The Pennsylvania Observer

February 1, 2016

The Pennsylvania State CLIMATOLOGIST
PENNSTATE
A Service to the Commonwealth
by the College of Earth and Mineral Sciences

January 2016 - Pennsylvania Weather Recap

By: Chris Colacito

After an unseasonably mild end to 2015, 2016 started off closer to what may be expected in the middle of winter. January was defined by streaks of cold punctuated by some above-average temperatures and a singular, intense snow event towards the end of the month. Other than the high-impact snowstorm, January was a relatively dry month across Pennsylvania relative to the number of days with precipitation. The month began with an outbreak of Arctic air associated with a strong area of high pressure that parked itself over the Northeast. Temperatures dropped across the state, with most stations experiencing lows at or below 10 degrees on the 5th and 6th. Lows even plunged below zero for some northern stations, including Bradford (-6) and Oswayo (-5).

Over the next week, two separate fronts associated with areas of low pressure swept across the state. The first of these systems brought relatively mild temperatures and rain for much of the state. Temperatures for much of the southeastern region of the state broke 60 degrees on the 10th and 11th, with some stations in the Philadelphia area even reaching above 65. The second storm that passed through later that week brought colder temperatures and even some snow.

The next two weeks were relatively tranquil, with seasonably cold temperatures and little precipitation. Finally, on the 21nd, tranquility disappeared. A strong area of low pressure started to brew along the Gulf Coast, eventually intensifying into a full-blown winter storm as it raced up the Atlantic coast over the next two days. The system prompted blizzard warnings throughout much of the southeastern portion of the state. The heaviest snow was concentrated across that same region, with totals sharply dropping towards the northwest. Record and near-record totals were measured at many stations, with locations such as Allentown, Harrisburg, Shippensburg, and Lebanon seeing well over two feet of snow. As far west as locations in Somerset County, along the spine of the Appalachians, observed 48-hour snowfall totals near three feet.

Here are the weather extremes across Pennsylvania (**observations taken at 8AM EDT**) during January 2016 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.

Parameter	Location	Value	Date (8 AM EDT)	County
Highest Temperature	Philadelphia NE AP	**66°F**	January 10th	Philadelphia
Lowest Temperature	Bradford Regional AP	**-6°F**	January 5th	Warren
Greatest Cumulative Liquid Precipitation	Littlestown 0.8 Mi. NNW	**5.22"**	January 1st-31st	Adams
Least Cumulative Liquid Precipitation	Stanfordville 0.4 Mi. SE	**1.10"**	January 1st-31st	Susquehanna
Greatest Cumulative Snowfall	Somerset	**48.4"**	January 1st-31st	Somerset

Links to Pennsylvania Weather Stories during January 2016

Man thought dead survives brutal winter conditions
http://wnep.com/2016/01/18/man-presumed-dead-now-a-living-medical-miracle/

Turnpike drivers help trucker in wintry weather
http://www.wpxi.com/news/news/turnpike-drivers-form-human-chain-help-trucker-fal/nqCsJ/

Warm early winter may affect bees
http://www.goerie.com/winter-topic-for-bee-producers

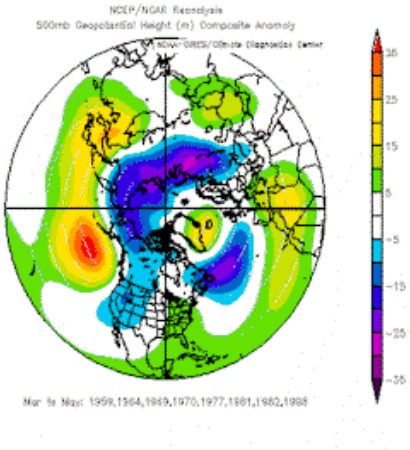
Another Pennsylvania prognosticating groundhog purveys winter outlook
http://www.readingeagle.com/news/article/oscar-the-groundhogs-call-more-winter-plowable-snow-in-february

The Pennsylvania Observer

The Pennsylvania State CLIMATOLOGIST

PENNSTATE

A Service to the Commonwealth
by the College of Earth and Mineral Sciences



FEATURED CLIMATE HIGHLIGHT

By: Faith Eherts

What are "teleconnections" and how are they used?

