Graphing Temperature Models

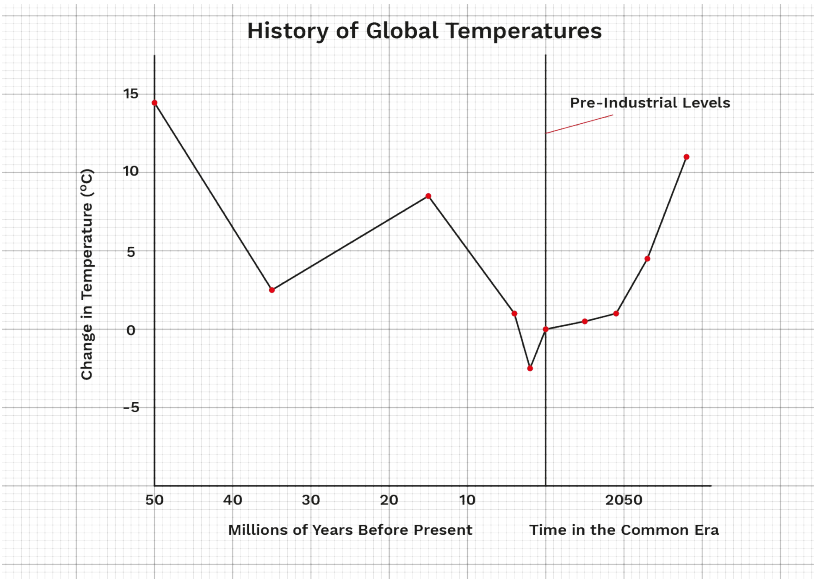
Average global temperatures have changed many times in the Earth's past and are expected to increase dramatically in the near future due to climate change. We know this thanks to **climate models**, which allow us to make such conclusions and predictions. In this activity, your students will have the opportunity to create a graph that shows the changes in average global temperatures over time while using data from climate models to depict what they may be in the future.

The temperatures provided in the activity for '**Millions of Years Before Present**' are estimates from real scientific data but are not exact. Nonetheless, this activity allows your students to practise more advanced graphing skills while getting an idea of how temperatures have changed over time, and how they could change in the future. Following the activity, we recommend asking your students the questions provided below and discussing the answers together.

Preparation

Prior to starting the activity, we recommend going through the hand out carefully with your students. Each student should be provided with a copy of the handout.

Answer key



Following the activity, we recommend discussing the following with your class:

What has caused these changes in temperature in the past?

The average temperature of our planet has historically oscillated between ice ages and warmer periods. This was not caused by humans but by changes in the energy radiated by the Sun, the Earth's orbit around the Sun, and the angle at which the Earth rotates.

These changes in temperature were very gradual, with no more than **1°C of change in the global average temperature over the past 10,000 years**. This extremely slow rise or fall in temperatures ensured living things had the **time to evolve** to the gradually changing conditions, offering a level of **stability** that allowed for the development of human civilisation.

What's so different about the changes we've seen since the 1850s?

Until recently, the Earth was in a natural cooling phase, which started around 5000 years ago. This cooling was steering us towards a new ice age, due to start in about 1500 years. However, somewhere around 1850, **global temperatures started to rise dramatically**. For the past 250 years, humans have been releasing greenhouse gases into the atmosphere, causing the Earth to warm by roughly 1.1°C when it should still be cooling!

So the difference between the changes in temperature we're seeing today and those we've seen in the past is that temperatures are changing much faster now. Consider the rises and falls of the graph you have made.

The large squares before pre-industrial times represent 10 million years over which those rises and falls were spread. Each large square in the common era represents only 200 years! That's 200,000 times faster than pre-industrial times!

Despite there being similarly rapid and large changes in temperature in the distant past, current global warming is dangerous because **most living things**, including humans, have **not experienced changes of this scale and speed before**, so it will be challenging for them, and us, to adapt.

What does the future look like?

If little to no climate action is taken to reduce emissions and the amount of greenhouse gases in our atmosphere, we can expect to see an **increase of 4.5°C** in global temperatures **by 2100** and an increase of roughly **11°C by 2200 (visible in the graph).**

As part of the Paris Agreement, every country involved pledged to limit global temperature rise **to well below 2°C** above pre-industrial levels, and preferably below 1.5°C. Most countries have set out how they will try to achieve this under policies. However, **under current policies, warming is expected to increase by 2.7-3.1°C**. With global warming actually increasing faster, drastic action must now be taken to reduce emissions and limit these rising temperatures.

We welcome feedback and would be delighted to hear your thoughts on this activity. Feel free to send an email to schools@climatescience.org and we'll be sure to get back to you soon :)