The Coastal Front

Fall 2010

Volume I-2

Inside This Issue:

Editor-in-Chief:
Chris Kimble

Editors:
Jean Sellers
Stacie Hanes
David Glenn
Mike Cempa

Meteorologist in Charge (MIC):
Albert Wheeler

Warning Coordination Meteorologist (WCM):
John Jensenius

Science and Operations Officer (SOO):
Dan St Jean

To subscribe, email: GYX-Newsletter@noaa.gov

July 21 Supercell Tornadoes

By Chris Kimble, Meteorologist

All the right ingredients came together at the same time during the afternoon of July 21, 2010 to produce one of the biggest tornado outbreaks in Maine history. Southerly winds brought warm, moist, unstable air and allowed thunderstorms to form. The strong westerly jet stream above the surface allowed supercell thunderstorms to form and begin to rotate. And the low level boundaries were able to increase the spinning motion that allowed tornadoes to form. It is rare for all of these ingredients to come together in Maine and produce this many tornadoes.

There were more than 100 reports of severe weather (damaging winds or large hail) from New York to Maine. There were also 4 tornadoes in New England that afternoon, including 3 in Southern Maine. Three tornadoes in one day ties the record for the most tornadoes ever recorded in the same day in the state of Maine (also occurred on 5/31/2009, 11/7/1971, 7/31/1971, 7/1/1963, and 7/2/1958).

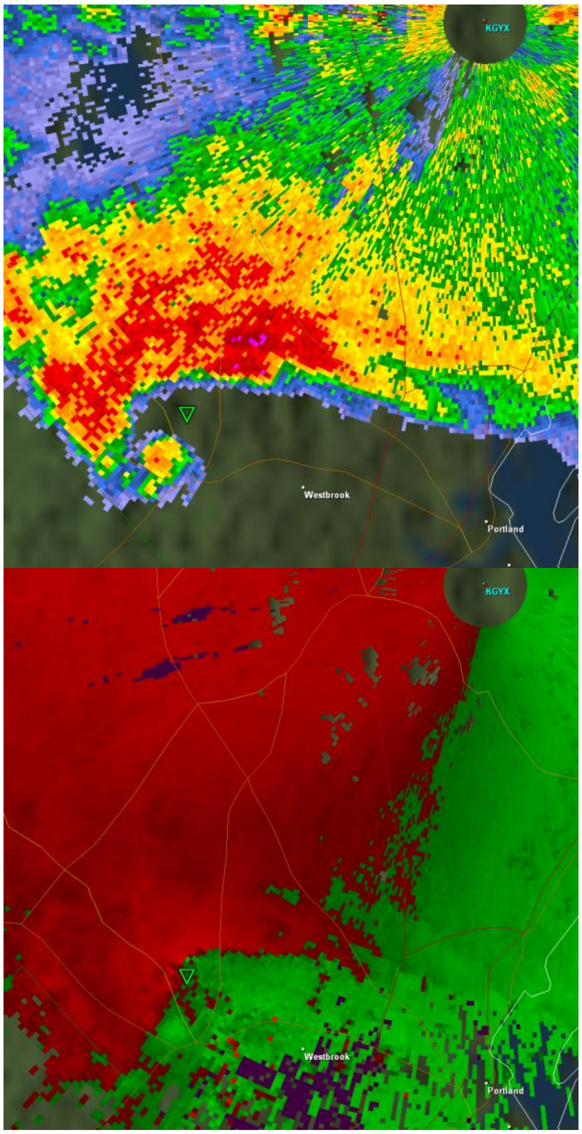
Surface low pressure tracked eastward out of the Great Lakes and into Northern New England. A warm front pushed northward ahead of the surface low, allowing southerly winds to bring warm moist air into southern Maine and New Hampshire. Dewpoint temperatures near 70 degrees indicated very high moisture content in the air: a key ingredient in atmospheric instability which produces thunderstorms.

