

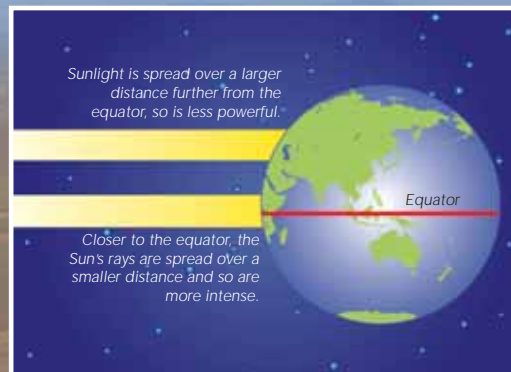
# What Makes Up the Weather?

## Where Do Clouds Come From?

We all know that rain comes from clouds, but what are clouds and where do they come from? There are several different types of cloud, and not all produce rain. Clouds are formed when water vapour in the air changes from an invisible gas into tiny droplets of water that you can see. When this happens high in the **atmosphere** where it's extremely cold, sometimes around  $-30^{\circ}\text{C}$ , the water vapour will change into millions of tiny ice crystals. Depending on the air temperature this will either fall as snow or rain.

## Why Does It Blow?

You can't see it, but you can feel it. You can also see evidence of it wherever you look. So what is wind? It is simply air in motion. Sometimes wind is light or drops away to nothing. At other times it can be powerful enough to blow down trees and damage buildings. But what causes wind and why does it blow? As with all other aspects of the **weather** it's the Sun that's behind it all. The Sun's rays heat up the Earth, but in a very uneven way. The regions around the middle of the Earth—called the equatorial regions—receive more direct sunlight than the areas at the top and bottom—called the polar regions. And land heats up more quickly than the oceans during the day, and loses heat faster at night. The atmosphere tries to 'smooth' out this uneven heat pattern by transporting air about—and this produces wind.



## Water and Ice From the Sky!

One of the most amazing things about planet Earth is the fact that it experiences rain—that is, water falls from the sky. You might think this is not so special, but this is the only planet we know about where rain can happen. If there are any other planets with water, it would either be too cold or too hot for the water to remain a liquid—it would freeze or boil away instead. This is why some scientists call Earth the 'Goldilocks' planet—not too cold, not too hot—it's just right!

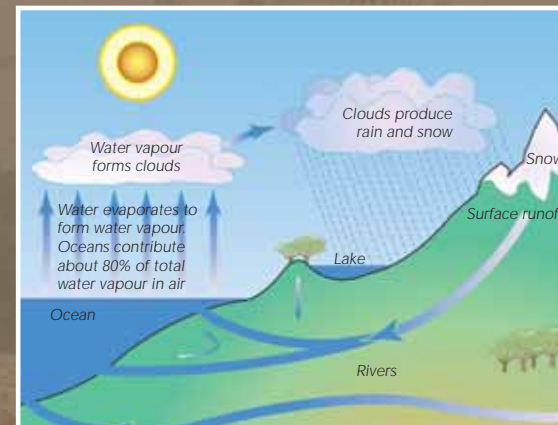
Just like fish, we live at the bottom of an ocean, but ours is an ocean of air, not water. This ocean of air is called the **atmosphere**. Just like the sea, the atmosphere is constantly moving, with currents, breaking waves and tides. However, unlike the ocean, you can't see the atmosphere because air is invisible. But you certainly can see the effects that take place within it—effects like rain, **thunder** and **lightning**, rainbows and clouds. And when it moves you can feel it—feel the wind as it blows past your face.

## King of the Sky—the Mighty Thunderstorm

A **thunderstorm** is a truly awesome display of the power of nature. Massive columns of air rise high into the sky to produce a huge, tall cloud called a **cumulonimbus**. This can be up to 15 kilometres high! It's packed with electricity, strong winds, heavy rain and even frozen rain that we call **hail**. The cumulonimbus produces powerful bolts of electricity that we call **lightning** and the massive crash this makes we call **thunder**. Some hail can be as big as cricket balls. Strong thunderstorms sometimes cause **tornados**. (See also pages 28–29.)



## Round and Round—The Water Cycle



Under certain conditions the tiny water droplets inside clouds begin to stick together to form larger drops that eventually fall to the ground as rain. If **temperatures** near the ground are cold enough, snow can fall instead of rain and this is just what the skiers want! All the water on Earth is constantly being recycled. Rain falls into lakes and rivers and also soaks into the ground. This water eventually runs off into the sea. The Sun heats the surface of the water and some of the water evaporates—it turns into a gas called water vapour (like steam from your kettle). This rises to form clouds, and eventually the water falls again as rain from the clouds. This endless cycle has been going on for millions of years.

# The Climate of Australia

Every day you'll notice changes in your environment. It might be hotter or colder, cloudy, rainy or **fine**, and the air may be dry or humid. These short-term changes we call the **weather**. But over a long period, say 30 years or more, the **average** of all the daily weather changes make up what is called the **climate**. Climate varies widely around the world. And because Australia is so large, it experiences a huge range of different climates. In the far north it's tropical—hot and humid all year, with a Wet Season and a Dry Season. Far south in Tasmania it's cooler and snow sometimes falls in the winter. In the vast inland deserts, there's much less rain than near the coast.



## Dry and Dusty

You might boil on a summer's day in the Australian desert, but in winter it can be freezing at night. There's not much rain, so the countryside is dry. The air is dry too because **humidity** is low.



Hobart, Tasmania, with Mt Wellington in the background.

## Grasslands Get More Rain

These areas are hot in summer, but the southern parts can be quite cold in winter. There is a little more rain than in the desert—enough to support large areas of grasslands—and that explains the name!

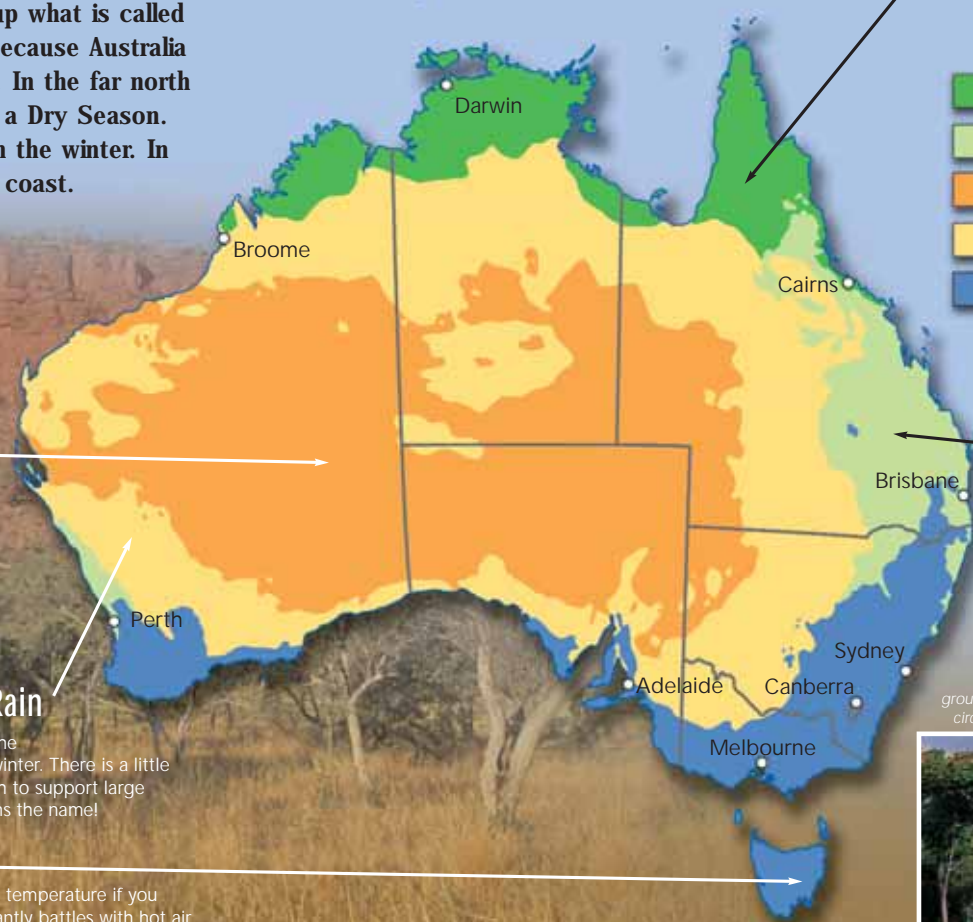
## Ups and Downs

You'd have to get used to big changes in temperature if you lived here. Cold air from the south constantly battles with hot air from the north so there are big variations across the year. Rainfall is also more constant from month to month than in the tropics.

## Hot and Sweaty

Here it's hot all year round. It has a Wet Season from about November to April; the rest of the time it's dry. During the Wet Season it's always very humid – you'll sweat a lot when you're outside.

*Tropical rainforest of far northern Queensland. Plants grow here that don't grow anywhere else.*



- Tropical
- Subtropical
- Desert
- Grassland
- Temperate

## The Meat in the Sandwich

Here the climate is part way between tropical and temperate. It's described as subtropical. There is still a Wet Season/Dry Season rainfall pattern, but **temperatures** vary more throughout the year than in the tropics.

*Many Brisbane homes are raised above the ground (high-set) on 'stumps' so that the air can circulate better and help keep the house cool.*



# Observing the Weather

Every day, across Australia and around the world, we measure the **weather**—**temperature**, wind strength, **humidity**, rainfall and **cloud** cover. All together these are called **weather observations**. Some observations are taken by people. Others are made by machines called **automatic weather stations**. Some even come from aircraft in flight, ships at sea and floating platforms in the ocean called buoys. Still more information comes from weather **radars** and meteorological **satellites**. All this is transmitted to central offices where weather forecasters, called **meteorologists**, work. They process the information on giant computers to produce weather forecasts for the next few days ahead.

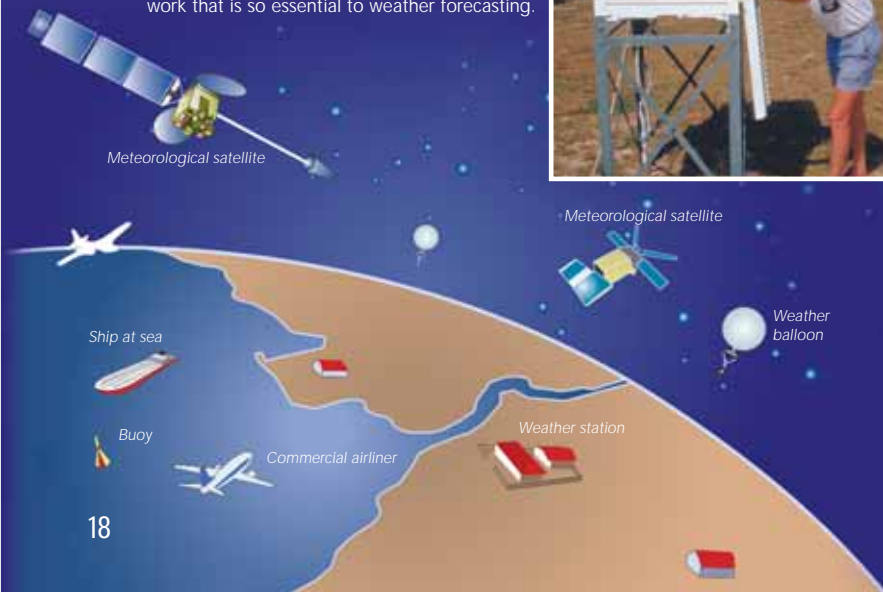
## People Power

All over Australia people called weather observers take weather observations so that you can know what the weather will be tomorrow. Weather observers work for the Bureau of Meteorology and at set times throughout the day, they send their observations to their local meteorological office. These observations form part of the worldwide network that is so essential to weather forecasting.



Meteorological satellite

Weather balloon



## Doing it by Machine

Instead of people taking observations, machines called automatic weather stations (or AWSs) can perform the same tasks. There are several hundred AWSs across Australia, including in remote desert areas. AWSs have the big advantage of being able to transmit weather observations every half an hour, 24 hours a day, every day of the year—a workload not possible for a human observer.



## In-flight Weather

Did you know that the plane you travel on when you go on holiday might also be taking weather observations? Commercial aircraft carry special instruments to measure temperature, winds and air pressure as they fly along. This information tells what sort of weather is happening high above the ground. This is important because what is happening in the **atmosphere** above us has a major connection with the weather on the ground.



## Adrift in the Ocean

Floating objects called buoys carry instruments that measure wind speed and direction, air pressure and sea **temperature**. They are really floating automatic weather stations. These buoys are carried far out to sea on special scientific ships. Once dropped into the water, they float about under the influence of the winds and ocean currents. They send the observations to **satellites** high above the Earth and from there to national weather offices.

## All at Sea

Many ships sailing across the ocean, including passenger vessels, cargo carriers and scientific craft, carry weather instruments that the crew use to make observations. They measure **air pressure**, air and seawater temperature, wind speed and direction and note cloud cover and sunshine information. These observations tell meteorologists in detail what conditions are like at sea.

