National Park Service
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Natural Resource Stewardship and Science

Weather of Delaware Water Gap National Recreation Area and Upper Delaware Scenic and Recreational River

Eastern Rivers and Mountains Network Summary Report for 2014

Natural Resource Data Series NPS/ERMN/NRDS—2015/814

ON THE COVER
Sunset over West Branch of the Delaware River near Shehawken Creek.
Photograph by: Caleb Tzilkowski

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All manuscripts in the series receive the appropriate level of peer review to ensure that the information is scientifically credible, technically accurate, appropriately written for the intended audience, and designed and published in a professional manner.

This report received informal peer review by subject-matter experts who were not directly involved in the collection, analysis, or reporting of the data. Data in this report were collected and analyzed using methods based on established, peer-reviewed protocols and were analyzed and interpreted within the guidelines of the protocols.

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List of Key Acronyms

ASOS	Automated Surface Observing System
COOP	National Weather Service Cooperative Observer Program
CWOP	Citizen Weather Observer Program
DEWA	Delaware Water Gap National Recreational Area
ERMN	Eastern Rivers and Mountains Network
FAA	Federal Aviation Administration
GOES	Geostationary Operational Environmental Satellite
IFLOWS	Integrated Flood Observing and Warning System
NADP	National Atmospheric Deposition Program
NARR	North American Regional Reanalysis
NCDC	National Climatic Data Center
NOAA	National Oceanic and Atmospheric Administration
NPS	National Park Service
NRA	National Recreation Area
NWS	National Weather Service
PDSI	Palmer Drought Severity Index
POR	Period of Record
PRISM	Parameter-elevation Regressions on Independent Slopes Model
RAWS	Remote Automated Weather Stations
SRR	Scenic and Recreational River
UPDE	Upper Delaware Scenic and Recreational River
USDM	United States Drought Monitor
USGS	United States Geological Survey

Introduction

Weather and climate are widely recognized as key drivers of terrestrial and aquatic ecosystems, affecting biotic as well as abiotic ecosystem characteristics and processes. Global and regional scale climatic patterns, trends, and variations are critical to the cycling of elements, nutrients, and minerals through ecosystems and can deliver pollutants from regional and even global sources (National Assessment Synthesis Team 2001). These variations and trends influence the fundamental properties of ecologic systems such as soil-water relationships and plant-soil processes and their disturbance rates and intensity. Information obtained from meteorological monitoring will be useful to interpreting and understanding changes in species composition, community structure, water and soil chemistry, and related landscape processes (Marshall and Piekielek 2007).

The purpose of this report is to provide a concise weather and climate summary for the period from January 1 through December 31, 2014, and to place current patterns and trends in an appropriate historical and regional context (Marshall et al. 2012). It is our intention that this report will satisfy an inherent interest in meteorological phenomena and meet a portion of the Eastern Rivers and Mountains Network (ERMN) Weather and Climate Monitoring objective:

- Document current status and long-term trends in air temperature and precipitation at multiple temporal scales (e.g., daily, monthly, seasonal, annual, and decadal) and spatial scales (e.g., individual stations and aggregated stations such as climate divisions) utilizing existing weather and climate monitoring programs and datasets.

To accomplish this objective, a variety of atmospheric data streams were evaluated for their quality, longevity, and applicability to the ERMN parks. Since no single weather observing network contains all the pertinent measures of atmospheric phenomena to assess ecosystem health, an objective analysis of the data networks was developed and outlined in the
Weather and Climate Monitoring Protocol for the Eastern Rivers and Mountains Network and the Mid-Atlantic Network of the National Park Service (Marshall et al. 2012). Through this analysis, a select number of weather/climate observing stations were chosen as representative of each park; these are the primary data sources used to profile climate summary and trends.

In addition to a suite of summary tables, graphs, and narratives, we specifically identify a series of key weather indicators to report status and trends. This report includes a summary of several of these indicators for the period of record of selected stations (ending on December 31, 2013). These key indicators are further described in the protocol (Marshall et al. 2012) and summarized in the body of this report.

Climate of the Pocono Mountains and Eastern Plateau

Delaware Water Gap National Recreation Area (NRA) lies in Pennsylvania Climate Division 1 "Pocono Mountains" and New Jersey Climate Division 1 "Northern NJ," while Upper Delaware Scenic and Recreational River (SRR) lies within Pennsylvania Climate Division 1 and New York Climate Division 2 "Eastern Plateau." A climate division is a region that is reasonably homogenous with respect to climatic and hydrologic characteristics and is frequently used for compiling climate statistics (http://www.esrl.noaa.gov/psd/data/usclimdivs/data/map.html). Pennsylvania and New York are each divided into 10 climate divisions; New Jersey has three divisions.

The three climate divisions encompassing Delaware Water Gap NRA and Upper Delaware SRR are generally considered to have a humid, continental type of climate, but the varied physiographic features have a marked effect on the weather and climate of the various parts of the Delaware River valley. The prevailing westerly winds carry most of the weather disturbances that affect the region from the interior of the continent, so that the Atlantic Ocean has limited influence on the climate of the area (Davey et al. 2006). Coastal storms do, at times, affect the day-to-day weather, especially in the winter. Also, storms of tropical origin can have the greatest effect within this portion of the Pennsylvania–New Jersey–New York region, causing severe floods in some instances (Gelber 2002).

Temperatures are moderately continental, with the tempering effects of the Great Lakes contributing to cloud production in the winter and onshore winds reducing the heat at times during the summer. The lowest readings in the winter occur with polar air masses of Canadian origin settling over the Northeast after a fresh snowfall. The highest readings of the summer happen when the sub-tropical fair weather system, the Bermuda high, pushes westward into the Carolinas; its clockwise circulation will direct hot, humid air from the Gulf region into the Delaware River valley. The southwest winds gain additional warmth when descending the crest of the Appalachians.

Precipitation is fairly evenly distributed throughout the year. Annual amounts generally range between 34–52 in (864–1,320 mm), while the majority of places receive 38–46 in (965–1,168 mm). Greatest amounts usually occur in the late-spring and summer months; while February is the driest month, having about 2.0 in (51 mm) less than the wettest months. Precipitation tends to be somewhat greater in the mountains, due primarily to coastal storms which occasionally frequent the area. During the warm season these storms can bring heavy rain, while in winter, heavy snow or a mixture of rain, ice, and snow may be produced.

Surface winds blow from the west and northwest in the cold season and from the southwest during the warm half of the year. Thunderstorms follow a frequency that matches the solar cycle, occurring between the equinoxes and reaching a peak near the summer solstice. Hail is relatively infrequent, but flash floods and damaging thunderstorm winds affect parts of the river valley each summer. On average, tornadoes pass through the area about once every three years. The direct effects of an Atlantic hurricane are uncommon, though remnant rains from hurricanes and tropical storms have contributed to the region's worst floods. Ice storms, which can cause significant disruption, occur at irregular intervals and are primarily confined to the months between December and March (Kocin and Uccellini 2004).

Observing Stations

Twelve weather observing stations, comprised of three observing networks, were selected around Delaware Water Gap NRA and Upper Delaware SRR. Representative stations within a 100-km range of each park were chosen based on several criteria, which include proximity to the park, the representativeness of the station to the parks' elevation profile, the type and frequency of observations, the period of record of the data, and data availability (Marshall et al. 2012). Moreover, the percentage of time a station reports particular parameters (e.g., temperature) can influence its data inclusion. Using this criteria, 11 of the 12 stations were used for this report, with the exception being Deposit, NY which did not report data in 2014; nearby station, Walton 2 (WALN6), was used as its replacement.

Two stations, Port Jervis (1893-current) and Pleasant Mount 1 W (1952-current), were used for a long-term trend analysis using the period of record for both stations ending December 31, 2013. Graphs of these long-term trends are shown in the Appendix section of this document. For temperatures, long-term means and the standard deviation above and below the long-term mean are computed for each indicator. Because precipitation distributions do not fall on a normal curve like temperature distributions do, standard deviations are not computed for the precipitation indicators.

The following are the climate indicators selected for each of the parks:

- Highest Annual Maximum Temperature – A measure of the individual highest maximum temperature each year
- Average Annual Mean Temperature – A measure of the composite mean temperature (averaging the maximum and minimum on a daily basis) for an entire year
- Annual Number of Hot Days (Maximum Temperature equal to or exceeding 90 °F)- A measure of warm season heat using a threshold of days with 90F maxima
- Lowest Annual Minimum Temperature – A measure of the individual lowest minimum temperature each year
- Annual Number of Cold Nights (Minimum Temperature equal to or below 32 °F) – A measure of the cold season chill using a threshold of days with 32F minima
- Growing Season Length (Number of Days Between Last Freeze in Spring and First Freeze in Fall) – A measure of the local growing season as tallied by the total number of days between the last 32F in the spring and the first 32F in the fall
- Annual Precipitation – A measure of total liquid (and its equivalent melted snow) for all days
- Annual Snowfall – A measure of total solid precipitation (includes sleet and hail; does not include freezing rain)

- Annual Number of Extreme Precipitation Days (Liquid equal to or greater than 2.00") – A measure of frequency of heavy precipitation events during each year
- Winter Precipitation (January 1 – March 31) – The three month total precipitation including rain and melted snow
- Spring Precipitation (April 1 – June 30) - The three month total precipitation
- Summer Precipitation (July 1 – September 30) - The three month total precipitation
- Autumn Precipitation (October 1 – December 31) - The three month total precipitation including rain and melted snow

The average value of a climate element over 30 years is defined as a climatological normal, which is calculated and established by NOAA's National Climatic Data Center (NCDC). Every ten years, NCDC computes new thirty-year climate normals for selected temperature and precipitation elements for a large number of U.S. climate and weather stations. The current (as of 2014) normals cover the period 1981–2010. In this report, the 30-year normals established by NCDC are used as the baseline for comparisons (e.g., departures from normal). In cases where data for the 30-year normal period are not available, we use alternative comparisons, such as the new pseudo-normal from NCDC or a recent 10-year period. In some cases, sufficient data may simply not be available to calculate normals. For metrics that NCDC may not routinely calculate a normal, such as the number of days with more than 2 in (55 mm) of rain or liquid equivalent, normals are calculated using the same time period (e.g., 1981−2010) as the current NCDC standard. Throughout the report, descriptions of a station's values as compared to the normals are described as a difference from the "average", "mean", "typical", "long-term value", as well as "normal", to improve the readability of the document. However, all of these terms are comparing a value from one year at that station to that station's normal, whether it be the 30-year normal or the pseudo-normal calculated on a shorter time frame.

The NCDC also calculates and provides climatological ranks for selected temperature and precipitation elements (http://www.ncdc.noaa.gov/temp-and-precip/ranks.php). Data and statistics are as of January 1895 providing a substantial period of record to place the current year in historical context.

In addition to the summary information available in this report, a near real-time data stream has been made available to the ERMN through a Web interface for the selected stations along with monthly, seasonal, and annual summaries. The Web interface is accessible through the following link: http://climate.met.psu.edu/NPS/interface.php.

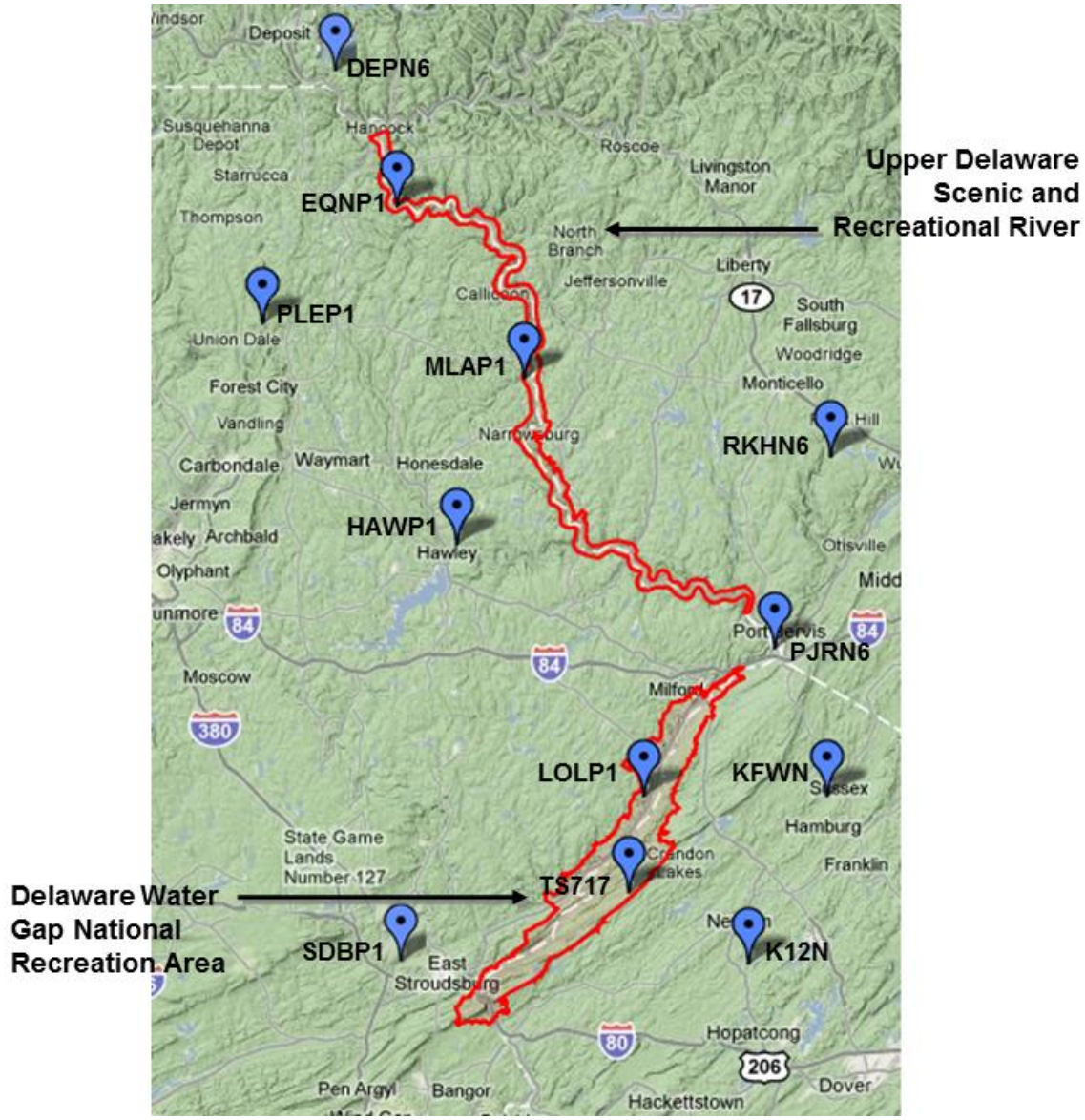

Figure 1. Location of weather observing stations around Upper Delaware Scenic and Recreational River and Delaware Water Gap National Recreation Area. See Table 1 for station names.

Table 1. List of weather observing stations around the Upper Delaware Scenic and Recreational River and Delaware Water Gap National Recreation Area selected as most representative of the parks in 2014.

Station	Observing Network	Station Name	Period of Record (POR)		Percentage of Time Reporting Temperature for 2014	Percentage of Time Reporting Precipitation for 2014	Percentage of Time Reporting Temperature for entire POR	Percentage of Time Reporting Precipitation for entire POR
PJRN6	COOP	Port Jervis	01/01/1893	Present	99.7	99.7	96.9	94.1
EQNP1	COOP	Equinunk 2 NW	03/01/1957	Present	-	99.7	-	99.2
HAWP1	COOP	Hawley 1 E	11/01/1897	Present	100.0	100.0	76.8[1]	81.2
DEPN6	COOP	Deposit	05/01/1953	Present	-	-	95.2	95.3
SDBP1	COOP	Stroudsburg	12/01/1910	Present	100.0	100.0	90.9	91.6
KFWN	ASOS	Sussex Airport	12/27/2000	Present	100.0	85.5	98.7	97.7
K12N	ASOS	Aeroflex-Andover Airport	10/25/2000	Present	95.9	96.4	85.5	80.3
RKHN6	COOP	Rock Hill 3 SW	05/01/1953	Present	68.8	69.3	98.0[2]	98.2
PLEP1	COOP	Pleasant Mount 1W	10/01/1924	Present	99.5	99.7	98.7[3]	98.0
MLAP1	COOP	Milanville	08/01/1945	Present	99.2	98.6	35.0[4]	43.7
TS717	RAWS	Blue Mountain Lakes	12/11/2007	Present	80.8	-	83.2	64.8
LOLP1	RAWS	Loch Lomond	01/01/2005	Present	100.0	100.0	88.9	88.9

[1] Hawley 1 E did not start reporting temperature until 08/02/1962. The percentage time of reporting temperature is based upon this por.

[2] Rock Hill 3 SW did not start reporting temperature until 07/01/1962. The percentage of time reporting temperature is based upon this por.

[3] Pleasant Mount 1 W did not start reporting temperature until 12/01/1951.The percentage of time reporting temperature is based upon this por.

[4] Milanville did not start reporting temperature until 06/20/1963. The percentage of time reporting temperature is based upon this por.

Temperature Summary

Calendar year 2014 averaged well below the long-term mean temperature (Tables 2 -4). Maximum temperatures departed as much as -1.6 degrees Fahrenheit (°F) -0.9 degrees Celsius [°C]) for the year (Table 2) and minimum temperature readings averaged as much as -1.9 degrees Fahrenheit (°F) -1.1 degrees Celsius [°C]) (Table 2). Only three months in 2014 featured all the reporting stations with near or warmer than normal average temperatures. January, February, March and November had below-average temperature departures at all sites (Table 4). For the entire contiguous United States, 2014 was the 34th warmest in the past 120 years, however the northeast climate region of the nation had its 51st mildest year (60 is exactly normal).

