

**Overview of Extensive Ice Storms in Minnesota
Pete Boulay State Climatology Office DNR-Waters**

Introduction

The State Climatology Office has the old Minneapolis Weather Bureau records in its holdings. Included in these records are forms that Weather Bureau personnel filled out to send to the Monthly Weather Review. Inquiries requesting damage reports for severe storms were sent by the Weather Bureau to telephone, power, railroad and post offices in Minnesota. Not only were wind, hail, and tornado reports collected, reports on ice or “glaze” was also part of the process. This “Severe Local Storms” file spans from the early 1930’s to the 1950’s. Numerous ice storm events have occurred in Minnesota’s past and upon reviewing these old reports, some patterns emerge.

From historical ice storm remarks, it would appear that the heaviest concentration of ice would occur where there is a significant rise in elevation. Along the Minnesota shore of Lake Superior, there is a rise of about 1,000 feet (300 m) over the first 5 to 8 miles (8 to 13 km) inland. Temperatures tend to be warmer during the winter in the vicinity of Lake Superior. So, ground temperatures near the lake may stay above freezing, while temperatures at the higher elevations may be below freezing and accumulate more ice. Wind speeds found at higher elevations may also be a contributing factor.

Another place that seems to have a higher frequency of heavier ice accumulations is the Buffalo Ridge in southwest Minnesota. Whether this is because of higher wind frequencies at these elevations or because of adiabatic cooling is open for debate. Perhaps it is both.

Case Studies

March 26-27, 1950

An event that took place on March 26-27 1950 caused severe icing in Duluth. There was ½ to 1 ½ inch of ice with the heaviest on top of the hill in Duluth and to the southwest between Duluth and Cloquet. Some ice was observed to break branches and twigs at Beaver Bay in Lake County but no major damage was caused there.

November 6-7, 1947

Another event with a more detailed description was one that took place on November 6-7, 1947. A letter from Minnesota Power and Light was sent to the Minneapolis Weather Bureau describing the storm: “The sleet and snow storm of November 6-7, 1947 affected us most severely to the south and west of Cloquet. The heaviest ice loading experienced was between Cloquet and Floodwood where at points we had ice accumulations of as much as three inches in cross section. The loadings elsewhere were not as heavy and varied considerably.... Between Virginia

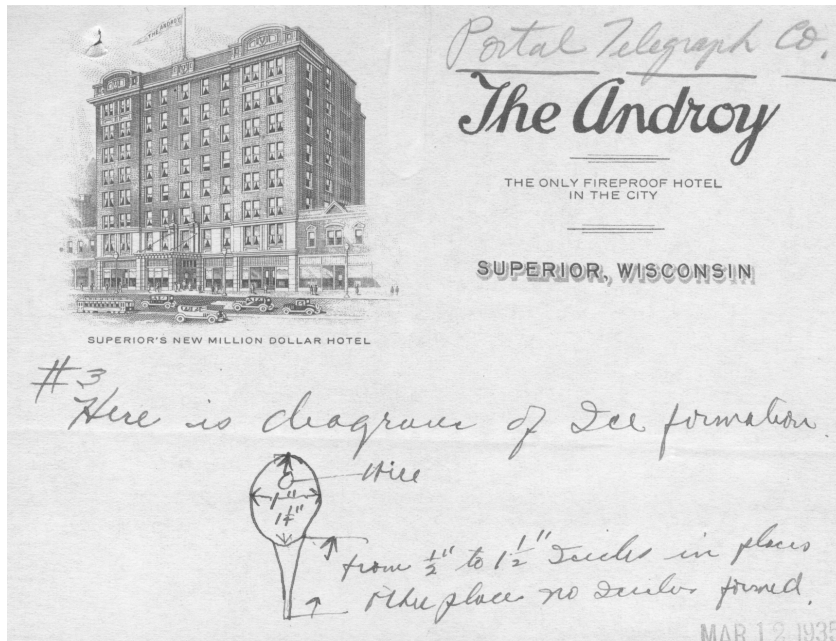
and Ely loading was principally snow and this built up to 6 inches at some locations... On the hill in back of Duluth we experienced $\frac{1}{4}$ of ice.”

