SKYWARNEWS

National Weather Service State College, PA - Fall 2004

"Working Together To Save Lives"

The Campbelltown Tornado

Kevin Lipton, General Forecaster

Wednesday, July 14th started out on a somewhat dreary note with gray skies and fog, something that was all too common during the summer of 2004. It was hard to imagine that a powerful tornado could affect Campbelltown later that day, or on any other day for that matter. Big tornadoes happen only in the Midwest, right? Unfortunately, it did happen. An F3 tornado (see the end of the article for the Fujita Tornado Scale), with winds between 175 and 200 miles per hour, ripped through Campbelltown around 3:05 PM EDT, blasting more than 100 homes, completely destroying 32 of them. A total of 24 people were injured, one critically. This type of tornado is more typical of storms seen across the southern and central plains of the United States, a region known as "tornado alley."

The storm system which helped spawn this tornado originated across southern Canada, with a trailing cold front extending into western Pennsylvania early Wednesday morning. In addition, a warm front was slowly moving northeast across south-central Pennsylvania. It was very close to the juncture of these two fronts where the tornado developed and caused extensive damage. In addition, several other severe thunderstorms affected central Pennsylvania that afternoon, many producing large hail and several weaker tornadoes.

However, the biggest tornado that day (and of the entire summer for central Pennsylvania) developed over extreme southeast Dauphin County very close to Hershey. It was approximately 2:52 PM when Doppler radar showed broad rotation aloft west of Hershey, indicating that the developing thunderstorm was attaining motions conducive to tornado formation. A *severe thunderstorm warning* had previously been issued for Dauphin County at 2:28 PM EDT, effective until 3:30 PM EDT due to the intense storm signature being indicated by radar. Between 2:56 PM and 3 PM, radar indicated the storm was getting stronger and that the rotation was tightening (becoming concentrated in a smaller area), which indicated that tornado development was imminent. A tornado warning was then issued for Lebanon County at 2:59 PM EDT, and specifically mentioned the strong rotation indicated by radar near Campbelltown. The tornado touched down about 1 mile west of Campbelltown at 3:05 PM EDT, heading east and striking a housing development about one quarter of a mile south of Route 322. It was within this housing complex that most of the damage occurred, with 32 homes being completely destroyed, and another 37 sustaining at significant damage. The tornado then continued traveling east for more than seven miles; crossing Route 322 west of Mount Pleasant, crossed several fields and finally lifted up about 2 miles northwest of Cornwall around 3:15 PM EDT. The overall width of the tornado was estimated at one quarter of a mile across.

In addition to the 69 homes damaged or destroyed in Campbelltown, an additional 50 homes were damaged in the vicinity by downburst winds (straight line gusts often associated with severe thunderstorms). Also at least 9 farm buildings were damaged. This F3 tornado was the strongest to hit Lebanon County since June 18, 1970. Needless to say, what started out as a dreary but quiet day turned into

one of the most active in recent memory. It was a day that will be remembered for a long time.

The Fujita Scale:

(F0) Gale tornado (40-72 mph)

(F1) Moderate tornado (73-112 mph)

(F2) Significant tornado (113-157 mph)

(F3) Severe tornado (158-206 mph)

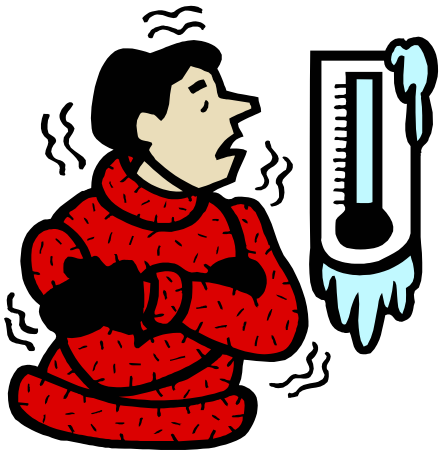
(F4) Devastating tornado (207-260)

(F5) Incredible tornado (261-318 mph)

Black Ice – The Invisible Danger

Joe Villani, General Forecaster

There are many hazards in the winter time that cause driving problems. Snow, sleet, and freezing rain are all common occurrences in Central Pennsylvania and most people are aware of the dangers associated with these types of winter precipitation. Also, it is typically not a challenge to determine if roads might be slippery since we can see snow, sleet or freezing rain falling on the ground or hitting our windshields. Black ice on the other hand, can be very dangerous and can occur under clear and otherwise tranquil weather conditions.



Let's take a closer look at black ice and define what it is. Black ice is ice (usually clear) that forms on ground surfaces, typically due to snow melting and re-freezing. Since it is almost invisible, it is difficult for drivers to recognize when black ice is on a road. Ground surfaces that look dry, but appear as slightly different shades signify the presence of black ice. When in poorly lit areas, black ice is nearly impossible to spot and can result in serious and possibly fatal accidents. In situations where black ice may be present, people should drive at slower speeds and allow extra time for braking. Also, make sure to leave plenty of space between your automobile and the vehicle in front of you. Many winter driving accidents occur due to motorists not being cautious enough and not recognizing potentially hazardous road conditions.

Here are a couple of situations that are favorable for black ice formation. Black ice can cover a road even after a sunny day. Snow banks may melt after a day in the sun, with water trickling onto roadways and then re-freezing after sunset. People should not let their guard down even when no winter precipitation is falling or has fallen recently. Another way black ice can form is when it rains or snows during the day or evening, then temperatures fall to freezing or below (32 degrees Fahrenheit) after dark. While the air temperature is important in allowing black ice to form, ground surface temperature is the main reason for black ice formation. Even when the air temperature is below 32 degrees during the day, road temperatures may be well above freezing. However, as soon as the sun sets, road temperatures can drop rapidly, allowing for black ice to form quickly.

