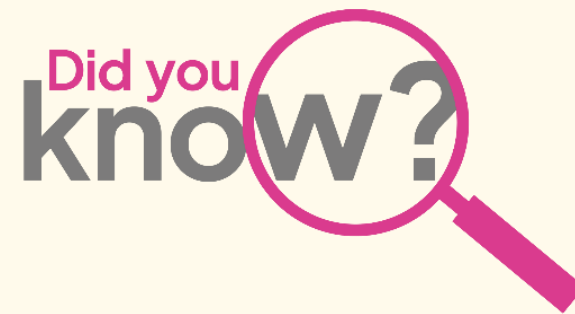# EcoTeachMeet:
Introducing climate and science research to children

25th March 2024

Dr Rebecca Ellis
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Today we will…

1. Look at the Primary Science Teaching Trust's 'Did you know?' resources

   - **FREE resources describing cutting-edge research**
   - **Linked to primary curriculum topics**
   - **Related investigations for children**

2. Try a DRAFT interactive climate model and consider their potential to build climate change literacy in the primary classroom

Did you know?

Topic: Sound / Climate change

Dr Rebecca Ellis, PSTT College Fellow, links cutting-edge research with primary science
rebecca.ellis@pstt.org.uk

Soundscapes can help restore coral reefs

The 'rainforests of the oceans'

Coral reefs are one of Earth's natural wonders (Figure 1). Healthy reefs are a habitat for millions of species, including sea horses, lobsters and sea turtles. The first coral reefs formed 240 million years ago. That's before the dinosaurs were alive. Today's reefs are thousands of years old. Corals attach themselves to the ocean floor so some people think that they are plants or even rocks. In fact, corals are made up of thousands of small animals called polyps. Polyps look like upside down jellyfish. They use their tentacles to catch food from the water. They live in groups called colonies.

Because corals are attached to rocks and don't move, what do some people mistake corals for?

Threatened habitats

Climate change is bad for coral reefs because:

- High levels of **carbon dioxide** gas in the **atmosphere** makes the water more **acidic**. This weakens coral and slows its growth.
- Climate change also brings more storms. This can destroy coral reefs.
- Corals become stressed when water temperature [...] get rid of their algae and turn white. [...] coral bleaching. Coral can [...] **heatwave** if the [...]

Topic: Food chains / Climate change

Dr Rebecca Ellis, PSTT College Fellow, links cutting-edge research with primary science
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Termites can help rainforests survive droughts

Scientists have discovered that termites have an important job in rainforests.

What are termites?

Termites are insects (Figure 1). They live in groups called colonies and eat dead plants, dead animals and their poo. Termites can break down even tough wood into simple materials such as water and useful **nutrients**. Because they can do this, they are called **decomposers**.

Recycling in nature

All food chains start with plants - the producers that can make their own food (Figure 2). The animals that eat plants are called herbivores. Animals who eat plants and meat are carnivores. [...]

What is the word to describe animals which eat plants and animals?

What is the meaning of the word 'nutrients'?

What happens to autumn leaves once they fall off the tree?

Did you know?

Topic: Weather / Climate change

Dr Rebecca Ellis, PSTT College Fellow, and
Prof. Dudley Shallcross, Professor of Atmospheric Chemistry at the University of Bristol, link cutting-edge research with primary science
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It's raining all over the world

Scientists have discovered that extreme rainfall events across the globe can be connected.

Weather watching

Human beings love to talk about the weather. It has a big effect on us. Should we wear a coat? Should we go for a bike ride or go to the cinema? For centuries we watched the weather. We noticed how animals behaved before storms. We looked at the appearance of clouds. However, we could only predict the weather for the next few hours. Then in 1854, Admiral Robert Fitzroy set up the Met Office. **Meteorologists** built weather stations and recorded the weather carefully. They began to understand the Earth's climate and weather patterns.

How did people try to predict the weather before we had weather forecasters?

Are weather forecasts always accurate?

Today, **satellites** in space can look down at large areas of the planet at once. **NASA** say they give us 'eyes on the Earth'. **Supercomputers** also help us make sense of the weather across the planet. Temperatures are used to predict how much evaporation of water will take place. Wind speeds and directions are used to predict how weather will move. The weather can be forecast days or weeks ahead. Huge mistakes are now rare, but they do happen. This can be devastating when we fail to prepare for extreme weather.

Use the glossary to find out what satellites and supercomputers are.

How do you think we get photographs of clouds from above, like those in Figure 1?

Why do NASA say that satellites give us 'eyes on the Earth'?

Figure 1. An image from NASA's Aqua satellite showing a violent storm over Western Europe on 27 February 2010. © MODIS Rapid Response Team, NASA GSFC. Labels of countries added by PSTT.

What is extreme weather?

Extreme weather means weather that is different from what we usually expect. It can be too hot, too cold, or too wet. It can also mean strong winds, storms, and floods. **Climate change** is making extreme weather events more common and more intense. We are now seeing more heatwaves, storms, and floods than ever before (Figure 2). In July 2022, the UK had a **heatwave** with temperatures of 40° C. This was the hottest day ever recorded in the UK. The heatwave caused many problems, including wildfires. In 2019, **Hurricane** Dorian hit the Bahamas and North America. It was one of the strongest hurricanes ever recorded. In the same year, tropical **cyclone** Idai caused floods and landslides in Africa. It was the third deadliest southern hemisphere cyclone on record.

Can 'extreme weather' be dangerous for people? Give some examples.

Did you know?

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

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.

[...] find the simile that has been used?
[...] to understand why the ice keeps

Topic: Trees / Climate change

Dr Katharine Pemberton, PSTT College Fellow, and
Prof. Dudley Shallcross, Professor of Atmospheric Chemistry at the University of Bristol, link cutting-edge research with primary science
katharine.pemberton@pstt.org.uk

Tree restoration now or never

What is climate change?

Can we stop climate change?

One way to slow down climate change is by using **clean energy** (Figure 1). Another way is to replant areas that were once covered by trees but are not anymore. Trees absorb carbon dioxide, so the more trees we plant, the more of this gas is removed. In a recent paper, scientists estimated how many more trees we could grow on the whole planet to try to slow down climate change.

How can we slow down climate change?

How can growing trees help limit climate change?

