SKYWARNEWS

NATIONAL WEATHER SERVICE
STATE COLLEGE, PA

FALL 2014

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Is Central Pennsylvania the Cloudiest Place in America?

Mike Dangelo—Senior Forecaster

A debate rages among residents of our region over just how cloudy it is in Central Pennsylvania – but is it the cloudiest place in America? The short answer is, "No, but really close." A quick check on the National Climatic Data Center (NCDC) web site provides a list (table 1) of the Cloudiest Cities (http://www.ncdc.noaa.gov/extremes/extreme-us-climates.php). On the list, Binghamton, NY and two of the mountainous locations in WV (which are very similar in geographic location/climate to Central PA) make the top-ten cloudiest places.

Cloudiest

STATION NAME	CLOUDY DAYS
Mount Washington, NH	244
Astoria, OR	239
Quillayute, WA	239
Olympia, WA	228
Seattle Sea-Tac AP, WA	226
Portland, OR	222
Kalispell, MT	214
Binghamton, NY	212
Elkins, WV	212
Beckley, WV	210

Table 1. Cloudiest Locations

But, by and large, the table is dominated by locations in the Pacific Northwest (WA, OR). However, all of the information on the web page seems devoid of data for non-contiguous states (HI, AK) – so I would look for more information before pronouncing this as the best list for cloudiness.

A more complete look at the "cloudiness" of the nation can be found on a very old fax-era map found in the archives and colorized for easier viewing. The map (Fig 1) is labelled "Mean Sky Cover, Sunrise to Sunset, Annual." While the source of the data is not known, it is probable that the values are from the old sunshine sensors which used to be placed at many observing locations. However, it is a good depiction of how sunny and bright it may or may not be. (cont. p. 2)

Climate Change and Maple Syrup?

John La Corte—Senior Forecaster

As we hear more and more about rising CO2 levels and a warming planet, so too are we hearing about the effects such as rising sea levels and shrinking glaciers. But what about maple syrup? Yes the stuff most of us like on our pancakes or waffles, it may become more scarce as our world continues to heat up.

At Milroy Maple Farms in Somerset County here in Pennsylvania, they have been tapping trees and producing maple syrup for three generations.

(cont. p. 4)

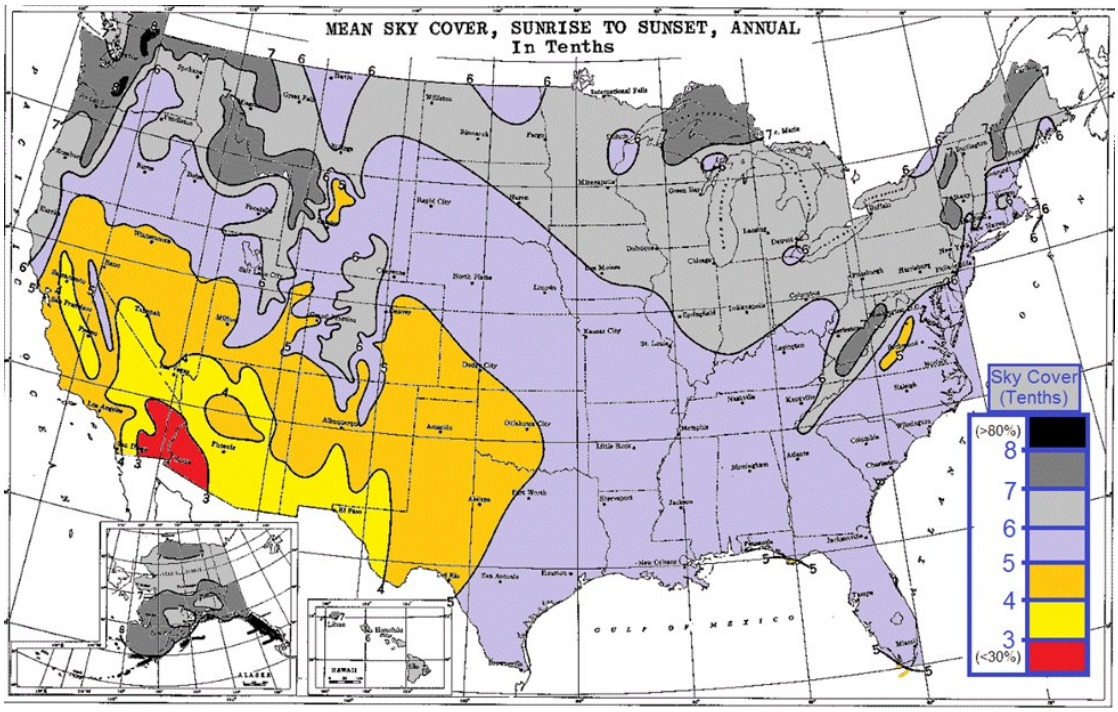


Figure 1. Mean Sky Cover

Cloudiest Place cont:

On both the table and the map, the designation of cloudiest location/ region is clearly the Pacific Northwest, which extends up into southern/southeastern Alaska. However, the next-cloudiest locations would be the Northern Rockies, the UP of MI, and the spine of the Appalachian Mountains – including right here in central PA!

When is it Going to Snow?

Kevin Fitzgerald—Senior Forecaster

As the days grow cooler and the leaves begin to fall across Pennsylvania, thoughts turn to when the first snowflakes will fly across the Commonwealth. Although an accurate prediction of the first snow is usually only possible only a few days in advance, climatology can tell us when it's most likely to occur, as well as the earliest and latest extremes. The average date of the first measurable snowfall ranges from early November across the Northwest Mountains, to early December across the Lower Susquehanna Valley. Although most years are fairly close to the averages, there can be large year to year variations, as Table 1 shows .

First Snow Climatology

CITY	EARLIEST DATE	AVERAGE DATE	LATEST DATE
YORK	OCT 19 (1972)	DEC 9	JAN 26 (1992)
LANDISVILLE	OCT 19 (1972)	DEC 8	JAN 22 (2007)
SOUTH MTN	OCT 17 (1977)	DEC 3	JAN 26 (1992)
SHIPPENSBURG	OCT 19 (1972)	NOV 30	JAN 24 (1992)
HARRISBURG	OCT 19 (1972)	NOV 30	JAN 23 (1992)
TAMAQUA	OCT 16 (2009)	NOV 29	JAN 23 (2007)
WILLIAMSPORT	OCT 15 (2009)	NOV 23	JAN 16 (1924)
CONFLUENCE	OCT 4 (1974)	NOV 19	JAN 17 (2005)
STATE COLLEGE	OCT 16 (2009)	NOV 17	DEC 20 (1982)
RIDGWAY	OCT 16 (2009)	NOV 16	DEC 21 (1946)
WELLSBORO	OCT 16 (2009)	NOV 14	DEC 15 (1979)
EBENSBURG	SEP 30 (1993)	NOV 10	DEC 18 (1998)
WARREN	OCT 12 (1988)	NOV 9	DEC 11 (1948)
BRADFORD	OCT 11 (1988)	NOV 7	DEC 16 (1998)
KANE	OCT 7 (2001)	NOV 4	DEC 3 (1985)

Table 1. Snow Climatology for Central Pennsylvania

The statistics are based on data from NWS Cooperative Observer network over the last 50-100 years. However, historical records indicate even earlier snowfalls occurred across Pennsylvania during the 1800s. The earliest record of snow in Pennsylvania came on August, 26 1985, when snow showers were sighted at Harvey's Lake, just west of Wilkes Barre. The Annals of Buffalo Valley (Linn 1877) reported a heavy snow storm on October 5, 1836, after which snow was reported one and a half feet deep across Penns Valley in eastern Centre County.