Another way black ice can form is one that really catches motorists off guard. After prolonged very cold conditions, we can sometimes see a rapid warm up with very moist air pouring back into the region. If this occurs at night, the moisture can actually condense on the still below freezing roads and walkways and cause a thin layer of ice to form. It is especially misleading because air temperatures may actually be well above freezing. Because the ground loses its heat slower than the air, the pavement can remain below freezing and cause the black ice to form, sometimes with disastrous results.

People should always be aware of black ice in the evening, overnight, and morning hours when the air temperature is near or below 32 degrees. Not only should motorists be concerned about black ice, but pedestrians should be as well. Slipping on black ice while on foot can result in serious injury. Personally, I have had a run-in with black ice. Back in college I slipped in a parking lot during the evening hours, on pavement that looked "dry". Fortunately for me, I landed on my back and avoided serious injury. However a friend was not so lucky. He slipped on black ice on the steps just outside of his apartment and tore his Anterior Cruciate Ligament **(**ACL), which required surgery. So as

you can see, black ice can be very hazardous when on foot too.

The Summer of 2004 in Review

John La Corte, Senior Forecaster

Once again, after a promise (sort of) of a warm and dry summer, central Pennsylvanians got the opposite and weathered a cool wet summer. Summer is the time of year of picnics, barbeques, ball games and hiking. After suffering through the second snowy and cold winter in as many years, more than a few citizens were no doubt looking forward to sunshine and warm breezes. These were limited this year.

The "traditional summer" is comprised of the months from June through August. However most believe the real warm season begins in mid state Pennsylvania in May. This year the region was treated to an exceptionally warm and dry May to get the ball rolling, but things changed soon after. June reversed the temperature trend ending up slightly below normal at both Harrisburg and Williamsport. July and August merely continued on the chilly side. While it ended up not being record setting cold, it did mark the second straight year of below normal temperatures during our “warm season”.

What was noteworthy this past summer was the rainfall. While at Williamsport it was wetter than normal, the real news was at Harrisburg where the second wettest summer in history was recorded. The 19.36 inches of rain that fell from June 1st through the end of August was nearly 9 inches above normal, and ran second only to the summer of 1972. Some weather buffs may recall that 1972 was the summer that began with a visit from the infamous Hurricane Agnes. Catastrophic floods ensued when the storm dumped more than 10 inches of rain over a wide part of the region. In all, the summer of ’72 saw 23.33 inches of rain in Harrisburg, a summer not soon forgotten.

How did Williamsport fare? The 14.35 inches of rain from June through August was 2.44 inches above normal. While above average, it was only good enough to make it the 18th wettest summer on record.

Similar to the summer of 2003, dry days seemed to be at a premium. In all there are a 12 weekends from the beginning of June to the end of August. In Harrisburg just 2 of these saw both days remain rain free. Williamsport fared a little better with 5 of the weekends managing to stay dry. All told, about 50% of the days this past summer saw at least some precipitation fall. Once again the big losers were vacationers and businesses that cater to outdoor activities during what is usually our best time of year.

It might be recalled that early cool wet conditions adversely affected the agricultural community during the summer of 2003. This year we had a warm and dry May which was followed by a June that was only slightly cooler than normal and not tremendously wet. This seemed to result in better growing conditions for local farmers this summer. With the exception of some late season wet weather hampering hay production in some areas, the weather seemed to not make much news with regards to Pennsylvania agriculture this summer. The author can attest to the fact that we enjoyed some of the best locally grown sweet corn ever this year!

How did the summer fare elsewhere around the state? Table 1 summarizes temperatures for a smattering of stations around Pennsylvania. It ended up averaging below normal across the entire state, coolest near the Great Lakes where Erie was 2.7 degrees below normal.

	June	July	August	Avg	Departure
Williamsport	66.7	71.0	70.2	69.3	-1.1
Harrisburg	70.0	74.3	72.8	72.4	-1.1
Philadelphia	71.8	76.3	75.0	74.4	-1.0
Scranton	65.1	70.0	68.8	68.0	-2.0
Pittsburgh	67.6	71.3	68.6	69.2	-1.5
Erie	65.2	69.7	67.3	67.4	-2.7

Table 1. Summer Temperatures and Deviations

As for precipitation at the same sites, Table 2 summarizes the wet summer. Overall it looks like the southern half of the state was the soggiest. The big cities of Pittsburgh and Philadelphia were both more than 5 inches above normal while as previously mentioned, Harrisburg was very wet seeing rainfall nearly 9 inches more than normal.

	June	July	August	Avg	Departure
Williamsport	3.29	7.99	3.07	14.35	2.44
Harrisburg	4.31	7.97	7.08	19.36	8.92
Philadelphia	4.57	7.91	4.17	16.65	5.15
Scranton	4.31	4.20	4.90	13.41	2.60
Pittsburgh	5.01	5.67	6.13	16.81	5.35
Erie	1.82	5.82	2.42	10.06	-1.71

Table 2. Summer Precipitation and Deviations

So what does the upcoming winter have in store for the region? Well the Climate Prediction Center is expecting the 3 month period from December to March to stand a pretty good chance of being colder than normal over most of the state. As far as precipitation goes, they expect drier than normal conditions over the region just downwind from the Great Lakes while the rest of the state has equal chances of being wet or dry. See figures 1 and 2.

At the state Climatologist's office, Paul Knight and his crew have made the observation that during the last two 2 winters we have suffered greatly where snow is concerned. They are attempting to correlate the previous 2 snowy winters to the back-to-back snowy winters of 1977-78 and 1978-79. They note that the winter of 1979-80 saw below normal snowfall throughout the state and are predicting the upcoming winter to follow suit.

