Ocean-Observing Satellites Transcription

We have the satellites also on orbit which gives us a broader view of the planet. I want to step back with a little bit of history on our measurements from space, because they have been so crucial in the last two decades in developing this connection between what we view from space, and what we can view from a ship. This is Skylab which was America's first space station, launched into orbit in 1973. Gee, the year I graduated from high school and began my venture in oceanography. With the Skylab we were able to measure the salinity. They put an antenna on Skylab to measure microwave emissions from the surface.

We think of the emissions from the surface of any body in terms of the temperature of that radiation. Since we know from theory that salinity changes in the ocean, the microwave emissions should vary, and Skylab proved that to us. At least it was theoretically possible to measure salinity variations on the surface of the ocean from on orbit with a microwave antenna and sensor. We did not have until recent years the radiometers and antennas sensitive enough to resolve these variations of salinity at the surface of the ocean.

So meanwhile, back in the Skylab days, the whole idea of measuring salinity from space was put on the back burner, and they went ahead and starting launching the weather satellites, because as soon as they got on orbit they realized you could really view the weather from space, and make enormous progress in weather forecasting. They also put in what was called the Advanced Very High Resolution Radiometer, the AVHRR on that satellite, and it got these magnificent views of temperature variations in the oceans.

Here we see the Gulf Stream. It gave us this much more detailed picture of the ocean circulation. It's not just a gyre in the North Atlantic, but with eddies and variations and very dynamic circulation. This bought in a whole new era of oceanography where sending something like the Challenger expedition in one ship to view all this variation in the ocean looked like an impossible challenge. We really did need satellites to understand the rapidly changing ocean.

In the early 1990s, a new kind of satellite was put on orbit, the TOPEX/Poseidon satellite. This is one that was worked on for many years. It's an altimeter to measure the distance between the satellite and the sea surface so that we could measure sea level from space, mapping the entire planet every 10 days. We've been doing that continuously through a series of satellites since 1992.

It gives us what is now an iconic picture of sea level rise from satellite altimetry. The oceans are getting warmer, and the polar ice is melting, and they are adding to sea level rise. The average rate is about 3 mm per year. Your fingernails grow faster than that, but you know taken over time, it's a big number. It may be accelerating. It's a major concern to us in this 21st century.

Bringing this back up to 2011, we had finally determined in the 1990s my first day at NASA headquarters in 1997, I told them I want to do salinity from space, and I know just the guy who could do it for us. That was Gary Lagerloef who was the principal investigator for the Aquarius instrument. We

had already had discussions in the 1990s that we were technologically ready to put together a radiometer to measure salinity variations over the ocean to go with our detailed temperature variations.

We embarked on that with Argentina. After launch in mid-2011 we got our first light image, our first month of salinity data on orbit. It made us all so happy because we could see the major features of the ocean circulation as we knew them, the salinity signatures of the subtropical gyres, the high in the North Atlantic and the South Atlantic and in the mid latitudes, and the difference in salinity between the Arabian Sea and the Bay of Bengal. We knew there was a big difference there.

Now is this challenge to collect this information and begin to tease out all the features of the ocean circulation, that we can see salinity from space. We know that there's the big freshwater plume from the Amazon and Orinoco Rivers, but now we can watch them evolve through time from space.

We can also see the difference in the high salinity desert like region of the Arabian Sea versus the low salinity in the Bay of Bengal, where the major rivers are flowing into the head of the Bay of Bengal making these lower salinity features. We're excited to be able to perhaps for the first time look at the winter time temperatures and salinities of the ocean, because the vast depths of the ocean are filled with water that was at one time at the surface; it got cold and salty enough to sink to the bottom. So those processes are now accessible to us to understand ocean water formation at the surface, because we can measure both the temperature and the salinity.