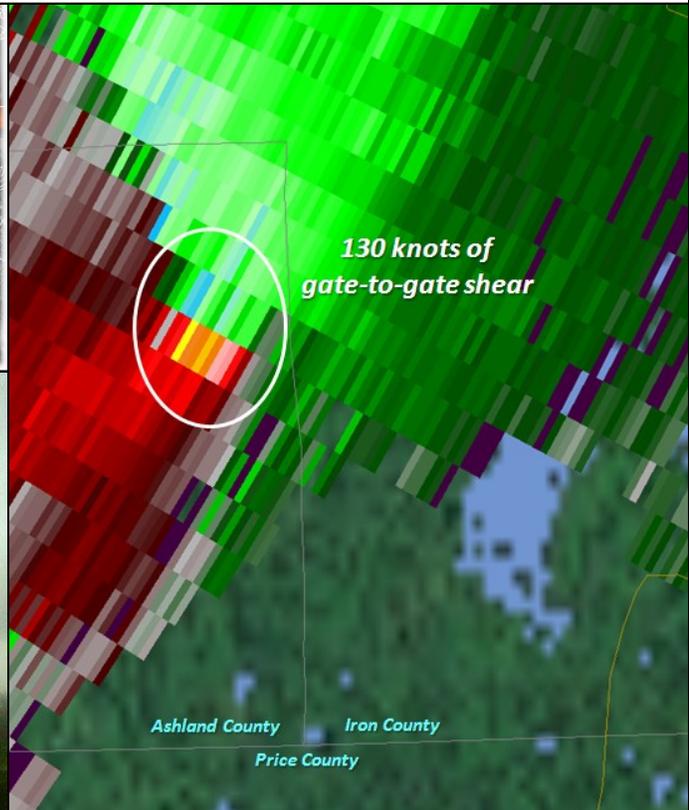
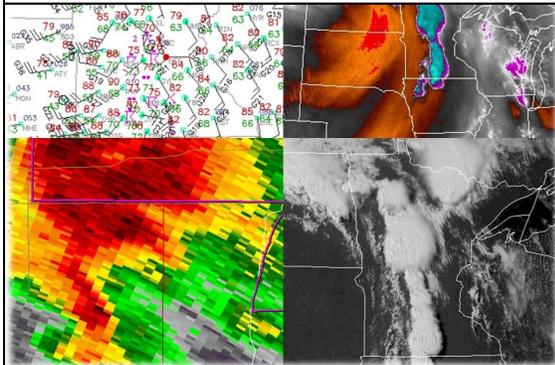




2010 NWS Duluth Severe Weather Recap



Summary

2010 was a busy year for severe weather for the National Weather Service office in Duluth, Minnesota. In 2010, we issued a combined total of 221 Tornado Warnings, Severe Thunderstorm Warnings, Special Marine Warnings, and Flash Flood Warnings. Only a year prior, 65 such warnings were issued by our office, less than a third of what occurred in 2010.

There was significant severe weather across the Northland, beginning with an EF-2 tornado in Pine County on June 17th. This was the first strong tornado in the area in nine years.

Many storms this summer were prolific hail producers. We received several baseball size hail reports on a few different days. Additionally, some storms brought strong, damaging, downburst winds, like the storm that hit Hayward, Wisconsin.

