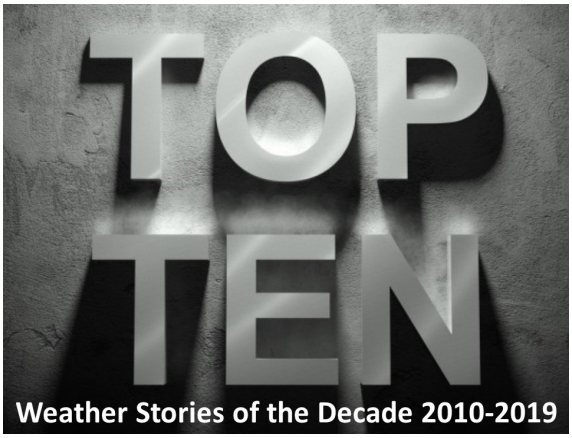
NATIONAL WEATHER SERVICE

MARQUETTE, MICHIGAN

2019
Yooper Weather Review

TOP 10 WEATHER EVENTS OF THE DECADE *METEOROLOGIST, JON VOSS*

If you follow us on Facebook, you likely saw our countdown of the Top 10 Weather Events of the Decade (2010-2019)! On the next few pages we recap the countdown and discuss the #1 events.



INSIDE THIS ISSUE

SPECIAL POINTS OF INTEREST

- Get to know some of our favorite weather to forecast, the challenges we face and more throughout the Newsletter.
- Become a Weather-Ready Nation Ambassadors! More details towards the end of the newsletter.

TOP 10 WEATHER EVENTS OF THE DECADE

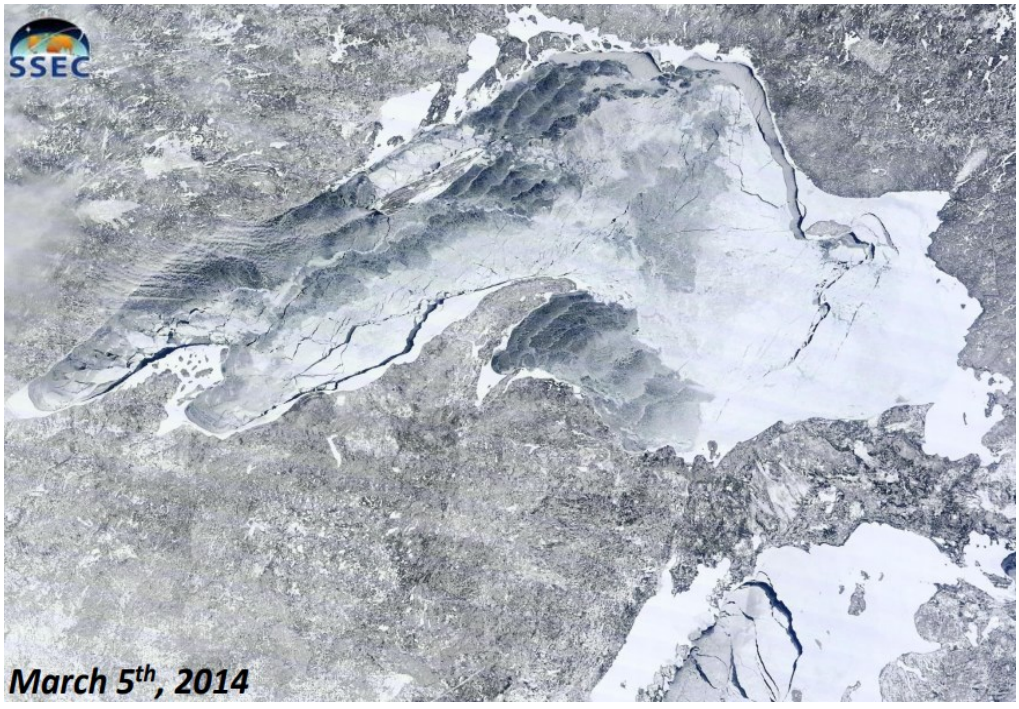
Fall/Cold Weather Events		*Warm Season Events*
Tie! Fall Storm of Late October 2017 & West/Northwest Upper Michigan Major Ice Storm April 27th, 2017	#10	Record to near Record Warm Fall of 2016
Valentine's Day Blizzard of 2015	#9	Supercells of Iron Mountain April 28, 2015
Record Cold February 2015 & Lake Superior Freezes Over Again	#8	Flash Flooding Event in parts of Marquette/Dickinson/Iron counties October 17-18, 2016
Blizzard of February 19-20, 2014	#7	Severe Weather Event over Marquette and Iron counties on April 10, 2017
Record Winter Storm of April 14-17, 2018	#6	Tennis to Softball sized hail at Muskallonge Lake State Park on June 30, 2018
The Powerful Fall Storms of 2010-2011	#5	Supercells of Marquette County on June 8, 2012
Record Snowy November 2014	#4	Record Warm March 2012
Pre- and Post-Thanksgiving Winter Storms of 2019	#3	The Summer of 2016 Severe Weather Season
Record to Near Record February of 2019	#2	The Duck Lake Wildfire of Late May 2012
Record Cold Winter of 2013-2014	#1	Father's Day Flash Flooding of 2018

RECORD COLD WINTER OF 2013-2014 STATS

- Multiple cities across Upper Michigan experienced their record coldest four month stretch from Dec. 2013 through March 2014. Many of these locations also broke the record for sub-zero days that winter.
- NWS Marquette broke a record with 75 consecutive days at or below freezing from Dec. 6, 2013 through February 18, 2014. Ishpeming and Herman broke similar reports.

