NORTHEASTERN STORM BUSTER

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Evan L. Heller, Editor/Publisher
Steve DiRienzo, WCM/Contributor
Ingrid Amberger, Webmistress

SPECIAL 20TH ANNIVERSARY ANTHOLOGY ISSUE

Forty of the best feature articles of Northeastern StormBuster's past 10 years

Northeastern StormBuster *is a quarterly publication of the National Weather Service Forecast Office in Albany, New York, serving the weather spotter, emergency manager, cooperative observer, ham radio, scientific and academic communities, and weather enthusiasts, all of whom have a special interest or expertise in the fields of meteorology, hydrology and/or climatology.*

From the Editor's Desk

It is with great pride that we bring you this very special edition of Northeastern StormBuster. It's been a remarkable 20 years, and I am very proud to have been a part of it for most of that time, first as a contributing author, and then also as its Editor, since 2004. Ten years ago we brought you the 10th Anniversary issue, where we presented 20 of the best articles from 1996 to 2005. This time around, there were so many more great articles to choose from, that I had to do something to help me choose the very best. After a while, it was apparent that there were going to be more articles. So, I decided to focus on only the past 10 years. With over 190 feature articles to choose from, I finally managed to get the list down to 40. With so many great articles it would not have been practical to try to eliminate any more from contention. So this issue is twice as packed with great reading as that initial anniversary issue 10 years ago. This time, I decided to take an anthology approach, presenting the articles in chronological order by issue date. At the end of the 40 articles, there is one bonus article, and then two new articles related to climate, one being the seasonal wrap-up that I write for every issue. There's plenty of reading here for your enjoyment…something fun to do on those cold winter days to come. Enjoy!

GOLF AND LIGHTNING SAFETY: WHAT YOU NEED TO KNOW

Joe Villani
Meteorologist, NWS Albany

Evan L. Heller
Meteorologist, NWS Albany

Each year during the spring and summer months, thousands of people flock to golf courses. In northern states, golfers approach the first tee with unabated enthusiasm once the weather becomes warm enough to play. Most people, especially avid golfers, are quite familiar with the risks and dangers involved in partaking in this ever more popular outdoor activity.

We've learned that being out in the sun for more than an hour or two puts people at risk for serious sunburns, and that long-term exposure can even lead to skin cancer. The dangers the sun poses have been well-publicized, and are commonly known, particularly to golfers and other spring and summertime enthusiasts of the outdoors. But when the weather becomes unsettled, another major risk to golfers arises: thunderstorms, and the greatest danger associated with them is lightning.

In the Northeast, including New York state, thunderstorms occur quite frequently during the late spring and the summer. According to the National Lightning Safety Institute, 15 people were killed in New York state between 1990 and 2003 due to lightning strikes. Still many more have been struck and merely injured. New York has been ranked 18^{th} highest state in the country for lightning deaths. Not all people are adequately sensitized to the danger lightning poses, but they really need to be, and they also need to take appropriate measures to ensure their safety.

It's important to always take proper precautions to prevent being struck by lightning, particularly out on the golf course. Lightning is more likely to strike the taller of objects in open areas. This poses a serious problem to golfers during a thunderstorm, since an upright human is usually the tallest object on a course besides trees, especially when standing out in fairways or on greens. Due to their large size, trees are very susceptible to being struck by lightning. A person sheltered beneath a tree when lightning strikes it will usually also be struck, since trees are very good conductors of electricity all the way down to the ground and into the immediately surrounding air. The use of metal golf clubs, as well as electric carts, which are also made mostly of metal, is no more safe, since both of these will also readily conduct electric currents. The bottom line is that there is no safe location on a golf course during a thunderstorm. One location, however, is a best choice.

So, what should you do if you encounter a thunderstorm on the golf course? First of all, be aware of the weather conditions expected on the day you plan to golf. If there's a forecast potential for thunderstorms, have a plan of action should you find yourself, say, at the 12^{th} hole, and you suddenly hear thunder or see lightning. The best thing you can do is immediately seek shelter. When you first hear thunder, the core of the storm is probably closer than you think, and you need to promptly start heading back to the safest location on the golf course: the clubhouse. A second option would be to get inside a heavy, and fully-enclosed vehicle. There is generally still adequate time at this point to seek safe harbor. But do not hesitate to take immediate action! If you wait for even a minute, you may find yourself caught outside with the storm quickly on your heels, and you could become rain-soaked, or worse! It's also important to know that lightning can also strike well away from the main core of a storm, as far as several miles. Golfers and other warm-season outdoor sports enthusiasts have actually been struck by lightning directly beneath clear skies. Even if a thunderstorm should interrupt the smooth flow of your game, it's usually only temporary. If you have the time and patience to wait it out, many storms last just 15 minutes to a half hour, and you can resume play afterwards. The bad news is that other storms sometimes follow.

Climatologically speaking, most thunderstorms occur during the afternoon and early evening hours, so if you'd like to avoid encounters with most storms, set a tee time between 6 and 8 am, and be finished in time for a relaxing lunch. The morning hours also happen to be generally the coolest time of the day during the hot summer months, so, if you are an early riser, by all means, take advantage! However you choose to 'slice' it, heed this advice and have yourself a safe and enjoyable golfing season!

UPPER AIR OBSERVATIONS AND FORECAST QUALITY

Evan L. Heller
Meteorologist, NWS Albany

One of the important services provided by the National Weather Service is upper-air observations. Albany is one of 92 NWS Upper-Air observing stations across the United States and its possessions that perform routine upper-air observations as part of the NWS's Upper-air Observations Program. An Upper-Air observation, or run, provides a snapshot of conditions in the atmosphere, usually to as high up as 20 miles or more. This is accomplished by the launching of a lightweight radiosonde attached to a large lighter-than-air balloon designed to withstand the extreme conditions it encounters on its ascending trip through the atmosphere. The vast majority of stations routinely fill their balloons with helium. The radiosonde itself is an instrument that continually measures pressure, temperature and relative humidity, and calculates wind direction and speed based on the instrument's motions, throughout its journey. These motions are tracked by satellites. Most of the stations routinely perform two upper-air runs per day, 12 hours apart; one in the mid-morning, and one in the early evening. Additional, special, upper-air runs are occasionally performed by offices anticipating significant or rapidly-changing weather conditions.

Upper-air data is a vital part of the process that goes into the making of timely and accurate forecasts. The coded meteorological data collected during an upper-air run produces a sounding, which graphically depicts the changes in the various weather parameters within the more or less vertical slice of the atmosphere through which the radiosonde traveled. Data produced also are input into formulas which calculate various parameters that aid in the forecasting of significant events such as the potential for severe weather and heavy rainfall, important summertime concerns. The data is also used by NWS's National Centers for Environmental Prediction (NCEP), located in Camp Springs, Maryland. Here, data is ingested from the observations into computer models which, in turn, produce digital guidance products and maps that NWS meteorologists utilize in creating their forecasts.

Of course surface observations are important, but without reliable data from the levels of the atmosphere that drive weather systems, forecasting would be a tremendous challenge, like it was prior to World War II, when upper-air observations were performed using low-flying planes and kites, which normally could not get more than about 20,000 feet up into the atmosphere. Luckily, we've come a long way since then. Balloons are made more durable, and can reach levels in the atmosphere which airplanes, and certainly kites, previously could not. Additionally, with their horizontal mode of travel, it was hard for airplanes to be able to get an adequate vertical representation of the atmosphere. Radiosondes have also improved, with better designs and instrumentation. The ground equipment and computer software systems which monitor and process data have continually undergone improvements, as well. And further improvements are sure to come.

As one of a team of six upper-air observers here at the Albany office, and as our Upper Air Program Leader, I strive for the consistent production of high-quality upper-air data. We do the best we can to get in our two runs per day. But on occasion, mechanical things go wrong that are beyond our control, and we end up without an upper air run. When a station misses an observation, it means there's a 'hole in the grid' over that part of the country, and important upper-air information gets left out of NCEP's models. It follows that the spatial resolution of the data in and around that area decreases, values need to be interpolated, and forecasts are not as reliable. Thus, the importance of the NWS Upper-air Observations Program in the forecasting process can not be understated. For more information about it, you may visit the following internet link: http://www.ua.nws.noaa.gov/.

MY VISIT TO A CONTROLLED BURN

Hugh Johnson
Meteorologist, NWS Albany

The Albany Pine Bush Preserve Commission conducted their 6th Annual Controlled Burn on the Pine Bush grounds on Thursday, August 24th. I was fortunate to have been able to attend this particular burn session. Weather conditions had put the controlled burn on hold on several occasions. My forecast from the day before foretold of a cloudy day with a 40 percent chance of rain, along with temperatures holding in the 60s. Because this threat of rain was in the 'chance' category, the controlled burn was placed in 'wait and see' mode.

The day of the controlled burn didn't turn out exactly as expected. Some showers fell south of Albany very early in the day, and a short wave moved north of the Capital District during the morning, touching off showers across the Southern Adirondacks. There were no showers affecting the immediate Albany area. The clouds even broke up partially, allowing temperatures to reach well into the 70s. A light northeast wind prevailed as expected.

About fifteen people from the Preserve, as well as a couple from the Massachusetts Conservatory, also attended the burn. Craig Kostrzewski, a fire weather specialist and the new Director of the Pine Bush Preserve Commission, was the Line Supervisor, and Joel Hetch, the Operations Supervisor, for the burn. Everyone gathered at the end of Madison Avenue (past the western end of Washington Avenue, at the westernmost portion of the Albany city limits) around 9 a.m.

Just prior to the gathering, Joel had called me during duty at the Albany National Weather Service Forecast Office for a briefing in order to decide whether to carry out the burn. I provided an update of the weather situation. Once at the site, I called the weather office, and spoke with Joe Villani, one of the forecasters on duty. Based on radar data and trends, we both agreed that the threat of rain was minimal, probably closer to a 20 percent chance than a 40, and not until later in the day. But another concern at the time was the relative humidity. Even as late as 9 a.m., there remained dew on the grass in shaded areas. To figure the relative humidity (RH), I had the privilege of slinging a psychrometer (every meteorologist's dream). My initial input was a dry bulb temperature of 68º, and a wet bulb temperature of 62°. This translated to an RH of 65%, which was very close to the reading at the weather office. Joel indicated that, for a controlled burn, ideally, the RH should be about 40%. Our Fire Weather Forecast indicated a low RH of 50% for that area by afternoon. We had to wait until the dew burned off, and the RH dropped below 60%. Thus, the pre-burn briefing was held off until after 10 a.m.

The briefing included a safety drill on how to properly deploy a fire emergency tent. Joel discussed many safety rules, and emphasized the lines of communication. This was followed by an extensive walk through the sections of the Pine Bush that were to be included in the day's burn. It was explained that excessive underbrush was affecting the health of the native shrub pines, resulting in a buildup of fine fuels, which constitutes an increased fire danger during dry periods.

We reassembled at the starting point around noon, and Joel and the rest of the team continued to prepare for the burn. I took another weather observation. Due to breaks of sunshine, the dry bulb temperature had risen to 74°, and the wet bulb was 63°, yielding an RH of 58%. The wind was very light, and mainly northeast. I then began providing half-hour weather observations close to the burn site. By 12:30 p.m., most of the group had set up in their assigned spots inside the Pine Bush to commence a test burn. My 12:30 p.m. readings were: a temperature of 76°, and; a wet bulb of 63°; so, the RH was down to 53%. The wind remained very light northeast. A gust to 8 mph was noted. I called Joe back at the office, and we both agreed that any further wind gusts would likely be no higher than 10 mph. After relaying this information to Joel, the command to begin the test burn was given.

The test burn was required in order to see how the fire would behave. The biggest challenge was to keep the smoke from moving across the Thruway, which was less than a thousand feet to our northeast. Since the winds were mostly light, the goal was to control the spread of the fire by producing a 'strip' fire, with heat-induced convection producing tall flames parallel to one another, at about 10-foot intervals.

The results of the test burn indicated that the fine fuels were a little wetter than optimal (about 15% moist vs. the ideal value of around 10%), yet it was acceptable enough so that Joel was able to give the green light to commence the actual burn. People trained in fire behavior ignited the fire by lighting matches to gasoline. The smoke that was produced rose mostly vertically, as desired, and well over a hundred feet into the atmosphere. Another important factor in a controlled burn is the Haines Index. This index is an indicator of low-level instability. Ideally, it should be around a 4 or a 5, not the less stable 3 that was forecast for the day. The calculated index was actually closer to a 4, and according to Joel, the fire behaved as if it were indeed a 4. The flames reached about four feet high and burned only the underbrush, not the pines themselves. It had been more than two decades since this specific area had last been burned. The burn took only about an hour, and Joel stated that drier vegetation (fuels), and about 10 percent lower relative humidity would have cut the burn time in about half.

After the burn, there was a debriefing, which was of shorter duration than the pre-burn briefing. Joel and Craig both felt that while much underbrush didn't burn due to high moisture, the operation was wholly a success. They indicated that another burn in the same vicinity is likely sometime in the near future. I didn't stay for the 'mop-up', as I wasn't permitted to return to the still-smoldering areas without official fire safety certification. During the debriefing, one fire briefly flared up to about 6 feet high, but I was assured it would quickly extinguish.

This was a great experience for me. Attending the burn enhanced my knowledge of outdoor fire control and prevention. Plus, I was able to apply my own weather observing skills to the situation. I also learned that folks are making good use of the fire weather information found on our local National Weather Service website.

THE FOGGIEST TIME OF THE YEAR

Bob Kilpatrick
Hydrometeorologist, NWS Albany

Evan L. Heller
Meteorologist, NWS Albany

As the days get shorter, and the nights get longer, we tend to get an increase in both the frequency and severity of fog during the predawn hours in and around the Capital Region. While fog can occur any time of year, dense fog poses the greatest problem from late August through late October. There are a number of reasons for this.

The first reason, as mentioned before, is that the nights get longer. The sun reaches its northern zenith, directly overhead the Tropic of Cancer, around June 21st. From then on, it starts making its way southward, and around September 22nd, crosses the equator on its way 'down under'. Not only are the days getting shorter, the sun is getting lower, so the sun isn't heating the air and ground as directly as it did during June and July. Even more important is the fact that the nights are getting longer. After sunset, when the sky is clear, heat rises from both the ground and surrounding air, and escapes into space. This process, known as radiational cooling, occurs as calm winds allow air to cool to the dew point temperature. Long nights, therefore, give this process extra time to occur, while the shorter days help keep temperatures closer to the dew points, requiring less time to form fog once the nightly process commences. Once the dew point is reached, moisture in the air condenses and forms 'radiation fog'. This kind of fog is also often formed in valleys when cold air 'drains' from surrounding hills. Oftentimes, hilltops and mountain peaks will be in the clear, above the fog layer.

Fog also forms in the fall as a result of cool air overlying the still-warm waters of lakes and large rivers. One often observes 'steam fog' rising off a warm lake surface on a cool morning. This kind of fog is predominate over and near mountain-surrounded lakes, where cool air drains off the higher terrain, and flows over the warm water which adds moisture to it. Trees and plants add even more moisture to the air through transpiration, exacerbating steam fog. Steam fog is common until the first freeze in fall begins to wind down the process.

Steam fog doesn't occur every fall morning, and there are several reasons why. For one thing, when a cold air mass crosses the Great Lakes, moisture from the lakes often forms low clouds, and rain or snow showers instead. Major low pressure systems and fronts also are accompanied by clouds and precipitation. Oftentimes, such systems will even spread out a veil of high-level cirrus or cirrostratus. The cloud cover quells the radiational cooling process, making fog formation unlikely. Additionally, when there's a strong pressure gradient between high and low pressure systems over the area, winds result which, through mixing, prevent radiational cooling and, thus, fog formation.

Most fog forms mainly between Midnight and 3 a.m., and is usually at its worst between 4 and 7 a.m., just before sunrise. But once the sun rises, it begins to heat the air at the top of the fog layer, and the fog eventually burns off. This may not occur, however, if it becomes cloudy above the fog layer.

Dense fog can be more than just a nuisance. Fog has a big impact on the transportation industry, especially commercial aviation. Planes must carry tons of extra fuel in case they are re-routed to another airport. In some cases, passengers have to be shuttled to their final destinations, and luggage and cargo gets left behind. At busy airports such as Chicago O'Hare and Atlanta Hartsfield, inbound flights can be significantly delayed, and everything backs up as extra care has to be taken to keep planes a safe distance apart. Some flights may be cancelled. Automobile travel is also affected. Some of the worst multiple-car pile-ups occur when drivers suddenly encounter dense fog on highways. After an initial collision, oncoming vehicles may not see the accident in time to avoid plowing into it.

Fog in a forecast is often worded as 'patchy early morning fog' or 'areas of fog after midnight'. Because there are so many local variables, it's impossible to forecast fog on a site-specific basis. Even the airports for which we prepare site-specific aviation forecasts usually need to have their forecasts updated from hour to hour for fog.

Drivers are profoundly affected by fog, and when it's forecast, one should be prepared for rapid changes in visibility. Because the chance of an automobile accident increases as fog thickens, it's best to avoid driving in fog, if possible. Wait for conditions to improve. When the fog is not so thick, you can usually see far enough ahead to be able to stop safely. If driving a car with fog lights, use them in dense fog. If not, be sure to use only your low-beam headlights, so as to avoid the bright reflective glare from high-beams that can impede your driving. It's also not safe to drive with only your parking lights on.

They're not bright enough in foggy conditions for you to be seen. Also be sure to reduce your speed and allow plenty of distance between your vehicle and the one ahead of you. Don't drive so slow, though, that you'll be a 'sitting duck'. If the forecast calls for fog, allow extra time for your trip, and arrive at your destination safely.

BLACK ICE – THE INVISIBLE DANGER

Joe Villani
Meteorologist, NWS Albany

There are a number of weather hazards during the winter season that cause problems for drivers. Snow, sleet and freezing rain are all familiar occurrences throughout eastern New York and western New England, and most people are aware of the dangers associated with these types of wintry precipitation. And it's usually not challenging to be able to determine if roads might be slippery, since we can usually see when snow, sleet or freezing rain is falling on the ground, or hitting our windshields. On the other hand, black ice, equally as dangerous, is virtually invisible. It occurs mainly when weather conditions become clear and tranquil.

Let's take a closer look at black ice, and define what it is. Black ice is relatively clear ice that forms on ground surfaces, usually due to snow melting and re-freezing. Since it's almost invisible, it's difficult for drivers to recognize when it's covering a road. A ground surface that appears dry, but assumes slightly varying shades, might reveal the presence of black ice. When in poorly lit areas, black ice is nearly impossible to spot, and can cause serious, and possibly fatal, automobile accidents, particularly for the unwary. On roadways where black ice may be present, you should slow down, and avoid excessive braking. Also, make sure to leave plenty of space between your vehicle and the one in front of you. Many winter driving accidents occur as a result of motorists failing to use extra caution and to anticipate potentially hazardous road conditions.

Now we will discuss a few situations that are favorable for black ice formation. Even after a sunny day, black ice can cover a road. Snow mounds may melt after a day in the sun, with water trickling onto roadways, and re-freezing after sunset.

Thus, drivers should never let their guard down, even if there's been no recent occurrence of wintry precipitation. Another way black ice can form is when it rains or snows during the daytime or evening with air temperatures just above freezing (32º F), with temperatures falling below freezing after sundown. While air temperature is an important factor in the formation of black ice, it's ground surface temperature that's the key indicator of black ice potential. Even when air temperatures are below 32º during the day, road surface temperatures may still be well above freezing. However, as soon as the sun sets, road temperatures can drop rapidly, causing a quick formation of black ice. People should be aware of black ice, especially during the evening, overnight and early morning hours when the air temperature is near or below 32º.

Not only do <u>motorists</u> need to be concerned about black ice, but so should <u>pedestrians</u> be concerned. Slipping on black ice while on foot can result in serious injury. I've had my own run-in with black ice. Back in college one evening, I slipped in a parking lot, on pavement that looked essentially dry. Fortunately for me, I landed on my back, avoiding serious injury. A friend of mine, however, wasn't so fortunate. He slipped on black ice on the steps just outside of his apartment, tearing his Anterior Cruciate Ligament, which then required surgery. So, as you can see, black ice can be very hazardous to people on foot, too.

In summary, perhaps snow, sleet and freezing rain get all of the headlines during the winter season, but black ice is a hidden danger that can be just as dangerous, to both drivers and pedestrians alike.

EL NIÑO: WHAT IS IT, AND WHAT IMPACTS CAN IT HAVE ON OUR WEATHER?

Kevin S. Lipton
Meteorologist, NWS Albany

This winter, many climate and weather experts will be using two words rather frequently-*El Niño*. That's because there's indeed a moderate El Niño episode underway across the central and eastern Pacific Ocean, and it's currently forecast to persist well into the late winter, and possibly, early spring months. But what exactly is 'El Niño', and how can it affect weather conditions here in the northeast? These are just a couple of the issues that will be addressed here.

An El Niño episode actually refers to a pool of abnormally warm water that develops across the central and eastern equatorial Pacific Ocean, as shown in Figure 1, and it usually occurs roughly every 3 to 7 years. The exact cause of an El Niño episode is still up for debate, but one of the key factors is weaker than normal easterly trade winds across the equatorial Pacific Ocean, which allows warmer water from the west to propagate eastward. Under normal conditions, these trade winds are keeping warmer water entrenched in the western equatorial Pacific Ocean, allowing cooler water to progress eastward, and upward from a lower depth, reaching the surface somewhere in the eastern Pacific Ocean. However, when these easterly trade winds weaken (or even reverse), as during El Niño, the pool of very warm water that piles up across the western Pacific Ocean is what shifts eastward. When the water temperatures across a large portion of the central and eastern Pacific Ocean become abnormally warm for several months, an El Niño episode is considered to be underway. Although many might think this warmer than normal water would be welcome, it actually can have an adverse effect on sea life, since warmer water tends to hold less oxygen and other vital nutrients than colder water. This reduction in oxygen can cause a significant loss of sea life. The warming can further adversely affect the larger ecosystem across the eastern Pacific Ocean. Other animals, such as birds, rely on fish for food, and a decrease in the fish population can then lead to either a reduction in the bird population or a change in migratory patterns for birds who may be forced to search for food elsewhere. Over the centuries, Peruvians have noted that these events have had a tendency to begin in late December, near Christmas, hence giving them the Spanish name 'El Niño', for 'Little Boy/Christ Child'.

As for weather, this aforementioned warming during El Niño also tends to shift weather patterns around over the Pacific Ocean and other parts of the globe, as the overall energy exchange between the ocean and lower atmosphere is altered. One pronounced change is that thunderstorms, usually associated with low pressure over the normally warmer waters of the western Pacific Ocean, shift eastward, in association with the eastward displacement of the warmer water below. This can then alter the jet stream that lies north and east of the Pacific Ocean, which the continental United States is downwind from. In general, during an El Niño episode, the jet stream often 'splits' over the eastern Pacific Ocean, with one stream entering southern Canada, and the other, sometimes referred to as the subtropical jet stream, traversing the southern United States, and bringing stormy weather to such places as California and Texas. In addition, as the frequency of storms coming in from the Pacific Ocean increases during the winter months, increasingly mild air is often drawn into the U.S. and Canada, which also results in a reduction in the amount of cold, continental air normally present at still higher latitudes. So, milder winters are often the result, particularly across the northern Plains, Great Lakes states and southern Canada. Of course, this doesn't guarantee that there'll be no snow or cold throughout the winter months – it just favors less snow and cold than would normally be expected across these regions.

So, what about the northeast? Well, the intensity and northward extent of the warming diminishes somewhat, but statistics do show that at least some of this warmth reaches the northeast states. Some more memorable winters that were heavily influenced by El Niño episodes include the winters of 1982-83 and 1997-98, the latter episode of which is considered one of the strongest ever recorded. Although these winters tended to be rather mild in the northeast, they also had locally heavy snow associated with them. In fact, in Albany, the total snowfall for the 1982-83 winter was 75.0 inches, while for the 1997-98 winter, it was 52.3 inches. Normal annual snowfall for Albany is 62.7 inches. Thus, despite warmer than normal temperatures, snowfall can be quite variable across the northeast during winters in which an El Niño episode is occurring.

The expectation of the current El Niño to persist through this winter is heavily weighted in the forecast of winter-season temperatures across the United States as depicted by the Climate Prediction Center of NOAA. As can be seen in Figure 2, the odds are largely in favor of temperatures averaging above normal levels for the period December through February (this 3-month period being referred to as either 'meteorological winter' or 'climatological winter') across much of the northern Plains and Great Lakes region. These odds diminish somewhat over the northeast states, but still lean in favor of above normal temperatures. Interestingly, the odds of warmer than normal temperatures are much lower over the southeastern U.S. This is due to the fact that above normal cloudiness and rainfall normally associated with an active southern branch of the jet stream typical during the winter months in El Niño episodes is expected to keep this region a bit cooler than would normally be expected.

So, the next time you come across the words 'El Niño', you should now have a basic understanding of what it is, and how it may impact the weather across the U.S. Via your computer, you can keep tabs on the status of the current El Niño episode by going to: CPC: Expert Assessments - ENSO Diagnostic Discussion. At this site, you can access the latest reports, and obtain current water temperatures and other climate information for the central and eastern Pacific Ocean.

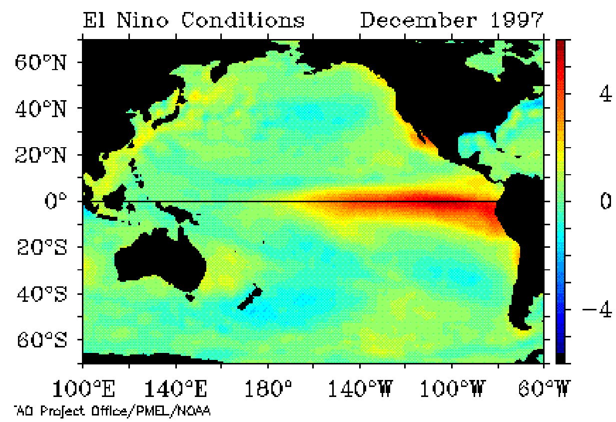


Figure 1. Anomalies in sea surface temperatures associated with an El Nino episode.

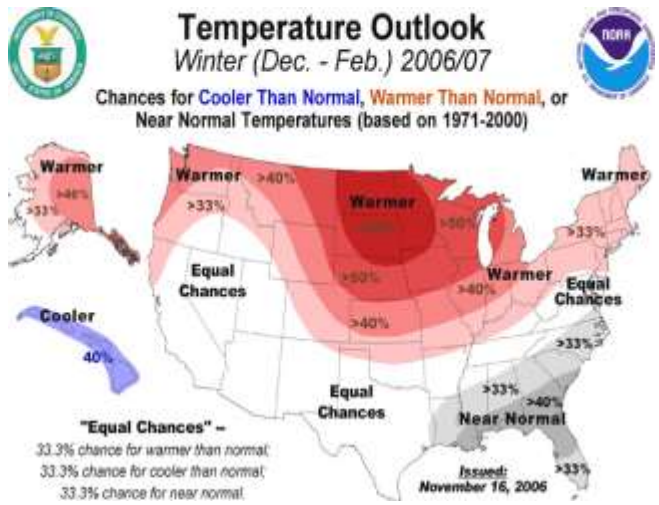


Figure 2. Climate Prediction Center Temperature Forecast for Winter 2006-07.

WINTER HYDROLOGY

Steve DiRienzo
Service Hydrologist, NWS Albany

Winter weather poses a significant challenge to the monitoring and forecasting of the Albany area's hydrologic conditions. There are several reasons for this, including: ice on the rivers that may jam; floats in stilling wells that become frozen in ice; ice that forms in lines that use pressure to monitor river stage, and; the presence of ground frost. Many precipitation gages don't do a good job measuring the liquid equivalent of snowfall, and so, snow surveys to measure the water contained within ground snow pack are important.

River ice will form when water temperatures drop to near freezing, and the daily average air temperatures remain below freezing. The daily average, or mean, temperature is simply the daily high temperature plus the daily low temperature, divided by 2. For example, if today's high temperature was 36°F, and the low temperature was 14°F, the average temperature would be 25°F. River ice can cause a multitude of problems, including unrepresentative river stage readings, and ice jams.

Ice jams come in two basic varieties: freeze-up and break-up. Freeze-up jams usually occur in early to mid-winter during extreme cold weather. According to local studies, it takes 3 consecutive days with daily *average* temperatures below 0°F to get freeze-up jams. This type of cold weather usually occurs only across the northern part of the Albany Forecast Area. For break-up jams to occur, ice of around one foot thickness is necessary, with a daily average temperature of 42°F or more. Water rising due to rain or snowmelt breaks up the ice into large chunks which can jam under bridges, or at bends in the rivers.

Ice jams tend to recur at preferred locations, and they can lead to river flooding. Water can back up behind a jam, which acts like a dam, flooding property along the river. This temporary ice dam may break suddenly, sending a wall of ice and water downstream, which can result in flash flooding. In addition, the ice itself may physically damage or destroy property along the river as it scrapes its way downstream.

Ground frost is another product of cold weather. Frost in the ground develops when soil temperatures cool to near freezing, and daily average air temperatures are below freezing. Extreme cold weather, with little or no snow on the ground, will lead to deep frost depths. Such ground frosts can lead to water main breaks, as water freezes in the pipes. Another problem when the ground is frozen is increased runoff from rain or snowmelt. Frozen ground increases the chance that rain and/or snowmelt will lead to flooding or flash flooding.

As mentioned earlier, snow surveys to measure the water equivalent of snow on the ground are important. Snow, when it melts, acts like rainfall, and even without rain, melt from a deep snow pack can cause flooding. Many of our cooperative observers and cooperators provide the National Weather Service (NWS) with ground Snow Water Equivalent (SWE) measurements. The NWS will occasionally make SWE measurements during the off weeks, and in areas not covered by our cooperators and observers.

Spotters and cooperators, as always, are an important link between the NWS and ground truth information. The U.S. Army Cold Regions Research and Engineering Laboratory River Ice Guide can be found at: http://www.crrel.usace.army.mil/ierd/tectran/IEnews15.pdf.

River ice can be reported to the Albany NWS office at:
http://cstar.cestm.albany.edu:7775/Hydrology/hyd_forms/ICE_REPORT.htm. Any and all reports of river ice and ground frost depths are always appreciated.

WHAT HAPPENS TO BUGS IN WINTER?

Kevin S. Lipton
Meteorologist, NWS Albany

As the weather gets colder, and the days, shorter, we usually see fewer and fewer bugs around outside, until finally one day – they all seem to be gone. But where did they go? Perhaps they've taken cover inside our warm homes until the balmy weather returns come spring.

Insects, like snakes, are cold-blooded. This means that their body temperatures are dependent on the temperature of their environments. This is different than for warm-blooded animals, such as humans, whose bodies strive to maintain relatively steady internal temperatures, independent of the surrounding environment. Thus, for insects, cold weather can severely impact their daily lives, even to the point of causing death. So, with this sensitivity to external temperatures, how in the world can insects survive the winter? Well, different insect species have their own ways of coping with colder weather. One method of coping is by simply migrating to a warmer location. But only some species of winged insects can do this. Butterflies are one type of insect that migrate to warmer climes. For example, the Monarch Butterfly migrates to areas of northern Mexico in the winter, and other types of butterflies migrate to areas of the southern United States.

Another way in which some insects survive the winter is by slowing their activities down to a dormant state. This state is known as 'diapause'. During this state, insects are inactive – all activities are temporarily suspended. Insects neither grow nor develop in this state, and their metabolic rates are kept just high enough to barely keep them alive. This is essentially a 'hibernation' state. Additionally, insects deplete much of the water content from their bodies, diminishing the chances of them freezing to death. Perhaps more interestingly, many hibernating insects actually build up glycerol in their bodies during the fall, which acts as an antifreeze during the cold winter months.

Honeybees cluster tightly together in hives during winter months, vibrating their wing muscles to keep the temperature of the hive warmer than the outside. Where do they get the energy to do this? From the honey they collect during the warmer months!

Many other insects remain alive throughout winter via a process known as 'overwintering'. There are various ways in which they accomplish this. Immature larvae, like caterpillars, for instance, overwinter by sheltering themselves under heavy covers of leaf litter, while grubs tend to burrow more deeply into the soil. Other insects overwinter as nymphs, existing in a smaller, immature form of their parents. These nymphs sometimes overwinter in the waters of ponds and streams, even beneath ice. They can even feed and grow during the winter months. Some of these nymphs include dragonflies and stoneflies, as well as springtails. In fact, springtails can sometimes be seen on the snow pack during relatively mild days in winter. Their hopping motion gives them the nickname 'snow flea'.

Several other insects and insect-like creatures overwinter inside eggs which are deposited by adults during the fall. Spiders, for instance, lay their eggs in fall, with the spiderlings remaining encased in egg sacs until the warm weather returns. Of course, the easiest way for an insect to overwinter is by seeking shelter in a warmer environment, which many spiders and ladybugs do during the late fall when they enter homes.

