

Year 11 into 12

Weather Hazards Workbook



In a world with a rapidly growing population, and with technological developments leading to faster travel and quicker communication, it is difficult to ignore that humans are becoming increasingly vulnerable to natural hazards.

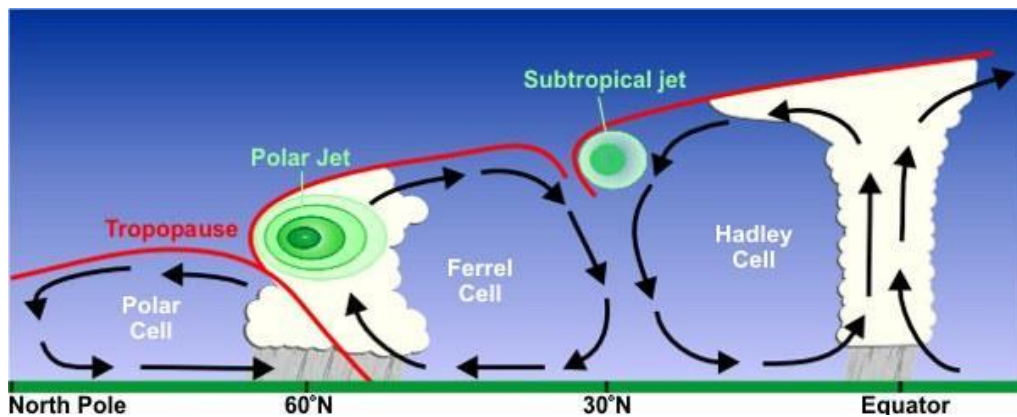
Due to the interference to the GCSE content caused by the pandemic, Weather Hazards was not taught at GCSE. However, it is an important part of understanding the content of Tectonic processes and hazards, and an understanding of weather hazards is expected in order that comparisons can be made between tectonic hazards and other hazards such as climatic hazards and meteorological hazards. Therefore this work addresses that gap in your knowledge.

What are the features of global atmospheric circulation?

Key Point: The most important influence on worldwide variations in climate is latitude.

Can you draw a diagram that shows how solar insolation differs at different latitudes and that explains why air is warmer at the equator and colder at the poles?





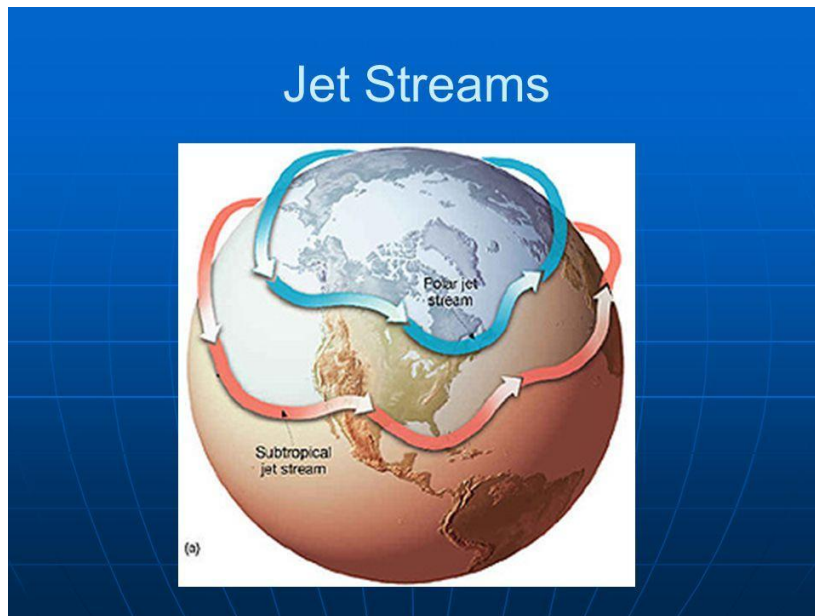
Study the diagram above and then complete the gap filler using these words (not in order) :-

low	strongly	dense	equatorial flow	colder
rises	altitude	pressure	Poles	insolation
polar	flow	sinks	Equator.	

