Weather Forecasting

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NWS Gaylord MI

2019 Michigan Winter Operations Conference
What Will We Talk About Today?

• Winter precipitation forecast challenges
• New Snow Squall Warning
• Finding snow information on NWS Gaylord’s website
Winter Forecast Challenges in the Great Lakes

NWS Gaylord

Lake effect snow Great Salt Lake
Courtesy of powderchaser
IT'S NOT WORTH IT, ROY! LET'S JUST GIVE HIM OUR NOSES & LET HIM GO!
Winter Challenge #1: Limited Marine Observations
Buoys get removed in winter
Winter Challenge #1: Limited Marine Observations

Very few ship observations
Winter Challenge #1: Limited Marine Observations

Lots of cloudy days in the winter
Why are cloudy days a problem?
Challenge #2:
Slight variations in wind direction have big impacts on snowfall

North-Northwest Flow

Northwest Flow
Snowfall differences with slight differences in wind direction
Challenge #3
Great Lakes Ice Cover
Ice cover varies from year to year
March ice cover differences on Lake Superior 2012 versus 2014

March 8, 2014

March 11, 2012
Small Amounts of Ice can make a big difference in Lake Effect Snow

Notice just a relatively small area of ice in Northern Lake Michigan
Northwest winds - No Ice cover
Northwest winds - Ice cover
Challenge #4
Elevation
Seasonally = 8 to 12 inches more snowfall for every 100 foot change in elevation
During winter storms, temperatures generally drop about 1 degree Fahrenheit for every 300-400 foot rise in elevation.
December 20-21, 2012

Heavy Wet Snow in Gaylord

Mix of rain and snow in Alpena
## December 20-21, 2012

### Gaylord Observations  
Elevation 1400 feet

<table>
<thead>
<tr>
<th>Time</th>
<th>Temp</th>
<th>Wind Direction</th>
<th>Wind Speed</th>
<th>Visibility</th>
<th>Weather</th>
</tr>
</thead>
<tbody>
<tr>
<td>9:53 AM</td>
<td>32.0 °F</td>
<td>24.2 °F</td>
<td>30.0 °F</td>
<td>92%</td>
<td>29.74 in</td>
</tr>
<tr>
<td>10:53 AM</td>
<td>32.0 °F</td>
<td>23.6 °F</td>
<td>30.9 °F</td>
<td>96%</td>
<td>29.71 in</td>
</tr>
<tr>
<td>11:53 AM</td>
<td>32.0 °F</td>
<td>24.2 °F</td>
<td>30.9 °F</td>
<td>96%</td>
<td>29.64 in</td>
</tr>
<tr>
<td>12:36 PM</td>
<td>33.8 °F</td>
<td>24.8 °F</td>
<td>30.2 °F</td>
<td>87%</td>
<td>29.52 in</td>
</tr>
<tr>
<td>1:31 PM</td>
<td>32.0 °F</td>
<td>22.5 °F</td>
<td>30.2 °F</td>
<td>93%</td>
<td>29.44 in</td>
</tr>
<tr>
<td>1:53 PM</td>
<td>32.0 °F</td>
<td>20.8 °F</td>
<td>30.9 °F</td>
<td>96%</td>
<td>29.43 in</td>
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</tbody>
</table>

