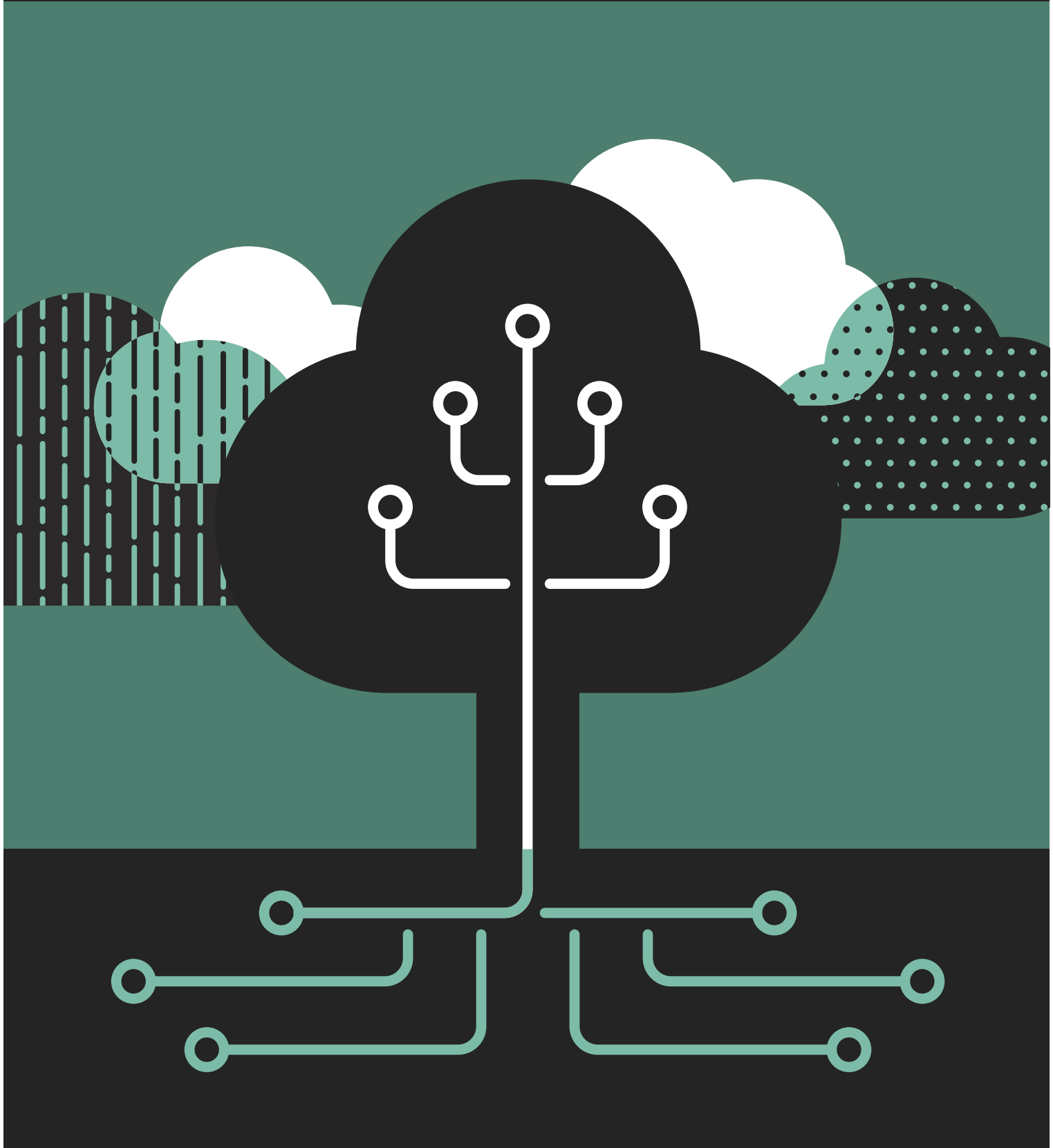




Volcanic Ash Emergency

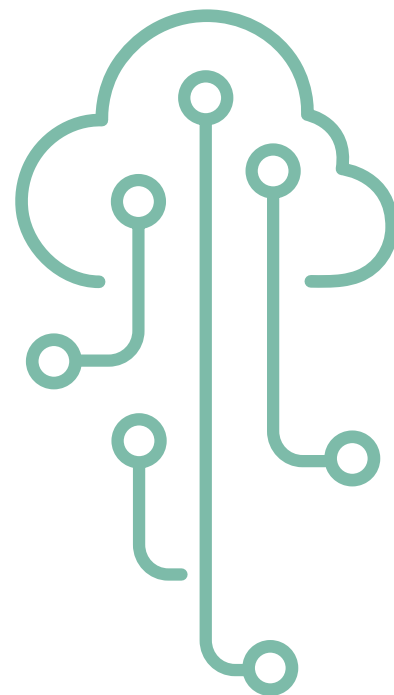
Coding activity



Introduction

Overview

You may know the Met Office best for the weather reports that you hear on the news or read on your phone. But did you know that our forecasts reach as far as space? Or that we help organisations, not just in the UK but across the world, to make decisions to help people stay safe and thrive? We also have one of the largest supercomputers dedicated to weather and climate in the world. How amazing is that?



Time required

45-60 minutes



Materials required

- Internet access
- YouTube access
- Volcanic Ash PowerPoint

Currently, Microsoft is working with the Met Office to build a new supercomputer that will transform the way we forecast the weather in the future. Combined with the expertise of our incredible colleagues, this new supercomputer will help us send earlier and more accurate warnings of severe weather, protecting people by giving them and their communities time to make effective decisions to keep safe. It will also increase the Met Office's understanding and analysis of climate change and support the organisation's efforts to reach net zero by 2030.

Future coders, can you find the bugs in the code to help the Met Office provide a volcanic ash forecast to airports?

Learning outcomes

By completing this lesson, students will be able to:

- Explore how observations and coding are important to the Met Office when forecasting the weather.

Activity steps

Resources

Introduction video of the Met Office: <https://www.youtube.com/watch?v=5HJrej9Hu28>

Follow along with our Data Scientist Stephen and Scientist Kirsty here: <https://www.youtube.com/watch?v=pPMJduJaDQQ>

