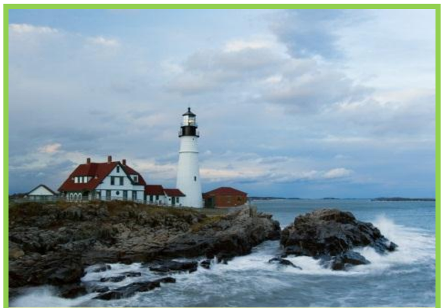

Photo by Mike Cempa

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The Coastal Front

Spring 2013

Volume IV-1

Record-Breaking New England Blizzard

By Michael Ekster, Senior Forecaster

The Blizzard of February 8-9, 2013 will long be remembered for its 20-30+ inch snowfall totals across a wide area of Maine and southeastern New Hampshire (Figure 1), as well as the accompanying blizzard conditions during the early morning hours on the 9th. Portland, Maine's 31.9 inches of snow places the Blizzard of 2013 solidly atop the list of Portland's top 5 greatest snowstorms (Figure 2 on next page); it was the first storm on record to deliver greater than 30 inches of snow since snowfall records began in 1882.

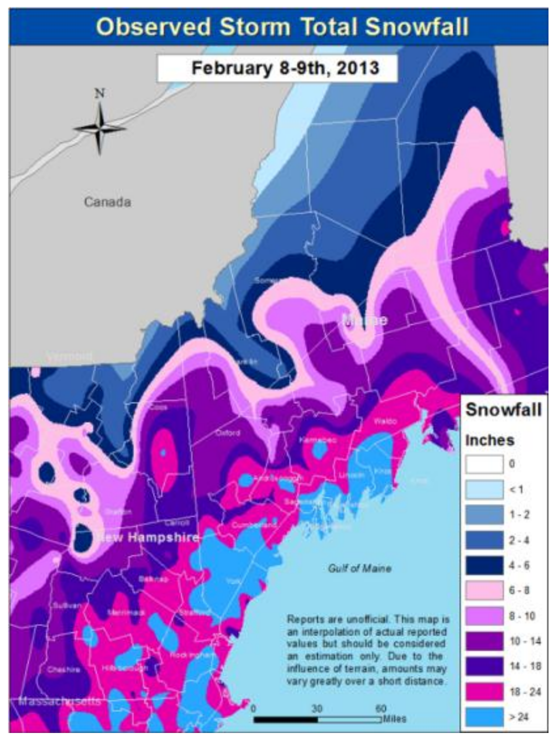

Figure 1: Map of total snowfall during the 2013 Blizzard. The most populated areas of New England received 20 to 30 inches of snow along with blizzard conditions.

On February 7th, one low pressure system was moving east across Illinois while another low was moving northeast across Georgia. National Weather Service computer models predicted these two weather systems would merge off the Mid-Atlantic coast and then move northeast as one large, intense storm. The main forecast challenge was figuring out how quickly the merger would take place. If the merger took place later, then New England would be spared the worst of the storm as it headed out to sea. A quicker merger meant a much better chance for New England to experience blizzard conditions (winds 35+ mph, visibility ¼ mile in falling/blowing snow for 3+ hours).

Record-Breaking New England Blizzard (Continued)

The coastline's impressive snowfall totals were aided by a prolonged period of ocean-enhanced snowfall owing mainly to a strong coastal front that set up just offshore during the morning of the 8th. The coastal front is a fairly common occurrence on the coast of New England during the winter months and often enhances snow totals during a winter storm. It develops due to changes in temperature and wind direction between the land and the ocean. In essence, it acts as a small-scale warm front with warm air over the water meeting the cold air on land. Portland received about 10" of snow from this feature even before the brunt of the blizzard arrived. While the precipitation shield did not look overly impressive on radar early in the morning on the 8th, the snow was extremely fluffy with snow to liquid ratios approaching 80 to 1, and therefore piled up quickly.

1. Feb. 8-9 2013…………31.9"
2. Jan. 17-18 1979………27.1"
3. Feb. 17-18 1952……..25.3"
4. Jan. 23-24 1935……...23.3"
5. Dec. 17-18 1970……..22.8"

Figure 2: Top 5 snowstorms at Portland, Maine (since 1882).

