Hvaða áhrif hefur bráðnun íss á sjávaryfirborð? (Nemendaverkefni)

Vangaveltur:

Ef fljótandi ís (ísblokkir og hafís) bráðnar mun þá yfirborð sjávar um allan heim hækka?

Ef landís (jöklar og skaflar) bráðnar mun þá yfirborð sjávar hækka?

Yfirlit

Bráðnun íss á Norður-Íshafssvæðinu

Svæðið á Norður-Íshafi sem hafís hefur þakið um aldaraðir hefur farið minnkandi. Í marga áratugi hefur hafís bráðnað meira á sumrin en það sem hefur frosið á vetrum. Áætlanir sýna að hafið umhverfis Norðurpólinn gæti verið orðið íslaust á sumrin þegar árið 2030!
Hvernig mundi bráðnun þessa hafíssvæðis sem er stærra en Indland hafa áhrif á heiminn?

Bráðnun íss á Suðurskautslandinu

Á Suðurskautinu eru jöklar, jakar og hafís fljótandi í kringum það. Hvernig myndi bráðnun þessara þriggja mismunandi tegunda af ís hafa áhrif annars staðar í heiminum?

Tími
1 klukkustund

Verkfæri

- tveir gengsæir plastbalar
  Um 20 x 15 x 5 cm
- tveir gengsæir plastbalar
  Um 10 x 10 cm
- tveir bollar af fiskabúrsmöl
- tússpenni (permanent)
- mælikanna
- tveir merkimiðar
- litatússpennar

Orðaforð

Ís
Lagís
Jökull
Hafís
sjávaryfirborð

1

Hvaða áhrif hefur bráðnun íss á yfirborð sjávar? (Nemendaverkefni)

Undirbúningur:

<u>Búðu til (frystið) tvo sams konar klaka.</u>

1. Settu vatn í annan smærri plastbalann svo það sé mest u.þ.b. 1 cm djúpt.

2. Mældu vatnið í mælikönnu svo þú vitir nákvæmlega hve mikið þú er með.

3. Settu sama magn af vatni í báða smærri plastbalana og frystu það.

<u>Búðu til tvö líkön af “landi og sjó”</u>.

1. Límdu miða utan á báða stærri plastbalana.

2. Skrifaðu “Ís á landi” á annan þeirra og “Ís í vatni” á hinn.

3. Settu einn bolla af möl í hvorn balann og hagræddu því vel í öðrum enda balanna þannig að það verði “landið”.

4. Helltu varlega 3 ½ dl af vatni í hvorn balann. Vatnið má ekki þekja mölina. (Hún verður að standa upp úr).

5. Í balann “Ís á landi” skaltu setja annan klakann á mölina og hann má ekki ná niður í vatnið.

From Antarctica's Climate Secrets, By LuAnn Dahlman

6. Settu hinn klakann í balann merktan "Ís í vatni" ofan í vatnið og þar má ísinn ekki liggja á mölinni.

7. Nú skaltu merkja með tússpennanum strik utan á balann þar sem yfirborð vatnsins er núna.

8. Nú skulið ræða um hvert við annað hvað hvert líkan merki með tilliti til raunveruleikans. Hvað þýðir hvort líkan í raunverulegum heimi?

Hver er þýðing vatnsyfirborðsins í líkönunum?

Bíddu eftir að ísinn þiðni.

1. Nú eiga báðir plastbalarnir að vera á stað þar sem þeir geta verið óáreittir þar til ísinn hefur þiðnað. Ef þeir eru látnir bíða í meira en nokkrar klukkustundir er nauðsynlegt að láta lok á þá svo vatnið gufi ekki upp.

2. Þegar ísinn í báðum plastbölunum hefur þiðnað skaltu skoða merkið sem þú settir við yfirborðið áður en ísinn þiðnaði. Settu nýtt merki við yfirborðið aftur.

Hugleiðsla…..

Hugsaðu þér þorp við sjóinn með götum, húsum og búðum rétt ofan við fjöruborðið. Hugsaðu þér nú hvernig hækkun yfirborðs sjávar mundi hafa áhrif á þetta þorp miðað við hækkun sjávaryfirborðs. Lýstu því hvað gæti gerst í þarna eftir ár og svo annað ár ef sjávaryfirborð hækkar og vatn þekur meira og meira af landinu.

Skoðaðu nú aftur vangaveltukaflann fremst í þessu verkefni. Reyndu að svara spurningunum um hafísinn, Grænlandsísinn og ísinn, jakana og jöklana á Suðurpólnum byggt á niðurstöðum rannsóknar þinnar sem þú varst að gera.

Hvað með fjörubyggðina?
Notaðu litla hluti til að tákna byggingar, vegi og bílastæði í líkaninu þínu (plastbölunum) sem táknar landið. Hvað gerist eftir því hvaða ís bráðnar? Hafís, jakar eða jöklar?

Activity 3C-How Does Melting Ice Affect Sea Level?

Practice

Got the Big Idea?

When ice that is floating in the ocean melts, sea level does not change. This applies to all floating ice, including sea ice and ice shelves. When ice that is on land melts and runs into the sea, additional water is being added to the ocean, so sea level rises.

Get ready to present

Think of an introductory comment or question you can use to explain what the two models show.

As the ice will likely melt during the Flexhibit, you may want to make a chart with drawings or photographs showing how the two models look before and after the ice melts. Emphasize the observed change in water levels so you can draw a connection to changes in sea level. Another option would be to prepare an extra set of the models so that Flexhibit attendees can see what they look like before and after melting.

