Sea Level Change Experiment

As the world warms up scientists are becoming increasingly worried about ice melting at the north and south poles. But why? What are the consequences for us if this ice starts to melt? Does it matter if the melting ice is on land as a glacier or already floating in the sea as an iceberg?

Find out the answers to these questions and maybe more with this very practical demonstration. Designed to help your pupils visually appreciate the consequences of sea and land ice melt as a result of global warming, this activity will encourage discussion and debate on this topical issue.

Using knowledge gained from this activity, pupils can then extrapolate their findings to interpret the effects of ice melt on Scotland as a whole, its coastal communities and at a more local level too.

At a glance, you will need:

- A waterproof tray with high sides (at least 10cm high)
- A margarine tub for freezing a block of ice
- Access to a freezer
- An object or material to use as an island
- A ruler

Workshop	Title	Pre/Post	Suggested CfE Stage
Climate Change	Sea level change experiment	Pre/Post	Second/Third/Fourth

Learning Intention

- We are learning about how melting ice in our polar regions could change global sea levels.
- We are learning to interpret experimental observations and place them in a local context.

Task

- We will build a model that will represent an island in the sea.
- We will perform an experiment where we can observe the differences between the melting of floating ice or land based ice on our model island.
- We will extrapolate this data to real life situations.

Success Criteria

- Through group experimentation, pupils will be able to demonstrate an understanding of the implications of sea and land ice melt on coastal regions.
- Pupils will gain a greater appreciation of the implications of global warming on Scotland and Scottish coastal communities.

Evidence ideas

- Peer discussion of group findings.

CfE Capacities

Successful Learners:

- with enthusiasm and motivation for learning through combining arts and crafts, physics, maths and geography.
- able to link and apply different kinds of learning in a new situations
- able to make reasoned evaluations through carrying out experiments and extrapolating observations to real life situations

Confident Individuals:

- able to assess risk and make informed decisions on global climate change and the implications at a local level

Responsible Citizens:

- able to develop knowledge and understanding of the world and Scotland's place in it
- able to evaluate environmental and scientific issues
- able to develop informed, ethical views of complex issues.
- able to make informed choices and decisions about our environment and the protection of it

Effective Contributors:

- able to work in partnership and in teams
- able to apply critical thinking in new contexts

CfE Outcomes and Experiences

Social Studies - People, place and environment
Supports:
I can discuss the environmental impact of human activity and suggest ways in which we can live in a more environmentally-responsible way. SOC 2-08a

I can identify the possible consequences of an environmental issue and make informed suggestions about ways to manage the impact. SOC 3-08a

I can identify threats facing the main climate zones, including climate change, and analyse how these threats impact on the way of life. SOC 4-12a

Science – Planet Earth (Processes of the planet)
I can apply my knowledge of how water changes state to help me understand the processes involved in the water cycle in nature over time. SCN 2-05a

By contributing to experiments and investigations, I can develop my understanding of models of matter and can apply this to changes of state and the energy involved as they occur in nature. SCN 3-05a

I can explain some of the processes which contribute to climate change and discuss the possible impact of atmospheric change on the survival of living things. SCN 3-05b

Science - Topical Science
Supports:
I can report and comment on current scientific news items to develop my knowledge and understanding of topical science. SCN 2-20b

Mathematics – Number, money and measure (Measurement)
I can use the common units of measure, convert between related units of the metric system and carry out calculations when solving problems. MNU 2-11b

I can solve practical problems by applying my knowledge of measure, choosing the appropriate units and degree of accuracy for the task and using a formula to calculate area or volume when required. MNU 3-11a

I can apply my knowledge and understanding of measure to everyday problems and tasks and appreciate the practical importance of accuracy when making calculations. MNU 4-11a

Mathematics – Number, money and measure (Data and analysis)
I have carried out investigations and surveys, devising and using a variety of methods to gather information and have worked with others to collate, organise and communicate the results in an appropriate way. MNU 2-20b

Description

Working in groups, pupils will need a watertight tray in which to construct an island. This will be the focus of the investigation. The island must be attached to the bottom of the tray (or too heavy to float) and must be made from non-absorbent materials. Pebbles and rocks are great to act as a base, your pupils can then decorate the top of their island with trees, houses etc. This can really bring home to pupils the effects of ice cap melt on coastal communities.

Once the islands are made, attach a millimeter scaled ruler to the inside wall of the tray using waterproof glue or blu tac then pour water into the tray. Make the water deep enough to float ice cubes in, but not too deep that your island is submerged. This will be your 'model Scotland'.

There are two parts to this experiment, the first is to observe the effects of melting floating ice (i.e. icebergs); the second is to observe the effect of ice melting from land glaciers.

Melting Sea Ice Experiment.
Melting sea ice such as that seen over the Arctic Ocean does not affect sea level rise because the ice is already displacing the weight of the water it contains. To demonstrate this, pupils need to place some ice cubes into the 'sea'. Make sure the ice cubes float and do not touch the bottom of the container. Measure the water level using the ruler attached to the tray side. Leave the tray until the ice cubes have melted, then measure the water level again. Pupils should observe that the water level has not changed.

Melting Land Ice Experiment.
Melting land ice such as that seen on Greenland and Antarctica will affect global sea level because this ice is land based and therefore is not displacing sea water. To demonstrate this, pupils need to place a quantity of ice onto their island above sea level. Measure the level of water as before. Leave the tray as the land ice melts. Pupils could return at intervals to measure the amount of sea level rise as the ice melts. Pupils should observe a measurable increase in sea level. If you wish, this measurement could be used to work out the increase in water volume too.

Important note on sea level rise.
This activity looks at only one aspect of sea level rise, there are of course, others. Ocean thermal expansion is one. As the air temperature rises it warms the sea, causing the sea to expand. This in itself is enough to cause a small amount of sea level rise. The other issue is one of isostatic rebound. Areas of land including Northern Europe and especially Scotland and Scandinavia as well as parts of Canada and the US are slowly rising. Britain is in fact, ever so slowly tilting with Scotland getting higher and southern England sinking slightly. This is because during the last ice age, the huge weight of the ice sheets depressed the land on which they rested. Once the ice melted, the land, released from the crushing weight of all the ice, started to rebound and is still recovering from that depression to this day. We are able to see this effect in Antarctica today. If you were to take a cross section of the Antarctic continent, you would see that underneath the thick sheets of ice, much of the continental land is below sea level, squashed down by the massive weight of all the ice above it.

Web Resources

https://www.cresis.ku.edu/research/data/sea_level_rise/index.html
http://www.geographypages.co.uk/sealevel.htm
http://flood.firetree.net/

Our Dynamic Earth Climate Change poster
http://www.dynamicearth.co.uk/documents/27217%20Climate%20Poster.pdf

Enjoyed this activity? Get in touch at education@dynamicearth.co.uk and let us know how it went. Remember to visit the website regularly for further activities as we are constantly working on novel content to enhance your Dynamic Earth experience both pre and post visit.