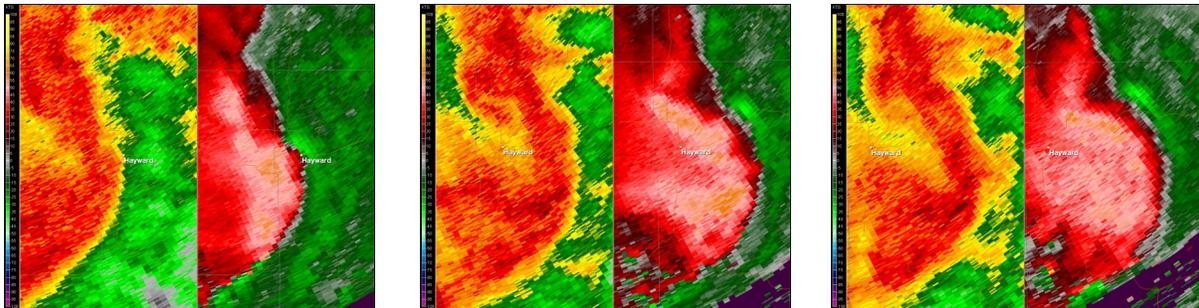
There were 19 total days this year in which some form of severe weather was reported. Despite the strength of some of the storms, there were no fatalities, and few injuries.

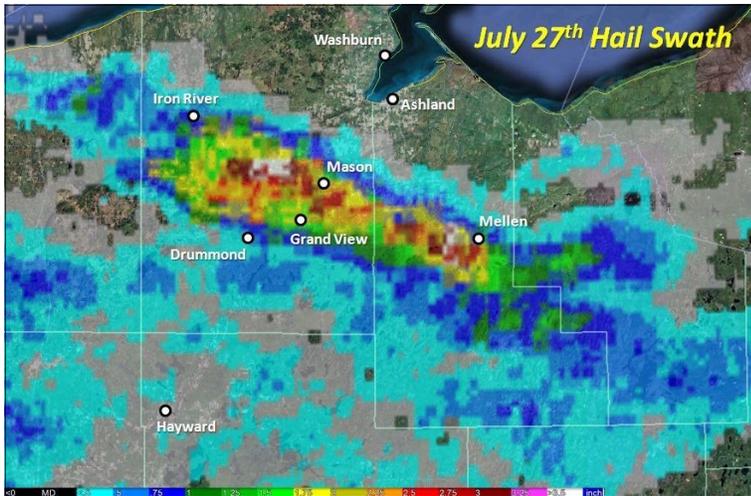
Hail and Wind

There were a few storms that produced some significant large hail or wind damage. Below is a collection of various images from a few of these storms.

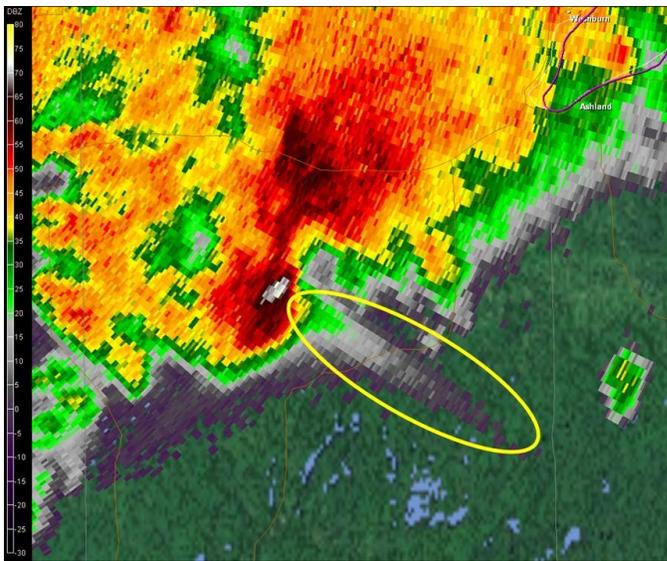


These two images are from the July 14th storm in Hayward. The one on the left was taken on a NWS Storm Survey. The one on the right is courtesy of Terrell Boetcher at the Sawyer County Record newspaper. Below is a progression of radar images as the storm passed through.

