Monsters of the deep

Huge, freak waves may not be as rare as once thought

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On July 26th 1909 the SS Waratah, en route to London from Melbourne, left Durban with 211 passengers and crew. She was due in Cape Town three days later but never arrived. The steamship was last sighted along the east coast of South Africa—known to sailors as the “wild coast” for its violent weather—struggling through a stormy sea with waves more than nine metres (30 feet) high. No trace of the vessel has ever been found.

A theory which might explain her disappearance, and that of some other vessels, is that they were struck by rogue waves—which begin with a deep trough followed by a wall of water the size of an eight- or nine-storey building. For many years oceanographers dismissed sailors’ reports of rogue waves much as they did stories of mermaids. But in 1995 an oil rig in the North Sea recorded a 25.6-metre wave. Then in 2000 a British oceanographic vessel recorded a 29-metre wave off the coast of Scotland. In 2004 scientists using three weeks of radar images from European Space Agency satellites found ten rogue waves, each 25 meters or more high.

A typical ocean wave forms when wind produces a ripple across the surface of the sea. If the wind is strong, the ripples grow larger. A hurricane can amplify a wave to a few stories. But trying to create giant rogue waves in a laboratory tank is very difficult, making them hard to study. Now researchers led by Eric Heller of Harvard University and Lev Kaplan of Tulane University, New Orleans, have started using microwaves rather than water waves to create a laboratory model.

Rogue waves are not tsunamis, which are set in motion by earthquakes. These travel at high speed, building up as they approach the shore. Rogue waves seem to occur in deep water or where a number of physical factors such as strong winds and fast currents converge. This may have a focusing effect, which can cause a number of waves to join together. Such conditions exist along Africa’s wild coast, where strong winds blowing from the north-west interact with the swift and narrow Agulhas current flowing down the coast to produce enormous waves. Dr Heller, who likes to sail, says there may be other mechanisms at work too, including an interference effect that causes different ocean swells, traveling at different speeds, to add up to produce a rogue, and a non-linear effect in which a small change in something like wind direction or speed causes a disproportionately large wave.

To study the phenomenon the group created a platform measuring 26cm by 36cm on which they randomly placed around 60 small brass cones to mimic random eddies in ocean currents. When microwaves were beamed at the platform, the researchers found that hot spots (the microwave equivalent of rogue waves) appeared far more often than conventional wave theory would predict; they were between ten and 100 times more likely.

Dr Heller says the results tend to support anecdotal evidence from seamen that rogue waves are not as rare as once thought. He thinks the work could also be used to understand more about the formation of these dangerous waves, perhaps to the point where it would one day be possible to provide a warning in places where rogue waves may be prone to appear. Seafarers would be thankful for that.