The Four Seasons
National Weather Service Burlington, VT
VOLUME VIII, ISSUE I
SPRING 2022

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Letter from the Editors

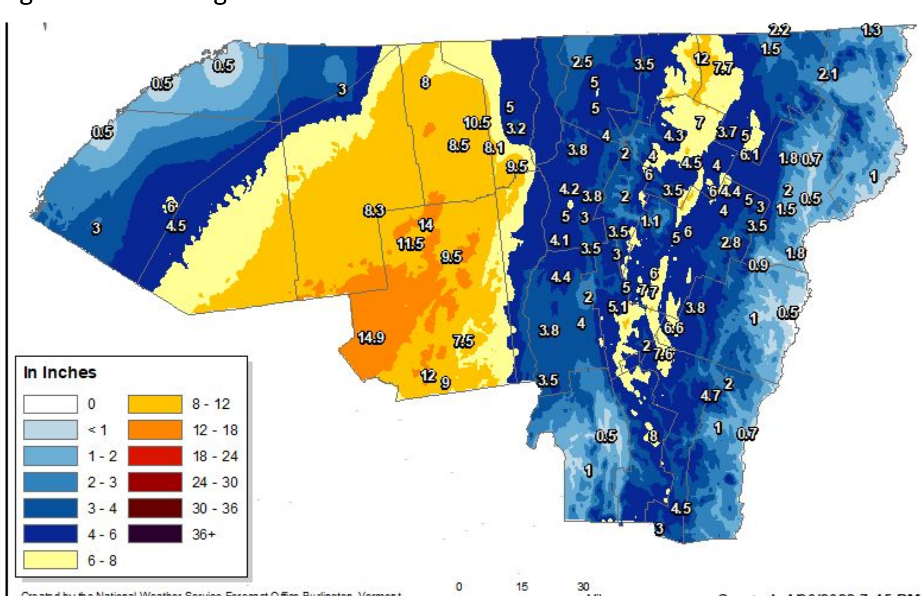
Welcome to our spring newsletter! The season of renewal, it marks the beginning of the four seasons and for some it may be the best of them all. The days are getting longer, it's easier to feel comfortable outdoors, and we tend to see more sunny days. In this year's spring newsletter, we've got a nice variety of stories for you. We begin by recapping the spring snowstorm that we saw in April before getting ready for the upcoming severe weather season, Then we have a great account of the most relevant research presented at the Northeastern Storm Conference hosted by NVU-Lyndon Atmospheric Sciences students and a breakdown of the changes to our public and fire weather zones that was implemented in April. Finally, we say our fond goodbye to a meteorologist who moved onto the Central Weather Service Unit in Nashua, NH, while welcoming in our new Administrative Support Assistant.

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

Heavy Wet Snowstorm of April 2022

By Seth Kutikoff

A memorable late season snowstorm caused widespread power outages and road closures on April 19th. Only a few locations remained unscathed on the edges of the Burlington forecast area. Storm total snowfall is shown below.



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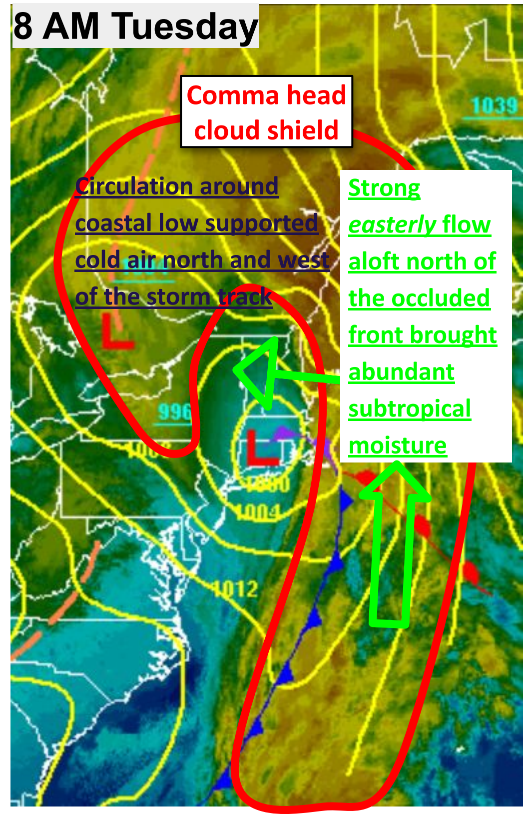
How Did it Happen?

