Photo by Margaret Curtis

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The Coastal Front

Spring 2015

Volume VI-1

Welcome Southwest New Hampshire!

By John Jensenius, Warning Coordination Meteorologist

On December 2nd, our office assumed responsibility for providing forecast services for Hillsborough and Cheshire Counties in southwest New Hampshire. This change was the result of a long-standing request from the State of New Hampshire to have just one weather forecast office serve the entire state. For those old enough to remember, prior to the mid-90s, the Gray office provided the forecasts for all of New Hampshire (and also for all of the State of Maine). In the mid to late 90s, the National Weather Service's modernization, which included new Weather Forecast Offices and the new Doppler radars, changed areas of responsibility for the various NWS offices around the country. For southwest New Hampshire, the radar in Taunton, Massachusetts, provided the best coverage, so the Taunton office was assigned responsibility for that area at the time. More recently though, technologies have changed and communication speeds have increased considerably. Now, the office in Gray routinely receives data from the Taunton radar, as well as other surrounding radars, and we can immediately display this data on our computer screens. In fact for western Cheshire County, we'll also be relying on radar data from the NWS Albany radar, which provides good coverage for that area.

Our overall goal was to make the transition from NWS Taunton to NWS Gray seem as transparent as possible those who use our products. There was a lot of effort required to make this transition happen smoothly. From a technical perspective, many of our forecast products had to be changed to include the new counties. Communication and distribution software had to be changed to ensure that we received the

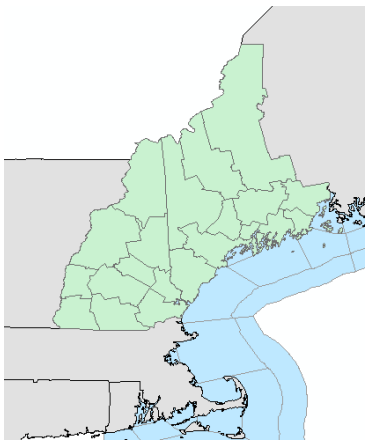

Figure 1: The GYX County Warning Area now includes all of New Hampshire

information we needed, and that the products we issued got where they needed to go. In addition, the graphical software that we use to generate many of our forecast products had to be changed to allow for the increased area.

Over the years that the Taunton office served southwest New Hampshire, they built relationships with many people and organizations. Prior to the transition, we met with emergency managers to assure them that they would continue to receive the same level of service from our office. We also created an emergency managers weather briefing web page that we update twice daily. We attempted to contact all weather spotters in those counties so that we could assign them new weather spotter IDs, and to provide them with contact information for our office. In addition, we reached out to the cooperative observers in that area and started servicing their equipment. New climate products have begun being issued for Manchester (MHT) as well.

With the addition of Hillsborough and Cheshire Counties, our office now serves an area of about 21,000 square miles and a population of about 2.3 million residents. Hillsborough and Cheshire Counties account for about 1580 square miles and 480,000 of those people. Manchester and Nashua are now the two largest cities in our forecast area in terms of population.

Blizzard of 2015 Rocks New England

By Michael Kistner, Meteorologist Intern

On January 27th a significant nor'easter struck Eastern New England. The high winds and heavy snow brought blizzard conditions across most of coastal Maine, New Hampshire, and southeast New England. In Portland, ME 23.8 inches of snow fell, which ranks as the 4th largest snowstorm to hit the city since records began in the early 1940s. Many areas across Southern New Hampshire approached 30 inches or more of snow and just across the state border, Worcester, MA broke an all-time record snowfall with 34.5 inches reported.

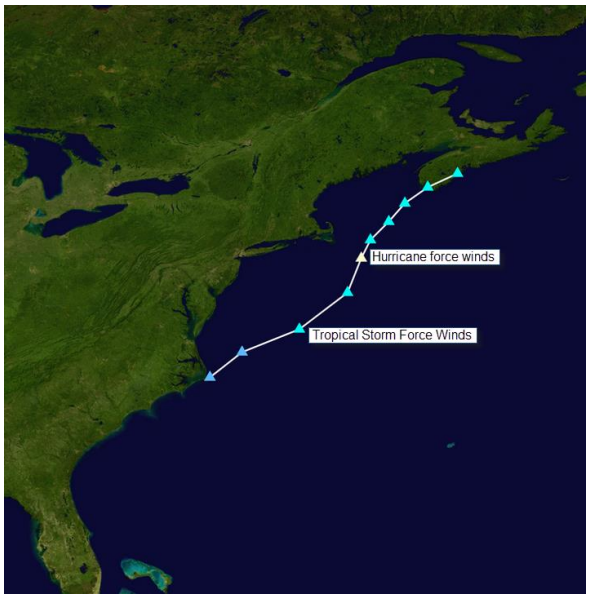

Figure 2: Track of the center of low pressure as it moved up the East Coast.