### Alpena Observations  
Elevation 600 feet

<table>
<thead>
<tr>
<th>Time</th>
<th>Temp</th>
<th>Wind Direction</th>
<th>Wind Speed</th>
<th>Visibility</th>
<th>Weather</th>
</tr>
</thead>
<tbody>
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<td>35.1 °F</td>
<td>24.5 °F</td>
<td>33.1 °F</td>
<td>92%</td>
<td>29.80 in</td>
</tr>
<tr>
<td>11:11 AM</td>
<td>35.6 °F</td>
<td>24.8 °F</td>
<td>33.8 °F</td>
<td>93%</td>
<td>29.76 in</td>
</tr>
<tr>
<td>11:17 AM</td>
<td>33.8 °F</td>
<td>22.8 °F</td>
<td>33.8 °F</td>
<td>100%</td>
<td>29.76 in</td>
</tr>
<tr>
<td>11:38 AM</td>
<td>33.8 °F</td>
<td>23.2 °F</td>
<td>32.0 °F</td>
<td>93%</td>
<td>29.74 in</td>
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<tr>
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<td>23.5 °F</td>
<td>32.0 °F</td>
<td>93%</td>
<td>29.73 in</td>
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<tr>
<td>11:54 AM</td>
<td>33.1 °F</td>
<td>21.9 °F</td>
<td>30.9 °F</td>
<td>92%</td>
<td>29.74 in</td>
</tr>
<tr>
<td>12:06 PM</td>
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<td>22.8 °F</td>
<td>32.0 °F</td>
<td>93%</td>
<td>29.70 in</td>
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<tr>
<td>12:22 PM</td>
<td>33.8 °F</td>
<td>24.8 °F</td>
<td>32.0 °F</td>
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<td>29.68 in</td>
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<tr>
<td>12:26 PM</td>
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<td>24.8 °F</td>
<td>32.0 °F</td>
<td>93%</td>
<td>29.67 in</td>
</tr>
<tr>
<td>12:47 PM</td>
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<td>25.2 °F</td>
<td>33.8 °F</td>
<td>93%</td>
<td>29.65 in</td>
</tr>
<tr>
<td>12:54 PM</td>
<td>35.1 °F</td>
<td>24.8 °F</td>
<td>33.1 °F</td>
<td>92%</td>
<td>29.66 in</td>
</tr>
</tbody>
</table>
So what happened with regard to snowfall accumulations?

1200 AM
12/21/2012
HEAVY SNOW 9 SSW GAYLORD
M13.8 INCH OTSEGO

24 HR TOTAL THRU 12 AM. SNOWDEPTH 12 IN.

<table>
<thead>
<tr>
<th>ID</th>
<th>LOCATION</th>
<th>MAX TEMP</th>
<th>MIN TEMP</th>
<th>24 HR PRECIP</th>
<th>SNOWFALL</th>
<th>SNOWDEPTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANJ</td>
<td>SAULT STE MARIE</td>
<td>30</td>
<td>27</td>
<td>0.68</td>
<td>6.1</td>
<td>10</td>
</tr>
<tr>
<td>APN</td>
<td>ALPENA</td>
<td>37</td>
<td>24</td>
<td>0.61</td>
<td>2.5</td>
<td>2</td>
</tr>
</tbody>
</table>
Challenge #5
Radar Limitations

Why Lake Effect Snow Doesn’t Always Show on Weather Radars

Radar beam travels higher in the sky away from radar.

Lake Effect Snow is usually lower than 10,000 feet and radar beam misses it 60 miles from the radar.
Is it snowing here?
Is it snowing in these locations?

Yes
Challenge #6
Varying computer model solutions

This is a problem both summer and winter, all across the United States. Differences in computer model solutions - which have a large impact on the forecast.
Computer Variation in storm tracks from 1 model run (Ensemble Forecasts)
Challenge #6
Varying computer model solutions
Why is storm track important?

Heaviest snow normally falls 150 to 200 miles to the left of the surface low track.
With all of these challenges...How do meteorologists put the forecast together?

Creating a Forecast: Like putting a puzzle together

- Current observations
- Various computer models
- Pattern recognition
- Forecaster expert analysis and assessment

Diagram:
- Computer Models
- Observations
- Pattern Recognition / Trends
- Scientific analysis and assessment
Introduction to Snow Squall

Warnings

Winter 2019-2020
What is a Snow Squall?

A snow squall is an intense, but limited duration, period of moderate to heavy snowfall, accompanied by strong, gusty surface winds and possibly lightning. Snow accumulation may be significant with a snow squall.

For more information visit weather.gov
There is a long history of deadly accidents associated with snow squalls.

Snow squalls can cause localized extreme impacts to the traveling public and to commerce for brief periods of time.

The rapid onset of whiteout conditions, combined with gusty winds and falling temperatures can cause extremely dangerous conditions for motorists.

