

Oceanography from Space

Probing North Atlantic Eighteen Degree Water and Fresh Water in the Arctic

Narrator: APL-UW oceanographers are exploring the world's oceans... from space.

Kathie Kelly: The Gulf Stream comes up here. It brings very warm water....

Narrator: APL-UW's Kathie Kelly was among the first oceanographers to use the large data sets returned from satellite sensors to study the oceans.

Kelly: The type of data I use is primarily satellite observations, but I also use historical data — hydrographic data which are measurements in the ocean.

Narrator: One of Kelly's areas of study is the Atlantic just south of the Gulf Stream.

APL-UW oceanographer and polar scientist Jamie Morrison studies the Arctic Ocean.

Jamie Morison: In the past, what we've had to do is go out in airplanes, land on the ice. Or take a ship. And because of that sea ice, it's very hard to get at an old-fashioned hydrographic station. So there are very few data points.

Narrator: Now, Morison can look down on the Arctic from a dramatic new vantage point. From space. Orbiting GRACE and ICESat satellites generate ultra-precise measurements and offer visibility of areas where few measurements had been taken before.

Morison: The satellites — their great contribution is that they look over the whole Arctic Ocean. The beauty of the satellite systems — ICESat to measure sea surface height and GRACE to measure bottom pressure... with those two satellites, we can look at the difference between the weight of the water measured by GRACE and the height of the water column measured by ICESat and figure out the density. We can relate that to the freshwater content.

Narrator: Atmospheric factors, the amount of fresh water in the Arctic Ocean, plus where it circulates all add up to a kind of global thermostat.

Morison: So the big change is this shift in freshwater pathways. Specifically, Eurasian river water.

Narrator: Satellite data reveal to Morison a major change in the location of fresh waters from Russian rivers emptying into the Arctic. Enough, he believes, to have a potential effect on global thermohaline circulation.

- Morison: It's kind of a throttling valve for this large-scale world ocean overturning circulation. Anything that acts as a throttling valve on that process of overturning affects the long-term thermal transfer on a global scale.
- Narrator: Analysis of satellite sensor data is helping form a picture of complex ocean and atmospheric interaction in the North Atlantic Ocean and the creation of mode water, a deep layer of nearly homogeneous temperature.
- Kelly: The mode water that we're looking at is subtropical mode water and in this particular location is referred to as 18 degree water because it's usually 18 degrees.
- Kelly: The Gulf Stream — a warm current carries heat from the tropics into the mid-latitudes and then it dumps its heat to the atmosphere and the major region for that loss of heat is where the mode waters form. We call this 'passing the heat baton' in the mid-latitudes. And so the way this region could affect climate is by the amount of heat that passes to the atmosphere.
- One of the ideas that we had for trying to understand changes in volume — the amount of loss in mode water — was the path length. And we use that as a proxy. So while the field program is out making measurements and they can actually look at each term and see how it contributes to the mode water — again, they can only do that over the two-year period. What we do is look at a 20-year period and we use proxies for these various processes and then we do a simple model that involves those proxies and see how well we can duplicate the observed volumes.
- Narrator: Massive shifts in air and water, affecting global climate — now detectable, observable, and measurable in their entirety from space by satellite.
- Morison: It opens up a huge window that was closed before.

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