

The background of the image is a composite of three elements: a massive hurricane with swirling white clouds and dark blue water, a large orange and white striped flag flying from a mast on the left, and a white lighthouse perched on a rocky island in the upper right. In the foreground, the dark hull of a ship is visible, with the name 'HENRY B. SMITH' printed in white. The ship's white superstructure is also visible, featuring a bridge with windows and a ladder extending from the deck. The overall mood is one of historical significance and the power of nature.

THE WHITE HURRICANE

REMEMBERING
100 YEARS LATER

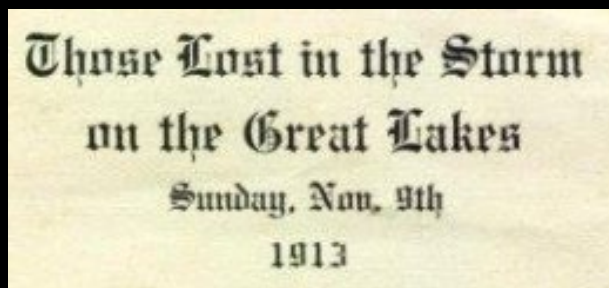


For four days in November 1913, the worst weather that the Great Lakes could muster was centered in Lake Huron and wreaked havoc and devastation that had not been known before or since.

When it was all over, 19 ships were stranded, 19 ships were lost (some have yet to be located 100 years later), and over 250 sailors were dead. (The exact number is not known, due to the record keeping of the day.)

Because of the combination of such high winds and snowfall, the storm was called the "White Hurricane".

In memory of





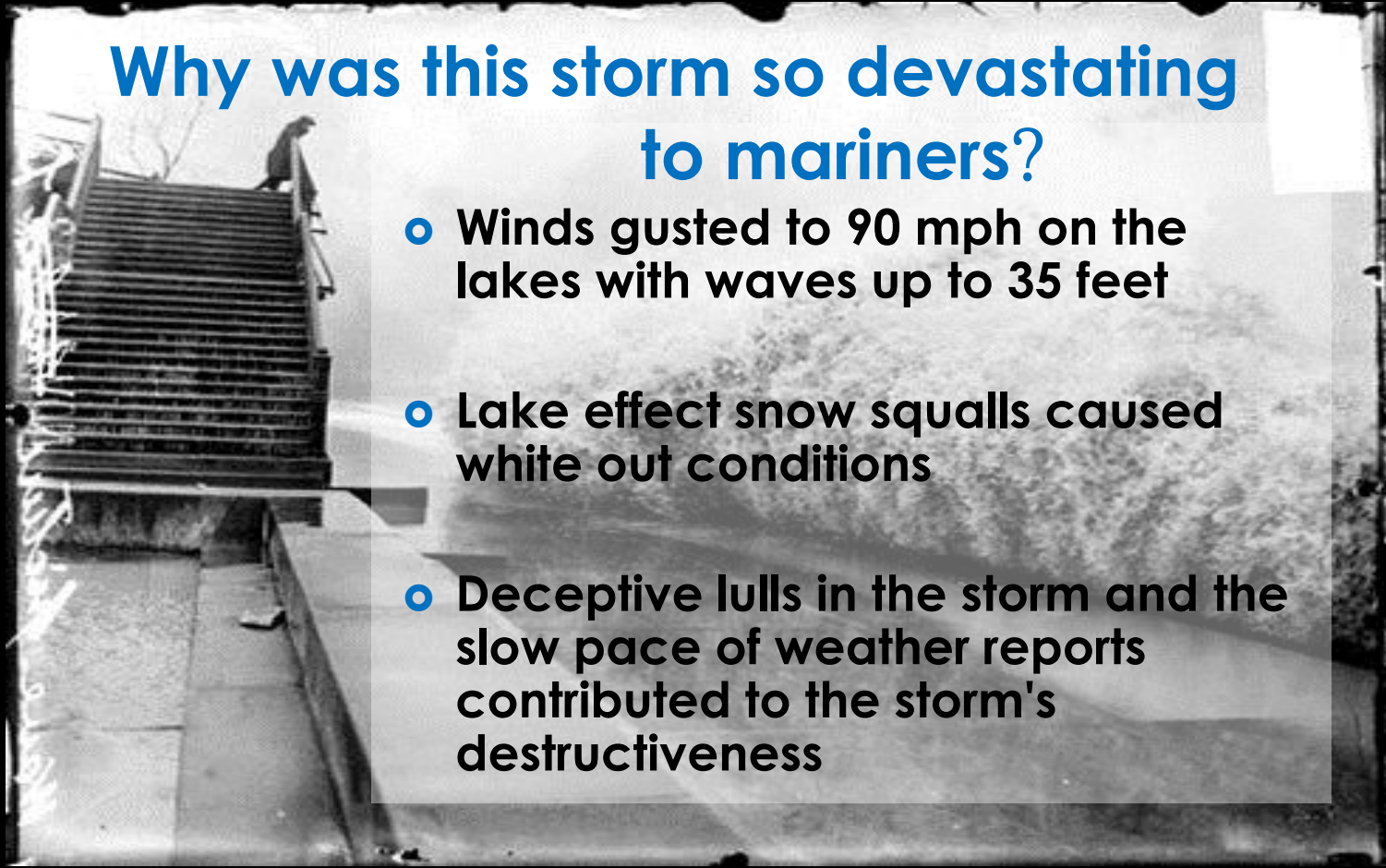
The Great Lakes Storm of 1913

- Storm nick-named the “Freshwater Fury”, “White Hurricane”, and the “Big Blow”
- A blizzard with hurricane-force wind gusts that devastated the Great Lakes Basin, the Midwestern United States, and the Canadian province of Ontario from November 7-10, 1913.
- The financial loss in vessels alone was nearly \$5 million US, or about \$100 million at current value. This included about \$1 million at current value in lost cargo totaling about 68,300 tons, such as coal, iron ore, and grain
- Lake Huron was the hardest hit by the storm, claiming the lives of 178 people.

The Great Lakes Storm of 1913

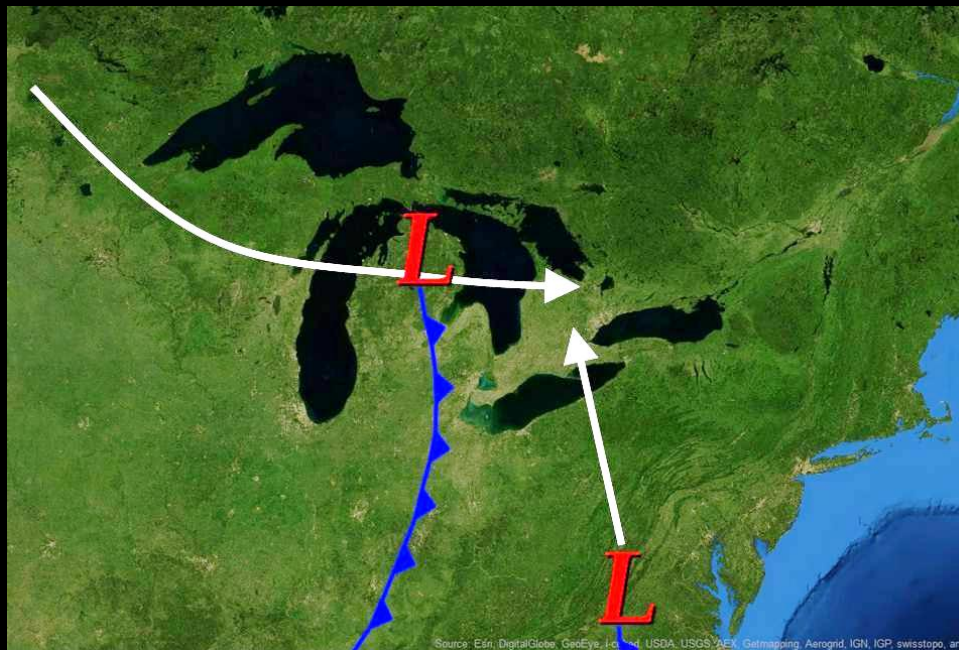
Why was this storm so devastating to mariners?

- Winds gusted to 90 mph on the lakes with waves up to 35 feet
- Lake effect snow squalls caused white out conditions
- Deceptive lulls in the storm and the slow pace of weather reports contributed to the storm's destructiveness

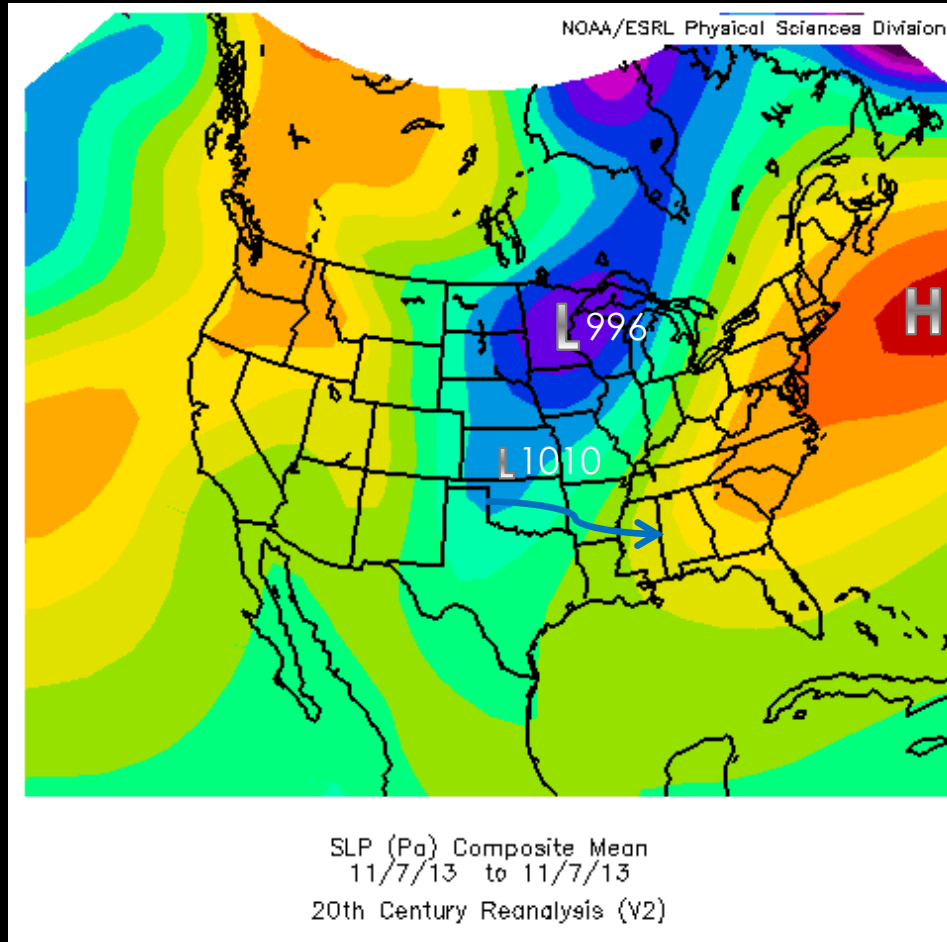


The Weather

- Storm developed from two separate weather systems which eventually merged over Ontario