The Blizzard of 2015 was a powerful storm. In many ways it was similar to the Blizzard of 2013, although the 2015 storm was slightly weaker and impacted a smaller area. The

storm will likely be remembered for many years to come, as it was the start of a month long torrent of snowfall that caused numerous problems from roof collapses to draining town budgets with snow removal efforts.

The Blizzard of 2015 formed in a similar way as many nor'easters have in the past. An Alberta Clipper, which is a fast moving system that lacks any significant moisture and gets its name from the Canadian Province where the low forms, dropped southeastward and raced across the Upper Midwest. This system would eventually start to track eastward across Kentucky and eventually into West Virginia. The low would continue to weaken as it passed the Appalachian Mountains and a new surface low pressure formed off the Mid-Atlantic Coast. Meanwhile, cold high pressure was stationed over Southern Quebec. The cold air mass in the north would meet up with the warm and moist air mass over the Gulf Stream and the result was rapid cyclogenesis or "bombogenesis." The storm would continue to rapidly intensify as it tracked northeast and the powerful low with hurricane force winds was stationed just to the east of Cape Cod by 7AM on January 27th. The storm continued to push off to the northeast from there and pounded Southern New Hampshire and Eastern Maine with heavy snow and strong winds into the evening hours. Figure 2 on the prior page shows the track of the low as it moved up the East Coast. The heaviest snowfall occurred from Eastern Massachusetts through Downeast Maine. It is typical for nor'easters to develop very heavy snow bands imbedded within mostly widespread moderate snowfall. It is these bands which provide the heaviest snowfall and can cause storm total snowfall to vary drastically even over short distances.

So how do nor'easters like the Blizzard of 2015 develop these heavy snow bands? The counterclockwise flow around the storm pumps moisture from the Atlantic over the cold dry air mass over land via a low level jet stream. Where these two air masses meet a tight temperature gradient sets up from the mid-levels of the troposphere down to the surface. This leads to strong vertical motion along the frontal boundary that sets up within this gradient. The tight temperature gradient combines with strong convergence of moist air at the boundary leading to the formation of the heavy snowfall bands. The bands usually set up from northwest to southeast and are usually positioned west-northwest of the surface low pressure center. The observed snowfall map from the Blizzard of 2015 indicates where the heavy snowfall band set up over the southern half of our forecast area (Figure 3).

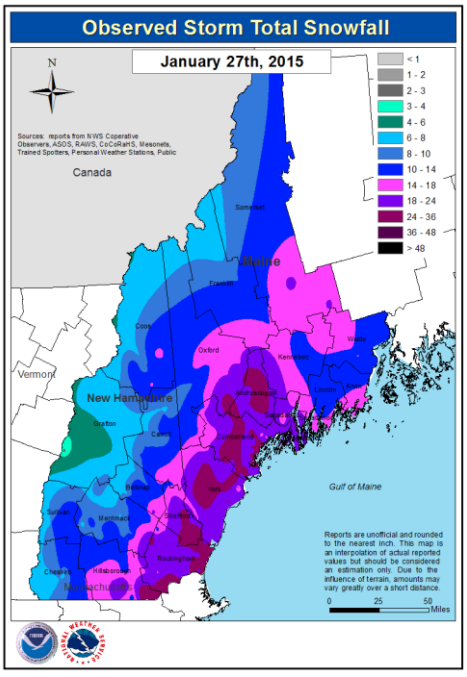

Figure 3: Map of storm total snowfall from the Blizzard of 2015.

Amounts just outside the band were in the 6 to 14 inch range, but inside the band the amounts were between 20 and 30 inches with drifts up to 6 feet deep. During the peak of the storm, snowfall rates were as high as 4 inches per hour and combined with the 40 to 50 mph wind gusts to bring the visibility down to one quarter mile or less across much of the area.

