



The Four Seasons



National Weather Service Burlington, VT

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WINTER 2014-15

Table of Contents

Primer on Climate Change	1-5
The Major North Country Ice Storm of December 2013	6-8
The Science Behind The Froude Number & Upslope Snow	9-11
Fall 2014 Summary	12-14
Operation: Snowpack	15-16
Outreach Event: "No Two Snowflakes Are Alike"	17
Inside Our Web Site: The Higher Summits Forecast	18



Letter from the Editors

Welcome to the Winter 2014-2015 edition of *The Four Seasons*, a quarterly newsletter issued by the National Weather Service in Burlington, VT. In this edition we'll take a hard look at climate change and how it's affecting us here in Vermont and northern New York. Then we'll take a look back at this past fall, and revisit the major ice storm that affected the North Country last December. Also featured is a glance at how and why we measure snowpack in the winter, a peek into an upcoming outreach event, and a more in-depth look into one of the staples of winter weather in the North Country, upslope and mountain snows. Finally we'll delve into another section of our website, the higher summits forecast. Thanks for reading and we hope you enjoy this edition of the newsletter.



What are the key terms we need to understand when talking about Climate Change?

1. **Weather.** This refers to actual day-to-day atmospheric conditions that we experience. For example, on November 11, 2014 the high temperature in Burlington Vermont was 62 degrees, it was sunny and there was no rain.
2. **Climate.** This refers to the typical conditions we can expect to happen, determined by averaging observed weather conditions over a sufficiently long period of time. For example, in mid-November, we expect the high temperature in Burlington to be in the upper 40s with mostly cloudy skies and about 0.10" of rain daily.
3. **Climate Variability.** This refers to the changes in the climate that are due to natural forces, and usually take place over the course of thousands to tens of thousands of years.

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4. **Climate Change.** This refers to the changes in climate that are due to human influences, and take place over the span of decades or a century - a much more rapid pace than what occurs naturally.

How have scientists determined that human induced climate change is occurring?

Over the past 30 to 40 years, researchers have been developing increasingly complex computer simulations of the earth's climate system. The earth's climate system, depicted in Figure 1 below (source: IPCC), is a very complicated mix of energy feedback occurring between the ocean, land and atmosphere. These computer simulations are initially run, starting out with observed historical data and ending at the current time, and then verified with how well their "forecasts" match various observed trends. Through various experiments with the simulations, individual model components are changed in order to better understand what balance of natural and human-caused (anthropogenic) forces provide the most accurate "forecast" when compared to reality. Repeatedly, researchers find that human-caused forces are the main driver that produces model results that best match reality. Keep in mind that although one researcher may determine a slightly different mix of forces from that found by another researcher, this *does not* change the fact that human influences are at work. This is precisely how science works. Each research scientist builds upon the work of others before them and refines the results. Consider the process in which scientists and mathematicians centuries ago went from believing the world was flat to realizing it was round and then trying to figure out exactly how big the Earth was. The fact is that the Earth was always round, but calculated size, determined by use of mathematical models, varied with each attempt.

How is climate change related to today's weather?

In a sense, there is not much of a relationship. The magnitude of climate change, with warming of less than 1 degree Fahrenheit per decade, is very small when compared to the day-to-day and year-to-year natural variability. Humans cannot sense the difference between a temperature of 68 degrees and 68.5 degrees. So to link a single hot day,

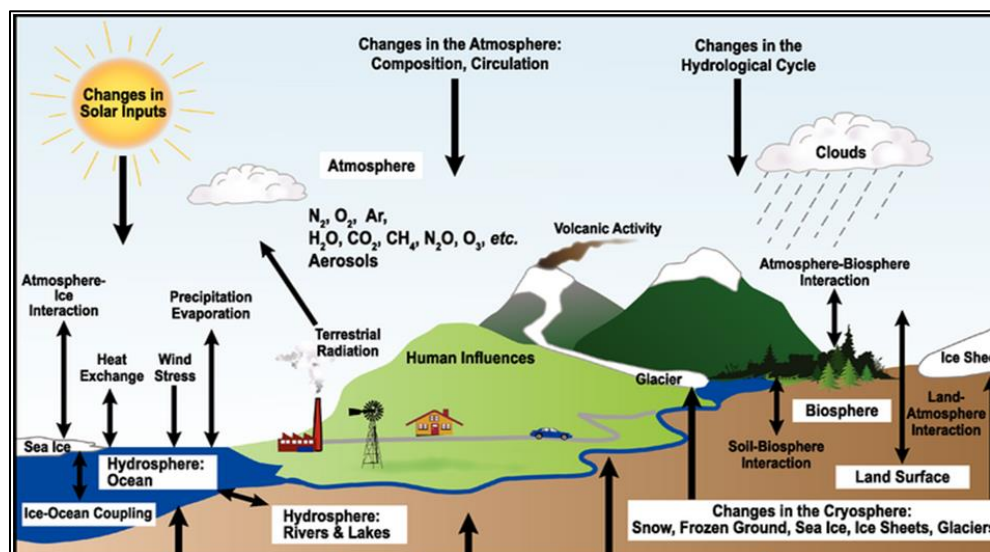


Figure 1. The Earth's Climate System (Source: IPCC, Intergovernmental Panel on Climate Change)

or even a heat wave as proof of existence of global warming (or a cold wave as proof that global warming does not exist) is invalid. Rather, longer term patterns need to be examined. In a sense, climate change is about changing the odds of how often patterns occur. The National Center for Atmospheric Research put together a nice video explanation showing how climate change is much like a baseball player on steroids. Over the course of the player's career, they will hit more home runs than they would have without use of steroids, but they will still strike out. See the video at: <https://www.youtube.com/watch?v=MW3b8jSX7ec>.

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So what are the climate change related patterns that we've observed locally?

It has been getting warmer and wetter, with the fastest rate of change happening in the last 40 years, which is consistent with what has been observed in many other areas of the world.

Figure 2 shows the average temperatures for Burlington VT, one of the locations we have a long term record for. The average temperature since 1905 has risen about 3 degrees, however since 1975, that trend has been at a faster rate. Despite the warming trend, the year to year variation is still large. This is due to the natural variability forces, so even in a warming climate we can still have cold years, though the frequency of such events is reduced.

Figure 3 shows the same trends are being seen at Saint Johnsbury, Vermont as well. This indicates that the changes we see in Burlington are not solely due to the expansion of the urban environment in the local area. The observations indicate that we are warming much more quickly during the winter and in particular at night, especially over the past 40 years. These trends are shown in Figure 4 on the next page.

The warming climate also means that the time period between the last spring frost and first fall frost is getting longer. In the last 4 decades, many locations in Vermont and northern New York are now seeing growing seasons nearly 2 weeks longer. A longer growing season also means a shorter winter season. The yearly ice-out contest at Joe's Pond in West Danville VT has proven to provide an excellent dataset for how the warming climate is changing when area ponds and lakes lose their ice in the spring. Figure 5 shows that the ice is, on average, now melting almost 2 weeks earlier when compared to the late 1980s.

The years are trending wetter as well. Figure 6 shows the trends in those observations. Though the rate of change in the trend over the past 40 years is not much faster, there has been increased variability from year to year. That can be seen in the differences between the wet and dry years over the past 20 years as compared to the period in the early to mid 20th century. This greater variability fits in with the (Continued on Page 4)

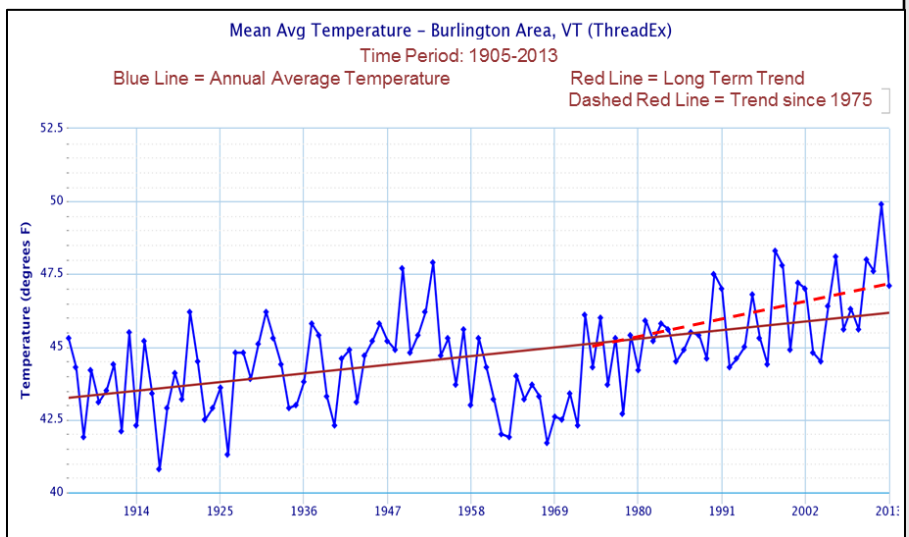


Figure 2. Mean annual temperatures at Burlington, VT (KBTV) from 1905 – 2013. The red line is the long term trend and the dashed red line is the trend since 1975.

