Typhoon Haiyan

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A case study about the causes and impacts of tropical storm Haiyan

When tropical storm Haiyan struck southeast Asia in November 2013, it caused havoc in an already deprived area. This region is vulnerable to extreme weather hazards such as typhoons, and any methods to reduce the impact can be limited by poverty.

Populations are growing, so there is pressure to use land that is at risk of the flooding, storm surges and extreme winds created by tropical storms. Some scientists warn that in future there may be an increased chance of more storms of this scale, if climate change and sea level rise affect weather patterns.

Key vocabulary

tropical storm, typhoon, population density, depression, landfall, Saffir-Simpson scale, storm surge, infrastructure

Learning outcome

In this unit you will:
- learn how natural hazards can have an impact on people's lives
- consider how such hazards can be managed and prepared for in the future.

Relevance to specifications

Exam board	Link to specification
AQA A	Unit 1: Physical Geography, Section A, Challenge of Weather and Climate, page 11 http://filestore.aqa.org.uk/subjects/AQA-9030-W-SP-14.PDF
AQA B	Unit 2: Hostile World and Investigating the Shrinking World, Section A, Living with Natural Hazards, page 13 http://filestore.aqa.org.uk/subjects/AQA-9035-W-SP-14.PDF
Edexcel A	Unit 1: Geographical Skills and Challenges, Section B, Challenges for the Planet, page 15 http://www.edexcel.com/migrationdocuments/GCSE%20New%20GCSE/9781446911907_GCSE_Lin_Geog_A_Issue_5.pdf
Edexcel B	Unit 1: Dynamic Planet, Section A, Introduction to the Dynamic Planet, Topic 2, Changing climate, page 13 http://www.edexcel.com/migrationdocuments/GCSE%20New%20GCSE/9781446911914_GCSE_Lin_Geog_B_Issue_5.pdf
OCR B	Unit B563: Key Geographical Themes, Theme 3: Natural Hazards, page 16 http://www.ocr.org.uk/Images/82581-specification.pdf
WJEC A	Unit 2: The Options, Physical Options, Theme 8, Weather and Climate, page 19 http://www.wjec.co.uk/qualifications/geography/geography-gcse/16128.pdf?language_id=1
WJEC B	Unit 2: Living in Our World, Theme 2: Physical Processes and Relationships Between People and Environments, 1 Weather and Climate, page 16 http://www.wjec.co.uk/uploads/publications/17213.pdf
CCEA	Unit 1: Understanding Our Natural World, Theme B: Our Changing Weather and Climate, pages 12 and 13; a copy of the specification can be downloaded from: http://www.rewardinglearning.org.uk/microsites/geography/gcse/index.asp
Cambridge IGCSE	Theme 2: The Natural Environment, page 17 http://www.cie.org.uk/images/150857-2016-syllabus.pdf
Edexcel IGCSE	Section A, The Natural Environment and People, Topic 3, Hazardous Environments, page 9 https://www.edexcel.com/migrationdocuments/IGCSE%20New%20IGCSE/IGCSE2009_Geography_(4GE0)_Specification.pdf

Typhoon Haiyan

> " Typhoon Haiyan was one of the strongest tropical storms ever recorded, and the deadliest to hit the Philippines. "

In November 2013 a **tropical storm** began developing in the Pacific Ocean southwest of the Philippines. This developed into a super-**typhoon**, known locally as Typhoon Yolanda and internationally as Typhoon Haiyan. It was one of the strongest tropical storms ever recorded, and the deadliest to hit the Philippines. It was responsible for over 6300 deaths.

The Philippines is a group of over 7000 islands in southern Asia, located between the Tropic of Cancer and the equator (Figure 1). It is the seventh most populous nation in Asia, with a population of 98.4 million throughout the islands

Figure 1 The Philippines in southeast Asia

(according to the CIA Factbook). **Population density** (the number of people per square kilometre, or how crowded a place is) is distributed unevenly across the islands, and is greatest in the cities (such as Tacloban City). The Philippines is a less economically developed country (LEDC), with an average gross domestic

product (GDP) per capita of $2765. This can be compared with nearby Malaysia with an average GDP of $10 500, and a world average of $13 100 (Figure 2). This directly influences how prepared the area can be for hazards.

The Philippines suffers from earthquakes and volcanoes (it is part of the Pacific 'Ring of Fire') and also from seasonal tropical storms (Figure 3). This is because it has a tropical climate, including a monsoon season, so most storms occur when the oceans are warmer, between November and May.

What caused Typhoon Haiyan?