Primary Science Teaching Trust

Addressing Eco-anxiety

International

National

Regional

Local

- Share & celebrate solutions
- Small steps
- Science → knowledge → improvements

Climate-related articles

- Tree restoration now or never

- It's raining all over the world

- Termites can help rainforests survive droughts

- Geoengineering could slow the melting of Arctic ice

- Soundscapes can help restore coral reefs

Supported by Teacher Guides

Tree restoration now or never
Curriculum link: Trees
Use satellite images to investigate changes in land use

Termites can help rainforests survive droughts
Curriculum link: Food chains
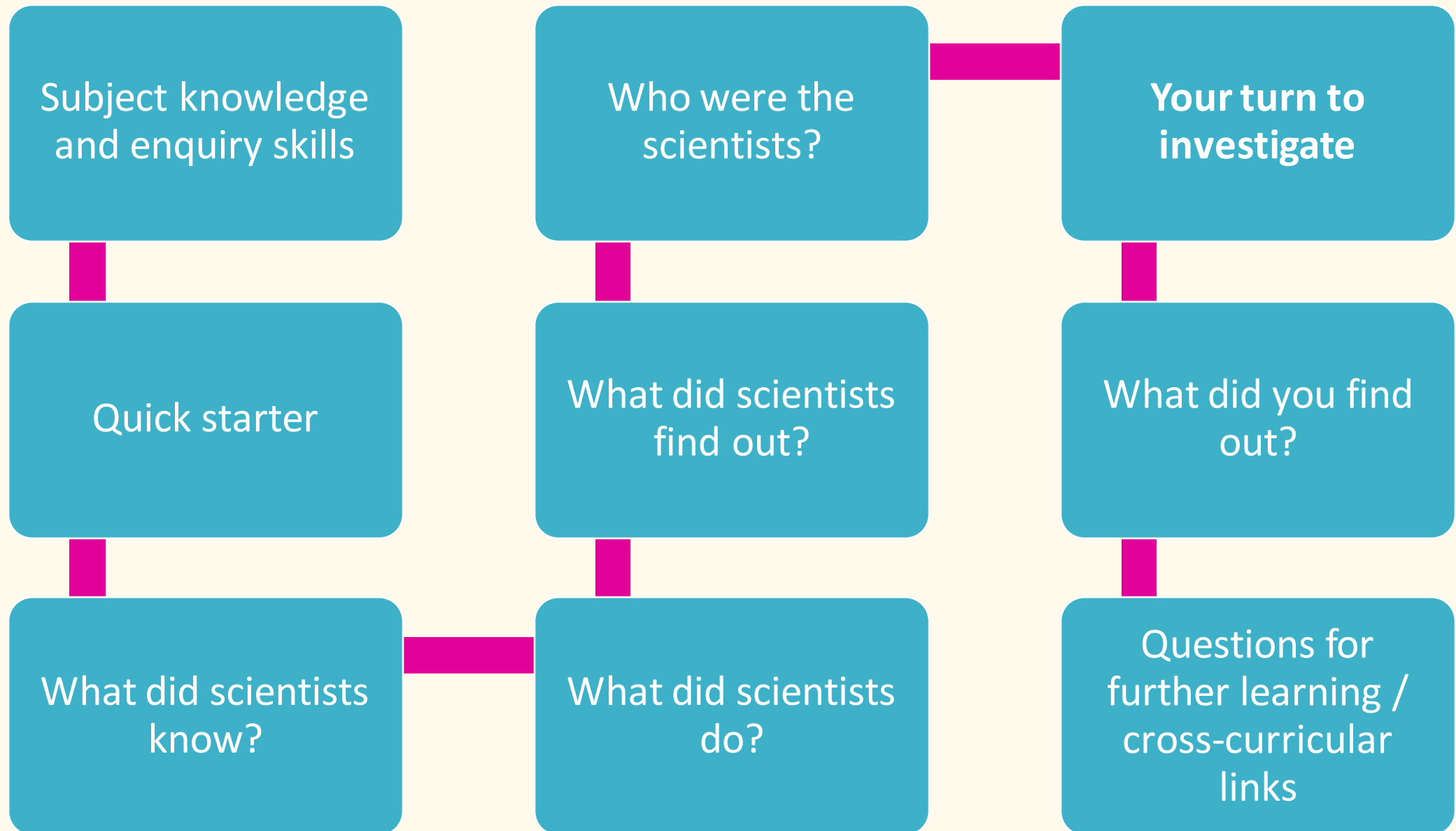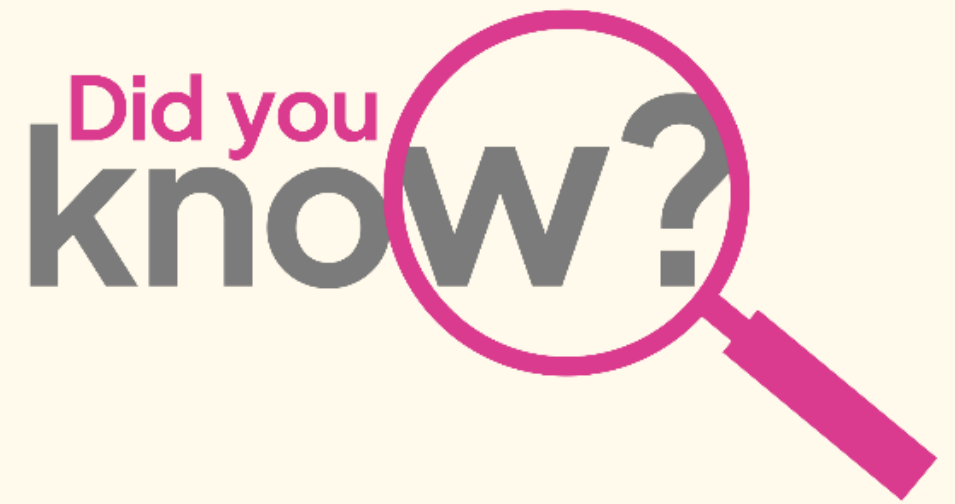Investigate how different conditions affect termite tunnels

Soundscapes can help restore coral reefs
Curriculum link: Sound
Make a hydrophone to show that sound travels through water

© Tim Lamont

Teacher Guides

Did you know?

Subject knowledge and enquiry skills	Who were the scientists?	**Your turn to investigate**
Quick starter	What did scientists find out?	What did you find out?
What did scientists know?	What did scientists do?	Questions for further learning / cross-curricular links

Tree restoration – it's now or never

Subject knowledge

- Recognise that environments can change and that this can sometimes pose dangers to living things
- Understand how greenhouse gases are responsible for global warming and how tree planting might offset climate change

Enquiry skills*

Observing and measuring
Using senses and measuring equipment to make observations about the enquiry.

Interpreting and communicating results
Using information from the data to say what you found out.

Summary of science research

A team of scientists investigated how many new trees could be planted worldwide and how this could affect climate change. They calculated the total area of land worldwide which was suitable for tree growth using satellite data and climate maps. The scientists found out that the potential new tree growth could remove two-thirds of man-made carbon dioxide from the Earth's atmosphere, potentially reducing global warming.

Related investigations for children

- Use satellite images to estimate types of land use
- Use satellite images to investigate changes in land use and consider the effect on the climate

Quick Starter Activity

© Explorify

What did the scientists know about climate change?

Greenhouse gases in our atmosphere, such as carbon dioxide (CO_2), act like layers of blankets around the Earth.

Without them, the planet would be covered in ice and too cold to live on.

