



Photo by Mike Cempa

The Coastal Front

Fall 2017

Volume VIII-2

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Simplifying Winter Headlines

By Justin Arnott, Science and Operations Officer

In the past, there has been a large number of different ‘headlines’ that the National Weather Service has used to convey the details of high impact winter weather. To increase clarity and reduce confusion, beginning in October of 2017 there will be an effort to simplify some of the winter weather products issued by the National Weather Service (NWS). This effort will focus on two areas, Hazard Consolidation and Text Product Simplification.

This winter, there will be a streamlined set of hazard products that forecasters at NWS Gray will use to convey high impact winter precipitation events. The changes will not be dramatic, and users will continue to find watch, warning, and advisory products available. The chart in Figure 1 summarizes each of the products that will be in use this year and a description of what is meant by the term “watch”, “warning”, and “advisory”.

Winter Precipitation Headline Summary

Watch

Winter Storm Watch

POTENTIAL for a significant storm within the next few days

Warning

Winter Storm Warning
Blizzard Warning
Ice Storm Warning

DANGER due to imminent, special weather conditions that will result in marked risk to public safety, infrastructure and property

Advisory

Winter Weather Advisory

CAUTION ADVISED for imminent, special weather conditions that will impact public safety

Note: No changes to wind chill headlines



National Weather Service
Gray, Maine

Figure 1: Summary of winter weather watch, warning, and advisory products issued by the National Weather Service.

Simplifying Winter Headlines (continued)

Note that there are a few products (e.g. freezing rain advisory and blizzard watch) that you may have heard of in the past that will no longer exist. Finally, there will be no changes to the wind chill headlines issued by NWS Gray.

Another change coming this winter is to the look of the watch/warning/advisory text products. Specifically, the terms “What”, “Where”, and “When” will now be used to highlight the most important questions our users have about winter weather events:

- What: What weather is causing the hazard including information such as snow and ice accumulations?
- Where: Where is the hazard expected to occur?
- When: When is the expected hazard to occur and also, when are conditions expected to be at their worst?

An example of the new product format is shown in Figure 2.

Again, the goal with these product changes is to bring increased clarity and reduced confusion, so that our customers have the best information available to make good decisions for mitigating the impacts of winter weather, helping move us closer to the goal of becoming a Weather Ready Nation.

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IAZ008-009-MNZ086-087-094-095-020215-  
/O.NEW.KARX.WS.W.0001.170501T1813Z-170502T1800Z/  
Mitchell-Howard-Dodge-Olmsted-Mower-Fillmore-  
Including the cities of Osage, Cresco, Dodge Center, Rochester,  
Austin, and Preston  
113 PM CDT Mon May 1 2017  
  
...WINTER STORM WARNING IN EFFECT UNTIL 1 PM CDT TUESDAY...  
  
* WHAT. .A wintry mix. Look for significant reductions in  
visibility at times. Additional snow accumulations of 4 to 7  
inches and ice accumulations of a light icing are expected.  
  
* WHERE. .Portions of north central Iowa, northeast Iowa and  
southeast Minnesota.  
  
* WHEN. .Until 1 PM Tuesday. The heaviest snowfall rates will  
occur until 7 PM this evening.  
  
* ADDITIONAL DETAILS...Plan on difficult travel conditions,  
including during the evening commute.  
  
PRECAUTIONARY/PREPAREDNESS ACTIONS...  
  
A winter storm warning means significant amounts of snow, sleet  
and ice are occurring. Strong winds are also possible. This will  
make travel very hazardous or impossible. The latest road  
conditions for the state you are calling from can be obtained by  
calling 5 1 1.
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Figure 2: Example of the new format for the text of winter weather statements.