In those years in which an early snow occurs, many mistakenly assume that it means a snowy winter is on the way. However, that is not always the case. For instance, the early snowfall of October 19, 1972 was followed by one of the least snowy winters on record across the Lower Susquehanna Valley, where just 4.5 inches was recorded at York and 8.3 inches at Shippensburg.

Frequency of early snowfalls across central Pennsylvania can be measured by the number of years in which measurable (cont. p. 3)

Snow cont:

snow occurred during October. Figure 1 shows that in Kane Pa, October snow is likely about once every three years.

A similar chart for Harrisburg (Figure 2) reveals the rarity of October snow across the Lower Susquehanna Valley, where only 4 of the last 125 years saw measurable snow.

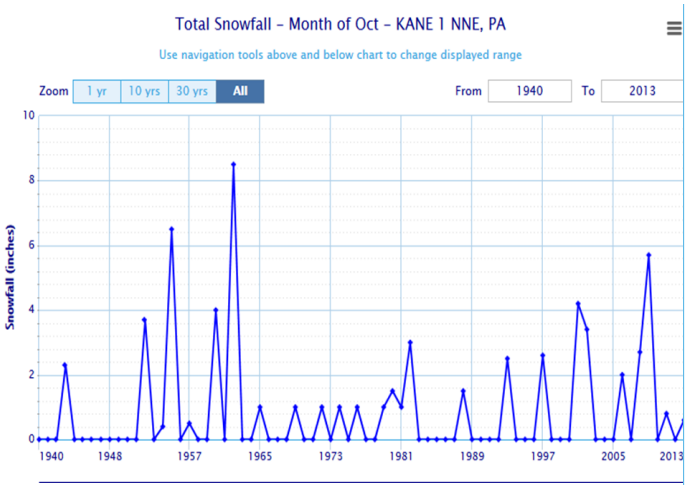


Figure 1. Snow Climatology for Kane, Pa

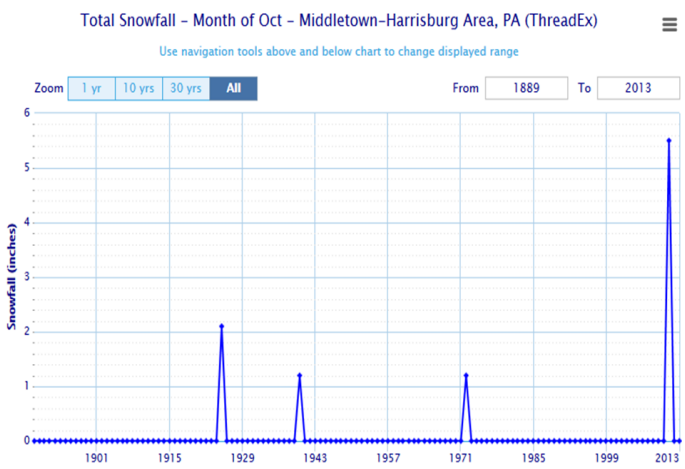


Figure 2. Snow Climatology for Harrisburg, Pa

State College Oct 16, 2009: Record Earliest Snow

Maple Syrup cont:

Ideally, sugar maples need warm days and cold nights to get their sap flowing. Maple syrup producers start drilling their tap holes when daytime high temperatures start getting into the 40s while the overnight temperatures still fall below freezing. A couple of decades ago, these conditions could usually be counted upon to occur from late February into early March. In recent years however, producers have found they must now tap their trees earlier, as much as a month earlier in fact. In 2012 maple syrup production was down as much as 40% over the northeast when the cold snowy winter turned abruptly to record warmth in March, severely curtailing the conditions that are favorable for the sap to flow and be harvested from the maple trees.

The areas from southern Ohio through West Virginia, Pennsylvania and Maryland are on the southern edge of the large scale maple syrup production zone that extends up into the northeastern U.S.. As conditions warm, climate change forecasters at the U.S. Forestry Service expect the maple trees to gradually disappear in favor of other species expanding north, and so too will the livelihood of maple syrup producers over much of the region, or will they? The dire outlook of the U.S. Forestry Service is not necessarily shared by other researchers. Some say that the sugar maple is not as fragile the Forestry Service suggests and that between that and advances in sap harvesting technology, maple syrup production should be fine for many years to come. However the Forestry Service believes that when they actually count the number of maple tree seedlings, the numbers are down. Add to that the biggest danger of the seedlings being eaten by deer and stressed by insects which are advancing north as the climate warms, and they are not as optimistic.

Whatever happens, the controversy is not likely to disappear any time soon. For more on this, read ***Climate Change Not So Sweet For Maple Syrup*** by Julie Grant which was the source of this short article.

http://wesa.fm/post/climate-change-not-so-sweet-maple-syrup

The Summer in Review

John La Corte—Senior Forecaster

As autumn arrives, we look back at the passing of the summer of 2014 and realize something unusual just happened; it was cooler than normal! After what seems like an endless parade of recent hot summers, the region had its first chilly summer in several years, which most would probably agree really wasn't all that bad.

Temperature

For meteorological purposes, summer extends from the beginning of June through the end of August. After a warm start in June, July and August quickly reversed the trend with August ending up some 4 to 5 degrees cooler than normal over much of the central part of the state. With July and August ringing in on the below normal side, they more than erased the warm start to the summer. Figure 1 shows that almost the entire state ended up between 1 and 3 degrees cooler than average for the season, making it the coolest summer since 2004.