Needless to say, insects do not simply disappear when the colder weather arrives. Although many do not survive the long, harsh winter, many insects do remain alive, only in a less active state, becoming more active when spring returns. Or, they simply move to a more conspicuous location. So, if you're ever wondering where all the bugs have gone, just look a little closer, and you might find them! But don't expect them to move terribly fast.

THREE MAJOR HOLIDAY WINTER WEATHER EVENTS IN 2007

Neil A. Stuart
Senior Forecaster, NWS Albany

Ingrid Amberger
Senior Forecaster, NWS Albany

John S. Quinlan
Senior Forecaster, NWS Albany

After a warm start to the winter, the weather had turned cold and stormy by mid-January, and continued through February and March. Ironically, three of the biggest events of the winter occurred during mid-month holidays. The first was the Martin Luther King Day Ice Storm from January 14-15. This was followed by the Valentine's Day Snowstorm on February 14, and, finally, the St. Patrick's Day Snowstorm of March 16-17. Each storm had a significant impact on the region, with many traffic accidents and delays, cancelled flights at airports, and school closings. A summary of each storm follows, in chronological order, beginning with the Martin Luther King Day Ice Storm.

A. The Martin Luther King Day Ice Storm

Prior to the Martin Luther King Day Ice Storm, an arctic boundary moved southward across the region on Saturday, January 13, and stalled over the Mid-Atlantic region Saturday night. With the passage of this boundary, cold air was drawn in at and near the surface on northerly winds. Waves of low pressure moved eastward along the boundary during the long weekend.

A weak low passed to our south on Sunday, resulting in periods of light freezing rain. However, the primary, deeper low moved from the Ohio Valley eastward across the local area on Monday, bringing heavier precipitation. The precipitation did start out as a period of sleet late Sunday night into early Monday morning, with snow across the southern Adirondacks. However, everything eventually changed to freezing rain.

Why freezing rain? At the surface, there was cold air, but aloft, warmer air moved in, causing the precipitation to melt as it fell through the warm layer. Then, the rain drops hit the freezing objects at the surface, and froze on contact. Warmer air did work in at and near the surface in the Capital District, and to the south and east, Monday afternoon and evening. Elsewhere, temperatures remained below freezing.

Significant ice accumulations occurred (Figures A1a and A1b), rendering over 100,000 utility customers without power. Ice accumulations across the region were between 1/3" and 1" (Figure A2). Saratoga County was hit particularly hard, with up to an inch of ice, resulting in about half the power outages. To make matters worse, winds increased Monday evening, placing additional strain on the already burdened trees and power lines. This led to additional power outages, even after the freezing rain had ended.

The low deepened and moved off to the northeast across the Canadian Maritimes Monday night and Tuesday, drawing arctic air in across the region. By Wednesday morning, temperatures fell into the single digits, and even to below zero.

Figure A1a. Ice accumulation of ½" in Albany County on January 15, 2007 (Image courtesy Neil A. Stuart, NWS Albany, NY).

Figure A1b. Ice accumulation of ½" in Albany County on January 15, 2007 (Image courtesy Neil A. Stuart, NWS Albany, NY).

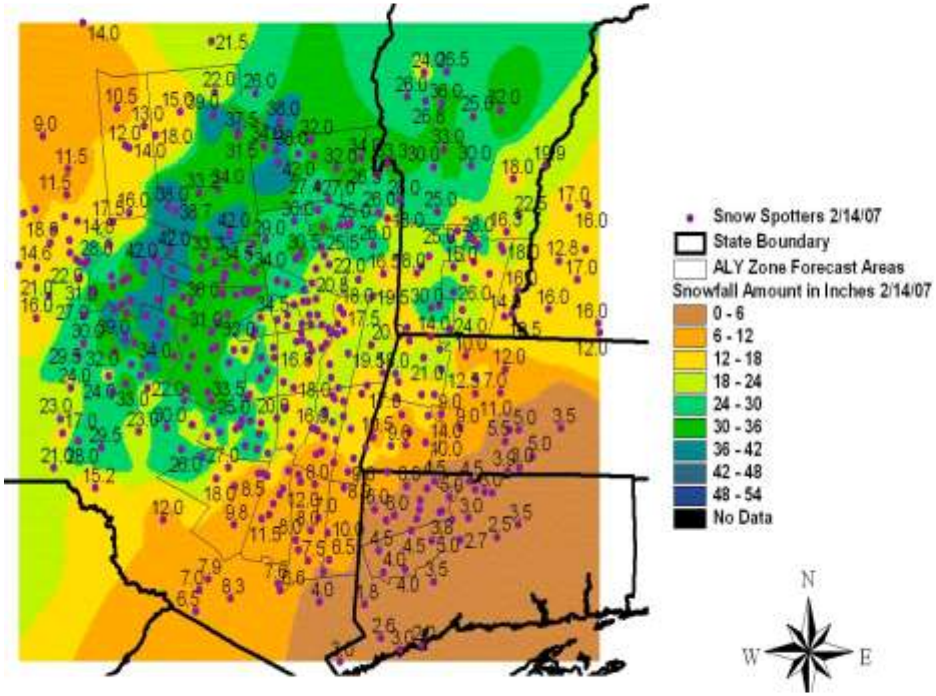


Figure B2. Snowfall map for Valentine's Day Snowstorm (Image courtesy of John Quinlan, NWS Albany, NY).

B. The Valentine's Day Snowstorm

The historic Valentine's Day Storm was the first of two big snow events during the winter. It was the result of a weather pattern across North America that was just beginning to transition from cold and dry to more normal and stormier. The upper-atmospheric pattern that caused below normal temperatures across the eastern U.S. from mid-January into mid-February suppressed the storm track well to the south of our region, keeping the region cold and dry. By mid-February, the upper pattern began to change, and the Valentine's Day Storm signaled the change to more normal and stormier conditions.

Low pressure formed over the deep south early on Monday, February 12th. This system headed eastward into the southeastern United States on Tuesday, February 13th, and redeveloped along the mid-Atlantic coast by Wednesday morning, Valentine's Day. The low rapidly intensified as it passed just south of Long Island during the day on Valentine's Day. The low headed northeast along the coastline Wednesday night.

The area was pummeled with from one to more three feet of snowfall (Figure B2). Intense mesoscale snow bands developed, resulting in snowfall rates of 2 to 4 inches an hour, with localized amounts of 6 inches an hour, as indicated by radar returns (Figure B1). Warmer air moved in aloft at the 6,000- to 8,000-foot level, resulting in sleet mixing in with the snow at Albany and points south. Once the storm moved to our east Wednesday afternoon, cold air was rapidly drawn back into the area.

The forecast models were very accurate, with the potential for a significant event becoming evident 5 to 7 days before the storm. Especially within 3 to 5 days of impact, all the models were providing the same picture, a big snowstorm resulting from a very rare combination of cold Canadian air and tropical moisture, as evidenced by the satellite imagery presented in Figure B3. Such a combination typically results in snowstorms. Two to three days before impact, the majority of some 30+ forecast models suggested a large area of 1 to 2 foot snowfalls, with local amounts of up to 3 feet! Such agreement between over 30 forecast models two or more days in advance was nearly unprecedented, and provided the confidence for forecasters to predict the storm with great accuracy. The forecast models also suggested a mix with sleet from the southern Catskills through the Taconics and Berkshires.

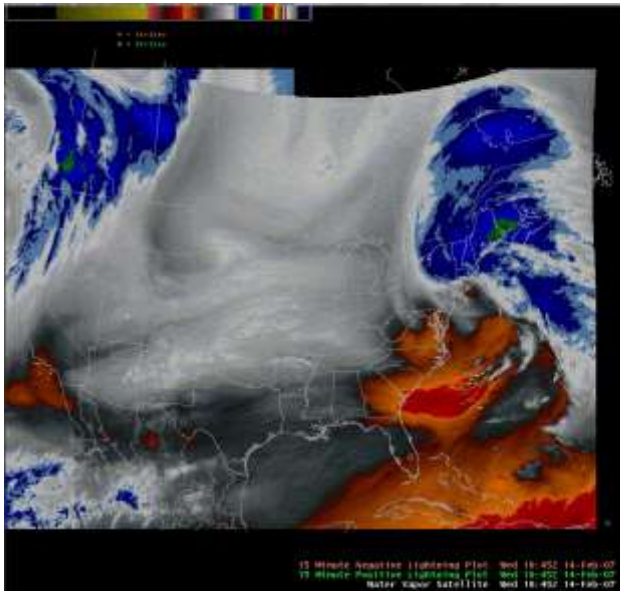


Figure B3. Satellite imagery with 15-minute lightning plot overlay for 2:45 PM EST February 14, 2007. Note the classic comma-shaped cloud pattern, with the comma head and heaviest snow over upstate New York and northern New England.

C. The St. Patrick's Day Snowstorm

The St. Patrick's Day Snowstorm was an historic event that was the second-biggest St. Patrick's Day snowstorm on record for Albany, with 13.1 inches of snow. On March 16-17, 1956, Albany received 15.9 inches. On Wednesday, March 14, just two days prior to the onset of the St. Patrick's Day 2007 storm, the region basked in the first springtime weather of the season, with highs in the mid 60s. Cold Canadian high pressure built into the region on Thursday and Friday, as low pressure along the Gulf Coast merged with a storm heading southeast across the western Great Lakes (Figures C1a and C1b). The clash of the cold air with the Canadian and Gulf Coast storms was just the right set-up for a big snowstorm for the interiors of New York and New England.

Snow began across the region around midday Friday, March 16, and continued, heavy at times, through much of the night, ending around sunrise on Saturday, March 17. One intense mesoscale snow band developed from the Catskills through northwestern Connecticut and parts of the Berkshires, resulting in snowfall rates of 2 to 3 inches in an hour, as indicated by radar (Figure C2). However, sleet was mixed with the snow in Connecticut and the Berkshires, cutting down on snow amounts there. Overall, 1 to 2 feet of snowfall was observed in eastern upstate New York, with the most in the northern Catskills (Figure C3). The Capital District averaged between 13 and 16 inches. Parts of the Berkshires, southern Vermont, northwestern Connecticut and the Poughkeepsie area saw a mix with sleet and freezing drizzle during the early morning hours of St. Patrick's Day, but most of those locations still received more than 9 inches of snow and sleet. The Adirondacks were just north of the heaviest snow, but still managed to receive 6 to 9 inches of snow.

The forecast models hinted at the possibility of a major snowstorm 3 to 5 days prior to impact, but were not in very good agreement on timing and location until 2 days prior to the storm. Even 24 to 48 hours prior to impact, there was considerable disagreement as to how much precipitation would fall, and where mixed precipitation would cut down on snow amounts. There was enough agreement among the forecast models that all precipitation types added together would result in major snow amounts, independent of any sleet or freezing rain accumulations. Heavy Snow and Winter Storm Watches were issued during the afternoon of March 15, and Warnings were issued during the early morning of March 16. Even though model accuracy and consistency was not as good as for the Valentine's Day Storm, it is clearly evident that forecast models, and forecaster interpretation of them, continues to improve each season.

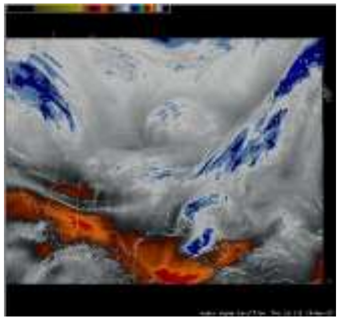


Figure C1a. Satellite picture of the Gulf Coast Storm and western Great Lakes Storm at 7 PM EDT March 15, that merged and became the St. Patrick's Day Storm.

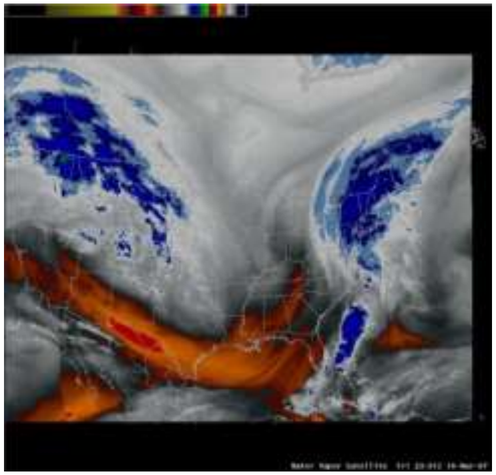


Figure C1b. Satellite picture of the Gulf Coast Storm and western Great Lakes Storm at 7 PM EDT March 16, that merged and became the St. Patrick's Day Storm.

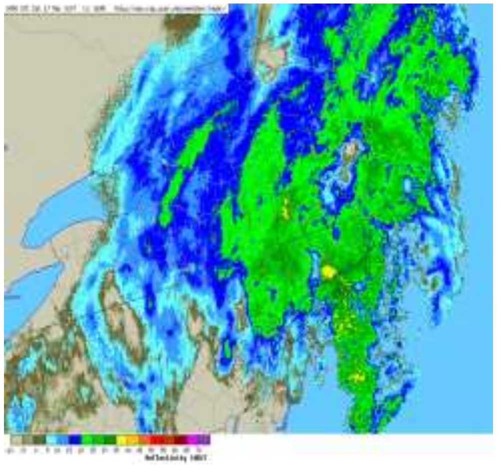


Figure C2. Regional radar at midnight on March 17, showing the mesoscale band from southern New York through northwest Connecticut and the Berkshires of Massachusetts. Image courtesy of the National Center for Atmospheric Research (NCAR).

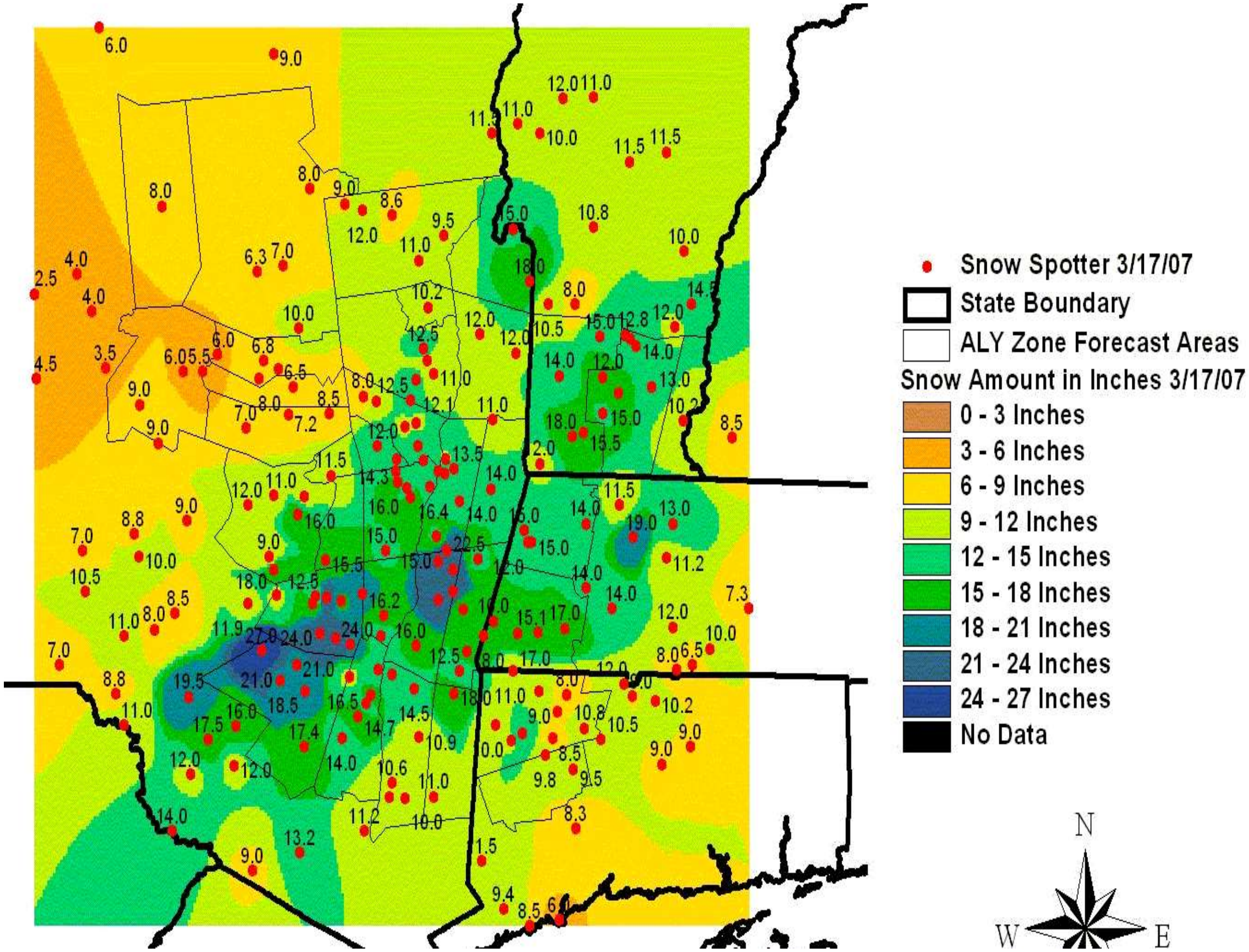


Figure C3. Observed snowfall for the St. Patrick's Day 2007 snowstorm (Image courtesy of John Quinlan, NWS Albany, NY).

SUMMER SWELTER CAN BE DOWNRIGHT DANGEROUS!

Kevin S. Lipton
Meteorologist, NWS Albany

Evan L. Heller
Meteorologist, NWS Albany

Although many people look forward to the hot, sultry days of summer, too much heat over an extended period of time can be downright dangerous – even deadly! This is particularly true for the sick and elderly living in urbanized areas. And the combination of heat and high humidity is especially hazardous, making the body difficult to cool, and placing extra stress on the body's circulatory system – especially the heart.

Since 1997, heat has been the number one weather-related killer in the United States, with an average of 170 fatalities per year. In the 40-year period from 1936 to 1975, it's estimated that nearly 20,000 people in the United States succumbed to the heat, with more than 1,250 deaths during one year alone – 1980. And these numbers may actually be underestimated, with many of the deaths possibly having been attributed to 'old age' or pre-existing heart ailments. In reality, the inability of the body to stay sufficiently cool during extreme heat may have been the true cause.

Considering the staggering effects that heat can have on the human population, the National Weather Service has developed a useful tool in its efforts to more effectively alert the public to the dangers of heat waves. The Heat Index (HI) uses a combination of actual air temperature and relative humidity (RH) to produce an 'apparent temperature' – a measure of how hot it actually feels with the humidity factored in. Weather forecasters can assess the effects of heat and humidity on the human body, and relay this information to agencies that, in turn, develop plans for mitigating the ill effects of the heat.

Below is the Heat Index table, displaying values of the index. The HI always increases for any given temperature as the RH increases, and vice versa. For example, at an air temperature of 90 degrees when RH is 45 percent, HI is 93 degrees, while for the same air temperature with an RH of 55 percent, HI increases to 97. This index is a good indicator because the higher the humidity, the less apt sweat is to evaporate, and thus, the lesser is the cooling effect on the skin. In contrast, the lower the humidity, the more readily sweat can evaporate, thus producing a greater cooling effect. This effect is indeed why the expression “It’s not the heat, but the humidity” came about. In Arizona, when the air temperature is over 100 degrees, the RH is often under 15 percent, creating an HI nearly identical to, or even lower than, the actual air temperature. It should be noted that the HI values were devised for conditions of light wind and shade. Exposure to full sunshine can actually increase HI values by up to 15 degrees F.

Temperature (°F)

Relative Humidity (%)	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
40	80	81	83	85	88	91	94	97	101	105	109	114	119	124	[illegible]	[illegible]
45	80	82	84	87	89	93	96	100	104	109	114	119	124	130	137	
50	81	83	85	88	91	95	99	103	108	113	118	124	131	137		
55	81	84	86	89	93	97	101	106	112	117	124	130	137			
60	82	84	88	91	95	100	105	110	116	123	129	137				
65	82	85	89	93	98	103	108	114	121	128	136					
70	83	86	90	95	100	105	112	119	126	134						
75	84	88	92	97	103	109	116	124	132							
80	84	89	94	100	106	113	121	129								
85	85	90	96	102	110	117	126	135								
90	86	91	98	105	113	122	131									
95	86	93	100	108	117	127										
100	87	95	103	112	121	132										

Likelihood of Heat Disorders with Prolonged Exposure or Strenuous Activity

Caution Extreme Caution Danger Extreme Danger

Heat Index table

Here are heat risk categories, as listed by the National Weather Service, for people in elevated risk groups:

CAUTION: Fatigue possible with prolonged exposure and/or physical activity.

EXTREME CAUTION: Sunstroke, heat cramps and heat exhaustion possible with prolonged exposure and/or physical activity.

<u>DANGER</u>: Sunstroke, heat cramps and heat exhaustion likely, and heatstroke possible, with prolonged exposure and/or physical activity.

<u>EXTREME DANGER</u>: Heatstroke/sunstroke highly likely with continued exposure.

Here are definitions of heat-related problems, and the actions to take regarding the varying degrees of heat symptoms listed above:

<u>Heat Cramps:</u> Painful spasms (usually in muscles of legs and abdomen) possible; heavy sweating.

<u>First Aid Actions for Heat Cramps (self or other)</u>:

1. Apply firm pressure on cramping muscles, or apply a gentle massage to relieve spasm.
2. Give sips of water. If nausea occurs, discontinue.

<u>Heat Exhaustion</u>: Heavy sweating; weakness; cold, pale or clammy skin; fainting and vomiting. A normal body temperature is possible, and, therefore, this factor should not be used to indicate the occurrence of heat exhaustion.

<u>First Aid Actions for Heat Exhaustion</u>:

1. Get victim out of sun. Lay victim down and loosen victim's clothing.
2. Apply cool, wet cloths to victim.
3. Fan victim, or move victim to air-conditioned room.
4. Give victim sips of water. If nausea occurs, discontinue. If vomiting continues, seek immediate medical attention.

<u>Heat Stroke (also known as Sunstroke):</u> Elevated body temperature of 106ºF or higher; hot, dry skin; rapid and strong pulse; possible unconsciousness.

First Aid Actions for Heat/Sunstroke:

1. HEAT STROKE IS A MEDICAL EMERGENCY! SUMMON EMERGENCY MEDICAL ASSISTANCE OR GET THE VICTIM TO A HOSPTIAL IMMEDIATELY! DELAY CAN BE FATAL!
2. Move victim to a cooler environment. Reduce victim's body temperature with a cold bath or sponging.
3. Remove victim's clothing, and use fans and air conditioners.
4. If victim's body temperature rises again, repeat steps 1-4. Do NOT give fluids.

Fortunately, there are ways to mitigate the worst effects of extreme heat, several of which are listed below.

Heat Wave Safety Tips:

1. **Slow Down**. Strenuous activities should be reduced, eliminated or rescheduled to the cooler times of the day (e.g., early morning or late evening hours). Individuals at risk, particularly the elderly, should stay in the coolest available location (which may not necessarily be indoors).

2. **Dress for summer**. Wear lightweight, light-colored clothing. Lightweight materials 'breathe' easier, and the light colors reflect heat and sunlight, helping your body maintain a normal temperature.

3. **Eat less**. Certain foods, such as those rich in proteins, increase the body's heat production, and can actually increase water loss.

4. **Drink plenty of water or other NON-ALCOHOLIC fluids**…even if you don't feel thirsty. Your body needs water to keep cool. Persons who have epilepsy, heart or liver disease, are on fluid-restrictive diets, or who have a problem with fluid retention, should consult a physician before increasing their consumption of fluids.

5. **DO NOT DRINK ALCOHOLIC BEVERAGES**. Alcoholic beverages actually cause the body to increase the rate of water loss – something which is dangerous during a heat wave.

6. **Spend more time in an air-conditioned location**. Air conditioning in homes and other buildings significantly reduces heat danger, and spending adequate time in an air-conditioned environment offers relief.

7. **DO NOT spend too much time in the sun**. Sunburn makes the job of heat dissipation by the body that much more difficult.

By following these safety tips during the next heat wave, you can greatly diminish the potential dangers of heat stress on your body. Don't let hot summer weather turn you into a fatal statistic!!!

Much of this information is from NOAA's National Weather Service brochure entitled *Heat Wave: A Major Summer Killer*, which was produced as a cooperative effort between NOAA's National Weather Service, the Federal Emergency Management Agency, and the American Red Cross.

UNDERSTANDING AIR QUALITY…AND BREATHING EASIER!

Kevin S. Lipton
Meteorologist, NWS Albany

Summertime livin', and the breathing is…not easy. At least this is the case for many who live in the northeastern part of the United States. Summer is perhaps the season with the poorest air quality in the northeast states – mainly due to two pollutants: ozone and particulates. On days when either or both of these fill the air, many will experience an exacerbation of general allergies, some symptoms of which may include breathing difficulties and unusual fatigue. And for those who are particularly vulnerable to poor air quality (e.g., young children, the elderly and individuals with lung or heart ailments), such days may be downright dangerous. Fortunately, we're able to predict when such highly polluted conditions are likely to occur, enabling people to take the necessary precautions to protect themselves from the unhealthy air.

The Environmental Protection Agency (EPA) has created the Air Quality Index (AQI) to indicate how clean or polluted the air is, or is expected to be, on any given day. This index focuses on the health effects that may be produced after breathing varying concentrations of polluted air – whether these effects occur a few hours, or even several days, after breathing the air. The EPA calculates five major pollutants regulated by the Clean Air Act: ground-level ozone; particle pollution (particulate matter); carbon monoxide (CO); sulfur dioxide (SO_2), and; nitrogen dioxide (NO_2). Of these, ground-level ozone and airborne particles have the greatest impact on human health in the United States.

Ozone (O_3) is a colorless gas that can be found in the air we breathe. That which is present very high up in the atmosphere, at altitudes over 12 miles above the earth's surface, is actually a good thing, since it shields the earth from the sun's harmful ultraviolet rays. But the same gas right near the earth's surface, where we can breathe it in, is a potentially harmful pollutant. It causes inflammation and irritation of the respiratory system, especially during physical activity. This may produce such symptoms as shortness of breath, coughing, and throat irritation, and may exacerbate asthma and allergies. In addition, repeated short-term ozone exposure may cause damage to the developing lungs of children, which may lead to reduced lung function in adulthood. In adults, frequent ozone exposure may accelerate the natural decline in lung function that occurs as part of the normal aging process. So, although ozone may be good high up in the atmosphere, it's real bad down below. So, how does ground-level ozone form? It's the result of a reaction in the presence of sunlight between chemicals known as Volatile Organic Compounds, or VOCs, and oxides of nitrogen. Some sources of VOCs and nitrogen oxides include: automobile exhaust; electricity generation stations; gasoline dispensing facilities; consumer products such as paints and cleaners, and; off-road engines such as those run by aircraft, trains, construction equipment, and even lawnmowers. The key is that sunlight initiates chemical reactions amongst these substances to form ozone – which is why ground-level ozone tends to be much more problematic in the summer, especially when the weather is sunny and hot.

Particulates, or particle pollution, refers to particles present in the air which are a mixture of solids and liquids of varying sizes. The smaller particles – those that are less than 10 micrometers in diameter – pose the greatest threat to human health since they can pass through the nose and throat more easily without being filtered out by hair or mucus. This means they're more apt to reach deep into the lungs and sinuses. For reference, ten micrometers in diameter is just a fraction of the thickness of a single human hair. Very small particles, with diameters less than 2.5 micrometers, are referred to as 'fine particles', and can be particularly dangerous due to their small size and ability to penetrate sensitive membranes. Such small particles are typically produced from the burning of fuels such as coal, wood, oil and diesel, and come from such sources as power plants, motor vehicles and wood stoves. Unlike ozone, high concentrations of particulate matter don't necessarily need sunlight in order to build up. Such buildups can even occur during cold winter months. Breathing air that contains high concentrations of particulate matter can cause a wide array of negative health effects, particularly for people with lung or heart disease, and in older adults. In these cases, short-term exposure to high concentrations of these particulates can aggravate heart or lung problems, often resulting in shortness of breath, coughing, chest pain, palpitations, fatigue and, in rare cases, an irregular heartbeat or even a heart attack. Even healthy individuals may experience reduced lung function and wheezing. High levels of particulate matter can even increase the body's susceptibility to respiratory infections. And even longer-term exposure has been associated with the development of lung diseases like bronchitis.

So, with all the negative effects unhealthy air can have on humans, the EPA developed the AQI. It's on a scale from 0 to 500. The higher the AQI, the higher the level of air pollution, and the greater the health concern. As can be determined from the color table which follows, an AQI value of 45 represents good air quality with little potential ill effect on public health, while an AQI over 300 represents hazardous air quality. An AQI of 100 generally corresponds to the national air quality standard, or the level the EPA has set as the threshold value for healthy vs. unhealthy air. Thus, AQI values below 100 are generally considered satisfactory. When AQI values rise above 100, the air quality is considered to be unhealthy - at first for certain sensitive groups of people, then for a broader base of the population as AQI values increase.

Air Quality Index Levels of Health Concern	Numerical Value	Meaning
Good	0-50	Air quality is considered satisfactory, and air pollution poses little or no risk.
Moderate	51-100	Air quality is acceptable; however, for some pollutants there may be a moderate health concern for a very small number of people who are unusually sensitive to air pollution.
Unhealthy for Sensitive Groups	101-150	Members of sensitive groups may experience health effects. The general public is not likely to be affected.
Unhealthy	151-200	Everyone may begin to experience health effects; members of sensitive groups may experience more serious health effects.
Very Unhealthy	201-300	Health alert: everyone may experience more serious health effects.
Hazardous	> 300	Health warnings of emergency conditions. The entire population is more likely to be affected.

The EPA AQI (Air Quality Index).

So – when AQI values reach unhealthy to very unhealthy levels – what should you do? First and foremost, limit your exposure to the outside air as much as possible. In particular, reduce prolonged, strenuous outdoor activity. Generally, the higher the AQI, the more people who will be adversely affected. So, for 'very unhealthy' air, even normally non-sensitive individuals should heed these precautions. Perhaps instead of jogging outside, take an indoor stroll – maybe at the local mall. When outdoor particulates approach high levels, some of them can 'spill' indoors through cracks and crevices. Fortunately, certain air filters and cleaners can help reduce these particulates indoors. In addition, eliminating indoor tobacco and candle use, as well as reducing the use of wood burning stoves and fireplaces, can also mitigate indoor particle levels.

When AQI values are expected to reach 100 or higher, the National Weather Service (NWS) office here in Albany disseminates Air Quality Advisories, based on information released by state agencies. For instance, the New York State Department of Environmental Conservation (NYSDEC) issues air quality health advisories for New York State, which the NWS then disseminates as an Air Quality Advisory, or AQA, that eventually reaches the public, media outlets and NWS web pages.

For more information on the effects of poor air quality on health, and ways to reduce exposure to pollutants, visit www.airnow.gov. Much of the information contained in this article can be found there, along with more information. Remember – stay informed, and breathe easy this summer!

THE DANGERS OF SNOW SQUALLS

Brian J. Frugis
Meteorologist, NWS Albany

Most people are aware of the dangers associated with typical winter storms, such as the coastal Nor'easters that we deal with on occasion during the winter months. The large amounts of snow and ice they can produce over a one- to two-day period can profoundly impact travel. Lake-effect snow is another winter hazard, although this is more or less confined to locations close to the lakeshore, and thus doesn't typically have a profound impact on eastern New York and western New England. However, there is another winter danger, which can come about quite suddenly, and which can impact any portion of eastern New York and western New England. This is the frontal snow squall, the wintertime cousin of a thunderstorm. While snow squalls rarely produce large amounts of snow, their quick-hitting nature can pose a great deal of danger, especially to those traveling on roadways.

Snow squalls develop in a similar fashion to summertime thunderstorms. These squalls usually develop in a line, either along or ahead of a powerful arctic cold front. A strong upper-level disturbance can also produce squalls. In the summertime, thunderstorms will develop along a frontal boundary separating warm, humid air from cooler, drier air. Comparatively, in winter, snow squalls may develop along a boundary separating chilly air from more brutal arctic air pouring south from far northern Canada. As this extremely cold air moves in, both at the surface and aloft, the air being displaced is forced to rise and produce some vertical growth to the squalls (about 5,000 to 10,000 feet worth). As a rule, though, winter squalls don't grow nearly as tall as summertime storms. The most difficult pro-squall ingredient to rustle up during winter is moisture. While summertime humidity is easily drawn north from the Gulf of Mexico and Atlantic Ocean, wintertime moisture is usually quite limited, especially with the seasonal pattern of frequent cold frontal passages that usher in cold, dry air masses from the north and west. However, the Great Lakes, and more specifically, Lake Ontario for our region, can help provide just enough additional moisture to help produce the snow squalls. Although frontal snow squalls are rare, they can occur a few times each winter season if all the right ingredients come together.

