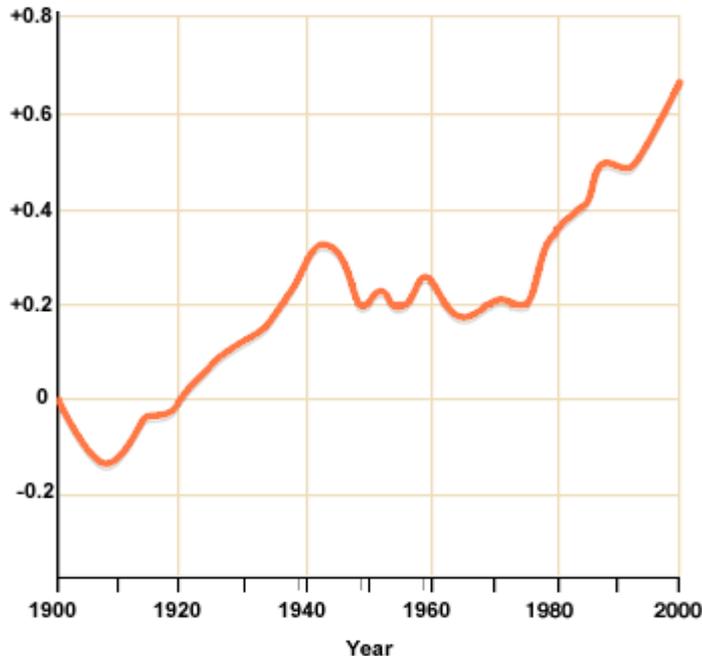


## Revision Sheet Atmosphere

### Global warming / Greenhouse Effect

Graph - Global temperatures.



(Source: [bbc.co.uk/scotland/learning/bitesize/higher/geography](http://bbc.co.uk/scotland/learning/bitesize/higher/geography))

When describing the variations on the graph you should be able to:

- Describe the general trend of the graph ( does it increase/ decrease / plateaux ).
- Describe the highest and lowest points on the graph and when this happens also include the overall range in temperature (max - min temp).
- Pick out any significant changes e.g. a sharp increase and the year this happens.
- What year does the graph start to climb above the norm?
- **Remember you must use figures and dates from the graph in your answer!!**

#### Physical reasons for climate change

- Solar energy - sun spot activity can increase global temperatures..
- Volcanic eruptions - an increase in atmospheric gases given out by a large eruption can change the amount of solar radiation which reaches the earth.
- Wobble, roll and stretch - the earths orbit changes affecting the amount of insolation reaching the earth.
- Changing oceanic circulation and land masses - warm ocean currents can change or stop which shuts of a heat supply to certain parts of the globe.

## Human Reasons for climate change

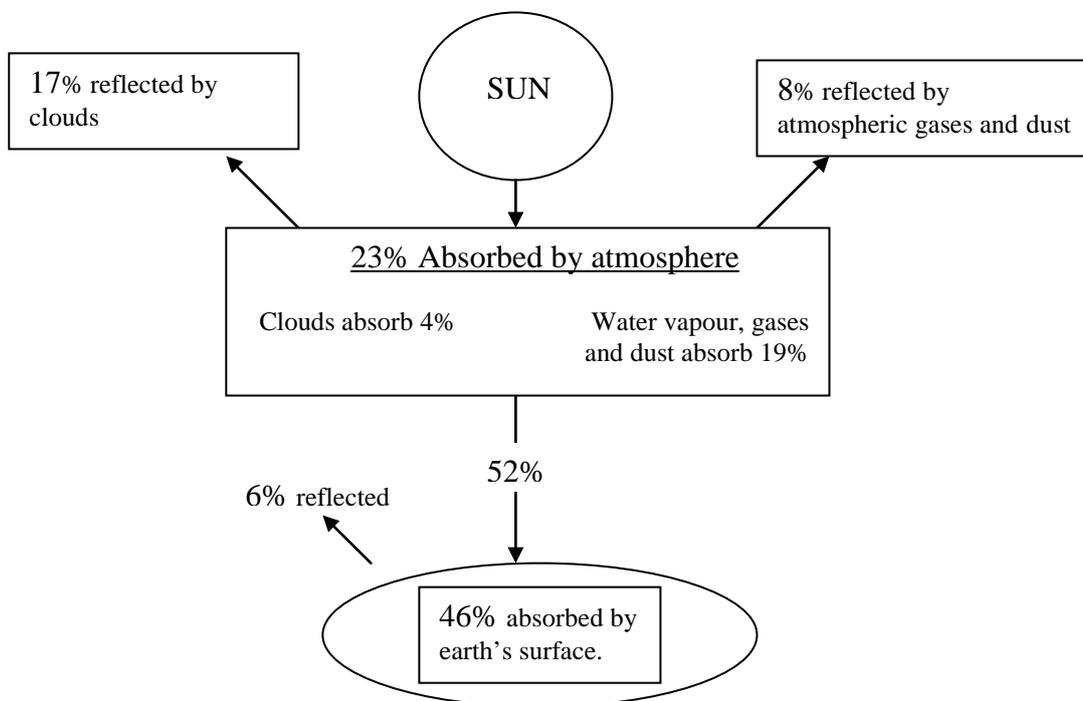
- Increased fossil fuel burning - increased car ownership, cheap air travel, domestic heating, rapid growth of Chinese economy.
- Deforestation - logging burning and clearing tropical rainforests increases CO<sub>2</sub>.
- Increased methane - increased rice production from paddy-fields, increased numbers of flatulent cattle, more waste disposal sites.
- Increased Nitrous Oxides - car exhausts, fertilisers and deforestation.
- CFCs - found in solvents, refrigerators and foam production.