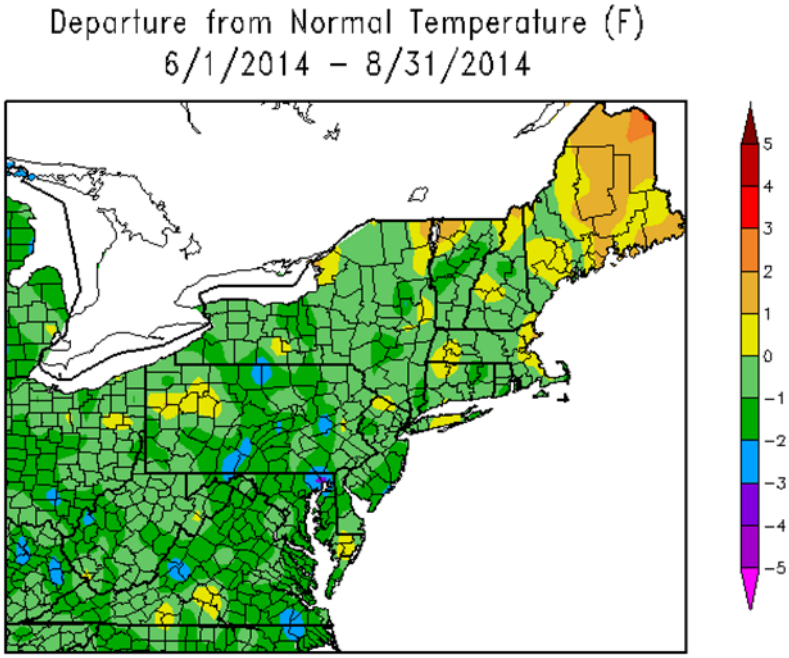


Figure 1. Summer Temperature Departure From Normal

Another measure of how warm or cool the summer has been comes from looking at the number of days the high temperature reached or exceeded 90 degrees. Table 1 shows that in Central Pennsylvania, Altoona and State College never reached 90, and at all the locations included, the number of 90 degrees days was below normal for the season. (cont. p. 5)

	# Days 90	Normal # 90 Deg Days
Altoona	**0**	**6**
Lancaster	**14**	**16**
Harrisburg	**9**	**17**
State College	**0**	**7**
Williamsport	**5**	**13**

Table 1. The number of 90 Degree s vs. Normal

Summer cont:

Precipitation

The summer will also go down as being wetter than normal in most areas. The abnormal rainfall combined with the developing cool temperatures in July to force many local gardeners into battle with early blight, a soil borne fungus that thrives in cool-wet conditions. Figure 2 shows that almost all of the region saw above normal rainfall during the summer months.

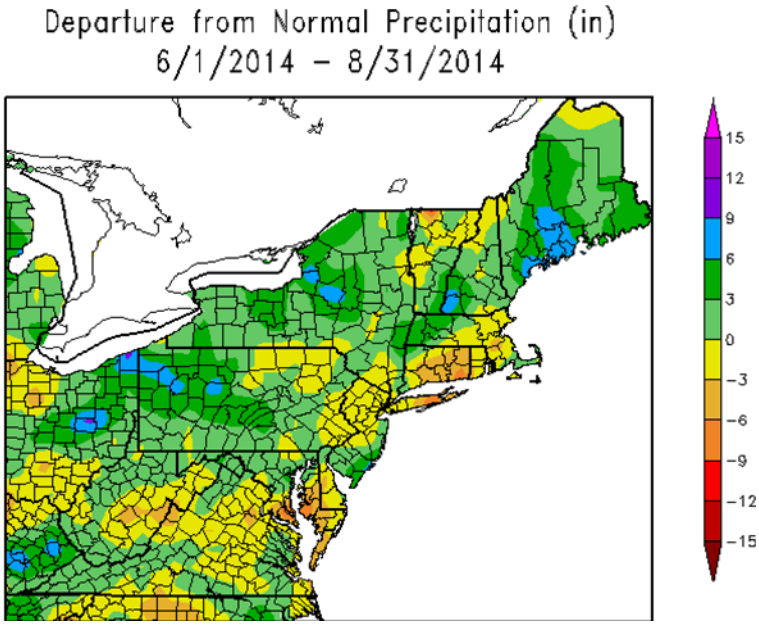


Figure 2. Summer Precipitation Departure from Normal

Despite the wet summer, August ended with a period of relatively dry weather that has so far continued into October. At this time of year we often look to developments in the tropics for potential sources of the kind of widespread rain that the region needs as we enter the cold season. However this year the tropics have been rather quiet. The below normal activity was predicted earlier this summer when it became apparent that a weak El-Nino would develop in the South Pacific. Each year our parent agency, NOAA (National Oceanic and Atmospheric Administration) makes a hurricane season forecast. While last year's forecast didn't work out quite as planned, this year's forecast has been spot on so far. One of the ingredients considered in the seasonal forecast is whether or not there will be an El-Nino. When there is an El-Nino, upper level wind patterns change on a global scale and these patterns actually become unfavorable for storms to form even as far away as the tropical Atlantic. Thus far we have seen just seven named storms with only Hurricane Arthur causing much concern for the US as it skirted the Outer Banks of North Carolina before it moved out over the New England coastal waters.

Winter

At this time of year it's always fun to speculate about what the upcoming winter will bring. Last winter's bitter chill and above normal snowfall are probably still fresh in most memories, especially since it had been so long since we had a "real" winter over the most of the eastern United States. The official seasonal forecast comes from our Climate Prediction Center (CPC) and they issue outlooks for temperature and precipitation (not snowfall). For the months of December through February (the meteorological winter) temperatures locally are expected to pretty much be in the "coin flip" region where there will be a slightly elevated chance of being warmer than normal over northern Pennsylvania up through the rest of the northeastern US, while most of the rest of our region will remain pretty close to 50-50 (Figure 3). This means the large scale pattern shows little or no meaningful signal, leading to little or no confidence (skill) in predicting temperatures warmer or cooler than normal.

Unfortunately as far as precipitation goes, the same weak signal leads to the same uncertain forecast of "equal chances" (Figure 4). Drier than normal conditions are expected through the Great Lakes with the slightly elevated chance of the drier conditions creeping into far western Pennsylvania, but for most of us it's another coin flip.