Tornado damage in Gorham, ME

While a warm front turned winds to the south at the surface, the jet stream 3 miles above the surface was screaming out of the west at 50 knots. The difference between the wind at ground level and the wind above the ground, what meteorologist refer to as wind shear, is a key factor which can allow supercell thunderstorms to form. It is these supercell thunderstorms which produce the majority of severe weather, including tornadoes.

July 21 Supercell Tornadoes (continued)

By mid afternoon thunderstorms had already begun to form. Thunderstorms were aided by the several surface boundaries in place. A warm front was stretched from near Laconia, NH to Portland, ME and along the Midcoast. A cold front was pushing into New Hampshire from the west. These boundaries are the borders of different air masses, and the wind tends to converge along the boundaries, helping to force the air to rise and form thunderstorms. The varying wind directions near the boundaries can also promote spinning in the atmosphere and make tornado formation more likely.



Radar reflectivity (top) and velocity (bottom) image at time of Gorham, ME tornado on July 21, 2010

Several of the thunderstorms that formed during the afternoon were able to take advantage of the unstable air along with the wind shear and become supercell thunderstorms. These thunderstorms are stronger, and usually last longer than ordinary thunderstorms. The rotation in supercells is where most tornadoes form. As the supercells moved from west to east along the warm front, they were able to absorb some of the spinning air near the boundary and produce tornadoes.

The first tornado occurred near Limerick in northern York County at 6:19 PM. It tracked on the ground for about 1.5 miles, snapping trees and damaging buildings. It was rated an EF-1 on the Enhanced Fujita scale, with winds estimated at 90 mph. The same storm continued moving east and produced another tornado in Gorham, Cumberland County at 6:40 PM. This tornado stayed on the ground for about 5 miles as it uprooted thousands of trees and damaged buildings from Buxton through Gorham. This was also rated an EF-1 with winds estimated at 90 mph. The storm continued through the northern part of Portland and along the Midcoast, following the warm frontal boundary. Fortunately it did not produce any more tornadoes, but there were many other reports of wind damage especially in Phippsburg and Georgetown.

Another thunderstorm later tracked through Southern Maine and produced an EF-1 tornado in Alfred at about 7:24 PM. This tornado snapped trees for 5 miles before lifting. The storm continued to the east and caused straight line wind damage in Saco.

Overall three tornadoes occurred in southern Maine that afternoon. Although there have been other times in the past when as many as 3 tornadoes were recorded on the same day in Maine, this is the first time that this many tornadoes have occurred in Southern Maine. Thousands of trees were snapped or uprooted, several buildings were damaged, and many were without power. Hopefully it will be a long time before it happens again!

Storm Ready

By David Glenn, Meteorologist

"Some 90% of all presidentially declared disasters are weather related, leading to around 500 deaths per year and nearly $14 billion in damage. StormReady, a program started in 1999 in Tulsa, OK, helps arm America's communities with the communication and safety skills needed to save lives and property–before and during the event. StormReady helps community leaders and emergency managers strengthen local safety programs." ***- www.stormready.noaa.gov***

StormReady is a "grass roots" program sponsored by NOAA's National Weather Service that focuses on improving communication and severe weather preparedness for local communities. It helps emergency managers and community leaders strengthen local hazard mitigation and emergency response plans.

What are some benefits of becoming StormReady?

The StormReady program encourages communities to take a proactive approach to improving local hazardous weather operations. Here are a few of the benefits of becoming StormReady:

- Improves the timeliness and effectiveness of hazardous weather warnings for the public;
- Provides detailed and clear recommendations which will help local emergency managers establish and improve effective hazardous weather operations. It can also help justify costs and purchases needed to support hazard mitigation and emergency response plans;
- Rewards local hazardous weather mitigation programs that have achieved a desired performance level;
- Provides a means to possibly acquire additional Community Rating System points assigned by the National Flood Insurance Program (NFIP);
- Provides an image incentive to communities, which once recognized, can identify themselves as being StormReady and can help ensure your community is prepared for other civil emergencies.

What does it take to become StormReady?

