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 – APRIL 3. 2023

PENNSYLVANIA WEATHER SUMMARY MARCH 2023

By: Kevin Appleby

March 2023's monthly temperatures averaged near to slightly-above seasonal levels. The above-average anomaly paled in comparison to what Pennsylvania observed in February, in which monthly averages were upwards of six to nine degrees Fahrenheit above average. As a result, the monthly mean temperature in March was actually very close to the monthly mean temperature from February across most observing sites. For perspective, monthly average temperatures in March should be upwards of seven to ten degrees warmer than February, on average. Precipitation was a different story with much of the state running dry, especially southeastern PA. The only exception to the drier-than-average conditions was across northwestern portions of the state and some higher terrain in the Laurel Highlands.

The month started on the mild side, but a storm cut through the state on the 3rd into the 4th. Colder air arrived behind this disturbance, which brought moderate rainfall totals to the state with upwards of an inch falling over parts of central and eastern PA. A strong ridge of high pressure was the main driving force behind what was generally a chilly middle two weeks of the month. Much of the Commonwealth saw below-average temperatures from March 10th-15th, with a few weak disturbances bringing bouts of light rain and even some light measurable snow to parts of the state. On the 13th into the 14th, a coastal storm brought some accumulating snows to Northeastern Pennsylvania, although the higher snowfall totals associated with the storm were observed much farther north and east.

It remained cool as the storm pulled away from the area. A brief warmup, driven by robust warm-air advection ahead of another storm, allowed temperatures to briefly climb above average shortly before Saint Patrick's Day. The next disturbance cut through the Great Lakes, bringing periods of light to moderate rain, particularly to western Pennsylvania. The associated cold front dropped temperatures significantly, with Pittsburgh, Philadelphia, and State College among the locations in the Keystone State observing their lowest temperatures of the month after the front moved through the state.

High pressure began to strengthen to the south, resulting in a pattern change following the preceding mid-month cold snap. High temperatures started rising persistently to above average levels as the calendar flipped to astronomical spring. The milder temperatures would continue through the 27th of the month. A weak system arrived late in the day on the 27th, but a mostly sunny start in Eastern PA allowed temperatures to climb substantially to the point where Philadelphia reached their highest temperature of the month (66°F) during the afternoon.

Temperatures climbed once again due to a sunny start to the 29th as a cold front emerged from the Great Lakes that afternoon. This front packed a punch, with very strong winds along it. Precipitation moved from northwest to southeast, with heavy rain mixing and eventually changing over to snow as temperatures plummeted. The front weakened as it marched farther southeast in the state. This set the stage for a sunny but cool 30th. Clouds increased late ahead of an area of low pressure responsible for bringing rain showers to the state on the 31st to conclude the month.

Severe weather summary: 16 damaging winds, 0 hail, and 0 tornado reports
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 March 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	Waynesburg 1 Mi. E	74°F	March 2nd	Greene
Lowest Temperature	Laurel Summit	9°F	March 20th	Somerset
Greatest Cumulative Liquid Precipitation	Laurel Summit	5.30”	March 1st-31st	Somerset
Least Cumulative Liquid Precipitation	Covington 2 Mi. WSW	1.61”	March 1st-31st	Tioga
Greatest Cumulative Snowfall	Lake Harmony 2.4 Mi. WNW	21.2”	March 1st-31st	Carbon

Links to Pennsylvania Weather Stories during March 2023

Warm February Leads To Early Spring Bloom In Philadelphia
https://www.inquirer.com/news/early-spring-2023-philadelphia-pennsylvania-new-jersey-bartrams-mt-cuba-20230309.html?outputType=amp

Perspective On Lake Erie’s Low Winter Ice Coverage
https://www.statenews.org/news/2023-03-24/lake-erie-didnt-have-much-ice-this-winter-why-not

Complications Of Early Spring for Plants and Wildlife In PA
https://www.alleghenyfront.org/spring-arrived-early-for-some-this-year-and-its-complicated/

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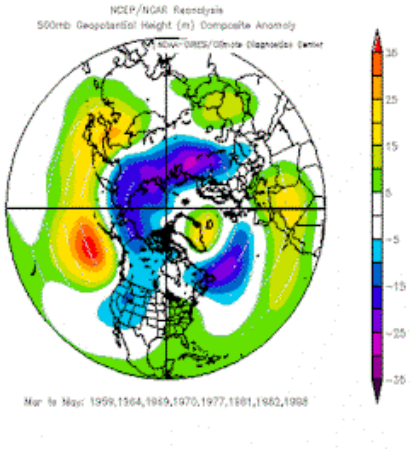