The full brunt of the blizzard arrived just after midnight on the 9th. This occurred as winds gusting to 50 mph coincided with intense snow banding that moved onto the coastal plain (Figure 3). Often intense snow banding will form on the western edge of rapidly intensifying low pressure systems. These snow bands have the potential to produce snowfall rates of 1 to 4 inches per hour or more and sometimes allows for snowstorm records to be challenged if the band stalls. In the case of the February 9th blizzard, the snow band remained over much of the coastal plain for at least 4 hours before weakening and moving back east and out to sea. Many locations within this band picked up over a foot of snow during this relatively short period of time. Thereafter, the snow decreased in coverage and intensity as the daylight hours of the 9th progressed and the storm moved out to sea. However, blowing and drifting snow remained an issue for several hours after the snowfall ended as strong winds continued.

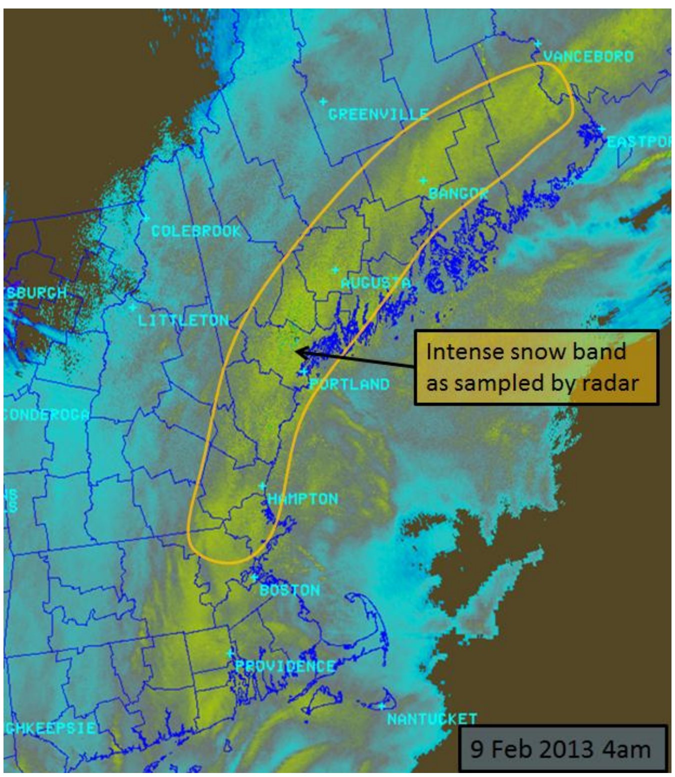

Figure 3: Radar imagery showing an intense snow band during the height of the blizzard.

Several other snow events followed in the wake of the blizzard. Both Portland, ME and Concord, NH had the 3rd snowiest February on record, with 49.6" and 43.6", respectively.

Winter Ice Can Lead to Spring Flooding

By Tom Hawley, Hydrologist

During the winter and spring months ice jams can occur in New England when large chunks of ice block the normal flow of a river. Once an ice jam forms water levels can rise rapidly behind it. When the jam breaks water levels can rise rapidly downstream. Ice jams are very local in nature, affecting just one or two towns. However ice jams can be very destructive to homes and businesses and can also destroy or seriously damage infrastructure like bridges and roads. This is due to the fact that in addition to the flood waters, large chunks of ice are also moving in the water and can act as battering rams hitting homes and bridges, causing additional damage.

Figure 4: Ice jam on the Kennebec River at Augusta.

Ice jams generally form in the same place in a river each year. They form at bends in the river or constrictions or in areas where the slope of the river changes from steep to flat. Ice jams can also form around bridge, piers, and shallower areas of the river.

There are two types of ice jams: the freeze-up jam and the breakup jam. Freeze-up jams occur early in the winter when temperatures are cooling and the water becomes super cooled. Frazil ice forms in turbulent areas of rivers and gives the appearance of slush. The frazil ice adheres to bridges and rocks and can build up on the bottom of the river. Frazil forms on days when the temperature is very cold and can form and build up quickly leading to a jam. Frazil forms throughout the winter and will adhere to the underside of ice sheets.

