WHAT ARE HURRICANES?

by Karl Donert

HURRICANES are low pressure weather systems formed in tropical areas with winds speeds greater than 118 km/h. They rotate in an anticlockwise direction in the northern hemisphere and clockwise in the southern hemisphere.

Hurricanes are also called **typhoons** and **cyclones** in different parts of the world (Figure 1).

Where and when do hurricanes form?

Hurricanes are born over tropical oceans where there are warm waters, humid air and converging winds in intertropical regions (Figure 2).

The hurricane season normally runs from 1 June to 30 November, when the water temperature in these regions is relatively high (greater than 27°C).

How often do hurricanes form?

On average, around the world there are 45 storms of hurricane force per year. Usually nine major storms form each year in the tropical Atlantic and Gulf of Mexico area, with six of them becoming hurricanes and two of these becoming intense hurricanes (those with sustained winds exceeding 209 km/h).

What do hurricanes look like?

Hurricanes are circular rotating storms with thick clouds spiralling around a central clearer area or 'eye' (Figure 3).

A hurricane has three distinct elements:

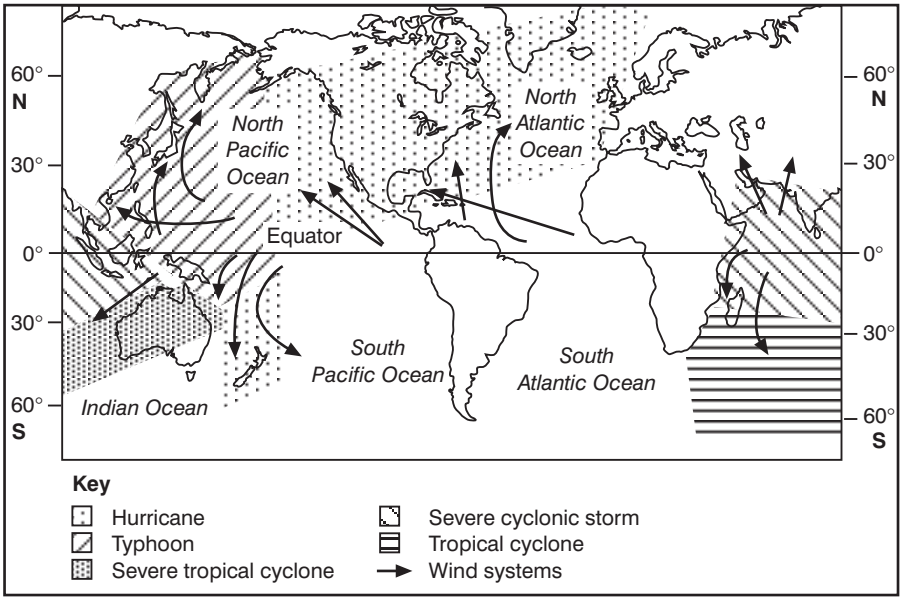

Figure 1: **Hurricane-force wind systems**

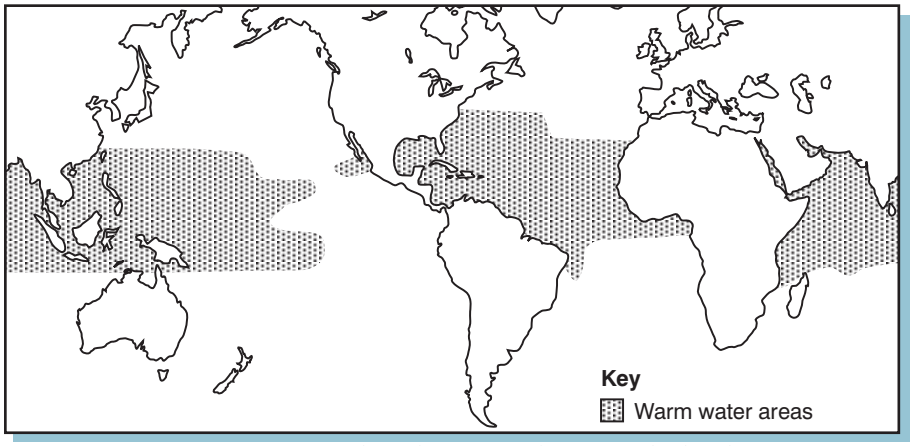

Figure 2: **Warm water areas where hurricane-force winds develop**

1 **Hurricane eye**: a region usually 30–60 km in diameter found at the centre of a hurricane where skies are often clear and winds are light. The lowest pressure readings are found here.

