

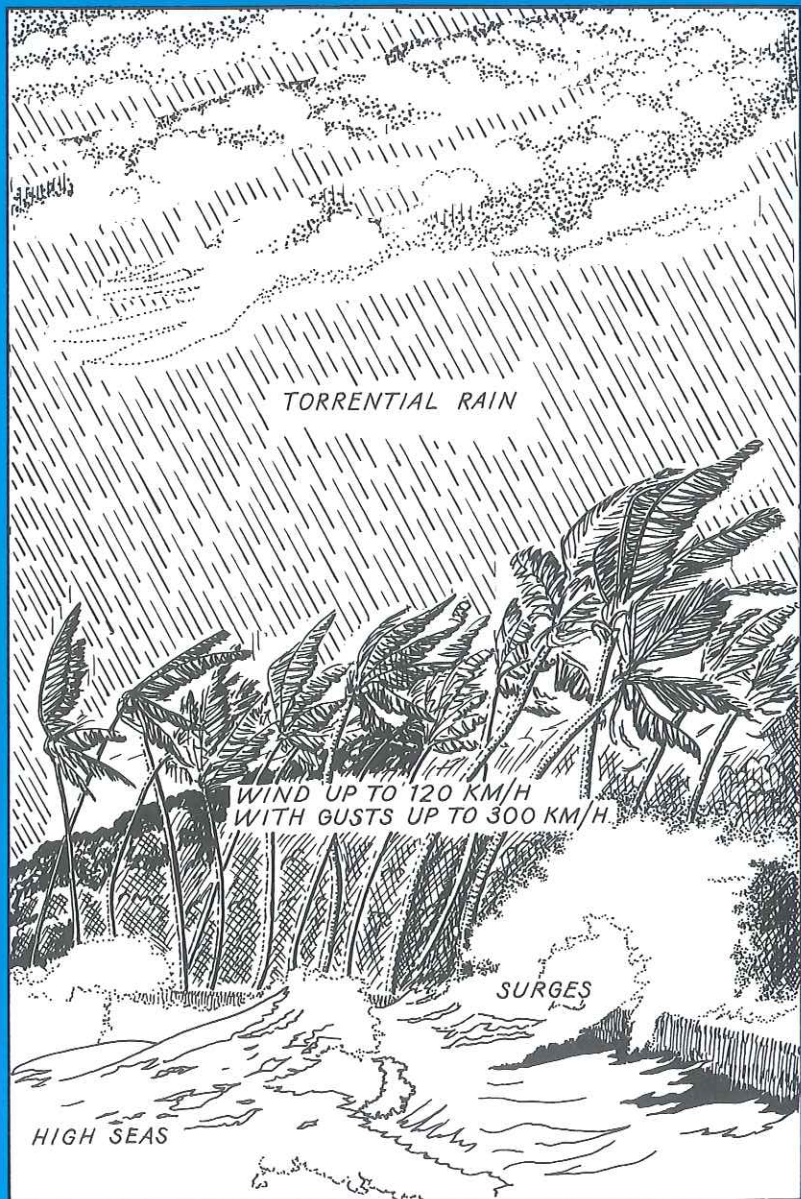
An example of an extreme natural event

# TROPICAL CYCLONES IN THE SOUTH-WEST PACIFIC

Tropical cyclones are sometimes called:

- hurricanes (U.S.A.)
- typhoons (Asia)
- willy willies (Australia).

They are huge storms which form over warm **tropical** waters bringing torrential rain, strong winds and huge waves. They are very destructive and can cause great loss of life and property.



