**Glaciers, Icebergs and Sea Level Rise:**

**The effect of global warming on polar bears, penguins and people**

***The main thing I want you to remember is that the Arctic and Antarctic regions are poles apart in their response to global warming.***

1. *Globes and critters* 
   1. You’ll need globes, models or pictures of polar bears and penguins, maps of the Arctic and Antarctic region.
   2. Students need hands on time with globes – unfortunately, inflatable globes often do not represent the poles clearly.
   3. Questions to consider:
      1. Which pole has ocean, which has land?
      2. Where do polar bears live? Where penguins?
   4. Let younger children explore models or pictures of polar bears and penguins Quiz them on which animal lives where. Have them act out behaviors like:
      1. Polar bear: jumping on ice, walking on all fours, swimming like dog
      2. Penguin: waddling, sliding on tummy, swimming like it’s flying
   5. Have students do cut and paste worksheet, and color in as desired.
2. *Glaciers and icebergs* 
   1. You’ll need two tanks of water – ice floats in one, and melting ice runs into the other from some external surface. You can do this with soda bottles as demonstrated today.
   2. Questions to consider:
      1. If ice suspended above water melts, will water level rise?
      2. If floating ice melts, will water level rise?
      3. Which experiment represents which pole?
      4. Which experiment is a glacier, and which an iceberg?
   3. Most students expect the water level to rise when the floating ice melts. Discuss how much they expect it to rise, and why. Point out that most of the ice is already in the water.
   4. Have the students predict whether water level will rise, fall or stay the same in each tank. I like to have them vote on a tally sheet. It takes a few hours for ½ liter of ice to melt, so you may want to set up the experiment and return to it. Using warm water may help the ice melt faster.
   5. Close the loop – when floating ice melts, water level does not rise AT ALL.
   6. Watch the online video of this experiment, listed below.
3. *Effect of global warming*
   1. Arctic ice is melting quickly
      1. Ice is only a few meters thick to start
      2. Melting pale ice reveals dark water (demonstrate with globe)
      3. Dark water absorbs sun & warms faster
      4. Vocabulary: albedo, positive feedback
      5. Arctic ice may be gone in your lifetime
      6. Polar bears may go extinct
   2. Antarctic ice is melting slowly
      1. Ice is almost 5000 m thick
      2. Melting ice reveals more ice => no change in albedo
      3. Will not melt completely in 1000 years
      4. If it did melt, sea level would rise about 65 m (see calculation below)
      5. Partial melt => coastal inundation in North Carolina
      6. Warm water endangers penguin’s prey

*Maximum Potential Sea Level Rise*

It is not hard to estimate the amount of sea level rise if all the ice in the world melts. Remember that the ocean is 4,000m deep on average, and that about 2% of the world’s water is frozen. If all that water were on land (and most is), then melting the ice would cause sea level to rise by 2%, or 80 meters. The official maximum sea level rise is about 65 meters, so the rough calculation isn’t bad at all.

For comparison, Raleigh is about 100 meters above sea level, and the empire state building is almost 400 meters tall. So, apocalyptic visions of mountaintops showing above a global ocean are just fiction. Remember that this simple calculation is based on melting ALL the ice in the world – that’s actually unlikely to happen in the next 1000 years or so.

**Resources**

* A great demonstration of the different effects of melting icebergs and glaciers

<http://oceandrilling.coe.tamu.edu/curriculum/Sea_Level/Ice_Volume/activity.html>

* Maps showing elevations and regions at risk to different sea level rises

<http://www.globalwarmingart.com/wiki/Sea_Level_Rise_Maps_Gallery>

* My web page on global warming and sea level rise

<http://cynthiacudaback.org/Bootkext/WhatCanIDo/GlobalWarming/GlobalWarming.html>

* A source for in-class presentations on climate change and other ocean topics

<http://OceanAndYou.com>