January 2014 averaged below normal temperatures and February continued the downward trend with well below normal temperatures (Figures 2 and 3), but by far, March brought the largest monthly negative departures for the winter (and year) and this allowed the winter months to rank between 20-26th coldest in 120 years (Table 5). The mean temperature departures in January ranged from 4.9°F (2.5°C) at Hawley, PA to 5.8°F (2.3°C) in Port Jervis, NY (Table 4). A cold episode brought morning readings well below 0°F (-17.8°C) during late January and February, with the lowest values in many sections occurring on February 12 with minima near -10°F (-23.3°C) (Table 2). The number of sub-zero days at Pleasant Mount tallied 32 compared with the normal of 12 (Table 2).

The spring was warmer than normal in the region, with climate division rankings of 20-26th warmest in the past 120 years (Table 5). The first significant heat spell occurred from May 27-28th when readings rose to 86°F (+30°C). Most sections had their last freeze and frost around April 29th, though some spots noted frost on May 8th which contributed to a growing season length which was about a week longer than average at Port Jervis, NY (substituted for Matamoras) (Table 2). Temperatures during May and June averaged above normal at all sites, except for Rock Hill, NY (Table 4).

The summer season started with very warm conditions, with virtually all stations averaging above normal in June (Table 4). With the exception of Sussex Airport during August, -0.1°F; -0.1°C), all stations averaged below normal during August and above normal during September. July tallied the more negative anomalies than positive departures (Table 4). Despite this season varying from the 32nd warmest to 50th coldest in 120 years (Table 5), the annual maxima were set on July 3-4.

Autumn temperatures started above average (Tables 3 and 4; Figures 2 and 3). Frosts and freezes occurred near the long-term average date, with most sections noticing sub-freezing readings (<0°C) on October 20. November was the only autumn month with all stations averaging below seasonal levels. Temperatures during December were well above seasonal levels, with readings as much as 4.4°F (2.4°C) above normal at Stroudsburg (Table 4). Overall, the annual average temperature for 2014 averaged substantially below normal (Table 2) with values of -1.6°F (-0.9°C).

The maps in Figures 2 and 3 were created using estimates from the Parameter-elevation Regressions on Independent Slopes Model (PRISM). PRISM uses an interpolation scheme for temperature between actual observations and corrects these estimates for changes in topography across the region (Daly et al. 2002). More information can be found at http://www.prism.oregonstate.edu/.

Table 1. Status of 2014 temperature indicators compared to the 30-year normal (1981–2010) and the station period of record at the Port Jervis (PJRN6) and Pleasant Mount 1 W (PLEP1) stations.

Temperature Indicator	Port Jervis, NY 2014	Port Jervis, NY 1981–2010	Port Jervis, NY 1893-2013 Mean (1 SD)	Pleasant Mount 1 W, PA 2014	Pleasant Mount 1 W, PA 1981-2010	Pleasant Mount 1 W, PA 1952-2013 Mean (1 SD)
Average Annual Temperature	46.9°F 8.3°C	48.6°F 9.2°C	49.5 (48.2 – 50.7) °F 9.7 (9.0 – 10.4) °C	42.4°F 5.8°C	43.9°F 6.6°C	43.3 (41.9 – 44.8) °F 6.3 (5.5 – 7.1) °C
Average Annual Maximum Temperature	58.0°F 14.4°C	59.9°F 15.5°C	NA	52.3°F 11.3°C	53.6°F 12.0°C	NA
Maximum Temperature	93.0°F 33.9°C	95.2°F 35.1°C	96.6 (93.4 – 99.7) °F 35.9 (34.1 – 37.6) °C	84.0°F 28.9°C	88.3°F 31.3°C	88.4 (85.7 – 90.9) °F 31.3 (30.9 – 32.7) °C
Hot Days (days with Tmax≥90°F/32°C)	2	8	16 (7 – 26)	0	0	1 (0 – 2)
Average Annual Minimum Temperature	35.8°F 2.1°C	37.3°F 2.9°C	NA	32.5°F 0.3°C	34.1°F 1.2°C	NA
Minimum Temperature	-10.0°F -23.3°C	-5.4°F -20.8°C	-7.8 (-14.3 - -1.3) °F -22.1 (-25.7 – -18.5) °C	-15.0°F -26.1°C	-12.0°F -24.4°C	-13.1 (-18.6 - -7.6) °F -25.1 (-28.1 – -22.0) °C
Cold Days (days with Tmax≤32°F/0°F)	56	31	NA	82	61	NA
Sub-freezing Days (days with Tmin≤32°F/0°C)	158	148	142 (131 – 153)	174	169	173 (160 – 185)
Sub-zero Days (days with Tmin≤0°F/-17.8°C)	24	6	NA	32	12	NA
Growing Season Length (days between last spring Tmin 32°F/0°C and first fall Tmin 32°F/0°C)	173	158	152 (137 – 167)	150	136	129 (112 – 145)

Table 3. Summary of monthly average temperatures for 2014 for the selected stations.

Station name	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Port Jervis	PJRN6	18.8°F	20.4°F	26.9°F	46.5°F	59.2°F	66.7°F	70.9°F	67.5°F	62.5°F	53.6°F	36.3°F	33.2°F	46.9°F
		-7.3°C	-6.4°C	-2.8°C	8.1°C	15.1°C	19.3°C	21.6°C	19.7°C	16.9°C	12.0°C	2.4°C	0.8°C	8.3°C
Hawley 1 E	HAWP1	17.8°F	18.4°F	25.4°F	44.0°F	56.8°F	64.7°F	68.2°F	64.2°F	60.2°F	50.8°F	35.0°F	31.5°F	44.8°F
		-7.9°C	-7.6°C	-3.7°C	6.7°C	13.8°C	18.2°C	20.1°C	17.9°C	15.7°C	10.4°C	1.7°C	-0.3°C	7.1°C
Deposit*	DEPN6	15.9°F	18.0°F	24.1°F	42.4°F	55.0°F	62.7°F	66.2°F	63.2°F	59.2°F	50.0°F	33.7°F	30.2°F	43.4°F
		-8.9°C	-7.8°C	-4.4°C	5.8°C	12.8°C	17.1°C	19.0°C	17.3°C	15.1°C	10.0°C	0.9°C	-1.0°C	6.3
Pleasant Mount 1 W	PLEP1	14.8°F	16.4°F	22.8°F	42.5°F	54.5°F	63.1°F	66.1°F	62.6°F	58.4°F	48.3°F	31.7°F	27.9°F	42.4°F
		-9.6°C	-8.7°C	-5.1°C	5.8°C	12.5°C	17.3°C	18.9°C	17.0°C	14.7°C	9.1°C	-0.2°C	-2.3°C	5.8°C
Milanville	MLAP1	18.1°F	18.6°F	27.2°F	45.8°F	58.6°F	65.9°F	69.8°F	66.0°F	62.1°F	52.6°F	36.4°F	31.7°F	46.1°F
		-7.7°C	-7.4°C	-2.7°C	7.7°C	14.8°C	18.8°C	21.0°C	18.9°C	16.7°C	11.4°C	2.4°C	-0.2°C	7.8°C
Stroudsburg	SDBP1	20.6°F	23.4°F	31.7°F	48.8°F	61.2°F	68.3°F	71.2°F	68.7°F	63.4°F	54.0°F	38.4°F	34.9°F	48.7°F
		-6.3°C	-4.8°C	-0.2°C	9.3°C	16.2°C	20.2°C	21.8°C	20.4°C	17.4°C	12.2°C	3.6°C	1.6°C	9.3°C
Rock Hill 3 SW	RKHN6	M	M	M	M	55.4°F	63.6°F	67.2°F	63.7°F	M	M	34.0°F	M	M
		M	M	M	M	13.0°C	17.6°C	19.6°C	17.6°C	M	M	1.1°C	M	M
Sussex Airport,	KFWN	21.6°F	22.1°F	31.4°F	49.7°F	62.0°F	69.6°F	73.3°F	70.1°F	65.2°F	55.9°F	39.0°F	35.0°F	49.6°F
		-5.8°C	-5.5°C	-0.3°C	9.8°C	16.7°C	20.9°C	22.9°C	21.2°C	18.4°C	13.3°C	3.9°C	1.6°C	9.8°C
Aeroflex-Andover Airport	K12N	M	M	31.3°F	48.3°F	60.3°F	68.5°F	71.7°F	68.8°F	63.9°F	54.3°F	38.7°F	34.9°F	M
		M	M	-0.4°C	9.1°C	15.7°C	20.3°C	22.1°C	20.4°C	17.7°C	12.4°C	3.7°C	1.6°C	M
Blue Mountain Lakes	TS717	24.8°F	M	M	46.9°F	58.9°F	66.9°F	69.1°F	66.6°F	61.8°F	52.3°F	36.7°F	32.2°F	M
		-4.0°C	M	M	8.3°C	15.0°C	19.4°C	20.6°C	19.2°C	16.6°C	11.3°C	2.6°C	0.1°C	M
Loch Lomond	LOLP1	21.9°F	25.0°F	31.1°F	48.0°F	60.1°F	68.0°F	70.1°F	67.8°F	63.0°F	53.7°F	38.3°F	33.8°F	48.4°F
		-5.6°C	-3.9°C	-0.5°C	8.9°C	15.6°C	20.0°C	21.2°C	19.9°C	17.2°C	12.1°C	3.5°C	1.0°C	9.1°C

Table 4. Summary of 2014 departure from normal temperature based on 30-year normal (1981–2010) for the selected stations.

Station name	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Port Jervis	PJRN6	-5.8°F	-7.3°F	-9.2°F	-1.5°F	0.9°F	0.0°F	-0.3°F	-2.0°F	0.8°F	3.6°F	-3.7°F	4.0°F	-1.7°F
		-3.2°C	-4.1°C	-5.1°C	-0.8°C	0.5°C	0.0°C	-0.2°C	-1.1°C	0.4°C	2.0°C	-2.1°C	2.2°C	-0.9°C
Hawley 1 E	HAWP1	-4.9°F	-6.7°F	-8.2°F	-1.2°F	1.2°F	0.3°F	-0.3°F	-2.9°F	0.6°F	2.5°F	-3.7°F	3.4°F	-1.6°F
		-2.7°C	-3.7°C	-4.6°C	-0.7°C	0.7°C	0.2°C	-0.2°C	-1.6°C	0.3°C	1.4°C	-2.1°C	1.9°C	-0.9°C
Deposit*	DEPN6	-4.8°F	-6.0°F	-7.5°F	-1.2°F	1.5°F	0.7°F	0.4°F	-2.0°F	1.0°F	3.1°F	-3.8°F	3.2°F	-1.3°F
		-2.7°C	-3.3°C	-4.2°C	-0.7°C	0.8°C	0.4°C	0.2°C	-1.1°C	0.6°C	1.7°C	-2.1°C	1.8°C	-0.7°C
Pleasant Mount 1 W	PLEP1	-5.1°F	-5.8°F	-7.3°F	0.3°F	1.4°F	1.0°F	0.0°F	-2.2°F	1.4°F	2.3°F	-4.6°F	2.6°F	-1.4°F
		-2.8°C	-3.2°C	-4.1°C	0.2°C	0.8°C	0.6°C	0.0°C	-1.2°C	0.8°C	1.3°C	-2.6°C	1.4°C	-0.8°C
Milanville	MLAP1[1]	M	M	M	M	M	M	M	M	M	M	M	M	M
		M	M	M	M	M	M	M	M	M	M	M	M	M
Stroudsburg	SDBP1	-5.2°F	-5.1°F	-5.3°F	0.0°F	2.5°F	0.6°F	-0.7°F	-1.5°F	1.0°F	3.4°F	-2.0°F	4.4°F	-0.7°F
		-2.9°C	-2.8°C	-2.9°C	0.0°C	1.4°C	0.3°C	-0.4°C	-0.8°C	0.6°C	1.9°C	-1.1°C	2.4°C	-0.4°C
Rock Hill 3 SW	RKHN6	M	M	M	M	-1.5°F	-1.8°F	-1.9°F	-4.5°F	M	M	-4.2°F	M	M
		M	M	M	M	-0.8°C	-1.0°C	-1.1°C	-2.5°C	M	M	-2.3°C	M	M
Sussex Airport	KFWN[1]	-4.6°F	-6.8°F	-6.1°F	1.1°F	3.6°F	2.8°F	2.4°F	0.1°F	3.8°F	5.3°F	-2.1°F	4.1°F	0.3°F
		-2.6°C	-3.8°C	-3.4°C	0.6°C	2.0°C	1.6°C	1.3°C	0.1°C	2.1°C	2.9°C	-1.2°C	2.3°C	0.2°C
Aeroflex-Andover Airport	K12N[1]	M	M	-6.6°F	-1.4°F	1.1°F	0.8°F	-0.6°F	-1.9°F	0.9°F	2.5°F	-3.2°F	3.0°F	M
		M	M	-3.7°C	-0.8°C	0.6°C	0.4°C	-0.3°C	-1.1°C	0.5°C	1.4°C	-1.8°C	1.7°C	M

[1]Indicates a station's Period of Record is ten or more years but less than 30 years. In these cases, the departure from normal values were calculated with normals derived from data spanning the length of the station's period of record. Stations with a Period of Record of less than 10 years were not included in this table.

* indicates estimated value based on less than 12 months of data (usually 11)

M = missing data (Monthly statistics are reported as' M' if greater than 4 days of data are missing).

*Deposit data is substituted with data from Walton 2 (WALN6)

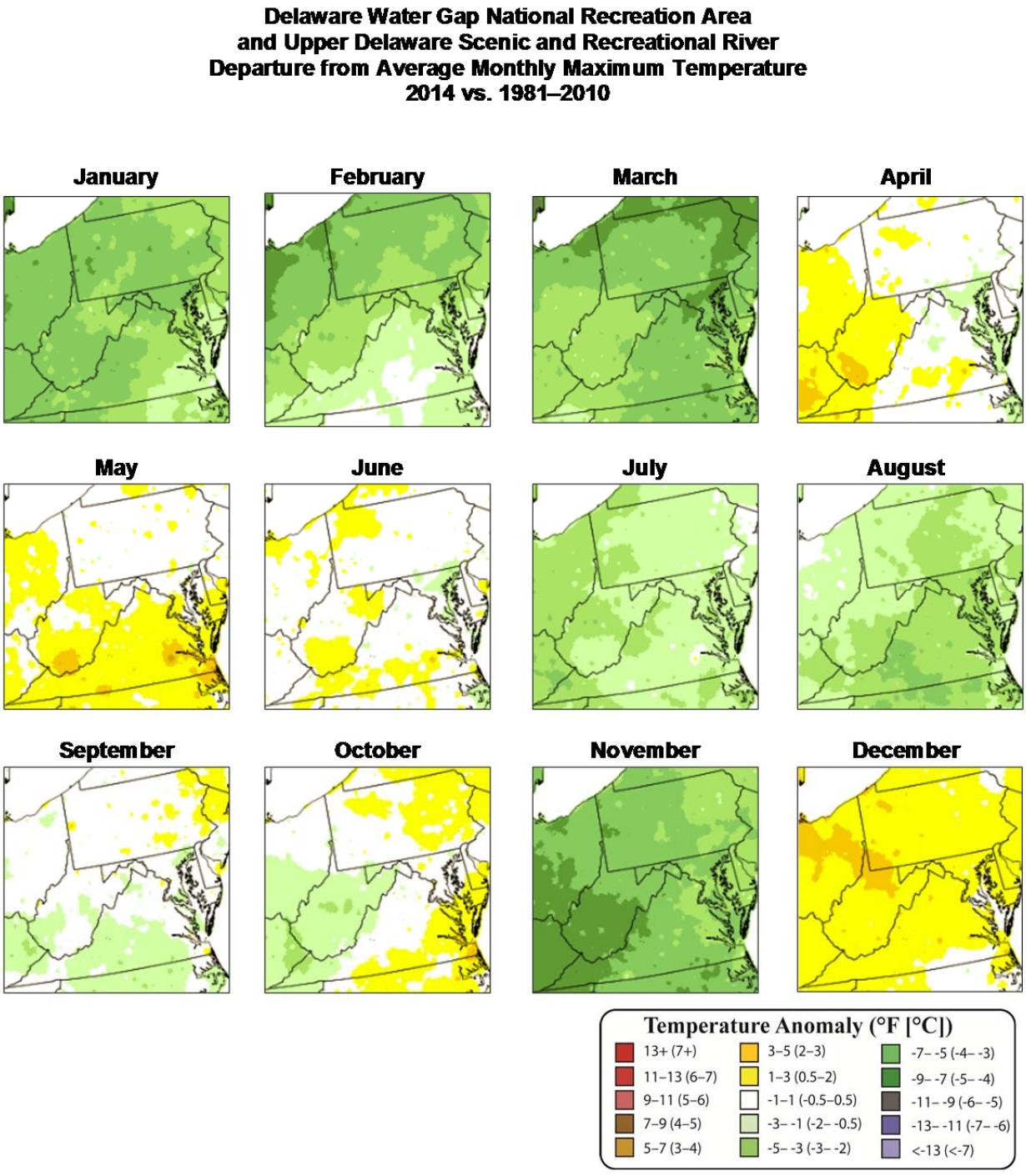

Figure 2. Maps showing departure from average monthly maximum temperature compared to the 30-year normal (1981–2010).

