Marginal Ice Zone (MIZ) Program

Office of Naval Research Departmental Research Initiative

Narrator: Scientists and engineers from more than a dozen research institutions around the world, including the Applied Physics Laboratory at the University of Washington, are focused on the Marginal Ice Zone—the area between declining unbroken sea ice and the expanding areas of open water.

Craig Lee: The Marginal Ice Zone Program was motivated by dramatic changes we've been seeing in sea ice. We think that as we get more open water in the Arctic the physics of how the ice breaks up and melts may change.

Narrator: More open water means more waves. Wind-driven waves can break up sea ice, hastening melting.

Lee: In March of 2014 the Marginal Ice Zone Program began its fieldwork. We began by setting a cluster of instruments—or an array of instruments—in the Beaufort Sea. This was done by coordinating aircraft and setting instruments in four clusters stretching from somewhere near the coast of Alaska and ranging offshore about 400 km. This was very intensive work done by a multi-national group of investigators from a number of different institutions. The Applied Physics Laboratory-University of Washington supplied the field camp logistics. The British Antarctic Survey supplied aircraft—a twin Otter and then two other aircraft. And then a large group of investigators from all over the world, really, went out to deploy instruments on the ice. Woods Hole was responsible for the ice-tethered profilers. They did a profiling instrument that sits on the ice and has a little crawler that goes up and down the line in the water below. The British Antarctic Survey, the Scottish Association for Marine Science, and the Laboratory of Villefranche were responsible for what we call ice mass balance buoys which measure the thickness of the snow and the ice, temperature, the various processes that are responsible for the melting of the ice. These are used to look at the motion of the ice and then tells us something about how the waves are impacting the ice. There are similar instruments, designed here at the Applied Physics Lab, that are designed to measure waves in the open water.

The unique part about this experiment is that we are using aircraft to put instruments on the ice early in the season and then later, when there's open water, we'll come back out with a very small ship and we'll use that to put out floats and the kinds of autonomous gliders that you see here in this laboratory. The Office of Naval Research funded this large program looking at the physics of the marginal ice zone. The Navy is very interested in being able to predict when the ice will break up, where it will break up in the seasonal term, and in the longer term they are interested in knowing where might we see an ice-free arctic during the summer?

One of the novel aspects of the Marginal Ice Zone Experiment is that it's mostly autonomous and that rather than going up there and working mostly from ice breakers and being up there through the whole time of the experiment, we have the ability to now put out robots which sample for a much longer period of time and they do so pretty much without our aid. They make their samples and they collect their measurements and then they telephone home using a satellite telephone. That information all comes back to the laboratories in the UK, in France, and here in the US. And one place where that's done initially, and where you can see that, is on the Marginal Ice Zone website. There are figures that show the atmosphere, ice, and ocean all combined and that takes data from many of these instruments plotted in one place.

An important aspect of a program like this, and the real reason why there are so many people involved and so many instruments, is that no one group and no one instrument can measure everything that we need to know about the ocean and up gassing in the atmosphere. So, while each group processes its information independently, the real value comes when we all get together and we integrate that information: what the air temperature is doing, and what the wind is doing, how the ice is responding, how it's moving, whether there were more waves on the ice and whether it's melting more quickly. And then within the ocean, whether we see changes in the temperature or do we see warming or do we see more mixing under the ocean, depending on how much open water we see and what the ice is doing.