March 3-5, 1935

Probably the most damaging ice event for the Duluth area before 1950 was the event of March 3-5th, 1935. At the time it was called “The worst ice storm in Duluth’s history.” The area covered by this storm was centered at Duluth and extended up the Lake Superior coast to Beaver Bay. The damage extended eastward along the south coast of Lake Superior to Ashland. Swan Lake to the Northwest was the farthest west the storm reached and on the southern side, Moose Lake and Solon Springs, WI. The worst of the storm extended about 40 miles to the west and south of Duluth. There was no damage farther to the south at Sandstone.

The storm began with rain and moist snow falling at the Duluth Weather Bureau in at 7th Ave West and 8th Street in Duluth (elevation 160 m (526 feet) above Lake Superior and 1km from the lake) at 10pm on March 3. The temperature was 26 degrees. By the morning of the 4th, the snow stopped but the rain continued. At 11:00 am a half-inch rod was $\frac{7}{8}$ inch by $1\frac{5}{8}$ inch and at 4pm the same rod was $1\frac{3}{8}$ inch by $2\frac{1}{4}$ inches. The lights started going out in Duluth by 6pm on the 4th due to power lines breaking. By the morning of the 5th Duluth was virtually isolated from the outside world except for short wave radio. A local ham radio operator sent the Duluth National Weather Service reports. The final ice coating on a half-inch rod was 2 inches by $2\frac{1}{4}$ inches and weighted $2\frac{1}{4}$ pounds to the foot at 7:00 am of the 5th. It is unknown where the Duluth Weather Service was measuring the ice on this rod, but it is likely that it was at their office since they mention that the total amount of precipitation for the storm was 1.02 inches. Smooth hard ice of $\frac{5}{8}$ inches thick was noted on sidewalks in Duluth at 7pm on March 5th.

This storm was different in the fact that it affected areas closer to the lake such as the city of Superior, Wisconsin and downtown Duluth. There was mention that the areas hardest hit were in the western section of Duluth west of 57th Avenue. Four streetcars had to be abandoned in the storm, three of them in the western part of the city. A heavy salt mixture and pick axes were used to try to free the stuck streetcars. A one-mile stretch of telephone poles along Thompson’s Hill was broken off as if they were toothpicks due to the ice. A Duluth, Masabi & Northern Railway engineer measured some of their cables at Proctor on March 6, 1935 and found that the ice in some instances was 7 inches in circumference. 75% of shade trees reported ruined in Moose Lake. Thousands of trees were stripped of their limbs leaving just a center stub. Conifers appeared to hold up better. Hibbing also had damage due to ice with the breaking of large and small branches. The Portal Telephone Company in the city of Superior, Wisconsin noted ice from $\frac{1}{2}$ to $1\frac{1}{2}$ inches in diameter with the thickest ice at 73rd Street and Grassy Pt.



The Portal Telephone Company measured the ice accumulation and sent the Weather Bureau this diagram from the March 3-5, 1935 ice storm.

One side note to this ice event was that: “During the evening of the 4th, with many residences out of light, the streetcar trolley flashes, due to poor contact of trolley and wire became quite noticeable because of the darkness. Many people were alarmed at the weird flashes of light. Numerous calls were received by the Weather Bureau, newspapers and radio station, asking if there was a violent electrical storm in progress, or if there was a terrible fire or northern lights in the vicinity.”

April 3-4, 1999

There are some modern cases that also support thicker ice at higher elevations away from the lake. One was an ice event on April 3 and 4, 1999 with accumulations of up to .25 inch according to Storm Data. The storm caused extensive damage to an 800-foot television tower on the hill above downtown Duluth. The winds were gusting at 50mph. At the time of this ice storm the Duluth National Weather Service 6.8 miles (11km) from the lake and 825 feet (251m) above Lake Superior. The temperatures at this site were between 1 and 3 degrees C cooler than at the lake locations of Duluth Harbor (KDYT) and city of Superior (KSUV) Here is a sample of the National Weather Service METARS on April 4, 1999 at 5Z (11PM April 3 local time)

KDYT 040455Z AUTO 06028G35KT 7SM OVC008 02/01 A2983 RMK AO2
 KSUW 040456Z AUTO 05020G31KT 5SM -RA FG OVC006 01/01 A2981 RMK AO2
 KDLH 040455Z 10020G32KT 2SM -FZRA BR BKN005 OVC009 M01/M01 A2977 RMK AO2 PK
 WND 11038/0358 CIG 003V007 SLP101 P0002 T10061006

I'm not certain how much ice accumulated in downtown Duluth, but it appears as though this ice storm was worse in areas with higher terrain above the lake. The high winds during this event were East-Northeast.

