Photo by Bob Marine

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The Coastal Front

Spring 2017 Volume VIIII-1

Is Record Cold a Thing of the Past?

By Chris Kimble, Forecaster

In October 2016, NOAA's 41st Annual Climate Diagnostics and Prediction Workshop (CDPW) was held in Orono, Maine on the University of Maine campus. Having this event held nearby gave NWS Gray an opportunity to attend and present some of the research that staff at our office has done. Forecaster Chris Kimble attended the workshop on behalf of NWS Gray and presented an Assessment of Temperature Extreme Trends in Western Maine and New Hampshire. This presentation focused initially on the trends observed in record highs and record lows at Portland, Maine over time, but was expanded to include our other climate reporting locations at Concord, New Hampshire and Augusta, Maine. A full summary of this presentation and others from this workshop is at: http://www.nws.noaa.gov/ost/climate/STIP/41cdpw_digest.htm

Figure 1: NWS Gray Forecaster presents at the 41st Annual CDPW in Orono, Maine. Photo by Ellen Mecray.

The idea for the NWS Gray study came from followers on Facebook, which occasionally commented with observations that Portland rarely sets record lows anymore. We decided to look into this observation to assess its validity and identify potential causes.

Figure 2: Facebook comments triggered a NWS Gray research project.

Record Trends (continued)

After combing through the record books we noted how many times each year appeared in the records for both record highs and record lows (ties were included). If all years were just as variable then we would set roughly the same number of record highs and record lows each year. In truth, all years are not as variable, and the departure from the expected frequency of setting these records can tell us something about how extreme that year was.

What we found was that there was no observable long term trend in the frequency of record high temperatures at Portland. However, there was a sharp downward trend in the frequency of record lows. What our Facebook followers had noticed was real! Figure 3 below shows the trend in frequency of record highs and record lows at Portland.

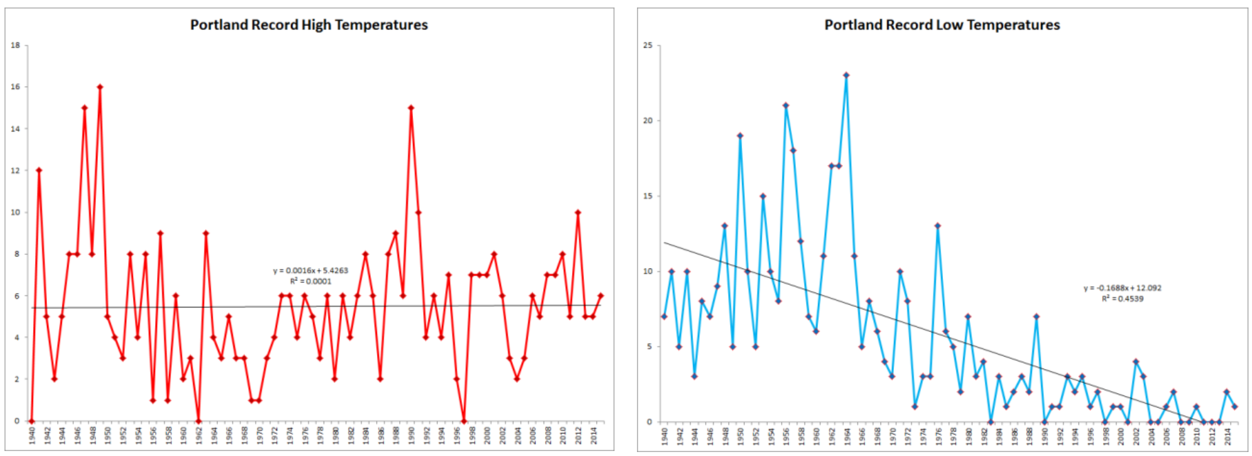

Figure 3: Total record highs per year (left) and record lows per year (right) at Portland. On average, Portland sets 5.6 record highs per year and 5.4 record lows. There is no discernable long term trend in the frequency of record highs, though there is a sharp decrease in frequency of record lows.