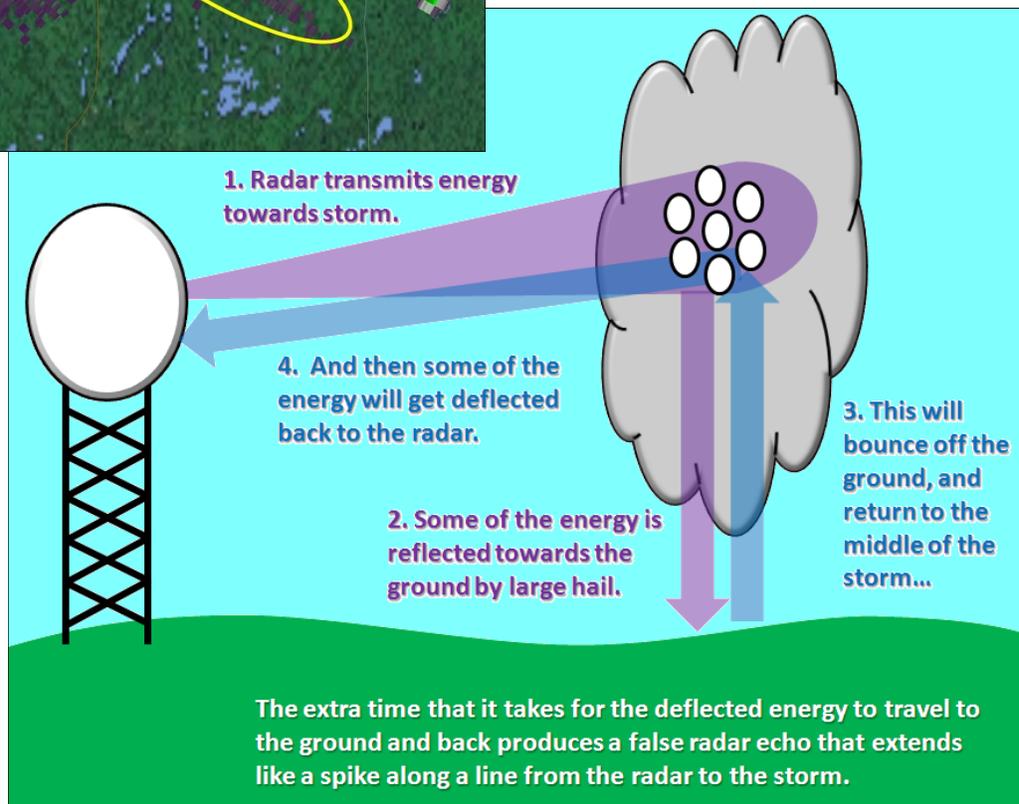




To the left is an image from the National Severe Storms Laboratory that basically provides an estimate for the maximum size of the hail in a given area, and integrated over several hours on the afternoon and evening of July 27th. The result is a "hail swath map". You can see that the NSSL algorithm estimated a broad swath of at least golfball sized hail, with some pockets of hail up to 3 to 4 inches in diameter. We didn't have anything quite that large reported to us.



To the left is a 0.5 degree reflectivity image showing one of the intense thunderstorms from July 27th exhibiting a signature known as a "three body scatter spike". This feature is explained in the graphic below, and tends to correspond with large hail. This radar image was taken about when the NSSL map above left was estimating 3-4" diameter hail.



