The Pennsylvania State CLIMATOLOGIST
PennState College of Earth and Mineral Sciences
A Service to the Commonwealth by the College of Earth and Mineral Sciences
THE PENNSYLVANIA OBSERVER – MAY 2. 2023

PENNSYLVANIA WEATHER SUMMARY
APRIL 2023

By: Kyle Eck

The beginning of April opened with a mild and unsettled weather pattern across the Commonwealth. A potent storm tracked through Pennsylvania on the 1st, dropped beneficial rainfall for at least the western half of the state, and dropped temperatures below average in its wake. Temperatures increased statewide ahead of another cold front that traversed the state on the 6th and 7th. Like the previous storm, much of the rain associated with the front was focused across western and central PA, with little measurable rain falling over eastern PA.

A drier weather regime dominated the Commonwealth starting on the 8th. High pressure settled in over the Northeast and allowed for very dry air to filter into the Keystone State. With the onset of the ridge developing over the Northeast, temperatures held around five degrees below average for most of the state. Each of the next several days, temperatures rose steadily as mainly sunny skies ensued, and winds shifted to a more southerly direction as the ridge moved east off the coast. Various cities across Pennsylvania recorded their first 80-degree day of the year on the 12th, but the record-breaking heat did not arrive until the 13th and 14th. Many areas observed temperatures upwards of twenty to thirty degrees above average. State College set a record high [86°F] on the afternoons of both the 13th and 14th, and places like Harrisburg and Scranton exceeded the 90-degree mark during this time. With the abnormal warmth and dry conditions in place, Red Flag Warnings were posted by the National Weather Service, and many places in eastern Pennsylvania developed moderate drought conditions according to the U.S. Drought Monitor.

Drearier conditions returned for the 15th and 16th, however, temperatures held above average. A cold front swept through the state late on the 16th into the 17th, dropping temperatures significantly - down to below average levels and upwards of thirty to thirty-five degrees cooler than readings from the middle of the month. A few places later recorded snowfall on the 17th, with places like Pittsburgh and State College recording a trace of snow for the first time during the month. A ridge developed over the eastern US on the 19th, and temperatures abruptly jumped from the 40s and 50s back into the 70s and 80s in the span of 48-72 hours.

Another storm with an associated cold front passed through the Commonwealth on the 22nd and 23rd, bringing some beneficial rains to the state but also some severe weather to southeastern PA with reports of damaging wind, hail, and an EF-1 tornado confirmed in Berks County. With this storm came a pattern-switch – a trough dug into the Great Lakes and Northeast. For much of the rest of April, temperatures hovered near- to-below average. Towards the end of the month, a potent storm in the Great Lakes and Midwest spawned steady, and at times heavy, rain for areas that badly needed it in central and eastern PA. These areas received upwards of two to four inches of rain for the last couple of days of April.

For the month, temperatures averaged near-to-above average – generally within five degrees Fahrenheit of normal monthly levels. Precipitation was generally below average but the rain to end the month ended up cutting precipitation deficits substantially, especially across central and eastern PA.

Severe weather summary: 89 damaging winds, 2 hail, and 1 tornado report

Severe storm reports taken from the Storm Prediction Center storm reports archive

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Here are the weather extremes across Pennsylvania (**observations taken at approx. 7AM EST**) during April 2023 from the NWS Cooperative, ASOS, and CoCoRaHS Networks of which our office receives routine observations. The extremes occurred in the 24-hour period prior to the date listed for COOP/CoCoRaHS stations.

Parameter	Location	Value	Date (7 AM EST)	County
Highest Temperature	Harrisburg Capital City AP	92°F	April 13th	York
Lowest Temperature	Bradford 4 Mi. SW Res 5	17°F	April 8th	McKean
Greatest Cumulative Liquid Precipitation	Neshaminy Falls	6.22”	April 1st-30th	Bucks
Least Cumulative Liquid Precipitation	Pittsburgh Allegheny County AP	1.77”	April 1st-30th	Allegheny
Greatest Cumulative Snowfall	Hidden Valley	1.9”	April 1st-30th	Somerset

Links to Pennsylvania Weather Stories during April 2023

Early Warmth Brings Higher Pollen Counts To Parts of PA
https://www.cbsnews.com/philadelphia/news/unusual-warm-weather-causes-spikes-in-early-allergy-season/

Roller-Coaster April Temperatures Challenge Fruit Growers
https://lancasteronline.com/news/local/cold-weather-poses-challenges-for-pennsylvania-fruit-growers/article_dc8d6356-4000-51ed-8c24-2d282d054286.html