Multiple Tornadoes Strike Maine's Lakes Region

By Mike Ekster, Lead Meteorologist

On the First of July, 2017, atmospheric ingredients came together in Maine for a record number of tornadoes to touch down in the state for one day (Figure 3). The five tornadoes that touched down bested the single day record of three, which occurred on July 21st, 2010. The first tornado touched down as a waterspout on Sebago Lake at 2:25 PM, with the last tornado lifting up in Otisfield shortly after 6:35 PM. In addition, a daily record number of tornado warnings (seven) were issued by the National Weather Service in Gray, ME during this event. In fact, the most tornado warnings previously issued by our office in an entire calendar year was only six. Thus more warnings were issued in one day than in any prior year.

Why so many tornadoes in one day? Several ingredients need to come together in one place at the same time in order for the

environment to be conducive for tornadoes. The 4 basic ingredients are wind shear, moisture, instability, and some form of large scale lift that will help initiate thunderstorms (e.g., a warm or cold front). During the early afternoon hours of July 1st, a warm front lifted northward into central New Hampshire and southern Maine providing the lift and focus needed for thunderstorm development. In addition, fast westerly winds aloft coupled with slower southeasterly winds near the ground in the vicinity of the warm front allowed for strong wind shear. Strong wind shear is a necessary ingredient for getting storms to rotate, which could then allow for tornado development. Lastly, a very moist air mass was in place with dew point values well into the 70s. High dew points allow for the development of sufficient instability which allows for storms to grow and persist. The resulting moist low level air allows storm cloud bases to be relatively low to the ground which makes it easier for funnel clouds to reach the surface (Figure 4 next page). This juxtaposition of these ingredients occurs most frequently in "Tornado Alley" and is much less frequent in Maine and New Hampshire.

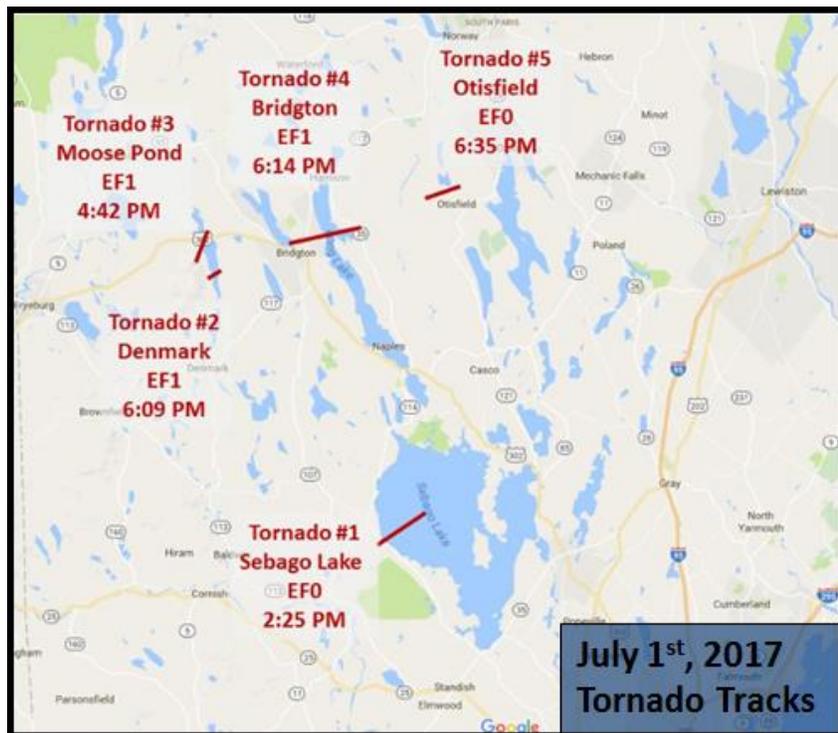
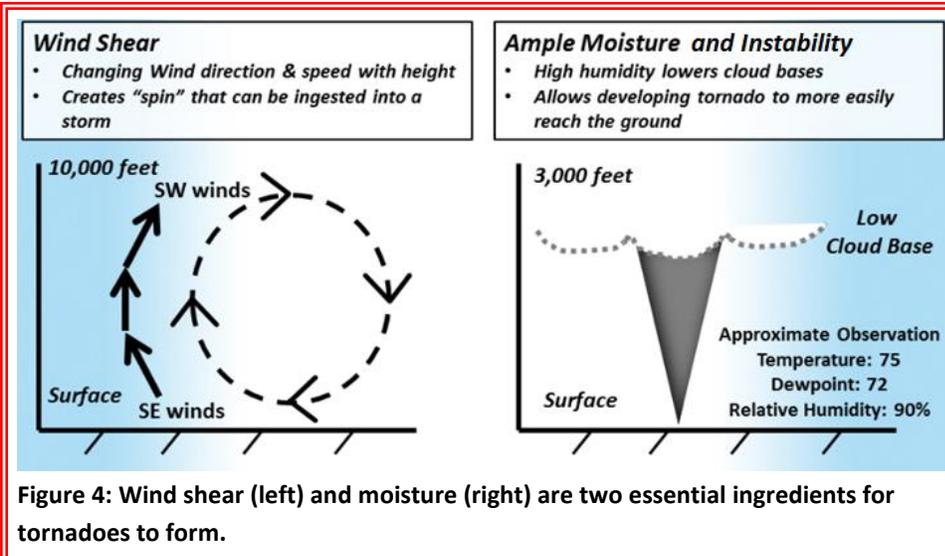