(cont. p. 6)

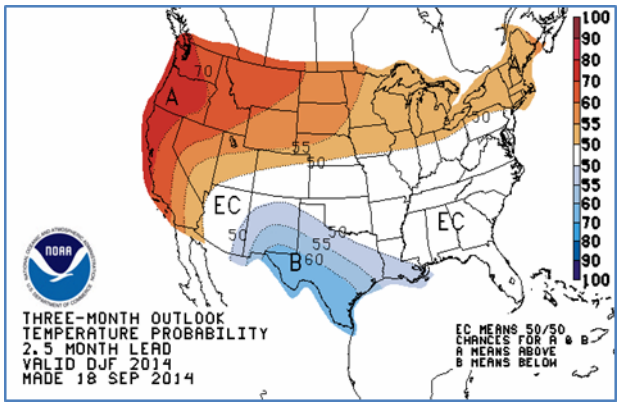


Figure 3. Temperature Outlook for Dec – Feb

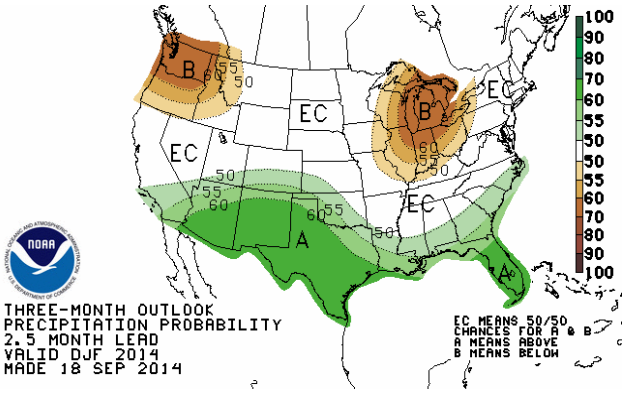


Figure 4. Precipitation Outlook Dec — Feb

Summer cont:

For another perspective, at this point we like to turn to the Old Farmer's Almanac for their annual prediction winter outlook. They are the experts, having been in the business of seasonal forecasting for over 200 years. You may recall the Old Farmer earned some serious kudos last year when he called for a cold and snowy winter, and we had above normal snowfall and suffered the worst cold in 20 years. Using a secret formula derived by their founder Robert B. Thomas in 1792, along with some modern refinements that utilize technology and scientific calculations, they are calling for yet another hard winter. The prediction is for much of the eastern U.S. to be cold with above normal snowfall for those of us who live in the northeast.

Whether we shiver our way through another long winter, or we return to the trends of recent years where milder conditions prevail, we will return in the spring to review it all and take a look forward to the upcoming warm season.

Update Your Spotter Information

Bill Gartner—General Forecaster

Winter is on its way! How cold or warm, snowy or rainy it will be is really anyone's guess, but the weather will go on and we need your Spotter reports. Your reports help us to monitor ongoing winter storms, determine the need for possible changes to advisories and warnings, and provide real-time snowfall totals to the public, news media and other partners, and other NWS offices.

Spotter reports are also used to verify our watches and warnings, as well as to prepare storm summaries and snowfall total maps of winter events. Even if you are not able to call in reports during a storm, but can give us a post-storm total snowfall, we'd still love to hear from you when a storm is over.

Please report the following:*

Snow:
- When snow accumulation reaches 3 inches
- When snow accumulation reaches 6 inches
- Storm total after the snow ends (also water equivalent if possible)
- If snow is falling at the rate of 1 inch or more per hour

Ice:
- Any occurrence of or accumulation of freezing rain or freezing drizzle
- Accumulation of ice of ¼ inch or more on trees or wires

Other:
- When forecast winter precipitation differs significantly from observed (i.e. snowing with no snow in forecast, sleet...when only snow is forecast...)
- Any other significant weather occurrence/oddity (i.e. flooding due to snow melt/ice jam, damage from strong winds not associated with a thunderstorm)

And, remember thunderstorms that produce wind damage and flooding rains are still possible even in winter.

*This list of reporting criteria is available on our web page: http://www.weather.gov/ctp/reportSevere

(cont. p. 7)

E-spotter

As mentioned previously, the e-Spotter program is going away…SOON. A new web-based program to replace it is in the works. Stay tuned! We also encourage you to use our Facebook and Twitter feeds to get information to us.

Becoming a Spotter

If you know someone interested in becoming a SkyWarn Spotter or you would like a review of the basics, here is a list of Spotter training classes scheduled for this Fall.

November 13th: Columbia County

November 20th: Juniata County

Pre-registration is required. For more information, please go to http://www.weather.gov/ctp/SpotterTalks

Update your spotter contact information

Please help us to keep your contact information up to date. While we hope to get a report from you when severe weather occurs, from time to time we call or email spotters to investigate significant storms. Thus, it is important to keep your contact information current. If any of your contact information (name, phone number/s, addresses, etc.) has changed recently, please let us know. Send an email or 'snail mail' note to us at one of the addresses below.

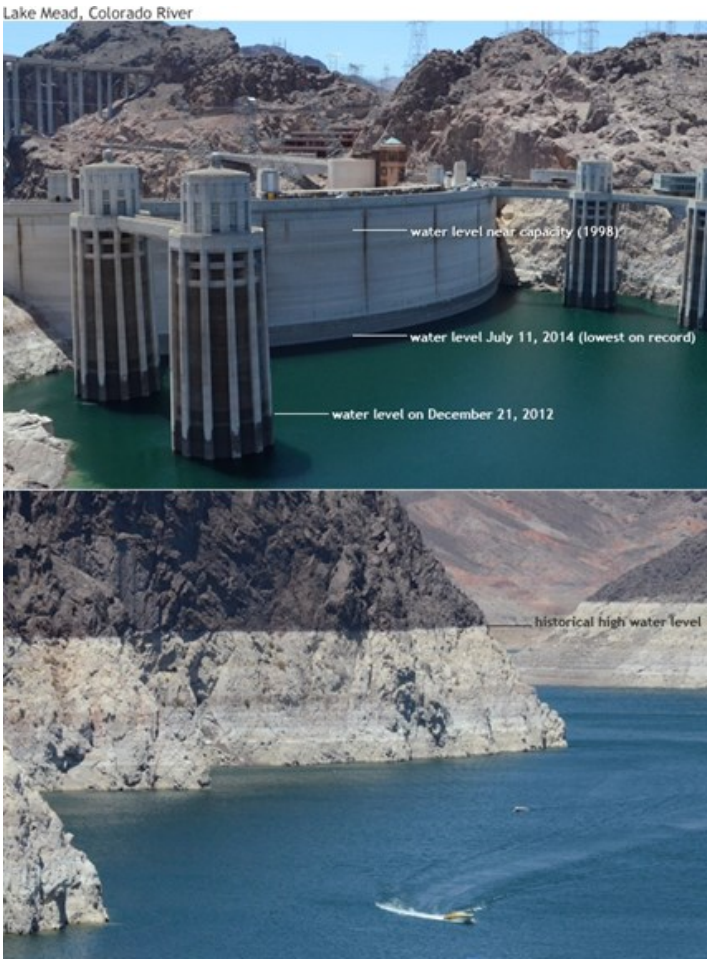
email: william.gartner@noaa.gov

U.S. mail:
William Gartner/Skywarn Spotter update
NWS/WFO State College
328 Innovation Blvd, Rm #330
State College, PA 16803

Western drought brings Lake Mead to lowest level since it was built

Taken from Climate.gov

On July 11, the day these photos were taken, the Lake Mead reservoir reached its lowest water level since the lake was first filled during the construction of the Hoover Dam in the 1930s, according to the Bureau of Reclamation. The lake's elevation was 1,081.77 feet—147.23 feet below capacity and 133.99 feet below its last peak in 1998. Similar to how the rings in the cross-section of a tree trunk can tell a story about that tree's past, the high points and low points of Lake Mead's water history can be glimpsed from observing recent photos taken at the Hoover Dam.