The other type of ice jam is the breakup jam. This type of jam is typically more dangerous because the jam consists of large chunks of ice and is extremely unstable, often forming very rapidly. The breakup jam usually occurs during or immediately after a heavy rain event. The rising water level lifts and breaks the ice, moving it downstream where it can jam. This can be very dangerous as large chunks of ice move and jam rapidly and then flow out of the river channel. Mid-winter breakup jams can also freeze in place causing additional problems later in the season.

Dual-Pol Radar Helps Visualize the Rain/Snow Line

By Chris Legro, Forecaster

In the middle of summer 2012, the National Weather Service in Gray received an important upgrade to the Weather Surveillance Radar. Dual-polarization (or dual-pol for short) is part of a national effort to improve the existing radar system. Dual-pol allows meteorologists to see both how tall and how wide radar-sampled targets are. Rain drops are wider than they are tall, falling like a hamburger bun, while hail tumbles and is roughly as wide as it is tall, and so on. This has exciting implications for how forecasts can be improved in the short term by having more confidence in precipitation type. One such implication is that the elusive rain/snow line is now possible to visualize in real-time.

There are several dual-pol variables which help meteorologists to determine where the rain/snow line is located. The first is differential reflectivity (ZDR), which is the difference between the power returned from the target in the horizontal and the power returned in the vertical. Flatter rain drops have high ZDR values because the power returned in the horizontal is larger than the power returned in the vertical. Areas of high ZDR are more likely to be rain, while areas of snow would be very low ZDR or near zero. Arguably the most powerful dual-pol variable for finding mixed precipitation in the winter is correlation coefficient (CC). CC is a measure of how well radar targets are correlated, as in are the targets uniform in size and shape or are there many different types present in the volume being sampled. As one might expect, low values of CC indicate low correlation and a mixed precipitation type is most likely. This is why CC is so powerful in identifying areas of melting and mixed precipitation.

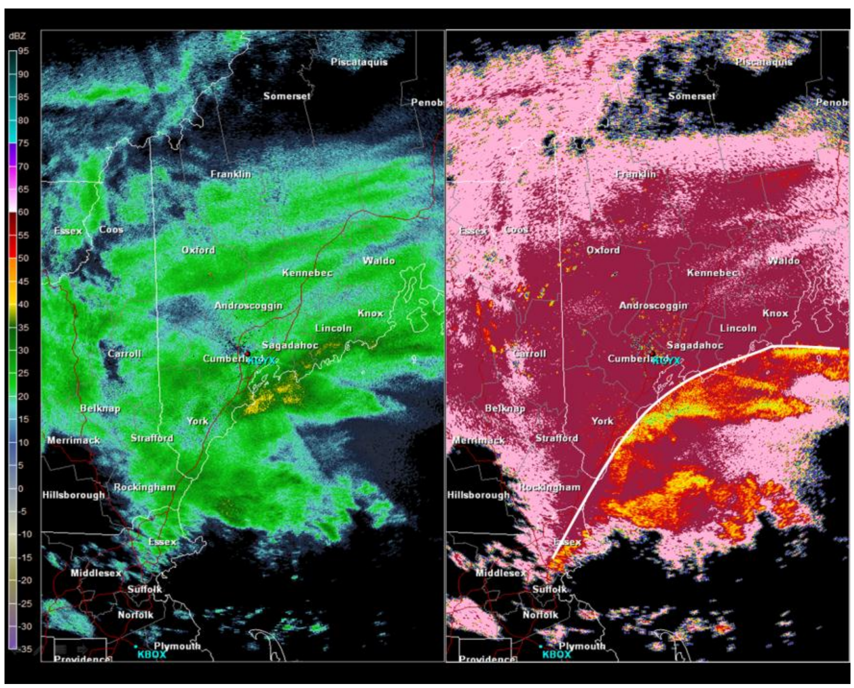

Figure 5: Radar reflectivity (Z, on left) and correlation coefficient (CC, on right). The areas of low CC indicate snow is melting, leading to rain along and south of this area (white line).