Microsoft Makecode Arcade game links:

- First Exploration game, suitable for beginner coders (recommended for KS2 or equivalent): <https://arcade.makecode.com/S99399-41900-03900-14926>
- Deeper Discovery, suitable for those who like a greater challenge (recommended for KS3 or equivalent): <https://arcade.makecode.com/S65534-18611-51234-61037>
- A full solution game: <https://arcade.makecode.com/S94913-78553-82888-23447>
- First Exploration activity booklet (recommended for KS2 or equivalent)
- Deeper Discovery activity booklet (recommended for KS3 or equivalent)
- Teacher Solutions booklet

01

Explain to the group that they will listen to an introduction from Data Science Research Manager, Stephen, and Scientist, Kirsty. They will then be set a coding challenge.

Kirsty will explain how observations and coding are important when forecasting for airports to keep people safe, especially when a volcano has erupted.

Stephen will explore the Volcanic Ash game. The group can follow along with Stephen or take part independently.



10 minutes



Groupwork

02

After the introduction from Kirsty and Stephen, pause the video at 6 minutes 45 seconds. Then choose which version of the game you would like the group to work on. Tell the group that the aim of the game is to find the bugs in the code to help provide a volcanic ash forecast to airports.



10 minutes



Groupwork

Activity steps

Game versions

We have two versions of the game that groups can choose from. First Exploration is for students who are new to coding. Deeper Discovery is for students who are more familiar with some of the concepts around coding and may have worked with a Scratch-like coding environment before.