Interaction of a moisture-laden, mature, and classically structured coastal storm (analyzed to the right) with a negatively-tilted upper level low produced the ingredients for heavy wet snow. Diabatic cooling from heavy snowfall caused temperatures to fall enough to support snow despite relatively warm temperatures. Most of the snow became slush (as seen in photo below) as temperatures remained above freezing throughout the storm in many locations.



How Wet was the Snow?

Snow ratios were extremely low. Typically anything 8:1 or lower is considered a very wet snow; reported values were even lower, even below 5:1! Consider that snow ratios are inversely related to density of snow, so that for every inch of snowfall, a 5:1 ratio is twice as heavy as a 10:1 snow ratio.

Considering how the snow caked onto surfaces in a manner comparable to ice accretion, modest wind speeds resulted in weighted down tree limbs. CoCoRaHS observer NY-ES-12 in Saranac Lake, New York observed extensive damage including many fallen birch trees. In Hancock, Vermont, only 1.5 inches of snow was enough to impact pine tree branches with dead branches fallen in VT-AD-20's yard.

How much did the snow weigh?

An observer in Swanton, Vermont reported 2.5" of snowfall that had a liquid equivalent of 0.63", or a 4:1 snow ratio (25% water). Since water has a weight of 62.4 pounds per cubic foot, this snow would weigh 15.6 pounds per cubic foot. The snow load, or weight over a given surface area, would then be 3.25 pounds per square foot. Note if you double the snow depth and keep the same snow ratio, you double the snow load.

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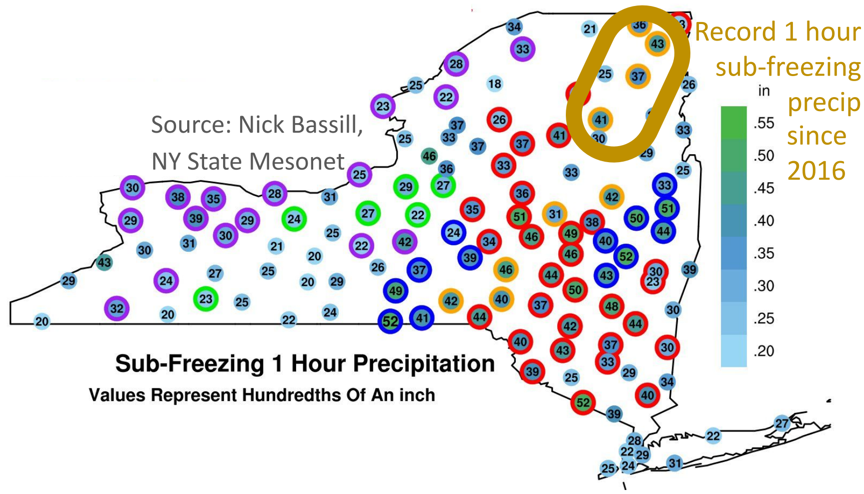
Heavy in weight *and* Rate!

If we assume a 5:1 snow ratio, 0.4" of liquid in one hour results in a quick 2" of snow. And indeed, CoCoRaHS observer VT-OL-9 noted about 2.5" of new snow between 6 and 7 AM. In northern New York, particularly in the eastern Adirondacks, very heavy precipitation rates were also observed. Hourly precipitation in the circled area of the map peaked at 0.36" to 0.43"!



Daily precipitation reports at 7 AM April 19.

CoCoRaHS station comparison	**VT-WR-17**	**VT-WR-22**
Elevation	2026 ft	985 ft
7 AM Temperature	31	33
Snowfall	6.8"	0.7"
Precipitation (gauge catch)	0.95"	0.96"

Elevation dependent snowfall

We often say snowfall will be elevation dependent, especially in early and late winter season storms when temperatures near the ground are relatively warm. The expected snow level, or elevation at which snow rather than rain would fall at the surface, often varies during the course of a storm and by location, making it difficult to gauge exactly how much snowfall differences are due to just elevation. However, two observers in Rochester, Vermont measure precipitation only about 2.5 miles apart but roughly 1000 feet in elevation difference. Note in the chart that each observer measured nearly the same amount of precipitation. At the low elevation site, wet, slushy snow was observed with less than an inch accumulated. Meanwhile nearly 7 inches of very heavy, wet snow accumulated at the high elevation site.

