A view of Agate Beach looking south toward Newport shows a rip current (right of center), the broad dark patch in the middle of the surf zone angling to deeper water. The rip current would not be visible from the beach.

ROBERT HOLMAN
OREGON STATE UNIVERSITY

Sewing up the mysteries of rip currents

Scientists at Oregon State University are using cameras to discover where and how dangerous rip currents are made

By BEN LARSON
THE OREGONIAN

To U.S. Coast Guard rescuers searching for a missing swimmer on the Oregon coast, it's an all too familiar story.

A father romping in the shallow surf with his two children. One minute they're splashing in the waves, squealing with delight. The next, they're fighting to escape a rip current that can flow at a speed of 3 feet per second and pull a swimmer more than 600 feet offshore within minutes.

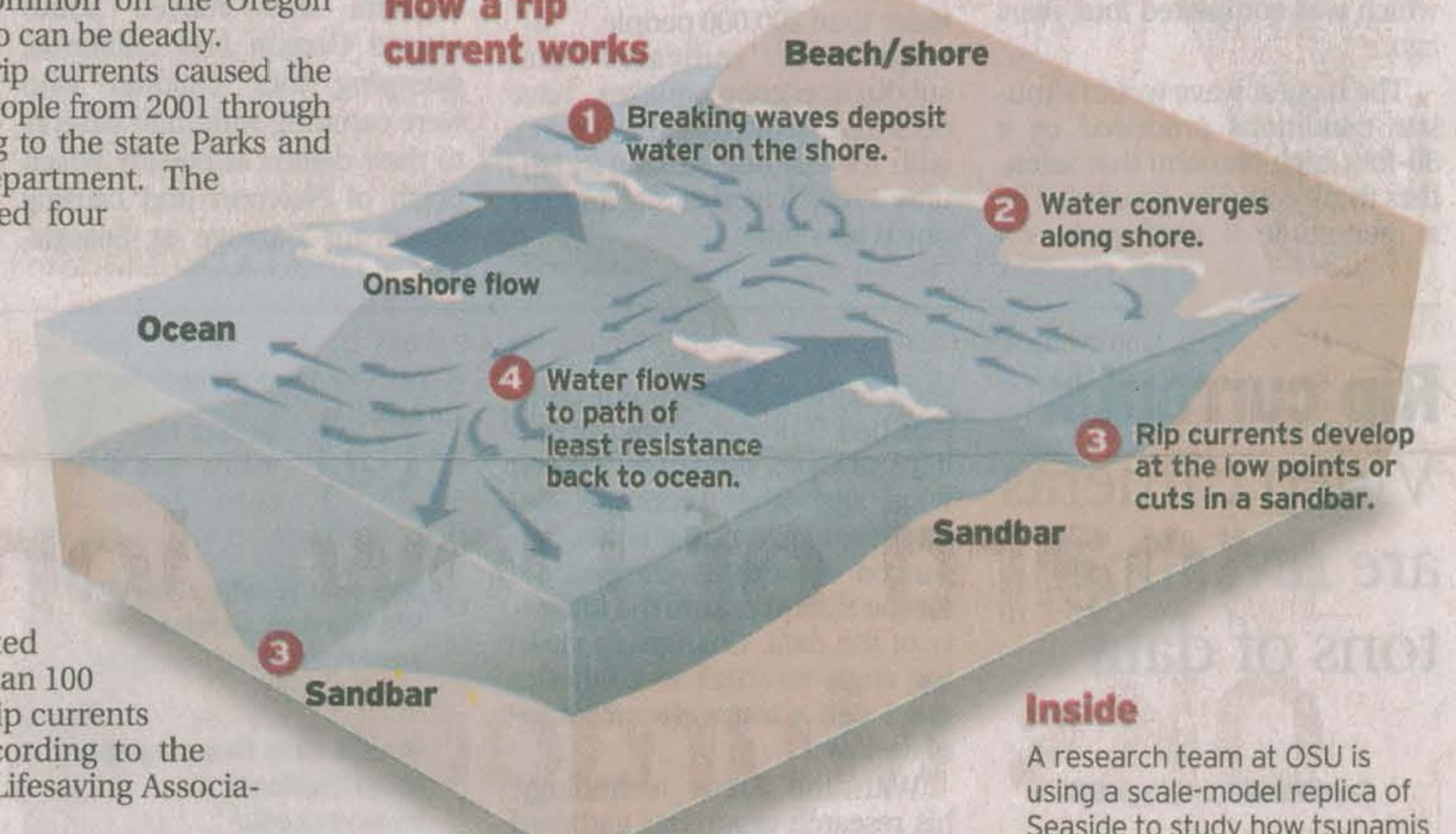
"It's a gorgeous beach, everybody's playing around in the surf, and those little channels can be quite steep," said Robert Holman, an Oregon State University oceanography professor. "You can stumble into one of those things and then get carried out by the current."

Born of the age-old dance between ocean waves and shoreline, rip currents — often inaccurately called rip tides — are common on the Oregon coast. They also can be deadly.

In Oregon, rip currents caused the deaths of 12 people from 2001 through 2006, according to the state Parks and Recreation Department. The victims included four teenagers, a 12-year-old boy and a 7-year-old girl. During the same period, 13 people were rescued and the department lists two "self-rescues."

In the United States, more than 100 people die in rip currents each year, according to the United States Lifesaving Association.

Please see **RIP CURRENTS,** Page B9



Inside

A research team at OSU is using a scale-model replica of Seaside to study how tsunamis would affect the city | **B9**

Rip current safety tips

Rip currents are a leading surf hazard for beachgoers. Here's what to do if you get caught in a rip current.

