RECENT TYPHOONS IN SOUTH-EAST ASIA

by John Davidson

TYPHOONS are very large, violent storms that form over the tropical waters of the Pacific Ocean. Similar tropical storms that form in the Atlantic Ocean are called hurricanes, and those that form in the Indian Ocean are called tropical cyclones. This unit looks at how these huge storms develop and at their effects on countries in two different parts of South-east Asia: the Philippines and Myanmar (Burma).

Countries at risk from typhoons and tropical cyclones in South-east Asia are shown on Figure 1. Each year storms are given names from a list agreed by the countries of this region – most are named after flowers, animals and star signs. Although typhoons and cyclones can occur in any month, they are more likely to affect South-east Asia between May and November.

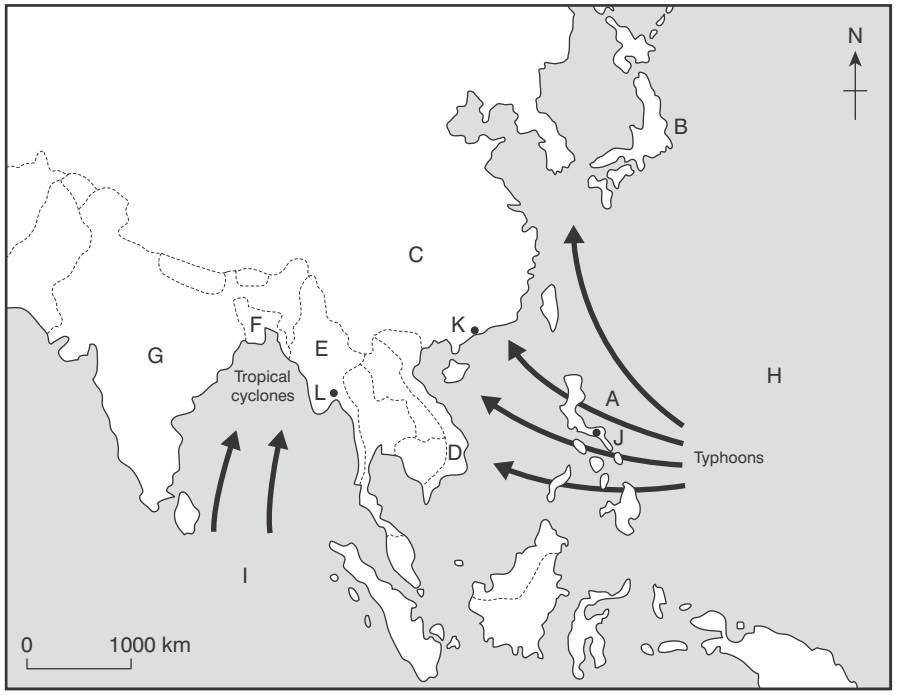

Figure 1: **South-east Asia**

How do typhoons form?

For typhoons and tropical cyclones to form, there needs to be a large area of sea water warmer than 26 degrees Celsius, and the air above must have a humidity of at least 75%. This is most likely to happen over the tropical parts of the Pacific and Indian Oceans between May and November in the northern hemisphere. Typhoons form as follows:

1 The warm sea heats up the air above, causing very large bubbles of moist air to rise up into the atmosphere.

2 The air then cools, and the water vapour condenses to form a large thunderstorm.

3 The rising air leaves an area of low pressure at sea level and as more air is sucked in, strong winds develop.

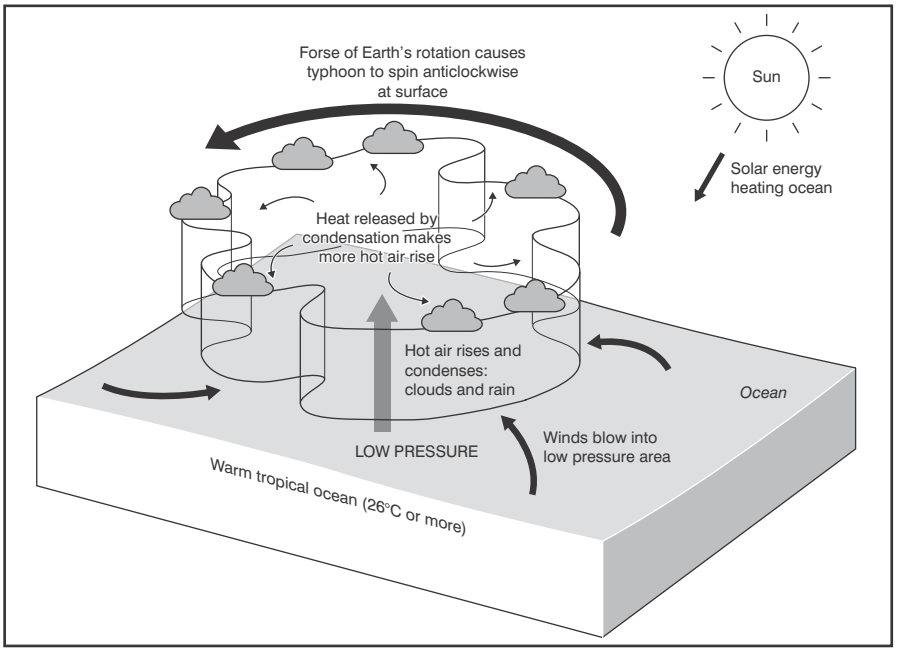

Figure 2: **Formation of a cyclone**

4 The storm begins to spin anticlockwise (in the northern hemisphere) as a result of the force of the Earth's rotation (known as the Coriolis force).

5 Heat is released by the condensing water vapour which causes the whole storm to heat up, and more air to rise. This creates even more low pressure which sucks in more air at

Scale	Pressure in millibars (mb)	Average wind speed (km/hr)	Height of storm surge (metres)	Damage level
1	980	119–153	1.2–1.7	Minimal
2	965–979	154–177	1.8–2.6	Moderate
3	945–964	178–209	2.7–3.9	Extensive
4	920–944	210–249	4–5.5	Extreme
Super Typhoon		Over 241	Over 5.5	Catastrophic
5	920 or less	Over 249	Over 5.5	Catastrophic

Figure 3: **Modified Saffir-Simpson scale**

sea level. The whole process becomes self-sustaining, as the more air that is sucked up and condenses, the more energy is released to heat the storm.

Typhoons and tropical cyclones will continue to develop while they stay over warm water, forming a storm system that can be several hundred kilometres across. When the wind speed reaches 119 km per hour it is classified as a typhoon. Figure 3 shows the Saffir-Simpson scale that is used to classify typhoons, tropical cyclones and hurricanes. In the Pacific Ocean, the Super Typhoon category is used when wind speeds reach 241 km per hr.

The north-west Pacific is sometimes called Typhoon Alley, because between 15 and 25 typhoons can develop here every year. Ocean currents and warm trade winds tend to push warmer water into this region, meaning that conditions are ideal for forming typhoons. In comparison, the Indian Ocean usually produces only 3 to 5 tropical cyclones per year.

What are the hazards?

Typhoons and tropical cyclones have very strong winds and bring very large amounts of rainfall. There are five major hazards to people and property associated with typhoons and tropical cyclones.

1 **High waves:** The very strong wind speeds can create waves of up to 15 metres, which can be a major problem for both ships out at sea and coastal areas.

2 **Storm surge:** As a typhoon or cyclone nears land, the winds push up even higher waves in the shallower water. There is also a local rise in sea level because in very low pressure areas, there is less atmosphere pushing down on the sea. These two effects produce storm surge with waves several metres higher than normal sea level. On low-lying coasts, and in river deltas, these waves race inland causing extensive flooding and inundating the land with salty water.

