Photo by John Jensenius

The Coastal Front

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Skywarn Spotter Training

By Chris Kimble, Forecaster

Over the last several decades, technology has greatly improved our ability to observe and forecast the weather. Tools like satellite and radar provide more insight than ever into what the weather is doing right now. Computers have allowed for greater integration of all the data, and complex forecast models provide valuable insight into how weather systems will evolve over the next several days. But, no matter how advanced technology has become, forecasters rely on volunteers to report the ground truth of what's really happening in their town.

Figure 1: A supercell thunderstorm tracks across Portland, Maine on June 23, 2013. Photo by Chris Legro.

While weather radar is a great tool to view thunderstorms and other precipitation events above the ground, there are often significant gaps between what the radar sees above the ground and what is observed at ground level where it matters most. Skywarn Storm Spotters provide invaluable information to NWS forecasters during and after severe thunderstorms, tornadoes, flash floods, and snow storms.

If you have an interest in weather and want to become a volunteer Skywarn Storm Spotter, attend one of our Skywarn training sessions. There will be several training sessions offered this spring and summer. For dates and locations visit our website at: http://www.weather.gov/gyx/skywarn_skywarn.htm.
If your organization would like to volunteer to host a spotter training session, contact the National Weather Service at 207-688-3216.

Be Prepared for Severe Thunderstorms

By John Jensenius, Warning Coordination Meteorologist

The threat of thunderstorms increases as the weather gets warmer. While all thunderstorms contain potentially-deadly lightning, some present other threats, as well. These threats include high winds, hail, tornadoes, and flash flooding.

There are three basic ingredients needed for the formation of thunderstorms: moisture, an unstable atmosphere, and a trigger (a source of lift). **Moisture** (water vapor in the air) is needed for cloud formation, cloud growth, and the development of precipitation within the cloud. An **unstable atmosphere** allows warm, moist air near the ground to rise rapidly to higher levels in the atmosphere where temperatures are much colder. A **trigger** sets the atmosphere in motion, such as a cold front or other atmospheric phenomenon that causes the air to rise.

All three ingredients contribute to the formation of a thunderstorm. In fact, as the magnitudes of these ingredients increase, so do the chances that a thunderstorm could become severe.

The National Weather Service uses a WATCH and WARNING program to alert the public to potentially severe weather. In the summertime, Watches and Warnings are issued for severe thunderstorms, tornadoes, and flash flooding.

A WATCH indicates that the atmospheric conditions are favorable for severe weather to develop. A WARNING indicates that severe weather is imminent or is already occurring. If a WARNING has been issued for your area, be prepared to seek a safe shelter if you are in the path of the storm.

Here are basic definitions of the severe weather for which Watches and Warnings are issued:

SEVERE THUNDERSTORM - A thunderstorm that produces damaging wind gusts of 58 mph or more and/or hail 1 inch or greater in diameter.

TORNADO - A violently rotating column of air that extends from the cloud to the ground.

FLASH FLOOD - Flooding that occurs very rapidly, usually due to very heavy rain from a slowly moving thunderstorm.

SPECIAL MARINE WARNING - Issued for marine areas for storms with frequent wind gusts of 34 kts (about 39 mph) or greater.

If you see any signs of a severe thunderstorm or you observe any damage caused by severe weather please report what you've observed to the National Weather Service and any appropriate law enforcement agencies.

Dual Pol Radar Looks Deeper Inside Thunderstorms

By Chris Legro, Forecaster

The National Weather Service office at Gray is coming up on the two year anniversary of the radar's dual polarization upgrade. This upgrade has allowed forecasters to see not only the relative size (horizontal), but also the shape (horizontal and vertical) of their targets. This is an invaluable tool for discriminating between flat snowflakes, hamburger shaped rain drops, and round sleet pellets. However, dual polarization is useful beyond the winter season as well. In the warmer months, it is just as important to be able to tell the difference between hail and rain inside thunderstorms. A large rain drop can return power to the radar that is similar to that of a hailstone. To a forecaster in the office, this can make two very different storms appear the same on a computer screen. Dual polarization (Dual Pol) allows a deeper look inside the storms.

By July of 2013, much of the Northeast was stuck in a very warm and humid air mass. Warm, humid air is great fuel for thunderstorms but difficult for forecasters, because some days that can mean hail and some days that can mean heavy rain. In many cases, this is the difference between a severe thunderstorm warning and a flash flood warning. On July 2nd, this was the exact set up facing the forecasters at Gray.