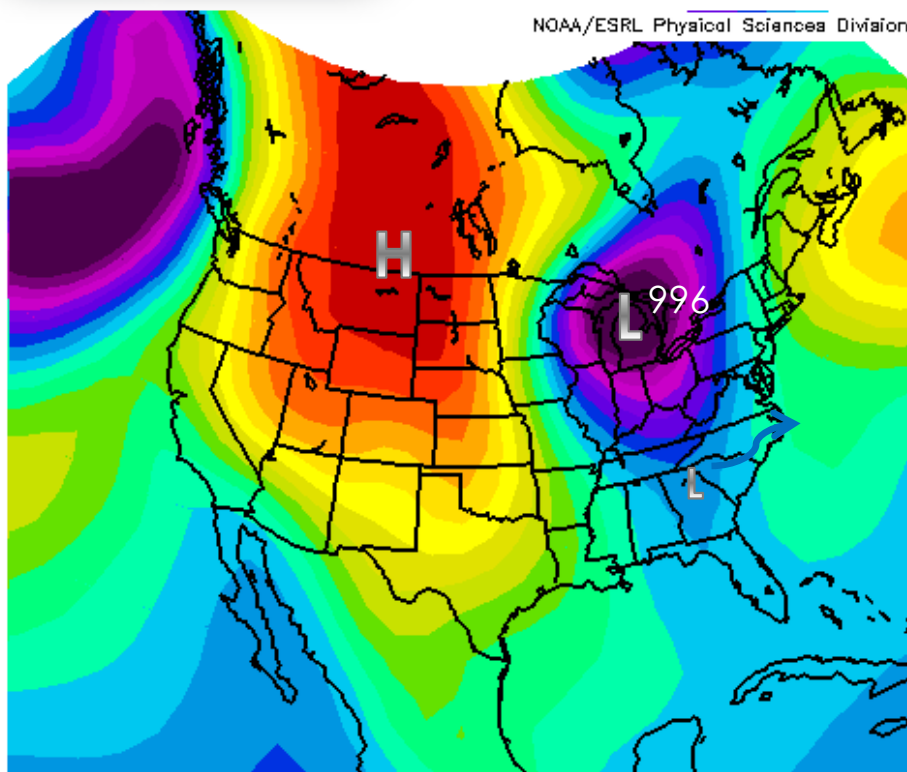
The Weather



November 7th

- An Arctic cold front moved south out of Canada with temperatures falling to the single digits behind it. Water temperatures were above normal for early November across the Great Lakes.
- Strong southwesterly winds developed ahead of the front with strong northwest winds behind it. Storm Warnings issued for the Great Lakes on the morning of the 7th.

The Weather

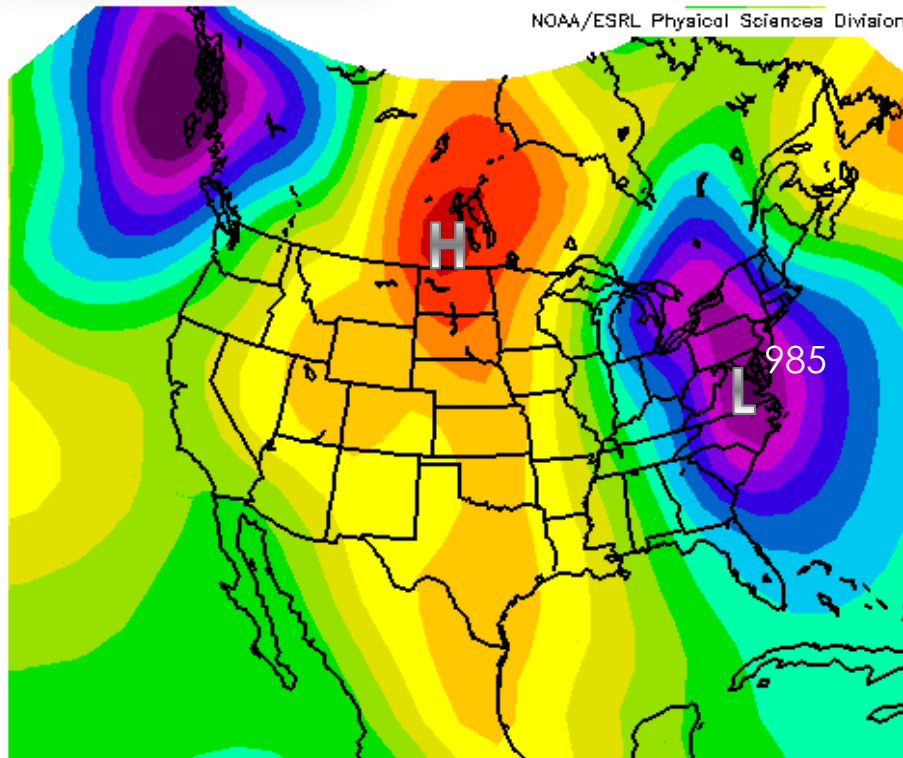


SLP (Pa) Composite Mean
11/8/13 to 11/8/13
20th Century Reanalysis (V2)

November 8th

- Storm warnings continued on Lakes and posted along eastern seaboard.
- Southern low moved off the Outer Banks, NC and “bombed”.

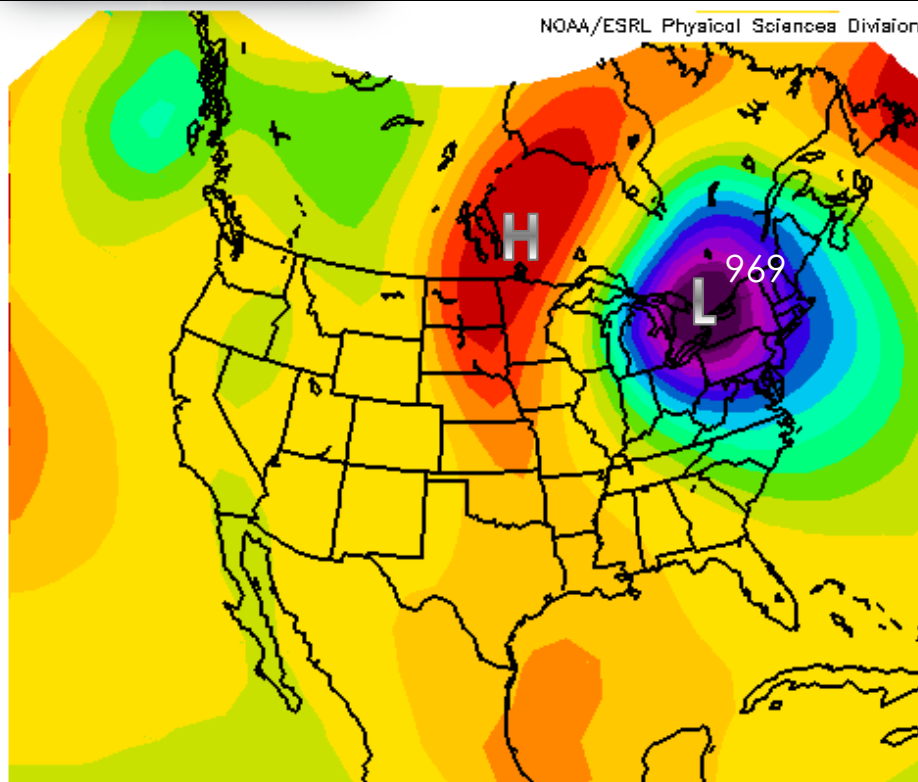
The Weather



November 9th

- Storm warnings continued on Lakes Huron, Erie, and Ontario.
- Snow fell across the Great Lakes and Ohio Valley with more than a foot in portions of OH/WV/PA.
- Winds raged as the low moved westward to Erie PA and deepened to 969mb during the evening.

The Weather



SLP (Pa) Composite Mean
11/10/13 to 11/10/13
20th Century Reanalysis (v2)

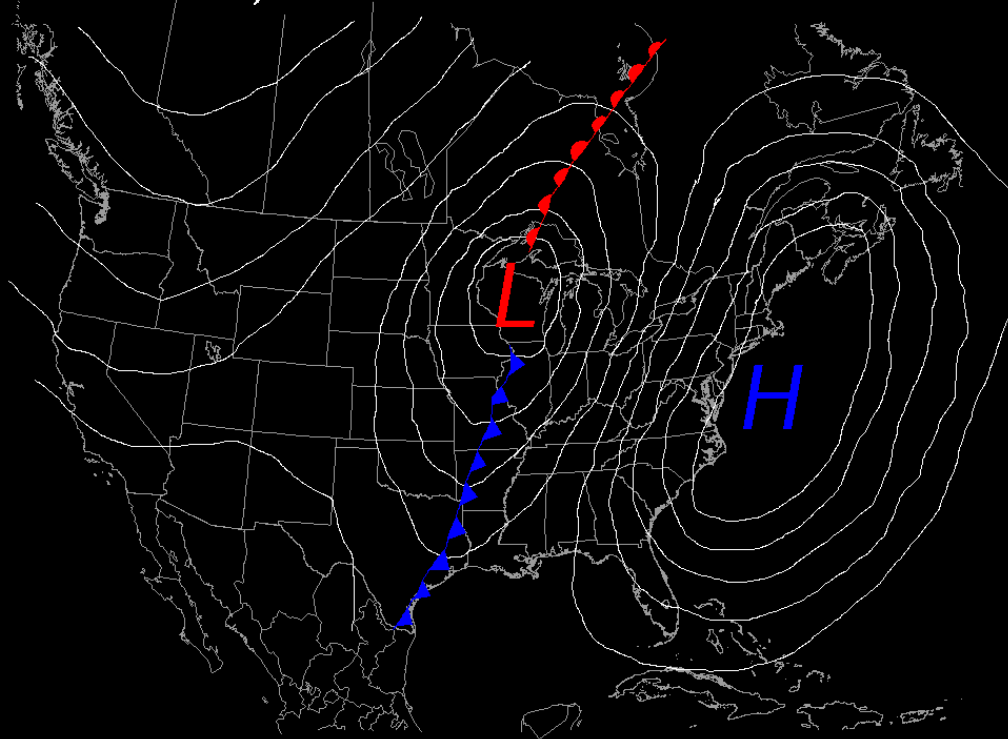
November 10th

- Storm warnings raised again for Lakes Superior and Michigan.
- A southwest wind of 76 mph was measured at Buffalo on the 10th.
- Storm finally exited to the northeast on November 11th.



The Weather

November 7, 1913 7 AM EST





The Blizzard

- Intense lake effect snows occurred as the arctic air moved over the warm lake water.
- The wind and snow combined to cause white out conditions, blinding ships and people on land alike.
- Tremendous snow drifts of 4-5 feet were reported.



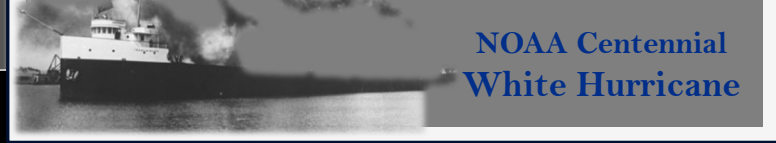
Cleveland streetcar stranded in the blizzard