2 **Eye wall**: a wall of clouds and thunderstorms that surround the eye.

3 **Spiral rainbands**: bands of thunderstorms that spiral around the hurricane.

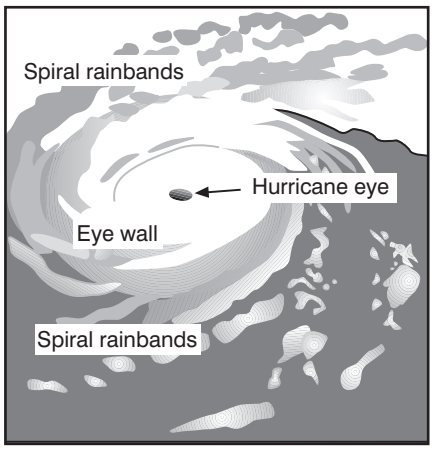

Figure 3: **View of a hurricane**

Naming hurricanes

The biggest hurricanes all have names (Figure 4).

NAMING HURRICANES

- Naming storms improves communication and safety.
- New lists of names are issued each year.
- The whole alphabet is used except for 'Q' and 'U'.
- Hawaiian names are used for Central Pacific storms.
- The names of major hurricanes are usually only ever used once.

Figure 4: **The naming of hurricanes**

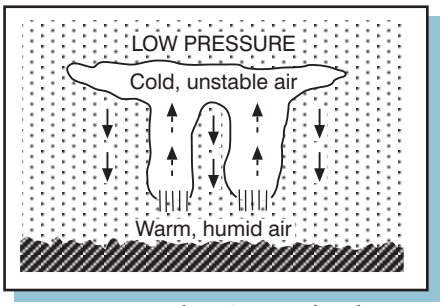

Figure 5: **How hurricanes develop**

How do hurricanes develop?

Hurricanes form from a low pressure system (Figure 5) when an unstable atmosphere leads to the development of convection (Figure 6).

Strong vertical updrafts lift air and moisture upwards, resulting in the development of large cumulonimbus clouds. The air exits at the top of the cloud and begins to sink.

Movement of hurricanes

The movement of hurricanes is closely related to the global wind systems (Figure 1). The easterly winds in the tropics usually steer hurricanes westwards. Most storms then gradually swing north-westwards. If the storm moves further north, the prevailing westerly winds steer it north-eastwards.

The typical hurricane originating in the northern hemisphere usually moves towards the west, then north-west, then north, and finally north-eastwards as it moves into higher latitudes.

Stage 1: Tropical disturbance

The beginning of a hurricane: an area of pressure slightly lower than the surroundings, with clouds and some precipitation.

Stage 2: Tropical depression

There is a drop in pressure in the centre of the storm and the winds increase to between 37 and 63 km/h.

Stage 3: Tropical storm

The storm becomes stronger as the central pressure drops.

Surface winds increase to speeds of 64 and 118 km/h. The appearance begins to resemble a hurricane.

Stage 4: Hurricane

If the surface pressure continues to drop, the storm becomes a hurricane when sustained wind speeds exceed 118 km/h. The storm has the familiar hurricane appearance.

Figure 6: **The four stages of hurricane development**

As a result, the Gulf and east coasts of the USA are at great risk of experiencing one or more hurricanes each year. Fortunately hurricanes are relatively slow to develop and their movements can be fairly well forecast with modern computer modelling techniques (see ***GeoActive*** unit 229 *Weather Forecasting*).

Because hurricanes derive their energy from the warm surface water and from the latent heat of condensation, they tend to dissipate rapidly when they move over cold water or over a large mass of land.

Hurricane damage

Hurricanes involve high wind speeds and can be very destructive. They may also cause damage due to:

- **Flooding** – a common occurrence with hurricanes. Heavy rains and ocean waters brought ashore by strong winds can result in flooding. The drainage systems in many cities cannot cope with such an increase in water, and the gentle slopes of many coastal areas slow down the runoff.
- **Storm surge** – an abnormal increase in the level of the ocean, sometimes more than several metres high and miles wide. Storm surges can come ashore up to five hours before the storm and cause severe damage in low-lying coastal areas. These surges are usually responsible for many hurricane-related deaths. They are especially damaging when the storm surge occurs during a high tide.