However, the amount of **carbon dioxide** in the Earth's atmosphere has increased since humans started burning fossil fuels.
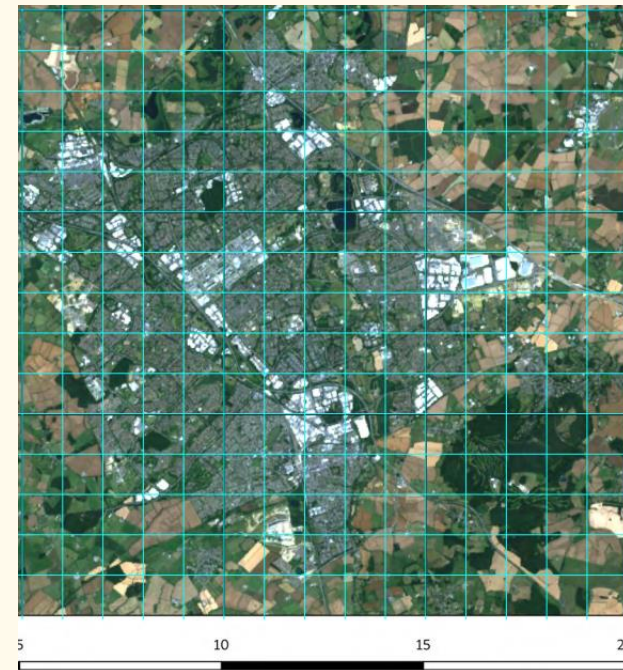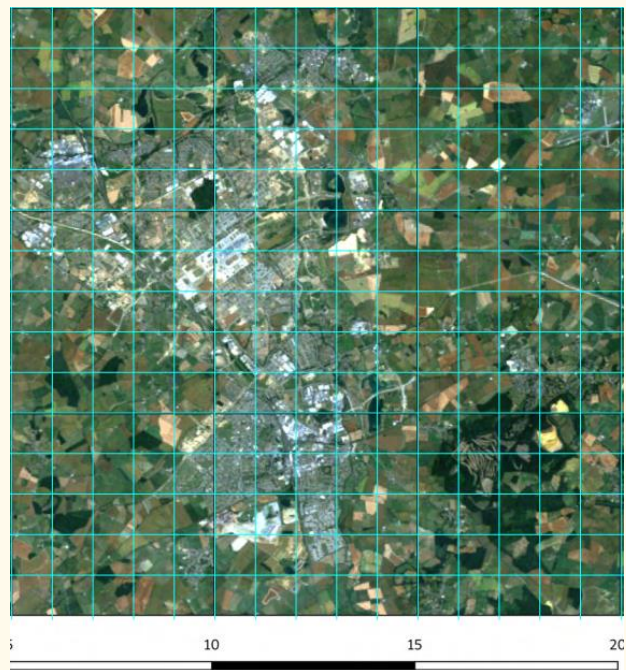
Now, the high levels of greenhouse gases in the atmosphere are causing the surface of the Earth to become too warm.

Enquiry type: Using secondary sources for research

Compare satellite images of Milton Keynes (UK) in 1984 and 2019.
What do you think you can see?
How much of this land could be used to plant trees?

- Each square of the blue grid represents an area of 1km x 1km or 1km^2.
- Look at the different colours of the squares:
    - Grey squares represent land covered by buildings and roads (**urbanised**).
    - Green and brown squares represent land covered by farmland, woodland or other countryside.
- For this investigation, assume that any squares which are mostly green or brown squares could be used to grow trees.

Calculate the percentage of total land available for tree planting?

$$\% \text{ of total land that could be used to grow trees} = \frac{number\ of\ green\ or\ brown\ squares}{total\ number\ of\ squares} \times 100$$

'The challenge of climate change is formidable. For children and young people to meet it with determination, and not with despair, we must offer them not just truth, but also hope. Learners need to know the truth about climate change – through **knowledge-rich education**. They must also be given the hope that they can be agents of change, through hands-on activity...'

Rt Hon Nadhim Zahawi (MP)

Considerations for Climate Science at KS2

1. **Age-appropriate science concepts** e.g. light travelling in straight lines, representation of Sun and atmosphere

2. Multimedia and visual images can facilitate **dual coding** (but irrelevant illustrations could be a distraction and add to cognitive load)
EEF Cognitive Science Approaches in the classroom: A review of the evidence 2021

3. **Scaffolded** tasks provided alongside time for **exploration and play.**

4. **Climate anxiety** being prepared to lead children towards constructive hope

Considerations for Climate Science at KS2

5. Think about children's common misconceptions about climate change and global warming.

"Many, but many things harm the world around us cause pollution, but greenhouses are extraordinarily dangerous...Furthermore, destroy all green houses"!!!!!

Okhee Lee, Benjamin T. Lester, Li Ma, Julie Lambert & Melissa Jean-Baptiste (2007 p123
) Conceptions of the Greenhouse Effect and Global Warming among Elementary Students from Diverse Languages and Cultures, Journal of Geoscience Education, 55:2, 117-125, DOI: 10.5408/1089-9995-55.2.117
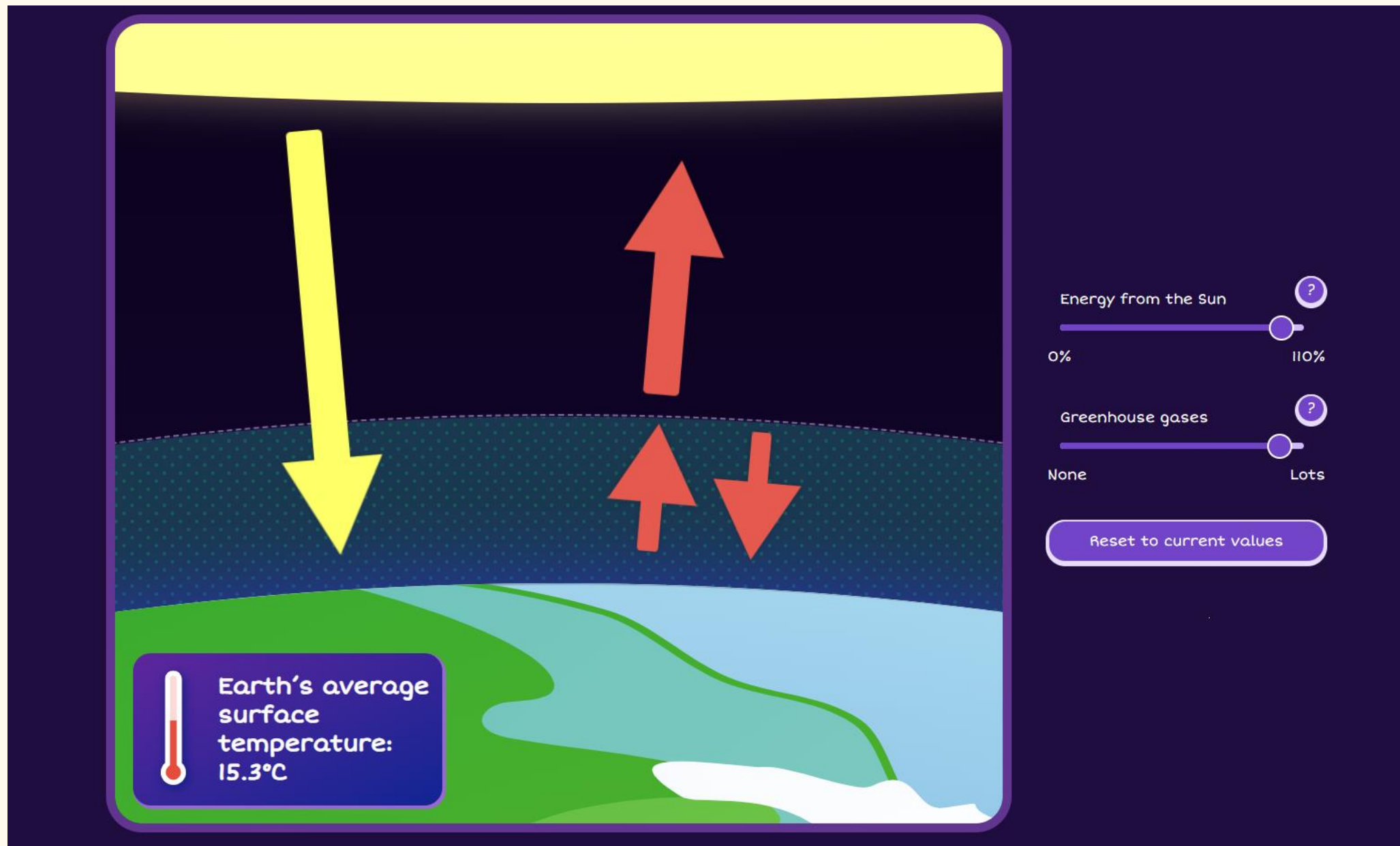
Challenge 1

