

Background information

Year 6, unit 3: Weather extremes

What is an extreme weather event?

An extreme weather event is any weather event that is unusual, severe or unseasonal for a particular place at that time of year. Flooding, drought, cyclones, hailstorms, heatwaves, dust storms and extreme cold spells are all examples of extreme weather events that can occur in Australia.

Cyclones

What is a cyclone?

A cyclone is a violent storm characterised by high-speed winds rotating clockwise around a low-pressure system in the southern hemisphere and anticlockwise in the northern hemisphere. They form over warm, tropical waters and have sustained winds of 63 km/h or greater near the centre. Cyclones produce winds in excess of 200 km/h and have effects hundreds of kilometres from their centre.

The severity of a cyclone is described in categories, which are determined by the maximum wind speed. The Australian Bureau of Meteorology classifies cyclones by the following wind speeds:

Category 1 – wind speeds less than 125 km/h

Category 2 – wind speeds between 125–164 km/h

Category 3 – wind speeds between 165–224 km/h

Category 4 – wind speeds between 225–279 km/h

Category 5 – wind speeds more than 280 km/h.

Such extreme events are called cyclones in Australia, hurricanes in the United States and typhoons throughout South-East Asia.

The centre of the cyclone is known as the eye. The eye is a clear, calm region that often produces light winds and clear skies and can vary in size from 10 km to 100 km depending on the severity of the storm. The wall of the eye is the part of the cyclone with the strongest winds and the heaviest rainfall.

What causes cyclones?

Cyclones need warm tropical waters with a surface temperature of 26.5° C or higher to form and develop. They occur in areas of low pressure and develop when the air is heated by the Sun and rises rapidly. As the air rises it becomes laden with moisture from the water evaporating over the warm oceans and this moisture-laden air condenses into massive thunderclouds. Cooler, heavier air then rushes in to replace the rapidly rising warmer air and the coriolis effect, caused by the Earth's rotation, forces the winds to spiral upwards.

As the cyclone builds in intensity it begins to move and is sustained by a steady flow of warm, moist air. Cyclones lose their intensity when they move over cooler waters or land due to the loss of the warm, moist air that is their energy source.

Where and when do cyclones occur?

Australia generally experiences cyclones along the Northern Territory coastline, and the northern coastlines of Western Australia and Queensland due to the warmer ocean temperatures and their proximity to the tropics.

The Australian cyclone season generally runs from November to April.

The impact of cyclones on people and the environment

Tropical cyclones are dangerous due to their destructive winds, heavy rainfall and damaging storm surges. They can impact on people and the environment in a variety of ways. There can be damage to trees and crops over large areas, severe erosion may occur due to the heavy rains, and people and animals may be seriously injured or even lose their lives. Property damage will occur and people and animals may be without shelter for many months. Cyclones can also have an economic impact on businesses, people, surrounding infrastructure such as roads and powerlines and food and fresh water supplies.

The destructive winds can cause extensive property damage and turn flying debris into potentially lethal weapons. Wind damage is affected by the maximum speed of wind gusts, the duration of high, sustained wind speeds and variation in the direction of the wind. The topography of the land can also play a part in the destructiveness of the wind. Hills and mountains can provide shelter from the wind on the leeward side and in some instances, such as over crests in the terrain, wind speed can increase.

Cyclones bring heavy rainfall that can produce extensive flooding, particularly in low-lying areas. This can lead to further damage to property and possible loss of life. The duration of the rain and the topography of the land can be contributing factors. The quantity of rainfall depends on the amount of moisture within the cyclone.

Cyclones can also bring about storm surges. A storm surge is a surge of seawater that is typically two to five metres higher than the normal tide level. It is caused by a combination of strong winds pushing the water towards the shore and the low air pressure system around which a cyclone is based. Surges vary in size due to the speed of the winds, the topography of the land, the presence of coral reefs, the size and speed of the cyclone and the tidal flow at the time. Potentially dangerous surges occur along low-lying coastlines, and across inland waterways such as rivers, lakes and estuaries. The pounding nature of the waves causes serious damage to coastal structures as well as flooding and coastal erosion that can dramatically change the existing shoreline.

How do scientists monitor and track cyclones?

Examining trends in tropical cyclones is problematic as only a few develop each year and the overall sample size is quite small. This makes it hard to find meaningful trends. Before the use of satellites and electronic tracking, cyclones were manually recorded and analysed by meteorologists. This meant there was very little consistency in the data collected over time and across different regions. With the

introduction of electronic tracking and the use of satellites, scientists are better able to look for trends and make more accurate predictions. When scientists first started to make predictions about cyclones they could only give a one-day warning but advances in science such as computer modelling and satellite tracking has now extended warnings to five days. Despite these advances, there are still considerable problems with forecasting the severity and the path of tropical cyclones.

Cyclones vary in their predictability with some rapidly changing course or intensity and so it is difficult to predict what might happen next. Considerable effort has gone into improving the forecasting skills of meteorologists who track cyclones. Today we have more accurate computer modelling that can simulate the possible path of a cyclone. No one model is more accurate than another so the prediction for a cyclone's path comes from a combination of information from several computer models. Scientists are now also able to make use of satellites to monitor the progress of cyclones and this, combined with a better understanding of the physics of tropical cyclone movement means scientists are better able to predict the development and path of cyclones. All this information combines to provide the basis of the official forecast.

How can people prepare for cyclones and attempt to reduce their impact?

Homes built in areas prone to cyclones must meet the National Building Code for cyclones. These homes are better able to withstand the strong winds associated with cyclones as the code determines how roofs should be attached to walls and how the walls should be attached to the foundations. Such structures must be able to withstand the wind action and remain stable and not collapse.

People living in cyclone prone areas need to take responsibility for their homes and property during a cyclone. Preparations include ensuring windows are fitted with shutters or metal screens, checking the condition of the roof and repairing any loose tiles, eaves or roof screws. Also, any overarching branches should be trimmed and the yard cleared of any debris or materials which may become dangerous during the strong winds.

Families can also prepare by having an evacuation plan in place and ensuring all members of the family are aware of what to do and where they may evacuate. Plans need to also be made for any pets during this time. It is also useful to identify the strongest part of the house where you can shelter and ensure supplies include a first-aid kit, a battery-operated radio, torches, non-perishable food and water. Locate any important documents and medications.

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