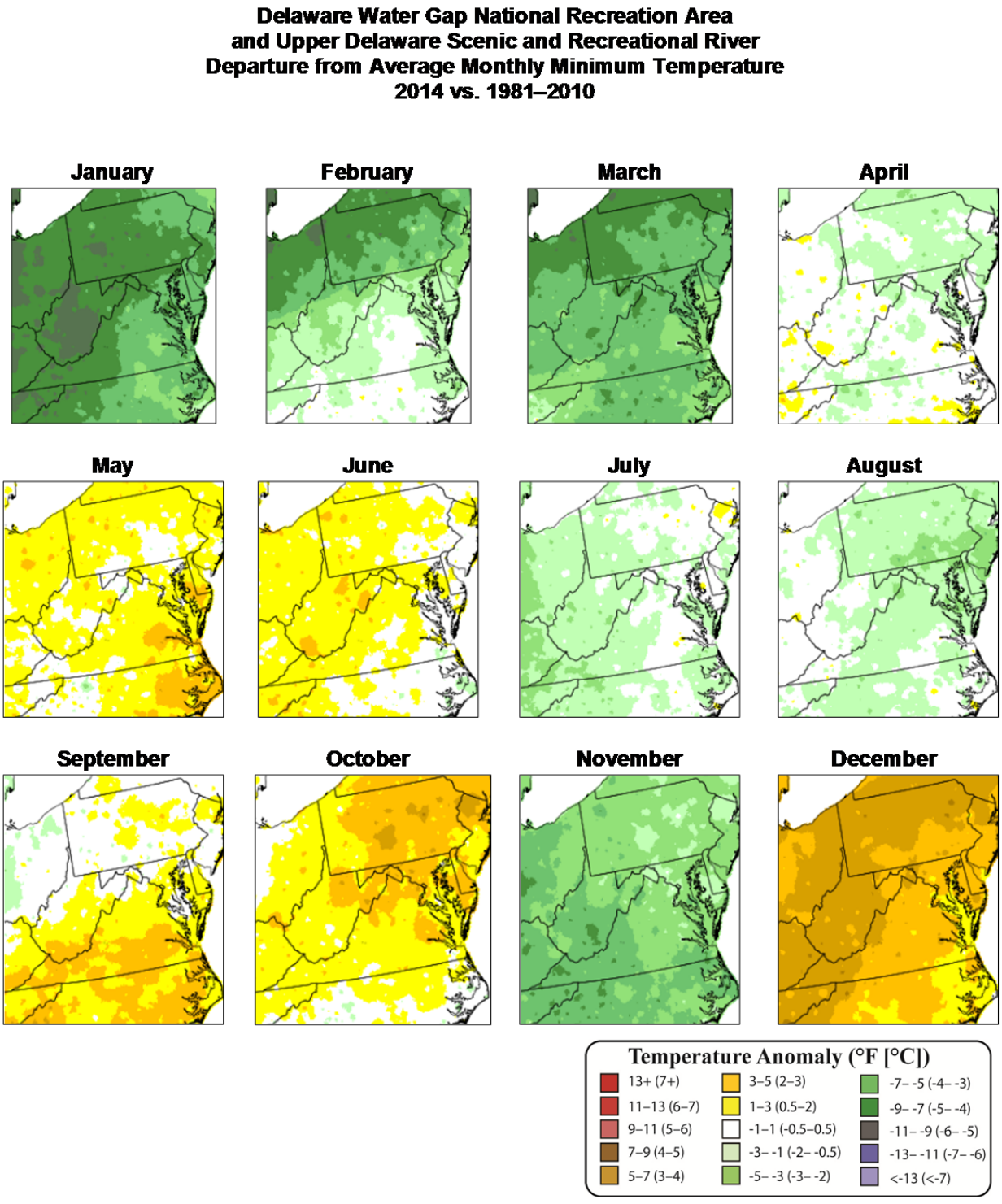

Figure 3. Maps showing departure from average monthly minimum temperature compared to the 30-year normal (1981–2010).

Table 5. Seasonal and annual temperature and precipitation rankings for 2014 over 120 years (1 = warmest/wettest year and 120 = coldest/driest year) for Pennsylvania Climate Division 1 (top), New Jersey Climate Division 1 (middle), and New York Climate Division 2 (bottom). T = Tie.

PA Climate Division 1 Rankings "Pocono Mountains"	**Jan–Feb–Mar WINTER**	**Apr–May–Jun SPRING**	**Jul–Aug–Sep SUMMER**	**Oct–Nov–Dec AUTUMN**	**Jan – Dec ANNUAL**
Temperature-2014	T113	T24	T50	T21	T73
Precipitation-2014	51	49	96	58	79
NJ Climate Division 1 Rankings "Northern NJ"	**Jan–Feb–Mar WINTER**	**Apr–May–Jun SPRING**	**Jul–Aug–Sep SUMMER**	**Oct–Nov–Dec AUTUMN**	**Jan – Dec ANNUAL**
Temperature-2014	T107	T20	T32	T16	T44
Precipitation-2014	41	28	103	42	59
NY Climate Division 2 Rankings "Eastern Plateau"	**Jan–Feb–Mar WINTER**	**Apr–May–Jun SPRING**	**Jul–Aug–Sep SUMMER**	**Oct–Nov–Dec AUTUMN**	**Jan – Dec ANNUAL**
Temperature-2014	113	T26	T70	26	T77
Precipitation-2014	T58	29	79	36	44

Precipitation Summary

The trend toward lower than average annual precipitation (rain and melted snow, ice, sleet, etc.; hereafter precipitation) continued for calendar year 2014 (Table 6) in part due to having one of the drier summers in recent decades (Table 5). As should be expected, all five of the wettest days occurred during the warmer half of the year [between April and October] (Table 7). The highest accumulated liquid occurred in mid-October (Table 8). Only the months of February, May, July and October averaged above-normal precipitation at the majority of stations in the region (Figure 4; Table 9). Dry spells were noted in February (once), May (once), July (once) and October (thrice), which is typical for an average year (Table 7). Snowfall was above normal, due, in large part, to a very cold winter. The number of days with excessive rainfall (>1.0 in [25 mm]) was near to the long-term average for northeastern Pennsylvania (Table 6).

The year began with below-normal precipitation during January and March (Figure 4), however, February was rather moist. The first three months of 2014 were ranked close to normal with the Eastern Plateau region tied for 58th place and 60 is normal in 120 years of record keeping (Table 5). Essentially, all stations reported above-average precipitation (rain and snow) during the month of February with the only near normal (96 percent) tallied at Deposit, NY, in February (Table 9).

Spring 2014 (April–May–June) was wetter, but only one month (May) had the majority of stations with 100 percent or more of normal rainfall (Table 9). This three month period ranked from the 28th to 49th wettest in 120 years for the three climate divisions encompassing the parks (Table 5). Three of the wettest days (May 17, June 13 and 14), and only one of the longer dry spells occurred during this season (Table 7).

The summer had sporadic rainfall with generally well-above-average precipitation in July and in some places in August, but by September, the stations tallied only about 37 percent of normal (Table 9). September was particularly dry with one long dry spell (Sept 23-Oct 3) (Table 7). There were no direct effects of any hurricanes or tropical storms during this period.

Bucking the trend for the last decade, the autumn was generally drier than normal, with total precipitation ranging from 9.0–13.1 in (229–333mm) (Table 6). October was the wettest of the fall months, as stations tallied 76-162 percent of normal rainfall (Table 9). Pleasant Mount, PA, measured 7.40 in (187 mm), for the maximum accumulation (Table 8). November was dry, with the majority of the stations averaging less than 75 percent of the normal rainfall, but this was not as dry as September (Table 9). Precipitation during the last three months of 2014 ranked between 36th wettest and 62nd driest for the climate divisions surrounding the parks. Snowfall during the year tallied 56.7-60.0 in (144-152cm) which was above average.

Overall, 2014 had between 86-103 percent of the normal precipitation (Tables 6 and 9) and this was very similar to the previous two years.

Table 2. Status of 2014 precipitation indicators compared to the 30-year normal (1981–2010) and the station period of record at the Port Jervis (PJRN6) and Pleasant Mount 1 W (PLEP1) stations.

Precipitation Indicator	Port Jervis, NY 2014	Port Jervis, NY 1981–2010	Port Jervis, NY 1893-2013 Mean (min – max)	Pleasant Mount 1 W, PA 2014	Pleasant Mount 1 W, PA 1981-2010	Pleasant Mount 1 W, PA 1923-2013 Mean (min – max)
Annual Precipitation	39.7 in 1,008 mm	46.4 in 1,179 mm	43.5 (26.9 – 71.8) in 1,105 (683 – 1,824) mm	43.3 in 1,100 mm	49.5 in 1,257 mm	48.3 (34.2 – 72.2) in 1,227 (869 – 1,834) mm
Autumn (Oct, Nov, Dec) Precipitation	9.0 in 229 mm	11.8 in 300 mm	10.2 (3.4 – 18.1) in 259 (86 – 460) mm	13.1 in 333 mm	12.7 in 323 mm	11.9 (5.0 – 20.3) in 302 (127 – 516) mm
Heavy Precipitation Days (days with ≥1.0 in [25 mm] rain)	12	11	NA	6	11	NA
Extreme Precipitation Days (days with ≥2.0 in [51 mm] rain)	1	2	2 (0 – 9)	2	2	2 (0 – 7)
Micro-drought (strings of 7+ days without rain)	6	8	NA	6	5	NA
Annual Snowfall	56.7 in 118.7 cm	42.5 in 108.0 cm	45.2 (9.3 – 97.1) in 1,148 (236 – 2,466) mm	60.0 in 152.4 cm	68.5 in 174.0 cm	72.2 (27.3 – 128.5) in 1,834 (693 – 3,264) mm
Measurable Snow Days (days with ≥0.1 in [0.3 cm] snow)	20	20	NA	34	28	NA
Moderate Snow Days (days with ≥3.0 in [7.6 cm] snow)	5	5	NA	6	8	NA
Heavy Snow Days (days with ≥5.0 in [12.7 cm] snow)	4	2	NA	4	4	NA

Table 7. Top five wettest days and top five dry spells (consecutive days with a trace or less of liquid precipitation) during 2014 from the Hawley and Pleasant Mount stations.

Wettest Days in 2014	Dry Spells in 2014
Oct. 16: 4.99 in (127 mm)	Feb. 23–Mar. 12
May 17: 2.34 in (59 mm)	Sep. 23–Oct. 3
Jun. 14: 2.12 in (54 mm)	May 26–Jun. 4
Aug. 2: 1.97 in (50 mm)	Oct. 31–Nov. 6
Jun. 13: 1.96 in (50 mm)	Oct. 9–15

Table 8. Summary of 2014 monthly total precipitation for selected stations.

Station name	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Port Jervis	PJRN6	3.3 in	3.3 in	2.3 in	2.2 in	4.7 in	3.9 in	6.5 in	2.6 in	1.9 in	3.4 in	2.6 in	3.1 in	39.7 in
		84 mm	84 mm	58 mm	55 mm	119 mm	100 mm	166 mm	65 mm	49 mm	85 mm	67 mm	78 mm	1009 mm
Equinunk 2 NW	EQNP1	2.9 in	2.7 in	2.3 in	3.0 in	3.4 in	6.2 in	4.6 in	4.9 in	1.9 in	5.2 in	2.6 in	3.1 in	42.6 in
		72 mm	68 mm	59 mm	77 mm	86 mm	156 mm	118 mm	124 mm	47 mm	131 mm	65 mm	78 mm	1082 mm
Hawley 1 E	HAWP1	2.1 in	5.6 in	2.0 in	2.9 in	4.7 in	5.0 in	5.3 in	5.6 in	1.3 in	4.1 in	2.1 in	3.4 in	44.1 in
		53 mm	142 mm	50 mm	72 mm	120 mm	126 mm	135 mm	143 mm	34 mm	105 mm	54 mm	87 mm	1121 mm
Deposit*	DEPN6	2.9 in	2.5 in	2.8 in	3.4 in	5.5 in	5.8 in	5.0 in	1.8 in	2.8 in	6.5 in	3.1 in	3.5 in	45.6 in
		73 mm	64 mm	72 mm	87 mm	141 mm	146 mm	126 mm	46 mm	72 mm	164 mm	78 mm	90 mm	1158 mm
Rock Hill 3 SW	RKHN6	M	M	M	M	5.2 in	3.9 in	4.4 in	1.6 in	M	M	3.1 in	M	M
		M	M	M	M	131 mm	100 mm	113 mm	41 mm	M	M	80 mm	M	M
Pleasant Mount 1 W	PLEP1	3.0 in	3.1 in	2.9 in	3.9 in	5.0 in	4.4 in	4.4 in	2.2 in	1.5 in	7.4 in	2.1 in	3.6 in	43.3 in
		76 mm	79 mm	73 mm	99 mm	127 mm	111 mm	111 mm	55 mm	37 mm	187 mm	53 mm	92 mm	1100 mm
Milanville	MLAP1	2.5 in	3.3 in	1.9 in	2.1 in	5.2 in	4.5 in	5.1 in	3.1 in	0.9 in	5.3 in	1.8 in	3.6 in	39.3 in
		63 mm	85 mm	49 mm	53 mm	133 mm	114 mm	128 mm	78 mm	23 mm	136 mm	46 mm	90 mm	997 mm
Stroudsburg	SDBP1	4.8 in	4.4 in	2.9 in	6.6 in	4.2 in	4.4 in	5.9 in	1.9 in	1.9 in	4.3 in	3.3 in	3.8 in	48.3 in
		123 mm	111 mm	74 mm	167 mm	107 mm	113 mm	149 mm	48 mm	48 mm	109 mm	83 mm	97 mm	1228 mm
Sussex Airport	KFWN	2.4 in	3.1 in	M	M	M	M	5.4 in	2.7 in	1.0 in	2.8 in	2.2 in	2.9 in	M
		62 mm	79 mm	M	M	M	M	138 mm	70 mm	24 mm	71 mm	56 mm	74 mm	M
Aeroflex-Andover Airport	K12N	M	M	3.2 in	6.7 in	3.3 in	3.5 in	4.9 in	2.8 in	0.8 in	3.5 in	3.2 in	3.2 in	M
		M	M	81 mm	171 mm	83 mm	90 mm	124 mm	70 mm	21 mm	88 mm	82 mm	82 mm	M
Blue Mountain Lakes	TS717	M	M	M	M	M	M	M	M	M	M	M	M	M
		M	M	M	M	M	M	M	M	M	M	M	M	M
Loch Lomond	LOLP1	3.4 in	2.8 in	2.4 in	5.3 in	4.1 in	3.0 in	6.6 in	1.1 in	1.2 in	3.6 in	2.9 in	3.2 in	3.3 in
		85 mm	70 mm	60 mm	135 mm	105 mm	76 mm	168 mm	28 mm	31 mm	92 mm	73 mm	81 mm	84 mm

* M = missing data (Monthly statistics are reported as' M' if more than 4 days of data are missing).

*Deposit data is substituted with data from Walton 2 (WALN6)

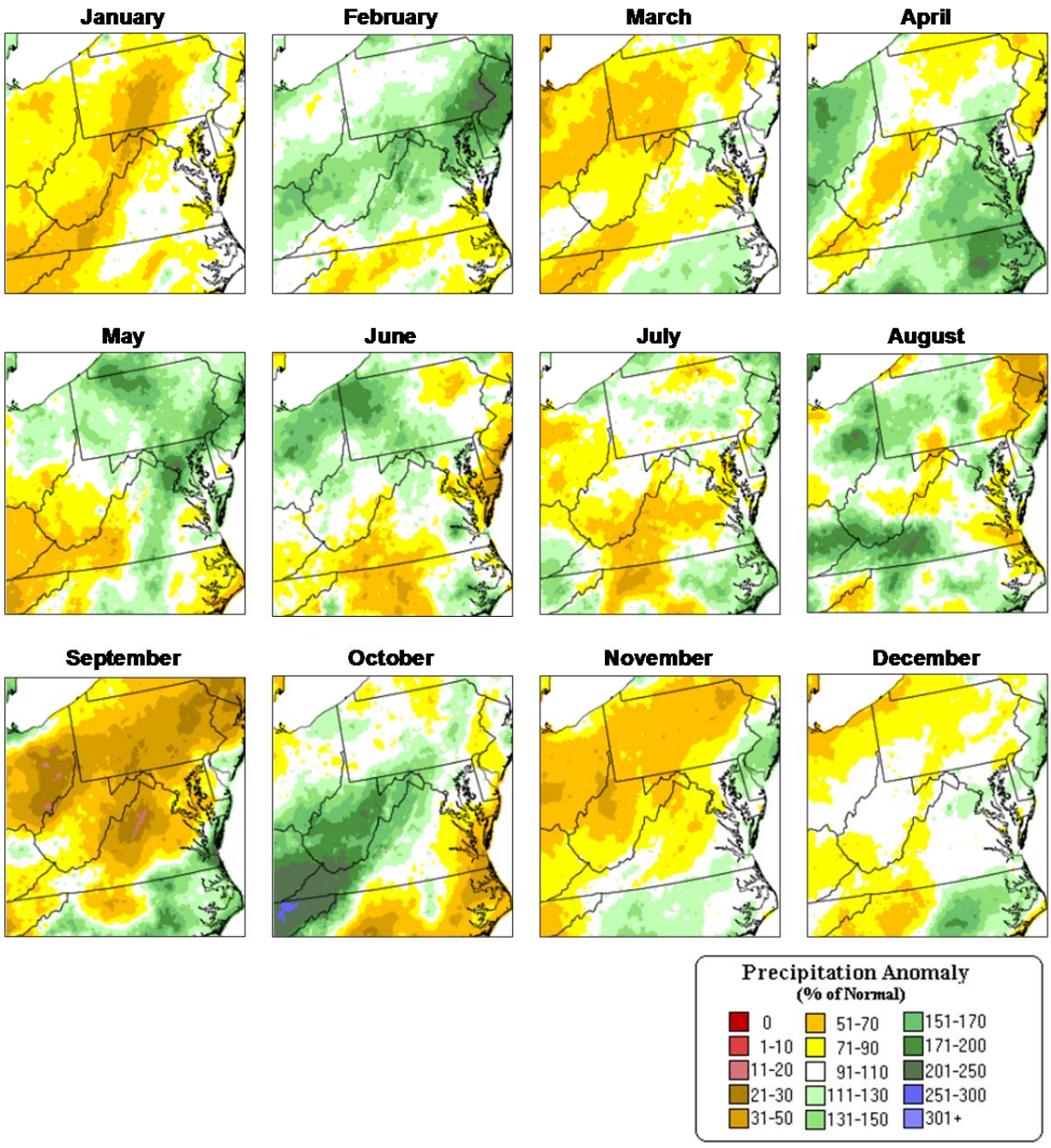

Figure 4. Maps showing percent of average monthly precipitation compared to the 30-year normal (1981–2010).