Without the Sun, what does this model show that life on Earth would be like?

EXT: Why does the energy from the Sun setting go up to 110%
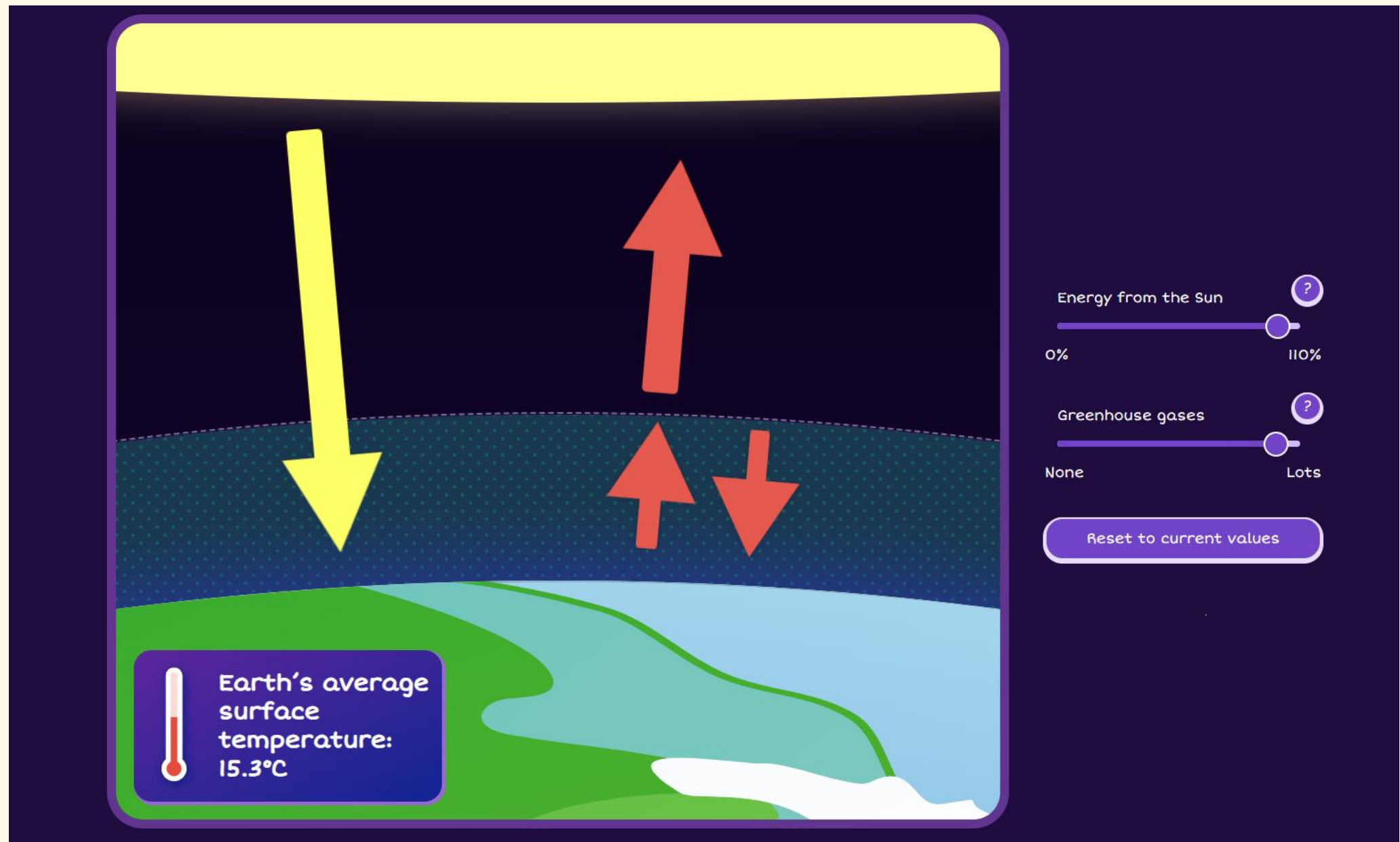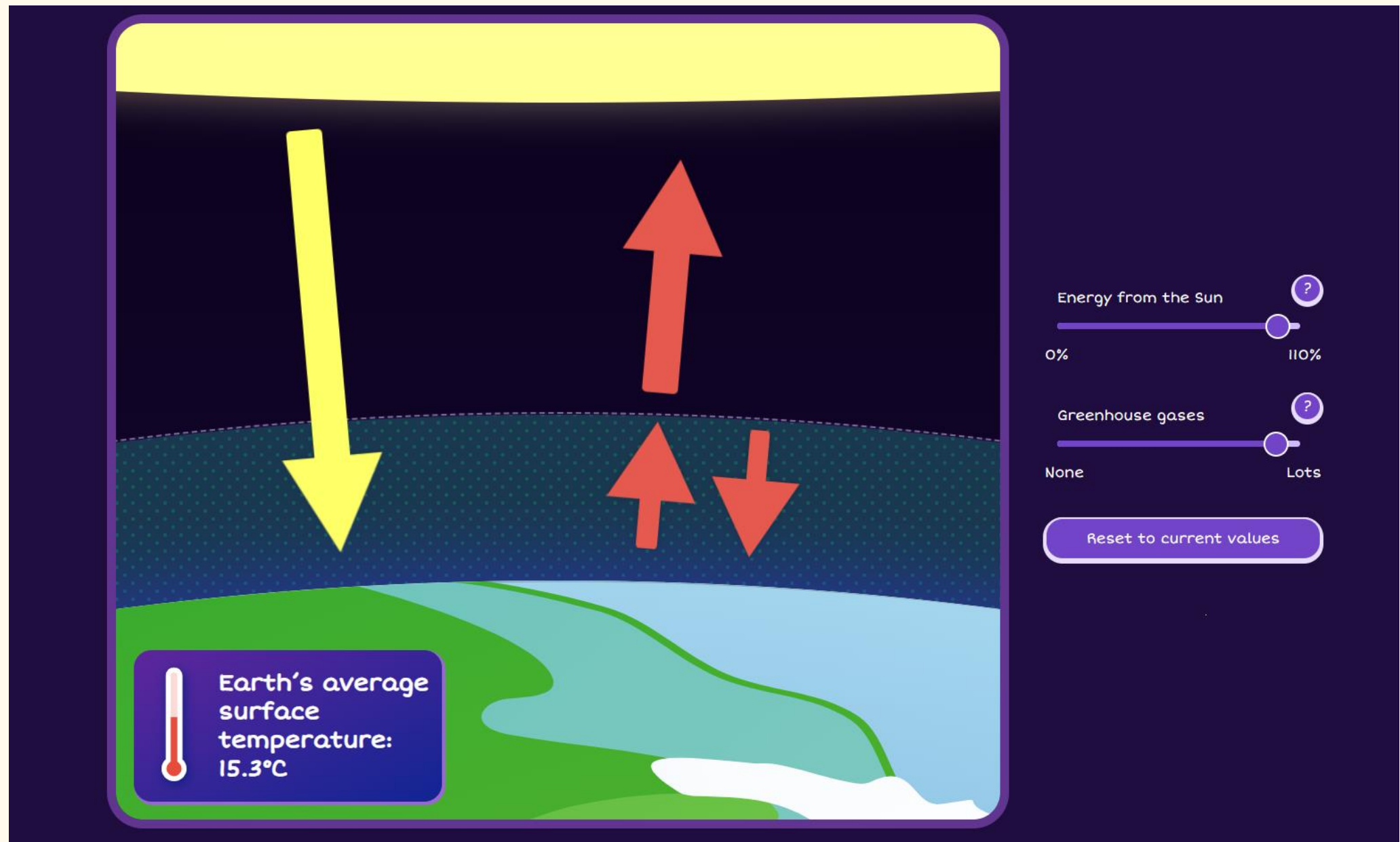
Challenge 2