March 22, 1991

A more serious ice storm began during the afternoon of March 22, 1991 and ended as the event changed to heavy, wet snow on the 23rd. This event coated the city of Duluth with as much as 6 inches of ice (according to Storm Data.) The 850-foot WIDO TV tower was toppled. 4 million pine trees were damaged or destroyed with the heaviest damage at G.C. Andrews State Forest near Moose Lake in Pine County (about 65 km) away from the lake.

Conclusion

In conclusion, there is enough evidence to suggest that the thickest ice accumulates in the higher elevations from Lake Superior. While severe icing can occur within the first one mile inland in the city of Duluth, the most severe icing appears to begin 3 to 5 miles inland at places such Nopeming, Proctor, and Duluth Heights. Thicker ice also accumulates in Carlton County to the southwest of the Lake Superior as well, 30 miles or more away from the lake. This area is largely outside the contour on the 50-year mean recurrence interval map. Perhaps plotting a lower thickness contour in areas near Lake Superior within the first 100 m (300 foot) rise away from the lake and a higher thickness contour is in order for higher elevation roughly at areas 200 meters (600 feet) higher than the lake

It's puzzling that there aren't very many mentions of thicker ice along the North Shore of Lake Superior to the northeast of Duluth. This could be because of two reasons. One is that people have a tendency to report what they see. Ice storms were reported in great detail, even in the 1930's because they impacted power and telephone communications. The largest population center is around Duluth so naturally the ice storms would have a greater impact there and not as much of a vocal impact up the coast. Another reason may be the simple fact that most people that live along Lake Superior northeast of Duluth live in close proximity to the water at a lower elevation. Thicker ice may be forming farther inland, but few people are affected since most live by the lake.

Elsewhere in Minnesota, the Buffalo Ridge in southwest Minnesota also appears time and time again to have a thicker concentration during ice storms. The higher elevation there seems to be enough for slightly cooler temperatures and allow more ice to accumulate. The 50-year recurrence mean interval map does have southern Minnesota in an area for thicker icing, but perhaps a special consideration could be made for the Buffalo Ridge area. This is an area mainly in Lincoln, Pipestone, Murray and Nobles County with elevations about 120 m (400 feet) higher than the surrounding area.

Historical Lists of Ice Storms in Minnesota 1861-1953

Here are some historical pre-1954 severe ice storms in Minnesota from the State Climatology Office "Severe Local Storms" and anecdotal reports.

Feb. 10, 1861. Ice storm near Elk River. Coatings of a 1/2 inch of ice reported. The ice broke off many large branches and saplings were bent to the ground.

Nov. 26, 1896. Severe ice storm over southwest and central Minnesota. 1.42 inches of rain fell at Bird Island and 1.20 inches of rain at Montevideo. The ice caused a great deal of damage to trees and shrubs.

Jan. 26, 1916. Severe ice storm hits Mower County. Hundreds of birds killed.

Feb. 22, 1922. Blizzard, ice and thunderstorms across Minnesota. Winds hit 50 mph in Duluth while thunderstorms were reported in the Twin Cities. Heavy ice over southeast Minnesota with 2 inches of ice on wires near Winona. Over two inches of precipitation fell. This was also one of the largest ice storms ever in Wisconsin history with ice four inches in diameter on telegraph wires. One foot of ice-covered wire weighed 11 pounds. One killed and four injured in Wisconsin.

Dec. 14, 1933. Severe ice storm hits southeast and central Minnesota.