Click on the most appropriate link:

- First Exploration game link, suitable for beginner coders (recommended for KS2 or equivalent) - <https://arcade.makecode.com/S99399-41900-03900-14926>
- Deeper Discovery game link, suitable for those who are familiar with coding (recommended for KS3 or equivalent) - <https://arcade.makecode.com/S65534-18611-51234-61037>
- Full solution game - <https://arcade.makecode.com/S94913-78553-82888-23447>
- After you have decided which version the group will work through, go to slides 4 and 5 on the PowerPoint and introduce the video of a volcano erupting to the group.

Using either the video of our scientists explaining volcanoes (between 3 minutes 10 seconds and 5 minutes 39 seconds) or the explanation that can be found in each of the activity booklets and in the Science Behind the Game section (below), talk to the group about how important it is for the Met Office to collect observations.

03

Depending how many devices you have that can access the game, students may work individually or you can split them into groups of two or more to work through the First Exploration or Deeper Discovery activity booklet.

This activity can also be completed as a whole class. You can follow along with our Data Science Research Manager, Stephen, using the video provided. The game walk through can be found at 7 minutes 24 seconds.



25 minutes



Groupwork



Individual task

Activity steps

Remind the group that the game works by the group/s or individual students taking responsibility for driving a LiDAR (Light Detection and Ranging) van (slide 6) around the virtual map to collect volcanic ash weather observations. It then needs to be driven back, with the weather data, to the Met Office supercomputer.

Try to avoid the lava!

1. Tell the students to work through the booklet and look out for the three main tasks to complete
2. Collecting the volcanic ash weather observations
3. Sending the data to the Met Office supercomputer
4. Deciding whether to shut the airport, based on the data you have collected.

04

When the students have fixed the bugs, move to slide 9 and explain that they can explore ways of playing with the code further, to enhance or change the game.

Some suggestions are given below and on slide 9:

- Can you try to change the ash decision threshold? Instructions can be found in your activity booklet – First Exploration or Deeper Discovery.
- You have looked at our code in a graphical format, but at the Met Office a lot of our scientists and software engineers write code in a programming language called Python. If you'd like to see the code in a different format, there's an option to choose the Python version of the code. If you scroll over to the right-hand side of the screen you will see JavaScript and Python options. More instructions can be found in the Deeper Discovery activity booklet.



15 minutes



Groupwork



Individual task

Happy coding!

If, after taking part, you are eager to find out more about the Met Office and what we can offer in terms of a career, have a look at our website. We have a range of roles, not just in weather and climate, that you might be interested in <https://www.metoffice.gov.uk/about-us/careers>.

Educator information

The Science Behind the Game

(also in the activity booklets)

There are many active volcanoes located all over the world. When volcanoes erupt they release magma, hot gases and ash. Eruptions are dangerous to people living near the volcano, and also to people living far away because ash in the atmosphere can travel around the globe. This ash can also be hazardous for aeroplanes travelling through it. Volcanic ash is formed of tiny pieces of rock that have been heated to very high temperatures. When these ash particles get sucked into the jet engines of planes they cause a lot of damage. The particles can be invisible to our eyes; we use special equipment to find them.

To help pilots stay safe, the Met Office provides forecasts of volcanic ash using a combination of observations and computer models. To create a forecast, we need to find out where the ash is now. This is called an observation. Volcanic ash observations are made in a number of different ways - using satellite data, radar and LiDAR (Light Detection and Ranging), for example. The Met Office uses an instrument called a LiDAR sensor to measure ash clouds. LiDAR works by sending pulses of laser light through the atmosphere, which is scattered by volcanic ash particles. Some of this light reflects back to the instrument and can be used to work out the height and concentration of ash. As well as a ground-based LiDAR network, and LiDAR equipment fitted to aircraft, the Met Office has a van fitted with a LiDAR, which can be deployed around the UK to wherever observations are needed.