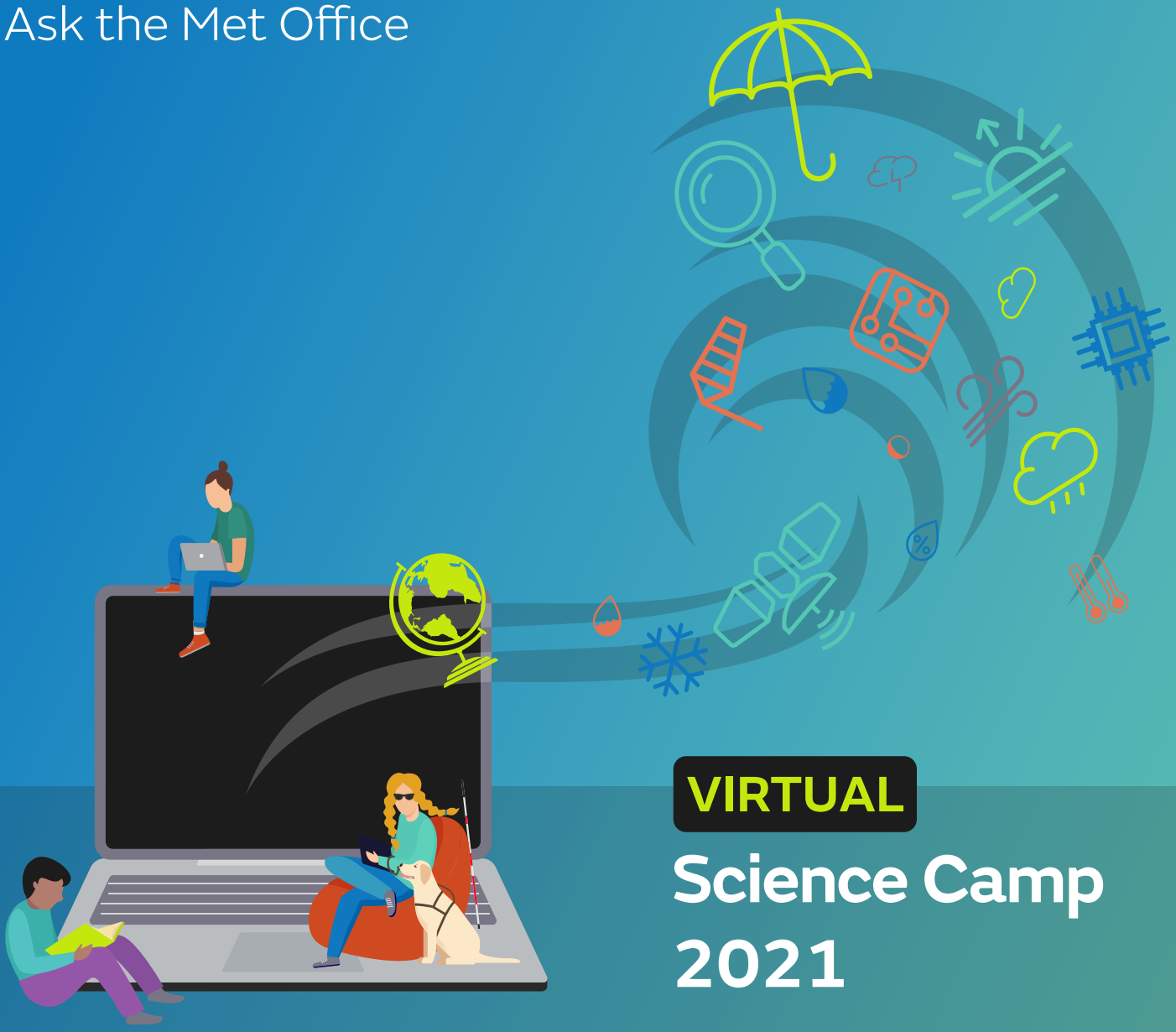
Met Office

Leader pack

Sessions 7-10

Climate
Climate Change
Our Future Workforce
Ask the Met Office



VIRTUAL

Science Camp 2021

Thank you for joining us for the first Virtual Science Camp 2021!