Remember - don't just write a list, explain each point in turn.

## Consequences of Global Warming

- Rise in Sea level - melting of ice caps.
- Strengthen coastal defences - high cost!
- Major problems for low lying countries e.g. Netherlands and Bangladesh.
- Natural vegetation zones may change. E.g. spread of desertification.
- Wildlife sensitive to temperature change.
- Worst effected areas would be developing countries who rely on single cash crops for their earnings if crops fail.

## Global heat budget



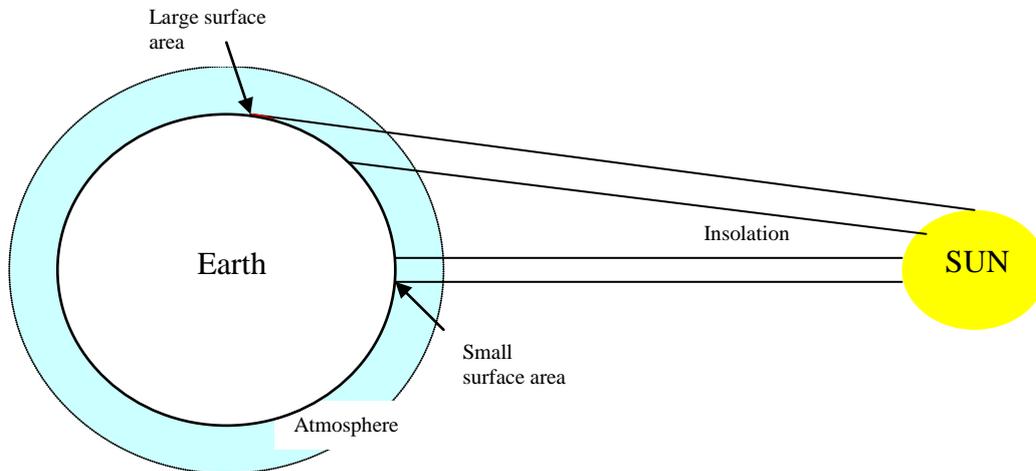
This diagram shows what happens to the sun's energy on its journey to the earth. Before the sun reaches the earth it is interrupted by clouds and dust in the atmosphere. Some of it is absorbed (23%) and the rest is reflected back out into space.

The remaining 46% of the sun's energy is absorbed by land and water.

6% is reflected off the earth surface back into the atmosphere (albedo effect). This reflected heat is trapped in our atmosphere and keeps our planet warm (greenhouse Effect).

## Earth's Energy Balance

You need to be able to explain why tropical latitudes receive more solar energy than the poles.



- A small area is being heated at the equator so the heat is concentrated. This creates a surplus of energy between 35° North and 35° South of the equator.
- Energy is spread over a larger surface area at the poles due to the curvature of the earth.
- Energy at the poles has to travel further through the atmosphere so there is more chance of it being reflected off dust, gas and cloud.
- Ice and snow reflect the heat back into the atmosphere at the poles (albedo effect).
- Green vegetation at the equator absorbs more of the sun's energy.

This means there is a surplus of energy at the equator and a deficit at the poles. Energy is therefore transferred from areas of surplus to areas of deficit in two ways:

- By atmospheric circulation
- By oceanic currents.

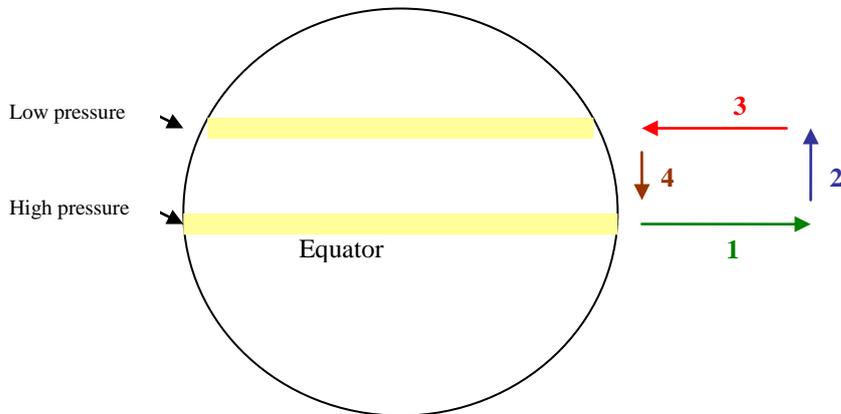
## Atmospheric Circulation.