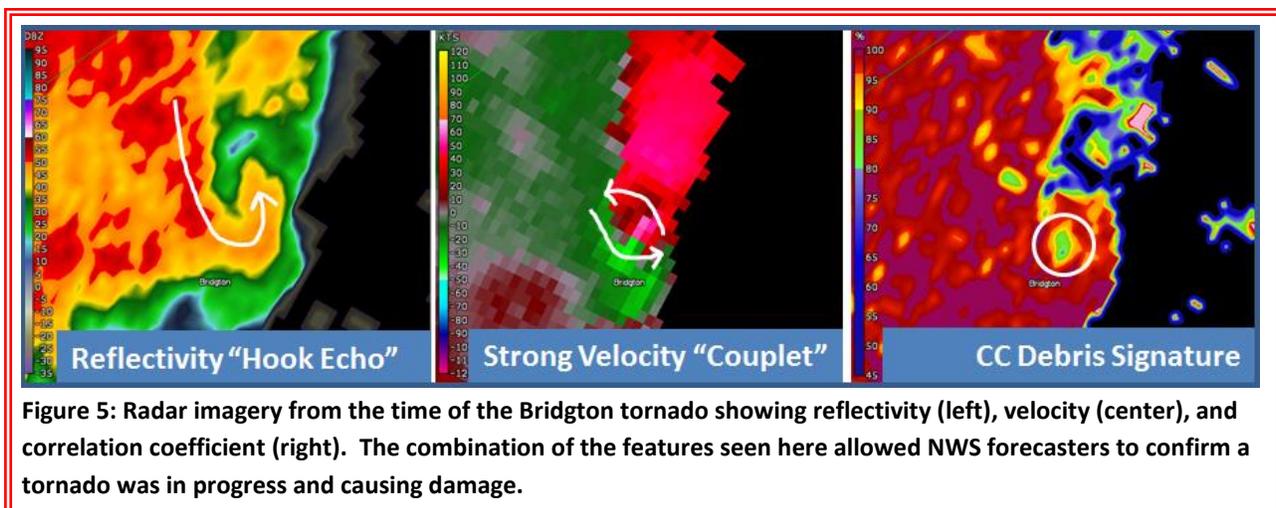
Figure 3: Map of the tracks of tornadoes on July 1, 2017 as determined by NWS storm survey teams.



Storm spotters are our most reliable resource for “ground truth”, i.e., what the storm is actually producing. However, Doppler radar is also a very valuable resource for determining if a thunderstorm is severe or not. In addition, the radar can give us clues

as to the potential for tornadoes. On July 1st, several of the thunderstorms exhibited strong rotation on radar. This rotation in tandem with weather conditions favorable for tornadoes allowed the NWS office in Gray to issue potentially life-saving tornado warnings with an average lead time of 16 minutes. Several radar features common in tornadic thunderstorms existed on July 1st, such as “hook echoes” and strong velocity couplets (strong green inbound winds next to strong red outbound winds). The Doppler radar even picked up on a debris signature as a tornado lofted branches and leaves high into the air near Bridgton (Figure 5).