One significant factor in the observed trend here is the period of records available at Portland. The 1960s and 1970s were a colder period across the continent and indeed across the globe while temperatures today are generally warmer. Since this cold period occurred near the beginning of the Portland Jetport's available records (began in November 1940), it helps to tilt the long term trend in cold records downward especially in combination with warming in recent decades. The reason for these broader changes has to do with both natural variability and longer term climate change.

Another significant factor in the trends here is land use change in the surrounding area. The combination of airport expansion and suburbanization of the nearby area has changed the microscale climate where the observations are taken. When observations began at the Jetport in 1940, the area surrounding the airport was open farmland on the outskirts of the city. Meteorologists know that open fields will cool down much more efficiently at night than more urbanized areas with more concrete, buildings, and trees. In fact, a period of overlapping temperature records from Downtown and the Jetport in the 1940s reveals nighttime temperature differences of as much as 15 degrees! While the open fields in the area near the Jetport led to

Record Trends (continued)

very cold nighttime temperatures through the 1960s, gradually the nearby land began to change. There were several projects at the Jetport itself along with expansion of nearby neighborhoods. In 1971, the Maine Mall was built nearby with more shopping plazas complete with large buildings and expansive parking lots soon to follow. Over time the character of the land near the observation site changed from open fields to suburban, making those very cold nighttime temperatures less common. In fact, of the 17 days that Portland has recorded a temperature of -20F or colder, only 3 have occurred since the Maine Mall was built in 1971, and none have been observed since 1980.

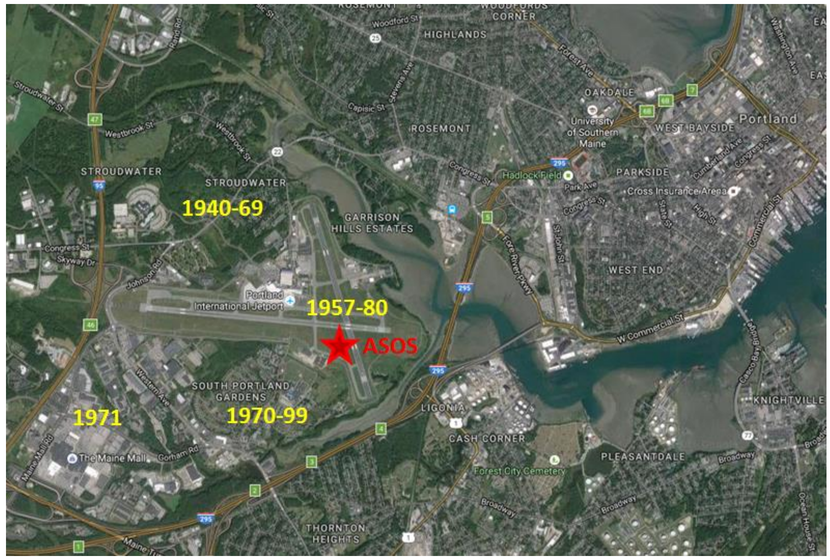

Figure 4: Satellite imagery from Google Maps shows the more recently developed areas near the Portland Jetport. The location where observations are taken is indicated by the red star, while the periods of development of nearby areas are indicated in yellow.

The same study was conducted for Concord, New Hampshire, which has a much longer period of record available (dating back to 1868). Due to more years in the database, records are set less frequently. On average there are 2.8 record highs set per year and 2.9 record lows. Although there was no significant linear long term trend in record highs or record lows, the second half of the 20th century stands out as a distinct period of extreme cold. Notably, this cold period lasted about a decade longer at Concord (through the 1970s) as compared to Portland. Recent decades have seen fewer record lows, on par with periods in the more distant past.