FEATURED CLIMATE HIGHLIGHT 1

By: Karl Schneider

Degree Days

Like temperature and precipitation, degree days are a common statistic listed on any climate report, but their meaning is not as obvious. Heating Degree Days (HDD) and Cooling Degree Days (CDD) are two metrics which are commonly used to estimate energy consumption due to the need for heating or cooling in indoor spaces. The underlying assumption is that the energy required to heat (cool) a building increases linearly as the outdoor temperature diverges from 65°F – called the "base" temperature.

The calculation for degree days is simple – just calculate the difference between the daily mean temperature and 65°F. Typically, the daily mean temperature is reported as the average between the high and low temperature for the day. For example, if the high temperature is 40°F, and the low is 20°F, the daily mean temperature is 30°F. Taking the difference between this value and 65°F, the result is 35 HDD, since the mean is below 65°F. Likewise, for a day with a high of 90°F and a low of 70°F, this gives a daily mean temperature of 80°F and therefore 15 CDD.

While degree days are calculated daily, it is often the total number of degree days accumulated over a period (such as a month or season) that is most useful. For instance, we could compare the total number of heating degree days accumulated over multiple winter seasons to assess how the heating demand differed. Compared to temperature anomalies, degree days provide a more direct way to relate energy consumption (due to heating/cooling) to observed temperature.

Similarly, Growing Degree Days (GDD) provide useful information about the impacts of temperature on plant growth. Calculating GDD is like calculating CDD but utilizes a different base temperature; these base temperatures vary widely – anywhere between 40°F and 60°F are common for most crops and vegetation in Pennsylvania. Unlike CDD, however, GDD may be capped when the mean daily temperature is above a threshold, such as 90°F. This is based on the premise that vegetative growth is related to temperature until heat stress begins to impact the growth of the plant.

The accumulation of GDD over the season can be used to calculate the current growth stage of a crop, or to help forecast the date that a crop will reach a particular growth stage. Growing Degree Days can also be used to predict pest and insect emergence, as they provide a more accurate estimate of development compared to calendar date alone, leading to more informed decisions about pesticide and fertilizer use.

You can view daily HDD, CDD, and GDD on our Climate Office website: https://climate.met.psu.edu/data/current/#cdr .

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FEATURED CLIMATE HIGHLIGHT 2

By: Christian Lasher

Potential Impacts of Weather on Mosquito-Borne Illnesses

Mosquito-borne illnesses have been a known public health threat for decades, with Zika and West Nile virus being two of the more prominent illnesses in the public consciousness during this time. Another virus that is a threat to parts of the eastern United States, particularly the Gulf Coast and Northeast is Easter Equine Encephalitis, also known as EEE. This mosquito-borne virus is extremely dangerous, as there is currently no treatment for those who contract encephalitis due to EEE. Febrile illness is a possibility from EEE, which is characterized as an illness that causes fever, chills, body aches, and joint pain for about one to two weeks. However, the more dangerous outcome of EEE is the possibility of contracting a neurologic disease. The CDC has been monitoring an uptick in this virus's prevalence over the past decade or so, with a notable spike occurring in 2019 (Fig. H1), with many cases reported in the northeast United States. This highlight will discuss the potential impacts of late winter and early spring weather patterns on mosquito populations and on resultant case counts of diseases like EEE.