July 1st, 2017 was a very busy day for the staff on duty at the National Weather Service in Gray. Not only did 5 tornadoes occur in Maine, but significant flash flooding occurred in New Hampshire. Thanks to our storm spotters and the Doppler radar, we were able to get warnings out ahead of time for both the tornadoes and flash flood events. While tornadoes are rare in Maine and New Hampshire, the right ingredients do occasionally come together to allow for between 2 and 3 tornadoes every year on average.



Air Quality Forecasting

By Martha Webster, Maine Department of Environmental Protection

The Maine Department of Environmental Protection (Maine DEP) has two meteorologists who handle the air quality forecasting duties. The State of Maine has been divided into 7 forecast regions and another region comprising of the top of Cadillac Mountain called ‘The High Elevations of Acadia NP’. Air Quality Forecasts are issued for each day of the year, typically by 3 PM on weekdays and updated as necessary on weekends & holidays.

Air Quality Forecasts are issued on the Air Quality Forecast home page (<http://www.maine.gov/dep/air/ozone/>), a telephone hotline (1-800-223-1196), the Environmental Protection Agency’s (EPA’s) AirNow website, EnviroFlash, and Twitter (see home page for more info and links). In addition, when forecasting ‘UNHEALTHY FOR SENSITIVE GROUPS’ (USG) or worse, an air quality alert is issued through a portal to the National Weather Service (NWS), a Citizen’s Alert Bulletin is activated on the Maine State home page, and a press release is circulated.

Air quality forecasts are issued by category of the Air Quality Index (AQI) as shown in Figure 7 on the next page. For more information on the AQI visit:

<http://www.maine.gov/dep/air/ozone/airqualityindexandhealth.html>

Maine DEP and EPA’s health warnings for many AQI levels are not designed to encourage sedentary activity or avoidance of the outdoors. Rather, the messages encourage people to pay attention to how they are feeling and to consider how long they exert themselves or change the level of their activity. For instance one can jog a shorter distance on an ‘Unhealthy for Sensitive Groups’ or higher category day or one could walk rather than jog. If one’s route is along a road perhaps these days are times to exercise in a park or other venue away from traffic. In addition, one may be able to change the time of day to exercise.

