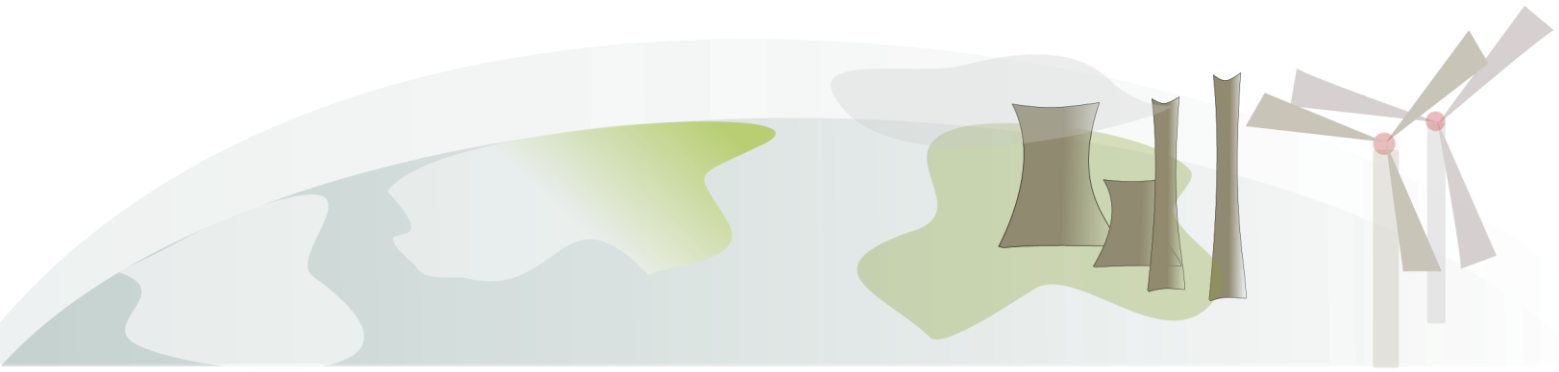

Climate Change – Resources

Thank you for downloading this Climate Change resource from *GeoBus* - https://geobus.st-andrews.ac.uk/

This resource pack was developed in partnership with Dr James Rae and Dr Rosanna Greenop of the School of Earth & Environmental Sciences, University of St Andrews. Special thanks are also due to Rasa Juras for her involvement.

The development of these resources would not have been possible without the generous support of the *GeoBus* sponsors, past and present - which we gratefully acknowledge.

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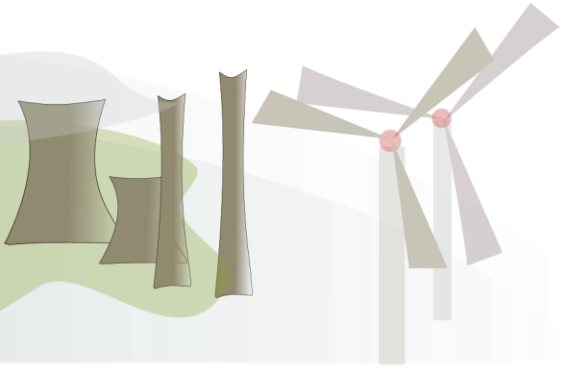
GeoBus

Climate change:
it's happening, it's us, it's serious, it's solvable

Climate Change: it's serious

Sea Level Rise



Overview

Activity Description	The influence of melting ice caps on sea-level will be explored and experimentally demonstrated.
Time	40-50 minutes
Learning Outcomes	• Learn how climate change will impact sea-level • Understand the impact of melting land ice vs sea ice • Explore how different topographies may influence ice-melt
Student Organisation	Groups (discussion)
Materials Needed	Sea Level Rise student worksheet (one per group)
Other resources	Transparent containers (about 20cm x 15cm x 5cm), gravel or plasticine to build land surfaces, coloured white board markers, ice, water, rulers [Optional: monopoly houses, hairdryer, desk lamps] This material was adapted from an Andrill teaching resource, which can be found here: http://cleanet.org/resources/42700.html

Background information

The area covered by sea ice in the Arctic Ocean has been shrinking. For many decades, more sea ice has melted away during summers than has reformed during winters. Projections show that the ocean around the North Pole could be ice-free during summer months as early as the year 2030! The ice sheet on Greenland is also shrinking. Over the past 30 years, the total area of the Greenland ice sheet affected by summer melting has grown significantly and one big difference is that the melting ice sheet is land ice, not sea ice.

