Dangerous sneaker waves puzzle scientists

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Cannon Beach in Oregon is a popular site for tourists, but has also experienced dangerous sneaker waves. Credit: Jeff Hollett

On January 16, 2016, a sudden swath of large and powerful waves swept through seaside communities along 450 kilometers (280 miles) of

Pacific Northwest coastline. From Washington to northern California, water rushed past normal tide lines and filled beaches and streets, stretching hundreds of meters inland.

These "sneaker waves" are aptly named given their unannounced arrival, which occurs when massive waves push extra water onshore—a higher-than-usual water level that scientists refer to as runup. At best, these events take beachgoers by surprise. At worst, they are disastrous and fatal.

Researchers taking interest in these surprise events are starting to understand how they unfold. The data gathered so far suggests distant storms created the swells that drove the 2016 sneaker wave and another that occurred in early 2018, according to Chuan Li, a civil engineering graduate student at Oregon State University who presented his team's most recent work on the two massive waves last month at the 2018 AGU Fall Meeting in Washington, D.C.

As researchers learn more about what caused these events, Li said they hope to better inform the public about the possibility of an unexpected and powerful sneaker wave.

"The bottom line is we're trying to better understand these extreme runup events so we can inform the public," Li said. "This work is motivated by wanting to provide additional safety for beachgoers and ultimately creating more awareness and better warning systems."

Taking the "sneak" out of "sneaker waves"

Sneaker waves are fairly common in the Pacific Northwest. But the 2016 one was different.

"Video footage showed really large wave runup events within two or three hours of each other," Li said. "The runup was so strong and went so far that people were up to their knees and water went all the way up into an inlet. We saw some pretty unusual phenomenon on this particular day."

Li and other scientists were confounded: the wave activity measured deep in the ocean and on shore resembled conditions for a small tsunami, but without the triggering earthquake or telltale atmospheric disturbances.

"These long runup signals are often generated by things like earthquakes, submarine landslides, and tsunamis, or sometimes by waves at the surface," said Ryan Mulligan, a coastal engineer and oceanographer from Queens University in Kingston, Ontario who was not involved in the research. "I don't think I've ever seen effects in the deep ocean and on shore like that unless it's a tsunami. So if it's not a tsunami, then what is going on?"

To get to the bottom of this mystery, a team of researchers at Oregon State University examined the near- and off-shore conditions leading up to and during the sneaker wave. They turned to existing data gathered by sensors and instruments off the Pacific Northwest coast: tide gauges, wave buoys, and bottom sensors on the ocean floor.

Examining the wave patterns around the runup event, Li's team observed unusually long and rapidly increasing peak wave periods both near the shore and further out at sea, indicating that a large swell may have driven the runup. What exactly caused the swell was not yet clear, but Li suspects distant storms may have been responsible.

As Li and his colleagues began to dive deeper into analyzing the instrumentation data, they learned that the 2016 sneaker wave was not a one-off event.

Two years later—nearly to the day—another massive runup event burst on the scene. It produced similar oddball signals and yielded another wave of attention on social media. But Li says there is still not enough information readily available to protect the public from these occurrences.

Sneaker waves don't move in a predictable pattern like most wave sets, making them difficult for passersby to anticipate, according to Li.

"Visitors often don't know much about the dangers of this particular part of the world, where we get very big waves," Li said. "They might think, I can just stand by the edge of the water and I'll be okay. But [these events] are the leading cause of death by drowning in this area."

Li's team now plans to further explore the possible drivers of this event and better understand potential generation mechanisms.

"We're hoping to do some numerical modeling and lab work—running some short waves immediately followed by very long waves—to see if we can replicate some of this," Li said. "We're going to try to understand as much as possible."

More information: Generation of unusually large runup events. agu.confex.com/agu/fm18/meetin … app.cgi/Paper/458132

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