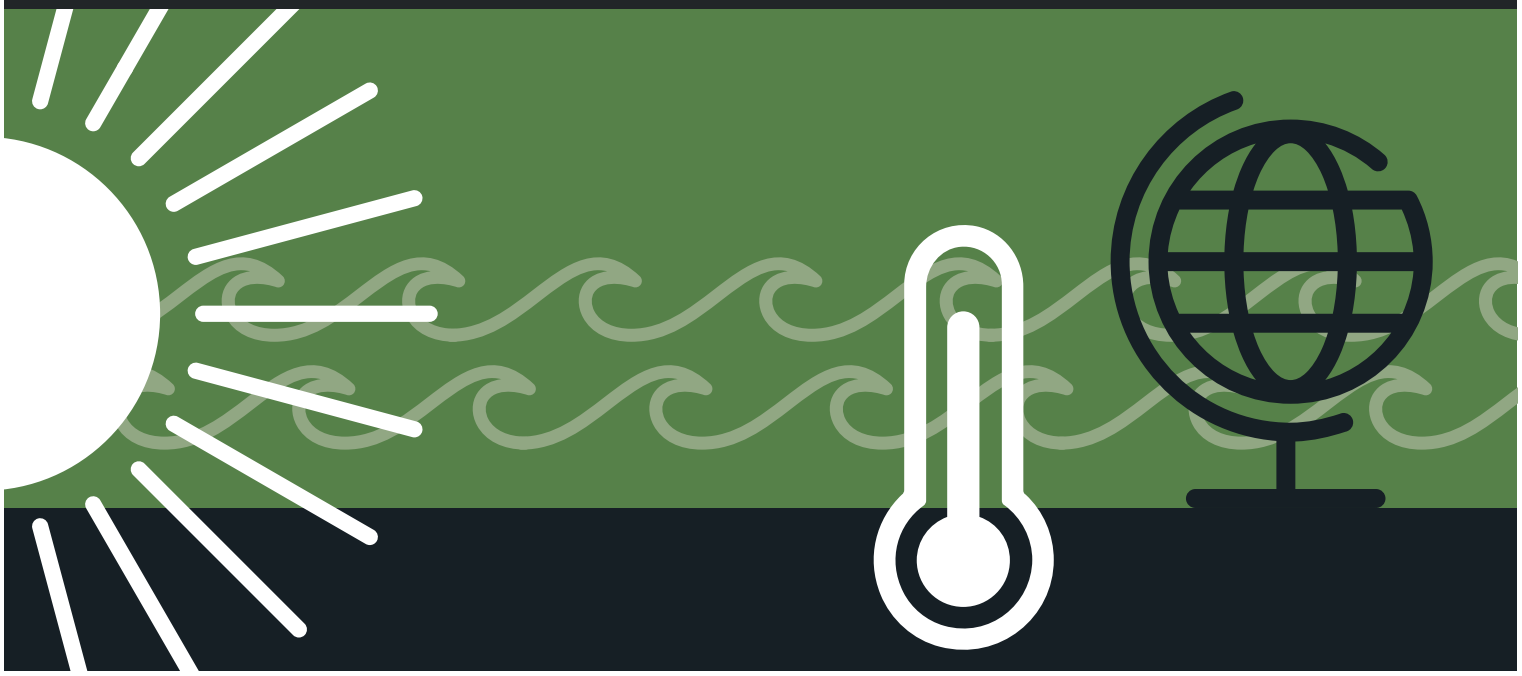

Session 1 – Our Climate

Summary

Welcome to an exciting exploration of our planet's climate. What is our climate made of? In this first session of three, you'll discover the range of diverse climates found around the world through a climate matching game. Additionally, you'll have the opportunity to participate in an experiment aimed at uncovering the key components of Earth's climate system.

50 minutes

Materials required

- Basketball/Football
- Blu Tack (or similar) or a small button
- Two balloons
- Water
- Funnel
- Lighter – Safety gas lighter for a cooker is best (Please consider H+S when using a lighter)
- Internet access to YouTube
- Climate Matching game
- Colouring pencils or felt tips – red, yellow, green, grey, blue and purple

Activity Steps

01 What is weather? What is climate?

10 minutes

Start the discussion with the group by exploring the concept of weather and climate. Ask the group to discuss what they know about weather and climate. Can they distinguish between the two? What is the difference? Take some suggestions.

Tell the group that the weather describes the conditions of the atmosphere over hourly or daily timescales, and we take measurements of 'variables' such as temperature, rainfall, cloud cover, sunshine, and wind speeds to understand this.

Climate is the average of these conditions over longer time periods – typically around 30 years and in a particular place. That place could be the town where you live (mention your nearest town), the UK , or even of the whole planet! The key thing to remember, when we think about 'climate', is that it covers longer timescales which could span two or three of your current lifetimes.