As for temperatures, they have not yet made their expectations known. They do note that Novembers that follow cool wet summers have a very high likelihood of being colder than normal. December isn't tied so tightly to a nasty summer and thus could go either way. A quick look back for how winters faired temperature-wise for the cities mentioned in tables 1 and 2 above showed the winter of 79-80 was a bit colder than normal over all but the northeastern part of the state where it was balmier than normal, but not by much.

Lastly the author consulted the ultimate oracle of long range forecasting, the Old Farmer's Almanac. Having been around since Benjamin Franklin made some of the first weather observations in our country; they use a closely guarded secret formula to make bold predictions for the whole country. Basically they predict a slow start to the winter with above average temperatures and below normal snowfall into February before old man winter starts firing on all cylinders. They say that storminess and cold will last well into March making the season cold and snowy overall. As usual, we shall see.

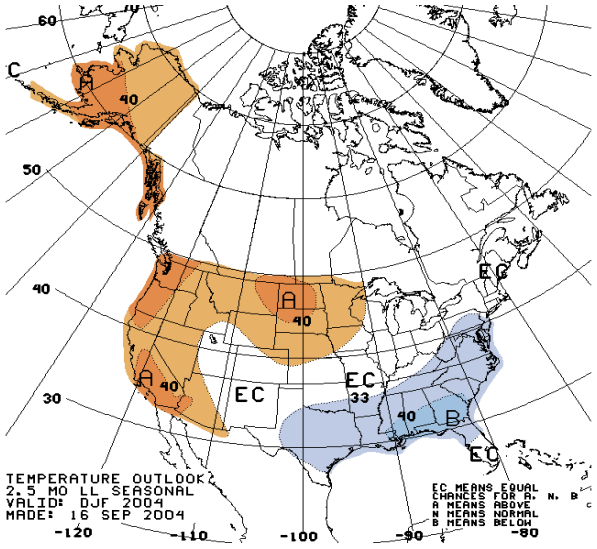


Figure 1. Winter 2004-05 Temperature Outlook

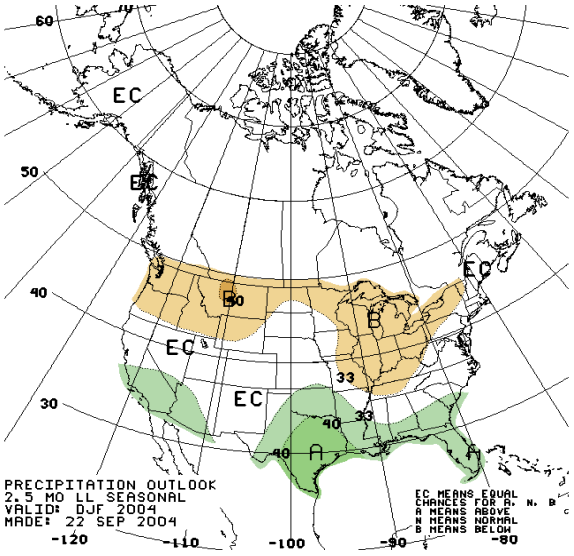


Figure 2. Winter 2004-05 Precipitation Outlook

The Reasons for Seasons

Richard Grumm, SOO

There are several reasons why we have seasons, but the two most important factors are the elliptical orbit of the earth about the sun and the tilt of the earth on its axis. We call this tilt the **angle of inclination**.

Because our orbit is elliptical (see figure 1), the distance to the sun varies as we move around our star. This results in the earth is actually being closer to the sun during our winter (northern hemisphere), when we get to within about 91.5 million miles of the center of our solar system.

During the summer the distance increases to around 94.5 million miles. This results in a paradox where the earth is actually receiving about 7% more solar radiation during the northern hemispheric winter than in summer.

To imagine an elliptical orbit, put two pins in a board and make a loop of string with a pen pulling the string so it can move about the two points. This allows the pen to draw an ellipse about the two foci of the ellipse. (A circle is an ellipse with one focus point) If you use a red and yellow pin for each point, the yellow pin would represent the "sun". The point closest to the "sun" would be perihelion and the point farthest from the "sun" would be aphelion. The earth reaches perihelion on 4 January and aphelion on 4 July each year. Thus incoming solar energy hitting the earth is about 7% higher on 4 January as compared to 4 July.

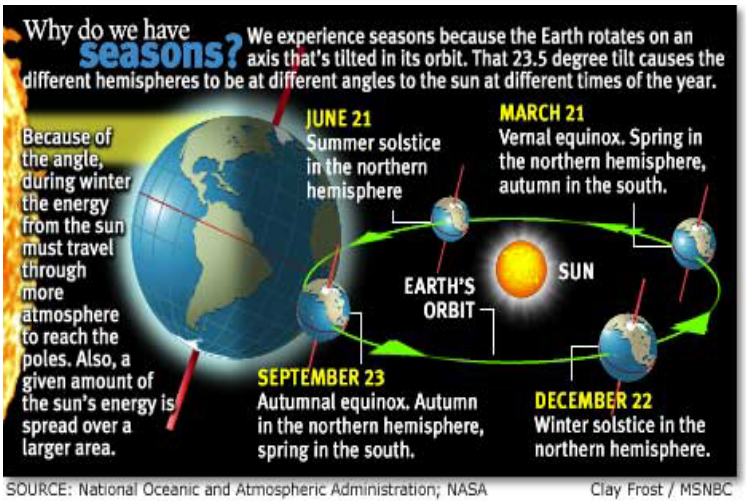


Fig 1. Illustration of the Earth's orbit about the sun and the Earth's angle of inclination.

While we vary in distance from the sun as we orbit about the solar system (figure 1), the earth's tilt is by far the most important factor causing the seasons. The earth is tilted on its axis by 23 ½ degrees. This causes the angle of the sun's rays striking the earth to change with latitude and time of year as the earth rotates about the sun. During the northern hemispheric summer, the sun's direct rays reach their highest point at 23 ½ degrees north latitude, the tropic of Cancer. Conversely, in the northern hemispheric winter, the sun reaches its most southern point of 23 ½ degrees south latitude, the tropic of Capricorn. The inclination has two main effects that impact our seasons.