Hurricane	Date	Areas struck	Deaths
'The Great Hurricane'	10–16 October, 1780	Martinique, St Eustatius, Barbados	22,000
Hurricane Mitch	26 October – 4 November 1998	Central America, Honduras, Nicaragua	11,000+
Galveston, Texas	8 September 1900	Galveston Island	8,000
Hurricane Fifi	14–19 September 1974	Honduras	8,000
Dominican Republic	1–6 September 1930	Dominican Republic	8,000
Hurricane Flora	30 September – 8 October 1963	Haiti, Cuba	7,200
Martinique	6 September 1776	Point Petre Bay	6,000

Figure 7: **The most deadly Atlantic hurricanes on record**

Source: E. N. Rappaport and J. Fernandez-Partagas (1995) 'The Deadliest Atlantic Tropical Cyclones, 1492–1994', NOAA Technical Memorandum NWS NHC-47, National Hurricane Center

- **Tornadoes** – these also develop during hurricanes. For example, severe damage was inflicted during the life of Hurricane Andrew by small tornadoes formed in the eye wall of the hurricane. The strong, damaging winds of the hurricane frequently cover the smaller tornado paths, making it difficult to distinguish their damaging effects.

Case Study

Mitch: a deadly Atlantic hurricane

Mitch was ranked as the second most deadly hurricane ever witnessed in the western Atlantic, with some of the strongest winds ever recorded (Figures 7, 8 and 9). The death toll was reported to be over 11,000, with thousands of other people missing. It is likely that the final death toll will never be known. More than 3 million people in an extremely poor region were either made homeless or were severely affected.

Figure 10, and Figure 11 on page 4, catalogue the destruction that Mitch created. Despite the advances in science and in weather forecasting, storms such as this cannot be predicted or controlled, and their effects continue to be devastating.

Hurricane	Date	Maximum wind speed (km/h)
Allen	7 August 1980	277
Camille	17 August 1969	277
Gilbert	13 September 1988	268
Mitch	26 October 1998	260
Florida Keys	3 September 1935	235