Early this winter a coastal low pressure system developed and tracked into the Gulf of Maine. With the early season waters still warm, northeast winds to the north of the low center helped to bring warmer air into coastal areas. This led to a tricky forecast as it would be cold enough for plenty of snow just inland, but coastal areas might favor rain. With such a large population living

Dual-Pol Radar and the Rain/Snow Line (Continued)

along the coast, this is a significant forecast problem. The forecast called for heavy snow inland, with a mix or change to rain along the coast. On the morning of December 27, 2012 a very clear rain/snow line was evident when viewing CC. Low values of CC represented areas of melting aloft, and warm surface temperatures below the beam meant that no refreezing occurred and precipitation type was rain. The white line in Figure 5 (previous page) marks the rain/snow line aloft, which matched surface observations of rain in Portsmouth, NH and Cape Elizabeth, ME.

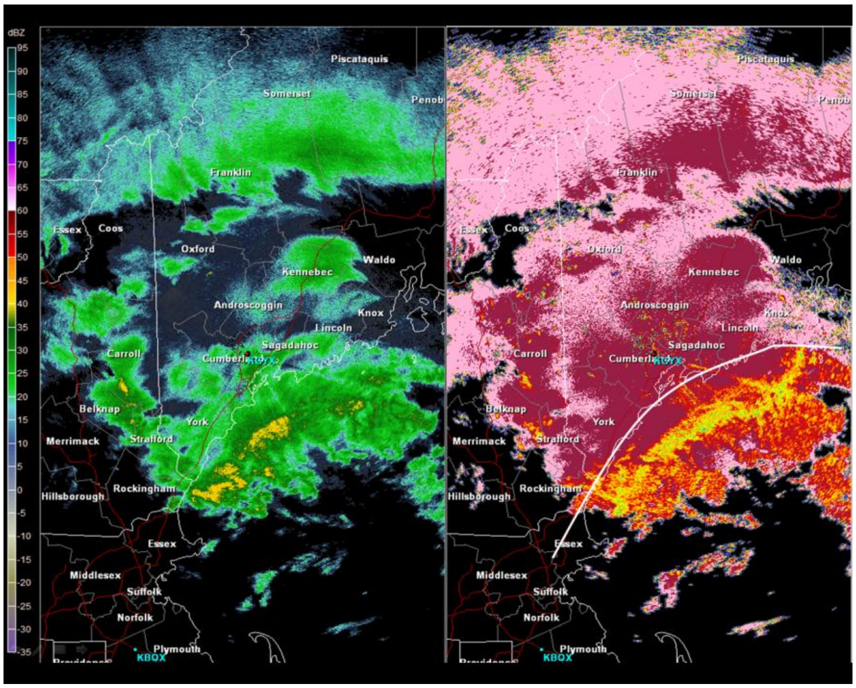

Figure 6: Radar reflectivity (Z, on left) and correlation coefficient (CC, on right). The rain/snow line (areas of low CC) shifted offshore as the storm progressed. The white line is the earlier rain/snow line from Figure 5.

As low pressure strengthened in the Gulf of Maine, winds on the coast shifted to a more northerly direction. The result was colder air being pulled off the land and farther out over the waters. The rain/snow line followed suit, edging out to sea with time during the day on the 27th. The white line in Figure 6 represents the original rain/snow line, with the cooler colors on the right panel showing where the rain/snow line had moved to in the afternoon.

Observations confirmed sleet stopped mixing in at the Portland Jetport, and Cape Elizabeth flipped over to all snow. However, by having dual-pol data in real-time the forecast was updated to include more snow for coastal communities. In the end 6 to 12 inches of snow fell along the Maine coastline, with 2 to 4 inches for the New Hampshire Seacoast. Dual-pol has allowed the rain/snow line to go from a buzz word to a dynamic feature that can be tracked live on computer screens, with the promise of improved precipitation type forecasts in the future.

Spotter Training Classes Coming!

The NWS is looking for volunteers to help us observe significant weather conditions. Check our website for dates and locations of upcoming training classes to become a Skywarn Storm Spotter. The next free class will be in Durham, NH on April 4.

http://www.erh.noaa.gov/gyx/spotters_skywarn/skywarn.shtml

Winter Weather Review

By Chris Kimble, Forecaster

December started out generally warm with no real arctic air able to invade New England. By the middle of the month, the pattern began to shift when 5.58 inches of rain fell from the 16th thru the 21st in Portland. The cold finally arrived just in time for Christmas, and the first big snowfall of the season came on December 27th when 11.6 inches fell in the city.