Around 3:00 PM, a cluster of thunderstorms began to form west of the Connecticut River, to the southwest of Lebanon, New Hampshire. At 3:06 PM, this cluster crossed the river with reflectivity (power returned) values approaching 45-50 dBZ. The image shows some of the dual polarization variables that helped forecasters diagnose what was falling from the sky over western New Hampshire. Differential reflectivity (ZDR - top right) showed targets that were wider than they were tall, indicating larger rain drops. Specific differential phase (KDP) was approaching 1 deg/km, which meant that these storms had a higher liquid water content. With additional information

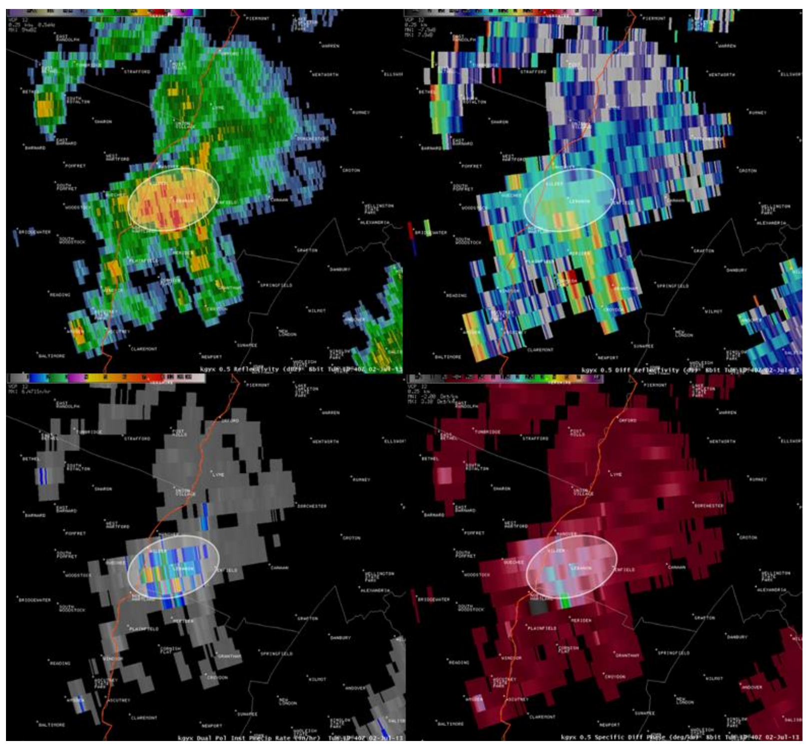

Figure 2: Reflectivity (Z - top left) shows a thunderstorm has moved into western New Hampshire. Differential Reflectivity (ZDR – top right) indicates large rain drops are forming. Specific Differential Phase (KDP – bottom right) shows a high liquid water content in the thunderstorm. Instantaneous Rainfall Rate (bottom left) indicates very high rainfall rates of 4 to 6 inches per hour. The result was flash flooding in Lebanon, NH as very heavy rain fell over a short period of time.

about the shape of the targets and their liquid water content, dual polarization now allows for a more accurate estimate of rain rate at any given time. In the bottom right, instantaneous precipitation rates peaked between 1 and 2 inches per hour, which is fairly typical for summertime thunderstorms.

About 20 minutes later reflectivity increased only a small amount, normally not a cause for any alarm. However, dual polarization variables were telling a much different story. ZDR had increased to between 2 and 3 dB, indicating large, hamburger shaped rain drops were dominating the radar signal. KDP spiked near 3 to 4 deg/km, which is reserved for only very high liquid water content. This combination produced instantaneous precipitation rate estimations approaching 5 inches per hour. Within the next ten minutes forecasters had issued a flash flood warning for parts of Grafton and Sullivan Counties, including the city of Lebanon.

By 3:40 PM the cluster of thunderstorms had moved over Lebanon, and there was little change in radar presentation at the time. Reflectivity remained 45-50 dBZ, ZDR continued to show large rain drops dominating the precipitation, while KDP remained very high. The resulting instantaneous precipitation rates also stayed in the 4 to 6 inch per hour range. This was confirmed when the thunderstorms moved directly over the instrumentation at Lebanon Municipal Airport, dropping 1.50 inches of rain in just 30 minutes. The resulting flash flooding caused evacuations as well as millions of dollars in damage to homes, businesses, and roadways across the area. Without the aid of Dual Pol radar, this event may have gone unnoticed until the storms crossed the airport, costing the people of western New Hampshire 30 minutes lead time on a dangerous flash flood.

