

# What Does Salinity Look Like? Transcription

What does salinity look like in the ocean? So, we're talking about skin to deep. Here in one plot is the whole story kind of in a gross sense from skin to deep. The red line here is temperature as a function of pressure or depth. Pressure in decibars and depth in meters are about the same. This would be the depth of the ocean from zero to 2000 meters, or zero to 6000 feet if you're not a metric thinker.

You can see the red line which is temperature. It's warm at the top, at least in the subtropics where this came from, and decreases to a much lower number by the time you get to 2000 m. If you look at salinity (the blue curve), in this case the salinity is highest near the sea surface, decreases to a 1000 m., and then stays fairly constant with a slow decrease maybe below a 1000 m. In this case in the subtropics the surface of the ocean is saltier than the deep water.

This is from a measurement in the year or two. If we we're able to measure the same thing 25 or 50 years ago we would largely see the same thing. There might be small changes, but whatever is happening here it tells us that the ocean is generally in some kind of near-equilibrium state. Now we all talk about global warming and climate change and things like that, they may really be there, but in terms of the ocean and the deep sea the changes are so small that we can barely tell them from the equilibrium state right now.

What you're seeing right here would have been the same 25 or 50 years ago in the deep sea. One of the interesting questions is how does the ocean maintain this state. Normally if you think about the temperature being high at the surface, cooler deeper in the water column, you'd think there would have to be some diffusion that would eventually equal, diffuse, and smooth itself out; the same for salinity, high at the top, low at the bottom. Diffusion would smooth out those gradients, but in fact the gradients seem to stay the same. So there must be some processes there that are maintaining these gradients between the surface and the deeper ocean.

Now we're going to come to the surface, the skin part in a little bit here, but let's talk about the deep part first. This is at a depth of one kilometer in the ocean. That's a 1000 meters so that's like 3000 feet in the ocean. You can see here that by the colors are almost all in various states of green which means the numbers here are between roughly  $34 \frac{1}{2}$  and  $35 \frac{1}{2}$  in salinity units, which means in a kilogram of sea water you would have something between  $34 \frac{1}{2}$  and  $35 \frac{1}{2}$  grams of this salt stuff.

It's amazing that the ocean is pretty homogenized. Most of the world here the salinity is within one unit at a 1000 m. So there's not a very big signal there, and that's traditionally why we didn't know very much because you couldn't measure this that well.

You might look off the Mediterranean between Africa and Spain, there's a little red area surrounded by a lighter green area. That is an area where there is a deep salinity signal. That's the outflow of the Mediterranean Sea into the Atlantic. The Mediterranean is a very salty ocean, one of the saltiest anywhere in the world because there is so much evaporation in the summer time. That evaporation causes the surface water to get very salty and some of it pours out into the Atlantic; that's the little bullet that you see there. It obviously mixes away pretty quickly into the background. If we had

more time we could go into the importance of that little bullet there and it is important in terms of the deep circulation of the world ocean.

If we went into the next slide which is the same thing again, but now this is at 3 km. depth. This is at roughly 9000 ft., more than a mile down, almost 2 miles down there. You can see once again we are all green, but we're even more homogenized here. The whole world ocean has a signal that's barely more than half of a salinity unit here between  $34 \frac{1}{2}$  and 35. So it makes measuring this a challenge; we can do that now, but it makes it a challenge to measure it and try to decide what the properties are, and how they got there, and what we can learn about the circulation by looking at the salinity signal.