Table 9. Summary of 2014 percent of normal precipitation based on 30-year normal (1981–2010) for selected stations.

Station name	Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Port Jervis	PJRN6	102	113	63	53	116	90	167	66	43	76	73	81	86
Equinunk 2 NW	EQNP1	91	105	67	85	91	152	119	128	45	131	68	90	98
Hawley 1 E	HAWP1	68	206	64	76	123	111	142	158	33	110	60	104	103
Deposit*	DEPN6	83	96	88	92	140	136	113	45	67	162	81	108	102
Rock Hill 3 SW	RKHN6	M	M	M	M	113	84	105	39	M	M	77	M	M
Pleasant Mount 1 W	PLEP1	93	109	82	98	106	88	95	53	30	156	49	98	88
Milanville	MLAP1[1]	M	M	M	M	M	M	M	M	M	M	M	M	M
Stroudsburg	SDBP1	139	143	76	161	94	92	125	43	38	91	79	93	95
Sussex Airport[1]	KFWN	78	120	M	M	M	M	122	64	24	68	60	87	M
Aeroflex-Andover Airport[1]	K12N	M	M	82	146	79	79	110	78	18	76	93	83	M

[1]Indicates a station's Period of Record is 10 years or more but less than 30 years. In these cases, the departure-from-normal values were calculated with normals derived from data spanning the length of the station's period of record. Stations with a Period of Record of less than 10 years were not included in this table.

M = missing data (Monthly statistics are reported as' M' if more than 4 days of data are missing). *pro-rated for months available

*Deposit data is substituted with data from Walton 2 (WALN6)

Drought Status

There are a number of drought indices used to estimate the severity of drought in an area using algorithms that incorporate recent temperatures, rainfall, soil moisture, and other information (http://www.drought.gov). The main indices we report are the Palmer Drought Severity Index (PDSI) and the United States Drought Monitor (DM) – Drought Intensity Index. While both indices provide excellent summary information on broad-scale conditions, local conditions (such as at the park scale) may vary.

The PDSI is a soil moisture algorithm calibrated for relatively homogeneous regions and is calculated on a monthly basis using precipitation and temperature data, as well as the water content of the soil. The values vary between extremely moist (>4.0) and extreme drought (<-4.0), with "normal" values ranging between -1.9 and 1.9. Monthly PDSI values for Pennsylvania Climate Division 1 in 2014 are shown in Figure 5.

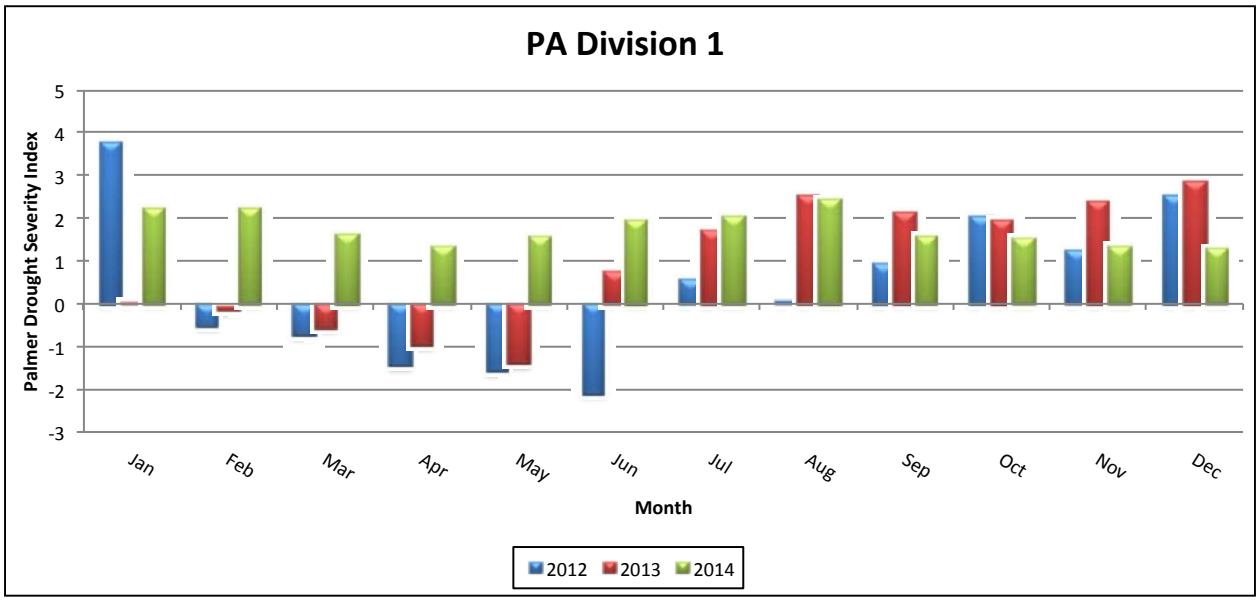

Figure 5. Monthly Palmer Drought Severity Index (PDSI) values for Pennsylvania Climate Division 1, 2012–2014.

The DM – Drought Intensity Index is a synthesis of multiple indices (including the PDSI) and impacts, and represents a consensus of federal and academic scientists (NIDIS 2014). The DM produces a summary map of drought intensity for the nation and all states each week. It is on a scale ranging from abnormally dry (D0) to exceptional drought (D4). Mid-month (i.e., the second or third week) values for Pennsylvania (Figure 6) and the Northeast (Figure 7) are shown for 2014.

According to the PDSI for PA Climate Division 1, every month, except January, February, and August during 2014 were within the normal range. February through June experienced considerably wetter conditions when compared to 2012 and 2013.

The DM – Drought Severity Index for Pennsylvania (Figure 6) and the Northeast (Figure 7) shows normal conditions throughout most of the growing season (May through October); with dry weather noted in September and October across Eastern PA and Northern NJ.

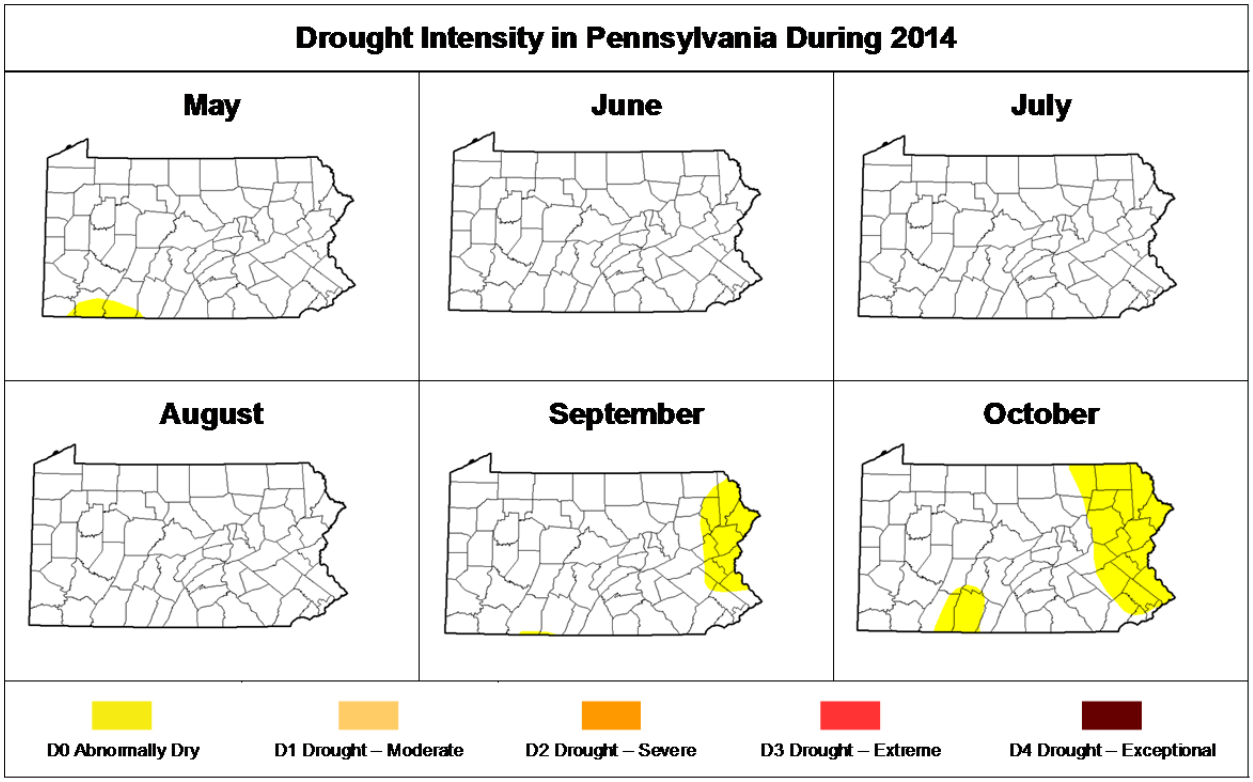

Figure 6. Mid-month values of the United States Drought Monitor (DM) - Drought Intensity Index for Pennsylvania in 2014.

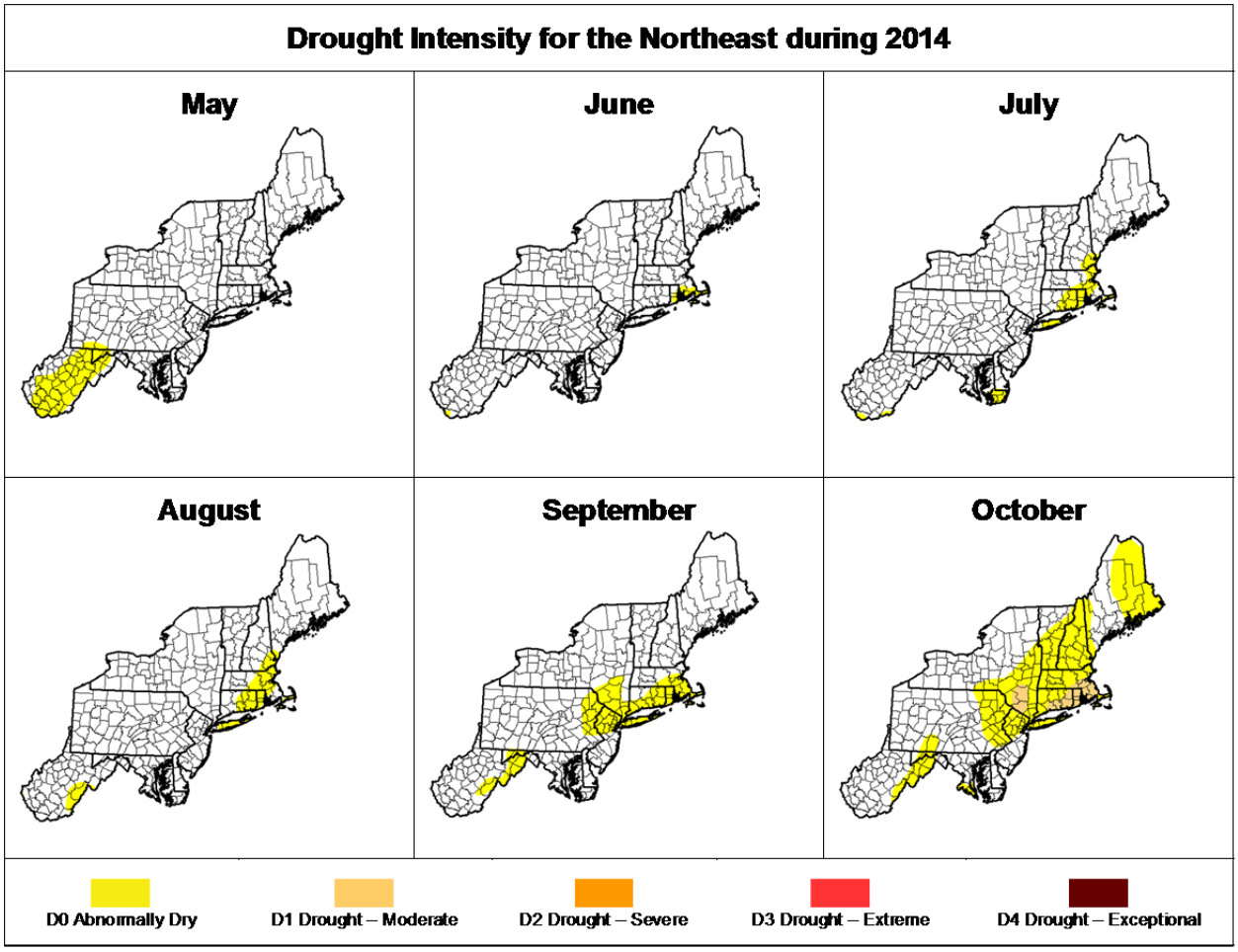

Figure 7. Mid-month values of the United States Drought Monitor (DM) - Drought Intensity Index for the Northeast in 2014.

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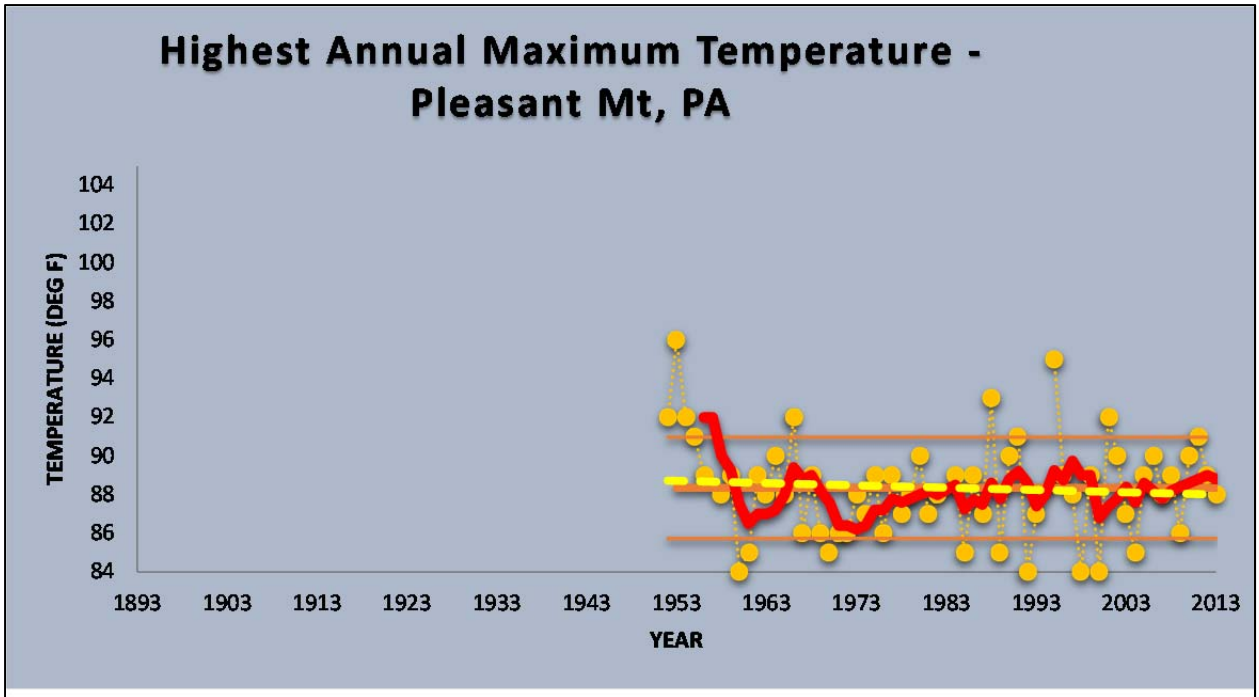
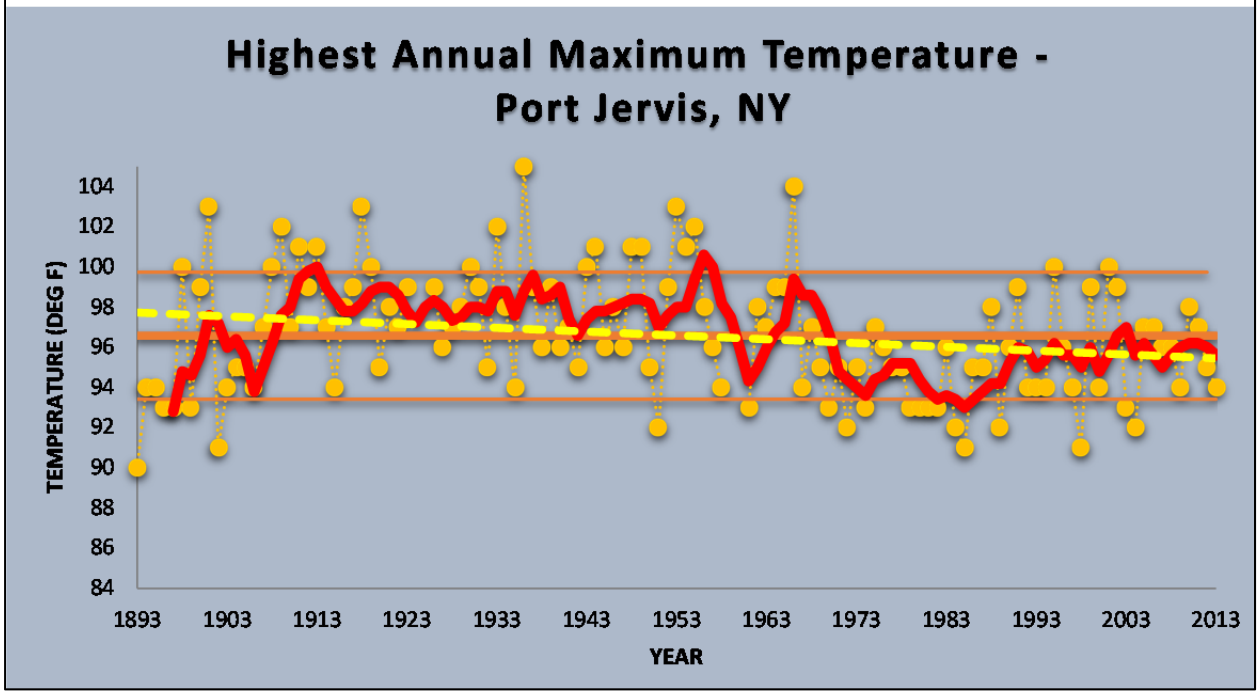
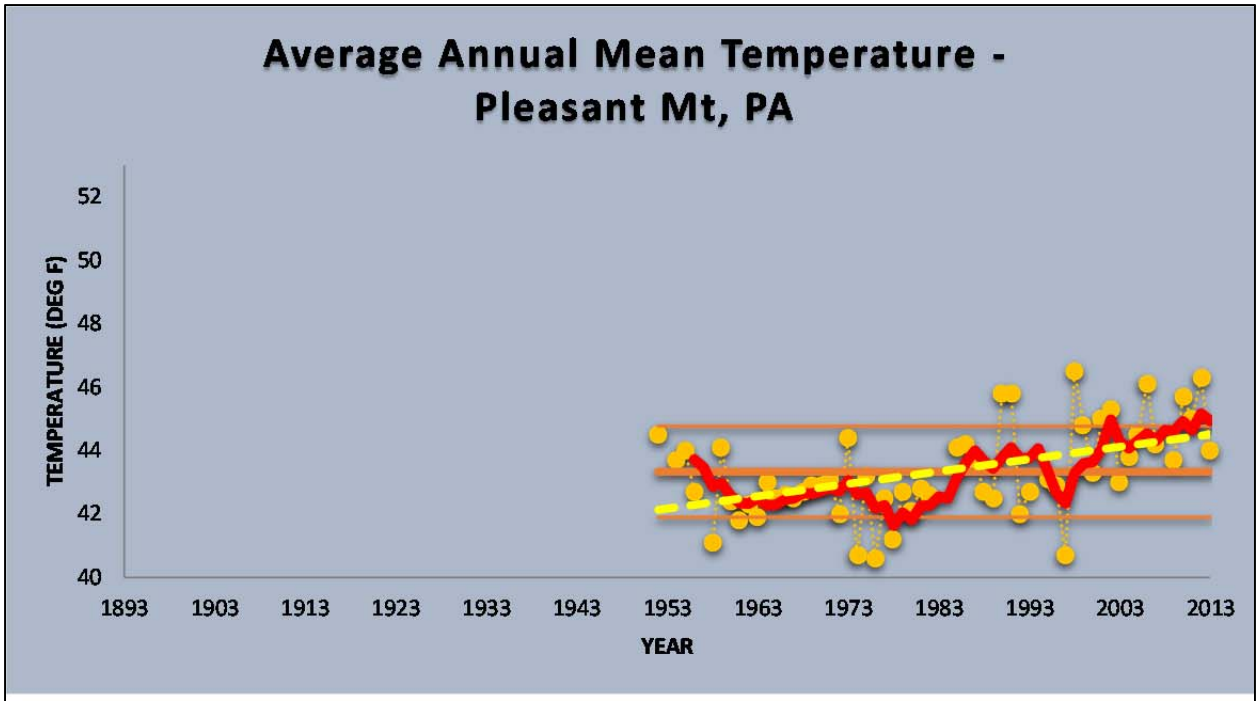
Appendix