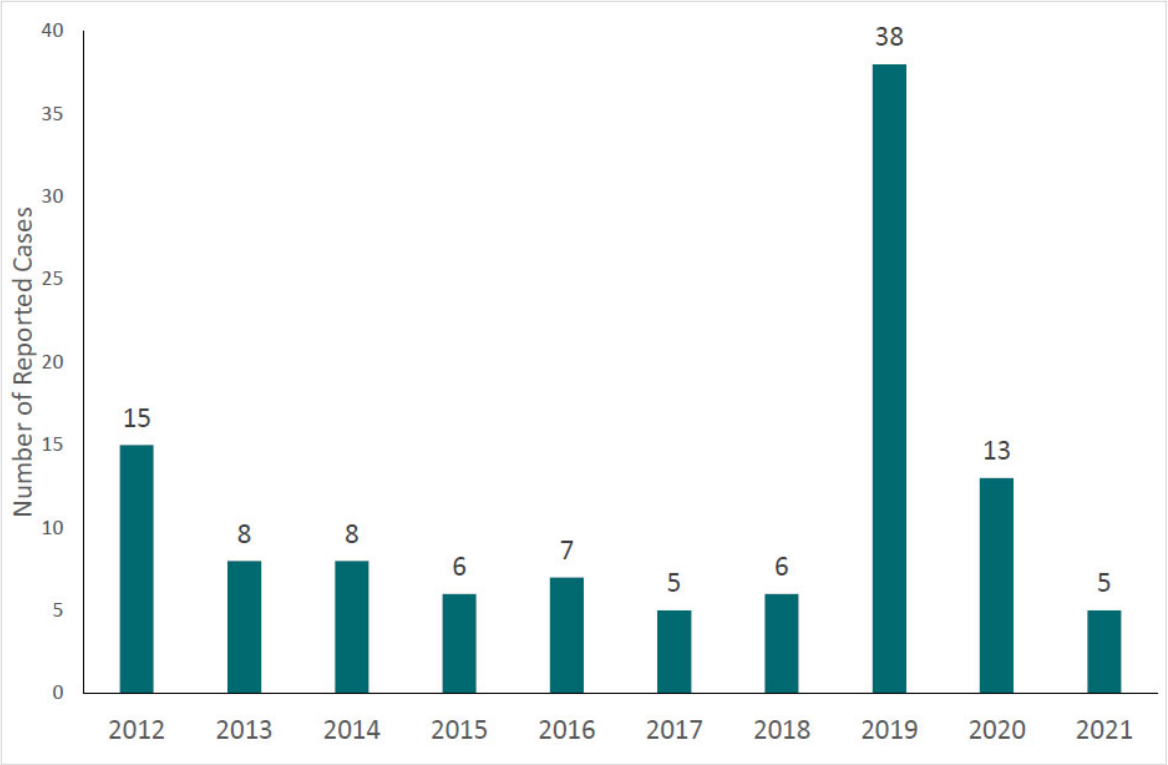

Figure H1 *– Eastern equine encephalitis virus neuroinvasive disease cases reported (2012-2021). Figure courtesy of the Centers for Disease Control and Prevention (CDC).* *https://www.cdc.gov/easternequineencephalitis/statistics-maps/index.html*

One factor that can lead to an increase in mosquito populations is abnormally warm temperatures during the winter and early spring. Warmer winter temperatures lead to a higher population of mosquitoes surviving and potentially being active earlier during the spring. Fig. H2 illustrates temperatures are much higher during the first three months of this year compared to 2019, the year with the highest reported cases of EEE since 2012. While temperature is only one factor involved with mosquito reproduction and activity, these warmer temperatures could possibly lead to an increase in mosquito populations this spring and summer.