3 **Heavy rain:** Typhoons and cyclones can pick up over 2,000 million tonnes of water every day which is then released as torrential rainfall. This can produce extensive floods in lowland areas and cause flash floods in upland valleys.

4 **Mudflows:** When heavy rain falls on slopes, it quickly saturates the soils, which may then start to flow downhill, particularly if the area is farmed or vegetation has been cleared. These mudflows can wreck fields and destroy property. Because mudflows are thick and sticky, it is very difficult for people caught in them to survive.

5 **Very high wind speeds:** Wind speeds of over 120 km/hr can cause many structures to fail. Roofs and poorly constructed buildings are especially at risk. Flying objects picked up by the winds, such as tree branches and bits of buildings, become missiles and can be deadly.

Case Studies

The effects of Typhoon Fengshan on the Philippines

The Philippines are directly in the path of typhoons forming in the north-west Pacific (Figure 4). The Philippines consist of over 7,000 islands, which are mainly hilly volcanic areas with fertile soils. Over 100 million people live on these islands which are farmed intensively for crops such as rice.

On 20 June 2008, the Philippines were hit by Typhoon Fengshan (also known as Typhoon Frank). The category 3 typhoon developed from a tropical storm in less than two days. It came in from the south-east and hit the middle of the Philippines with wind speeds of over 180 km/hr. It then moved slowly north-west, dumping over 350 mm rainfall in 24 hours – equivalent to roughly half the annual total rainfall received in southern England. Extensive damage was caused to both property and crops. Inland, the volcanic soils became saturated with rainwater and mudslides developed, damaging houses and crops, and killing over 600 people. In the valleys, floodwaters rose to 2 or 3 metres deep. Loss of life was low because most people received warnings in time to move to higher ground, but over 300,000 were made homeless. Along the coast, there were fewer casualties because people were prepared after clear warnings were given as the typhoon was tracked by satellites as it approached the Philippines. However, there was considerable damage to property. Out at sea, 800 people were drowned when the ferry *Princess of the Stars* capsized in the high waves. Most ferries had been ordered to stay in port, but unfortunately this ship sailed into the eye of the typhoon after having misunderstood where the typhoon was heading.

Tropical Cyclone Nargis

On 2 May 2008, Myanmar (Burma) was struck by Tropical Cyclone Nargis which had formed in the Indian Ocean (Figure 5). Nargis was the worst tropical cyclone to hit mainland Asia since 1991. It was a category 4 storm with peak winds of 215 km/hr. The storm surge was 3.7 metres and the onshore winds forced a

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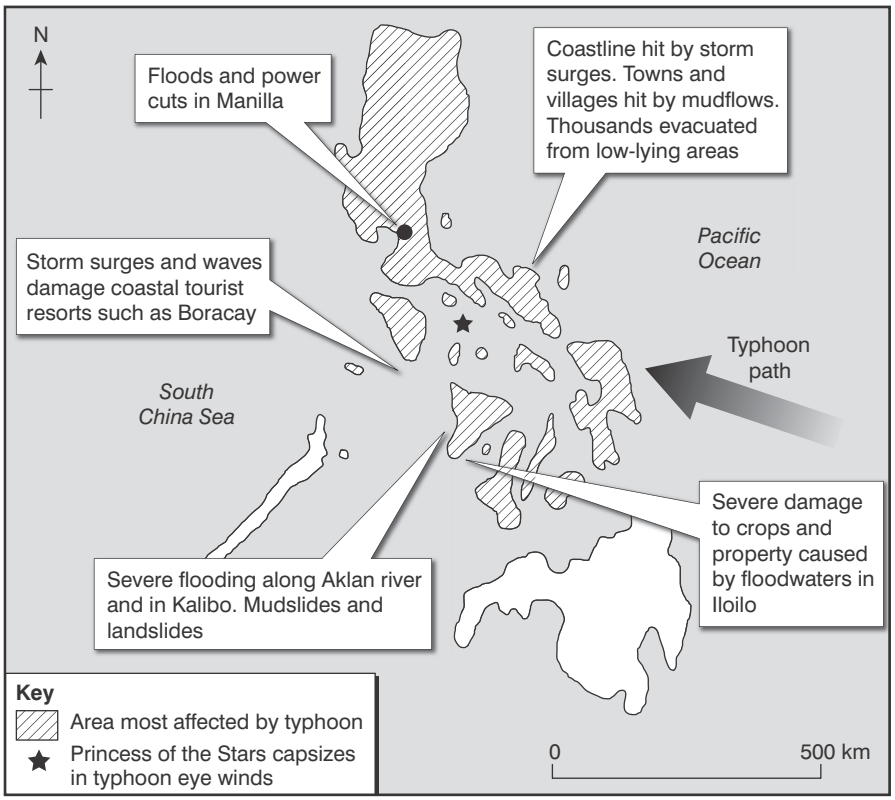