PSU Professor Explains Northern Lights Observed In PA
https://www.alleghenyfront.org/a-penn-state-professor-explains-how-the-northern-lights-put-on-a-show-for-pennsylvanians/

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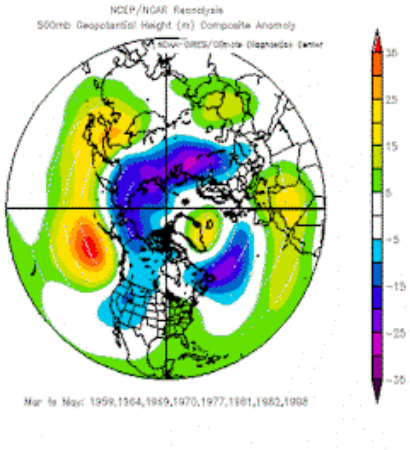

FEATURED CLIMATE HIGHLIGHT 1

By: Jason Sedeski

April Temperature Ups and Downs

Pennsylvania had particularly interesting temperature variations throughout the month of April. Looking at graphs of the daily temperature ranges at a few stations spread across the state, provided by SC ACIS, the variations are consistent and obvious. Fig. H1 is the best example, taken from Pittsburgh International Airport. The thick blue lines represent the daily temperature ranges. Wherever these lines meet the red line along the top, that signifies a record high maximum temperature for that day at that station.

As seen in Fig. H1, the daily temperature range in Pittsburgh oscillated from below average temperatures to well above normal temperatures (and even some daily records) over the first three weeks of the month. The daily high temperatures set or tied the record maximum temperature on three occasions. Fifteen days featured low temperatures that dipped below the normal range. While temperature variations during the spring months are common, this sine wave-like pattern to the daily temperature swings was particularly pronounced.

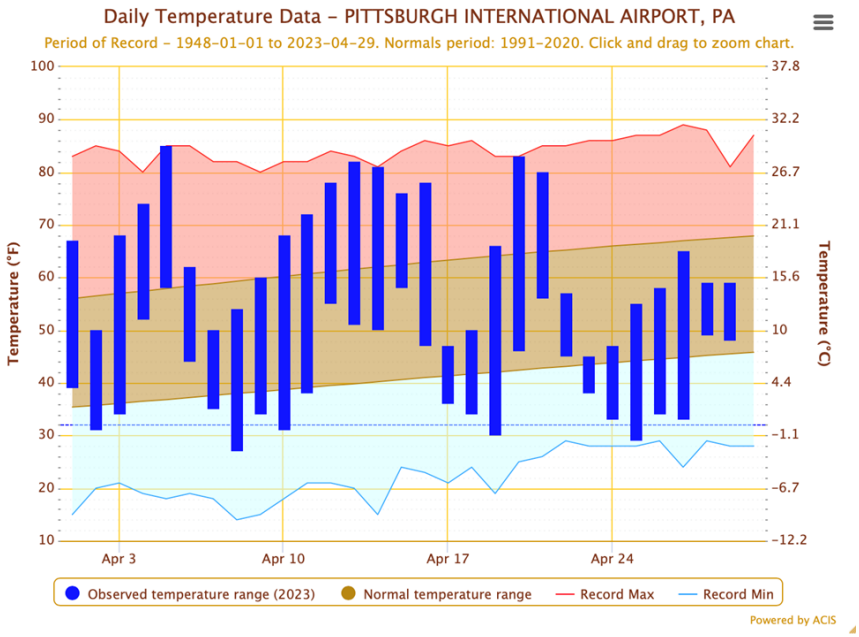

Figure H1 *– Observed daily temperature ranges (thick blue boxes) compared to normal diurnal temperature range (brown shaded area) and record daily max temperature records (red line) and record daily min temperature records (blue line) for Pittsburgh, PA during the month of April 2023. Image and data courtesy of Northeast Regional Climate Center's State Climatologist – Applied Climate Information System (SC-ACIS).*