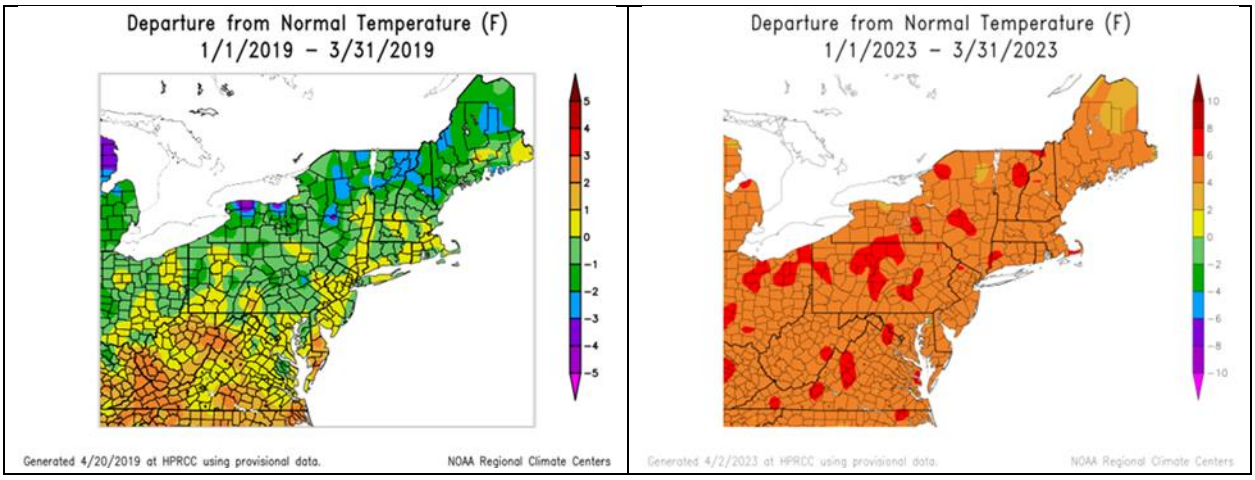

Figure H2 *–Departure from normal temperatures from Jan 1-Mar 31, 2019 (left) and from Jan 1-Mar 31, 2023 (right). Data courtesy of the High Plains Regional Climate Center (HPRCC).*

Another factor to consider is precipitation. Increases in precipitation during the winter leads to higher chances of standing water in the spring from snow melt, leading to more breeding grounds for pests like mosquitos.

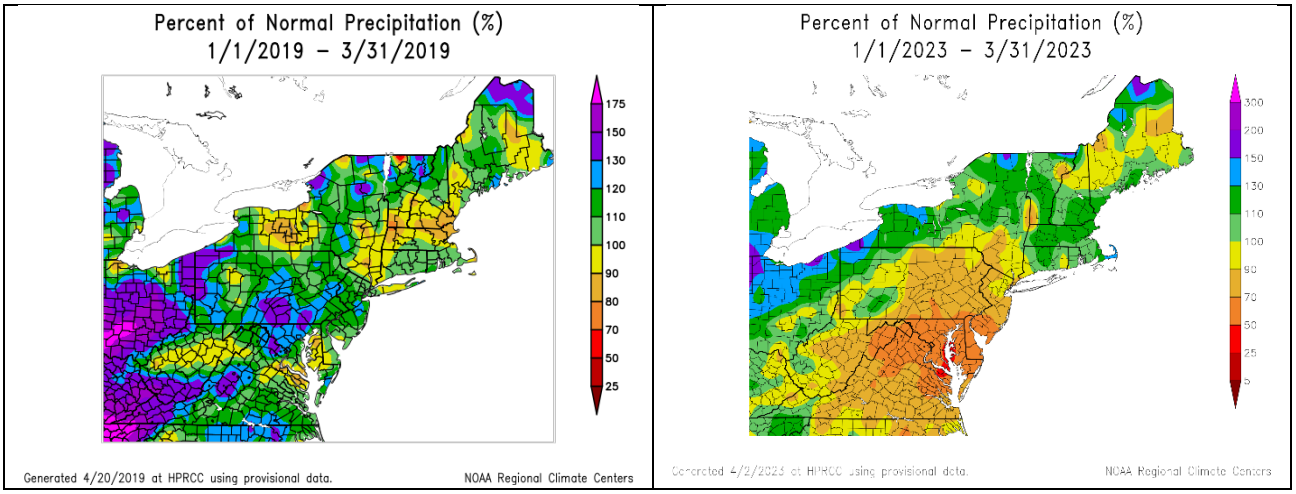

Figure H3 *– Percent of normal precipitation from Jan 1-Mar 31, 2019 (left) and from Jan 1- Mar 31, 2023 (right). Data courtesy of the High Plains Regional Climate Center (HPRCC).*

Fig. H3 shows the percent of normal precipitation for 2019 compared to this year. The anomalies from 2019 indicate that the relatively wet late winter and early spring was one of the primary factors leading to an increase mosquito population and the resultant risk of EEE. The relatively dry conditions observed this year, thus far, could help alleviate increased mosquito populations but precipitation during the remainder of spring will determine just how much of a risk will be posed by the insects. Be sure to protect yourself from mosquitos this spring and summer by using plenty of insect repellent when outdoors.

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LONG RANGE OUTLOOK

By: Jason Sedeski

March 2023 continued to be cool over the Rockies and West Coast. The warmest temperature anomalies were concentrated along the Gulf Coast. Much of the western U.S. was wet during the month while much of the Southern Plains measured just half (or less) of the normal monthly precipitation. Parts of the Gulf Coast and southern Mid-Atlantic also observed a drier-than-normal month of March.