Winter Weather Review

By Chris Kimble, Forecaster

	HIGH	LOW	AVE	PRECIP	Snow
December	31.5 (-5.8)	17.2 (-3.2)	24.4 (-4.4)	4.44 (+0.42)	26.2 (+13.0)
January	30.2 (-1.0)	12.6 (-0.8)	21.4 (-0.9)	4.05 (+0.67)	17.6 (-1.6)
February	31.4 (-3.2)	12.7 (-3.7)	22.1 (-3.4)	4.27 (+1.02)	34.2 (+22.1)
Winter 2012	31.0 (-3.3)	14.2 (-2.6)	22.6 (-3.0)	12.76 (+2.11)	78.3 (+33.9)

Table 1: Winter 2013-14 climate statistics and departure from normal for Portland.

Winter began near normal but took a sharp turn toward colder weather by the middle of December. The first significant snow of the season (and the largest) occurred on December 14-15 when 12.4 inches fell in Portland. Several more storms brought snow during the month along with an ice storm for the Midcoast region just before Christmas. Some of the coldest air in years was felt by the beginning of January with Portland falling to -14 degrees. The temperature fell to 0 or lower on 10 days during the winter. There was a brief break with above normal temperatures in mid-January, but the arctic chill returned by the end of the month. February continued the cold trend but added several more snow storms as well. February was the snowiest month of this winter season. All three winter months were colder than normal for the first time since 2003.

Ice Storm Causes Major Disruptions

By Chris Kimble, Forecaster

A few days before Christmas, a significant ice storm impacted much of the Midcoast and Capitol regions of Maine. From December 22 to December 24, several rounds of freezing rain fell with ice accumulations of half an inch to one inch occurring. This icy coating on trees was enough to cause many limbs to break and cause widespread power outages. During the peak of the storm, more than 100,000 customers were without power with some power outages lasting more than a week. It was a dark and cold Christmas for a lot of people.

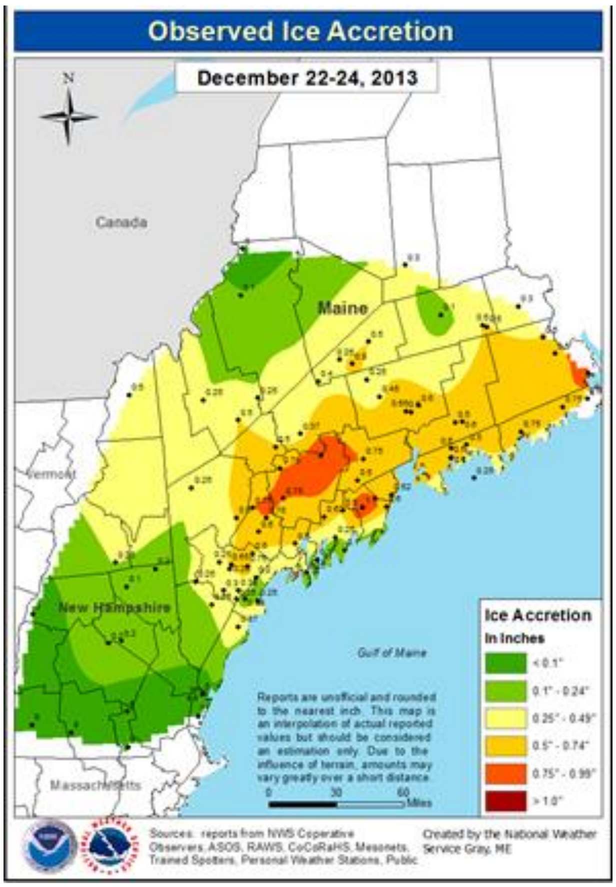

Figure 3: Total ice accumulation from December 22-24, 2013. The hardest hit area was the Midcoast and Capital region of Maine.

What caused all this ice? A cold front moved south across the region and then became stationary south of the area. Several waves of low pressure moved east along the front over the next few days, with the front moving back and forth across southern Maine. As each wave moved by, it spread warm, moist air northward. This air was warm enough to produce rain. But for those areas that remained to the north of the front, temperatures stayed below freezing in a shallow layer at ground level. The rain fell into this shallow cold layer and did not have time to freeze on the way down. As a result, this rain fell to the ground as liquid but froze after landing on the ground, trees, power lines, roofs, sidewalks, and roadways. Because much of the Midcoast region stayed to the north of the front as these waves brought more and more rain, the ice accumulation kept getting thicker. Eventually the weight of ice on trees was enough to cause the limbs to bend and break, falling onto power lines and homes.