Location	Number of Days with High Temperature at or below 32 F	Beginning Date	End Date
Herman	90	November 22, 2013	February 19th 2014
Marquette NWS	75	December 6th, 2013	February 18th, 2014
Ishpeming	75	December 6th, 2013	February 18th, 2014
Ahmeek	53	December 28th 2013	February 18th 2014
Clarksburg	52	December 29th 2013	February 18th 2014
Watton	52	December 29th 2013	February 18th 2014

- Deep frost levels resulted in billions of dollars in damage to water and sewer mains, roads and other vital infrastructure across 9 of 15 Upper Michigan counties.
- Prolonged cold resulted in Lake Superior freezing over in early March 2014, with the highest ice coverage since March 2003. Ice measuring 4 feet thick hampered ice breaking operations in the spring and caused damage to vessels. The thick ice cost the Great Lakes economy an estimated $705 million with nearly 7 million tons less freight hauled by U.S. cargo ships than the previous winter-spring shipping season. By mid-June 2014, ice was still observed on the lake.
- Limited evaporation due to the ice and continued above normal precipitation caused Lake Superior water levels to rebound, marking the beginning of a prolonged near-record high levels.



WHAT SPAKRED YOUR PASSION FOR WEATHER?

"Cold, and what I thought was snowy, weather in my hometown of Duluth, MN."
- Jordan Wendt, Meteorologist

FATHER'S DAY FLASH FLOODING 2018

- 3 to 7 inches of rain fell during the early morning hours of June 17, 2018.
- NWS Marquette issued their first ever Flash Flood Emergency.

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...THIS IS A FLASH FLOOD EMERGENCY FOR CENTRAL AND SOUTHERN
HOUGHTON COUNTY...

...THE FLASH FLOOD WARNING REMAINS IN EFFECT UNTIL 845 AM EDT FOR
HOUGHTON...WESTERN BARAGA AND NORTHEASTERN ONTONAGON COUNTIES...

At 531 AM EDT, local law enforcement reported flash flooding in
central and southern Houghton County. Three to six inches of rain
have already fallen over the past 5 hours. Flash flooding is already
occurring. Law enforcement reports that multiple roads are
impassable and have asked that residents stay off area roadways
until the water subsides and debris is cleared.

This is a FLASH FLOOD EMERGENCY for central and southern Houghton
County. This is a PARTICULARLY DANGEROUS SITUATION. SEEK HIGHER
GROUND NOW!
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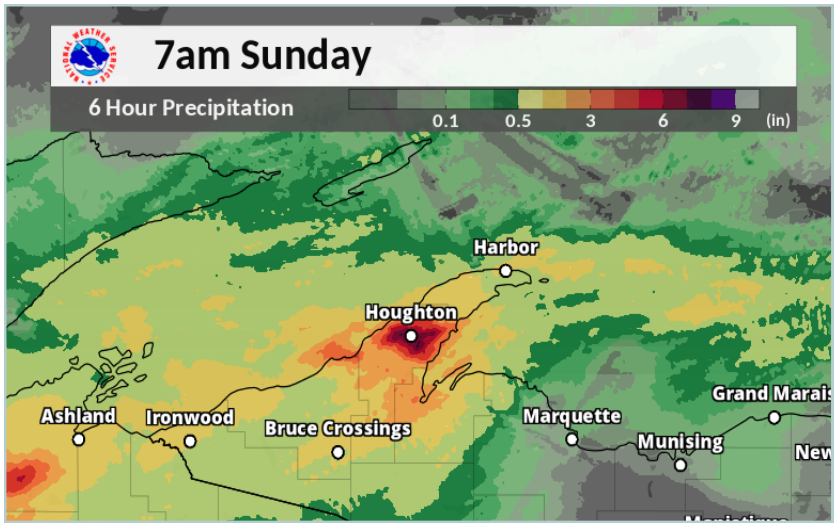


- Catastrophic flash flooding occurred across much of Houghton County.
- According to the NOAA Precipitation Frequency Atlas, this event indicated a 1000-year recurrence interval.
- During the worst conditions, nearly all roads were impassable across central and northern Houghton County.
- Homes and businesses were flooded and sustained damage, including Michigan Tech., where the first floor of their Administrative Building flooded.