Air at the Equator is heated _____. As a result it becomes less _____ and _____ to a high _____. This creates a global climate zone of _____ pressure, the _____ zone. After rising it spreads out and begins to _____ towards the North and South _____. Meanwhile the low _____ received at _____ latitudes results in _____, dense air and high _____. As the air _____ towards ground level, it spreads out and flows towards the _____.

Annotate the diagram according to the paragraph above.

What are the jet streams?



Define a jet stream:

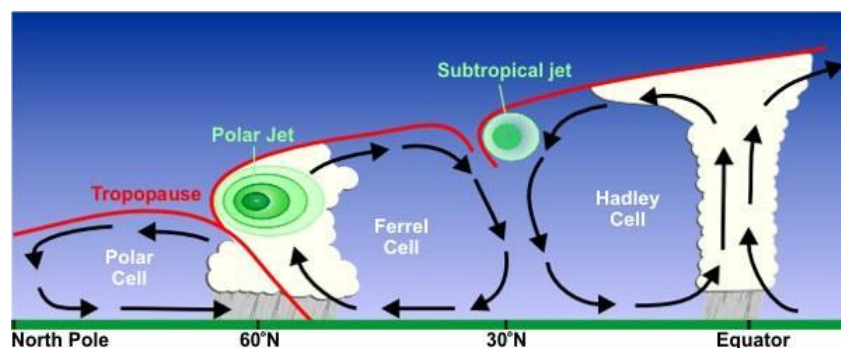
There are four altogether – two of two types in each hemisphere. Which way do they flow?

What do disturbances along a jet stream do?

Is the position of the jet streams constant?

How do global pressure and surface winds influence precipitation?

Annotate the diagram with the facts about global pressure and surface wind's influence on precipitation(the bullet points below) :



- Rainfall is high and constant throughout the year near the Equator (convictional rain).
- The low pressure area around the Equator is known as the ITCZ – intertropical convergence zone. Rain is sometimes torrential. The ITCZ sometimes extends, in waves, further than normal and tropical storms develop along these waves.
- Rainfall is often higher in coastal areas in Western Europe due to the movement of the jet stream over the Atlantic. Rain-bearing weather systems known as depressions or cyclones follow the jet stream, often bringing stormy conditions to the UK's west coast. Rainfall is often low around the Tropics of Capricorn and Cancer. Dry air descends there as part of the Hadley cell resulting in arid conditions.

- Precipitation is very low in polar regions and falls mostly as snow.

The global distribution of tropical storms

What are tropical storms?

What rises?

What does this create?

What begins to spiral around a calm central point once warm air has reached high altitudes?

What is this calm central point known as?

What occurs as the warm air cools and condenses?

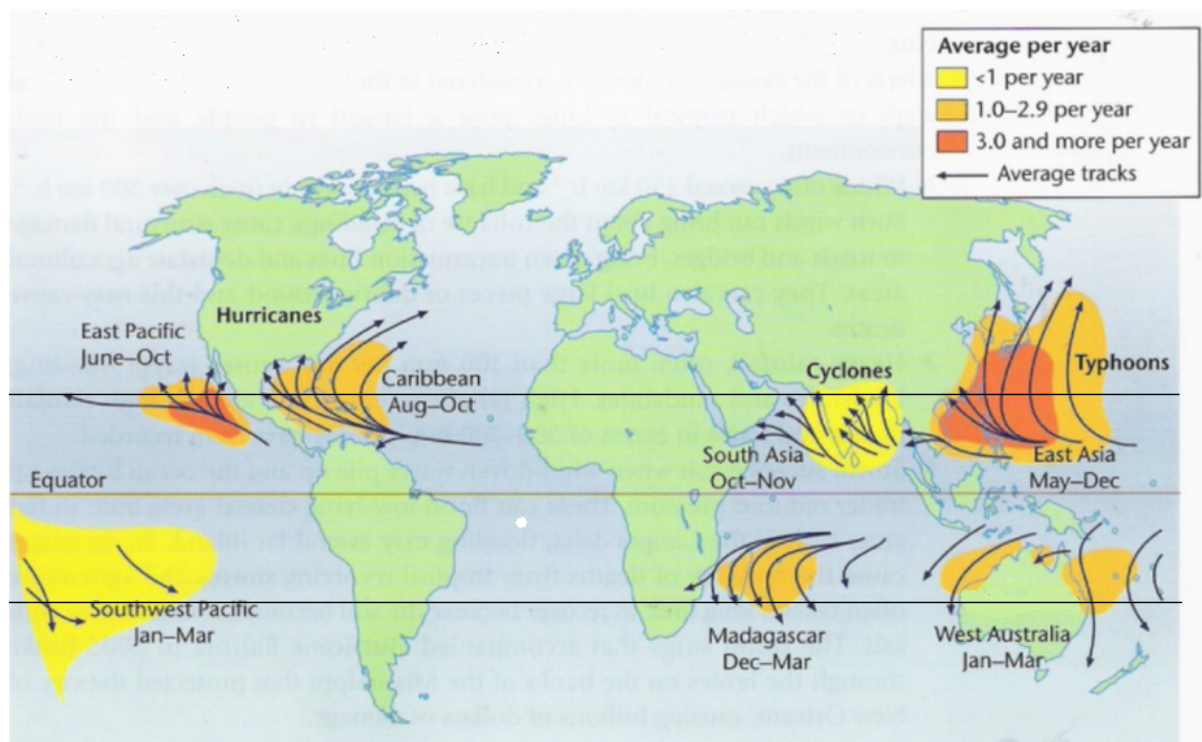
Key Point:

A UN report on global climate stated that from 2001 to 2010 more than 500 tropical storm disasters killed nearly 170,000 people, affected over 250 million people and caused damage estimated at US\$380 billion.

What are the different names for tropical storms?

- 1.
- 2.

3.



Why are tropical storms distributed where they are?

The conditions needed for a tropical storm to form

How do tropical storms form?

What is the Coriolis effect? (You need to understand this to understand why tropical storms form)

Can I draw the diagram?

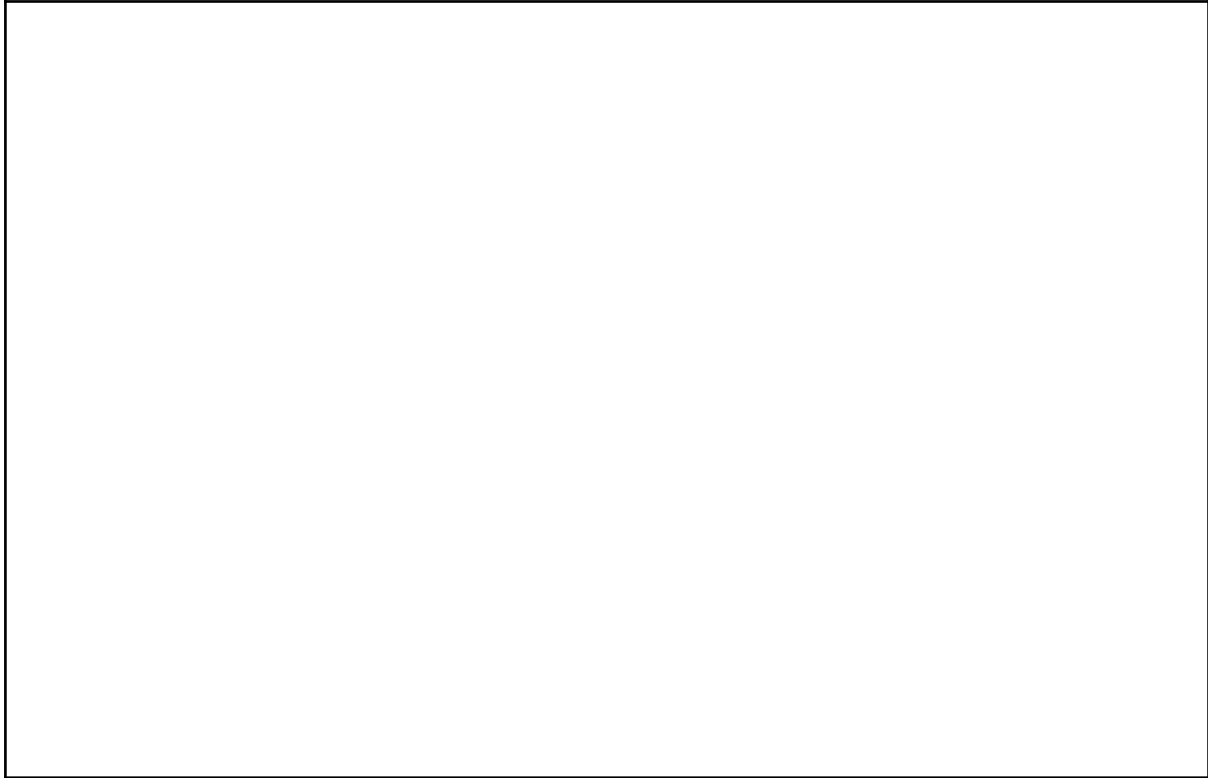
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The sequence of events that cause tropical storms to form:

1. Air is heated above the surface of warm tropical oceans. It rises rapidly under low-pressure conditions.
2. The rising air draws up more air and large volumes of moisture from the ocean causing strong winds.
3. The Coriolis effect cause the air to spin upwards around a calm central eye of the storm.
4. As the warm air rises it cools and condenses to form large cumulonimbus clouds which generate torrential rain. The heat given off when the air cools powers the tropical storm.
5. Cold air sinks in the eye, therefore there is no cloud so it is drier and much calmer.

6. The tropical storm travels across the ocean in the prevailing wind.
7. When the tropical storm meets land it is no longer fuelled by the source of moisture and heat from the ocean so it loses power and weakens.

Can you draw the diagram of how a tropical storm forms using the points above?



Other key facts about tropical storms

- They travel from east to west
- They lose their energy source (the sea) when they hit land
- As they hit land friction also slows them down
- As they lose energy they change direction
- Tropical storms in the northern hemisphere track north
- Tropical storms in the southern hemisphere track south
- An average tropical storm has a lifespan of approximately one week to two weeks

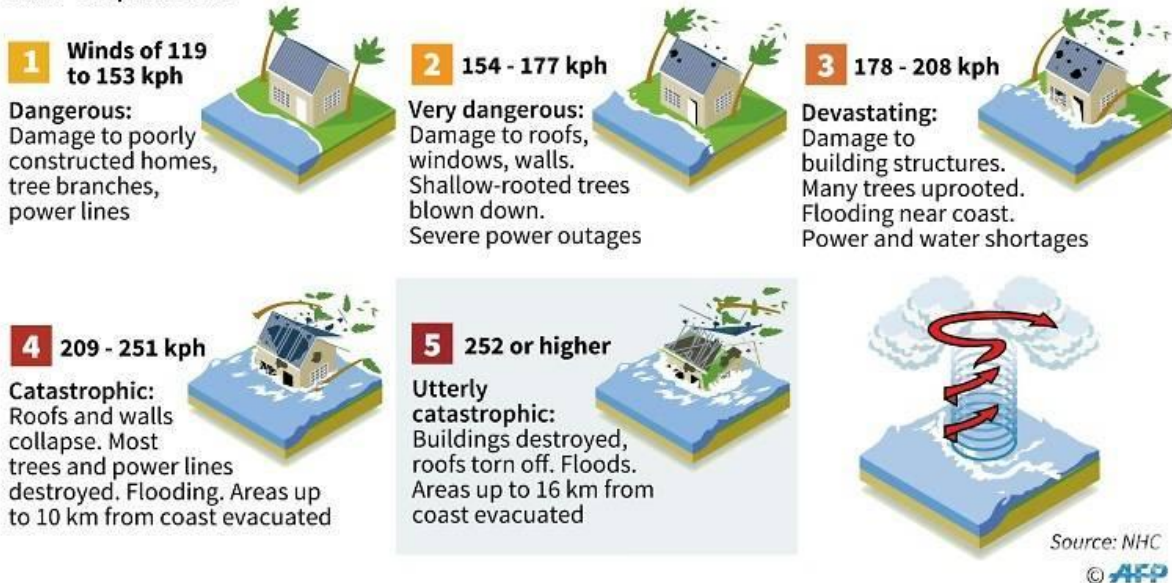
The primary and secondary effects of tropical storms

Primary Effects	Secondary Effects

How do we measure tropical storms?