Reported damage

The combination of wet snow accumulation and strong winds helped produce many downed power lines and trees. At 9:15 AM, over 18,000 power outages were reported in Vermont and about 30,000 across the Burlington forecast area. In Lyndonville, VT, sections of metal roofing were reportedly peeled up and off a home. Several feet of power line fell across North Williston Road, just south of Vermont Route 117. Downed trees and wires were observed in North Hudson, NY, Wilmington, NY, and Duxbury, VT. Other road closures due to downed power lines occurred in Hinesburg, VT, and due to a downed tree in Cornwall, VT. Due to how busy crews were, many closures remained for several hours. Likewise, some power outages lingered into the nighttime hours.

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Sticky snow…

Tree blocking road on Main Street in Burlington, VT at 7:30 AM.

But it didn't *stick* around

One of the benefits of a mid-April snowfall is that if you wait long enough, the snow will be gone. That was true in a matter of hours for many areas, especially in Vermont where the storm's dry slot entered during the afternoon and temperatures soared well above freezing. The warm up aided storm recovery as no additional damage was observed while power was restored.

Snow had melted off of trees with some remaining on grassy surfaces at 5:30 PM in South Burlington, VT. Temperatures had recovered into the low 40s and partial sunshine also helped contribute to rapid snow melt.

Severe Weather Review for 2022 by Brooke Taber

As we transition from cold and snowy weather into warm and humid conditions typical of late spring and summer months, we should prepare now for the potential of severe weather. Last year we experienced our first severe weather event on 26 March 2021, which featured an EF1 tornado near Middlebury, VT. As a whole we experienced a near normal season, with 49 severe thunderstorm warnings issued by the Burlington, VT Weather Forecast Office, with 127 reports of severe weather. A majority of the reports were from gusty thunderstorm winds, which knocked down trees and power lines, with just a handful of 1 to 1.25 inch hail reports. The strongest wind measured was a 63 mph gust at Ogdensburg Airport, NY on 20 July 2021.

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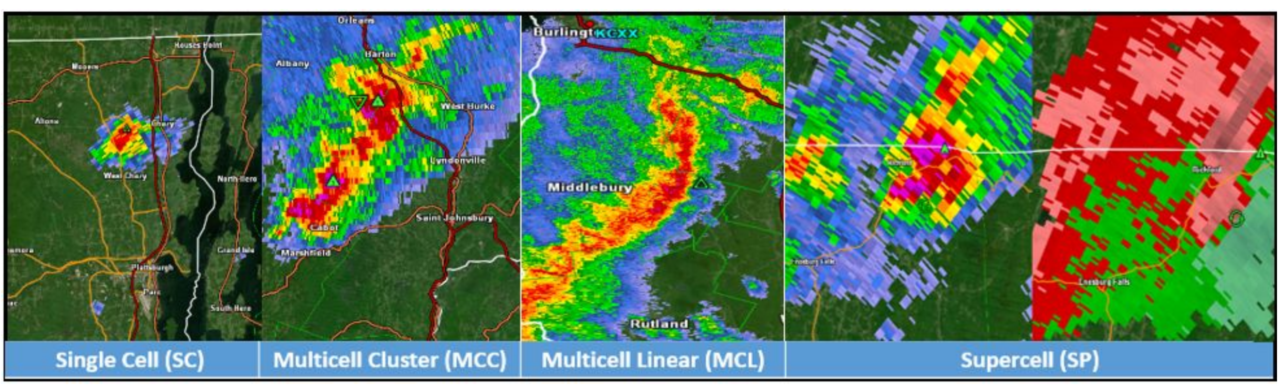
Many of our thunderstorms are driven off warm and humid conditions, which creates an atmosphere favorable for thunderstorm development. Severe weather is most frequent during the months of May, June, July and August, with a majority occurring during mid to late afternoon hours when heating and instability is the highest. We experience a thunderstorm on average about 20 to 30 days during a typical year with a third of them becoming severe. The National Weather Service defines a severe thunderstorm as a thunderstorm that can produce damaging winds in excess of 58 mph, large hail of one inch or large, or a tornado. Damaging thunderstorm winds are the primary severe weather threat across the North Country, followed by large hail.