The first effect is that when the sun is overhead, the rays strike the earth at a 90 degree angle and are then most efficient at heating the earth's surface. As you move north or south of this point, the incoming energy is received at decreasing angles, resulting in energy that is more spread out and less efficient at heating the earth's surface. To illustrate this, take a globe with the proper tilt and shine a flashlight on the tropic of Capricorn. Note that no light reaches the North Pole and the beam is at a low angle and spread out over the northern hemisphere. This is the main reason why it's colder in the winter than the summer in the northern hemisphere. The same effect is of course true in the southern hemisphere when the beam (sun) is shining directly on the tropic of Cancer. Our summer is their winter.

The second effect is the impact of the earth's atmosphere. When the sun light is directly overhead, the rays pass through the least amount of atmosphere. This allows most of the energy to reach the surface and heat the earth up. This in turn warms the lower layers of the atmosphere. Where the sun light comes in at an angle, it has to pass through more of the atmosphere, losing more energy in the process before reaching the surface. Thus, during the winter in Pennsylvania with the sun being low on the horizon, we get diffuse sunlight at the surface as the energy passes through a considerably larger volume of atmosphere. Combined with intrusions of cold air masses from the north, winter is a relatively cold period.

So, while we are closest to the sun during December and January, the angle of inclination has the effect of wiping out the increase in solar radiation. The result is that are colder at a time of year when we are actually closest to the sun and receiving its maximum energy.

The tilt has other indirect effects that help determine the seasons; it results in the solstices, equinoxes and amount of daylight. The tilt allows the sun to reach its most northern point in the sky around 21-22 June of each year. In the northern hemisphere we call this the summer solstice. After this, the sun moves southward reaching the equator on about 22-23 September of each year, we call this the autumnal equinox. The southward trend continues until about 21-22 December when the winter solstice is reached. From this day the pattern reverses and the sun reaches the equator again on its way north on about the 21st or 22nd of March, the spring or "Vernal" equinox. The exact day of the month varies due to our calendar and the elliptical path about the sun as determined by Kepler's laws on

planetary motions. The period between the winter solstice and spring equinox is shorter (89 days) than the period from the spring equinox and the summer solstice (93 days). A subtle, often missed point here is that the dates of the summer and winter solstice's do not line up with the time that we reach farthest (aphelion) and closest (perihelion) points from the sun, as was explained earlier.

The last byproduct of the angle of inclination is the earth's daily revolution about its own axis, producing our 24-hour day. While the 24 hour part of the day does not vary (significantly), the length of daylight varies with latitude and time of year as the angle at which the suns direct rays hit the earth changes. Daylight is longest in the northern hemisphere at the height of summer when the sun is highest in the sky, around the 21st of June. Conversely, daylight is shortest in the north around the 21st of December when the sun is very low in the sky. Combined with our elliptical orbit and 23 ½ degree angle of inclination, our daily rotation cycle led many ancient civilizations to build monuments to predict the seasons as they were acutely aware of the variation in the length of day based on the time of year.

So while it all may sound rather complicated, a simple model may go a long way to explaining why days are long or short or why it gets cold or warm at roughly the same time year after year.

Holy Hurricanes Batman!

John La Corte, Senior Forecaster

Here in the mountains of central Pennsylvania, hurricane season is someone else's problem, right? Well the summer of 2004 hopefully taught the state a lesson in just how important these tropical behemoths can be even in areas far removed from the sultry waters of the equatorial Atlantic.

The summer of 2004 will no doubt be remembered less for being cool and wet over much of the eastern part of the country than for the extraordinary hurricane activity that was spawned. While an active season was forecast, it is doubtful that anyone expected the kind of target practice the storms played on Florida and eventually much of the Eastern United States.

The first storm of note was Bonnie, which formed in early August. After meandering for a time in the central Gulf of Mexico, Bonnie took aim at the Florida Gulf coast where it eventually made landfall near Apalachicola on the 12th. Bonnie indirectly affected the weather in Pennsylvania when an upper level shortwave ahead of the storm swept the tropical moisture northeastward and caused localized heavy rains here in the region. This would prove to be a harbinger of the season yet to come, as more tropical activity would eventually bring some of the worst flooding in nearly a decade to the Keystone state.

The most destructive hurricane to hit Florida this year was Charley. It made landfall on the southwest coast near Cayo Costa, just north of Captiva during the evening of August 13. What made Charley remarkable was how it rapidly strengthened just before landfall, causing winds of more than 140 mph. This made Charley a category 4 storm on the Saffir Simpson Hurricane Scale (the strongest storms are ranked category 5). The storm continued northeastward and eventually devastated Punta Gorda and neighboring Port Charlotte. Charley then continued up the eastern seaboard while weakening rapidly. Thankfully for Pennsylvania, the forecast heavy rain and flooding never materialized with the storm. But the season was still young.

The next storm of note was Frances. After wreaking havoc in the Bahamas, Frances weakened slightly and came ashore near Sewall's Point on the east coast of Florida as a category 2 hurricane. Widespread damage from wind and flooding was reported as the storm crossed the peninsula on the way to its eventual track up through western Pennsylvania. Torrential rains followed Frances on its path inland through the Appalachians with the storm dropping as much as 6 inches of rain on parts of central Pennsylvania.