	HIGH	LOW	AVE	PRECIP	Snow
December	39.8 (+2.5)	24.1 (+3.7)	32.0 (+3.2)	8.30 (+4.28)	24.8 (+11.6)
January	34.3 (+3.1)	16.4 (+3.0)	25.4 (+3.1)	1.36 (-2.02)	7.3 (-11.9)
February	35.1 (+0.5)	21.0 (+4.6)	28.1 (+2.6)	6.07 (+2.82)	49.6 (+37.5)
Winter 2012	36.4 (+2.0)	20.5 (+3.8)	28.5 (+2.9)	15.73 (+5.08)	81.7 (+37.3)

Table 1: Winter 2012 climate statistics for Portland.

Though much of January was dry and warm, an arctic air mass arrived toward the end of the month, with temperatures falling to around 0 degrees for a few days. In fact, January 23rd was the coldest day in Portland for 6 years with a high of only 8 degrees. The low of -4 on the 24th was the coldest temperature of the season. But by the end of the month, warmer weather had arrived and the snow built up on the ground since December had melted to only a trace.

February 2013 will long be remembered for the record-setting blizzard on the 8th and 9th when 31.9 inches of snow fell in the city along with winds gusting to 56 mph. A wide area of southern New Hampshire and southwest Maine received 20 or more inches of snow along with blizzard conditions. Several more snow storms through the rest of the month allowed February to accumulate the 3rd highest total snowfall for the month with almost 50 inches.

CoCoRaHS Corner – Measuring Snow Depth

By Nicole Becker, Observing Program Leader

In each of the past several editions of the Coastal Front newsletter we have brought you the CoCoRaHS Corner. This section is designed to provide useful tips and reminders to our valued CoCoRaHS volunteers to assist them in providing quality observations. As the winter season is winding down and snow is finally melting, this edition tackles snow depth measurement.

Measuring snow depth can be tricky, especially when wind-blown snow leads to significant drifting. Here are some helpful tips for measuring snow depth.

- Select a snow measurement area where the effects of wind and drifting are minimized.
- Measure snow depth once a day at the time of observation.
- Use a metal or wooden yard stick to measure snow depth.
- In areas where snow is wind-blown, take several measurements and then take an average of those measurements to obtain the snow depth. Do not include the extremely large drifts or areas scoured out by the wind.
- Do not measure directly under a tree.

Thank you for all your snowfall observations! We appreciate your efforts!

Local Weather Observers Needed

By Stacie Hanes, Senior Forecaster

The Community Collaborative Rain, Hail and Snow Network, or CoCoRaHS for short, is a network of volunteer backyard weather observers working together to measure and map precipitation in their local communities. CoCoRaHS is a non-profit community-based program which has its origins at Colorado State University in the late 1990s. By using low-cost measurement tools, stressing training and education, and utilizing an interactive website, the aim is to provide high quality data for natural resource, education, and research applications. CoCoRaHS has now been established in all fifty states. Anyone with an enthusiasm for watching the weather can participate. By providing daily observations, participants are contributing an important piece of weather information to many users. During what we call "March Madness" we try to get as many new observers to sign up as possible.

So how does it work? Every time it rains, snows, or hails, volunteers take precipitation measurements and enter them onto a website (http://www.cocorahs.org). Once the data are entered, they are then displayed on a map. The data are analyzed and used for many situations ranging from water resource analysis to flood warnings. Some users include the National Weather Service, emergency managers, farmers, and teachers. NOAA is a major sponsor of CoCoRaHs. We are looking for more observers, so anyone interested in joining CoCoRaHS should visit the website and click "Join CoCoRaHs". Although formal training is not a requirement, keep an eye out for upcoming training dates this spring on the CoCoRaHs website.

Like us on Facebook!

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

For questions, comments, or suggestions contact us at

GYX-Newsletter@noaa.gov

Photo by Mike Cempa