Severe weather awareness week across northern New York and all of Vermont was April 24th through April 30th. The purpose of severe weather awareness week is to provide the public with information about severe weather, review severe weather safety protocols and think about a plan when severe weather approaches. Our mission here at the National Weather Service is to issue timely and specific severe weather watches and warnings in an effort to save lives and minimize potential property damage.

The figure below highlights the many different types of thunderstorms and their associated shapes and sizes. Our most frequent type of thunderstorm structure is what we call multicell clusters. These are clusters of strong to severe thunderstorms, which typically produce very heavy rainfall, frequent lightning and localized damaging winds. Our second most frequent thunderstorm type based on radar reflectivity structure is multicell linear. These lines of thunderstorms, sometimes in a bow-like structure, move very



quickly, contain frequent lightning and can produce scattered to widespread trees down and power outages. The third most frequent type of severe thunderstorm is a pulse storm, followed by a supercell. A pulse storm is very small in areal coverage and typically only lasts for 20 to 30 minutes. Meanwhile, a supercell is the most powerful type of storm, and can last for several hours, while producing large hail, damaging winds and even a tornado if conditions are favorable.

As always if you witness severe weather, please communicate with us on Facebook https://www.facebook.com/NWSBurlington/ or Tweet@NWSBurlington with your reports. In addition, you can send a report via our webpage at the following address: https://www.weather.gov/btv/stormreport. Please include the what, where, and when with your reports and remember if reporting hail, please include the size. Your severe weather reports are very helpful to our warning operations, while providing ground truth of what forecasters are examining from Doppler radar data.

Local Research Presented at Northeastern Storm Conference

By Rebecca Duell

The Northeastern Storm Conference was held right here in Burlington on March 11th-13th of 2022. The conference is an annual conference hosted by the student American Meteorological Society Chapter at Northern Vermont University, in Lyndon, Vermont. Each year, the conference brings together meteorology students and professionals from across New England and the Mid-Atlantic to present and learn about all of the latest research in our field being performed right here in the Northeastern U.S. This year, the weather in Vermont did not disappoint our visitors as the Conference occurred right in the middle of one of our spring snowstorms. While most of our forecasters were working the storm (or were called in to work the storm!), we were able to free up several of our meteorologists to send to the conference to present local research and host panels.

One of the questions that we get asked often is “What do you do on quiet sunny days?”. Well, we still need to put out forecasts multiple times a day, but when the weather is quiet we are often able to find time to work on side research projects to develop and refine our skills as forecasters. NWS Burlington is proud of our long history of contributing to scientific research through performing local studies on all kinds of impactful weather, running local weather models used by other NWS offices as well as our media friends and local weather enthusiasts, and conducting and publishing many case studies after major weather events. We are thrilled that many of our newer forecasters are continuing on the tradition of getting involved in local research. This article will present the projects that were presented by NWS Burlington meteorologists at the workshop. This is just a peak into some of the many research projects going on behind the scenes at NWS BTV.

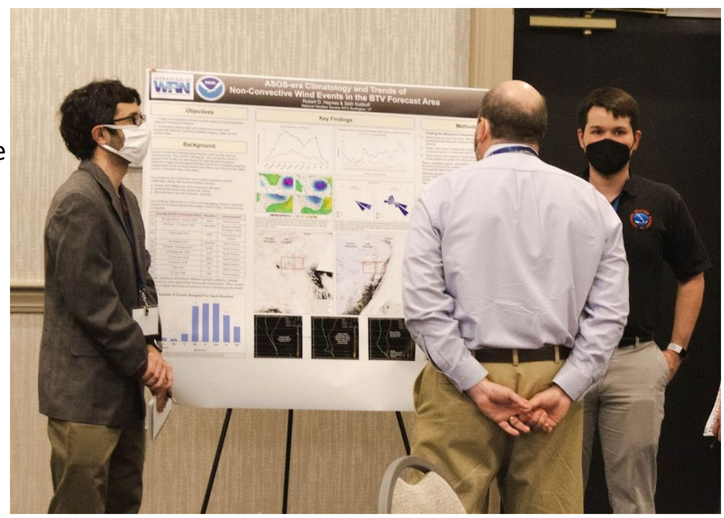


Figure 1: NWS BTV meteorologists Seth Kutikoff (left) and Robert Haynes (right) present their research at the Northeastern Storm Conference