The general phrase 'tropical storm' refers to an intense low pressure weather system, or **depression**, which creates a revolving storm: these are known as hurricanes, cyclones or typhoons in

Area	GDP per capita ($)	Population density (people/km^2)	Population growth (%/year)	Death toll
Tacloban City	2200	1100	+37	5800 (estimated – may be 10 000)
Visayas region (including Tacloban City, Samar and Leyte islands)	2450	278	+6	6200 (estimated)
Philippines (whole)	2765	337	+7	6340+ (Red Cross and locals estimated more than 10 000 deaths; President Aquino estimated just 2500)

Figure 2 The Philippines: some facts and figures
Sources: www.nscb.gov.ph, www.ncca.gov.ph
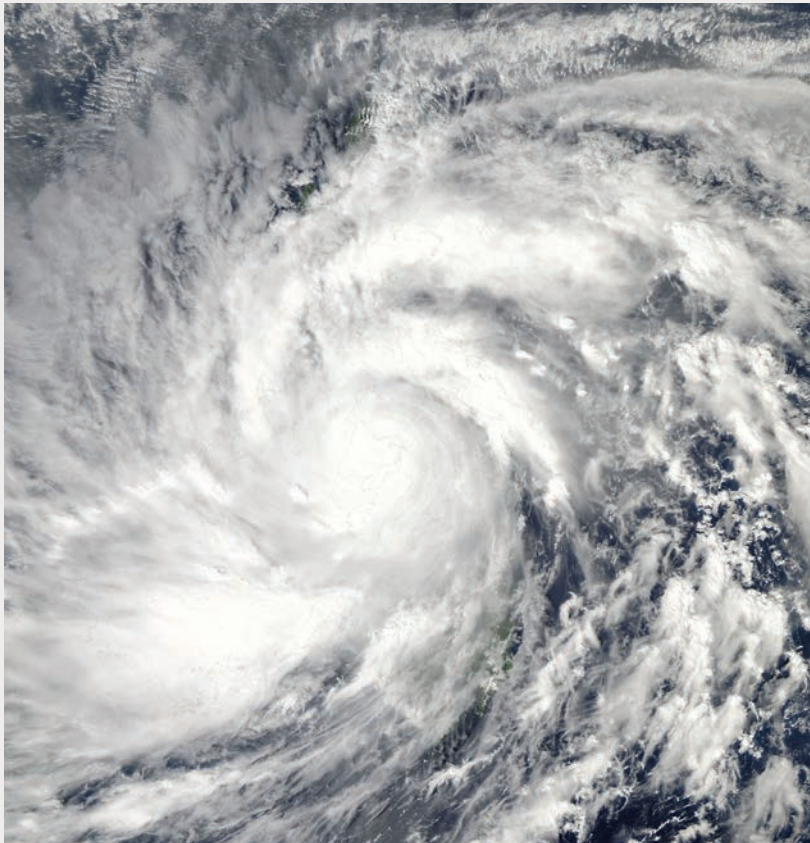
Figure 3 Typhoon Haiyan moves across the Philippines
Source: NASA/Geoff Schmaltz

different parts of the world (see Figure 4). These depressions can travel great distances, and last days or weeks. They always form over the sea between the Tropics of Cancer and Capricorn, on either side of the equator, where ocean waters are warmer than 27°C and the depth is at least 60 m.

The tropical heat creates a lot of evaporation from the ocean into the air, and the water vapour rises, cools and condenses to build clouds. This causes an area of low pressure to form near the surface because the air is rising up and away. High-pressure cold air from the atmosphere is sucked down towards the ocean surface, where it mixes with the rising warmer air. This creates a swirling

movement of rising and falling air. The natural turn of the Earth then spins these depressions away from the equator and from the oceans towards land (see Figure 3). Once the storm reaches speeds of over 119 km/hr it is classed as a tropical storm (or a typhoon/hurricane).

Landfall is when the storm hits land, and at this point the storm loses energy and gets weaker.

Tropical storms are measured on the **Saffir-Simpson scale**, from Category 1 to 5 (Figure 5). The strongest winds and the heaviest rain are experienced on the edge of the storm.

> " Tropical storms are measured on the Saffir-Simpson scale, from Category 1 to 5. "

Typhoon Haiyan began in early November 2013 in the Pacific Ocean and then was blown towards the Philippines (Figure 6). The storm was monitored by the Joint Typhoon Warning Centre (JTWC) which made predictions so that some people could be evacuated.