We have established that some parts of the globe receive more heat from the sun than others. It is this difference in temperature that leads to the formation of winds.

Global winds account for 80% of heat transfer.

The 3 Cell model explains this energy transfer.

### The Hadley Cell



1 = Sun heats the air and it rises at the equator to create an area of low pressure on the earth's surface.

2 = As the air cools it spreads out towards the poles.

3 = Cool air is dense and therefore sinks back down to earth at about 35 ° N and 35 ° S of the equator. As it sinks it is pressing down on the earth creating an area of high pressure.

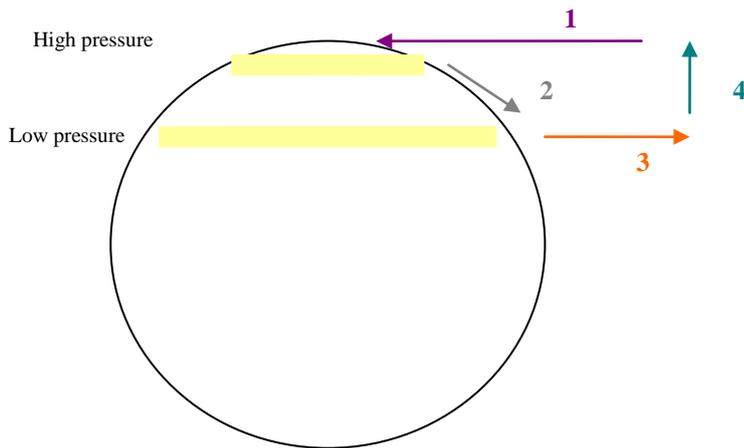
4 = Air moves from high to low pressure, so air rushes in at ground level to replace the rising air.

This is called the Hadley Cell and the effect of the air sinking or rising creates two pressure belts across the globe. Air pressure is the weight of the air pressing down on the earth's surface.

Rising air = low air pressure

Sinking air = high air pressure.

## The Polar Cell



1 = Dense cold air falls in polar regions creating areas of high pressure.

2 = It then spreads to lower warmer latitudes.

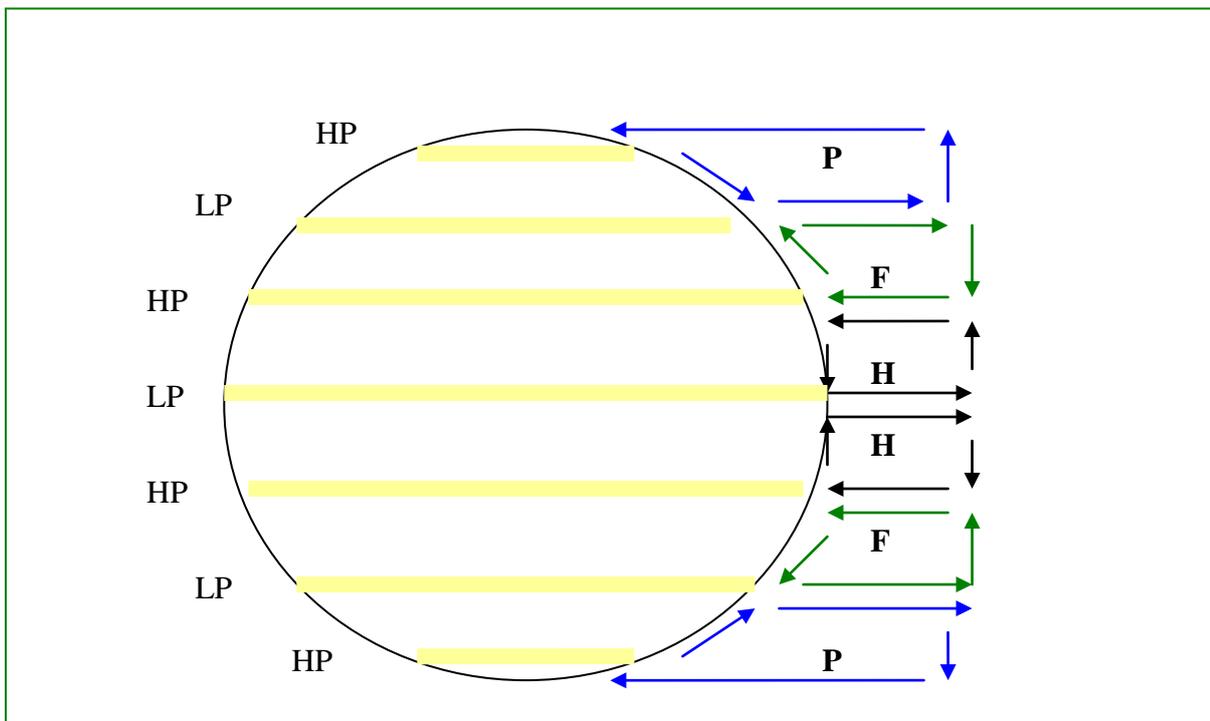
3 = As the air rises it expands and becomes lighter and therefore rises.