So, what exactly can be expected during a snow squall? Like thunderstorms, snow squalls are short-lived events, usually less than 30 minutes in duration. They usually are fast-moving due to the strong winds aloft associated with either the arctic frontal boundary itself or a powerful upper-level disturbance. Within this brief period, heavy snow can occur, easily reducing visibility to below one mile. In addition, winds can gust over 35 m.p.h., producing blowing snow, which reduces visibilities even further. This is caused by stronger winds aloft being brought down to the surface by the heavier precipitation. In some of the strongest snow squalls, thunder and lightning may also be observed, as with a summertime thunderstorm.

The main concern with snow squalls is that visibility can drop from unrestricted to less than a quarter of a mile in mere seconds. This is a danger to drivers, especially when driving at high speeds. The most dangerous highways are those that are oriented east-to-west, such as Interstate-90 and Interstate-84, since snow squalls will generally be moving west to east along a cold frontal boundary. As the visibility quickly lowers, it causes many drivers to slam on their brakes in a panic reaction. This can cause them to either skid off the road on freshly fallen snow, or cause other motorists to collide with them from behind. Many such multiple-car accidents have occurred on I-80 in Pennsylvania due to wintertime snow squalls.

Many times, snow squalls will produce only an inch or two of accumulation. However, it takes only a thin coating of snow to make roads dangerous, especially when the visibility is reduced. Since snow squalls usually produce only a minimal amount of accumulation, winter storm watches and warnings are rarely issued for them. The National Weather Service still has ways of keeping the public informed about snow squalls. Short-term forecasts (NOWCASTS) and, sometimes, Special Weather Statements (SPSs), will be issued when these squalls will be heading towards your area. These products can be easily found on the front page of our website (http://www.weather.gov/albany), or by listening to NOAA Weather Radio. These statements will let you know exactly when the squalls can be expected, and their estimated speed and direction of movement. In addition, you can keep up with the forecaster's thinking ahead of time by reading our Area Forecast Discussion (AFD), also posted on our website. Forecasters will often express their opinions about whether or not snow squalls will be of concern.

Keeping informed about impending snow squalls can aid you in your decision on whether or not you should alter your travel plans. Remember, it's always best to arrive at your destination safely, even if it means being a little late.

As always, we appreciate reports of any real-time weather hazards. If you encounter a snow squall, let us know, but wait until conditions improve and it's safe to do so. Information on your location, estimated lowest visibility, and amount of accumulated snow encountered will be helpful in letting others know about the impending danger.

OUR TRIP TO ALBANY INTERNATIONAL AIRPORT

Hugh W. Johnson IV
Meteorologist, NWS Albany

Evan L. Heller
Meteorologist, NWS Albany

NWS Albany employees were treated to a tour of Albany International Airport on Tuesday, January 8th. Our goal was to see how our forecasts and products were being utilized, and to observe airport operations in different departments. Several airport employees were kind enough to guide us through the extensive tour, which lasted about 2 hours.

Upon our arrival at the tower facility on this record-breaking warm winter's day, we were first taken up to the FAA Terminal Radar Approach Control (TRACON) room. We learned that as many as 1,100 planes a day fly in and out of the airport, although the average is actually closer to 400. The air traffic controllers are responsible for the lowest 10,000 feet of airspace in and around the airport. Beyond 10,000 feet, Boston Air Traffic Control takes over. While we were in the TRACON room, we saw the better part of a dozen planes "in action" on their new, modern radar scopes.

We were informed that a ceiling of 500 feet or lower severely impacts take-offs and landings on Runway 28, as it's the shorter runway (7,200 feet vs. 8,500 feet for Runway 01/19). Low IFR ceilings usually preclude the use of Runway 28, unless south winds are especially strong as this would pose a crosswind problem on runway 01/19. There is also no Runway Visual Range (RVR) for Runway 28. Runway 19 has a 2,400-foot RVR threshold, making it a Category II runway. Most of the smaller aircraft exclusively use the longer Runway 01/19.

We were advised of a significant dilemma Airport Operations frequently encounters during the winter months: After a significant snowstorm, how quickly can Airport Operations clear Runway 28 before a significant west wind (if any) develops behind the departing low pressure area, creating snow drifts? They need to plow Runway 28 before the wind kicks in and creates the drifts. Airport operations rely on our products, and this is the reason Operations often calls both prior to the beginning of, and at the end of, a snowstorm.

The next part of the tour took us up into the tower. Rarely are there more than two controllers working in the tower at once. The controllers explained the procedures involved in guiding aircraft into and out of the airport.

Then we went back downstairs, where an FAA employee showed us an interesting video of how the national airspace was impacted during the unfolding of 9/11. He explained that controllers across the country were required to maintain a minimum of 3 miles of airspace between each aircraft while bringing them into the nation's airports. Amazingly, thousands of planes were safely brought down without even one reaching into another's 'bubble'. He also showed us a video demonstrating how profoundly even isolated thunderstorms can disrupt air traffic, even if they are well-forecast.

For the first time, we were taken on a trip around the airport grounds. We rode in a shuttle bus, and traversed much of the 1,200 acre site. We were shown the GRE (Ground Run Exposure), a facility where they repair aircraft. We also saw the 'Fuel Farm' and the State Police Air Maintenance facility. We were told that much of the area is marshy, and that a portion of the field is frequently shrouded in fog. The airport is located near the junction of the Mohawk and Hudson Rivers, which impacts the airfield by providing the moisture to create locally dense fog. We also visited the 'Snow Farm', where snow removal from the runways and surrounding terminals adds up to an increasingly huge snow mound as winter progresses. We saw that the snow dome was easily 20 feet high, despite the fact that there was no leftover snow pack on this unseasonably mild day. It was our understanding that during the snowiest winters, the snow dome can easily encompass the entire parking lot (which looked to be larger than a football field!). After over 100 inches of snow officially fell at Albany during the winter of 2002-03, (for our 3rd snowiest winter on record), come June, the snow dome had to be forced to melt, as it appeared it would not do so in time for the following winter.

We then checked out the Airport Operations Building, where workers receive our Airport Weather Warnings, augment the Automatic Surface Observing System (ASOS), take EMS calls, deal with Lost and Found, and monitor airport security. Finally, we paid a visit to the official ASOS site.

Our tour guides expressed their appreciation for our quality forecasts, and complimented us on our Area Forecast Discussions (AFDs). Hugh asked if there was anything we can do better regarding the discussions. They said they were fully pleased with our AFDs. The tour was very enlightening, and gave everyone an opportunity to put a face with a name. Our heartfelt thanks go out to our Albany International Airport tour guides, who took the time out of their busy schedules to help provide us with a better understanding of how our day-to-day interactions with them impact one other.

NWS Albany personnel with Albany International Airport's Automated Surface Observing System (ASOS) in the background (1/8/08).
Pictured (l. to r.): Hugh Johnson; Evan Heller; Kim Sutkevich; Brian Frugis; Thomas Wasula, and; Brian Montgomery.

THE LEGACY OF AN ICE STORM

Hugh Johnson
Meteorologist, NWS Albany

December 2008 started out innocently enough: mild and dry. It then turned a bit colder but remained benign. However, by December 5th, long-range computer models were hinting at trouble ahead. They indicated a storm might impact our region with some sort of wintry precipitation.

By December 7th, shorter-range models continued to show a storm would be bearing down on us by the end of the work week. The storm that would clobber us was already producing unusual weather: like snow in Las Vegas!

Low pressure had worked across the southern tier of the U.S. At the same time, energy from a hyperactive northern jet stream joined forces with this "Dixie Storm" to form a formidable "Miller A" type storm that loaded up with Gulf of Mexico moisture, and made a turn up the eastern seaboard. High pressure from eastern Canada sealed our fate by wedging a shallow surface-layer of sub-freezing air over the Northeast while tropical moisture charged northward.

At this point, National Weather Service forecasters in Albany were confident about the track of the storm, and that it would bring a significant amount of precipitation. However, the type of precipitation remained in question.

Forecasters thoroughly examined the forecast model soundings, and the initial consensus was that more sleet than either freezing rain or snow would fall. The process by which sleet and freezing rain form are similar but not the same. Sleet is the result of melted, or partially melted, snow flakes that have fallen through a warm layer (above freezing) high above the ground, then through a thick and cold-enough layer to re-freeze before hitting the ground. Freezing rain is also the result of snow flakes melting through a warm layer, but in this case, the layer is warm and thick enough so that rain drops do not re-freeze until they make contact with the ground or objects near it. The difference in temperature between freezing rain and sleet may be only a degree or two through the column of the atmosphere. However, the difference in impact between a sleet storm and an ice storm is huge. Sleet storms, while producing slick plowable roads, rarely cause power outages, as sleet (ice pellets) bounces off trees and power lines. Occasionally, ice pellets can short out transformers. Freezing rain, however, accretes on any and all surfaces, and can knock trees onto power lines, transformers, homes and roads.

Freezing rain started falling early on Thursday, December 11th. Initially, the rain froze on only metallic surfaces and untreated sidewalks. By late in the day, it had become obvious that enough ice would fall to produce widespread power outages. FEMA, SEMO and Emergency Managers were well-briefed by the National Weather Service on the impending hazard. As nightfall rolled in, heavy freezing rain, occasionally mixed with sleet and embedded thunderstorms, pounded our area. Ice began accreting at an alarming pace, despite surface temperatures being slightly above freezing in some cases. Much of the ice accretion was on surfaces just above the ground. Large branches were snapped off, and whole trees, uprooted, falling onto power lines. Power began failing by late Thursday evening, and the number of residences without power began escalating rapidly by early Friday morning. The freezing rain briefly turned to a little snow before ending, which brought down even more trees and power lines. Gusty winds brought down even more tree branches. Temperatures flirted with freezing, which, when combined with the gusty winds and a little December sunshine, shredded ice off trees, with the ice looking like shrapnel as it became airborne.

The number of customers without power peaked at over 250,000, nearly a quarter of the population of the entire Capital Region and adjacent western New England. The area from Clifton Park southeast to Niskayuna was hit the hardest. Further north and west, more sleet and snow fell, which spared these areas from significant power loss. This was the largest power outage in our area since the freak October 4th snowstorm in 1987. But unlike the 1987 storm, the power outages with this storm came with frigid temperatures, and people scrambling to find generators in an attempt to save their pipes and keep their unheated homes habitable. Unfortunately, improper use of a generator resulted in at least one death due to carbon monoxide poisoning. Hotels and motels quickly reached maximum capacity, and many shelters were opened by the American Red Cross.

About half of the National Weather Service Albany staff lost power at home, some for as many as four days! Nevertheless, National Weather Service members continued to work to produce accurate forecasts crucial to the power restoration effort. Full power restoration in our area, which involved teams of workers deployed from as far away as

Michigan, took nearly a week, while in portions of New Hampshire, hit even harder by the ice storm, it took more than two weeks! Total damage from the storm was still being assessed as of March 19th, and is expected to exceed 25 million dollars! It may take more than a year to clean up the residual debris and damage from this storm.

While the December 2008 ice storm, with as much as an inch and a third of ice, was very bad, the Ice Storm of December 1964, which also crippled the Capital District, was slightly worse. Worse still was an ice storm that devastated a good chunk of the Appalachians in late January 2009, with up to three inches of ice accretion, power outages lasting several weeks, and scores of deaths. However, the worst ice storm on record took place over the North Country, and a large portion of Quebec and Ontario, in January of 1998. As much as six inches of ice virtually destroyed a large portion of the Canadian electrical grid, knocking out power to millions. Full power restoration was not realized for over a month, and many fatalities resulted.

Ice storms are arguably more disruptive and devastating than blizzards. Hopefully, our area will not have to endure another ice storm anytime soon.

THREE-BODY SCATTER SPIKES

Thomas A. Wasula
Meteorologist, NWS Albany

National Weather Service meteorologists can use a "Three-Body Scatter Spike" (TBSS) radar signature as justification for issuing a Severe Thunderstorm Warning for large hail potential. The TBSS is sometimes called a hail spike. A TBSS showing up on a radar display nearly always indicates severe thunderstorm hail (greater than or equal to three-quarters of an inch in diameter). It is typically identified by a spike of weak reflectivity echoes extending out from a thunderstorm's strong reflectivity core, and away from the radar location.

The TBSS, or hail spike, occurs as a result of the scattering of radiation. The spike results from the microwave energy of the radar striking the hail, and being deflected to the ground. The energy reflects from the ground back to the wet hail, and then finally returns to the radar. These three scatterings produce the triple reflection that gives this signature its name. The radar beam energy hitting the ground at least once, and the hail many times, then results in a weaker return echo than the initial radar energy that went from the radar to the hail, and right back to the radar. The hail spike results due to the energy taking more time to go from the hail to the ground and back, in contrast to the energy that went from the hail right back to the radar. Putting it another way, this radar feature is caused by the radar beam hitting the wet hail, scattering to the ground below, then scattering back upward into the sky, then finally, being scattered by the hail aloft. Figure 1 is a schematic of the TBSS. A TBSS appears only at the height levels aloft that accompany the most intense hail. Hail cores are most intense typically at higher radar elevation heights.

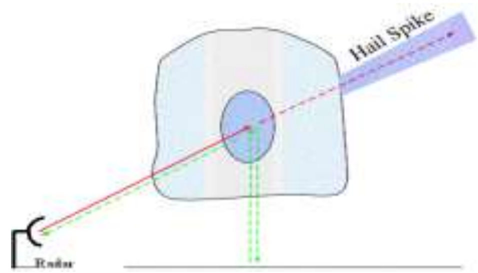


Figure 1: Diagram of a Three-Body Scatter Spike (TBSS) (courtesy of Lyndon St. College, VT -http://apollo.lsc.vsc.edu).

On June 16, 2008, devastating, large-hail-producing thunderstorms struck portions of upstate New York. There was over $16 million worth of agricultural damage to orchards in Ulster County, and over a half million dollars worth in Dutchess County. A great example of a TBSS during this event was displayed on the Albany (KENX) radar over western Dutchess County. The storm was located north of Poughkeepsie near the Hyde Park area at 2146 UTC, or 546 pm EDT (Fig. 2). The KENX radar is located northwest of the hail core and its associated TBSS. The TBSS showed up on the 0.5°, 0.9° and 1.3° radar elevation angles (between 5,000 and 12,000 feet Above Ground Level (AGL)). A severe thunderstorm warning was issued 15 minutes earlier, mentioning the potential for golf-ball-size hail. The presence of the TBSS increased forecaster confidence that large hail was occurring. A tornado warning for a potential tornado was also issued, at 548 pm EDT, based on the reflectivity and storm-relative velocity radar data. No tornado was confirmed, but golf-ball-size hail was reported at Hyde Park at 555 pm EDT (Figure 3).

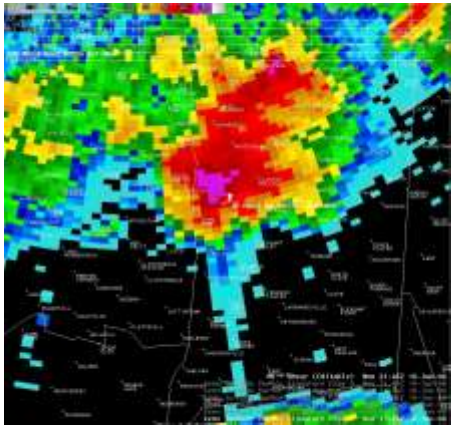


Figure 2: 2146 UTC KENX 0.5° Base Reflectivity data. The TBSS extends southeast from the 65-75 dBZ reflectivity core. The KENX radar is located northwest of the TBSS.

Figure 3: Golf-ball-size hail, presented by Hyde Park Cooperative Observer.

Hail spikes, or TBSSs, are radar features that are indicators of large, damaging hail, helpful in justifying issuing Severe Thunderstorm or Tornado Warnings (large hail can be mentioned in Tornado Warnings). Forecaster confidence in the potential for large hail (≥ three-quarters of an inch in diameter) increases when a TBSS shows up on a WSR-88D radar.

2009-A SUMMER TO REMEMBER

Evan. L. Heller
Climatologist, NWS Albany

The summer of 2009 shall long be remembered in Albany for the amount of rainfall the city received. The 18.51" total (Table 1) makes this past summer the 3rd wettest on record…the wettest since the upstart of the National Weather Service's Albany office. More than half the total (9.91") was received in July alone. This made July 2009 the wettest July on record at Albany (Table 3b), exceeding the previous record of 9.37", which had existed for the past 138 years! It was also the 2nd wettest of all months on record. Only September 1999 (#1), thanks in large part to Hurricane Floyd, and July 1999 (#2) were wetter. During this month, two daily precipitation records were broken. These occurred on the first and last days of the month. Together, these two dates accounted for more than half of the monthly total. Needless to say, flooding was a big issue in and around the Capital Region. Although August was the driest of the three months of climatological summer, the last of the season's three precipitation records was broken during the month, on the 18th, when 1.48" of rain fell.

There were no records at all in June in Albany, despite the nice-sized rainfall total. The only other record of note for the season was the occurrence of a minor heat wave from August 16th-18th (Table 3c). A heat wave exists if the temperature reaches 90º for three consecutive days. The season wound up being slightly below normal (Table 1), with June being the most normal month, July being on the cool side, and August being on the warm side.

Partly cloudy conditions made up the majority of the days of summer (Tables 4a-c), with a total of 49 of the 92. Only 9 days were considered cloudy, with the balance (34) being clear days. So there was plenty of sunshine to be had.

It was an interesting season from the standpoint of rainfall, but temperatures were not off the deep end, with only August 16th-18th recording 90º or higher (Table 2).

STATS

	JUN	JUL	AUG	SEASON
Avg. High/Dep. From Norm.	74.9°/-2.6°	77.4°/-4.8°	80.3°/+0.6°	77.5°/-2.3°
Avg. Low/Dep. From Norm.	57.2°/+2.2°	59.2°/-0.8°	61.7°/+3.4°	59.4°/+1.6°
Mean/ Dep. From Norm.	66.0°/-0.3°	68.3°/-2.8°	71.0°/+2.0°	68.4°/-0.4°
High Daily Mean/date	76.0°/25th	76.0°/29th	80.0°/18th	
Low Daily Mean/date	50.5°/1st	62.5°/8th&13th	61.0°/29th & 31st	
Highest reading/date	86°/25th	85°/28th	91°/17th	
Lowest reading/date	36°/1st	50°/15th	48°/8th	
Lowest Max reading/date	64°/18th	69°/2nd	65°/29th	
Highest Min reading/date	67°/24th	70°/29th	70°/18th, 21st & 22nd	
Ttl. Precip./Dep Fm. Norm.	5.02"/+1.28"	9.91"/+6.41"	3.58"/-0.10"	18.51"/+7.59"
Ttl. Snowfall/Dep. Fm. Norm.	0.0"/±0	0.0"/±0	0.0"/±0	0.0"/±0
Maximum Precip/date	1.30"/18th	2.76"/1st	1.48"/21st	
Maximum Snowfall/date	0.0"	0.0"	0.0"	

Table 1

NORMALS, OBSERVED DAYS & DATES

	JUN	JUL	AUG	SEASON
High	77.5°	82.2°	79.7°	79.8°
Low	55.0°	60.0°	58.3°	57.8°
Mean	66.3°	71.1°	69.0°	68.8°
Precip	3.74"	3.50"	3.68"	10. 92"
Snow	0.0"	0.0"	0.0"	0.0"
OBS. TEMP. DAYS 2009				
High 90º or above	0	0	3	3/92
Low 70º or above	0	1	3	4/92
High 32º or below	0	0	0	0/92
Low 32º or below	0	0	0	0/92
Low 0º or below	0	0	0	0/92
OBS. PRECIP. DAYS 2009				
Days T+	17	21	12	50/92/54%
Days 0.01+	15	18	9	42/92/46%
Days 0.10+	11	12	7	30/92/33%
Days 0.25+	9	8	4	21/92/23%
Days 0.50+	2	4	3	9/92/10%
Days 1"+	1	3	1	5/92/5%
PRECIP. & SNOW DATES				
1.00"+ value/date	1.30"/18th	1.44"/29th	1.48"/21st	
2.00"+ value/date	-	2.76"/1st	-	
2.00"+ value/date	-	2.42"/31st	-	
3.5" snow value/date	-	-	-	

Table 2

RECORDS

ELEMENT	JUNE			
	1st		2nd	
NONE	/	/	/	/

Table 3a

ELEMENT	JULY			
	1st		2nd	
Precipitation/Date|Prev Rec./Yr.	2.76"/1st	1.59"/2005	2.42"/31st	1.29"/1939
Top 10 Wettest Julys/Rank|#1 Amount/Year	9.91"/#1	9.91"/2009		
All-Time Wettest Months/Rank|#1 Amount/Year	9.91"/#3	11.06"/Sept. 1999		

Table 3b

ELEMENT	AUGUST			
	1st		2nd	
Precipitation/Date|Prev Rec./Yr.	1.48"/21st	1.23"/1997	/	/
Heat Wave	August 16-18		-	

Table 3c

ELEMENT	SEASON			
	1st		2nd	
All-Time Wettest Summers/Rank|#1 Amount/Year	18.51"/#3	27.21"/1871		

Table 3d

MISCELLANEOUS

JUNE

Avg. wind speed/Dep. Fm Norm.	5.3 mph/-2.3 mph
Peak wind/direction/date	33 mph/NNE/22nd
Windiest day avg. value/date	9.7 mph/22nd
Calmest day avg. value/date	1.8 mph/4th
# clear days	7
# partly cloudy days	18
# cloudy days	5
Dense fog dates (code 2)	15th, 20th, 27th & 30th
Thunder dates (code 3)	14th, 15th, 26th, 27th
Sleet dates (code 4)	-
Hail dates (code 5)	-
Freezing rain dates (code 6)	-

Table 4a

JULY

Avg. wind speed/Dep. Fm Norm.	5.5 mph/-1.5 mph
Peak wind/direction/date	38 mph/W/16th
Windiest day avg. value/date	13.4 mph/11th
Calmest day avg. value/date	1.2 mph/20th
# clear days	9
# partly cloudy days	19
# cloudy days	3
Dense fog dates (code 2)	1st, 8th, 9th & 17th
Thunder dates (code 3)	1st, 3rd, 6th, 7th, 11th, 12th & 16th
Sleet dates (code 4)	-
Hail dates (code 5)	-
Freezing rain dates (code 6)	-

Table 4b

AUGUST

Avg. wind speed/Dep. Fm Norm.	4.9 mph/-1.4 mph
Peak wind/direction/date	39 mph/WSW/18th
Windiest day avg. value/date	8.7 mph/5th & 7th
Calmest day avg. value/date	0.7 mph/14th
# clear days	18
# partly cloudy days	12
# cloudy days	1
Dense fog dates (code 2)	2nd, 3rd, 10th, 14th, 15th, 20th & 21st
Thunder dates (code 3)	10th, 18th, 19th & 21st
Sleet dates (code 4)	-
Hail dates (code 5)	-
Freezing rain dates (code 6)	-

Table 4c■

ARCTIC SEA ICE EXTENT

George J. Maglaras
Senior Meteorologist, NWS Albany

Trends in Arctic sea ice extent are frequently used as a measure of climate change, especially the summer minimum extent. While changes in weather patterns and ocean currents from one season to the next can cause large variations from year to year, a multi-year trend of increasing sea ice extent is seen as evidence of a cooling climate, while a trend of decreasing sea ice extent is taken as evidence of a warming climate. This article will present the latest Arctic sea ice extent statistics.

Arctic sea ice extent is defined as an area of sea water where ice covers 15 percent or more of that area. Thus, for any square mile of sea water to be included in the ice extent total, at least 15 percent of that square mile must be covered with ice.

Based on satellite measurements of Arctic sea ice extent which began in 1979, the average summer minimum Arctic sea ice extent for the period from 1979 to 2000 is 2.59 million square miles. For 2009, the summer minimum extent was reached on September 12, and was 1.97 million square miles. As a result, the 2009 minimum extent was 23.9 percent below the 1979-2000 average.

There has been a noticeable trend of decreasing ice extent since satellites began measuring Arctic sea ice extent in 1979. The lowest summer minimum ice extent occurred in 2007, and was measured at 1.60 million square miles (38.2 percent below the 1979-2000 average). This caused great concern that global warming was accelerating, and that the Arctic could be ice-free during the summer months within a relatively small number of years, thereby further accelerating the impacts of global warming.

However, in 2008, the summer minimum ice extent increased to 1.75 million square miles, and, as stated earlier, the 2009 minimum increased further to 1.97 million square miles. Thus, the 2009 summer minimum was 23.1 percent above the 2007 summer minimum, but still 23.9 percent below the 1979-2000 average.

Has the summer Arctic sea ice extent begun to recover, or is the recent rise in summer ice extent just a brief pause in the overall decreasing trend? It will likely take several more years of observations before these questions can be answered.

THE 2000s: OUR WETTEST DECADE ON RECORD

Hugh W. Johnson IV
Meteorologist, NWS Albany

Although the decade will not be over until January 1 2010, officially here in Albany, we have endured our wettest decade on record. Through December 15th, we have accumulated over 430.4" of precipitation this past decade, averaging 43.04" per year. This already squeaks by our previous wettest decade, the 1870s, which had an average of 43.01" per year. The 1840s was close behind that, with an average of 42.22" per annum. The 30-year normal precipitation total (based on 1971-2000 data) for one year is 38.60". Nine of the 10 years of the past decade were above normal. 2008 was the wettest year, with 47.79", and 2005 was close behind, with 47.72". It is ironic, however, that the precipitation total in 2001 was only 28.59", the driest year since 1965! Our driest decade on record was 1910-19, with an average of 31.47" per year, closely followed by the 1960s, with an average of 31.75" per annum.

Taking a look at each of the 12 months of the 2000s uncovers another interesting statistic. Only four months from the past decade had a large anomaly from the 30-year norm for precipitation. Those months were June, July, October and, to a lesser extent, December. The average precipitation for June was 4.73", just about an inch above the normal of 3.74". Despite one of the driest July's on record being in 2002, with under an inch recorded, the 10-year July average was 5.50", two inches above the 30-year normal! October's decadal average was just over an inch beyond the 3.23" 30-year normal value, with the last five years being well above normal. December averaged 3.52", compared to the 30-year normal of 2.76".

The wettest June of the decade was 2006, with a total of 8.74" of precipitation. Torrential rains with much higher rainfall amounts just to the west of Albany produced a flood of record along sections of the Mohawk River. The wettest July (and month, overall) of the past decade was this past year, with 9.91", and it was also the wettest July in well over a century. Record flash flooding took place in Columbia County on the 29th. Nine inches of rain fell in October 2005, with flooding noted across most of our County Warning Area several times during the month. There were many other significant flood events this past decade, more so than in any other decade of recent memory. Another memorable flood took place in early April 2005, when combined snowmelt and copious rainfall produced a flood of near record in the Esopus Basin. The wettest day of the decade belongs to June 6th of 2000, when 3.30" fell, smashing the old daily record for that date. Only a month later, 3.23" fell on July 15th, for a close second, and a daily record for that date.

Most of the months (excluding June, July, October and December) averaged close to normal precipitation during the past 10 years. February actually averaged a little below normal…only 1.94", compared to the normal of 2.27". While July 2005 and 2007 were very wet at Albany International Airport, almost all of the rainfall came with scattered thunderstorms that missed a lot of other areas nearby. The Mid Hudson Valley was very dry during July 2005, and the Mohawk Valley was parched in July of 2007.

With an overall wet decade, how did we fare with snowfall in the 2000s? Ironically, when one averages our seasonal snowfall over the past decade thus far, the result is just slightly more than the 30-year normal of 62.7". Could this wet decade be a reflection of significant climate change, or are we just in a wet cycle? Only time will tell!

ICE SAFETY TIPS FOR WINTER RECREATION

John S. Quinlan
Senior Meteorologist, NWS Albany

During many years, the ice surface on bodies of water in eastern New York and adjacent western New England is thick enough to support some recreational activities before the end of December. Above normal temperatures in some years, as well as periods of thaw and rain events, can act to delay the onset of ice formation, or to decay ice that is already in place. In addition, a deep blanket of snow may cover the ice during some years, which may weaken the ice beneath it. The snow acts as an insulator that slows down the freezing process, but also can prevent the ice from becoming thicker. In fact, the weight of the snow can cause the ice beneath it to fracture or turn the top few inches of ice into slush.

For people to venture out on an ice-covered body of water, an ice thickness of 4 inches or more is needed. Snowmobiles and ATVs need at least 5 inches, cars and light trucks need at least 8 to 12 inches, and medium trucks need at least 12 to 15 inches, of ice thickness.

Factors which can be used to assess the strength of the ice include: the ice appearance; ice thickness; daily temperature; snow cover; water depth under the ice; size of the water body; water chemistry; currents, and; distribution of the load on the ice.

If you do venture out on an ice-covered body of water, do not go alone. Let others know where you are planning to go, and use common sense. If you do get involved in an emergency, call 911, or your local emergency number.

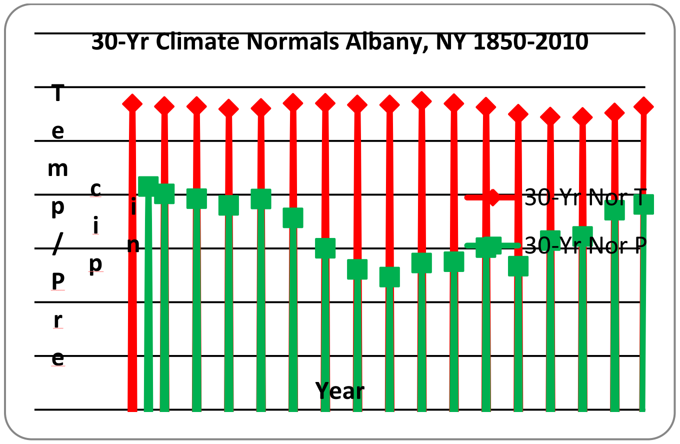
The Minnesota Department of Natural Resources has a very informative Ice Safety Page which can be found at:
http://www.dnr.state.mn.us/safety/ice/index.html

USING LONG-TERM CLIMATE RECORDS TO PREDICT FUTURE TRENDS

Steve DiRienzo
Service Hydrologist, NWS Albany

There is a relatively long record of weather observations for Albany, New York, with continuous monthly data extending back to 1820, and discontinuous records into the late 1700s. The Albany weather record is assumed to be a good proxy for examining long-term trends or cycles in the Albany Hydrologic Service Area since Albany, New York is well-centered within the area. Weather data from the official records, which are located on-site at the National Weather Service Office in Albany, was entered into a spreadsheet for analysis. Charting Albany precipitation, temperature and snowfall data reveals cycles on the order of 100 years for both precipitation and snowfall. These cycles appear to correlate well with past flood/drought cycles in the Albany area.

National Weather Service climate "normals" cover a 30-year period of record, and are updated at the end of each decade ending in zero. The current Albany climate "normals" represent averages from 1971 to 2000, and the update to be done on January 1st of 2011 will cover 1980 – 2010. The 30-year "normals" usually differ from the long-term averages. When we plotted the 30-year "normals" for temperature and precipitation, we found that annual temperature has varied some during the past 190 years, but that the variability in precipitation is far greater. This can be seen in the following graph.



You'll notice that the driest 30-year period (ending in 1930) coincides well with the beginning of the Dust Bowl period of the 1930s. It seems that the dryness was part of a large-scale signal that extended from the Great Plains of the United States and Canada at least all the way to Albany. Since that time, Albany has been getting gradually wetter with time. The previous decade (2000-2009) was the wettest decade in the Albany climate record. However, the 30-year climate "normals" from the second half of the 1800s were wetter than the current 30-year "normal". It is possible that the pattern of 'wetting, drying, wetting' is part of a repeating cycle that has a period of around 150 years from peak to peak. If this is true, we may be looking at a continuation of wet conditions for the next 20 years or so, and the flood and flash flood threat may remain high for the foreseeable future. Unfortunately, we may also see a continuation of the high cost of flood damage clean-up costs that have recently plagued the area.

WHAT APPS DO METEOROLOGISTS USE?

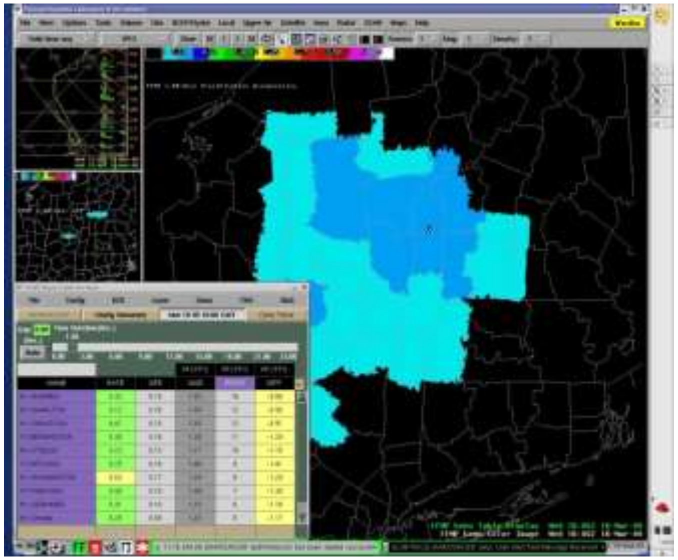
Brian Montgomery
Senior Meteorologist, NWS Albany

"There is an app for that", and apps within apps, and those apps in research and development for your National Weather Service. Computer technology advancements continue to amaze many of us, including those ever-popular smart wireless devices, with weather apps available on the go. However, what apps do National Weather Service meteorologists use every day to prepare forecasts, issue those life saving warnings, and assist with analyzing the atmosphere?

