Weather & Climate

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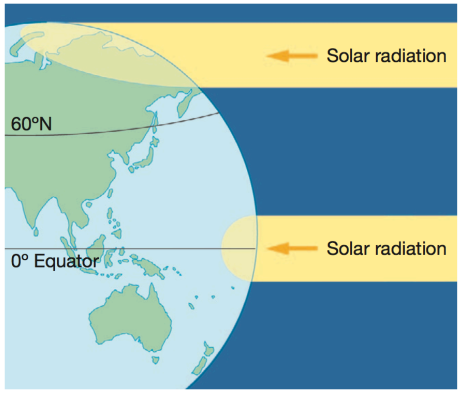
Weather & climate defined

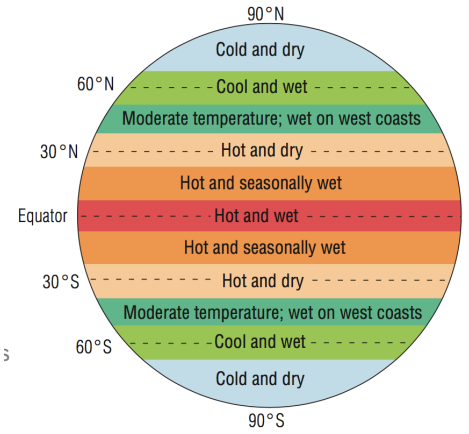
Weather is the day-to-day condition of the atmosphere at a particular place. It includes all the daily changes in temperature, precipitation, wind, sunshine, humidity (the amount of moisture in the air) and atmospheric pressure. Weather maps, or *synoptic charts*, use symbols to show the pattern of these changes.

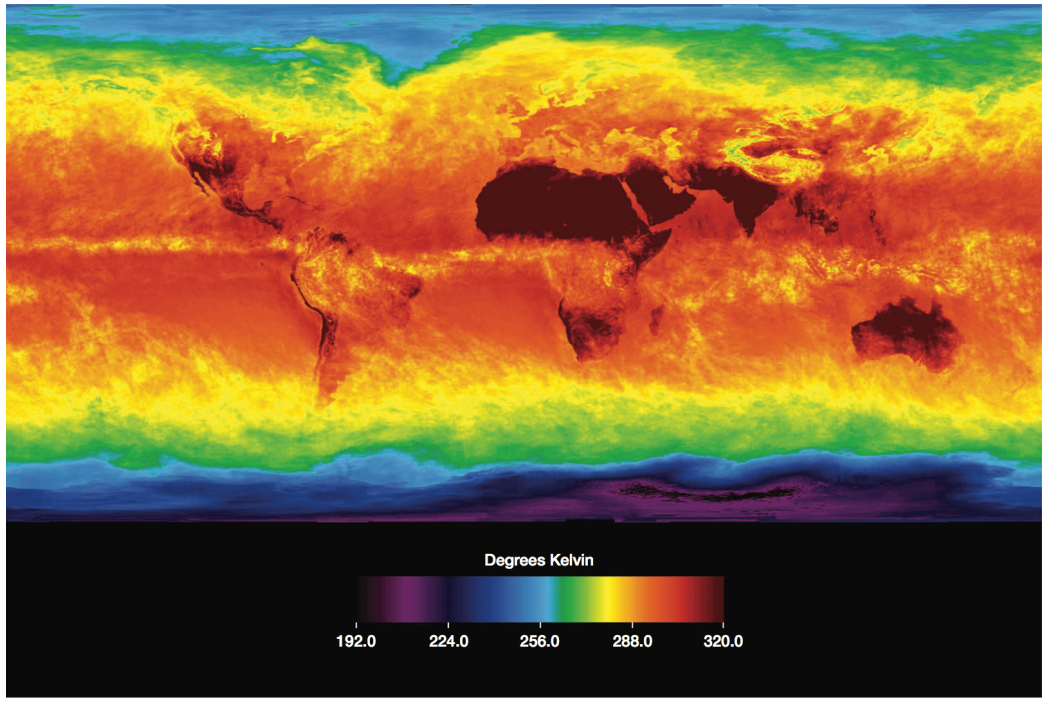
Climate is the long-term weather pattern for a place or region. The climate of a place depends on its latitude, the season, its aspect, how close it is to the sea, ocean currents and its height above sea level (elevation).

Factors affecting climate

- **Latitude**
- **Altitude** (On average, temperature drops by approximately 6.5°C with every 1000 metres of increase in elevation)
- **Distance from the sea**
- **Ocean currents**
- **Seasonality**
- **Aspect**
- **Mountain barriers**