4 = As the air rises it cools down again and spreads north and south.

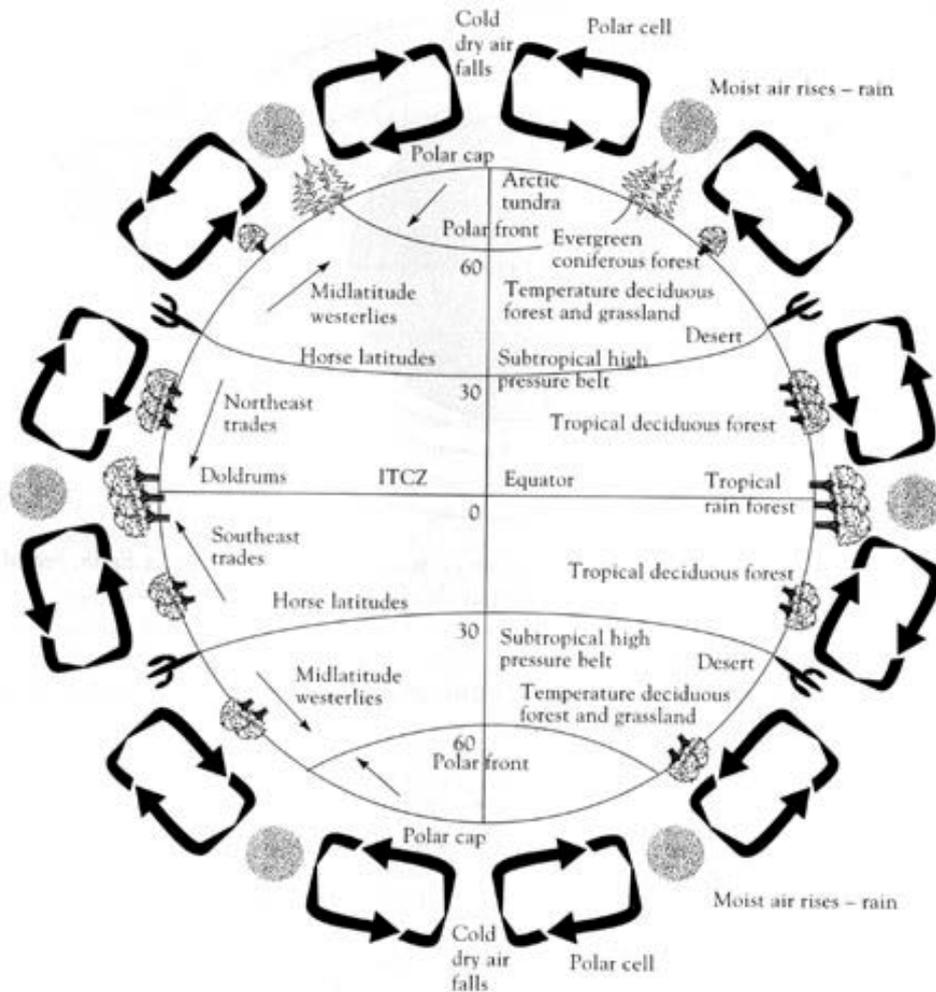
Similar to the Hadley Cell the Polar Cell creates two bands of low and high pressure.

The Ferrel Cell is a response to the other two cells.

This cell feeds warm air to high latitudes and transfers cold air back to the subtropics for warming.