Tornadoes

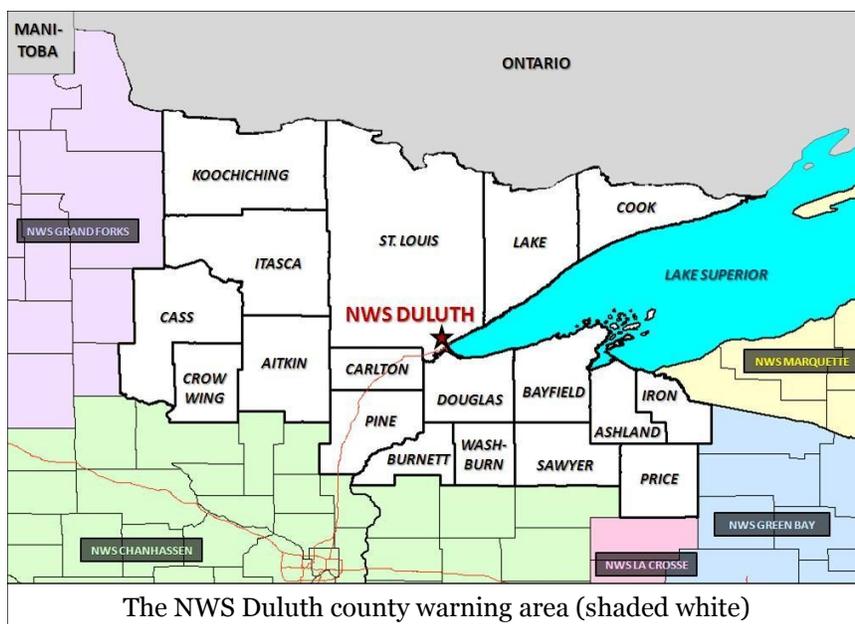
Date	Begin	End	County(s)	State	EF	PL	PW	Inj
June 17	1.5 SSW Nimrod (*Wadena Co.)	3.6 SSW Osnawa	*Wadena, Cass	MN	0	14.8	200	0
June 17	1.0 NNE Haypoint	1.5 NE Haypoint	Aitkin	MN	0	0.7	25	0
June 17	5.0 ENE Rush City (**Chisago Co.)	3.9 WNW Grantsburg	**Chisago, Pine, Burnett	MN, WI	2	7.8	400	2
June 17	3.9 WNW Grantsburg	3.9 W Grantsburg Airport	Burnett	WI	0	0.3	200	0
July 14	5.0 ESE Cloverdale	5.0 ESE Cloverdale	Pine	MN	0	0.3	100	0
July 27	0.5 N Morse	1.0 ENE Morse	Ashland	WI	2	0.9	650	0
July 27	7.2 E Peeksville	9.1 E Peeksville	Ashland	WI	0	1.9	600	0
July 27	5.9 NW Springstead	3.5 N Springstead	Iron	WI	1	4.8	660	3

**Note that Wadena County is in the NWS Grand Forks county warning area.
**Note that Chisago County is in the NWS Chanhassen county warning area.
PL is path length in miles, PW is path width in yards, and Inj is number of injuries.*

There were quite a few tornadoes in the Northland in 2010. A total of 8 tornadoes occurred in the NWS Duluth county warning area in a span of 41 days this summer. The most active day in our area was June 17th, in which 4 tornadoes occurred. These tornadoes were part of a much larger outbreak that day, one that spawned 74 tornadoes across 4 states, including Minnesota and Wisconsin.

The 8 total tornadoes in our county warning area is tied with 1985, 1992, and 1993 for the third highest total on record, behind only the record year of 1969 (15), and 1971 (9).

June 17th was only the fifth time in the record books (since 1950) that 4 or more tornadoes occurred in the NWS Duluth county warning area on a single day. Therefore, June 17, 2010 saw the most tornadoes in a single day in our county warning area since May 7, 1993.



Only one other year on the record books has seen two days with 3 or more tornadoes in the

county warning area, and that was in 1993. It is very unusual to have a year with two very active tornado days in the Northland.