Impacts of Typhoon Haiyan

By 7 November, Haiyan was labelled a Category 5 storm, with estimated wind speeds up to 314 km/hr. This
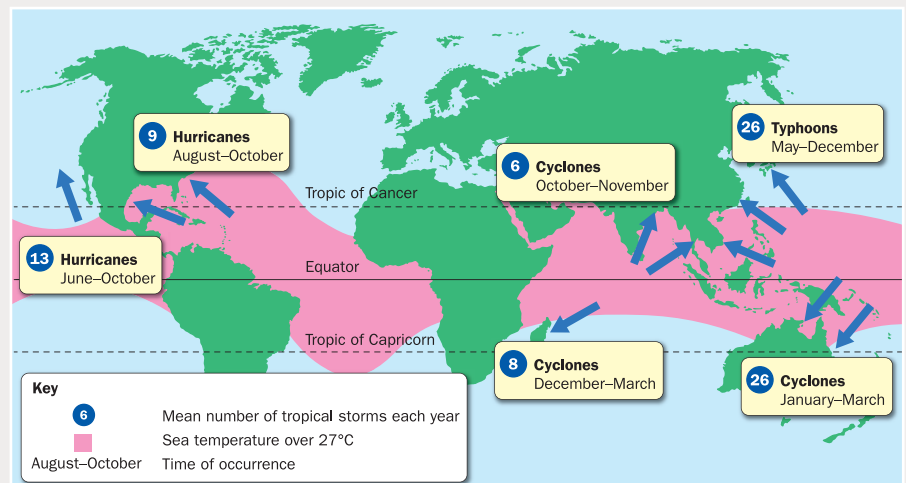
Figure 4 Global distribution of tropical storms, showing their local names

	Wind speed (km/hr)	Air pressure (millibars)
Category 1	119–153	> 980
Category 2	154–177	965–979
Category 3	178–208	945–964
Category 4	209–251	920–944
Category 5	> 251	< 919

Figure 5 The Saffir-Simpson scale

Figure 6 The path taken by Typhoon Haiyan

'super-typhoon' made landfall in the Philippines, and then five other areas, including southern China and Vietnam. However, the Philippines was the worst affected. The storm gradually weakened as it moved north, until by 11 November it had disappeared.

> **One of the worst impacts of a tropical storm is a storm surge.**

One of the worst impacts of a tropical storm is a **storm surge**, when the sea level rises unusually high because of winds and low air pressure (a storm surge should not be confused with a tidal wave or tsunami). A 7.5 m wave reached the coast (Figure 7), and a 5 m surge hit Tacloban City. Here at least 5800 people were killed. In rural Hernani, over 700 m away from the sea, the floods were so powerful that bodies were washed out from graves, which caused local people much grief.

Tacloban City was by far the worst-hit area. Around 90% of all buildings were destroyed, trees were uprooted or flattened, debris covered the land, electricity supplies were cut and **infrastructure** and communications destroyed. Some 5 million people saw their homes destroyed or become uninhabitable, and the airport was unusable. Of the total 6340 fatalities (estimated), almost all were in Tacloban.

Essential infrastructure such as the airport, roads, bridges, electricity supplies and communications were destroyed either by storm surge, winds, or later by landslides. This made it difficult to organise the emergency services, slowing the rescue efforts. By 11 November, the region was declared to be in a 'state of national calamity' and the international community was called upon for aid.
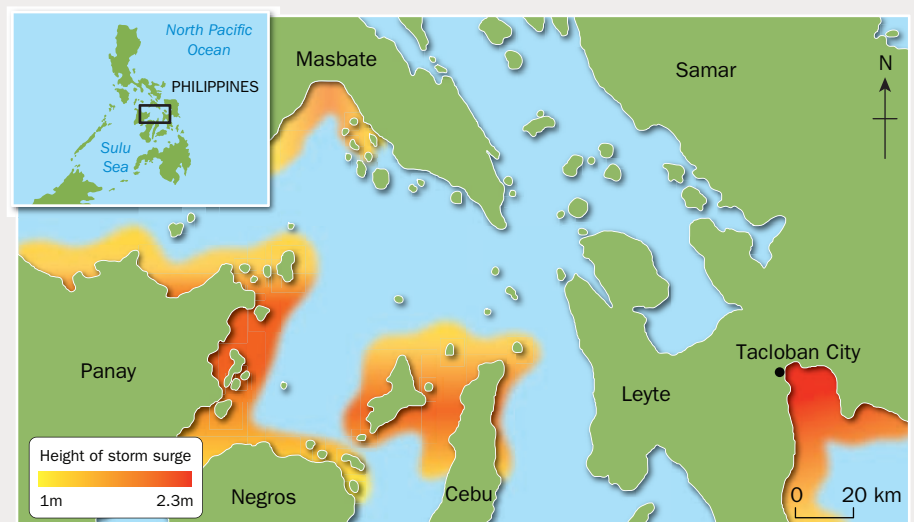

Figure 7 The storm surge brought flooding to low-lying areas

Emergency response

The emergency response was coordinated by the World Health Organisation and the United Nations (UN), and by other non-governmental organisations (NGOs) such as the Red Cross and the DEC (Disasters Emergency Committee). The DEC launched an international fundraising appeal on 12 November via television, radio, internet and social media – particularly Twitter. This raised millions of pounds worldwide in weeks.