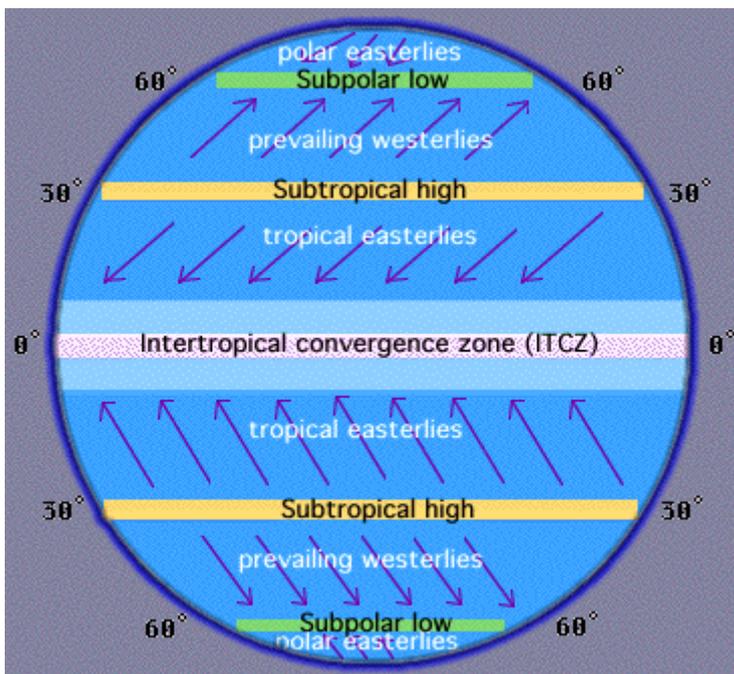


Putting it all together you can see how these cells create bands of high and low pressure across the globe.



Source: [www.life.umd.edu](http://www.life.umd.edu)

As you can see from the above picture these pressure belts influence the vegetation we find across the globe. Low pressure is associated with wet weather (this is where we find rainforests). High pressure is associated with dry weather (where we find deserts).

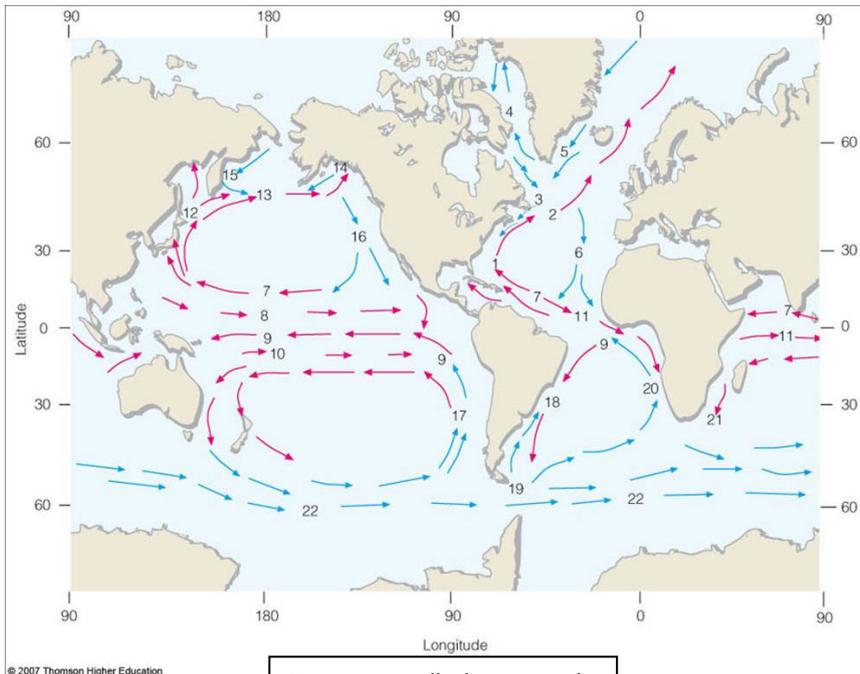


Global winds blow from high to low pressure. The earth is constantly rotating and deflects winds to the right in the Northern Hemisphere and to the left in the southern hemisphere. This is called the **Coriolis Effect**.

Source: [www.csa.com](http://www.csa.com)

## Ocean Currents

Ocean currents, like the atmosphere, act a bit like a machine transferring energy from the Tropics to the higher latitudes.



- 1- Gulf Stream
- 3- Laborador Current
- 7- North Equatorial Current
- 8- North equatorial. Counter current
- 9- South Equatorial Current
- 10- South Equatorial Counter Current
- 11- Equatorial Counter Current
- 12- Kuroshio Current
- 14- Alaska Current
- 16- California Current

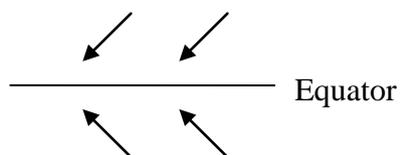
Source : apollo.lsc.vsc.edu

You should be able to describe and explain the general pattern of ocean currents on a world map.

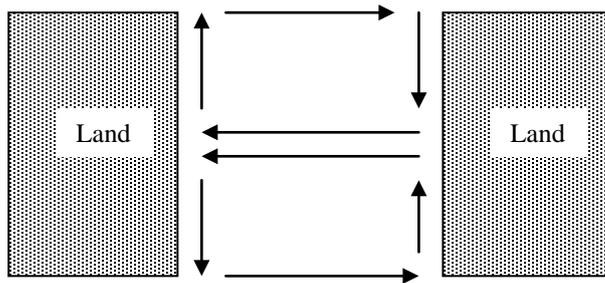
You can see from the map that in the large oceans of the Pacific and the Atlantic the currents form a pattern of large loops. Each loop is called a **GYRE!**

Explaining how a gyre is formed can be tricky so follow the points. I have used the Atlantic Ocean as an example:

1. At the equator the sun is directly overhead and this is where large volumes of water are warmed. When water is heated up it starts to move (convection currents).
2. The frictional drag of the NE/ SE trade winds over the surface of the water help to push the water in a westerly direction.