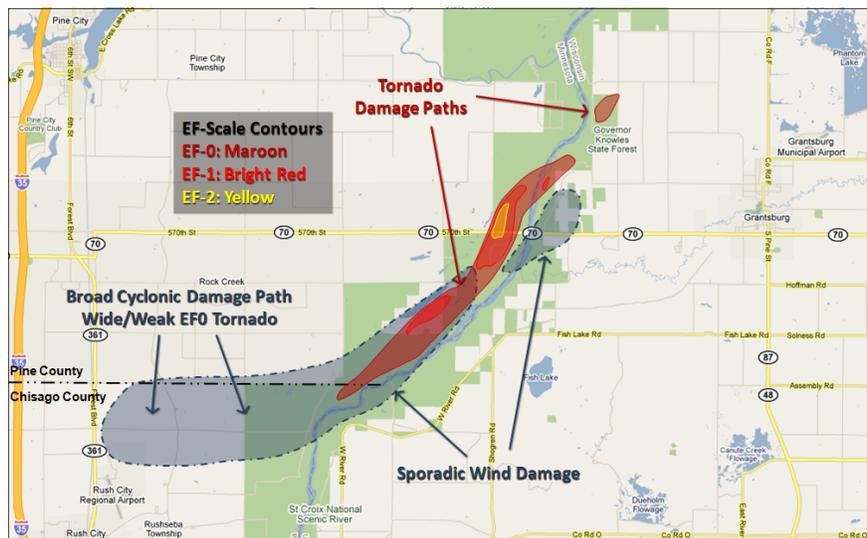
Other 2010 Tornado Facts/Records

- The EF-2 tornado in Pine and Burnett counties on June 17th was the first strong tornado in the area since the F3 Siren, Wisconsin tornado of June 18, 2001.
- That very same tornado was only the second strong tornado on record in Pine County, Minnesota. The only other one occurred on July 7, 1970.
- Up until June 17th, it had been 9 years since the NWS Duluth CWA had a strong tornado. Going back to 1950 when tornado records begin, the longest time between strong tornadoes in our area was previously 6 years and 3 days between July 3, 1985 and July 5, 1991.
- The tornado that struck the Turtle Flambeau Flowage on July 27th was the first tornado in Iron County since July 7, 1970, and only the 4th tornado in the county since 1950.
- Also on July 27th, we saw the first tornado(es) in Ashland County since May 12, 1998, and only the 8th and 9th tornadoes in the county overall since 1950.
- NWS Duluth issued a total of 34 Tornado Warnings in 2010, after only issuing 1 in all of 2009.
- All of the tornadoes were preceded by a Tornado Warning.

St. Croix River EF-2 Tornado

This tornado occurred on June 17th. It started in the NWS Chanhassen area of responsibility in extreme northeast Chisago County, but mainly tracked through Pine and Burnett Counties.

This tornado started at 8:44 pm CDT about 5 miles east-southeast of Rush City, Minnesota. It tracked to the northeast for 7.8 miles, eventually ending 3.9 miles west-northwest of Grantsburg at 9:05 pm CDT.



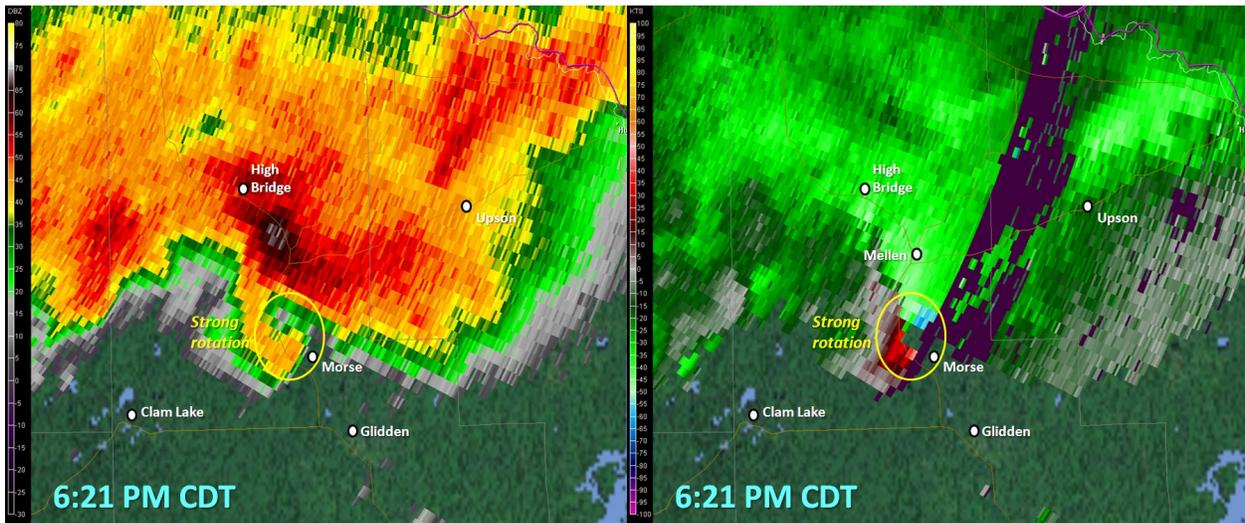
The most severe damage was found where the tornado crossed Highway 70 about 1/2 mile west of the St. Croix River in Pine County. At this location, a strapped down mobile home was

