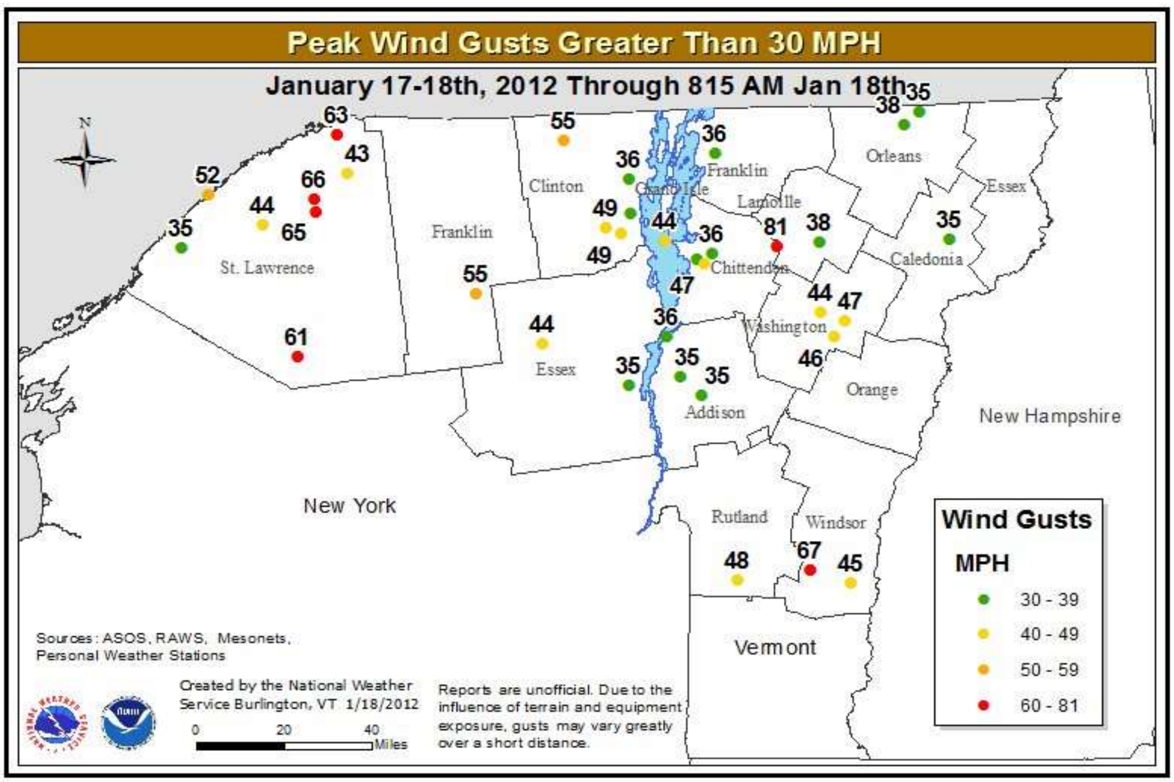
High Wind Event on January 18, 2012

Introduction

During the late evening through overnight hours on 17-18 January 2012, an intense area of low pressure tracked just north of the Saint Lawrence River, producing very strong wind gusts across the North Country. At Potsdam, New York the wind gusted to 66 mph shortly after midnight, while an 81 mph wind gust was measured atop Vermont's highest peak Mount Mansfield. These strong gusts caused numerous power outages across northern New York and parts of central and northern Vermont. At the peak of the event, over 10,000 people were without power across northern New York, including the Saint Lawrence Valley and over 2,500 people had no power in parts of Vermont. In addition, some minor structural damage was reported in Ogdensburg, New York, along with some downed tree limbs. Figure 1 below shows a plot of peak wind gusts greater than 30 mph. Click here for a public information statement for a list of wind gusts reported.