Next in line was "Ivan the Terrible". A classic Cape Verde hurricane, the storm was born in the early days of September over the sweltering waters of the far eastern tropical Atlantic Ocean. Nearly 2 weeks later on September 16th, after Ivan had decimated Granada, Jamaica and the Cayman Islands, it came ashore near Gulf Shores Alabama. Though it hit Alabama, Ivan was huge at landfall and caused considerable damage over a wide area including much of the Florida Panhandle. Ivan then continued up through the Appalachians and eventually interacted with a strong frontal system in Pennsylvania dropping prodigious amounts of rain over areas that had just received heavy rain from the remnants of Frances. Rainfall totals of between 5 and almost

10 inches were reported over most of Pennsylvania. This caused catastrophic flooding over much of the Susquehanna and Juniata River valleys, resulting in disaster declarations for many communities.

As if the eastern US had not suffered enough, along came Jeanne. It formed and meandered about for several days over the waters just north of the Dominican Republic where flash flooding killed more than 1000 people. The storm then lingered for a time while strengthening over the warm waters east of the Bahamas. After making a loop offshore, the storm headed west and made a beeline for the already abused east Florida coastline. It made landfall very near the spot where Frances had hit, exactly 3 weeks prior, in the vicinity of Stuart Florida.

Jeanne was a category 3 storm when it hit causing widespread wind and flooding damage. It then tracked over the already saturated terrain of the southeastern United States before heading up the eastern slopes of the Appalachian Mountains. So with yet another slug of tropical moisture associated with an old hurricane taking aim at the northeastern United States, the forecast of heavy rain and flooding began to sound like the playing of a broken record. Thankfully for Pennsylvania, most of the state was spared Jeanne's worst and the heavy rain and flooding was confined to just the far southeastern part of the state.

A look back in the history books fails to find a year so affected by the worst the tropics have to offer. Here in Pennsylvania, it is not unusual in summer or fall to see the rains from a dying tropical storm or hurricane, and several years have even seen the remnants of a couple of old storms affect the region. But never have we seen the remnants of 5 separate storms move through and cause flooding. The height of it all was the span of 19 days when Frances, Ivan and Jeanne all took swipes at the state. The flooding that ensued will go down as the worst on record in some areas. It almost makes one look forward to the cold and snow of winter so that we can relax for a while...almost.

For more information on hurricanes and the Saffir Simpson scale, visit the National Hurricane Center on the internet at: http://www.nhc.noaa.gov/

The Man Behind the Curtain

Les Thario, ESA

Most of us recall the movie, The Wizard of Oz and the in-famous line "Pay no attention to that man behind the curtain!" Well that could be uttered each day a meteorologist or hydrologist prepares the daily forecast in offices from coast to coast.
The men and women behind the curtain are the Electronic/Information technology staff employed at every National Weather Service and River Forecast Center office throughout the country.

Everyday hundreds of electronic (ET) and information technology (IT) folks spend their work days repairing, calibrating, performing preventative maintenance, and developing the hardware and software to aid the forecasters in doing their job.

This electronic equipment is located at sites ranging from the busiest airports to the most remote places in the country, such as forecast offices in Nome, Alaska to Key West, Florida.

A typical day in the life of an electronic technician could involve several hours of what we refer to as "windshield time". Often we drive (at some locations like Alaska we fly in planes so small it is difficult to even move inside of them!) several hours before we can even start our repair or maintenance on a piece of equipment. One such piece of equipment is known as the ASOS, short for the Automated Surface Observation System. This system is comprised of several elements that supply the meteorologist/hydrologist with observational and climatology data. These data include air temperature and dewpoint, wind speed and direction, precipitation data, cloud height, freezing rain and thunderstorm information, atmospheric pressure and present weather. ASOS is not only important to forecasters, but is integral to the nation's aviation system as it provides vital take off and landing information directly to the pilots.

The modern day ET is a very "well rounded" technician. We work on everything from equipment built in the 1950's to the latest computer software and hardware. We are constantly challenged to incorporate new technology while maintaining the old.

Another system we maintain is the WSR-88D Doppler Radar, also known as NEXRAD (Next Generation Weather Radar System). This radar provides real time weather radar data for the

forecaster. The WSR-88D or NEXRAD has been commissioned and in use by the National Weather Service since around 1990. This complex system has had several hardware and software enhancements over the past decade, but will one day reach the end of its life cycle. When that day inevitably arrives, we will then "hit the books" and learn a new system.

Ever heard the soothing sounds of what we affectionately call "IGOR"? Well that's the text-to-speech NOAA Weather All Hazards Radio broadcast. The electronic staff also maintains this NOAA radio system. The system is used to bring not only daily forecast information to the public but also distributes severe weather watch and warning information. It can also be used to broadcast public information statements ranging from air quality bulletins to information concerning the latest Terror Alert Level.

Perhaps the most complex system we maintain is the Automated Weather Information Processing System (AWIPS). This computer system takes in all our data and puts it in one location for the forecasters and hydrologists, allowing them to integrate information in ways that were previously not possible. The complex system is networked with every other forecast office throughout the country, enabling data sharing and transfers at a rate hundreds of times faster than only a few years ago.

What else do we do? The list can include installing and maintaining telephone lines and modems for communication or data transfers. With the growing use of the Internet, the ET staff is increasingly called upon to help maintain and troubleshoot National Weather Service Internet systems. Our office computer network is extensive and sophisticated; we are called upon to take care of it. Even though the government is moving toward "paperless" offices, many products still require printing. When the printers malfunction, guess who gets the call? The River Forecast Center monitors and forecasts the river and stream levels across much of Pennsylvania. In order to do this, a myriad of river and stream gages are utilized. When they break, we get the call. Basically, if it has wires, we probably have something to do with keeping it up and running.

So next time you see or hear a National Weather Service or River Forecast Center broadcast you'll know that it was all made possible with the help of "that man behind the curtain"

El Nino

Dave Martin, General Forecaster

After two stormy and cold winters, you may be wondering what is in store for the upcoming winter. One of the factors involved in forecasting outlooks for the winter season is the presence (or not) of El-Nino. NOAA (National Oceanic and Atmospheric Administration) is forecasting a weak to moderate El-Nino this season.