Below are graphs illustrating long-term trend analysis for multiple climate indicators. For temperature indicators, yearly values are marked by the dotted orange line, the 5-year moving average is indicated by the thick red line, the long-term linear trend is shown by the dotted yellow line, the long-term mean is marked by the thick orange line, and the first standard deviation above and below the long-term mean are delineated by the solid orange lines. Similarly for precipitation indicators, yearly values are marked by the dotted teal line, the 5-year moving average is indicated by the thick green line, the long-term linear trend is shown by the dotted yellow line, and the long-term mean is delineated by the thick light blue line.

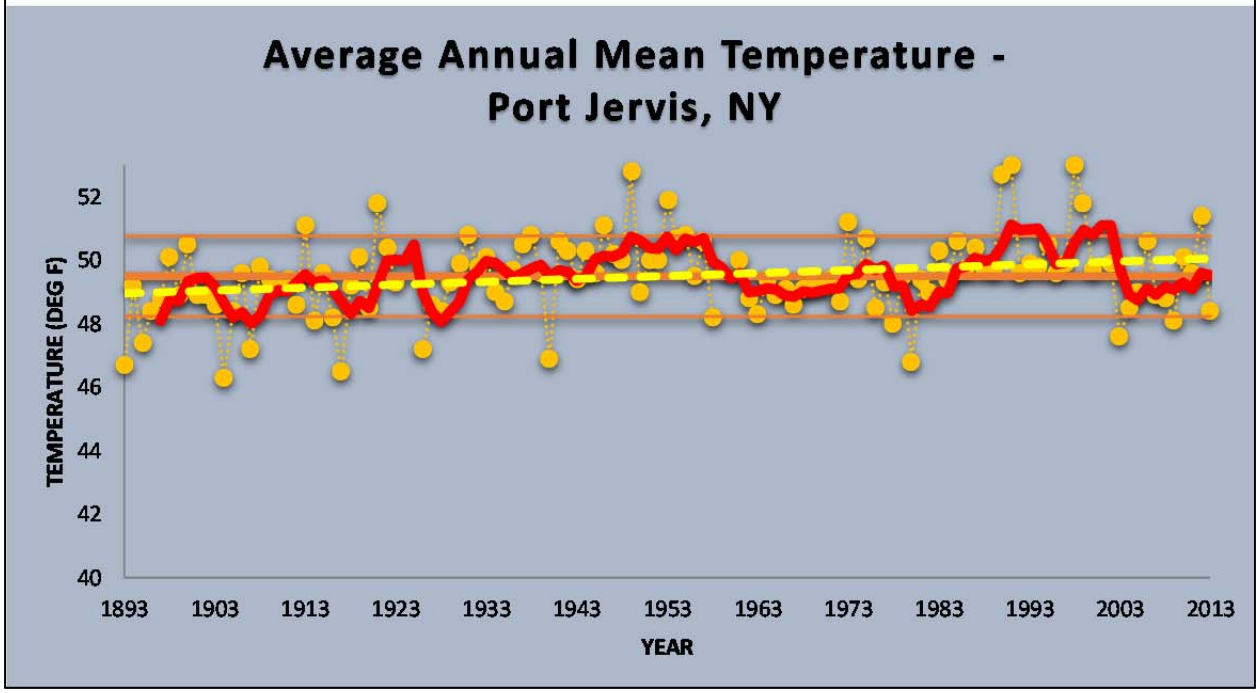


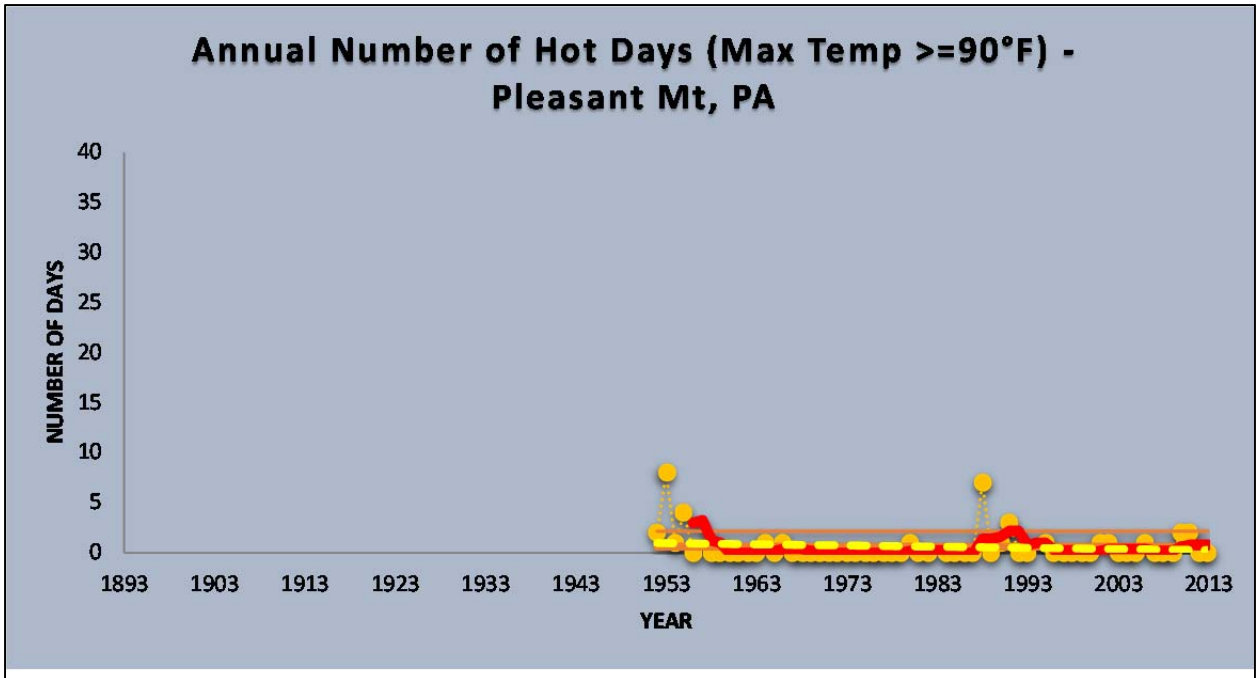
Annual Maximum Trends: The stations are relatively close to each other (only 74 km apart), the trends are the same, slightly downward. The average annual maximum temperature is 96.6°F (1SD ranges from 93.4-99.7°F) at Port Jervis and 88.4°F (1SD ranges from 85.7-90.9°F) at Pleasant Mount (Table 2).



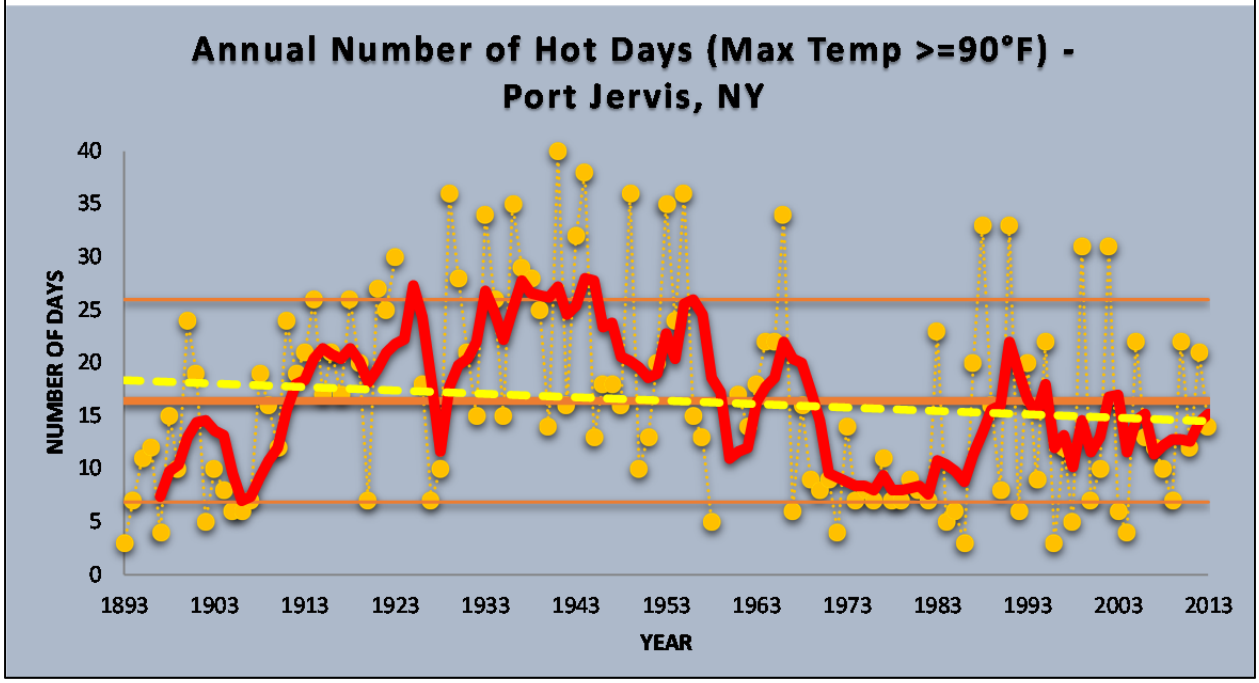


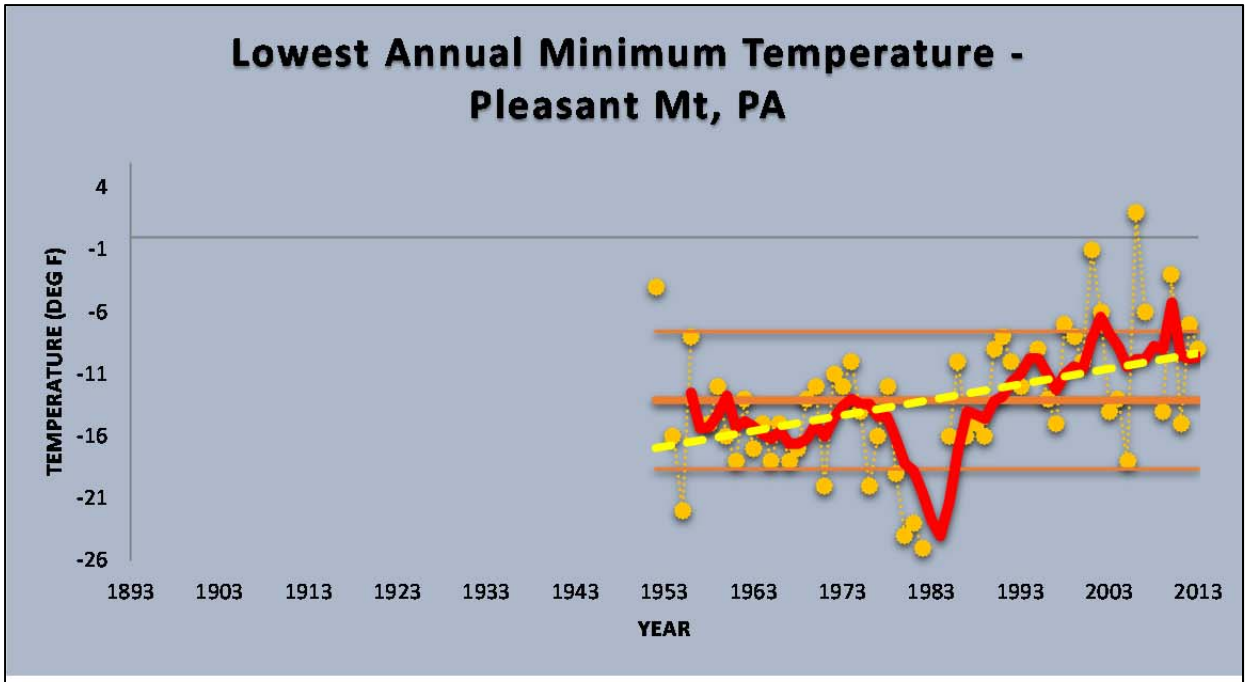
Annual Mean Trends: Both stations exhibit a rise in the average annual temperature with a trend of more than 2°F (1.3°C) at Pleasant Mount in the last 60 years. The average annual mean temperature at Pleasant Mount is 43.3°F (1SD ranges from 41.9-44.8°F) and 49.5°F (1SD ranges from 48.2-50.7°F) at Port Jervis (Table 2).