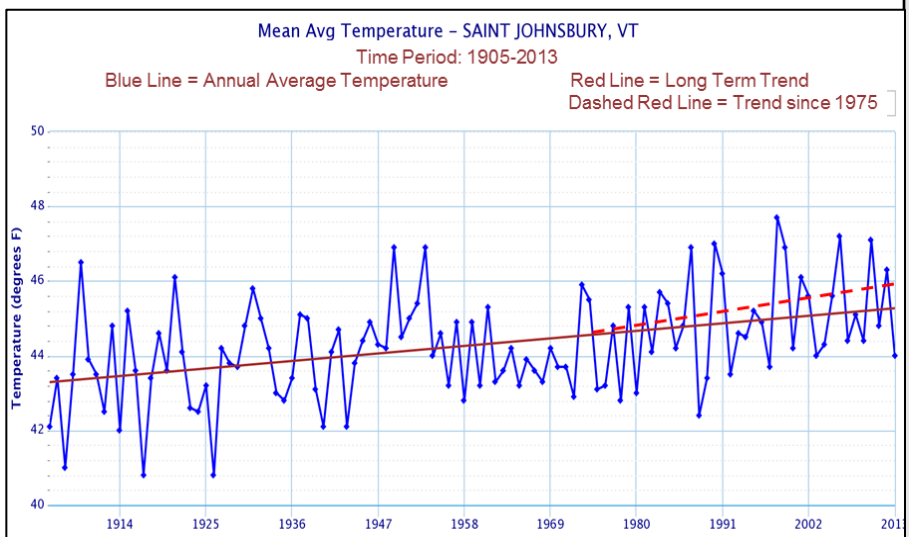
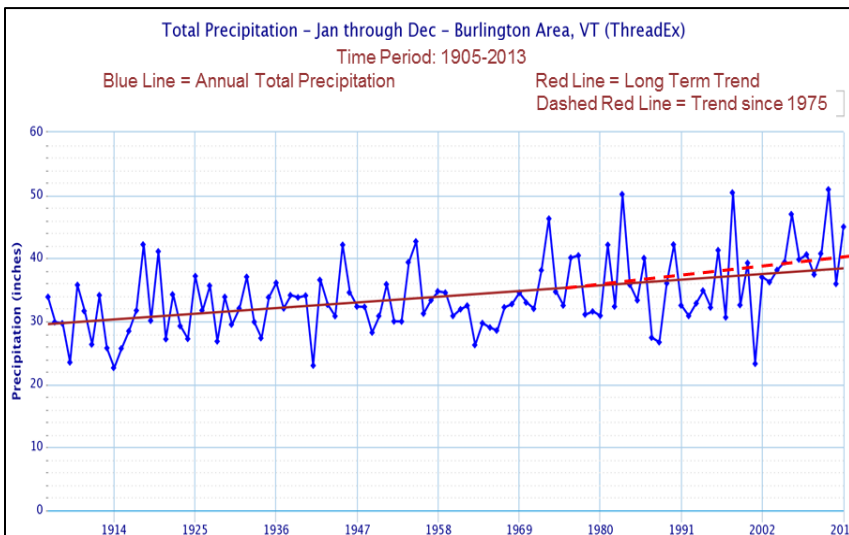
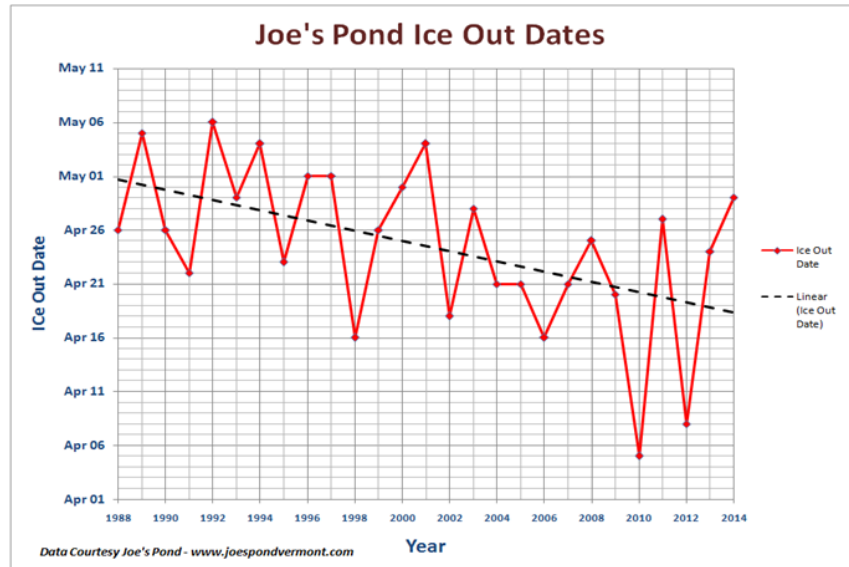
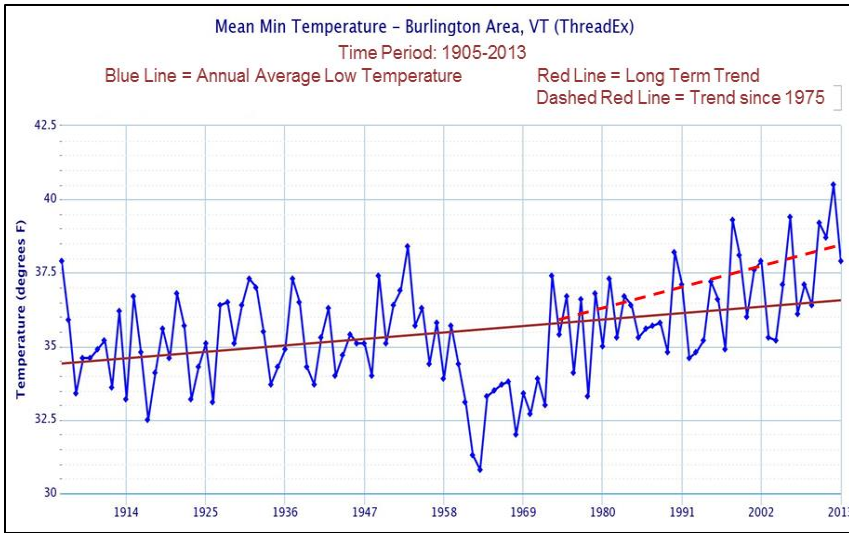


Figure 3. Mean annual temperatures at Saint Johnsbury (SJBV1) from 1905 – 2013. The red line is the long term trend and the dashed red line is the trend since 1975.

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theory that climate change will also lead to longer lasting weather patterns, whether they be wet or dry. Another way to view the wetter trends is to look at how many days per year we have heavy rainfall. Figure 7 on the next page shows that we are seeing more of these heavy rain days per year.

Snowfall is tricky as a warmer and wetter climate can either mean more snow or more rain, all depending on the exact temperature. It appears that, at least right now, we are trending towards more snow. However, at some point, we will warm enough that those marginal temperature-snowstorms we have now will simply be plain rain storms, so the expectation is that in the future we will see a downward trend develop. Figure 8 shows the long term snowfall trends in Burlington, while Figure 9 shows the trends on Mount Mansfield.

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Figure 4 (Top). Mean annual minimum temperatures at Burlington (KBTv) from 1905 – 2013. The red line is the long term trend and the dashed red line is the trend since 1975.

Figure 5 (Middle). Joe's Pond, VT Spring "Ice Out" dates from 1988 – 2014 (Source: www.joespondvermont.com)

Figure 6 (Bottom). Mean annual precipitation at Burlington (KBTv) from 1905 – 2013. The red line is the long term trend and the dashed red line is the trend since 1975.

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So how can we be sure that the patterns we've seen will continue into the future as the climate researchers say?

Well, we just have to trust the experts who are working hard to understand all the complex interactions between the atmosphere, ocean and land that have roles in the Earth's climate system. As the understanding increases, those interactions are programmed into updated climate models. Just as day-to-day weather models that we meteorologists rely on are getting more accurate each year, so are the climate models.

What are some other sources I can access to read about local information on climate change?

NOAA's Climate Portal:
<https://www.climate.gov/>

Vermont Climate Assessment from the University of Vermont:
<http://vtclimate.org/>

Regional Climate Centers:
<http://www.ncdc.noaa.gov/customer-support/partnerships/regional-climate-centers>

Figure 4 (Top). Number of days at Burlington (KBTv) from 1905 – 2013 that 1" or greater of liquid precipitation was recorded. The red line is the long term trend and the dashed red line is the trend since 1975.

