Tales from a Grad Student: Shallow Overturning Circulation Transcription

Here I want to talk little bit more about salinity that's not that small, but it is a smaller phenomenon. As we discussed it changes with depth. There's not only the circulation on the horizontal plane, there's the deep water formation that I already mentioned. But I'm particularly concerned with the so-called shallow overturning circulation. There are different parts to this overturning circulation. Generally it brings healthy water below the surface towards the equator at depths of 100-150 meters, and brings freshwater from the equator in the subtropical region, which is the SPURS region.

This is a schematic of evaporation minus precipitation. A positive value or this red area loses freshwater at a net effect. This blue region gains freshwater on a net effect. You can see that the pattern of sea surface salinity follows this pattern pretty closely, but it displays somewhat to the north which is an indication that there are ocean processes that basically push water from the fresh area into this region.

We'll look at this graph which is a little bit more quantitative. This is a plot that shows latitude from north to south; it shows freshwater transport. Dashed is the atmosphere and the solid line is the ocean. Whenever you have a positive value—this is the zero line—that means you bring freshwater to the north; when you have a negative value, you bring it to the south. For easier understanding I re-marked the atmosphere as arrows. As you can see the atmosphere constantly moves freshwater out of the SPURS area. The ocean compensates for that and brings freshwater in from the north to the south.

This is a … I'm sorry, it's the other way around. Here's south and here is north. You can basically trace how the high salinity, that you see in the middle of the North Atlantic, gets subducted and brought towards the equator, and how from the equator you bring freshwater in the region of the sea surface salinity maximum. This is basically what I wanted to investigate. Again this is an average PSU.

We had the opportunity to use this sensor which is a CTD. Generally, when you are on a research ship you'll go to your station, and then you'll lower your sensor over the side of the ship while you rest in the same position, lower the sensor, get it back up, and then go to the next station and repeat that procedure. In fact you obviously need a long time. These things are usually done at very deep profiles. You don't get a very good horizontal resolution. This instrument is basically like a little fish. It undulates between the surface and a certain depth which can't be too deep, obviously. But it undulates while the ship is moving at 8 knots. It gives you an amazing horizontal resolution that you cannot achieve with a regular CTD. We're measuring temperature, pressure, and conductivity here. From those variables we can deduct the salinity of seawater.

I'll give you a little sneak-peek on the data we collected on the Spanish cruise. It's really amazing how variable this area is. When you look at maps like this, and I'm going to skip back here for a second, you see maps collected over long time spans over many, many cruises. They are heavily averaged to yield this smooth depiction. If you actually go there, I think the salinity is even more impressive. These are features that I'm very interested in and I'm working on currently. You see these intrusions of fresh

and warm water in an area where I wouldn't have expected them. They form very strong gradients. It might be very important to the variability of this region. It was thought to be a very quiescent region.