The Blizzard

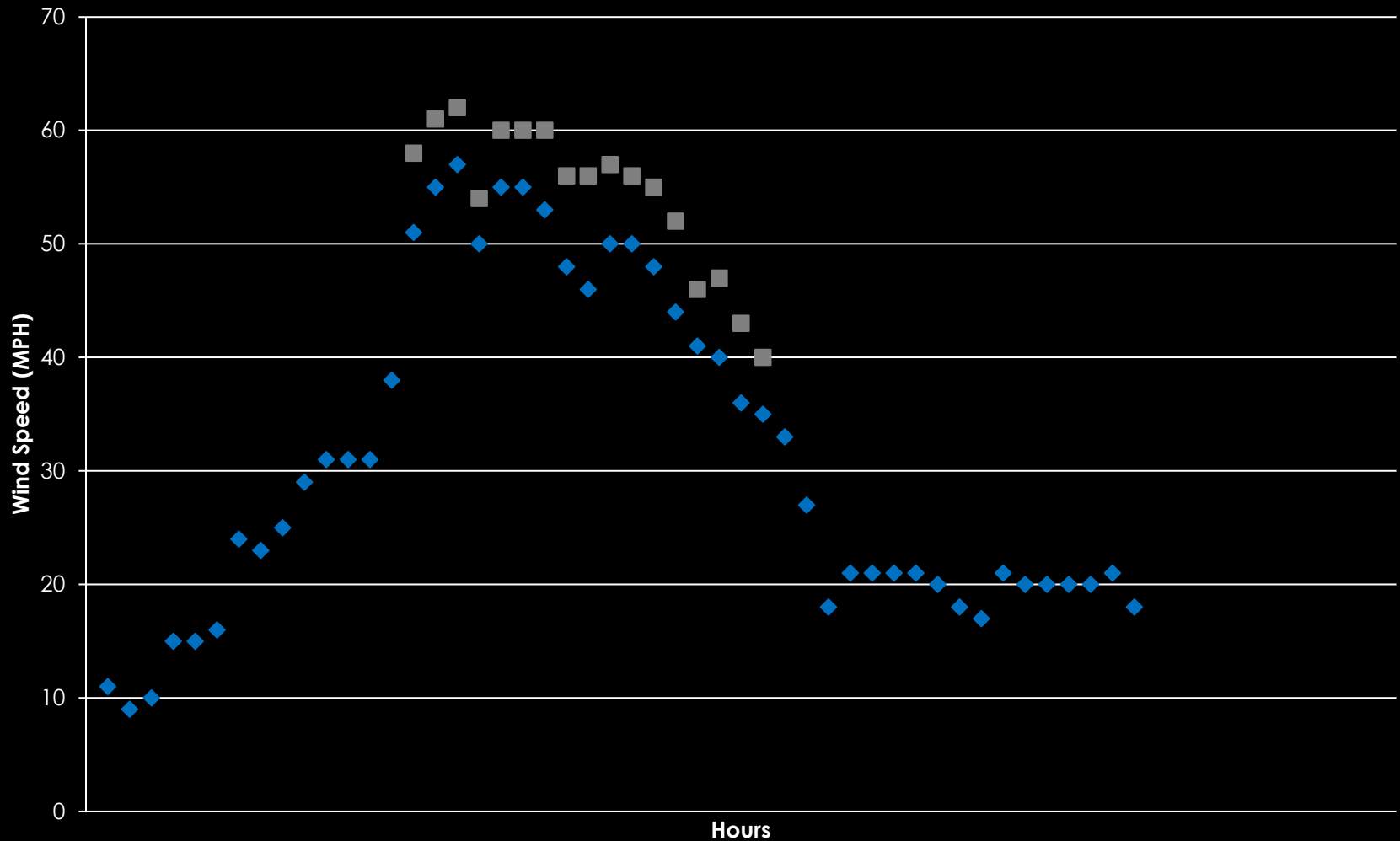


Telephone poles blown down in Cleveland.

- Port Huron, MI and Cleveland, OH were two of the hardest hit cities.
- Cleveland broke their 24 hour snowfall record with 17.4 inches in 1 day and a 3-day total of 22.2 inches.
- Extensive telephone and power outages. Telegraph lines were down for days.



November 9 and 10th, 1913 Hourly wind reports at Cleveland Weather Bureau



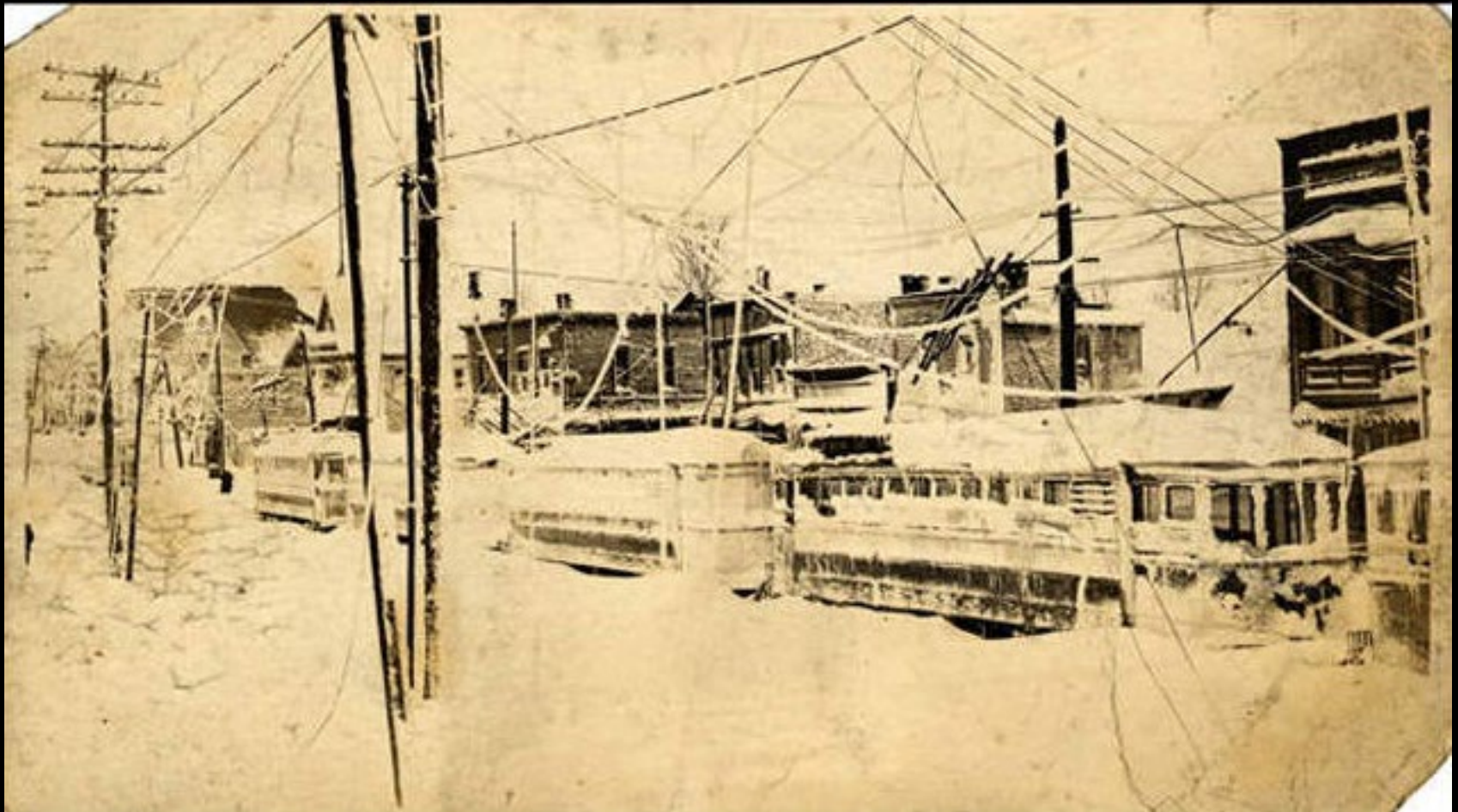


NOAA Centennial
White Hurricane





NOAA Centennial
White Hurricane





NOAA Centennial
White Hurricane



Sunday, 9th.

The barometer fell quite rapidly after the midnight hour and unusually rapid after the morning observation till 4:00 p.m.

At 8:30 p.m., the barometer attained its minimum of 28.26 and remained nearly stationary till 10:00 p.m., when it began rising.

During the night of the 8-9, up to 3:10 a.m., the winds were fresh to brisk southwesterly, veering to northwest and increasing to brisk and high during the forenoon, followed in the afternoon and at night by a northwesterly gale, attaining a maximum wind velocity of 62 miles per hour from the northwest at 4:40 p.m., and an extreme wind velocity of 79 miles per hour from the west at 4:40 p.m.

Light rain mixed with very moist snow began at 4:30 a.m., and continued until 10:18 a.m., when the rain ended. Moist snow continued falling, nearly all melting as it fell, with only 0.8 inch on ground at 7:00 p.m., and by midnight it is estimated that 4.3 inches had fallen.

After 10:30 p.m., the barometer began rising and the wind was mostly westerly.

The observer remained on duty till midnight, and engaged lodging at the hotel, instead of going home five miles distant.

Long before midnight several of the street car lines were completely stalled by the heavy snow.

Monday, 10th.

The westerly gale continued throughout the night of the 9-10, diminishing somewhat after the morning observation and backing to southwesterly.

The gale was accompanied by snow, at times heavy, and at 7:00 a.m., the average depth on the ground was, 9.4 inches.

Fresh to brisk southwest winds throughout the day, still accompanied, at times, by heavy snow, 17.4 inches falling during the 24 hours ending at 7:00 p.m., which breaks all previous records by 4.4 inches in any 24 hours, and an average depth of 16.8 inches on ground at 7:00 p.m.

Snow was still falling when the observer left office at 11:00 p.m.

The barometer rose rapidly throughout the entire day.

Observer remained down town during the night.

Business and industrial activity paralyzed; shops and factories could not open their doors, and many of the down town stores were unable to resume business for lack of electricity or car service; all schools closed.

No map issued; telegraph lines down; not a wire working; 121,000 telephones out of order.

Trains on steam roads running many hours behind schedule time and in many instances not at all.

Suburban car service at a stand still, causing serious shortage in the milk supply for a time.

Two deaths from exposure, and two persons were electrocuted by coming in contact with live wires.

Tuesday, 11th.

Car service on some of the city lines was resumed late in the afternoon and some telephones were in working condition, but the telegraph wires are all still down and no weather map could be issued to-day.

The snow is being removed by city on down town streets and business is reviving slowly.



Blizzard conditions
paralyzed several
cities across the
Great Lakes Region.



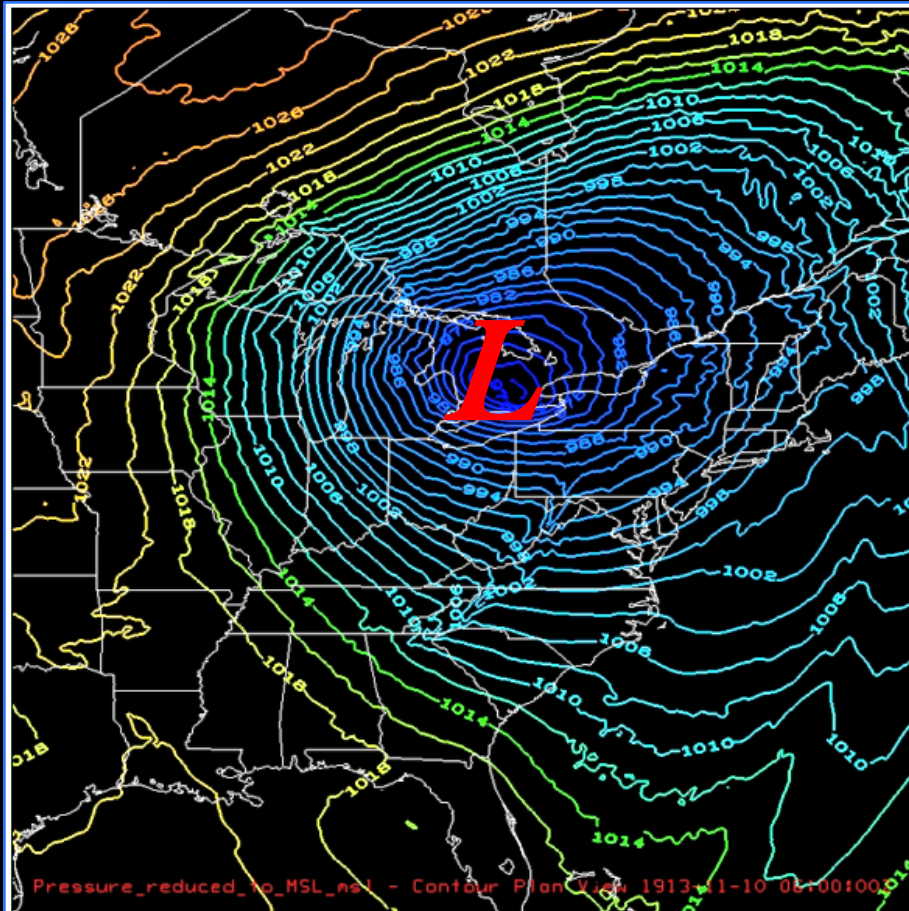
Shipwrecks

The days following the storm brought the horrific realization that many of the ships on the lakes were gone and not just missing as dead sailors washed onshore. The bulk of those were found downwind of Lake Huron in Ontario.