Since 2013 we have welcomed over 1,500 young people to Met Office HQ for our Science Camps. However, due to the pandemic, our plans had to change, so we have chosen to run Science Camp 2021 virtually. This is an exciting opportunity to reach a wider audience with our exciting and interactive content.

To get the most out of this content, we thought we would provide you with a handbook that gives a bit of background to the video sessions, alongside instructions on how to recreate some of the activities or ideas for extension activities.

Every three weeks we will release three videos on topics relating to weather and climate. There will be pauses within these videos for discussion, experiments, activities, and lots of opportunities for the students to engage with the session.

Making our material accessible to all is important to our Education Outreach programme, so we have included suggestions and guidance below to help make sure our sessions are accessible to a wide audience. We have focused on keeping the sessions as interactive as possible and designed activities around equipment that is easy to find around your home or place of study. We have also tried to minimise the use of printed resources to reduce our impact on the planet.

Below you will find everything you need to get started for each session, this will include session aims, resources you might need as well as suggested activities to carry on exploring the topic beyond the sessions. You might want to make sure you have your camera ready to capture this amazing experience that we hope the students will love!

And don't forget, as we go along you can submit your questions to us via Twitter **@metofficelearn** or email us **science.camp@metoffice.gov.uk**. Our final session on 26 November will be LIVE and you will be able to interact with our panel of experts in different roles from around the Met Office.

If you have any further questions, please contact us at **science.camp@metoffice.gov.uk** or look on our dedicated Science Camp 2021 page **Met Office Virtual Science Camp - Met Office**.

Feel free to tag us in any posts you wish to make us aware of on our Twitter feed **@metofficelearn** using the hashtag #MOSciCamp.

Before you start the sessions

We have provided a link to an "**Introduction to the Met Office**" video to get the students engaged and excited for their learning over the next few weeks. You might want to show this video in your own time before you start Virtual Science Camp 2021.

Session 7

Climate

Aims of session 7

- To understand the difference between weather and climate
- Examine the components of the Earth's climate system
- To understand the science basis to climate change, including the greenhouse gas effect
- To look at how climate change might affect weather across the world

Summary

This session introduces the concept of climate and climate change. The difference between weather and climate are discussed. The components of the Earth's climate system are then explored. Finally, we begin to investigate how this climate system is undergoing change as a result of human actions as we explore modern-day climate change.

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 of 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.

CO2 - 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.

COP26 - COP26 is the 26th edition of the United Nations Climate Change Conference. Nations from across the world come together in Glasgow in 2021 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; 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 also human activities.

Fossil-Fuels - biomass lain down in the Earth millions of years ago, such as coal, oil, and natural gas, which when burnt 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 e.g. water vapour, carbon dioxide, methane and nitrous oxide.

Paris Agreement – The UN 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 tell us 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 - The weather describes the conditions of the atmosphere over hourly or daily measurements such as temperature, rainfall, cloud cover, sunshine, and wind speeds.

Guidence for experiments and activities in session

What is weather and climate discussion

Take some ideas from the class on what they believe weather and climate are. Hopefully you will hear that weather describes the conditions of the atmosphere over hourly or daily measurements such as temperature, rainfall, cloudiness, sunshine, and wind speeds.

Climate, on the other hand, is the average of these conditions over longer time periods ranging from years to decades to hundreds of years.

Which balloon will burst?

Take some ideas from the class on which balloon they think will burst. The balloon filled with water, or the balloon filled with air?

This exercise is considering which would heat up more quickly and burst - the oceans or the atmosphere? Play the video again to see the answer.

What is climate change discussion

Discuss the questions below in small groups. Come back together as a group and allow groups to share one or more of their thoughts with the class.

- What is climate change?
- What does it make you think of?
- What are some of the impacts of climate change?