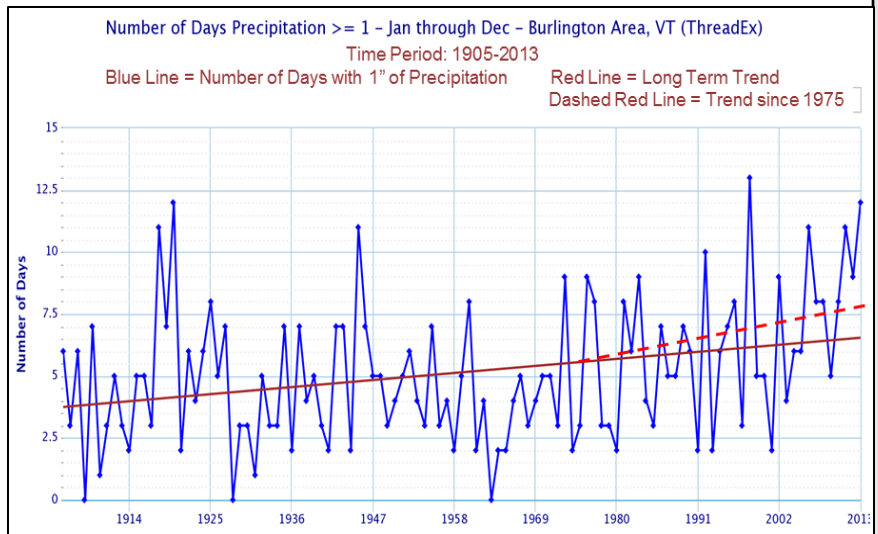


Figure 5 (Middle). Total annual snowfall at Burlington (KBTv) from 1905 – 2013. The red line is the long term trend and the dashed line is the trend since 1975.

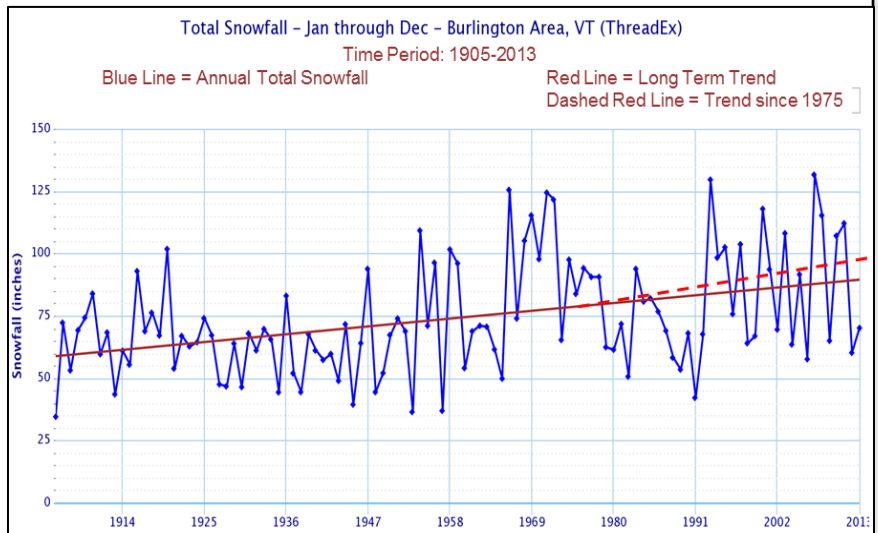
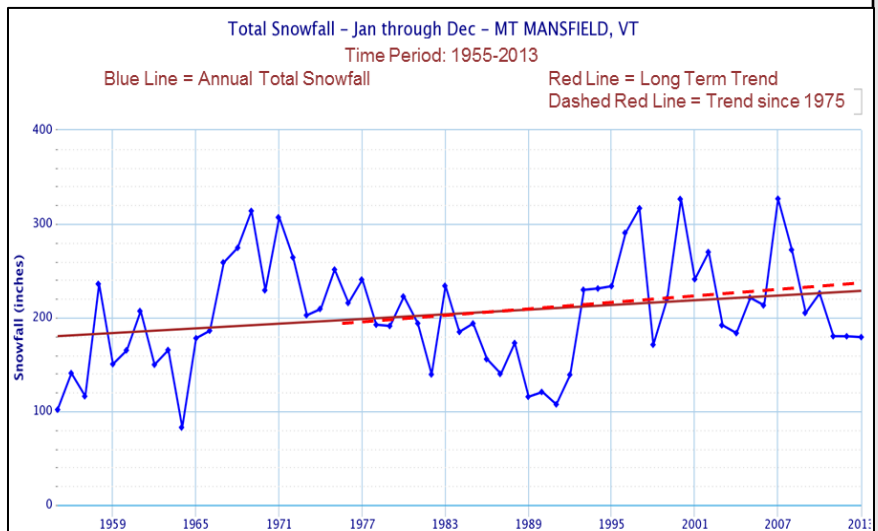


Figure 6 (Bottom). Total annual snowfall at Mount Mansfield (MMNV1) from 1955 – 2013. The red line is the long term trend and the dashed red line is the trend since 1975.



The Major North Country Ice Storm of December 2013

- Brooke Taber



Berkshire, VT 12/22/13

Photo Courtesy of Josh Ramsdel

A prolonged ice storm occurred across portions of northern New York and into Vermont, including the Champlain Valley on December 21st and 22nd of 2013. The December 2013 ice storm was the largest icing event since the ice storm of January 1998, and impacted many of the same areas. The December 2013 ice storm produced widespread power outages, along with numerous vehicle accidents. The final cost of the storm was estimated to be between 8 and 10 million dollars for northern New York to central and northern Vermont, including the Tug Hill Plateau and the Saint Lawrence River Valley. At the peak of the storm, more than 75,000 customers were without power across the North Country with some outages lasting up to a week. Figure 1 below shows the North Country storm total ice accumulation for December 21st and 22nd 2013. The heaviest ice accumulation of 0.75" to 1.25" occurred across the lower elevations of the Saint Lawrence and Champlain Valleys as well as parts of the Missisquoi and Lamoille River Valleys in Vermont. Meanwhile, across the higher terrain of the Adirondack and Green Mountains very limited ice accumulation occurred as temperatures were above freezing throughout the event.