Reset to current values.

What would life be like on Earth without any Greenhouse gases?
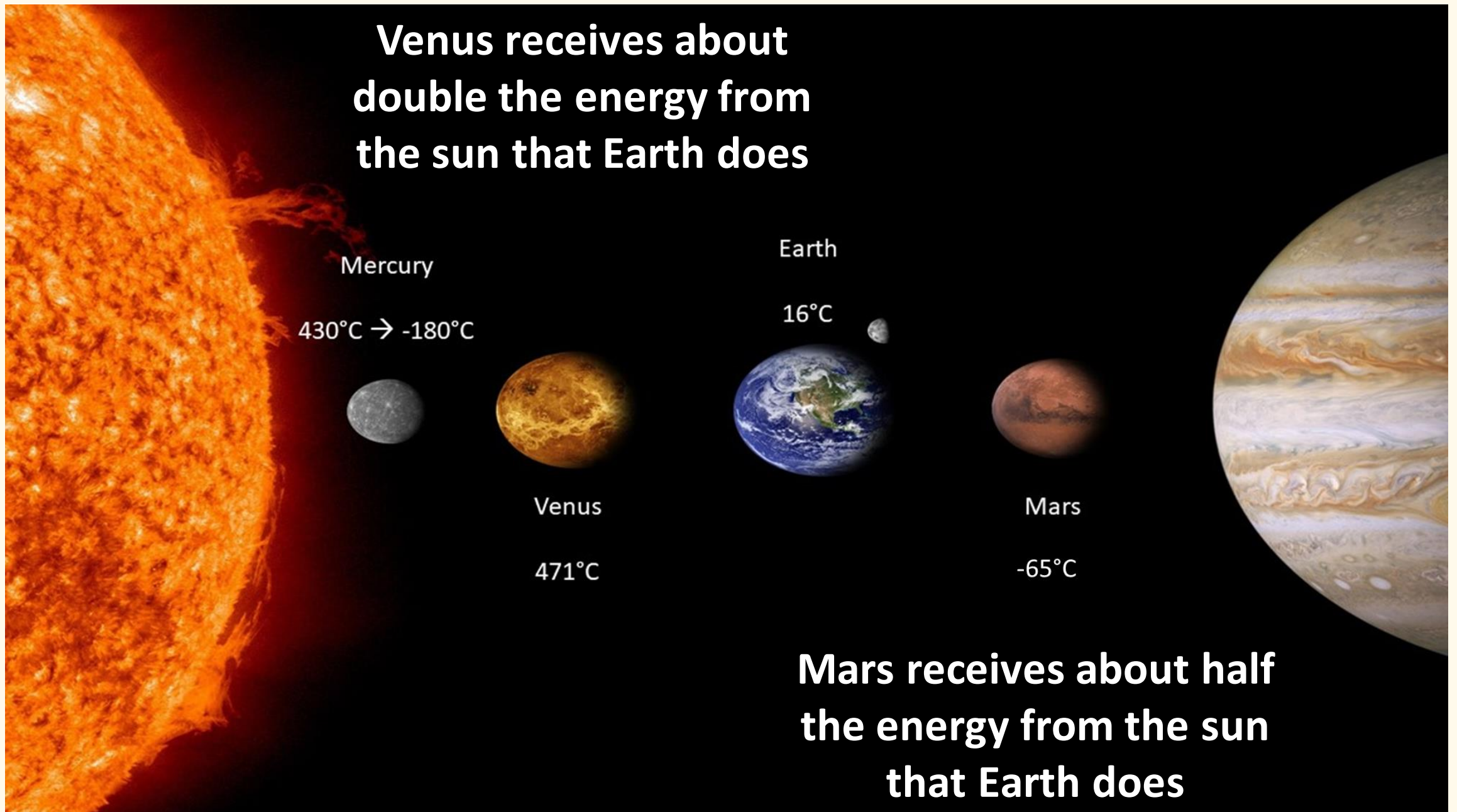
Make a prediction then explore.
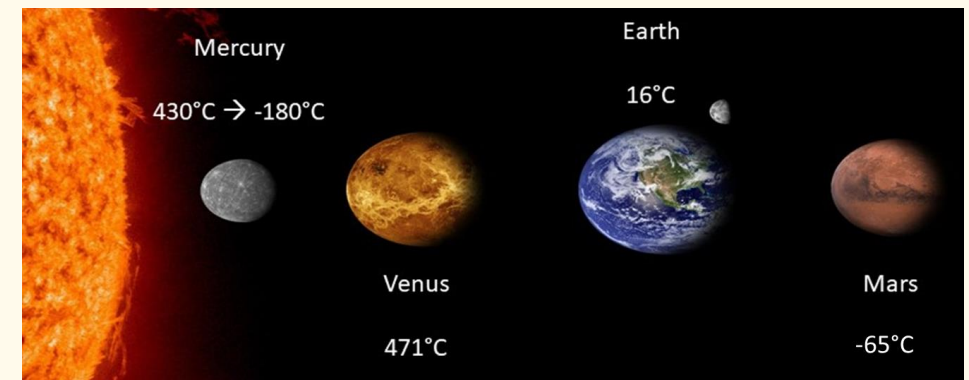
EXT: Name two Greenhouse gases

Challenge 3
Explore the pattern: What happens to the average surface temperature as Greenhouse gases are increased / decreased?