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Synoptic Pattern (Large Scale)

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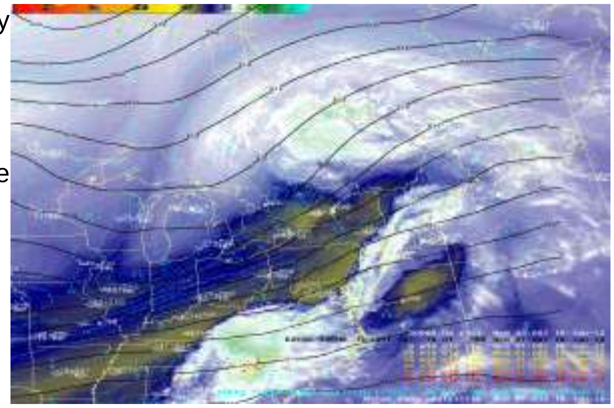

Figure 2 shows a water vapor loop on 18 January 2012 from 0101 UTC (0801 PM EST) to 1101 UTC (601 AM EST) with RUC 500 hPa height (black lines), 500 hPa vorticity (light blue), and 500 hPa upper air (plotted white). The darkening on the image across eastern Great Lakes into the Saint Lawrence River Valley is associated with potent shortwave energy in the jet stream winds aloft.

This energy aloft, combined with an approaching left front quad of a 250-hPa jet, helped in the rapid development of an intense 984 hPa low pressure area centered across western New York. The pressure gradient between building high pressure across the western Great Lakes and departing low pressure across the Saint Lawrence Valley produced conditions favorable for wind gusts up to 65 mph.

Click to enlarge

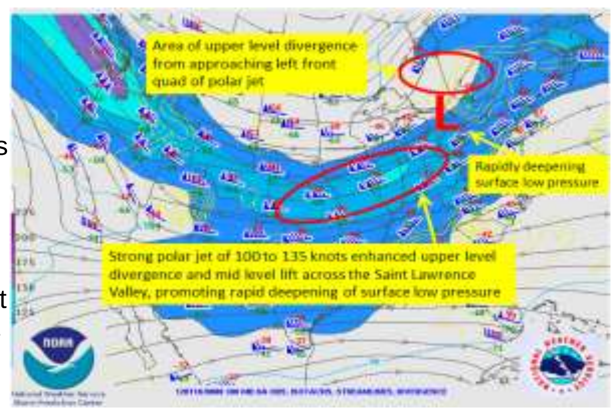

Figure 3 shows the 300 hPa (30,000 feet above the ground level) upper air analysis on 18 January 2012 at 0000 UTC (0700 PM EST). Isotach, are lines of equal wind speeds (blue contours), streamlines (black lines), temperatures (red), and areas of upper level divergence (yellow line) in Figure 3.

This shows a 100 to 135 knot westerly polar jet across the Ohio Valley with the left front quadrant of this jet approaching western New York. This is a region of upper-level divergence which promotes mid-level lift and aids in the development of surface low pressure. Given the magnitude of the jet and associated upper-level divergence, along with vigorous shortwave energy, factors came together to promote rapid surface low pressure development across western New York.

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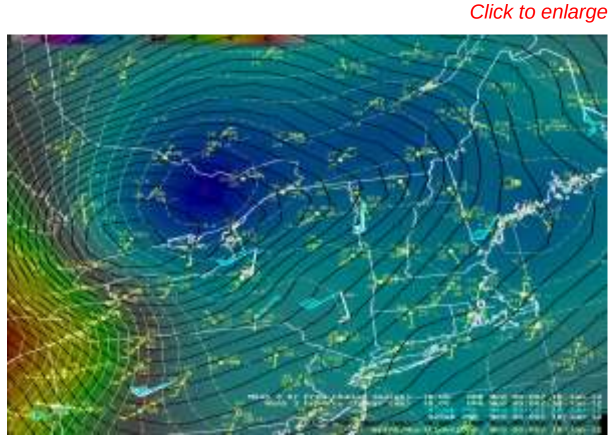

Figure 4 shows a surface analysis loop from 0000 UTC (0700 PM EST) to 0900 UTC (0400 AM EST) on 17th/18th January 2012, along with mean sea level pressure (black lines), surface observations (plotted in yellow), MSAS 3-hour pressure change (image and dotted yellow lines) and 850 hPa (plotted in light blue) and 925 hPa (plotted in white) VAD wind profile. A strong 988 hPa low pressure just north of Lake Ontario at the beginning of the loop travels northeast along the Saint Lawrence Valley and deepens to 983 hPa north of Montreal at the end of the loop. The greatest 3 hour pressure falls (drawn as isallobars, or lines of equal pressure change), provide forecasters with guidance on the development and track of surface low pressure. The strong pressure fall-rise couplet from NE-SW suggested very strong winds oriented in the direction of greatest pressure falls (i.e., from the southwest toward the northeast). Furthermore, the favorable track of low pressure (just north of the St. Lawrence River) and orientation of the Saint Lawrence Valley aligned with the isallobaric gradient helped to channel the wind and produce gusts up to 65 mph on 18 January 2012.