Photo courtesy of Melissa Lubinski


Photo courtesy of MSP Aerial Survey


Photo courtesy of Michigan Tech

- Recovery efforts continued for several months after the flooding.
- Governor Rick Snyder declared a State of Disaster for Houghton County following the historic flooding, with damage estimates in the millions of dollars. That same weekend, prior to the Father's Day flooding, Gogebic and Menominee counties also experienced flash flooding.

LAKE MICHIGAN HIGH LAKE LEVEL FLOODING CONCERNS

METEOROLOGIST, RYAN CONNELLY

Anyone who's driven on M-35 south of Escanaba, or gone fishing at Gladstone, or walked the boardwalk in Manistique knows this already: Lake Michigan is high. Really high. In fact, the U.S. Army Corps of Engineers reports that the Lake Michigan-Huron system is 3 feet above the long-term monthly average for December, which is tied for the all-time record. This has led to two significant flooding events along the Lake Michigan shoreline. Though both caused flooding, they were two very different events.

The first happened Friday night, July 19, in Manistique. A complex of severe thunderstorms pushed east through northern Wisconsin and just clipped part of Menominee County before moving out over northern Lake Michigan. This complex was no ordinary summer thunderstorm, however. It was so big and so strong that it created some weather of its own. Specifically, it created a small-scale low pressure area in its wake – known as a "wake low."

Winds quickly gusted to nearly 50 mph from places like Port Inland to Manistique and Escanaba – not *with* the thunderstorms, but *after* them! This rapid increase in winds from the south pushed water into Manistique and Escanaba. The water rise significantly damaged the boardwalk in Manistique and flooded the parking lot of a brewery and winery, forcing it to close early – not good for business on a Friday night!

The second Lake Michigan flood this year happened on Monday, October 21, along the Bay of Green Bay. A strong fall low pressure system moved from the central U.S. into northern Wisconsin and then slowly to the north across Lake Superior.

What builds the waves with these big fall storm systems is not just the wind speed. It is also the fetch length – how much distance over water the wind is traveling – and the fetch duration – how much time the wind has been blowing over the water. A south wind blowing up the entire length of Lake Michigan from near Chicago to Manistique poses much more of a risk than a wind blowing across the lake. Slow-moving storms also pose much more of a risk than a fast-moving one.

This storm actually did not have a very long fetch length, since the wind was mainly coming from the east. But it *was* a slow-moving storm, meandering through northern Wisconsin for nearly 24 hours! This allowed the water to build up throughout the day, eventually to the point where it flooded numerous homes and business from Gladstone and Escanaba south to Cedar River and even as far south as Menominee. Since Lake Michigan's water levels haven't been this high since the mid-1980s, most people could not remember a time when the Bay of Green Bay flooded because of a strong wind from the east. Lakeshore flooding along Lake Michigan remained a problem into the winter, with a storm in November causing similar flooding.

Thankfully no one was injured from this flooding, and damage has been mostly minor. But until Lake Michigan recedes again – and that could take a few years! – this kind of lakeshore flooding may continue to happen from time to time.

Lake Michigan from Manistique during a fall high wave event. Photo courtesy of Jim Salzwedel

WHAT DO YOU LOVE MOST ABOUT THE WEATHER IN THE UPPER PENINSULA?

"The diversity of weather is what I enjoy. It truly is a 4-season environment!
- ***Joe Phillips, Meteorologist***

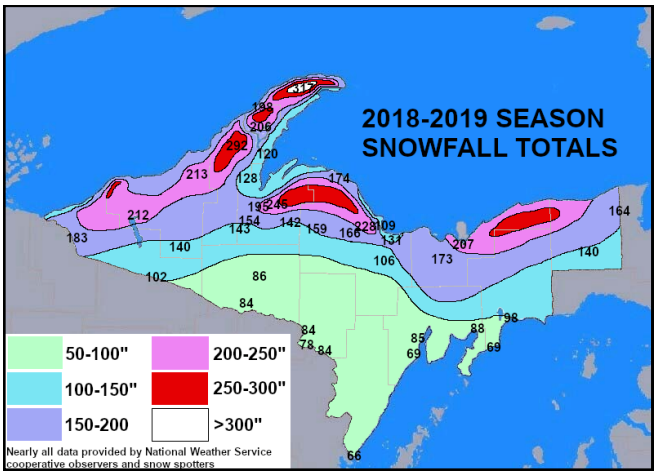
LAKE-EFFECT SNOW FORECASTING & COMMUNICATION CHALLENGES

METEOROLOGIST, JACLYN RITZMAN

It is no secret that we receive our fair share of winter weather here across the Upper Peninsula of Michigan! While we deal with a variety of different forcing mechanisms that each have their unique challenges in forecasting and messaging of impacts, we're most famous for our lake-effect snow (LES) events. While our entire snowpack isn't solely made up of LES, it augments the snowpack, especially for of Lake Superior Snowbelt communities.

What makes the Upper Peninsula ideal for LES? Much like downstate, the majority of Upper Michigan shares a border with either Lake Superior or Lake Michigan. During the summer months, the Great Lakes slowly absorb incoming energy from the sun, ever-so slowly warming to on average 50-60°F on Lake Superior and 60-70°F on Lake Michigan by September/October. It is these relatively warm waters that prime this region for LES season, especially through the fall and early winter months when cold air outbreaks spread across the Upper Great Lakes.