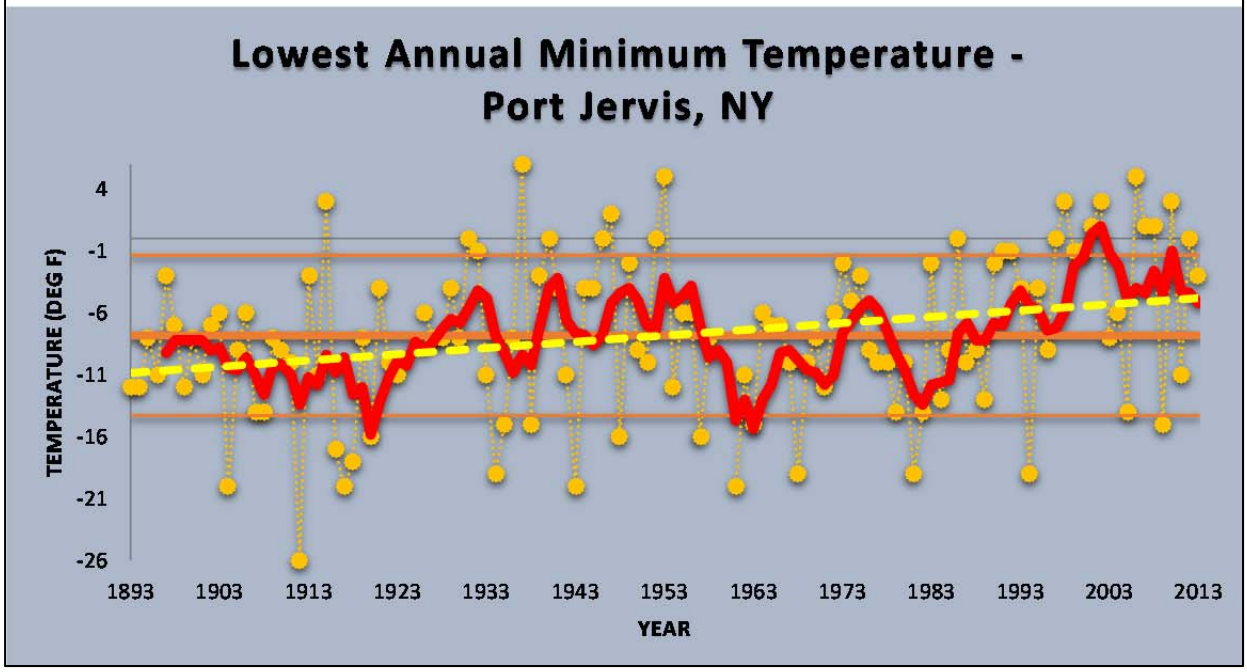


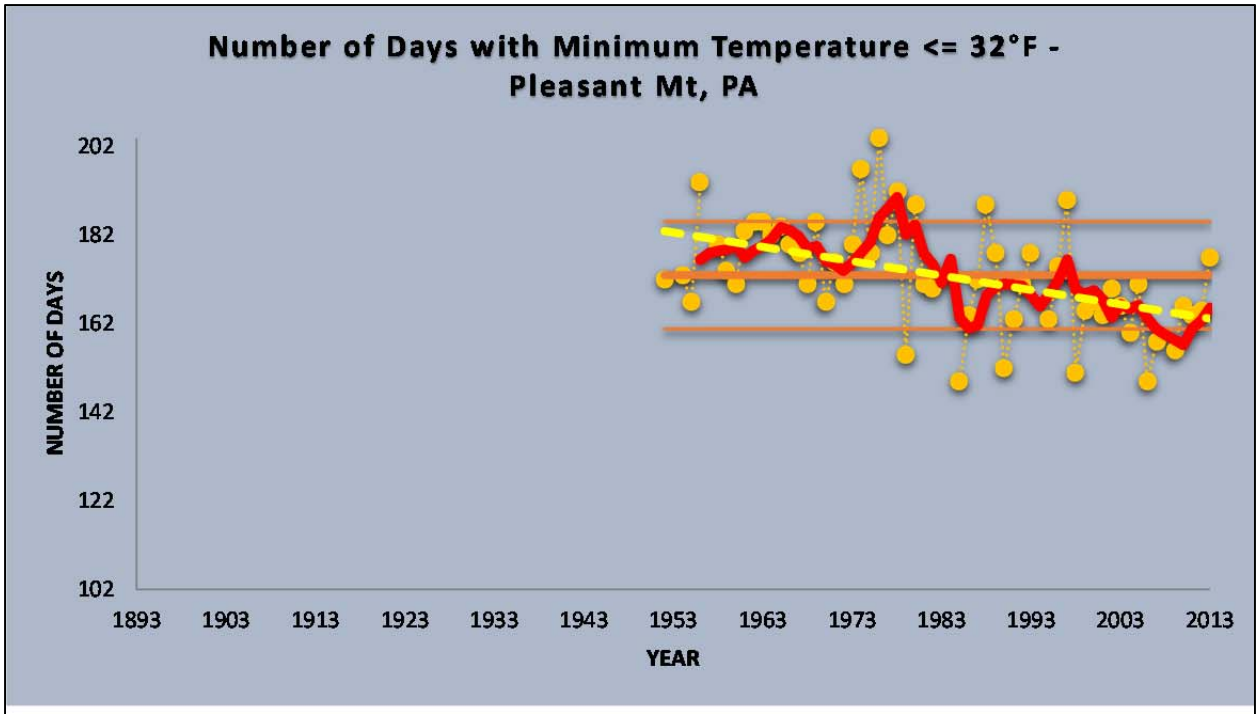
Annual Number of Hot Days: No trend is evident for Pleasant Mount, but a slight decline (~3 days) has been noted at Port Jervis during the past 120 years. The average number of annual hot days is 16 (1SD ranges from 7-26) at Port Jervis and 1 (1SD ranges from 0-2) at Pleasant Mount (Table 2).



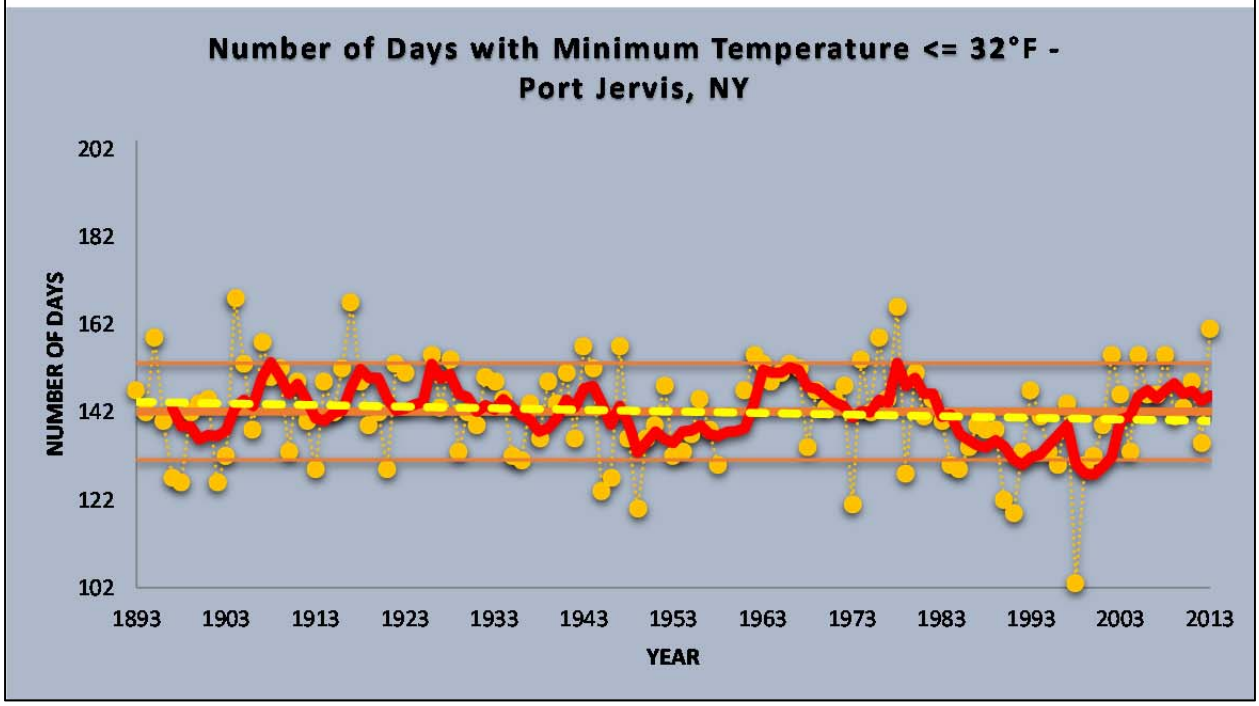


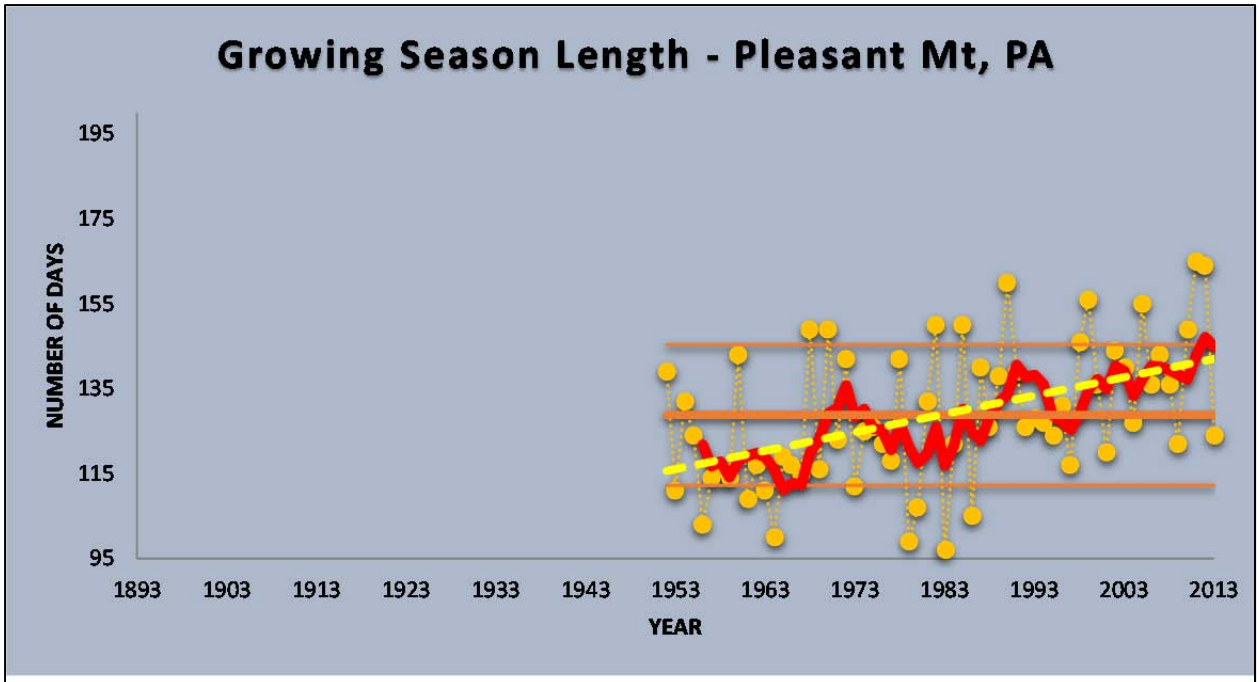
Annual Lowest Minimum Temperature: Both stations exhibit a rise in the annual minimum temperature with a trend of more than 5°F (2.8°F) at Port Jervis in 120 years. The average annual minimum temperature is -13.1°F (1SD ranges from -18.6-(-7.6) °F) at Pleasant Mount and -7.8°F (1SD ranges from -14.3-(-1.3) °F) at Port Jervis (Table 2).



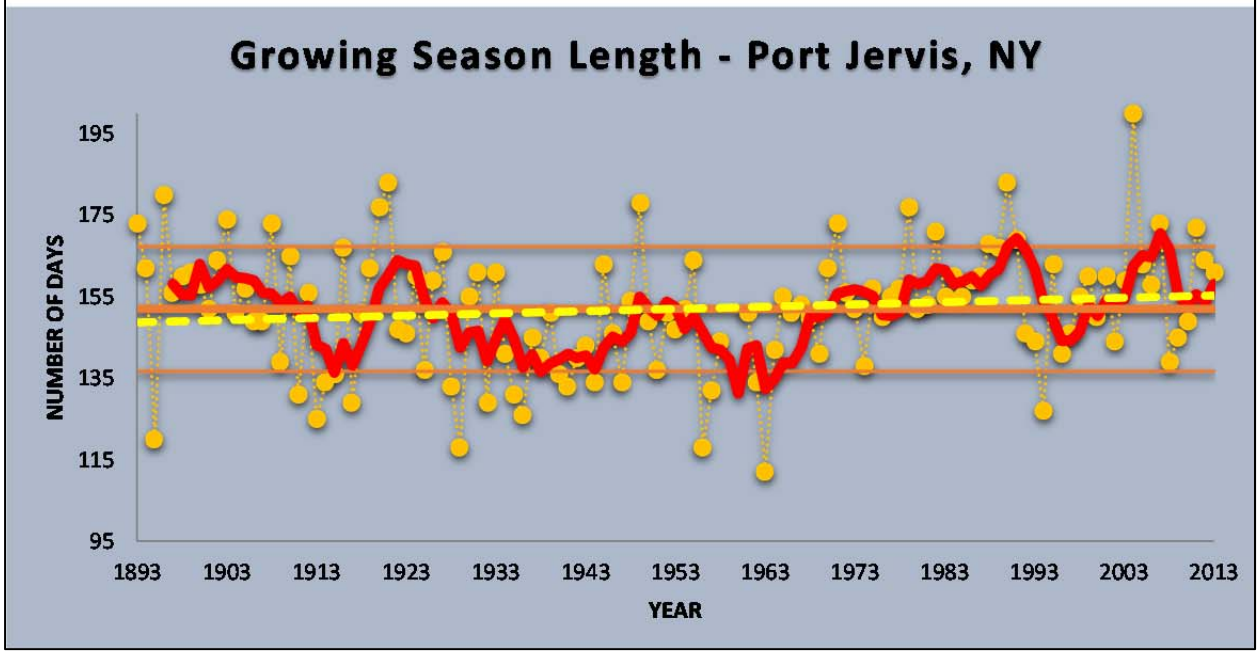


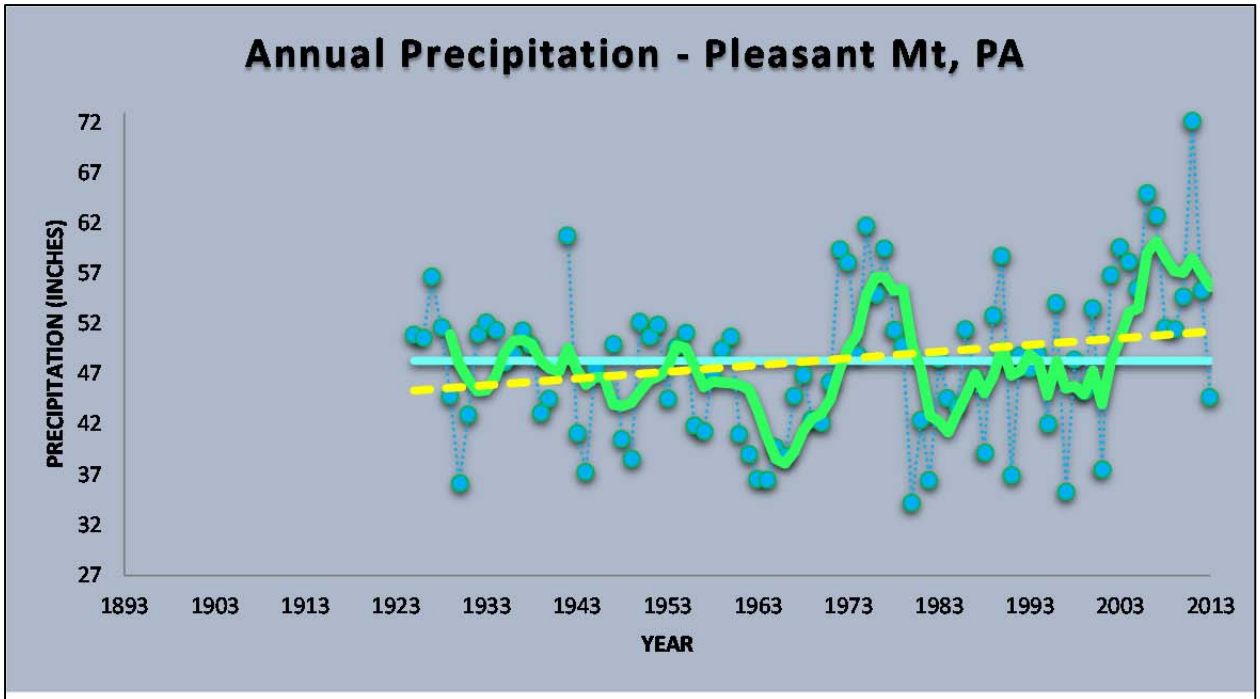
Annual Number of Days with Minimums at or below Freezing: Both stations exhibit a decrease in the annual number of sub-freezing nights. Pleasant Mount shows a decline of 20 nights, while Port Jervis exhibits less than 10 fewer nights. Minimum temperatures are very sensitive to any changes in the local surroundings. The average number of nights is 142 (1SD ranges from 131-153) at Port Jervis and 173 (1SD ranges from 160-185) at Pleasant Mount (Table 2).



