POLAR PARTNERSHIP

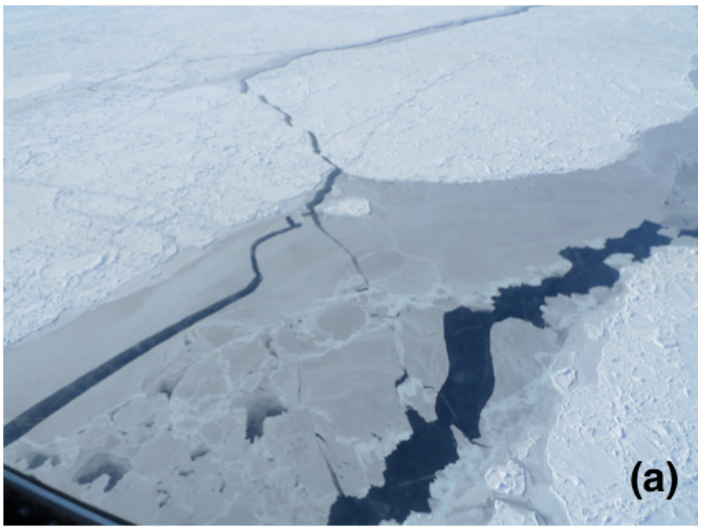
PUZZLING OVER ARCTIC CLIMATE

ENGAGE: Introduction to the Arctic Map (as a puzzle or map)

As a class or in small groups discuss and record responses on the map page

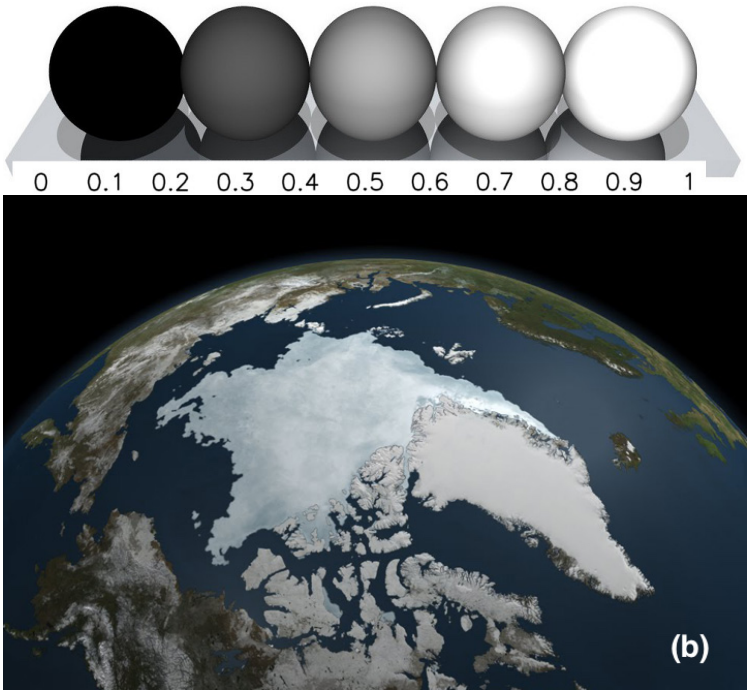
- Do you know what ocean you are looking at?
- How does this differ from what you expected to see?
- What do you see that you wonder about when looking at the map?

After recording responses share & discuss as a class.



EXPLORE: What is Sea Ice?

The Arctic is an ocean encircled by land. Countries including the U.S., Canada, Greenland, Russia, Iceland, Finland, Norway and Sweden wrap around the outside of the Arctic Ocean. For most of us when we think of the Arctic we think of cold and ice. Most of what we are thinking of is actually **sea ice**, ice that forms on the surface of the ocean. Just 40 years ago, in 1980, this ocean was almost completely covered all year round by a layer ~ 12 ft. (3.7 meters) thick of floating sea ice in the central Arctic! The Artic was a very large, very thick surface of white.



However since 1980 the Arctic has changed. Photograph (a) is of Arctic sea ice from March 28th, 2012. It shows sections of open water and thinning ice. In March the Arctic is still pretty cold, but 2012 was a record year for Arctic sea ice, and not in a good way! It holds the record seasonal low for Arctic sea ice minimum.

