

# Mixed Layers in the Ocean Transcription

Then we go to the ocean surface. An important concept here is that the ocean very slowly exchanges properties in the interior. One of the ways in which you can detect water characteristics, which I mean heat and salt and other things that I am not going to talk about today (for instance CO<sub>2</sub> and other gases) is really at the surface. So whatever you can see and you can take a profile let's say of the North Atlantic because we are interested in that area, it is really just the surface which is in contact with the atmosphere right above it.

The water that is beneath especially at 2 or 3 kilometers originates from the area that I just showed, from the really Arctic seas. Why this is happening is because we have a strong pycnocline. That just means a high increase in density over a short depth, which basically isolates the surface zone from the deep water.

We're especially interested in this surface zone. That is the zone of the so-called mixed layer where properties tend to be homogeneous with depth. This is where the water mass characteristics are set. Once they leave the surface, and they are not influenced or changed on the surface, they stay relatively constant. This is just another schematic where you can see the deep water layer that I just explained. The pycnocline refers to the density; the thermocline refers to the temperature; the halocline refers to the salinity. In most cases the thermal effect surpasses the effect of salt on density.

So the approximate thermocline is a good way to think about the density. But right now, and it definitely comes out in this graphic, and it is good, is that the mixed layer changes over the seasons, but it also changes with depth. I think that this is kind of a little bit misleading here. You can see here it should be the constant mixed area in the summer which is shallower in general than the winter. In the winter you have more mixing and you have colder temperatures which means you lose heat at the surface, and that makes the water denser it overturning or convect.

This shows the distribution of these properties in the north to south. Again it is just a schematic. But we can see that there's a mixed layer, the pycnocline, and a really deep layer. Here I think that you can see that the waters in the deep layer are only in contact with the atmosphere right over here, right next to the poles. That's where the characteristics are set. That basically works the same as the pycnocline, and these areas of overturning circulation that I am especially interested in called shallow overturning circulation.

We have a very nice video of a computer model that NASA visualized. I'll just let this run for a bit. Keep this video in mind for later aspects. You've probably seen schematics of the ocean that show one or two large arrows. That's just a schematic view of the ocean, an average view of the ocean. This is more of how the actual ocean looks like. There's a lot of turbulence and it's a chaotic system.