

Topics: Properties and uses of materials (reflectivity) / Climate change

Dr Rebecca Ellis, PSTT College Fellow, links cutting-edge research with primary science

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Geoengineering could slow melting of Arctic ice



Figure 1. Foil reflects heat, July 2022 © Mr J Day

The UK issued its first ever heat-health alert in July 2022. Temperatures were above 40°C in some places. The advice was to stay cool indoors, have plenty to drink and close the curtains in rooms that faced the Sun. Some teachers covered their classroom windows with foil to reflect the heat (Figure 1). Scientists worked out that the heat wave was ten times more likely because of **climate change**.

What were people advised to do during the heatwave?

Why do you think this will help?

Climate change in the Arctic

Climate change is happening faster in the **Arctic** than anywhere else in the world. **Average** global temperatures have risen by about 1°C. In some parts of the Arctic, they have risen more than 4°C. There is no land under the ice in the Arctic, just ocean. Some of the ice melts in the summer and it reforms in the winter. This means there is some old ice and some young ice.

NASA uses **satellites** to look at the sea ice. They have found two changes in the last ten years:

1. Summer sea ice has decreased by 13%.
2. There is much less old ice now.

Why do you think the sea ice has changed?

The importance of sea ice

The frozen Arctic Ocean at the top of our world works like a massive sun umbrella. This is because ice (especially the bright, old ice) reflects the Sun's heat. When the ice melts there is darker blue water underneath. This does not reflect the heat as much as the ice. Instead of being reflected, the Sun's heat is absorbed by the planet. Think about the difference we feel wearing a black shirt rather than a white one on a hot day. As sea ice decreases, more of the Sun's heat warms the Arctic Ocean. This causes even more ice to melt. The cycle gets worse and worse. Unless we stop global warming, soon there could be no Arctic ice left in the summers.

Can you find the simile that has been used?

How does it help you to understand why the ice keeps the planet cool?

Without sea ice in the summer, what will polar bears do? They rely on it as a habitat for hunting and breeding (Figure 2). The ice also stops ships being able to disturb marine creatures such as narwhals, whales and belugas.



Figure 2. A polar bear on the sea ice © Andreas Weith



Figure 3. Hollow glass microspheres
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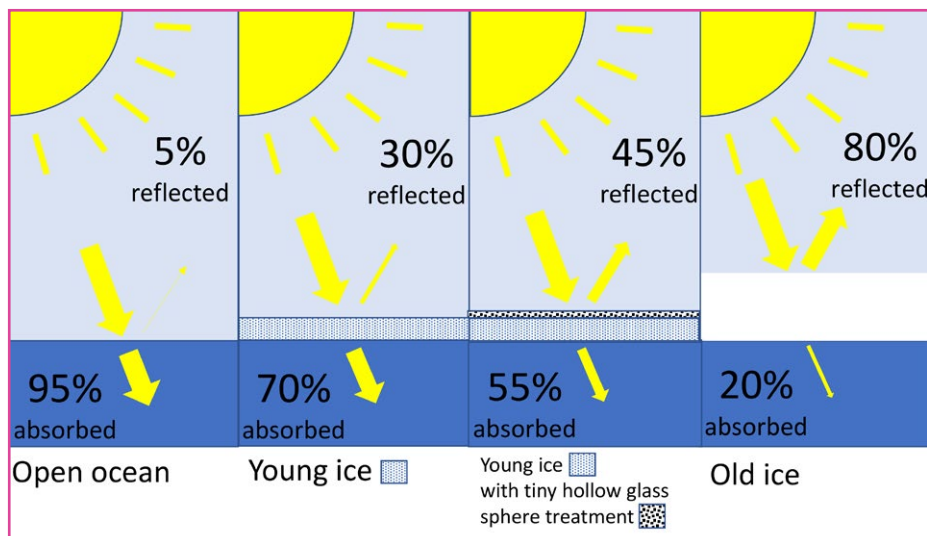


Figure 4. Sunlight reflecting and absorbing © Dr R. Ellis, PSTT

What can we do to protect sea ice?

A team of scientists lead by Dr Leslie Field have been developing a geoengineering solution. They tested a selection of harmless materials to see how much heat was reflected (reflectivity). Then, they covered ice with the most reflective of these materials. They compared how quickly the ice melted. Tiny hollow glass beads (microspheres) were the most effective. This is a common, lightweight product that looks like sand (Figure 3). It is easy to manufacture, transport and spread.

What does the word microsphere tell you about the material?

When a thin layer is placed on young ice, it reflects an extra 15% of the sunlight (Figure 4). This slows down melting. More young ice can then thicken and become bright, old ice. Scientists don't want to put the microspheres all over the Arctic. They would target places where the ice is thin. The longer the ice stays, the less heat will be absorbed.

Can you summarise what the scientists have found out?

Geoengineering in the future

Geoengineering changes nature. We would not normally want to do this. However, climate change is also caused by humans. Many people think it is probably worse to do nothing about it.

Other geoengineering solutions include space reflectors that block the Sun's light or spraying seawater to increase the reflectivity of clouds. There could be unknown side-effects with geoengineering. It would be better to reduce greenhouse gases and limit global warming. However, our progress in tackling climate change is slow. Geoengineering projects might give us time. Indeed, Dr Leslie Field describes her technology as, "The backup plan I hoped we'd never need."

Explain the strengths and weaknesses of geoengineering.

Glossary

Arctic – the regions around the North Pole

average – a calculated 'central' value of a set of numbers. To calculate it, add up all the numbers, then divide by how many numbers there are

climate change – a long-term change in the average weather patterns on Earth

geoengineering (also called climate engineering) – the deliberate and large-scale intervention in the Earth's climate system

heat wave – at least three consecutive days of unusually hot weather

reflectivity – the property of reflecting light or radiant heat

satellites – a moon, planet or machine that orbits a planet or a star

The paper that inspired this work was:

Restoring Arctic Ice: A New Way to Stabilise the Climate.

By Leslie Field and Anthony Strawa.

Published in **Arctic Circle Journal** (9 March 2021), last accessed 1.12.23

Acknowledgement:



This resource contributes to XAIDA – a project supported by the European Union's Horizon 2020 research and innovation programme under grant agreement No 101003469.

Investigations for children are described in the Teacher Guide which can be accessed [here](#).