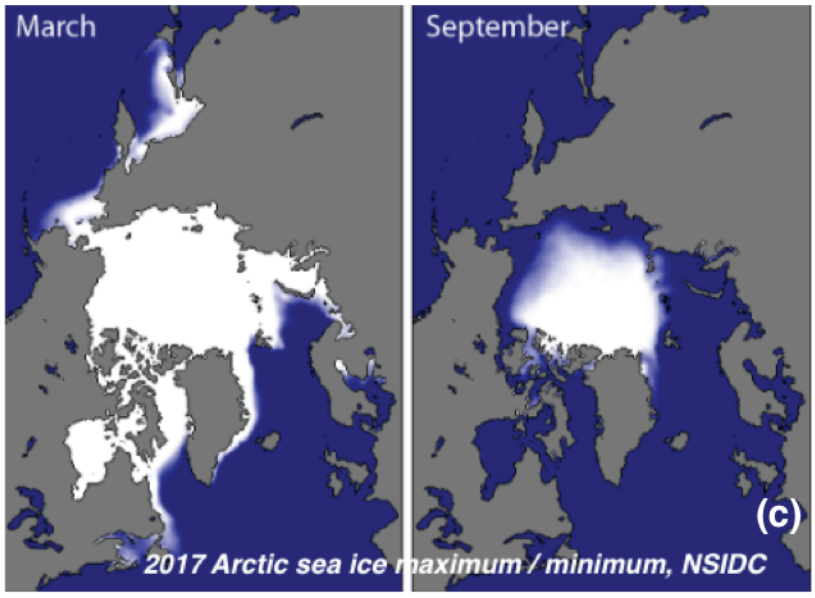
Albedo is a measure of surface reflection of solar radiation, how much light energy bounced off and how much is absorbed. Polar albedo is part of what has been stabilizing Earth's climate for thousands of years. Ice and ocean

water have albedo ratings based largely on their color, with different amounts of the sun's energy being reflected or absorbed. Think about when you go outside in the middle of the day in the summer, what color shirt would you prefer to stay cool in white or dark?_____ In the graph on the top of image (b) white has a high reflective rating of 1 and black is not very reflective and has a low rating of 0. Examine image (b).

Using Image (b): What do you think, is the color of ice or the color of ocean water is more reflective of solar radiation causing less energy absorption? _____
Use the albedo numbers shown to estimate the albedo for sea ice _____
Now estimate the albedo for the ocean _____

Now build a prediction that <u>includes your reasoning</u>. What would you predict what be the climate impacts in **your community** of loss of Arctic sea ice cover?

_____



EXPLAIN:
Arctic Change
On September 16th, 2012 Arctic sea ice reached an all time low, a full 49% below the 1979 to 2000 average. That's a loss of almost half the sea ice!
Image (c) from the National Snow and Ice Data Center, shows an annual sea ice maximum and minimum from 2017.

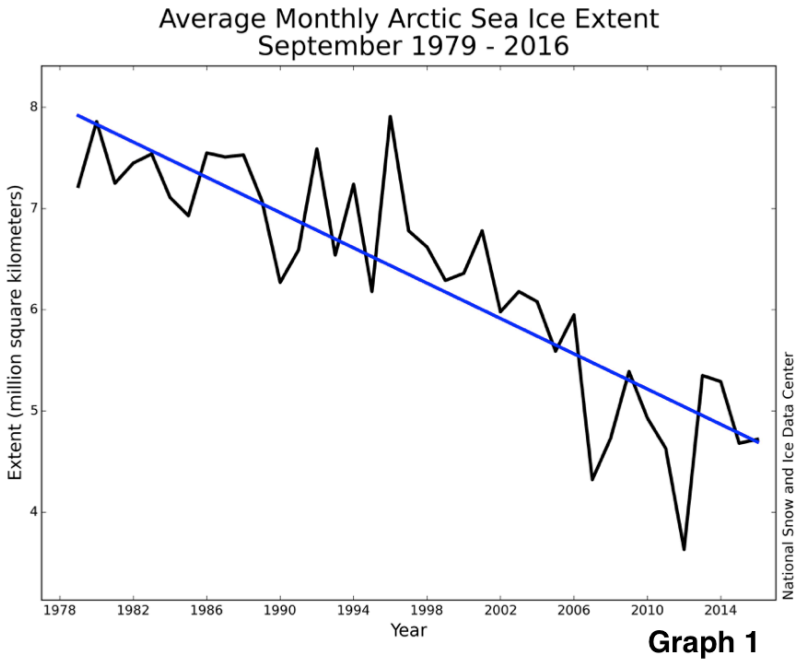
We would expect there to be seasonal variability in ice cover in the Arctic. Many Arctic residents even make estimating the percent of sea ice cover it into a game and bet on what date will have the lowest sea ice cover! Look at these pictures of sea ice seasonality and consider why these months would be selected to show sea ice extremes. What do you think?