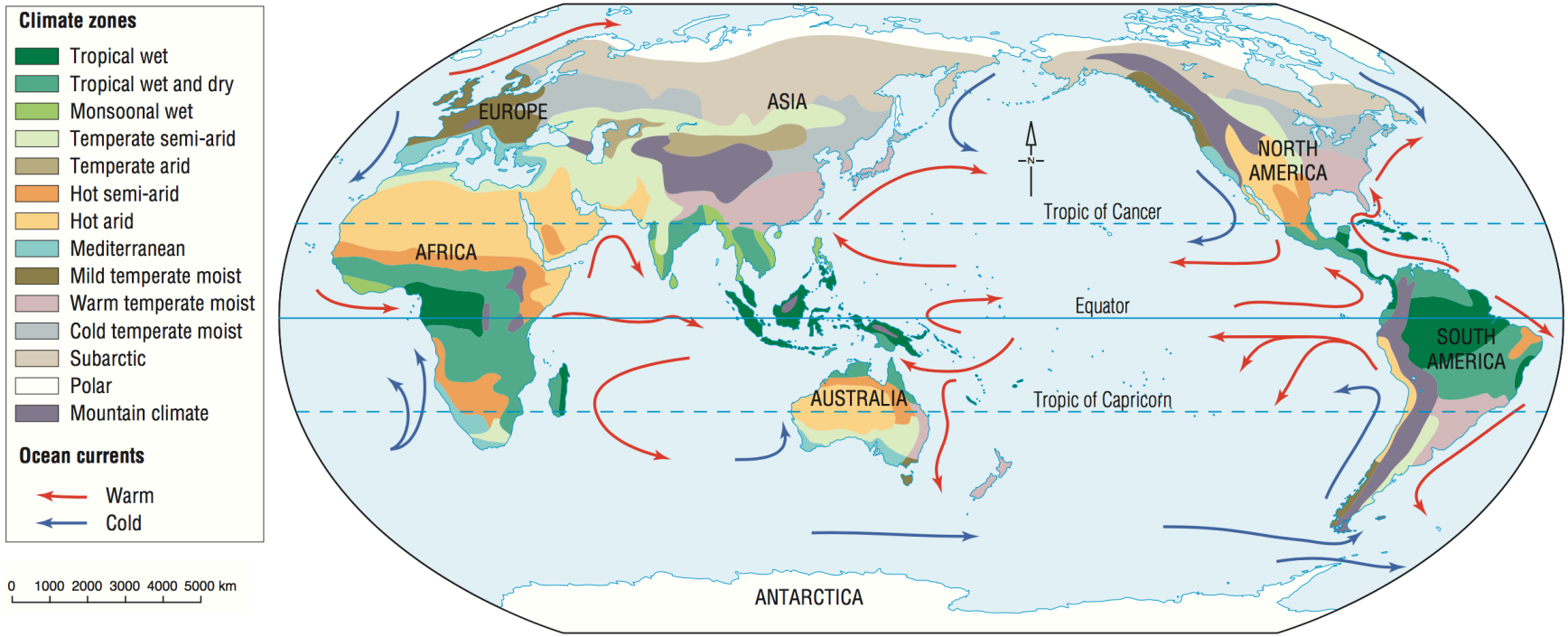




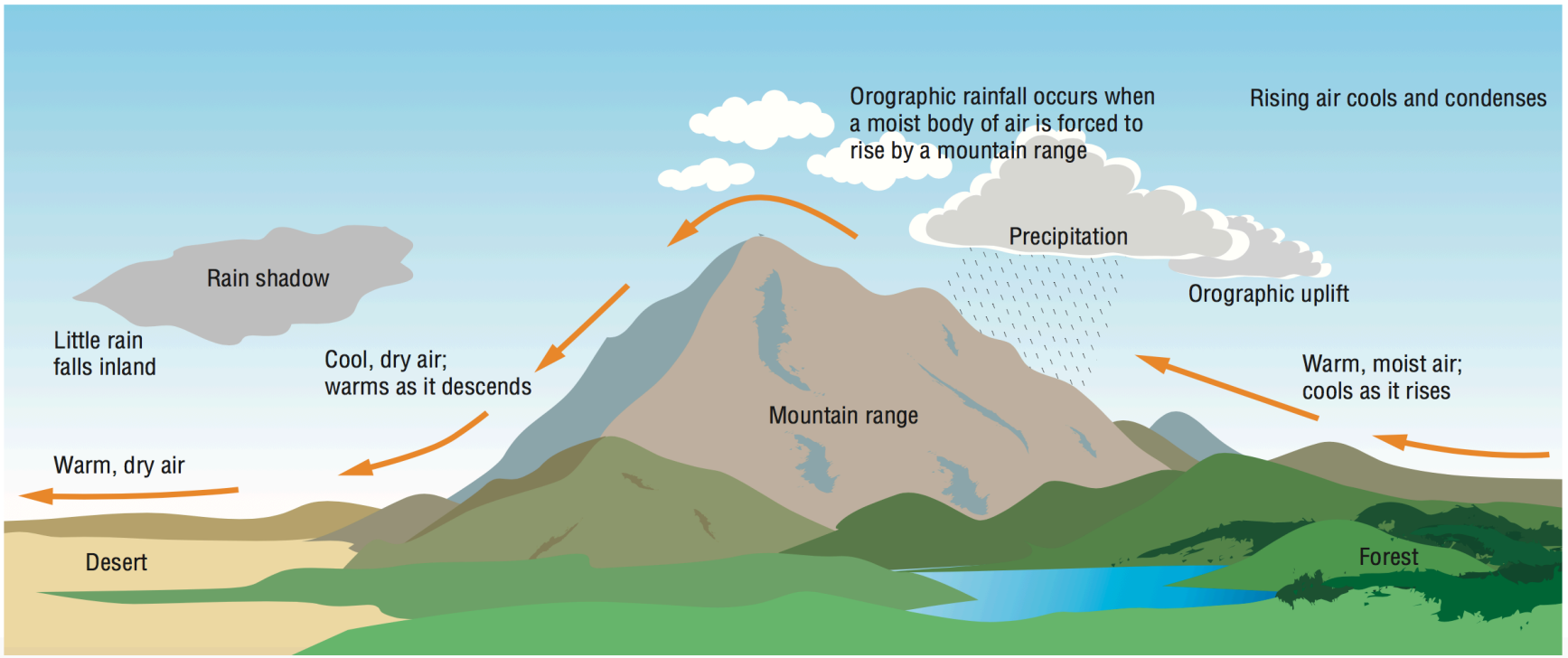


Latitude

Ocean currents



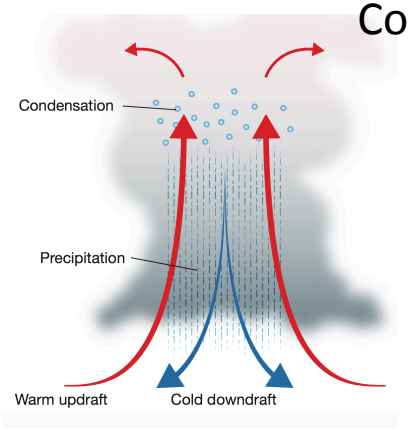
Mountain barriers



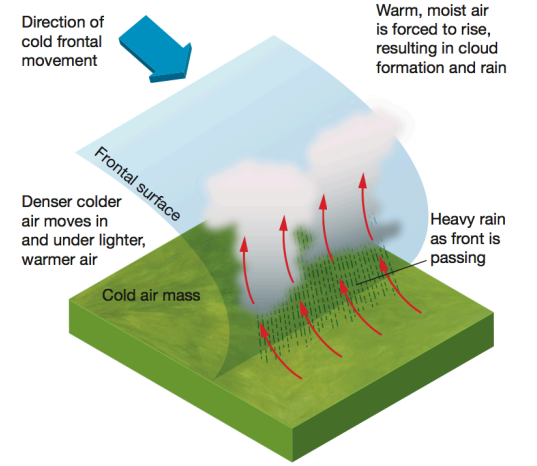
Types of rainfall

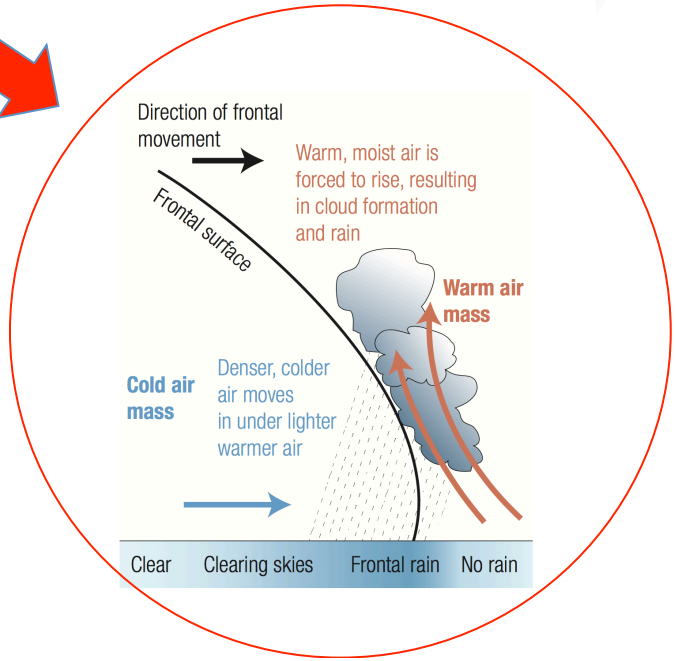
- Frontal rain
- Convectional rain
- Orographic rain

Convectional rainfall



Principal rainfall types





Frontal rainfall

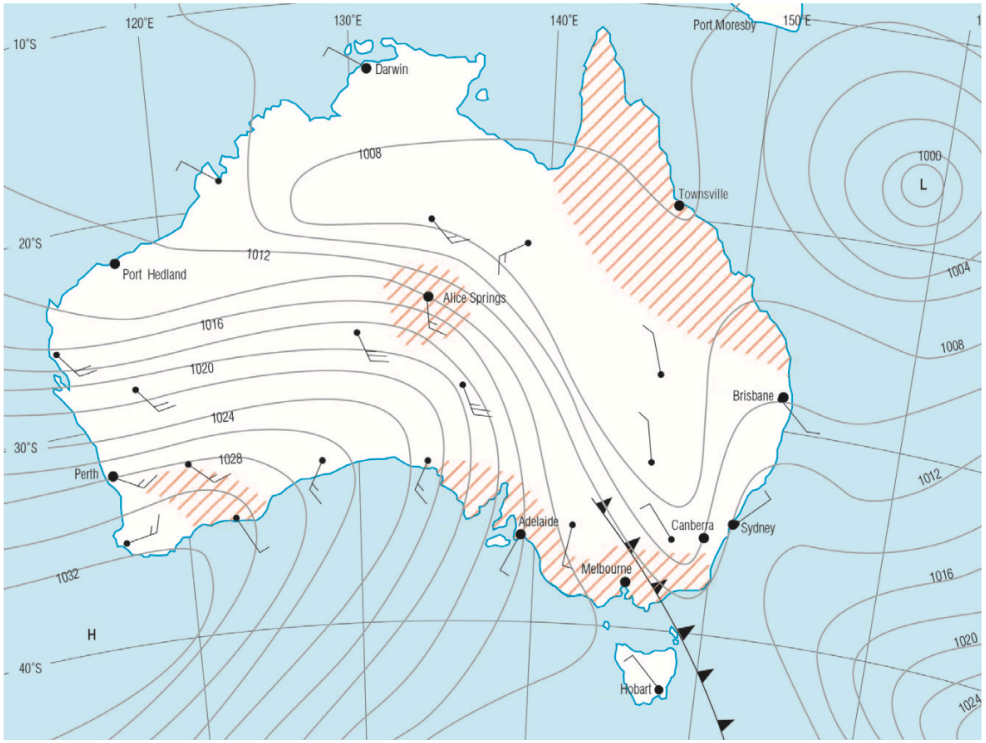
Key elements of weather maps

Warm fronts occur when a warm parcel of air overtakes a colder, denser air mass, and is forced to rise. As with a cold front, rain often results as air rises. Warm fronts are not common in Australia.