On Lake Huron:

- 15 vessels suffered total loss or were stranded
- 8 a total constructive loss
- They could only ride out the storm as best they could, and try to reach a protected bay or harbor.

Shipwrecks



Simulated Mean Sea Level Pressure

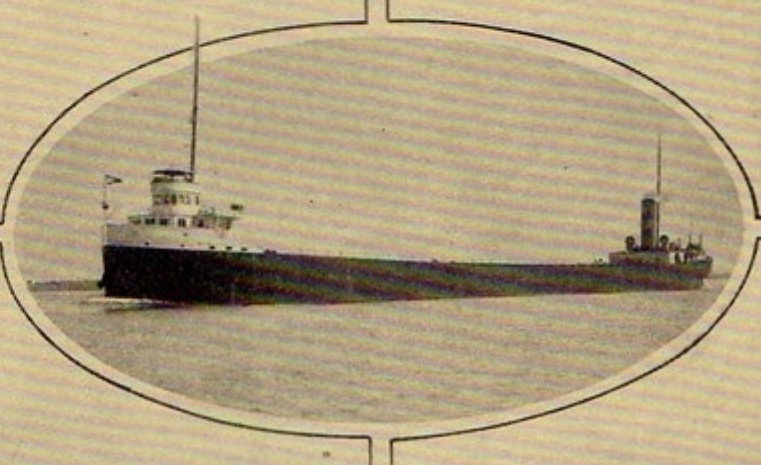
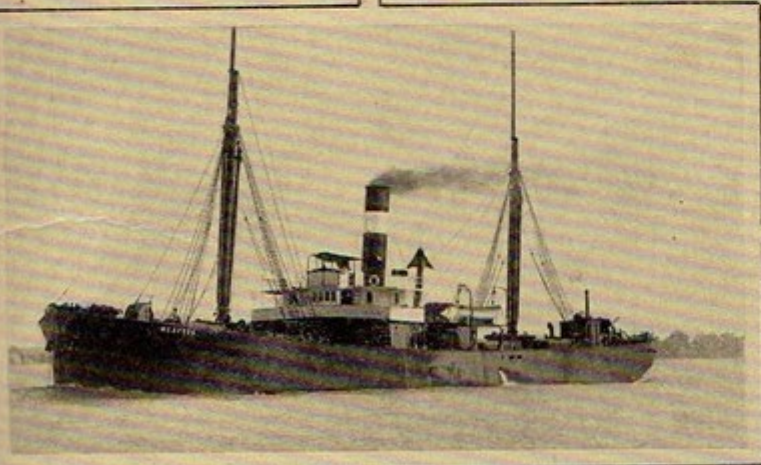
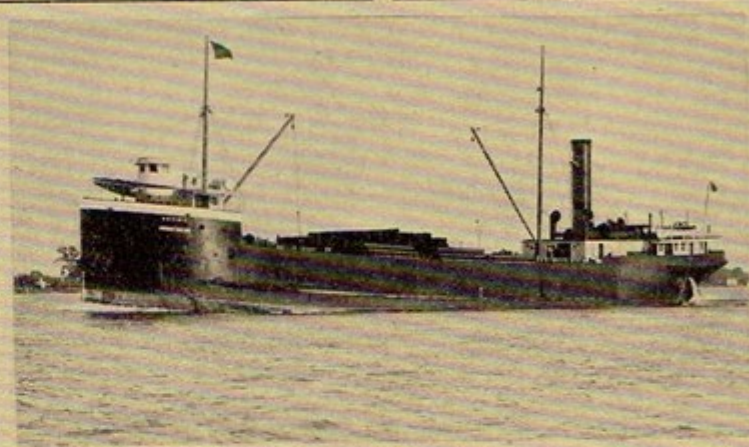
- November 9th was the most destructive day of the storm as the system rapidly intensified and backed towards the Great Lakes.
- Winds and wave conditions became extreme with wind gusts to 90 mph and waves exceeding 35 feet.



Shipwrecks

- The greatest losses occurred across southern Lake Huron with at least 8 boats suffering a total loss and 7 others stranded.
- Three ships have not been found yet.

Vessels That Have Totally Disappeared

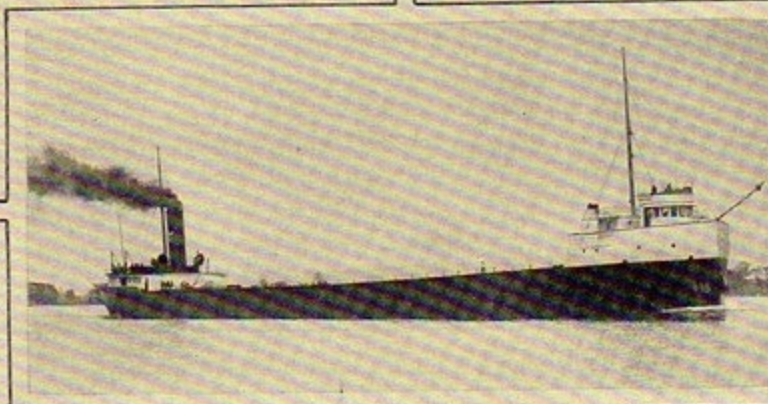
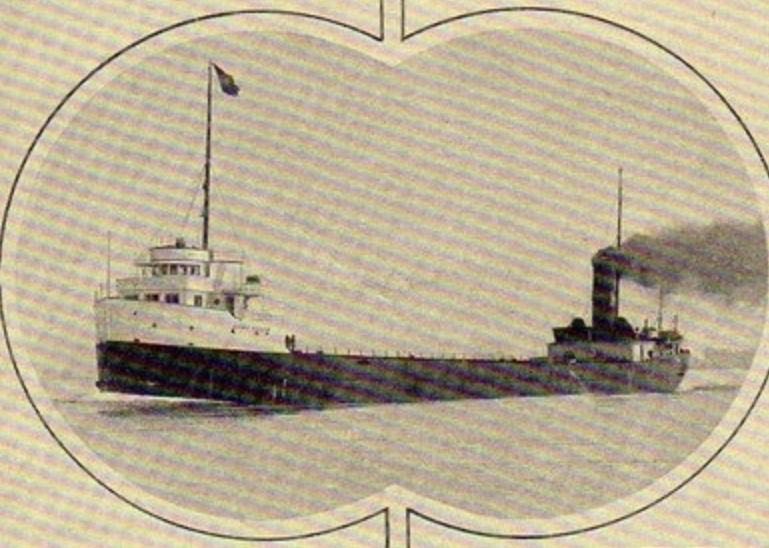
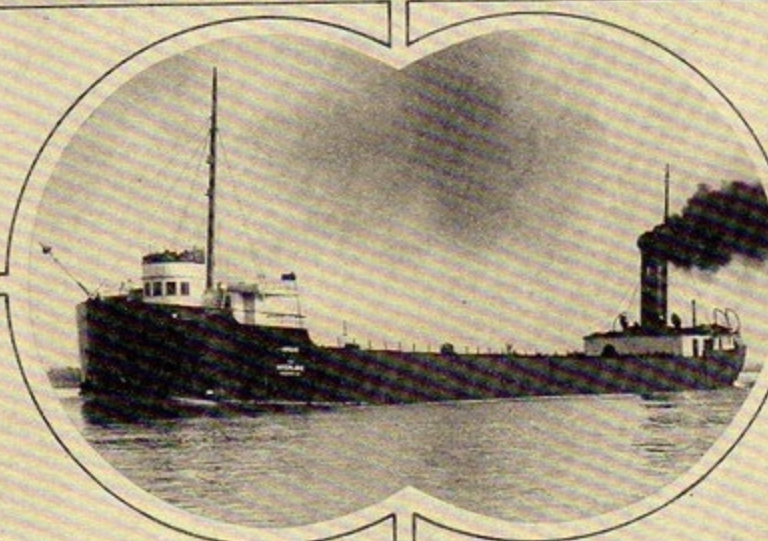
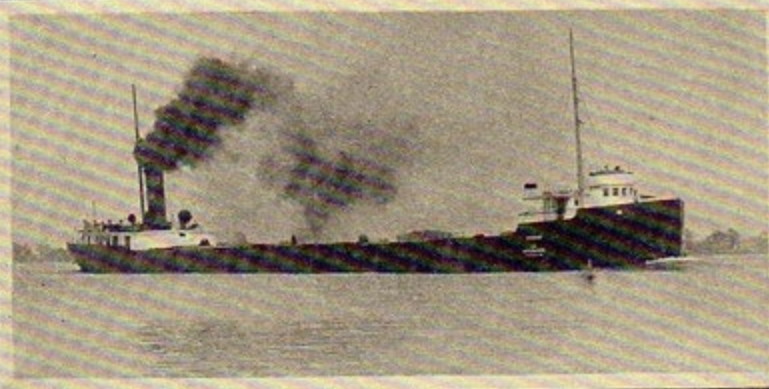