FEATURES OF TROPICAL CYCLONES

# 33

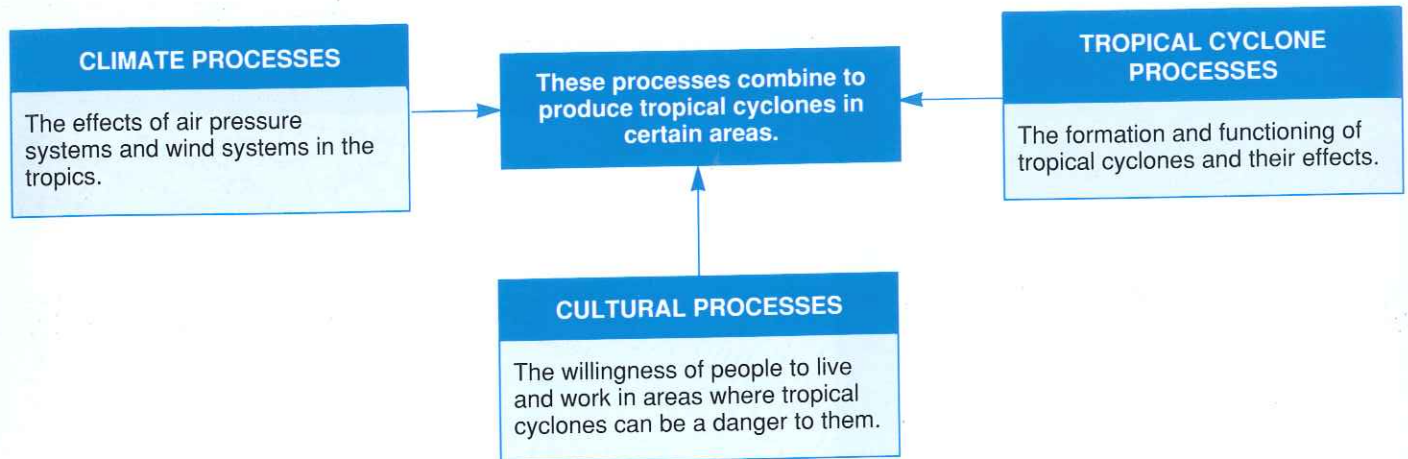
Tropical Cyclones  
in the south-west Pacific

## PROCESSES CAUSING TROPICAL CYCLONES

What processes cause tropical cyclones? How often are they hazardous in the south-west Pacific?

The processes causing tropical cyclones to be hazardous in the south-west Pacific are summarised in resource 33.1.

### 33.1 PROCESSES PRODUCING TROPICAL CYCLONES

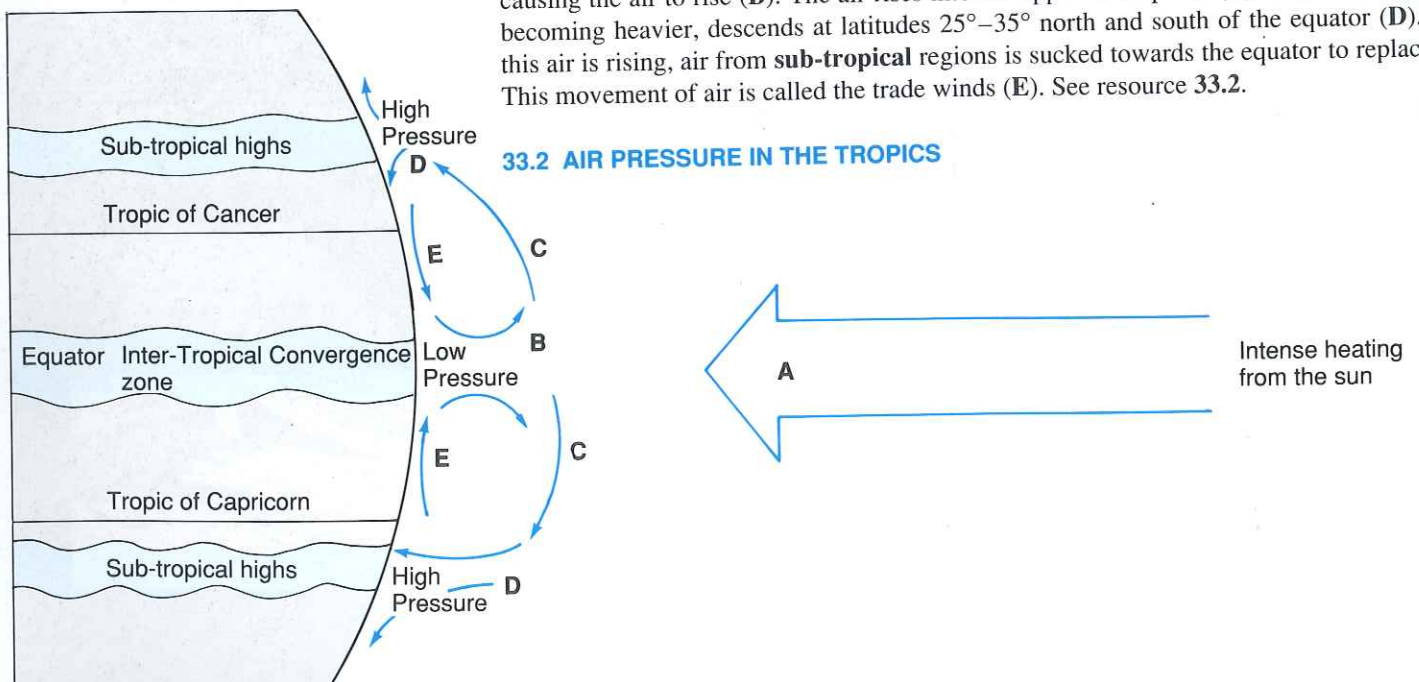


### CLIMATE PROCESSES

Tropical cyclones are *very* low **depressions** (see resource 21.6 and accompanying text). The air pressure is so low that air rushes in towards the centre creating very strong winds.