El-Nino was discovered in the early 1800s, as monks and fisherman noted large variations in the fish and bird populations off the South America Coast near Peru and Ecuador. This variation was caused by warmer than normal ocean temperatures in these "El-Nino" years and resulted in depressed fish harvests off the western shores of South America. The name El-Nino literally means "the boy" in Spanish, and because it usually occurred around Christmas time, it also could be known as the "the Christ child".

ENSO (El-Nino Southern Oscillation) refers to the entire cycle of the El-Nino, which is a recurring phenomenon. The El-Nino part of the cycle refers to the warm phase, while La-Nina is the cold phase of the ENSO. With La-Nina, departures are reversed, and sea surface temperatures are colder than normal around the Equator off the South American Coast. During these cold phases, fish harvests tend to be plentiful.

Weather-wise, El-Nino plays a large part in where the subtropical jet stream sets up, especially during the winter months. When El-Nino is present, it usually weakens by April and its effects in other seasons tend not to be as pronounced as during the winter. Some years see neither an El-Nino nor a La-Nina. This is often referred to as a neutral phase.

Recently El-Nino has appeared more frequently and several have been stronger than normal. Significant El-Nino's occurred during the 1972-73, 1982-83 and 1997-98 winter seasons. The Eastern United States had their warmest winter in 25 years during the winter of 1972-73.

Usually with El-Nino, drier and warmer conditions prevail across the northern United States, while cooler and wetter than normal conditions prevail across southern and western states. For Pennsylvania, affects tend to be less clear cut during El Nino years. While the "signal" is weak, El Nino tends to correspond to

western and northern sections of the state to be a bit warmer and drier than normal.

There are other factors beyond El-Nino and La-Nina that influence the winter season across the USA. The North Atlantic Oscillation (NAO) is one of these. The NAO has a large influence, especially across the Northeastern United States and Europe. When the NAO is negative (sea level pressures above normal across the North Atlantic), the northeastern states often have a stormy and cold winter. One of the problems with the NAO is the ability to forecast its occurrence. While it has been shown that El-Nino can be forecast several months in advance, the NAO has proven harder to forecast more than just a few days or a week in advance.

The last two winters have seen weak to neutral El-Nino's in the Pacific while being dominated by a negative phase of the NAO. Since it is more difficult to forecast the NAO, winter forecasting over the northeastern United States becomes hard (or impossible) to pin down. As we know, the last two winters have been colder and snowier than normal here in Pennsylvania.

Other ingredients in the long range forecast are not confined to just the phase of the El Nino or NAO. The Climate Prediction Center also employs the use of numeric computer models to help gage the expectations for the upcoming seasons. So while we are entering into a new El Nino, and the NAO over the last two seasons has tended negative, the official outlook calls for the likelihood of a drier and cooler than normal winter for central Pennsylvania. See the article above, "The Summer of 2004 in Review" for figures showing the forecasts expected for the upcoming season.

So whether one looks to the El-Nino, NAO, Farmer's Almanac or Tarot Cards, forecasting the upcoming seasons seems like it will remain a challenge for some time to come.

Winter Weather Driving: A Challenge Under the Best of Circumstances

Victor Cruz, Meteorological Technician

Under the best of conditions, winter driving is tough on motorists and vehicles. With a little preparation, though, drivers can make it through the toughest driving conditions.

1. Charge - Cold weather is hard on a battery. Keeping battery terminals clean helps, but a load test by a qualified technician will determine if your battery has what it takes this winter. Also check flashlight batteries and cellular phone batteries.

2. Get a grip - Before winter arrives, make sure your car is equipped with tires that are able to handle winter weather.

3. See and be seen - Clear windows, mirrors and lights. Keep windshield wipers and defrosters in good working order and washer reservoirs filled with no-freeze windshield washer fluid.

4. Slippery when wet - In temperatures at or just-above 32 degrees, a thin layer of water can cover the ice, causing extremely slippery conditions. The distance needed to stop doubles.

5. Keep your engine cool - Make certain cooling system antifreeze is mixed with an equal portion of water for maximum protection.

6. Key solution - Frozen door locks can be overcome by carefully heating the end of a key with a match or a lighter. A squirt of de-icer spray is another quick method.

7. Air it out - Don't start your car in a closed garage or idle your engine with windows closed. Carbon monoxide, present in exhaust fumes, is almost impossible to detect and can be fatal.

8. Finish up - Road salt, slush and grime are especially hard on car's finish. To help prevent rust and paint damage, keep cars washed and waxed.

Winter Advice for Parents of Young Drivers

Winter driving can be challenging to any motorist, but slippery roads can be especially difficult for novice drivers dealing with snow and ice for the first time.

1. Help your teen practice - Under supervision, let your teen try slow-speed maneuvers on a wide-open snow or ice-covered parking lot. Practice hard braking and steering in skidding situations.

2. Don't wait for the worst of winter - A novice driver's first on-road experience with winter-weather driving should not occur during a major blizzard. Wait until conditions are less severe.

3. Limit your teen's driving to daylight hours - Until your teen gains experience; consider limiting driving on slippery conditions to daylight hours only.

4. Preach zero tolerance - Remind your teen that driving under the influence of drugs and alcohol is dangerous under any conditions, and that the risk is even greater on slippery roads.

5. Maintain your teen's car in proper working order - winter weather is tough on cars' mechanical systems. Stopping in slippery conditions requires brakes and tires that are in top condition.