Cold fronts occur when a mass of cold, dense air pushes in under a mass of warm air, forcing it to rise. As the warm air rises, it cools and condensation takes place. Lower temperatures are experienced once the front has passed.

Ⓛ Low-pressure systems form when warm air rises rapidly. They are typically associated with unstable weather conditions: cloudy skies, rain and relatively strong winds.

Ⓗ High-pressure systems are typically characterised by stable atmospheric conditions: gentle winds, clear skies and little chance of rain.

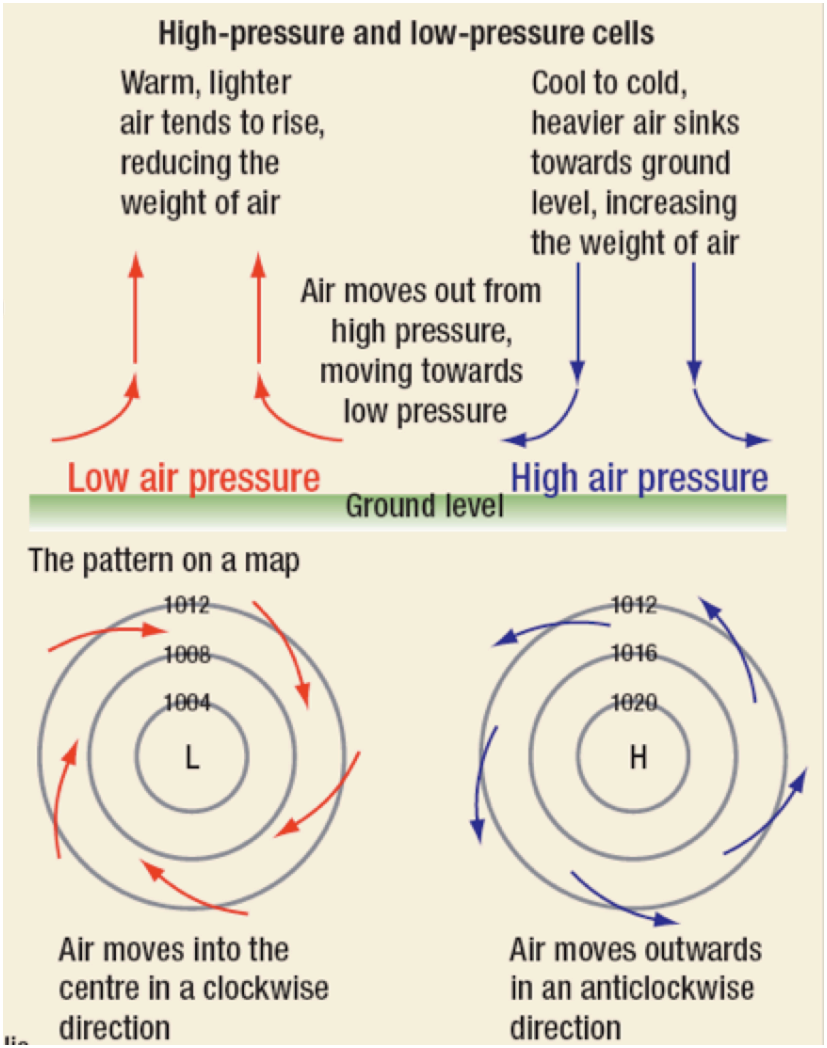


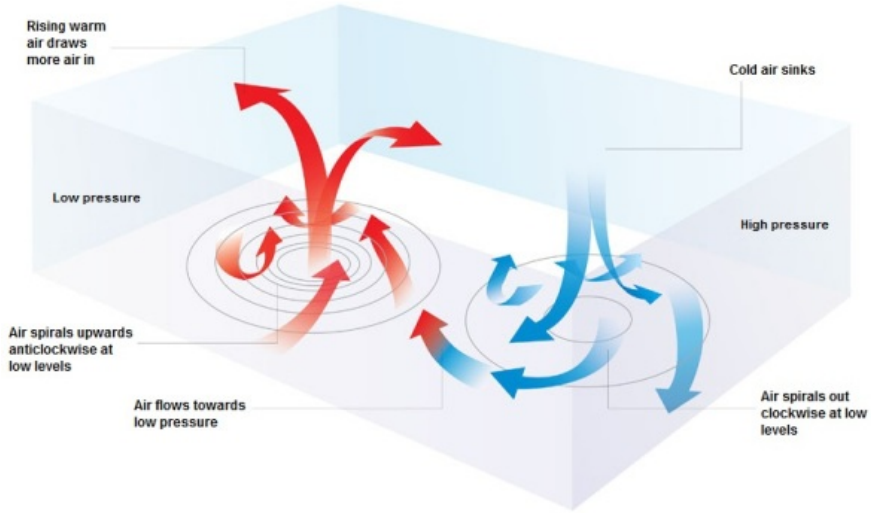
Rainfall areas are shown by shading or cross-hatching.

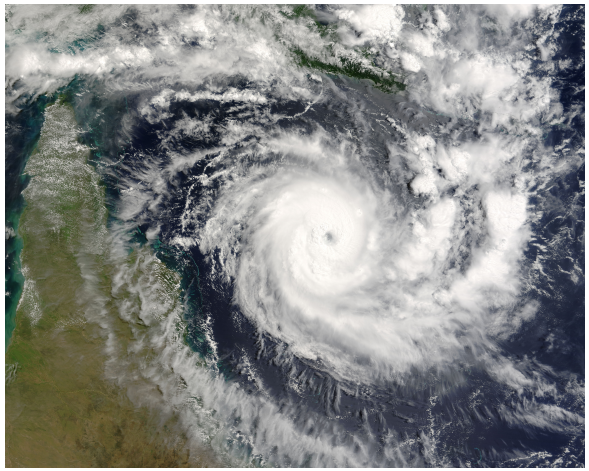
—1212—
Isobars join places with the same atmospheric pressure. Air pressure is measured in hectopascals (hPa). Isobars are usually drawn at intervals of 2 hPa. Isobars that are well spaced indicate only gentle winds. Isobars close together indicate relatively strong winds.

Wind direction and strength are shown for selected locations using lines with small barbs or tails; the more barbs there are, the stronger the wind. Winds are named after the direction they blow from; for example, Alice Springs is experiencing a moderate southerly wind.

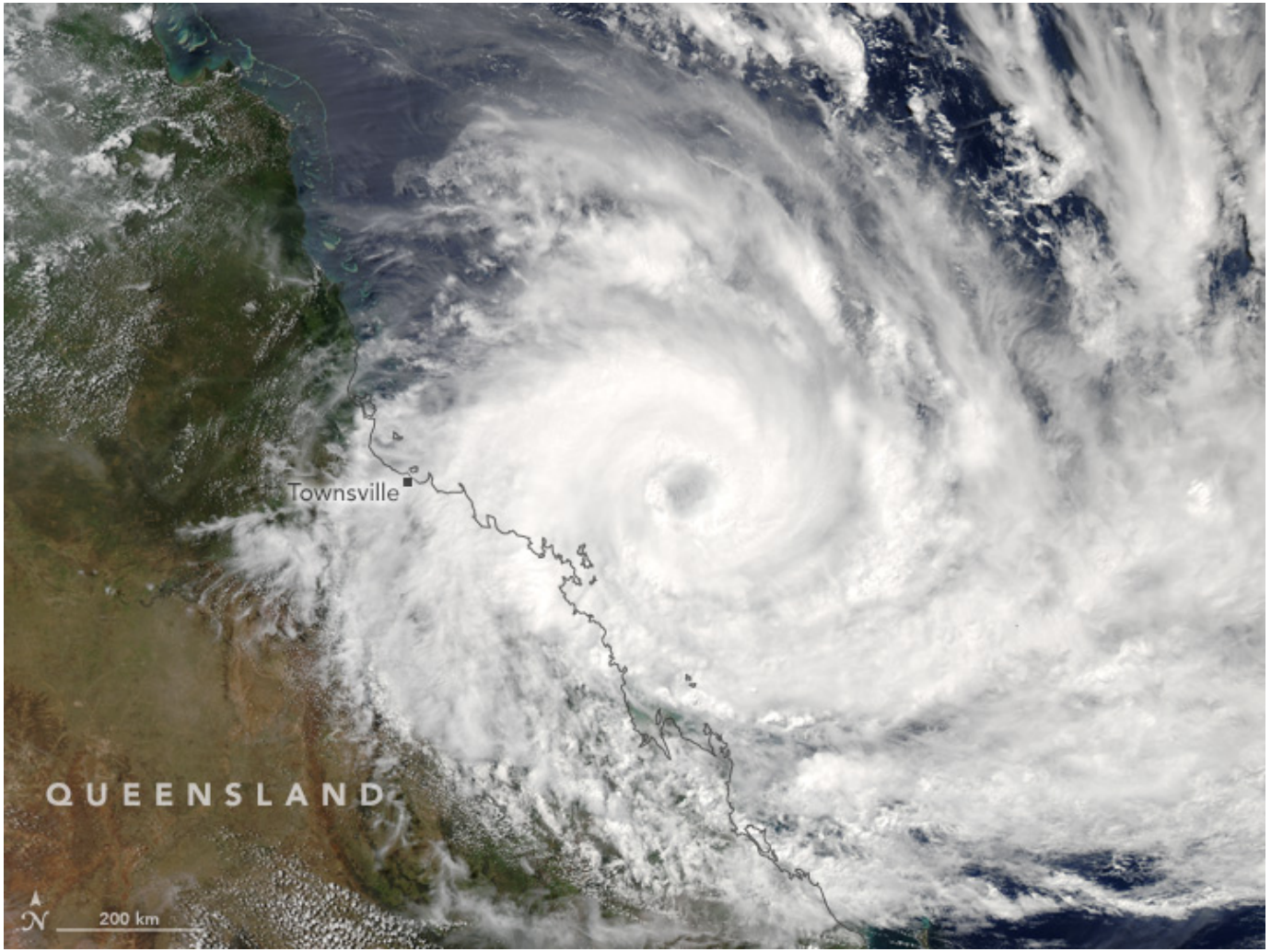
Air movements associated with pressure systems



