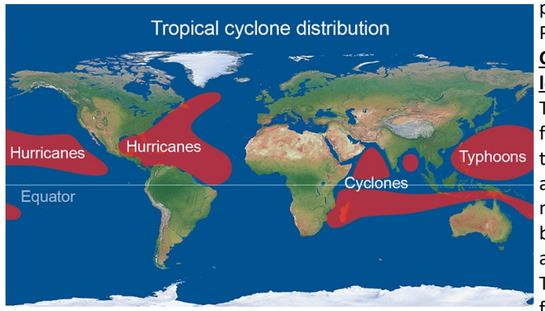
Unit 1: Topic 1c Hazardous Earth—Tropical Cyclones

What are tropical cyclones?

Tropical cyclones are know by different names around the world: Hurricanes in the Caribbean and east Pacific, Cyclones in in the Indian ocean and Indonesia and Typhoons in the west Pacific.



Conditions and location:

Tropical cyclones only form where water temperatures are above 26.5°C in summer and late autumn between the tropics 5° and 30°.

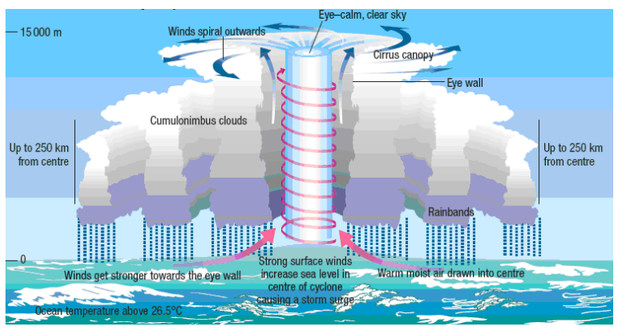
The factors required for their formation are likely to occur in the ITCZ (inter-tropical convergence zone) which is the main source area for tropical cyclones. This is an area of permanently low pressure which is part of the atmospheric circulation cell at the equator (Hadley Cell).

What are the key factors in their tropical cyclone formation?

1. Warm sea temperatures
2. High humidity—lots of moisture
3. Rapid cooling—rising air must condense quickly
4. Low wind shear—winds need to blow in the same direction
5. Coriolis force gives the cyclone spin— not usually within 5° of the equator
6. Existing low pressure— smaller storms come together

Key characteristics:

- In an area of **low pressure** very warm, moist air rises through the atmosphere sucking more air up behind it. A dense cloud of cirrus cloud forms a canopy covering the cyclone.
- The earths coriolis effect (spin/rotation) helps the rising air to spiral and drags in strong winds. Around the centre are high banks of cloud and rainbands.
- At the centre of the storm is the eye. The eyewall has the heaviest rain and strongest winds and are up to 640km wide and 10km high. The eye itself often has no winds and clear skies.



Tropical cyclone intensity and dissipation

Tropical cyclones are powered by heat energy that is released when warm moist air condenses. The warmer the water the more intense the tropical cyclone would be. When the cyclone makes landfall it will begin to dissipate because it loses energy moving away from the energy powered by warm water. It will dissipate into a normal low pressure system within a couple of days. The Saffir-Simpson scale classifies tropical cyclones.

Scale Number (Category)	Sustained Winds (MPH)	Damage	Storm Surge
1	74-95	**Minimal:** Unanchored mobile homes, vegetation and signs.	4-5 feet
2	96-110	**Moderate:** All mobile homes, roofs, small crafts, flooding.	6-8 feet
3	111-130	**Extensive:** Small buildings, low-lying roads cut off.	9-12 feet
4	131-155	**Extreme:** Roofs destroyed, trees down, roads cut off, mobile homes destroyed. Beach homes flooded.	13-18 feet
5	More than 155	**Catastrophic:** Most buildings destroyed. Vegetation destroyed. Major roads cut off. Homes flooded.	Greater than 18 feet

What impacts do tropical cyclones have on people and the environment?

Tropical cyclones are hazards in themselves but the storm also produces specific physical hazards:

1. **High winds** up to 250kmph uprooting trees, damaging infrastructure, buildings, causing injury and loss of life.
2. **Intense rainfall** leading to flooding, damaging property and injuring people from fast-flowing water.
3. **Storm surges** are created from large areas of low pressure allowing the sea level to rise and combined with high winds a large mass of water is forced towards land. This can erode beaches, damage sea defences and contaminating farmland and freshwater.
4. **Coastal flooding** caused by intense rainfall and storm surges can affect large areas of low lying land including farmland and the tourist industry.
5. **Landslides** are triggered because soil becomes saturated due to intense rainfall and in areas with steep slopes where the soil can no longer hold its position sliding down the slope.