The atmosphere can be thought of as an ocean above the surface of the earth, continuously flowing, where a small disturbance in the flow can turn into large waves downstream. This concept can be applied directly to weather forecasting in the form of teleconnections. A weather pattern emerging in one part of the world can indicate an upcoming pattern in a completely different region before it can be seen on computer weather models. In this way, teleconnections are most useful in medium range (1-2 week) forecasting. Last month, the highlight focused on the El Nino/Southern Oscillation. This month, the focus will shift to pressure patterns outside of the tropical Pacific. In the vicinity of the North Atlantic, two teleconnections aid forecasters in determining future North American and European weather – the North Atlantic Oscillation (NAO) and the Arctic Oscillation (AO).

Definitions and Impacts

NAO

The state of the NAO can be described as being in one of two modes– positive or negative. Each state has very different effects on storm tracks, evolution and frequency over North America, particularly during the winter months. The mode is determined through comparison of the average atmospheric sea level pressures over Iceland and the Azores (off the coast of Portugal). When there is a relatively larger-than-normal pressure gradient between these two regions, in can be implied that the NAO is positive and the jet stream will tend to stay between the two locations. In other words, the jet stream will remain in a west-east orientation through eastern North America, the North Atlantic, and into Western Europe. Therefore, westerly winds implies relatively milder weather for the eastern U.S. and northern Europe during the winter, but cooler conditions over northern Canada and the Mediterranean. At the beginning of February, the NAO is forecast to decrease from the positive state to near neutral. A medium-range forecast for the eastern U.S. for the first week of February would therefore likely include above average temperatures.

On the other hand, a negative NAO – when there is a relatively weaker-than-normal pressure gradient between Iceland and the Azores – implies the opposite. A lack of strong forcing between these two areas promotes atmospheric blocking and a meandering of the jet stream in more of a north-south orientation in eastern North America, the North Atlantic, and Western Europe. As the jet stream dips south over the eastern U.S. and Western Europe, these areas see more Arctic air outbreaks and generally cooler weather (although the U.S. sees more snow and northern Europe does not). Conversely, as the jet stream brings more disturbed weather to northern Canada and the Mediterranean, the weather tends to be warmer and wetter.

AO

The AO is determined through examination of the surface pressure over the Arctic and the resulting winds that circulate the region counter-clockwise at high latitudes. The phase of AO (positive or negative) can last anywhere from a couple weeks to many months, potentially having long-term impacts on North American and European weather patterns.

Lower than average surface pressures over the Arctic promote stronger circulating winds, which contains the frigid arctic air to the poles. In turn, this pattern limits the amount of cold air outbreaks in the U.S. and southern Europe, resulting in warmer than average winters. This is described as the positive phase of the Arctic Oscillation.

When the surface pressure over the North Pole is higher than average, the strong circulation around the Arctic weakens. This allows for cold air to migrate southward over North America and Europe, resulting in a cooler than average conditions during the winter.

The AO is forecast to decrease from very positive to about neutral by the start of February, much like the NAO. Both teleconnections (NAO and AO) would both indicate above average temperatures in the eastern US in their current and projected phases.

Some links for additional information on these teleconnections:

- https://www2.ucar.edu/news/backgrounders/weather-maker-patterns-interactive-map#map
- https://climate.ncsu.edu/climate/patterns/NAO.html
- For current conditions and medium range forecasts: http://mp1.met.psu.edu/~fxg1/multiind.html