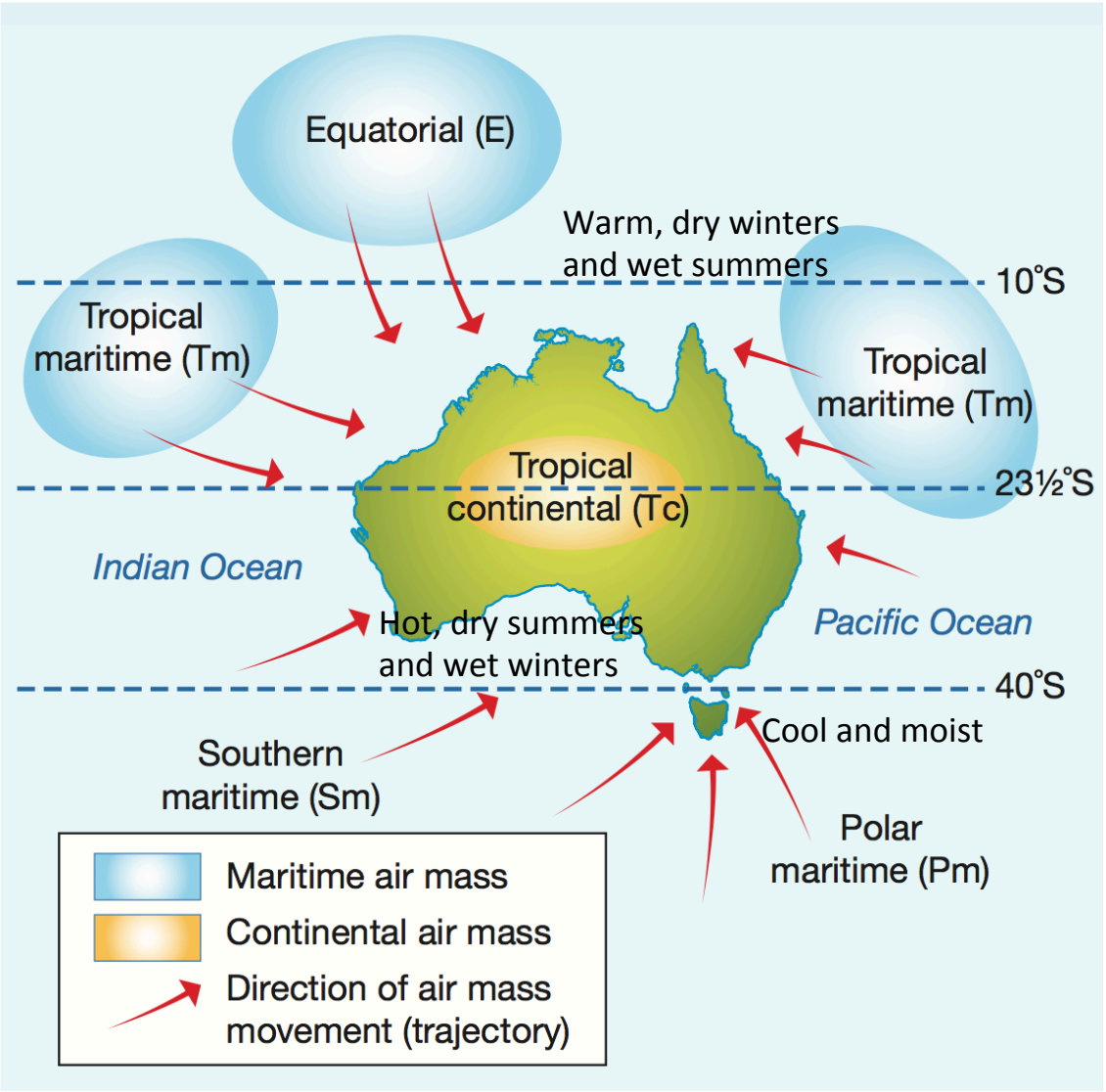


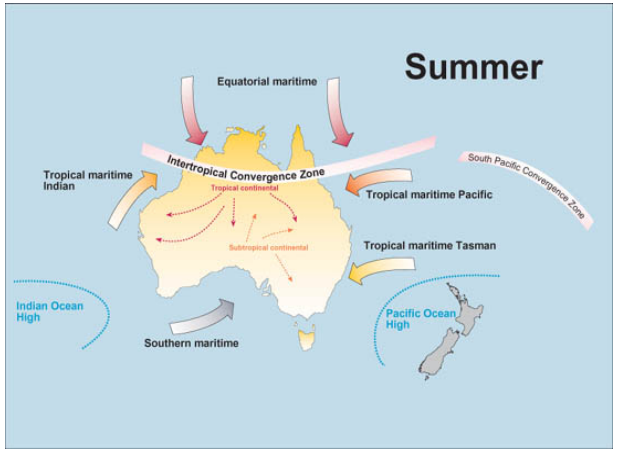


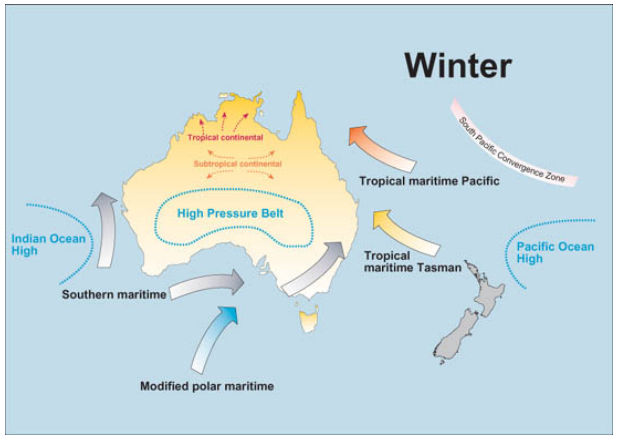
Cyclone Debbie, 2017



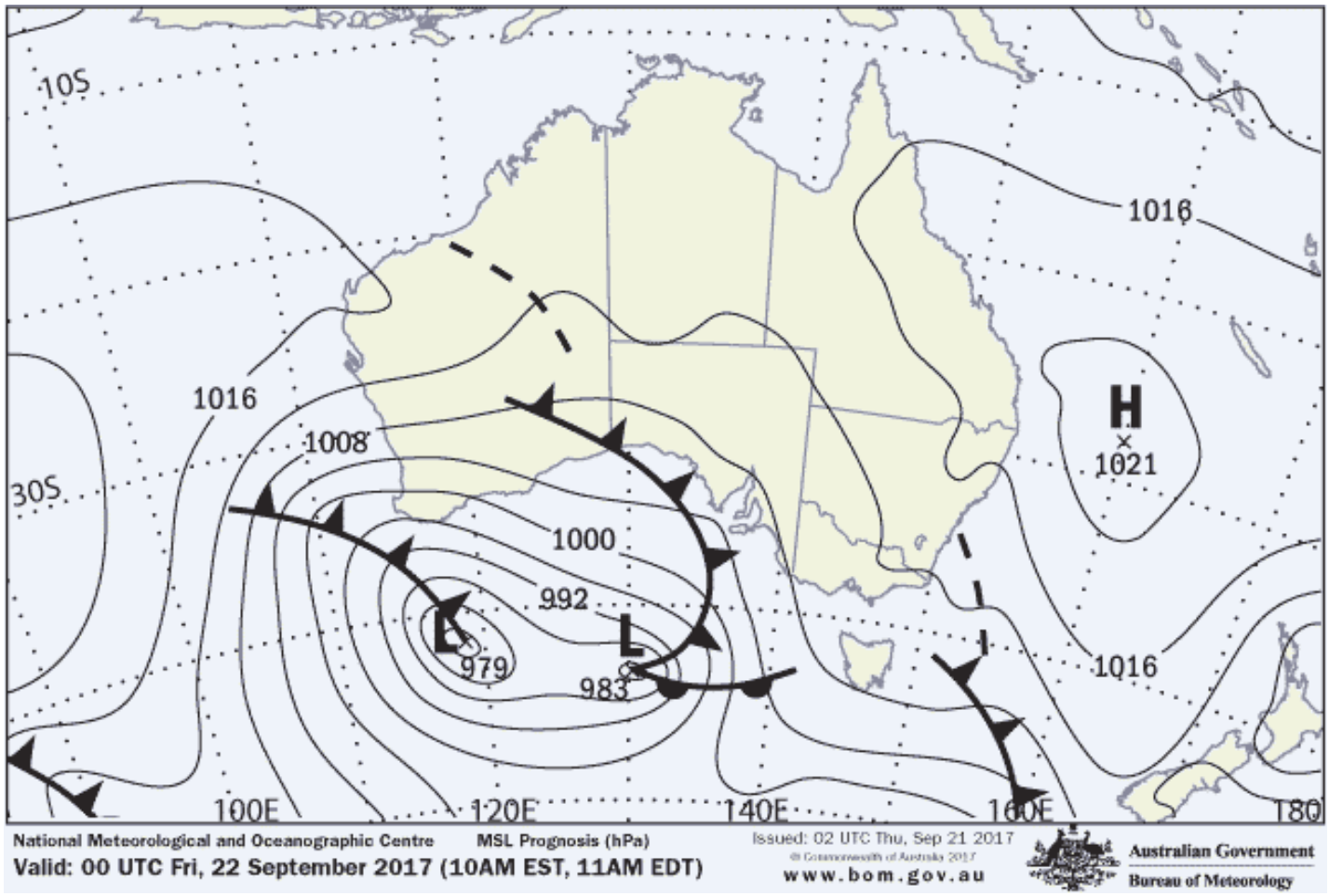
Australian air masses



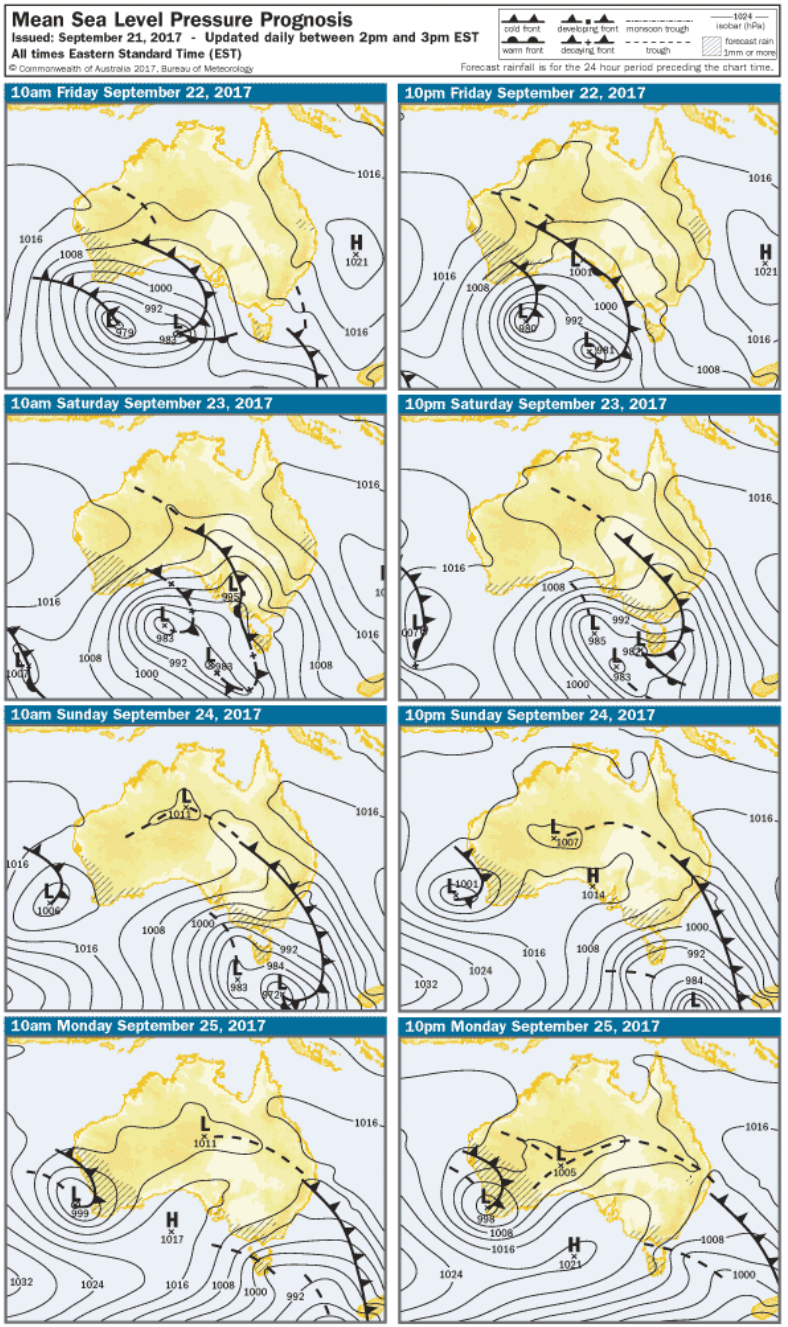




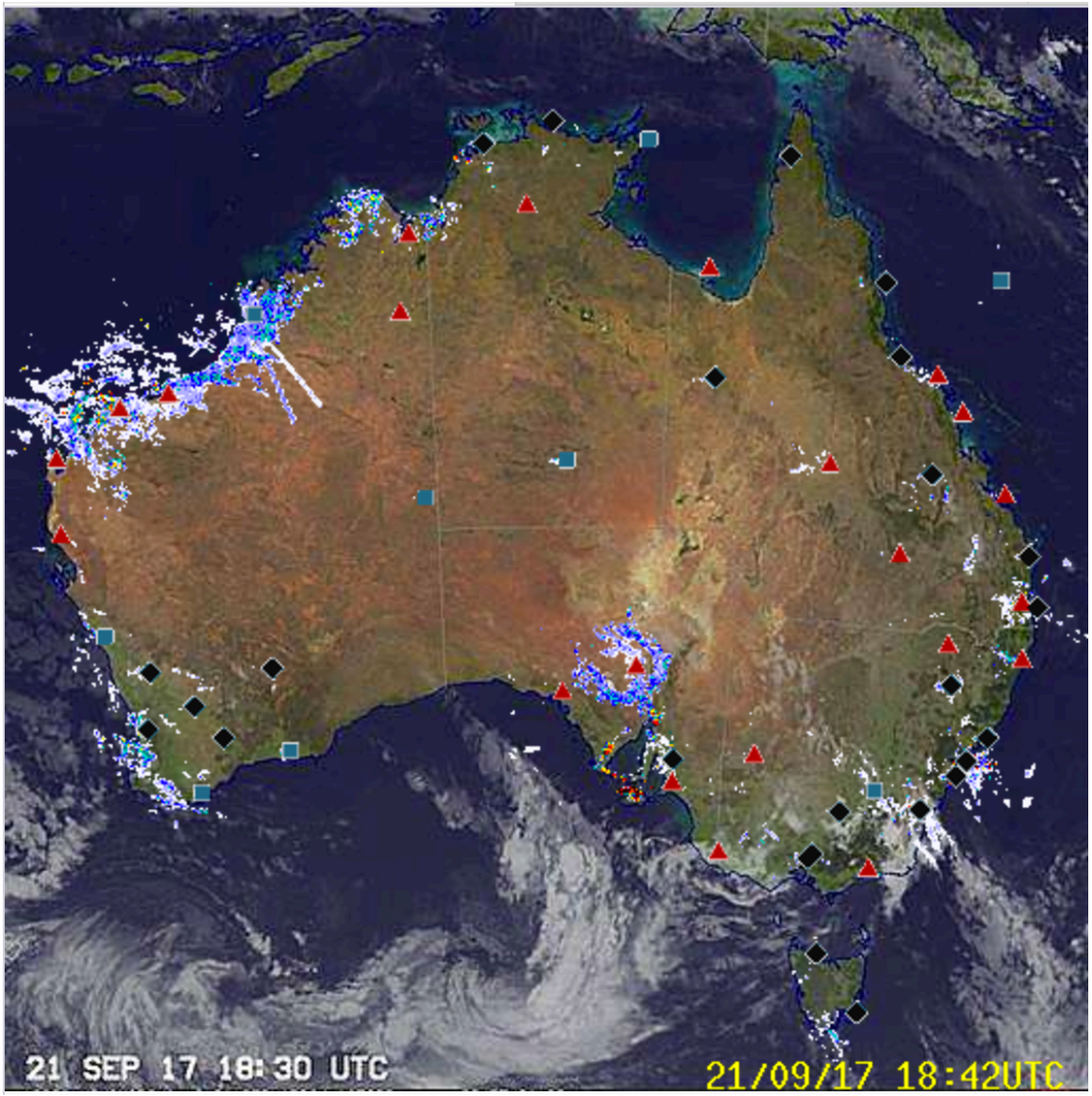
Applying knowledge



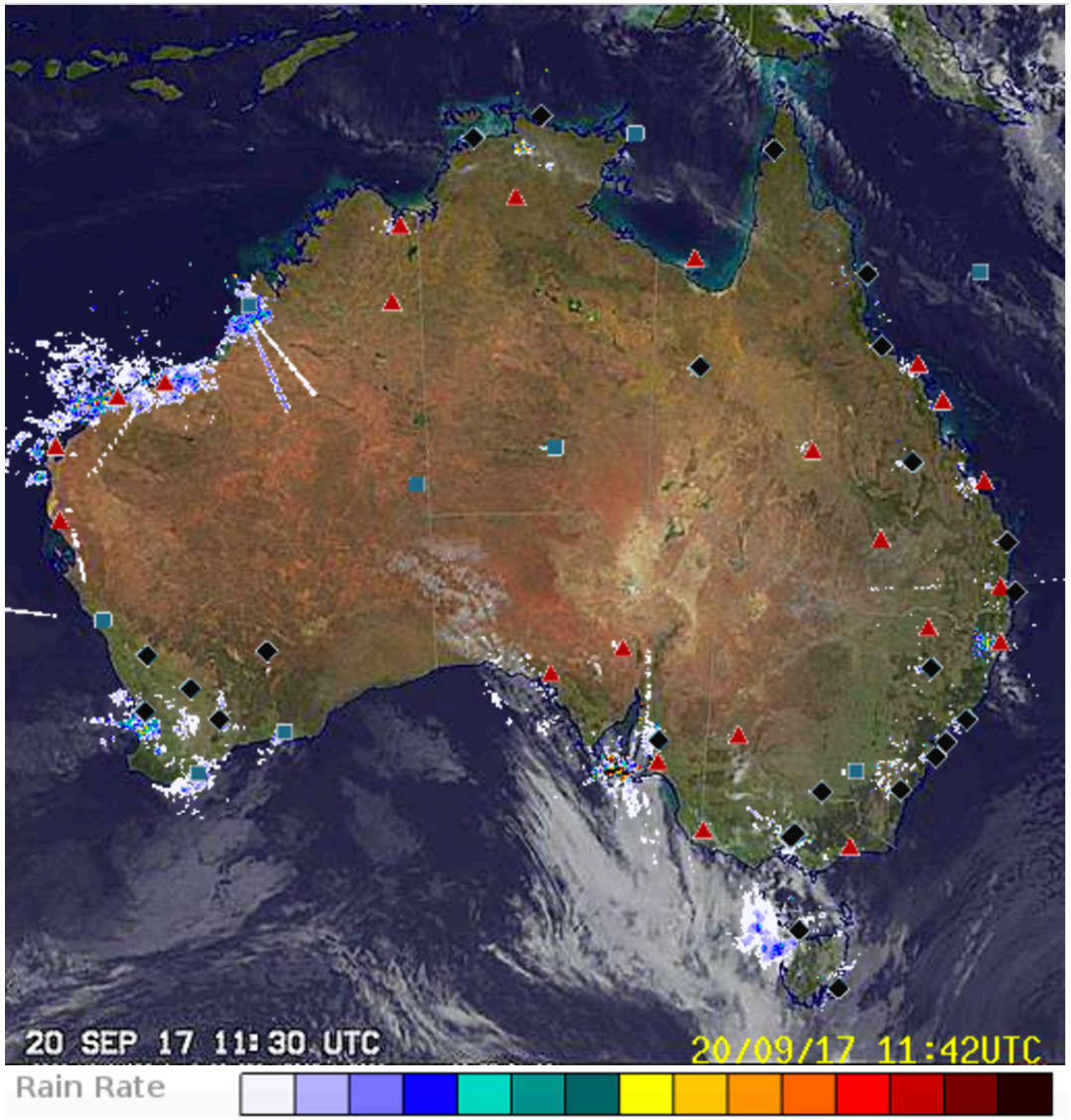
Applying knowledge: Synoptic forecast maps



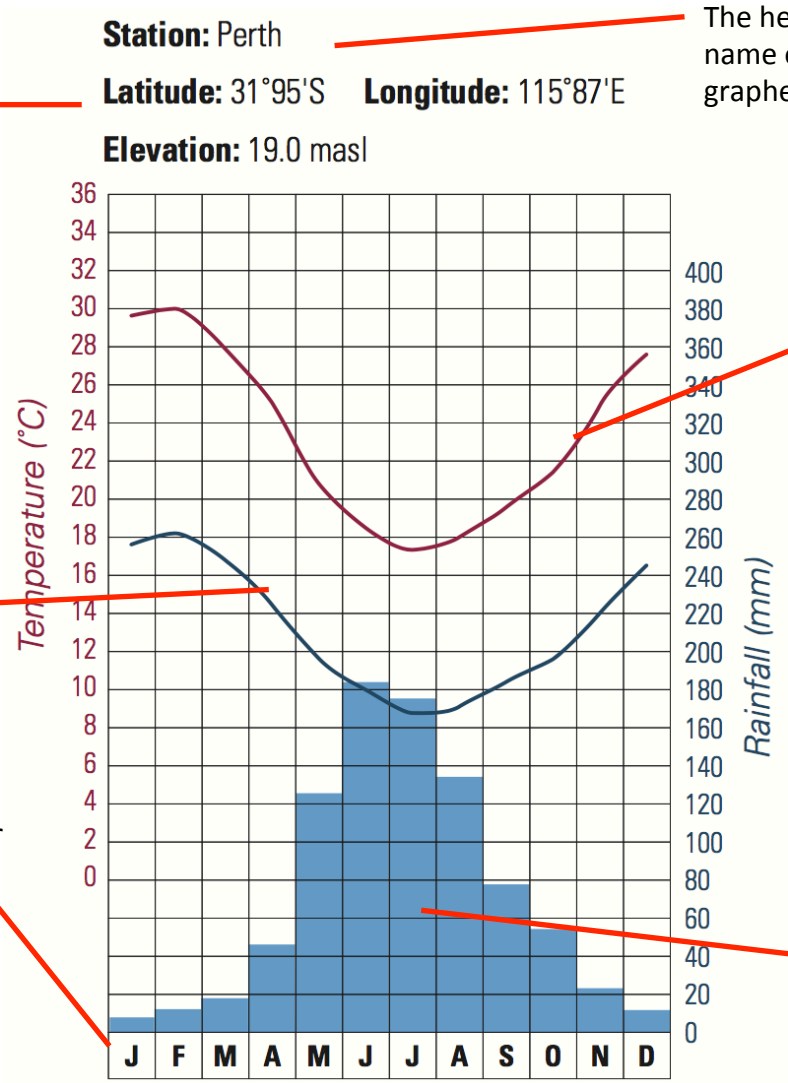
Satellite image



Rain radar



Perth, Western Australia



Latitude and longitude can be used to pinpoint the location of Perth on a world map