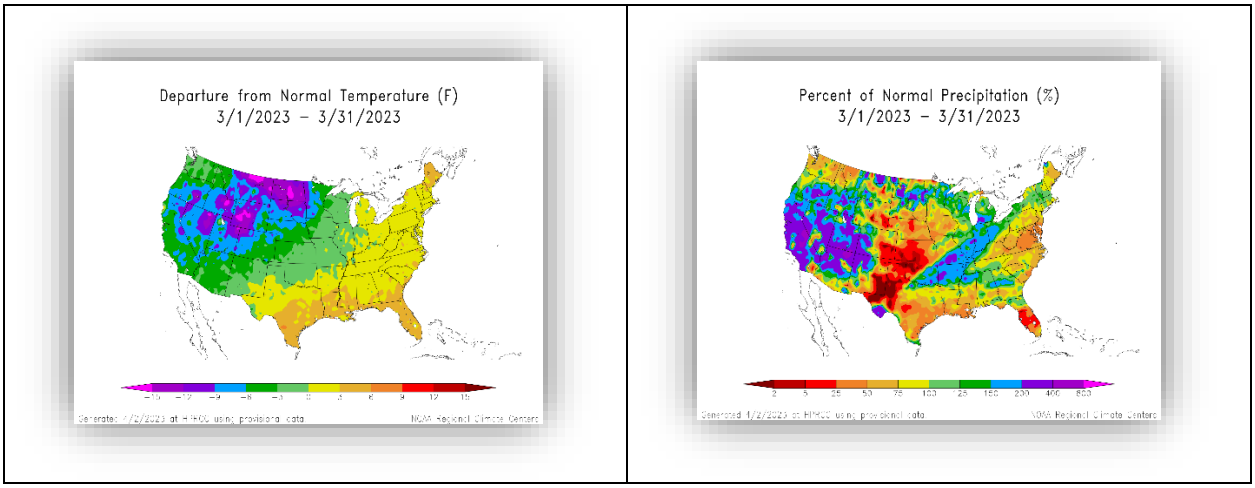

Figure L1 *- Temperature and precipitation anomaly maps for March 2023. Images courtesy of the High Plains Regional Climate Center.*

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-Gulf coast	Cool-N. Rockies	Dry- S. Plains	Wet- West
1897	1896	1899	1903
1904	1897	1907	1904
1907	1898	1910	1905
1908	1899	1911	1899
1910	1906	1916	1906
1911	1912	1918	1907
1918	1913	1925	1911
1921	1917	1930	1912
1925	1924	1936	1918
1935	1932	1940	1920
1938	1943	1954	1937
1945	1944	1955	1938
1953	1948	1956	1952
1967	1950	1959	1958
1974	1951	1962	1974
1997	1952	1963	1975
2000	1954	1966	1978
2004	1955	1967	1982
2007	1960	1971	1983
2011	1962	1972	1989
2012	1964	1978	1991
2016	1965	1982	1995
2017	1969	1986	2006
2018	1996	2011	2011
2020	2002	2013	2018

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.