There is a large low pressure zone at the equator because the sun is overhead (A) causing the air to rise (B). The air rises into the upper atmosphere (C) where it cools and becoming heavier, descends at latitudes 25°–35° north and south of the equator (D). As this air is rising, air from **sub-tropical** regions is sucked towards the equator to replace it. This movement of air is called the trade winds (E). See resource 33.2.

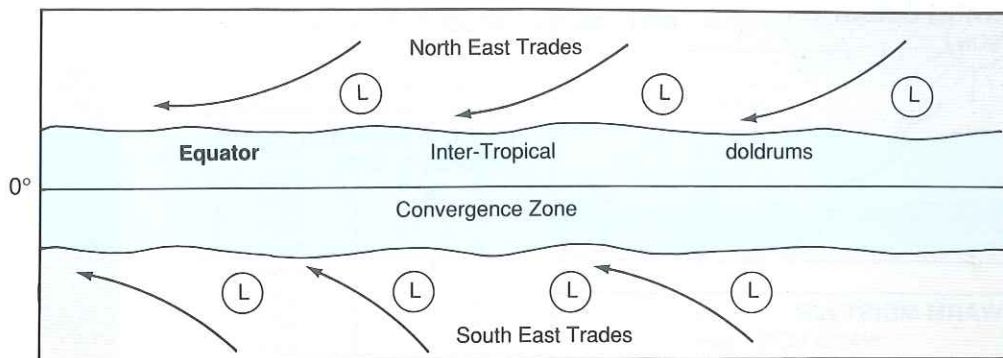
### 33.2 AIR PRESSURE IN THE TROPICS





As these winds moving towards the equator meet, rainstorms can occur, similar to **frontal rainfall** (see resource 27.6). These are called Inter-Tropical Convergence Zones (ITCZ) – see resource 33.3.

### 33.3 INTER-TROPICAL CONVERGENCE ZONE



The trade winds blowing towards the ITCZ do not blow in a straight line but on an angle from the south-east in the Southern Hemisphere. This is caused by the force of the Earth's rotation which deflects or bends the winds. This is called the **coriolis force**.

The coriolis force is weak at the equator but strong enough at the edge of the ITCZ to spin the winds into low pressure systems. Under special conditions, these can develop into tropical cyclones.

## ACTIVITY

Fill in the gaps in the following sentences using the words listed in the box.

Tropical cyclones, sometimes called \_\_\_\_\_, are huge storms bringing \_\_\_\_\_, \_\_\_\_\_ and \_\_\_\_\_. They start as \_\_\_\_\_ pressure systems near the edge of the \_\_\_\_\_. They form here because the \_\_\_\_\_ winds converge and are bent by the \_\_\_\_\_ force to form \_\_\_\_\_.

RAIN	TYPHOONS
TRADE	WAVES
WIND	DEPRESSIONS
CORIOLIS	
ITCZ	
LOW	

An aerial view of tropical cyclone damage in Tonga.





# TROPICAL CYCLONE PROCESSES

The combination of features needed to turn a low pressure zone into a tropical cyclone is shown in resource 33.4.

## 33.4

The sun heats the ocean (a minimum water temperature of 26.5°C is needed for tropical cyclones to form).

