The Four Seasons

National Weather Service Burlington, VT

VOLUME IX, ISSUE I

SPRING 2023

Table of Contents

Letter from the Editors

Welcome to our spring newsletter! What a spring it was for our region with regards to daytime conditions, frequently pleasant for outdoor activities. While recent weeks have been quiet, we did have a period before greenup when fire weather conditions were in place, which we talk about in a couple of articles in this issue's newsletter. We also get you ready for severe weather season as days get hotter and more humid, recount a recent outreach event, and discuss what it means to bust a snowfall forecast and how we define success. Thanks for reading, and have a great summer! Please let us know any topics you want us to cover in future newsletters by pressing the big oval below.

Like the newsletter? Let us know what you want to see more of in future issues!

Thunderstorm Season is Here!
Are You Ready???
By Rebecca Duell

It's been a slow start to the severe weather season, but it's only a matter of time until things ramp up this summer. While we usually have more thunderstorms in May than we've seen this year, climatologically our most active months don't occur until June and July. The most common thunderstorm threats for Vermont and northern New York are strong winds, lightning, and flash flooding. We typically see our strongest winds in thunderstorm lines (bow echoes) or microbursts. Winds from these types of storms can exceed 70 mph, which can be very damaging to property and very dangerous if you're caught in the storm. For reference, these "straight-line winds" can be as strong as a weak tornado! We also see plenty of lightning in this area, so remember *When Thunder Roars, Go Indoors!* Flash flooding can also occur during and after storms, so remember if you encounter water on the roadway, never try to drive through it! *Turn Around, Don't Drown!*

Are you ready for this year's severe weather season? We've included a thunderstorm safety checklist on the next page to help you prepare.

...Continued from Page 1

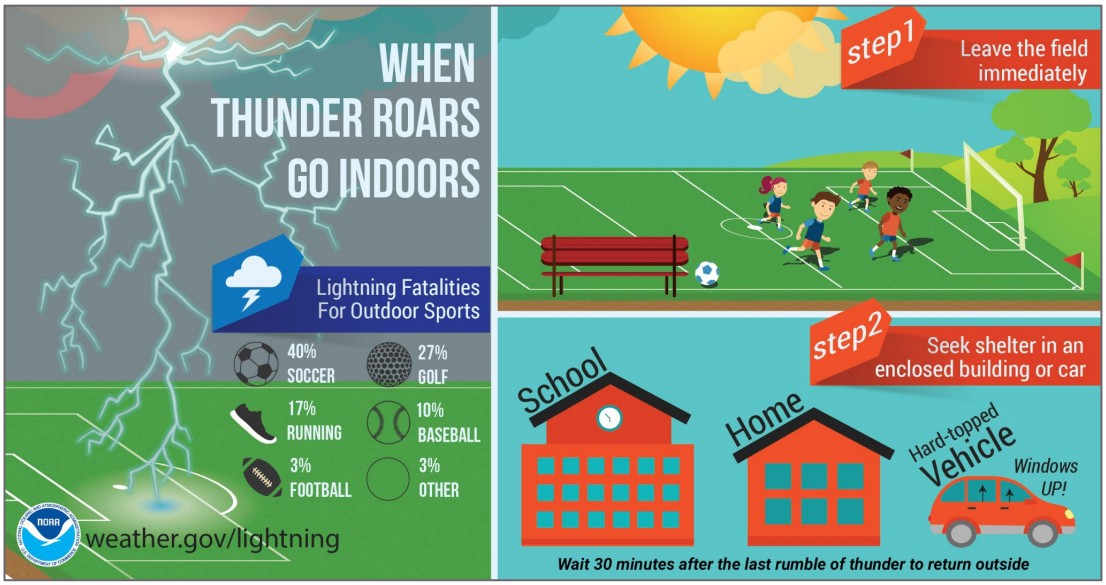
Before Severe Weather (do these now!!!):

- ❑ **Be Weather-Ready:** Check the forecast regularly to see if you're at risk for severe weather. Listen to local news or a NOAA Weather Radio to stay informed about severe thunderstorm watches and warnings. Check the Weather-Ready Nation for tips.
- ❑ **Sign Up for Notifications:** Know how your community sends warnings. Many of our communities depend on media and smartphones to alert residents to severe storms.
- ❑ **Create a Communications Plan:** Have a family plan that includes an emergency meeting place and related information. Pick a safe room in your home such as a basement, storm cellar or an interior room on the lowest floor with no windows. Get more ideas for a plan at: https://www.ready.gov/make-a-plan
- ❑ **Practice Your Plan:** Conduct a family severe thunderstorm drill regularly so everyone knows what to do if a damaging wind or large hail is approaching. Make sure all members of your family know to go there when severe thunderstorm warnings are issued. Don't forget pets.
- ❑ **Prepare Your Home:** Keep trees and branches trimmed near your house. If you have time before severe weather hits, secure loose objects, close windows and doors, and move any valuable objects inside or under a sturdy structure.