3. When the water meets a land mass it is deflected to the north and south.



4. As the current moves north and south it meets the colder currents travelling from the poles. This cold water does not mix with the warmer waters from the equator and creates some strong deep sea currents.
5. The water also gets pushed eastwards by the next band of subtropical winds.
6. The current then meets another continent and is deflected back to the equator.

Here is a possible exam answer which describes and explains the pattern of ocean currents using the North Atlantic Gyre as an example. Note how it includes specific **names of currents!**

### **Describe**

- Ocean currents follow loops or gyres - clockwise in the northern hemisphere and anti-clockwise in the southern hemisphere.
- Currents from the poles to the equator are cold  
Currents from the equator to the poles are warm.

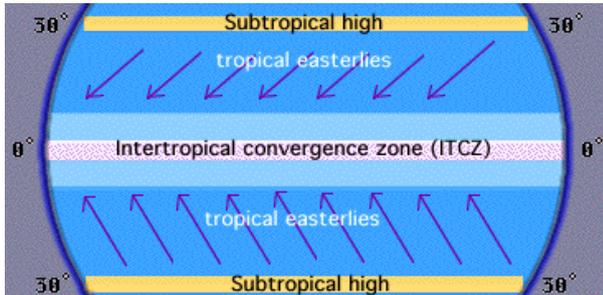
### **Explain / account**

- The **vast areas** of water in the Atlantic and Pacific allow these loops to form.
- Currents are affected by the prevailing winds. **Frictional drag** over the surface of the oceans starts to put the water in motion.
- This happens at the equator where the **trade winds** meet and cause water to move in a westerly direction.
- The water also starts to move as the water is **heated** up at the equator.
- When the water moves west - in the case of the north Atlantic it meets the continent of North America. The water then gets **deflected** northwards. This is called the **North Atlantic Drift**.

- It then meets cold currents moving down from the **poles**, i.e. the **Labrador current**.
- The water also gets caught up in the next band of **sub tropical winds** which push the currents east wards.
- The current then reaches another continent (Africa) and gets **deflected** southwards, this is known as the canaries current.
- Density differences due to **differential heating** result in chilled water sinking to the ocean floor and returning equatorwards.

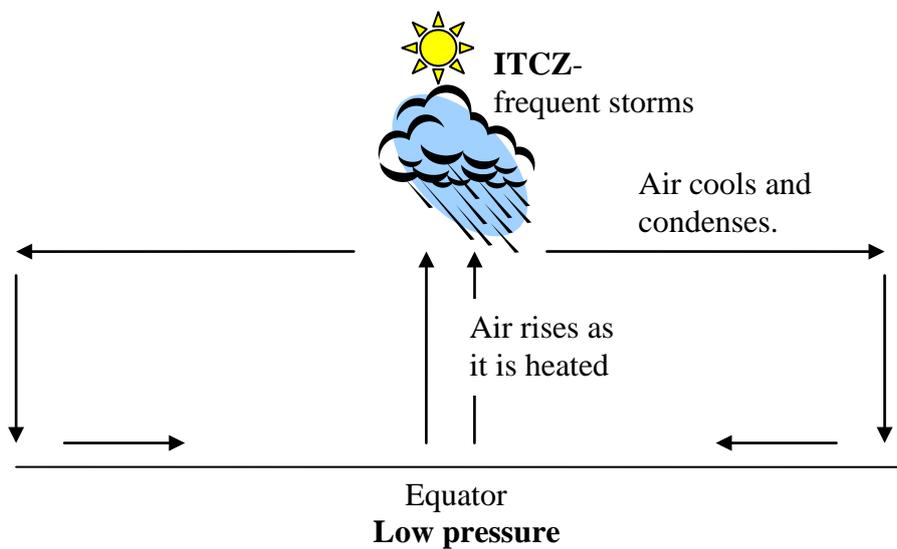
## ITCZ Inter Tropical Convergence Zone.

The ITCZ is where the North Easterly trade winds meet the South Easterly trade winds.



It is a good idea to look back at the Hadley Cells and remind yourself of the air movement.

The air at the equator is being heated by the overhead sun and therefore rises, the ITCZ can therefore also be described as a band of low pressure.