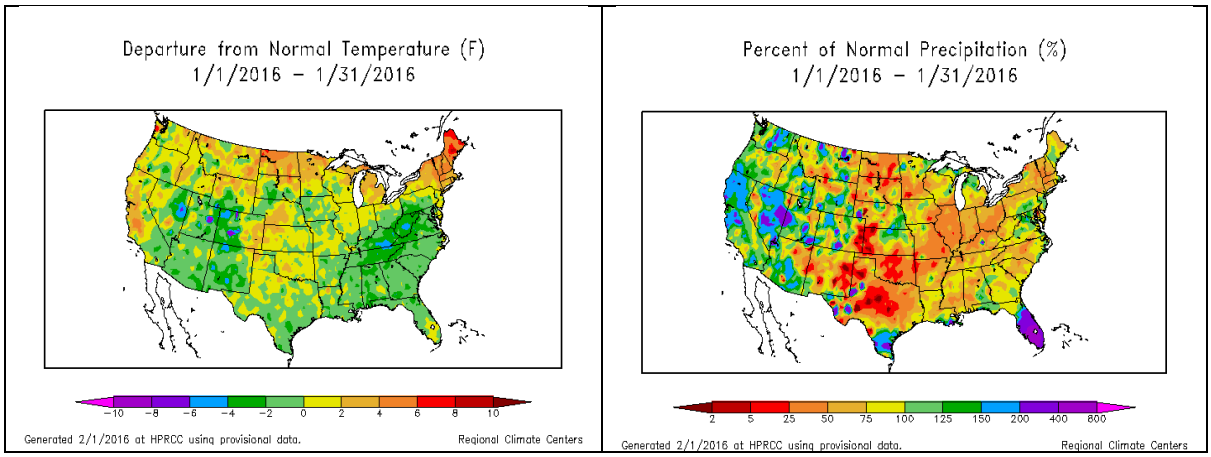
The Pennsylvania Observer

The Pennsylvania State CLIMATOLOGIST
PENNSTATE
A Service to the Commonwealth
by the College of Earth and Mineral Sciences

LONG RANGE OUTLOOK

By: Samantha McGowan

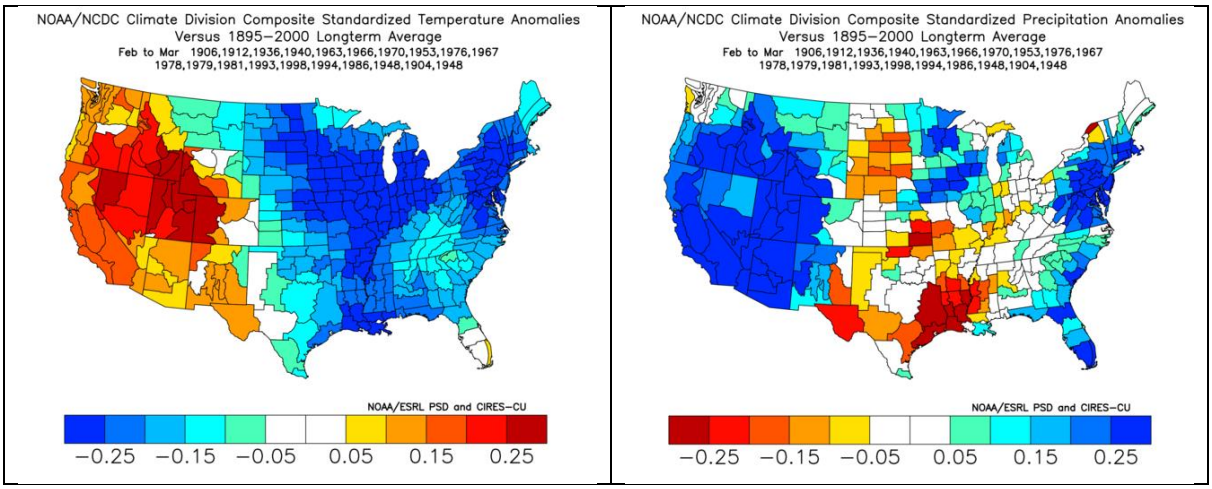
The month of January was relatively warm across much of the northern continental United States, with the Northeast experiencing the largest departures from normal as was the case in December. The coldest temperatures across the country were along the spine of the Appalachians, centered over Kentucky. January was very dry across much of the central part of the country, especially the Deep South. Wetter than normal conditions were relatively sparse, but much of Florida was exceptionally wet.