...Continued from Page 2

During Severe Weather

- ❑ **Stay Weather Ready:** Continue to listen to local news or a NOAA Weather Radio to stay updated about severe thunderstorm watches and warnings.
- ❑ **At Your House:** Go to your secure location if you hear a severe thunderstorm warning. Damaging wind or large hail may be approaching. Take your pets with you if time allows.
- ❑ **At Your Workplace or School:** Stay away from windows if you are in a severe thunderstorm warning and damaging wind or large hail is approaching. Do not go to large open rooms.
- ❑ **Outside:** Go inside a sturdy building immediately if severe thunderstorms are approaching. Sheds and storage facilities are not safe. Taking shelter under a tree can be deadly. The tree may fall on you. Standing under a tree also put you at a greater risk of getting struck by lightning.
- ❑ **In a Vehicle:** Being in a vehicle during severe thunderstorms is safer than being outside; however, drive to closest secure shelter if there is sufficient time.



After the Storm

- ❑ **Stay Informed:** Continue listening to local news or a NOAA Weather Radio to stay updated about severe thunderstorm watches and warnings. More severe thunderstorms could be headed your way.
- ❑ **Assess the Damage**: After you are sure the severe weather threat has ended, check your property for damages. When walking through storm damage, wear long pants, a long-sleeved shirt and sturdy shoes. Contact local authorities if you see power lines down. Stay out of damaged buildings. Be aware of insurance scammers if your property has been damaged.

Red Flag Event on 11 April 2023

By Brooke Taber

On 11 April 2023 the National Weather Service in Burlington, Vermont issued a Red Flag Warning from 10 AM to 10 PM for the Champlain Valley and Lower Connecticut River Valley Fire Weather Zones. A Fire Weather Watch was issued on the previous day, to provide lead time and heighten awareness of potential critical fire weather conditions. These conditions included critically low relative humidity values and gusty southwest winds, along with very dry fine deal fuels per pre-coordination with our fire partners. Southwest winds of 15 to 25 mph with frequent gusts 25 to 45 mph were expected, along with minimum relative humidity values in the 20 to 30 percent range. A red flag warning is issued when minimum relative humidity values less than 30 percent and sustained or frequent gusts 25 mph or higher are expected for at least 2 hours, along with dry/receptive fuels per coordination with our fire partners. Figure 1 below shows the geographical area the Red Flag Warning was in effect for on 11 April 2023.