Why do we use the term "blizzard" to describe this storm as opposed to just another nor'easter? A blizzard is the name given to an extreme winter storm which contains the combination of snow and strong winds capable of producing whiteout conditions. The NWS defines a blizzard as having sustained winds or frequent gusts to 35 mph or higher along with heavy falling or blowing snow, reducing visibility to one quarter mile or less. Once these conditions are met for 3 hours or more, the NWS considers it to be a blizzard. These blizzard criteria were met across the coastal plain of Maine from Downeast through the Midcoast and Portland and into southeast New Hampshire as far west as Concord and Manchester. Blizzard conditions were also observed in Massachusetts. Blizzards are one of the most dangerous types of winter storms as whiteout conditions and heavy drifting can make travel impossible.

The highest snowfall totals from the Blizzard of 2015 were comparable to amounts seen from the Blizzard of 2013 across Southwest Maine and Southern New Hampshire. However, the Blizzard of 2013 was a stronger storm reaching a central pressure of 968mb, 7mb lower than the lowest pressure reached by the Blizzard of 2015. The peak wind gust from 2013 blizzard was 89 mph on Mount Desert Rock, Maine while this year's storm saw a peak gust of 78 mph on Nantucket. The track of the storm in 2015 was a bit further east than the Blizzard of 2013, which confined the higher winds to the coastal counties and limited the amount of power outages. One more comparison of these two storms is the rating they received from the Regional Snowfall Index (Figure 4). The Blizzard of 2015 was rated a Category 3 with an RSI score of 6.16 and the Blizzard of 2013 rated a Category 4 with an RSI of 10.09.

Category	RSI Value	Description
1	1–3	Notable
2	3–6	Significant
3	6–10	Major
4	10–18	Crippling
5	18.0+	Extreme

Figure 4: Description of the Regional Snowfall Index scale, a system used by NOAA to assess the societal impact of winter storms. The Blizzard of 2015 a 6.16 while the 2013 Blizzard rated a 10.09.

Both storms were historic blizzards in parts of Maine and New Hampshire. The likelihood of seeing a similar storm in any given year is less than 2%. To experience two such storms within just two years of each other is a very rare event. Those of us who enjoy snow and forecasting snowstorms were excited at this rare treat. The rest of us had to cope with digging out from a couple more feet of snow.

NWS Staff Profile

The staff profile column introduces you to a new NWS staff member every issue. This issue we introduce you to General Forecaster Chris Legro.

What is your role at the office? In addition to issuing daily forecasts for New Hampshire and western Maine, I also lead or assist in the program areas for radar, severe weather, aviation, science, and storm spotter training.

How long have you worked for the National Weather Service in Gray? 4 years

Where else have you worked? I have interned at the forecast office in Taunton, MA, and worked as a meteorologist-in-training at the Quad Cities, IA/IL forecast office for 2.5 years.

Where did you grow up? Rhode Island

Where did you get your education? I received my BS in atmospheric science at Cornell University and received my Masters in environmental studies (atmospheric concentration) from UMass Lowell.

How did you first get interested in weather? My first weather memories are from the late summer and fall of 1991. Hurricane Bob made landfall in Rhode Island, and the eye passed right over my hometown. I was fascinated by the sunshine and calm in the center of the eye, preceded and followed by such lashing winds. Just a few months later the Perfect Storm impacted New England, and solidified my interest.

What is the most challenging aspect of your job? That you can never know it all! The job is a constant learning process. You can work in meteorology in the same area for decades, and still not know everything there is to know. The science is constantly evolving, and it's a challenge and pleasure to try and keep up with those changes.

What is the most memorable event that you have worked? I have worked many significant events in my nearly 7 years working for the National Weather Service. I have had the chance to work record setting snowstorms at two different forecast offices. One was the Groundhog Day Blizzard of 2011, the largest snowstorm in the Quad Cities, with 18.4 inches. The second was the February 2013 blizzard, the largest snowstorm at Portland with 31.9 inches. Oddly enough, both storms broke records set in January 1979. However, the event that stands out the most was the June 5, 2010 tornado outbreak across the Midwest. Thunderstorms formed in my forecast area and tracked through the Ohio Valley and into the Northeast, producing at least 53 tornadoes along the way. A large EF2 tornado formed in my eastern forecast area. It was the first time I surveyed storm damage that included houses with roofs and walls missing. The best part about it was that everyone in the path took heed of the warnings and there were no injuries.