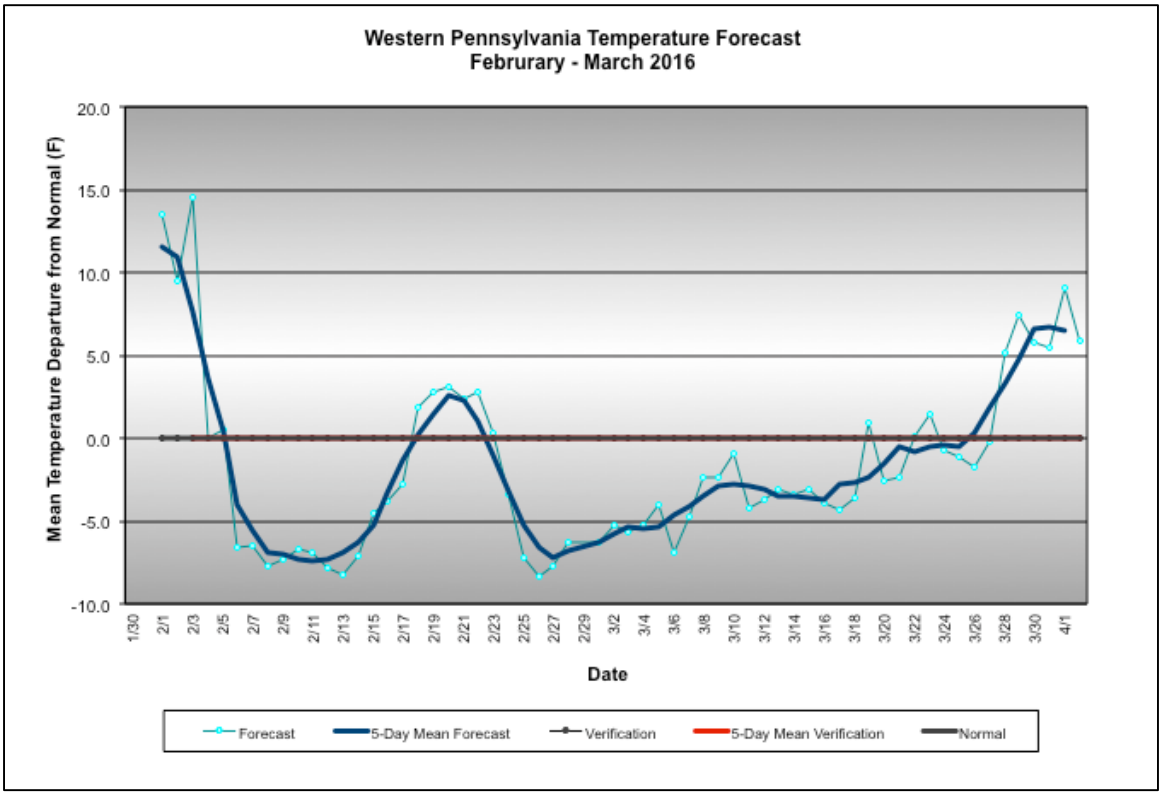
Using the four anomalous regions described above, climate records were examined for the 25 years in each region that historically are closest to what was seen this year. After identifying common years in the four anomaly categories, the years with the most categories in common and highest rank are used as analogs. Below is a table containing a list of years in which the anomalies in past Januaries matched what was seen in 2016.

