SPURS_Webinar 2: Q&A Transcription

SPURS_Webinar 2 (3/5/13) – Question and Answer Section

Website for this webinar: http://cosee.umaine.edu/programs/webinars/spurswebinars/spurswebinars2/

Video: http://vimeo.com/61218997

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

Question: As Greenland's ice caps melt, are there predictions on how this is going to effect thermohaline circulation patterns over the next 100 years?

Dr. Schmitt: Yes. There's quite a bit of modeling work done on that. The speculation is that as it freshens the waters around Greenland, they'll be less prone to sinking, and there'll be less deep water formation. It will be slowing down the thermohaline circulation. However that's a controversial topic. It depends on how strong the mixing rate is. So there is quite a bit of work being done on that topic.

Question: Wouldn't the depth of the ocean basins also contribute to the salinity difference between the Atlantic and the Pacific?

Dr. Schmitt: Well, the depths are not all that different. I think it's actually more of the width of the ocean. The Atlantic is relatively narrow compared to the Pacific. That means when you have the continental air blowing in off the Sahara at the trade wind latitudes and in off the continental US at mid-latitudes, you have dry continental air. It tends to absorb more water. It takes about a 1,000 km. before the atmosphere has about as much water as it is going to hold.

So when you have a narrower ocean, a greater percentage of the ocean is under the influence of continental air. That's the case in the Atlantic. Whereas if you have a very wide open ocean like the Pacific, only a modest fraction of it is under the influence of dry continental air. So I think it is more of the width of the ocean rather than the depth of the ocean that causes the Atlantic to be saltier.

Question: Why are hurricanes formed where the ocean is most salty?

Dr. Schmitt: They actually are formed a little bit south of that. They tend to form where the ocean is warmest. Hurricanes sort of track between the heaviest rainfall and the heaviest evaporation regions—so they're somewhere in between there. But they do mainly feed off very warm water. They can often go into salty regions. I will offer one bit of speculation; when a hurricane is growing it depends on how deep the supply of warm water is. In some of those regions that are saltier, such as where we were for the SPURS cruises, in fact we did have a number of hurricanes in our area back in September.

When the water is salty, it tends to have a pretty deep mixed layer. So it has a lot of warm water close to the surface. If you go to other regions where the water is fresher like where the Amazon is flowing into the ocean, it tends to trap the heat right at the surface. You might only have 20 m. of warm water, whereas at another place—a salty place—you might have a 100 m. of very warm water. So when there's more warm water, the hurricane can get more intense. There may be a bit of truth to the idea that saltiness is associated with stronger hurricanes.

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Question: **Is the data that you are collecting with SPURS going to be used to look at the trend towards more and larger storms in the eastern United States?**

Dr. Schmitt: Not directly. We're really just trying to understand the oceanic processes that are controlling ocean salinity. We think if we sort out what the ocean is doing, we'll be able to have a good calibration of what these changing salinity trends really mean for the intensification of the water cycle.

Question: Does the amount of river input and the sediment concentration have any significant effect on ocean salinity?

Dr. Schmitt: That's an interesting puzzle, isn't it? Yeah, the rivers are generally fresher than the oceans. They do in fact carry a bit of salt to the ocean. They end up helping to concentrate salt in the ocean. Why the ocean is salty is rather a complex problem. There are weathering processes going on at the bottom of the ocean: remineralization; the formation of manganese modules. For each given ionic species in the ocean, there's some complex balance of inputs from rivers, inputs from the atmosphere, interactions with the biology within the ocean. Every ion, sodium, chlorine, bromine has its own interesting story to tell. But it so happens that in general the ocean is about 3 ½ % salt. Part of the way it maintains its salinity is the flow of salt from the rivers.

Question: If the oceans in general are getting saltier, is that going to affect or exacerbate ocean acidification?

Dr. Schmitt: There is one interesting effect of salinity on the ability of the ocean to absorb carbon dioxide, which is the cause of ocean acidification. So when the water is saltier it does absorb a little more carbon dioxide. I did want to clarify one thing; only the salty regions are getting saltier. The fresh regions are getting fresher. The total amount of salt in the ocean will stay about the same. And we have a little bit of dilution going on because of the melting of the ice caps that is causing sea level rise. That's a very small effect. We're not going to see very much change in the average salinity of the ocean. We're just seeing the salty areas are getting saltier, and the fresh areas are getting fresher.

Question: Are you or your team interested in looking at the fresher spots in the ocean as well, because you went to the saltiest ones? Are the fresher spots in the ocean of similar interest to your group?

Dr. Schmitt: Oh yes, absolutely. We like to say that SPURS come in pairs, and we hope to do freshwater SPURS in a few years. Because of the complications on the ocean side it was easier to tackle the salty SPURS before the fresh SPURS. We're hoping in a few years to probably go to a tropical region, and take a look at some of these places where the rain is falling heavily and really causing strong stratification in the upper ocean that will inhibit the mixing. One of the things we are looking at in SPURS is mixing, vertical mixing processes. In the salty regions we expect to have strong vertical mixing, and in the fresh regions we expect to have inhibited vertical mixing, because of these halocline effects on density. So yes, we certainly hope to do a fresh SPURS in a few years.

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Question: If thermohaline circulation slows down, is that going to decrease the amount of carbon dioxide the ocean is able to absorb?

Dr. Schmitt: Yes, I think it would. That's part of what we call the physical pump. There's two ways for the ocean absorb carbon dioxide. One is relying on biological processes, phytoplankton blooms which are being eaten by copepods. The other method is cold water sinking at high latitudes. If thermohaline circulation were to slow down, that would inhibit the absorption of carbon dioxide by the ocean.

Question: Do you have any suggestions as to how to explain the density driven circulation to students?

Dr. Schmitt: Well, I think that if people were able to navigate that map there were a few other little demonstrations, little movies, that I didn't use—I just used one of them; there were some student demonstrations and then other demonstrations as well. I know Susan Humphreys has one of those movies—that density bowl—on the map. Are there other ideas?

Carla: Speaking for the other side, there are going to be on the archive pages for this webinar, there are going to be a lot resources that have been developed already to help teach some of the physical concepts like density and circulation in the ocean related to salinity that we have kind of put together in a little collection. In addition to the resources that are in the map, there are a couple lesson plans, activities, and even blogs that you can explore. If anybody has a specific question on some of that, I can get you in contact with the right people to find something that will fit.

Question: What was your favorite discovery or the most interesting thing you found during the SPURS expedition?

Dr. Schmitt: For me it was finding the salinity to be so high in the SPURS region. When I took my courses as a graduate student in oceanography, we were taught that the salinity maximum was about 37.3 in the North Atlantic. Then when we went out there, and we found it was 37.8 which is quite a big change—quite a bit higher than we expected. So that was the single most exciting thing for me and for SPURS. Of course we deployed a lot of very fascinating instruments which Fred will be able to tell you about next week, but just finding that high salinity was the high point for me. Thank-you.