

Researchers Study Coastal Hazards of Increasing Wave Heights, Rising Sea Levels

October 10 2008

(PhysOrg.com) -- While hurricanes Gustav and Ike were pummeling the Gulf Coast with rains and record flooding, researchers at Oregon State University were studying why wave heights in the Pacific Ocean have been increasing in recent years and how this phenomenon –coupled with global warming – might affect coastal erosion, flooding and development along the Pacific Northwest coast.

Peter Ruggiero, an assistant professor of geosciences at OSU, is developing new computer models that factor in the increasing wave heights, as well as rising sea levels and the potential increase in frequency of El Niño weather conditions. El Nino is a cyclic water temperature weather pattern that results in warmer-than-normal ocean temperatures and triggers larger storms in the Pacific Ocean.

“We’re trying to see how a combination of these different processes – bigger waves, higher sea levels and potentially more frequent and intense El Niño conditions – could affect coastal areas along the Pacific Coast in a range of ways, from coastal erosion and lowland flooding to planned development,” said Ruggiero, whose research is funded in part by a \$190,000 grant from Oregon Sea Grant at OSU.

Although considerable research is being done on the effects of rising sea levels, Ruggiero and his colleagues want to know how higher wave heights and larger-than-usual storms could combine with sea level rise to deliver devastating impacts along the coastline of the Pacific Northwest.

“If you’re thinking only about sea level rise, you’re missing the boat,” Ruggiero said. “When we combine all these processes, the probability of waves overtopping a dune or banging into a sea cliff is three to 10 times greater than models that use only sea level rise projections.”

When waves overtop a dune or contact the base of a sea cliff, erosion occurs.

Ruggiero’s colleagues – Paul Komar, an emeritus professor in the OSU College of Oceanic and Atmospheric Sciences, and Jonathan Allan, of the Oregon Department of Geology and Mineral Industries – have been documenting observed wave heights in the Pacific Ocean for the last 30 years. Their research shows that the average wave height has increased more than 40 centimeters (15.7 inches) during that time, and the average wave height of the five largest winter storms per year is increasing at a rate of up to seven centimeters (2.75 inches) per year.

“There has not been a lot of research into what’s causing this increase in wave heights,” said Ruggiero. “But the data clearly shows it’s happening. And if this trend continues, we need to know what we’re up against, and what the relative impact on the outer coast will be. My preliminary research is showing that increased wave heights definitely play a significant role in the frequency and magnitude of coastal hazards such as erosion and flooding, so now we need to be figuring out the physics.”

The project is extremely complicated, however, because landforms and sand at the outer coast are constantly rearranging themselves, said Ruggiero, who has been doing research on a section of coastline near Long Beach, Wash., where one part of the beach is retreating five to 10 meters (16 to 32 feet) each year, but another part is being built up. Wave run-up, or the thin layer of water that slides up onto the beach after a wave breaks and washes ashore, has been increasing faster in the Pacific Northwest than sea level rise during the past three decades, Ruggiero

said.

And nobody knows for sure exactly how global warming will affect sea level, El Niño patterns and wave heights. “It’s very complicated stuff,” he said. “And when you start putting it all together, you wonder what the long term effects will be. We need to know.”

So do people who do planning and development along the coast. The computer models and data Ruggiero’s team are developing could become valuable tools for planners, who work with 20-year-old inundation maps created by the Federal Emergency Management Agency before global warming and sea level rise were issues.

“Our ultimate goal is to develop products that coastal decision-makers can use with regard to planned development and evacuation procedures in coastal areas,” Ruggiero said. “You have the majority of the world’s population living within 50 miles of a coast. The more (hurricane) Ikes and Indian Ocean tsunamis happen, the more attention coastal hazards will get, and unless something drastically changes, these situations are going to get worse.”

Provided by Oregon State University

Citation: Researchers Study Coastal Hazards of Increasing Wave Heights, Rising Sea Levels (2008, October 10) retrieved 1 May 2024 from <https://phys.org/news/2008-10-coastal-hazards-heights-sea.html>

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