The Planets Model

Venus receives about double the energy from the sun that Earth does

Mercury
430°C → -180°C

Earth
16°C

Venus
471°C

Mars
-65°C

Mars receives about half the energy from the sun that Earth does
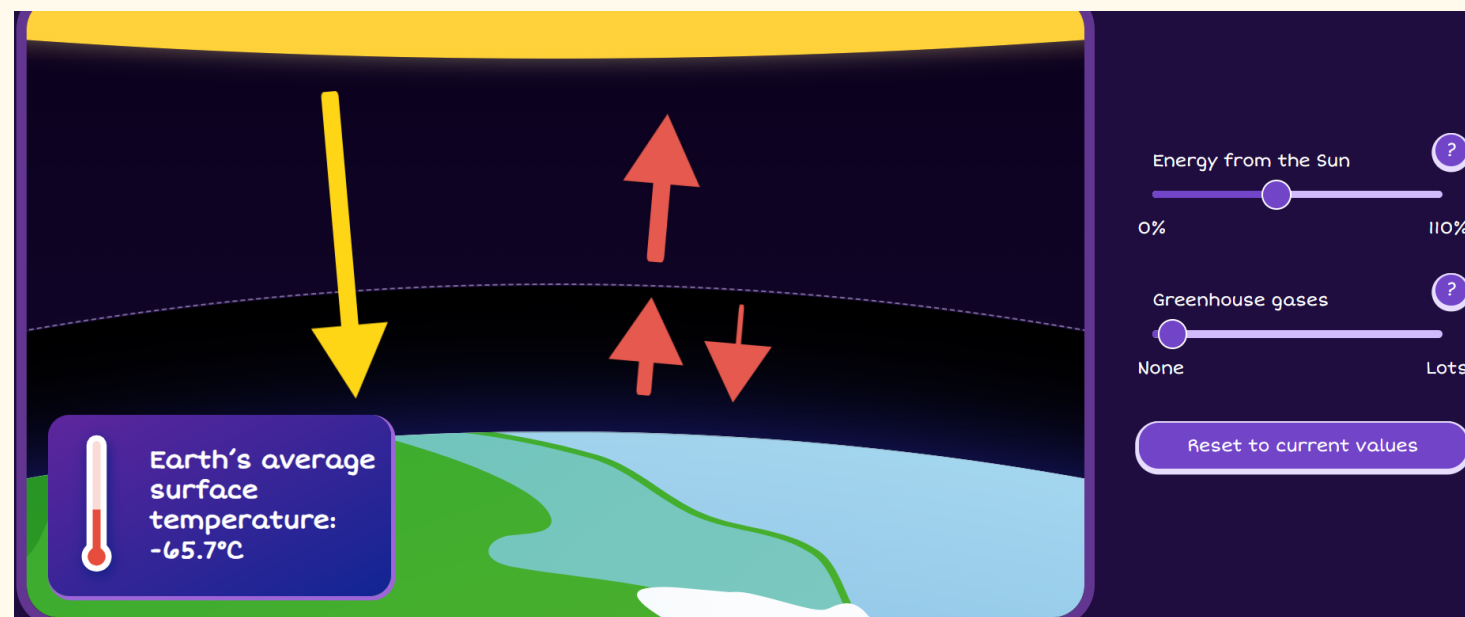
Solar system challenge

Climate Change Model

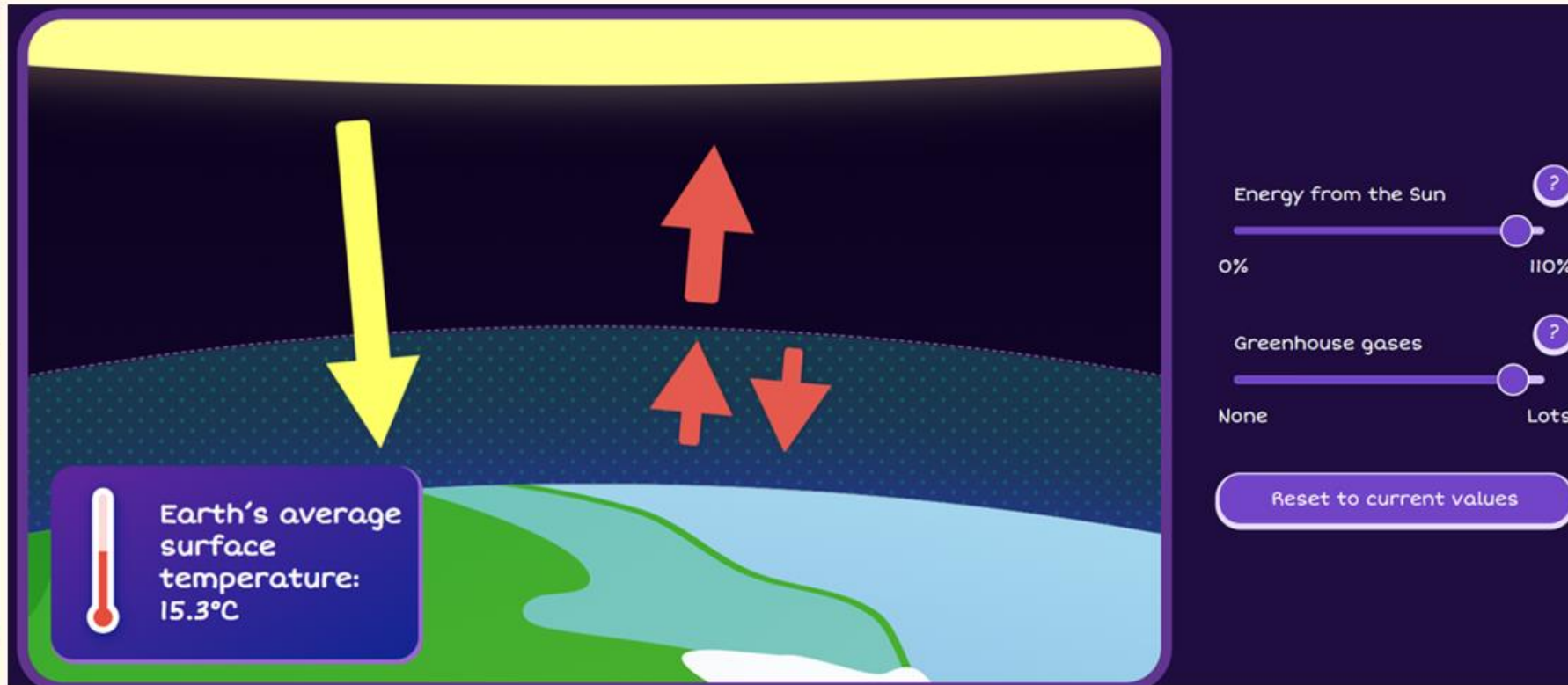Mars receives about half of the Energy that Earth does.

