



**Topic:** Exercise / Staying healthy / Climate

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## Climate models help us plan sports events

The Earth is about 4.5 billion years old and it has warmed up and cooled down in the past. Now, it is warming faster than ever before. Burning **fossil fuels** has increased **carbon dioxide** in the **atmosphere**. This is a heat trapping gas and acts like a blanket around the Earth. Average temperatures have risen by about 1.2 °C in the last 200 years.

We need to think carefully about summer sports events so that they are safe for athletes and spectators. For example, how hot could the summer Olympic Games in Paris get? Some scientists suggest that we must plan for the worst possible cases.

**Have you ever been hot when watching or taking part in a sport?**



*Figure 1. Exhausted runner resting in the shade.*

### Should we worry about getting too hot?

Our bodies try to maintain a temperature between 36-38 °C. When it is very hot, our heart works harder. We can get heat rashes or swollen feet. Symptoms of heat exhaustion include headaches, dehydration, cramps and feeling dizzy. If we do not cool down, there is a risk of heat stroke. A doctor is needed urgently for body temperatures above 40 °C.

**How do you know that your heart is working harder?**

**What types of exercise make your heart beat faster?**

If we get too hot, we sweat. When the sweat **evaporates**, it uses our body heat. This cools the skin and the blood just under the skin. As the blood moves round the body, the body is gradually cooled.

### What happened in the last summer Olympic Games?

Thousands of athletes from around the world compete in the Olympics Games every four years. The 2020 Summer Olympics took place in Tokyo, Japan. It was the hottest Games in history. Temperatures reached 35 °C and **humidity** was high.

The athletes were fit and had trained for the heat. They drank plenty of water and rested in cool places. Ice packs, slush drinks and ice jackets helped the athletes to cool down. The organisers provided mist sprays and ice baths.

There were special arrangements for some events. The water in Tokyo Bay reached 29 °C and was described as 'hot as soup'. To avoid the hottest part of the day, long distance swimmers raced at 6.30am. The marathon took place 800km away in a cooler location.

Despite all this, newspapers reported that Olympic athletes were 'tortured in the hottest Games ever'. The sand was almost too hot for the beach volleyball players to stand on. Some tennis players suffered heat exhaustion. They had to stop their match and one left the court in a wheelchair. The world number one tennis player, Novak Djokovic, explained why the conditions were so tough. He said, "You're constantly dehydrated. You feel like you have weights on your shoulders." It was recommended that in the future, more breaks were planned for sports like tennis.

**What did the organisers do to help athletes cope with the heat?**

**Which of these ideas would be useful for children taking part in school sports day?**

## How hot might the Paris Olympics get?

The 2024 Paris Olympics are being held in July and August. This is the time of year when Paris is hottest. In 2003, there was a record-breaking **heatwave** in August lasting 15 days. It was the hottest summer for 500 years. There were 'tropical nights'. These are when temperatures do not drop below 20 °C. Tropical nights make it hard for people to sleep and recover.

During heatwaves, parts of Paris can be 10 °C warmer than the nearby countryside. Water evaporates from ponds, vegetation and the soil. This helps to cool the air. Plants reflect more sunlight than tarmac, and trees also provide shade from the sun.

Which month do you think would be good for sporting events? Why?



Figure 2. The Olympic rings in Paris. © Anne Jea

## What did the climate scientists do?

The climate scientists used **climate models**. These are computer programmes. They are based on our understanding of the world's weather systems. Climate models can be 'set' to represent our current climate. This includes global warming caused by humans. They can also be 'set' so that they represent a climate without global warming. Scientists can compare the weather possibilities from the models at these different settings.

Climate scientists wanted to find out how hot future heatwaves could be. Usually, climate models take weeks or months to work out the weather possibilities. The scientists knew the weather conditions most likely to bring heat from Africa. So, they used these conditions in the models. This saved time. The weather possibilities were calculated by the computers in a few hours!

## What did the climate models show?

The climate models did not give us an accurate weather forecast for the Paris Olympics. They did warn us about future extreme weather possibilities. They showed that heatwaves hotter than the one in 2003 are now possible. This table shows how much hotter they might be:

Heatwave (15 days)	Average Temperature over 15 days	Average daytime temperatures	Average nighttime temperatures
Actual 2003 heatwave	26.8 °C	36.8°C	16.8°C (possibly some tropical nights)
Heatwaves that might occur in the future	30.8 °C	40.8 °C	20.8°C (likely to have many tropical nights)

## How will this information help?

The City of Paris is working with climate scientists. They plan to plant more trees. They also want more buildings to be covered with greenery. Rooftops may be painted white. Blackout blinds and open windows should be used instead of air conditioning. People might need to adapt their working hours to avoid the hottest part of the day.

Climate models can be used to help other cities prepare for sports events. Climate scientists cannot tell us the exact year of the next major heatwave. They can tell us how often we can expect to have a heatwave and how hot it might be. This information can be used to plan for the future.

### Glossary

**atmosphere** – the layer of gases surrounding the Earth or another planet

**carbon dioxide** – a colourless gas with no smell that is naturally present in air. It is made from carbon and oxygen

**climate models** – a computer representation of the Earth's climate system, including the atmosphere, ocean, land and ice.

**evaporates** – the process by which a liquid turns into a gas (vapour)

**global warming** – the long-term increase in the Earth's overall surface temperature

**fossil fuels** – such as coal, oil and natural gas are formed from the remains of ancient plants and animals and are found in Earth's crust

**heatwave** – at least three consecutive days of unusually hot weather

**humidity** – a measure of the amount of water vapour in the air

### The paper that inspired this work was:

*Ensembles of climate simulations to anticipate worst case heatwaves during the Paris 2024 Olympics.*

By P. Yiou, C. Cadiou, D. Faranda, A. Jézéquel, N. Malhomme, G. Miloshevich, R. Noyelle, F. Pons, Y. Robin, M. Vrac

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Investigations for children are described in the accompanying Teacher Guide.