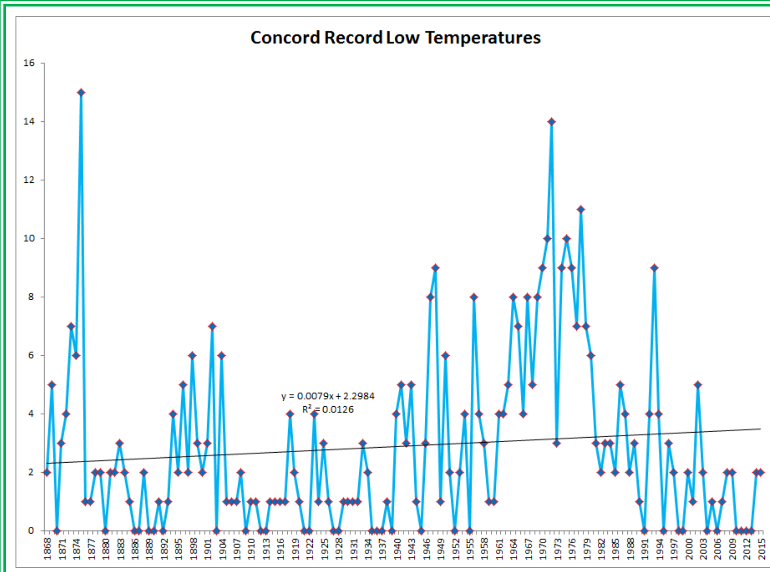

Figure 5: Total record lows per year at Concord. While there is no long term linear trend, there was a sharp increase in record lows in the 1960s and 1970s and a sharp decrease in the last few decades.

NWS Provides Weather Support for New Hampshire

By Justin Arnott, Science and Operations Officer

Each year, around 100,000 people descend upon Loudon, NH, for racing events at the New Hampshire Motor Speedway in July and again in September. This number of people is similar to the total population of Manchester, NH, making Loudon one of the largest "cities" in the state on race day. With so many people concentrated in such a small area, there is an increased vulnerability to weather hazards, which, during the summer and early fall, include thunderstorms (and associated lighting, hail, winds, and tornadoes), wind, rain, and even high temperatures.

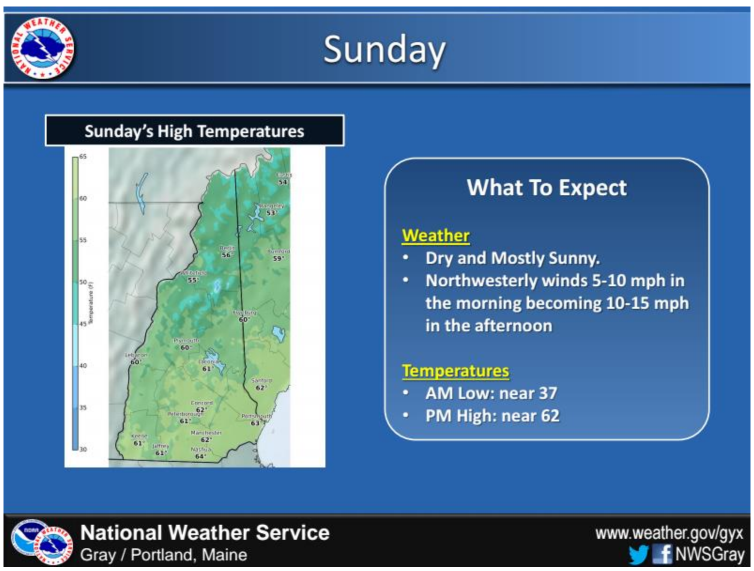

Figure 6: Example of decision support forecast information provided to public safety officials.

The National Weather Service in Gray provides Decision Support Services to state and local emergency management officials in charge of public safety at these events. Well before the event, these services include conference calls describing the outlook for potential weather hazards. As the event approaches, in addition to the conference calls, our office provides event "briefing packages" that provide public safety officials with expected weather conditions for each day of the races.

For the 2016 race on September 25, two National Weather Service forecasters were deployed to the New Hampshire State Emergency Operations Center in Concord. This face-to-face contact allows us to better convey our forecast expectations on how weather conditions may impact public safety at the event. On race day, we participate in event conference calls and provide ongoing weather support before, during, and after the race.

While the weather for this particular race was quiet with a mostly sunny sky and seasonable temperatures, the time spent building relationships with our partners was beneficial. Through these meetings, we learn about the specific impacts that weather has on public safety at the event, while our emergency management partners learn about the types of forecast products and information the National Weather Service provides.