The heading tells us the name of the place being graphed

The temperature scale is located on the left-hand side of the graph

Average maximum monthly temperature is shown by a line graph, which is coloured red

When plotting temperature, be careful to mark the centre of the column

The precipitation scale is located on the right-hand side of the graph

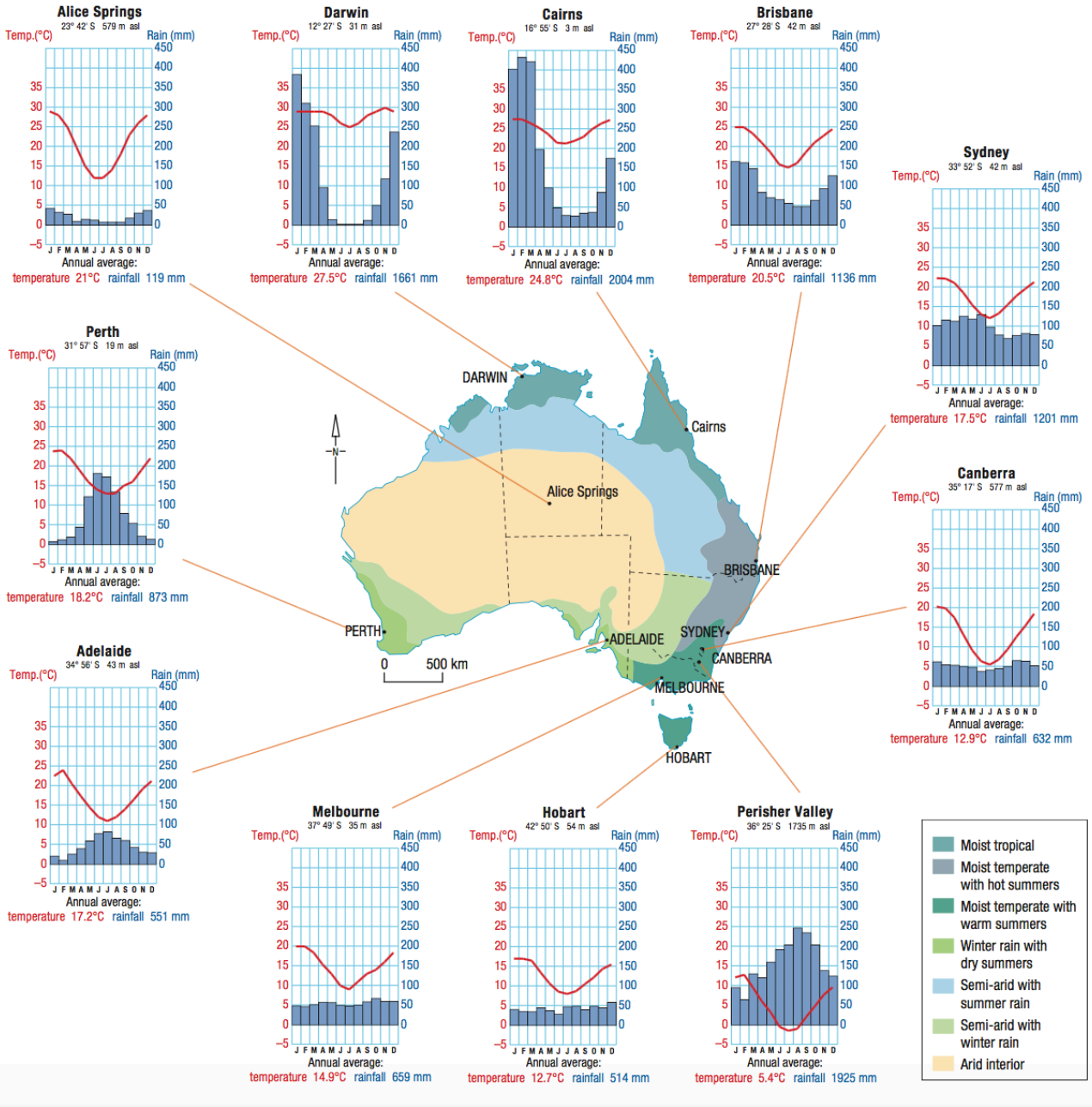
The letters stand for the months of the year

Average monthly rainfall is shown by a column graph, which is coloured blue

Mean min. temp. °C: 13.3

Mean max. temp. °C: 23.3

Rainfall: 869.4 mm


Alice Springs
23° 42' S 579 m asl
Temp.(°C)
Rain (mm)
Annual average:
temperature 21°C rainfall 119 mm
Darwin
12° 27' S 31 m asl
Annual average:
temperature 27.5°C rainfall 1661 mm
Cairns
16° 55' S 3 m asl
Annual average:
temperature 24.8°C rainfall 2004 mm
Brisbane
27° 28' S 42 m asl
Annual average:
temperature 20.5°C rainfall 1136 mm
Sydney
33° 52' S 42 m asl
Annual average:
temperature 17.5°C rainfall 1201 mm
Perth
31° 57' S 19 m asl
Annual average:
temperature 18.2°C rainfall 873 mm
Canberra
35° 17' S 577 m asl
Annual average:
temperature 12.9°C rainfall 632 mm
Adelaide
34° 56' S 43 m asl
Annual average:
temperature 17.2°C rainfall 551 mm
Melbourne
37° 49' S 35 m asl
Annual average:
temperature 14.9°C rainfall 659 mm
Hobart
42° 50' S 54 m asl
Annual average:
temperature 12.7°C rainfall 514 mm
Perisher Valley
36° 25' S 1735 m asl
Annual average:
temperature 5.4°C rainfall 1925 mm
J F M A M J J A S O N D
DARWIN
Cairns
Alice Springs
BRISBANE
PERTH
ADELAIDE
SYDNEY
CANBERRA
MELBOURNE
HOBART
N
0 500 km
Moist tropical
Moist temperate with hot summers
Moist temperate with warm summers
Winter rain with dry summers
Semi-arid with summer rain
Semi-arid with winter rain
Arid interior

Describing climate

Task: Use the descriptors to describe Perth's climate.

Describing climate

Figures 4–8 provide the terminology needed to describe the climate of places.

Average monthly temperatures	
Temperature range	**Description**
above 30˚C	very hot
20˚C–30˚C	hot
10˚C–20˚C	warm
0˚C–10˚C	cool
-10˚C–0˚C	cold
below -10˚C	very cold

Figure 4: Describing average monthly temperatures

Annual temperature range	
Temperature range	**Description**
below 5˚C	small
5˚C–15˚C	moderate
15˚C–30˚C	large
above 30˚C	very large

Figure 5: Describing annual temperature range

Annual precipitation		
Cold to warm climates	**Description**	**Hot to very hot climates**
below 250 mm	slight	below 375 mm
250 mm–500 mm	small	375 mm–625 mm
500 mm–1000 mm	adequate	625 mm–1125 mm
1000 m–1500 mm	large	1125 mm–1750 mm
above 1500 mm	very large	above 1750 mm

Figure 6: Describing annual precipitation (rainfall)

Monthly average rainfall	
Amount	**Description**
below 50 mm	dry month
50mm to 150 mm	wet month
above 150 mm	very wet month

Figure 7: Describing monthly averages

Rainfall distribution
Summer rainfall maximum: over 60 per cent in the summer half of the year
Winter rainfall maximum: over 60 per cent in the winter half of the year
Evenly distributed rainfall: no summer or winter maximum

Figure 8: Describing distribution

Weather-based fieldwork

3.6

In the field:
Measuring weather

The aim of this fieldwork activity is to measure and record weather-based data in the school playground. Once the data has been collected and recorded, you will compare it with weather data from the Bureau of Meteorology.

How to record weather data

A variety of instruments can be used to record weather data for a specific location. You can use:

- traditional weather-recording instruments
- a handheld weather-recording device (see Figure 3.32)
- a handheld digital tool (such as an Apple iPhone or iPad or an Android device) that has the ability to record weather data at your location. You may need to add weather-recording applications to your digital tool.

To ensure the accuracy of your weather data, ensure that the site you select to record your data is:

- in the open and not under cover
- free from obstructions, such as overhanging trees or walls and fences
- not close to heating or cooling vents.

3.32 A handheld weather-recording device

Temperature

A thermometer (see Figure 3.33) is used to record air temperature.