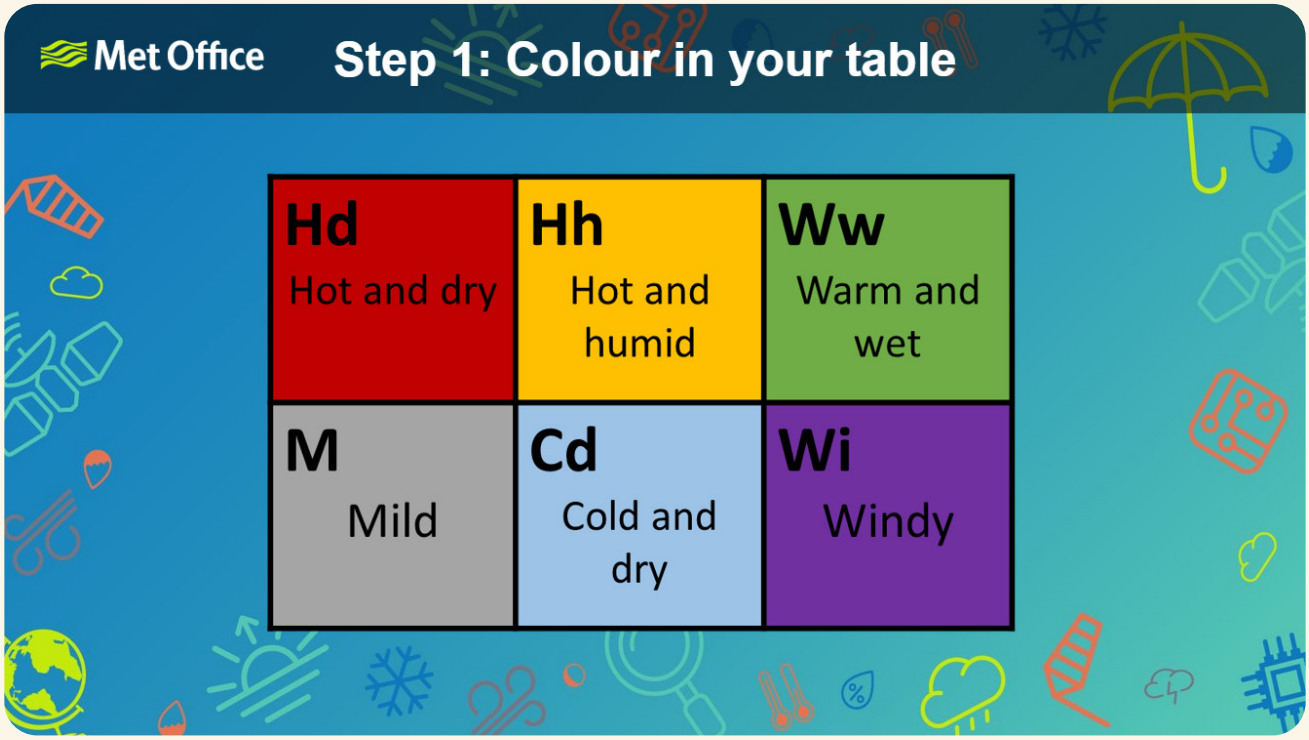
This question is about generating discussion – don't worry too much about questions being 'right or wrong'. We'll explore these questions during the rest of session 7 and session 8.

HINT: the causes of climate change will be discussed later.

Additional activities after session

Climate Location Matching game

- We've given you some examples of average climate conditions at five locations from around the world. Can you match the climate conditions to the location? We've given you instructions and the answers on the PowerPoint, there's also a PDF of the worksheets.
- We've given you five grids. These can be printed off and handed round the group, or if you're working on your own. You could also do this on the PowerPoint.
- Use the colour code to colour each grid box according to the average climate conditions indicated in the top left of the box.
- Together, these boxes represent the climate conditions at one location from around the world. Match the grids 1-5, to the 5 locations. Each grid is matched to one location.
- Take some time to think about the differences between these climates at different locations.



Session 8

Climate Change

Aims of session 8

- To understand the impacts of climate change both in the UK and globally.
- To understand that there are multiple possible 'futures' for climate change.
- To understand how we may reduce the effects and impacts of future climate change.

Summary

In this session we'll be looking more closely at the impacts of climate change on the UK and globally though examining possible future climate change scenarios. We'll then discuss how we can we reduce the effects and impacts of climate change with little changes in our daily routines that we can all take part in.

Word Bank

Adaptation - Action that helps cope with the impacts of climate change. One example may be building a flood defence along a river which may flood.

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 of protecting life on Earth.

Attribution - there can be many different drivers of extreme weather events like heatwaves or floods. Some of these are natural, but we can link others to climate change, driven by human activity. Attribution is the process of determining whether climate change has had an influence on an event's intensity or frequency of occurrence.