AWIPS, Advanced Weather Interactive Processing System, is the system used by National Oceanic and Atmospheric Administration/National Weather Service (NOAA/NWS) meteorologists to analyze and disseminate operational weather data, including time-sensitive, high-impact warnings that include tornadoes and winter storms. This was the first time a system integrated surface observations, numerical models, satellite imagery, radar displays and hydrological information into one cohesive application. In fact, this network is the backbone of our 24/7 operations and communications. A major upgrade is currently underway with the implementation of the AWIPS Software Product Improvement Plan. This ambitious project and the services-oriented software re-architecture will form the basis of the next-generation system known as AWIPS II. We will have more insight for you once this state-of-the-art system is available (before 2012).

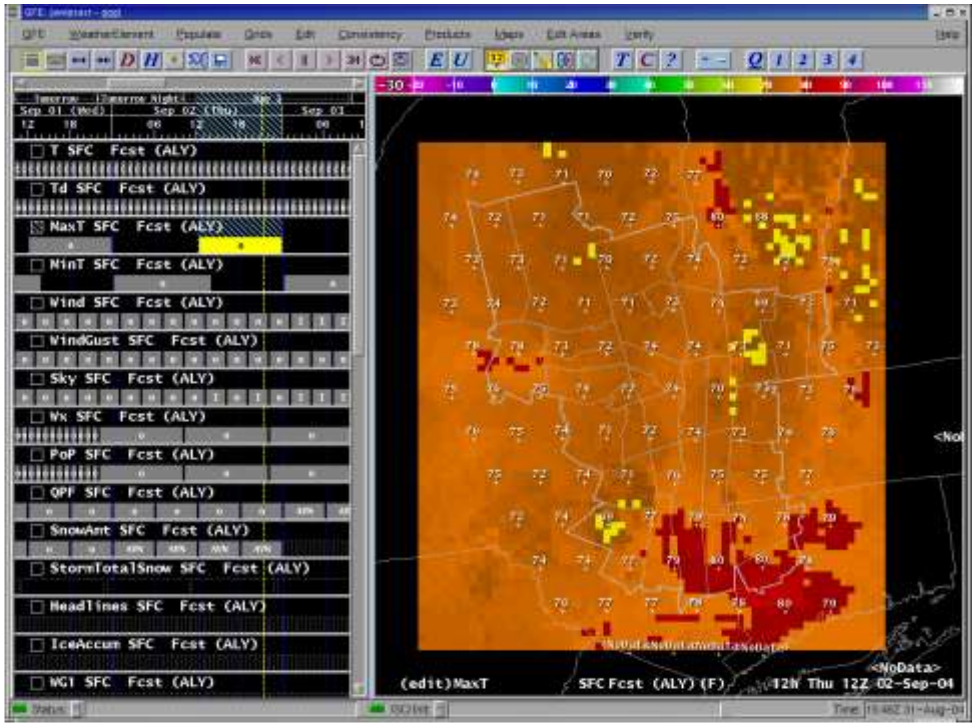
AWIPS display monitors, 3 for graphics, one for text.

FFMP, Flash Flood Monitoring and Prediction, is another app NWS meteorologists are utilizing, to assist with flash flood forecasting. This software system is an integrated suite of multi-sensor applications that detects, analyzes, and monitors precipitation, and generates short-term warning guidance for flash flooding automatically within AWIPS. FFMP provides forecasters with accurate, timely and consistent guidance, and supplements forecaster event-monitoring with multi-sensor, automated event-monitoring. You can monitor river forecasts from our Advanced Hydrologic Prediction Service (AHPS) at: http://water.weather.gov/ahps2/index.php?wfo=aly.



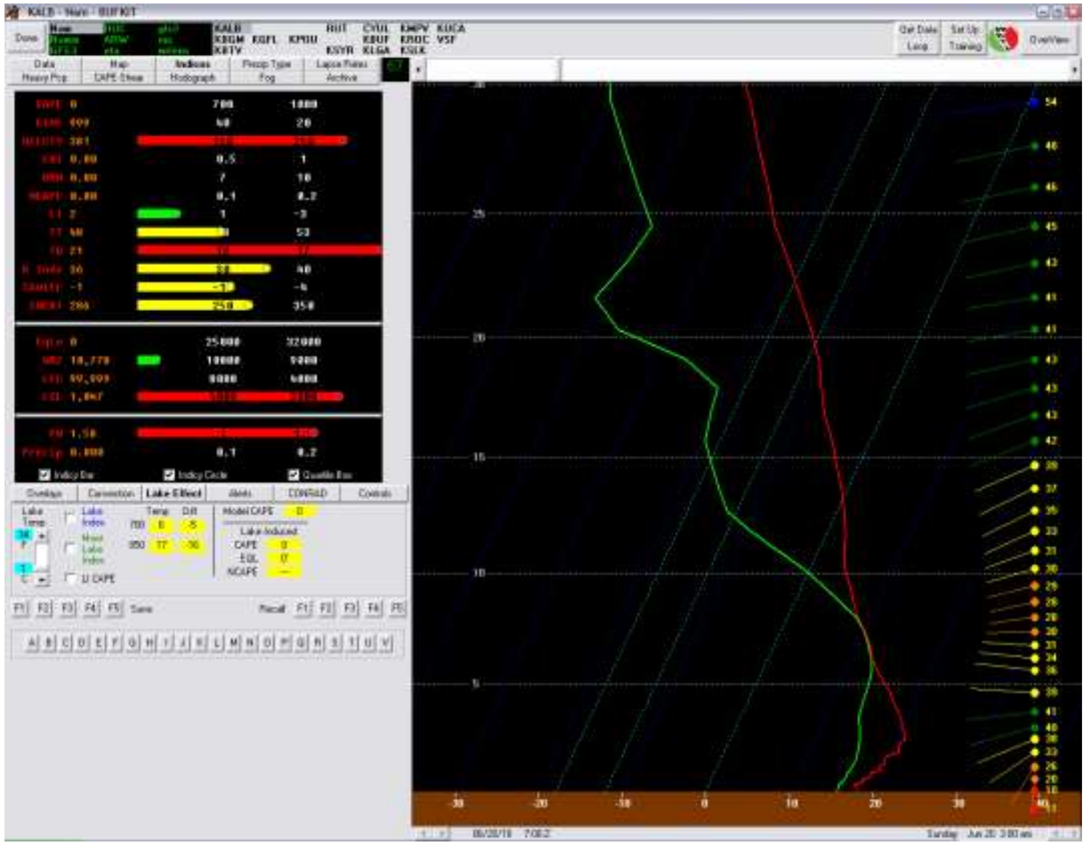
Typical FFMP display for NWS Albany's Hydrological Warning Area

GFE, Graphical Forecast Editor, is the actual graphical on-screen editor that allows meteorologists to create detailed graphical depictions of upcoming weather, while at the same time creating a numerical database of weather information ("grids") representing the same forecast. This technology also frees the forecaster from typing several text messages that describe the same weather for different clients. Furthermore, this digital approach ensures consistency among all forecasts supporting different services for the same area and time. All forecasts from GFE are available from the National Digital Forecast Database (NDFD), which can be examine at: http://www.weather.gov/forecasts/wfo/sectors/aly.php.



GFE display for use at the NWS ALY office

BUFKIT is a forecast profile visualization and analysis tool kit that offers a unique insight at a forecast point like Albany, for example. This PC-based application takes hi-resolution hourly forecast profiles from a numerical model, and displays the output in a graphical vertical profile of the atmosphere. The initial intent of this tool was to assist forecasters with lake- effect snow, but has since been expanded to include severe weather parameters, fire weather indices, and aviation predictions.



BUFKIT display showing forecast sounding and data table for ALB.

So, plenty of apps (even more not listed here) are available to your National Weather Service meteorologists to assist them with forecast preparation and the issuance of those life-saving watches, warnings and advisories. So what app can you buy for your best protection against hazardous weather? NOAA Weather Radio All Hazards! This device should be as common as CO/smoke detectors in everyone's home. More information is available at: http://www.erh.noaa.gov/aly/WxRadio.htm.

IRENE INUNDATES OUR REGION…WITH DESTRUCTION

Hugh Johnson
Meteorologist, NWS Albany

It's been more than a decade since our region was directly impacted by a Tropical Storm. Our area has often felt the indirect impact of tropical systems, even as recently as last year, with the remnants of Nicole bringing over half a foot of rain to portions of the region. However, our last direct hit from a Tropical Storm was by Floyd back in September 1999. That storm brought a quick end to a drought that summer, and produced moderate to major flooding to many of our watersheds, with 6 to 12 inches of rainfall.

While the tropical season had been active this year, it was only the ninth tropical system that was the first to strengthen into a hurricane. That storm was Irene, which had been a well-defined tropical wave that formed off Cape Verde on August 15th and headed west. It became the season's first hurricane, ironically only after it had made landfall a number of times, firstly in Puerto Rico on August 22nd. It then began to turn north, battering much of the Bahamas, and briefly spinning up to a major Category 3 hurricane as it moved perilously close to the east coast of Florida.

Irene had actually weakened a touch as it tracked toward North Carolina, making its first U.S. landfall at Cape Lookout on August 27th as a high-end Category 1 hurricane, with sustained winds of up to 85 mph. The storm then tracked northward around 15 mph, the eye becoming cloud-filled, and dry air beginning to entrain into its southwest side - hopeful signs that the storm might weaken.

However, even after tracking over land for 80 miles, Irene maintained Category 1 hurricane strength as it moved into the mouth of Chesapeake Bay very early on August 28th. It then turned slightly northeast just off the Delmarva Peninsula, making its second U.S. landfall at Little Egg Inlet in southern New Jersey. It was the first hurricane to make direct landfall in New Jersey since 1903! As it churned up the Jersey coast, it finally weakened to a high-end tropical storm before making its third and final landfall on Coney Island, in Brooklyn, New York City, at 9:00 a.m.

It then accelerated and tracked more northeast through western Connecticut and the Connecticut River valley of western Massachusetts and Vermont, and then turned more east northeast across Southern New Hampshire into Maine. The storm passed about 60 miles to the east of Albany at 2:00 p.m. on Sunday, the 29th. The barometric pressure fell to 28.89 inches, the lowest August barometer reading on record at Albany.

Heavy bands of rain showers well ahead of the main storm began falling in our southern zones early Saturday morning. Then the rain shield directly associated with Irene overspread the region Saturday evening from south to north. Rainfall rates quickly increased to between one half and one inch per hour by Sunday morning. In the immediate Capital District, the wind increased out of the north, reaching a maximum sustained speed of around 25 mph, and gusting over 50 mph, by mid-morning.

The gusty winds, coupled with fully-leaved trees and very wet ground, began producing a plethora of power outages during the morning, spreading from our southern areas northward, to include most of the region by midday. Unlike Floyd, the ground was well-saturated before the rains of Irene arrived, thanks (but no thanks) to several heavy rainfall events earlier in August.

As a result, flooding and flash flooding commenced quickly, and an historic event unfolded. The worst thing about the storm was the flooding. Total rainfall, most of which fell in under a 24-hour period, ranged from around 3 inches in extreme northern Herkimer County, to a phenomenally high 13.80 inches at Durham, in Greene County! Most areas received around 5 to 10 inches of rainfall. The swath of heaviest rainfall was generally across the higher terrain to the west of the Hudson Valley. The 4.69 inches that fell at Albany International Airport on August 28th smashed the old record for the date of 3.50 inches set in 1971, and produced the second-wettest day on record at Albany. The storm total rainfall was officially 4.83 inches.

Most of our rivers and streams rose rapidly to produce major or record flooding. Floods of record included: many points on the Schoharie Creek; Granville on the Mettawee River; Cold Brook (Mt. Tremper) on the Esopus Creek; Rosendale on the Rondout Creek; Canajoharie on the Canajoharie Creek; Poughkeepsie on the Hudson River; Rockinhgham on the Williams River; Bennington on the Walloomsac River, and; Saxtons on the Saxtons River.

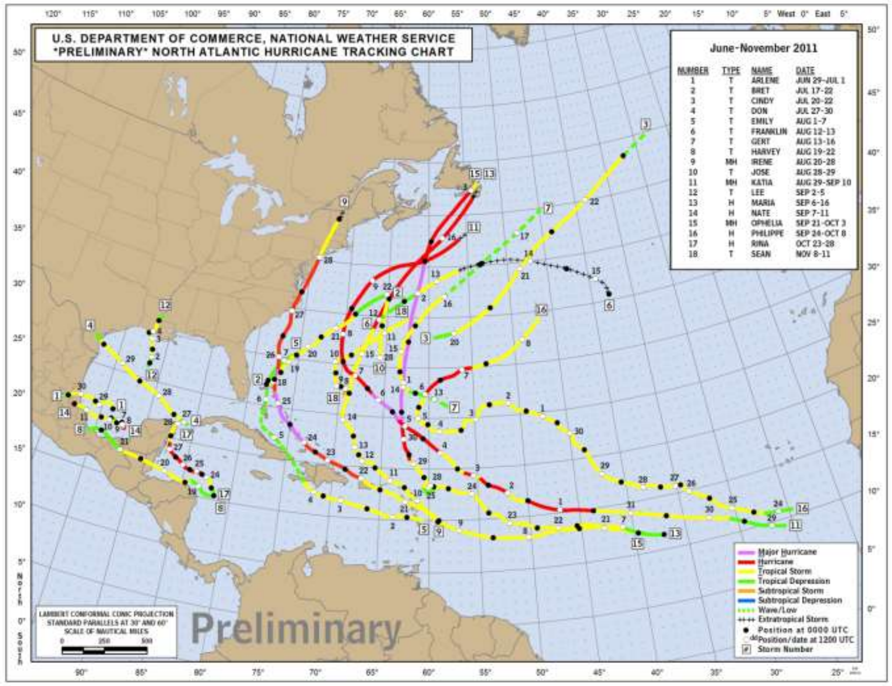
Many towns in the vicinity of the watersheds were damaged or destroyed, and millions of dollars in crops were lost. Dozens of roads were washed out, especially in the state of Vermont, where whole towns were physically cut off from the surrounding areas. Several people were swept away by the torrents of water.

Monday dawned a beautiful day with lots of sunshine, lowered humidity, and a sense that the atmosphere had finally calmed down. However, the sunshine also revealed the unprecedented damage brought on by Irene. It took over a week for all 300,000 residences and businesses who had lost power to have it restored. It will take years for many of the towns to rebuild.

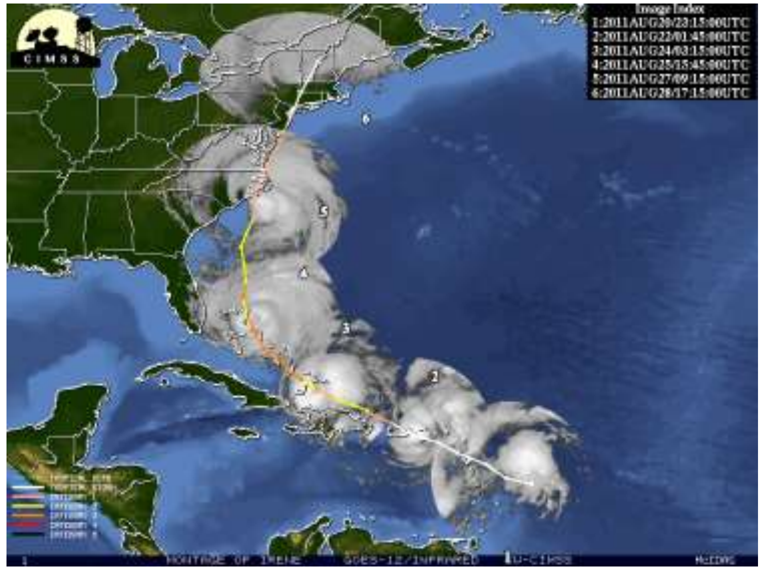
A REVIEW OF THE 2011 ATLANTIC HURRICANE SEASON

Brian Montgomery
Senior Meteorologist, NWS Albany

The 2011 Atlantic Hurricane Season saw 19 named storms, 7 of which were hurricanes, 3 of them intense, compared to a season that has an average of 11 named storms, 6 being hurricanes, 2 intense. This represents the third-highest total (tied with 1887, 1995 and 2010) since official records began in 1851. This past year's totals include: a post-storm decision to upgrade Tropical Storm Nate to hurricane status, and; the addition of a short-lived, unnamed tropical storm that formed in early September between Bermuda and Nova Scotia. This unnamed storm, along with several other weak, short-lived named storms, could have gone undetected were it not for modern satellite technology. The strongest hurricane of 2011 was Hurricane Ophelia, which peaked as a Category 4 with 140 mph winds and a central pressure of 940 mb (barometer of 27.76" Hg) on October 2, when it was just northeast of Bermuda. Below is the preliminary track summary map from the National Hurricane Center.



Hurricane Irene was the most notable storm of the season. This storm developed on the evening of Saturday, August 20th, east of the Leeward Islands. It had a peak wind of 120 mph, making this storm a major hurricane…Category 3 on the Saffir-Simpson scale. Irene was the lone hurricane to hit the United States in 2011, with its landfall near Cape Lookout, North Carolina, at approximately 7:30 a.m. EDT on Saturday, August 27th. This was the first hurricane to make landfall in the United States since Ike struck southeast Texas in 2008. Irene was also the most significant tropical cyclone to strike the Northeast since Hurricane Bob in 1991. From historic flooding to strong winds producing structural damage, Irene left a permanent mark in its wake. We have a preliminary overview available on our web page at:
http://www.erh.noaa.gov/aly/Past/2011/Irene_Aug2011/Aug_28_2011.htm



Satellite imagery montage and track of Irene, August 2011.

THE BIPOLAR BEHAVIOR OF THE PAST TWO WINTERS

Hugh Johnson
Meteorologist, NWS Albany

As many probably remember, the winter of 2010/11 was snowy and cold across our region. As we approached the winter of 2011/12, a major nor'easter slammed areas mainly south and east of Albany prior to Halloween, causing heavy wet snow to knock out power to millions. Many wondered if that unusually early snowstorm was a harbinger of the winter to come.

As it turned out, despite having somewhat similar antecedent conditions to the winter of 2010/11, snowfall this past winter was well below normal, and it was the least snowiest winter since 1988/89. Temperatures ran well above normal, and it was also the mildest winter since 2001/02.

The past two winters featured a negative or cold cycle of the El Niño Southern Oscillation, (ENSO), otherwise known as La Niña. The La Niña this past winter was a little weaker than the strong one of 2010/11. The Pacific Decadal Oscillation (PDO) remained in its cold phase, and in fact, appeared to have strengthened even deeper into the cold phase than last winter.

So, why did the past two winters turn out to be so completely different? Last year, much of the winter saw a large high pressure block in the atmosphere near Greenland, which forced the polar Jetstream to dive well south of our region. This jetstream combined forces with the Pacific Jetstream, and became the conduit for strong storms to churn up the eastern seaboard and deposit huge amounts of snow. Meteorologists refer to this persistent blocking pattern as the Negative Atlantic Oscillation (-NAO).

In stark contrast, the Atlantic Oscillation this past winter was strongly positive (+NAO); instead of high pressure, a large low pressure polar vortex area was parked over Greenland, and high pressure was planted near the Azores well to the south. This setup forced the polar jet stream to remain unseasonably far to the north, often near or even to the north of the Canadian border for a portion of the season. The Pacific Jetstream remained well south of our region. The net result was that many storms missed our region, and those that hit were not all that strong.

Okay, so why the drastic difference in these North Atlantic Oscillation patterns? One possible reason for the huge switch in the NAO could be that the Quasi-Biennial Oscillation (QBO) last winter was in its negative, or easterly, phase. The QBO is a 29-month cycle that sees lower stratospheric winds switch from east to west in a binary mode. When the stratospheric winds are easterly, the tropospheric winds that steer the weather patterns tend to be weaker. This, in turn, favors high-pressure blocking in the North Atlantic. The QBO had actually switched to its positive westerly phase very late during the winter of 2010/11, but has remained in that phase this past winter. In the positive or westerly phase of the QBO, the winds are westerly in the lower stratosphere, and much stronger in the troposphere. In this stage, there is a tendency for less blocking in the Greenland area of the North Atlantic, favoring a +NAO.

Another change with this past winter was a flare-up of solar activity. Some scientists argue that when the sun becomes more active, there is a tendency for the sun's surface to be slightly hotter, which could help the earth warm a little more than usual.

However, as mild as our winter was, Alaska endured one of its coldest and snowiest winters on record. Brutal winter cold and heavy snows plagued much of Eastern Europe, with snow as far south as Greece. While the Polar Jetstream remained well north over North America, it plunged unusually far southward across Eastern Europe and into Asia.

Mild weather has continued well into March as of this writing. However, keep in mind that just because we had a mild winter does not necessarily mean the rest of spring, or even summer, will be above normal. There is even a chance we will see more snow this spring, so you might not want to put away the snow blower for the season just yet.

SPRING 2012: WARMEST SINCE BEFORE THE CIVIL WAR

Evan L. Heller
Climatologist, NWS Albany

If you go back only to when National Weather Service records began for Albany in 1874, then we just got through our warmest spring on record. But since we have records going even further back, we know more specifically that this was the warmest spring since before the start of the U.S. Civil War. The mean temperature was 52.4°, which was 5.4° above normal (Table 1). The mean of the warmest season on record was only a tenth of a degree higher, and occurred in 1859 (Table 3d).

It all began in March when Albany, New York registered a mean temperature for the month of 45.9°, an astounding 10.9° above normal (Table 1). This made it the warmest March ever recorded, taking into account continuous data dating all the way back to 1820 (Table 3a)! This past March was also the first time since January of 1932 that we recorded a warmest month. A special thanks goes out to one of our meteorologists, Hugh Johnson, for pointing this out. In fact, all but two of our warmest months are from 1900 or before. Albany's other post-1900 warmest month is from November, and it was in 1931. With the record warmth of March came an astonishing number of daily temperature records. These totaled 19: 7 maximums; 5 high minimums, and; 7 high means (Table 3a). The most profound of these daily records was a high minimum from the 21st, of 56°, which eclipsed a 99-year-old record by a full 10 degrees. The warmest reading recorded for the month was 81°, on the 22nd (Table 1), while a below normal 13° was recorded as the month's low reading, on the 6th. The last measureable snowfall, 0.3", was recorded on the 9th. But a far greater measureable snowfall of 4.8" occurred on the 1st (Table 2b). The last flurry fell on the 31st. Other records for March (Table 3a) included: #1 Warmest Mean Minimum March (for the first time since 1903), and; #2 Warmest Mean Maximum March…plus there were two different wind records.

The month of April was much closer to normal for temperatures. The 48.1° mean was a mere 0.3° above normal. Even so, a daily record was set for the month's warmest maximum temperature of 91° on the 16th, as well as for the high mean for the date. Both replaced records from just 10 years prior (Table 3b). There were also 2 daily maximum wind speed records set. The 16th was indeed an outlier with its 91° high. No other day during the month of April reached even 80°, and April 16th became the earliest calendar date Albany had ever reached 90 degrees or above (Thanks again, Hugh!). Previously, the earliest occurrence had been the very next calendar day…having been set in 2002. The season's last freeze occurred April 30th…with a low of 29°. There was more rain in April than in March in Albany, being just below the normal for the period. The first daily inch or more of rain for the year occurred on the 21st, and two more inch-plus days followed in May, as wetness further increased (Table 2b). April was also very tranquil in regards to both severe and wintry weather. There was no wintry precipitation or dense fog of any kind recorded at Albany International Airport during the entire month, and there were also no thunderstorms (Table 4b).

May rounded out the season with a return to above-normal temperatures, but only about half above normal as March. The 5.8° above normal monthly mean low temperature contributed to the only temperature record for the month (Table 1), as May came in 7th for Top 10 Warmest Mean Minimum March (Table 3c). Another 91° high was achieved on the 29th, a day with severe weather in Albany. The first thunderstorm of the season had occurred on the 4th (Table 4c). May 2012 was wet (Table 2a), and the 6.03" total placed it at #122 for All-Time Wettest Months in Albany. But with March being as dry as it was, Spring 2012's 10.54" total just could not crack Albany's Top 10 Wettest Springs list.

STATS

	MAR	APR	MAY	SEASON
Avg. High/Dep. From Norm.	55.7°/+11.3°	59.6°/+1.3°	73.4°/+4.0°	62.9°/+5.5°
Avg. Low/Dep. From Norm.	36.0°/+10.3°	36.5°/-0.8°	52.9°/+5.8°	41.8°/+5.1°
Mean/ Dep. From Norm.	45.9°/+10.9°	48.1°/+0.3°	63.1°/+4.8°	52.4°/+5.4°
High Daily Mean/date	66.0°/21st	71.5°/16th	79.0°/29th	
Low Daily Mean/date	22.5°/5th	40.5°/5th	51.0°/1st	
Highest reading/date	81°/22nd	91°/16th	91°/29th	
Lowest reading/date	13°/6th	29°/30th	37°/12th	
Lowest Max reading/date	28°/5th	44°/22nd	56°/1st	
Highest Min reading/date	56°/21st & 23rd	54°/15th	67°/29th	
Ttl. Precip./Dep. Fm. Norm.	1.54"/-1.67"	2.97"/-0.20"	6.03"/+2.42"	10.54"/+0.55"
Ttl. Snowfall/Dep. Fm.Norm.	5.1"/-5.1"	0.0"/-2.3"	0.0"/-0.1"	5.1"/-7.5"
Maximum Precip./date	0.77"/1st	1.17"/21st	1.40"/29th	
Maximum Snowfall/date	4.8"/1st	-	-	

Table 1

NORMALS, OBSERVED DAYS & DATES

NORMALS & OBS. DAYS	MAR	APR	MAY	SEASON
NORMALS				
High	44.4°	58.3°	69.4°	57.4°
Low	25.7°	37.3°	47.1°	36.7°
Mean	35.0°	47.8°	58.3°	47.0°
Precipitation	3.21"	3.17"	3.61"	9.99"
Snow	10.2"	2.3"	0.1"	12.6"
OBS TEMP. DAYS				
High 90° or above	0	1	1	2/92
Low 70° or above	0	0	0	0/92
High 32° or below	1	0	0	1/92
Low 32° or below	12	11	0	23/92
Low 0° or below	0	0	0	0/92
OBS. PRECIP DAYS				
Days T+	20	15	20	55/92/60%
Days 0.01"+	11	7	16	34/92/37%
Days 0.10"+	4	4	12	20/92/22%
Days 0.25"+	2	3	6	11/92/12%
Days 0.50"+	1	3	4	8/92/9%
Days 1.00"+	0	1	2	3/92/3%

Table 2a

NOTABLE PRECIP & SNOW DATES	MAR	APR	MAY
90° Event Value/Date | Remarks		91°/16th	91°/29th
1.00"+ value/date	-	1.17"/21st	1.39"/8th
1.00"+ value/date	-	-	1.40/29th
3.5"+ snow value/date	4.8"/1st	-	-

Table 2b

RECORDS

ELEMENT	MARCH	
Daily Maximum Temperature/Date | Previous Record/Year	68º/8th	66º/2000
Daily Maximum Temperature/Date | Previous Record/Year	69º/12th	67º/1890
Daily Maximum Temperature/Date | Previous Record/Year	70º/13th	70º/1946
Daily Maximum Temperature/Date | Previous Record/Year	69º/18th	65º/1966
Daily Maximum Temperature/Date | Previous Record/Year	78º/19th	75º/1894
Daily Maximum Temperature/Date | Previous Record/Year	78º/20th	74º/1903
Daily Maximum Temperature/Date | Previous Record/Year	81º/22nd	80º/1938
Daily High Minimum Temperature/Date | Previous Record/Year	48º/19th	48º/1983
Daily High Minimum Temperature/Date | Previous Record/Year	51º/20th	49º/1903
Daily High Minimum Temperature/Date | Previous Record/Year	56º/21st	46º/1913
Daily High Minimum Temperature/Date | Previous Record/Year	49º/22nd	44º/1949
Daily High Minimum Temperature/Date | Previous Record/Year	56º/23rd	53º/1938
Daily High Mean Temperature/Date | Previous Record/Year	53.0º/8th	50.5º/1942
Daily High Mean Temperature/Date | Previous Record/Year	57.5º/13th	53.5º/1946
Daily High Mean Temperature/Date | Previous Record/Year	57.0º/18th	55.5º/1927
Daily High Mean Temperature/Date | Previous Record/Year	63.0º/19th	61.5º/1894
Daily High Mean Temperature/Date | Previous Record/Year	64.5º/20th	61.5º/1903
Daily High Mean Temperature/Date | Previous Record/Year	66.0º/21st	58.5º/1921
Daily High Mean Temperature/Date | Previous Record/Year	65.0º/22nd	58.5º/1938
Top Ten Warmest Marches Value/Rank | Remarks	45.9º/#1	Warmest since 1859
Top Ten Warmest Mean Maximum Marches Value/Rank | Rmks.	55.7º/#2	-
Top Ten Warmest Mean Minimum Marches Value/Rank | Rmks.	36.0º/#1	Warmest since 1903
Daily Maximum Wind Speed/Direction/Date/ | Prev. Record/Year	46 mph/8th	45 mph/2005
200 All-Time Windiest Dates Average Value/Date | Rank/Rmks.	20.0 mph/26th	#136/10-way tie

Table 3a

ELEMENT	APRIL	
Daily Maximum Temperature/Date | Previous Record/Year	91º/16th	89º/2002
Daily High Mean Temperature/Date | Previous Record/Year	71.5º/16th	71.0º/2002
Daily Maximum Wind Speed/Direction/Date/ | Prev. Record/Year	45 mph/9th	43 mph/2000
Daily Maximum Wind Speed/Direction/Date/ | Prev. Record/Year	43 mph/27th	39 mph/1996

Table 3b

ELEMENT	MAY	
Top Ten Warmest Mean Minimum Marches Value/Date | Remarks	52.9º/#7	-
200 All-Time Wettest Months Average Value/Rank | Remarks	6.03"/#122	-
Daily Maximum Wind Speed/Direction/Date | Prev. Record/Year	45 mph/16th	44 mph/1997

Table 3c

ELEMENT	SPRING	
Top Ten Warmest Springs Average Value/Rank | Remarks	52.4° /#2	Warmest spring since 1859

Table 3d

MISCELLANEOUS

MARCH

Avg. wind speed/Dep. Fm. Norm.	8.0 mph/-1.7 mph
Peak wind/direction/date	46 mph/WNW/8th
Windiest day avg. value/date	20.0 mph/26th
Calmest day avg. value/date	1.7 mph/1st
# Clear days	6
# Partly Cloudy days	18
# Cloudy days	7
Dense fog dates (code 2)	1st
Thunder dates (code 3)	None
Sleet dates (code 4)	1st, 2nd & 3rd
Hail dates (code 5)	None
Freezing rain dates (code 6)	1st

Table 4a

APRIL

Avg. wind speed/Dep. Fm Norm.	9.5 mph/+0.3 mph
Peak wind/direction/date	45 mph/W/9th
Windiest day avg. value/date	18.5 mph/27th
Calmest day avg. value/date	3.3 mph/1st
# Clear days	3
# Partly Cloudy days	21
# Cloudy days	6
Dense fog dates (code 2)	None
Thunder dates (code 3)	None
Sleet dates (code 4)	None
Hail dates (code 5)	None
Freezing rain dates (code 6)	None

Table 4b

MAY

Avg. wind speed/Dep. Fm Norm.	6.3 mph/-1.7 mph
Peak wind/direction/date	45 mph/NW/16th
Windiest day avg. value/date	14.0 mph/10th
Calmest day avg. value/date	1.3 mph/18th
# Clear days	5
# Partly Cloudy days	15
# Cloudy days	11
Dense fog dates (code 2)	None
Thunder dates (code 3)	4th, 16th, 24th, 29th & 30th
Sleet dates (code 4)	None
Hail dates (code 5)	16th
Freezing rain dates (code 6)	None

Table 4c

SUMMER SAFETY TIPS FOR PETS

Joseph Villani
Meteorologist, NWS Albany

During the warm summer months - most of us spend a substantial amount of time outdoors. We are all prone to various hazards such as sun exposure and heat exhaustion. While people certainly need to adhere to summer safety, we must be aware that our pets also are vulnerable to certain dangers. Even the healthiest pets can suffer from dehydration, heat stroke and sunburn if overexposed. Heat stroke can be fatal if not treated promptly. Here are some safety tips from the ASPCA to help prevent your pet from overheating so that you and your pets can have an enjoyable and safe summer.