The average surface temperature on Mars is -65°C.

Can you set the model to show these conditions?

What can you conclude about Mars' atmosphere?

Children's feedback model 1

The challenges were really fun, we had to work together to solve them.

Moving the Greenhouse gases up made the temperature go up. We wanted to know what temperature would be really bad.
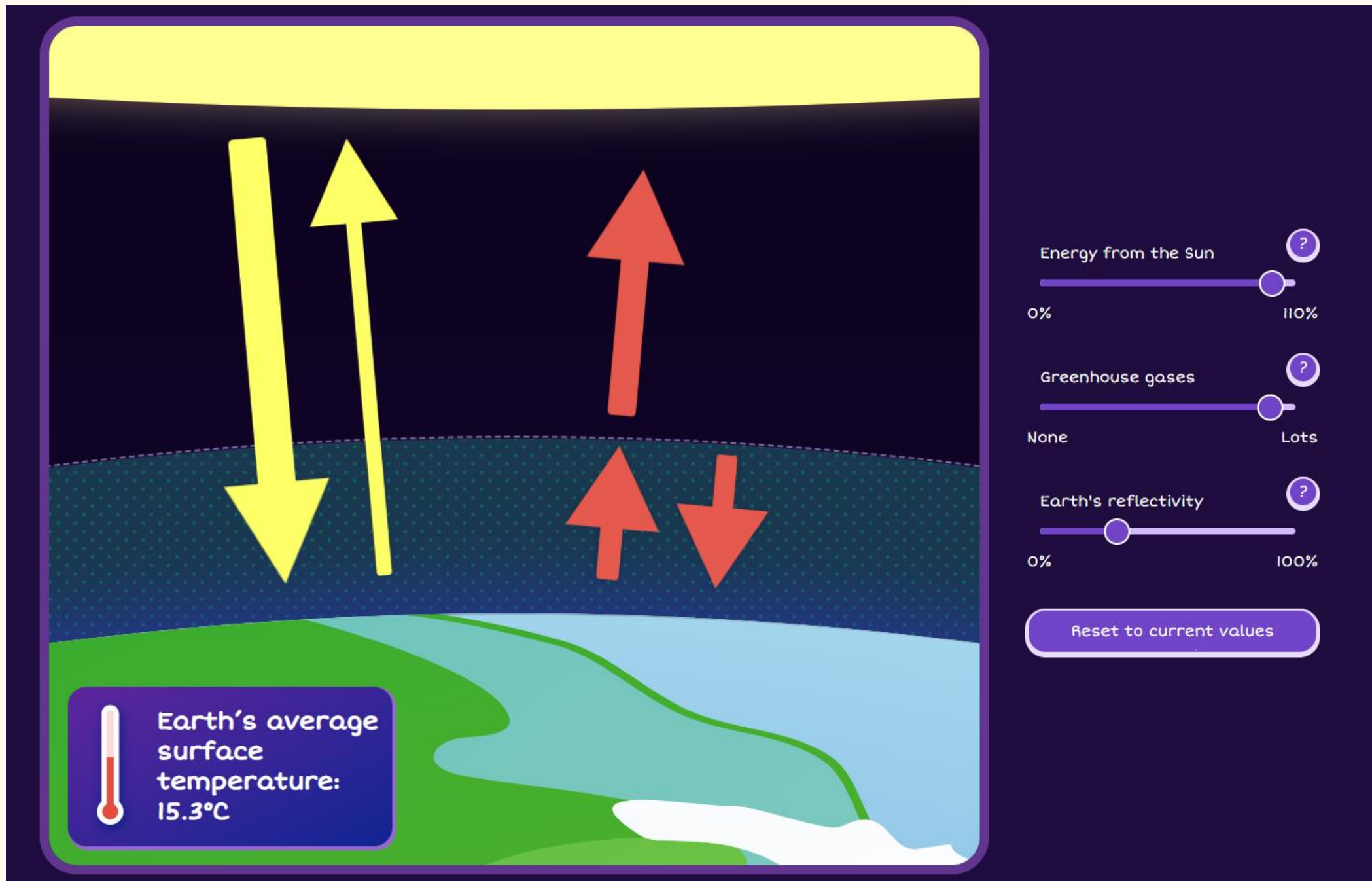
I really liked trying to get the model cold enough to be like Mars. We had to change the energy and greenhouse gas settings.

The challenges were really fun, we had to work together to solve them.