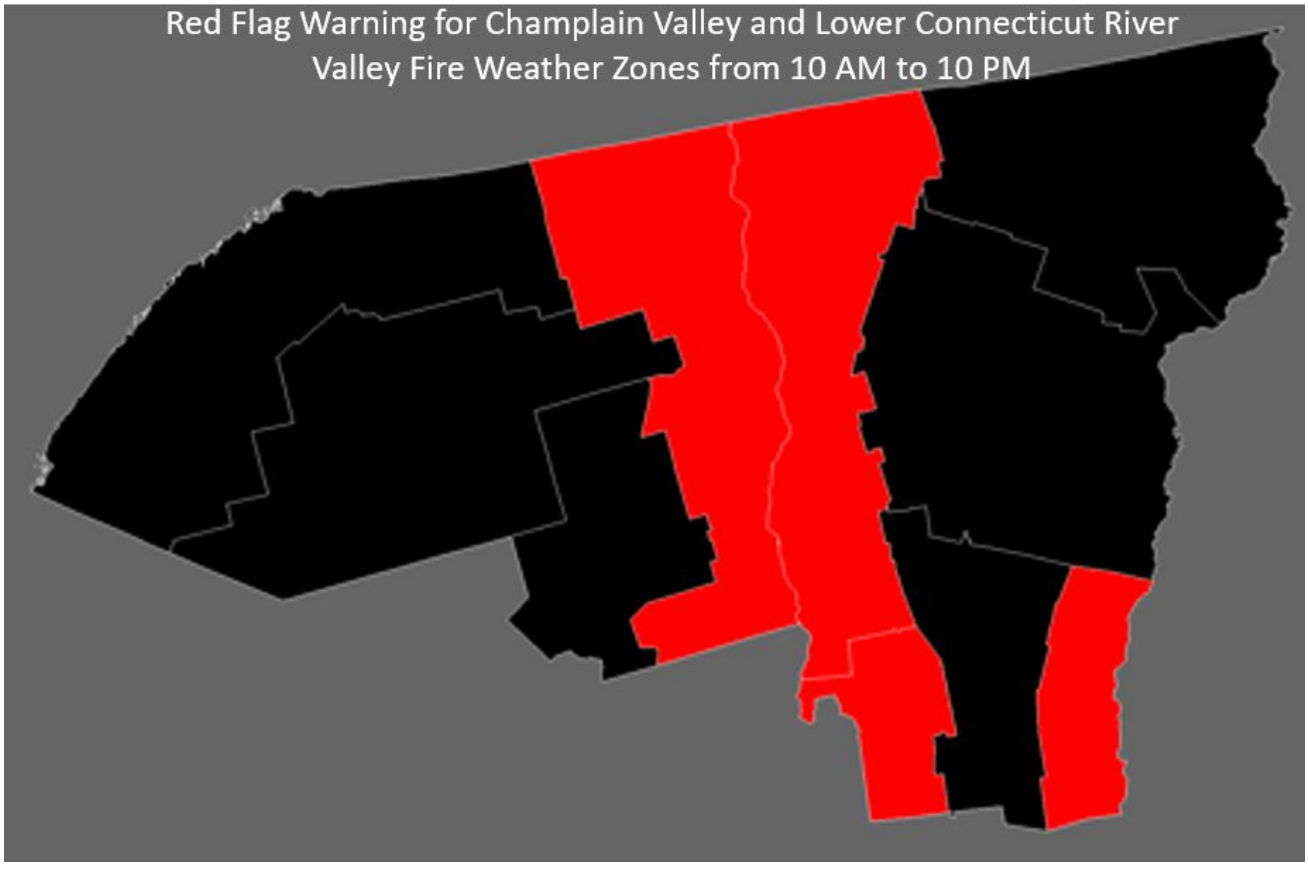


Figure 1. Red Flag Warning area colored in red

The fire danger rating per our fire weather partners on 11 April 2023 was high across the Champlain Valley, Connecticut River Valley, and parts of central Vermont (Fig. 2, next page). The fire danger rating is a system that allows fire managers to estimate fire danger for a given area. The fire danger ratings describe conditions that reflect the potential, over a large area, for a fire to ignite, spread and require suppression action. When the fire danger is "high", fires can start easily from most causes and fine fuels, such as dead grass will ignite readily and could become difficult to control. Figure 2 (next page) shows the fire danger rating for 11 April 2023 for Vermont and New York.

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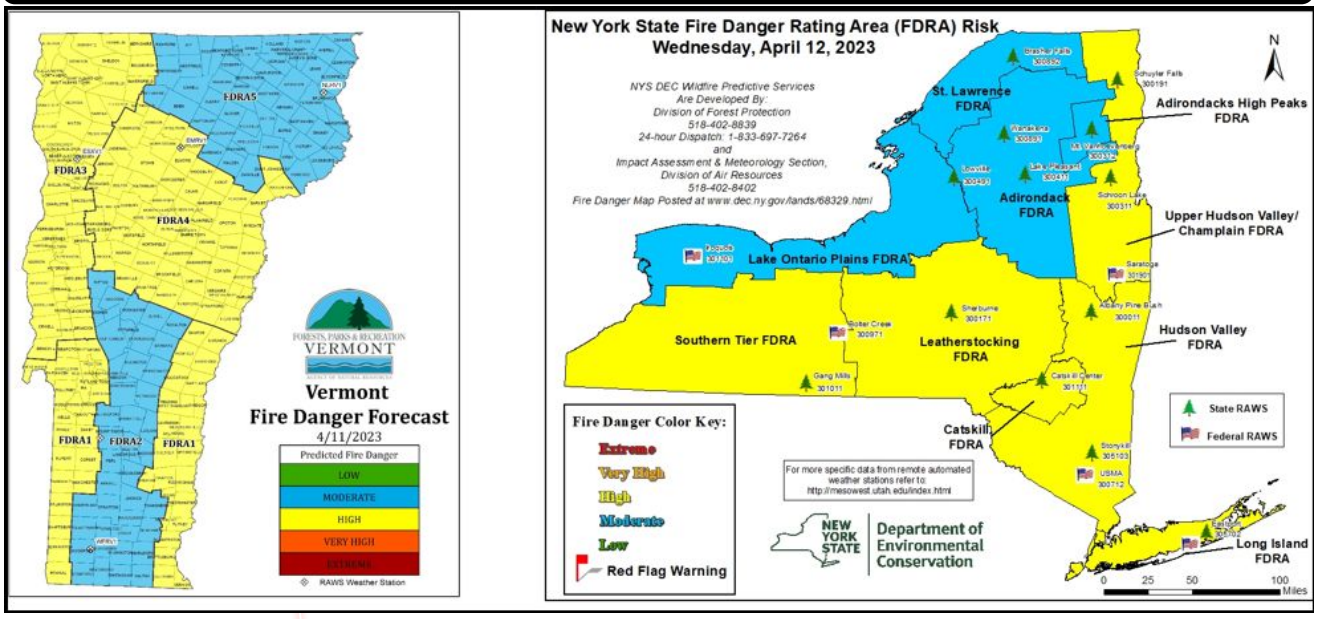

Figure 2. Fire danger ratings for Vermont (left) and New York (right)

The surface analysis indicated a tight pressure gradient or difference between low pressure over southern Canada and high pressure centered over the Ohio Valley. This gradient combined with a potent 3000 to 4000 feet above ground level wind maximum of 40 to 60 mph, created very gusty south to southwest winds across our region. Several locations on the favorable downslope regions of the eastern Adirondacks witness gusts over 50 mph, with many sites in the 30 to 45 mph range. This caused several power outages with downed power lines causing a 6 acre fire in northern Clinton County, with additional fires occurring across parts of the Champlain Valley.