In the southern hemisphere, Antarctica has both ice sheets on land, with floating ice shelves, and sea ice surrounding it.

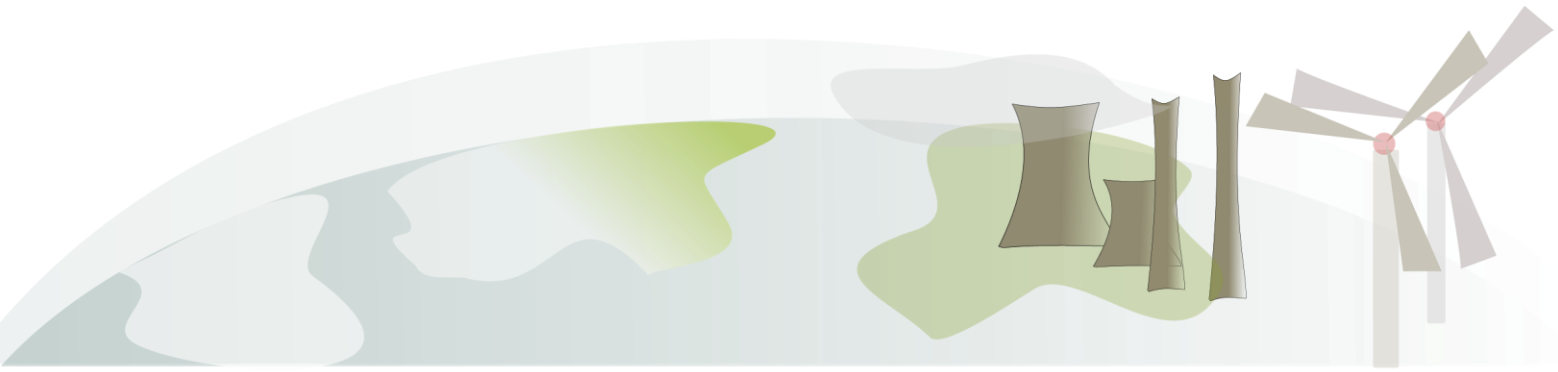
Talking Points

How might the melting of this sea ice (representing an area larger than the country of India) affect the rest of the world?

What effect might melting land ice have? For example, the melting of the Greenland ice sheet.

Use this sea level rise video about Greenland (1 min long) to motivate discussion.
https://www.youtube.com/watch?time_continue=106&v=yLm7PSsvW8g

To summarise, use this video, which further explores the impacts of melting ice sheets (6 mins long).
https://www.youtube.com/watch?v=b6CPsGanO_U



Classroom Activity

In this activity, you will make two ice sheet models that are identical except for one factor – one will have ice on “land” and the other will have ice in the “sea”.

Compare how melting ice influences the sea level in each model.

What you need:

Transparent containers (about 20cm x 15cm x 5cm – plastic takeaway containers are a good size)

Approximately 2 cups of gravel per container, or a largish ball of plasticine

White board markers (ideally 2 per group)

Ice (roughly a handful per container)

Lukewarm water (cold also works, it just takes longer for the ice to melt!)

Rulers

[Optional: monopoly houses, hairdryer/table lamp to simulate warming conditions]

Method:

1. Label the containers ‘land ice’ or ‘sea ice’ – depending on numbers, each person/group can do an example of both (two containers per group), or half of the groups can do ‘land ice’ and half ‘sea ice’ (one container per group)
2. Set up the land in each container so that it comes half way up the side of the tub and there is land at both ends with a gap in the middle – either pour in the gravel and make a pile at each end, or warm up the plasticine and use it to build land forms at either end of the container

   [Note: the land surface should be approximately the same height in all containers]
3. In the ‘land ice’ containers: place ice cubes on to one of the land surfaces