The hardest hit area was from interior Cumberland County eastward to Augusta, the Midcoast, and Downeast. This was the first ice storm to affect this region since December 2008. After the ice finally ended, a prolonged period of cold weather followed. This made it even more difficult for people who had lost power and the ice remained on the trees for several weeks. Even though the ice storm happened before Christmas, Augusta did not rise above freezing again until January 6. People in this region will likely remember the dark, icy Christmas of 2013 for a long time.

Polar Vortex

By Mike Cempa, Senior Forecaster

Ten things you should know about the Polar Vortex:

1. It is a persistent large-scale upper level cyclone that exists in the Earth's northern and southern Polar Regions.
2. It is persistent, and therefore exists year-round, although it weakens in summer and strengthens in winter.
3. Its location can vary, but the most favorable locations are northern Canada and Siberia.
4. Because it is an upper air feature, it does not exist at the earth's surface.
5. It is not something that you can visibly observe, like tornadoes, lightning or thunderstorms.
6. When it is strongest, it becomes a closed circulation, and tends to trap some of the coldest air in the hemisphere in its circulation, both at the surface and aloft.
7. Several times during the winter, a chunk of the polar vortex breaks off and moves southward with the jet stream.
8. This past winter, hemispheric circulations, for the most part, kept the polar vortex over northern Canada, and also favored sending pieces of it southward to the continental U.S.
9. The Polar Vortex is not something new. It is a part of the normal weather patterns, and meteorologists have been talking about the polar vortex for many years.
10. In and of itself, it is not dangerous to humans, but the very cold polar air associated with it can be.

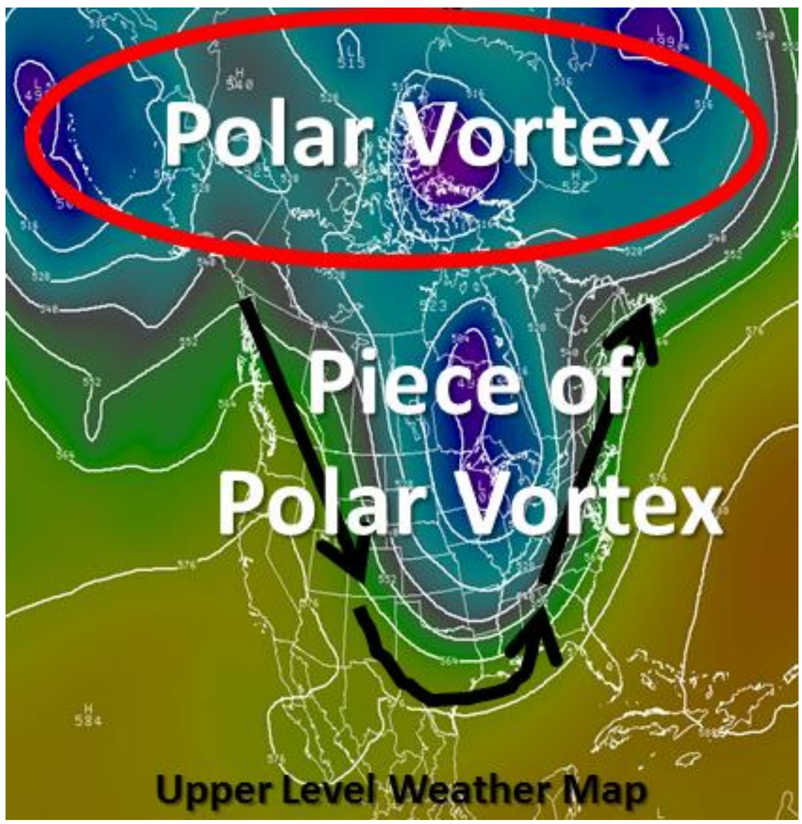

Figure 4: The Polar Vortex is a large scale cyclone that exists near the Earth's poles. Sometimes, pieces of this vortex get dislodged by the jet stream and can send very cold Arctic air southward.

NWS Staff Profile

By Margaret Curtis, Meteorologist Intern

The staff profile column introduces you to a new NWS staff member every issue. This issue we introduce you to Electronics Technician Scott Chick.

What is your role at the office? Primary Weather Service Radar Technician. I am the senior Electronics Technician, which basically means I've been here the longest. My responsibilities also include maintaining most of the electronic systems associated with the Forecast Office, remote weather data gathering equipment, and our NOAA Weather Radio transmitters. It's a total team effort between my coworkers and me that keeps the office equipment and computers functioning properly.

How long have you worked for the NWS in Gray? I was hired in 1992 when the office was still located at the Jetport in Portland. I was here when the office moved to Gray in 1994.