Dealing with tropical cyclones—vulnerability

Some countries are more socially, physically and economically vulnerable.

Socially: areas where poverty leads to poor construction of housing is more easily damaged. Poorer areas are less likely to have access to shelter, food, clean water and medical care. Old and young people are also more vulnerable as they are more likely to struggle evacuating.

Physically: Low lying island nations and coastal locations are much more at risk from high winds and storm surges whereas areas of high relief are particularly at risk from landslides.

Economically: countries with high levels of development are less vulnerable due to accurate weather predictions, coastal defences to manage storm surges and evacuation procedures.

Dealing with tropical cyclones—preparation

Preparation depends on accurate forecasting and then communications. Measuring atmospheric pressure using anchored ocean buoys and shipping data gives early indications. Satellite technology identifies cloud formations and the eye of tropical cyclones which are then tracked real time. When landfall is if forecast the government will activate defences, evacuation procedures and emergency services. Emergency kits should include a range of the following: first aid kit, non-perishable food, matches, water, torch.

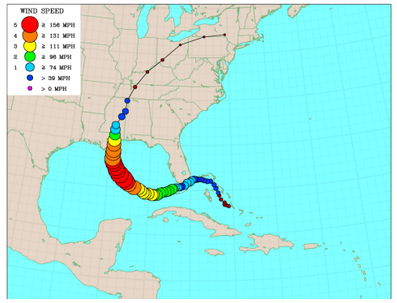
Dealing with tropical cyclones—response

Teams of rescue workers search for survivors and provide shelter, food and medical services. Repair and reconstruction follows of the affected areas including power supplies, water and

Tropical cyclone preparation and response
Developed country case study- USA, Hurricane Katrina

Fact file:

29th August 2005, Category 3, 6m storm surge, 1800 deaths, $100 billion



Preparation:

Forecasting and tracking was very good. Mayor of New Orleans ordered and evacuation. Many people were unable to leave due to a lack of transport. The Superdome was set up as an evacuation emergency shelter. Approximately 80% of the city were evacuated before the storm hit, those left either stayed at home or went to the Superdome. However, when the storm surge created by the storm hit the city the levees and barriers were overwhelmed flooding over 80% of the city.

Response:

This was criticised by many as too slow and not effective. The Superdome trapped people with limited food. The emergency services were unprepared for the scale of destruction. The poorest regions of the city, without cars were hit hardest and survivors felt betrayed by their government.

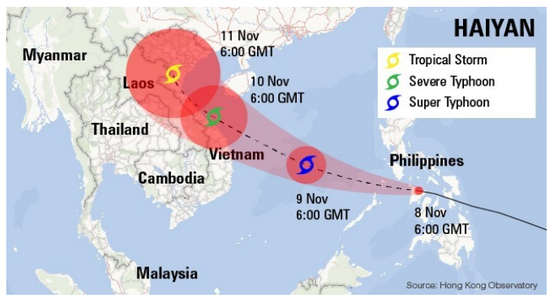
Tropical cyclone preparation and response
Emerging country case study– Philippines, Typhoon Haiyan

Fact file:

2-7 November 2013, Category 5, 5m storm surge, 7000 deaths, $3 billion

Preparation:

Japan assisted the tracking of the typhoon and the government used a public storm warning signal (PSWS) originally at category 1 but as it moved closer to the islands the level increased. When it made landfall at category 4 those people at risk of flooding and landslides were evacuated to safer areas. The military sent planes and helicopters to help with the aid effort. Unfortunately government emergency shelters were not placed on high enough land to escape the storm surge.



Response:

7 areas of the Philippines were placed under a 'state of national calamity'. Roads were blocked and damage to airports slowed the relief effort with some areas remaining isolated for days. Burst water pipes and contamination form sea water left many people without a source of clean, safe water. Evacuation from badly hit areas was difficult without electricity so could only be done during daylight hours. These delays caused panic amongst the population getting aid and 'rushing' the evacuation planes where the police and military maintained order.