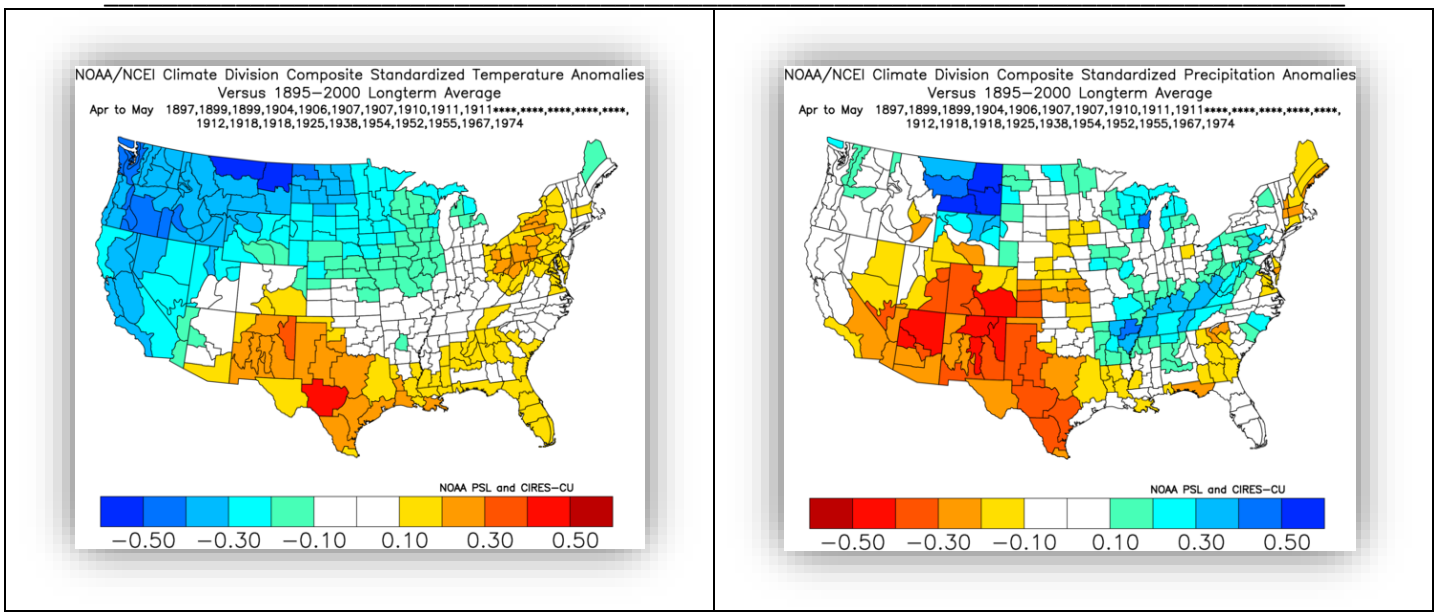

Figure L2 – *April and May composite standardized anomaly maps of temperature and precipitation. Anomalies are shown in standard deviations above and below normal. Images courtesy of the Earth System Research Laboratory Physical Sciences Division.*

Based on the imagery above, the warmest anomalies are centered over the Southern Plains and Mid-Atlantic, including Pennsylvania. Colder than average temperatures are favored to persist across parts of the West and Northern Rockies through the end of May based on the analogous years used in this analysis. Precipitation is favored to be above normal across the Ohio River and Southern Mississippi River valleys while parts of the Deep South and Southwest may see drier conditions for April and May.