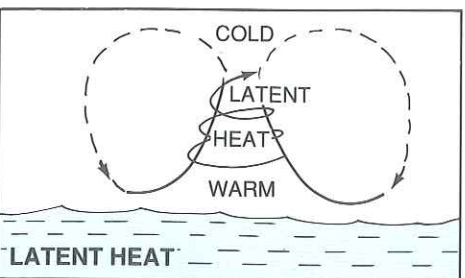
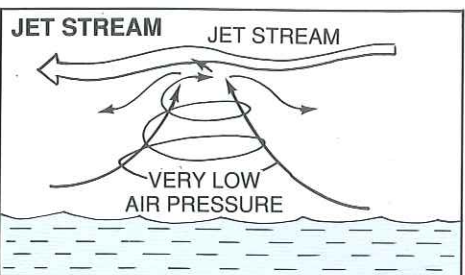
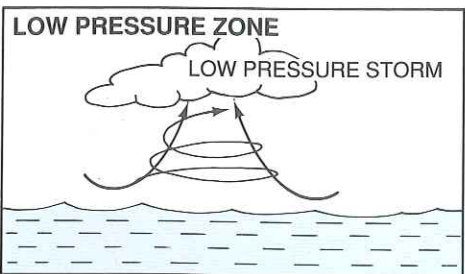
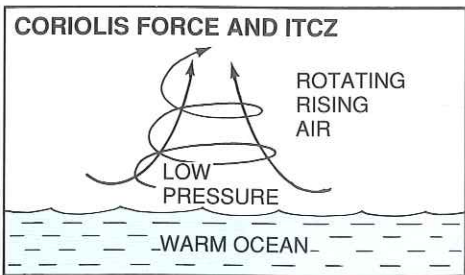
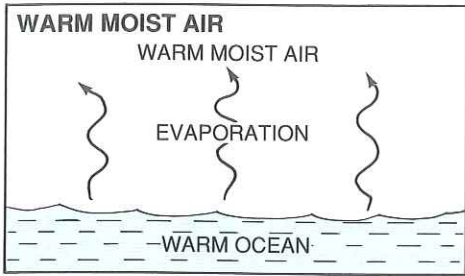
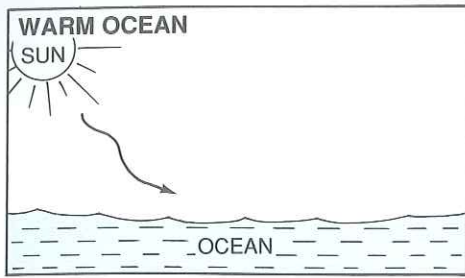
The warm ocean heats the air above and causes rapid **evaporation** of water.

The warm moist air rises and the coriolis force and ITCZ spin the rising air in a clockwise direction (in the southern hemisphere).

The moist air is sucked in, it rises and cools, condensing and forming clouds and rain.

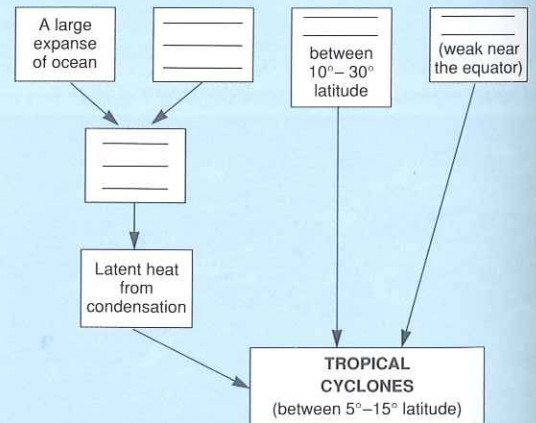
Jet streams are high speed air currents circling the Earth between 10°- 30° latitude. When a jet stream passes a deep depression (low) it sucks the air out of it causing more air to rush in.

Tropical cyclones depend on a continuous supply of warm moist air to give them energy. As the warm moist air **condenses**, huge amounts of heat (latent heat) are released keeping the tropical cyclone warm and the wind spiralling.



## ACTIVITIES

1 Referring to resource 33.4 complete the following diagram using the words below.



- CORIOLIS FORCE
- INTENSE HEAT OF THE SUN AT TROPICAL LATITUDES
- OCEAN HEATED TO AT LEAST 26.5°C
- JET STREAM

2 Write a paragraph stating why tropical cyclones form between latitudes 5°-15°.

3 Warm air rises and cool air descends. With this in mind, look at resource 33.4 (Latent Heat box) and explain how the supply of latent heat can be a continuous cycle.

# WHEN AND WHERE DO TROPICAL CYCLONES OCCUR IN THE SOUTH-WEST PACIFIC?

■ Annual frequency – see resource 33.5.

## 33.5 TROPICAL CYCLONES 1958–1977

Year	South-West Pacific	World Total
1958	7	81
1959	2	69
1960	8	70
1961	4	81
1962	3	78
1963	7	72
1964	4	84
1965	4	79
1966	6	80
1967	8	91
1968	8	84
1969	6	72
1970	3	82
1971	6	97
1972	10	88
1973	8	74
1974	3	74
1975	5	76
1976	9	85
1977	7	67
Total	118	1584
Average	5.9	79.2

Total for one tropical season is attributed to the year in which the season began.