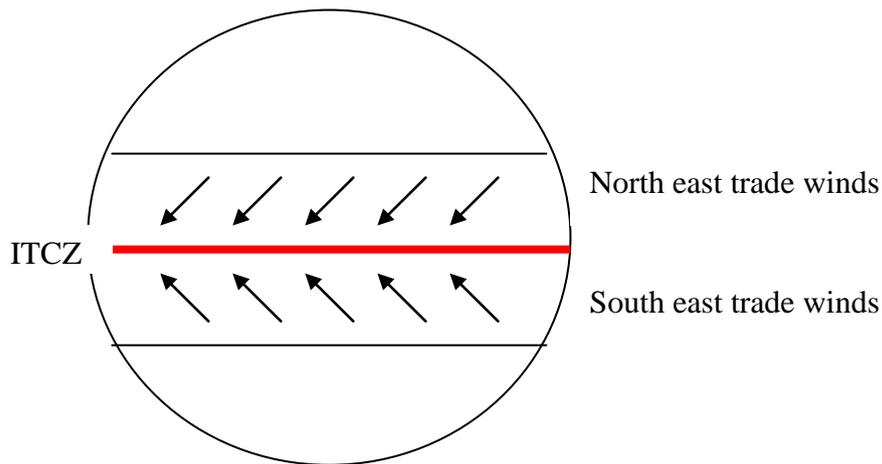
We need to know how this band of heavy rain showers effects the west coast of Africa, as this is where the effects of the ITCZ are felt the most.

It is commonly thought that the sun is overhead at the equator all year round, this however is not true. Due to the earth spinning on a tilted axis the position of the overhead sun migrates northwards, when we have our summer solstice (longest day) and then migrates southwards, our winter solstice (shortest day).

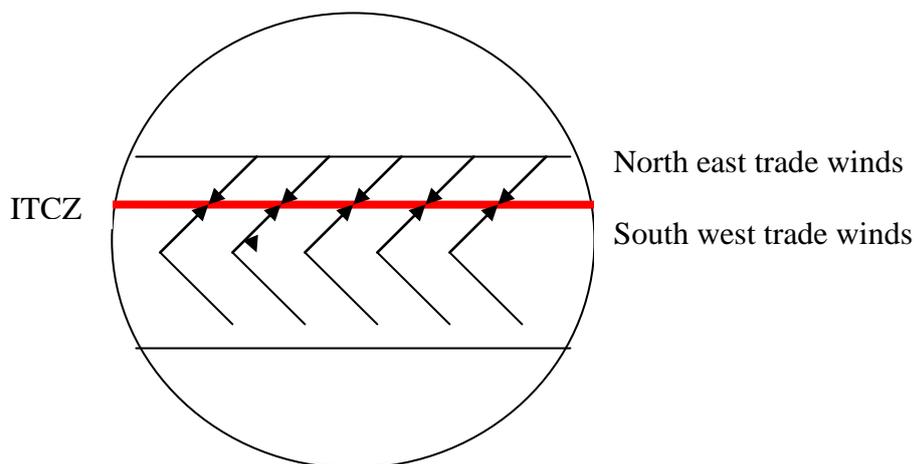
This means the ITCZ is also going to travel north and south through out the year. This means the heavy rain showers on the West coast of Africa are very seasonal.

The first thing you need to know is the nature of the tropical winds which converge (meet) at the ITCZ.

## Air masses and the ITCZ



As the ITCZ moves north with the position of the overhead sun it pulls the South east trade winds into the northern hemisphere. These winds then change direction due to the Coriolis force and loop round to become south westerlies.



Now look at these trade winds over Africa.

**The north east winds are called Tropical Continental (cT).**

These winds travel over land and are therefore dry.

**The South west winds are called Tropical Maritime (mT).**

These winds have travelled over the Atlantic Ocean and are therefore wet.