Jan. 9-10, 1934. Sleet and ice storm over southwest Minnesota. Hardest hit was Slayton, Tracy and Pipestone. The thickest ice was just east of Pipestone with ice measuring 6 to 8 inches in diameter. At Holland in Pipestone County 3 strands of #6 wire measured 4 1/2 inches in diameter and weighed 33 ounces per foot. The ice was described as: "very peculiar in formation being practically round on three sides, the lower side being ragged projectiles like icicles: in other words pointed. The frost and ice were wet, not flaky like frost usually is. In handling this, it could be squeezed into a ball and did not crumble."

Mar. 4, 1935. Ice storm sweeps across Duluth. Half a million dollars in damage was done to trees and shrubs. See detailed discussion.

May 1, 1935. An unusually late snow, sleet and ice storm over east central Minnesota. The heaviest ice was between St. Paul and Forest Lake and westward to Buffalo in Wright County with snow and ice accumulations of 1 to 1.5 inches on wires. The Downtown Minneapolis weather bureau recorded 3 inches of snow.

April 23-25 1937. Ice sleet and snowstorm coated wires in extreme western Minnesota. Moist snow and sleet froze to branches and wires that measured from 2 to 3 inches at Beardsley and Luverne Minnesota.

Apr. 16-18, 1939. Snow, sleet and ice storm across southern Minnesota. Ice was 1/16 to 1/2 inch in the vicinity of Faribault.

Mar. 27-28, 1940 Ice storm over West Central Minnesota. Ice was ½ to 2 inches with icicles to 15 inches on some wires. The heaviest ice was from Fergus Falls to Wadena and Sauk Center to Elbow Lake. 813 poles down due to ice.

Apr. 2-5, 1940. Very destructive ice storm from Aitkin to Grand Rapids to Beaver Bay. Ice thickness ranged from ¼ inch to 3 inches. The storm was the most severe in the St. Lois River valley from Duluth to Carlton and to Nopeming, MN. The highest points such as Kenwood and Duluth Heights received the most ice. There was also ¼ to 1 inch of ice reported in the Iron range especially the Virginia area.

Nov. 10-11, 1940 (Armistice Day Storm) Destructive storm any way you look at it but regarding ice there was 1/8 to ½ inch of ice on wires with ice thickness to 1 inch in Pine City and Lake Benton. Peak wind during the storm was 63 mph in Duluth. There was a great note written up on this particular event of Nov 10-11, 1940. Here's what it says in full. It was a series of questions from M.R. Hovde, the meteorologist in charge. The answers are from the General Plant manager of Northwestern Bell Company.

Damage in Minnesota only

To overhead wires, poles, etc.

**Northwestern Bell and Tri-State Telephone & telegraph Company Repairs and Replacements.
\$79,000 total estimated cost.**

Thickness of ice on wires-

Generally 1/8 to 1/2 inch diameter. 1 inch in diameter in two small areas.

Time ice first began to form-

Early morning of November 11, 1940

Length of time ice remained on wires-

About 24 hours

Locality of heaviest ice formation-

1-inch diameter in small area near Pine City.

1-inch diameter in vicinity of Lake Benton.

Approximate number of wires down -1600

Approximate number of pole down -2400

Extent of delay of service-

Average 18 hours for toll and 36 hours for exchange lines out of service.

Remarks: The above covers damage to both Northwestern Bell and Tri-State Telephone Company plant in Minnesota. The greatest damage was in the area about 20 miles east and west of a line from Sandstone to Albert Lea.

Feb. 9, 1943. Ice storm across southern Minnesota with the heaviest concentration of ice (1/4 inch) in the vicinity of Lake Benton and Hendricks in Lincoln County near the South Dakota border. Minneapolis had 1/16 coating, St. Paul had 1/8 inch of a coating.

March 14-16, 1943. Snow, sleet and ice storm south of a line from Duluth, St. Cloud and Ortonville. Heaviest ice was in the vicinities of Lake Benton, Springfield and Windom. Ice thickness was $\frac{1}{2}$ to $\frac{3}{4}$ inch around St. Cloud to $\frac{3}{4}$ to 2 inches in the Pipestone, Ruthton, Lake Wilson, Slayton and Tracy. A good description of the ice was submitted in one report. "...Ice was 2 inches across and $1\frac{3}{4}$ inch deep on wire. A little frost ice was near the wire with the outside solid ice. The ice was irregular in shape. Duluth had 6 inches of snowfall at the city office with 13 inches at the airport. The ice was confined to Moose Lake and south.