### ACTIVITIES

- Using resource 33.5:
  - Construct a line graph to show the South-West Pacific's statistics.
  - In what way is the average – misleading – helpful?
- Using resource 33.6:
  - Construct a bar graph.
  - In what *season* do most tropical cyclones occur in the South Pacific? Why?

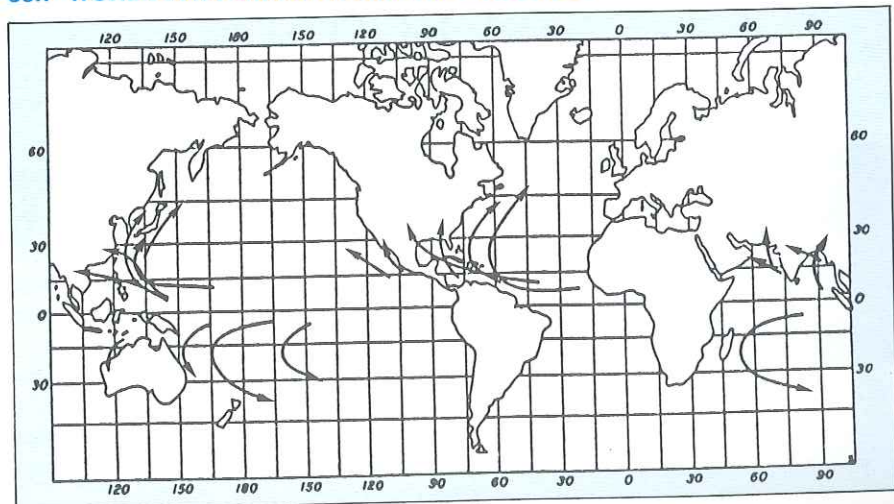
■ Monthly frequency – see resource 33.6.

## 33.6 MONTHLY FREQUENCY (AVERAGE) IN SOUTH-WEST PACIFIC

JAN	FEB	MAR	APRIL	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
2.0	2.0	1.9	0.7	0.1	0.1	–	–	–	–	0.1	0.7

■ Location – see resources 33.7–33.9.

## 33.7 WORLD PATTERN OF TROPICAL CYCLONES



### ACTIVITY

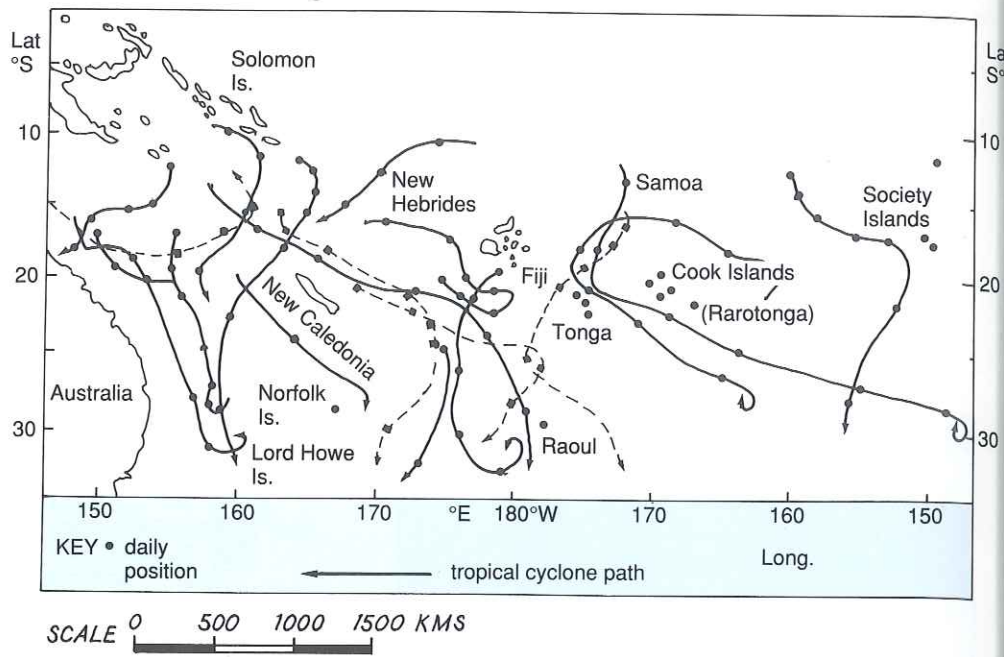
- Refer to resource 33.7.
- Where do most of the world's tropical cyclones occur?
  - Why is this?



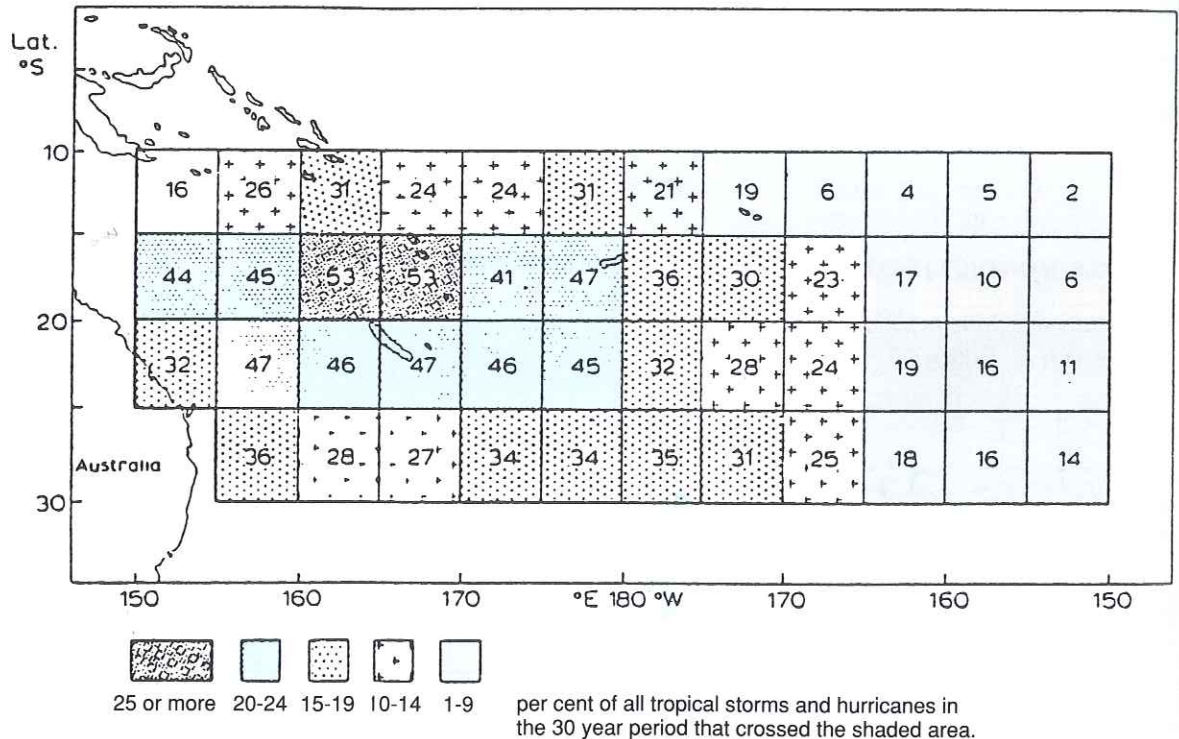
# ACTIVITIES

- 1 Refer to resource 33.8.
  - a Between which latitudes do most tropical cyclones form?
  - b What is the average number of days tropical cyclones last for?
  - c Between which latitudes do most tropical cyclones die out? Suggest why?
  - d What is the furthest distance travelled by a tropical cyclone in one day? What problems does this pose?
  - e In what general direction do tropical cyclones travel in the south-west Pacific?
- 2 Using resource 33.9.
  - a Name the island groups that experience the most tropical cyclones.
  - b Describe and explain the pattern on the map.

