Physicist counts bubbles in the ocean to answer questions about climate, sound, light (w/ Video)

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The bubbles in your champagne that appear to jump out of your glass and tickle your nose are exhibiting a behavior quite similar to the tiny bubbles found throughout the world's oceans, according to bubble physicist Helen Czerski.

But while the champagne bubbles are likely to raise your spirits, those in the ocean can cause clouds to form and affect the climate.

"Bubbles are little packets of gases that rise or fall and can be carried around as if they're on little conveyor belts," said Czerski, a post-

doctoral fellow at the University of Rhode Island Graduate School of Oceanography. "They carry carbon dioxide and oxygen from the atmosphere down into the ocean, and then when they go back up again they pop and sulfur compounds from marine plants are sent upward, forming particles in the air that lead to the formation of clouds."

Czerski is studying how to detect and count ocean bubbles of different sizes to help scientists in other disciplines create more accurate models. She said that scientists have found it difficult to judge the effect of bubbles on their data for years and usually have had to add a "fudge factor" to account for them.

"For instance, bubbles ring like bells when they are formed or when sound waves go past them, and if you're studying sounds traveling through the ocean - like sounds from whales or sonar - bubbles can get in the way of what you're trying to listen for," said Czerski, who earned a Ph.D. from Cambridge University before spending a year studying bubbles at Scripps Institution of Oceanography in San Diego and then moving to URI.

"Bubbles also scatter light strongly in the oceans and make things cloudy, so if you're studying light in the ocean you need to understand bubbles," she added.

The URI scientist uses an acoustical resonator to detect and count bubbles of different sizes in the water column. The device can detect bubbles from 3 to 170 microns in size, and she is assessing the accuracy and uncertainty in the measurements.

She recently used the resonator to collect bubble data near the Hawaiian Islands and in the Santa Barbara Channel off Southern California. She counts bubbles down to 10 meters deep - most bubbles don't go down much further than that, she said. The big ones float back to the surface

while the smallest ones gets squeezed out by the pressure as they sink.

"Just after a wave breaks, there are loads of bubbles and they're changing really, really quickly," Czerski explained. "They're stretching and squishing and bumping into each other and breaking into smaller bubbles and they're doing it all too fast for us to see directly. Whenever they break up, each new bubble makes a 'ping' sound, and if you hear it you can say something about those new bubbles."

Czerski said that understanding the physics of bubbles is increasingly important as climate models become more and more refined.

"We need to study bubble distribution and where they go in the water column to understand the exchange of gases that they carry," she said.

According to Czerski, while carbon dioxide and oxygen get carried into the ocean via bubbles, a chemical compound produced by phytoplankton gets carried out of the ocean via bubbles.

"No one really knows why phytoplankton create dimethyl sulfide, but they do, and it passes into bubbles and is carried up and out," she said. "These bubbles supply sulfur to the atmosphere, which acts as a seed for cloud droplets to form.

"Climate is made up of a whole bunch of little things, including bubbles, and these little things matter because there are lots of them," Czerski said.

Czerski began studying bubbles after earning a Ph.D. in a field she described as "blowing things up," which included becoming expert at high-speed photography. She then looked for disciplines in which she could apply this knowledge.

"I've always been fascinated by small things that do stuff that's too fast for us to see," she said. "And I like building experiments that help us see those things."

She learned to scuba dive in order to deploy instruments for measuring bubbles, and she now believes that getting in the water is a vital step for any aspiring bubble scientist.

"You can't really understand what's going on under the sea unless you go there yourself," Czerski concluded. "There is a huge benefit to directly experiencing the world you're studying. The rules are different down there."

Provided by University of Rhode Island