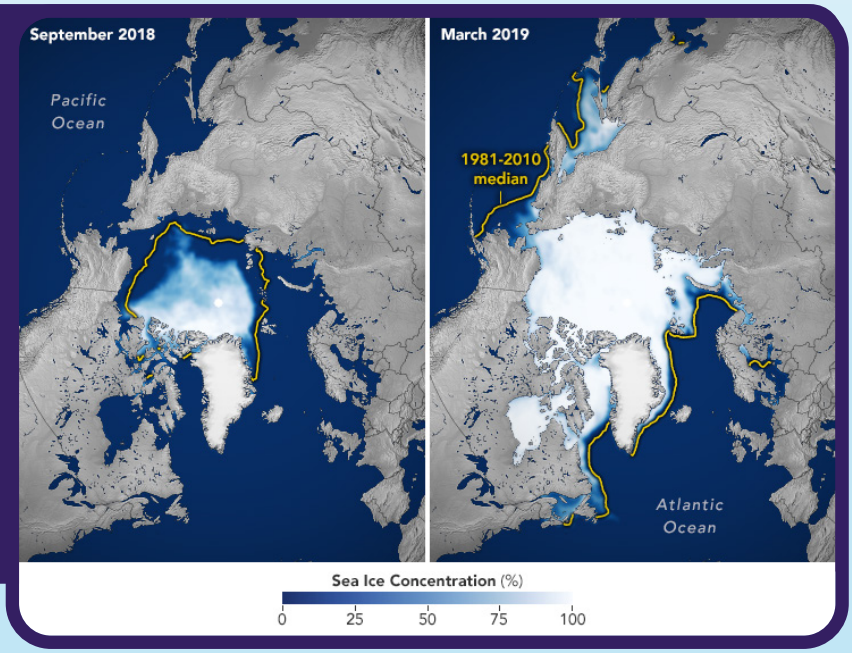
eo kids
earth observatory for kids

Making and Melting Ice at Earth's Poles

Around the poles of Earth, there is no Elsa using her magic powers to freeze the ocean. Instead, cold winds and months of darkness do the trick. When seawater freezes and floats on the surface, it is called sea ice. This type of ice is seasonal in the Arctic and Antarctic – growing in the winter and shrinking in the summer for each hemisphere. This floating ice influences polar ecosystems and weather, as well as global climate.

Arctic Sea Ice

Sea ice around the Arctic usually covers about 14 to 16 million square kilometers (5.4 to 6.2 million square miles) each March. It shrinks to about 7 million square kilometers (2.7 million square miles) by the end of summer. September 2019 brought one of the lowest sea ice minimums in 40 years. The sea ice cap shrank to almost 4 million square kilometers (1.6 million square miles).



How Does Sea Ice Form?

Summer: Sea Ice Minimum

Throughout the summer months – when the poles are warmest and brightest – sea ice melts and breaks up. The melting usually ends by September in the Arctic and February in the Antarctic. This is known as the sea ice minimum. However, not all sea ice melts each summer. There is typically some left around both polar regions.

Winter: Sea Ice Maximum

During the winter months – when the poles are coldest and darkest – the water on the ocean surface starts to form tiny ice crystals. These crystals get pushed together by waves and currents, forming chunks of ice that freeze together. In the north, Arctic sea ice usually covers the greatest area in March. In the south, Antarctic sea ice cover is greatest in September. Scientists call this the sea ice maximum.

Vocabulary

hemisphere – Half of Earth. The equator divides Earth into the Northern and Southern Hemispheres.

polar – The areas around the North and South Pole.