Where else have you worked? Prior to employment with the NWS, I worked as Electronics Technician at National Semiconductor and Fairchild Semiconductor in South Portland, Maine from 1984 until 1992. Prior to that, I served as a U.S. Navy Avionics Technician 1st Class (E6). During my just over six year enlistment, I worked on Douglas TA-4J Skyhawk avionics at VT-25, NAS Chase Field in Beeville, Texas from 1982 - 1984. Before that, I was a Temporarily Assigned Duty (TAD) technician from VP-26 or Patrol Squadron 26 (Lockheed P-3 Aircraft) at Naval Air Station Brunswick, Maine where I worked on a variety of aviation electronic systems at the Aircraft Intermediate Maintenance Department (AIMD). Prior to my Navy adventures, I was a dishwasher at a Caribou, Maine restaurant called Yusef's. I also worked for various potato farmers, either picking potatoes or driving a Potato barrel truck.

Figure 5: Scott Chick works as an Electronic Technician and helps maintain the office equipment. He is also heavily involved in maintenance on the WSRD 88D radar.

Where did you grow up? I spent my entire early life in Caribou, Maine. At age 18, I enlisted in the U.S. Navy and left home.

Where did you get your education? My education really began in Caribou, Maine. I still respect the school system there as several of my classmates and friends are still teaching there today.

My electronics education began by shadowing my father, John Chick. He was the sole Electronics Technician at the Caribou, Maine, National Weather Office, from the mid-1950s until his retirement in 1985. I use to pay attention and help my father out in any way I could when he was at the Caribou Office or visiting remote sites. My formal electronics training came from a combination of Navy avionics schools, National Semiconductor equipment maintenance schools, and over twenty training courses at our NWS Training Facility in Kansas City, MO.

How did you first get interested in weather? Growing up, I never had a strong interest in weather. After being laid off from National Semiconductor in 1992, I scrambled to find another electronics technician job. After sending out more than 140 resumes and finding no employment in Maine, my father suggested that I contact his old supervisor, Jack Lucas, at the Portland, Maine, NWS Forecast Office. My timing was perfect as there was a "Training Position" open. Jack helped me work through the application process and I was selected for the training position.

What is the most interesting part of your job? I would have to say working with some excellent technicians. In the early years of my NWS employment, I was so fortunate to work with and learn from Area Electronics Supervisor Jack Lucas, and ET Shop Supervisor Senior Technician Bob Young. Both were masters of electronics knowledge, people with great pride, excellent technical skills and unwavering support for their employees and co-workers.

What is the most challenging aspect of your job? Today, technology changes much more quickly than back in my early employment days. This makes it difficult for technicians to become "experts" or Master technicians. The job now requires us to document our work more thoroughly which requires much more in the way of administrative work for us. When I was first employed in the NWS, I came to work, I was assigned my daily tasks, and I completed them. Documentation of my work was summarized on a bi-weekly basis. Today, much more time is spent on computers reading and responding to emails, reviewing detailed documentation of maintenance tasks, and taking mandatory on-line courses.

What is the most memorable weather event that you have worked? Co-worker Dave Chouinard and I responded to a failure of our NOAA Weather Radio broadcast on the summit of Mt. Washington a few years back. This was probably the most difficult and demanding maintenance task of my career. We replaced the antenna and RF cable. It took two trips in two days due to the scheduling of summit trips. Winds exceeded 80 mph with a gust to over a 100 mph while snow and rime ice accumulated quickly. I had to tether the wrench to my wrist, and it took both arms to hold the wrench in place while attempting to remove the mounting bolts. Normally a five minute task in calm weather, it took more than twenty minutes to remove the two U-bolts that secured the fiberglass antenna mast to the mount as wind gusts tried to remove me from the summit and coated me with rime ice as fast as I could break it off.

A Note from the Editors

The NWS in Gray has brought you the Coastal Front newsletter 4 times per year since 2010. It is our pleasure to bring you articles about northern New England weather each season. Starting this year, the Coastal Front will begin producing new issues twice annually: with Spring and Fall editions. We hope to provide more detailed content in each issue of the Coastal Front, while continuing to expand the NWS presence on social media including Facebook and Twitter. We will also be providing more content on our webpage as well. www.weather.gov/gray

If you aren't already following us on Facebook, go to our page and "Like" us. We normally provide several updates per day about recent and upcoming weather as well as other interesting weather-related blurbs.

Our next scheduled edition of the Coastal Front will be for the Fall of 2014. As always, thanks for reading!

Like us on Facebook!

www.facebook.com/US.NationalWeatherService.Gray.gov

For questions, comments, or suggestions contact us at

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Photo by Chris Legro