Pets can get dehydrated quickly, so give them plenty of fresh, clean water when it's hot outdoors. Make sure your pets have a shady place to go to get out of the sun. Be careful to not over-exercise them, and keep them indoors when it's extremely hot. Symptoms of over-heating in pets include excessive panting or difficulty breathing, increased heart and respiratory rate, drooling, mild weakness, stupor, or even collapse. They can also experience seizures, bloody diarrhea and vomiting, as well as elevated body temperatures to over 104 degrees. Animals with flat faces, like Pugs and Persian cats, are more susceptible to heat stroke since they cannot pant as effectively. These pets should be kept cool in air-conditioned rooms as much as possible. If you suspect your pet is suffering from heat stroke, get help from your veterinarian immediately.

Never leave your animals alone in a parked vehicle, not even for a brief moment. On a hot day, a parked car can become like a hot furnace in a very short amount of time. This can occur even with the windows open, and could lead to fatal heat stroke. Leaving pets unattended in cars in extreme weather is also illegal in several states. When the temperature is very high, don't let your dog linger on hot asphalt. Being so close to the ground, your dog’s body can heat up quickly, and sensitive paw pads can burn. Keep walks during these times to a minimum.

Giving your dog a lightweight summer haircut can help prevent overheating. Shave down to a one-inch length, never to the skin, so that your dog still has some protection from the sun. As far as skin care, be sure that any sunscreen or insect repellent product you use on your pets is labeled specifically for use on animals.

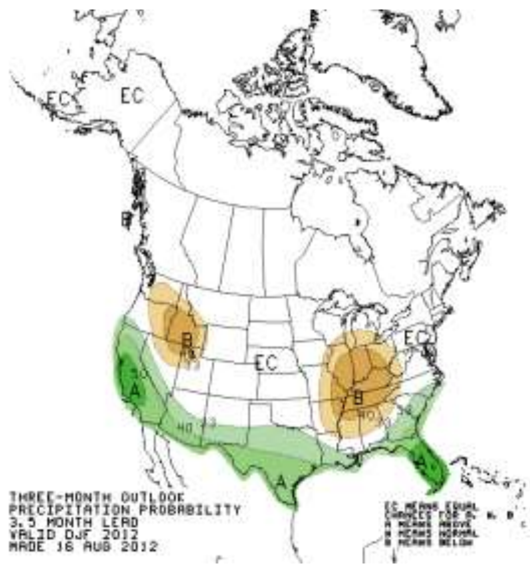
A visit to the veterinarian for a late spring or early summer check-up is a must. Make sure your pets get tested for heartworm if they aren't on a year-round preventive medication. If you plan to have your pet outdoors a lot, ask your veterinarian to recommend a safe flea and tick control program.

Hopefully these simple summer tips will help you and your pets have an enjoyable and safe summer. I recently took my Australian Cattle Dog on his first hike in the Adirondacks up Hadley Mountain in northwest Saratoga County. I made sure he had his tick and flea prevention well beforehand, and gave him plenty of water during the hike. I have found that having a portable water bowl for a dog is very useful, especially to bring on a hike. We had a safe and fun day!

HOW DO YOU INTERPRET CLIMATE OUTLOOK PRODUCTS?

Ingrid Amberger
Senior Meteorologist, NWS Albany

The Climate Prediction Center (CPC) issues monthly and seasonal (3-month) temperature and precipitation outlooks on the third Thursday of each month in terms of departures from normal. The contours on these outlook maps show the total probability (%) of three categories: above (A); below (B), and; the middle (normal) category (N). The sum of the probabilities of these three categories is 100%. The categories are based on the 1981-2010 normals, and represent the coldest or driest third of years (10 years) defining the B category, the warmest or wettest third defining the A category, and the remaining 10 years in between defining the middle (normal - N) category. The colored shading on the maps indicates the degree of confidence the forecasters have in the category. The darker the shading, the greater the level of confidence.



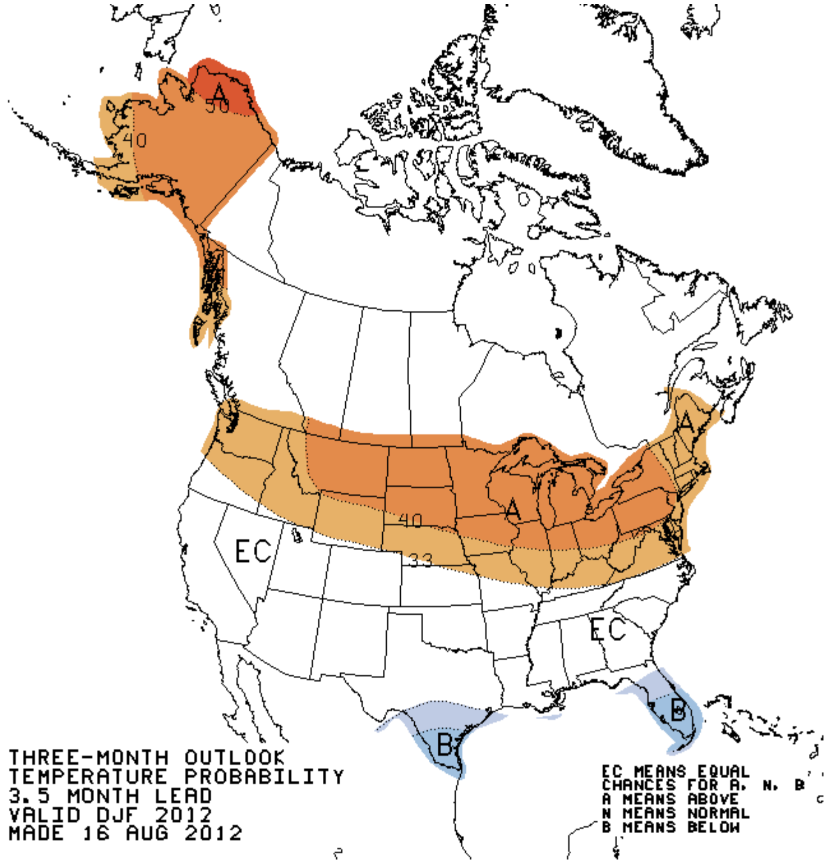
To make it possible to display three categories on one map, we assume that when either A or B is the most likely category, the probability of the middle category remains at 33.33% for most situations. When the forecasters decide that one of the categories is the most likely one, they assign probabilities which exceed 33.33% to that category, and label the map with an "A" or "B" in the center of the region of enhanced probabilities.

Forecasters use many forecast tools to look for signs that an area/region of the country will have a tendency or enhanced probability to be in either the above (A) or below (B) category. The forecast probabilities given on the map generally fall far short of complete confidence (100%) in any single category. When the probability of the above (A) or below (B) category is greater than 33.33% by some amount, the probability of the opposite category declines by that amount, while the probability of the middle category remains at 33.33%.

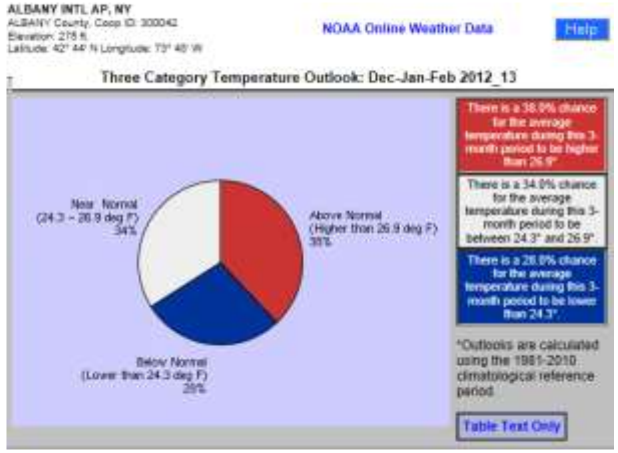
When probability values of the favored category reach 70% or higher, the probability of the opposite category is fixed at 3.3%, and the probability of the middle category is adjusted to values (less than 33.33%) which cause the sum of the three probabilities to equal 100%. In areas/regions where the forecasters have no forecast tools which favor the chance of either 'above' or 'below', the chance of both of these categories is defined to be 33.33% each, and the region is labeled "EC", which stands for Equal Chances.

Interpretation of the 3-month temperature outlook for the Northern Plains and Great Lakes region (map below) shows there is a 40% chance the average temperature for December, January and February will be above normal. The most likely category is 'above normal', but there's still a 33.33% chance for 'normal' and a 26.67% chance for 'below normal'. The 26.67% below normal comes from the calculation 100% - (40% + 33.33%) = 26.67%.

Local Three-month Temperature Outlooks (L3MTO) are generated from the seasonal outlooks issued by CPC using a method of statistical downscaling. The transformation from a large scale to a small scale creates a more detailed forecast for a particular location out of a forecast for a larger area. This is done for 32 locations in east central New York and adjacent western New England. The L3MTO is available in several formats: tables; text discussions, and; graphical outputs including Pie Charts, Temperature Range Graphs and Probability of Exceedance (POE) curves. The L3MTO is released simultaneously with the national product on the third Thursday of every month.



The pie chart is the simplest of the product formats, and shows the expected chance for the 3-month temperature to occur in each of three categories: Above Normal; Near Normal, and; Below Normal. The larger the pie slice, the higher the chance of occurrence.

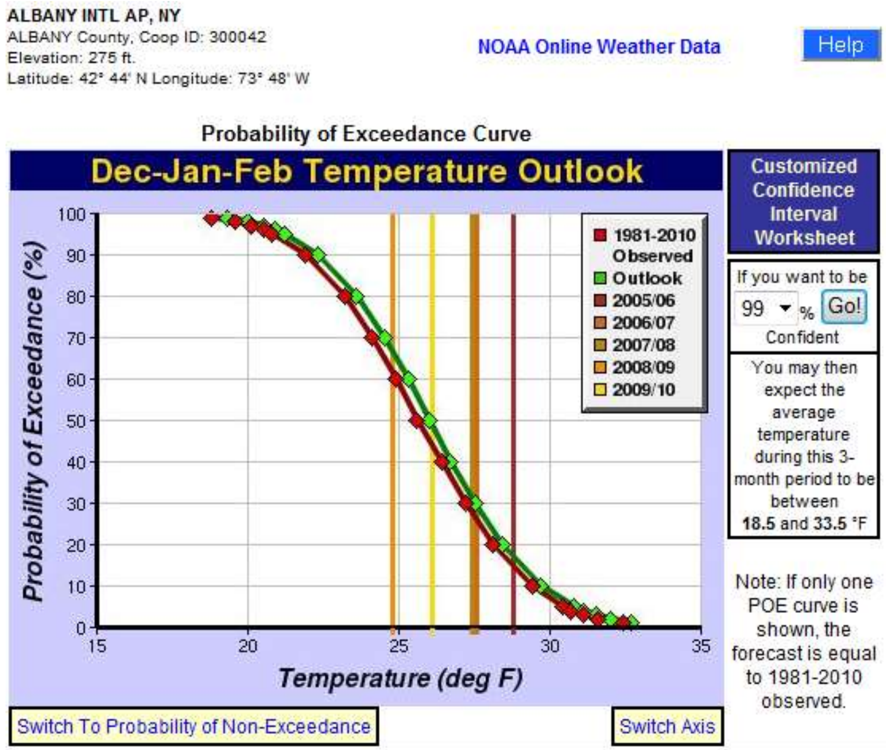


The Temperature Range Graph shows the expected range of the average 3-month temperature. It can be viewed for five confidence intervals: 99%, 95%, 90%, 75%, and 50%.

Current % Confidence Interval Table

	SON	OND	NDJ	DJF	JFM	FMA	MAM	AMJ	MJJ	JJA	JAS	ASO	SON
Median	51.1	39.9	30.4	26.0	28.1	36.7	47.2	57.9	65.9	69.9	68.4	61.0	50.9
99%	55.2 47.0	45.6 34.2	37.6 23.2	33.5 18.5	35.6 20.6	42.4 31.0	52.6 41.8	61.8 54.0	69.5 62.3	73.8 66.0	72.3 64.5	65.1 56.9	55.0 46.8

The Probability of Exceedance (POE) Graph provides the most detailed outlook information in the L3MTO suite. It shows the expected chance (y-axis, in percent) that the average 3-month daily mean temperature will exceed (or be greater than) the temperatures shown on the x-axis. The graph contains a red curve 1981-2010 normal for the period, and a green curve forecast/outlook for the period.



Climate Prediction Center: http://www.cpc.ncep.noaa.gov/
Local 3-Month Temperature Outlook: http://www.nws.noaa.gov/climate/l3mto.php

OUR REGION WAS SPARED THE WORST FROM SANDY

By Hugh Johnson
Meteorologist, NWS Albany

On October 22nd, the 18th tropical system of the year, Sandy, formed south of Jamaica in the Caribbean Sea. It intensified fairly quickly to a Category 2 hurricane as it slammed into portions of Jamaica and Haiti. It then tracked north into southeastern Cuba, after which it weakened to a low-end Category 1 hurricane/high-end tropical storm due to land interaction. It brushed the Bahamas, and its outer bands of rain hit sections of the east coast of Florida, as well as North Carolina. An anomalous ridge of high pressure in the mid-levels of the atmosphere forced the storm to track mainly due north very slowly as its center remained off the southeast coast. Meanwhile, a high amplitude trough was located west of the entire Appalachian chain, with surface high pressure anchored over Hudson Bay and across Newfoundland.

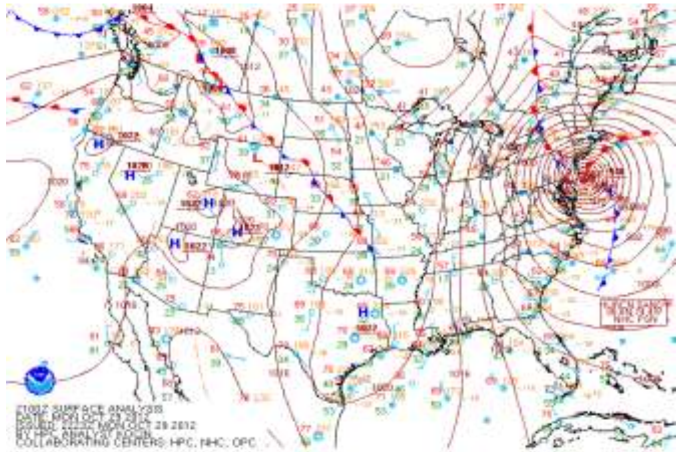
The tropical system continued to track in a mainly northerly fashion from October 26th through the 29th. At the same time, a significant upper-level disturbance, including a very strong jet, took aim toward the Mid-Atlantic States, poised to interact with Sandy. The high to the northeast strengthened, which ultimately prevented Sandy from heading out to sea. As the strong energy from the Mid-Atlantic interacted with Sandy, it pulled Sandy back to the northwest, over the Gulf Stream but well off the Delmarva Peninsula. This is a very unusual track. Sandy actually strengthened, with core winds clocked to 90 mph before it made landfall near Atlantic City, NJ around 800 p.m. EDT on the 29th. At this point, it had lost some of its tropical characteristics but packed a stronger punch than a typical high-end category 1 hurricane would have, due to the fact it had become fully absorbed into the mid-Atlantic system. A few hours prior to landfall, it had a central pressure of only 940 millibars, one of the lowest on record. It became embedded within a very large mid-latitude low pressure area which, in combination with the full moon occurring on the 29th, and the trajectory of the storm approaching from the east southeast, likely contributed to the record storm surge. Once it made landfall, post-tropical system Sandy tracked west northwest across southern Pennsylvania, then turned northward into western New York State on Halloween. It weakened quickly after landfall as dry air in the mid-layers of the atmosphere worked into it.

Unlike Irene, interior eastern New York and adjacent western New England escaped the worst of Sandy's wrath. Nevertheless, record flooding from a tidal surge worked up the Hudson River. The water level at Poughkeepsie crested at 9.54 feet. Tidal flooding was noted all the way north to Albany. Minor flooding occurred in Warren County as water from a strong northerly fetch piled up into the village of Lake George. A few river gages in the Catskills came close to flooding but no points went above flood stage as rainfall amounts were not particularly heavy. In fact, much of the Hudson Valley saw rainfall amounts under an inch due to the valley shadowing created by easterly winds descending down the western flanks of the Berkshires and Taconics, drying out the air. Also, drier air from the Canadian Maritimes was injected into the right side of Sandy, which helped further mitigate rainfall amounts everywhere in our region despite us being on the right side of the storm track. The maximum rainfall amounts were a little over 3 inches, in western Greene County.

The winds were forecast to be the worst impact from Sandy. While they did not reach quite the destructive levels as feared or forecast, we did have reported gusts up to 70 mph in our region, mainly across the higher elevations. A trained weather spotter located near Hancock, MA, in the Berkshires, reported the highest wind gust…77 mph. Most of our area had peak wind gusts in the 50-59 mph range. The official high wind gust at Albany International Airport was 49 mph; lower than the peak gust there from Irene. There were minor damage reports of mainly downed trees and wires, especially across the higher elevations and south of Albany, and there were also scattered power outages. There was one storm-related fatality in our forecast area; a woman was killed in Kerhonkson, Ulster County, NY when a large section of roofing blew into her windshield. The worst of the effects of Sandy happened during the late afternoon and evening hours of the 29th. By Tuesday, the 30th, as Sandy was well inland to our southwest, the wind initially decreased, and so did the scattered rain bands.

While our area escaped the very worst of the storm, the central and northern coast of New Jersey was devastated along with portions of New York City, Long Island and even southern New England. The combination of hurricane force wind gusts, and an incredible storm surge of over 12 feet, resulted in over 100 lives being lost there. It will take years, if not decades, to rebuild the homes that were damaged, destroyed or washed out to sea. It will also take some time to assess the total cost of the damage from the storm, but it is already several billions of dollars.

Our thoughts and prayers go out to all of those folks who are still suffering as a result of Sandy.



Surface map depicting Sandy shortly before landfall near Atlantic City NJ

METEOROLOGY AND ALBANY FIRE WEATHER

Ian Lee
Meteorologist, NWS Albany

As we exit the winter doldrums and enter the beginning of spring and warmer weather, the transition shifts from snow and mixed precipitation to severe weather and thunderstorms. One aspect of the season that is often overlooked, however, is fire weather. Fires can occur especially when there is a combination of dry atmospheric conditions, dry fuels and persistent winds. The NWS Albany Fire Weather program locally employs specific criteria to determine heightened potential for fire danger (Table 1). A combination of these criteria can trigger the issuance of a Red Flag Warning (RFW). A red flag event involves a combination of a critical fire weather pattern and significantly dry fuels.

There are two phases to the fire weather season: cured/transition (Pre Green-Up) and green (Green-Up). These phases are differentiated by the amount of moisture available, the transition from one to the other in Albany's forecast area occurring at some point in the spring. Pre Green-Up is characterized by dry leaves and branches, and Green-Up, by increased vegetative moisture due to leaf-out. Fire potential in the NWS Albany forecast area is highest during the Pre Green-Up stage, with the lack of fuel moisture coupled with antecedent dry conditions promoting rapid fire growth and spread.

The large-scale weather setup for fire danger is an area of dry high pressure across the region over the course of several days. Low pressure systems must also interact with these areas of high pressure to generate gusty winds which, when coupled with dry conditions, enhance the potential for fire.

Although a large-scale weather pattern such as an area of dry high pressure can promote widespread dry fuels and red flag conditions, local boundary layer effects can also significantly influence fire potential. The local topography of the NWS Albany forecast area also plays a crucial role. Locations that are sheltered from gusty winds are less likely to experience fires than locations located in more open areas. Downsloping of winds also plays a key role in our fire potential. Downsloping refers to winds that descend from an area of higher elevation to that of lower elevation…typically down a mountain slope. As this air descends, it compresses, warms and dries, helping to increase fire potential, particularly if gusty winds and dryness are already present. Thus, it is important to understand local weather influences in addition to the large-scale weather pattern when determining the potential for fires in the NWS Albany forecast area.

The NWS Albany fire weather season typically runs from mid-March to early June, with April being the climatological peak for increased fire potential. Since 2006, NWS Albany has issued 15 RFWs, with 2011 being the most active year in the last decade, when 7 RFWs were issued. This year, the NWS Albany fire weather season began March 15, coinciding exactly with the start of the New York State Department of Environmental Conservation's burn ban.

Criteria	Pre Green-Up	Green-Up
Wind	Gusts over 25 mph for two or more consecutive hours	Gusts over 25 mph for two or more consecutive hours
Relative Humidity	Less than 30% for two or more consecutive hours	Less than 30% for two or more consecutive hours
Rainfall	Less than ¼ inch during previous 5 or more days	Less than ¼ inch during previous 8 or more days
Fuels	None	Keetch Byram Drought Index (KBDI) above 300

Table 1. NWS Albany criteria for RFW issuance.

THE MAY 29, 2013 EASTERN NEW YORK TORNADOES

Thomas A. Wasula
Meteorologist, NWS Albany, NY

Luigi F. Meccariello
Meteorologist, NWS Albany, NY

The National Weather Service (NWS) at Albany conducted damage surveys on May 30th and June 1st, confirming three tornadoes that occurred on May 29, 2013 across eastern New York. Collectively, the three tornadoes affected portions of Montgomery, Schenectady, Schoharie and Saratoga Counties late that afternoon.

The first of these was a long-path tornado that touched down at 6:47 p.m. EDT in the town of Florida, situated on the border of Montgomery and Schenectady Counties. This tornado continued on towards the east-southeast for 13 miles across most of Schenectady County before ending near the corner of Campbell Avenue and Broadway at Hillhurst Park, located in the city of Schenectady, at 7:04 p.m. EDT. The tornado had a narrow path at the beginning of its track in the town of Florida near Scotch Bush. There, trees were uprooted, and part of a roof was torn off a home near the intersection of Bernaski Road and NY Route 30. There was a distinct zigzag pattern found in the farm fields across from a home on Bernaski Road, indicative of a possible multi-vortex tornado. A farmhouse near the intersection of Route 30 and Merry Road had a 100+ year old barn destroyed (**Figure 1**), with several trees snapped and uprooted in different directions, and cars damaged.

The damage was more impressive and widespread in Schenectady County, where the tornado was around a mile wide at times, with EF1 to EF2 damage. Extensive damage was observed from NY Route 159. Numerous hardwood and softwood trees were toppled, uprooted or sheared. Schenectady County Emergency Management brought the survey team to 451 South Shore Rd. in Mariaville, where a well-built 200 x 70 foot horse barn was almost completely leveled. A person sustained a serious head injury trying to seek shelter under the stairs of an adjoining barn. This horse barn was located right near Mariaville Lake, where debris (i.e. siding and shingles) was hanging from power lines. An eyewitness claimed to have seen the funnel cloud overhead. A four-wheel all-terrain vehicle (ATV) was moved about 100 feet from its original location, and a tree was snapped and tossed over 40 feet from its base. The house at 451 South Shore Rd. was slightly shifted off its foundation. A pickup truck was severely damaged with a 2 x 4 board impaled in its side (**Figure 2**). Debris from the roof of the barn was scattered as far as over a half mile away, and was seen in the yards of homes along Route 159. Impressive damage was viewed along Route 159 and North Kelley Street, where five high-tension power line towers were mangled and destroyed by the tornado. The survey team was able to see heavy damage sustained by three of the towers. One of them was twisted and crushed from the tornado (**Figure 3**). The damage from the tornado extended for nearly a dozen miles in Schenectady County. It was determined that it crossed Interstate 90 along Putnam Rd. in Rotterdam. The damage was predominately EF1 and EF0 from Putnam Rd. to its endpoint in Hillhurst Park.

Based on the damage observed from the Montgomery and Schenectady County tornado, estimated maximum wind speeds were 125 mph. This classified the tornado as a solid EF2. The operational Enhanced Fujita Scale is a set of wind estimates based on degree of damage. This tornadic damage scale was modified from the old Fujita Scale by a team of meteorologists and engineers, and was implemented on February 1, 2007. The EF scale ranges from 0 to 5, and has estimated 3-second wind gust ranges in miles per hour (mph). An EF0 has winds of 65-85 mph, and an EF1 has winds of 86-110 mph. An EF2 has estimated 3-second wind gusts of 111-135 mph. Estimates of the damaging gusts are based on the subjective judgment of the survey team on 8 levels of damage to 28 structural and vegetative indicators. More information on the EF Scale, and the transition from the old Fujita Scale, can befound at the following website:
http://www.ncdc.noaa.gov/oa/satellite/satelliteseye/educational/fujita.html.

Two shorter path length tornadoes touched down in Schoharie and Saratoga Counties. An EF1 tornado hit Summit and East Jefferson between 6:57 p.m. and 7:02 p.m. EDT. The estimated maximum wind speeds were 100 mph, with an estimated path width of 200 yards, and a path length of 1.6 miles. A brief touchdown occurred along a ridge line in East Jefferson. The damage swath from the woods was seen from the juncture of Dutch Hill and Wharton Hollow Roads with the assistance of a local fire department chief. Dozens of hardwood and softwood trees had fallen in different directions, and were sheared off (**Figure 4**). The fire chief explained that fallen trees from the tornado were removed from Enid and Baptist Church Roads. The team was taken to Baptist Church Road, and they saw several trees uprooted, having fallen in different directions. The tornado appeared to have begun in Summit, and there was no damage to structures, nor were there any injuries or fatalities from it. A damage survey was undertaken on June 1st in Schenectady and Saratoga Counties by NWS Albany Warning

Coordination Meteorologist Steve DiRienzo. An EF1 tornado occurred in Vischer Ferry in Saratoga County, with estimated maximum wind speeds of 100 mph, a path width of 200 yards, and a path length of nearly a mile. The tornado occurred at 7:10 p.m. EDT, and the damage was concentrated near the intersection of Riverview Rd. and Willow Spring Drive. The damage included: a roof ripped off a well-built shed (**Figure 5**); windows blown out of a home; a barn slightly shifted off a foundation, and; approximately 100 hardwood and softwood trees snapped, sheared off and uprooted. There were no injuries or fatalities from the tornado.

The Albany forecast area averages two to three tornado events each year based on a tornado climatology mean period from 1950-2010. The Montgomery-Schenectady County tornado was the first EF2 tornado since the F2 tornado on July 21, 2003 that struck Kiskatom and Catskill in Greene County in the Albany County Warning Area that covers east-central New York and western New England. This was a long-track supercell on a convective line that had a tornado with a path that went into Columbia, Rensselaer, and Bennington Counties. The last tornado to touch down in Montgomery and Schenectady counties was in Cranesville and West Glenville on September 4, 2011. This was a significant EF1 tornado that was nearly a half mile wide at times. Another, brief, EF0 tornado touched down near Auriesville in Montgomery County on September 22nd of that year. Montgomery County has had nine tornadoes since January 1, 1950. This was only the 4th tornado to strike Schenectady County since the beginning of the 1950s! One tornado occurred on August 21, 1971, when an F0 hit part of the county. The 2nd of the four Schenectady County tornadoes occurred on June 24, 1960. This significant F3 tornado touched down just east of the city of Schenectady, and moved northeast nearly 11 miles into southeastern Saratoga County, where it dissipated south of Round Lake. That long-track Greater Capital Region tornado produced nine injuries, and damage totaling approximately $25 million. The length of the May 29th EF2 was very comparable to the historic June 24th one.

Figure 1: Barn destroyed at the corner of Bernaski Rd. and NY Route 30. This barn was over 100 years old. Photo Source: NWS Albany

Figure 2: Truck destroyed at 451 South Shore Rd. in Mariaville. A wooden board was driven into the truck below the rear windshield. Photo Source: NWS Albany

Figure 3: A high-tension power line tower destroyed (one of five severely damaged along this stretch). This was seen from NY Route 159 and North Kelly Road. Photo Source: NWS Albany

Figure 4: Extensive tornado tree damage viewed along a ridge line in Schoharie County from the junction of Dutch Hill and Wharton Hollow Rds.
Photo Source: NWS Albany

Figure 5: Significant shed damage about 100 yards south from Riverview Road.
Photo Source: NWS Albany

VOLCANIC EFFECTS ON GLOBAL CLIMATE

Kevin S. Lipton
Meteorologist, NWS Albany, NY

Snowflakes falling in Albany, New York during early June; hard freezes killing crops across the higher elevations of western New England during June, July and August; ice cover lingering on some rivers and ponds into the summer months; these were just some of the features of "The Year Without a Summer" in 1816 across the northeast U.S. It is believed that this unusually cold summer was largely due to the effects of a tremendous volcanic eruption that occurred in April of 1815 near Indonesia. This volcano (named Tambora) is believed to be the largest-known historic eruption, and it had significant global effects. It's estimated that the stratospheric aerosol cloud produced by this eruption led to a peak global surface cooling of nearly 2° F. How can a volcanic eruption have impacts on climate literally around the globe? Contrary to popular belief, the global cooling effect is not simply due to the shadowing effects from the ash cloud emitted by a volcano. Rather, it's largely dependent on how much sulfur dioxide (SO_2) gas is contained within its plume, and how high this sulfur-rich plume extends into the atmosphere. The particles within the ash cloud are relatively large, and tend to fall out over a period of a few weeks. So, although this may lead to local or regional cooling effects, by the time the ash cloud expands to a larger area, most of the particles have usually fallen out of the atmosphere, and the ash cloud has dispersed. However, when sulfur dioxide from the eruption reaches high into the atmosphere – into the layer known as the stratosphere - chemical reactions between the sulfur dioxide and water vapor create sulfate aerosols. These sulfate aerosols can then form into a reflective haze layer approximately 12 or more miles above the earth's surface, which can then spread via wind currents across the globe. This haze layer tends to reflect incoming energy from the sun, limiting the sun's full warming potential at the earth's surface and lower atmosphere, and resulting in a cooling effect.

Just how much cooling can occur from a volcanic eruption? As mentioned above, the cooling effect from the 1815 Tambora eruption led to an estimated peak surface cooling of nearly 2° F. In more recent times, the 1991 eruption of Mount Pinatubo in the Philippines led to an estimated peak surface cooling of around 1° F. The Pinatubo eruption was actually much smaller relative to the cataclysmic Tambora eruption, but still ejected enough sulfur dioxide into the stratosphere to allow for global surface cooling. A sudden drop in earth's average temperature, even of less than 1° F over a period of several months to a year, can still have profound effects on overall circulation patterns and weather. Perhaps some of the extreme weather events observed during the early to mid 1990's, including the October 1991 "Perfect Storm," the March 1993 "Superstorm", and the extreme northeast winter of 1993-94 could, at least in part, be attributed to the shock to the climate system produced by the sudden cooling from Mount Pinatubo's May-June 1991 eruption.

Recent research suggests that where a volcano erupts relative to its distance from the equator can create different patterns of cooling, and warming, too, within several years following an eruption. For instance, recent studies indicate that large volcanic eruptions which occur in tropical regions (low latitudes) tend to lead to significant cooling of Northern Hemisphere continents in the summer months following the eruption, yet actually are associated with winter warming of these continents for two years after the eruption. Such patterns were observed after the May-June 1991 Pinatubo eruption, as large portions of North America and western Europe experienced unusually warm winters in 1991-92 and 1992-93, with a very cold summer in 1992. Computer simulations of this and similar tropical eruptions are consistent with these observations. It is speculated that a change in atmospheric circulation patterns, particularly the Artic Oscillation (AO), may have lead to the observed winter warming, with the pattern favoring a positive phase of the AO. This would tend to limit the southward extent of cold air intrusions during the winter months, and would also allow for the frequent infusion of relatively warm oceanic air from the Pacific Ocean in North America, and the Atlantic Ocean in Europe, keeping these continental areas somewhat warm. However, the occasional warming of oceanic temperatures across the central and eastern equatorial Pacific Ocean, known as El Niño, also occurred during these winter months, so it is possible that the observed warming effects could have been amplified by this additional oceanic warming effect. The correlation with higher-latitude volcanic eruptions – those which occur closer to the Arctic regions – is somewhat weaker, as indicated by computer simulations. However, some computer simulations do suggest a reduction in the southeast Asian summer monsoon with higher-latitude eruptions.

It should be noted that another phenomena associated with large sulfur dioxide injections into the stratosphere from volcanic eruptions also occurs – increased stratospheric ozone loss. A reduction in the concentration of ozone (O_3) levels in the stratosphere occurs as the sulfate aerosol cloud resulting from the volcanic injection of sulfur dioxide increases ozone-depleting chemical processes in this layer of the atmosphere. This tends to lead to an increase in the areal extent of the polar "ozone hole" for a couple of years after such an eruption.

So, as you can see, large volcanic eruptions can have significant effects on the global climate. However, in order for this to occur, they must inject large amounts of sulfur dioxide high into the atmospheric layer known as the stratosphere. This can create a sulfate aerosol cloud within a few weeks to months after such an eruption, which can then spread across the globe, reflecting incoming solar energy, and leading to cooling temperatures at the earth's surface and lower atmosphere. This can also alter circulation patterns in the lower atmosphere, leading to unusual weather patterns and temperature anomalies. The most important aspect of a volcanic eruption is the concentration of sulfur dioxide emitted, and how high into the atmosphere a plume of it can reach. Thick ash clouds with only limited sulfur dioxide gases can lead to temporary cooling on local to regional scales, but the ash tends to fall out of the atmosphere within weeks, therefore reducing its effect on cooling the earth's surface on a global scale. On the other hand, the sulfate haze from a sulfur-rich plume can remain in the stratosphere for 2 to 4 years after an eruption, and therefore has a much greater capacity to influence the earth's climate, for several years.