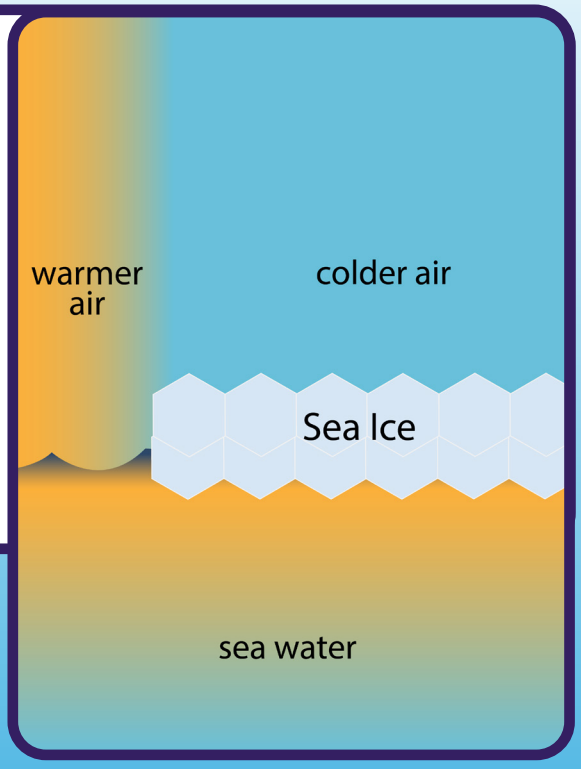
Why Is Sea Ice Important?

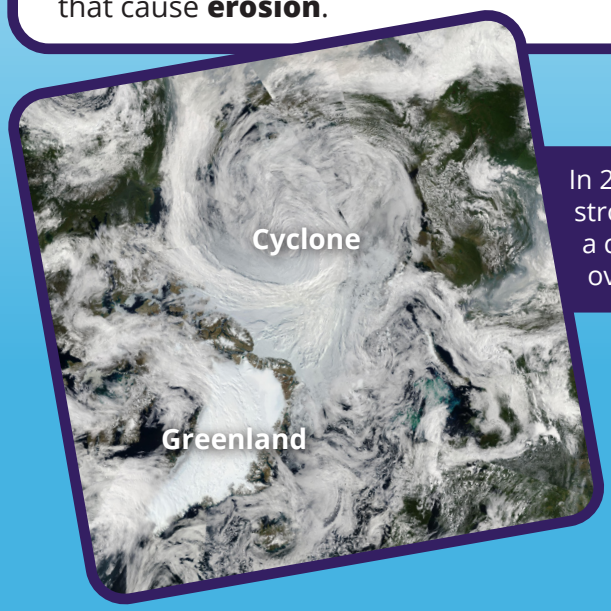
Weather

Sea ice affects weather because it separates the water below the ice from the air above. Just like a lid prevents water in a container from escaping, sea ice acts like a lid, preventing heat from escaping and warming the air above. This helps the air above the ice stay cold and dry.

The cold air around the poles affects how air moves around the entire planet, changing where clear skies and storms move around Earth.

Sea ice also can work like a barrier to coastlines, protecting beaches and ice shelves from wind and waves that cause **erosion**.





In 2012, a rare strong storm called a cyclone formed over the Arctic.

Ecosystems

Ocean life thrives near the edges of sea ice. Melting and freezing help circulate nutrients. The sinking of denser saltwater also stirs up nutrients from the depths. The nutrients nourish tiny marine **organisms** called phytoplankton. These nutrients and abundant summer sunshine make phytoplankton thrive near the surface. Phytoplankton are the beginning of the food chain for many marine animals, including fish and krill, which become food to larger animals like penguins and orcas.

In the Arctic, phytoplankton blooms appear as swirls of green and turquoise in the blue ocean water.

