# *Wave Chasers*

## Deep Flows Through the Samoan Passage

**Narrator:** The Samoan Passage. Below, a deep ocean choke point between the North and the South Pacific oceans seen as a vital part of the Earth's climate system. In early 2014, the APL-UW team known as the Wave Chasers returned for the third time in three years to the Samoan Passage – to learn more about the massive amount of water churning through this ocean abyss 5500 meters below the surface.

**James Girton:** In the Samoan Passage Abyssal Mixing Experiment, we're studying the flow of Antarctic bottom water through the passage just north of Samoa just before it crosses the equator. This is water coming from the south flowing along a boundary current on the western boundary of the south Pacific and then getting constricted in a small passage and flowing into the north Pacific.

**John Mickett:** Most people think of the deep abyssal circulation as sluggish. We've know that's not the case in specific areas.

**Matthew Alford:** It's just one of these incredibly special places in the ocean where you can measure the incoming properties of the fluid and measure the outgoing properties and there is really a big, measurable difference. We know that's because of mixing and the big contribution of this experiment is that we actually measured how much mixing there really is.

**Girton:** In this project, we had three cruises total and the first cruise was a mapping cruise where we wanted to scope out the geometry of the Samoan Passage and really figure out what the details of the separate connected passages are. The second cruise was to deploy a mooring array that had been been done 20 years earlier and measure the transport through the passage as well as map out the flow pathways through the connected passages. The third cruise was to focus on the processes that were driving the turbulence and the flow constrictions.

So a lot of these flows can be seen a little bit like a flow in a river where you have a rock in the river and the flow goes over it and causes a hydraulic jump or a wave behind that flow. We found some real surprises about how the flow is kind of diverted around these bumps.

**Alford:** You can imagine this river, this undersea river of water and we think of it as 35 Amazon Rivers worth of water that's going northward through this passage. The passage is so complicated, it's three dimensional and it really looked like the Grand Canyon. There's no single path through it — it can go left, it can go right, it can go over.

Especially on this last cruise we knew we had several locations we wanted to focus on that were sort of hot spots of mixing.

**Girton:** So we did several cross-stream tow-yos, we did some along-stream tow-yos. And we deployed moorings in different configurations in key locations within the flow that would tell us where the most mixing was occuring or how the mixing and the flow pathway was determined.

**Alford:** And just so you know, tow-yoing is basically like a yo-yo with a CTD — you're moving this instrument up and down. You're towing it. So you're moving it through the water as it goes up and down so you're tracing kind of a saw-tooth pattern through the water as you steam along.

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**Girton:** This Antarctic bottom water is of interest because it's the main supply for deep water in the Pacific Ocean because there's no deep water created anywhere in the North Pacific. And so then all of the water in the North Pacific at the bottom has to have come through this pathway.

**Mickett:** Trying to figure out how to parameterize those processes in global cimate models is gonna be key…to really correctly account for how this very special region modifies the ocean water that goes through there.

**This is APL — The Applied Physics Laboratory at the University of Washington in Seattle.**