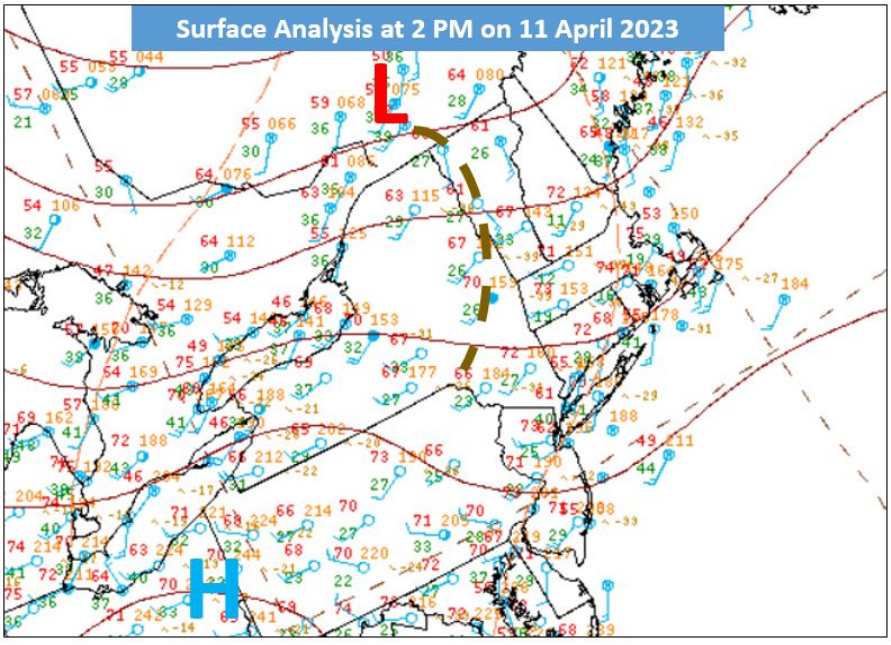

Figure 3. Surface Analysis at 2 PM on 11 April 2023

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Temperatures were well into the 60s, which is much above normal for mid-April, while dew points were in the mid to upper 20s, creating the very low relative humidity values. Figure 3 (prior page) shows the Weather Prediction Center surface analysis at 2 PM on 11 April 2023.

Finally a quick look at the New York State Mesonet maps for observed minimum relative humidity and peak wind gusts indicated red flag conditions were easily meet across northern New York. Furthermore, a quick analysis indicated similar conditions were observed across the Champlain Valley of Vermont and lower Connecticut River Valley, but with slightly less wind. Observed gusts in the 35 to 45 mph range were common over northern New York with minimum relative humidity values in 20 to 25 percent range. Peak wind of 52 mph was observed at Malone and 51 mph at Ellenburg, New York. Meanwhile, over Vermont the winds gusted between 25 and 35 mph, with observed minimum relative humidity values ranging between 20 and 30 percent. Given observations both locations exceeded red flag warning criteria for multiple hours on 11 April 2023, justifying the need for the warning. A special thanks to our fire weather partners for the solid coordination on this event. The final figure 4 below shows the observed peak wind gusts and minimum relative humidity values from the New York State Mesonet.