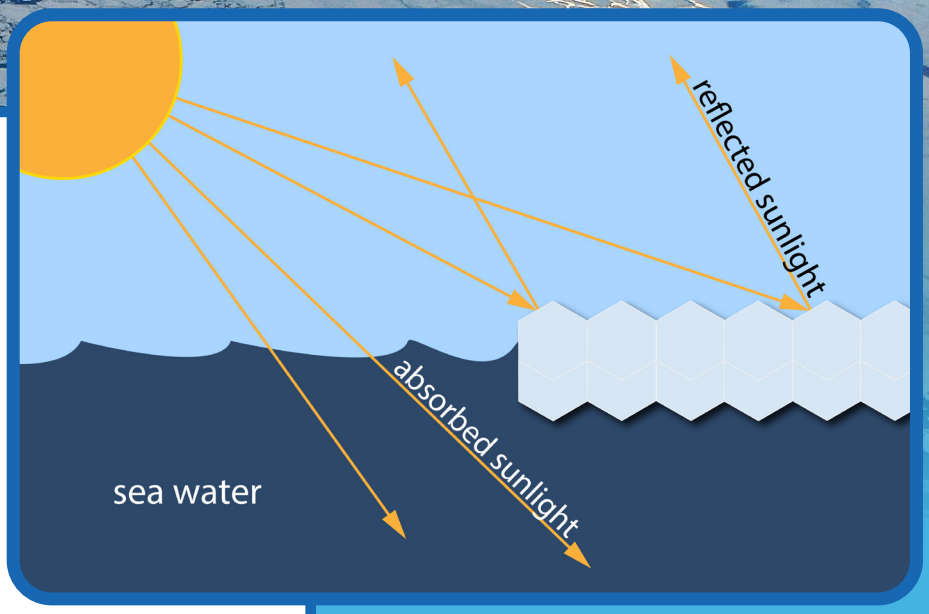
Vocabulary

erosion – Breaking down of Earth's surface through mechanical or chemical processes.

organisms – Any living cell, plant, or animal.

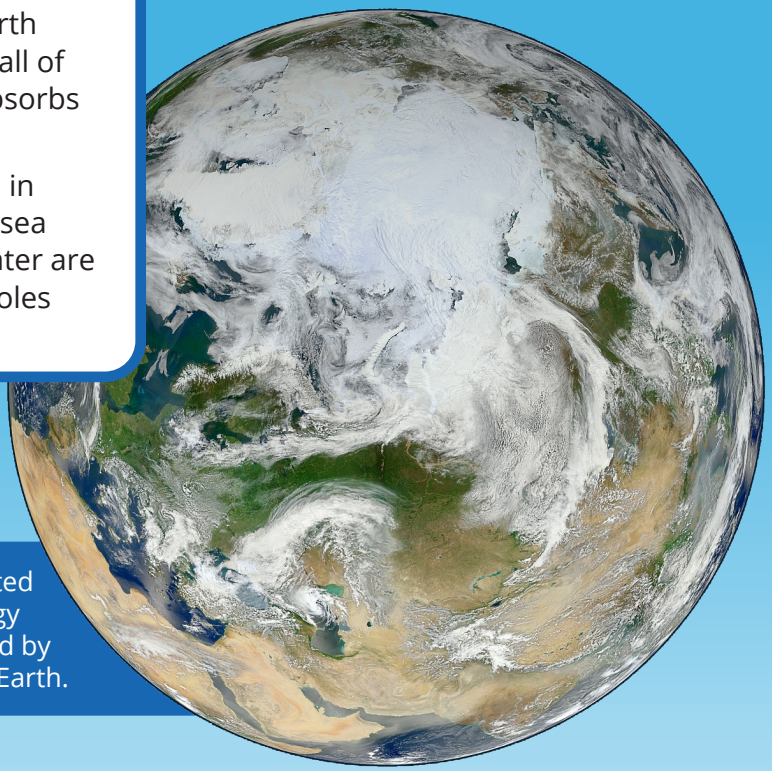
Air Conditioning for the Climate

Earth's climate is driven by how sunlight is reflected and absorbed. Light-colored materials reflect sunlight, making it cooler, and dark materials absorb sunlight, making it warmer. If you've ever worn a black shirt on a hot day, you have probably felt the warm sunlight being absorbed by your shirt. If you wear a white shirt, it would reflect the sunlight and keep you cooler.



On Earth, white snow and ice reflect sunlight back into space. When more sunlight is reflected, Earth stays cooler. More sea ice could make parts or all of Earth cooler. However, darker ice-free water absorbs sunlight and makes the water and air warmer.

As the balance of ice versus water has changed in recent years, Earth's climate has warmed. Less sea ice, more melting, and more exposed ocean water are leading to warmer air temperatures near the poles and elsewhere on Earth.



Earth's climate is affected by how the Sun's energy is absorbed or reflected by different materials on Earth.

Sea Ice, Not Sea Level

Sea ice does not influence global sea level. Just like melting ice cubes won't cause a full glass of water to overflow, melting sea ice won't raise sea level because the ice is already part of the ocean.

DIY Science

Saltwater is Cool (Literally)

In your home and in the ocean, freshwater and saltwater do not freeze at the same temperature. Salt lowers the freezing point by a few degrees, which can be the difference between icy or wet sidewalks and ice-covered or open sea water. Now it's your turn to see how saltwater freezes compared to freshwater.

