

**Topic:** Weather / Climate change

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cutting-edge research with primary science

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## It's raining all over the world

Scientists have discovered that extreme rainfall events across the globe can be connected.

### Weather watching

Human beings love to talk about the weather. It has a big effect on us. Should we wear a coat? Should we go for a bike ride or go to the cinema? For centuries we watched the weather. We noticed how animals behaved before storms. We looked at the appearance of clouds. However, we could only predict the weather for the next few hours. Then in 1854, Admiral Robert Fitzroy set up the Met Office. **Meteorologists** built weather stations and recorded the weather carefully. They began to understand the Earth's climate and weather patterns.

How did people try to predict the weather before we had weather forecasters?

### Are weather forecasts always accurate?

Today, **satellites** in space can look down at large areas of the planet at once. **NASA** say they give us 'eyes on the Earth'. **Supercomputers** also help us make sense of the weather across the planet. Temperatures are used to predict how much evaporation of water will take place. Wind speeds and directions are used to predict how weather will move. The weather can be forecast days or weeks ahead. Huge mistakes are now rare, but they do happen. This can be devastating when we fail to prepare for extreme weather.

Use the glossary to find out what satellites and supercomputers are.

How do you think we get photographs of clouds from above, like those in Figure 1?

Why do NASA say that satellites give us 'eyes on the Earth'?

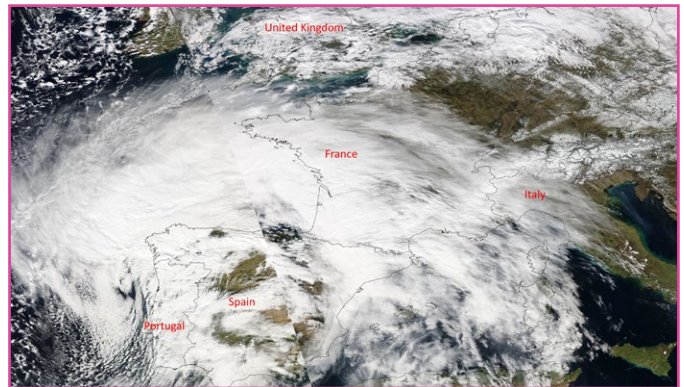


Figure 1. An image from NASA's Aqua satellite showing a violent storm over Western Europe on 27 February 2010. © MODIS Rapid Response Team, NASA GSFC. Labels of countries added by PSTT.

### What is extreme weather?

Extreme weather means weather that is different from what we usually expect. It can be too hot, too cold, or too wet. It can also mean strong winds, storms, and floods. **Climate change** is making extreme weather events more common and more intense. We are now seeing more heatwaves, storms, and floods than ever before (Figure 2). In July 2022, the UK had a **heatwave** with temperatures of 40° C. This was the hottest day ever recorded in the UK. The heatwave caused many problems, including wildfires. In 2019, **Hurricane Dorian** hit the Bahamas and North America. It was one of the strongest hurricanes ever recorded. In the same year, tropical **cyclone** Idai caused floods and landslides in Africa. It was the third deadliest southern hemisphere cyclone on record.

Can 'extreme weather' be dangerous for people?  
Give some examples.



Figure 2. Extreme rain causes flooding in Oxford (UK) in 2007. © John Barker

## What did the scientists know?

Scientists knew that regional weather can be linked. In Figure 1, we see a storm stretching about 2,500 km from the Atlantic Ocean to Northern Italy.

## What did the scientists do?

The scientists wanted to know if rainfall events further apart were also connected. They looked for patterns using satellite data. An example of their results can be seen in Figure 3. The red patch shows a region in South Asia with extreme rainfall. The blue patches show that there was also heavy rain in many other places, some over 13,000 km away. It was raining in 6 of the 7 continents across the world. The scientists called these long-range connections teleconnections.

The prefix 'tele' means 'far away'. Can you think of any other words which begin with 'tele'?



Figure 3: The satellite data identified places (blue) connected to an extreme rainfall event in Asia (red). © Petr Dlouhý. Arrows and shading added by PSTT.

## How do we get weather teleconnections?

The Earth is wrapped in a thick blanket of air. This is the Earth's **atmosphere**. Differences in air temperature, create winds that blow across the planet. The Earth is also spinning. This causes the atmosphere to swirl around like an ocean. There are currents of air that reach high speeds. Scientists think that these fast-moving currents act like bridges. They link weather systems together. Learning about **teleconnections** will help us forecast extreme weather. As our climate changes this will be very useful. It will help us become prepared and protect lives.

### Glossary

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

**climate change** – a long-term change in the average weather patterns on Earth

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

**meteorologist** – a scientist who studies weather patterns

**NASA** – the National Aeronautics and Space Administration, a U.S. government organisation responsible for the scientific study of space

**satellite** - anything that orbits a planet or a star

**supercomputer** – a very powerful computer

**hurricane** – a storm or system of winds that rotates about a centre of low atmospheric pressure, moving at speeds of 30-50 km/hour and often bringing a lot of rain. Called hurricanes when they develop over the North Atlantic, central North Pacific, and eastern North Pacific, but known as **cyclones** when they form over the South Pacific and Indian Ocean, and **typhoons** when they develop in the Northwest Pacific.

**teleconnections** – a causal connection between weather systems which occur a long distance apart

### The paper that inspired this work was:

*Complex networks reveal global patterns of extreme-rainfall teleconnections.*

By Niklas Boers, Bedartha Goswami, Alijoscha Rheinwalt, Bodo Bookhagen, Brian J. Hoskins and Juergen Kurths.

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Investigations for children are described in the Teacher Guide which can be accessed [here](#).