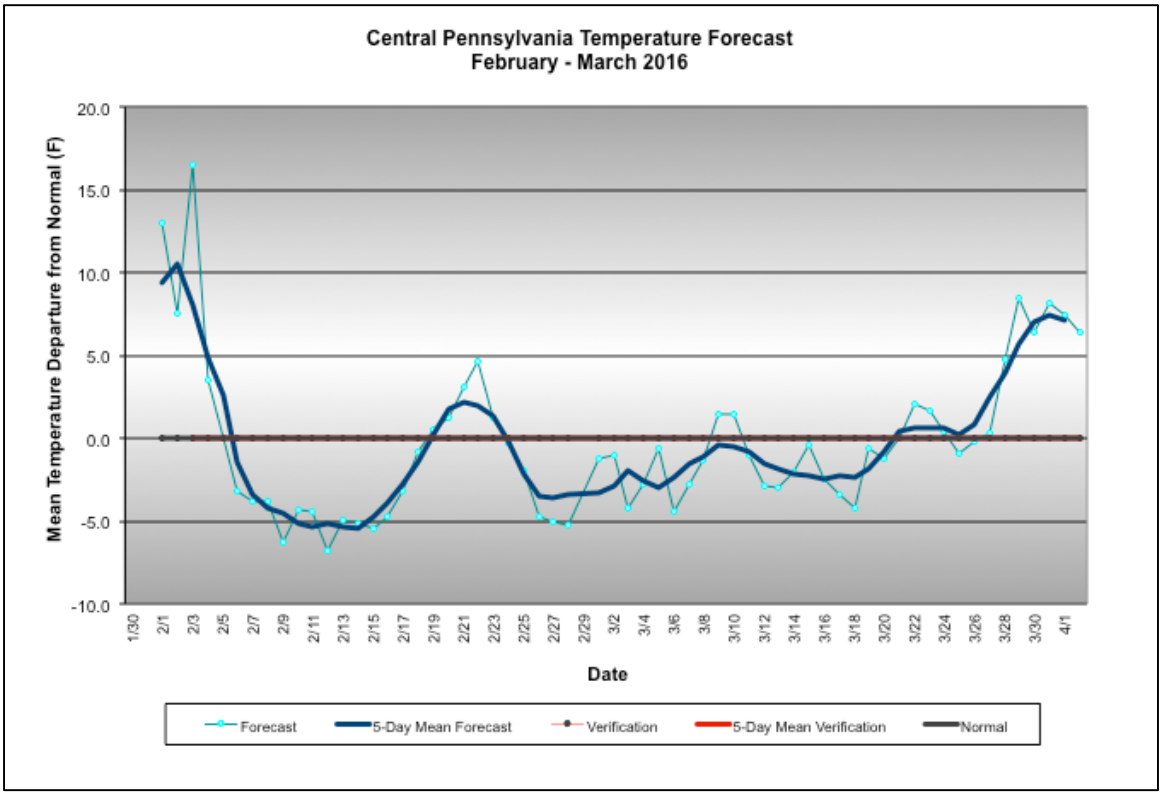
Cold Kentucky	Warm NE	Wet FL	Dry South
189501	190601	189901	190101
189701	191301	190301	190201
190501	191601	190401	190401
191201	191901	190601	190901
191801	193201	191201	191101
193601	193301	191501	191201
194001	193701	192401	191401
194801	194701	192501	192801
196101	194901	192601	194001
196301	195001	193601	194201
196601	195101	194801	194301
196801	195201	195801	195301
197001	195301	196401	195901
197601	196701	196601	196301
197701	197501	197301	196701
197801	198901	197801	197001
197901	199001	197901	197101
198101	199301	198601	197601
198201	199501	198701	198101
198401	199801	199101	198601
198501	200201	199301	198801
199401	200601	199401	200001
200301	200701	199801	200301
201001	200801	201001	200901
201401	201201	201101	201401