Without getting into the complex microphysical processes behind these LES events, often times we can say for near-certainly that, yes it is going to snow. However, sometimes the biggest challenge is where the heavier snow is going to develop and persist, and



"...small shifts in LES bands can lead to large changes in expectations and impacts."

Often times the challenges in forecasting and communicating lake-effect snow events boil down to where the heavier bands of lake-effect snow develop and how long they persist over a given location. While there are other factors that go into forecasting snowfall amounts (i.e. how fluffy the snow will be), one of the driving factor behind where lake-effect snow falls is related to the wind fields. How strong the winds are, and especially what direction they're coming from.

To maintain well-organized LES bands, we like to see steady, persistent winds that do not change much in direction over a given time and areal extent. Subtle changes in the wind direction from the surface up through nearly 8,000-10,0000+ feet above ground level can lead to small shifts in where LES bands remain persistent. However, these small shifts in LES bands can lead to large changes in expectations and impacts. An example of this was what occurred in early November, when a heavy-lake effect snow band forecast to graze the city of Marquette shifted 8 to 10 miles west, and thus brought more significant impacts to the city itself.

Given the shape of Lake Superior and the typical patterns that bring us cold air advection, we typically see the development of multiple lake-effect snow bands, some stronger than others, with the impacts and expected snowfall amounts highly-variable over a given area. The important thing to remember during these types of situations is that these bands can wobble or shift around slightly, so you may find yourself in and out of the heavier lake-effect snow, especially if you're out traveling.

WHAT IS THE MOST CHALLENGING PART ABOUT FORECASTING FOR THE UPPER PENINSULA?

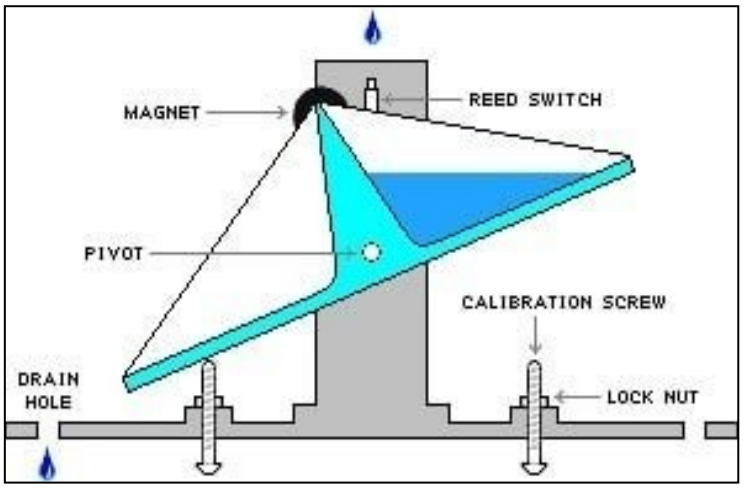
"Lake-effect snow. There are so many factors that play into the types of lake-effect snow that can happen here." ***- Linda Gilbert, Lead Meteorologist***

HYDROLOGY FIELD WORK

METEOROLOGIST, KEITH WHITE

Much of the work performed by Meteorologists at the National Weather Service (NWS) is done in front of a bank of computers. Analyzing data, creating forecasts, and communicating with our partners are easily done from the comforts of one's favorite office chair. However, there are also opportunities to get out of the office, get to know the geography, the geology, and the people of the area we serve. In particular, the office Hydrology Program offers several of these!

Rain Gage Calibration: In the late April to early May timeframe, it's typically safe to assume the snow is just about done for the Upper Peninsula winter season and most precipitation will fall as rain going forward. So, once per year around this time, we take this opportunity to ensure several of our automated "tipping bucket" rain gages are uncovered and calibrated. We currently have 8 of these located throughout the Upper Peninsula at United States Geological Survey (USGS) river gaging stations, and the USGS are happy to allow us to use their systems to transmit the data. They also display this data on their website, as long as we keep the gages properly calibrated.



These gages work by collecting a small amount of water into a little "bucket" that tips over and empties once it's reached a certain amount. After tipping, a second "bucket" faces up, which repeats the process and tips back when full. With each tip, the rainfall amount increases. The calibration process determines how much water fits into these little buckets before they tip. To calibrate, a device is wired to the gage to count the tips, and a special, slow-drip funnel is placed over the buckets with a known amount of water inside. If the buckets tip too many times for the known amount, the gage is over-counting and a screw is adjusted downwards with an Allen wrench. The opposite is true if the buckets tip too few times.

Surveying Flood Stages: Whenever a new river gaging site is established, or after sufficient time that the characteristics of a river bed, banks, or infrastructure surrounding the river has changed significantly, flood stages must be (re)established. In a manner similar to how Urban Planners and Engineers survey land, but with slightly less precision (flood stages are set to the nearest half a foot), river beds are surveyed to determine the height at which the river would have to rise to be considered "bankfull". In NWS terminology, this is "Action Stage". Then, the height at which the river would begin to impact surrounding infrastructure is set to Minor Flood Stage. If the river were to continue to rise and inundate roads, homes and businesses, further levels of Moderate and Major Flood Stages are set.