Annual highway fatalities from these events can exceed fatalities from tornadoes and floods combined for portions of the U.S.
Winter-related Motor Vehicle Fatalities Lead Other Hazards

Number of Fatalities

817

13 36 49 92 39 41 144 77 82 27

Average number of fatalities per year from various meteorological hazards for the period 1996–2011. Totals for all hazards except winter-related motor vehicle and winter-related aviation fatalities are from Storm Data.
“Short-fused” in nature

Issued for smaller geographic areas for up to 60 minutes

Lead time will generally be 20 to 30 minutes or longer

Issued in a Polygon Format

Similar in format to Severe Thunderstorm Warnings
Snow Squall Warning

Valid Until
9:45 AM EDT Friday
March 16, 2018

Hazard
White out conditions in heavy blowing snow

Impact
Dangerous life-threatening travel

Potential Exposure
Population: 135,894
Highways: I-81
I-88
US-11
BULLETIN - EAS ACTIVATION REQUESTED
Snow Squall Warning
National Weather Service Binghamton NY
339 PM EST Sat Feb 13 2016

NYC007-023-107-109-132115-
/O.NEW.KBGM.SQ.W0001.160813T2039Z-160813T2115Z/
Cortland NY-Broome NY-Tompkins NY-Tioga NY-
339 PM EST Sat Feb 13 2016

The National Weather Service in Binghamton has issued a

* Snow Squall Warning For...
Southern Cortland County in Central New York...
Northwestern Broome County in Central New York...
Southeastern Tompkins County in Central New York...
Northern Tioga County in Central New York...

* Until 4:15 PM EST

* At 3:38 PM EST, a dangerous snow squall was located over South Danby or 12 miles southwest of Ithaca, moving northeast at 50 mph.

HAZARD...White-out conditions in heavy snow and blowing snow.

SOURCE...Radar indicated and webcams.

IMPACT...Dangerous, life-threatening travel.

* The dangerous snow squall will be near...

Slaterville Springs around 3:50 PM EST.
Berkshire, Richford and Harford around 3:55 PM EST.
Whitney Point and Lisle around 4:05 PM EST.
Marathon around 4:10 PM EST.
Willet and East Freetown around 4:15 PM EST.

PRECAUTIONARY/PREPAREDNESS ACTIONS...

Conditions will deteriorate rapidly with near zero visibilities in snow and blowing snow. Travel will become impossible. You should wait until the squall passes before traveling or find a safe place to wait out the squall away from any road or highway indoors if traveling.

&&

LAT...LON 4260 7600 4242 7586 4235 7585 4214 7645 4225 7654 4228 7654 4228 7656 4230 7658
TIME...MOT...LOC 2038Z 240DEG 42KT 4227 7643
$$
What to do during a Snow Squall?

❖ Remain alert to the latest forecast and travel conditions. Consider avoiding or delaying travel until the snow squall passes your location.

❖ Leave extra time if you must travel during snow squalls.

❖ Reduce your speed and turn on headlights!

❖ Don’t slam on brakes!

SNOW SQUALL WARNING means...

Expect severe travel difficulties

Rapid white out conditions and near zero visibility
How do I receive a Snow Squall Warning?

- NOAA Weather Radio
- Website: [http://weather.gov](http://weather.gov)
- Mobile: [http://mobile.weather.gov](http://mobile.weather.gov)
- iNWS: [https://inws.ncep.noaa.gov](https://inws.ncep.noaa.gov) (Public Safety Officials only)
- NWSChat: [https://nwschat.weather.gov](https://nwschat.weather.gov)
- Twitter
- Other local and state dissemination systems
- State DOT Variable Message Signs (VMS) in some areas
- Future: Cell Phone Wireless Emergency Alerts (WEA)
Finding Snow Info On NWS Gaylord Website

Select “Snow”
Three Days of 12 Hour Snowfall Forecast Available
Three Days of Expected Snow Ratio Data Available
Finding Hourly Weather Graphs

Click on your desired location
Finding Hourly Weather Graphs
Hourly Weather Graphs
Hourly Weather Graphs

Thursday, September 26 at 2pm
Temperature: 58 °F  Dewpoint: 42 °F  Wind Chill: N/A  Surface Wind: W 18G28mph  
Sky Cover (%): 50%  Precipitation Potential (%): 4%  Relative Humidity (%): 55%  
Rain: <10%  Thunder: <10%  Snow: <10%  Freezing Rain: <10%  Sleet: <10%
Questions or want more information?

Pat Bak
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NWS Gaylord

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www.weather.gov/gaylord