Local High Wind Events Research

During the poster session of the conference, NWS Burlington meteorologists Robert Haynes and Seth Kutikoff presented their research titled “**ASOS-era Climatology and Trends of Non-Convective Wind Events in the BTV Forecast Area**” (Figure 1). Over the past couple of years, Robert and Seth have been examining high wind events that have occurred over the past 25 years in Vermont and northern New York. They developed a pool of high wind events and identified the weather patterns that lead to different types of high wind events. Their research will help our forecasters identify future high wind events through pattern recognition based on past events. Seth and Robert found that most high wind events in our area occur between September and May. They identified several types of high wind events typical to our area. The most common pattern that leads of our high wind events is when deep cyclones track near the Great Lakes Region or when we see strong

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cold frontal passages that are characterized by strong post-frontal winds. Smaller subsets of events involve strong winds along the Green Mountains (often times resulting from mountain waves, or "wave breaking"), as well as wind events as a result of rapidly deepening coastal cyclones. They also found that strong winds from the north or northeast are uncommon , and typically develop from a recurving tropical cyclone undergoing extratropical transition.

Local Freeze Climatology Research

NWS Burlington Science and Operations Officer Peter Banacos presented his work titled "**Visualizing Decadal Changes in the Freeze Climatology across Vermont and Northern New York**". His study examined different trends in the timing of the first and last freezes of the season across the area. The freeze climatology is especially important for agricultural purposes, including planting and harvesting. When successive 30-year freeze climatologies are compared, these statistics can also be used to quantify an agriculturally relevant aspect of climate change. The study noted high variability in the range of first/last freeze days across the North Country, which is a result of the varying topography as well as proximity to Lake Champlain and other smaller bodies of water. His study found that generally the smaller, sheltered valleys of the Adirondacks and Northeast Vermont experience the earliest first freezes and the latest last freezes in our area. Meanwhile, areas very near Lake Champlain typically experience the latest first freeze and earliest last freeze of the season. Peter also examined how the freeze climatology has changed over time, and found that later first freeze and earlier last freeze dates are evident in the more recent years. The shift has resulted in a mean lengthening of the growing season by 3.9 days across northern New York and by 4.9 days across Vermont. For more information on the freeze climatology for our area, see our website with all the climate information here https://www.weather.gov/btv/climoFreeze compiled by Peter Banacos.

Testing Lightning Jump Algorithms in VT & NY

Northern Vermont University meteorology student Andrew Grautski presented a project that Grautski, Rachel Palladino (also an NVU meteorology student), and NVU meteorology professor Dr. Ari Preston are working on titled "**Testing Lightning Jump Algorithms in Vermont**". The research team from NVU is working in partnership with NWS Burlington on their study. Their research investigates the effectiveness of lightning jump algorithms for prediction of severe thunderstorms in the NWS Burlington County Warning Area. They are testing different lightning jump algorithms to evaluate their effectiveness and time saving capabilities for identifying severe thunderstorms. The students have been hard at work on the project, and we at NWS Burlington are excited to incorporate their findings and best practices into future warning operations at our office.

Figure 2: NVU Student Andrew Grautski (right) presents NVU research to NWS BTV Science and Operations Office Peter Banacos (left) during the Poster Session

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Local Severe Storms Research

Figure 3: NWS BTV Meteorologist Rebecca Duell presenting.