The highest rust-colored ring on the concrete dam structure shown in the top photo marks the height of the water when the lake is near capacity (it's never allowed to *literally* fill to the tip-top). The top of the dark ring around the water intake towers at image left in the foreground indicates the height of the water level on December 21, 2012—the highest the lake has been this decade. At the time, water levels were down 95.4 feet from 1998 levels. The white "bathtub ring" seen on the rocky sides of the reservoir in the bottom photo shows the historical high water level in the reservoir. The ring is a coating of minerals, deposited on the rocks while they were covered by water.

The Lake Mead reservoir—the largest in the United States—stores Colorado River water for delivery to farms, homes, and businesses in southern Nevada, Arizona, southern California, and northern Mexico. According to the National Park Service website, about 96 percent of the water in Lake Mead is from melted snow that fell in Colorado, Utah, New Mexico, and Wyoming. Each year, these "Upper Basin" states are required to allow a minimum flow of Colorado River water to reach Lake Mead.

This year's new low was hardly unexpected. Runoff in the Upper Colorado River Basin was 94 percent of average in 2014, but that flow wasn't enough to make up for the previous two years' shortfalls: runoff was only 47 percent of normal in 2013 and 45 percent in 2012, according to the Bureau of Reclamation.

The past two years are a continuation of a15-year dry spell in the U.S. Southwest that has led to more water going out of Lake Mead than coming in. The lake reached a recent high of 1,215.76 feet in November 1998, but it has not approached that level since. The Bureau's Boulder Canyon Operations Office projects the lake's elevation to continue to drop through the fall, falling to approximately 1,080 feet in November of this year.

Fluctuations in regional climate and the resulting water level in Lake Mead are an expected part of its operation, but many scientists are concerned that the recent prolonged drought could be a sign that the region will confront significant water supply challenges as greenhouse gas concentrations continue to rise.

Projections of precipitation changes in the Colorado watershed are less certain than those for temperature changes in the Southwest, but rising temperature along with declining snowpack and stream flows may threaten the reliability of surface water supply across the Southwest, according to the 2014 National Climate Assessment.

The report also warns that the current drought could be just beginning. Southwest paleo climate records show that severe mega-droughts at least 50 years long have occurred in the past several thousand years. Unlike those ancient droughts, however, similarly dry periods in the future are projected to be substantially hotter, and for major river basins such as the Colorado River Basin, drought is projected to become more frequent, intense, and longer lasting than in the historical record.

(cont. p. 9)

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Lake Mead cont:

References

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Lake Mead Levels to Drop to Historic Lows. Bureau of Reclamation. July 08, 2014.

2015 Lake Powell Water Release to Lake Mead Will Increase. Bureau of Reclamation. August 13, 2014.

Garfin, G., G. Franco, H. Blanco, A. Comrie, P. Gonzalez, T. Piechota, R. Smyth, and R. Waskom, 2014: Ch. 20: Southwest: Climate Change Impacts in the United States: The Third National Climate Assessment, J. M. Melillo, Terese (T.C.) Richmond, and G. W. Yohe, Eds., U.S. Global Change Research Program, 463-465. doi:10.7930/J08G8HMN.

Original article : http://www.climate.gov/news-features/featured-images/western-drought-brings-lake-mead-lowest-level-it-was-built

Why Was July Cool and Wet?

Richard Grumm—Scientific Operations Officer

The summer of 2014 was relatively cool and wet over most of Pennsylvania with the month of July being one of the coolest in recent memory over portions of the central and eastern United States. The cool pattern during July was the result of a persistent area of above normal heights (a ridge) and temperatures over the western United States and Canada which led to a corresponding area of below normal heights (a trough) and temperatures downstream over the eastern U.S.. The yellow area in Figure 1a (top left) shows that the heights at 500 mb (approximately 18,000') were above normal while the blue region downstream or east of this feature shows where heights were below normal. Figure 1b (top right) shows the 850 mb (approximately 5000') temperatures and departures using the same color scheme as in Figure 1a. Meteorologists commonly use these levels to diagnose large scale circulation patterns. Generally, when there is a ridge (high heights) in the western United States there is a corresponding trough in the eastern United States (lower heights). This is why when it is cool in the eastern United States it is often warm in the western United States.

(cont. p 11)