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

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

Guidance for experiments and activities in session

Resources you will need

- 2050 heatwave PowerPoint for forecasting activity, and/or the PDF if you wish to print it out
- Climate card game PDF. Cut out cards prior to lesson. Ask children to match the cards to create sets
- Paper/pens etc. for poster making

Forecasting for a heatwave in 2050:

- This can be done in a number of ways. For example, the children could practice in pairs with a printed version of slide and then could present back to the class in front of a projected PowerPoint slide.

- Encourage the children to introduce themselves at the beginning of the broadcast.
- Return to the recording to see how our presenters would forecast this 2050 heatwave.

Impacts of Climate Change globally:

- Climate card game. Ask the children to match the cards to create sets.
- The answer is the original order the cards are in.
- These are matched to create a narrative. Each green 'in our location of...' card matches with a blue 'Due to climate change...' card and a grey 'An impact of this is...' card and also an orange 'what can be done to help...' card.
- Encourage the children to consider the 'what else would you suggest' part of the orange card if they finish early.

What would happen if there were crop failure in India?

- Encourage the children to consider how these global impacts may affect us in the UK.
- An example for India: What would happen if there was crop failure in India? Would this affect us? If so, how do you think this might affect us?
- Discussion points: one example may be impacts on importing goods and food. Idea that the world is connected, and there are global 'knock-on' effects of climate change.

Poster – How can we reduce the impact of Climate Change?

Here are some ideas on ways to reduce the impact of climate change. We suggest that the children either take one of these ideas or come up with their own. Here we'd like them to be as creative as they like... they don't necessarily need to be achievable!

- **Ideas:** They could draw the school with some new energy-efficient systems? Perhaps add a solar panel farm or some wind turbines? They could draw a vegetable garden where they grow food? Perhaps they could draw a new transport system for the area where they live?

Discussion points:

1. Reduce, re-use and recycle - making new materials, such as clothes and electronics, uses energy in factories. This energy usually comes from fossil fuels, such as oil and gas, which contribute to greenhouse gas emissions. Also, these products may be produced abroad, and so are transported large distances to reach their new owners. This means we can try and reduce the amount of new material being made by reducing the amount we use. This can be done by reducing, re-using and of course, recycling.

2. Transport – Some common forms of transport, such as cars and aeroplanes, contribute a significant amount to carbon emissions. Why not choose to cycle or walk to school if you can? Perhaps you could take the train or share a car with someone who lives near you. If you travel abroad, why not take a train instead of flying, as this helps to reduce emissions for the same journey.

3. Energy use – This is perhaps one of the easiest changes to make. Turn of lights and appliances when they aren't in use – like a phone charger or TV. When you are cold inside in the winter, add an extra layer like a warm jumper instead of turning the heating up. These will all help to reduce energy consumption.

4. Plant trees – Why not plant a tree? Or better yet, maybe you could work with your school to plant a woodland area. Trees help to remove carbon dioxide from the atmosphere. They can also create a great habitat for wildlife!

5. Food – What we eat and where we buy it from can be very important. The production of meat contributes to increased emissions, so you could choose to increase the number of vegetarian meals you eat. You could also choose to shop locally and to buy in season fruit and vegetables. This will mean that they haven't been transported large distances and therefore help to reduce emissions.

6. Encourage others – The more people who are talking about the issue of climate change, the better. Perhaps you could tell those who you live with about what you learned today. Maybe you could encourage them to make some of the same changes you are making. Together, we can all work to make a difference.

Additional activities after session

Precipitation Projections:

- As with the 'temperature' projections we showed for the UK, we have also provided projections for precipitation
- These show projected future trends for precipitation in winter for the end of the century.

- As we learned previously, precipitation is water that falls to the ground and includes rain, snow and hail.

Encourage the children to compare these two projections.

- Prompt questions: In which scenario (high or low emissions) is there greater precipitation, meaning that it is wetter? Are there any impacts that you can think of associated with increased precipitation? Which world would you rather live in?
- Which projection is wetter? The high emissions future is wetter. This means increased emissions will lead to wetter winters.
- Which projection is more extreme? The higher emission future is more extreme.
- What are some possible impacts of the changes you have observed? Increased precipitation may lead to increase chance of flooding, cause travel disruption, cause loss of crops etc. Flooding is the main issue.
- Which would you rather live in? Hopefully following a discussion on impacts the children may decide that lower emissions is a 'safer' world.