Mesoscale Setup (Small Scale)

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Figure 5 shows the Buffalo, New York rawinsonde sounding at 0000 UTC (0700 PM EST) on 18 January 2012. This sounding shows strong surface to 850 hPa wind fields ranging from 30 to 65 knots, with winds of 70 knots at the top of the mixed layer.

Surface to 3 km lapse rates were 6.3° C/km, which suggested enough low level instability to promote good mixing and the potential to transport the top of the mixed layer winds to the surface. These low level conditions, combined with subsidence/sinking motion aloft behind jet couplet/short wave energy contributed to very gusty winds across the North Country.

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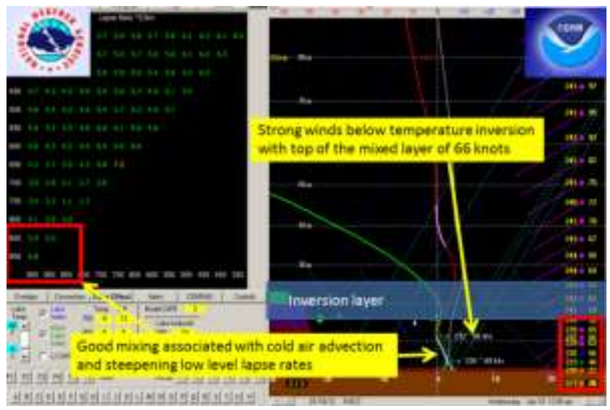

Meanwhile, Figure 6 shows a model sounding from the locally run BTV 4KM-WRF model as viewed through Bufkit at 0500 UTC (1200 AM EST) for Massena, New York on 18 January 2012. This model sounding shows top of the mixed layer winds of 66 knots, with favorable low-level mixing due to cold air advection and steepening low-level lapse rates.

Forecasters use the top of the mixed layer winds as a good indicator of potential wind gusts, when good momentum transfer can occur. This happened on January 18th, as surface wind gusts to 60 knots occurred at the Massena, New York automated surface observation station (ASOS). On other occasions, a developing temperature inversion will prevent good downward momentum transfer, resulting in the highest winds occurring over the higher summits, above the inversion.

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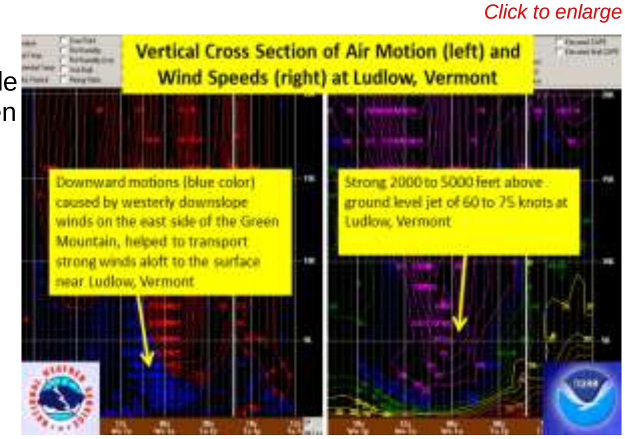

In addition to strong winds across the Saint Lawrence Valley, conditions were also favorable for gusty winds on the eastern side of the Green Mountains, especially near Ludlow, Vermont. Figure 7 shows the BTV 4KM-WRF model vertical cross section of air motion (left) and wind speeds (right) at Ludlow, Vermont on 18 January 2012. Strong westerly low level winds cause the air to rise on the western side of the Green Mountains (upslope), then quickly descend on the eastern side (downslope), to produce a strong pressure couplet and very gusty winds. The downslope motion helped to transport winds of 60 to 70 knots at 2000 to 5000 feet above the ground toward the surface. This combined with favorable low level mixing produce localized wind gusts to 65 mph on the eastern side of the Green Mountains, especially near Ludlow, Vermont. The exact opposite occurs on the western slopes of the Green Mountains from Rutland to Cambridge associated with southeast downslope winds, where localized gusty winds can develop if conditions are favorable. However, if these strong winds occur above the temperature inversion, limited mixing will occur resulting in much lower surface winds, with the stronger gusts remaining across the higher mountain peaks.