Nov. 8, 1943. Severe ice storm in the Twin Cities, and heavy snow over southwest Minnesota. One person died in St. Paul as a trolley car slid off the tracks and hit a pole. A Minneapolis man died shoveling snow. Many telephone poles down due to the ice. Places like Worthington, Windom, and Marshall saw 14 to 16 inches of snow.

Nov. 30, 1945 Ice storm across southern two-thirds of Minnesota. Freezing drizzle in the Twin Cities, ice about $\frac{1}{4}$ inch thick across southern Minnesota with some damage to Trees and power lines in Houtson County.

Feb. 5, 1946. Ice storm with the heaviest concentration of ice $\frac{1}{16}$ to $\frac{3}{4}$ inches in diameter in the vicinity of Lake Park, Swift County on the South Dakota border. $\frac{1}{4}$ inch to $\frac{5}{8}$ inch of ice in Lyon County. $\frac{3}{8}$ inches of ice at Pipestone and $\frac{5}{8}$ inches at Ruthton. $\frac{1}{2}$ inch to $\frac{3}{4}$ inch of ice west of Bird Island, west of Wadena and West of Marietta. There was damage to trees in Swift County.

Feb. 27, 1948. Severe ice storm over central Minnesota. At the St. Cloud Weather Office $\frac{1}{2}$ inch of clear ice was measured. 65 telephone poles were down between St. Cloud and Rice.

Nov. 6, 1947. Snow and ice storm stretched from New Ulm to Duluth and the Iron Range. Ice/snow of 1-4 inches in diameter on telephone wires in an area 75 miles wide and 260 miles long from New Ulm to Iron Range area. 2400 poles were down with 13,000 wire breaks.

Dec. 5, 1948. Sleet and ice storm in the southeast.

Jan. 24, 1950. Ice storm over southwest Minnesota. Ice on telephone wires from $\frac{1}{3}$ to 1.5 inches. Bismarck, North Dakota had 17 inches of snow. A Northern Pacific passenger train derailed at Detroit Lakes with no injuries.

Mar. 7, 1950. Snow and ice storm across Minnesota. The heaviest ice was in northwest and west central Minnesota. The heaviest ice was found in Norman County near Twin Valley. 52 electrical poles were down in this area with ice up to $\frac{1}{2}$ inches on wires. All communication lines out of Fargo were out with wind gusts estimated up to 60 mph. In order to provide temporary long distance service to and from isolated communities short wave radio equipment was used to bridge the gaps.

Mar. 26, 1950. "Phenomenal" ice storm in Duluth. The ice thickness on wires ranged from ¼ inch to about 2 inches. The heaviest ice formation occurred along the top of the hill back of Duluth and in an area between Duluth and Cloquet. About 100 Minnesota Power and Light poles were down. The Duluth Weather Bureau at the airport had a peak wind gust of 85mph. Heavy ice also formed in the extreme western part of the state between Crookston and Breckenridge.

Apr. 8,1950. Ice storm in western Minnesota caused major damage Pipestone to Elbow lake. Ice on wires ranged from 1/16 to 2 ¼ inches in diameter. A coating of ice was reported over the rest of southern and central Minnesota with lesser damage.

Jan. 14,1952. Glaze, sleet and ice storm across Minnesota from St Cloud south into Iowa. 1,100 Northwestern Bell telephone wires down. The Buffalo Ridge in the Pipestone area the hardest hit with ¾ inches of solid ice on Northern State Power wires with icicles to 3 inches. Northwestern Bell reported ice to 1 ½ inches of ice on their wires in the same area. Thunder and a shower of ice pellets accompanied the storm in New Ulm and Mankato. Minneapolis General Hospital treated 81 people, victims of falls on icy streets.

Nov. 20,1953. Freezing rain hits parts of Minnesota. 3 inches of ice on wires at telephone wires at Lake Benton.

Dec. 4,1953. Snow sleet and ice storm caused extensive damage in extreme southwest Minnesota.