   In the ‘sea ice’ containers: place the same amount of ice in the middle of the container
4. If you are using houses, place them on a land surface (not one covered by ice!)
5. Pour water in to each container so that it just comes up to the level of the land but doesn’t flood over it, and draw a line on the outside of the container to mark the starting water level
6. Measure the water level, making sure it is approximately the same between the land ice and sea ice containers
7. Every 3-5 minutes, record the change in water level and estimate the percentage of ice that has melted

   [Note: to speed up the experiment, simulate rises in global temperature by adding a lamp over the container, or using a hairdryer]
8. After 30 minutes, record the final measurements and mark the new water level using a different coloured marker

Talking Points

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: the floating ice is displacing its own volume already. This is also why melting ice cubes in drinks don't make the drinks spill when they melt.

When ice that is on land melts and runs into the sea, additional water is being added to the ocean, so sea level rises. This means that the melting of land ice will have a much bigger impact on rising global sea levels. It is estimated that if the whole of the Greenland ice sheet melted, sea level would rise by approximately 7m, flooding coastlines around the world.

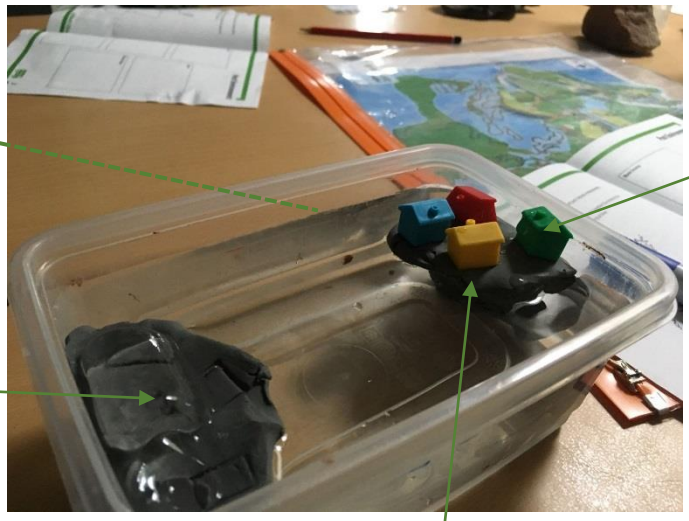
You can explore recent changes in ice cover in Greenland and Antarctica using interactive images at:

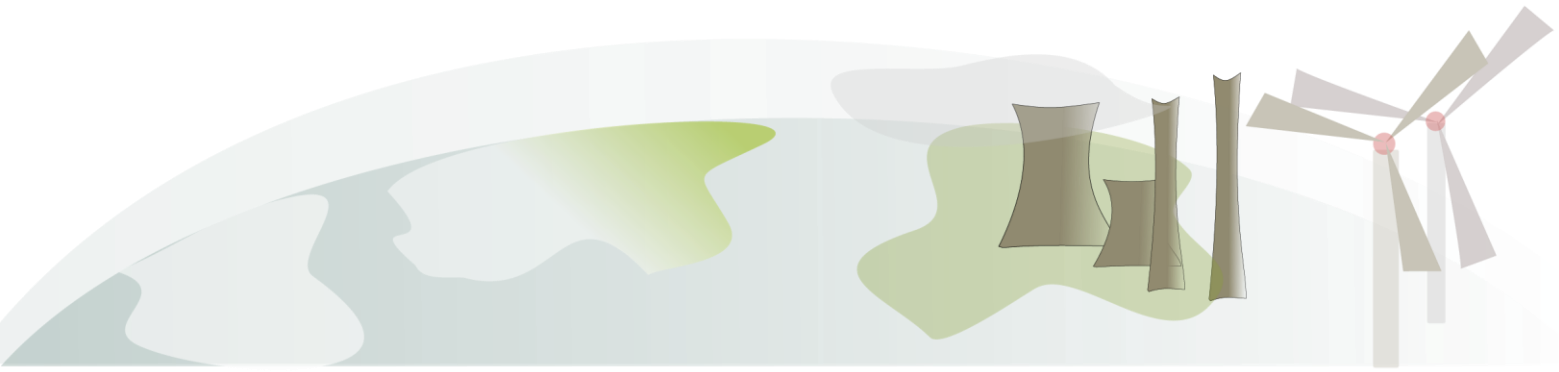
http://climate.nasa.gov/interactives/global-ice-viewer/#/