Additional explanation and video: You can use the "wardrobe analogy" to explain weather and climate.

Video

https://www.youtube.com/watch?v=bjwmrg__ZVw
[0.25 – 1.12]

To illustrate the difference between weather and climate, you can think of the difference between what you're wearing today and all the clothes in your wardrobe. What you wore yesterday might be different to what you're wearing today, as the weather might have changed. But if you look at all the clothes in your wardrobe, the number of trousers and t-shirts you have in there, year-on-year probably doesn't change that much, as these prepare you for your climate. What you have in your wardrobe might be very different to what someone who lives in the Arctic has in theirs. That's because their climate is different to yours.

Tell the group that our climate in the UK is relatively mild. Our climate means that we expect our summers to be relatively warm whilst we expect our winters to be cooler and wetter. However, the variations we experience in the UK are much smaller than those experienced in other climates around the world. This means we have a 'temperate' climate here in the UK.

02 Climate Matching game activity

15 minutes

Tell the group we are going to look at other climates around the world in a climate matching game.

Split the group into pairs and give them the examples of average climate conditions at five locations from around the world. Ask the groups if they can match the climate conditions to the locations.

(These can be printed off and handed around the group or you can complete as a whole group)

- Use the codes on Slide 4 to colour each grid according to the average climate conditions indicated in the top left of each grid box.
- Each of these 5 grids represents the climate conditions at one location from around the world.
- Match grids 1-5 to the 5 locations on slide 3.
- Each grid should be matched to one location.
- Further instructions can be found on slide 2.

When completed, ask the group to take some time to think about the differences between these climates at different locations across the world.

03 What influences the Earth's climate system?

15 minutes

Tell the group that we are going to look at our Earth's climate in more detail. Ask the group if they know what influences the Earth's climate – there are four components.

Take suggestions from the group.

You can think of our Earth's climate system as a favourite recipe – there are several key ingredients, which all need to be added in the right amounts to make the perfect system.

- The first ingredient is **energy from our Sun**.

The Sun importantly provides heat and light for the Earth. Hold up small button or a small ball of Blu Tack (this represents the Earth). Tell the group that if the Earth is this big, how big do we think the Sun is? **Answer - size of the football/basketball.**

Hold up the football/basketball - tell the group that this represents the Sun. This means that the Sun is providing the Earth with lots of energy. However, not all energy from the Sun is received the same way. Some parts of the Earth are better at taking in or absorbing the Sun's energy, whilst other parts of the Earth are better at reflecting the Sun's energy.

Ask the group to have a think about which parts of the Earth might be better at absorbing or reflecting the energy. If they are not sure, get them to think about what colour t-shirt they'd choose to wear on a very hot, sunny day – a black one, or a white one? Answer - white one, as that will keep you cooler.

The same can be said about our planet. Areas of white, like the ice in the Arctic and Antarctic, reflect the Sun's energy better than dark areas like the oceans, and help keep things cooler.

- The second key ingredient to our Earth's system is its **atmosphere**.

Tell the group that our atmosphere contains lots of gases which have an important influence on our climate. Some of these gases we call greenhouse gases.

Note
They may have heard about these, and usually we think of them as bad

Greenhouse gases allow the Sun's energy into the atmosphere but stop some of this energy exiting. This is what we call the greenhouse effect. Without it, Earth would be around 30 degrees colder than it is now - way too cold for us humans and most other forms of life. But we're adding more and more greenhouse gases to the atmosphere – particularly carbon-dioxide and methane.

- The third key ingredient for our climate system is the land surface and what is happening on it.

Discuss that trees take in carbon-dioxide and release oxygen and water vapour. Volcanoes erupt and, if they release enough particles into the atmosphere, can block out some sunlight and cool our climate. Some farming practices add a lot of greenhouse gases to the atmosphere – you might have heard that cows release methane?

Note
That is true - it's from their burps rather than their farts!

Now that we've considered the land, what about the oceans and other bodies of water?

04 Experiment – Earth's climate system

10 minutes

Materials required

- Two balloons
- Water
- Long flame gas lighter

- The fourth key ingredient is the role of water in our global climate system.

Explain to the group that we've talked about the land and will now look into the oceans and other bodies of water? They are going to take part in an experiment in which they will consider the example of the ocean.

- Hold up two balloons – one filled with water to about the size of a grapefruit, and one filled with air, both tied, and a lighter.
- Tell the group that the flame of the lighter is the energy in our global climate system, and so is representing heat from our Sun.
- Tell the group the one filled with water represents our oceans whilst the air-filled one represents our atmosphere.