Present

When you set up your station, be sure that visitors will be able to see the difference in water levels for the container with ice on land. Be ready to explain that the water level represents sea level for the whole world.

For visitors who are interested and engaged with the concept, you might share some of the estimates (below) of the amount of sea-level rise that would result from the melting of ice in different places.

Ice Sheet	Estimated Sea-Level Rise
Greenland	7 meters
West Antarctica	7 meters
East Antarctica	70 meters

Activity 3C-How Does Melting Ice Affect Sea Level?

Background Information for the Teacher

Ice Shelves are floating extensions of land glaciers that move toward the coasts under the weight of accumulating snow and ice in the interior of the continent. Approximately 44% percent of the coast of Antarctica has an ice shelf. As the ice shelf advances over the ocean, pieces break off forming icebergs. Advance and retreat of ice shelves is a natural cycle, however in 2002 the Larsen B Ice Shelf in the Antarctic Peninsula indicated that the glacier flow was accelerating. For more on the story go to this website.

http://earthobservatory.nasa.gov/Features/WorldOfChange/larsenb.php

The two largest ice shelves in Antarctica are the Ross Ice Shelf (487,000 sq mi/148,437.6 m, 2600 ft/792.48 m thick) and the Ronne Ice Shelf (430,000 sq miles/131,064 m, 3000 ft/914.4 m thick). The Ross Ice Shelf moves toward the ocean at a rate of approximately 3000 ft/914.4 m per year.

When glaciers move onto the oceans they add volume and increase sea level. However, once floating on the water, melting or break up of the shelf does not increase sea level rise.

Sea ice forms when ocean water freezes forming a thick solid sheet of ice that extends away from the shore.During the Arctic winter, 9.32 million sq m/15 million sq km cover the Arctic Ocean region which shrinks to 4.34 million sq m/7 million sq km in summer. For Antarctica, the sea ice extent ranges from 11.8 million sq m/19 million sq km in the winter to 2.17 sq m/3.5 million sq km in the summer. These large ice shelves work to control the heat exchange between the polar oceans and the atmosphere, limit the access of the water underneath to receive sunlight and increases the albedo of the oceans. The sea ice reflects solar radiation which helps keep the planet cool. Many scientists are concerned about shrinking ice because of its effect on climate as water absorbs solar radiation and adds to the Earth's heat budget. Pack ice are large rafts (floes) of ice which extend away from the shore. About 90% of the frozen ocean is pack ice. The other 10% is called fast ice and is attached to the land. Both these sea ice formations support a wide array of life from diatoms to seal and whales.

Fluctuations in floating ice (pack ice, fast ice, ice shelves and the North Pole ice cap) does not affect sea level. For more information on sea ice formation go to the website:
http://earthobservatory.nasa.gov/Features/WorldOfChange/sea_ice_south.php

Glaciers are large amounts of land ice that build up with the accumulation of snow falling over thousands to millions of years. Under the weight of the ice and the influence of gravity, glaciers move toward the coast. As the glaciers move over the surface of the land, they carve landscapes, erode and break up rocks, and carry away the resulting sediments. As the Earth's climate changes over geologic time, glaciers advance and retreat. In the last few decades most of the world's glaciers are retreating.
During cooler times in the Earth's history, glaciers covered large parts of continents and the sea level was lower than it is now. As the glaciers retreated and the ice melted, sea levels rose. When glaciers melt, water is returned to the oceans and sea levels rise.

For more information on glaciers, go to the website: http://climate.noaa.gov/warmingworld/glaciers.html
Arrigo, K. 1998. Antarctic Sea Ice Biological Processes, Interantionc, ad variability, Antarctic Research Series, Vol 73,

How Does Melting Ice Effect Sea Levels		
Students learn the difference in contribution to sea level rise by comparing the melting of floating ice and land ice.		
NSES gr 5-8	CLEP	ELF
EARTH Water, which covers the majority of the earth's surface, circulates through the crust, oceans, and atmosphere in what is known as the "water cycle." Oceans have a major effect on climate, because water in the oceans holds a large amount of heat. The earth processes we see today, including erosion, movement of lithospheric plates, and changes in atmospheric composition, are similar to those that occurred in the past.	2B Changes in ocean circulation caused by tectonic movements or large influxes of fresh water from melting polar ice can lead to significant and even abrupt changes in climate, both locally and on global scales. 4 A. Climate is determined by the long-term pattern of temperature and precipitation averages and extremes at a location. Climate descriptions can refer to areas that are local, regional, or global in extent. Climate can be described for different time intervals, such as decades, years, seasons, months, or specific dates of the year. 4 D. Scientific observations indicate that global climate has changed in the past, is changing now, and will change in the future. The magnitude and direction of this change is not the same at all locations on Earth. 7 A. Melting of ice sheets and glaciers, combined with the thermal expansion of seawater as the oceans warm, is causing sea level to rise. Seawater is beginning to move onto low-lying land and to contaminate coastal fresh water sources and beginning to submerge coastal facilities and barrier islands.	

Glossary

How Does Melting Ice Affect Sea Level?	Glacier	A large persistent body of ice that accumulates over time
How Does Melting Ice Affect Sea Level?	Ice sheet	A large glacier or system of glaciers covering a significant part of a land mass
How Does Melting Ice Affect Sea Level?	Ice Shelf	A floating sheet of ice permanently attached to a landmass.