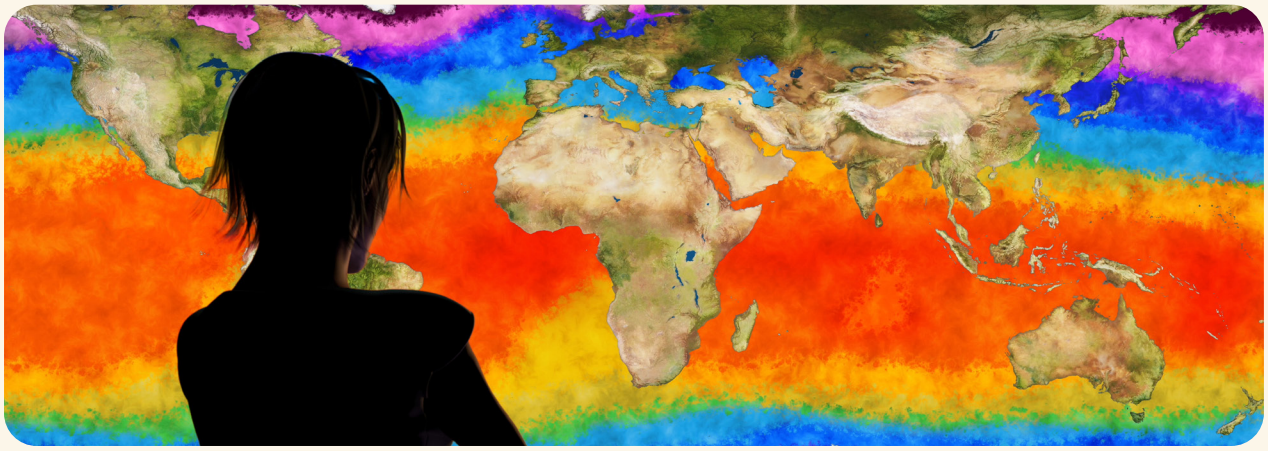
Other resources:

If you'd like to learn more about local climate projections in your area why not use the tool developed by the BBC with the Met Office to search for projections in your area using your postcode. **What will climate change look like in your area?** - BBC News

Learn more about how climate change is affecting people around the world in our exploring climate impacts lesson:

7-11 years – https://www.metoffice.gov.uk/weather/learn-about/met-office-for-schools/themes-for-7-11/resources-7-11/exploring-climate-impacts

11 – 14 years - https://www.metoffice.gov.uk/weather/learn-about/met-office-for-schools/themes-for-11-14/resources-11-14/exploring-climate-impacts



Session 9

Our Future Workforce

Aims of session 9

- There are a range of skills that we nurture and develop as an organisation.
- Students recognise that great minds don't think alike.
- Roles at the Met Office all interlink, we need a range of skills to keep people safe.

Summary

In this session you will delve into what it's like to work at the Met Office. What jobs do we have available and how do they link with each other to keep people safe and thrive?

Word Bank

Curiosity – a strong desire to learn more about something

Collaboration – working together with one or more people towards a common purpose

Flexibility – being able to change and compromise

Leadership – being able to lead a group of people towards a goal

Motivation – putting effort in a particular direction to achieve a goal

Negotiation – being able to lead a discussion between groups that can end with a mutual agreement being made.

Skill – is a talent or expertise that you've practiced or learned to take on a task or job.

Teamwork – working together in a group to achieve a goal

Guidence for experiments and activities in session

You'll be asked to take part in a skill matching session where you'll have a range of skill cards to print. Can you match them up to the jobs that our demonstrators describe?