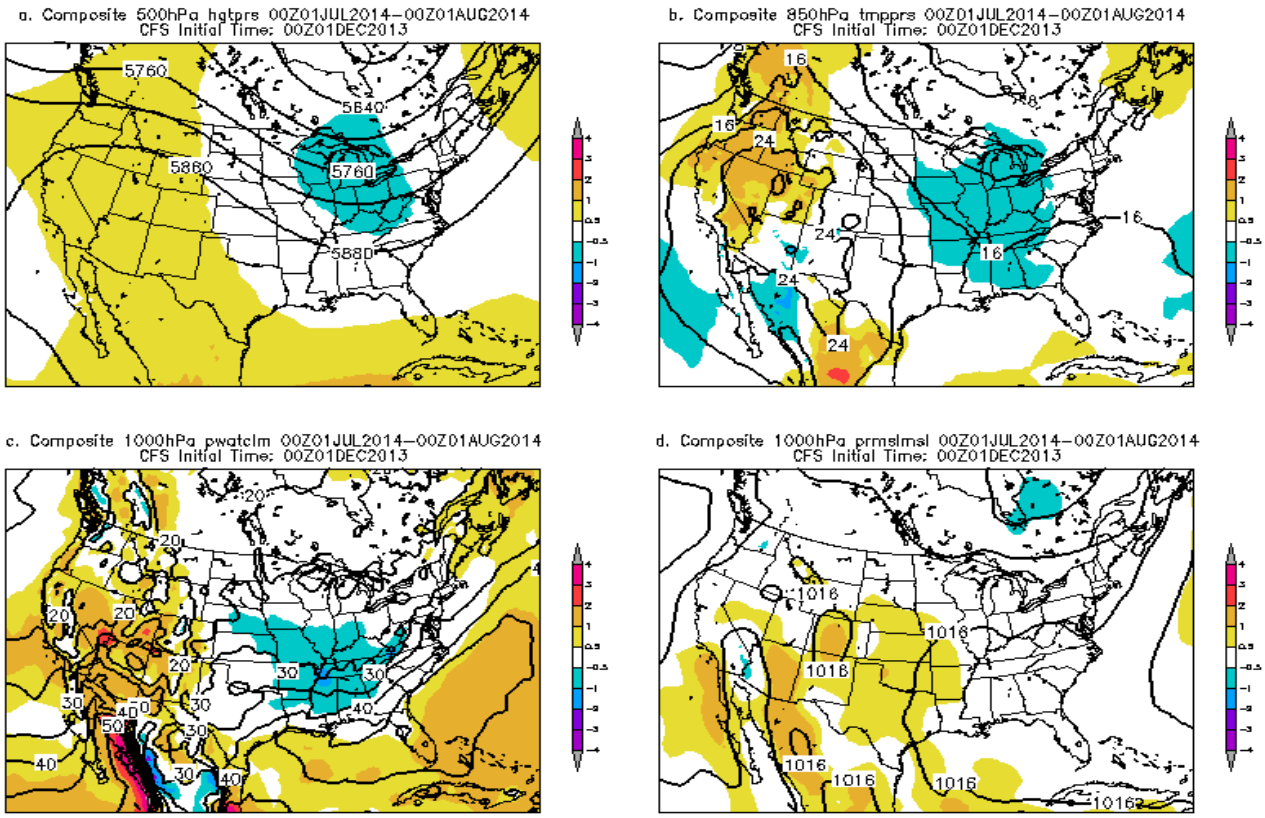

Figure 1. The average or mean pattern over the United States during July 2014. The data in each panel includes a) the 500 mb heights (meters) and the departure from normal, b) the 850 mb temperature (degrees Celsius) and the departure from normal, c) the precipitable water or moisture (millimeters) and the departure from normal, and d) the mean sea-level pressure (millibars—mb). The yellow areas are above normal, blue areas are below normal.

What is an Extreme Rainfall for Your Location?

Charles Ross - Service Hydrologist

We know it rains a lot here in central Pennsylvania. But what is an extreme precipitation event for your location? The National Weather Service has an interactive webpage where you can find this information for your own backyard.

For example, this summer here at the National Weather Service office in State College, we recorded around 2.50" inches of rain in just 60 minutes during a summer deluge. Using the new NOAA 14 web site, that rainfall total falls in line with a 100 year Average Recurrence Interval (ARI) rainfall event, which is quite a unique event! Not surprisingly, flash flooding was reported in the area during the thunderstorm.

Here at the NWS office in State College we are using this data in real time to monitor for extreme rain events. We have learned that short duration rainfall events with an ARI greater then 25 years often lead to minor flooding, while more significant flash flooding is seen for the 50 year and higher ARI values. Further research is underway to apply this information into our flood and flash flood warning program.

To view the information for your location go to: http://hdsc.nws.noaa.gov/ and click on Pennsylvania. You can move the red crosshair on the map to your own location, or if you know your latitude and longitude you can enter it directly. On the bottom of the page you will see a table of estimated values for a variety of different rainfall periods. There is also a graphical tab you can view which gives the user a picture of this data (see image below).

As a weather spotter, if you ever have rainfall values begin to exceed the 10 year threshold for your location during a short period of time, please call us with a spotter report, as that information is very valuable to our forecasters.

Feel free to email me (charles.ross@noaa.gov) if you have any questions on using this web page. I'll be happy to set up some time to walk you through this.

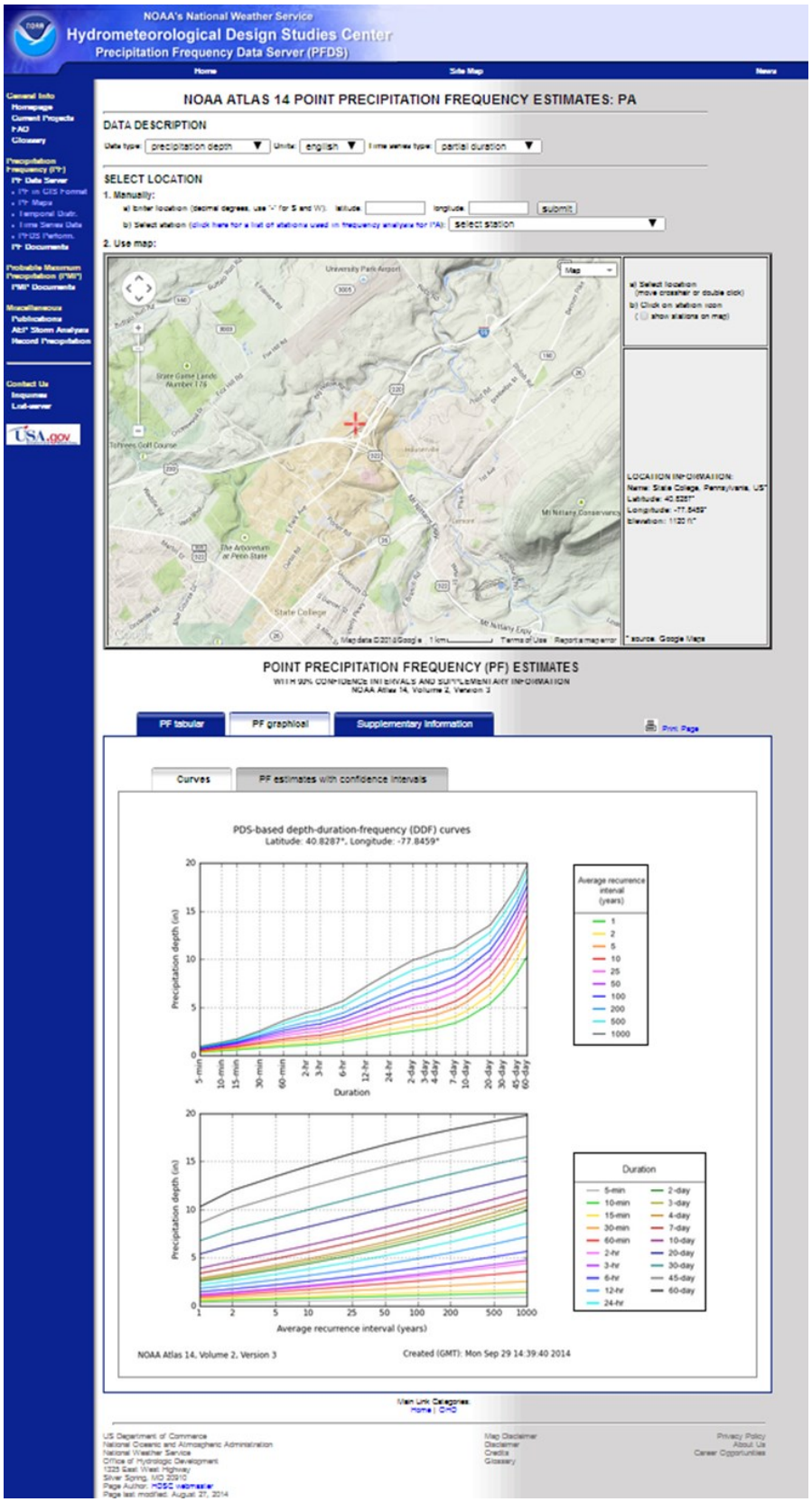

Figure 1. Snapshot of the NOAA 14 web page output for the State College NWS Office