6. Equip your car and your teen's car with a Winter Survival Kit.

Winter Survival Kit

A winter survival kit costs less than $75, but it could save your life:

1. Coffee Can Furnace (a candle lit inside a coffee can generates heat)
2. Carpet Strips (for traction under drive wheels)
3. Boots
4. Ice Scraper & Brush
5. Flares & Reflectors
6. Jumper Cables
7. Newspapers (great insulation when placed between skin and clothing)
8. Shovel & Sand or Cat Litter (for traction)
9. Tools & Flashlight
10. First Aid Kit
11. Food & Blanket
12. Tire Chains (for use on secondary roads only)
13. Prepaid Cellular Phone
14. NOAA Weather All Hazards Radio

Remember, it's usually best to remain with a stranded vehicle rather than to risk exposure or become lost while walking for help.

NWS On the Move!

Dave Ondrejik – Warning Coordination Meteorologist

The NWS in State College is moving our office location…but don't worry it is not too far from our current home. We are moving to the other side of Penn State's campus. For those of you who are familiar with State College, we are moving to the new Innovation Park near the football stadium. We will be sharing a 3 story building with several Penn State offices and several private companies. We are expecting the move to occur in February, but not sure what week. One thing is for sure…there will likely be a big snow storm during the move ;) (That is a better forecast then any groundhog can give!)

How will this affect your service? Hopefully it will be transparent. We expect our local operations to be down for about three days to complete the move of the equipment and satellite dishes. However, we are sending a contingent of meteorologists to our backup office in Binghamton, NY to maintain our daily operations.

We are hopeful that we can keep our current spotter 800 number, but at this time we are unsure. If there is a change in the number, we will send out the new information to you.

I would like to add a reminder…we still need you in the winter time. Your snowfall measurements are quite useful to us. We are very appreciative whenever we get those reading from you. Please call us anytime you get over 6 inches of snow. You can either call the spotter line, or report those numbers via the internet. Simply point your browser to:
weather.gov/statecollege
On the left side, under "Current Hazards" section, click on "Send us Reports". This will take you to a new page that allows you to enter snow and rainfall reports.

One final issue is to THANK everyone who provided severe weather reports throughout the season. Each and every report was useful and we appreciate your effort. After a very active summer and fall, we have had a total of 21 tornadoes in Central PA for 2004. Thanks to your reports and our warnings there were ZERO deaths due to tornadoes this year!

Now…time to clean out my desk for the upcoming move!

Snow Terminology Used in NWS Forecasts

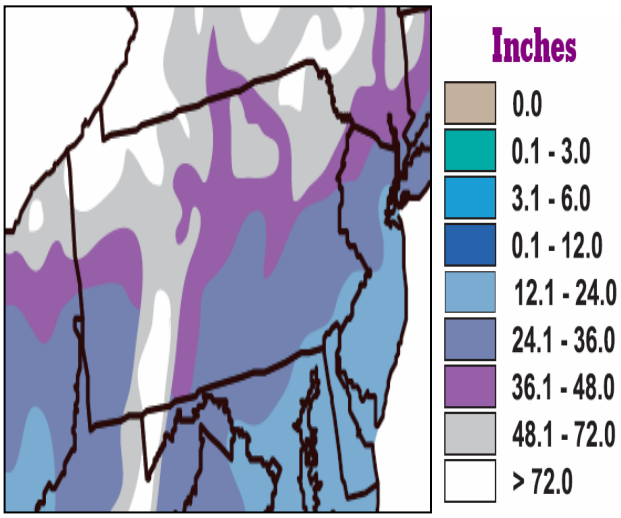
By Greg DeVoir, Senior Meteorologist

When one thinks of Central Pennsylvania in the wintertime, snow is one of the first things to come to mind, and in many cases lots of it! The graphic below shows annual snowfall for central Pennsylvania and its surrounds. Note that over half of the Keystone State receives more than 40 inches of snow in an average winter.

Snow can paralyze cities and towns, closing businesses and grocery stores, shutting down interstates and airports, and disrupting emergency and medical services. There are many different varieties of snow and different threats associated with each. As such, the National Weather Service uses different snow terminology to communicate the "character" and impact of snowfall events, from relatively minor to severe.

As the leaves (and mercury) continue to fall, now is a good time to review the snow terminology used in NWS forecasts and the threats associated with each.

SNOW FLURRIES: Light snow falling for short durations with no accumulation. Usually not a hazard, unless melting on roadways occurs prior to a rapid drop in temperatures.
SNOW SHOWERS: Snow falling at varying intensities for brief periods of time. Some accumulation is possible.
SNOW SQUALLS: Brief, intense snow showers accompanied by strong, gusty winds. Accumulation may be significant, and visibilities can be reduced to near zero.
BLOWING SNOW: Wind-driven snow that reduces visibility. Blowing snow may be falling snow and/or snow on the ground picked up by the wind.
BLIZZARD: Winds of 35 mph or more with snow and blowing snow, reducing visibility to less than ¼ mile for at least 3 hours.



Annual Snowfall (in inches) for Pennsylvania and surrounding areas.

Entering Snowfall Reports from the Web

Ron Holmes, Information Technology Officer

For the past 2 winters we have been supporting a means for you to report your snowfall observations directly to our office via the web (see below for the URL). Have you ever wondered what happens to these observations? As soon as you enter your snowfall reports they get written to a database and are stored there for anyone to retrieve at any time. In fact you can look up snowfall reports that you've entered for the past 2 seasons.

Every hour there are programs running that scan the database for new entries. If any are found they get retrieved and a window pops up right in front of the forecaster showing the reports that you've entered for that hour. Therefore by entering your reports you are alerting the forecaster as to how much snow fell in real time. This real time reporting allows the forecaster to make better decisions such as when to upgrade a watch to a warning.

Another benefit to your reports is that they are plotted and analyzed on a map automatically. Every hour a new map is generated so you can see how your reports match (or differ due to topographic influences) with others. At the end of the day a total snowfall map is stored for you to look at in the future by using the provided web interface (see below for the URL).