Trialled with 8 – 9 year olds

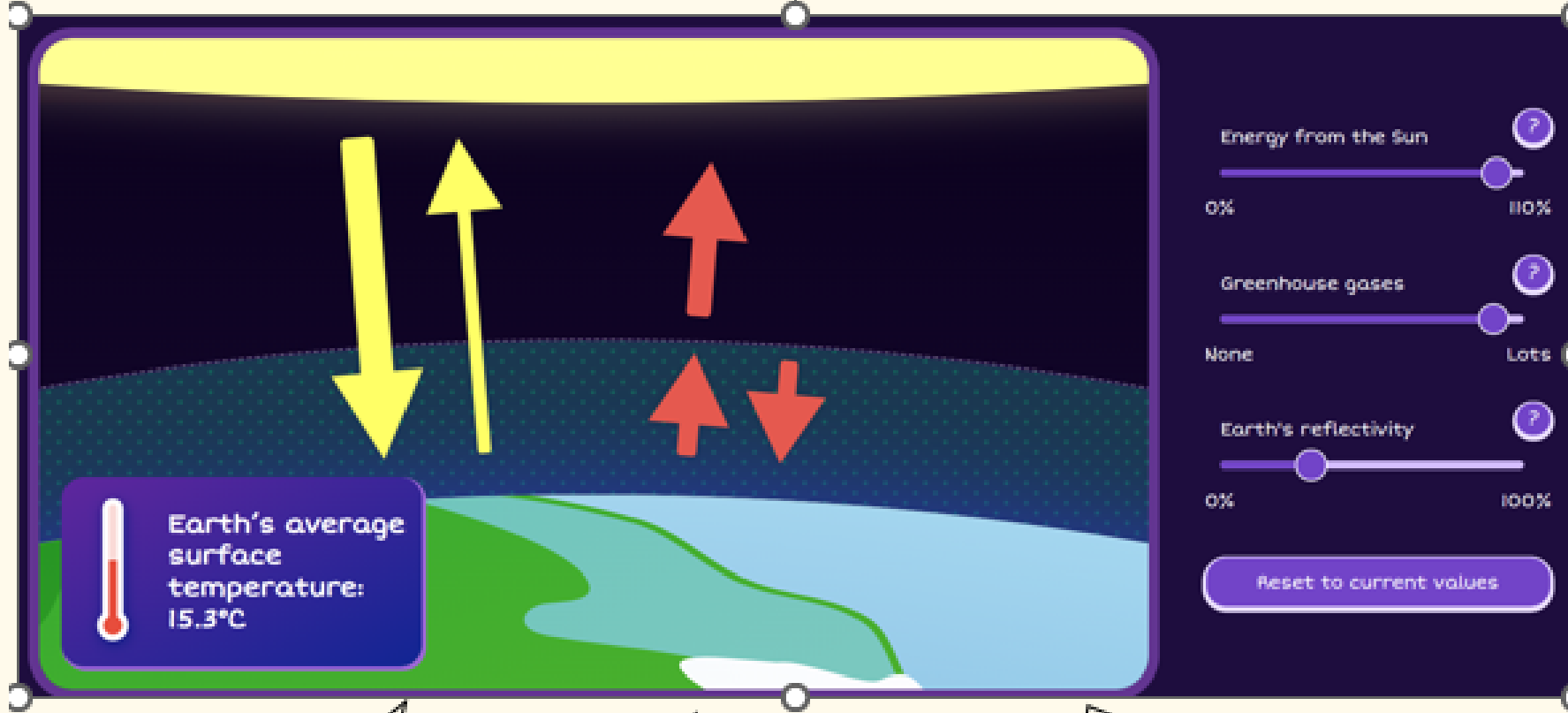# What's the difference between global warming and Climate Change?
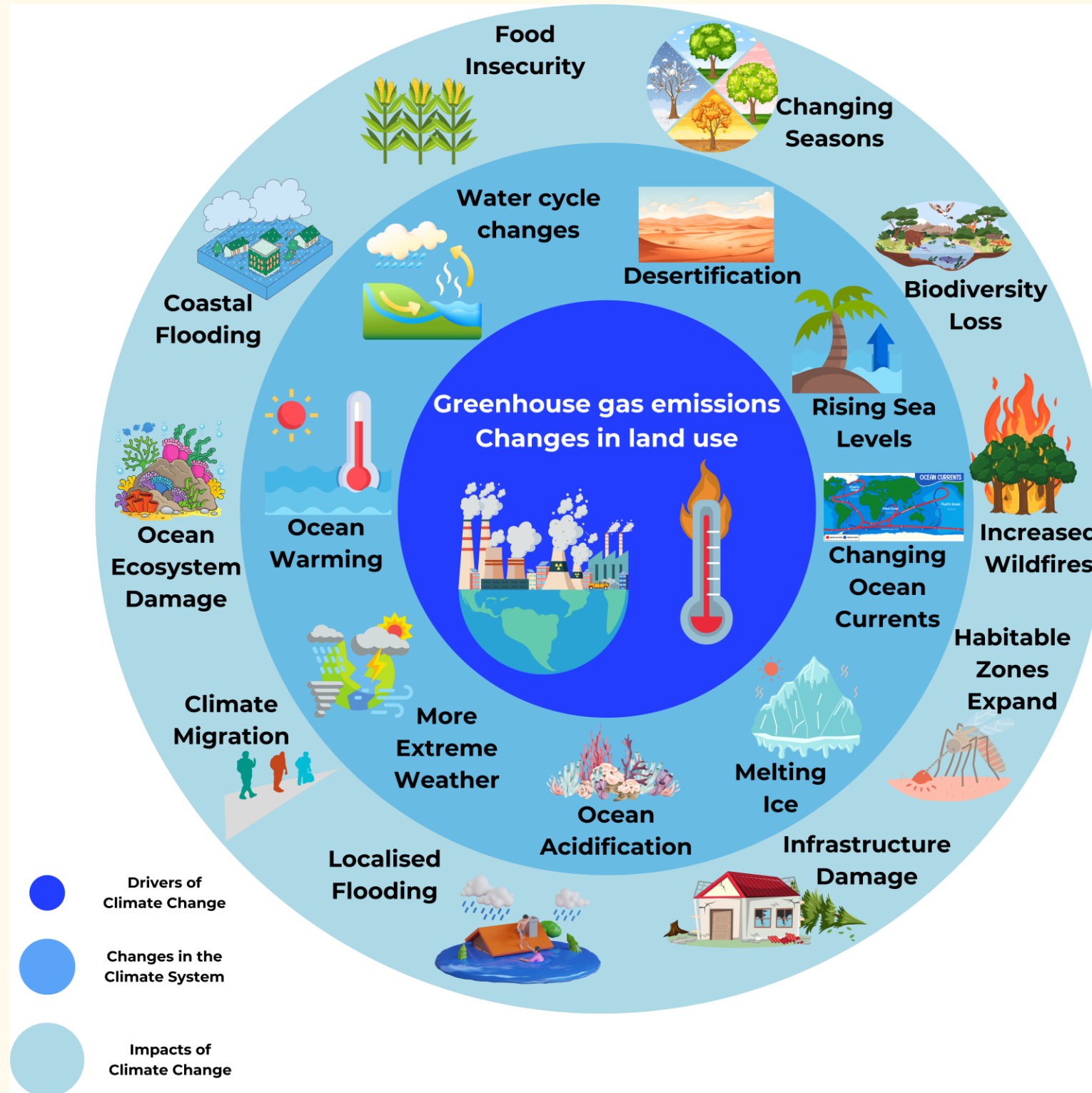
Challenge 4

Explore the pattern: What does the model show happens to average temperature as the Earth's reflectivity increases?

EXT: What surfaces on Earth have a high reflectivity?

Children's feedback model 1 and 2

It didn't need much of an increase in Greenhouse gases to change the temperature.

The challenges helped me understand how Greenhouse gasses change the global temperature.

It was really easy to use and the challenges were fun to try.

I didn't realise how important reflectivity is on the surface temperature.

We found that changing the reflectivity had a big impact on the temperature – that's why ice is important.

Trialled with 10 – 11 year olds

Feedback welcome…
Rebecca.Ellis@pstt.org.uk

Test with your class by Friday 19th April:

PSTT XAIDA Climate Project

January 2023

The Primary Science Teaching Trust (PSTT) would like to invite you to trial our XAIDA interactive climate models with primary children in your setting.

Acknowledgements

The climate change models have been developed with the collaboration of **Professor Dudley Shallcross** (University of Bristol), Professor Peter Stott (MET office) and Peter Norton (Learning Science Ltd).

We thank the following organisations who have funded our work on this project.

Professional development support

Primary Science Teaching Trust (PSTT) works with teachers across the UK to deliver **excellent science in primary classrooms**.

FREE tried and tested, curriculum-linked resources
 www.pstt.org.uk/resources/
Why and How magazine
Primary Science Teacher of the Year Award

Guidance for science subject leaders
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