## 33.8 TROPICAL CYCLONES IN THE SOUTH-WEST PACIFIC (10 YEAR PERIOD)



## 33.9 NUMBER OF TROPICAL CYCLONES THAT PASSED THROUGH EACH SQUARE (30 YEAR PERIOD)



# 34

## Tropical Cyclones in the south-west Pacific

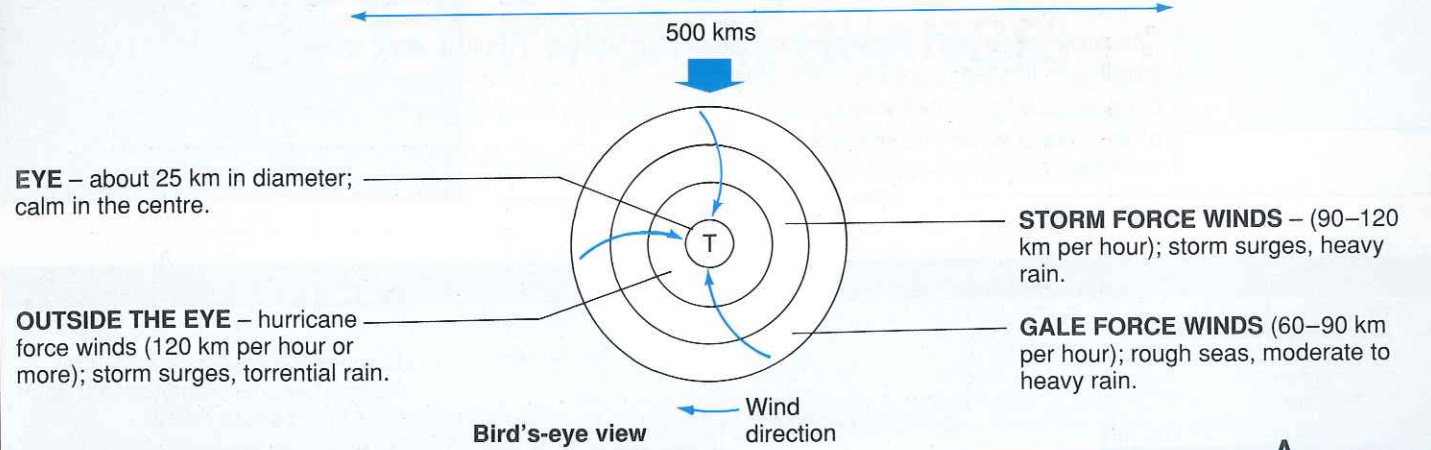
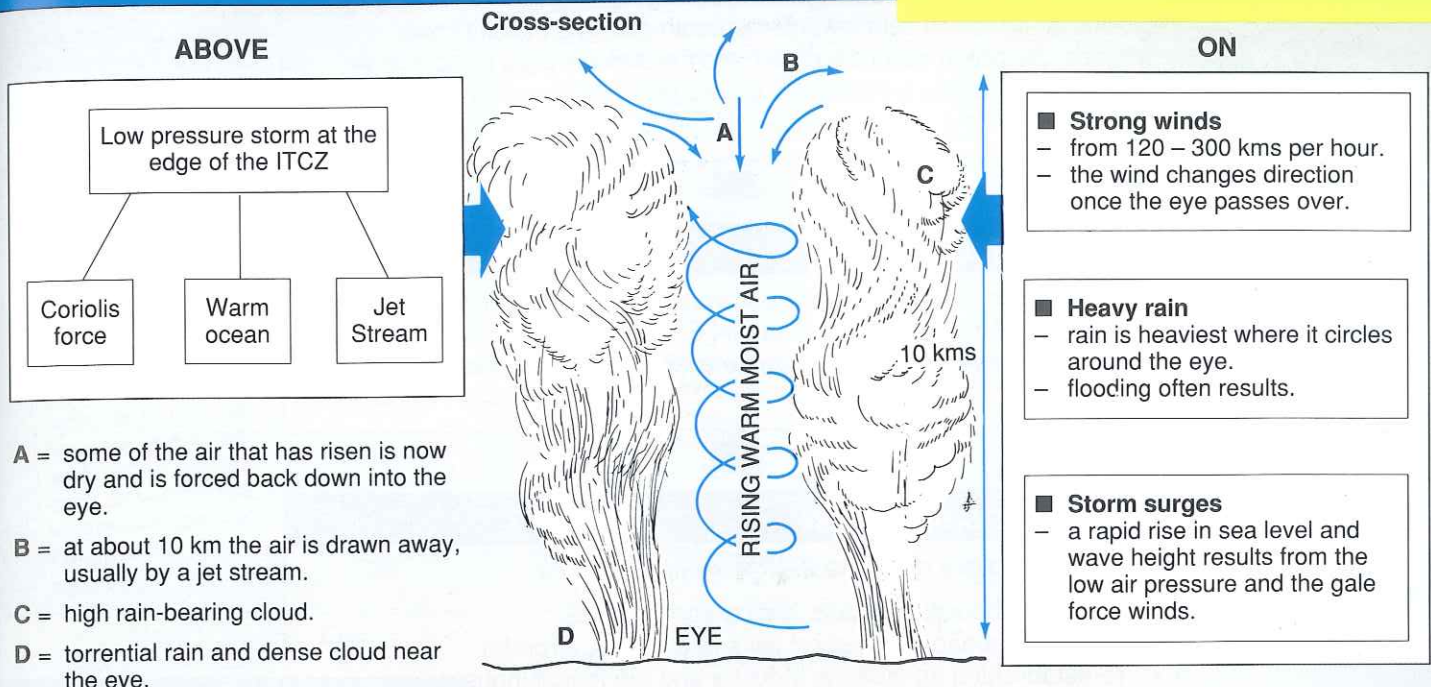
# SEQUENCE OF EVENTS

*What sequence of events occurs when a tropical cyclone is hazardous?*

Every tropical cyclone is different in terms of its duration and the strength of its force. However where tropical cyclones are hazardous to people, a general sequence of events tends to occur.

Bg 108  
110

**STAGE 1: PROCESSES ON AND ABOVE THE EARTH**



**ACTIVITIES**

- Imagine the tropical cyclone above is moving towards an island.
- In which direction is it likely to be heading? (See also resource 33.8.)
  - Why does the wind change to the opposite direction after the eye passes?
  - Draw a flow diagram to show the sequence of events likely to occur:
    - before the eye arrives
    - while the eye is overhead
    - after the eye passes.

**STAGE 2: EMERGENCY RESPONSE**

- Meteorologists observe the formation of a tropical cyclone using satellite photographs.
- Warnings are issued to locations likely to be in the path of the tropical cyclone.
- Emergency procedures are carried out, for example, staying indoors; listening to the radio; evacuation.
- The wind, rain and storm surges arrive and then stop as the eye passes over.



### STAGE 3: AFTER THE EYE

Winds now come from the opposite direction again bringing heavy rainfall and storm surges. Wind damage and flooding again result. As the tropical cyclone continues its path towards the south-east and into the lower latitudes, the ocean becomes cooler and the cyclone loses its source of energy and becomes a depression once again. The same happens if a tropical cyclone moves over a large land mass such as Australia.



### STAGE 4: RECOVERY

As the winds die down and the flood waters recede, the damage can be assessed and the clean-up can begin. Emergency aid (water, food, clothing, temporary housing) is made available and evacuation will occur if necessary.



### STAGE 5: REHABILITATION

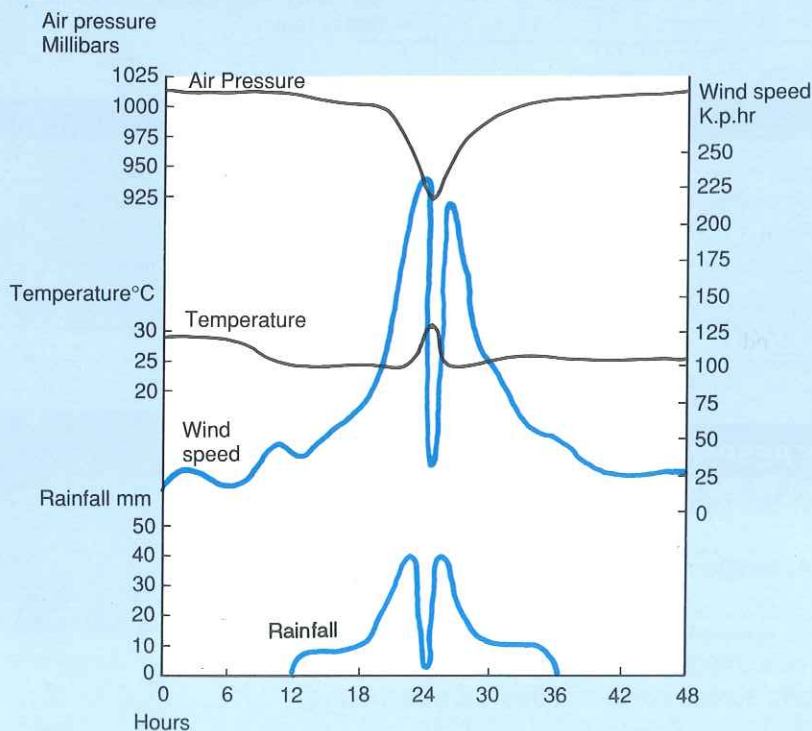
Longterm recovery may take 2–3 years and includes:

- rebuilding houses, schools, shops and factories.
- repairing damaged transport links (e.g. roads, airports).
- re-establishing agriculture, industry and the tourist industry.

The process is likely to be slow because Pacific Island nations tend to be small with limited resources. What resources they have however are concentrated on small islands so that if an island is hit, a large proportion of its resources will be threatened.

## ACTIVITIES

### 34.2 WEATHER CHANGES



1 Using resource 34.2 describe the changing weather conditions for each of the time periods below:

- 0–20 hours
- 21–28 hours
- 29–48 hours

Give each time period a title.

2 Copy resource 34.2 and using numbers indicate on your copy where the 5 stages in resource 34.1 would fit.

3 How could resource 34.2 help people prepare for a tropical cyclone?