You can also see the projected influence of different amounts of sea level rise on countries around the world using this map viewer.

http://geology.com/sea-level-rise/

Example of land ice experiment set-up:





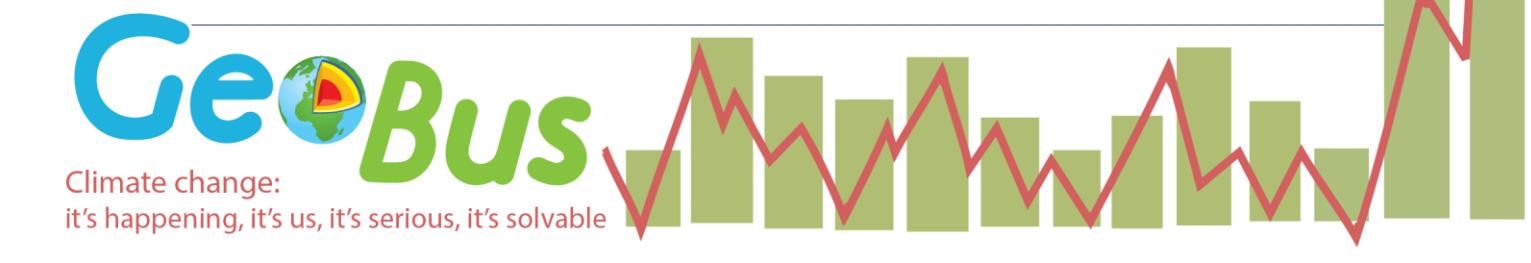
Land Ice vs Sea Ice

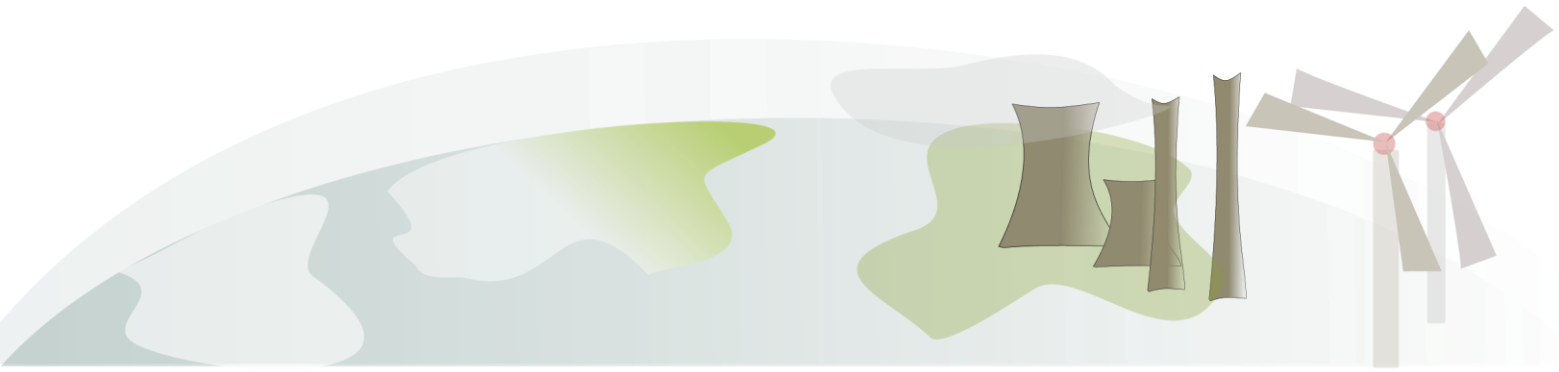
Results table

	Land Ice		Sea Ice	
Time (minutes)	Sea-level rise (mm)	Ice cover estimate (%)	Sea-level rise (mm)	Ice cover estimate (%)

Conclusion

Describe your results: has sea level changed in both containers? How much? Was the rate constant?





Results Graph

Chose an appropriate scale, and plot the recorded data for land ice. Add the data for sea ice in a different colour (if your group only did one, share data with another group).

Title: _____

Sea-level rise (mm)

Time (mins)

☐ Land Ice

☐ Sea Ice