This ice storm featured a complex area of low pressure near Pittsburgh, PA on December 22, 2013 at 1 AM, with a stationary boundary draped across western New York and into southern New England. The circulation around low pressure near Pittsburgh, PA, brought very warm and moist air north, while arctic high pressure near Hudson Bay, pushed low level cold air south. This battle zone between the two air-masses, combined with a favorable upper level jet stream and record high precipitable water values to produce this major ice
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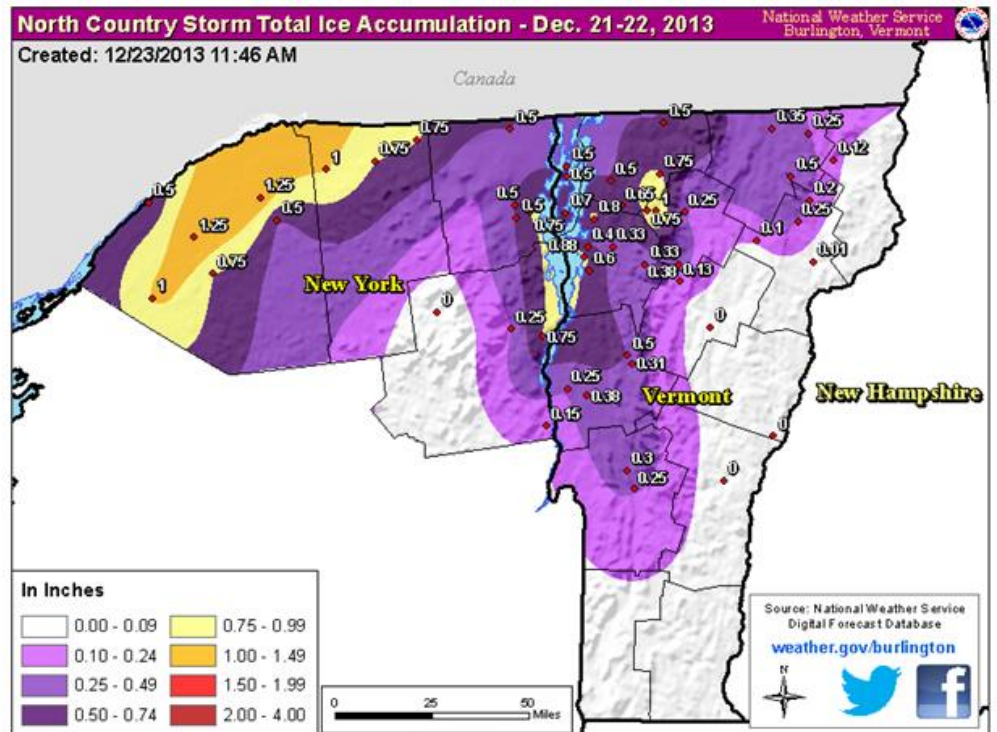
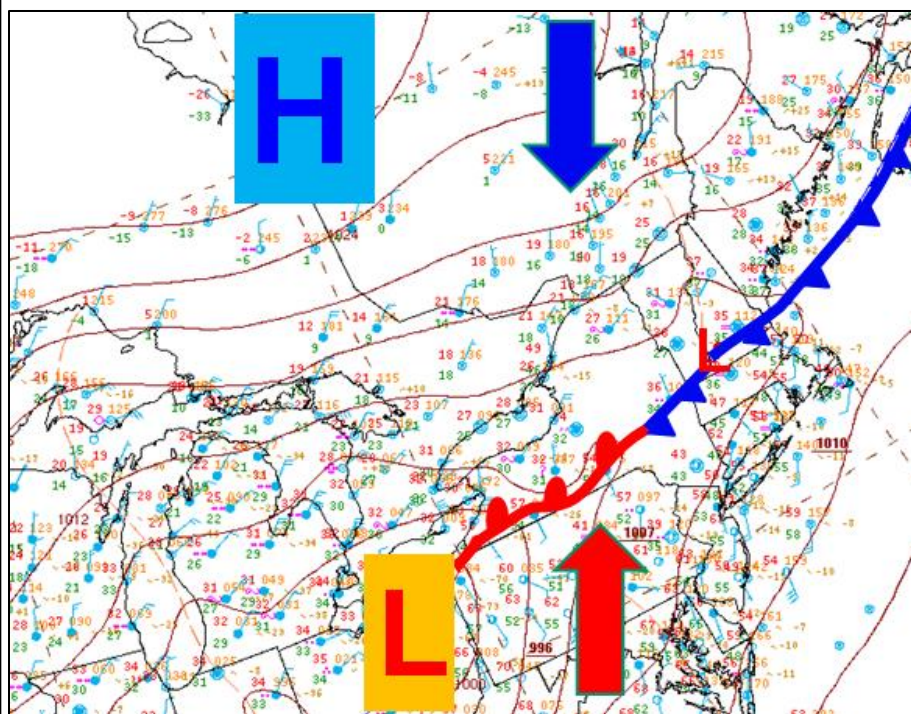


Figure 1. North Country storm total ice accumulations for December 21st through December 22nd, 2013.

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storm across the North Country. The 7 AM upper air sounding at Albany, NY had a precipitable water value of 1.43", or in the 99th percentile. Figure 2 to the left shows the surface analysis at 1 AM on December 22, 2013. Meanwhile, surface temperatures across the Champlain and Saint Lawrence Valleys were only in the 20s to near 30°F, while the higher elevations between 1500 and 2500 feet saw temperatures well into the 40s to near 50°F. We will further investigate the vertical temperature profile in the next section.

Figure 2. Surface analysis at 1 AM on December 22, 2013.

Figure 3 to the right shows the vertical temperature profile from Burlington to Mount Mansfield, VT on December 21, 2013 at 4 PM. This profile shows a complex thermal structure across our region, with a warm layer of temperature above freezing between 1000 and 3000 feet above sea level, while near the valley surface temperatures were only in the middle 20s. As precipitation fell in the form of snow in the cloud, it melted when going through the 2000 feet warm layer, before freezing again near the surface. In some cases across the northern Champlain Valley and parts of the Saint Lawrence Valley, the depth of the cold layer was deep enough to produce periods of sleet or ice pellets, caused by the rain drops re-freezing. This temperature profile is a classic signature for freezing rain events and is typically enhanced by our complex terrain across our region. (Continued on Page 8)

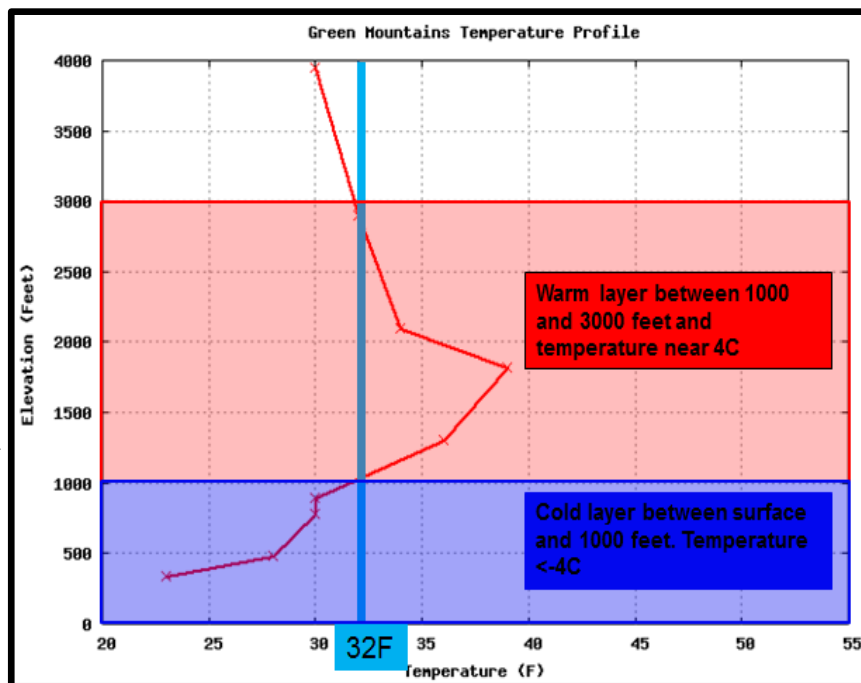


Figure 3. Vertical Temperature profile from Burlington to Mount Mansfield, Vermont at 4 PM on December 21st, 2013.

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Figure 4 below is a mosaic of ice storm photos from across the North Country. As you can see by the pictures the accumulation of ice damaged trees and produced numerous power outages, along with blocking many back country roads. This long duration event produced widespread ice accumulations of between one half and one inch across the Saint Lawrence and Champlain Valleys with up to 75,000 customers losing power. This event was the largest ice storm since January 1998 to impact the North Country and will be remembered for many years to come.



Figure 4. Pictures taken from December 21st – 22nd 2013. From Top Left clockwise: Berkshire, Vermont... Winooski, Vermont... Berkshire, Vermont (courtesy of Josh Ramsdell)... Stowe, Vermont (courtesy of Scott Braaten).

The Science Behind The Froude Number & Upslope Snow

-Michael Muccilli

Westerly flow upslope snow events are some of the more challenging events to forecast in Vermont. These are highly localized, possibly high impact events that affect the region. Upslope precipitation in general is produced by cool moist air being forced up the mountain slopes, and in this study, on northerly to westerly winds (See Figure 1). Depending on the details of each event, impacts can range from only a few inches along the peaks of the Green Mountains to a highway-closing 1 to 3 foot snowstorm along the western slopes of the Green Mountains and even into the Champlain Valley. One of the main factors in these events is the terrain of Vermont, as shown in Figure 2. The Green Mountains, with peaks as high as 4395 feet (Mount Mansfield) run primarily north to south through the central portion of the state and are one of the main contributors to upslope snowfall in the state. But what makes one event high impact while others go unnoticed except to the ski resorts?

Synoptic Weather Pattern

The state of the atmosphere leading up to an upslope (orographic) snow event can generally be characterized by an upper level trough or closed low moving through the region, typically with a vorticity maximum crossing the area. At the surface, a low pressure system is exiting the region, with increasingly westerly to northerly flow in the low levels of the atmosphere (See Figure 3a on Page 10). This west to northwest flow in the low levels combined with lingering low and mid-level moisture (See Figure 3b) leads to the development of upslope snow showers. It is then at this point when it becomes critical as to how the mesoscale features develop with time.

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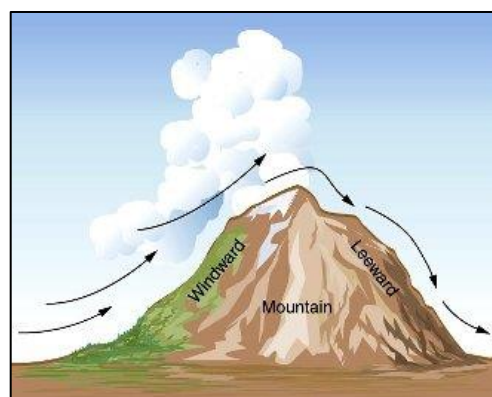


Figure 1. Illustration of upslope precipitation (courtesy of National Weather Service Wilmington, Ohio).