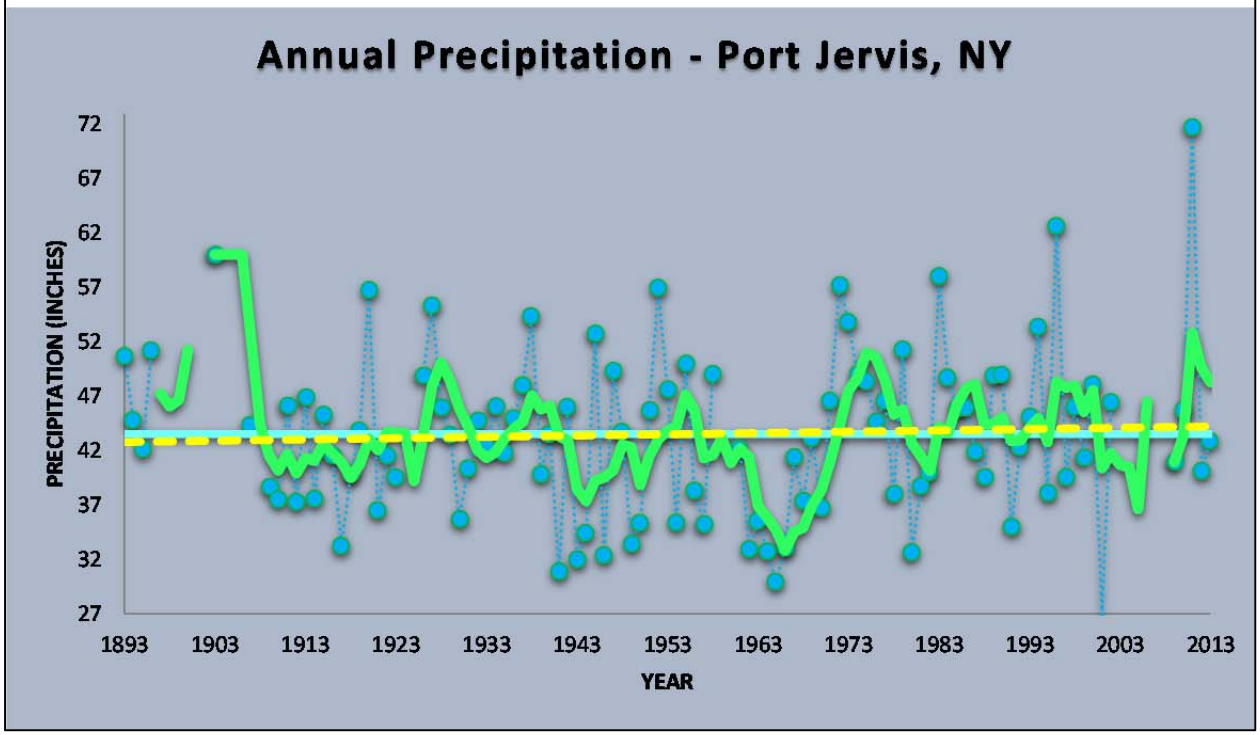


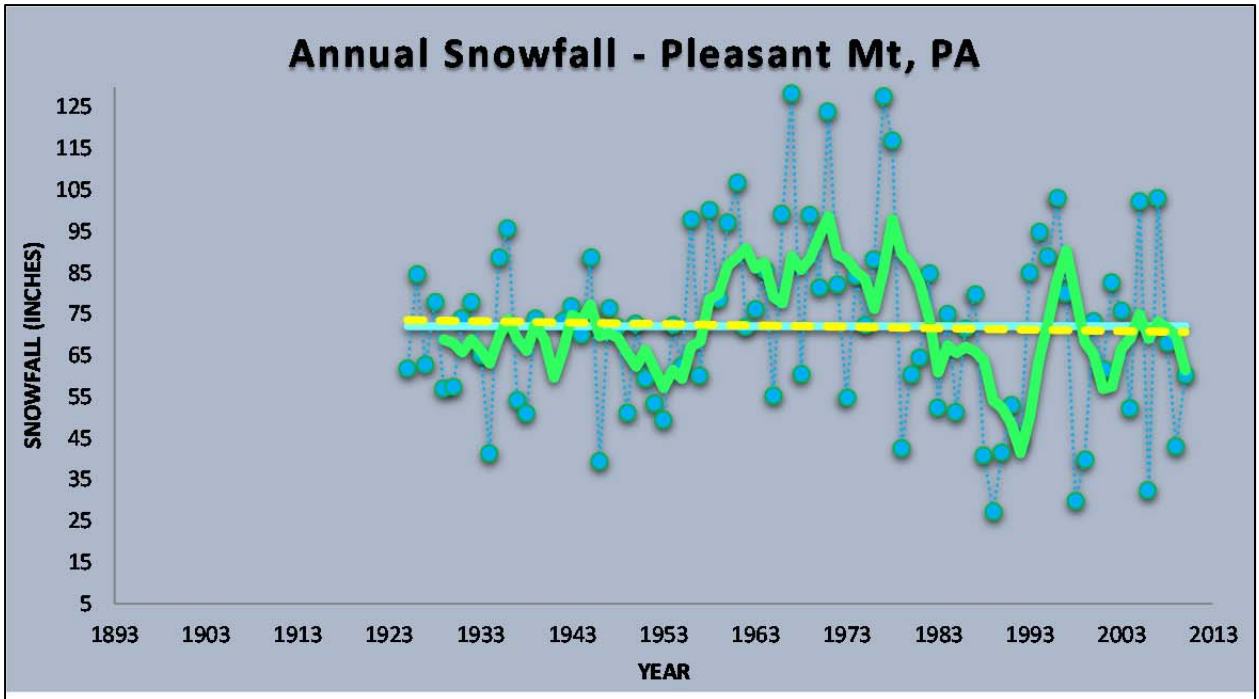
Growing Season Length Trends: Both stations exhibit an increase in the length of the growing season ranging from one to three weeks. The average annual number of days in the growing season is 129 (1SD ranges from 112-145) at Pleasant Mount and 152 (1SD ranges from 137-167) at Port Jervis (Table 2).



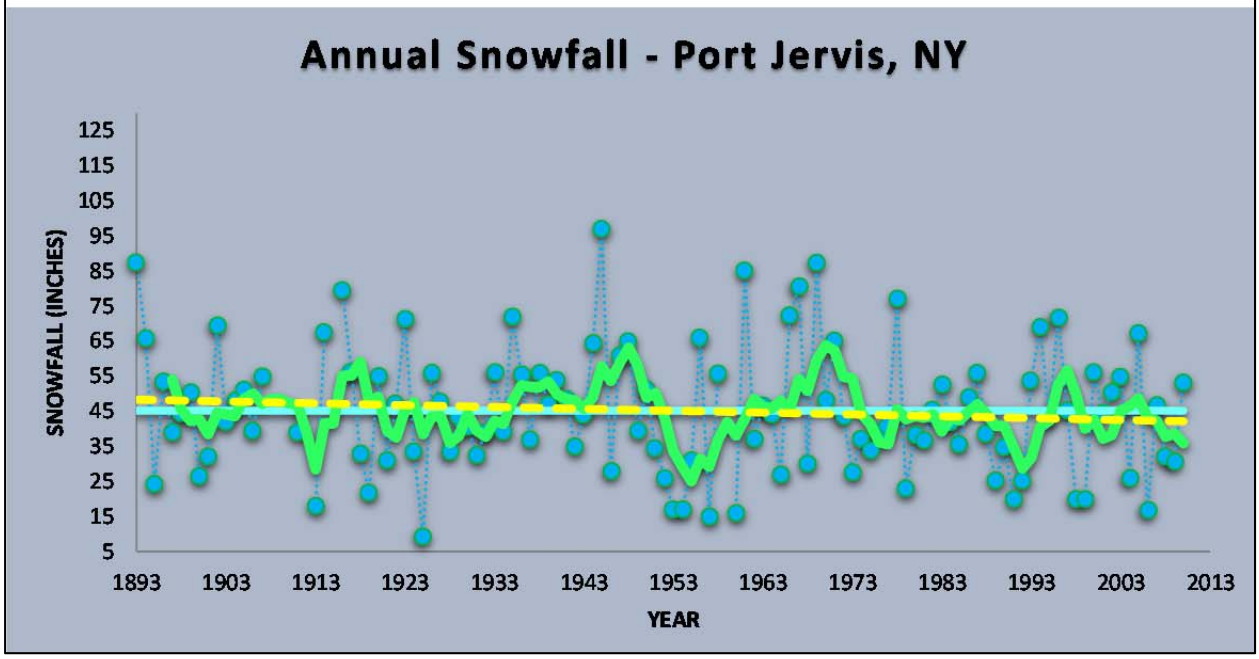


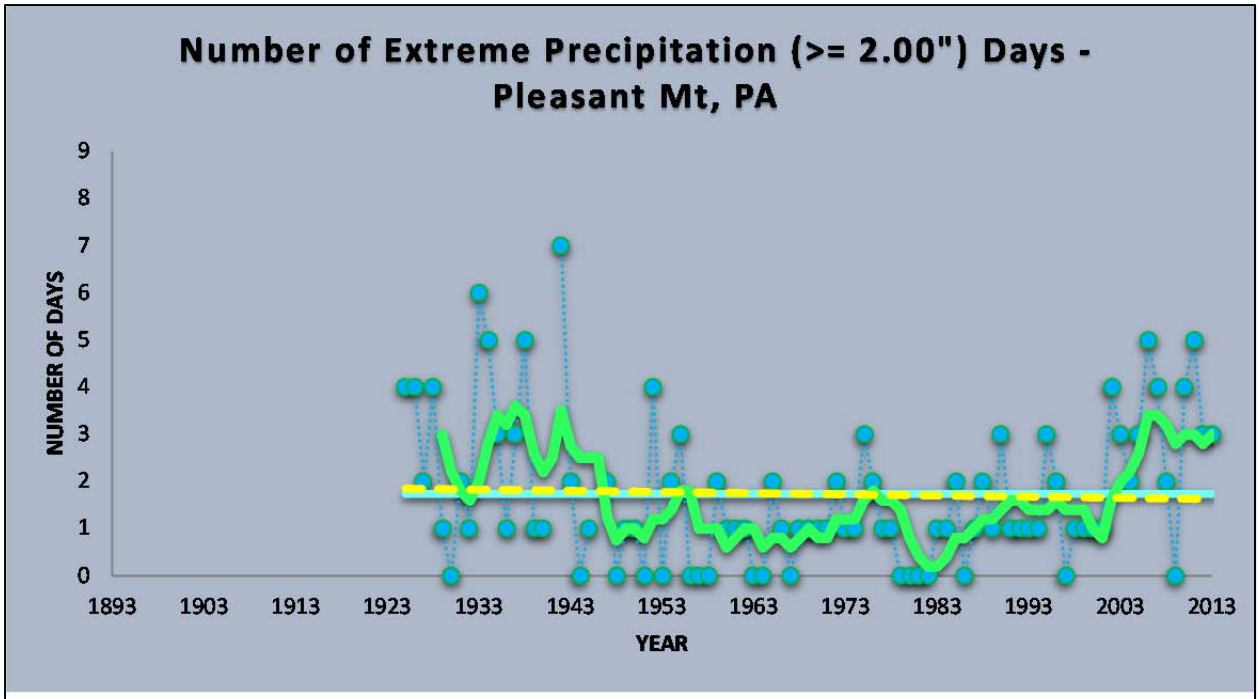
Annual Precipitation Trends: Both stations show a rise of at least 2 in over the POR. The average annual precipitation at Port Jervis is 43.5 in. (min of 26.9 in and max of 71.8 in) and 48.3 in (min of 34.2 in and max of 72.2 in) at Pleasant Mount (Table 6).



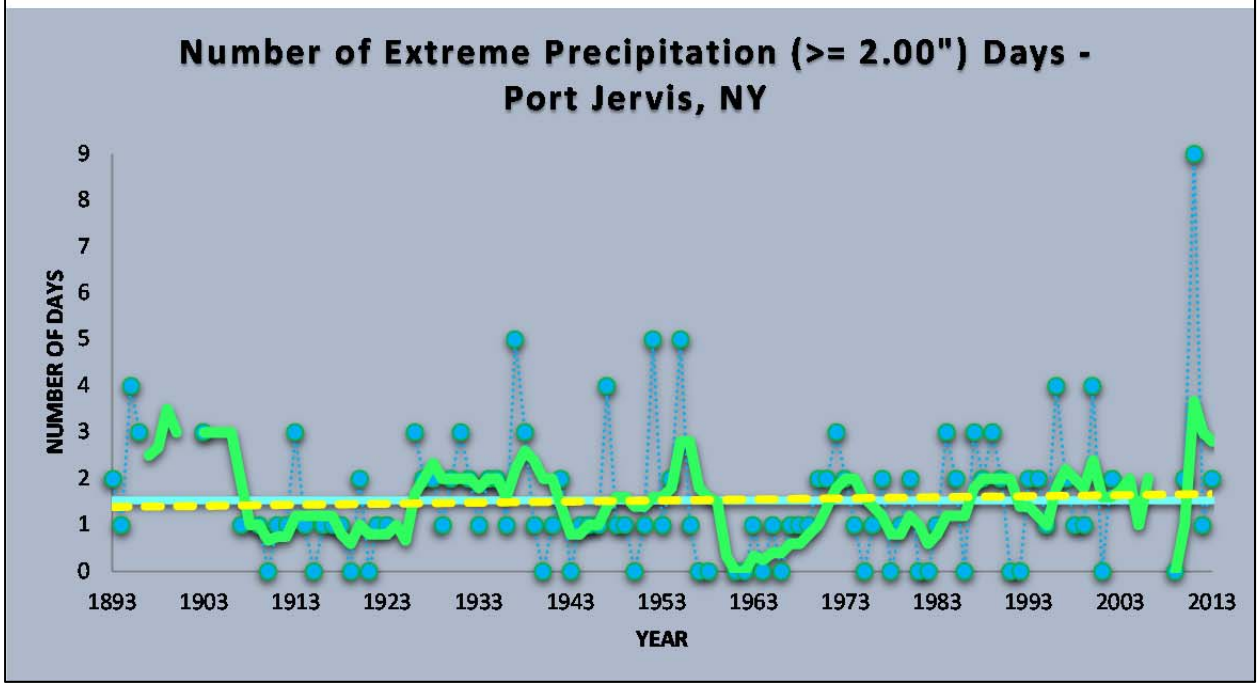


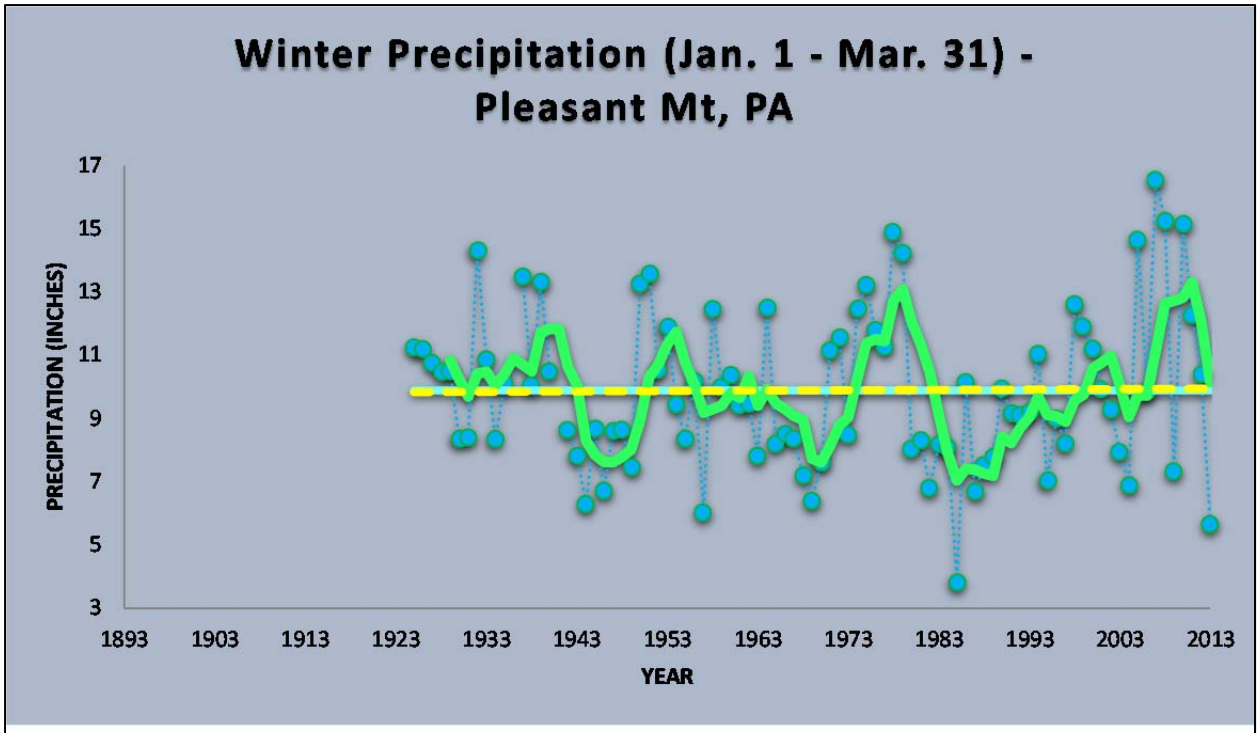
Annual Snowfall Trends: Both show a decline of 5-10 in of snowfall annually. The average annual snowfall amount at Pleasant Mount is 72.2 in. (min of 27.3 in and max of 128.5 in) and 45.2 in (min of 9.3 in and max of 97.1 in) at Port Jervis (Table 6).