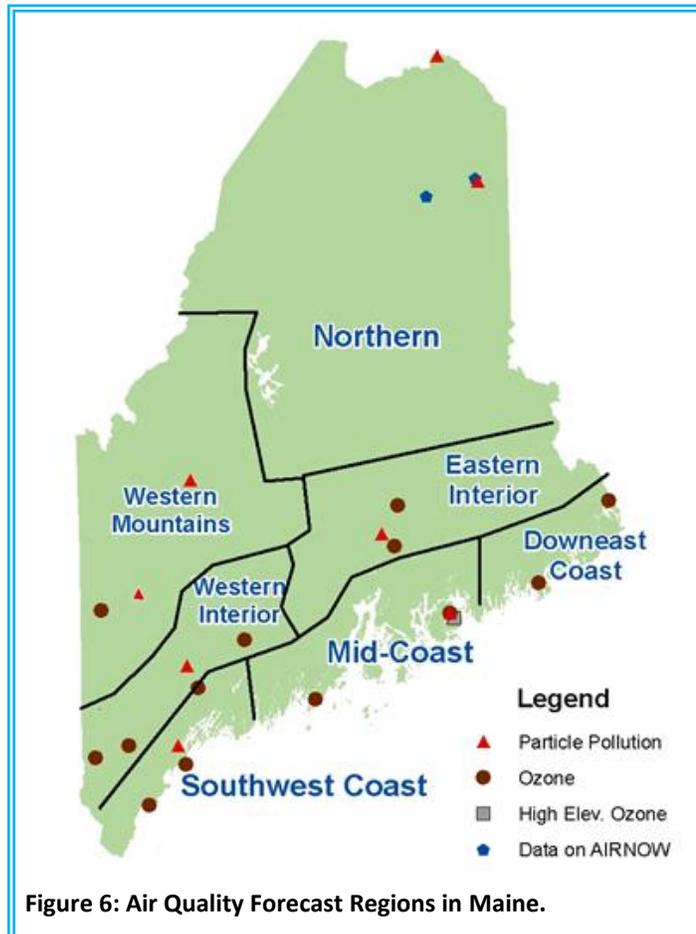


Figure 6: Air Quality Forecast Regions in Maine.

Air Quality Forecasting (continued)

Particle Pollution values are most often higher in the early morning hours and begin rising again after sunset. During the day, sunshine will cause turbulent mixing in the air which can cause Particle Pollution values to decline during the late morning and afternoon hours.

DESCRIPTOR	COLOR CODE	Ozone 8-hour Ave. (ppb)	AQI RANGE	Particle Pollution 24-Hour Ave. ($\mu\text{g}/\text{m}^3$)	Health implications
GOOD	GREEN	0 - 54	0 - 50	0 - 12.0	No health impacts are expected when air quality is in this range.
MODERATE	YELLOW	55 - 70	51 - 100	12.1 - 35.4	Sensitive people should consider reducing prolonged or heavy exertion. Watch for symptoms such as coughing or shortness of breath. These are signs to take it a little easier.
UNHEALTHY FOR SENSITIVE GROUPS	ORANGE	71 - 85	101 - 150	35.5 - 55.4	People with respiratory or heart disease, the elderly, children and teenagers should limit prolonged or heavy exertion. It's okay to be outside but take more breaks and do less intense activities. Watch for symptoms such as coughing or shortness of breath. Asthmatics should follow their action plans and keep quick relieve meds handy. Those with heart disease should watch for symptoms such as palpitations, shortness of breath or unusual fatigue and contact your health provider if necessary.
UNHEALTHY	RED	86 - 105	151 - 200	55.5 - 150.4	People with respiratory or heart disease, the elderly, children and teenagers should avoid prolonged or heavy exertion. Consider moving activities indoors or rescheduleing. Everyone else should limit prolonged or heavy exertion and take more breaks during all outdoor activities.
Very Unhealthy	Purple	106 - 200	201 - 300	150.5 - 250.4	People with respiratory or heart disease, the elderly, children and teenagers should avoid any outdoor activity. Move activities indoors or reschedule to a time when air quality will be better. Everyone else should avoid prolonged or exertion. Consider moving activities indoors or rescheduling to a time when air quality is better.

Figure 7: The Air Quality Index (AQI) ranges from good to very unhealthy.

Ozone is a photochemical pollutant which means it needs sunlight to ‘cook’ nitrogen oxides, volatile organic compounds and a few other compounds to form ozone. Therefore, ozone values are often low in the morning hours and begin rising around noontime and through the early evening hours. There are times when transported ozone levels remain high well into the evening hours along the coast and at high elevations in Acadia National Park and western mountains.

