PRESENTATION: SEA ICE VS. LAND ICE

When I discuss the physical properties of water with my students one of the issues that comes up every class is how ice forms. Once they understand that the water molecule expands and actually gets lighter and begins to form right at the surface of the water then the next flood of questions arises. Answering these questions always, I mean always, leads to Global Warming and it’s affects on ice loss around the world. In talking to them about Sea Ice vs. Land Ice I lose many students because the idea that Ice floats and the role of buoyancy have not come together yet.

To battle this constant distraction and provide an easy, fun, quick desk size experiment, I have borrowed the following little lab that gets the job done very quickly.

Question: Which melting ice, Sea Ice or Land Ice will have more affect on the ocean?

Materials Needed:

150 ml. beakers (two for each set or group students)

Ice cubes, needed to represent sea ice or land based glaciers.

Large beaker of flask for filling the beakers with water

Finally either a napkin or a Petri dish, or small bowl (one for each beaker)

Process:

Fill one beaker full of ice cubes until they actually are higher than the edge of the beaker. Place on the napkin or in the bowl or Petri dish, and slowly fill the beaker with water until the water is just about to spill out. This beaker will represent the land based ice.

Put 3 or 4 ice cubes in the beaker, place on the napkin or in the bowl or Petri dish and fill the beaker with water (the ice should float freely) carefully until it is just about to spill out. This will represent the great sheets of sea ice that form in the Arctic and Antarctic Oceans during the winter cycles.
Land Based Ice Beaker:

As the ice melts in this beaker in this beaker the water will begin to overflow fairly quickly as this ice is not floating but stuck on the bottom of the beaker which means that it’s weight is not being held up by the water but actually out of the water (ice cubes out of the water) or dragging the bottom like glaciers on land. As the Petri dish gets filled with overflow water or the napkin gets wetter and wetter. This shows that it is the landlocked ice and Ice Caps on Greenland, Antarctica and glaciers all over the world that will affect the depth of the oceans.

Sea Ice Beaker:

What will happen is that the floating ice will melt but there will be no water going over the side. Due to Archimedes Principle or buoyancy the weight of the floating ice cubes has already been displaced in the level of the water. So even as the floating ice melts it will not add any extra water to the glass as it already holding the displaced weight of the ice cubes and will not rise. If this holds true there should be no water coming over the side as the ice melts.

I let the students set all this up at their desks and then continue to discuss the story of ice, and the physical properties of water. As the lecture goes on you can hear the comments as the water in the one beaker starts to overflow and the other just sits there as the floating ice melts.

By the end of the period the idea about how it is the melting land based ice that will cause the sea levels to rise and freshen the oceans, even as the amount of sea ice seems to be diminishing. This also leads to further discussions of how the sun’s energy is stored in the water (heat capacity) as more and more of the sea ice does not return each year. This means that the oceans will get warmer and warmer and the land based ice will begin to melt faster which will lead to the level of the seas rising. It really gets them involved in what is usually a mundane lecture on the properties of water and chemistry.