THE 100TH ANNIVERSARY OF THE 1914 RECORD FLOOD AT SCHENECTADY, NEW YORK

Steve DiRienzo
Warning Coordination Meteorologist, NWS Albany

This year is the 100th anniversary of the record flood at Schenectady, New York. The record flood on the Mohawk River at Schenectady, New York occurred on 28 March 1914. This flood was accompanied by large ice floes and ice jams which did considerable damage to local infrastructure. More recent damaging floods with ice floes and ice jams occurred at Schenectady in January of 1996 and March of 2007.

Fig 1. United States Geological Survey gauge house, Lock 7, Mohawk River, before and after the 1914 ice jam.

Because getting direct measurements of river ice thickness is dangerous and discouraged, the National Weather Service Forecast Office in Albany estimates ice thickness based on a numerical equation developed by the U.S. Army Cold Regions Research and Engineering Laboratory (USACE, 2002):

$$h_j = \alpha\sqrt{U_j}$$

where h_j = calculated ice thickness on day j

$\alpha \approx 0.4$ (constant from WFO ALY studies)

U_j = Accumulated Freezing Degree Days from freezeup to day j

Accumulated freezing degree days are based on the daily average air temperature of a river basin in question. For river ice to increase in the basin on a particular day, daily average air temperature for that day has to average below freezing (32°F). We don't have measurements at every point across all river basins, but nearby measurement sites provide a good estimate.

When river ice gets to be around 10 or 11 inches thick or more, it becomes rigid enough to cause significant ice jams if it breaks up quickly before it has a chance to candle or rot. Ice jams cause flooding and structural damage along the Mohawk River every few years. There are also ice jam trouble spots along many other streams and rivers in the Albany Forecast Area.

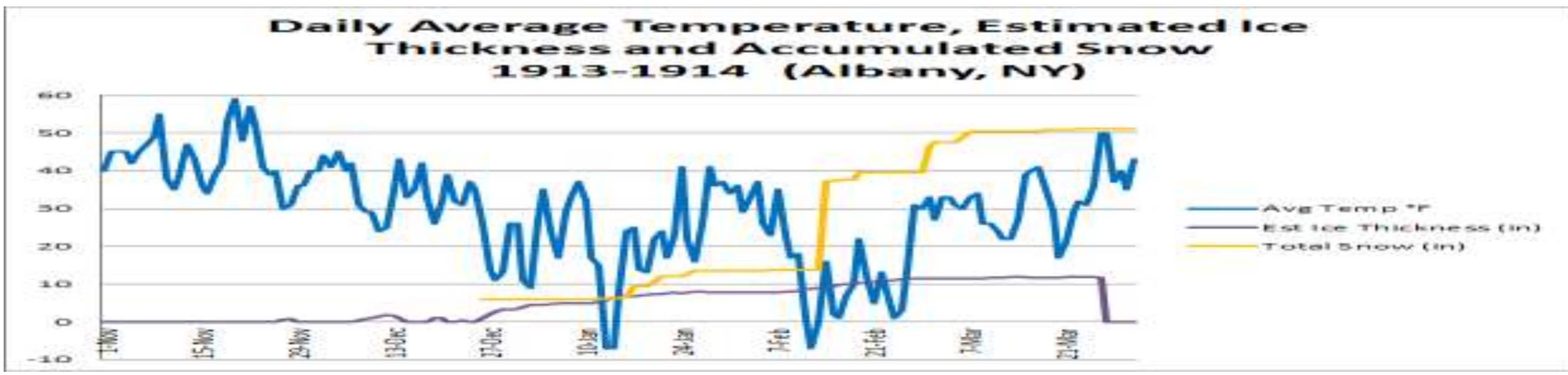


Fig 2. Estimated ice thickness and snowfall during the ice thickening period based on the Albany, New York observations from the winter of 1913-1914.

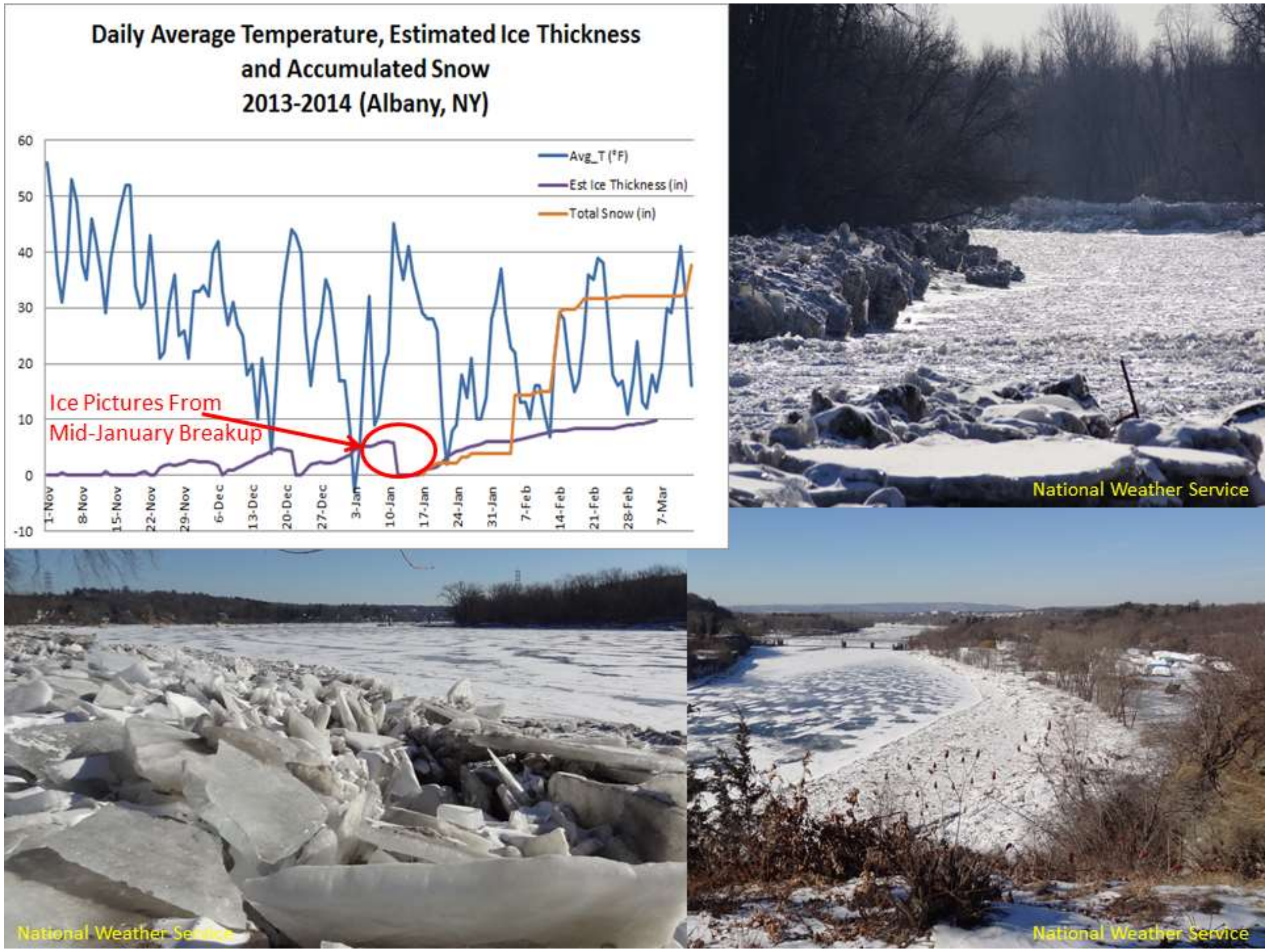


Fig 3. Estimated ice thickness and snowfall during the ice thickening period based on the Albany, New York observations as of March 13, 2014. Pictures show ice from a breakup that occurred in mid-January 2014.

Based on estimations, ice has become thick enough on the rivers this winter for significant ice jams – at least across the northern part of the Albany Forecast Area. Should breakup occur quickly, be alert for possible ice jams and ice jam flooding. We need a 7-10 day period of mild, sunny days, with nights below freezing, to gradually rot and break up the ice, and help alleviate the ice jam and ice jam flood threat. If you see an ice jam or ice jam flooding, please notify the National Weather Service.

References

USACE (2002) Engineering and Design: Ice Engineering. U.S. Army Corps of Engineers Engineer Manual 1110-2-1612.

USING GIS FOR SNOWFALL VERIFICATION

Joe Villani
Meteorologist, NWS Albany

Starting this winter season (2013-14), NWS Albany officially began using a new methodology to verify snowfall using Geographic Information Systems (GIS). This has allowed us to create a graphical representation of snowfall across our forecast area for each significant snow event. This new approach is more science-based in that we can now objectively look at snowfall maps based on interpolated snowfall reports. This is much more sophisticated than what had been done previously because only point-to-point forecast comparisons were performed. Now, meteorologists can get a more representative and visual perspective of snowfall across our area.

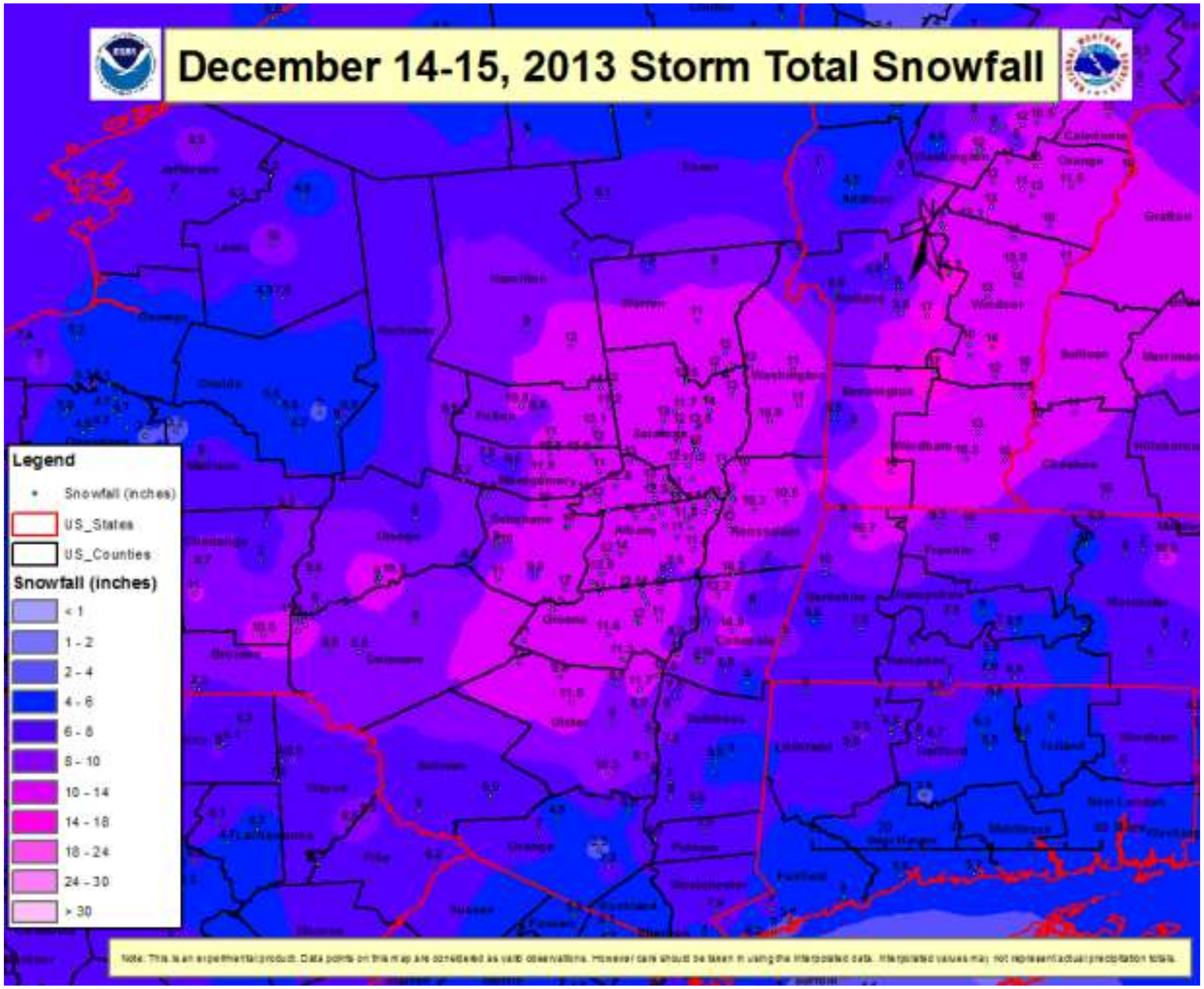


Figure 1 (Click on map for larger view)

This new process involves several steps. First, after a storm, storm-total snowfall reports are compiled, and careful quality control is done. Next, snowfall reports are imported into the ArcGIS software based on the latitude and longitude for each point. Finally, an interpolation scheme is run using the ArcGIS software to create a snowfall map. For consistency, colors are synchronized to match our forecast snowfall maps on our webpage. As an additional step, we also run a “zonal statistics” function to compute the mean snowfall within each of our forecast zones.

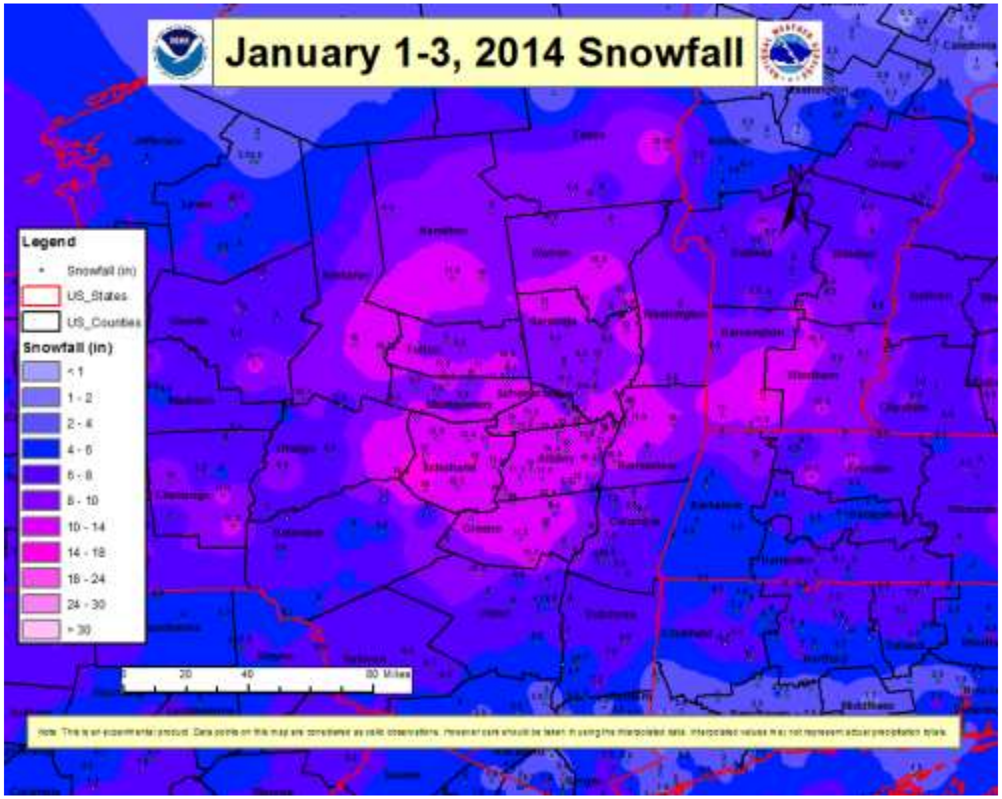


Figure 2 (Click on map for larger view)

The first significant snow storm we were able to use this new method for was the December 14-15, 2013 event. Looking at the map (Figure 1), a large swath of the heaviest snowfall (10-14 inches) fell from the eastern Catskills northward through the greater Capital District, eastern Mohawk Valley, the Lake George-Saratoga Region, and southern Vermont. Another significant snow storm occurred just after the New Year, from January 1-3, 2014. This storm (Figure 2) produced similar snowfall totals to the December 14-15 event. The biggest snow storm of the season thus far in terms of snowfall amounts and areal coverage has been the February 13-14, 2014 storm (Figure 3). A large area of 10 to 24+ inches of snow occurred across much of the region from the Capital Region southward. This time, less snow fell across the Mohawk Valley and Adirondacks.

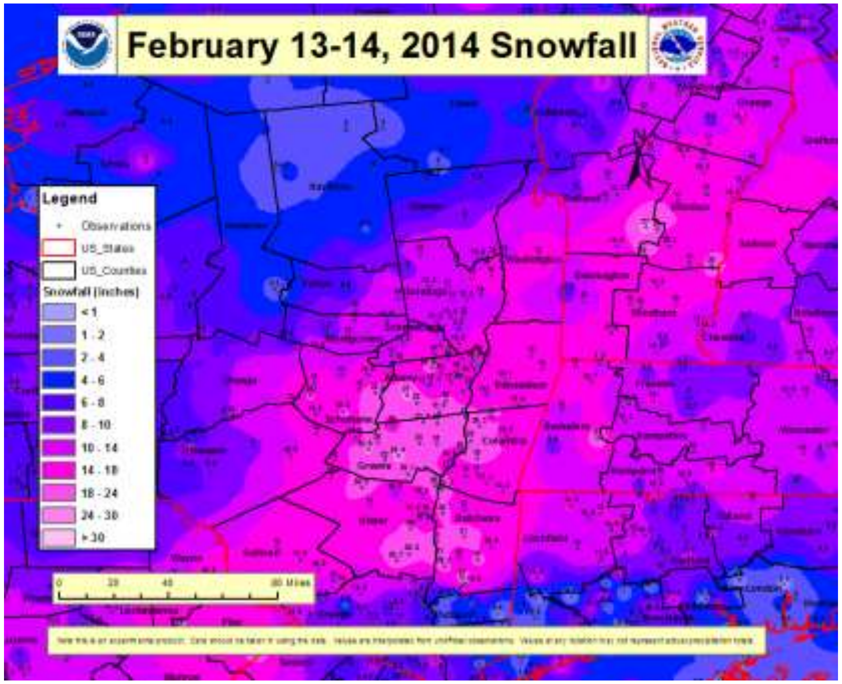


Figure 3 (Click on map for larger view)

We have also been able to take this process one step further by graphically and mathematically comparing our forecasts to observed snowfall. This has enabled us to see how accurate our snowfall forecasts are after an event. An example of this can be seen in Figure 4, which shows NWS Albany's snowfall forecast bias (in inches) for the February 13-14, 2014 snow storm. The warm colors indicate an under-forecast (low bias), while blue colors indicate an over-forecast (high bias).

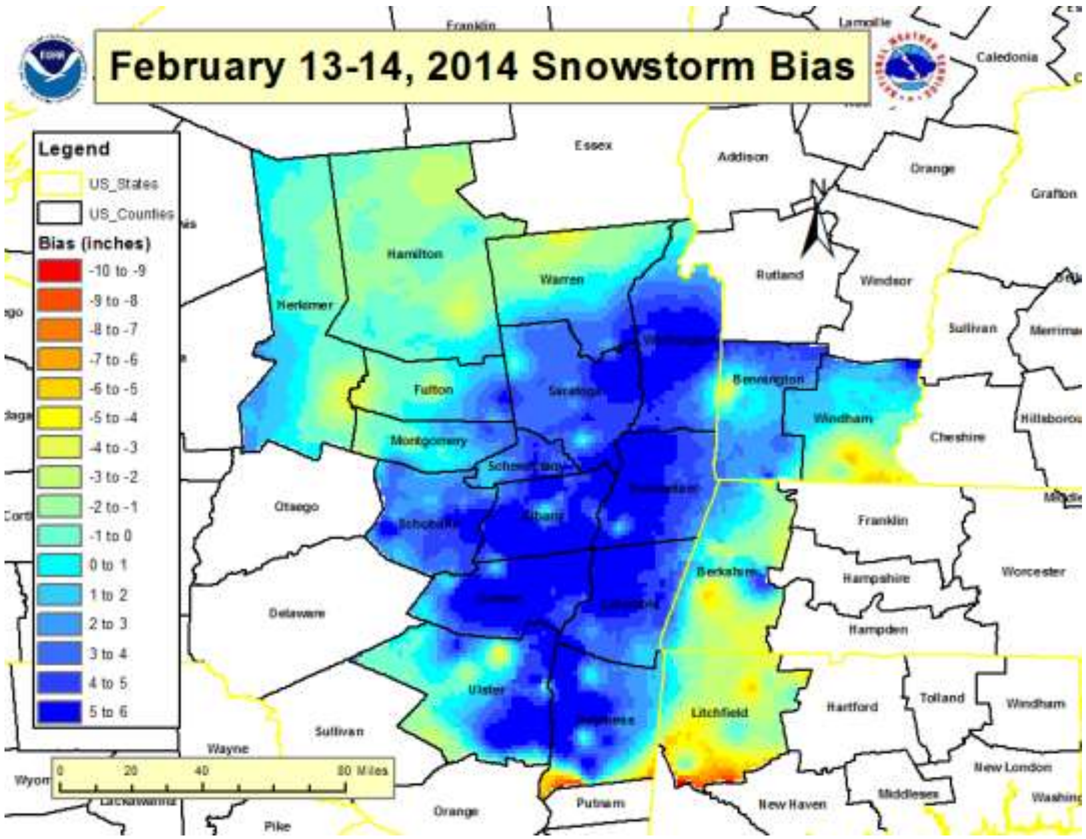


Figure 4 (Click on map for larger view)

Overall, this new method of examining snowfall after an event has been a big step forward for our office in terms of utilizing GIS technology to improve our operations. We will continue to evaluate new ways of incorporating GIS to help us here at NWS Albany become better forecasters.

THE MAY 22nd 2014 TORNADO

Thomas A. Wasula
Meteorologist, NWS Albany NY

The National Weather Service in Albany conducted a damage survey on May 23rd, confirming a significant EF3 tornado that occurred on May 22, 2014 in eastern New York. The tornado occurred in Schenectady and Albany Counties during the mid-afternoon. A long-path tornado touched down at 3:33 p.m. EDT northwest of the town of Duanesburg, and east of Braman Corners, in northwestern Schenectady County (**Figure 1**). There was some tree damage, and a roof was torn off of a shed. This tornado continued to the south-southeast for 7 miles across Schenectady County before ending in northwestern Albany County, at the intersection of Crow Hill and Bozenkill Roads, in the Town of Knox, at 3:55 p.m. EDT. The tornado had a narrow path at the beginning of its track in the northwestern reaches of the Town of Duanesburg. Trees were snapped and uprooted in different directions near the intersection of Route 30 and Duanesburg Churches Road (**Figure 2**). Some trees also fell into a pool, and there was shingle and roof damage to homes, as the tornado tracked southeast towards U.S. Route 20 and State Route 126.

Figure 1: Tornado track based on the NWS at Albany damage survey. The tornado crossed NY Routes 7 and 20, as well as Interstate 88.

Figure 2: Tree damage at the starting point of the tornado near the intersection of NYS Route 30 and Duanesburg and Churches Road. The initial damage was rated EF0, with snapped and uprooted trees *(NWS at Albany photograph)***.**

The tornado was most intense, in terms of the damage to a home along Route 20, in the Town of Duanesburg. Its path width was around a quarter mile at times. A well-built home was almost completely destroyed by winds of around 140 mph **(Figure 3**). The home was left with only one wall standing. There were no injuries or fatalities as the owner was not home at the time it occurred (between 3:45 p.m. and 3:50 p.m. EDT). The pets of the household were also found to be safe after the destruction. A motel and an ambulance station sustained some roof damage as the tornado pressed on further to the south, crossing State Route 7 and Interstate 88 around 3:50 p.m. EDT. Two tractor trailers tipped over on Interstate 88 around 350 p.m. EDT. Fortunately, the drivers did not sustain any injuries. At 3:51 p.m. EDT, a well-defined hook echo was on the Albany (KENX) radar (**Figure 4**), with a tornadic debris signature on its associated dual-polarization Correlation Coefficient product. The extremely low values of correlation coefficient indicated that siding, shingles, insulation, leaves and other debris were being lofted into the air. The tornado diminished around 3:55 p.m. EDT in extreme northern Albany County, in the Town of Knox. Significant EF0-EF1 tree damage occurred in its path, with additional sheds and barns destroyed, and roof damage to homes. Also, some campers and cars were damaged or overturned.

Figure 3: A home situated along State Route 20 in the Town of Duanesburg, almost completely destroyed. Only one wall remained standing after the tornado *(NWS at Albany image)*.

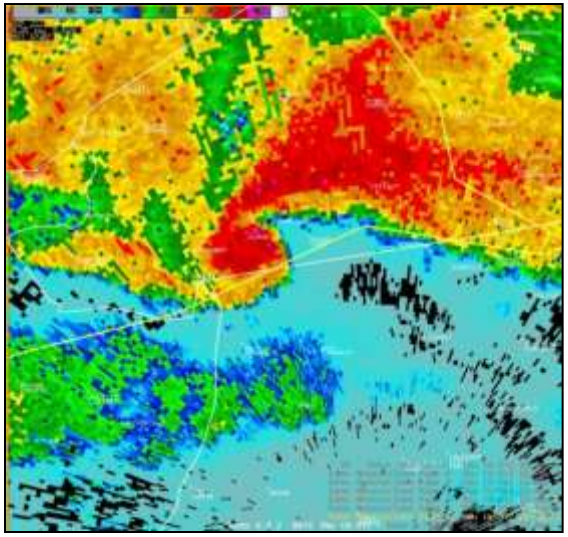


Figure 4: The KENX radar 0.5° Base Reflectivity image at 3:51 p.m. EDT showing the hook echo moving across Duanesburg and Delanson in Schenectady County. The corresponding Dual Pol Correlation Coefficient product (not shown) at this time indicated a tornadic debris signature, with siding, insulation, shingles and other debris lofted into the air.

The estimated maximum wind speeds produced by the Schenectady-Albany County tornado were 140 mph based on the damage it inflicted. This classified it as a solid EF3, confirmed by the near-complete destruction of the Duanesburg home. Most of the damage, however, was in the EF0-EF1 category, with numerous homes, barns, vehicles, trees and wires damaged. The operational Enhanced Fujita Scale is a set of wind **estimates** based on damage. This tornadic damage scale (which used to be the Fujita Scale) was put into effect February 1, 2007 by a team of meteorologists and engineers. The EF scale ranges from 0 to 5 and has estimated 3-second wind gust ranges in miles per hour (mph). An EF0 has wind gusts of 65-85 mph; an EF1, 86-110 mph. An EF2 has estimated 3-second wind gusts of 111-135 mph, while an EF3 has gusts of 136-165 mph. The estimates of the damaging gusts are based on the subjective judgment of the survey team on 8 levels of damage to 28 structural and vegetation indicators. More information on the EF scale and the transition from the Fujita Scale can be found at the following website: http://www.ncdc.noaa.gov/oa/satellite/satelliteseye/educational/fujita.html

The Albany forecast area averages two to three tornado events each year, based on a tornado climatology spanning from 1950 to 2010. The Schenectady-Albany County tornado was the first EF3 tornado in the Capital Region since the F3 tornado of May 31, 1998 that struck Mechanicville in Saratoga County. This was a high-end F3 tornado, with winds of up to 200 mph that caused over $70 million in damage and 68 injuries **(Figure 5).** The total path length of this tornado was 31 miles as it moved across southeastern Saratoga County into northern Rensselaer and Bennington Counties in the Albany forecast area**.** Schenectady County has had 3 tornadoes in the past four years! Only last year, a significant tornado struck Schenectady County on May 29th. Its long path length of 13 miles started in extreme eastern Montgomery County near the town of Florida, and moved eastward across most of Schenectady County, producing EF2 damage in Mariaville. It was up to a mile wide at times. Yet another tornado touched down in Montgomery and Schenectady counties, in Cranesville and West Glenville, on September 4, 2011. This was a significant EF1 tornado that was nearly a half mile wide at times. The May 22nd tornado was only the fifth one to strike Schenectady County since January 1, 1950! One tornado occurred on August 21, 1971, when an F0 hit part of Schenectady County. It's interesting to note that the only other documented Schenectady County tornado occurred on June 24, 1960. This significant F3 touched down just east of the city of Schenectady, and moved northeast nearly 11 miles into southeastern Saratoga County, where it dissipated south of Round Lake. Nine injuries and approximately $25 million in damage resulted from this long-track tornado that hit the Greater Capital Region. The path length of the May 29, 2013 EF2 tornado was very comparable to that of the historic June 24th one. Albany County has now had 8 tornadoes since 1950. The most memorable was the long-track EF4 tornado of July 10, 1989 that moved through Montgomery, Schoharie, Albany and Greene Counties.

Figure 5: F3 damage from the Mechanicville Tornado of May 31, 1998 (NWS at Albany photograph).

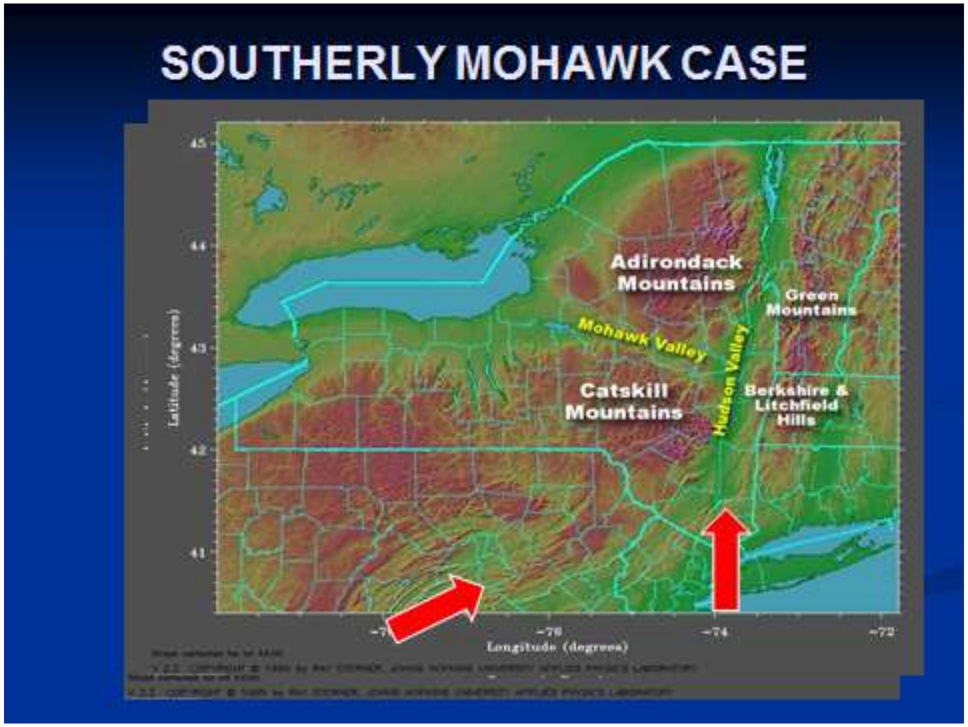
Tornado safety must be emphasized when events like May 22 arise. Fortunately, no one was killed or injured. Many people in the Duanesburg and Delanson areas stated that they heard the tornado warning 10 to 20 minutes in advance. The best option in terms of tornado safety is to get into a basement under sturdy protection, and to stay away from windows. If a household does not have a basement, then go to the lowest floor in a center room, which is usually a bathroom. In a mobile home, try to get out quickly and find a nearby storm shelter. There is no real safe option when caught inside a car in a tornadic situation. It is emphasized to avoid seeking shelter under a bridge; people have lost their lives trying to hide under bridges. If outdoors, when a tornado is nearby, it is suggested you lie flat against the ground, protecting the back of your head with your arms from potential flying debris. Remember…"When thunder roars, get indoors!"

SOUTHERN MOHAWK-HUDSON CONVERGENCE

Hugh Johnson
Meteorologist, NWS Albany, NY

It's been long known that valleys can have a local effect on weather. We have seen this with our Mohawk and Hudson Valleys. The surface wind in the Mohawk Valley is often skewed to a westerly flow that lines up with the valley. In the Hudson Valley, which runs north to south, a southwesterly flow through it is often channeled in a more southerly direction.

Myself and a number of SUNY Albany students have conducted research over a nearly ten-year span which has revealed that, during the warm months, a southwesterly surface wind well ahead of an oncoming cold front will become more westerly down the Mohawk Valley, and more southerly up the Hudson Valley. These two valleys converge in the Capital District. If these winds are accompanied by moist unstable air in the absence of any apparently strong synoptic forcing, single cell thunderstorms can suddenly erupt in the Capital District with little warning. Since this phenomenon always occurs in the vicinity of Albany International Airport, aviation traffic can be severely impacted. Refer to the figure below.