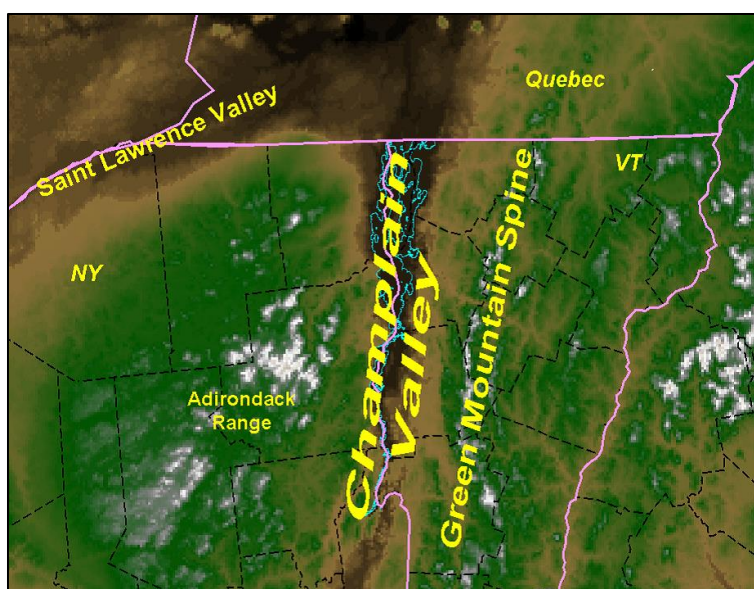


Figure 2. Locations of the Champlain Valley and the Green Mountains in Vermont.

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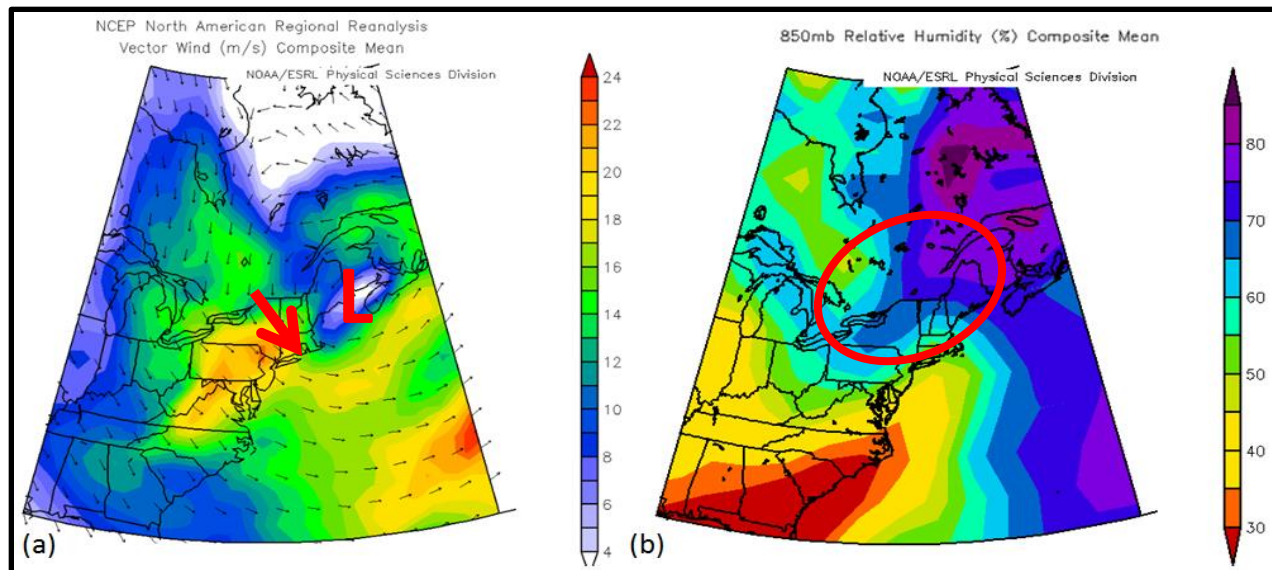


Figure 3. Composite Image showing (a) 850 mb wind speed and direction and (b) 850 mb relative humidity from 25 upslope snow cases between 2007-2012 . Note the departing low pressure system and the Northwest Winds in (a) and the lingering low level moisture in (b).

The Froude Number

Differences in the amount and distribution of snowfall in upslope events can be partly attributed to the difference between "Blocked Upslope Flow" and "Unblocked Upslope Flow", which can be quantified by the Froude Number. The Froude Number is a number representing the flow of air when it comes in contact with a barrier, or in Vermont's case, the Green Mountains. The Green Mountains are oriented such that within only 15 miles, the elevations rise from around 300 feet in Burlington (KBTV) to nearly 4400 feet on Mount Mansfield. The mountains are aligned from north to south, such that it acts as a barrier for westerly (or easterly) flow. In general westerly flow, the Froude Number is an estimation of whether the flow can make it over the mountains and is basically a ratio of the wind perpendicular to the mountain chain versus the atmospheric stability. If the Froude Number is high (> 1), the flow is supercritical and unblocked (Figure 4a). The air will flow freely over the mountains and deposit the heaviest precipitation on the east side. A Froude Number near 1 is considered critical, and the heaviest precipitation will likely fall along the barrier (Figure 4b). And if the Froude Number is low (< 1), it is called subcritical and is blocked (Figure 4c). The air will not make it over the mountain and the precipitation will back up behind the barrier.

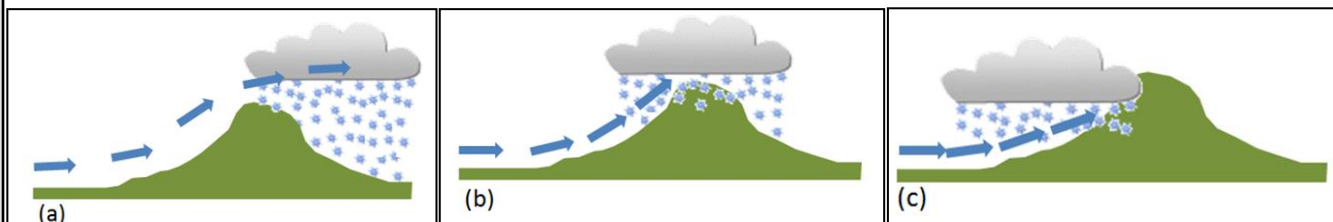
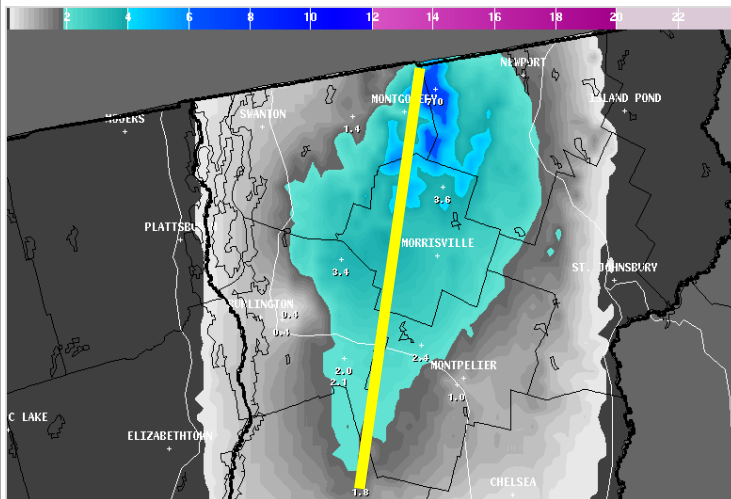


Figure 4. Illustrations depicting the different states of the Froude Number. 4a depicts unblocked flow, 4b depicts critical flow, and 4c depicts blocked flow.