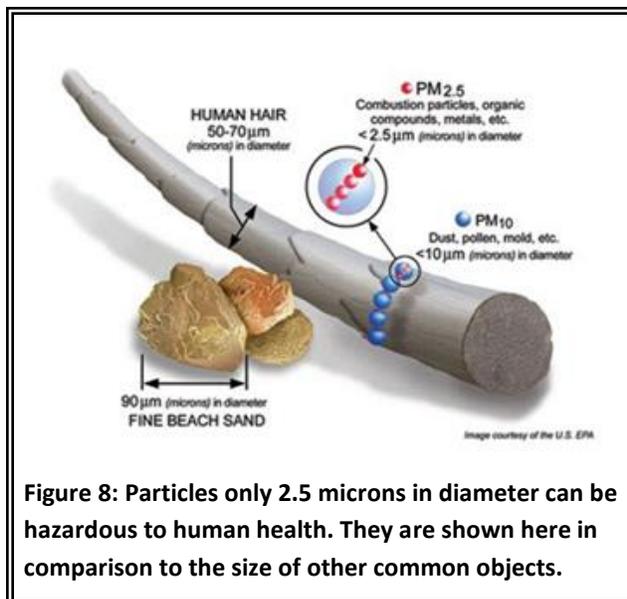
Air Quality Issues: Particle Pollution

By Martha Webster, Maine Department of Environmental Protection

There are a few different types of air pollution issues in Maine. This article will focus on Particle Pollution. If you are not familiar with air quality forecasting in Maine please review the previous article in this newsletter called “Air Quality Forecasting” and also: <http://www.maine.gov/dep/air/ozone/>

What is Particle Pollution?

Particle Pollution technically encompasses particles with a range of diameters from ultra-fine through coarse but for this article we will focus on PM_{2.5} which is the particles in the air that are smaller than 2.5 microns in diameter. These particles can only be seen with an electron microscope. This size is a concern because they are small enough to travel deep into the lungs, which is why forecasts are issued for this size of particle. Larger particles will either settle out before inhalation or be filtered out before reaching the deepest recesses of the lungs. Particle pollution is measured as a weight by volume using the units of micrograms per cubic meter ($\mu\text{g}/\text{m}^3$).



Where does Particle Pollution come from?

Particle Pollution is directly emitted from all types of combustion, including motor vehicles, power plants, residential wood burning, forest fires, agricultural burning, and some industrial processes. This is the primary formation mechanism, but Particle Pollution can also form from chemical reactions downwind of emission sources, a secondary formation source. Some components of Particle Pollution can be hygroscopic (water-seeking) and therefore humid conditions can enhance Particle Pollution levels, but a heavy rain can flush it out of the air.

Why is Particle Pollution a problem?

Once in the deep recesses of the lungs, Particle Pollution will impact the lung tissue itself but may also cause both chemical and physical impacts including transference into the blood stream. The health effects of Particle Pollution impact not only the lungs but the heart, eyes, nose and throat as well. Here are a few specific health effects of Particle Pollution:

- Irritation of the eyes, nose and throat
- Coughing, chest tightness and shortness of breath
- Reduced lung function
- Irregular heartbeat
- Asthma attacks
- Heart attacks

Air Quality Forecasting (continued)

Those who are more affected by Particle Pollution include children, the elderly and those with an existing heart or lung disease. Once Particle Pollution levels reach or exceed the ‘Unhealthy for Sensitive Groups’ category on the Air Quality Index (AQI) scale, even healthy adults who exert themselves are considered a sensitive group. This is because exertion increases the amount of air one is breathing which increases the pollution exposure. One can learn more about the health effects by going to: <https://www.airnow.gov/index.cfm?action=aqibasics.particle>

Particle Pollution in Maine

Maine DEP has been monitoring and forecasting Particle Pollution for a number of years at sites such as the one in Figure 9. Much has been learned from this monitoring. There are two ways in which Particle Pollution is measured. The first way is a filter method using the Federal Reference Method (FRM) monitors on a 1 in 3 day or 1 in 6 day schedule. This filter data is not available for months, making it not usable in real time. Since the early 2000’s, continuous monitors have been used to supplement the filter measurements and more importantly to inform the forecasting of Particle Pollution. This data is available in near-real time. The continuous monitor type currently in use within the Maine monitoring network is the Beta Attenuation Monitors (BAMs). These monitors measure hourly values of Particle Pollution, and every hour that data is gathered and sent to Maine DEP’s web site (http://www.maine.gov/dep/air/ozone/hourly_data.html) as well as EPA’s AirNow web site (<https://airnow.gov/>) for public display.



Figure 9: A typical monitoring facility used by Maine DEP to track particle pollution.

In general, Particle Pollution levels have been trending downward, and Maine has never been determined to be in nonattainment of the Particle Pollution National Air Quality Standards (currently a 24 hour, midnight to midnight, average of $35 \mu\text{g}/\text{m}^3$ and an annual average of $12 \mu\text{g}/\text{m}^3$).