This phenomenon, which has been coined Southern Mohawk-Hudson Convergence (SMHC), takes place an average of a couple of times a year, mainly during the summer months. If a lone thunderstorm can form and contain the right amount of shear and instability, it could become severe.

One scenario occurred on June 22, 2008. A storm “popped” just to the west of Albany International Airport. A lone cell developed and quickly transformed into a supercell, and a tornado warning was issued. While no tornado occurred, the cell produced large hail and some spotty wind damage. Another storm, possibly the result of SMHC, developed on July 21, 2010 and became briefly severe. Yet another formed on July 23, 2012.

SMHC does not occur often, so it's important to continue research into when and why it does. Initially, the local studies have had to rely on surface winds from the ASOS at Utica, nearly 90 miles west of Albany, to represent the mean surface flow down the Mohawk Valley. In 2009, however, the ASOS at Utica was moved to Rome Griffiss Air Force Base, so now the measurements are even further away from Albany.

In the near future, there should be additional surface observations available for this continued research, thanks to current weather monitors along the New York State Thruway throughout the Mohawk Valley that will be available to the National Service. That additional data could help further explain why SMHC only occasionally takes place.

A special "thanks" goes out to all the SUNY Albany students who have assisted with this project.

THE SUMMER WIND

Evan L. Heller
Meteorologist, NWS Albany, NY

Ol' Blue-Eyes sang about it. The summer wind has a different meaning to different people, depending upon where they live in the world. That's because there are numerous special localized winds that occur worldwide, and many are either unique to, or are at least a significant part of, the summer season. They are produced as the result of the effects of various combinations of meteorological, geographical and topographical features coming together. We will discuss a few of the more common and important of these summer winds.

'Foehn wind' is a general term referring to any of the worldwide local 'katabatic winds'…those that are adiabatically heated upon their journey down the lee sides of mountain slopes due to compression from increasing air pressure. The chinook is a very common North American example of a Foehn wind. It is a very common wind on the Lee Side of the Rockies, where the cold, moist air warms and dries adiabatically upon descent; but it is a wind most common during late winter and spring. There are some Foehn winds that occur in summertime as well. In the United States, perhaps the best-known example is the 'Santa Ana winds'. Though most common in fall and winter, these can be hot and extremely dry east to southeasterly downsloping winds in spring and early summer as well, that originate from high pressure in the Great Basin and upper Mojave Desert regions of the southwest, and heat upon descent as they channel down the valleys and canyons, and through the major mountain passes all the way to the southern California coast as far south as the northern Baja of Mexico (Figure 1). They are notorious for creating very hot conditions that dry out crops and vegetation, and cause major wildfires. Despite the heat associated with them, with surface temperatures often well exceeding 100 degrees Fahrenheit, the downsloping effect is actually only a small contributor. Most of the heating of this usually already warm desert air is attributable to compressional heating, as the wind gets "squeezed" through the mountain passes and valleys.

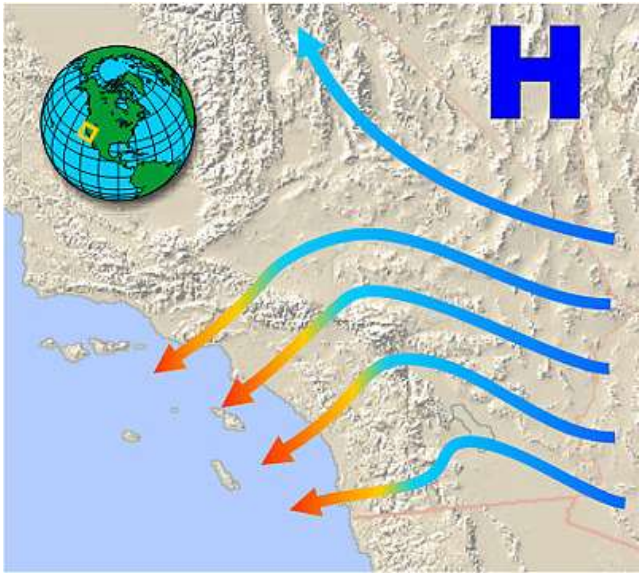


Figure 1. Schematic of the Santa Ana winds, with high pressure centered over the Great Basin/Mojave Desert regions of southern Nevada. *Image courtesy of* ***NOAA.***

A lesser-known Foehn wind is something known as 'The Brookings Effect', a local wind with the same characteristics as the Santa Ana Wind, and affecting the southern coast of Oregon. More well-known, however, and also with similar characteristics to the Santa Ana, is a local wind that frequents Santa Barbara, California. Known as a 'sundowner', this is a northerly wind heated on its journey south off the slopes of the Santa Ynez Mountains that lie just to the north, parallelling the east-west-oriented coast of Santa Barbara County. They occur with high pressure situated just north of the area. They tend to precede the Santa Ana winds by a day or two due to the typical slow eastward progression of the area of high pressure to the interior plateau and Great Basin, which triggers the Santa Ana winds further south.

Gradient winds are another type of wind phenomena, usually even more typical of the summer months. A good example of this is the 'Washoe Zephyr'. 'Zephyr' is a Greek term meaning *gentle west wind*. This wind provides some relief from the extreme heat that can occur across western Nevada in the summertime, and is the result of the daytime heating of the Great Basin causing a localized area of low pressure to form, and thus a pressure gradient, which, in turn, induces a wind flow that pulls cooler air down from the High Sierras of California. So, despite a wind flow off the mountains, this is not really a downslope wind as the air in the High Sierras tends to be already quite dry under high pressure when the Washoe Zephyr occurs, so the air arrives over western Nevada cooler than if it were introduced through downsloping.

Another example of a gradient wind, in an even more localized sense, is the 'Coromuel'. This is a sea-breeze-like south to southwest wind that affects only the La Paz region of Baja California Sur's east coast. This is because it's the only east coast area of Baja California Sur where a south to southwest wind is not obstructed by a mountain chain. The Coromuel is formed as the air over the peninsula is heated, creating low pressure, and a temperature gradient between the land and the Pacific Ocean off the west coast of the peninsula. This, in turn, results in a pressure gradient which induces a cool wind to blow northeastward from off the Pacific coast, across the peninsula to the east coast of the southernmost portion of the Baja.

Sea breezes are yet another type of gradient wind. In the U.S., sea breezes (Figure 2), while more common and more profound in the spring, can occur anytime through the summer months as well…especially in the northeast. The mechanism is roughly the same as for the Coromuel. Land heats up, a low forms, and cool southerly winds pull cooler air in off the colder ocean surface of the Atlantic. These are broader sea-breezes, though, as there are no mountains on Long Island or in New Jersey or southern New England which would suppress the sea breeze front from pressing well inland. In similar fashion, particularly along the shores of the Great Lakes, lake breeze fronts are common, mainly during late spring and early summer. These tend to be much more localized, and usually don't extend inland more than a few miles. Even so, it is not unusual to see a temperature variation on both sides of a lake breeze boundary of as much as 35 degrees Fahrenheit…particularly during the early part of the season. I've observed this much variation myself in conjunction with Lake Erie in northwest Ohio. Sometimes, low-topped thunderstorms will form along lake breeze and sea breeze fronts due to the convergence of the winds and the contrasts in air masses. Lake breezes sometimes develop in association with even smaller lakes…those such as Lake George and Lake Champlain; but because these are small lakes, the breezes tend to be less frequent and less pronounced, and occur more in spring because by mid-summer, lake temperatures are no longer so cool as to create that big of a contrast with the temperature over the land.

Figure 2. Radar Depiction of a sea breeze front along the coasts of Northern Florida and southern Georgia. Sea breeze fronts strengthen and move inland during the day, and weaken and retreat in the evening. *Image courtesy of* ***NWS Jacksonville, FL.***

Desert winds are also important summer winds, although they can occur throughout the year in the deserts of North Africa and Asia. We mention them here because they are hottest and most oppressive during the summer months. The 'sirocco' is a broad term encompassing a number of localized desert winds that are the result of an area of low pressure tracking east across the Meditteranean or far northern Africa. The sirocco is a moderately hot, usually semi-humid, and often dusty, mainly southerly, desert wind when it makes its landfall somewhere along the Mediterranean coast of Europe. The sirocco picks up moisture from the Mediterranean Sea on its journey there. Depending on the precise geographical location, some siroccos can wind up arriving drier and hotter than others. It is mostly dependent on the distance over water the wind must travel before making landfall on the other side. Obviously, the greater distance this initially hot and dry wind travels over water, the cooler and moister it will become. In different countries, this wind goes by different names. In Spain, it is known as a 'leveche'; in the Canary Islands, it is 'la calima'; in Malta, 'xiokk', and; in the slovak nations, it goes by the name 'jugo'.

The hot, dry desert winds that affect North Africa and the Arabian Peninsula cause the world's major dust storms. Sometimes satellite imagery picks up large swaths of dust leaving North Africa and travelling across the Atlantic Ocean (Figure 3). Dust from African dust storms has been found deposited in great quantities as far away as South America! The desert winds also go by different names in different countries; for example, in Morocco, they are known as the 'chergui'; in Libya, the 'ghibli'; and from Egypt to Saudi Arabia, the 'khamsin'. The 'simoom' is a very hot, dry and suffocating dust-laden wind that affects mainly the Sahara Desert, Syria, Jordan, Israel and the Arabian Peninsula. It is the wind most responsible for the changing landscape of the vast desert sand dunes. It is quite strong, but brief, rarely lasting more than 20 minutes. In North America, southwestern U.S. deserts such as the Mojave and the Sonora also produce sandstorms that change the landscape, but because they are much smaller than the deserts of North Africa and the Arabian peninsula, this occurs to a much smaller extent.

Another important desert phenomena is a fairly common wind known as the 'haboob'. The haboob derived its name from Arabic as they are strong and frequent in the African Sahara, and in the Saudi peninsula, Iraq and Kuwait. It is a desert dust storm that is the result of desert sands being sucked up with the surface inflow into developing thunderstorms, and then exiting in all directions through the thunderstorm downbursts after the storms reach their peak intensity. They occur more or less worldwide, even in the western U.S., and are frequently observed as walls of sand overtaking a region (Figure 4).

Figure 3. Vast amounts of Saharan dust can be seen being carried off of Africa out over the North Atlantic, as captured by the MODIS instrument aboard NASA's Terra satellite on March 2, 2003. *Image courtesy of* ***NASA.***

Figure 4. A haboob approaches NOAA's National Weather Service forecast office in Phoenix on August 11, 2012. *Image courtesy of* ***NWS Phoenix, AZ.***

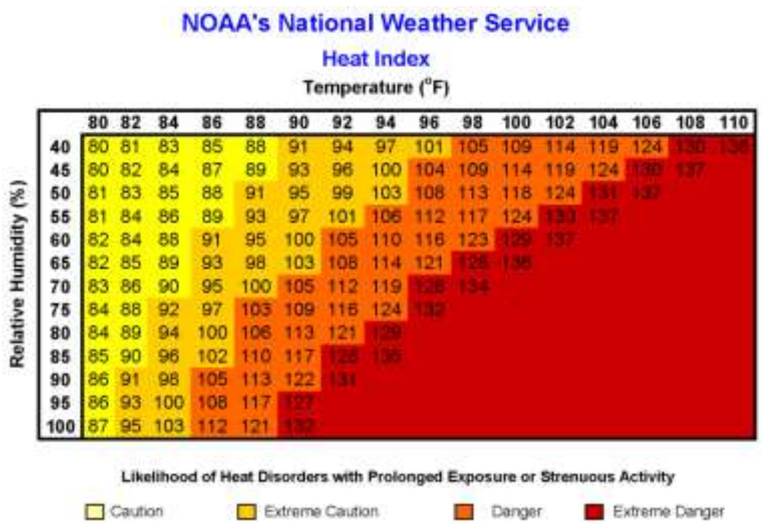
Even in the southern hemisphere, Australia has its share of desert-influenced localized summer winds. For example, the 'brickfielder' is a strong, hot and dusty northwest wind from the interior desert that affects Victoria and New South Wales in the summertime, and the 'Fremantle Doctor' is a cooling afternoon sea breeze affecting southwest coastal sections of Western Australia.

This is but a small sampling of the world's many 'summer winds'.

HEAT INDEX AND DEW POINT

Brian Montgomery
Senior Meteorologist, NWS Albany, NY

The American Meteorological Society (AMS) defines 'dew point' as the temperature to which a given air parcel must be cooled at constant pressure and constant water vapor content in order for saturation to occur. The dew point is related to relative humidity in that a high relative humidity indicates that the dew point temperature is close to the current air temperature. A relative humidity of 100% indicates that the dew point is equal to the current temperature, and that the air is maximally saturated with water. When the NWS issues heat advisories or Excess Heat Warnings, we are utilizing the combination of temperature and dew point to calculate relative humidity, and obtain the Heat Index.



NOAA's National Weather Service

Heat Index

Temperature (°F)

Relative Humidity (%)	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
40	80	81	83	85	88	91	94	97	101	105	109	114	119	124	130	136
45	80	82	84	87	89	93	96	100	104	109	114	119	124	130	137	
50	81	83	85	88	91	95	99	103	108	113	118	124	131	137		
55	81	84	86	89	93	97	101	106	112	117	124	130	137			
60	82	84	88	91	95	100	105	110	116	123	129	137				
65	82	85	89	93	98	103	108	114	121	128	136					
70	83	86	90	95	100	105	112	119	126	134						
75	84	88	92	97	103	109	116	124	132							
80	84	89	94	100	106	113	121	129								
85	85	90	96	102	110	117	126	135								
90	86	91	98	105	113	122	131									
95	86	93	100	108	117	127										
100	87	95	103	112	121	132										

Likelihood of Heat Disorders with Prolonged Exposure or Strenuous Activity

Caution | Extreme Caution | Danger | Extreme Danger

Credit: http://nws.noaa.gov/os/heat/index.shtml

For us to understand dew point, it is important to look at the climatology of this unique meteorological measurement. We have taken all of the observations from Albany International Airport (ALB) from 1980-2013, and performed a preliminary "dew point climatology" that we wanted to share with you. As for extremes, a maximum dew point of 79 degrees was achieved on June 16 1981, July 18 1982, July 11 1984, August 14 1988 and July 27 1997. The lowest was -36 degrees on December 25 1980. More work is needed, including expanding this climatology to other locations within our service area.

Below are the monthly average values

	January	February	March	April	May	June	July	August	September	October	November	December
1980	14.1	9.1	20.5	35.7	45.6	51.5	59.5	60.7	49.7	35.2	24.9	10.4
1981	4.0	25.3	22.3	32.9	45.6	54.5	59.4	58.2	49.6	35.1	26.9	19.3
1982	4.8	12.8	20.4	25.6	44.6	53.7	58.7	55.1	53.3	41.2	34.3	25.5
1983	14.2	16.9	27.5	35.4	45.9	57.2	62.3	63.3	54.3	42.5	31.7	16.7
1984	11.3	24.5	15.8	35.5	43.7	57.4	62.3	64.3	51.4	46.5	31.7	28.1
1985	12.6	18.0	21.3	35.0	45.7	52.6	59.9	59.3	56.0	42.3	34.8	18.5
1986	16.3	16.1	25.5	36.6	49.3	54.2	62.8	59.8	53.4	42.6	30.7	24.8
1987	16.3	11.8	27.1	39.7	47.0	58.6	63.2	57.0	53.9	38.0	30.3	23.6
1988	11.6	16.0	22.3	34.1	47.5	49.3	63.6	63.5	51.8	38.3	32.6	16.7
1989	16.9	14.7	20.3	29.2	48.5	58.6	61.1	59.7	53.5	42.5	28.0	4.8
1990	24.8	18.9	24.1	35.1	43.2	56.4	61.2	61.3	52.4	44.1	31.2	24.5
1991	14.5	19.6	26.0	35.8	50.1	55.4	59.4	61.4	50.6	43.2	30.3	21.7
1992	16.2	17.7	19.6	29.6	43.4	55.0	59.5	58.9	53.1	38.0	32.1	21.9
1993	19.2	7.8	21.4	34.8	45.4	54.5	60.9	62.4	53.9	39.5	30.2	19.8
1994	3.9	9.1	23.4	32.6	41.9	57.3	64.5	59.4	52.3	39.7	31.8	24.5
1995	24.8	12.7	30.2	30.7	45.9	54.0	62.6	59.1	50.3	45.8	28.8	16.4
1996	13.8	15.8	17.1	32.9	43.4	59.0	60.0	62.2	57.0	43.3	28.5	29.5
1997	14.7	21.5	23.4	30.5	39.6	55.5	59.6	59.8	54.6	41.6	31.0	23.5
1998	23.0	23.2	30.2	36.8	51.7	57.2	61.3	61.6	54.9	43.6	34.2	26.1
1999	17.4	20.0	21.4	30.8	45.7	56.9	62.9	59.0	56.5	40.2	34.3	22.3
2000	11.0	18.8	27.9	34.6	49.4	57.4	59.0	60.8	53.6	42.1	31.6	15.2
2001	18.6	17.8	22.1	31.0	46.2	58.2	57.0	62.9	53.4	40.5	35.5	26.8
2002	22.8	20.5	25.1	36.1	42.0	56.7	60.6	61.3	56.6	40.5	31.7	20.2
2003	9.4	11.9	23.3	30.2	46.0	56.6	61.2	64.1	56.3	40.9	34.2	21.3
2004	5.6	15.7	29.6	34.2	50.9	53.8	62.5	61.8	56.1	43.4	32.1	20.2
2005	12.7	17.5	21.7	32.0	41.1	61.3	62.9	62.9	55.8	44.9	32.3	19.4
2006	24.5	16.2	21.1	32.9	47.0	58.2	63.6	59.1	53.1	39.7	36.9	27.0
2007	18.8	8.3	19.9	30.9	42.5	56.0	59.5	59.4	53.6	48.2	28.3	20.5
2008	18.5	18.9	20.5	33.2	40.4	59.2	62.5	58.4	54.9	39.7	31.5	21.1
2009	9.8	16.6	21.4	31.8	44.6	54.9	58.8	61.6	51.6	39.7	34.9	18.1
2010	16.2	19.3	27.9	35.8	47.7	57.9	62.8	59.8	54.0	41.6	30.2	18.1
2011	13.8	13.9	22.0	35.8	50.5	56.3	62.1	61.8	58.7	43.5	35.3	26.5
2012	19.5	21.2	31.0	31.0	51.7	55.8	61.2	60.8	53.1	46.0	27.3	26.7
2013	17.6	16.5	22.0	30.4	46.2	57.2	64.9	58.6	51.6	42.8	25.4	19.8

These are the maximum values observed within the month (highlighted are monthly highest)

	January	February	March	April	May	June	July	August	September	October	November	December
1980	53	37	52	55	69	71	77	76	76	64	48	53
1981	41	58	56	61	70	79	75	70	70	61	51	39
1982	44	41	51	59	66	72	79	73	72	64	65	61
1983	46	49	56	61	67	74	78	76	75	71	55	46
1984	37	46	40	62	68	74	79	77	70	65	56	57
1985	48	50	59	62	67	69	74	76	75	67	61	48
1986	46	35	58	58	68	73	75	74	72	70	58	42
1987	41	35	61	58	71	71	76	73	70	55	59	47
1988	38	49	54	57	65	71	73	79	70	65	59	42
1989	40	46	58	56	70	73	76	75	73	65	61	36
1990	48	53	62	67	60	69	74	72	69	69	60	59
1991	39	45	59	62	72	73	75	72	74	66	54	53
1992	50	43	53	60	62	72	73	71	71	64	58	48
1993	55	33	48	58	63	72	75	74	76	61	60	44
1994	45	42	39	63	62	76	77	73	70	59	62	51
1995	61	37	56	59	71	71	76	76	68	67	61	37
1996	56	49	49	60	69	72	74	74	70	61	65	55
1997	50	56	56	59	60	77	79	73	72	64	58	38
1998	52	41	59	64	77	72	78	78	70	63	52	53
1999	53	53	52	49	66	77	77	74	72	61	61	52
2000	54	47	54	59	72	74	71	75	74	61	50	55
2001	37	43	34	59	63	73	76	74	72	62	61	60
2002	43	50	56	64	70	72	74	74	72	70	63	50
2003	38	39	58	52	61	73	74	75	72	62	60	52
2004	45	39	56	59	70	72	74	75	75	59	59	55
2005	55	43	41	55	61	74	76	75	72	68	59	40
2006	53	49	54	55	68	71	75	77	67	63	63	56
2007	59	32	50	57	66	71	72	75	71	68	52	48
2008	52	52	41	58	67	73	73	68	74	60	61	53
2009	32	46	49	59	64	68	72	75	69	62	54	54
2010	53	35	50	57	69	72	75	74	71	71	50	55
2011	42	39	48	65	67	73	75	74	73	65	59	55
2012	45	43	56	59	72	72	74	75	72	66	55	51
2013	54	36	50	60	69	72	75	73	77	66	61	50

These are the minimum values observed within the month (highlighted are monthly lowest)

	January	February	March	April	May	June	July	August	September	October	November	December
1980	-15	-23	-21	7	14	27	38	40	25	12	9	-36
1981	-26	-15	-3	5	23	37	41	37	22	16	9	-10
1982	-27	-13	-12	-1	22	39	42	30	34	22	6	-7
1983	-23	-20	5	12	24	33	42	48	33	18	14	-23
1984	-28	-16	-17	8	26	36	48	46	26	20	13	0
1985	-15	-9	-5	6	16	35	41	45	32	17	15	-9
1986	-15	-6	-11	16	15	32	41	34	33	20	1	-3
1987	-17	-19	-8	6	21	34	43	36	29	15	-6	-14
1988	-25	-7	-9	12	24	30	44	40	29	19	16	-21
1989	-14	-10	-23	-1	32	39	46	41	28	27	-2	-19
1990	2	-14	-6	6	14	34	44	48	29	18	9	-10
1991	-15	-13	-1	10	22	38	43	49	25	19	11	-5
1992	-12	-14	-5	-1	16	37	42	45	28	22	15	-6
1993	-13	-21	-13	13	28	34	46	46	27	12	1	-15
1994	-30	-17	1	13	15	31	46	44	31	17	1	-8
1995	-5	-23	-1	-2	12	34	46	42	31	21	9	-2
1996	-22	-14	-5	6	23	32	48	48	30	20	6	-4
1997	-18	-3	0	-1	20	39	44	44	35	25	10	0
1998	-10	-4	-2	20	34	33	49	42	29	27	22	-6
1999	-17	-9	-3	12	21	30	48	39	35	23	12	-4
2000	-20	-8	3	10	18	40	42	45	28	19	5	-8
2001	-2	-7	1	12	15	35	38	35	37	5	12	8
2002	-1	-2	-3	3	21	36	39	44	39	17	4	-9
2003	-17	-22	-15	0	18	38	47	40	39	21	2	-1
2004	-24	-16	-3	5	18	39	44	48	39	21	11	-15
2005	-20	-4	-9	8	20	44	48	49	31	25	0	-3
2006	-8	-11	-5	15	11	40	48	41	35	21	20	-3
2007	-12	-14	-18	0	11	34	40	41	36	22	8	-5
2008	-10	-7	-4	6	17	43	48	44	38	21	4	-9
2009	-11	-7	-4	11	21	24	42	45	35	22	22	-8
2010	-16	0	0	15	20	37	45	43	38	22	6	2
2011	-19	-9	-7	9	24	28	42	49	36	24	20	6
2012	-9	-4	1	6	25	45	45	43	36	19	8	9
2013	-9	-7	0	1	21	31	47	41	35	17	-1	-8

DWINDLING SUNSPOTS: COULD THIS AFFECT CLIMATE CHANGE?

Hugh Johnson
Meteorologist, NWS Albany

Evan L. Heller
Climatologist, NWS Albany

When scientists look at all the possible factors that may contribute to climate change, one aspect that cannot be overlooked is the periodic heat fluctuations that take place in the photosphere, or outer surface of the sun. The photosphere has dark spots in it, known as sunspots, and they fluctuate. It might seem that the more sunspots there are on the sun, the cooler the photosphere should be because the sunspots are dark, and therefore they ought to radiate cooler temperatures. As it turns out, however, the more sunspots there are, the warmer the sun's surface is, by up to 0.2 percent. This is because sunspots are correlated to a more active photosphere, in which there is more magnetic force and heat. The 0.2 percent seems like a small number, but any fluctuation over an area that emits temperatures over 10,000 degrees Fahrenheit is substantial, even at a small fraction of a percent.

A normal sunspot cycle from peak to peak is about 11 years, but it can vary anywhere from 9 to 14 years. The last sunspot cycle peak ended earlier this year. Some scientists believe that we are heading for at least a 100-year minimum in sunspot activity. A few even claim sunspot activity could approach the level of the Marauder minimum during the next sunspot cycle. The next cycle will peak around 2025, with the minimum expected to be sometime in 2019.

Sunspot activity has been tracked for many centuries, and their strength and length of cycle have varied quite a bit. The chart below shows the many sunspot cycles since 1600. Notice the lack of sunspot activity between 1650 and 1715; this lull in activity is known as the Marauder Minimum. This was the same time the northern hemisphere was going through the "Little Ice Age", a time of exceptionally cold winters when the large rivers in Europe froze and many people died of starvation due to crop failures. Another sunspot minimum was noted in the early 1800s when there was a notable cool-down in the Northern Hemisphere. The notorious "Year Without a Summer", in 1816, where crops failed in New England, came right after an unusually low sunspot minimum. In this case, however, it should be noted that there was a significant volcanic eruption of Mt. Tambora in Malaysia in 1815 that likely also contributed to this specific cooling.

There was a resurgence of sunspots starting around 1940, which lasted through about 1990. Initially, the climate in the Northern Hemisphere appeared to cool a little through the mid-70s, but then warmed significantly from the late 70s until the late 90s. Since the late 90s, there has been a gradual decrease in the number of sunspots.

Could this mean the earth may “cool” again? New calculations indicate that the earth’s warming has, at the very least, slowed down quite a bit since the “Super El Nino” of 1998. This is the same time frame in which sunspot activity began declining.

There are scientists who believe that the lack of sunspots has little to do with global cooling. They feel, rather, that ocean surface temperatures, volcanic eruptions and, of course, carbon dioxide (CO2) emissions, have much more of an effect on the warming or cooling of our planet. Right now, both the Pacific Ocean and Atlantic Ocean surface temperatures are in their “cold phase”.

If sunspot activity should decline sharply, it will be interesting to see if the earth will actually start cooling, despite the many tons of CO2 that will likely be emitted into the atmosphere over the next decade. While the elements of climate change are fairly well-understood separately, there is far less certainty as to how they all work in combination. This means there is serious doubt about how climate change will ultimately play out.

NWS ALBANY PARTAKES IN LANDMARK 40TH ANNUAL NORTHEAST STORM CONFERENCE

Evan L. Heller
Meteorologist, NWS Albany

The 40th Annual Northeast Storm Conference was held March 6-8, 2015 at the Holiday Inn in Saratoga Springs, and was sponsored by Lyndon State College in Vermont, and the American Meteorological Society. This event marked a return to the venue, and the City of Saratoga Springs, after a 4-year hiatus. Last year's conference was held in Rutland, Vermont. Attendees this year numbered in the hundreds, mostly students and faculty representing numerous colleges in the northeast with atmospheric science curriculums, including SUNY Albany. There were also participants from various National Weather Service Offices, and a number of scientific corporations and media outlets. There were more than 50 presentations over this weekend-long event, including several from our office.

Jim Cantore of The Weather Channel was the Keynote Speaker for the Friday night opener which was followed by an ice cream social and refreshments. Saturday was the big day as things kicked off at 8 a.m. Coinciding presentations in two adjacent rooms offered attendees a choice of two at any given time throughout the weekend. Most of this day's presentations were 15 minutes in length, with breaks including an hour for lunch, during which was held a lunch banquet featuring another Keynote Speaker, Thomas Bogdan, of the University Corporation for Atmospheric Research. The vast majority of the day's talks were presented by students or faculty of the various colleges and universities in attendance, including several by SUNY Albany, and even a high school.

Poster presentations were held in the middle of the day's events, where attendees could get more personalized information from the authors/presenters. NWS Albany presented two posters. Representing our office, Luigi Meccariello revealed his poster "Storm-Scale Diagnostics of the EF-2 29 May 2013 and EF-3 22 May 2014 Schenectady County Tornadoes with Tornado Survey Analysis". Steve DiRienzo was also on hand to represent the poster he co-authored with our Service

Hydrologist, Britt Westergard, entitled "The One Hundredth Anniversary of the Record Flood at Schenectady on the Mohawk River".

After the second of the day's two poster sessions, the presentations resumed. This was followed by a formal panel discussion session, providing an opportunity particularly for atmospheric science students to learn about career opportunities in meteorology. The six guest panelists represented a broad spectrum in the field of atmospheric sciences: television media; aviation; a scientific corporation; SUNY Albany, the military, and; the federal government. For the latter, our John Quinlan was on hand to answer questions pertaining to job opportunities within NOAA and the National Weather Service.

Saturday wrapped up with the annual evening banquet event at the hotel, which I was unfortunately unable to stick around for. This night featured Keynote Speaker Dr. Louis B. Uccellini, Director of The National Weather Service, and the topic was "8 Days a Week: Leading the National Weather Service & Tracking the Snow".

The conference came to a close on Sunday with more talks commencing inside the two rooms immediately after Paul Kocin, of NOAA's NWS Weather Prediction Center, opened the day with a lively and humorous presentation entitled "Northeast Snowstorms Volume 3: The 21st Century". The noontime session of presentations in the Win-Place-Show room was dominated by meteorologists from our local office. Hugh Johnson presented *A Look at Both Cold and Warm Season Mohawk-Hudson Convergence Events.* This was followed by Kevin S. Lipton with *Multi-Scale Analysis of the 22 May 2014 Supercell and EF3 Tornado at Eastern New York.* And wrapping things up for us was Thomas A. Wasula with *A Comparison of 2 Recent Anomalously Large Hail Events that Impacted the Albany Forecast Area.*

The conference ended shortly after 1 p.m. Special thanks needs to go out to the AMS and Lyndon State College for putting together yet another great event. All the presenters did a fine job. I personally found this year's event to be the most enjoyable Northeast Storm Conference yet. If you would like to view any or all of the abstracts from the conference, they are available at this link: http://www.lyndonams.com/agenda/4586518165.

NOAA ONLINE WEATHER DATA - NOWData

Ingrid Amberger
Climatologist, NWS Albany

Did you know you can access climate data for many locations across east central New York and western New England via NOWData, NOAA's public on-line weather data tool? There are 21 locations across east central New York, and 9 locations across western New England including 2 in Litchfield County, Connecticut, 3 in Berkshire County, Massachusetts, and 4 across southern Vermont (Bennington and Windham Counties).

The period of record varies for each location and there may be missing data and/or gaps in the data. There are two listings for Albany: "Albany Area" and "Albany International Airport". Why is this? The "Albany Area" period of record dates to 1874 and includes the climate data from all six locations used for observations for Albany over the years, including "Albany International Airport" (refer to chart below).