Figure 8: **The strongest Atlantic hurricanes on record**

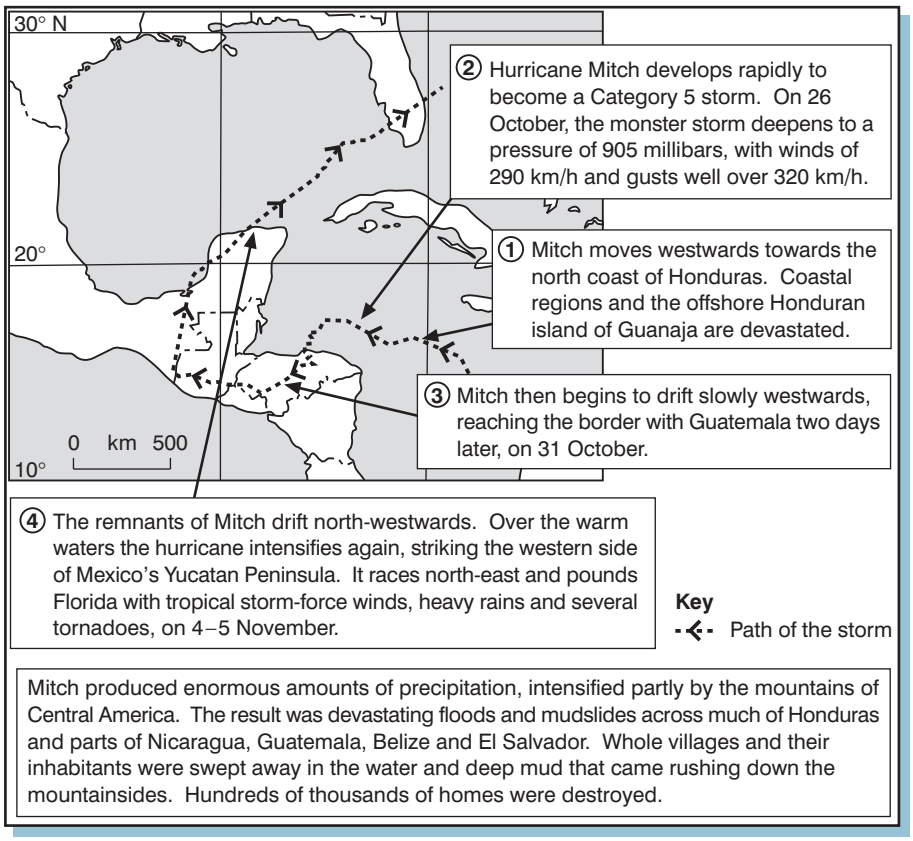

Figure 9: **The history of the storm**

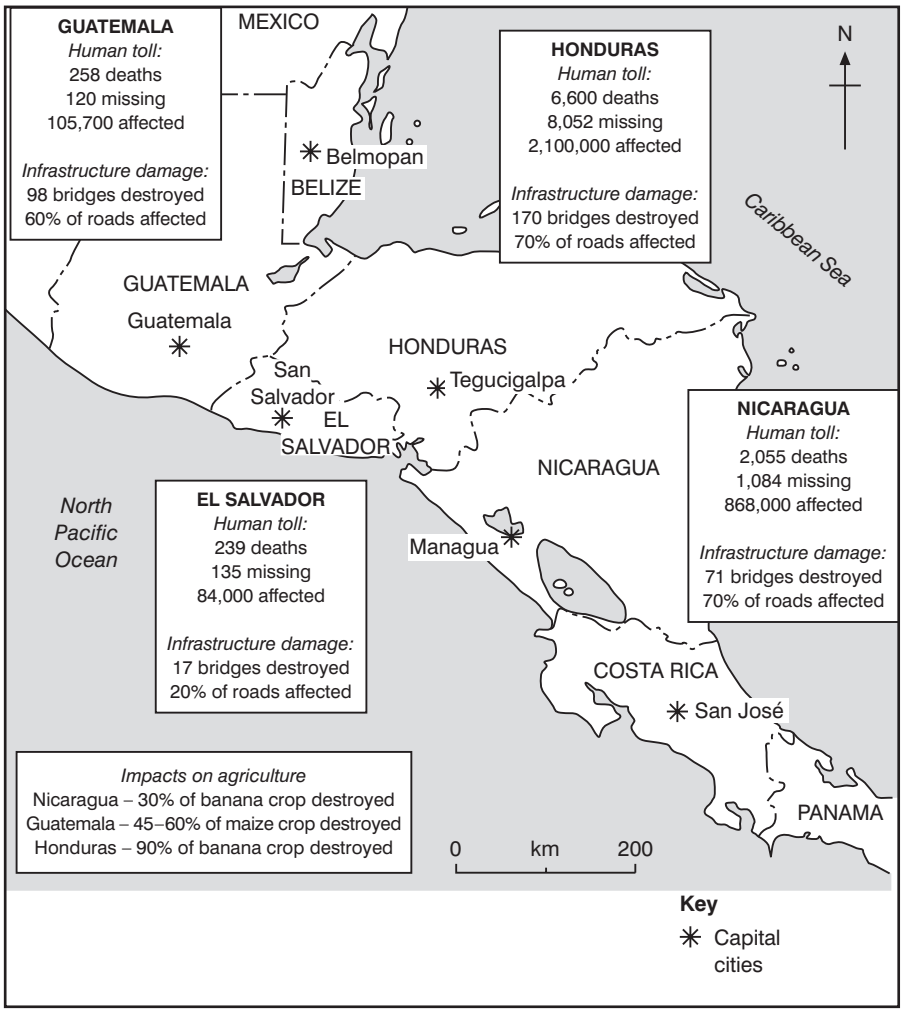

Figure 10: **Effects of Hurricane Mitch**

Activities

1 (a) Where are hurricanes formed?
(b) What conditions are necessary for the formation of hurricanes?
(c) Why do hurricanes rarely strike the British Isles?
(d) At what time of year is the Atlantic hurricane season?

2 Study the section on how hurricanes develop and the stages of formation.
(a) Write a short resumé of the main points.
(b) What is the main force that creates hurricanes?
(c) Using Figure 3 to help you, make a list of the main features of a hurricane.
(d) Are these easy to recognise?
(e) What are the main advantages of using satellite images to follow and study hurricanes?

