SPURS_Webinar 1: Q&A Transcription

SPURS_Webinar 1 (2/26/13) – Question and Answer Section

Note: Bold text in the transcript indicates questions from the audience. Non-bold text is a response from Dr. Eric Lindstrom or the host as specified.

Question: What types of researchers is most interested in using the data from SPURS?

Dr. Lindstrom: The essential question of SPURs is how the salinity is varying over the year. So oceanographers are fundamentally interested because we haven't had such detailed variations of salinity available to us in one spot to look at. Another group of scientists are the climatologists who are interested in how much the water cycle is changing, and why it is changing. It's quite a controversy actually in the climate modeling community as to how sensitive the climate models are to changes in temperature. How much more water vapor can the atmosphere hold?

There's quite a variation; there's no conclusion based on all the best physics of the climate models seem to be able to bring to the table as to how sensitive they are to water vapor. What is interesting I think from the ocean measurement perspective is the ocean is telling us a fact not a speculation about what's changing. It seems to suggest that this sensitivity to the water cycle is strong, and that the atmosphere and the climate are changing faster than the present day model physics are showing.

That's kind of one of those scary kind of facts that you get when you go out and study these things in detail. It's like going up to Greenland and finding out how fast it's melting, or going up to the Arctic sea ice and thinking that the theory says, "Oh, it should be going away slowly," and finding out that it's disappearing virtually before your eyes. These are the kind of changes that when brought together really solidify the science community around the critical nature of our warming planet.

Question: Are all those sensors an obstacle for marine travel? Do they get in the way?

Dr. Lindstrom: Well, the ocean is awfully big. It's kind of like space that way. There's a lot of stuff in space: space junk and rocks and stuff. Yet the space station only has to maneuver very occasionally to avoid being hit by something. Or a satellite can be up there for 10 years without ever having to do a maneuver even though there is a lot of stuff. So if you spend any time out on the open ocean, you hardly ever see a ship, or anybody, or anything; it's just vast stretches of water.

Our wave gliders have sensors on them. It's like air traffic control; they can see when ships are coming. They can actually phone home and tell us the scientists to change their course to avoid collision with ships. We're aware of all of this, but we are getting smarter sensors that can actually avoid ships.

Question: Are there any graphics or maps that Aquarius has made of the polar oceans?

Dr. Lindstrom: That's a very good question. That's one of the things that I am not so happy about. I would love to have more images of the polar oceans from Aquarius. Aquarius is designed to measure this microwave radiation to get salinity, and at low temperatures there isn't very much signal from salinity from the ocean. Below about 5 degrees sea we haven't yet really got a good signal out of our first year of data.

SPURS_Webinar 1: Q&A Transcription

That's one of the challenges that we will overcome in the next few years as we understand the measurement more, and make all the corrections for wind speed, temperature, and galactic background radiation, and the Faraday rotation in the ionosphere. There's just a host of different problems that come to interfere with the measurements. We're quite happy with its performance in the warmer oceans, and there's plenty to be learned there now. But the polar oceans are yet to be explored with Aquarius.

Question: **How do the variations in salinity affect organisms in the oceans—things like plankton, fish, anything else?**

Dr. Lindstrom: It's an interesting question. The variations in salinity in the open ocean are dramatic in terms of their impact on the density of seawater, but it's just pretty damn salty everywhere in terms of life being adapted to it. I would say the main impact of salinity on life in the ocean is how it changes the stratification, and the mixing in the ocean—how often does a phytoplankton get mixed down and sees light.

Also the salinity of the ocean impacts how much carbon dioxide is dissolved in the seawater. Many of the scientists who are interested in ocean acidification in our growing greenhouse world are very interested in knowing the surface salinity. So we have people producing products of alkalinity in the surface of the ocean from the new salinity data. There are tie-ins to life that are not so directly with salinity, but kind of its tangential impacts on circulation and chemistry.

Question: To what depths can the satellites detect salinity? To what depths can buoys and floats detect salinity?

Dr. Lindstrom: The salinity measured from the spacecraft is just in the upper few millimeters of the ocean; it is the skin surface of the ocean. We use the in situ measurements to get at salinity below the surface. All the surface drifters measure salinity at the top few inches of the ocean, and the wave gliders measure at the surface to 6 meters. We have special floats that measure the upper 2 kilometers, but also take detailed measurements in the upper 5 meters.

So we're combining these all together to try and understand the details of what have we missed by just measuring the upper millimeters of the ocean from space. Is that a biased view of surface salinity? Is a few meters down very different? From what we know the surface we measure is highly representative of the upper mixed layer of the ocean which can be 10-50 meters deep. So we are getting a good view of the upper ocean salinity despite only measuring the skin depth.

Question: You said that SPURS is in the ocean desert. How salty is it there compared to the rest of the ocean?

Dr. Lindstrom: The range of salinity in the open ocean is from 32 to 37 parts per thousand. You can think of that as grams per kilograms, so 35 grams of salt per kilograms of seawater. The salinity in the sub-tropical gyre of the Atlantic has seen maybe 2 tenths of a growth in the last 50 years. In my historical textbooks of what's the salinity of the ocean, it might say out in the middle Atlantic it is 34.4.

SPURS_Webinar 1: Q&A Transcription

Well, we were measuring 37.8. None of the oceanographers on board the ship had ever seen anything like that. We looked back through the historical records. We weren't able to find anything that high in the entire historical database. We were really convinced that this analysis of the last 50 years is that it really is getting saltier out there. We can detect these kinds of variations from space.

Question: What was the cruise itself like? Are you planning to go to sea again on another SPURS cruise?

Dr. Lindstrom: I sure would like to do that. There are 2 SPURS cruises going out in March to service the sensor web, but I am busy doing other work on the Global Ocean Observing System. So I am becoming more of a 747 scientist flying around the world rather than a seagoing scientist. But the pick-up cruise for our entire sensor web is in September, and I'm hoping to go to sea; that would be nice to be able to do that again.

It's beautiful being out there. I love the sea. I didn't want to come back. I'd still be out there if I could be. The Sargasso Sea out in the Atlantic—where we were—was beautiful, despite getting run around the ocean by 4 hurricanes, we all had a great time, and discovered a lot of interesting results.

Carla: Great. And what is being shown on the screen right now is actually the SPURS cruise blog that Eric wrote while he was out there. So if you guys are really interested in what it was like, and what kind of things they found and they saw, you can go check that out. I have to say it's a pretty fun read.

Question: What's next for NASA in terms of remote sensing of the oceans? Are there any new satellites or other missions planned?

Dr. Lindstrom: Yes indeed! We're always planning new missions. I'm the program scientist for SWOT (Surface Water Ocean Topography). It really does talk about the water cycle. Not only are we going to measure the sea level on the ocean to unprecedented scale and accuracy, we're also going to measure the slopes of all the major rivers on the planet, and water levels of 3 million lakes and ponds across the planet. We're going to measure not only the saltwater, but the freshwater, and where it is going on the surface of the planet. So combining that with other missions that we have like the Global Precipitation Measurement mission, and our ICESat to measure the ice, it is really going to be the decade of understanding where all of the water is on the planet, and where it's going, and what's it doing, and why it's doing it; for an oceanographer, that focus on water is nothing but a joy.