In addition to the real time reporting and map generation aspect of this web site a Public Information Statement (PNS) is automatically "written" by other programs running on the system. These programs query the database, extract the snowfall reports, and sort them alphabetically according to county and them by amounts from highest to lowest within that county. The PNS is created for the forecaster in ready-to-transmit form though it is quality controlled before it is transmitted. The ability to auto-generate this product, which can be very lengthy during an active storm, has been a huge time saver for the forecaster.

To enter your snowfall report at any time (and see maps of your reports) please visit: http://nws-sc.met.psu.edu/snowreport/ReportMain.jsp which can be found from the support web site at: http://nws-sc.met.psu.edu/index.jsp

Also please feel free to visit our Official National Weather Service web site at: weather.gov/statecollege

Ice Fishing Safety Tips

Dave Martin, General Forecaster

Winter can be an enjoyable time for outside activities, and central Pennsylvania certainly has a lot of those activities to offer. One outside activity is ice fishing. Though it can be relaxing and enjoyable, it can also be dangerous. With that in mind we offer some ice fishing safety tips:

- Understand your limitations.
- Get proper rest and nutrition.
- Carry snack food and drinking water with you.
- Be familiar with the area where you will be fishing.
- If traveling to a remote location, use caution. Travel with a partner if possible.
- Inform friends and family of your travel plans.
- Stay alert for adverse weather conditions.
- Avoid venturing out on the ice until ice is of sufficient thickness.
- Avoid areas that are snow covered, covered with water, or show cracks.
- Do not venture out on moving ice sheets.
- In late winter and early spring, stay off ice if the air temperature has been mild.
- Dress properly for conditions.
- Know local guidelines and regulations. Do not drive vehicles out onto the ice.
- Carry basic first aid supplies and know where to seek help if needed.

The Wonder of Fall's Colors

Barry Lambert, Senior Forecaster

The splendor of changing leaf colors in the fall is virtually unsurpassed in nature. Each year countless people book bus trips and vacations, or plan simple family day trips to view this autumn spectacular.

Why do trees change color early in the fall?

Deciduous trees such as Oaks, Maples, Birch and Elms shed their foliage each year at the end of the growing season. The shortened daylight hours and generally drier conditions prohibit the process of photosynthesis (or "putting together with light"), which is the "food making" process of leaves that turns water and carbon dioxide into glucose (food) with the aid of sunlight. Chlorophyll is a vital chemical in the photosynthetic process, and is also the reason for the dominant "green" color that a leaf displays throughout the summer months. As the chlorophyll disappears from the foliage during the fall, other "hidden" colors in the leaf appear "temporarily" before the leaf dies and falls off as the tree goes into a state of rest for the winter

What colors do specific tree types display?

Here in the northeast U.S., brilliant yellow is displayed by Poplar, Birch and Black Maples, while bright oranges and fiery reds typically come from Sugar and Red Maples, Dogwood and some variety of Oaks. Golden bronze and browns are associated with Beech and Oak trees.

Yellow, orange and brown colors are attributed to the presence of carotenoid (the chemical which gives carrots their orange color) in the leaves, while red coloring is caused by anthocyanins. While carotenoids are present, but hidden by chlorophyll throughout the summer months, anthocyanins are produced only during the autumn under warm sunny days and cool nights under 45F.

Why don't dead leaves at least stay on trees through the winter?

On a broadleaf tree (for example a maple or birch) the delicate thin leaves, which are made up of cells filled with water and sap, will freeze in winter. Any plant tissue unable to live through the winter's cold must be sealed off and shed to ensure the tree's survival.

As sunlight decreases during the autumn, the veins which carry sap into and out of a leaf gradually close. A layer of cells, called the "separation layer", forms at the base of the leaf stem. After this layer of cells is complete, the leaf is pinched off from the tissue that connected it to the branch, and it falls. The lone exception is Oak leaves. Their separation layer doesn't fully detach the dead leaves, and they remain on the tree throughout the winter.

We've had an extended period of color this fall here in Pennsylvania, about a week or so longer than usual. One of the primary reasons for the longer fall foliage viewing was the absence of frequent frost or a hard freeze across central and southern Pennsylvania. In addition, windy days were practically absent after the leaves began to

change color. However, the strong west winds on Saturday and Sunday, October 30 and 31 did a good job at stripping much of the remaining foliage from the trees. Thus we bid the foliage season a fond good bye, tune in next fall for a repeat performance.

The SKYWARNEWS Mailing List

John La Corte, Senior Forecaster

As most of you know, our news letter comes out twice a year and has always been published in black white. Unfortunately, with our mailing list exceeding 2000, the cost to print the news letter in color is prohibitive.

What we would like to do is advance the Skywarnews Newsletter into the 21st century and actually begin to incorporate color figures and diagrams. To do this however, we would need to reduce our traditional "snail mail" subscription list (and costs) and employee modern technology to deliver the letter to you. What we are proposing is to develop an electronic mail list and to email the news letter to you each Spring and Fall upon publication. This will allow you to receive and keep an electronic version of the newsletter or to print it out at your leisure, enjoying the articles from our devoted authors in full living color.

If you would like to help get this proposal off the ground, or have any questions regarding the proposed new method to publish the news letter, please send me your email address and we can add you to a new mailing list we will develop. Please e-mail your name and e-mail address to:

katherine.christ@noaa.gov

If you do not have a computer or internet access, not to worry, we still plan to mail our news letter out to those who want a copy in the mail. We just hope to reduce the number of mailings enough to allow us to send all copies to our readers in color and we can enjoy the colors of the spectrum as well as learn a little something about the weather and climate.

Just a reminder, if you change email addresses, please notify us so that we keep our mailing lists current.

SKYWARNEWS

National Weather Service
227 West Beaver Ave
Suite #402
State College, PA 16801

TO: