LITTLE EXPLORERS

WEATHER

STUDYING STORMS

WEATHER SATELLITE

LIFT THE FLAPS TO DISCOVER HOW WEATHER WORKS INSIDE AND OUT!

WHAT POWERS OUR WEATHER?

COOL CLOUDS

CHANGING SEASONS

MEASURING THE WEATHER

WHOOSHING WINDS

METEOROLOGY

MORE THAN 30 FLAPS!

WHAT IS WEATHER?

Sun, rain, wind and snow... it's all weather! Weather describes the changes that happen in the air around our planet, and what the air around you is like at a specific moment.

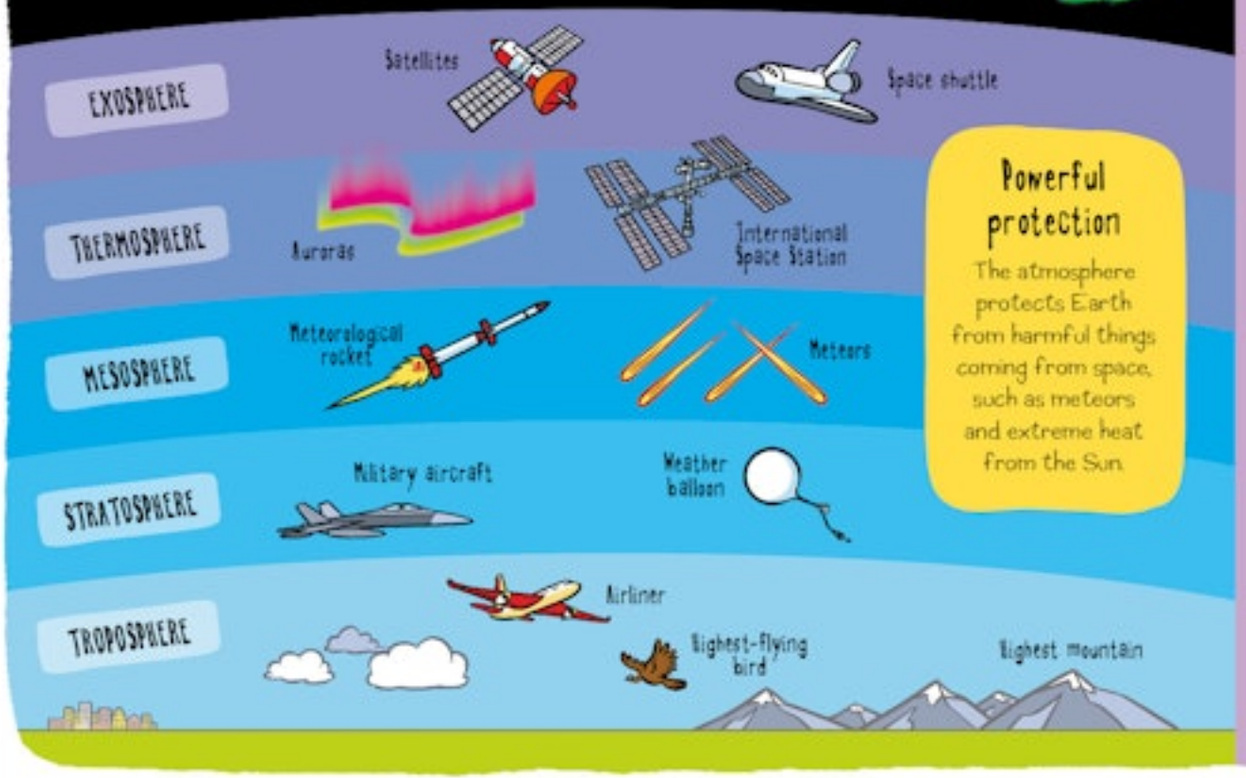
Awesome atmosphere

A layer of air surrounds Earth like a blanket. It is called the atmosphere and is made up of a mixture of gases that we breathe. There are five layers of the atmosphere. Weather happens when air moves around in the layer closest to Earth, the troposphere.

Super Sun

The Sun is a hot ball of gas, 150 million kilometres away from Earth – that's so far that it takes eight minutes for the Sun's light to reach us! The Sun's rays travel through space to heat the planet. Its heat causes air to move around and powers our weather.

Sun rays

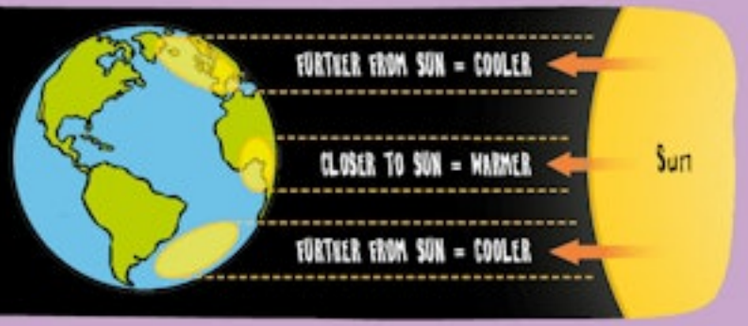


Powerful protection

The atmosphere protects Earth from harmful things coming from space, such as meteors and extreme heat from the Sun.

Hot or Cold

The Sun's rays spread out and hit different parts of our round planet in different ways. Areas closest to the Sun get more sunlight and heat. Areas where the rays are more spread out will be cooler.

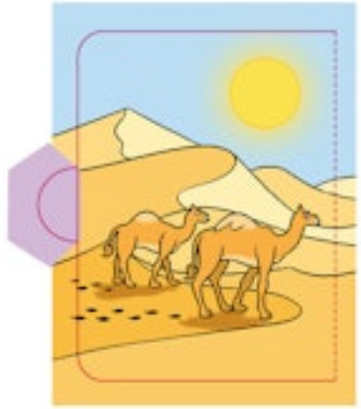


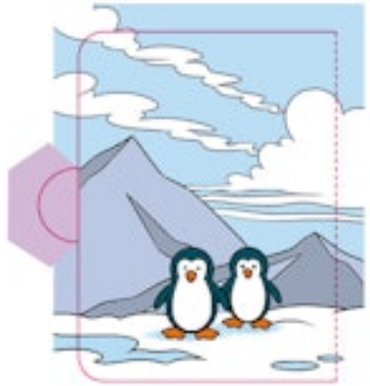
What is climate?

Climate is what the weather is normally like in a certain place. Some places, such as the Sahara desert in Africa, get lots of sunlight and very little rain. They have hot, dry climates. Other places, such as Antarctica, get less sunlight and are cold all year.

Look outside

Can you spot what the weather is today?





The Sahara desert is one of the hottest places on Earth. During the hottest months, temperatures can exceed 50°C.

The Sun is strongest in areas near the equator, an imaginary line that goes around the middle of Earth. These areas have tropical climates, which are warm and hot.

The coldest place on Earth is Antarctica, where temperatures can plummet to -94°C. Brrr!

THE SUN AND THE SEASONS

As weather patterns change through the year, we get different seasons. Many places have four seasons: spring, summer, autumn and winter. Which season is your favourite?

On a tilt

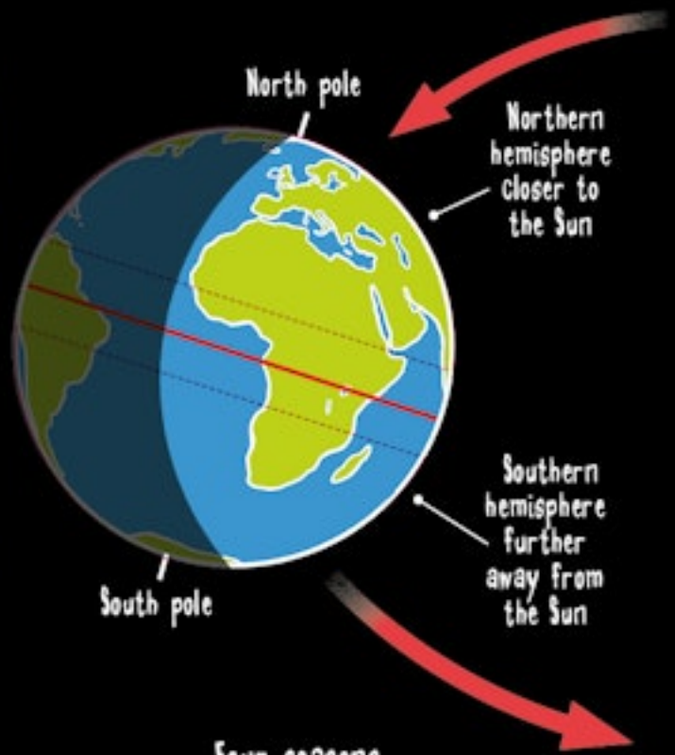
Earth tilts on its axis at at an angle of at 23.4 degrees. This means that it leans as it moves around the Sun. Places tilted towards the Sun get more heat and sunlight, and areas facing away from the Sun get less.

Top and bottom

The equator splits the planet into a top half called the northern hemisphere and a bottom half called the southern hemisphere. The two hemispheres have opposite seasons because of Earth's tilt.

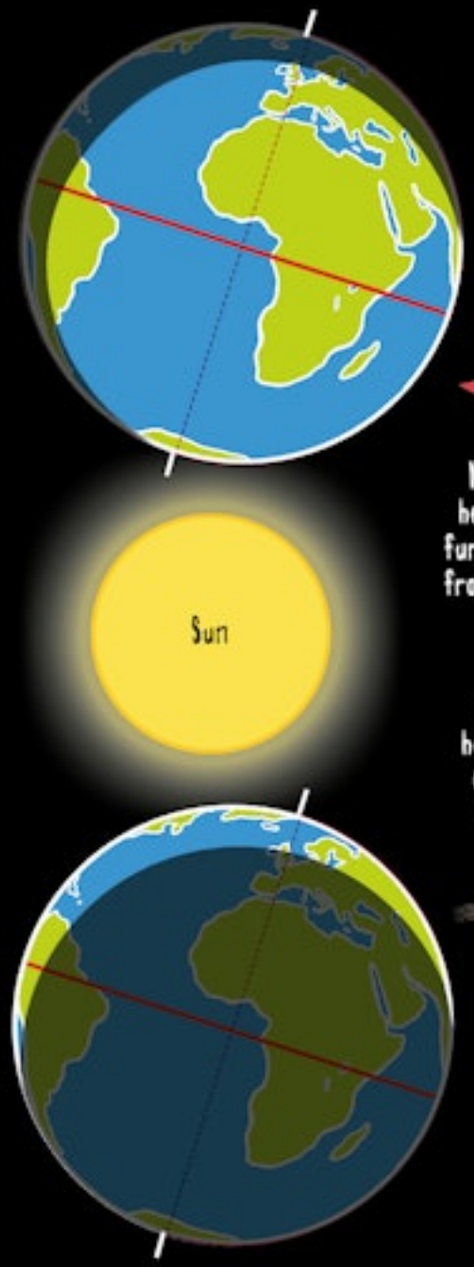
Always moving

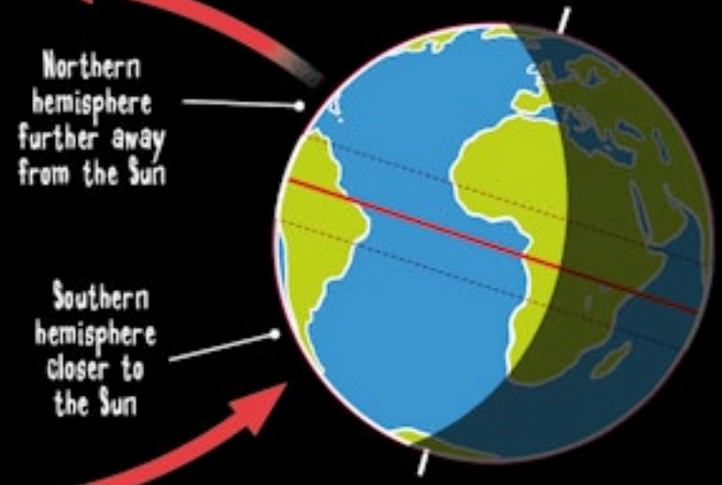
Earth is always moving around the Sun in space. It takes one full year for Earth to do a complete loop or orbit. During that time, parts of Earth get more or less sunlight than others, causing the different seasons.



Four seasons

When an area of the planet is closest to the Sun, it's summer. It is hot and bright. As Earth turns away from the Sun, the air cools and autumn arrives. Winter comes when an area is furthest away, with colder weather and sometimes snow. Finally, as Earth moves closer again, the air warms and spring blossoms.





Wet and dry

Some areas close to the equator are warm all the time and only have two seasons: wet and dry. In the wet season, rain falls freely and plants flourish. In the dry season, rain hardly falls at all.

Sun never sets

In the most northern parts of the world, the Sun does not set for more than 70 days. In summer, Earth is rotating on a tilted axis that means the North Pole is always facing the Sun.


WINTER
It is winter in southern hemisphere.
SUMMER
It is summer in the northern hemisphere.


SPRING
AUTUMN
When its autumn in the northern hemisphere it is spring in the southern hemisphere


SPRING
AUTUMN
While the northern hemisphere is in spring the southern hemisphere is in autumn.


SUMMER
In the summer it is warmer, the days are longer and more plants grow.
WINTER
In the winter the days are shorter and it is colder. Many plants stop growing.

THE WATER CYCLE

Did you know that the water you drink and the rain that falls on your head was once in the ocean? All the water on our planet is recycled over and over again, in a never-ending cycle.

Sun

What's inside a cloud?

Sun rays

① Evaporation

The Sun's heat warms up the water on the surface of the sea or a lake. The surface water turns to a gas called water vapour and floats up into the sky. This is called evaporation.

② Condensation

In the sky, the water vapour cools down into water droplets or ice crystals and gathers together to form in clouds. This is called condensation.

③ Precipitation

Finally, the water in the cloud becomes so heavy that the air can't hold it. It falls to the ground again as rain, snow or hail. This is called precipitation.

④ Collection

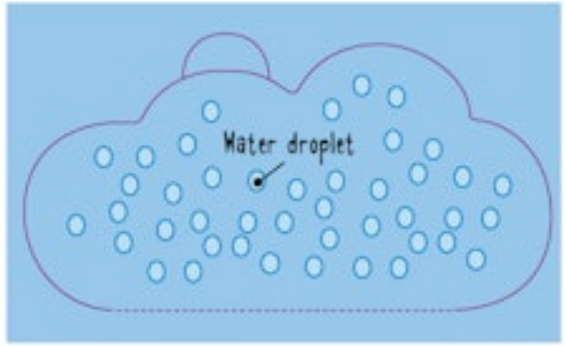
Just like anything on a hill, water flows downwards. It runs off the ground and through rivers and streams until it reaches a large lake or the sea. This is called collection.

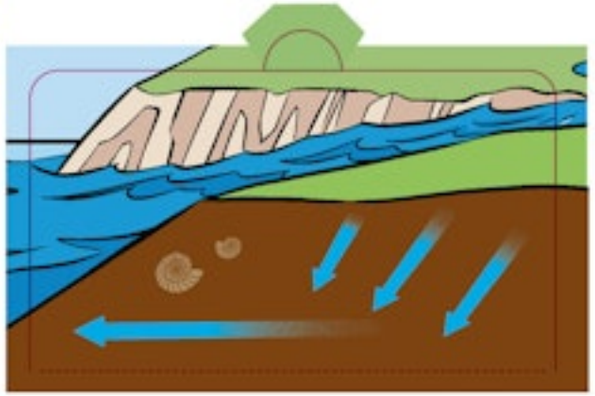
Ice storm

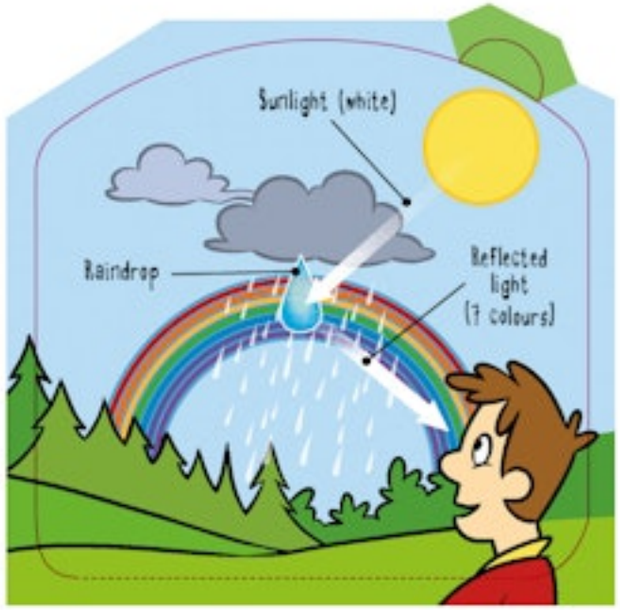
If it is very stormy, water droplets can be lifted even higher into the sky and freeze. They fall to the ground as hard balls of ice called hail.

Rainbow

When the Sun shines on a rainy day, you might see a rainbow!


Water droplet




Sunlight (white)
Raindrop
Reflected light (7 colours)

Some rainwater soaks into the soil too. It runs underground back to the sea.

The Sun's rays reflect off the raindrops in the sky to make arcs of colour: red, orange, yellow, green, blue, indigo and violet.

When wet clothes hang on the washing line, water leaves the clothes by evaporation.

Clouds are formed of teeny-tiny water droplets. Up to one million of these can form just one raindrop!

If the air close to the ground is very cold, ice crystals fall from clouds as snow.

Hailstones can be as big as tennis balls!

IN THE CLOUDS

On a sunny, rainy or grey day, you might see clouds in the sky. There are 10 common types of cloud, and they all mean different things for what weather we may have.

Cirrus

Cirrostratus

CirroCumulus

AltoCumulus

Is it a UFO?

StratoCumulus

Altostratus

Cumulus

Stratus

Nimbostratus

Cumulonimbus

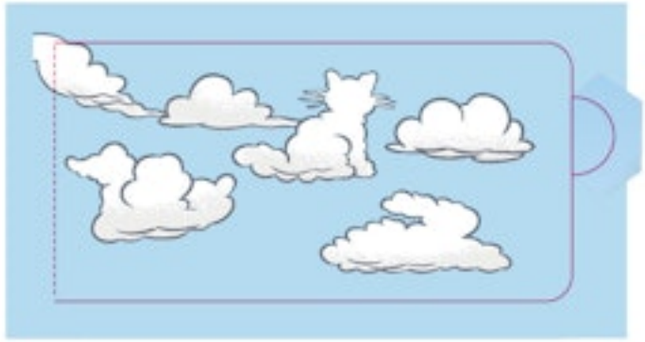
Fog

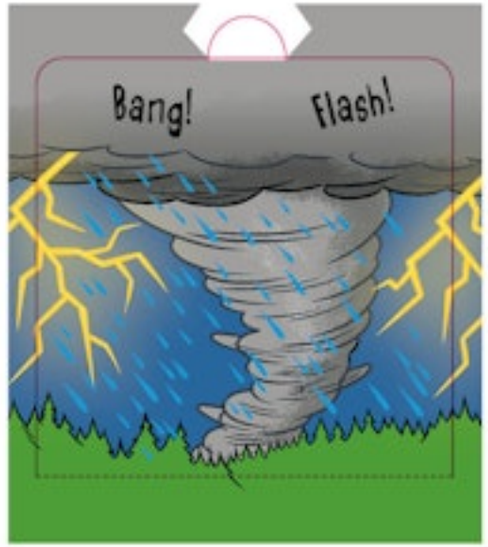
When clouds lie low on the ground, they create fog.

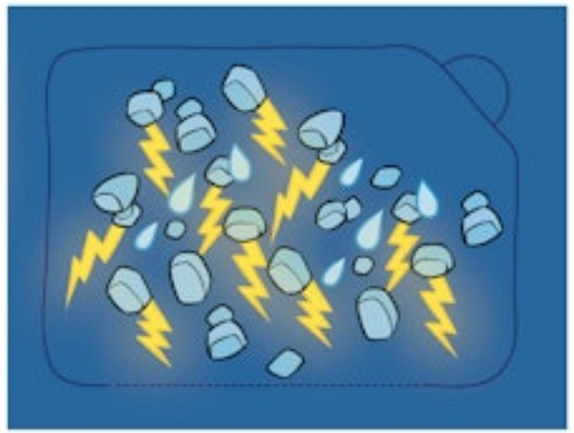
Stay safe

Lightning from clouds can be dangerous because it is electric. It heads to the ground and strikes the tallest object it finds. Never use an umbrella during a thunderstorm, and don't go in a swimming pool or near trees either. Stay safe indoors until the storm passes.


finally, I can
see again!




Bang!
Flash!



In Newfoundland, Canada, it can be foggy for a third of the year! Fog might stick around for weeks at a time before wind blows it away.

Cirrus clouds are thin and wispy in a blue sky, and often mean warm weather is coming. Cirrus clouds can take on the colour of the sunset! You might see them as orange or pink at dusk.

Some weather conditions produce clouds called lenticular clouds, which can look like flying saucers.

Clouds with 'cumulus' in their name are big and puffy. They are usually seen on a sunny day, but they can sometimes turn into stormier clouds. People like to spot shapes in cumulus clouds.

Nimbostratus clouds are dark and grey. They are full of rain or snow!

These tall, dark, grey clouds bring stormy weather, such as heavy rain, thunder and lightning, hail and tornadoes. Look out!

When water droplets and ice crystals rub together inside clouds, electricity builds up. It then jumps out of the cloud as a flash of lightning. Lightning makes the air heat up and move so fast that it creates thunder.

WHOOSHING WIND

A gentle breeze or a strong gale – some days you barely feel the wind at all, while other times it whooshes wildly around you! But where does it come from?

Under pressure

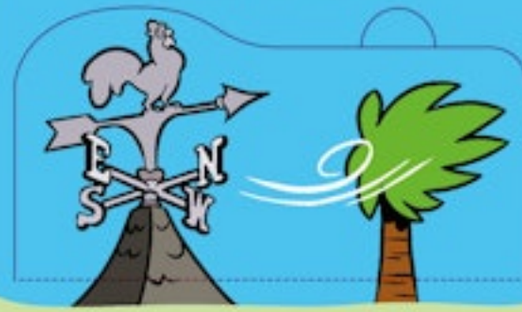
The weight of the air in the atmosphere presses down on Earth. This is called air pressure, and changes in air pressure cause wind.

Air on the move

Wind is created when air moves from areas of high pressure to areas of low pressure. The bigger the difference in pressure, the faster the air will move and the stronger the wind.

Which way?

Wind travels in all directions; the name we give to the direction of the wind is based on where it comes from, so a wind travelling from north to south would be a northerly wind.



How fast?

An anemometer is an instrument that tells you how fast the wind is blowing.

Wind power

As the wind blows across our planet, it can be used to help the planet too! Its energy can be used to make electricity. Wind spins the blades on a wind turbine, which in turn spin a machine inside. This changes the wind's movement energy to electrical energy.

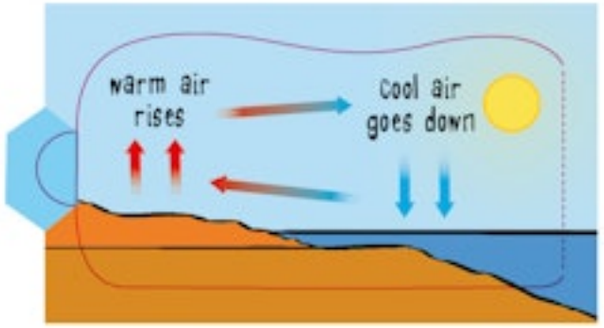
Calm to chaos

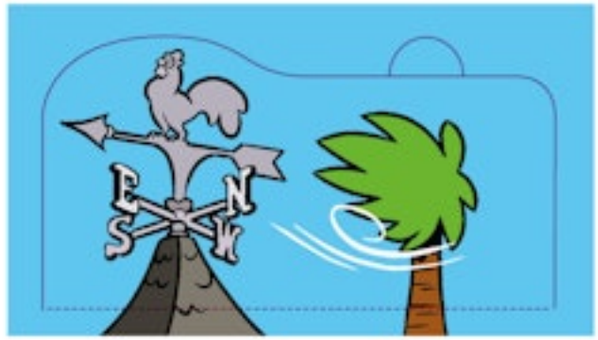
The Beaufort Scale measures how strong a wind is, ranging all the way from nearly nothing, to a strong windy gale, to a violent hurricane.

Beaufort Scale

Lift the flaps to see what each level on the scale looks like.

0	1	2	3	4	5	6	7	8	9	10	11	12
Calm	Light air	Light breeze	Gentle breeze	Moderate breeze	Fresh breeze	Strong breeze	Near gale	Strong gale	Gale	Storm	Violent storm	Hurricane


warm air
rises
cool air
goes down


E
N
S
W

Wind speed

less than 1 kilometre per hour

Wind speed

1-5 kilometres per hour

Wind speed

6-11 kilometres per hour

Wind speed

12-19 kilometres per hour

Wind speed

20-28 kilometres per hour

Wind speed

29-38 kilometres per hour

Wind speed

39-49 kilometres per hour

Wind speed

50-61 kilometres per hour

Wind speed

75-88 kilometres per hour

Wind speed

62-74 kilometres per hour

Wind speed

89-102 kilometres per hour

Wind speed

103-117 kilometres per hour

Wind speed

118 kilometres per hour or more

One large wind turbine can power around 1,500 homes in a year!

Breezes happen when air is warmed up by the Sun. This warm air rises and then cool air swoops in to fill the space

A weather vane helps to show the wind's direction. The arrow points to where the wind comes from. This weather vane shows an easterly wind.

EXTREME WEATHER

Sometimes the weather goes to the extreme. There might be too much rain or not enough. Winds might become too fast and too strong. Extreme weather can be dangerous and cause a lot of damage.

Tornadoes

A tornado is a spinning column of air that travels across land at high speeds during a thunderstorm.

Droughts

Droughts happen when there is very little rain for a long period of time. Water levels fall in rivers and lakes and crops and animals struggle to survive without it.

Hurricanes

A hurricane is a huge, swirling storm that starts above warm seas. It slows down as it moves closer to land but can thrash huge waves onto homes and cities along the coast before it stops.

Tsunamis

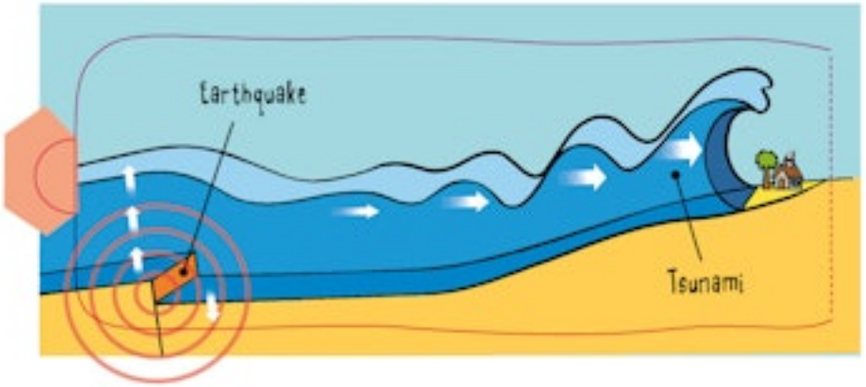
A series of huge waves racing across the ocean is called a tsunami. Tsunamis cause giant walls of water to crash onto the shore.

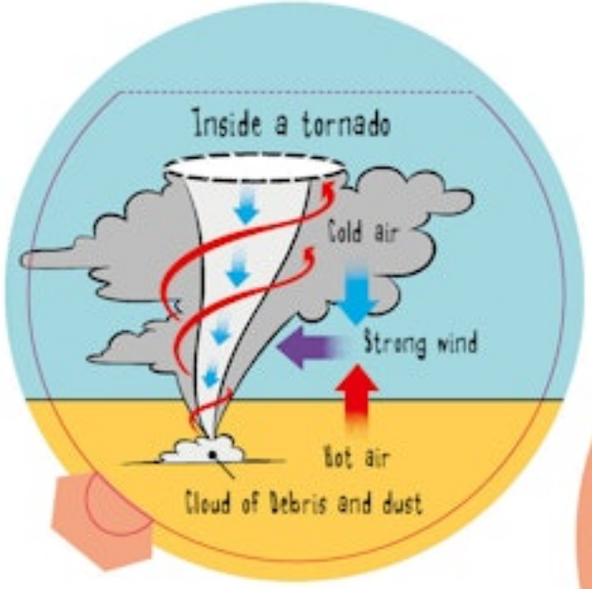
Floods

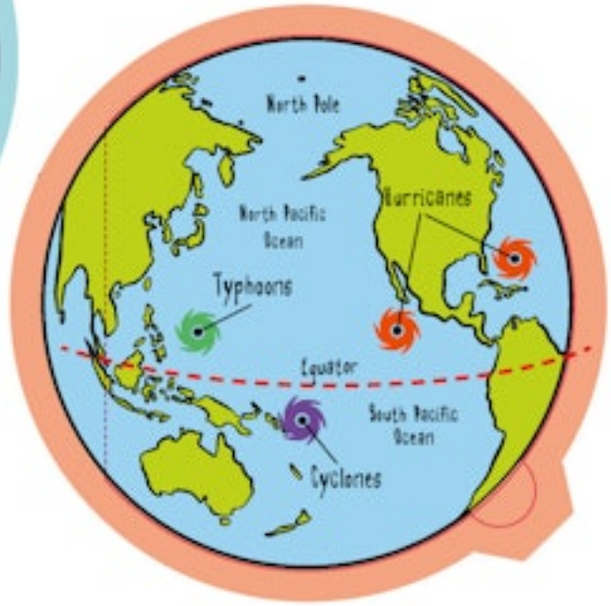
A flood happens when too much rain falls too quickly. Rivers and oceans rise, and water covers land. When rain falls quickly and heavily on dry land and has nowhere to go, it causes a flash flood.

Be prepared

Some people have survival kits packed and ready for when extreme weather hits. They take them with them if they need to leave their houses, or they can use them to survive at home in an emergency.


Earthquake
Tsunami


Inside a tornado
Cold air
Strong wind
Hot air
Cloud of Debris and dust


North Pole
North Pacific Ocean
Hurricanes
Typhoons
Equator
South Pacific Ocean
Cyclones


food
Batteries
First aid kit
Torch
Water
Blanket

Tsunamis are caused by earthquakes or volcanoes under the water. The force and movement of the ocean floor moves the water above, which triggers the tsunami.

Hurricanes have different names depending where in the world they are formed. They are called hurricanes when they are formed in the North Atlantic and North Pacific, and typhoons when they develop in the Northwest Pacific. They are called cyclones when they form below the equator over the South Pacific and Indian Ocean.

Tornadoes happen when the energy let out of a thunderstorm gathers in one small space. Tornadoes can travel as fast as 110 kilometres per hour – that's as quick as a car on a motorway!

It's important that these kits are kept in the same safe place so that they can be easily found in an emergency.

THE SCIENCE OF WEATHER

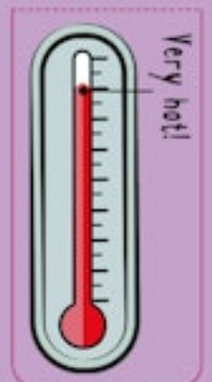
People who study the weather are called meteorologists. They use lots of instruments and technology to learn about the weather in our world. They can tell us if it will be rainy or sunny, warm or cold, and if extreme weather is on the way.

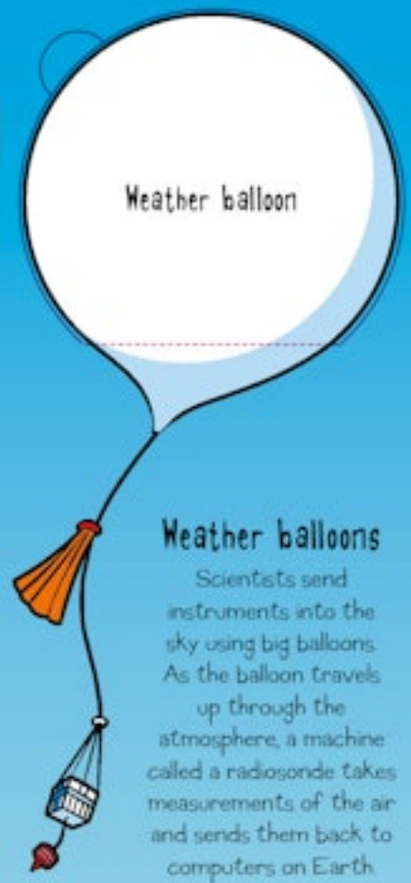
Barometer

A barometer measures the pressure in the air. Changes in air pressure help meteorologists predict changes in the weather to come.

Thermometer

Thermometers measure the temperature of the air. Is it warm or cold?



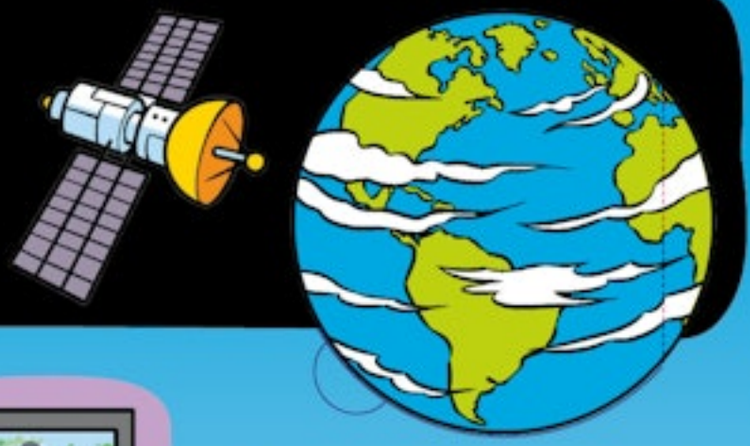


Weather balloons

Scientists send instruments into the sky using big balloons. As the balloon travels up through the atmosphere, a machine called a radiosonde takes measurements of the air and sends them back to computers on Earth.

Weather satellites

Weather instruments are even in space! Satellites hover and travel far above Earth and monitor changes in weather and climate. They can track storms and see extreme weather beginning to form.



Predicting the future

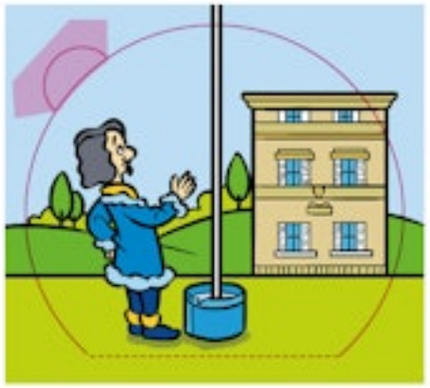
Scientists look at all the results of these studies and make a prediction of what the weather will be like over the next couple of days or weeks. This is called the weather forecast.

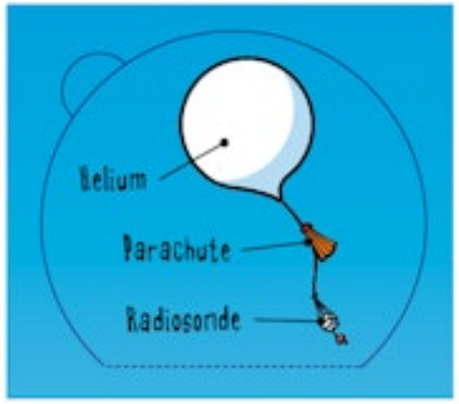
Nature knows

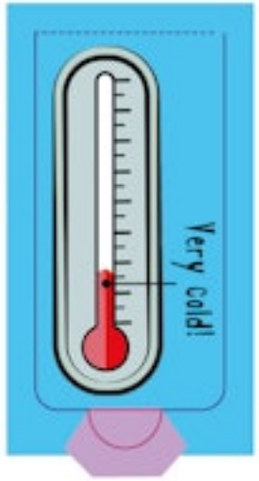
A pinecone is a natural way to predict the weather. When it is closed, it means that rain is likely coming.

Weather stations

Thousands of weather stations across the world keep track of changes in the weather and send information to scientists. They are found on land, at the top of mountains and out at sea.




Helium
Parachute
Radiosonde


Very cold!

Satellites take incredible photos of Earth from above! This is a satellite picture measuring the temperature on Earth. Red shows the hot areas, blue shows the cold areas.

When the weather is dry and sunny, the pinecone opens up!

Helium
Gas inside to help it float.

Parachute
For returning equipment safely to the ground

Radiosonde
Instruments for measuring atmosphere.

The lowest temperature ever recorded by a ground-based thermometer was -89.2°C in Vostock, Antarctica in 1983

Italian scientist Evangelista Torricelli invented one of the very first barometers in 1613. His early version was taller than his house!

OUR CHANGING CLIMATE!

The climate patterns of Earth change over time. Billions of years ago, Earth was a hot fiery rock, then it had rain for thousands of years after that! Now, we have a mix of weather across the globe, but this weather is changing too.

Keeping warm

The gases in the atmosphere work like a greenhouse to protect Earth and keep warmth in. They are called greenhouse gases.

Warming up

Pollution from humans, such as from cars, factories and rubbish, adds to the gases in the atmosphere. The blanket of air traps more heat, and the planet warms up quicker than it should.

Shrinking homes

The warmer planet means that thick sea ice at the poles melts, shrinking the homes of polar animals.

More extreme!

The changing climate brings more extreme weather. Rains can be heavier, and droughts can last longer. Hurricanes become stronger.

HOW CAN WE HELP?

The good news is that scientists are working hard to find ways to slow down climate change. There are lots of things that we can do too to help protect the planet we call home.

Switch off

Turn off taps and anything electric, such as lights and the television, when you're not using them. This saves power and water.

Tree power

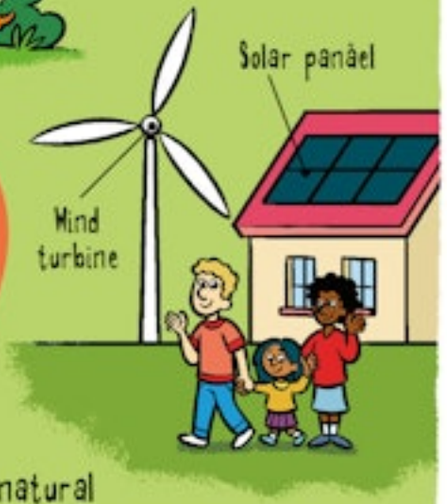
Plant a tree! Trees breathe in carbon dioxide, so they help to take it out of the air. Leave areas of your garden wild to give homes to small wildlife too.

Get on your feet

Whenever you can, walk, scoot or bike to places nearby, rather than drive. This cuts down on the pollution your family puts in the air.

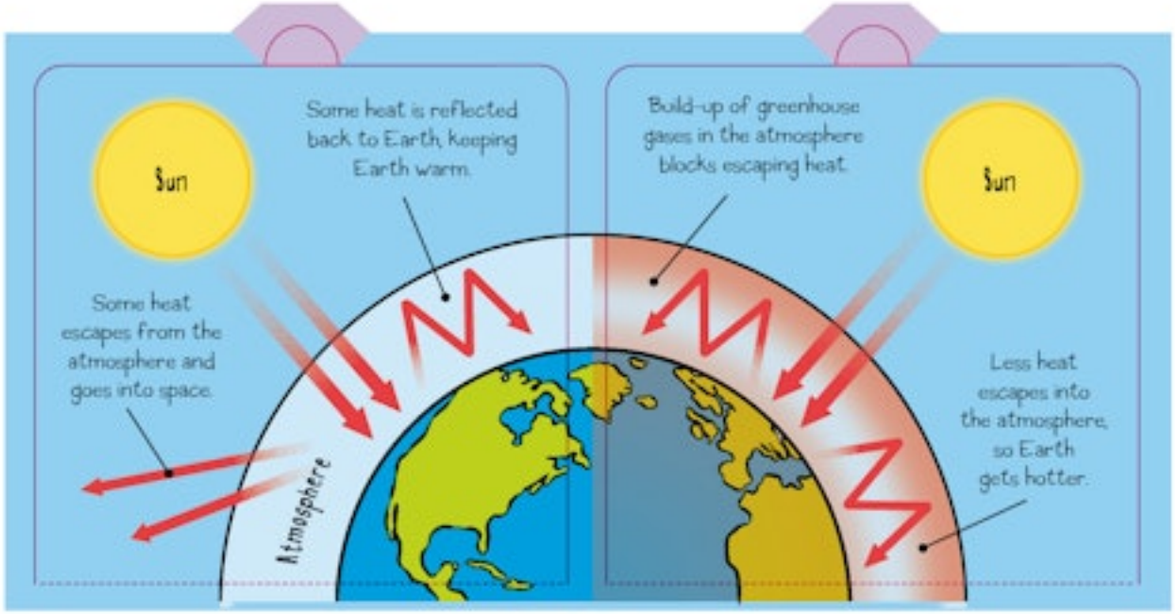
Local love

Shop at places nearby to save travel time and fuel. This supports your local farms and businesses and reduces the distance goods need to travel to get to you!



Go natural

Scientists are finding new ways to power the planet using natural energy, such as using the Sun and the wind. These are types of renewable energy, which means they will never run out. Solar panels and wind turbines can use this energy to make electricity.


Sun
Some heat is reflected back to Earth, keeping Earth warm.
Some heat escapes from the atmosphere and goes into space.
Atmosphere
Build-up of greenhouse gases in the atmosphere blocks escaping heat.
Sun
Less heat escapes into the atmosphere, so Earth gets hotter.

Like a greenhouse, the atmosphere traps warm air inside and protects plants from cold weather, to help them grow.

One of the main greenhouse gases is called carbon dioxide, and it is made when we burn things, such as trees and fuel. Trees and plants need carbon dioxide to live, so one way we could allow less of the gas into our atmosphere is by planting more trees

Across the globe, hot days are hotter than ever and are happening more often.