THE CHARLES S. PRICE
THE WEXFORD

THE REGINA
THE H. B. SMITH

March 1914 "The Marine Review" Magazine

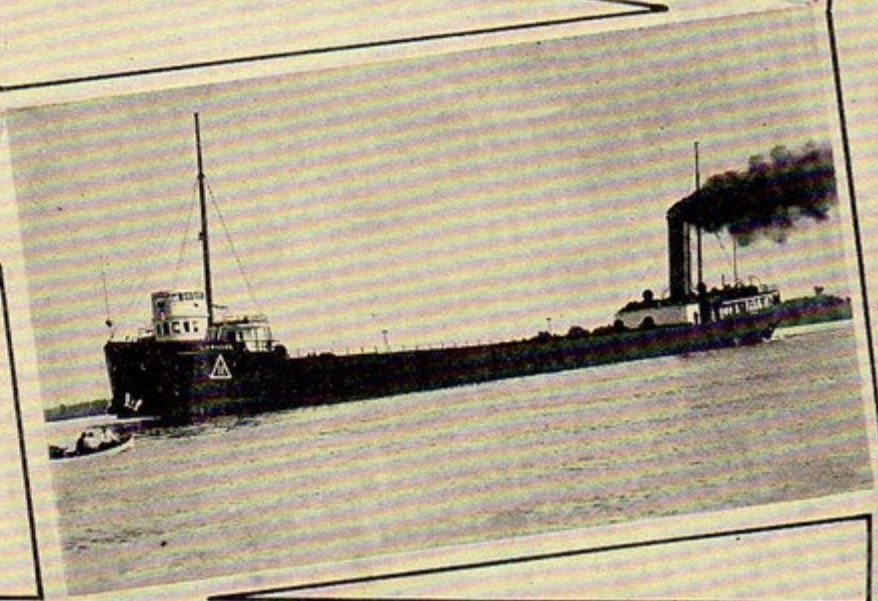
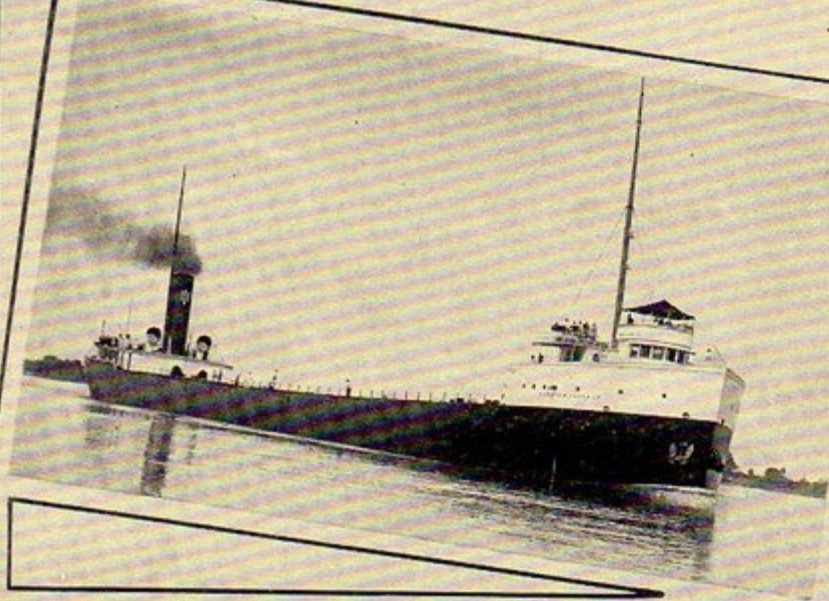
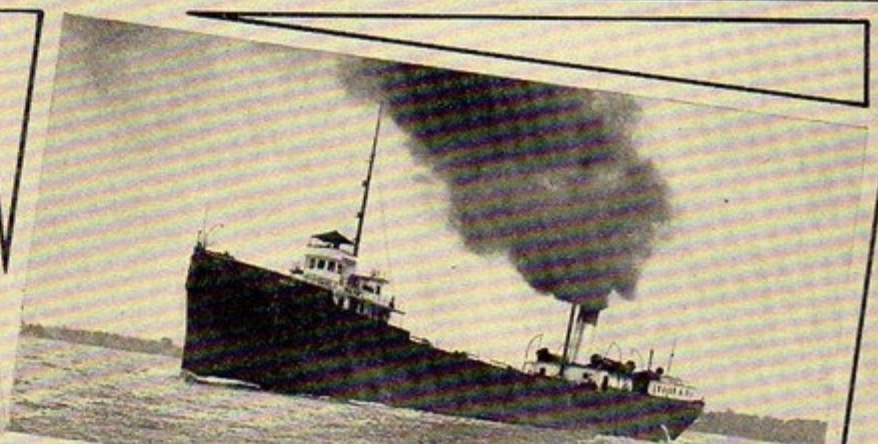
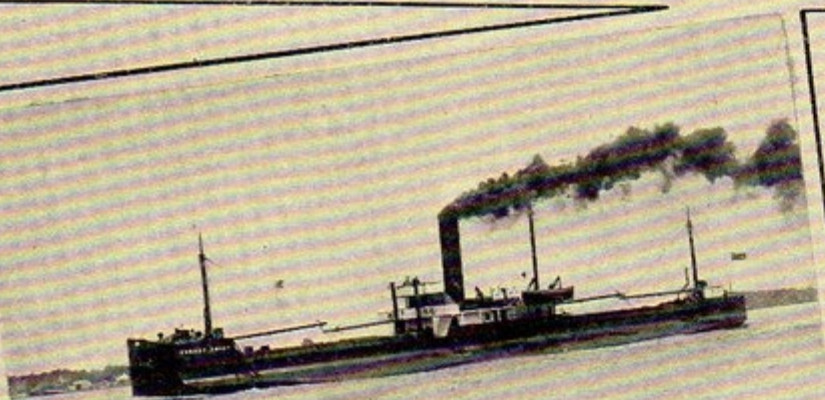
Vessels That Have Totally Disappeared



HYDRUS
JOHN A. McGEAN

ARGUS
ISAAC M. SCOTT

Vessels That Are Total Constructive Losses



TURRET CHIEF
H. M. HANNA JR.

MATOA
L. C. WALDO



NOAA Centennial
White Hurricane





NOAA Centennial
White Hurricane





G.J. Grammer

- G. J. Grammer, was driven ashore off Century Park in Lorain
- A freighter 418 feet long, and was built at Superior, Wis., in 1902.
- Lifesaving Station Report...
"At Lorrain, Ohio, the steamer G. J. Grammer, under command of Captain Burns of Buffalo, is hard ashore and in a dangerous position. Life savers are standing by, but are unable to take off the crew because of the heavy seas."
- The crew was eventually rescued



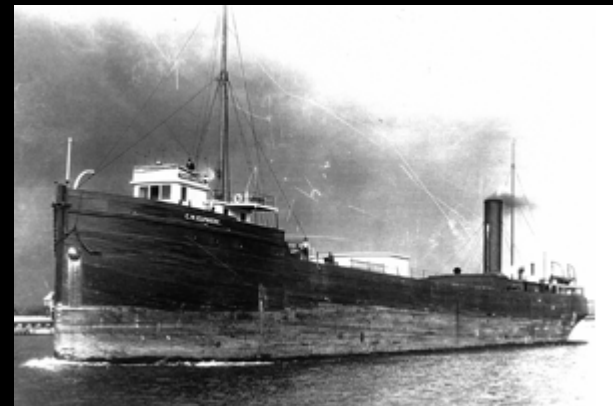
NOAA Centennial
White Hurricane





C.W. Elphicke

- A wooden steamer built in 1901
- 2406 gross tons, 430 feet
- Was carrying wheat ~\$100,000
- The ship went aground about 3 miles east of Long Pt., Ont. and soon after the wind and waves broke the vessel in 2
- Crew of 18 reached shore safely. Lifesavers assisted in the rescue





NOAA Centennial
White Hurricane



Lightship 82

- Built in Muskegon, MI and launched 1912
- 187 ton ship, 95 feet in length, twenty one feet in beam, with a ten foot depth. She was fitted with a 30 foot beacon mast, and was powered by a 100 h.p. steam engine.
- Her captain and crew were duty bound to remain on station during the storm and warn others of impending dangers off Point Abino, Ontario, 13 miles from Buffalo Harbor.
- Moored to the bottom poses some rather unique problems to marine architects. It is most difficult to keep a permanently moored ship stable in variable weather and water conditions.



www.buffalohistoryworks.com/light/light-vessel.htm



THE WEATHER:—

Tonight, fair, colder;
Moderate west winds.

The Detroit News

LATEST
EDITION

41ST YEAR, NO. 52, 1913

DETROIT, MICHIGAN, THURSDAY, NOVEMBER 13, 1913—TWENTY-FOUR PAGES.

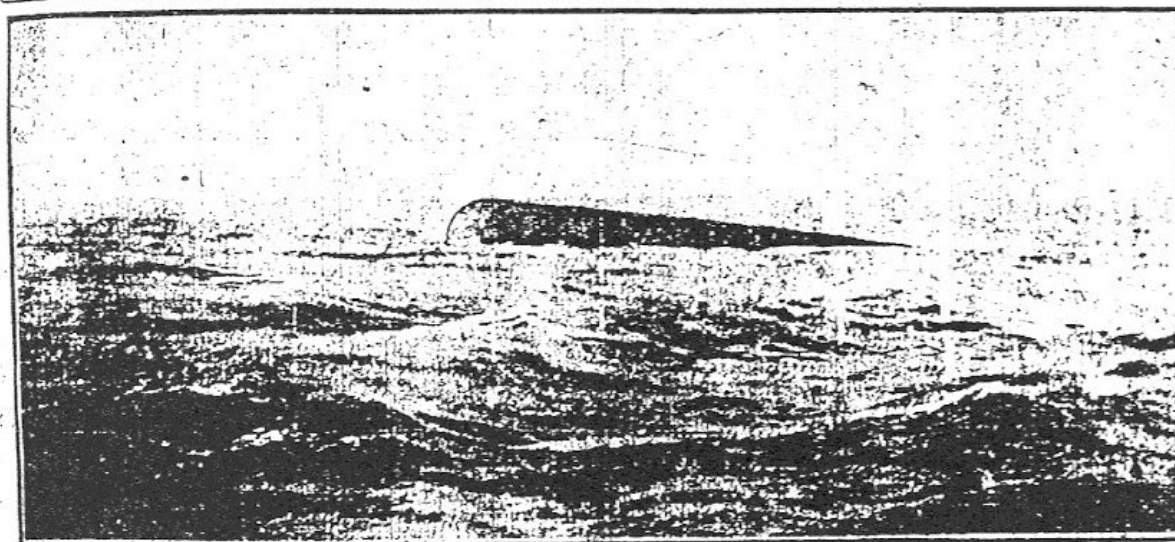
DETROIT AND OUTSIDE, ONE CENT; IF DELIVERED
THRU CARRIER, TWO CENTS.

DEATH TOTAL ON LAKES MAY BE 273

WILSON READY TO AID REBELS

DISASTER GROWS AS NEW REPORTS COME

GREATEST MYSTERY IN HISTORY OF GREAT LAKES DISASTERS



This Photograph of the Overturned Boat, the Identity of Which Nobody Has Been Able to Learn, Was Taken on Board the U. S. Revenue Cutter Morrill by John DeCosta, Master-at-Arms of the Boat's Crew. It Is the Only Photograph Taken to Date of the Strange Wreck.

DEAD AND MISSING ON GREAT LAKES.

Carruthers	28	Isaac M. Scott	28
Regina	22	Butters	20
McGean	28	Plymouth	7
Wexford	22	Leafield	15
Price	28	Lightship No. 82	6
Argus	26	Nottingham	3
Lafayette	12		
Hydrus	28		
Total	273		

Vessel men estimate the financial loss at \$3,000,000.

Michigan are the first so far accounted for shore Post Herald. (From Regina and unknown) were from Port Huron, one from Michigan, seven from Carruthers, nine from Western. Total—28. All of these bodies are now distributed at shore towns as the Canadian shore of Lake Huron. They have been positively accounted for, but it will take some time to establish their identity.

DEATH AND LOSS TOTALS MOUNT; MAY PROVE STORM WORST KNOWN

Loss of life and property totals mounting towards a point, which will mark the worst storm on the west coast since the great Inland, which today from the constantly increasing reports of wreckage. If the loss still mounting shall have been lost, it is greatly feared they are the death toll will be well towards 200 on the lakes alone. With the already 20 deaths caused on shore, the total may reach the 220 mark. Further loss are the storm, so far as known this morning.

Mysteries Still Unsolved.

Master James Carruthers, master of the wrecked vessel, was near Cedarville, Ind. He was found, believed lost with crew of 28 men. Captain Regina, master of the wrecked vessel, was near Port Huron, Mich. He was found, believed lost with crew of 22 men. Captain Price, master of the wrecked vessel, was near Port Huron, Mich. He was found, believed lost with crew of 26 men. Captain Argus, master of the wrecked vessel, was near Port Huron, Mich. He was found, believed lost with crew of 26 men. Captain Lafayette, master of the wrecked vessel, was near Port Huron, Mich. He was found, believed lost with crew of 12 men. Captain Hydrus, master of the wrecked vessel, was near Port Huron, Mich. He was found, believed lost with crew of 28 men. The loss of the Michigan, a 28-gun gunboat, was the worst disaster on the Great Lakes since the wreck of the USS Michigan in 1862. The ship was carrying a large amount of ammunition and was on its way to Lake Superior. The wreck was discovered on November 10, 1913, and the bodies of the crew were found on the shore. The ship's master, John DeCosta, was also found. The ship's identity was not known until it was found. The ship was found in a state of complete ruin. The wreck was the result of a severe storm. The ship was found in a state of complete ruin. The wreck was the result of a severe storm. The ship was found in a state of complete ruin. The wreck was the result of a severe storm.

THAT DEPOT LOOP SHOULD BE BUILT

The depot loop question has got to a point where public opinion will have to take a hand in it. Detroit has been trying her level best in recent years to induce the Pennsylvania railroad and the Baltimore & Ohio railroad to run into this city, because Detroit needs the greater

Who has blundered? Who is to blame? It is the same old combination of politics and the D. U. R. The agreement of August 7 between the city and the D. U. R. made provisions for the construction of a depot loop. It was not even begun. It was specifically provided for

WAITS TILL U. S. ENVOYS QUIT MEXICO

GIVES BLOOD TO
BROTHER IN VAIN
A girl and a half of the Smiths should not have the life of Russell French, aged 25, is missing. The girl has been found in a head-on collision on the D. U. R. near Warren, Mich. Saturday. He did not reach the shore at Green Hospital. Took that the transportation of a large quantity of blood into his brother's

SHIP MYSTERY IS NO NEARER A SOLUTION

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Shipwrecks

Firsthand Account from the Lake Carriers Association Report

"No lake master can recall in all his experience a storm of such unprecedented violence with such rapid changes in the direction of the wind and waves and its gusts of such fearful speed! Storms ordinarily of that velocity do not last over four or five hours, but this storm raged for sixteen hours continuously at an average velocity of sixty miles per hour, with frequent spurts of seventy and over.