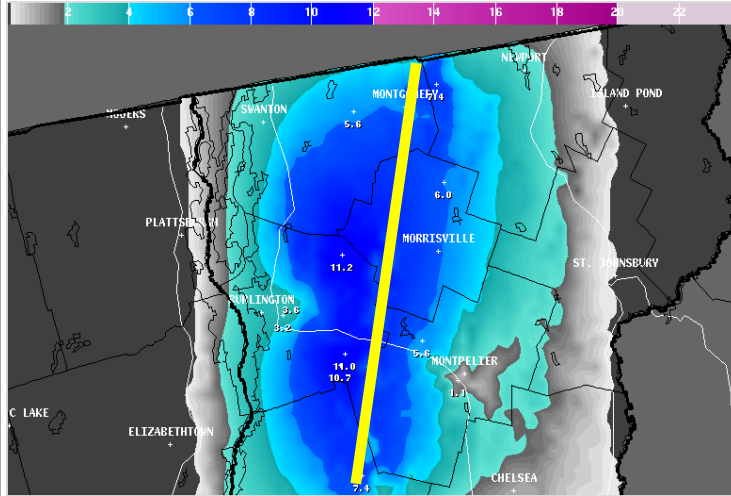
Types of Upslope Snow Events

Therefore Vermont's upslope snow events can be grouped into three distinct types. The first is the "Unblocked" case, with Froude Numbers greater than 1.0. In these cases the heavier snows will fall along and east of the spine of the Green Mountains (including Jay Peak, Waterbury, Stowe, and into the Northeast Kingdom) (See Figure 5a). The second type is the "Blocked" case, with Froude Numbers
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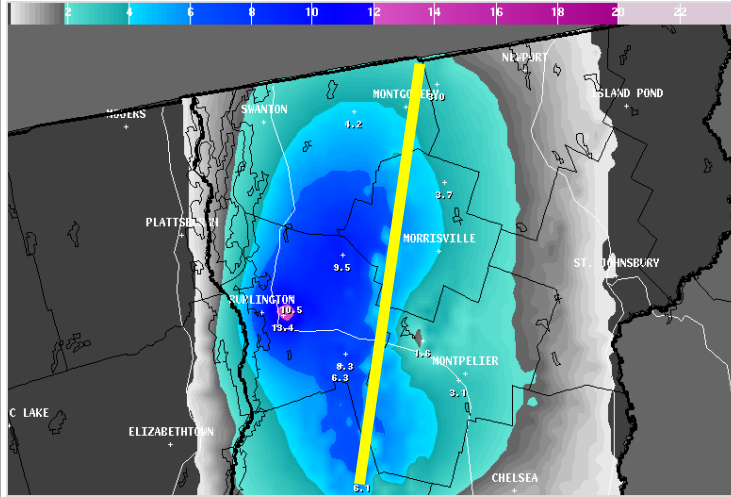
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a NOAA / National Weather Service Burlington, VT



b NOAA / National Weather Service Burlington, VT



c NOAA / National Weather Service Burlington, VT

between 0.5 and 1.0. In these cases the heavier snows will fall along the spine of the Green Mountains and along its western slopes (including the communities of Underhill, Jericho, Richmond, Bolton, and South Lincoln) (See Figure 5b). The third and more rare type is the “Very Blocked” case with Froude Numbers less than 0.5. In these cases the heavier snows will actually fall along the western slopes and into the Champlain Valley itself, including Burlington (See Figure 5c). It should also be noted that for these upslope snow events to be significant, research has shown that they need to last roughly 12 or more hours in duration.

There are several key factors that can influence the Froude Number during an event. The lower Froude Number events (blocked cases) typically exhibit a veering wind signature with west-northwest winds at the surface and northwest winds at mountain-top. There is also the presence of an inversion or isothermal layer near or below the mountain height level. In the unblocked cases (higher Froude Numbers), the vertical wind profile typically lacks a veering signature and is generally west-northwest throughout the lowest 4000 feet of the atmosphere. An inversion or isothermal layer is also typically absent below 4000 feet and conditions are generally well-mixed in the lower levels.

Conclusion

Westerly flow upslope snow events are some of the more challenging winter forecasting events in Vermont. These are highly localized, possibly high impact events that affect the region. The Froude Number has been identified as serving an important role in forecasting the snowfall distribution and location of the greatest expected amounts. It can also be used to help distinguish between high impact heavy snow events and more ordinary and lighter upslope snowfall.

Figure 5. Composites of total snowfall amounts for 25 upslope cases between 2007 – 2012 over Northern VT. 5a shows Unblocked cases, 5b shows Blocked cases, 5c shows Very Blocked cases. The yellow line represents the spine of the Green Mtns.

Fall 2014: Mild and Dry

-Michael Muccilli

Looking back at the meteorological fall of 2014, defined as the days from September 1st through November 30th, overall it was a relatively dry and mild time period that led to great fall foliage viewing across the North Country of Vermont and northern New York.

For the three month period, the temperatures at Burlington, VT were a couple of degrees above the 30-year normal (+2.4 degrees), and the majority of the area finished the period from 0 to 2 degrees above normal. Precipitation was below normal across nearly all of the area, with some locations running a several inch deficit. Burlington, VT finished the autumn 2.59 inches below normal, however Massena, NY was over 5 inches below normal. The driest locations (relative to

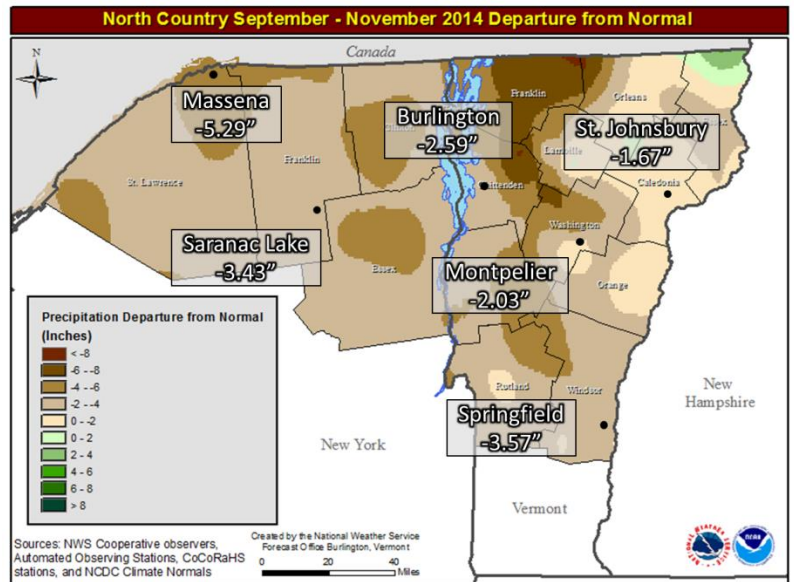
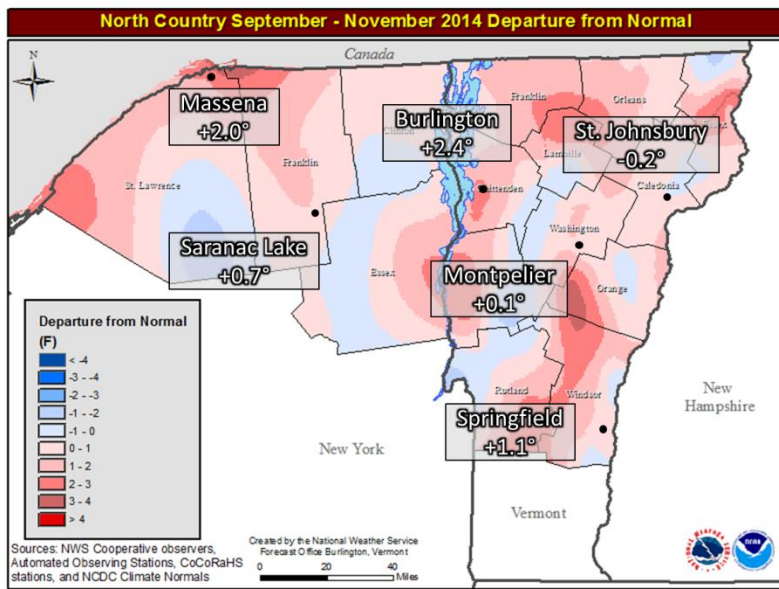


Figure 1. Total September – November 2014 Precipitation Departures from 1981-2010 Normals

Figure 2. Average September – November 2014 Temperature Departures from 1981-2010 Normals



normal) were the western slopes of the Green Mountains and the northern Champlain and Saint Lawrence Valleys. Figures 1 and 2 show the 2014 departures from the 1981 – 2010 climate normals across the North Country for both temperature and precipitation.

The Fall of 2014 started quickly in September with an initial shot of cold air leading to some early frosts and freezes, but quickly moderated leading to a very warm month of October, before slipping back slightly below normal for November. In addition to seeing the region’s first widespread accumulating snowfall during the week of Thanksgiving, portions of northern New York experienced significant lake effect snow during the third week of November. (Continued on Page 13)

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September Recap

September was a bit of a roller coaster ride. The month started off on the very warm side with a pair of near 90° days on the 1st and 2nd (88 and 89 degrees at Burlington). However the weather changed drastically mid-month when the autumn’s first chilly air mass moved into the region. The time period from the 12th through the 19th featured 5 days with high temperatures stuck in the 50’s and lows in the 30s and 40s, and even some 20s, with the area’s first frost. These temperatures were 10 to 15 degrees below normal for mid September. The temperatures did rebound again though for the end of the month with near-record and record-breaking highs in the 70s and 80s to close out the month, about 5 to 15 degrees above normal for late September. The month was overall dry with little in the way of significant precipitation events, which led to excellent fall foliage viewing opportunities.