Particle Pollution values can and do rise during any time of the year. However, in Maine there are two peaks of Particle Pollution levels: summer and winter. The summer peak is due to episodic regional events that occur when slow moving high pressure systems bring dirty air into Maine. [Years ago one Air Quality Forecaster in Southern New England began labeling the Highs by the number of days it took to move across the country. The higher the number the dirtier the air mass by the time it reached the northeast.]

Air Quality Forecasting (continued)

The winter peak is largely due to local emissions (such as wood stoves and fireplaces) being trapped near the ground by nocturnal temperature inversions. The good news for Maine citizens is that these locally trapped emissions rarely rise above ‘Moderate’ levels on the AQI. For a while Maine would average one regional winter event in 3 years where the Particle Pollution levels would reach the ‘UNHEALTHY FOR SENSITIVE GROUPS’ AQI level. In more recent years that has been less frequent. Often there is a clear diurnal trend of Particle Pollution. It is lower during daytime hours when there is good vertical mixing of the air and higher at night especially if inversions set up to trap pollution near the ground. As a result the highest values of Particle Pollution are generally around sunrise.

Forecasting Particle Pollution

Maine DEP’s Air Quality Meteorologists enjoy a great working relationship with the local NWS offices and use NWS products, including BufKit, to forecast air quality in Maine.

During the summer months Particle Pollution values are observed across the nation and in the region, then forecasts are made based on what is expected once the air mass reaches Maine. There are a few air pollution models that help inform the forecast for Particle Pollution but these are still in the early stages of development and need to be taken with a “grain of salt.”

Maine DEP’s Air Quality Meteorologists are continuously honing their air quality forecasting skills. It seems that every winter there is a new learning curve in forecasting Particle Pollution. Some of the confounders are: the national standards change periodically which results in revised AQI category ranges, and emission levels are always changing including the amount of residential wood smoke.

In regards to wintertime Particle Pollution, the air pollution models are even less helpful as local conditions prevail. Weather parameters of concern during the winter months are those that inform the likelihood and strength of a nocturnal inversion both during the early morning and evening hours of a day. If there are two Particle Pollution peaks in a day it is more likely that the 24 hour average will rise into the ‘MODERATE’ range of the AQI.

Maine DEP Air Quality Meteorologists made the decision several years ago to be a bit more protective and we forecast a rolling 24 hour average not the midnight to midnight block 24 hour average. Even so there are times when Particle Pollution will rise one evening and remain a bit high overnight but not rise the second night. If the Particle Pollution levels the first night are not expected to be high enough to cause any 24 hour average to be above the ‘GOOD’ AQI range the air quality forecast will be ‘GOOD’ for both days, but there will be text on the Air Quality Forecast home page mentioning a few hours of elevated Particle Pollution. This helps achieve the goal of continuing to provide an air quality forecast that is as accurate as possible so people know when to take actions to protect their health.

Fires Rage Across Maine 70 Years Ago

By Stacie Hanes, Lead Meteorologist and Fire Weather Focal Point

Over 200 fires burned between October 13 and 27, 1947 in the state of Maine. The fires burned a quarter of a million acres of forest, and obliterated 9 towns. A total of 2,500 people were left homeless, and over 1200 homes were razed to the ground. This year marks the 70th anniversary of the conflagration, and Acadia National Park is holding events October 17-18, 2017 concerning the fires, fire climatology, and fire management. Check out the events at:

<http://www.firesciencenortheastatlantic.org/>

The state had some early indications that the stage was being set for a conflagration: there were 108 consecutive days without rain from mid-July through early October, and snow melted early that spring. The National Forest Service recognized the danger and categorized Maine to be in a “high state of flammability,” urging residents to clean chimneys. The Forest Service also kept open fire watch towers which normally closed on September 30.

The first fires that developed were in Portland, Bowdoin, and Wells. By October 16, at least 20 separate fires were burning. Residents across Maine began to notice hazy skies, a smell of smoke in the air, and night skies that glowed red.

