



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. How hot will summer sporting events (such as the Olympic Games) be in the future? 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 2020 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 could Paris get in the future?

The 2024 Paris Olympic Games were held in Paris 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, Paris can be 10 °C warmer than the nearby countryside. Water evaporates from ponds, vegetation and soil in the countryside. 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 based on our understanding of the world's weather systems. Climate models can be 'set' to represent our current climate (where humans are burning fossil fuels and there is **global warming**). 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 heatwaves in the future could be. Usually, climate models take weeks or months to work out the weather possibilities. The scientists knew that winds from the south bring heat from Africa and 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 show that future heatwaves in Paris could be 4 °C hotter than the 2003 heatwave (see table below).

Heatwave	Average temperature over 15 days (°C)	
	Daytime	Nighttime
The 2023 heatwave	36.8	16.8 (possibly some tropical nights)
Heatwaves that might occur in the future	40.8	20.8 (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 simulation 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 made from decomposing 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 Teacher Guide which can be accessed [here](#).