NWS Burlington Meteorologist Rebecca Duell presented a research project that several of our meteorologists have been working together on over the past few years titled "**Identifying Critical Reflectivity and Differential Reflectivity Radar Thresholds for Severe Thunderstorms across Northern New York and Vermont**". The project is a joint effort between BTV meteorologists Brooke Taber, John Goff, Andrea Larocca (currently at the Center Weather Service Unit in Nashua, NH), and Rebecca Duell. Our group examined characteristics of thunderstorms that brought severe weather to Vermont and northern New York between 2017 and 2019. We established different radar thresholds that we will be using to help us improve our detection and increase our lead time when issuing Severe Thunderstorm Warnings on future storms. We also examined the environmental parameters that are typical of the different types of thunderstorms that our area gets. Our work was recently published as an Eastern Region Tech Attachment and is available online https://www.weather.gov/media/erh/ta2021-02.pdf for anyone who wishes to dive into the details of the project.

Professional Development for Students

In addition to research presentations, NWS BTV Warning Coordination Meteorologist Scott Whittier, Science and Operations Office Peter Banacos, and Meteorologist Rebecca Duell all served as panelists at different workshops to help give meteorology students the tools they need to succeed as they prepare to enter the professional meteorology world. Scott Whittier represented the National Weather Service on a Career Panel Discussion to introduce students to careers in the National Weather Service. Rebecca Duell worked with Cecy Del Carmen from NBC in Boston to run the Women in Science Workshop. Peter Banacos served as a panelist at a Resume Workshop where he was able to sit with students one-on-one and give them valuable advice and feedback on their resumes from the perspective of a hiring manager.

Figure 4: NWS BTV Warning Coordination Meteorologist Scott Whittier serving as a panelist on the Career Panel Discussion

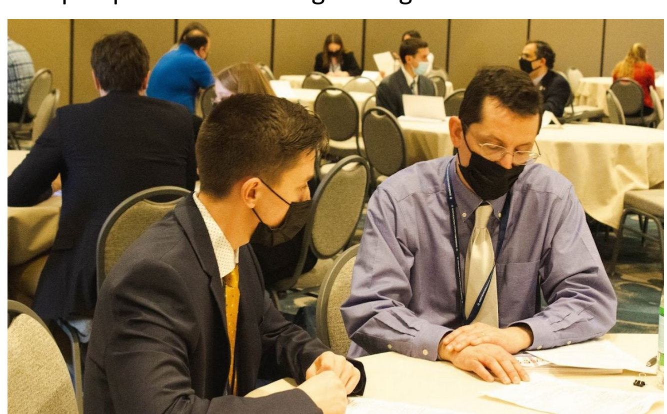
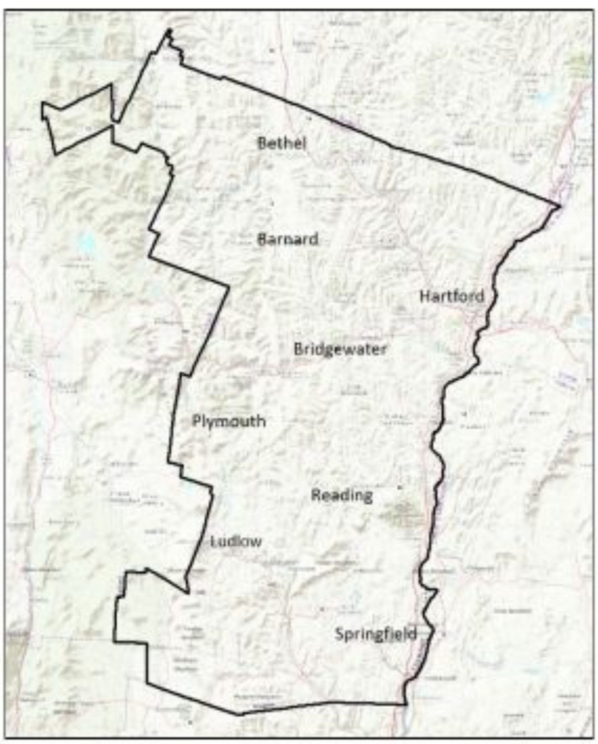


Figure 5: NWS BTV Science and Operations Officer Peter Banacos provides resume feedback to a student during the Resume Workshop