Organized fire departments, or brigades, were few and far between, with communications lacking and no centralized warning or command structure for the state. Firefighting resources were stretched to the maximum. Thankfully for the residents of Maine, men and boys from Maine and nearby states including New Hampshire, Massachusetts, and Vermont rushed to help extinguish the flames. Despite this, most homes in the towns of Shapleigh, Waterboro, Alfred, Lyman, Newfield, Kennebunk, Kennebunkport, Arundel, Dayton, Wells, Biddeford, and Saco were destroyed in the fires over the next weeks. The USS Little Rock came from Boston with 1,000 servicemen and firefighting equipment. The men fought the fires tirelessly. Many towns that would have otherwise been destroyed were saved due to these heroic efforts, including Hollis.

Mount Desert Island, which contains Bar Harbor and Acadia National Park, had a total of 17,188 acres destroyed, with 5 people dying because of the fire. Fires engulfed 67 townhomes in an area known as Millionaire’s Row in Frenchman Bay. Another 170 homes and 5 historic hotels were destroyed. As residents fled to nearby piers to escape the fires, fisherman from Winter Harbor, Gouldsboro, and Lamoine evacuated 400 people by boat. The nearby Jackson Laboratory exploded in a fireball over the ocean.

The fires were declared under control in late October, but continued to burn under the ground through mid-November. The fires were a wake-up call for Maine. A statewide firefighting and prevention meeting was held in 1948, and it is at that meeting that most Maine towns established volunteer firefighting departments. Maine developed a two-way public radio network, and a public education program was begun.

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 Margaret Curtis.

What is your role at the office? I am one of 5 general forecasters. My responsibilities include issuing forecasts, watches, and warning products for our area during my shift. I am also responsible for the computer system we use to create our forecasts including new tools and software updates.

How long have you worked for the National Weather Service in Gray? This is my 7th year here at the office. I spent 5 years as a Meteorologist Intern responsible for weather balloons and observations and was promoted to forecaster last fall.

Where else have you worked? In addition to my years here in Gray I have worked as a civilian forecaster for the US Army in Utah for 3.5 years.

Where did you grow up? I grew up in Sandwich, NH and am proud to be providing forecasts and warnings for my hometown.

Where did you get your education? I attended McGill University in Montreal where I got my Bachelor's degree in Atmosphere Science. I then studied at the University of Utah in Salt Lake City for my Master's degree.

How did you first get interested in weather? I spent a summer leading canoe trips on the Rangeley lakes. It seemed no matter which direction we planned the trip we were always paddling upwind. 1-2ft waves in an open canoe is quite a difficult paddle. When I finished that summer and went back to school I decided to take a course in weather. I quickly got hooked, although I still occasionally have to paddle upwind!

What is the most interesting part of your job? I like that every day is different. In Northern New England we see such a variety of weather that within a year I'll see blizzards, winter storms, freezing rain, thunderstorms and even occasionally tornadoes and tropical storms. Every day is different which keeps it interesting!



Figure 10: Forecaster Margaret Curtis has worked at NWS Gray since 2010.

NWS Staff Profile (continued)

What is the most challenging aspect of your job? The most challenging aspect is communicating what I expect to happen. Often I have a picture in my head of what will occur but transferring that into words and making sure everyone understands can be challenging. A "big snowfall" for one person may be small to another person!

What is the most memorable weather event that you have worked? The most memorable event is Tropical storm Irene. New Hampshire had widespread flooding- at one point it seemed like there were no north south routes through the White Mountains that were passable. We issued a number of Flash Flood warnings in the middle of the night. I remember discussing whether that was the right call because we knew it would wake everyone up via the tone alert. I was so glad we did because a few hours later they had to evacuate people from their homes because the river was rising too rapidly. It was very rewarding knowing that our actions helped keep people safe!

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For questions, comments, or suggestions contact us at

GYX-Newsletter@noaa.gov



Photo by Chris Kimble