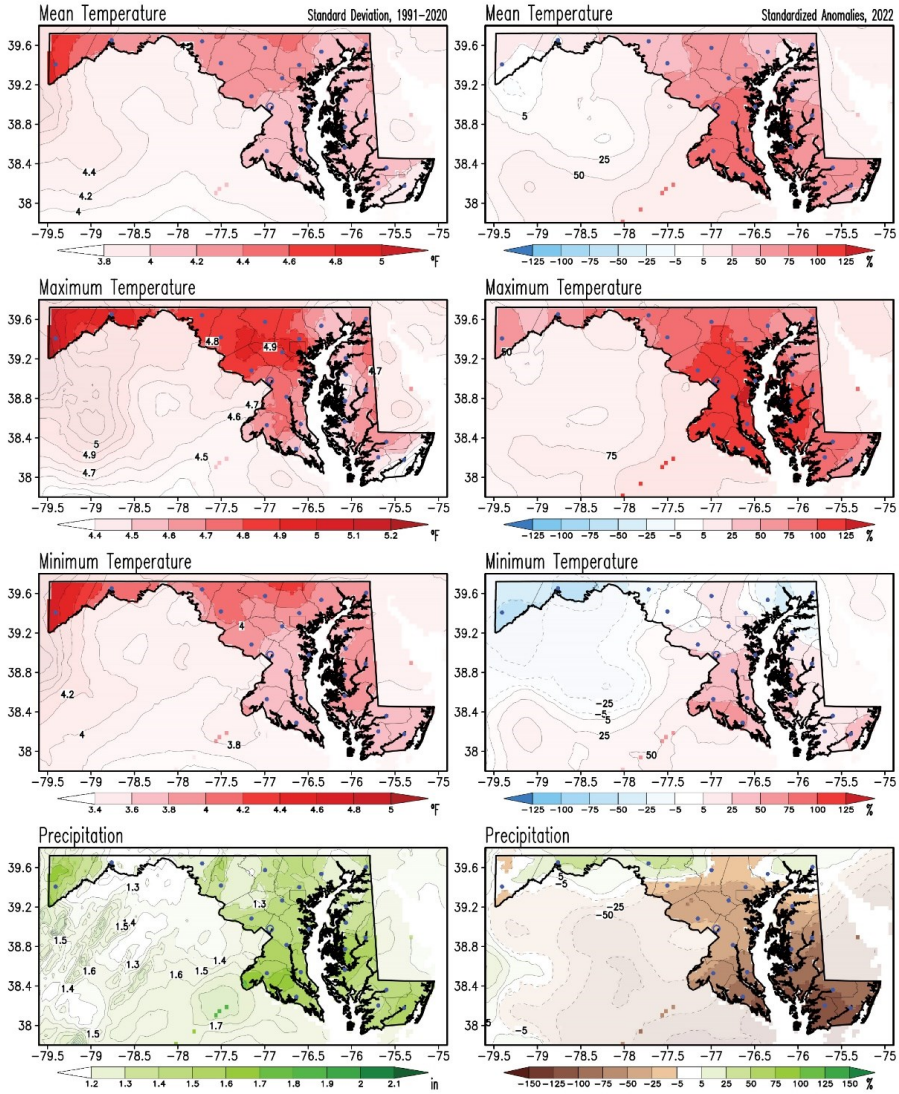

Figure 10. Standard deviation in February and standardized anomalies in February 2022. Standard deviations for mean, maximum and minimum surface air temperatures and precipitation are obtained for the period 1991-2020 (left column). Anomalies in February 2022 are obtained as percentage of the standard deviations (right column). The standard deviations in temperatures are given in °F and those in precipitation are in inches according to the color bars. Standard deviation is a measure of the year-to-year variability. 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, so units are in percent (%). Note that shading outside the state has been washed out for clarity purposes. Filled blue circles mark the county seats.

The standard deviation is a measure of the year-to-year, or interannual, variability of a climate variable. In this case the standard deviation is calculated for the same period as the climatology. Anomalies sometimes are compared against that variability in order to identity extremes in the climate record. When the anomalies are divided by the standard deviation they are named *standardized anomalies*.

References

Arguez A., I. Durre, S. Applequist, R. S. Vose, M. F. Squires, X. Yin, R. R. Heim Jr, and T. W. Owen, 2012. NOAA's 1981-2010 U. S. Climate Normals. An Overview. Bulletin of the American Meteorological Society. 93, 1687-1697, doi:10.1175/BAMS-D-11-00197.1 https://www1.ncdc.noaa.gov/pub/data/normals/1981-2010/documentation/1981-2010-normals-overview.pdf .

Kunkel, K. E., and A. Court, 1990. Climatic Means and Normals—A Statement of the American Association of State Climatologists (AASC), Bulletin of the American Meteorological Society, 71(2), 201-204. Retrieved Aug 20, 2022, from https://journals.ametsoc.org/view/journals/bams/71/2/1520-0477-71_2_201.xml

Vose and co-authors, 2014. NOAA Monthly U.S. Climate Gridded Dataset (NClimGrid), Version 3. NOAA National Centers for Environmental Information. DOI:10.7289/V5SX6B56 [access March 28, 2022].

WMO, 2017. WMO Guidelines on the Calculation of Climate Normals. WMO-No. 1203, Series. 29pp. https://library.wmo.int/doc_num.php?explnum_id=4166.