completely destroyed - resulting in two injuries. Minor structural damage was also noted to several surrounding homes and buildings, including two garages that were destroyed. A couple of structures had their roofs removed. Tree damage at this location was also substantial, with almost all trees either snapped off or uprooted. An EF-2 rating is being assigned for about a 1 mile length of the tornado damage path where it crossed Highway 70, but most of the tornado damage was EF-0 or EF-1 intensity. EF-2 damage corresponds to estimated 3-second wind gusts of 111-135 miles per hour. The maximum path width was about 400 yards.



Pine County Sheriff / Wisconsin State Patrol

Morse, Wisconsin EF-2 Tornado



The image on the left is the 0.5 degree reflectivity from the Duluth radar, and the image on the right is the 0.5 storm relative velocity from the Duluth radar. The green velocity data indicates winds that are flowing towards the radar (in this case located off the image to the northwest), and the red velocity data indicates winds that are flowing away from the radar.

This tornado started at 6:21pm CDT 0.5 miles north of Morse, and tracked for about 0.9 miles before lifting at 6:24pm CDT 1.0 miles east-northeast of Morse.

On the initial damage survey, limited road options precluded a more extensive survey. However, it was evident along Dry Lake Road that tornado damage had occurred with the vast majority of trees uprooted or snapped (pictured below). This area is in the Chequamegon National Forest.

A subsequent aerial survey by the Wisconsin DNR revealed some large patches of forest where trees were completely uprooted or snapped. The aerial photos looked very similar to what was seen with the Pine County EF-2 tornado, and the aerial photograph included on the previous page.

Because of the extensive nature of the tree damage, this tornado was rated an EF-2 on the Enhanced Fujita Scale. EF-2 damage corresponds to estimated 3-second wind gusts of 111-135 miles per hour. The maximum path width with this tornado was about 650 yards.



Turtle Flambeau Flowage EF-1 Tornado



This tornado likely began somewhere over the western parts of the Turtle Flambeau Flowage - on the southern tip of Big Island at 7:20pm CDT. Aerial photographs taken by the Wisconsin DNR showed evidence of tornado damage on smaller islands over the western part of the flowage between the Turtle Dam and Springstead Landing. These islands had large sections of trees completely destroyed - either snapped or uprooted, and the aerial photographs revealed trees laying across one another in a cross-hatched pattern, in a few cases at 90 degree incidence angles.

Substantial tree damage began occurring near Springstead Landing and east into a small neighborhood near the intersection of Flowage Rd. and Franks Ln. A stand of large trees between Flowage Landing Rd. and Simmons Rd. was completely demolished with similar evidence of tornadic winds. All of the trees were snapped or uprooted. Standing on the Springstead Landing, you can now see ridges on the opposite side of the lake, which according to area residents was previously impossible due to the density of the trees.