Before you answer you might want to consider what happens to temperatures during the day where you live. Consider when the hottest time of the day is – you can use this site to see: https://www.wunderground.com

Consider why this would be. Now consider when the coldest time might be. Now think about how this relates to Arctic Sea Ice. Why do you think they selected March & September: _____

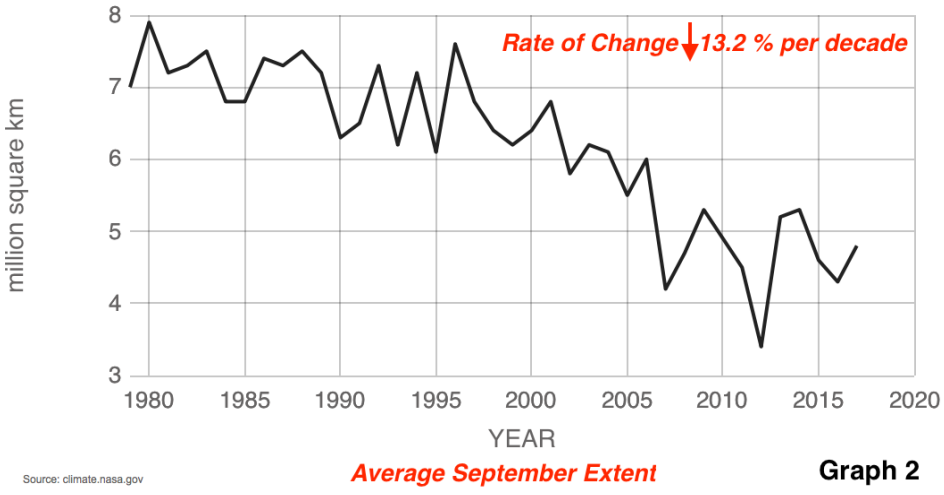
_____

LEARN FROM AN EXPERT ABOUT SEA ICE:
Arctic Sea Ice Continues a Trend of Shrinking Maximum Extents from NASA Goddard with Dr. Claire Parkinson (3:22 min video)
https://www.youtube.com/watch?time_continue=202&v=4VvSQZ3FnXQ



Graph 1

EXTEND: This graph by the National Snow & Ice Data Center is based on data collected from satellites that measure sea ice extent. Use the graph to describe what's happened with sea ice in the Arctic in the last 35 years?
According to this graph which year was sea ice extent the highest? _____



Graph 2

Now look at this graph of sea ice area from NASA based on the same satellite data.
According to this graph which year was sea ice extent the highest? _____

Do you notice any other differences between the two graphs?

Circle year(s) where you see a difference between the two graphs.

The data source is the same so why do they differ? It has to do with different recording practices. Simply stated both **extent** and **area** are based on a grid that looks at a certain percent of ice cover in an area, but ***extent*** will include everything within the outer boundaries of that calculation, while ***area*** will exclude sections within the grid that do not have the necessary percent coverage. It's a bit like looking at a piece of Swiss cheese and measuring its **extent** by the outer edges, or its **area** by subtracting the space in holes.

Consider why each of these approaches might be important. Respected science institutions may differ in how they record things. If you were asked to give a presentation on climate change focused on changes in Arctic sea ice to your science class, consider which graph would you select to use in your presentation and why?

EVALUATE:
Think about the NASA video clip. Review the ice cover using the puzzle or the map looking at 1980, 2012 and projecting into the future for 2050.

On the second page of the worksheet the map on the left is historic sea ice cover from The National Snow & Ice Data Center records, and the map on the right is projections for sea ice cover 2050-2059 from scientists who work on sea ice research.

Imagine the Arctic Ocean in the year you were born. What would it have looked like? Would sea ice cover have been closer to 1980 or 2012? You can look back at Graphs 1 and 2 to help you think of this. Now consider your parents and when they were born.

Compare today to the 2050 Arctic.

- Can we change the projected future for Arctic sea ice cover?
- What can we do to make a difference?

Make a Commitment to take action! Review the "What more can you do?" sheet of choices and put your initials under the item(s) you are are willing to commit to do. Every action has an impact so your choices matter!

ONLY COMMIT TO DOING SOMETHING THAT IS NEW FOR YOU. IT IS IMPORTANT TO CONTINUE TO DO THE GOOD THINGS YOU ARE ALREADY DOING, BUT ADDING TO WHAT YOU ARE ALREADY DOING WILL CREATE A DIFFERENCE!

ADDITIONS ITEMS TO CONSIDER:

- Visit the CUSP website (http://cuspmap.org/NYC/) and look at what is being done around NYC. Are there things you can add to the map?

- Read the short write up on Morgan Turner and how she is making a different as a "Surplus Steward"! What can you do the help with reducing what gets tossed? This might not seem like a direct link to climate but by reducing our consumption by reuse we save energy!