A thermometer 3.33

Method

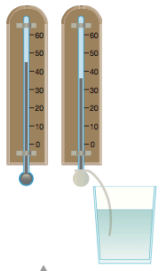
Using a thermometer or handheld weather-recording device, record the temperature.

Note: If using a thermometer, do not hold it by the bulb, as your body heat may affect the temperature reading.

Relative humidity

A wet–dry bulb thermometer (see Figure 3.34) is used to measure and record relative humidity.

Relative humidity is the amount of water vapour in the air. A wet–dry bulb thermometer is a standard mercury-in-glass thermometer. The thermometer bulb is wrapped in muslin, which is kept wet. The evaporation of water from the thermometer has a cooling effect, so the temperature indicated by the wet–dry bulb thermometer is less than the temperature indicated by a normal thermometer. The rate of evaporation from the wet–dry bulb thermometer depends on the humidity of the air: evaporation is slower when the air is already full of water vapour. For this reason, the difference between the temperatures indicated by the two thermometers gives a measure of relative humidity.



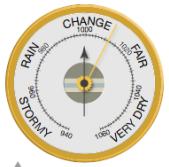
3.34 Wet–dry bulb thermometer

Method

Using a wet–dry bulb thermometer or handheld weather-recording device, record the relative humidity.

Air pressure

You can use an aneroid barometer (see Figure 3.35) to measure atmospheric pressure (air pressure). An aneroid barometer contains a sealed box from which most of the air has been removed. Any change in pressure will make the box shrink or expand. Levers magnify these changes, causing a pointer to move on a dial. Air pressure at sea level is generally around 1013 hectopascals (hPa). It can drop to 970 hPa during severe storms. In a high-pressure system it can reach 1040 hPa. A drop in air pressure, measured over a day or two, will indicate that unsettled weather is coming.



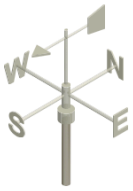
3.35 An aneroid barometer

Method

Using a barometer or handheld weather-recording device, record the air pressure.

Wind direction

A wind vane to show the direction from which the wind is blowing. Winds are named after the direction from which they blow. A wind blowing from the south, for example, is called a southerly.



3.36 A wind vane

Method

Using a wind vane (see Figure 3.36) or handheld weather-recording device, record the wind direction.

Wind speed

An anemometer (see Figure 3.37) is used to measure wind velocity (wind speed). An anemometer works by spinning in the wind: the higher the wind speed, the faster the anemometer spins. Wind speed is calculated by counting the number of revolutions per hour.

Method

Using an anemometer or handheld weather-recording device, record the wind speed.

3.37 An anemometer

Note: If you don't have an anemometer or handheld weather-recording device, estimate the approximate wind speed by observing the surrounding conditions and comparing these with the descriptions given in the Beaufort scale (see Table 3.38). This will give you the approximate wind speed.

Wind strength	Speed (km/h)	Description
Calm	0–2	Smoke rises vertically
Light air	2–5	Smoke drifts
Light breeze	5–10	Leaves rustle, vane moves
Gentle breeze	10–20	Leaves and small branches move
Moderate breeze	20–30	Small branches move, dust and paper are lifted
Fresh breeze	30–40	Large branches move, wave crests appear on water
Strong breeze	40–50	Large trees move, umbrellas are difficult to use
Moderate gale	50–60	Large trees sway
Fresh gale	60–75	Branches break off trees
Strong gale	75–90	Large branches come down
Full gale	90–100	Trees are uprooted, structural damage to buildings

3.38 The Beaufort scale is used to estimate wind speed.

Skillsbuilder

Making and using a simple rain gauge

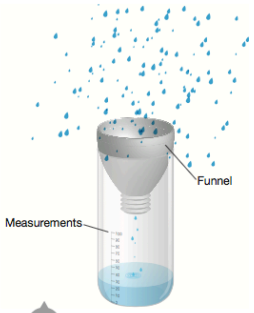
Making a rain gauge

To make a rain gauge (see Figure 3.39), you will need an empty clear-plastic 2-litre drink bottle and a ruler.

1 Cut the empty drink bottle in half, turn the top part upside down and push it into the bottom part to act as a funnel. The larger opening of the funnel should be the same size and shape as the bottom of the bottle.
2 Measure out and mark a scale in millimetres (mm) on the outside of the bottle. Alternatively, you could tape the ruler to the outside of the bottle. Either way, make sure the scale is vertical and that zero is at the bottom.

Measuring rainfall

1 Find a location for the rain gauge where it will not collect any run-off of rainwater—for example, from overhead trees, roofs or signs. There is a minimum distance that official rain gauges must be from such obstructions. For example, if a nearby tree is 5 metres tall, the rain gauge must be at least twice that distance (i.e. 10 metres) away.
2 To measure rainfall, hold the rain gauge so that your eye is level with the top surface of the water. Read the rainfall in millimetres from the scale (or the ruler) on the outside of the bottle.
3 To measure precipitation in the form of hail or snow, remove the funnel. Allow the ice or snow that collects in the bottom of the bottle to melt, and then measure it as in Step 2 (above).
4 Record your rainfall data and include the date and time of measurement.



3.39 A simple rain gauge

Rainfall

A rain gauge is used to measure the amount of rainfall received in a twenty-four hour period. Rainfall is measured in millimetres. A funnel collects the rainfall and directs it into a measuring tube.

Method

1 Place a rain gauge outside, free from obstruction.

Step 2

2 Measure the amount of water in the rain gauge. After you have measured the water, empty the rain gauge. You will need to measure rainfall at the same time each day.
Note: If you do not have access to a rain gauge, you can create your own. See the Skills builder box, 'Making and using a simple rain gauge'.

DID YOU KNOW?

Different types of clouds are given names derived from Latin words that describe their appearance—for example, cirrus (a lock of hair), cumulus (a heap), stratus (from *stratum*, a blanket or covering)—or other characteristics, such as nimbus (a shower of rain).

Nick: this DYK was on InDesign's pasteboard for this spread, from before I started work on the pages. Ok to include here?

How to access weather data

Bureau of Meteorology

The Bureau of Meteorology (BoM) is Australia's national agency for weather, climate and water. The BoM has numerous monitoring stations throughout Australia to record weather, climate and water data. You will find the weather station closest to where you recorded your weather data.

Method

1 Go to the Bureau of Meteorology (BoM) website. On the home page, select **Climate and Past Weather**, then click **Weather & climate data** to go to the Climate Data Online page.
2 In section 1 of the **Select using Text** tab, choose **Weather & climate** from the drop-down menu. Under Statistics, click the **Monthly** radio button. In section 2, type in the box the location where you recorded your data. Click the **Find** button. Click to select your location from the list, then click the weather station closest to your location. In section 3, click the **Get Data** button.

ACTIVITIES

Aim

To investigate weather data and the extent to which weather varies in an area.

Method

1 Select a suitable site in the school grounds or local community at which to record weather data. Ensure you use the same location each day at the same time.
2 Select the weather-recording device or instruments that you will use to collect your data.
3 Collect weather data on temperature, relative humidity, air pressure, rainfall (precipitation), wind speed and wind direction over a five-day period.
4 Copy the fieldwork data table below and record your findings. Include a description of the weather for each day.

Fieldwork data table
Date: _____ Time: _____
Location: _____

	Day 1	Day 2	Day 3	Day 4	Day 5
Temperature (°C)					
Relative humidity (%)					
Air pressure (hPa)					
Precipitation (mm)					
Wind speed (km/h)					
Wind direction					
Weather description					

5 Access the Bureau of Meteorology website and select your nearest capital city or the main town closest to your school or local community. Copy the table below into your workbook and add in the average monthly weather data on temperature, relative humidity, air pressure, rainfall (precipitation), wind speed and wind direction.

Average monthly data table
Date: _____ Location: _____

	Monthly average
Temperature (°C)	
Relative humidity (%)	
Air pressure (hPa)	
Precipitation	
Wind speed (km/h)	
Wind direction	

Evaluation

6 Analyse the weather data you collected by answering the following questions.
a Is there a link between air pressure and the weather? Explain.
b How do wind speed and direction affect the temperature?
c Can you see any patterns in the information you collected?
d Compare the weather data you collected with the monthly average for the area. Is there a similarity or a difference between them? Explain.
e Why do you think there might be a similarity or a difference?

Conclusion

7 What do the results of this activity tell you about weather conditions between, and within, areas?


Thank you!