

More meteotsunamis occur on Lake Michigan than any other Great Lake. New research may lead to lifesaving warnings about the potentially destructive waves.

By [Morgan Greene](#) -- Chicago Tribune |

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Marvin Katz, 87, recalls the summer of 1954 when a **meteotsunami** swept people near Montrose Harbor into the water and eight people drowned. “It just happened so fast. The water rose in seconds,” Katz remembered. He and his friends pulled one man from the water into his powerboat. At the time, people believed the water event was a seiche that hit the lakefront, but experts have since determined it was a meteorological tsunami. (Stacey Wescott/Chicago Tribune)

On an April afternoon in 2018, the scene from the shore of a Lake Michigan beach town **suddenly changed**. There was a pier jutting out into the lake toward a lighthouse. And then, everything was water.

Longtime outdoor photographer Todd Reed was at his downtown Ludington, Michigan, gallery when the sky turned dark. He jumped in his truck and headed to the beach, looking out with his camera past rain and hail.

“I could see that the pier didn’t seem to be there,” Reed said. “It was quite stunning.”

He left to shoot photos from another spot and returned minutes later to find the water had receded.

“We used to think of them as a rogue wave, but it’s a lot more than that,” said Reed, a Coast Guard reservist for decades. “The whole thing really emphasizes the need to maintain constant awareness when you’re near the Great Lakes in stormy weather.”

As summerlike temperatures start to arrive, and with the lakefront open again, Chicagoans are likely looking forward to beach season. But that also means meteotsunami season.



People flock to Lake Michigan at Rainbow Beach during warm weather in Chicago on April 22, 2019. (Zbigniew Bzdak / Chicago Tribune)

There’s no forecasting system in place, but recent research from National Oceanic and Atmospheric Administration scientists, published in the journal *Natural Hazards* and based on the Ludington meteotsunami, might help forecast future waves.

Most of the waves don’t end up causing severe damage and may be only a foot tall, but Lake Michigan is home to dangerous rip currents, and a 2019 [study](#) found meteotsunamis, which can play a role in creating rip currents, present “severe water safety hazards and high risks, more frequently than previously recognized.”

On the Fourth of July in 2003, the skies cleared near Warren Dunes State Park and swimmers headed back

into the water after a short-lived storm whirled across the lake. Seven people drowned, and the study found rip currents induced by meteotsunamis were the most probable cause of the deaths.

Climate change could also affect how and when they’re happening.

Meteotsunamis — driven by weather rather than earthquakes — pop up all over the world. That includes the Great Lakes region, where the waves occur, on average, more than 100 times a year, according to a 2016 [study](#). Chicago leads the pack with an average of 29 meteotsunamis a year. Buffalo, New York, on the eastern reach of Lake Erie, follows with an average 17 per year.

Generally much smaller than what you might picture when you hear “tsunami,” the weather-fueled waves can hit the shore after a storm has cleared, like the July 4 event. That can make them particularly dangerous, said David Kristovich,

head of the Climate and Atmospheric Science section of the Illinois State Water Survey, part of the Prairie Research Institute at the University of Illinois.

“By the time the waves reach certain locations, the storm may be done, so people are coming back to the beaches,” Kristovich said. “So being able to advise people about when meteotsunamis may be occurring and especially to remind them that you need to keep an eye out for a while after the storm passes — I think it could be very important.”

Eric Anderson, lead author of the [study](#) about the Ludington meteotsunami and NOAA Great Lakes Environmental Research Laboratory scientist, said the ability to forecast the waves “absolutely can save lives.”

“It isn’t like the Hollywood movie poster of a tsunami wave,” Anderson said, but a meteotsunami “can be dangerous, even if it’s rare.”

What differentiates meteotsunamis from a turbulent day on Lake Michigan is, in part, their longevity: **A normal wave can last seconds, while a meteotsunami can last from 2 minutes to 2 hours.** They are sometimes confused with seiches, which can be caused by similar conditions, but seiches tend to last longer, with waves taking on a seesaw motion.

In the Great Lakes, scientists have generally studied meteotsunamis **driven by both significant air pressure changes and strong winds**, usually spurred by thunderstorms, which are hard to predict.

Researchers found the Ludington meteotsunami was unusual for the Great Lakes because wind didn’t play a major role. Like many meteotsunamis that form in the ocean, the Ludington waves were pressure driven.

Scientists may be able to turn to existing weather prediction models that can pick up those conditions to forecast these types of meteotsunamis. “Up until now, we’ve basically said, we don’t have the infrastructure in place to forecast these type of events. Now we see, at least for this subset of meteotsunamis, we do,” Anderson said.

Another study offers possibilities to address forecasting gaps — from water level gauges and air pressure sensors to using satellite systems to detect meteotsunamis from space.

Forecasting has only been seriously considered in the last decade, the study said, and “much work remains to realize a truly comprehensive detection, forecast and warning capability.”

While “strictly aspirational,” it’s possible that meteotsunamis could eventually be predicted more than 24 hours in advance, the study said, which could allow the weather service to issue a watch, able to be upgraded to a warning or downgraded depending on the wave’s amplitude.

Among the most infamous — and deadliest — meteotsunamis was a Chicago wave that hit on a balmy June day in 1954, leading to the deaths of at least seven people.

“It was like an elevator was pushing it up,” [a witness told the Tribune](#) in 2019. “We looked up and realized all these people were in the water drowning and there was no one to help.”



Volunteer divers Robert Domkowski, left, and Chuck Napravnik, right, search Lake Michigan for three missing bodies at Montrose Harbor after a meteotsunami hit the lakefront on June 26, 1954. (Chicago Tribune historical photo)

The wave, as high as 10 feet tall and reaching from Wilmette Harbor down to North Avenue Beach, followed an earlier line of storms en route to southwest Michigan from Wisconsin. That bounce-back effect, when an unexpected wave catches those on the other side of the lake off-guard, can make meteotsunamis perilous.

The Ludington meteotsunami didn’t result in fatalities, but the waves also didn’t appear on a day when people clustered near the shore.

“Timing is everything,” Anderson said.

The future frequency and timing of meteotsunamis is unpredictable as climate change continues to alter

life in the Great Lakes. Winters are [warming](#) and the region could see more days with conditions conducive to thunderstorms, especially in spring, researchers say. So **there’s the possibility of more meteotsunamis — as well as a shift in when they occur.**

“You can imagine if the peak timing for these types of weather systems overlaps with the peak recreational time, you’re going to see more problems with meteotsunamis” Anderson said.

But scientists say it's still difficult to say what a changing climate might mean for meteotsunamis. The Midwest has seen more extreme precipitation, and increasing storminess could give way to more of the waves. But there are also competing effects, Kristovich said, and storms may not have the characteristics or movement needed to build harmful meteotsunamis. "What you need are not only big pressure changes, big wind changes at the surface, but you also need fast-moving storms," Kristovich said. "I do think the effects of climate change on not only these types of waves, but others, I think it's an open question that really would be beneficial to answer."

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Morgan Greene is a metro reporter for the Chicago Tribune who covers human interest stories, breaking news, the park district and everything in between. A Cleveland native, she graduated from the Theatre School at DePaul University, joined the Tribune in 2015 as an editorial assistant and still enjoys seeing a good show on a night off.