Radar Analysis (Small Scale)

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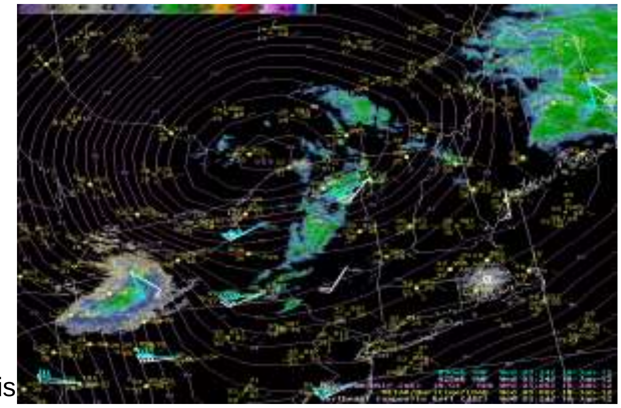

Figure 8 shows a composite mosaic radar reflectivity loop from 0324 UTC (1024 PM EST) to 0936 UTC (436 AM EST) on 18th/19th January 2012, along with mean sea-level pressure (purple lines), surface observations (plotted in yellow), and 850 hPa (plotted in light blue) and 925 hPa (plotted in white) winds from radar-based observations (VAD winds). The number of sea-level pressure contours across the North Country indicates a strong pressure gradient is present, aided by the deepening low pressure over the Saint Lawrence Valley and building high pressure from the Great Lakes. This combined with a strong low level jet and help from mesoscale effects due to topography, helped to produce very strong winds across the region. The broken line of light rain showers on the radar loop is associated with the surface cold front. Meanwhile, toward the end of the loop scattered lake effect snow showers developed across northern New York and were transported up to 150 miles downstream by the strong winds.

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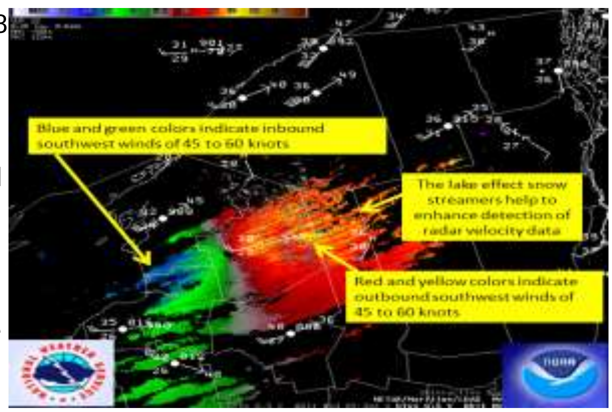

The final figure 9 shows KTYX 0.5° velocity on 18 January 2012 at 0530 UTC (1230 AM EST), along with surface observations (plotted white).The blue and green colors indicate inbound winds of 45 to 60 knots, while the red and yellow colors from the image show outbound winds of 45 to 60 knots.

In addition, the KTYX radar was detecting some lake effect snow streamers, which helped to enhance the detection of velocity data across the Tug Hill Plateau. The surface observations plotted in white, showed wind gusts between 40 and 50 knots across Saint Lawrence County from the southwest.

Conclusions

A number of factors combined to produce strong and damaging winds across the Saint Lawrence Valley and parts of Vermont on 18 January. During this event, Mount Mansfield recorded a peak wind gust to 81 mph, while Ludlow, Vermont recorded a 67 mph gust. Meanwhile, wind gusts between 55 and 65 mph were common across the Saint Lawrence Valley and parts of the northern Adirondack Mountains. These tropical storm force winds in populated areas produced some minor property damage and up to 15,000 people lost power during the event. Finally, temperatures returned to normal following this wind storm, with scattered mainly mountain snow showers falling across the North County.