*Warmest: 90°- South Hero, VT Sep 1st
 Coolest: 21°- Saranac Lake, NY Sep 19th
 Warmest at Burlington: 89°- Sep 2nd
 Coolest at Burlington: 32°- Sep 19th*

October Recap

October was a very mild month that featured well above normal and even some record breaking temperatures. 24 out of the 31 days at Burlington were at or above normal and 3 consecutive days mid month were in excess of 20 degrees above normal. October 15th, 2014 tied the record for the warmest October day on record at Burlington with a high of 80 degrees, low of 68 degrees, and a mean daily temperature of 74 degrees. Record highs were also set at Montpelier, Massena, and Mount Mansfield. The month of October also did not feature a below freezing temperature at Burlington, which is only the third occurrence in the historical record (since 1884), and the first time since 1920. The month however did have some of the first snowflakes of the season on the higher summits. October finished 5.4 degrees above normal at Burlington, 3.1 degrees above normal at Montpelier, and 5.1 degrees above normal at Massena. No snow fell during the month at Burlington.

*Warmest: 82°- Gouverneur, NY Oct 15th
 Coolest: 21°- Saranac Lake, NY Oct 13th
 Warmest at Burlington: 80°- Oct 15th
 Coolest at Burlington: 34°- Oct 20th*

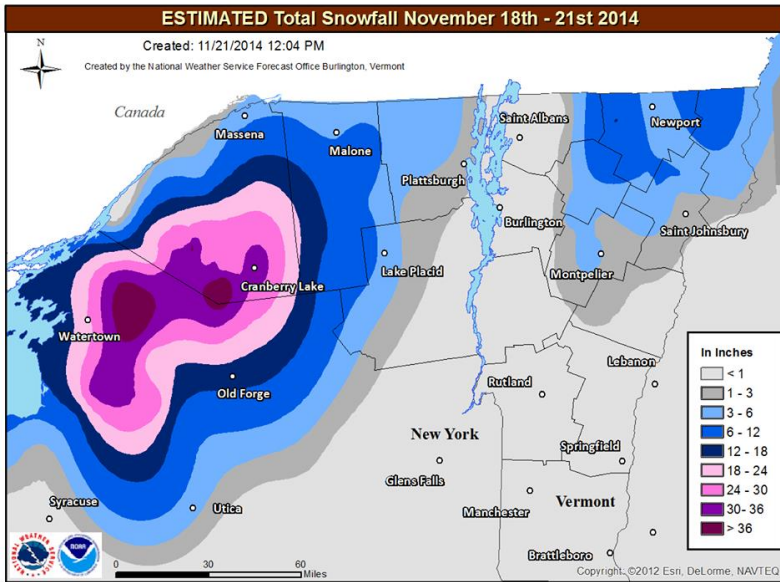


Figure 3. Estimated Total Lake Effect Snowfall from November 18th – 21st 2014

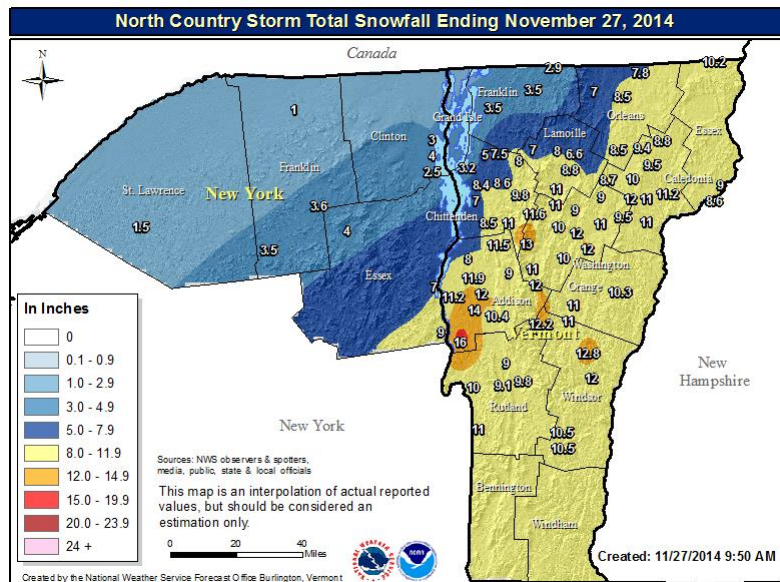


Figure 4. Reported Total Snowfall from November 26th – 27th 2014

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November Recap

November, in contrast to October, was much colder and featured a significant Lake Effect snow event on the heels of a very cold air mass mid month (See Figure 3 on previous page) and the season’s first significant widespread snowfall on the 26th (See Figure 4 on previous page). The Lake Effect event from November 18th – 21st brought localized amounts from 1 to in excess of 3 feet of snow to parts of the Saint Lawrence Valley and Adirondacks of New York. The snowfall event on the 26th then brought a widespread 4 to 12 inches of snow from parts of the Adirondacks eastward and across Vermont. The month itself finished exactly normal at Burlington, Vermont, near normal at Massena, New York, and slightly below normal across the rest of Vermont. The latter half of the month was the most active and featured both snow events but also several warm days including some near-record and record breaking high temperatures on the 24th (See Table 1 and Figure 5), just two days before the widespread snow storm. The coldest temperatures of the month were experienced on the morning of November 29th which saw

widespread lows in the single digits and teens and even a couple of below zero readings in the Northeast Kingdom and Adirondacks, including a -3° at Saranac Lake, NY and -2° at Canaan, VT. The month ended with 10.6 inches of snow at Burlington.

Warmest: 70°- Massena, NY November 24th
Coollest: -3°- Saranac Lake, NY November 29th
Warmest at Burlington: 67°- November 24th
Coollest at Burlington: 12°- November 29th

	New Record for 11/24	Old Record (Year)
Burlington	67°	65° (1999)
Montpelier	64°	60° (1979)
Massena	70°	69° (2003)

Table 1. Record Highs Set for November 24th, 2014

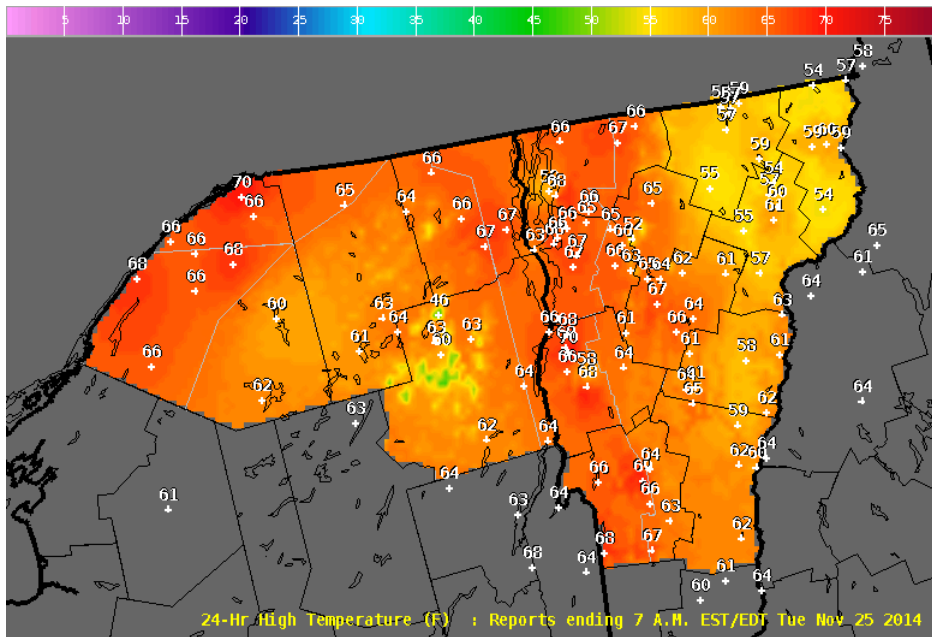


Figure 5. 24 Hour High Temperatures from 7 AM November 24th – 7 AM November 25th, 2014 across Northern New York and Vermont.



OPERATION: SNOWPACK

GREG HANSON

As we head into the heart of winter, the hydrology program at NWS Burlington turns our attention to the snowpack. Why is this important? The snowpack that accumulates in the Green Mountains and Adirondacks throughout the winter is like a water bank account. When it melts, snow can add more runoff to rivers and streams, in addition to any rain that might fall as well. The National Weather Service and other federal agencies use several different methods to assess snowpack nationwide. In Vermont and Northern New York, we rely on human observers, remote sensing, and computer models to give us the big picture.

The two elements of snowpack we measure are its depth and water content, or Snow Water Equivalent (SWE). The SWE is important because it tells us how much liquid water is held in our snow bank account, waiting for the spring melt.