The StormReady program is voluntary and costs nothing to apply. Some communities may need to upgrade their emergency preparedness operations to meet StormReady program guidelines. Established emergency management programs should incur little or no additional expense. Here are some necessary tasks:

- Incorporate your community's severe weather threats into your community's hazard mitigation and emergency response plans; Establish a 24-hour Warning Point;
- Establish multiple ways to receive severe weather warnings and forecasts and to alert the public; Create a system that monitors weather conditions locally; and,
- Promote the importance of public readiness through community seminars, spotter training and by conducting emergency exercises.

What areas across Northern New England are StormReady?

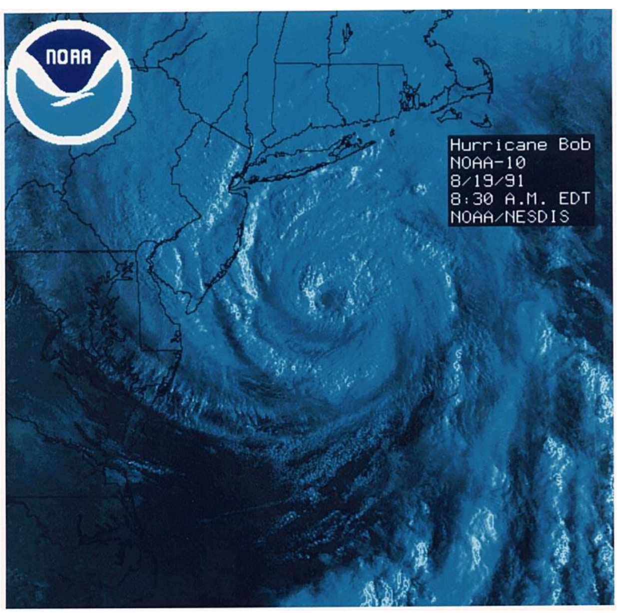
In Maine there are three counties (Aroostook, Penobscot, and Washington), three communities (Bangor, Caribou, Fort Fairfield), and one university (University of Maine at Presque Isle) participating in the StormReady program. New Hampshire is without any participation. To learn more about the StormReady program please visit the StormReady national website or contact our Warning Coordination Meteorologist by phone (207-688-3216) or email at John.Jensenius@noaa.gov.

Tropical Cyclones in Maine and New Hampshire

By John Cannon, Senior Forecaster

New England hurricane awareness week was held on July 19th-23rd. This recognition week, along with outreach visits by the hurricane hunter P3 Orion aircraft to our region earlier in the year, are important reminders that tropical cyclones can have significant impacts, even as far north as Maine and New Hampshire.

It has been quite a few years since Maine and New Hampshire have been directly affected by a Hurricane. Unfortunately, this can lead to complacency among coastal residents. The last hurricane to impact our area was in 1991, when hurricane Bob made landfall in southern New England and tracked across the coast of Maine. Bob produced a peak wind of 61 mph in Portland with winds as high as 92 mph in Wiscasset. Extremely heavy rainfall is also common with hurricanes and Bob was no exception. 7.83 inches of rain fell in Portland, creating flooding throughout the region, with nearly six inches of the rain falling in only six hours.



Visible satellite image as Hurricane Bob approaches New England in 1991.

Before Bob, Hurricane Gloria produced wind gusts as high as 86 mph on Goat Island with 80 mph gusts in Old Orchard Beach in 1985. This storm was nearly rain-free however, dropping less than a half inch in Portland.

Despite Hurricane Gloria being a "dry" storm, fresh and salt water flooding is a big threat in tropical cyclones. The interaction of extreme fresh water runoff into coastal estuaries and bays can interact with incoming storm tides and large battering waves to produce structural damage and coastal inundation along our coastline. In an effort to help visualize this coastal flood threat, a coastal flood nomogram has been created to forecast damage potential along the sandy southwest coast of Maine and New Hampshire. The real-time hourly forecast animations of storm tides and ocean waves can be found at http://www.gomoos.org/coastalflooding.