Obviously, with a wind of such long duration, the seas that were made were such that the lakes are not ordinarily acquainted with. The testimony of masters is that the waves were at least 35 feet high and followed each other in quick succession, three waves ordinarily coming one right after the other.

They were considerably shorter than the waves that are formed by an ordinary gale. Being of such height and hurled with such force and such rapid succession, the ships must have been subjected to incredible punishment."

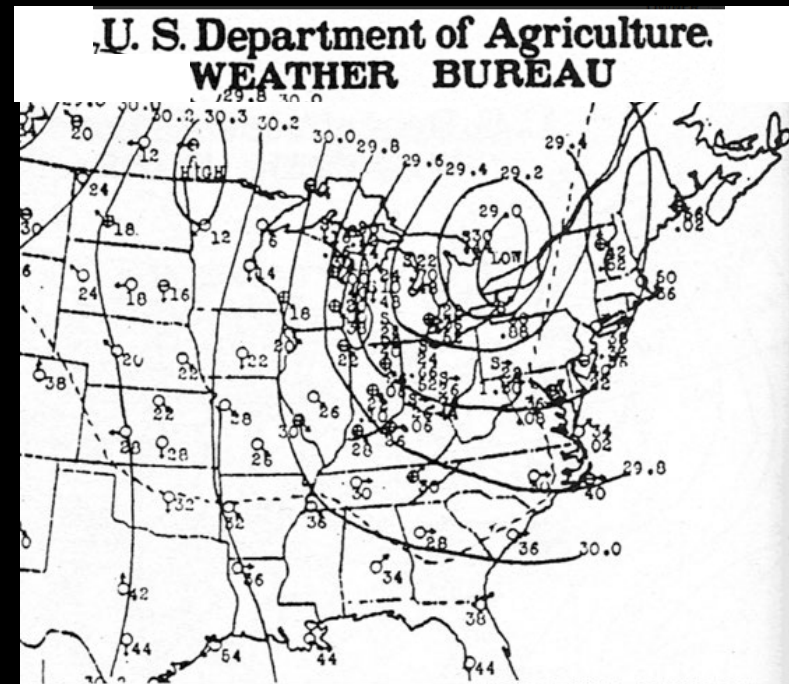
Shipwrecks

2 Survivor Stories

- An un-identified sailor washed ashore with the initials J.T. tattooed on his arm. Family members finally claimed the body although it had been badly battered. They proceeded with the funeral arrangements but during the ceremony, the real John Thompson walked into the gathering, shocking those that had come to grieve. John had changed ships and safely road the storm out in Toronto. He had seen his obituary in the paper and thought it would be a good joke to make an appearance.
- Another sailor, Milton Smith, had a premonition that something bad would happen upon the Freighter Prince. He left the ship despite efforts by his superior officers to get him to stay. Fortunately for him he was not convinced.

Forecasts Then and Now

- The Weather Bureau issued reports twice a day at 8 am and 8 pm.
- Forecasts were based largely on volunteer observations, kite instruments, and a sparse weather balloon network.
- In the early weather balloon days, data was not incorporated into real time forecasts because balloons had to be retrieved manually.



Forecasts Then and Now



Storm Warning hoisted at Sault Ste. Marie in the 1930's. At the moment this picture was taken, the wind was southwest, preceding a dramatic shift in the wind to the prevailing northwesterly direction.

Warnings

- In the past, the Weather Bureau ordered flags and pendants to be raised and lowered to signal mariners of warnings.



Forecasts Then and Now

1913 Forecasts

- During the 1913 storm, winds weakened on the 8th, misleading mariners to believe the storm was ending. The strongest winds occurred on November 9th resulting in the most destructive and deadly day of the storm. Confidence was low in forecast information.
- The storm really intensified during the day on November 9th between weather bureau update times.
- Once ships left port, they did not have any way to receive weather updates.
- By November 10th so many telegraph lines were down that the weather bureau had a hard time updating forecasts.



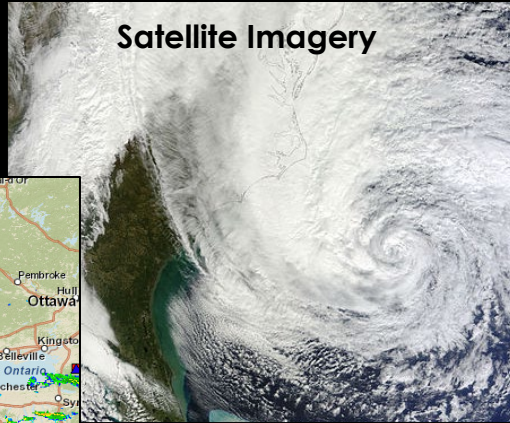
Forecasts Then and Now

Today's weather forecasts are based
on sophisticated technology.

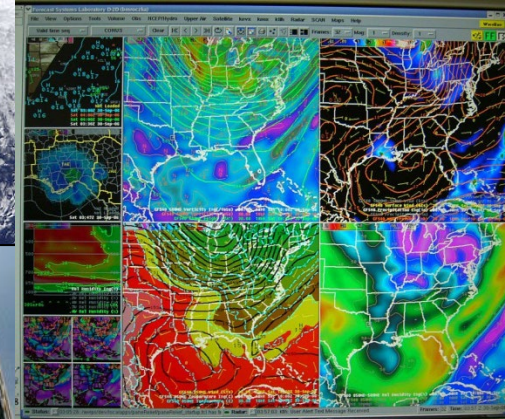
Doppler Radar



Satellite Imagery



Numerical Weather Prediction



**Radio Tracking/Data
Receiving device inside**

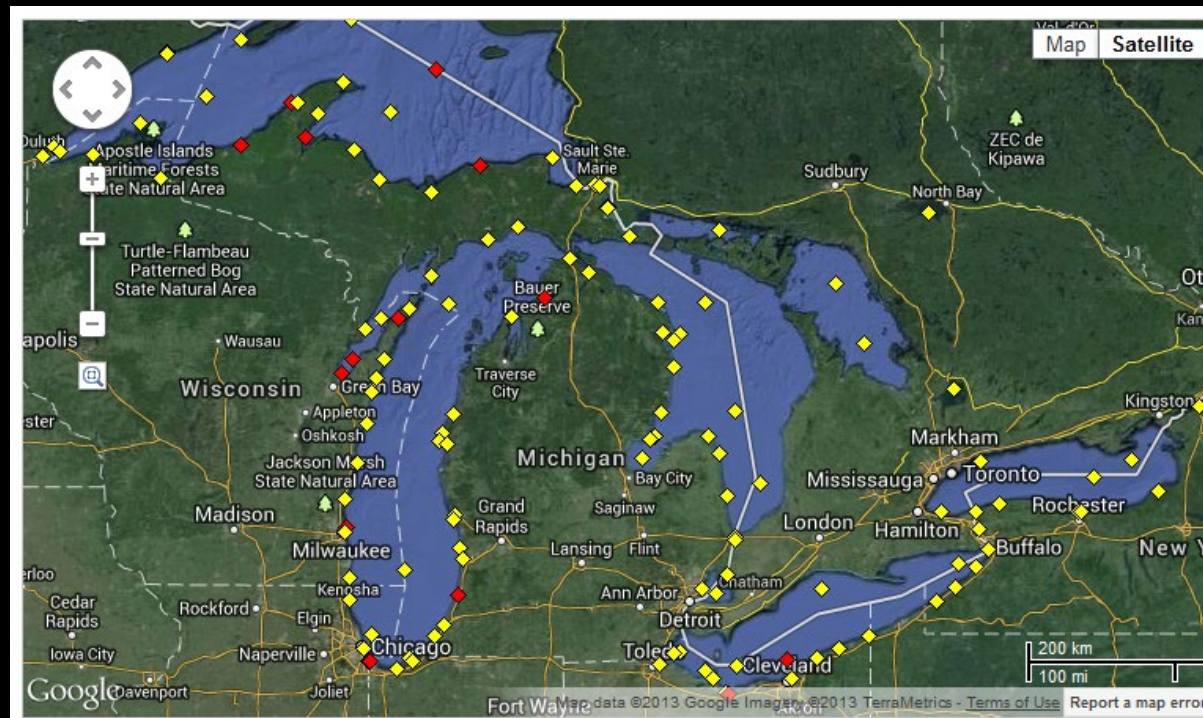


Upper Air Data

Forecasts Then and Now

National Data Buoy Center

Providing real-time marine observations from
buoys and coastal sites.



Forecasts Then and Now

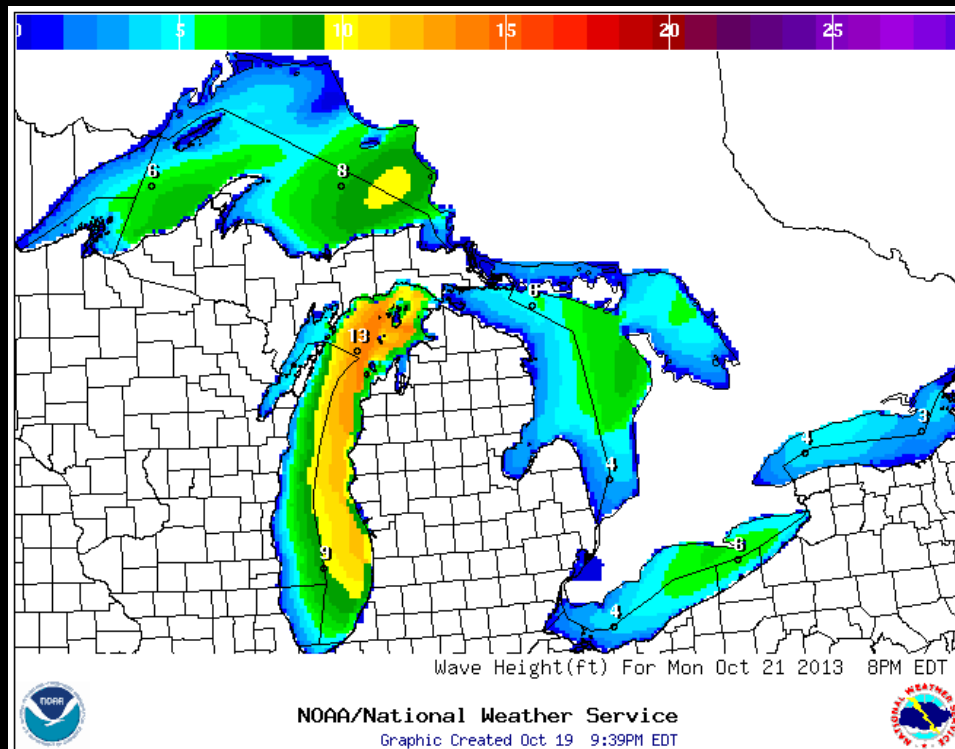
Today's forecasts utilize completely different data sources than they did in 1913.