Hurricanes

Saffir-Simpson scale



Responses:

Immediate:

- Evacuation to higher ground away from the impact of storm surges
- Or – emergency storm shelters
- Provide shelter in public buildings for those whose homes have been destroyed
- Provide tents
- Distributing emergency food and water (International Aid is relied on by LICs in this situation)
- Troops sometimes need to be used to clear roads if landslides have occurred so that aid can get through

Long-term:

- Repairing damage to buildings
- Repairing damage to infrastructure
- Repairing damage to businesses
- Investing in methods of protection and prediction e.g. early warning systems

- Investing in new sea defences

Responses will all depend on the wealth of the country affected, the help available from other countries, organisations and charities.

Reducing the effects of tropical storms

Monitoring tropical storms allows predictions to be made which can save lives and reduce damage

Monitoring by satellite

Satellites can detect rainclouds at altitudes of 16km plus. This is an indication that a tropical storm is likely to develop. The Global Precipitation Measurement Satellite monitors precipitation every three hours between the latitudes 65° north and south of the Equator to identify the high-altitude rainclouds.

Monitoring by aircraft

NASA flies drones (Global Hawk) across the Atlantic which monitor weather patterns. Onboard radar help understanding of the formation of tropical storms which improves forecasting.

Evacuation often doesn't happen, even if storms are predicted as the exact path can be uncertain.

Is it possible to protect against tropical storm damage?

What would you do to protect against tropical storms? (mitigation)

Can nature protect us?

How might climate change affect tropical storms?

Increasing sea temperatures	Will lead to thermal expansion (the sea expands and becomes larger so more water in the oceans)
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Rising sea levels	Will mean storm surges are expected to become higher.
Intensity of storms	Tropical storms are expected to become more intense with warmer oceans. Predictions suggest that for every one degree Celsius increase in sea surface temperature, wind speed will increase by 3 – 5 %.
Frequency and distribution	Category 4 – 5 storms will increase but 1-3 storm frequency will decrease. The regions where tropical storms occur are not expected to change as a result of climate change.
Uncertainty	Predicting the impact of climate change is unreliable. Change is more likely to be due to population growth in coastal regions.

Typhoon Haiyan



Facts:

Date: 8th November 2013 at 4.40 a.m.

Wind speeds of up to 314 km

6,190 people died

14.1 million people affected of which 4.8 million already lived in poverty

US\$12 billion overall damage

Over 1 million farmers and 600,000 hectares of agricultural land affected

11 million tonnes of crops destroyed

4.1 million people made homeless

Oil leak because an oil barge ran aground

Coastal environment contaminated by oil

Contaminated fishing waters meant fishing had to stop

Looting

8 deaths due to stampede for rice

Rice prices rose by 11.9 %

Flooding contaminated surface and groundwater with seawater, chemicals from industry, agriculture

Likelihood of diseases spreading increased.

Sort the effects listed above into primary and secondary effects.

Primary Effects	Secondary Effects

Immediate Responses	Long-term responses
Evacuation of 800,000	
Government sent out essential equipment and medical supplies	‘Build Back Better’ recovery plan of government – buildings would not just be re-built but upgraded to protect against future disasters
Once main airport was re-opened emergency aid supplies arrived	A ‘no build zone’ along the coast

It took a week to restore power supplies	A new storm surge warning system
Within two weeks food packs and water were distributed	Mangroves replanted
A curfew was imposed to reduce looting.	Plans for new coastal defences.
More than US\$1.5 billion was pledged in foreign aid.	

Useful websites to help you complete the tasks:

<https://www.americangeosciences.org/critical-issues/weather-hazards-basics>

<https://www.internetgeography.net/topics/what-factors-affect-climate/>

<https://www.metoffice.gov.uk/weather/learn-about/weather/types-of-weather/wind/what-is-the-jet-stream>

<https://www.bbc.co.uk/bitesize/guides/zyrg6fr/revision/4>

<https://www.internetgeography.net/topics/how-do-tropical-storms-form/>

<https://www.bbc.co.uk/bitesize/guides/zrv4jxs/revision/3>

<https://www.internetgeography.net/weather-and-climate/cyclone-idai-case-study/>

<https://www.nature.org/en-us/what-we-do/our-insights/perspectives/nature-can-help-communities-defend-against-future-storms/>

<https://www.bbc.co.uk/bitesize/guides/z37wrdm/revision/2>

<https://www.worldatlas.com/articles/10-ways-to-protect-yourself-in-the-face-of-a-cyclone.html>