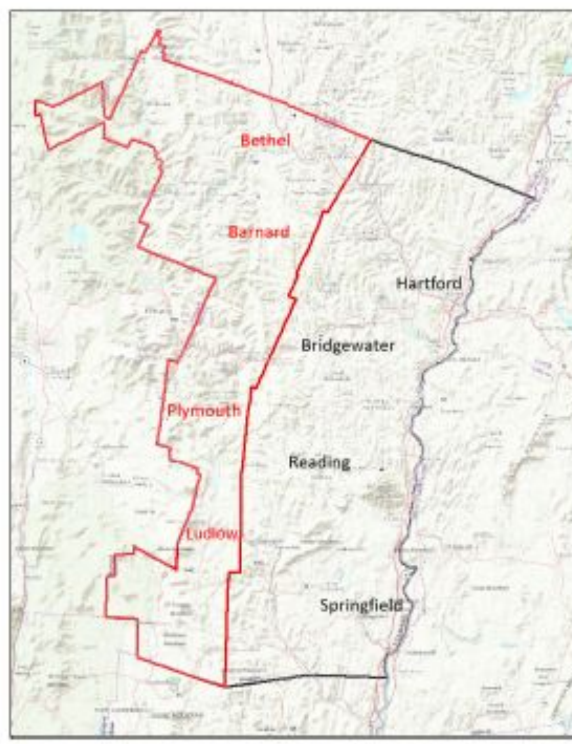
New Public and Fire Weather Zones

By Matthew Clay

Effective April 5, 2022, the NWS Weather Forecast Office (WFO) in Burlington, VT (BTV) changed the public zone for Windsor County, Vermont. Windsor County was split into Western Windsor County and Eastern Windsor County. This distinction was made based on the geographical differences, which impact the climatology of winter storms, dangerous heat, and downslope winds. Windsor County, Vermont features diverse topography with the southern Greens in the western half of the county and the Connecticut River valley (elevation < 1000’) in the eastern half. Additionally, most population centers in Windsor County, Vermont are near the Connecticut River. The separation of these different regions will allow for headlines more appropriate to the differing weather conditions within Windsor County, Vermont to better serve the public and our partners in this area. Figure 1 below depicts the newly implemented split of Windsor County.



Old Public Zone



New Public Zones

Figure 1. (Left) A map depicting the geographic outline of Windsor County, Vermont. (Right) a map depicting the new public zone split for Windsor County, Vermont. The areas in red show the geographic boundary for western Windsor County while the black shows the geographic boundary for eastern Windsor County.