3 Examine Figure 9 carefully.
(a) Use an atlas to identify the route taken by Hurricane Mitch.
(b) Where did the hurricane develop rapidly?
(c) Describe, in detail, the path taken by the hurricane.
(d) From the information provided, identify the areas most severely affected by the hurricane.

Foreign Aid Promised

Former Presidents George Bush and Jimmy Carter visited the disaster-stricken region and called for re-structuring and scaling back of international debt owed by Honduras and Nicaragua. As a direct result of the disaster, the International Monetary Fund began considering the formation of an emergency fund to help countries hit by natural disasters.

The United States announced on Thursday 5 November that it would supply $70 million in aid for Central America, and, on 10 November, an additional $10 million was added. Spain reported it would provide $105 million in aid and Sweden announced it would provide $100–$200 million over a three-year period. In addition, tonnes of food and grain were flown in by humanitarian organisations. Mexico provided an airlift of urgently needed supplies, and European countries donated $8 million. Canada supplied over $7 million in assistance. Additional help came from Japan and other countries.

Figure 12: **Newsline – aid for Hurricane Mitch victims**

Country	HONDURAS	Main cause of damage	NICARAGUA	Main cause of damage
Area affected	Entire country		North-western and northern parts	
Human toll	Estimated 6,500 dead with up to 11,000 missing. 1.5 million people displaced and homeless. Major food, medicine, and water shortages. Hunger and near-starvation widespread. Epidemics feared – malaria, dengue, and cholera		3,800 dead; 7,000 missing. 2 million people directly affected; 800,000 homeless. Heavy flooding over western Nicaragua. The dormant Casita volcano crater lake filled and the walls collapsed causing mudflows. Four villages were totally buried in the mud. Food and water shortages in flooded areas.	
Structural damage	Whole villages washed away. 70–80% of transportation infrastructure destroyed. Most bridges and secondary roads washed away. Airports under water. One-third of all buildings in the capital were damaged by the floods. 25 small villages in the north were swept away. Heavy damage along coastline and offshore islands from storm surge and hurricane-force winds. Severe damage to tourist resorts.		Infrastructure in affected regions devastated. Damage estimates $1 billion. Damage to 500,000 homes. 750,000 people lost their homes or possessions.	
Crop damage	70% of crops destroyed, estimated at $900 million. Large warehouses and storage rooms for coffee flooded. Maize and corn crops devastated.		30% of coffee crop destroyed. Beans, sugar, and banana crops devastated.	
Damage from Mitch in other countries				
El Salvador: Western part most affected by rain. 230 dead. 500,000 forced from their homes by flooding. 80% of maize crop lost. Coffee plantations and sugar cane crop severely affected. **Guatemala**: Over 200 killed by floods. 80,000 evacuated from their homes by flooding. Nearly 1 million directly affected by Mitch. Extensive damage to coffee and banana plantations. **Costa Rica**: Seven killed by flooding. Few thousand forced from their homes. **Belize**: Eleven dead or missing. Flood and crop damage extensive. Most of Belize City evacuated. **Mexico**: Nine reported killed. Many tourists cancelled holidays.				

Figure 11: **Destruction left by Hurricane Mitch**

(e) Write a newspaper story describing the movement of Hurricane Mitch. Make sure that you use relevant facts from this unit. Create a suitable, relevant headline.

4 Mitch left a devastating trail of destruction and disaster. Read the information in Figures 10 and 11.
(a) Use this information to identify the causes of the damage created in Honduras and Nicaragua (for example flood, winds, etc).
(b) Compare the damage caused by Mitch in the various countries. Then copy and complete Figure 11.
(c) 'The after-effects of a major disaster such as this are often more damaging than the event itself.' What evidence is given here to support this statement? Try to explain your answer.

5 Aid is usually provided by countries to support those who are stricken by disasters such as this. Read the news report in Figure 12.
(a) Identify the type of support given.
(b) Discuss why it is important to scale back the international debt owed by these countries.

6 Use the World Wide Web to learn more about Hurricane Mitch. Your teacher may be able to give you some hyperlinks to sources of useful information, or you could use a search engine.