This information sharing helps us take steps toward fulfilling the National Weather Service's ultimate goal of creating a Weather Ready Nation – a nation that is prepared to respond to weather-related hazards to protect life and property and enhance the national economy!

Cooperative Observers Recognized for Service

By Nikki Becker, Observing Program Leader

The NWS Weather Forecast Office in Gray, Maine, has and will present a total of 14 Length of Service Awards to individuals and institutions ranging from 10 to 55 years of service across Maine and New Hampshire. We are very lucky and proud to have every Cooperative Weather Observer who volunteers their time to report daily precipitation and temperatures. Their dedicated service is important to the NWS daily forecasting mission and the backbone of our national climate records. Not only were we able to present a golden jubilee for individual service, we also had the honor of presenting the same to an institution in 2016.

2017 AWARDS		
	New Hampshire	**Maine**
10 Years	Littleton, Salisbury	
15 Years	Keene	Andover, Turner
20 Years		Poland
25 Years		Bath, Winthrop
30 Years	Jefferson	
40 Years		Winthrop
45 Years		Livermore Falls
50 Years		Farmington, Augusta
55 Years		Eustis

Table 1: The observers in these locations are/were being awarded for milestones in their length of service in 2016 or 2017.

NWS Gray has or will honor two observers with prestigious awards for their exceptional quality of observations. There was one John Campanius Holm Award given to the observer of Meredith, NH. In order to be eligible for the John Campanius Holm Award, the observer has to have at least 20 years of service and there are only up to 25 given out in a year. The highest award for exceptional service an observer can receive is Thomas Jefferson Award, which will be given to the observer in Eustis, ME. No more than 5 Thomas Jefferson Awards are given out each year out of the 8,700 observers.

We are looking forward to giving out the next round of awards!

Skywarn Spotter Training Season is Here!

The summer season is when Maine and New Hampshire are most likely to see severe thunderstorms. During this season is when we rely heavily on our network of volunteer storm spotters who relay information to us about these storms as they roll through.

Would you like to be a storm spotter? We offer several training sessions through the year that are free to the public. Check out our Skywarn webpage to see if there is a training session offered near you: http://www.weather.gov/gyx/skywarn_skywarn.htm

If you would like to host a Skywarn training session, contact mike.cempa@noaa.gov

Tsunamis Pose a Rare Threat

By John Jensenius, Warning Coordination Meteorologist

Here in New England, most people don't think about the possibility of a tsunami. However, tsunamis can occur along any coastline around the world, including the coastlines of Maine and New Hampshire. Tsunamis are one of nature's most deadly phenomena and occur most often in the Pacific Ocean. Although tsunamis are usually caused by rapid movements of the ocean floor, tsunamis can also be generated by localized landslides and land slumps along the shoreline, or even asteroids plunging into the ocean. In rare cases, fast moving atmospheric pressure waves such as those caused by squall lines are capable of producing tsunami-like waves.

When you think of tsunamis, you probably think of the massive waves that struck areas of the Indian and Pacific Oceans in 2004 and 2011. While many lives were lost in the devastation that occurred over portions of Japan in 2011, dangerous tsunami waves crossed the Pacific Ocean at speeds of over 500 mph to reach the West Coast of the United States. While the tsunami wave that hit the West Coast was only a few feet high and arrived near the time of low tide, the powerful currents created by the tsunami wave caused an estimated 40 million dollars in damage when it hit California. In Crescent City harbor, the tsunami sank 16 boats, damaged 47 others, and claimed one life near the entrance to the harbor.

While Maine and New Hampshire are somewhat sheltered by George's Bank and the continental shelf, waves similar to those that hit California in 2011 are possible across the region. While a 2-foot wave may not sound like much, a tsunami wave will strike suddenly with the force of a raging river. Particularly vulnerable are vessels, docks, and piers along the coast and in the channels. Structures along the immediate coast also could be damaged if a tsunami would strike near the time of high tide.

