

Research team warns against overlooking Great Lakes' currents

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Although it can be easy to overlook their seemingly calm waters, the Great Lakes have a long history of dangerous currents. UW-Madison professor Chin Wu is taking a proactive approach to curb future accidents. Credit: National Weather Service

The history of the Great Lakes is one of people who underestimate their destructive power, often with tragic results. From two massive waves that smashed into Chicago's harbors in 1954 to a rip current that drowned a young swimmer in Port Washington, Wisconsin, in 2012, Lake Michigan and its neighbors have a track record of catching people

off guard with dangerous currents.

People still commonly refer to such events with terms like "sneaky waves," as if these incidents were aberrations that couldn't have been helped or anticipated.

Chin Wu isn't having it, because such incidents are, in fact, a long-established part of the lakes' behavior. "I say, 'sneaky waves?' These sneaker waves appear without warning, often surging high up on the beach with deadly force and creating rip currents, " says Wu, a professor of civil and environmental engineering at the University of Wisconsin-Madison.

Between 2002 and 2013, rip currents—essentially strong channels of water that flow out from the shore—were involved in 85 deaths and 256 rescues in the Great Lakes. But this still hasn't changed the common misperception that rip currents are only a threat in the ocean. Currently, the lakes' only safety measures against rip currents rely on observation of factors like wave heights and water levels—a relatively passive approach. Wu says it's possible to anticipate them based on possible causes in weather, the current's interaction with structures along the shore, and formations in the sea floor and sandbars.

Wu's research team—Ph.D. students Yuli Liu, Adam Bechle and Josh Anderson—is developing a real-time warning system for dangerous rip currents on Great Lakes beaches. Supported by a \$200,000 grant from the National Oceanic and Atmospheric Administration Great Lakes Coastal Storms Program, Wu recently began testing and implementing pilot systems at beaches in Milwaukee and Port Washington, as well as in Duluth, Minnesota.

His system will alert safety officials when conditions become conducive to rip currents, or when alarming wave patterns are poised to radiate

along the shoreline. Dubbed the [Integrated Nowcast/Forecast Operation System \(INFOS\)](#), the pilot program offers a mix of data on current conditions in an area. Ideally, it will catch the first stirrings of dangerous currents before they endanger people near the shore.



INFOS utilizes imaging equipment to gather real-time data on the Great Lakes' currents. Credit: Chin Wu

INFOS builds on the principles of the wave imaging and modeling systems Wu's research group has pioneered. Once INFOS is refined at the test sites, Wu hopes the system can be deployed throughout the region, protecting swimmers and the economies of communities that depend on beach tourism. "There are only risk level warnings for beachgoers, but that's kind of a reactionary approach, and Chin's is more of a proactive approach," says Julia Noordyk, a coastal storms specialist with the Wisconsin Sea Grant Institute. "Right now, there's no way to do real-time observation of dangerous currents forming. Hopefully, this project will change that."

"Part of the process is science, but an equally big part is outreach and education, bringing it to local communities," Wu says.

Wu has spent significant time coordinating with his project's partners and local officials at each pilot site. In the tradition of the Wisconsin Idea, he's determined to spread the benefits of science and engineering to people throughout the state and region.

Each pilot site is prone to a different kind of rip current, which creates an opportunity to flesh out some of the basic science of rip currents. Park Point Beach in Duluth sees a high occurrence of "bar gap" currents, which form in the gaps between sandbars. Milwaukee's Bradford Beach often has "headland" currents, which sweep along the shoreline and then out, amplified by variations in the sea floor. Finally, North Beach in Port Washington faces "structure-induced" rip currents, which occur when currents deflect off a pier or breakwater.

The key thing is to understand the basic mechanisms that cause [rip currents](#), Wu says. As inland seas, the lakes are subject to seiches—standing waves that essentially reverberate back and forth across a body of water—and to weather-generated tsunamis, known as meteotsunamis. Wu says researchers will need to pay more attention to those factors if they ever hope to capture dangerous currents in the lakes.

Despite these gaps, INFOS will still draw on deep and nuanced knowledge of how the Great Lakes are different from—and in some respects, actually are more dangerous than—other bodies of water. "In the Great Lakes, people underestimate the waves," Noordyk says. "In the ocean, there's a longer wave period, whereas in the Great Lakes, they just keep coming and coming."

When these threats resulted in the death of a teenage swimmer, Port Washington residents and Mayor Tom Mlada vowed that it wouldn't be

in vain. Over Labor Day weekend 2012, Tyler Buczek, 15, drowned in a rip current off one of the city's beaches. "When you see somebody's life cut short, you're reminded again of the power of Lake Michigan, and the need to respect that power," Mlada says. "The indication of a community's strength and character is not whether it suffers a tragedy, but how it responds."

Buczek's death helped motivate Wu to start the INFOS project—well before he even received a grant—and Wu has spent the last couple of years meeting with the Port Washington beach safety committee, hashing out an approach that factors in the unpredictability of Lake Michigan.

Mlada says he has faced some criticism that the emphasis on safety will stir up fear among potential beachgoers, potentially damaging the \$6 to \$10 million economic impact the beaches annually draw into the local economy. But Mlada argues that INFOS will ultimately make beachgoers in Port Washington feel more confident by connecting them with a wealth of information. "This is cutting-edge, but cutting-edge in all the right ways," he says. "It empowers people and keeps people informed."

Provided by University of Wisconsin-Madison

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