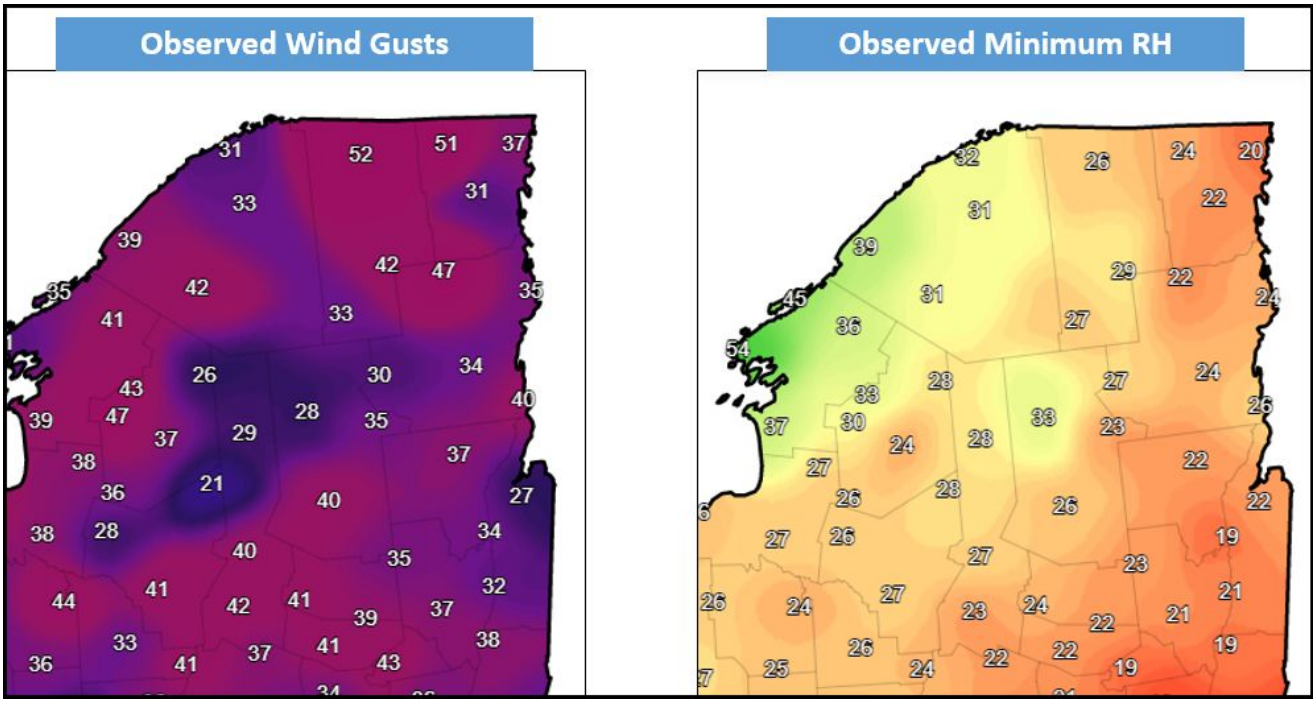


Figure 4. Peaked observed wind gusts (left) and minimum relative humidities (right) for 11 April 2023 Data provided by the New York State Mesonet.

NWS Burlington Hosts Hybrid SKYWARN and social science talk at Middlebury College

by Rodney Chai

Rodney Chai, Robert Haynes and Seth Kutikoff hosted a special hybrid SKYWARN and social science talk at Middlebury College, a leading liberal arts college in the nation. We liaised with Dr. Lizz Ultee, an assistant Professor in the Department of Earth and Climate Sciences as well as her student Molly. We had a great turnout, which was four times the expected attendance. Students who attended the talk hailed from a variety of disciplines, including humanities and social science but shared a common interest in weather.

NWS Burlington Meteorologist Robert Haynes giving SKYWARN talk to Middlebury College students

NWS Burlington Meteorologists Rodney Chai, Robert Haynes, and Seth Kutikoff with the Middlebury Students

Students were intrigued by the increased emphasis of social science in NWS operations, as the agency focuses on adopting social science best practices for effective communication of life-saving information to our communities. Students were also inspired by Rodney's sharing of his highly unique career path from Philosophy and Political Science to Atmospheric Science. Overall, this was a highly successful pilot test to experiment with a different version of SKYWARN talk geared towards liberal arts students, who might not have otherwise thought NWS' mission might be relevant to their disciplines. We plan to return during the fall semester for a full social science talk to a larger audience.

Did We Bust the Forecast?

By Robert Haynes

Meteorologist: Lackadaisical or Perfectionists?

Every so often on social media, we notice comments like “Another bust”, or “I’ll believe the snow forecast when I see it”. How does that joke go? “It must be nice to be wrong half the time and keep your job?” The joke is all in good fun, but does it suggest that we do not need to care if we’re wrong, and have no reason to improve or to put effort into our weather forecasts. The reality is often the opposite. If you meet or have met a few meteorologists, you’ll probably find a perfectionist (and I’m guilty of this). We’re trying to estimate temperatures, winds, precipitation, and snow with relatively high levels of precision when weather models struggle to depict the complexities of Earth’s atmospheric motion. Yet we like to get it absolutely correct. It can be thrilling to get a complex forecast right, but is it beneficial for your meteorologist to be a perfectionist? You might be surprised that the answer is usually not. Sometimes, we end up setting ourselves up for a forecast bust. So what we’ll do here is discuss how we determine success and why the focus of meteorology is moving away from perfect forecast precision.

How do we Measure Success?

Let’s first tackle the literal, mathematical definition of whether a forecast was successful. If we forecast a high temperature of 80 degrees and it hits 80 degrees on the thermometer, then our temperature forecast was without error. Of course we provide temperature forecasts beyond your town, and put temperature forecasts out for the whole region. From each area, we measure how far off we were from observed values (estimated for where no weather station exists) and take the “Mean Absolute Error” (MAE). We also determine whether our temperature forecast was biased too warm or biased too cold. For example, we can say we had a temperature “forecast bust”, when we’re 10 degrees off the mark. Here we’ll offer a behind the scenes look at how we see our temperature forecast proficiency. To help us see how we are doing comparatively, we score ourselves against available model guidance. Naturally, as the forecast range grows, so does our error.