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

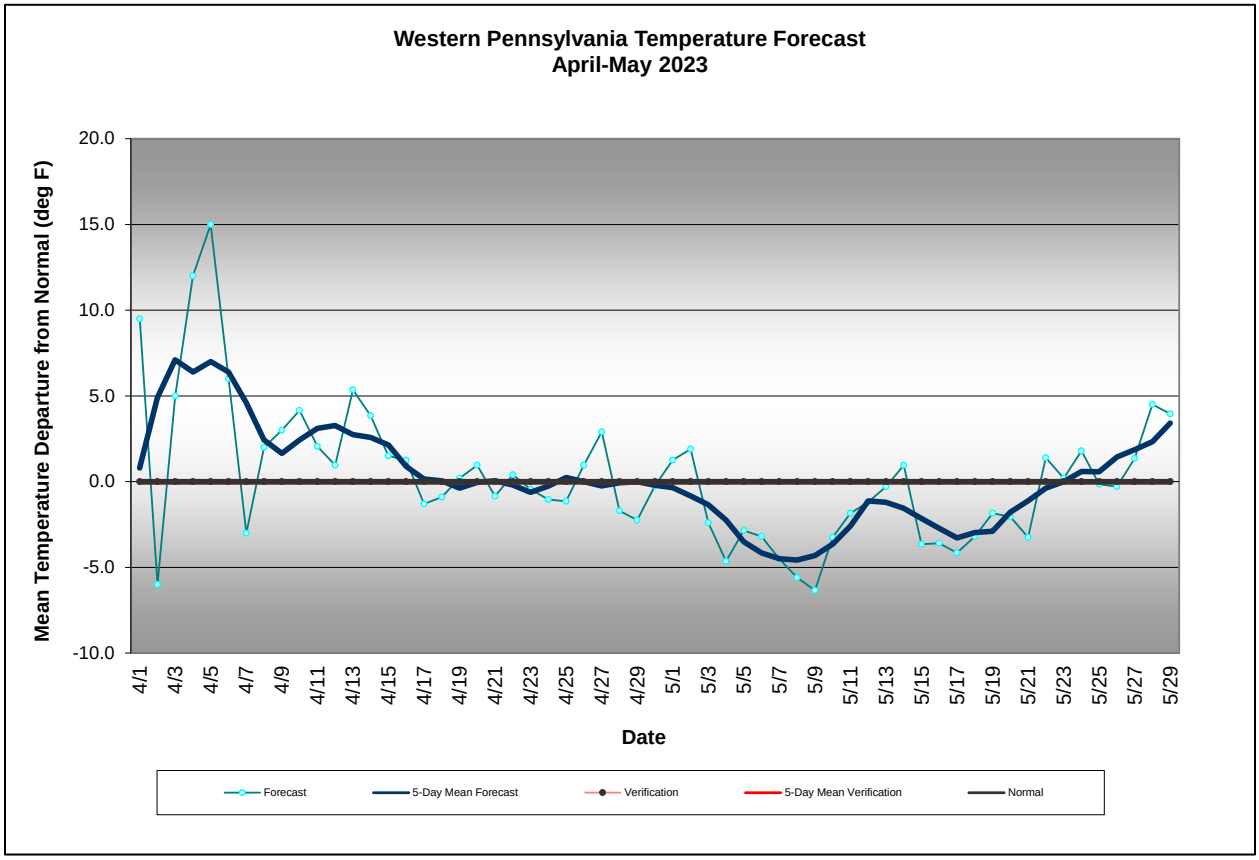

Figure L3 *– Daily temperature departures from normal for an average of select cities in western Pennsylvania. Values are calculated from historical temperature departures from normal for analogous years.*