Unlike wind-driven waves, a tsunami's speed depends on the depth of the ocean. In areas of the Pacific where the ocean depth is 20,000 ft, tsunami waves are usually less than a foot high and move as fast as a commercial jet. However, as a tsunami wave encounters shallower water the speed of the wave slows and the height increases. As the tsunami approaches land, the underwater terrain will often focus much of the wave energy on points of land that jut out into the ocean due to underwater ridges that extend out into the sea.

Even along the coast of New England, if you notice an unexpected rise or fall of the sea level, it might be a tsunami. The best advice is to get out of the water and move away from the water's edge. Be sure to monitor children closely and keep them a safe distance from the shoreline.

Always respect the power of moving water. Here are some sources of information on tsunamis:
http://www.nws.noaa.gov/om/Tsunami/
http://www.maine.gov/dacf/mgs/hazards/tsunamis/index.shtml
http://nws.weather.gov/nthmp/tpw/tsunami-preparedness-week.html

NWS Staff Profile

By Margaret Curtis, Forecaster

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

Figure 7: Forecaster Chris Kimble has worked at NWS Gray since 2009.

What is your role at the office? I am a General Forecaster responsible for preparing the public and aviation forecasts for western Maine and all of New Hampshire as well as issuing warnings for hazardous weather events. I also lead the office Climate program, which ensures accurate weather records are kept and maintains access to historical data. In addition, I prepare the office schedule, which maintains 24/7 staffing through the entire year. This can be a challenging process especially during periods of low staffing or holidays. I am also active on the social media team and am involved in the Skywarn spotter training program. Oh, and I shouldn't forget I prepare and edit the newsletter!

How long have you worked for the National Weather Service in Gray? I arrived in December, 2009, so I have been here for 8 winters.

Where else have you worked? I got my start in the NWS as a volunteer and later a student employee at the NWS in Memphis, TN. I later worked as an Intern at NWS Amarillo, TX before arriving in Maine as a Forecaster.

Where did you grow up? I grew up near Memphis, TN and lived there until I graduated high school.

Where did you get your education? I graduated from the University of Oklahoma at Norman in 2006.

How did you first get interested in weather? I've been interested in weather for about as long as I can remember. Growing up in the south, we did not see snow that often. I remember getting so excited any time snow was in the forecast, and I would spend as much time outside playing in it as I could. After all, it never really lasted long. I used to spend hours a day watching the Weather Channel and learning about all the interesting weather that goes on around the country each day. When I went to college in Oklahoma I also developed an appreciation for severe thunderstorms and tornados, often observing these up close. In fact, I still head out to the plains each spring to visit with friends and chase a few storms.

NWS Staff Profile (continued)

What is the most interesting part of your job? I enjoy looking deeply into what's going on with the weather and trying to figure out what's causing it in hope that we will improve our ability to forecast it. In New England, terrain and ocean effects often cause some interesting weather phenomenon even on a quiet weather day.

What is the most challenging aspect of your job? Working rotating shifts is quite difficult to adjust to. One week you're working overnight shifts and the next you're coming in for a day shift bright and early at 8 AM. That's something your body never really gets used to.

What is the most memorable weather event that you have worked? I recall the first Winter Storm Warning I issued at NWS Gray. It was a low pressure system moving in from the ocean, and our computer models were forecasting several inches of snowfall even though the temperature was hovering right around freezing. I knew it was going to be a tough call on whether it would be rain or snow. I woke up the next day after issuing the Winter Storm Warning and I looked outside to see nothing but a dry, bare ground! When my biggest forecast concern was whether it would be rain or snow, in the end nothing would fall at all! That's when I learned to never trust a storm moving in from the ocean.

Fast-Moving Storm Brings Very Heavy Snowfall

By Stacie Hanes, Lead Meteorologist

On December 29, 2016, a deep trough of low pressure moved over the East Coast of the United States. Potent energy associated with this upper level system allowed surface low pressure to develop and deepen rapidly as it moved up the Atlantic Coast and into the Gulf of Maine.