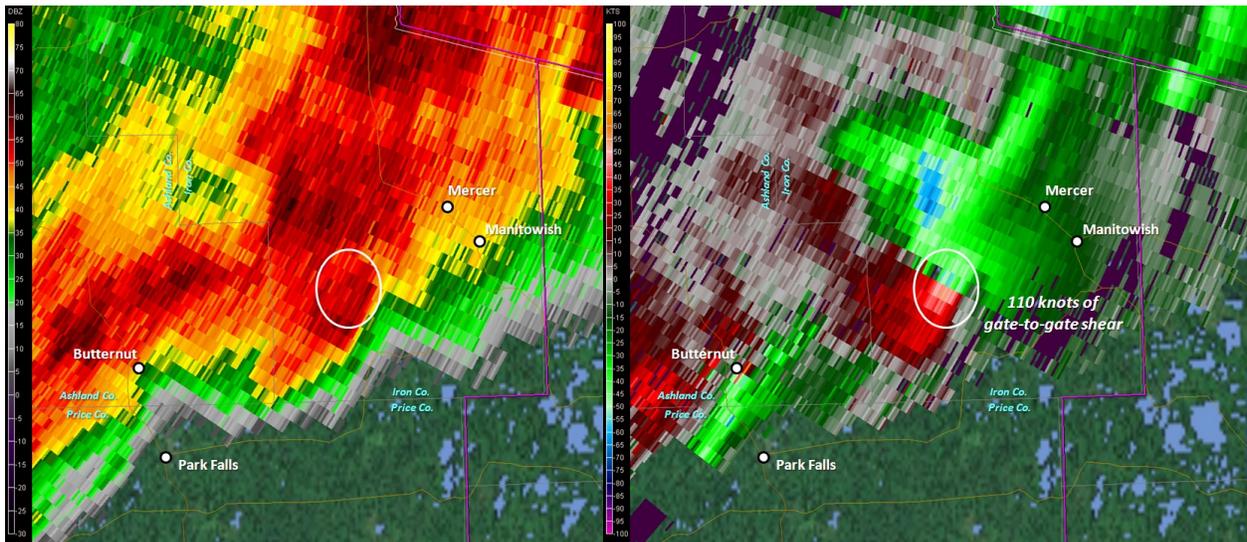
Impacts to cabins in the area started on the western edge of Simmons Rd. and then continued



into the neighborhood near the northern tip of Flowage Rd. Some structures in this area were damaged by falling trees. The tree damage in this neighborhood was still rather significant, with large trees up to 2 feet in diameter uprooted or snapped. The tornado then continued east where uprooted and snapped trees were noted along the edge of the shoreline near campsites D-31, C-2, and D-35 before damage became much more sporadic near the canoe portage. It was at this point where the damage path narrowed and the tornado likely ended at 7:26pm CDT. The total damage path was about 4.8 miles in length, and 660 yards wide at its widest.

It's important to note that this tornado path was embedded in a swath of rather substantial non-tornadic wind damage caused merely by intense thunderstorm wind gusts. The wind damage swath was about 1-3 miles wide and stretched across the Flowage such that most of the campsites received at least some sort of tree damage.

There were three injuries, as some people were caught out on the flowage during the storm and had to be transported to the hospital. Several people who were on the flowage reported hearing the Tornado Warning over a NOAA All Hazards Radio prior to the tornado hitting, and they had enough time to take cover.



The tight couplet of red colors against green colors in the right-hand image suggests very strong rotation. In these images, the radar beam is intersecting the storm about 11,500 feet above ground level. The "gate-to-gate shear" referenced on the storm relative velocity figure is referring to the maximum difference between a "gate", or pixel, of green velocity data, from a red gate immediately adjacent to itself. In this case, the maximum difference is 110 knots, or 127 mph. Remember, this is what the radar is measuring 11,500 feet above the ground - not necessarily what is happening at the surface.

NWS Duluth gives a big thank you to all our trained spotters, and area public safety officials! Their reports are extremely helpful before, during, and after severe weather, and the information they provide helps to protect life and property.

- [Link to NWS Duluth June 17th Web Page](#)
- [Link to NWS Duluth July 14th Web Page](#)
- [Link to NWS Duluth July 27th Web Page](#)