The dynamics of tropical systems change, however, as they reach northern New England, which often creates a challenging forecast. The cold North Atlantic waters, combined with the proximity of the jet stream, usually cause tropical systems to undergo "extra-tropical transition". This means the storm is transitioning from a warm core system to a Nor'easter type, cold core storm or vice versa (the most famous transitioning storm of modern times to affect the east coast was the "Perfect Storm" in 1991). This is important for citizens to know, since wind fields and rain bands can expand around this type of transitioning system. To view computer models that visually depict storms undergoing "extra-tropical transition", go to http://moe.met.fsu.edu/cyclonephase.

To help educate coastal residents, information on how you can prepare for a hurricane can be found at http://www.erh.noaa.gov/gyx/hurricane_awareness.htm.

Spring Weather Review

By Steve Capriola, Senior Forecaster

Spring time weather in Portland can be extremely variable. Heavy snows can fall in March and early April, while prolonged periods of cloudy, drizzly, foggy weather can plague the coastline for days on end. But none of that seemed to happen this spring as much of New England enjoyed one of the finest springs in memory with record warm temperatures in spring 2010.

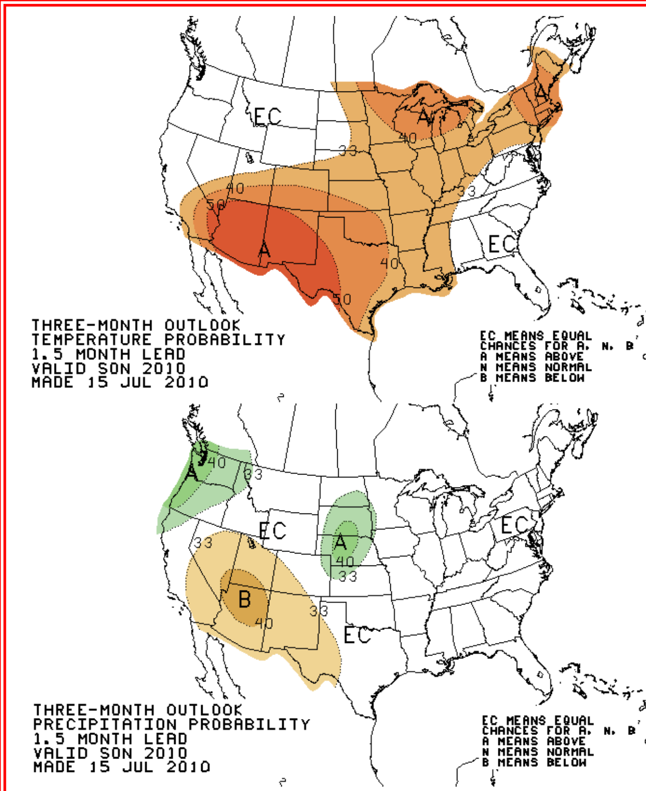
The average temperature for the spring months of March, April and May was 48.9 degrees; nearly two degrees above the old record warm spring of 47.0 degrees which occurred in 1991, and more than five degrees (5.2 degrees) above the 30-year normal. March and April were the warmest on record in Portland, and May was the second warmest.

This year, Portland had the wettest March on record with nearly a foot of rain (11.24 inches). Both April (1.50 inches) and May (1.77 inches) had much below normal rainfall which helped offset the record rainfall in March. Overall, spring had above normal rainfall by about two inches. With all the warm weather, Portland could only muster a tenth of an inch of snow this spring making this the third least snowiest spring on record. Only 1910 and 1921, with a trace of snow, had less snowfall than the spring of 2010.

Fall Weather Outlook

By Chris Kimble, Meteorologist

The Climate Prediction Center (CPC) produces three-month temperature and precipitation outlooks for the United States. The current forecast for this fall (September, October, and November) is available on the right. The forecast indicates an enhanced chance of above normal temperatures for the period across New England. Although day to day weather will vary between above and below normal conditions, the average temperature for this fall is expected to be above normal. Normally, high temperatures are in the 60s in September but fall into the 40s by late fall. The first freeze usually occurs by late September or early October. The precipitation forecast indicates equal chances of seeing above normal, below normal, or near normal precipitation. This means there are no major climatic signals which provide a good indication as to what precipitation patterns will look like across New England this fall. Normally precipitation during the fall months totals 10 to 12 inches. The first snow usually falls in November.