	1913	2013
Coastal Warning Display Program (Flags)	✓	
Wireless communication aboard all Great Lakes ships		✓
Doppler Radar (WSR-88D)		✓
NOAA Satellites		✓
Numerical Weather Prediction		✓
NOAA Weather Radio		✓
Mid Lake Buoys (showing wind, wave, temperature)		✓

Forecasts Then and Now

Forecasts Today

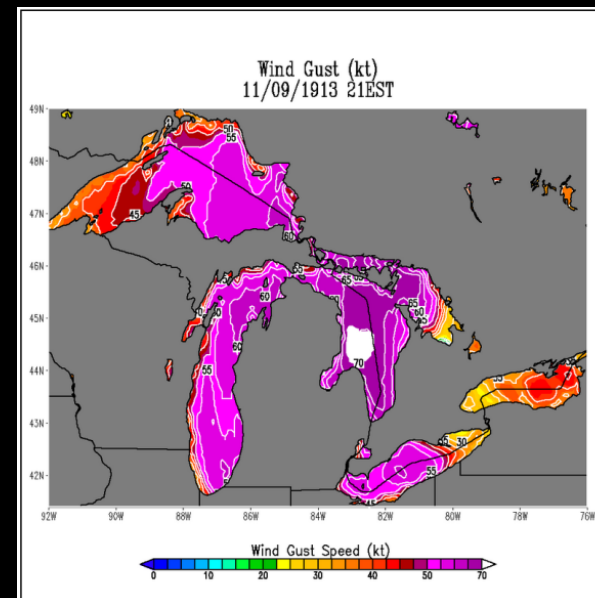
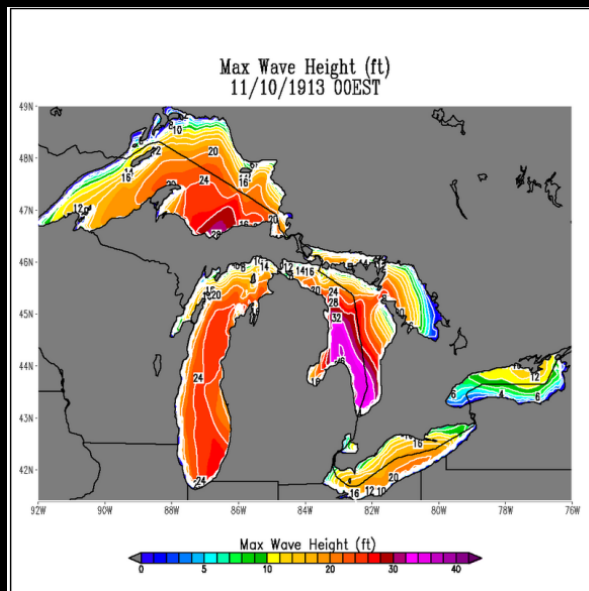
- The NWS runs a wave model to forecast wave heights and return period out to 5 days.
- Forecasts are updated at least 4 times a day.
- Graphical forecasts are accurate and easy to understand.



Forecasts Then and Now

Forensic Analysis

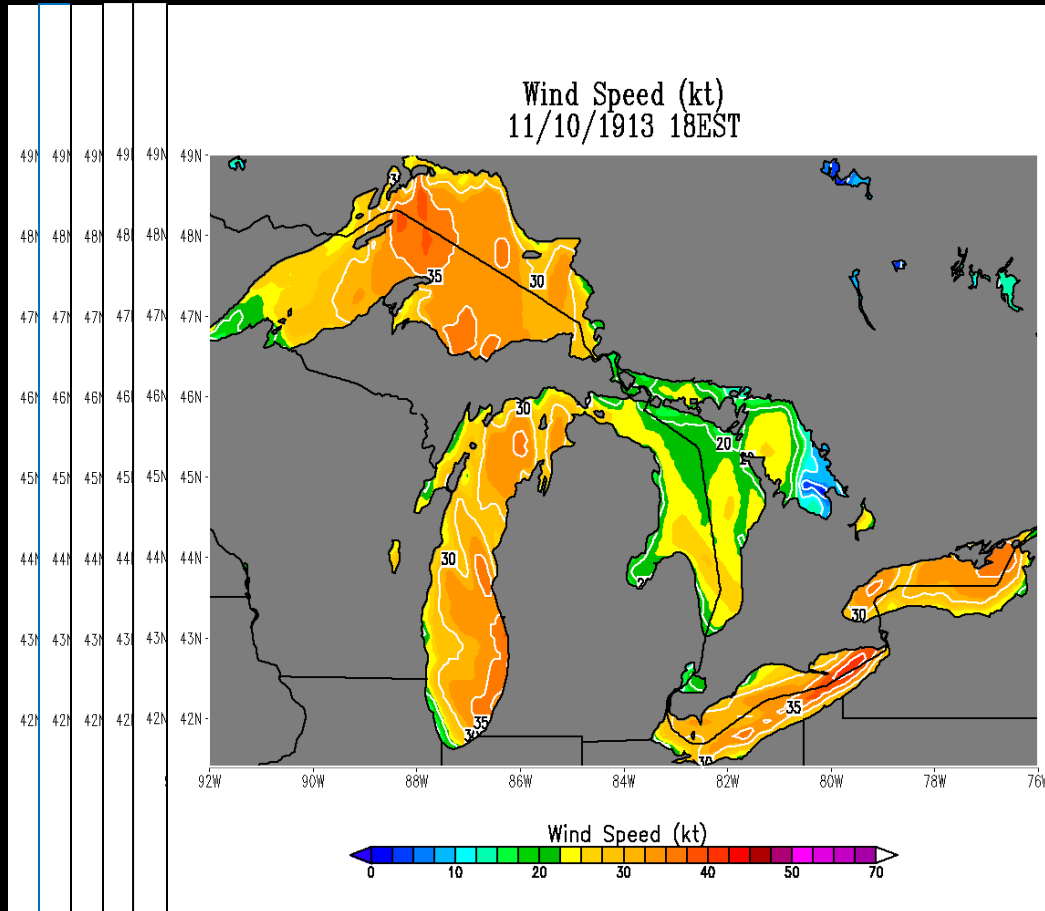
Despite limited observational data, NWS ran a simulation to re-create the storm and show the evolution of wind and wave conditions on all of the lakes.



Forecasts Then and Now

Sustained Winds

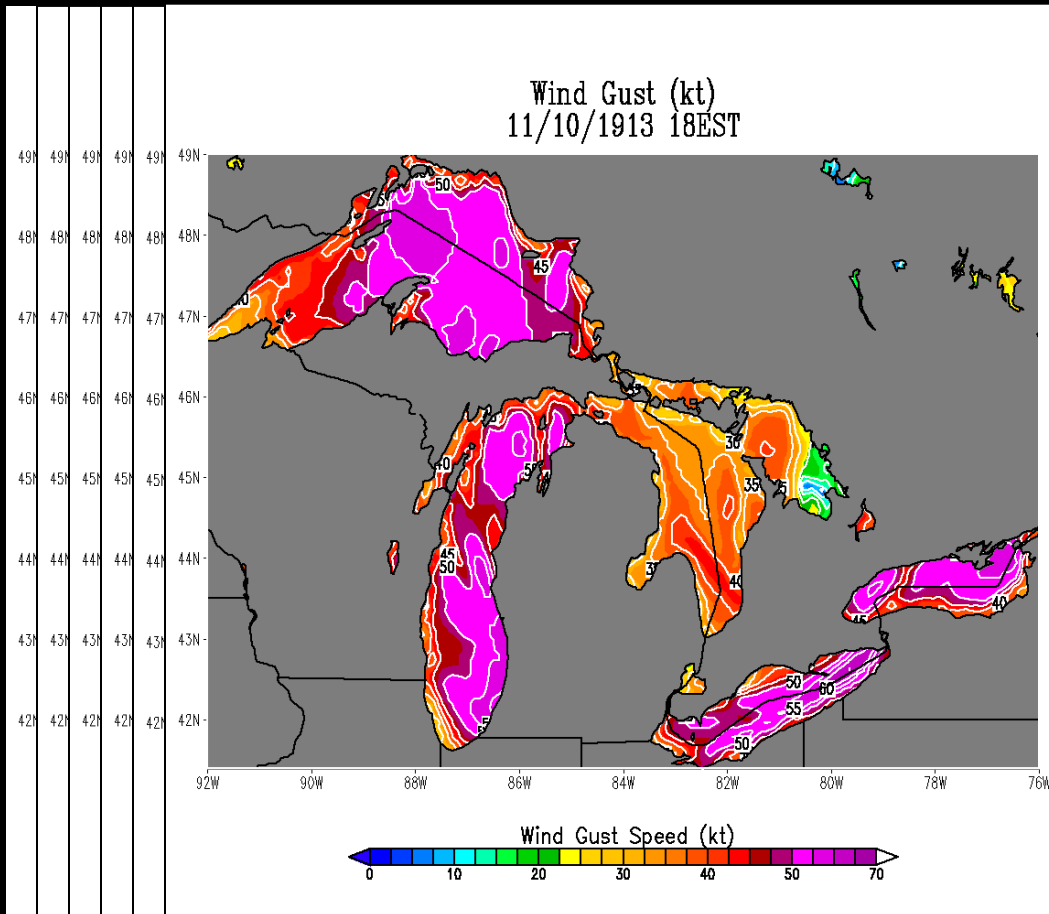
- Simulated winds from noon on November 9th – 6 pm November 10th
- Most of the shipwrecks occurred during the evening of November 9th when winds peaked.



Forecasts Then and Now

Wind Gusts

- Widespread wind gusts of 60-70 knots lasted for hours, battering the ships
- Survivors reported isolated gusts to 78 knots or 90 mph

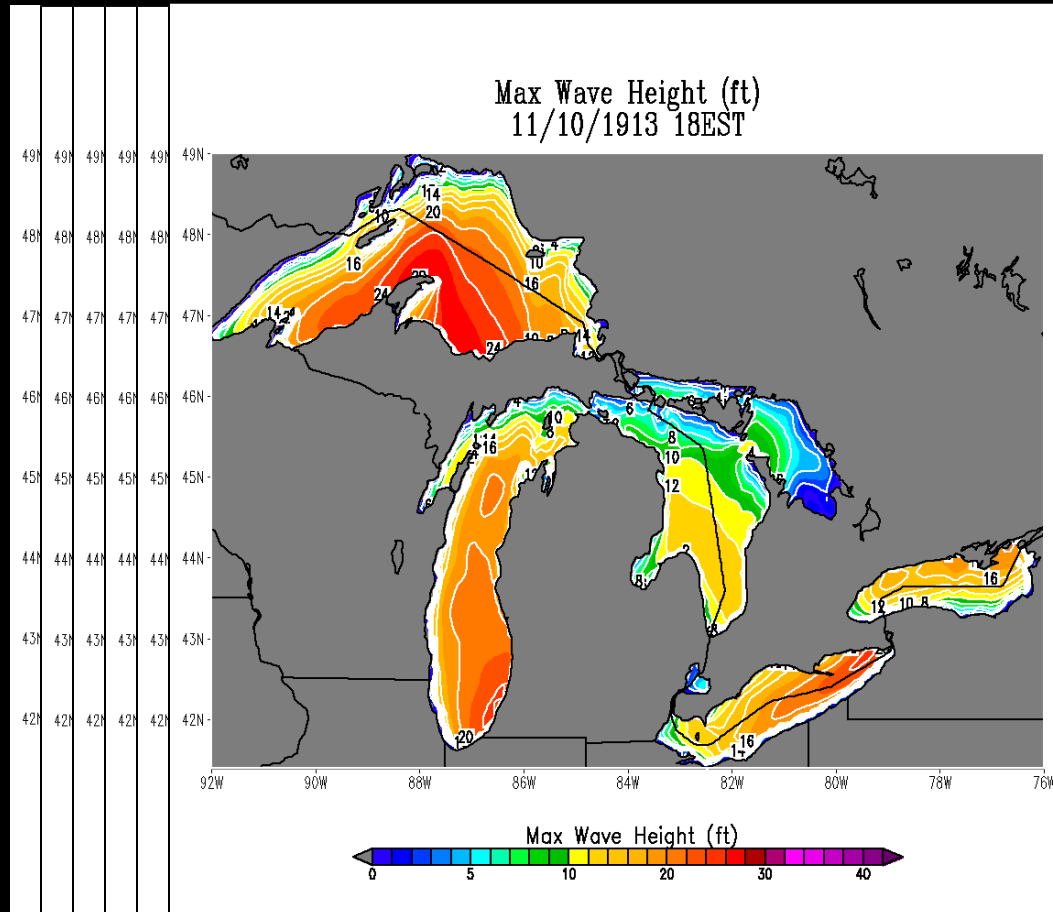




Forecasts Then and Now

Maximum Wave Height

- Maximum Waves represent the average of the highest 5 percent of waves
- Maximum waves occur every 3 to 5 minutes
- Significant waves were 12-22 feet on the Upper Lakes