Cool-Wet July cont:

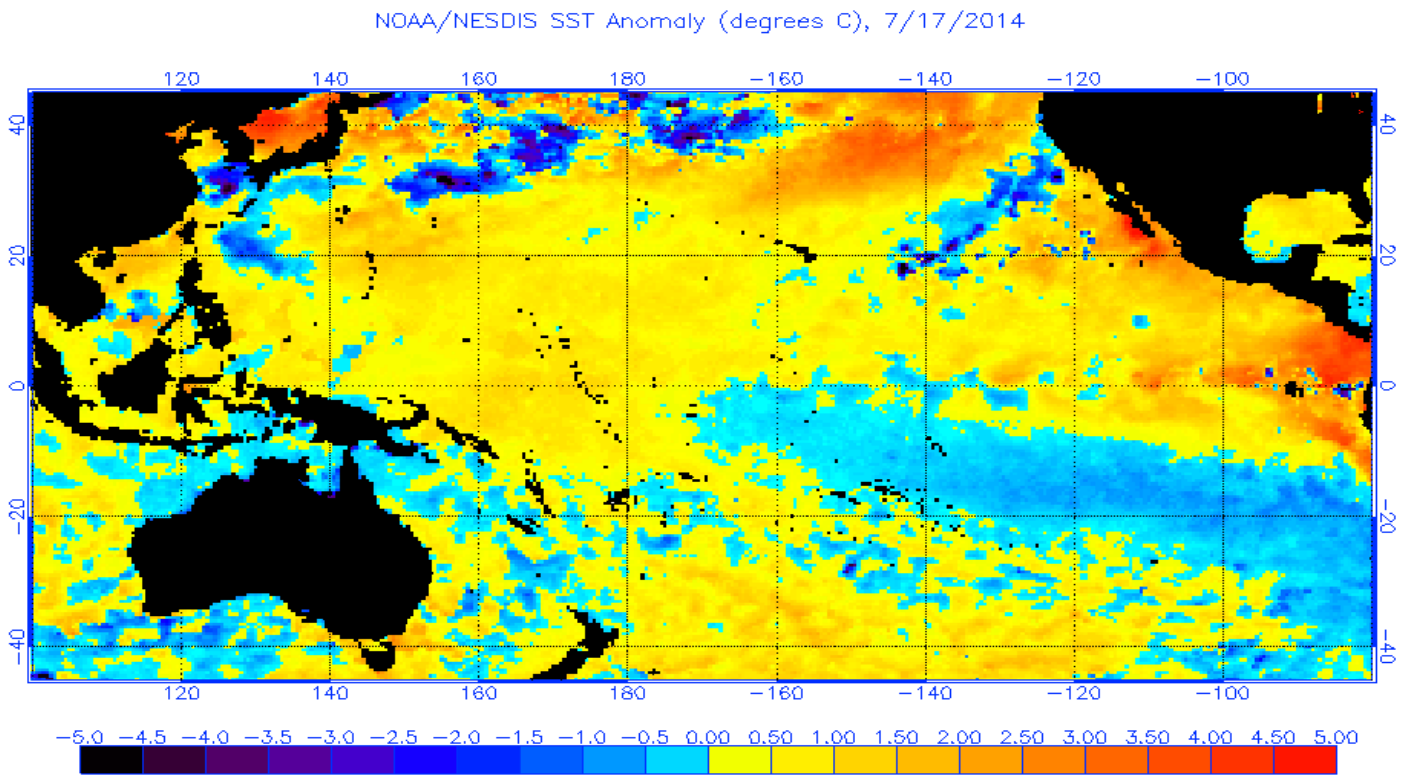

Figure 2. The sea surface temperature departures (departure from normal) over the Pacific Ocean on 17 July 2014. The yellow and red colors show areas of above normal sea surface temperatures. Note the much above normal area (red) sea surface temperatures close to the West Coast of the United States and Canada.

Why did we have the ridge in the western United States and Canada in July? It's like asking which came first, the chicken or the egg? However, this is a more difficult question. Many meteorologists believe that the area of warm water along the West Coast of the United States and Canada (Fig. 2) played a role in the pattern over the United States. This warm water may have helped produce and maintain the large ridge over western North America and thus the downstream trough over the eastern United States.

The sea surface temperatures in the Pacific Ocean are often used for seasonal forecasting. The El Niño and La Niña patterns are based on where the warm and cold water is over the tropical Pacific Ocean. Meteorologists and Climatologists use these patterns to estimate the likely 500 mb flow pattern for the winter. This same reasoning may be applied to possibly understand why we had a trough over our region during July 2014.

As for the wet weather, the persistent trough sometimes drifted to the west allowing for moisture to move into our region. The lower left panel of Figure 1 shows the moisture pattern during the month of July. East of the deep trough there was deep moisture (yellow colors). As the trough moved west or redeveloped over our region it allowed this deep moisture to move into Pennsylvania. This plume of deep moisture produced several big rainfall events when it moved over our region.

We are just beginning to understand how these large scale patterns translate down to our daily and seasonal weather in our back yards; that's why we are still wrong far too often. But hopefully our knowledge will continue to grow and some day we can confidently tell you how the weather for the upcoming season will behave.

Meteor Showers and Near Erath Objects 2014-15

Barry lambert—Senior Forecaster

We had an truly exciting start to the year "celestial-wise", considering that the first Near Earth Object (NEO) of 2014 (named - 2014 AA) actually impacted our planet late in the day on January 1st, somewhere over the middle Atlantic Ocean. This true space invader was discovered very early in the morning on January 1st and was only 6 to 9 feet in diameter. The bulk of this space rock likely broke up, and disintegrated as friction heated it while passing through the earth's atmosphere. Check out this link for actual video of the small asteroid, and other interesting details about its short-lived visit to our planet.

http://neo.jpl.nasa.gov/news/news182a.html

More recently a significant and widely viewed asteroid (or Bolide Meteor) lit up the late evening sky over the Mid Atlantic Region around 10:55 pm on September 14, 2014. Witnesses claim to seeing a bright blue or greenish, neon-like flash as this small space traveler burned up high in the earth's atmosphere. The majority of sightings were across the southern half of Pennsylvania, and along the Interstate 95 corridor between Washington D.C. and New York City. Plenty of interesting tidbits about (and video of) this Bolide meteor can be found here -

Eastern U.S. Fireball - September 14, 2014

Asteroids are rocky or metallic in composition (without atmospheres) that orbit the Sun but are too small to be classified as planets. Asteroids have quite a wide range in size, with the largest being Ceres (the first discovered asteroid in 1801), which has a diameter of about 600 miles (1,000 kilometers), down to the size of just pebbles. There are 16 known asteroids that have diameters of 150 miles (240 kilometers) or greater. The majority of main belt asteroids follow slightly elliptical and stable orbits, that revolve in the same direction as the Earth and take from three to six years to complete a full track around the Sun.