Materials

- ½ teaspoon
- 1 teaspoon
- 1 measuring cup
- Thermometer
- Food coloring
- Salt
- Two equal size containers with lids

Instructions:

1. Measure and pour 1 cup of water into each container.
2. Drop 1-2 drops of green food coloring in one container and 1-2 drops of blue food coloring in the other container.
3. Mix 1 ½ teaspoons salt into the green **solution**.
4. Put a lid on each container and shake to mix the food coloring, water, and salt.
5. Place the sealed containers in the freezer for two hours.
6. After two hours, take the containers out of the freezer and remove the lids.
7. Observe. How does the ice in the blue solution look compared to the green?
8. Measure and record the temperature of each solution. How does the salty green solution compare to the freshwater blue solution? Why?

Vocabulary

solution – A mixture where a substance is dissolved in a liquid.

NASA and other agencies have been measuring sea ice from space since 1979, using specialized sensors that measure microwave energy reflected by sea ice. More recently, NASA has used lidar technology (lasers) to measure the thickness of ice, which can improve our estimates of how much sea ice there is on Earth.

What's Happening?

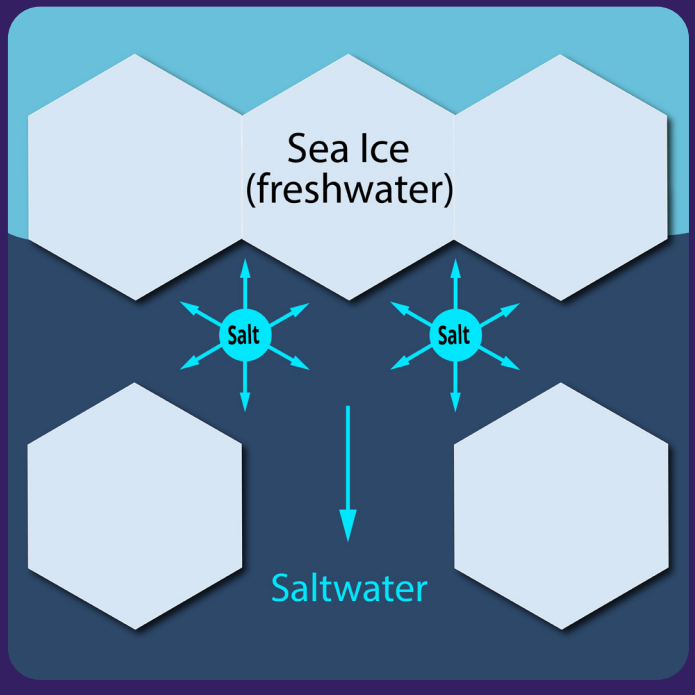
Saltwater freezes at a lower temperature than freshwater. Your saltwater solution is about as salty as the ocean: 3.5 percent. Did you notice the ice formed on the top of the water in both containers? That's because ice is less dense than water, so it floats.

Which Ice is the Coolest?

Salt in the saltwater blocks the ice crystals from forming, which causes the saltwater solution to freeze at a lower temperature. If the temperature is above -2° C (28.4° F), the saltwater will remain a liquid. Freshwater freezes at 0°C (32° F), which is warmer than the freezing point of saltwater.

What Did the Ice Look Like?

You may have also noticed that the ice in the saltwater solution was slushy and ice in the freshwater solution was clear and glassy. Ice crystals are made of freshwater, so in the saltwater, the salt blocks the ice crystals from forming. The salt is kind of like a bully, preventing the ice crystals from joining together, holding their molecular "hands" and making ice crystals. Eventually the ice crystals win, but it takes longer and the ice isn't as uniform as freshwater ice. Some pockets of saltwater get trapped in the ice here and there.



Sea Water Salinity

Salt naturally repels water molecules, preventing them from joining nearby ice crystals. This lowers the freezing temperatures of water. However, when temperatures are cold enough, -2°C (28.4°F), water molecules can join the ice crystals faster than the salt can interfere. The result is ice made of freshwater, with the extra salt being added to the liquid below. This colder and denser saltwater sinks toward the ocean floor and flows in deep currents back toward the equator.