Gage Maintenance: Many of the active river gaging stations in the area are operated by the USGS or hydroelectric energy producers. But there are several sites without automated gages where river information is needed by the NWS to provide warning services and so we have installed staff and/or wire weight gages to take manual readings. The maintenance or replacement of these gages sometimes requires putting on waders and getting into the river! We also need dedicated observers to take readings from these gages when rivers run high, so we often make stops along the way to talk with nearby residents and businesses and ask for their help.

HYDROLOGY FIELD WORK CONTINUED…

Snow Surveys: Although most hydro field work is much easier to perform in the spring and summer, there's good reason to get out and about in the late winter as well! Typically, the most significant flooding events in this area occur in the spring, coincident with large amounts of melting snow and an increasing likelihood for heavy rainfall. In order to accurately predict the likelihood of flooding, it's important to determine the amount of liquid water equivalent within the snowpack. It's also helpful to know the depth of frost within the upper layers of the ground, as frozen ground prevents soils from storing water and increases runoff into the river systems. This information can be inferred from model data, and snow water equivalent is also measured from planes, but it's always best to have "ground truth" *in situ* data to validate these models and remotely sensed measurements.

Keith White pictured measuring the frost

Measuring snow water equivalent is easy. We use a tube to collect a core sample of un-tampered snow in a location that is representative of the area at large, then weigh it on a scale specifically calibrated to convert the weight of the snow contained in the core to a liquid equivalent amount in increments of 0.10". In many cases, multiple measurements are taken and averaged. Frost depth measurements can also be pretty easy if you have permanent equipment set up in a single location. Here at our office, there is a hole about 6 feet deep with a 1" diameter PVC placed within. A removable tube with liquid inside that changes hue when frozen is inserted into the PVC. You can visually see the depth at which it is frozen, which correlates with where the ground is also frozen. Out in the field it's a little more fun. Essentially, you remove a patch of snow to get to ground level, and create your own hole in the ground with a metal pipe (it will probably take a sledge-hammer to get it through the frost layer. Then, expand that hole as much as possible by pulling the pipe in all directions. You can then take a straightened metal clothes-hanger with a little bend at the end of it, and feel for yourself where the ground is hard and where it's just regular old dirt.

WHAT SPARKED YOUR PASSION FOR THE WEATHER?

"I've always been fascinated by significant natural events from a young age, but especially weather-related ones. As a child, I used to rent books from the library on tornadoes, hurricanes, earthquakes, volcanoes, and more. My favorite movie was Twister for a long time, and my interest in the weather only grew over time. The opportunity to apply high-level math to real-world problems also tickled my fancy in college." ***- Keith White, Meteorologist***

MENOMINEE AND GLADSTONE TREEMAGEDDONS

METEOROLOGIST, RYAN CONNELLY

It was a slow start to severe weather season in 2019 – even by U.P. standards. Our office didn't issue its first Severe Thunderstorm Warning of the year until July 4th, which is about a month and a half later than normal for the first warning of the year. This delay didn't stop storms from turning destructive once the season got going. Let's take a look back at some of the more impactful thunderstorm events of 2019:

On Wednesday, July 24, a relatively weak line of thunderstorm formed along the Lake Superior lake breeze (the area where cooler air from over the lake collides with warmer air over land) through Marquette and Delta counties. But as these storms drifted south, one began to intensify over the Bay of Green Bay southeast of Escanaba. This storm then moved back onshore near Cedar River. As it did so, it quickly "pulsed" up in strength and generated a "microburst" – a short-lived period of damaging winds over a localized area that blow out in all directions. (Conversely, the winds from a tornado converge inward to a single point.)

The result was numerous large trees down in the area, especially along M-35 both north and south of Cedar River where the Menominee County Road Commission had to work quickly to clear fallen trees from the road. At the same time, a boater had to be rescued near Menominee, possibly due to winds from this thunderstorm as well.