Figure 4: **The Philippines**

wall of water into the low-lying Irrawaddy delta. This rice farming area has a high population density of over 2,000 people per km^2. At the same time as the storm surge, over 500 mm of rainfall fell across the area. This is roughly the same amount of rain that East Anglia receives in a whole year. The result was catastrophic. At least 150,000 people were killed or reported missing presumed dead, and an estimated 1.5 million people were made homeless, while 95% of all buildings in the Irrawaddy delta were damaged. At Bogale, one of the worst-affected towns in the delta, 95% of houses were washed away by the storm surge and as many as 10,000 people killed. Seven of the eight health centres in the region were destroyed and freshwater supplies were non-existent. This was a very strong cyclone but several factors made the effects more severe:

- The land here is low-lying – the winds literally pushed the water directly into the delta, destroying everything in its path.
- There was little warning – with few warning systems in place, most people simply did not know what was coming, or what to do in a cyclone.
- The cyclone struck at night, making it much harder to escape the rising water in the dark. The flimsy single-storey shacks that most people lived in quickly broke up in the winds and when the storm surge came, there was nowhere to escape to.
- There was little advance preparation, and people did not have emergency supplies and aid available.
- There were no evacuation plans in the event of a cyclone.
- In the days after the cyclone, many people were unable to find food or clean water.
- The Myanmar government made it difficult for aid workers to enter the country, and it was several days before a full relief effort was underway.
- In the last 30 years, mangrove forests along the coast of Myanmar have been cleared, so there was no natural protection from the winds and storm waves.

Longer-term effects of Tropical Cyclone Nargis

In June 2008, one month after the disaster, help had still not reached many communities stranded by the extensive floodwaters, despite the programme of international aid that had developed. In many of these villages a spirit of community help developed, with people working together to rebuild their homes with what materials they could salvage. Local Buddhist monks were actively involved by providing aid, sharing food and helping people to restart their lives. The longer-term aid programmes are now focusing on providing tools and building materials and helping people to be more prepared for future cyclones.