There are 3 primary types of asteroids: 1) **Amor asteroids** -- whose orbits approach but do not cross Earth orbit, and whose orbits are further from the Sun than Earth's orbit. Many of these asteroids have orbits which are entirely between Earth and Mars. Some of these are economically attractive in the near term. 2) **Apollo asteroid's** orbits cross Earth's orbit, but they spend most of their time outside of the Earth's orbital path. 3) **Aten asteroids** also cross Earth's orbit, but unlike the Apollos, Aten asteroids spend most of their time racing around inside Earth's orbit. Figure 1. shows the orbits of these three varieties of asteroids.

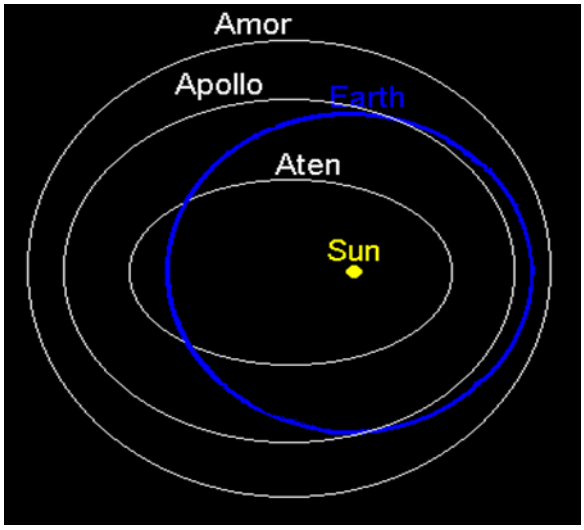

Fig 1. Asteroid orbits.

The tables in the following two links show all known NEO close approaches for the remainder of 2014 through the end of September 2015. Focus on the Lunar Distance (LD) from Earth and the size of the NEO. If the LD isn't much less than 1, and the object is small (say less than 20 meters in diameter) we can continue planning our vacations for the upcoming year with no worries whatsoever.

(cont. p. 13)

NEO Close Approaches Oct 2014 - Sept 2015

It's quite amazing to view an asteroid and significant meteor showers. Reporting a fireball (large meteor or small asteroid) is important and links to The American Meteor Society, and NASA's Jet Propulsion Lab Near Earth Object Program are excellent ways to both understand these occurrences, and perhaps more importantly to provide a detailed report of them.

http://www.amsmeteors.org/ (American Meteor Society)

http://neo.jpl.nasa.gov/ (NASA's JPL - Near Earth Object Program)

Residents of our fine planet have a brand new tool to better detect and assess the threat from future NEOs, called the "Fly-Eye" telescope. Check out the following link to learn about the details and importance of this telescope.

Fly Eye Telescope

Shifting our attention to meteor showers, the following table and links provides a comprehensive listing of major through minor meteor showers for the rest of 2014 and 2015.

2014 Major Meteor Showers (Class I)

Shower	Activity Period	Maximum		Radiant		Velocity	r	Max.	Time	Moon
		Date	S. L.	R.A.	Dec.	km/s		ZHR		
Quadrantids (QUA)	Jan 01-Jan 10	Jan 03	283.16°	15:18	+49.5°	42.2	2.1	120	0500	02
Lyrids (LYR)	Apr 18-Apr 25	Apr 22	032.32°	18:08	+32.9°	48.4	2.1	18	0400	21
Eta Aquarids (ETA)	Apr 29-May 20	May 07	046.8°	22:36	-00.6°	67.5	2.4	60	0400	07
Delta Aquarids (SDA)	Jul 21-Aug 23	Jul 30	126.9°	22:42	-16.4°	42.0	3.2	20	0300	03
Perseids (PER)	Jul 13-Aug 26	Aug 13	140.0°	03:12	+57.6°	60.5	2.6	100	0400	17
Orionids (ORI)	Aug 25-Nov 19	Oct 22	208.9°	06:24	+15.5°	67.1	2.5	20	0500	28
Leonids (LEO)	Nov 06-Nov 30	Nov 18	236.1°	10:16	+21.6°	70.6	2.5	15	0500	25
Geminids (GEM)	Dec 04-Dec 16	Dec 13	261°5	07:33	+32.2°	35.0	2.6	120	0100	20
Ursids (URS)	Dec 17-Dec 24	Dec 22	270°7	14:30	+74.8°	32.6	3.0	10	0500	01

Information and Table Template Courtesy the International Meteor Organization.

Table 1. List of Major Meteor Showers in 2014

A more detailed summary of each event in 2014 and 2015, including the best times to watch each particular meteor shower is contained in the following links.

List of 2014 Meteor Showers

List of 2015 Meteor Showers

Happy sky-watching everyone!

As many of you know, we now have a presence on both **Facebook** and **Twitter**. This provides new and easier ways for us to interact with you. These social media outlets allow us to post updates that may pique your interest on the weather system or event of the day. Perhaps more importantly, they also allow us to hear from you in a more informal yet robust fashion. We encourage everything from reports on the amount of snow or rain you have had to information on what is going on that may or may not be in the forecast.

Facebook allows for posts of varying lengths and is very friendly to graphical posts while **Twitter** is limited to posts that are no more than 140 characters in length, thus geared more to short precise information bursts that may or may not contain links to pictures or videos.

Using either platform, we look forward to hearing from you!

Remember when using **Twitter** keep messages short and concise (140 character limit). Because of this, abbreviations and punctuation may be used in such a way to keep the messages brief but still decipherable. A key characteristic of **Twitter** is the use of "hash tags". While not necessary, they are encouraged as they allow for easy categorizing and searching. Hash tags start off with the "**#**" (pound sign) character and help other **Twitter** users to find and procreate (re-Tweet) your information. An example we use here at the State College is **#ctpwx**. ***CTP*** is the "call sign" for our office and "**wx**" is the abbreviation for ***weather***. So a report may look something like **#ctpwx 4 inches of snow in your town and it's still snowing hard**. Another hash tag we search for is **#pawx** but these aren't the only ones. If you have a severe thunderstorm you may want to tweet something like **#ctpwx #severethunderstorm in your town at the time**. The idea is to fit as much information into that 140 character limit as possible and still be descriptive enough to convey what is happening and where.