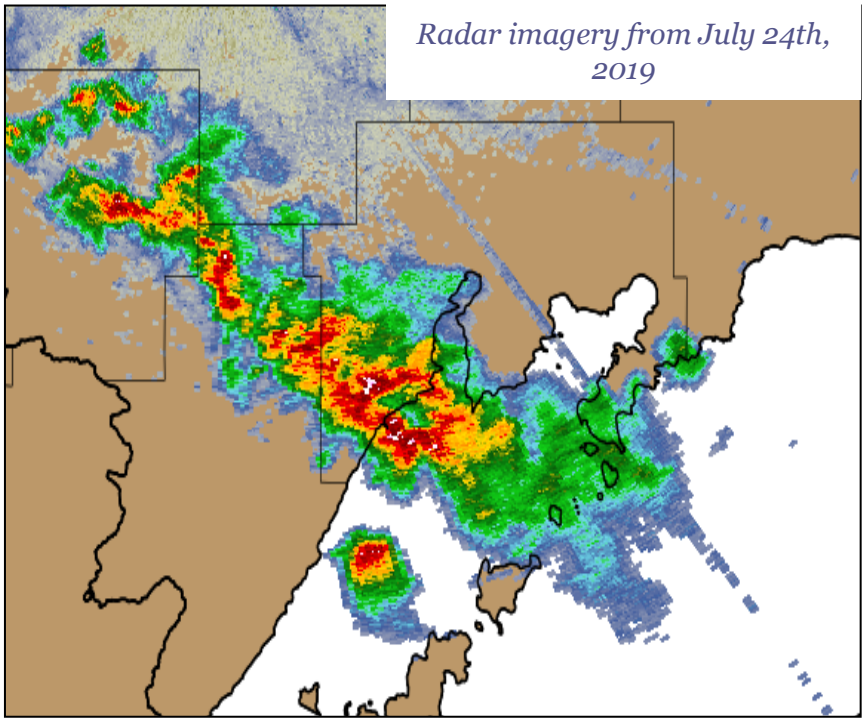
The next memorable storm was on Monday, August 5. This again affected parts of the central and southern U.P. This was a typical U.P. severe weather day: the forecast parameters we look at were mostly marginal and could have gone either way. It just so happens that on this day, they went severe over the U.P. Storms first downed trees in Calumet, Laurium, and Lake Linden.

There were numerous trees knocked down by this storm's wind throughout Gladstone and the Stonington Peninsula, particularly at Van Cleve Park. There was some scattered damage in Gwinn as well.

WHAT SPARKED YOUR PASSION FOR THE WEATHER?

"I first fell in love with weather at a young age! Growing up in northeast Wisconsin we saw a wide variety of weather—from big winter storms to severe thunderstorm events. However, the most memorable weather event I recall from growing up was that my high school graduation was postponed due the risk for tornadoes across the area that day, June 7th, 2007."

- Jaclyn Ritzman, Meteorologist



Radar imagery from July 24th, 2019

MENOMINEE AND GLADSTONE TREEMAGEDDONS CONTINUED…

Another thunderstorm with fairly widespread impacts occurred on Tuesday, August 27. This setup was unlike the others. Normally, severe thunderstorms occur in warm, moist environments where they are allowed to grow very tall – up to 40,000 feet or even higher. On this day, however, there was actually colder air moving in aloft in a pattern that looked more like fall. There were even Gale Warnings on Lake Superior! But this colder air aloft, along with the ground warming up quickly under the still-strong August sunshine, actually helped these thunderstorms to become severe, even as they only grew to about 25,000 feet off the ground. We sometimes call this kind of thunderstorms "low-topped" and I think you can see why now.

Despite their "low" tops, these storms were still significant. The NWS office in Negaunee officially recorded a 54 mph wind gust as this line of storms moved through, with estimates of 60-70 mph wind gusts elsewhere in Marquette County. This resulted in numerous downed trees and power lines from Ishpeming to Marquette. These storms also produced some small hail near Champion, and a reported brief waterspout near the lighthouse in Big Bay.

None of these storms contained tornadoes, but all of them downed trees and caused damage. In the U.P., as in many parts of the country, thunderstorms without tornadoes can produce wind damage that's just as significant as those that do contain weak tornadoes. So when you hear us issue a Severe Thunderstorm Warning, your plan of action should be the same: get indoors and stay away from the windows.

Photo courtesy of Jason Salzwedel

MEET SOME OF OUR NEW OFFICE STAFF!

NICK LANGLIEB

I grew up in southeast Wisconsin, about 4 blocks from Lake Michigan. I have been fascinated with weather since I was a child. I was given my first barometer on my 8th birthday and still own it today. The influence of Lake Michigan on the weather was what really drove my passion for meteorology. I graduated from the University of Oklahoma with a B.S. in Meteorology and a minor in Hydrology. While attending OU I worked at the National Weather Service Radar Operations Center, evaluating radar data from across the country. After graduating I started working as a meteorologist at the Great Falls, MT National Weather Service Office where I spent 9 years involved in information technology and mountain meteorology. I'm am very happy to be back in the Great Lakes region and living in the U.P. Outside of work I enjoy hiking, fishing, camping, gardening, snowshoeing and most of all hanging out with my family. I am grateful to be a part of the team at the National Weather Service in Marquette and for the opportunity to support forecast operations for the U.P.

WELCOME TO NWS MARQUETTE!