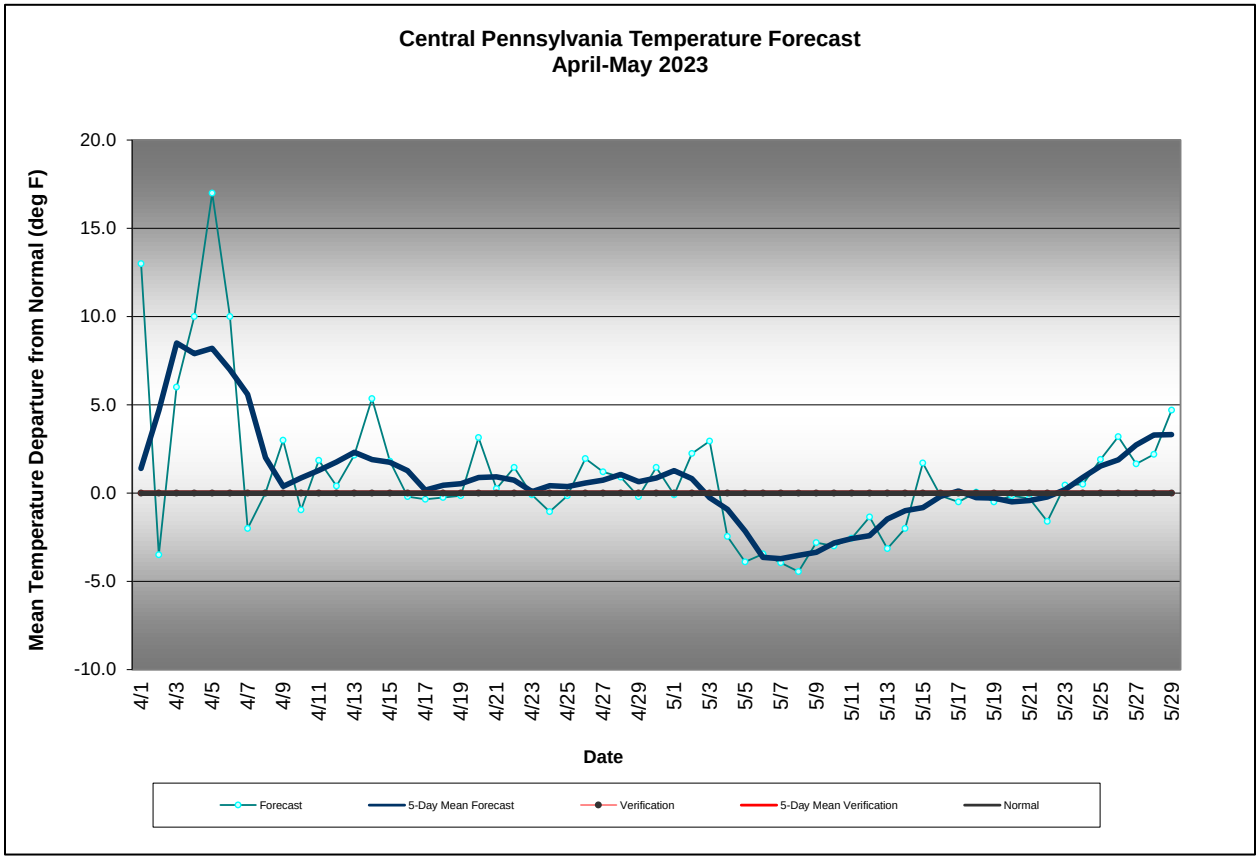

Figure L4 *– Same as Fig. L3 but for select cities in central Pennsylvania.*

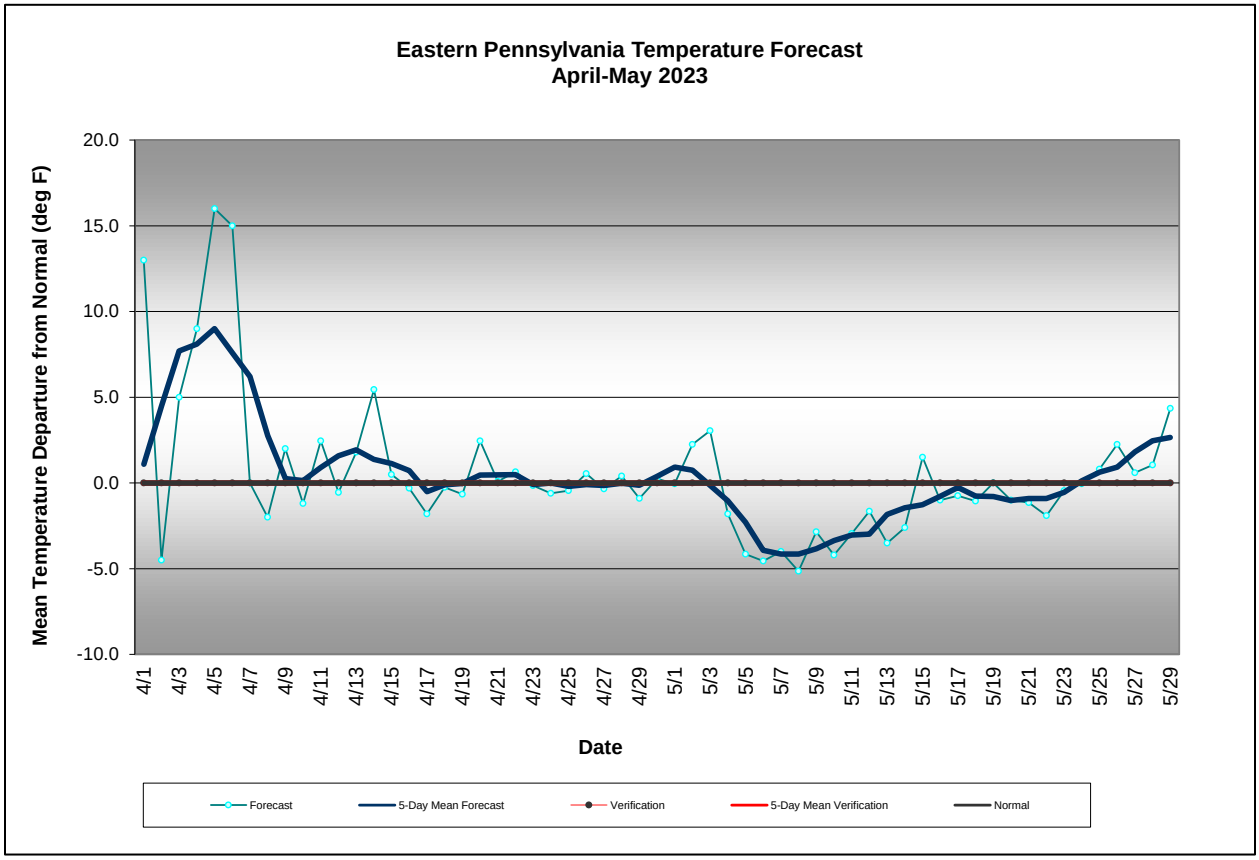

Figure L5 *– Same as Fig. L3 but for select cities in eastern Pennsylvania.*