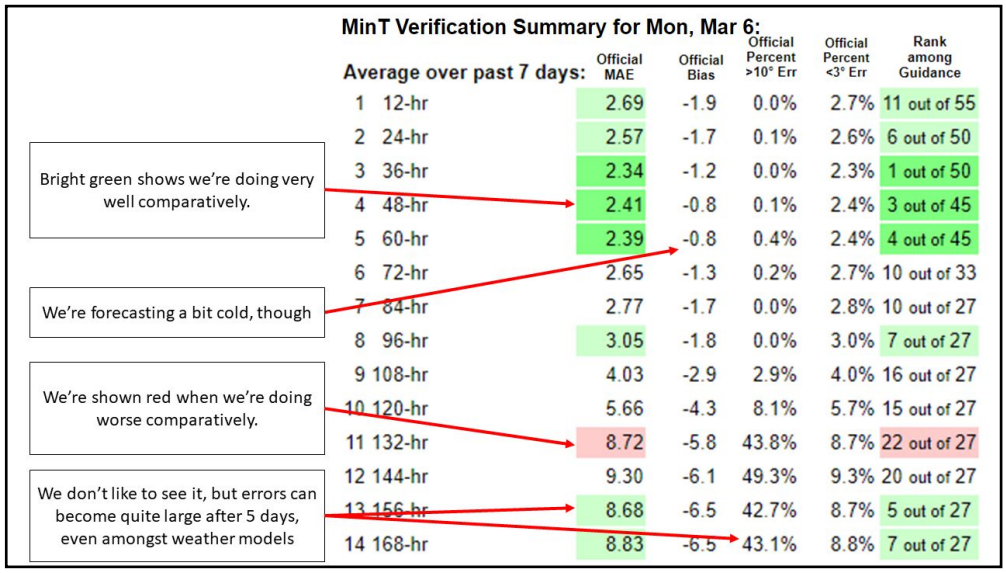


Figure 1. NWS BTV MinT Verification Summary

...Continued from Page 8

However, would anyone really bat an eye if instead of 80, we were 78 or 82 at the end of the day? The impact of being off by a couple of degrees is minimal. What if it was 32 degrees? Then being off by a couple of degrees can mean the difference between snow, freezing rain, or icy roads at 30, but if it's 34, then whatever the precipitation type, we don't need to worry much about the impacts to roadways. The point is that the level of accuracy needed is conditional. Additionally, we have to be reasonable about our expectations. To forecast snowfall within an inch of observed values is a lot to ask, especially when amounts are 12 to 18 inches. Would 1 inch really make that much of a difference at such numbers. Probably not, but we do verify forecasts against observations, which also include measurements from people who are not trained to take World Meteorological Organization standard measurements.

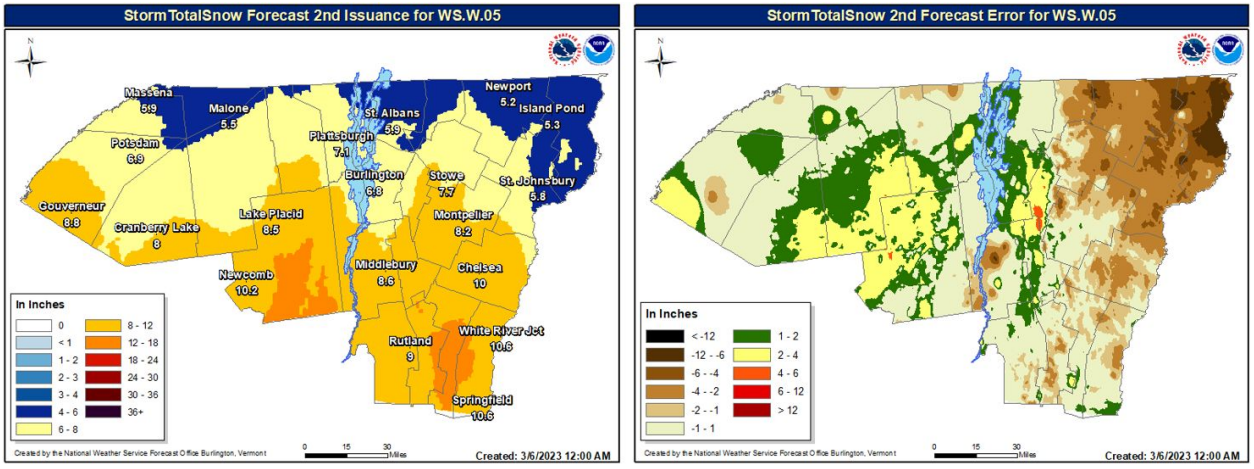
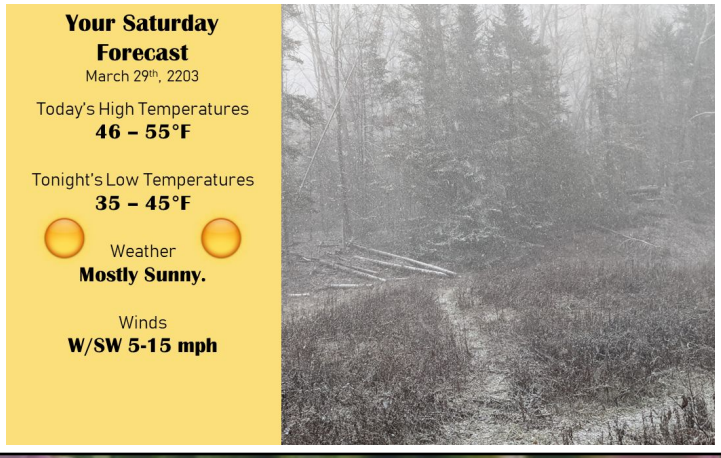