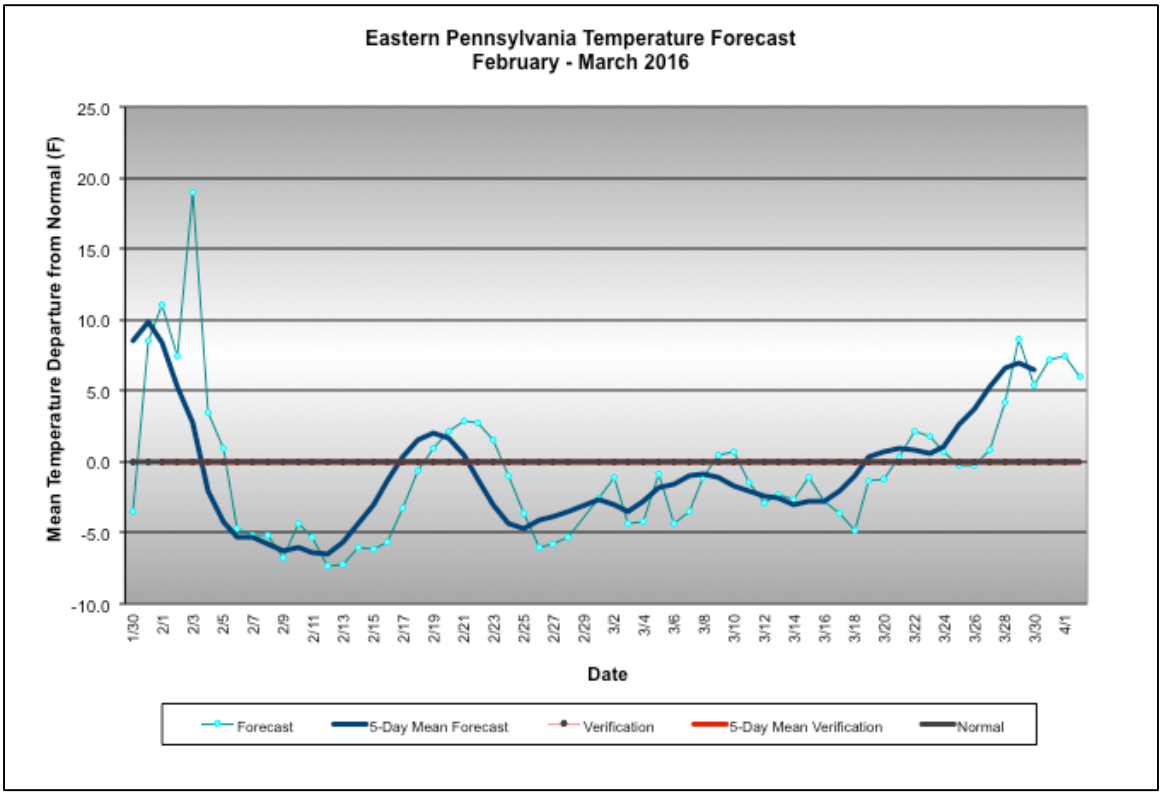
The colors in the table above indicate years in common among all four anomalous regions – yellow indicates two of the regions share that specific year, orange indicates three regions in common, and red indicates all four. Composite maps for the months of February and March using the analog years in the table above are shown below.



The above images show that late winter/early spring temperatures will be warmer than average west of the Rockies and cooler than average to the east. Much of the Eastern Seaboard will be wet along with the West, and dry conditions will continue in parts of the central U.S. Below are daily departure from normal temperature forecasts for the west, central and eastern sections of Pennsylvania.


Western Pennsylvania Temperature Forecast
Februrary - March 2016
Mean Temperature Departure from Normal (F)
20.0
15.0
10.0
5.0
0.0
-5.0
-10.0
1/30
2/1
2/3
2/5
2/7
2/9
2/11
2/13
2/15
2/17
2/19
2/21
2/23
2/25
2/27
2/29
3/2
3/4
3/6
3/8
3/10
3/12
3/14
3/16
3/18
3/20
3/22
3/24
3/26
3/28
3/30
4/1
Date
Forecast
5-Day Mean Forecast
Verification
5-Day Mean Verification
Normal


Central Pennsylvania Temperature Forecast
February - March 2016
Mean Temperature Departure from Normal (F)
20.0
15.0
10.0
5.0
0.0
-5.0
-10.0
1/30
2/1
2/3
2/5
2/7
2/9
2/11
2/13
2/15
2/17
2/19
2/21
2/23
2/25
2/27
2/29
3/2
3/4
3/6
3/8
3/10
3/12
3/14
3/16
3/18
3/20
3/22
3/24
3/26
3/28
3/30
4/1
Date
Forecast
5-Day Mean Forecast
Verification
5-Day Mean Verification
Normal


Eastern Pennsylvania Temperature Forecast
February - March 2016
Mean Temperature Departure from Normal (F)
25.0
20.0
15.0
10.0
5.0
0.0
-5.0
-10.0
1/30
2/1
2/3
2/5
2/7
2/9
2/11
2/13
2/15
2/17
2/19
2/21
2/23
2/25
2/27
2/29
3/2
3/4
3/6
3/8
3/10
3/12
3/14
3/16
3/18
3/20
3/22
3/24
3/26
3/28
3/30
4/1
Date
Forecast
5-Day Mean Forecast
Verification
5-Day Mean Verification
Normal