The surface low pressure system deepened into a significant coastal storm and made landfall on the mid coast of Maine after midnight on Thursday. Very heavy snowfall spread across New Hampshire and Maine during the evening hours on the 29th and into the early morning hours of the 30th. Hourly snowfall rates were at times around 6" per hour, and thundersnow (heavy snow and lightning occurring at once) was also widely reported.

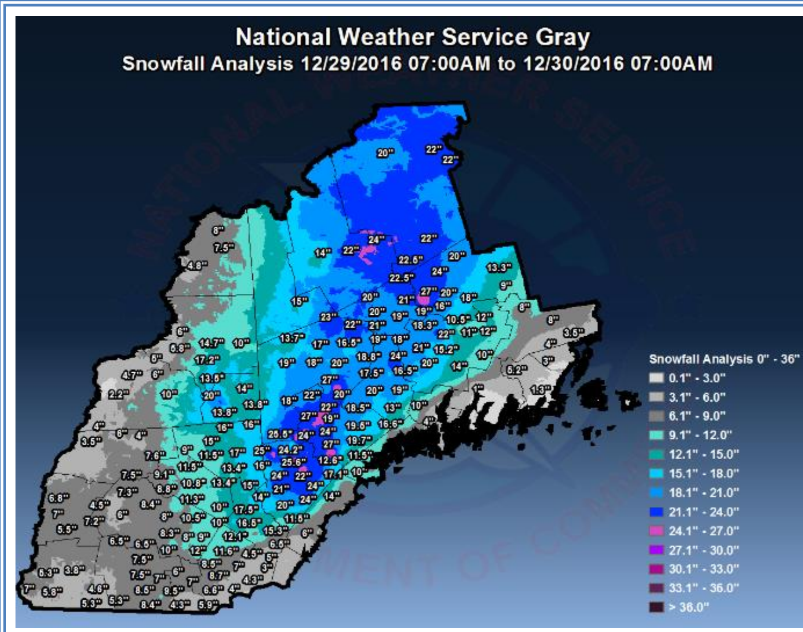

Figure 8: Storm total snowfall amounts of more than 20 inches were common in southern Maine, with most of that falling in a few hours.

Very Heavy Snowfall (continued)

This storm had a sharp delineation between where snow fell and where rain fell as a coastal front developed and meandered near the coast during the heaviest precipitation. This change to rain near the coast is what made for large differences in snowfall amounts for coastal locations versus locations just inland. At Portland 1.2 inches of snow fell early on before changing to rain, but late that evening the front moved back through and brought 6.5 inches of snow in just a couple of hours along with thunder and lightning. Meanwhile just a few miles inland at our office in Gray, precipitation stayed mostly snow and accumulated to 16.6 inches.

While 12 to 24 inches of snow is not that uncommon from a Nor'easter in northern New England, the most memorable aspect of this storm was just how heavy the snow was when it was coming down. The storm only lasted about 12 hours and was producing snowfall rates of 6 inches per hour during the height of the storm. Snowfall rates that high are exceptionally rare and make it impossible to maintain well-plowed roadways. Such extreme snowfall rates occurred in part due to just how quickly the storm intensified as it interacted with warm/moist air over the Atlantic and the cold, drier air over northern New England.

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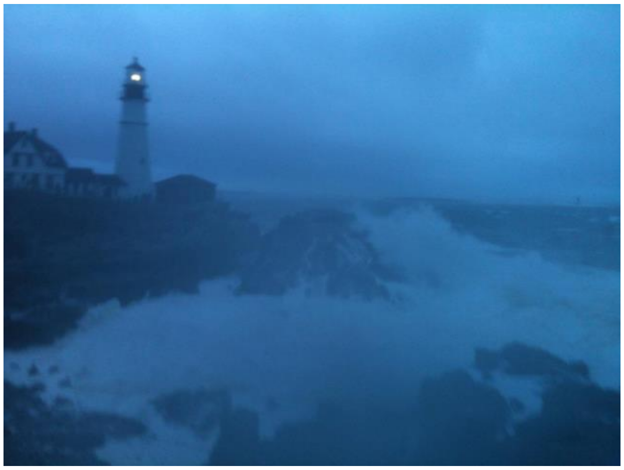

Photo by Chris Kimble