Figure 2. Left image: An example of a Storm Total Snowfall forecast issued March 4th. Right Image: Verification showing whether more or less snow was observed than forecast.

A perfectionist can try to be correct, but when going against model and observational deficiencies, it's easy to miss the forest for the trees. For example, on a high wind day where southwest gusts between 35 and 55 mph are possible, it will be more important for us to give the most attention to an accurate gust forecast that could impact whether you experience power outages than whether you will receive 0.05" of rain or 0.10" of rain and reach a temperature of 54 degrees as opposed to 57 degrees, which won't have the same impact as whether or not you get a 55 mph gust. We need to keep in mind the big picture and focus on what matters most when we put it all together.

Communication of the Forecast

The thing that matters most in our line of work… is you! We might have the perfect forecast, but if it doesn't reach you and help you make choices, then what good does it do? Presentation is also important, and we have to avoid conflicting signals. The example to the right is an exaggeration, but the colors, photos, and way we write out words should not be at odds with each other.



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Here's another hypothetical example. Look at the forecast wording and think about how you might react:

(1)

Forecast uncertainty is high tomorrow, there could be 3 to 15 inches of snow across the area. Winter Storm Warnings are in effect from 12 PM to 10 PM Saturday.

(2)

There's a wide range of snowfall forecasts, but there's at least a high likelihood (50 percent chance) that at least 6 inches will fall across much of the area, and some of it could be heavy, wet snow.

Line (1) can create considerable confusion between the statement of uncertainty and the large range without representing at least a likely impact. The "Winter Storm Warning" could be a total bust, and not everyone knows what a "Winter Storm Warning" means.

Line (2) gives a statement of uncertainty, and then uses a phrase to turn you over to something that you can know - that there is at least a coin flip's chance that you receive 6 inches of heavy, wet snow at 6 inches. This kind of message can help you plan depending on your level of acceptable risk, even if a large forecast range exists.

A weather forecast may be technically correct, but if it does not take into consideration the human element, then our effort may not be valuable. Messaging probability in a consistent and reliable basis can be hard, and we're human. We can fall prey to personal bias or overconfidence, but the best forecasters will make adjustments that fit incoming data, different perspectives, and keep in mind the impact their forecasts have on you.

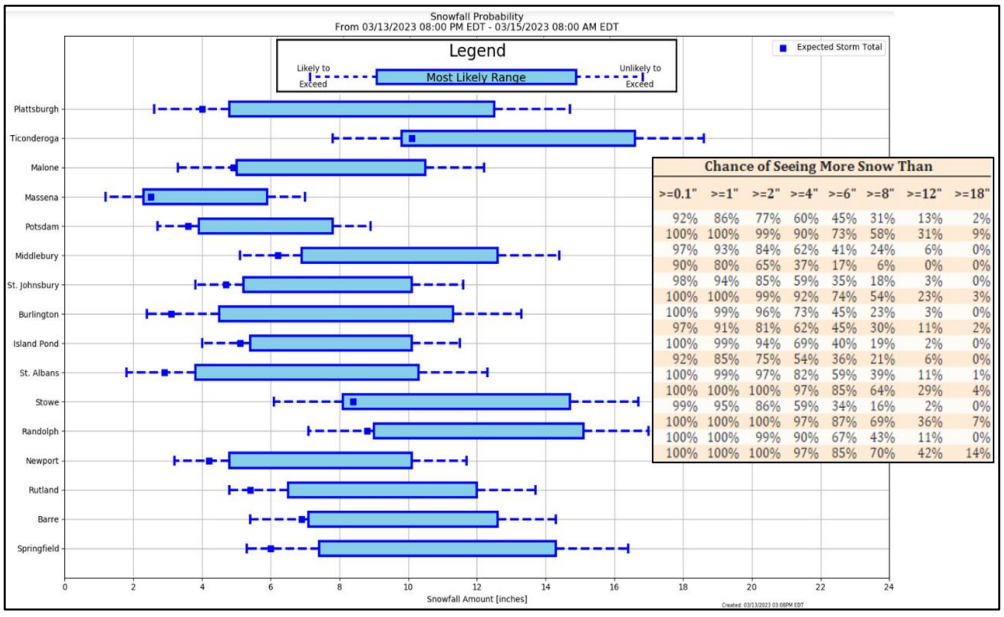

Figure 3. Box and whisker plot for the storm on March 14th of 2023. The whiskers showing the 10th and 90th percentile range between about 2 to 3 inches to 16 inches. In these cases, a probability of exceedance charts embedded may be more useful for planning.