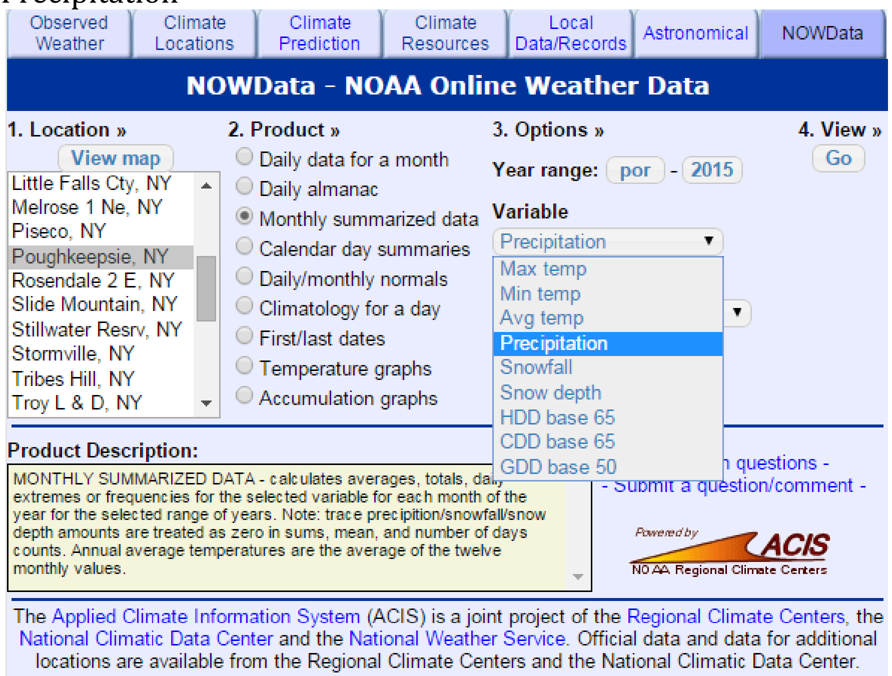
DATES	Albany NY Climate Record Locations
December 22, 1873 to June 30, 1874	Signal Services…U.S. Army opened first weather reporting station sponsored by the Federal Government at the Dudley Observatory at Dudley Heights, Albany
July 1, 1874 to March 12, 1880	Move to new building on the grounds of the Dudley Observatory, constructed near the original station location expressly for the purpose of weather reporting
March 13, 1880 to September 30, 1884	S.K. Grey's Building (4^{th} floor) at 42-44 State Street, Albany
October 1, 1884 to April 17, 1935	U.S. Custom House and Post Office, Albany
April 18, 1935 to May 31, 1938	New Post Office Building at Broadway and Maiden Lane, Albany
June 1, 1938 to present	Albany Airport Station at what is now Albany International Airport, Colonie
Original Source: U.S. Department of Commerce Weather Bureau, 1946 Annual Meteorological Summary	

There are numerous ways to view the data, which you control via the product and options you choose. You can look up data for a single day, month, season or year. A description is provided for each of the products. The variables available are:

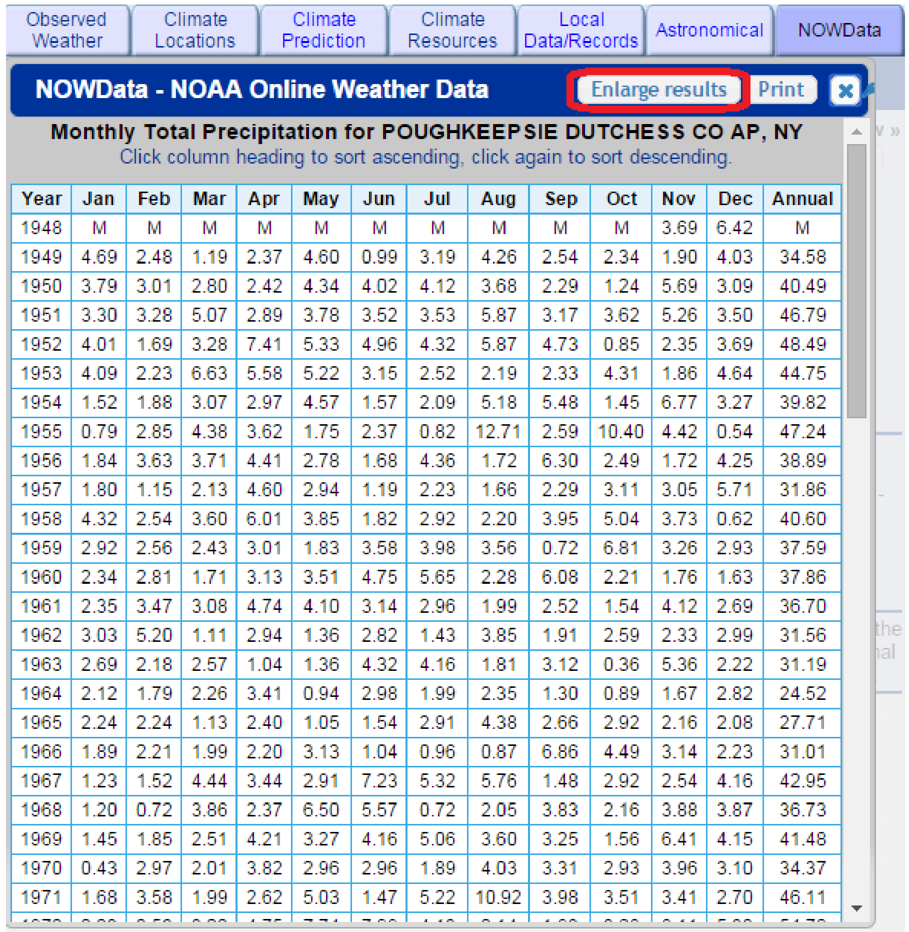
temperature (maximum. minimum and average); precipitation; snowfall; snow depth; heating degree days (HDD); cooling degree days (CDD), and; growing degree days (GDD). Please note that not all variables are available for each location.

Here is an example:

1. Location : Poughkeepsie, NY
2. Product: Monthly summarized data
3. Options:
    a. Year range = por - 2015 ("por" means period of record)
    b. Variable: Precipitation



4. View: Go (you can sort the data by clicking on the column headers)



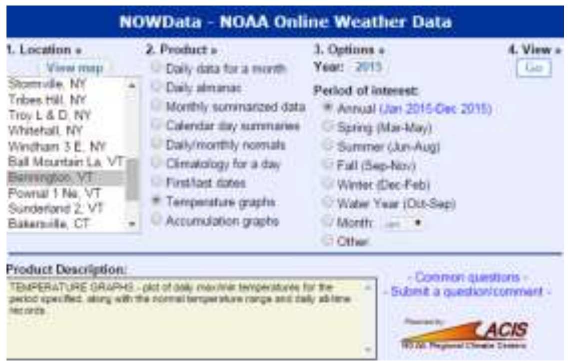
Monthly Total Precipitation for POUGHKEEPSIE DUTCHESS CO AP, NY
Click column heading to sort ascending, click again to sort descending.

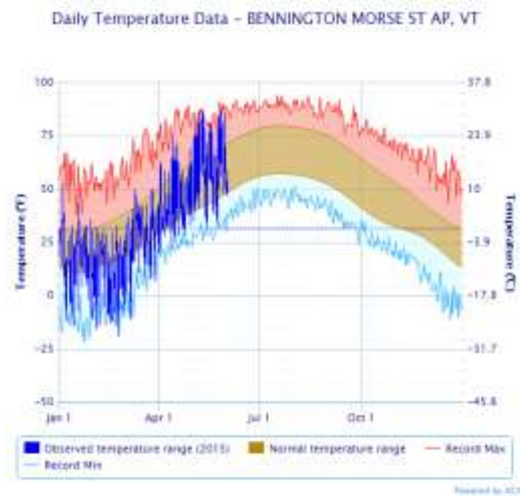
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1948	M	M	M	M	M	M	M	M	M	M	3.69	6.42	M
1949	4.69	2.48	1.19	2.37	4.60	0.99	3.19	4.26	2.54	2.34	1.90	4.03	34.58
1950	3.79	3.01	2.80	2.42	4.34	4.02	4.12	3.68	2.29	1.24	5.69	3.09	40.49
1951	3.30	3.28	5.07	2.89	3.78	3.52	3.53	5.87	3.17	3.62	5.26	3.50	46.79
1952	4.01	1.69	3.28	7.41	5.33	4.96	4.32	5.87	4.73	0.85	2.35	3.69	48.49
1953	4.09	2.23	6.63	5.58	5.22	3.15	2.52	2.19	2.33	4.31	1.86	4.64	44.75
1954	1.52	1.88	3.07	2.97	4.57	1.57	2.09	5.18	5.48	1.45	6.77	3.27	39.82
1955	0.79	2.85	4.38	3.62	1.75	2.37	0.82	12.71	2.59	10.40	4.42	0.54	47.24
1956	1.84	3.63	3.71	4.41	2.78	1.68	4.36	1.72	6.30	2.49	1.72	4.25	38.89
1957	1.80	1.15	2.13	4.60	2.94	1.19	2.23	1.66	2.29	3.11	3.05	5.71	31.86
1958	4.32	2.54	3.60	6.01	3.85	1.82	2.92	2.20	3.95	5.04	3.73	0.62	40.60
1959	2.92	2.56	2.43	3.01	1.83	3.58	3.98	3.56	0.72	6.81	3.26	2.93	37.59
1960	2.34	2.81	1.71	3.13	3.51	4.75	5.65	2.28	6.08	2.21	1.76	1.63	37.86
1961	2.35	3.47	3.08	4.74	4.10	3.14	2.96	1.99	2.52	1.54	4.12	2.69	36.70
1962	3.03	5.20	1.11	2.94	1.36	2.82	1.43	3.85	1.91	2.59	2.33	2.99	31.56
1963	2.69	2.18	2.57	1.04	1.36	4.32	4.16	1.81	3.12	0.36	5.36	2.22	31.19
1964	2.12	1.79	2.26	3.41	0.94	2.98	1.99	2.35	1.30	0.89	1.67	2.82	24.52
1965	2.24	2.24	1.13	2.40	1.05	1.54	2.91	4.38	2.66	2.92	2.16	2.08	27.71
1966	1.89	2.21	1.99	2.20	3.13	1.04	0.96	0.87	6.86	4.49	3.14	2.23	31.01
1967	1.23	1.52	4.44	3.44	2.91	7.23	5.32	5.76	1.48	2.92	2.54	4.16	42.95
1968	1.20	0.72	3.86	2.37	6.50	5.57	0.72	2.05	3.83	2.16	3.88	3.87	36.73
1969	1.45	1.85	2.51	4.21	3.27	4.16	5.06	3.60	3.25	1.56	6.41	4.15	41.48
1970	0.43	2.97	2.01	3.82	2.96	2.96	1.89	4.03	3.31	2.93	3.96	3.10	34.37
1971	1.68	3.58	1.99	2.62	5.03	1.47	5.22	10.92	3.98	3.51	3.41	2.70	46.11

When you "enlarge results", you can still sort the data. At the bottom of the table, you will find the mean as well as maximum and minimum values, with times of occurrence. Note that "M" means data is missing.

1991	1.50	1.95	3.82	3.58	5.05	2.21	2.72	4.92	4.81	4.07	3.70	3.03	41.36
1992	1.70	1.92	3.08	3.12	2.83	3.34	7.18	2.81	1.98	1.31	4.60	4.16	38.03
1993	M	M	M	M	M	M	M	M	M	M	M	M	M
1994	M	M	M	M	M	M	M	M	M	M	M	M	M
1995	M	M	M	M	M	M	M	M	M	M	M	M	M
1996	M	M	M	M	M	M	M	M	M	M	M	M	M
1997	M	M	M	M	M	M	M	M	M	M	M	M	M
1998	M	M	M	M	M	M	M	M	M	M	M	M	M
1999	M	M	M	M	M	M	M	M	M	M	M	M	M
2000	M	M	M	M	M	M	M	M	4.46	M	M	3.18	M
2001	1.71	1.38	4.34	1.04	2.52	4.04	2.61	2.04	4.29	0.79	0.81	1.95	27.52
2002	1.06	0.88	2.40	4.28	4.51	4.09	3.86	4.05	2.74	5.66	5.18	2.94	41.65
2003	2.58	2.64	3.08	1.48	3.83	4.57	2.53	4.30	9.23	4.35	4.32	4.01	46.92
2004	1.96	1.86	1.88	3.00	2.43	1.61	4.98	7.92	8.30	1.80	2.94	3.48	42.16
2005	4.83	1.59	3.88	3.76	1.98	4.97	3.08	2.01	0.63	17.59	4.68	3.57	52.57
2006	5.76	1.03	1.19	3.95	3.73	6.69	2.32	5.26	4.98	4.21	4.90	1.82	45.84
2007	2.87	1.91	3.36	7.72	1.37	4.21	4.76	4.33	1.97	4.20	3.40	4.91	45.01
2008	1.53	7.50	5.24	M	1.98	3.86	3.46	4.31	M	2.65	2.66	5.73	M
2009	2.09	0.81	1.92	1.89	6.32	9.25	6.39	4.94	1.69	4.04	1.46	3.75	44.55
2010	2.04	3.77	4.56	1.74	1.77	1.90	1.40	7.02	3.64	3.06	2.42	2.52	35.84
2011	1.78	3.65	5.17	4.63	5.16	4.62	2.24	13.23	10.10	4.10	2.94	4.39	62.01
2012	2.14	1.47	1.19	2.06	4.60	3.06	4.07	3.59	5.60	3.79	0.69	4.22	36.48
2013	2.05	1.61	1.48	1.32	4.19	9.82	3.14	6.61	2.32	1.61	2.43	3.33	39.91
2014	1.50	2.78	2.75	4.43	2.57	2.29	4.97	3.38	0.52	3.76	2.19	3.00	34.14
2015	2.94	1.36	2.17	2.23	1.97	M	M	M	M	M	M	M	M
Mean	2.61	2.47	3.11	3.49	3.91	3.75	3.74	4.14	3.62	3.49	3.43	3.26	40.97
Max	8.30 1979	7.50 2008	7.39 1983	8.51 1983	11.81 1989	9.82 2013	13.63 1975	13.23 2011	10.10 2011	17.59 2005	8.11 1972	8.65 1973	62.01 2011
Min	0.43 1970	0.32 1987	0.15 1981	1.03 1978	0.94 1964	0.30 1988	0.72 1968	0.64 1981	0.46 1986	0.36 1963	0.67 1976	0.54 1955	24.52 1964

You can also create graphs. Here is an example displaying 2015 temperatures for Bennington, Vermont. The graph shows the normal range of temperatures, and record maximums and minimums.





NOWData is a very powerful tool. A link to it can be found on our climate page at: www.weather.gov/aly/climate

WEATHER *ESSENTIALS*
With Kevin S. Lipton

COMPUTER MODELS AND WEATHER FORECASTING

In previous articles, we discussed the basics of meteorology, including how to interpret weather maps. We also looked at some of the properties of the atmosphere. The atmosphere is quite complex, and provides us with a huge amount of observational data of many variables – from the ground level right up through the troposphere and lower stratosphere. In order to be able to process all this data and use it to predict a future state of the atmosphere, the use of computers has become a requirement. In this installment of Weather Essentials, we discuss the basics of atmospheric computer models, and how they are used to assist meteorologists with developing weather forecasts.

Essentially, a computer model is a mathematical representation of the atmosphere at a given time. This mathematical representation consists of many complex equations, the basics of which are shown in Figure 1. These equations have many variables included within them which represent such atmospheric parameters as wind, pressure, temperature and water vapor concentration. The computer models process these equations in order to develop forecasts for all these parameters. Of course, predicting these parameters accurately relies on having accurate initial values. These initial values come from all the observational data that's available – including rawinsonde data (from weather balloons), surface observations, and radar and satellite data, just to name a few. In creating forecasts, tens of millions of computations are performed each second using the large amount of observational data.

Computer models represent the atmosphere via data points over a 3-dimensional grid. The closer these grid points are to one another horizontally and/or vertically within a grid, the higher the resolution of the model. Higher resolution models, in theory, should be able to more accurately depict smaller-scale atmospheric features such as fronts, or bands of precipitation within a storm. Higher resolution models are useful for forecasting the state of the atmosphere over shorter periods of time, and also over smaller regional areas. They also require greater computational power than lower resolution models. On the other hand, lower resolution models tend to be very useful in forecasting the state of the atmosphere over a larger area, such as across the globe, and also over a longer period of time.

Forecasts generated by computer models are only as accurate as the observational data (input) and predictive equations (numerical computer models) allow them to be. Errors can be introduced via: inaccurate or missing observations; failure of the models to resolve smaller-scale convection, boundaries and/or banding features associated with a storm system, or; imprecise first approximations factored into equations. These errors tend to grow with time, so that small errors in the observational data could end up having a huge negative impact on the predictability of important things such as the track and intensity of a potential storm system. The National Weather Service has many different numerical computer models, most of which are run through the National Centers for Environmental Prediction (NCEP). Atmospheric computer models are also produced by weather agencies and academic institutions throughout the world.

It should be emphasized that computer models are intended for use only as tools to assist meteorologists in predicting the future state of the atmosphere. They are guidance – not to be used for predicting a definite solution. Meteorologists, through education and experience, develop knowledge of the strengths and weaknesses associated with the various computer models. They look at historical atmospheric patterns, or analogs, to help determine whether a particular computer model may be more useful than another. And – perhaps most importantly – experienced meteorologists will first examine observational data, and only then assess whether a particular computer model is accurately representing the atmosphere. If it is not – he or she will likely shy away from that solution, because the forecast would likely also not be accurate.

So, as you can see, given the great complexity of the atmosphere, trying to determine its state at some point in the future requires computer models, but they must be used in conjunction with the education and experience of a meteorologist.

Wind Forecast Equations

1a. $$\frac{\partial u}{\partial t} = -u\frac{\partial u}{\partial x} - v\frac{\partial u}{\partial y} - \omega\frac{\partial u}{\partial p} + fv - g\frac{\partial z}{\partial x} + F_x$$

1b. $$\frac{\partial v}{\partial t} = -u\frac{\partial v}{\partial x} - v\frac{\partial v}{\partial y} - \omega\frac{\partial v}{\partial p} - fu - g\frac{\partial z}{\partial y} + F_y$$

Continuity Equation

2. $$\frac{\partial u}{\partial x} + \frac{\partial v}{\partial y} + \frac{\partial \omega}{\partial p} = 0$$

Temperature Forecast Equation

3. $$\frac{\partial T}{\partial t} = -u\frac{\partial T}{\partial x} - v\frac{\partial T}{\partial y} - \omega\left(\frac{\partial T}{\partial p} - \frac{RT}{c_p p}\right) + \frac{H}{c_p}$$

Moisture Forecast Equation

4. $$\frac{\partial q}{\partial t} = -u\frac{\partial q}{\partial x} - v\frac{\partial q}{\partial y} - \omega\frac{\partial q}{\partial p} + E - P$$

Hydrostatic Equation

5. $$\frac{\partial z}{\partial p} = -\frac{RT}{pg}$$

Figure 1. Basic Equations of the Atmosphere. **Courtesy of COMET/UCAR MetEd course "Impact of Model Structure and Dynamics."**

FALL 2015: QUITE MILD, INDEED!

Evan L. Heller
Climatologist, NWS Albany

The Fall of 2015 was unusually warm, and this was largely because it was also unusually sunny. The mean temperature for the season at Albany was 54.6°, which was 4.1° above normal (Table 1). This made it the 4th-warmest fall on record (Table 3d). A look at clouds reveals that there were only 24 cloudy days out of the 91 (Tables 4a-c), or a mere 26%. This is significant especially given that November tends to be our cloudiest month representing the climatological season. Even October was slightly cloudier, with November being cloudy for only 9 days. It should be noted that while there was no measureable snowfall this past fall, this is only somewhat unusual, and normally there is only about 3 inches of total snow accumulated through the end of November in Albany.

September, by far, saw the breaking (or tieing) of the greatest number of climatological records of the season (Table 3a). Close to half the records were daily records related to temperature, including a daily maximum temperature of 94° set on the 8th. One daily record was for precipitation at the end of the month, and it was a big one; 2.74" of rain fell, resulting in it being the 29th-wettest rainfall date in Albany history. September, with its whopping 6.89" rainfall total also wound up being the 69th-wettest month of all-time, and the 10th-wettest September of all-time. The month also cracked the Top 10 for both warmest September and mean maximum September (#s 3 and 2, respectively), but fell just short for mean minimum September, which essentially means temperatures, on average, were able to drop down closer to normals for the overnights. Certainly, the higher-than-normal number of clear to partly cloudy nights played a big role in achieving this. Two other daily records in September were for maximum daily wind speed.

In stark contrast to September, there was one record daily snowfall when a trace fell on October 18th, tieing the record from 1972 (Table 3b). Otherwise, there were no other records tied or broken. November was a little more interesting for records (Table 3c); another record high temperature was broken on the 6th, as was the daily high mean. It is the highest mean maximum November on record for temperature, resulting in it being the 4th-warmest November on record. Like in September, November also failed to crack its Top 10 for mean minimum monthly temperature…again attributable to many clear nights.

The last thunder heard for the season was on October 26th (Table 4b). Wind-wise, September was a relatively calm month, with an average speed less than half the normal for the month. (Table 4a). Despite this fact, the peak wind for the season also occurred in September.

THE STATS

	SEP	OCT	NOV	SEASON
Average High Temperature/Departure from Normal	79.9°/+7.7°	59.8°/0.0	55.7°/+7.8°	65.1°/+5.1°
Average Low Temperature/Departure from Normal	57.2°/+5.6°	39.7°/+0.1°	35.4°/+3.9°	44.1°/+3.2°
Mean Temperature/ Departure From Normal	68.6°/+6.7°	49.8°/+0.1°	45.5°/+5.8°	54.6°/+4.1°
High Daily Mean Temperature/Date	81.5°/8th & 9th	60.5°/7th	64.5°/6th	
Low Daily Mean Temperature /Date	57.0°/21st	36.0°/19st	30.5°/30th	
Highest Temperature reading/Date	94°/8th	75°/12th	73°/6th	
Lowest Temperature reading/Date	43°/27th	23°/19th	20°/24th	
Lowest Maximum Temperature reading/Date	67°/21st	46°/18th	39°/30th	
Highest Minimum Temperature reading/Date	71°/9th	52°/7th	56°/6th	
Total Precipitation/Departure from Normal	6.89"/+3.59"	3.20"/-0.48"	1.75"/-1.54"	11.84"/-1.57"
Total Snowfall/Departure from Normal	0.0"/-	T/0.0	T/-2.8"	T"/-2.8"
Maximum Precipitation/Date	2.74"/30th	1.20"/28th	0.73"/11th	
Maximum Snowfall/Date	0.0"/-	T/18th	T/14th	

Table 1

NORMALS, OBSERVED DAYS & DATES

NORMALS & OBS. DAYS	SEP	OCT	NOV	SEASON
NORMALS				
High	72.2°	59.8°	47.9°	60.0°
Low	51.6°	39.6°	31.5°	40.9°
Mean	**61.9°**	**49.7°**	**39.7°**	**50.5°**
Precipitation	**3.30"**	**3.68"**	**3.29"**	**10.27"**
Snow	**0"**	**0"**	**2.8"**	**2.8"**
OBS TEMP. DAYS				
High 90° or above	3	0	0	3/91
Low 70° or above	1	0	0	1/91
High 32° or below	0	0	0	0/91
Low 32° or below	0	7	11	18/91
Low 0° or below	0	0	0	0/91
OBS. PRECIP DAYS				
Days T+	13	14	12	39/91/43%
Days 0.01"+	10	10	7	27/91/30%
Days 0.10"+	7	4	4	15/91/16%
Days 0.25"+	5	4	3	12/91/13%
Days 0.50"+	4	3	1	8/91/9%
Days 1.00"+	3	1	0	4/91/4%

Table 2a

NOTABLE TEMP, PRECIP & SNOW DATES	SEP	OCT	NOV
First Frost/End of Growing Season	-	17th	-
Wet Spell (3+ cons. days of min. precip. criteria)	9th-14th/2.32" (6 days)	-	-
90° event	92°	-	-
90° event	94°	-	-
90° event	92°	-	-
Heat Wave (3 or more consecutive day 90°+)	7th-9th (3 days)	-	-
1.00"+ date	1.57"/12th	1.20/28th	-
1.00"+ date	1.11"/29th	-	-
1.00"+ date	2.74"/30th	-	-
First Snowfall (Trace or more)	-	18th	-

Table 2b

RECORDS

ELEMENT	SEPTEMBER	
Daily Maximum Temperature Value/Date | Previous Record/Year	94°/8th	93°/1945
Daily High Minimum Temperature Value/Date | Previous Record/Year	71°/9th	70°/1915
Daily High Minimum Temperature Value/Date | Previous Record/Year	68°/29th	68°/1967 (tie)
Daily High Mean Temperature Value/Date | Previous Record/Year	81.5°/8th	80.5°/1884
Daily High Mean Temperature Value/Date | Previous Record/Year	81.5°/9th	81.5°/1959 (tie)
Daily Maximum Precipitation/Date | Previous Record/Year	2.74"/30th	2.68"/2010
Daily Maximum Wind Speed Value/Direction/Date | Previous Record/Direction/Year	43 mph/W/3rd	30 mph/NW/1997
Daily Maximum Wind Speed Value/Direction/Date | Previous Record/Direction/Year	37 mph/NW/14th	35 mph/S/2007
Top 10 Warmest Septembers Mean Value/Rank | Remarks	68.6°/#3	-
Top 10 Mean Maximum Septembers Value/Rank | Remarks	79.9°/#2	-
Top 200 Wettest Months Value/Rank | Remarks	6.89"/#69	-
Top 200 Wettest Dates Value/Date/Rank | Remarks	2.74"/30th/#29	-

Table 3a

ELEMENT	OCTOBER	
Daily Maximum Snowfall Value/Date | Previous Record/Year	T/18th	T/1972 (tie)

Table 3b

ELEMENT	NOVEMBER	
Daily Maximum Temperature Value/Date | Previous Record/Year	73°/6th	72°/1948
Daily High Mean Temperature Value/Date | Previous Record/Year	64.5°/6th	64.0°/1948
Top 10 Warmest Novembers Mean Value/Rank | Remarks	45.5°/#4	Tie
Top 10 Mean Maximum Novembers Value/Rank | Remarks	55.7°/#1	-

Table 3c

ELEMENT	FALL	
Top 10 Warmest Autumns Mean Value/Rank | Remarks	54.6°/#4	-

Table 3d

MISCELLANEOUS

SEPTEMBER

Average Wind Speed/Departure from Normal	5.0 mph/-5.5 mph
Peak Wind/Direction/Date	43 mph/WNW/3rd
Windiest Day Average Value/Date	12.5 mph/30th
Calmest Day Average Value/Date	0.8 mph/16th
# Clear Days	9
# Partly Cloudy Days	17
# Cloudy Days	4
Dense Fog Dates (code 2)	23rd
Thunder Dates (code 3)	3rd
Sleet Dates (code 4)	None
Hail Dates (code 5)	None
Freezing Rain Dates (code 6)	None

Table 4a

OCTOBER

Average Wind Speed/Departure from Normal	7.3 mph/+0.1 mph
Peak Wind/Direction/Date	35 mph/W/19th
Windiest Day Average Value/Date	13.6 mph/19th
Calmest Day Average Value/Date	1.6 mph/12th
# Clear Days	2
# Partly Cloudy Days	18
# Cloudy Days	11
Dense Fog Dates (code 2)	31st
Thunder Dates (code 3)	25th & 26th
Sleet Dates (code 4)	None
Hail Dates (code 5)	26th
Freezing Rain Dates (code 6)	None

Table 4b

NOVEMBER

Average Wind Speed/Departure from Normal	9.0 mph/+0.7 mph
Peak Wind/Direction/Date	42 mph/N/2nd
Windiest Day Average Value/Date	16.2 mph/2nd
Calmest Day Average Value/Date	2.7 mph/13th
# Clear Days	4
# Partly Cloudy Days	17
# Cloudy Days	9
Dense Fog Dates (code 2)	26th
Thunder Dates (code 3)	None
Sleet Dates (code 4)	17th & 22nd
Hail Dates (code 5)	None
Freezing Rain Dates (code 6)	None

Table 4c

For more climate data and records, please visit our climate page at: www.weather.gov/albany/Climate.

A RECORD STRONG EL NIÑO FOR THE UPCOMING WINTER

By Hugh Johnson
Meteorologist, NWS Albany

A strong El Niño continues across the central Pacific Ocean. In fact, this El Niño already ranks as one of the three strongest ever in recorded history, with a chance for it to become the strongest one on record should it strengthen a little more through Christmas.

The warmest anomalies (compared to normal) were noted in the western portion of the central Pacific, where temperatures have run over 3 degrees above normal. This setup and the weather behavior during this past fall have been very similar to that of the 1982-83 El Niño season, the second-strongest on record. Unlike with the '72-'73 and '97-'98 El Niños, this past autumn featured milder than normal temperatures, and precipitation close to normal. The '72 and '97 falls were wetter, snowier and cooler than normal, overall.

The official NOAA Forecast calls for a milder than normal winter with "equal chances" of precipitation being either above or below normal. The winter of 1982-83 realized above normal temperatures and near normal precipitation.

Keep in mind, the winter of 1982-83, like most of our El Niño winters, ended up with above normal snowfall. The greatest January snowstorm on record occurred, with another big snowstorm in early February, and two more back-to-back storms in late April. There were just a couple of other much smaller snowfalls, and the season produced a total of 75.0" at Albany International Airport…15 inches above normal.

There is a "wild card" this year that has never been observed in past El Niño years; a blob of anomalously warm water (separate from the El Niño) in the northern Pacific just south of Alaska. This warm blob has been there for the past two winters, and it has been surmised that this warm pocket of water is helping contribute to a very strong and persistent ridge over the Western United States and Canada. In response to this ridge, Arctic air was driven southward into the northeast, bringing back-to-back colder and snowier than normal weather during the past couple of February and March months.

If this warm pocket of water persists and the El Niño weakens during the latter part of winter (which usually happens), could this ridge form again, allowing cold air to be driven into the northeast? Keep in mind, a southern Jetstream will likely remain active even as the El Niño wanes, as it takes time for the atmosphere to catch up with the ocean circulations. This setup could mean a couple of big snowstorms toward the end of winter, much like 1982-83 (even though the warm blob did not exist then).

Bottom line…even though this winter will likely be milder than normal, have your snow blower ready to go, and all winter preparations completed, especially for late winter.

For more climate data and records, please visit our climate page at: www.weather.gov/albany/Climate

WCM Words

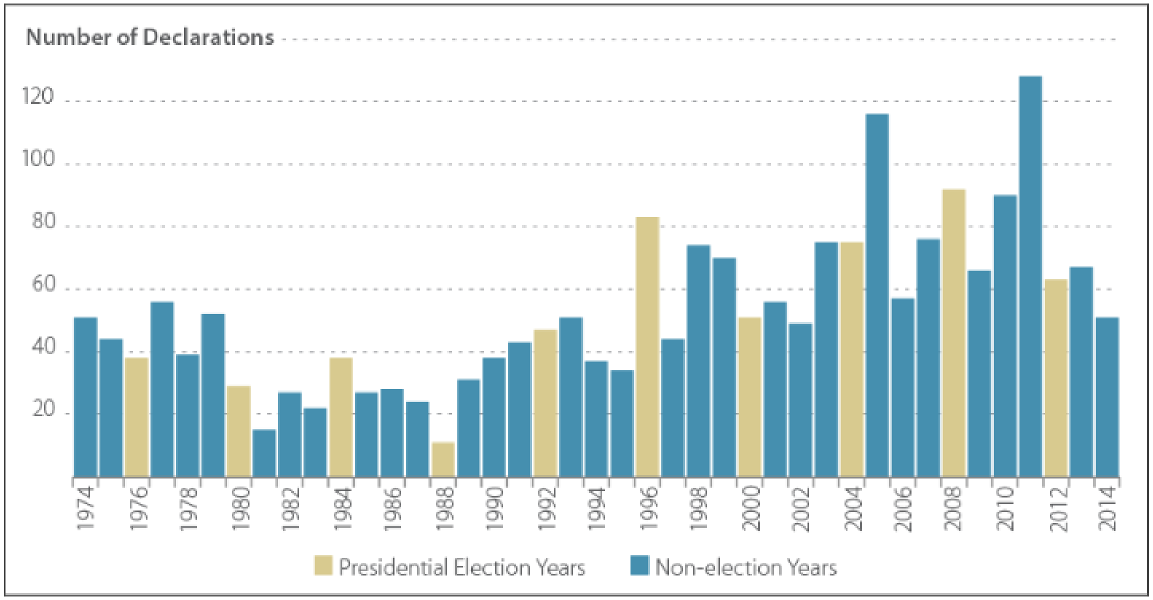
Steve DiRienzo
Warning Coordination Meteorologist, NWS Albany

The Robert T. Stafford Disaster Relief and Emergency Assistance Act authorizes the President to issue declarations that provide states and localities with a range of federal assistance in response to natural and man-made incidents. There are three types of declarations that can be declared under the Stafford Act: (1) Fire Management Assistance Grants; (2) emergencies, and; (3) major disasters.

When a state is overwhelmed by an emergency or major disaster, the governor may request assistance from the federal government. In general, when a request is submitted, representatives from the Federal Emergency Management Agency

(FEMA) meet with the state and compile a Preliminary Damage Report (PDA). Often, much of the information for the PDA comes from National Weather Service Offices in the affected areas. FEMA then makes a recommendation to the President as to whether a declaration should be issued. The President then has the authority to either make the declaration or deny the request.

Between 1974 and 2014, New York State received two (2) Fire Management Assistance Grants, 22 Emergency Declarations (#1 in the Nation) and 70 Major Disaster Declarations (#4 in the nation). There is a correlation between significant weather events and Emergency and Disaster Declarations. Nationally, most emergency declarations are for hurricanes, followed by snow-related events, droughts and severe storms. Most disaster declarations are for severe storms, flooding, hurricanes and tornadoes. In fact, between 1974 and 2014, about 90% of federal declarations were weather-related.



Source: CRS analysis based on data provided by FEMA.

Many of the above articles in this anthology related directly to the active weather regime we were in. Thankfully, the trend in declarations across the country over the past 4-5 years is downward, and let's hope that continues. We have certainly had our share of significant weather events.

Here at the National Weather Service, we strive to be the source of unbiased, reliable and consistent weather information. We're here to answer your weather and water questions 24 hours a day, 7 days a week. If you have concerns, please call us. If you have comments on Northeastern StormBuster, or any of the operations of the National Weather Service, please let me know at Stephen.Dirienzo@noaa.gov.