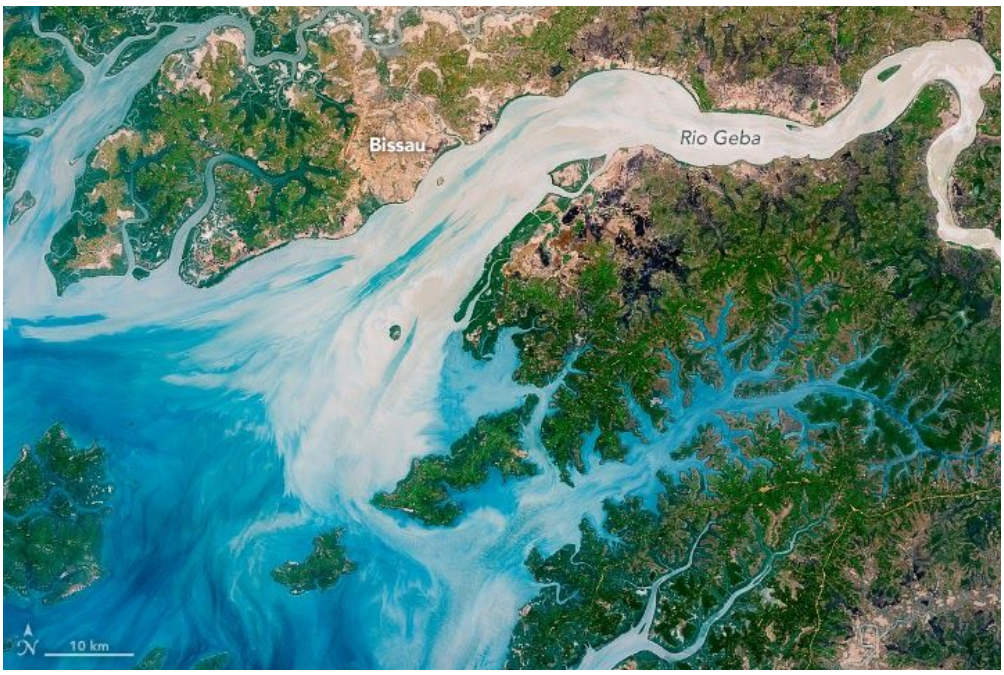
Fluids Lab
COESSING 2020
Exploring Density Currents

Motivation

Salinity and temperature are important drivers of ocean dynamics. In areas near the Equator, warm water sits on top of the ocean surface. In other places, closer to the poles, cold water sinks to the bottom of the ocean because of its higher density. Both temperature and salinity affect seawater density. In some cases, temperature dominates, in others salinity does. Rain also brings freshwater into the ocean, changing the local salinity and creating currents. Estuaries are an area where there is interaction between freshwater from rivers and ocean saltwater.

The competition between salinity and temperature can create beautiful instabilities in the ocean, in other cases, when denser water (either colder or saltier) is below a layer of lighter water (either warmer or fresher), the system is stable and stratified. Global ocean circulation is related to the interaction of water masses of different temperatures and salinity.

This lab investigates the behavior of temperature and salinity on a small scale.



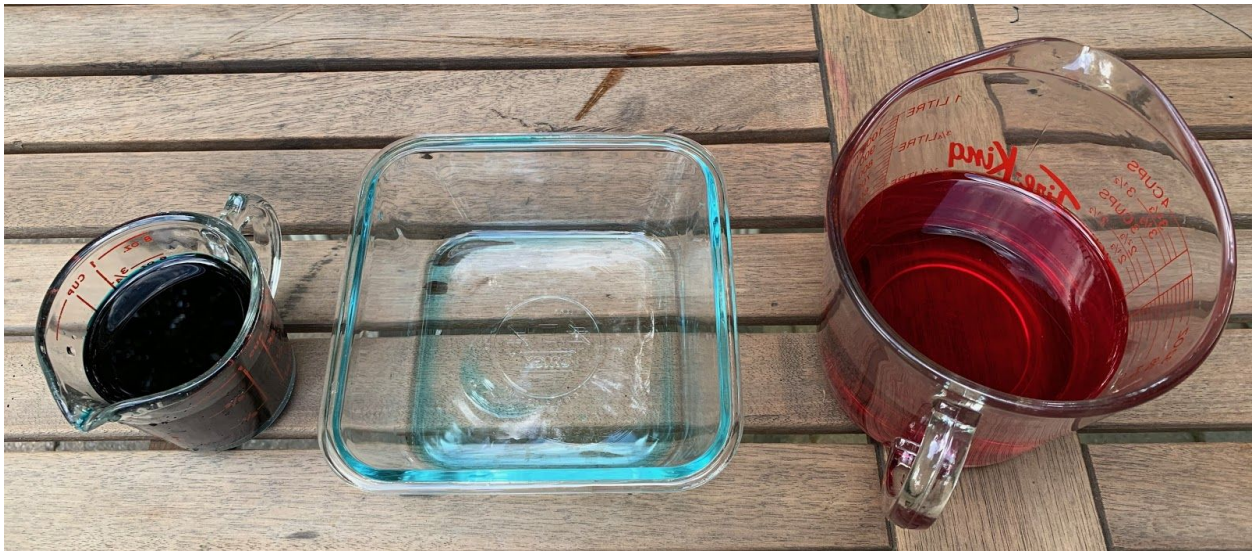
Estuaries near the coast of Guinea–Bissau
(https://earthobservatory.nasa.gov/images/92266/the-meandering-estuaries-of-guineabissau)

Experiments

Supplies: salt, 2 cups, blue and red food coloring and a bowl.

Procedure:

1. Dissolve salt with water in one cup and add blue food coloring to it
2. Warm up water, add red coloring and pour it in the other cup
3. Fill the larger bowl with water



For the experiment, slowly pour salty blue water at one side of the bowl and watch the water settle at the bottom of the bowl. ***Why is that?***

Second, slowly pour the red warm water on the other side. Watch where it goes…

Link to Youtube video: https://www.youtube.com/watch?v=0zPQrjCjTZ8.

Thinking More

In the experiment, above, we visualized the saltier blue water sinking to the bottom while the warmer red water stayed at the surface. What would happen if the top layer also contains some salt? What would happen then? Or if we warm the salty blue layer?

Double diffusion occurs when both salt and temperature are being exchanged between ocean layers. Find more information here: https://www.deepseanews.com/2013/01/ocean-staircases-and-salt-fingers-the-curious-case-of-double-diffusion/

Note - Many of these activities were inspired by Mirjam Glesser's Kitchen Oceanography projects found at https://mirjamglessmer.com/kitchen-oceanography/