TAYLOR PRISLOVSKY

Hello! My name is Taylor Prislovsky. I have a wife and baby daughter, and we have all just recently moved to the U.P. this past August! I am originally a southern boy who was raised in Knoxville, TN (go Vols!). I received my undergraduate degree at Mississippi State University (Hail State!), and am currently working on getting my masters from Mississippi State online. I've been working for the National Weather Service for just over a year now; I just moved from the Washington D.C./Silver Spring MD area to take up a meteorologist position up here. The reason that I am a meteorologist today is because I've always had a fascination. I used to watch the Weather Channel for fun, and would tell my friends and family if there was a severe thunderstorm warning or if snow was possibly forecasted. I really have a soft spot for snow; I absolutely love the sight of it. That is actually part of what I love about the U.P.; IT HAS SO MUCH SNOW!!! I guess this southerner is trying to get his fill-in of snow to make up for lost time after spending 25 years only getting a few inches once or twice a year! Another reason that I like the U.P. is because the area reminds me a lot of East Tennessee; the people and the landscape reminds me so much of my old home. I hope to get involved with the community this winter, and to get some skiing done! And when winter is over and summer is here, hiking is what I love to do! The U.P. has plenty of trails that I would love to explore when I get the time! So if you see me around, feel free to say hi!

2019 COOP CORNER

OBSERVATION PROGRAM LEADER, JIM SALZWEDEL

Cooperative Observers kept their measuring sticks handy from the beginning of the New Year. Just making it out to the gauge was tough at times; especially with 40 to 60 inches of snow-cover or just trying to keep your swampers upright on a glaze of ice fit for a zamboni. Here's a look at some of the more significant events from my YOOPER perspective. We'll journey from January through June of 2019, based off the release of the official NCEI Climate Publications for Michigan. I use this publication to gain a more detailed view of how the weather played out across the U.P. The U.P. is divided into two climate zones. Number 1 covers the west half of the U.P. and number 2 covers the east half. The split from west to east is at Marquette and Menominee Counties westward in Zone 1 and Alger and Delta Counties eastward in Zone 2. Here's a look at some of the more significant observations that our partner Citizen Scientists observed from January through June of 2019 and how things shaped U.P.

<u>January-2019</u>

Lower than normal temperatures arrived:

Amasa recorded (-40F...lowest, Official CO-OP reading in Mich.) on 1-20. Other stations dropping to 30F below or lower during the month were at the Alberta Ford Center(-33F), Bergland Dam(-31F), Clarksburg(-35F), Stambaugh (-34F) and Rudyard 5SE(-34). Officially the highest Monthly Snowfall was observed in Munising with just under 67". The U-COOP site in Painesdale tallied 72.7".

<u>February-2019</u>

Significant winter weather arrived with two *"Ole Time Blizzards"* and a significant Ice Storm falling in between. Over three quarters of an inch of ice was observed in portions of Marquette County. Heavy and wet snowfall was observed throughout both the U.P. climate zones during the month. The high water content in the snow coupled with the ice event caused significant property damage to many properties with metal roofs; as there was no significant warm up to let the snow load loose. Locations in the south-central U.P. (Banana-Belt) also got into the snow action. The Observers at the Cooperative site at the Escanaba Water Filtration Plant adjacent to Ludington Park measured up 39.6 inches of snow for the month. This amount is only a handful of inches below the long term seasonal snowfall normal for Esky. Well below normal temperatures continued across the Peninsula. Each of the COOP sites recorded below zero minimum temperatures during the snowy month.

Staff at the NWS Marquette Office, in Negaunee Township measured (89.9" of Snowfall)/6.88" Liquid Equivalent). This is 4.74" above the normal Liquid Equivalent for February. (14)Sites measured 3.00" of Liquid Equivalent or greater. Daily Snow Depth records were set at Escanaba, WFO Marquette, Sault Sainte Marie, Manistique, Big Bay and Herman. Five of (14) sites in Climate Zone 1 stacked up measured maximum Snow Depths reaching 50" or greater. Officially, Clarksburg measured a Maximum Snow Depth of 60". Unofficially, the Maximum Snow Depth reached 65" at the tail end of the month at Painesdale. Alberta and Amasa recorded daily minimum temperatures at (-33F), while Bergland Dam and Clarksburg recorded (-31F).

<u>March-2019</u>

Snowfall and precipitation waned as there were no big storms. Below normal precipitation was observed along with lower than normal temperatures across the Peninsula. A very slow draw down of the snowpack occurred.

(13)Sites observed -20F below zero or lower, with three of these sites bottoming out at around -30F below zero. Amasa(-30F), Clarksburg(-30F) and Stambaugh 2SSE(-31F). The maximum daily high temperature was 58F at Baraga 5W (Climate Zone 1) on 3-28.

2019 COOP CORNER CONTINUED & LENGTH OF SERVICE AWARDS

April-2019

Above normal precipitation amounts were observed, especially across the west half of the U.P. Here's a list of the sites that measured greater than 5.00" of liquid:
Bergland Dam (6.53"/+3.83" Above Normal), Ironwood WWTP(5.99"/+3.35" Above Normal), Ironwood No. 2(5.94"), WFO Marquette(5.02"), Watton 2WSW(5.19"), Herman(5.43"), Big Bay 1NW(5.03") and Covington 1NNW(5.24"). Only (1) site reached a maximum daily temperature of 65F in Climate Zone 2 and that was Moran on 4-23.