Fall 2010 Outlook for temperature (top) and precipitation (bottom).

Weather and Fall Foliage

By Mike Cempa, Meteorologist

Every autumn, nature puts on its grand display of color in northern New England, as the leaves change from green to shades of yellow, red and orange. However, as we know, this display can vary from year to year ranging from several weeks of glorious color, to a short and sweet display. So, what factors determine the kind of foliage display we get in a given year, and specifically how does the weather affect the way leaves change color?

First, we need to understand a little about how trees grow and survive through the year. The growth season in most trees in the northern hemisphere is relatively short. It runs from the spring, when it first becomes warm to support growth, until late June or early July. By this time, the buds for next spring are set, and the tree begins storing carbohydrates in its roots, branches, and buds that will help it through the winter and start the growing process for next spring. The way that trees do this is by gathering sunlight through their leaves and using the chemical chlorophyll to convert that sunlight into sugars and other carbohydrates. It's the chlorophyll in the leaves that make them green.

This process continues until late summer or early fall, when another event, triggered by the shortening days and lengthening nights, stops the flow of chlorophyll, carbohydrates and other nutrients to the leaves. Chlorophyll masks other pigments that occur naturally in the leaves, and once the chlorophyll is gone, these pigments begin to show themselves: cartenoids, which show as yellows, and anthocynanins which produce oranges, and reds. Eventually these pigments break down as well, either through their exposure to light, or by being frozen at night, and leave only tannins in the leaf which are brown.

The Presumpscot River in fall. Photo by Mike Cempa

So, how does the weather affect the color display? The late spring and early summer have some effect on the autumn color display. If it is warmer and wetter in this period then leaf growth and production of pigments will be enhanced, and set up the potential for a colorful autumn. However, the weather in the late summer and early fall plays a more significant role.

In the late summer and early fall, a long stretch of warm sunny days and cool, but above freezing, nights, produce the best color displays. These conditions produce a very gradual closing of the veins from the stem to leaf, allowing for carbohydrates to remain in the leaf, and produce additional formation of the pigments, especially the anthocyanins, which produce the great red and orange displays. An abnormally warm early autumn will reduce color because, it will extend the time that chlorophyll is present in the leaves, while colder than normal conditions during this period, will limit the production of pigments, and make for a potentially shorter and more yellow display.

Once the leaves are no longer green, the veins are no longer supplying carbohydrates to the leaves, and the leaf is no longer growing. It's just a matter of time until the pigments break down, and the leaf turns brown, dries out and falls off the tree. Strong winds or heavy rains during color change can cause premature leaf fall.

Changes to the Recreational Forecast

By Stacie Hanes, Meteorologist

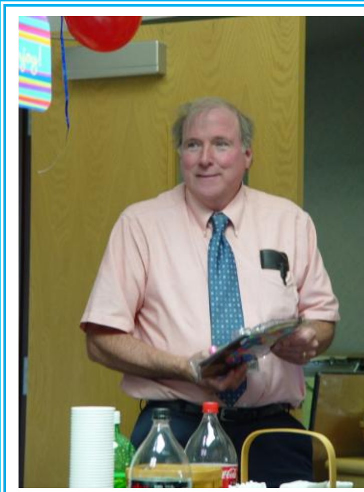
In January, our office solicited feedback on the Recreational Forecast. The Recreational Forecast is intended for the higher summits in northern New Hampshire and western Maine, and is used by outdoor enthusiasts. Specifically, we wanted to know who used the forecast and how they used it. We were also looking for suggestions as to how to improve the product. We received dozens of overwhelmingly positive responses in favor of keeping the Recreational Forecast. The responses came from skiers, hikers, first responders, pilots, teachers, business owners, and on-air meteorologists. This feedback told us volumes about how our product was used, in addition to things we could do to improve the forecast.