NWS Staff Become New HAM Radio Operators

By Stacie Hanes, Senior Forecaster

The National Weather Service in Gray, Maine recently hosted a series of amateur radio (HAM) radio classes at our office. The training was conducted by Thom and Tim Watson with several NWS staff members taking part in the training.

Figure 5: NWS staff participated in amateur radio (HAM) training in January, with 3 new staff members receiving HAM licenses.

The NWS has a long and wonderful history with the amateur radio community. SKYWARN is a volunteer program developed by the NWS in which trained volunteers report essential information on all types of weather hazards. These reports, along with Doppler radar and other technology allow the NWS to issue more accurate and timely warnings. For decades, amateur radio operators have provided this invaluable service in support of the SKYWARN storm spotter program by using their unique communications capabilities to share critical information between the NWS, the local emergency management officials, and storm spotter networks. Often the first news of a tornado on the ground or damaging winds will come from SKYWARN amateur radio networks. Most NWS offices have a HAM radio set-up in the office and encourage radio operators to assist during severe weather, either at the office or at home communicating via SKYWARN radio networks.

The training took place over the course of four weeks. The first lesson discussed the history of radio, including the discovery of radio waves and how the various radio bands have been used to communicate. HAM radio communication was also very important in World War II. Amateur radio technicians communicate with people all over the world (and even astronauts in space!) using voice, data, and even Morse code.

The next lesson reviewed the various radio bands and how they are licensed. Federal law regulates the use of radio waves with different classes of operators which operate at different frequencies. This class was designed to prepare us to be Technician class operators, requiring the most basic type of license. The basic functionality of a home radio station was also discussed, including the transmitter, receiver, and other gadgets needed to make our own radio stations either at home or mobile.

The final lesson discussed electricity and how to safely use electrical equipment to operate a radio station. More about radio waves was also discussed, including how they move through space. These waves can be reflected off of objects and terrain or reflected off layers in the atmosphere in order to send a signal over a great distance. It is even possible to bounce a signal off the moon and transmit around the world!

Once completing the required test, three NWS staff members obtained amateur radio licenses, complete with unique call signs. This will prove very useful during the upcoming severe weather season. We want to thank Tim and Thom Watson for generously donating their time to help train NWS staff and prepare them for the HAM radio test.

Storm Spotters: What's Their Role?

By Chris Kimble, General Forecaster

The job of a NWS forecaster involves putting together many different pieces of information and using it to come up with a forecast. When the weather turns violent, it becomes even more important to have as much information as possible in order to get warnings out to people who may be impacted by the weather. Summer thunderstorms can be some of the most exciting and challenging aspects of our jobs, as thunderstorm development happens very quickly and fast decisions must be made to get the word out about a severe thunderstorm, flash flood, or a tornado. The most high-profile tool we have is the Doppler radar, but arguably the most valuable is a quality report from our network of storm spotters. As powerful as Doppler radar is, it still has its limitations. Forecasters can see deep into a thunderstorm to assess its intensity, movement, and wind flow. But seeing inside the storm does not tell us directly what is happening at the ground. That's where the storm spotter comes in. Storm spotters help us fill in the gaps between what we expect to be happening and what is actually happening.

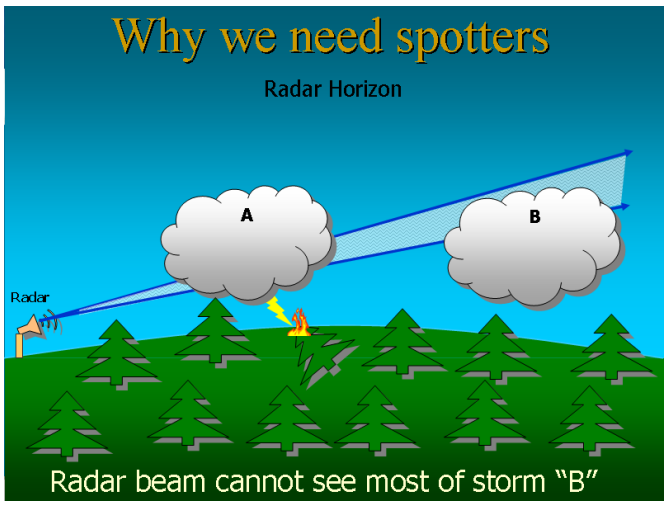

Figure 6: Storms farther from the radar will have much of their low levels obscured. The NWS relies on storm spotters to help fill in the gaps!