In summary, did we bust the forecast? Sometimes, the answer is yes. But did we at least provide an adequate message such that people can prepare for worst case scenarios? The danger is that we can become too focused on a specific outcome that we become inflexible to possibilities outside that expectation. This discussion can be seen in things like the hurricane forecast cone as well, which is a much more high stakes situation. For those situations where a forecast falls well outside our expectation, and causes severe impacts as a result, we do notice and reflect on how we can communicate it better for the next time. Our technology and understanding of meteorology continues to improve, and we're growing as an agency to leverage new tools to communicate possibilities.

National Weather Service Partners with Green Mountain National Forest to Provide On-Site Decision Support Services at the Robert Frost Prescribed Burn

By Adrianna Kremer

On April 14th, 2023 two meteorologists from National Weather Service (NWS) Burlington provided on-site decision support to the Green Mountain National Forest (GMNF) for a prescribed burn. Prescribed burns, also known as prescribed fires, refer to the controlled application of fire by a team of fire experts under specified weather conditions. These prescribed fires are important for several reasons: they help reduce hazardous fuels and unwanted fires, they recycle nutrients back into the soil, minimizes spread of abrasive species, and they improve habitats for different wildlife. While it might seem counterintuitive, prescribed burns also help promote the growth of trees, wildflowers, and other plants such as blueberries which was the reason for this burn.

This prescribed burn took place at the Robert Frost Interpretive Trail, near Ripton, Vermont, where roughly 7 acres were burned in about 2 hours. The NWS Burlington office provided several SPOT forecasts 12 to 24 hours prior to firing operations, so the GMNF crew had a sense of what conditions to expect, especially winds, relative humidity and mixing heights for smoke dispersion. A SPOT forecast is a detailed site-specific, near term forecast that the NWS provides to federal, state or local agencies per an official request. Typically these

Figure 1 (above) . NWS Burlington Meteorologist Adrianna Kremer providing weather updates on radio to the Green Mountain National Forest Crew on the Robert Frost Prescribed Burn.

Figure 2. (left) Robert Frost Wayside Park sign in the Green Mountain National Forest near where the meteorologists were stationed during the burn, approximately ¼ mile away from the burn site.

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forecasts support fire weather and prescribed burns, but can be used for special events, search and rescue or HAZMAT incidents. In order for the burn to occur, the weather conditions need to be within certain weather thresholds, otherwise the burn will be postponed to another date. Given the burn site's proximity to Route 125 and the Middlebury Bread Loaf Campus, the SPOT forecast was important in determining if conditions would be favorable for burning. The morning of the burn, the on-site meteorologists provided the crew with a verbal weather briefing. During the burn, observations were taken every half hour, or more frequently as needed, to update the crew with the latest current weather conditions and associated weather trends. Given safety protocols and concerns, the meteorologists were stationed about ¼ mile from the burn site in a location with similar conditions in order to provide accurate observations. These observations included temperature, relative humidity, as well as wind speed and direction. Other measurements included the probability of ignition (PIG) and the fine dead fuel moisture (FDFM), which are parameters related to relative humidity and fire behavior, which were coordinated with a GMNF Fuels Specialist at the burn. In addition, smoke behavior and smoke movement were reported to the crew, so they had a sense of potential impacts to travelers on Route 125 and the Middlebury Bread Loaf Campus.

Figure 3. Picture of the smoke from the 14 April 2023 Robert Frost Prescribed Burn

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Contributors:

Rodney Chai, Lead Meteorologist
Rebecca Duell, Meteorologist
Robert Haynes, Meteorologist
Adrianna Kremer, Meteorologist
Brooke Taber, Lead Meteorologist

Editors:

Rebecca Duell, Meteorologist
Seth Kutikoff, Meteorologist
Marlon Verasamy, Observing Program Leader

We Need Your Storm Reports!

Please report snowfall, flooding, damaging winds, hail, and tornadoes. When doing so, please try, to the best of your ability, to measure snowfall, estimate hail size, and be specific as to what damage occurred and when. We also love pictures!

For reports, please call:
(802) 863-4279
Or visit:
http://www.weather.gov/btv/stormreport

National Weather Service Burlington, VT
Burlington International Airport
1200 Airport Drive
South Burlington, VT 05403
Phone: (802) 862 2475
www.weather.gov/btv
Email: btv.webmaster@noaa.gov

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