May-2019

Widespread above normal precipitation was observed across both U.P. Climate Zones, with (21) sites measuring 5.00" of precipitation or greater. Colder than normal temperatures prevailed. Here's a list of some of the significant rainfall amounts:
Ishpeming WWTP(6.09"/+3.24" Above Normal), WFO Marquette(7.86"/+4.81" Above Normal), Garden Corners (6.13") and Rapid River 4SSE(6.70"). Big Bay 1NW and the WFO in Negaunee Twp. measured around 6.0" of snow for the month of May. (4) of the Climate Zone 1 sites reached 80F or higher. None of the Climate Zone 2 sites reached 80F.

June-2019

Below normal temperatures were experienced, especially across the eastern sections of the peninsula. Below normal rainfall was observed over the west while above normal rainfall was observed east. Here's a look at the Climate Zone 2 sites in the eastern U.P. that tallied up greater than 5.00" of rain:
Detour Village(5.24"/+2.34" Above Normal), Paradise(5.54"), Pickford(5.04"/+2.22" Above Normal), Sault Sainte Marie(5.67"/+2.82" Above Normal), Sault Sainte Marie-Sanderson(5.84"/+3.14" Above Normal), Tahquamenon Falls State Park(6.01"/+3.08" Above Normal) . (2) of the Climate Zone 1 sites reached 90F or higher on 6-30, Amasa 1W (91F) and the Iron Mtn-Kingsford WWTP (90F). None of the Climate Zone 2 sites reached 90F.

Jeff Dixon, 10 yrs., Stambaugh 2SSE

Darren Kotajarvi , 25 yrs., Ishpeming WWTP

Rick Schwartz, 15 yrs., Garden Corners

2019 COOP LENGTH OF SERVICE AWARDS CONTINUED…

Aleda Savolainen & Chuck Savolainen, 10 years, Jacobsville

Not pictured this edition: Thomas Erwin and Nancy Erwin, 10 years, Greenland 6N

What's the Difference Between Lake-Effect and System Snow?

System Snow

Tends to be…

* Widespread
* Wetter, dense snow with a higher amount of liquid water content
* Difficult to remove, especially with a shovel!

Lake-Effect Snow

Tends to be…

* Showery and localized
* Fluffier and more likely to blow around causing visibility restrictions
* Much easier to remove

HOW TO REPORT THE WEATHER TO US!

MPING

/NWSMarquette

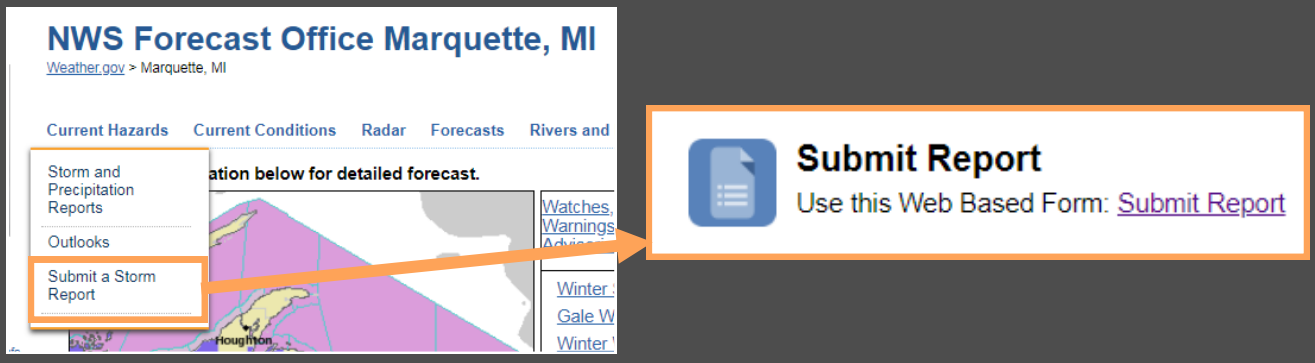
@NWSMarquette

SOCIAL MEDIA

nws.marquette@noaa.gov

EMAIL

From www.weather.gov/up



ONLINE at https://inws.ncep.noaa.gov/report/

WHO ARE OUR
WEATHER READY NATION AMBASSADORS?

Local community leaders who partner with the National Weather Service to help play a vital role in promoting weather safety information. Communities can become better informed and prepared in the face of hazardous weather.

We need your help!
Become a force multiplier!

What Do Our
Weather-Ready Nation Ambassadors do?

⇒ Promoting Weather-Ready Nation messages and themes to your stakeholders

⇒ Engaging with NOAA personnel on potential collaboration opportunities

⇒ Sharing their success stories of preparedness and resiliency

⇒ Serving as an example by educating employees on workplace preparedness

More information available at:

www.weather.gov/WRN/Ambassadors

Become a Weather-Ready Nation Ambassador at:

https://www.weather.gov/wrn/amb-tou

THE NATIONAL WEATHER SERVICE

provides weather, water, and climate data, forecasts and warnings for the protection of life and property and enhancement of the national economy.

We're on the Web!

www.weather.gov/up

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