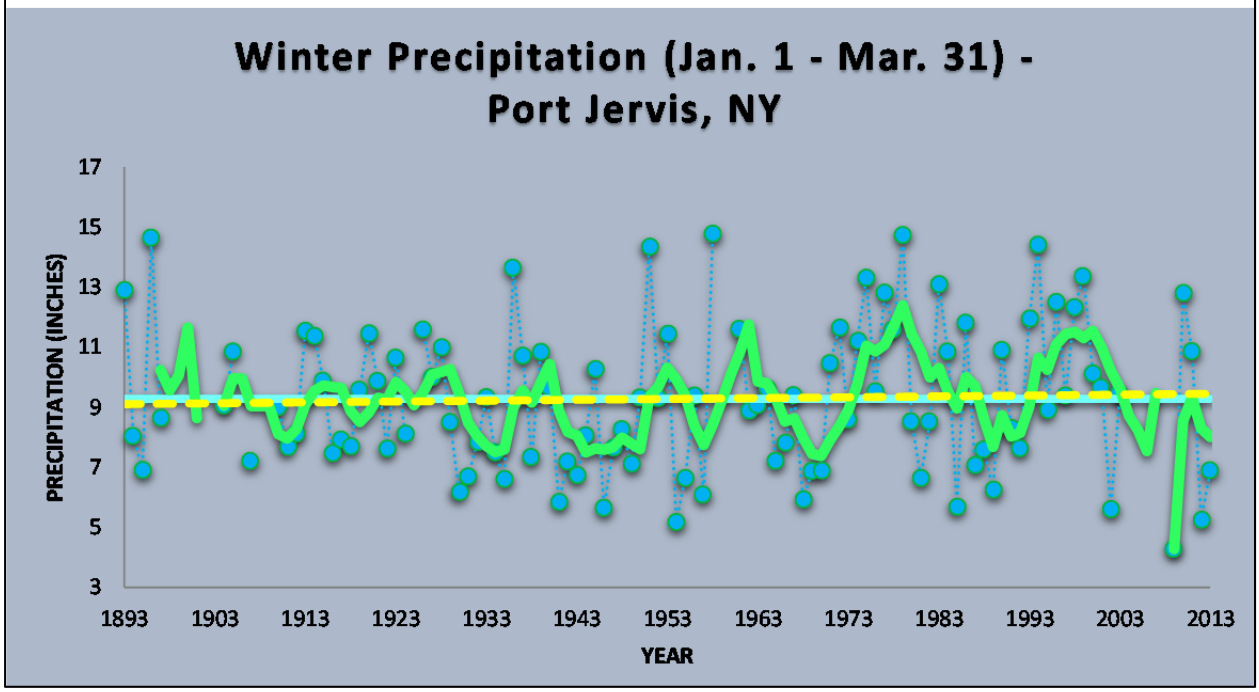


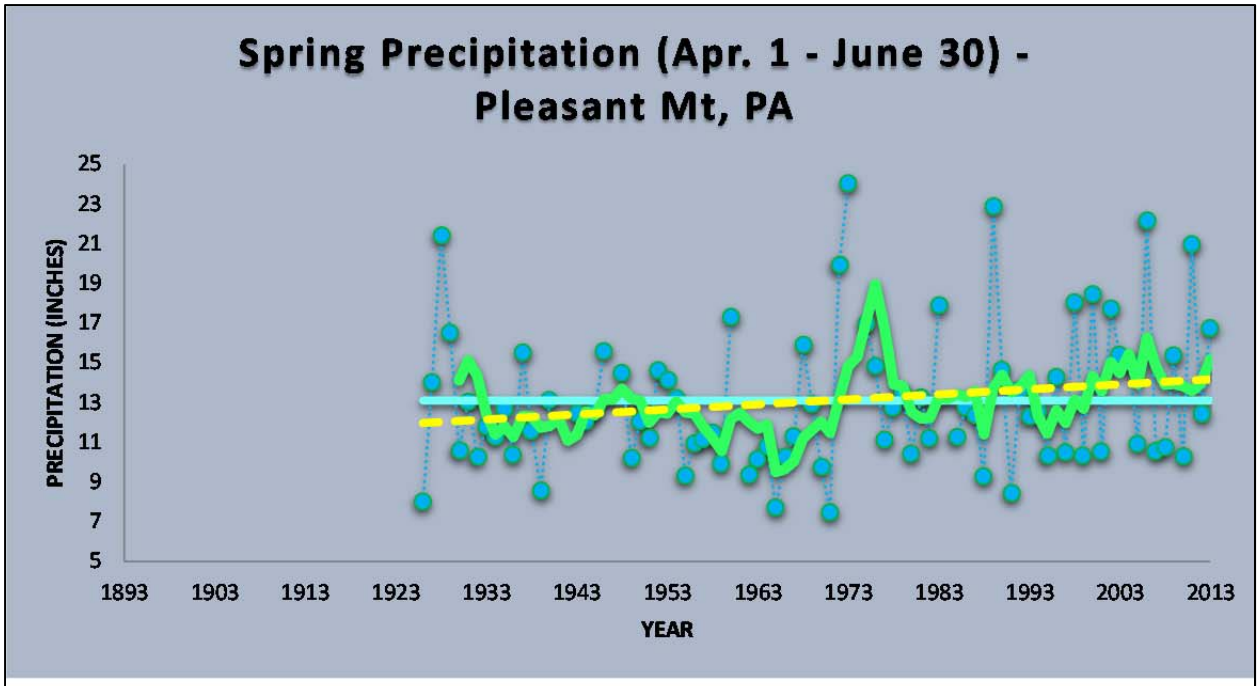
Annual Number of Extreme Precipitation Events: Pleasant Mount shows a slight decline, while Port Jervis shows a small increase. The average number of days at Port Jervis is 2 (min of 0 and max of 9) and 2 (min of 0 and max of 7) at Pleasant Mount (Table 6).



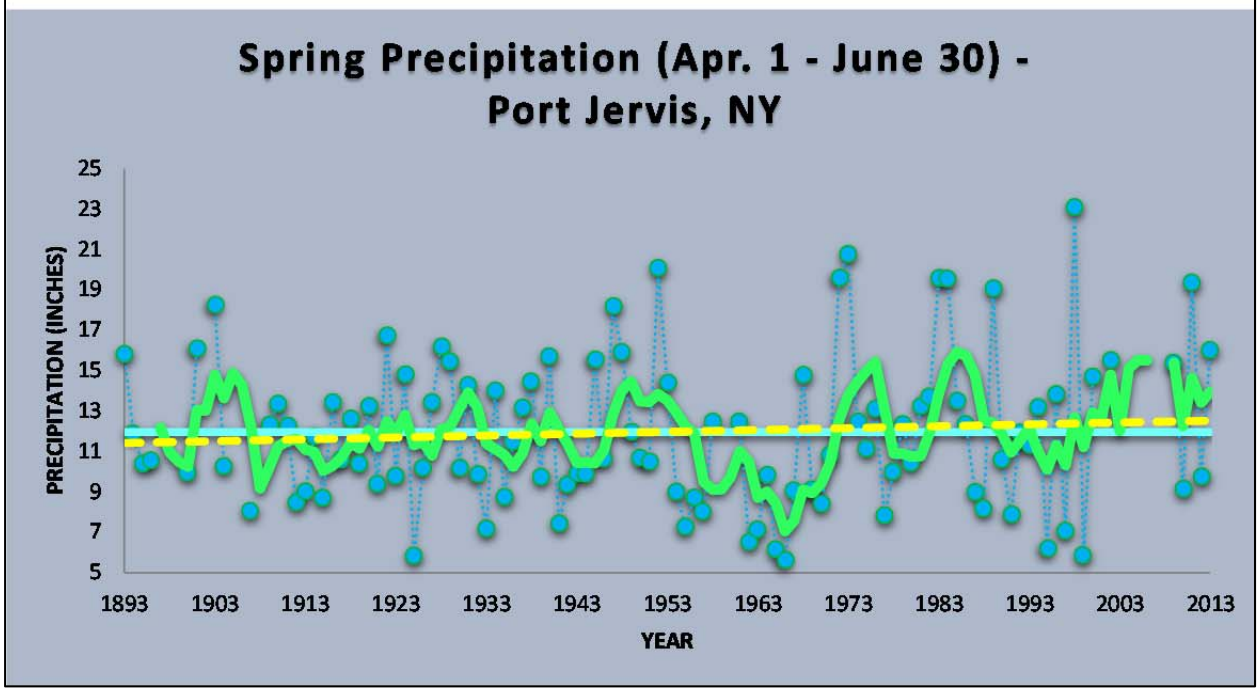


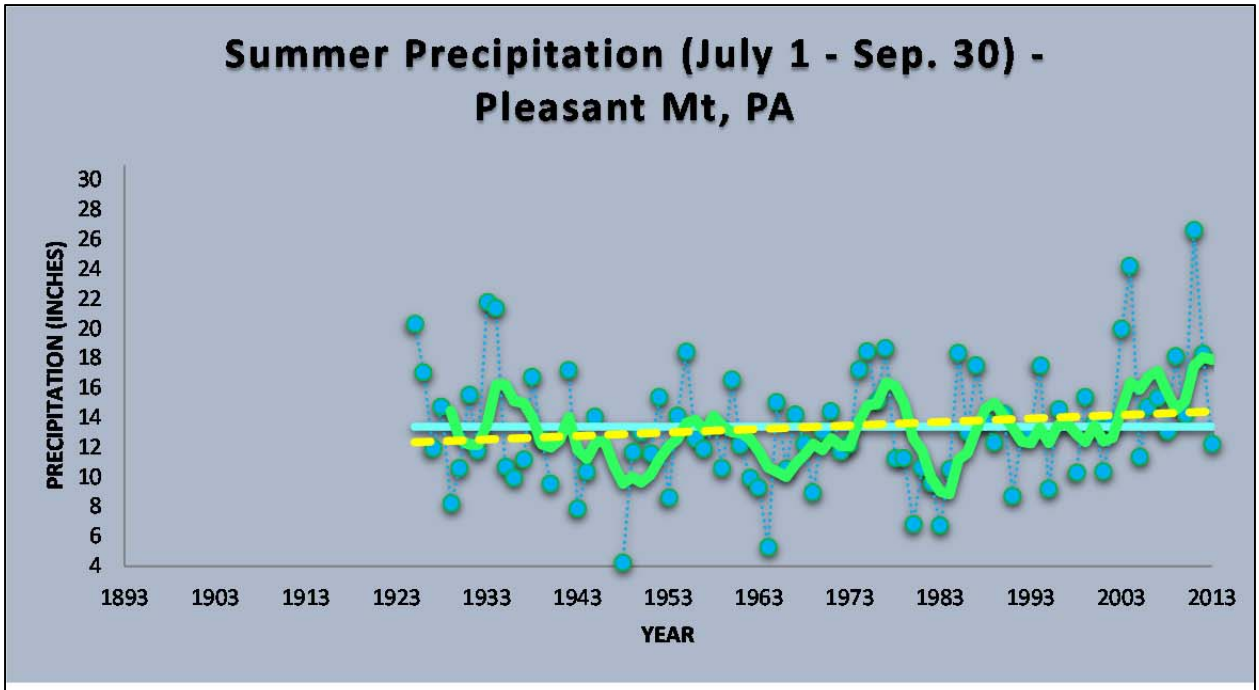
Winter Precipitation Trends: Both show very little change. Pleasant Mount's winter precipitation has ranged between 3.8 in to as much as 16.6 in over its period of record while Port Jervis has ranged from 4.3 in to 14.8 in.



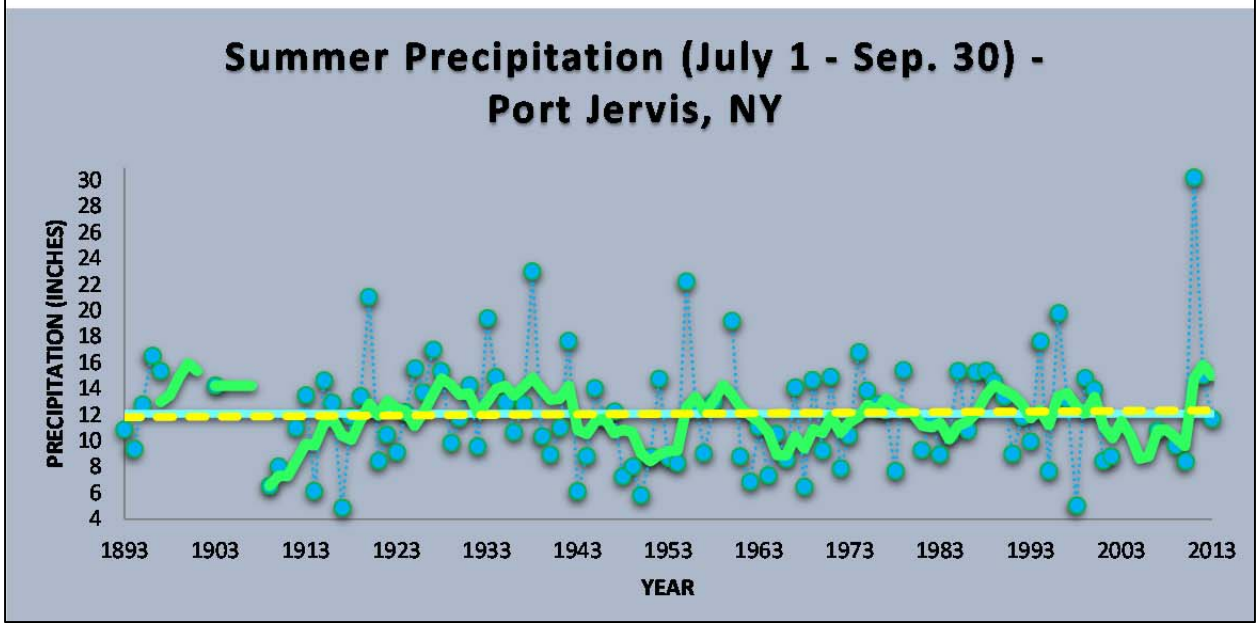


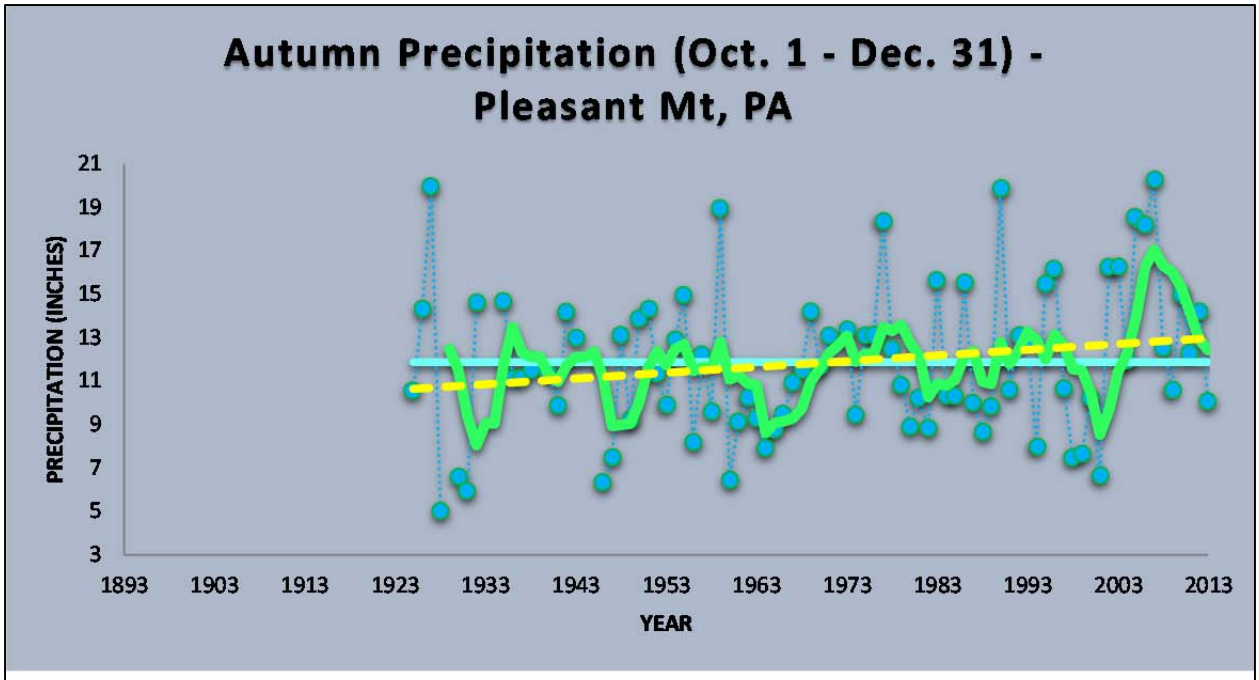
Spring Precipitation Trends: Both show a modest increase of the order of 1 to 2 inches (25-50 mm) per century for this season. Port Jervis has seen as much as 23.1 in and as little as 5.7 in during the spring while Pleasant Mount has seen between 7.5 and 24.1 in.



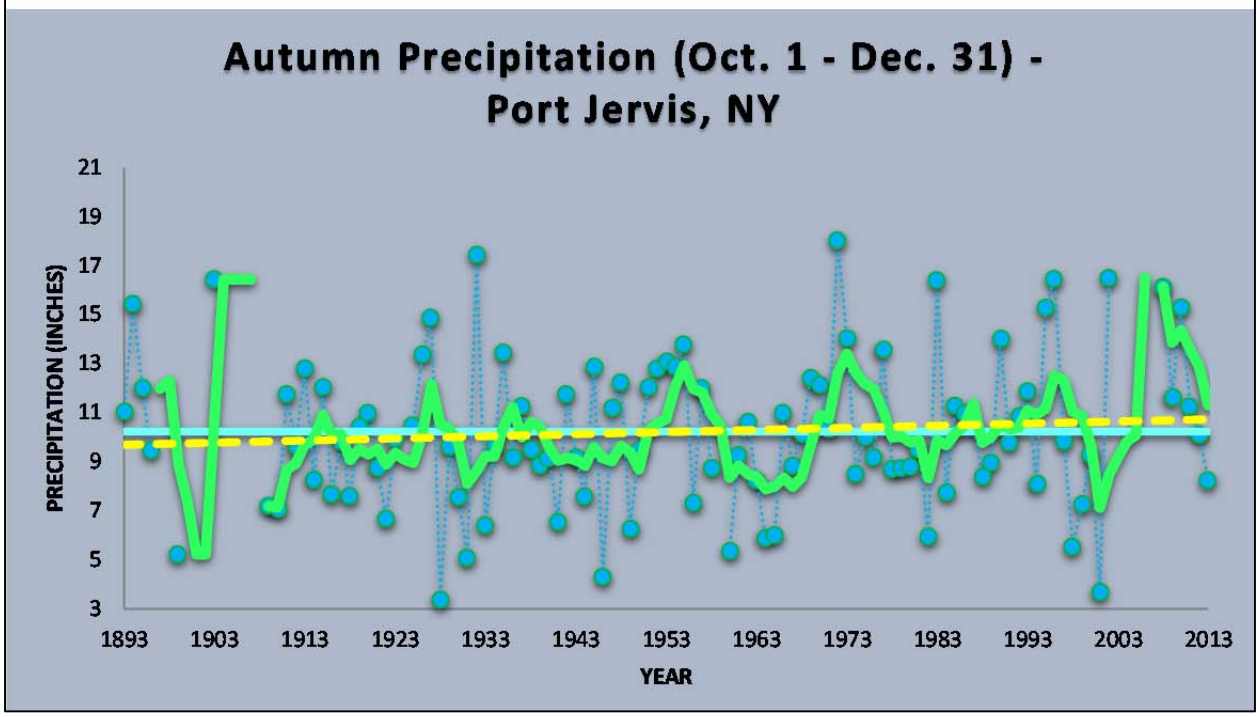


Summer Precipitation Trends: Both show a slight increase of the order of 1 inch (25mm) per century for this season. Pleasant Mount's summer precipitation has ranged between 4.3 to 26.7 in. while Port Jervis has seen a minimum of 4.9 in to a maximum of 30.3 in.





Autumn Precipitation Trends: Both show a marked increase of the order of 2 inches (50 mm) or more per century for this season. The average sum of precipitation during the autumn is 11.9 in (min of 5.0 and max of 20.3 in) at Pleasant Mount compared to an average of 10.2 in (min of 3.4 and max of 18.1 in) at Port Jervis.



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U.S. Department of the Interior

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