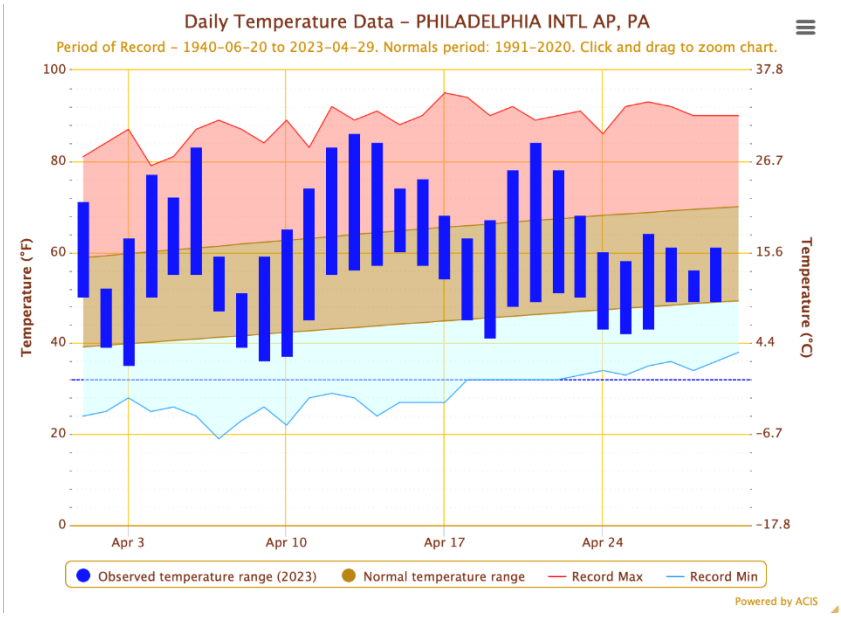

Figure H2 *– Same as in Fig. H1, but for Philadelphia, PA.*

Fig. H2 is displaying the same information but instead for Philadelphia International Airport. While less pronounced, this station shows a similar trend of remarkable temperature ranges that fluctuated from below to above normal. While there were no daily records broken like those observed in Pittsburgh, there were several stretches of well above normal afternoon highs and at least three days when the diurnal range was larger than the normal (i.e. the observed high temperature was higher than the daily normal high temperature and the observed low temperature was lower than the daily normal low temperature). Along with the relatively dry conditions for much of the month, this led to challenges for growers across the state with early crop growth followed by frost and freeze conditions.

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FEATURED CLIMATE HIGHLIGHT 2

By: Christian Lasher

First Statewide Red Flag Warning

On April 12th, the Commonwealth experienced a statewide Red Flag Warning, indicating dangerous fire conditions, for the first time in the history of the state of Pennsylvania (at least since NWS hazards were archived starting in 1986 from Iowa State's IEM website). Red Flag Warnings are issued when conditions favoring a wildfire are present or imminent. These conditions include strong winds, low humidity, and increased temperatures. This red flag warning was issued due to the following concerns at the time - strong winds up to 30 miles per hour and relative humidity between 20 and 30%.

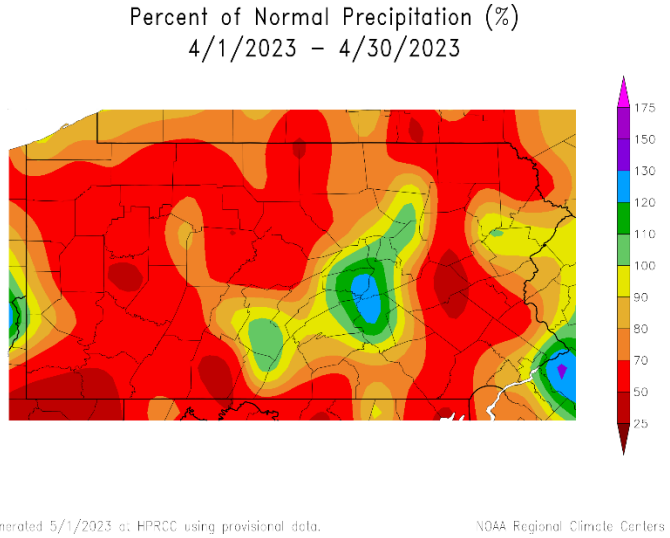

***Figure H3** – Percent of normal precipitation for the month of April 2023 in Pennsylvania. Image courtesy of the High Plains Regional Climate Center (HPRCC).*

The largest impact on the red flag conditions was, obviously, the dry conditions present that could easily allow for a fire to spread quickly. These dry conditions were present during much of the month of April across much of the Commonwealth as shown in the map above. This lack of precipitation along with abnormal warmth at times throughout the month allowed dead wood, brush, and many other types of common fuels for wildfires to become incredibly dry and increasing the risk for wildfires.

While Red Flag Warnings are not uncommon in Pennsylvania, the magnitude of this event was unprecedented for the state of Pennsylvania. It was the first time that all of Pennsylvania was covered by a Red Flag Warning and the first time that Erie County and Crawford County had ever received the issuance of this NWS hazard.

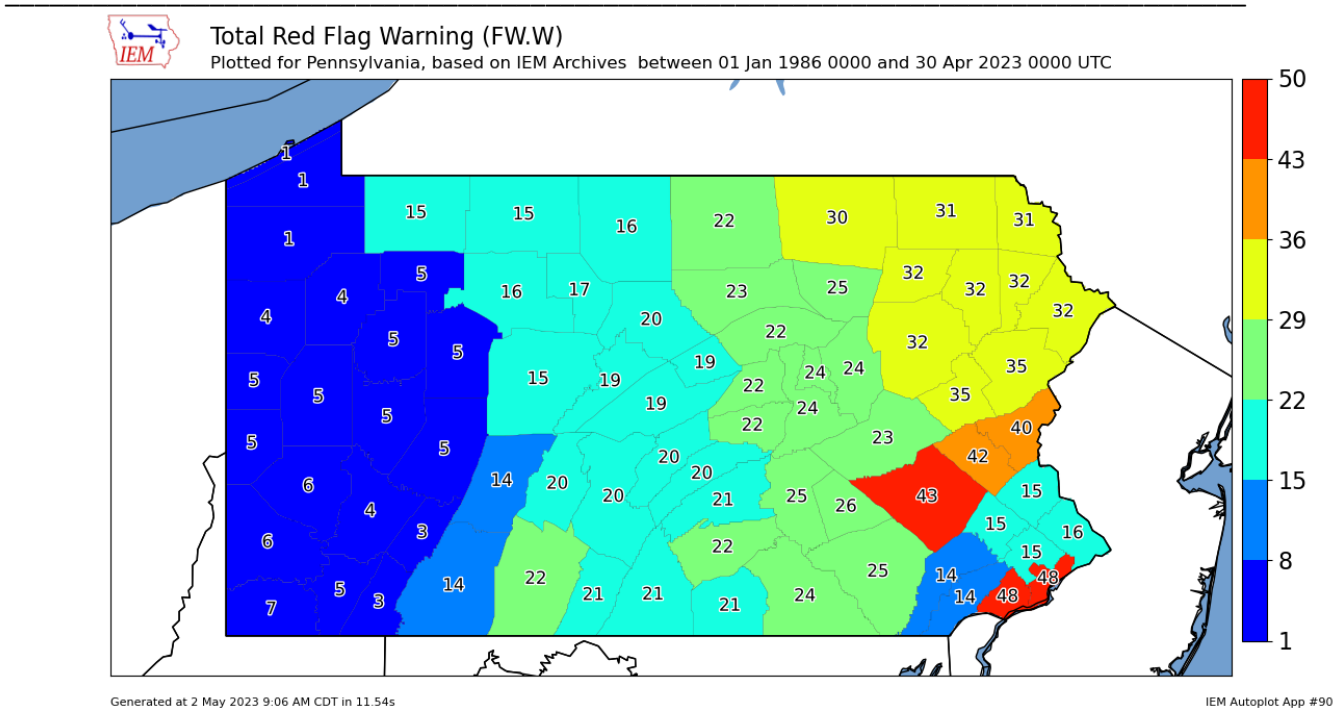

Figure H4 *– Total Red Flag Warning count from January 1st, 1986, to April 30th, 2023, 0000 UTC. Image and data courtesy of Iowa State University's Iowa Environmental Mesonet Archives.*

As a result of these favorable wildfire conditions, a large wildfire did occur on April 12th in Luzerne County, referred to as the Crystal Lake Fire. It was eventually contained on the 18th after burning 4,376 acres of private land, according to PA's Department of Conservation and Natural Resources. Luckily, no homes were known to be lost and no injuries were reported. This makes evident the importance of following National Weather Service watches and warnings and following the guidelines outlined within each alert issued.

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LONG RANGE OUTLOOK

By: Kevin Appleby

Despite the cool end to the month, April was milder than average across much of the Northeast and Mid-Atlantic while the Northern Rockies and Plains were much below normal, with some anomalies dropping to ten degrees Fahrenheit below normal. Dry conditions dominated much of the country, particularly over the Ohio Valley, Central Plains, and parts of the Deep South. The Upper Midwest was one of the few wetter than average locations, with parts of the Pacific Northwest and Southeast observing above normal precipitation as well.

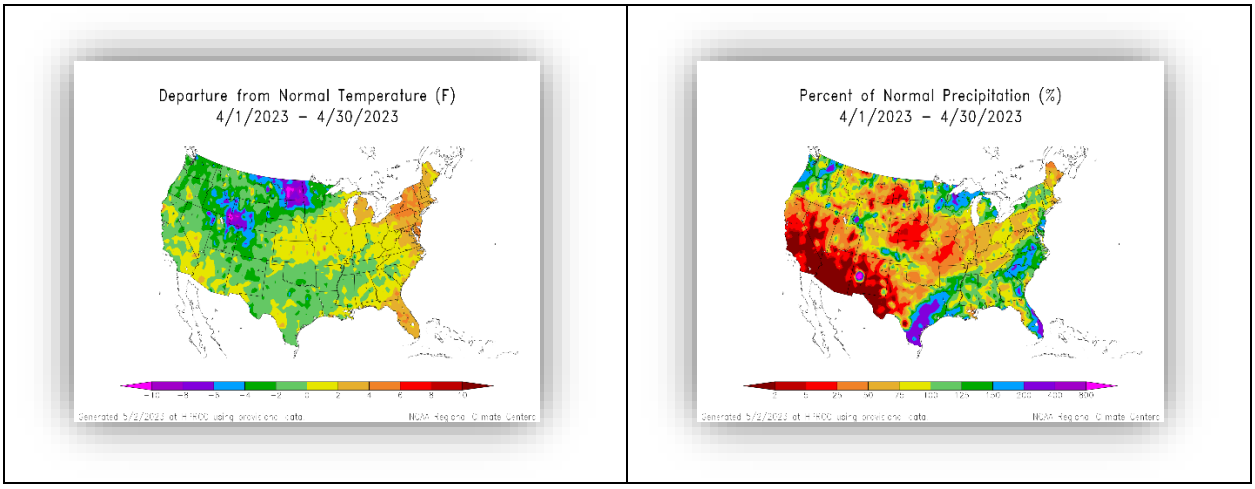

Figure L1 *- Temperature and precipitation anomaly maps for April 2023. Images courtesy of the High Plains Regional Climate Center.*

Using the relevant states and regions mentioned above, the 25 years with the highest and lowest values for temperature and precipitation for the relevant areas are listed in the table below. Yellow-highlighted years represent two regions with a common year while orange-highlighted years indicate three regions with a year in common.

warm-NE	cold-N. Plains	dry-ohio valley	wet- upper midwest
1896	1907	1900	1896
1910	1909	1902	1909
1915	1917	1895	1929
1921	1918	1896	1937
1941	1920	1899	1945
1942	1928	1906	1947
1945	1935	1915	1951
1952	1945	1916	1954
1955	1950	1926	1964
1960	1951	1930	1965
1968	1953	1934	1967
1976	1956	1942	1968
1981	1961	1946	1981
1986	1966	1949	1984
1987	1970	1960	1986
1991	1973	1962	1991
1998	1975	1963	1993
2002	1982	1971	1999
2005	1983	1976	2001
2006	1995	1985	2008
2008	1997	1986	2011
2009	2008	1988	2013
2010	2013	1997	2014
2017	2018	2001	2017
2021	2022	2012	2022

Table L1 *- Years in which the denoted anomaly for a specific region was observed. Years that are included in two of the anomalous regions are shaded in yellow, three regions in common are shaded orange, while all four in common are shaded red. Data courtesy of the National Centers for Environmental Information.*

Using the years that had at least two years in common, composite maps of temperature and precipitation were created and shown below.

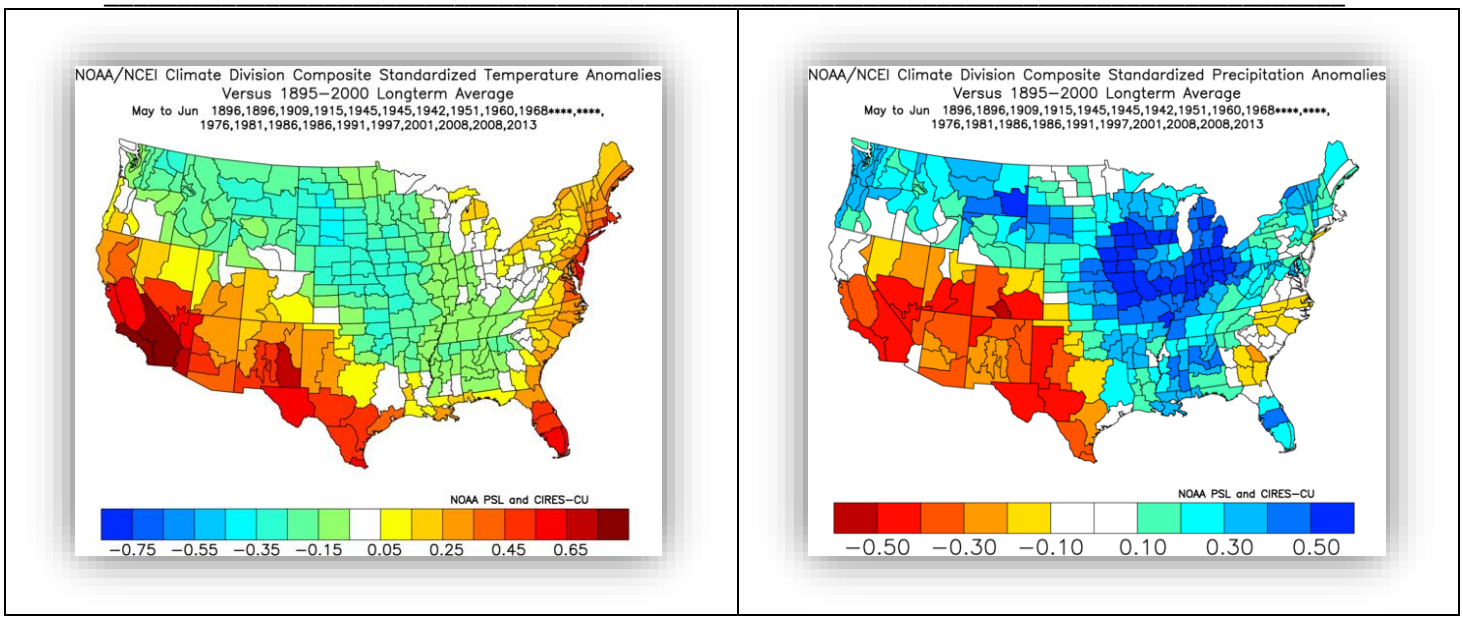

Figure L2 *– May and June composite standardized anomaly maps of temperature and precipitation. Anomalies are shown in standard deviations above and below normal. Images courtesy of the Earth System Research Laboratory Physical Sciences Division.*

The imagery above shows a warm signal for May and June across the southwestern United States, as well as the East Coast. Notably, the green and blue shading in the left image covers much of the Central and Northwestern United States, indicating below normal temperatures. Much of the Great Lakes and Midwestern United States show a wetter than average signal, while the Southwest would remain dry once again. Though not true for the entire country, most of the warmer than average anomalies line up with drier conditions, while wetter than average signals line up with cooler than average conditions.

Using Pennsylvania climate data for the ten highest ranked years after 1948, forecast temperature graphs are created and shown below.

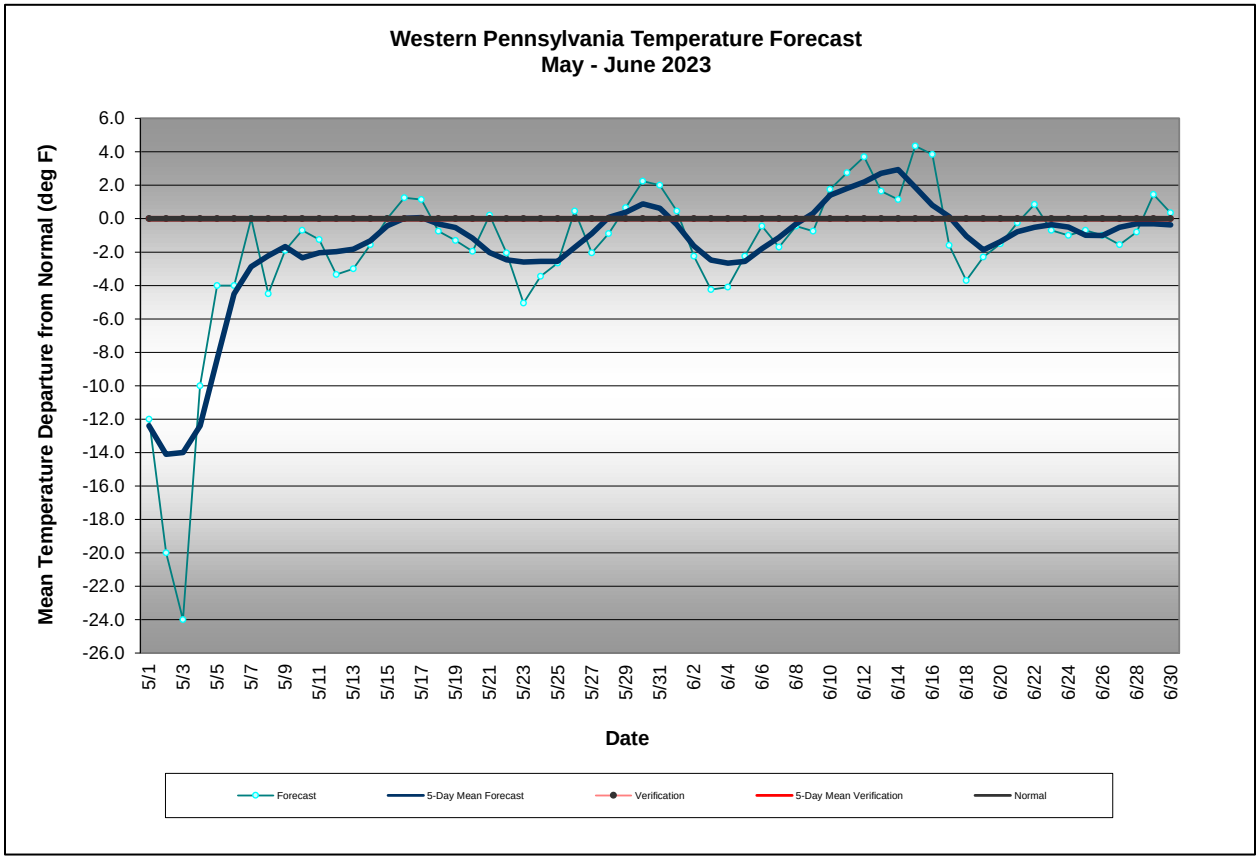

Figure L3 *– Daily temperature departures from normal for an average of select cities in western Pennsylvania. Values are calculated from historical temperature departures from normal for analogous years.*

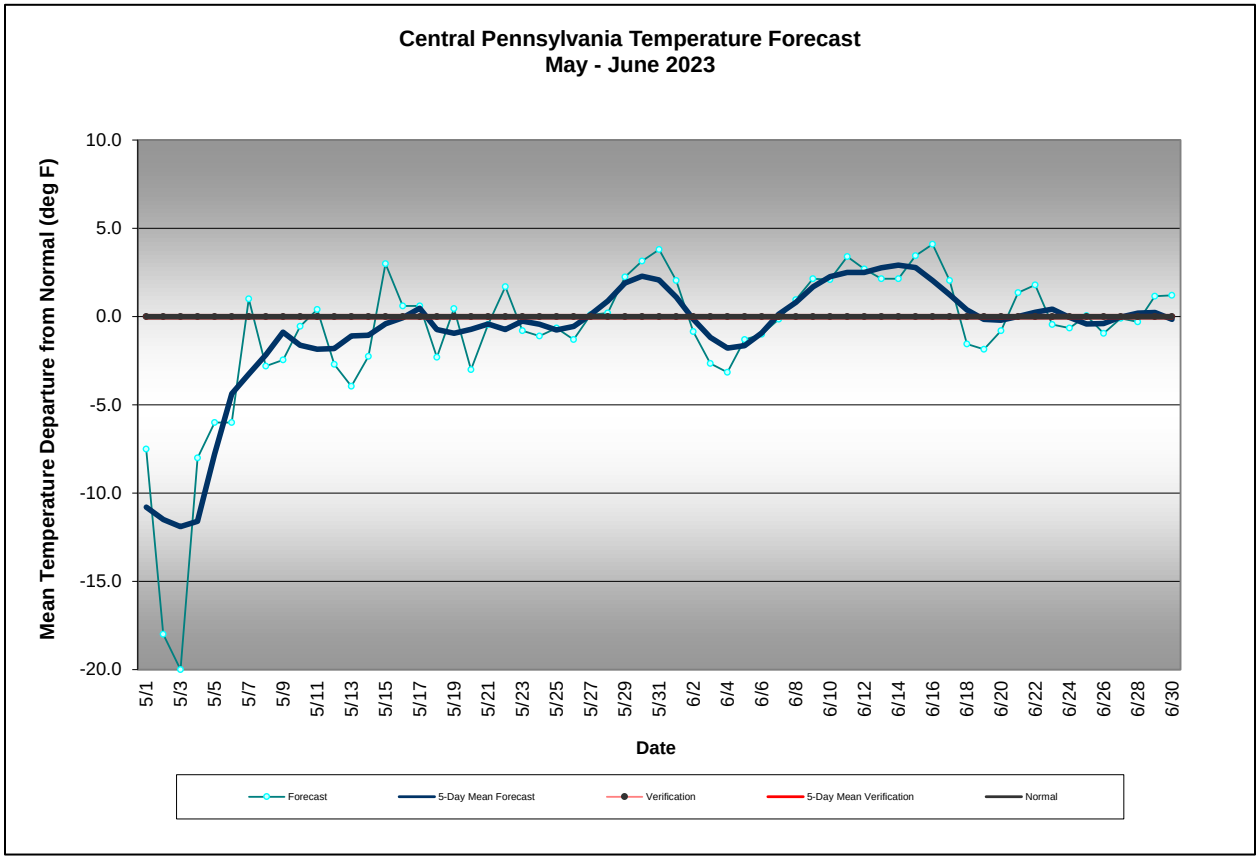

Figure L4 *– Same as Fig. L3 but for select cities in central Pennsylvania.*

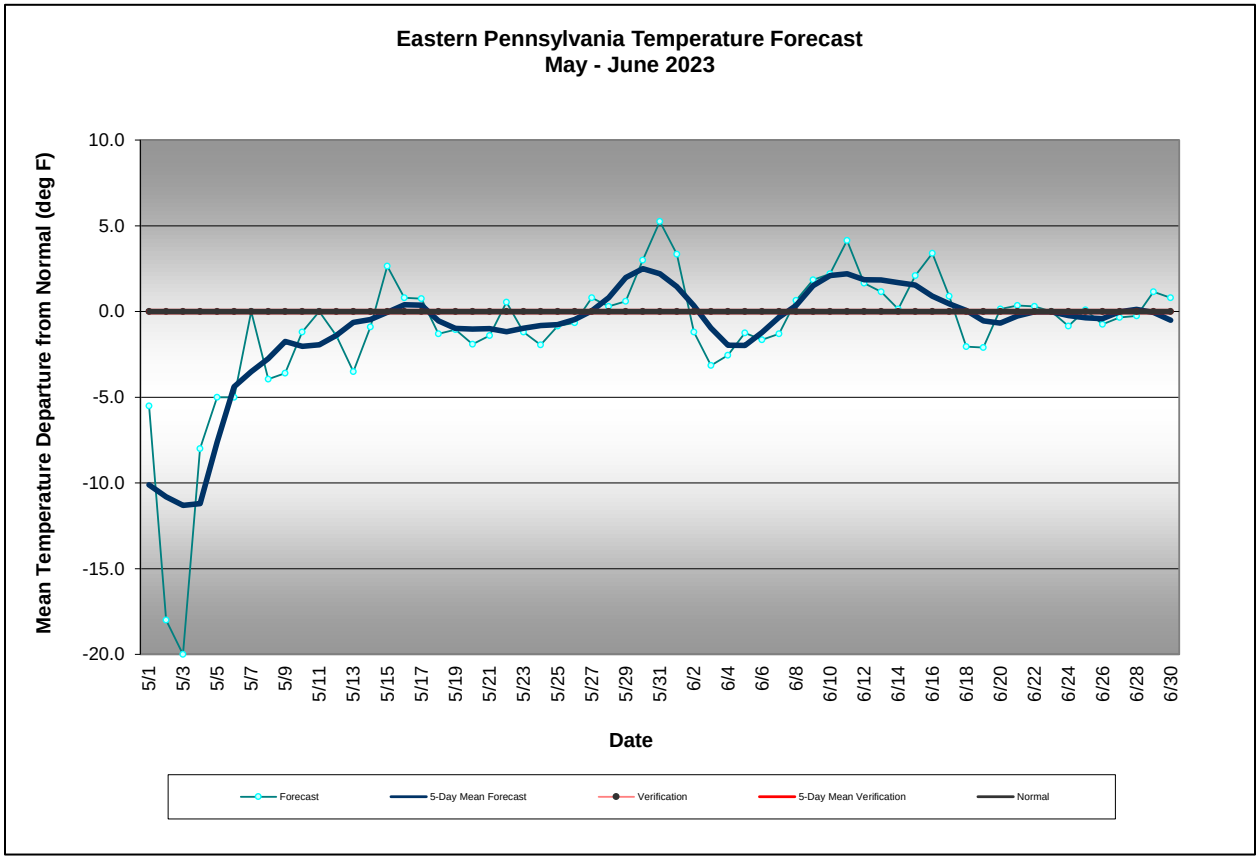

Figure L5 *– Same as Fig. L3 but for select cities in eastern Pennsylvania.*