- Ask the group - what do we think will happen when we bring the energy source into contact with the two balloons? Hint: one of the balloons is going to burst, and one of them will not.
- Which one do you think will heat more and burst, the atmosphere, or the oceans?
- Tell the group we are going to give this experiment a go... ask the group, do we trust the science?
- Hold the flame underneath the balloon with water in.. It should not burst! (You might want to practice the experiment before the lesson so that you are confident with this)
- Repeat with the balloon filled with air. This should pop.

Fun tip
You could ask a volunteer to stand underneath the balloon filled with water!

Discuss with the group why the balloon with water didn't pop. Take suggestions.

Science behind the experiment

The water absorbed the energy created by the flame, whereas the air was not able to absorb this heat as well and so the balloon popped. The water across our planet and in our oceans is very important for absorbing energy in the Earth's system. Oceans absorb a large amount of the energy from the Sun and hold onto this heat for a lot longer than the Earth's surface. This means that the oceans heat and cool much more slowly than the atmosphere and Earth's surface. The oceans therefore have a moderating effect on global temperature changes.

Tell the group that we now know that the greenhouse effect is very useful in trapping heat within our atmosphere. But what happens if we add more greenhouse gases to the atmosphere than occur naturally? Humans are currently releasing more and more of these gases into the atmosphere through everyday activities like driving a car, chopping down and burning trees, and using fossil fuels as our main source of energy. These activities, and many more besides, lead to an accumulation of excess greenhouse gases in our atmosphere. In turn, this causes more heat to become trapped within our global climate system.

Video

Show the group part of this video to explain further: What is climate? - Met Office climate change guide
https://www.youtube.com/watch?v=bjwmrg__ZVw
Time: [1.12/3 – 2.38]

05 Review

Review with the group what they've been discussing. Ask them to think about how they could convey this information to their friends and family. As an additional activity, they can create a presentation or poster to capture the facts they have learned to show other groups, the wider school, or friends and family.

NB
This is session one of three. Move to session 2 to continue learning about our future climate, which involves presenting a 2050s forecast.

Word Bank

Aerosols - a collection of airborne particles, typically less than 100th of a millimetre in size, that occur in the atmosphere.

Anthropogenic - caused or produced by humans.

Atmosphere - is the mass of air that surrounds the Earth. It contains nitrogen (78%) oxygen (21%) and traces of other gases. The atmosphere plays an important part in protecting life on Earth.

Climate change - Climate change refers to a large-scale, long-term shift in the planet's weather patterns and average temperatures.

Climate model - a mathematical representation of the climate system based on its physical, chemical and biological components, in the form of a computer programme. The computer climate models used at the Met Office Hadley Centre are detailed three-dimensional representations of major components of the climate system. They are run on the Met Office supercomputer.

Climate - average weather and its variability over a period of time, ranging from months to millions of years. The World Meteorological Organization standard is a 30-year average.

CO_2 – carbon-dioxide, a gas in Earth's atmosphere. It occurs naturally and is also a by-product of human activity, such as burning fossil fuels and land-use change. It is the principal anthropogenic greenhouse gas.

COP – COP is the annual assemblage of the United Nations Climate Change Conference of the Parties. Nations from across the world come together to discuss global progress towards limiting climate change. This includes reviewing progress on meeting the goals of the Paris Agreement.

Earth Climate System – the Earth climate system is a complex system of five main components: the atmosphere; the hydrosphere (oceans, lakes and water); the cryosphere (ice sheets, glaciers etc), the land surface and the biosphere (e.g. living creatures and plants). These five components are influenced by external forcings, two of which are the sun and human activities.

Fossil-Fuels - biomass lain down in the Earth millions of years ago, forms coal, oil, and natural gas. When these fossil fuels are burnt they produce carbon-dioxide.

Global warming - a rise in the Earth's temperature, often used with respect to the observed increase since the early 20th century.

Greenhouse gases - gases in the atmosphere, which absorb thermal infra-red radiation emitted by the Earth's surface, the atmosphere and clouds. Examples include water vapour, carbon-dioxide, methane and nitrous-oxide.

Paris Agreement – The United Nations describe the Paris Agreement as a legally-binding international treaty on climate change. It was established at COP21 in Paris, in 2015. The goal of the agreement is to limit global warming to well below 2°C, and preferably 1.5°C of global warming.

Projections - Computer models are used to simulate decades into the future. These models highlight that increasing greenhouse gas concentrations in the atmosphere lead to increasing global temperatures.

Uncertainty - the degree to which a value is unknown. In the context of climate change, uncertainty arises from imperfect understanding of the physics of the atmosphere; imperfect representation of the real climate in climate models, owing to limited computer power; and unknown future greenhouse gas emissions.

Weather - We use the term weather to describe the conditions of the atmosphere over hourly or daily timescales, and we take measurements of 'variables' such as temperature, rainfall, cloud cover, sunshine, and wind speeds.