One of the biggest limitations of Doppler radar is its inability to see what's happening at ground level. This is what we call the radar horizon. As the radar looks out toward the horizon it is looking at a slight tilt. The farther out it looks, the higher its view is above the ground. Add into

this the fact that the Earth curves away from the radar beam, and there can be a large area of the atmosphere the radar doesn't see. For a storm 75 miles away, the radar cannot see below about 8,000 feet. A lot of important things can go on below this level!

As a reminder to our valuable storm spotters, these are some of the most helpful things you can observe and relay to the NWS:

1) Damage – Any damage caused from a storm, we want to know about it. This can be an indication of a severe thunderstorm.

2) Hail – Hail of any size is valuable information. The NWS considers hail that is 1 inch in diameter (the size of a quarter) or larger to be especially important as it is likely to cause damage.

3) Wind – Strong thunderstorm winds are often the most damaging aspect to thunderstorms in New England. The NWS considers wind gusts to 58 mph or higher strong enough to cause damage.

4) Flash Flooding – Heavy thunderstorm rains can sometimes lead to flash flooding. Flash flooding occurs when water levels rise quickly and inundate normally dry areas. When roads become impassable or damaged, it is important that this information is passed on to the NWS.

5) Storm structure – Cloud types and storm structure is discussed in detail in the spotter training course. Features like wall clouds, funnel clouds, and even shelf clouds can be important signals of what's going on within the thunderstorm. If you have a good view of the storm and can let us know what you see, give us a call!

Submit Storm Report

Storm spotters are encouraged to relay reports to the NWS as soon as it is safe to do so. The sooner the information is passed on, the greater value it has to people downstream. Follow up calls may be made after a storm goes by, but real time reports are always the most valuable! Submit reports by calling the NWS in Gray at 1-800-482-0913 or by submitting a storm report from our website. http://www.erh.noaa.gov/gyx/stormreport.htm

Lightning Safety Awareness Week

By John Jensenius, Warning Coordination Meteorologist

The 2015 Lightning Safety Awareness Week is set for June 21st through June 27th. This year, the national kickoff event for the week will be held at Storyland in Glen, New Hampshire on Saturday June 19th. In addition, a series of lectures will be held prior to the main kickoff on Friday evening, June 18th at the Mount Washington Weather Discovery Center in North Conway.

While many of you may have visited Storyland as a child or with your children, you've probably never noticed the lightning protection on many of the buildings in the Park. Those animal guards standing atop one of the buildings aren't just holding spears, but are really pointing lightning rods toward the sky. And the flags on the castle are also lightning rods. In fact, if you look around at many of the buildings, you'll find that the spires and flags are not there just for decoration, but also to protect patrons and workers in the park. In addition to the lightning protection equipment, the park also has equipment to monitor for approaching lightning activity and a plan to get people to safety when thunderstorms threaten.

Figure 7: Statues and spires at Storyland are not just there for decoration. They are also there to serve as lightning rods to protect patrons from lightning.

Storyland's efforts set a good example of what can be done to protect the public from the dangers of lightning. It's also just as important for patrons to react appropriately. To help educate the public and get people to safety, Storyland is creating signage to identify safe buildings and to heighten awareness to the dangers of lightning.

Although many of the details for the two Lightning Safety Awareness Week kickoff events are currently being worked out, it's not too soon to mark your calendars and plan to join us. Lectures on lightning, lightning safety, and lightning protection are planned for Friday evening, June 18th at the Mount Washington Observatory Weather Discovery Center. The main kickoff event will be held at Storyland on Saturday, June 19th, and will include fun and information for both young and old. Please visit our web site in early June for more information on these exciting events! For more information on lightning safety, visit www.lightningsafety.noaa.gov

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Photo by Stacie Hanes