The destruction of infrastructure, particularly the airports, slowed relief efforts and often supplies were not reaching the places where they were needed (Figure 8). By mid-November, only 20% of those requiring aid in Tacloban had received it. There were also incidents of looting – made worse because only 100 police out of 1300 reported for duty. Some UN

Figure 8 Damage to infrastructure
Source: www.shutterstock.com; photo by Richard Whitcombe

staff were pulled out for safety reasons, and charity agencies could not get to the victims. Hospitals, which were damaged and low on supplies, were sometimes shut down for safety reasons. Amazingly, there were no major outbreaks of disease.

Some charity trucks were attacked and items stolen, including 33 000 large bags of rice. Armed police and soldiers were sent in, and the President declared martial law in some areas.

Some criticised the government for its slow response. Five days after the typhoon first struck, residents still had no water or safe shelter. Victims and government turned to the international community for help. The UN fundraising appeal totalled $788 million, and foreign nations donated $500 million (including $131 million from the UK alone). British and US forces were also drafted in to help. However, the estimated total damage exceeded $8 billion, so the disaster has been a serious setback for the country's future development.

The economy of the Philippines relies on farming, fishing, tourism and manufacturing – all of which were damaged. Grants were made for local fishing businesses to buy new boats, Oxfam provided rice seed to farmers, Save the Children helped build tent schools to educate children, and tourist resorts along the coast are slowly being rebuilt.

Much of the work in Tacloban was conducted by residents themselves, and is still continuing. Thousands signed up for 'cash for work' schemes, in which people are paid by charities to help rebuild the city. Businesses are still closed in Tacloban, and many people still live in temporary homes.

Following the storm, technology was important, with satellite images and thermal cameras being used. Social media such as Twitter and Google Person Finder helped people locate their friends and family members.

Future planning

Efforts are being made to improve satellite and computer monitoring to improve prediction in future.

Some soft engineering schemes like creating mangrove plantations or tree plantations are being introduced to reduce the impact of waves and to provide windbreaks.

The government has also worked to improve warning systems and emergency plans for next time, and the internet is being used more to inform people.

Conclusion

The storm was so severe that the names 'Yolanda' and 'Haiyan' have been retired from the official name lists and will never be used again.

The Philippines, and southern Asia as a whole, need to think carefully about future risks due to climate change.

Activities

1 Describe the formation of tropical storms. Use a drawing or comic strip in your answer.

2 Study Figure 4.
  a Where are most tropical storms found?
  b When do most storms occur in the Philippines?
  c What conditions in the sea and air are needed to create storms?

3 How many people lost their homes as a result of Typhoon Haiyan?

4 Study the information in Figure 2.
  a What is the GDP per capita of the Philippines?
  b State the population density of Tacloban City.
  c Suggest why wealth and population density might have influenced the impact of the storm.

5 Study Figures 6 and 7.
  a Describe those areas worst affected by the storm surge.
  b Suggest reasons for this distribution.

6 Visit www.dec.org.uk and www.unocha.org to investigate the current situation in the Philippines. What is the situation like now?

7 Research the different options for hard and soft engineering used to reduce the impact of tropical storms. Include protection against storm surges and winds, and for buildings and the environment.

8 Investigate how technology helps with reducing the impact of tropical storms, e.g. hurricane-proof buildings, satellites, typhoon warnings, etc.

9 a Research the impact of a tropical storm in a more developed country, e.g. Hurricane Sandy or Hurricane Katrina in the USA.
  b Compare the impacts, the responses, and any future planning for the hazard.

Learning checkpoint

- Typhoon Haiyan made landfall in the Philippines in November 2013.
- It was the deadliest tropical storm to hit the region, killing approximately 6340 people and affecting 14 million people.
- NGOs such as the Disasters Emergency Committee were heavily involved in providing aid through an internationally funded Philippines Typhoon Appeal.

Glossary task

Write glossary definitions for these terms:

depression
infrastructure
landfall
population density

Saffir-Simpson scale
storm surge
tropical storm
typhoon

Remember this case study

To help you remember this case study, make notes under the following headings:

What were the causes of Typhoon Haiyan?

What were the primary and secondary impacts?

How did the local and international community respond?

How might this area be protected in future?

Try to make your notes fit a single sheet of A4. You could use a detailed mindmap to help you.