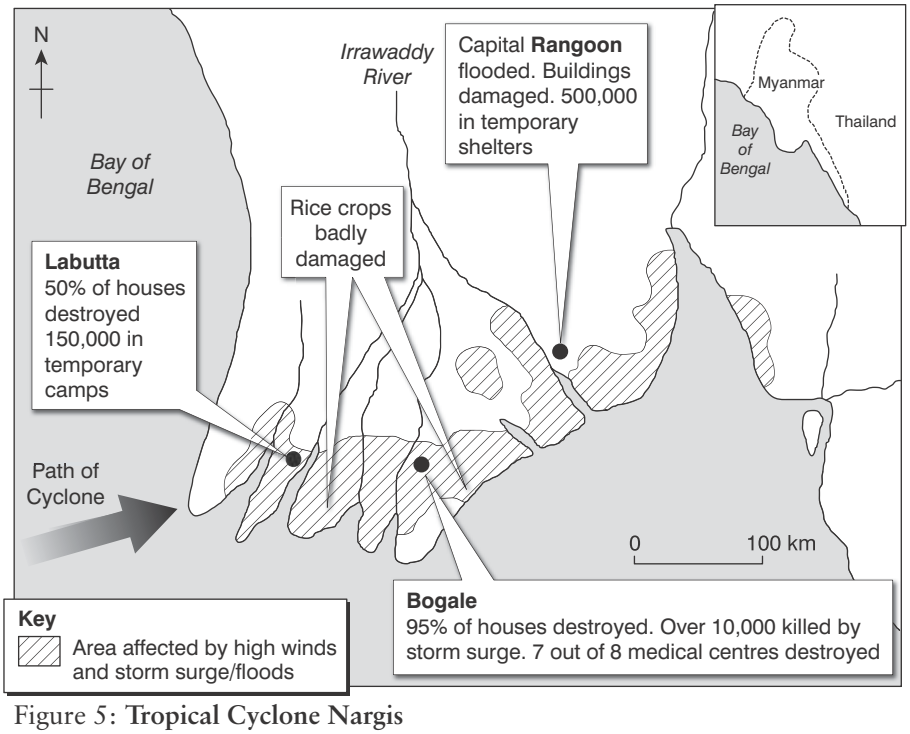

Figure 5: **Tropical Cyclone Nargis**

Activities

1 On a copy of Figure 1, name:
(a) countries A to G
(b) oceans H and I
(c) cities J, K and L.

2 Using Figure 2, briefly explain how typhoons and tropical cyclones form over warm tropical oceans.

3 Study Figure 6 which shows the percentage of typhoons occurring in each month in the north-west Pacific.
(a) Draw a bar chart to show the percentage of typhoons that form in each month.
(b) In which month is there the greatest risk of a typhoon occurring?
(c) In which month are typhoons least likely to occur?
(d) Work out the total percentage of typhoons that occur from May to November. Suggest why this is often described as being the typhoon season for the north-west Pacific.

Month	% of typhoons that developed in each month
January	2
February	1
March	2
April	3
May	4
June	6
July	14
August	21
September	18
October	15
November	9
December	5

(based on data collected over 45 years from 1959 to 2005)

Figure 6: **Monthly frequency of typhoons in the north-west Pacific Ocean**

	Tropical cyclone Nargis	Typhoon Fengshan
Date (month and year)		
Country affected		
Category (from Saffir-Simpson scale)		
Maximum wind speed		
Total rainfall		
Likely number of fatalities		
Number of people made homeless		

Figure 7: **Comparison: Tropical Cyclone Nargis and Typhoon Fengshan**

4 (a) On a copy of Figure 7, draw up a comparison of Tropical Cyclone Nargis and Typhoon Fengshan, using the case studies.
(b) Give three reasons why Cyclone Nargis produced a much greater loss of life than Typhoon Fengshan.

5 Using the web, find five pictures that show the effects of Cyclone Nargis. Create either a presentation or a short illustrated report to summarise the main impacts of Cyclone Nargis on the Irrawaddy delta region.

6 Using the web, find out about how people in places like the Philippines, Japan or Hong Kong receive warnings about typhoons. Write a short statement on how cyclone warning systems can save lives.

7 Using the web, look at examples of photos or videos showing the damage caused by Cyclone Nargis. Then study Figure 8 which shows the contents of survival kits delivered by charity organisations to people in the flooded Irrawaddy delta.
Choose *three* of the items listed and suggest why people need them to help them recover from the disaster.

- Tarpaulins and materials for building temporary shelters
- Blankets and towels
- Mosquito nets
- Water purification tablets
- Bottled drinking water
- Cooking equipment (pots and pans)
- First aid kits
- Surgical gloves and masks

Figure 8: **Survivors' aid kits delivered to people in the Irrawaddy delta**

Series 21 Autumn issue Unit 423 *Recent Typhoons in South-East Asia*