You'll need:

- Skills cards printed out and cut up for each group that you have
- Internet access to watch the video - **https://www.youtube.com/watch?v=gn8w6pqfxa8**

Skills cards – Helping Farmer Forth

- Start by discussing with the students again – what is a skill?
- This activity is very flexible and can be arranged for groups or individually, feel free to adapt it to your students.
- Using skill cards set 1, printed and cut out, discuss which skills might be useful to help Farmer Forth – what skills do we need to help our customers?
- Have a go at making two piles – which skills do you think we need, and which ones might be not as important? Are they all needed?
- Spend some time to think of ways that these skills may be used for helping Farmer Forth. Forecasting may be an obvious skill, but what about clear communication? Is the forecast going to be useful to Farmer Forth if it has not been communicated well?
- **Hint** [all the cards are useful skills to help Farmer Forth]

Skills cards – Helping Riya

- Again, adapt this activity to the needs of your students, working in groups or individually.
- Using both skill cards this time, set 1 and 2, printed and cut out, discuss which skill cards might be useful to help Riya understand what further impacts of climate change might be.
- If you can, link back to what we learned in session 7 and 8 on climate and climate change.
- Remember we need to work together an organisation, also work with partner organisations in India, and of course also work with Riya.
- **[Hint]** One example might be foreign languages. Sometimes we work with partner agencies and people who can speak foreign languages to translate information to help with communication of important science and information internationally.

- **[Hint]** Design is another important example. We often provide information in a very visual way, with diagrams, images and lots of colour. This helps with communication of information and makes it more exciting to read and understand. In the Met Office, we have team dedicated to design to help us communicate information effectively.

Get in touch with us if you would like to know more about how the other skills are important. You can contact us **@metofficelearn or email us at science.camp@metoffice.gov.uk**

Additional activities after session

- If you'd like to explore further opportunities with the weather and climate industry please download our lesson based around a graphic novel style cartoon.

7-11 years - https://www.metoffice.gov.uk/weather/learn-about/met-office-for-schools/themes-for-7-11/resources-7-11/weather-careers-stories

11-14 years - https://www.metoffice.gov.uk/weather/learn-about/met-office-for-schools/themes-for-11-14/resources-11-14/weather-careers-stories

Have a look at our dedicated careers pages: **https://www.metoffice.gov.uk/about-us/careers/working-here**

Like to explore further about skills? You may spot one of our demonstrators discussing the importance of teamwork! - **https://skillslaunchpad.org.uk/careers-hub/resources/skills-for-success/**

Session 10

Ask the Met Office

26th November **LIVE**
Keep an eye out for the link to join!

Aims of session 10

- Student will have the opportunity to ask any questions that they have to the Met Office special guests
- 'I have the best job in the world quiz' – where our demonstrators will compete for votes to crown them with "The best job in the world" title

Summary

Here's your chance to ask us any questions that you've not had chance to ask us during Virtual Science Camp. You'll also be taking part in the "I have the best job in the World" quiz where members of the Met Office will compete to be the winner of your votes, who, at the Met Office has the best job in the World?

You might even get a shout out on our Live Q+A if you tell us you'll be watching!

If you are not able to join in the live session, please feel free to tweet or email your questions to us **@metofficelearn** or **science.camp@metoffice.gov.uk** And finally, we hope that you have a wonderful Virtual Science Camp with us. We'd love to hear about your experiments, engagements, and feedback throughout.

You can contact us **@metofficelearn** or email us at **science.camp@metoffice.gov.uk**

If there's any further projects that you'd like to discuss with us, including our STEM Ambassador service, email us at stem@metoffice.gov.uk or go to our website to find out more:

https://www.metoffice.gov.uk/about-us/who/sustainability/community/schools-and-colleges
https://www.metoffice.gov.uk/weather/learn-about/met-office-for-schools

Glossary

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

Scenario - a simulated description of an event or series of actions and events.

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.

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Appendix

Session 9- skills cards

Scientific	Teamwork	Curiosity	Listening
Clear communication	Leadership	Forecasting	Planning
Negotiation	Computer programming	Flexibility	Collaboration
Social Media	Finance	Time management	Motivation

www.metoffice.gov.uk/schools

Skill cards set 1
Please print out and give a set to each group
Session 9

Problem solving	Networking skills	Teaching	Presentation skills
Legal skills	Engineering	Organised	Design
Decision making		Flexible	Research skills
Maths and statistics	Public speaking	Analysing data	Able to speak a foreign language

www.metoffice.gov.uk/schools

Skill cards set 2
Please print out and give a set to each group
Session 9