One way we measure the snowpack is by using an "Adirondack Snow Sampler". This is a five foot long fiberglass tube with serrated steel teeth at one end. To use it, the tube is plunged into the snow cover, and the snow depth is read on the graduated scale printed on the outside of the tube. Then the tube is retrieved from the snow, and along with it a plug of snow. We then hang the tube on a specially calibrated scale that reads out the water content



Adirondack Snow Sampler in 57 inches of snow

Adirondack snow tube and scale in their natural elements.



of the snow in inches. The concept is this: for the diameter tube we're using, an inch of liquid water weighs the same whether it's in the form of liquid water, 3 feet of fluffy snow, or a layer of sleet. They all can contain an inch of water.

Once we know the depth of snow and the water content we can calculate the snow density, which is a ratio of water content to snow depth. When we start getting to ratios over 50% we say the snow is very dense, and if the temperature is near freezing it's considered "ripe" or ready to melt. Lower densities need more warming and settling of the snow before melt will start.

(Continued on Page 16)

...Continued from Page 15

Starting in January snow pack observations will be taken every two weeks. Snowpack readings come from a diverse group that includes power companies, individual observers, and the US Army Corps of Engineers. The National Weather Service then issues scheduled Winter/Spring Flood Outlooks based on the snow conditions and forecast weather. Area waterways can usually handle the snowmelt; it's when we add rainfall on top that the problems arise.



NWS Meteorologist Brooke Taber demonstrates the use of an Adirondack Snow Sampler (Top Right).

NWS Meteorologist Jessica Neiles measuring 21 inches of Snow Water Equivalent in 57 inches of snow depth (Top Left)

Adirondack Snow Sampler showing 21 inches of Snow Water Equivalent (Bottom Left)

"No Two Snowflakes Are Alike"

Paul Sisson

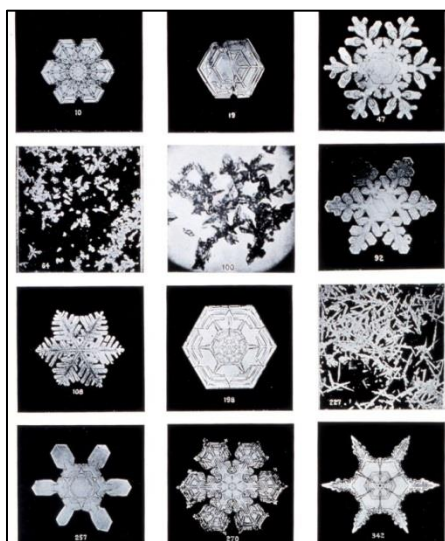
----"No two snowflakes are alike"----

This phrase comes from the work of Wilson "Snowflake" Bentley (1865-1931), who on January 15th, 1885 during a snowstorm in Jericho Vermont, was the first person to photograph a single snow crystal (snowflake) under a microscope. He went on to photograph thousands of snow crystal images and found "no two are alike." He published his work in his book, *Snow Crystals*, and in the American Meteorological Society's scientific journal, *Monthly Weather Review*.

To celebrate Wilson "Snowflake" Bentley's 150th birthday, the Jericho Vermont Historical Society will hold a symposium to discuss the seminal photographic and scientific contributions of his life's work. The event will be held at the Jericho Elementary School Auditorium, Vermont State Route 15, on Tuesday, February 10, 2015 at 7:00 p.m.

The Symposium will be moderated by Mark S. Breen, "Eye on the Sky" and Fairbanks Museum and Planetarium Meteorologist, St. Johnsbury, VT, Dr. Bruce Berryman, Professor of Atmospheric Sciences, Lyndon State College, Lyndonville, VT, John Miller, Professor of Photography, Johnson State College, Johnson, VT, and Paul A. Sisson, Science and Operations Officer, National Weather Service, Burlington, VT. This event is free and open to the public.

For more on Wilson "Snowflake" Bentley, please see the Jericho, Vermont Historical Society's Official Snowflake Bentley web site (www.snowflakebentley.com), or the Bentley Snow Crystal Collection (<http://bentley.sciencebuff.org/>) at the Buffalo Museum of Science. Many of his microphotographs can also be seen in the NOAA Photo Library (www.photolib.noaa.gov/nws/newsnowice1.html).



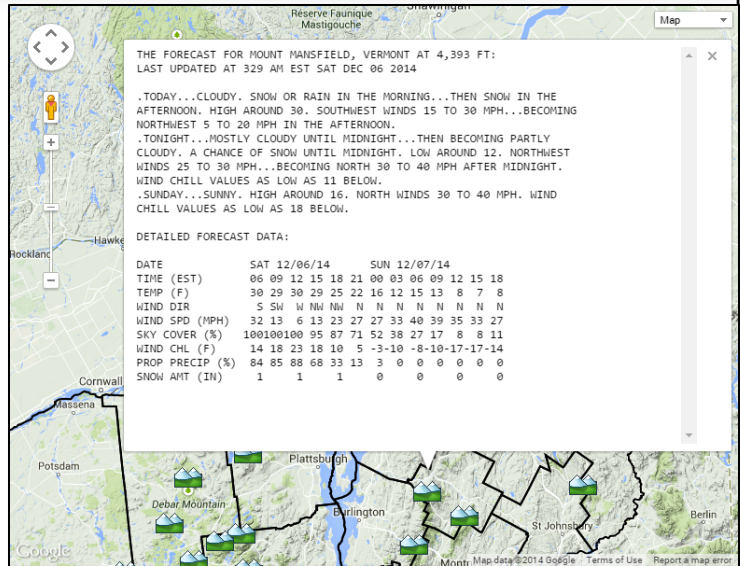
"Studies among the Snow Crystals" from Wilson Bentley's "The Snowflake Man", taken from the *Monthly Weather Review* in 1902, and available on the NOAA Photo Library.

Inside Our Web Site:

The Higher Summits Forecast

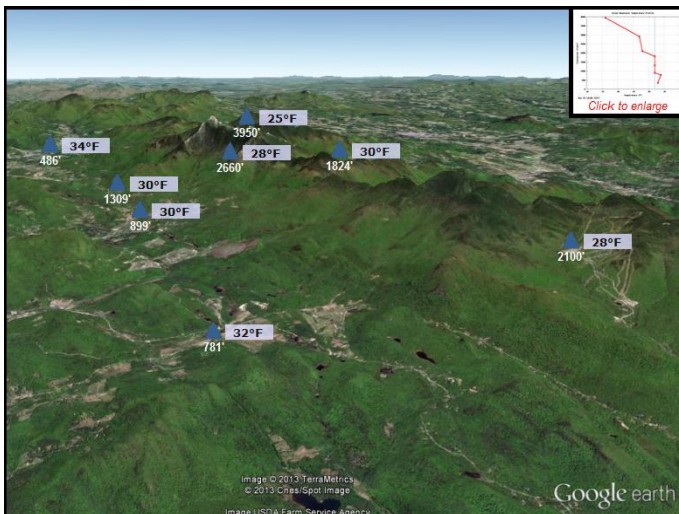
Conor Lahiff

In our last edition we spoke about our popular Lake Champlain Forecast, but as we head into winter our other recreational product takes center stage, the Higher Summits Forecast. As boaters hang up their gear for the winter, many people's thoughts turn to the mountains with interests in skiing, hiking, snowshoeing, etc. for the upcoming season. As we do with every forecast we produce, here we strive to provide the highest quality forecast information for the highest peaks across Vermont and Northern New York. On our website, under "Forecasts" and then the "Recreational" tab, (<http://www.weather.gov/btv/recreation>) you can find everything we produce for the mountains from daily forecasts to current conditions, and more.



An example of the point Higher Summits Forecast for Mount Mansfield, Vermont.

Our main delivery method of this forecast is through text, where at the top of the page we provide a broad overview of the conditions expected over the next 36 to 48 hours. Looking for a more detailed forecast for an exact mountain top? We can help there too, with our Mountain Point Forecasts (See Figure above).



A snapshot of the Mount Mansfield Regional Mesonet Profile

Here we've handpicked some of the more popular summit destinations across the area, and provided a highly detailed forecast in three-hourly increments for a variety of weather parameters such as temperature, wind, probability or precipitation, and more! Just use our handy Google Map interface and click on a mountain icon on the map for a forecast. You won't be disappointed!

Also be sure to check out our "Mount Mansfield Regional Mesonet Profile" (See figure to the left) (<http://www.weather.gov/btv/profile>) where we plot current conditions on and around Mount Mansfield to provide in essence a real-time vertical temperature profile over the northern Green Mountains. This can certainly aid you in your travels into the mountains on any given day!



The Four Seasons

Volume I, Issue II



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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>



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