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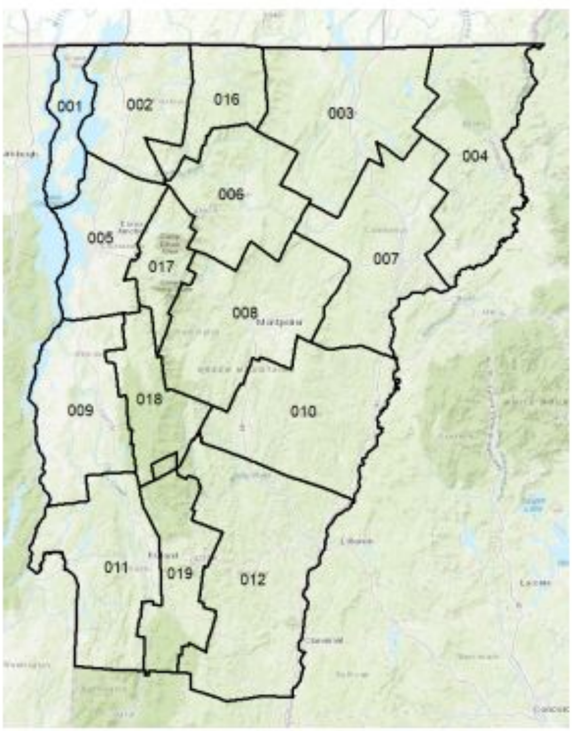
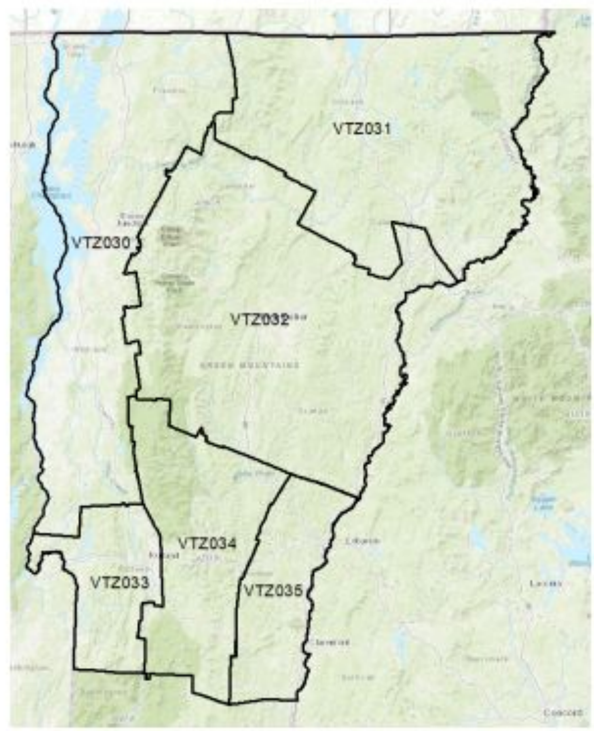
Effective April 5, 2022, the NWS Weather Forecast Office (WFO) in Burlington, VT (BTV) changed the Vermont fire weather zones within our County Warning Area (CWA). Instead of having 16 individual fire weather zones, we have worked closely with our fire weather partners to reduce the amount of fire zones down to 6 separate zones. The split of the zones has been decided based on topography, fuels, and weather. There has been a significant rework of the nationwide system for predicting wildfire danger (NFDRS) over the past several years. This system tasked state fire and land management agencies with reassessing Fire Danger Rating Areas (FDRAs), which are geographic zones consisting of similar fuels, topography and weather conditions. After working closely with our fire partners, we decided to use these new FDRAs as our new Fire Weather Zones to provide the best information possible to our partners. Figure 2 below are graphics depicting the changes to our fire weather zones.



Old Fire Weather Zones



New Fire Zones

Figure 2. (Left) A map depicting the geographic boundary of our previous fire weather zones for our forecast area of Vermont. (Right) a map depicting the geographic boundary of our new fire weather zones for our forecast area in Vermont. These new zones match the new Fire Danger Rating Areas (FDRAs) to better suit the needs of our partners.

Changes at BTV - Farewell Andrea, Welcome Christine!

Farewell and Good Luck, Andrea LaRocca!

In February we bid farewell to Meteorologist Andrea LaRocca as she headed off to Nashua, New Hampshire to work as an aviation meteorologist at the Center Weather Service Unit that serves the northeastern US airspace. Andrea originally was a student volunteer at NWS BTV in the summer of 2017 before starting full time as a meteorologist with us in spring of 2018. A Florida native and graduate of Florida State University for her undergrad, Andrea quickly fell in love with New England when she moved up to New Hampshire to attend graduate school at Plymouth State University in Plymouth, New Hampshire. While in Vermont, Andrea and her husband Peter welcomed an adorable baby boy, Otto, who they are excited to raise in New Hampshire. Andrea's quick wit, sense of humor, and delicious baked treats will be sorely missed by all of us here at BTV. We know she will do great work in her new job and wish Andrea, Peter, Otto, and four-legged son Bayou best of luck in New Hampshire!

Welcome Christine Hartman!

In late February, Christine arrived at our office to begin serving as our Administrative Support Assistant. Originally from a small town outside Pittsburgh, Pennsylvania, Christine enlisted in the U.S. Air Force in December 1979, traveling to Andrews Air Force Base, Maryland; Yokota Air Base, Japan; Patrick Air Force Base, Florida; Hickam Air Force Base, Hawaii; and finally the Vermont Air National Guard where she retired in May 2020. Christine received a BS degree in Web Design & Development from Champlain College and an AS degree in Computer Science Programming. In her free time, Christine enjoys power walking, biking, gardening, computers, and spending time with her granddaughter.

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Contributors:

Matthew Clay, Meteorologist
Rebecca Duell, Meteorologist
Seth Kutikoff, 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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@NWSBurlington

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