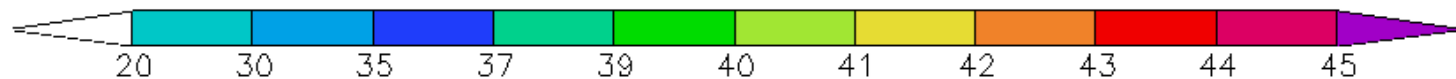
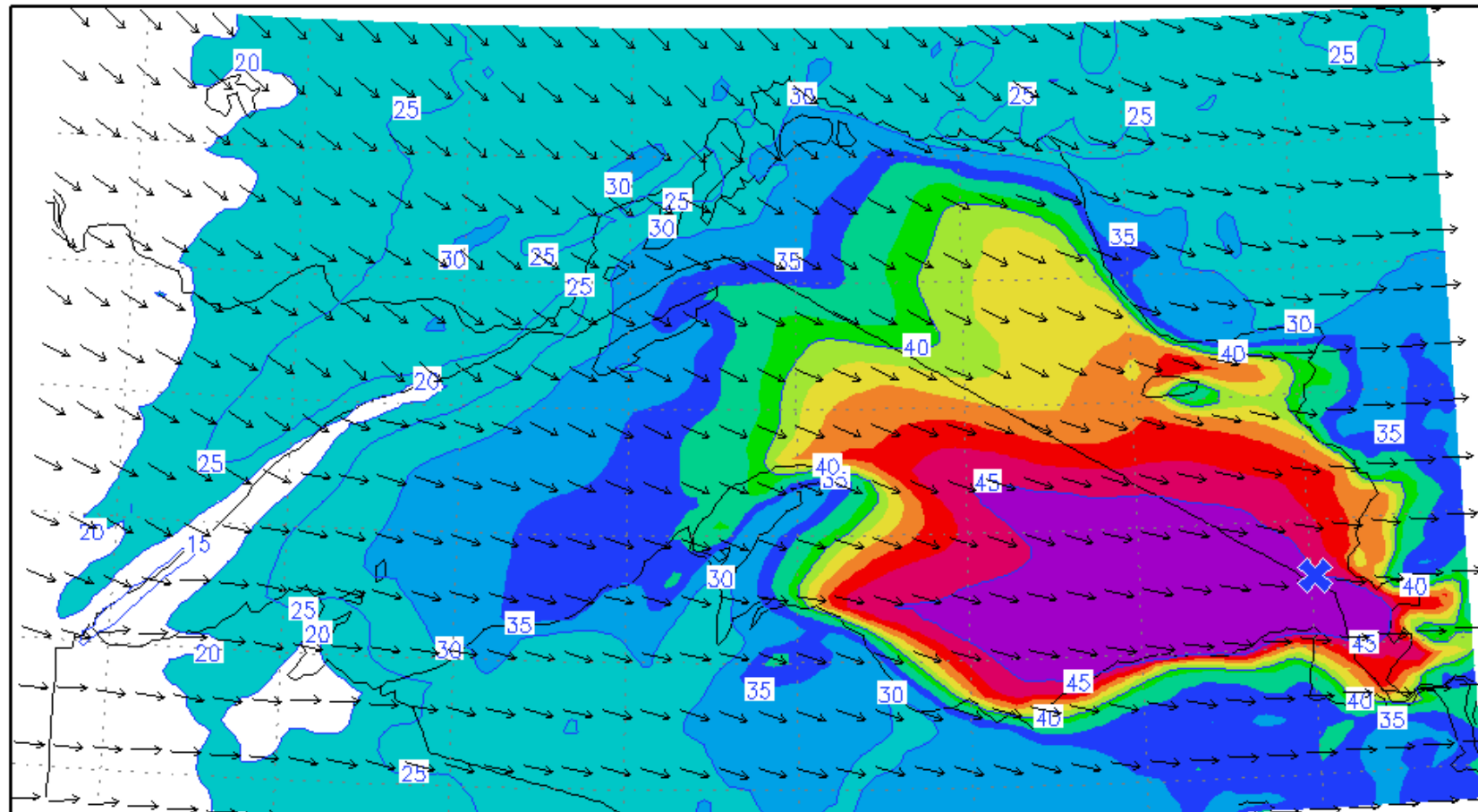


November Gales

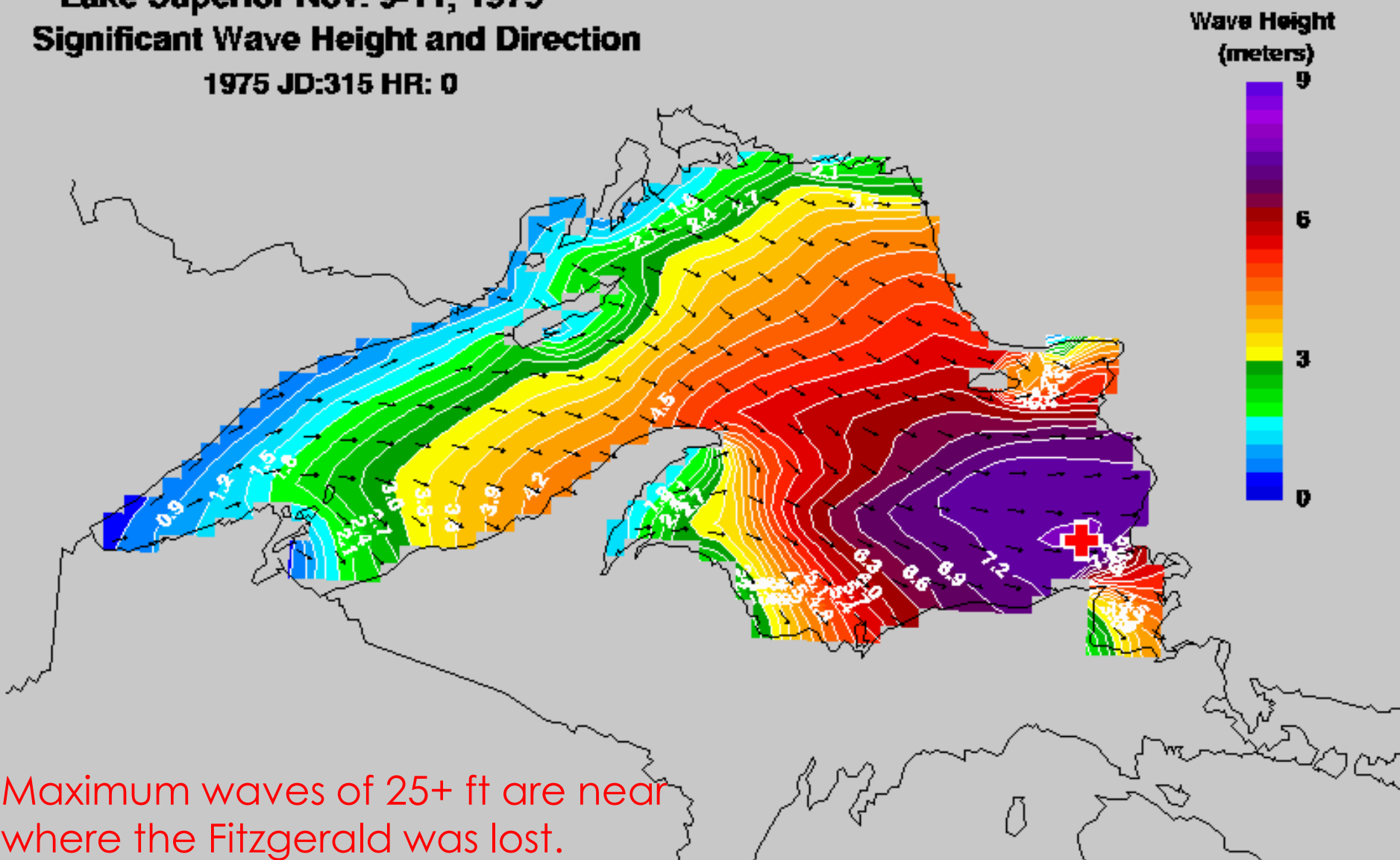
- Great Lakes Storm Nov 7-10, 1913 (~250 lives lost)
- Armistice Day Storm Nov 11, 1940 (65 sailors, 26 duck hunters lives lost)
- Edmund Fitzgerald Sinking Nov 10, 1975 (29 lives lost)

Final Voyage of the Edmund Fitzgerald November 9–11 1975

50m Wind Speed (kt) & Wind Direction -- 00Z11NOV1975



Last Voyage of the Edmund Fitzgerald
Lake Superior Nov. 9-11, 1975
Significant Wave Height and Direction
1975 JD:315 HR: 0



Thunder Bay National Marine Sanctuary



www.thunderbay.noaa.gov

- A 48-square-mile of protected area located in northwestern Lake Huron dedicated to preserving and honoring shipwrecks on the Great Lakes.
- A museum is located at the sanctuary near Alpena, MI - adjacent to Lake Huron.
- People may view shipwrecks by taking rides on a glass bottom boat.

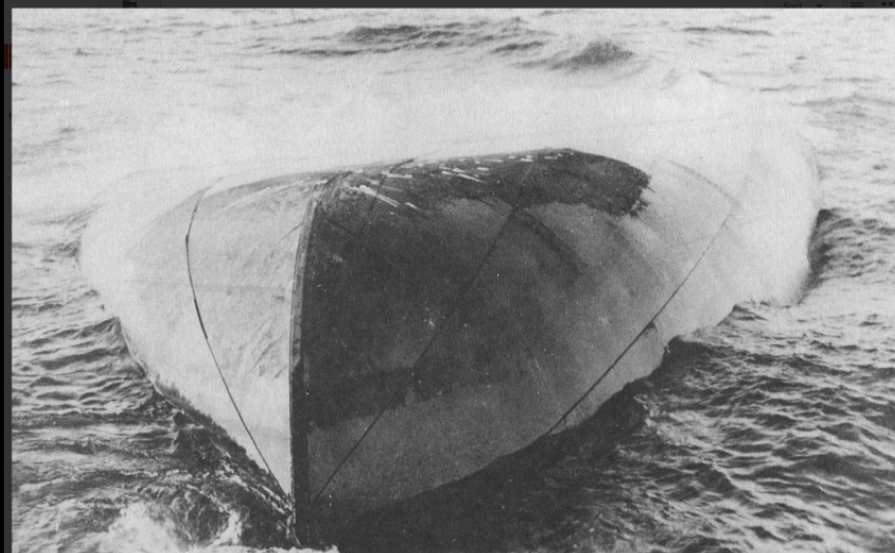
Thunder Bay National Marine Sanctuary

The Isaac M. Scott was one of the ships that perished during the 1913 storm that rests in Thunder Bay.



NOAA presence in the Great Lakes

The tremendous losses from the 1913 storm were a driving factor behind improvements to weather forecasts, data collection, and improvements in communication.



Capsized image of the Charles S. Price from 1913

NOAA presence in the Great Lakes



For more information
on the 1913 storm:

[http://www.regions.noaa.gov/great-lakes/centennial anniversary storm of 1913/](http://www.regions.noaa.gov/great-lakes/centennial_anniversary_storm_of_1913/)



[http://www.regions.noaa.gov/great-lakes/centennial anniversary storm of 1913/simulation/](http://www.regions.noaa.gov/great-lakes/centennial_anniversary_storm_of_1913/simulation/)