- Remain calm to conserve energy and think clearly.
- Never fight against the current.
- Swim out of the current in a direction following the shoreline. When out of the current, swim at an angle away from the current toward shore.
- If you are unable to swim out of the rip current, float or calmly tread water. When out of the current, swim toward shore.
- If you still are unable to reach shore, draw attention to yourself by waving your arm and yelling for help.
- If you see someone in trouble, don't become a victim, too: Call 9-1-1.
- Throw the rip-current victim something that floats: a lifejacket, a cooler, an inflatable ball. Yell instructions on how to escape. Remember that many people drown while trying to save someone else from a rip current.

Information: *www.ripcurrents.noaa.gov*

Rip currents: Video cameras are revealing tons of data

Continued from Page B10

Scientists at OSU and elsewhere are using sophisticated techniques to unravel the workings of these ocean phenomena.

"Rip currents are notoriously hard to predict," said Tuba Ozkan-Haller, an assistant professor of oceanography at OSU who has developed a model that helps forecast their formation.

Traditionally, scientists have relied on flow meters and other sensors positioned along the coast to study rip currents. But devices in the water and the scientists who put them there don't always fare well in such hostile environments.

"We're an evolution away from that," said Holman, who uses a system of cliff-mounted cameras to photograph large swaths of beach. "It's a lot easier to collect data from pixels than put a current meter in the water."

The operation, dubbed the Argus program, has grown into a sophisticated global network of automated video cameras that funnel data back to researchers in the Coastal Imaging Lab at OSU's College of Oceanic and Atmospheric Sciences.

Argus stations monitor beaches in Hawaii, Australia, England and New Zealand and on both coastlines of the United States. An Argus installation consists of multiple cameras controlled by a host computer.

Scientists must have a precise knowledge of the position of each camera to tease out complex beach physics from the millions of bytes of imagery. When wind and other processes disturb camera arrangements, advanced algorithms compensate for the shift to ensure the integrity of the data. Changes in viewing angle as small as 0.004 degrees can corrupt the accuracy of the data.

With the Argus technology, his research group has gathered "unprecedented" amounts of information, Holman said. They're able to study many oceanographic phenomena, including rip currents, long-shore currents, sandbar behavior and coastal erosion.

Cameras last longer and cost less than sensor arrays, and they can be just as effective. A single pixel contains some of the same information as a sensor reading.

"Before we developed these techniques, we had a much simpler idea of how sandbars work," he said. "Then we took data and found out we were just naive."

The coastal imaging project began in 1982 with a 35mm camera, a tripod and a guy in a tower. "We wanted to develop an understanding of the fundamental physics of beaches," Holman said.

Rip currents are narrow, fast-moving streams that transport water, debris — and occasionally people — away from the shoreline and toward the open ocean. The currents can span a width of about 160 feet, move at an average speed of 3 feet per second and extend seaward about twice as far as the surf zone.

Spotting the currents from the beach is tricky, though not impossible. One clue is the convergence of currents that flow parallel to the shoreline.

"If you see the long-shore current coming from both the left and right, there's probably a rip current in front of you," Holman said.

Robert Holman's Web site: http://cil-www.oce.orst.edu/pb

National Weather Service Rip Current Safety: www.ripcurrents.noaa.gov/index.shtml

Woods Hole Oceanographic Institution: www.whoi.edu/page.do?pid=11914&tid=282&cid=2470

National Center for Atmospheric Research: www.ucar.edu/news/releases/2005/ripcurrents.shtml

These constantly evolving channels of water, which run along the ocean surface, are the product of complex interactions among waves, currents, water levels and near-shore terrain.

"The most common cause has to do with the way sandbars are configured," Holman said.

When ocean waves approach the beach in some areas, they break on a sandbar before washing ashore as bubbly white foam. The water, its energy exhausted by the uphill shore climb, slides back to sea level.

But that backwash can't make it over the sandbar as easily as the rollers of incoming waves. The trapped water forms long-shore currents looking for a way out.

A rip current tends to drive through the sandbar where there are little channels or low points, Holman said.

The rift serves as a drain pipe for pent-up seawater all along the shore. The more water that flows through the conduit, the deeper the channel becomes. That creates a torrent of outflowing seawater fed by the ceaseless onslaught of new waves.

But the study of rip currents is not just pure science. Researchers also want to figure out how to predict where and when they'll appear.

Ozkan-Haller said rip currents can form even in the absence of a sandbar. In such cases, offshore canyons play an important role. The terrain governs how waves crash onto the beach, in much the same way that an optical lens manipulates waves of light.

"The rip current likes to live where the wave height is relatively low," Ozkan-Haller said.

Once a strong rip current establishes itself and carves a channel, it will remain in the same general location until something happens to change the situation, Ozkan-Haller said. "All of a sudden some big storm comes about, and the whole bathymetry is wiped out, so no more channel."

By matching her theoretical predictions of rip currents to video observations, Ozkan-Haller eventually may be able to deduce the terrain for unfamiliar environments. Once the technique is refined, a computer could determine the lay of the land using video footage of a remote location.

Such a capability would be invaluable to the U.S. Office of Naval Research, which partially finances the OSU research.

"Imagine you're a Navy Seal in a rescue operation," Ozkan-Haller said. "You don't want to jump right into a rip current or have your boat run aground. You want to figure out exactly how to go in."

Ben Larson: 503-221-8133; benlarson@news.oregonian.com