Based on the feedback, we have made numerous changes to the Recreational Forecast. Most people are aware that weather can change dramatically as you ascend a mountain, and splitting up the forecast by elevation made the most meteorological sense. Another big change was to expand the forecast beyond just the first period (the next 12 hours). We hope you will take advantage of the new and improved Recreational Forecast, found on our homepage under "Higher Summits". If you have any comments or suggestions, please e-mail Stacie.Hanes@noaa.gov.

Jim Mansfield Retires

By Al Wheeler, Meteorologist-in-Charge

James R. "Jim" Mansfield, Data Acquisition Program Manager (DAPM), WFO Gray, ME, retired from the National Weather Service on July 2, 2010 with almost 42 years of dedicated Federal service. Jim began his weather career in the U.S. Air Force (USAF) in 1970. His military service included a tour with the Army in Vietnam as part of a combat weather team supporting aircraft reconnaissance missions in and around the "Iron Triangle." In 1975 Jim started his civilian weather career providing balloon observations for the USAF in North Carolina. Jim's National Weather Service career began in 1977 when he was selected for a Meteorological Technician position at the Weather Service Meteorological Observatory in Alliance, NE. After Alliance, Jim worked in Burlington, VT and Patuxent River, MD. Jim's tenure as the DAPM at the Weather Forecast Office (WFO) Portland/Gray, ME, began in 1994. Jim has the distinction of being the first and only DAPM at WFO Gray!



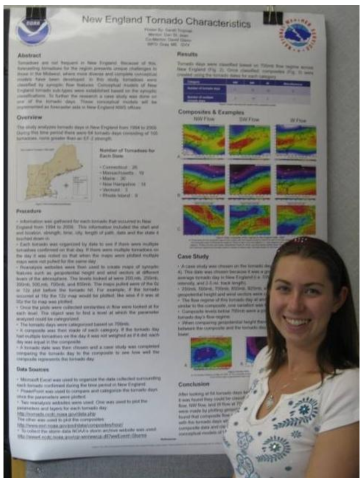
Jim Mansfield at his farewell lunch on July 1, 2010

Jim and his wife Jeanne began their retirement with a vacation to Alaska in July. They plan on staying in the Bridgton, ME area for the time being, with a possible move to their native Southern New England in the future.

My Summer at WFO Gray, ME

By Sarah Trojniak, Student Intern

As a Hollings Scholar from Michigan, I began my internship with the National Weather Service (NWS) in Gray, Maine with two goals: to help with tornado research and to experience what it was like to work for the NWS. Throughout my time here I was able to accomplish both goals.



Student intern Sarah Trojniak presents the results of her summer research.

Our tornado research looked at tornado days for New England from 1994 to 2009. There were 105 confirmed tornadoes and 64 tornado days during this time period. We started off by looking at different parameters such as pressure and wind at different levels in the atmosphere to see if there were similarities between the tornado days. We were able to categorize the upper level wind flow pattern for each individual tornado day into three groups: Southwest (SW) flow, Northwest (NW) flow, and West (W) flow. We found that 7 tornado days had NW flow, 32 tornado days had SW flow, and 20 had W flow. We then created a composite map for each of the three categories which will later be transformed into a conceptual model for forecasters in the region to aid them in forecasting potential tornado days. After the composites were created, I completed a case study for one of the tornado days - May 16, 2007 to understand how well the composite map we had created was able to represent the actual weather that day.

When I wasn't working on tornado research, I shadowed meteorologists and hydrometeorological technicians (HMTs) employed at the weather office. The HMTs and I released weather balloons twice a day. The balloons are attached to a radiosonde which is an instrument that measures temperature, dew point, pressure, and wind as the balloon moves through the atmosphere. In addition, I helped out with other HMT duties, including writing the Regional Weather Summary, sending out products, and taking observations. During severe weather I sat with the warning forecasters and learned how to issue Severe Thunderstorm Warnings. When storms did cause damage in the area, I had the opportunity to go on storm surveys with the Warning Coordination Meteorologist. Overall my time here at the NWS Gray has been very rewarding.

For questions, comments, or suggestions contact us at

GYX-Newsletter@noaa.gov

Photo by Mike Cempa