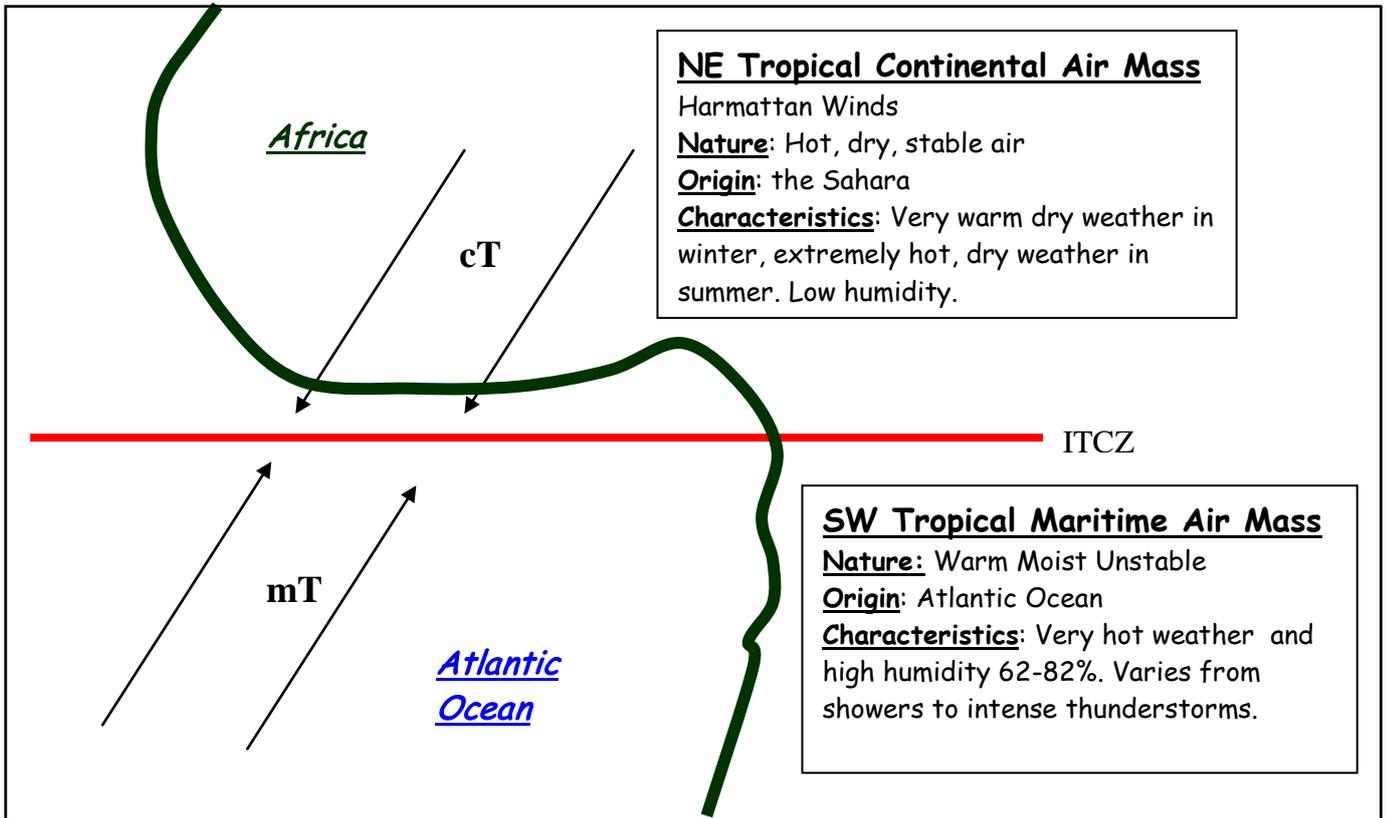
As the ITCZ moves north it will pull the mT winds over the land. This will bring wet weather to any places which lie **south** of the ITCZ. At the same time places to the **north** of the ITCZ will be experiencing hot dry weather.

**To summarise:**

**Directly underneath the ITCZ = convectional thunderstorms.**

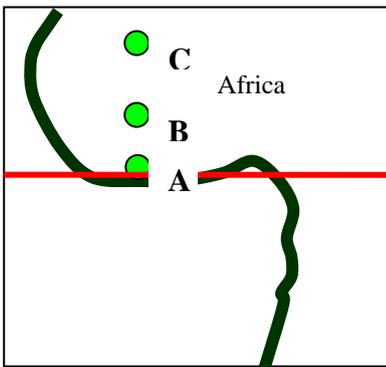
**South of the ITCZ = wet Weather from mT.**

**North of the ITCZ = dry weather from cT.**



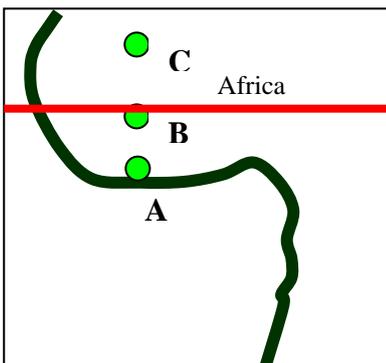
AS the ITCZ migrates north you need to be able to describe and explain the effect this has on African settlements from the coast to further inland.

**January**



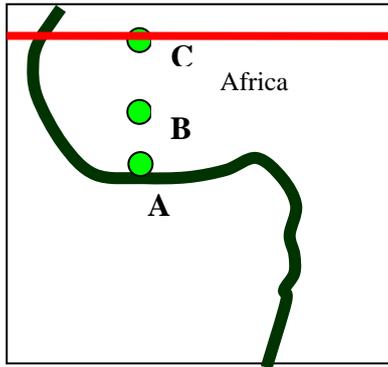
Town A - will be experiencing wet weather as it is directly underneath the ITCZ. It will also get the wet weather from the mT winds.  
 Town B and C - lie north of the ITCZ and therefore will be experiencing hot, dry weather from the cT winds.

**March**



Town A - has hot, wet weather from the mT winds this is because it lies south of the ITCZ and the mT winds are being pulled north into the low pressure zone.  
 Town B - ITCZ is directly overhead and will be experiencing the convective rain storms associated with low pressure.  
 Town C - lies north of the ITCZ and therefore will be experiencing hot, dry weather from the cT winds.

## June



Town C - The sun is at its most northerly point and town C therefore receives some rainfall.

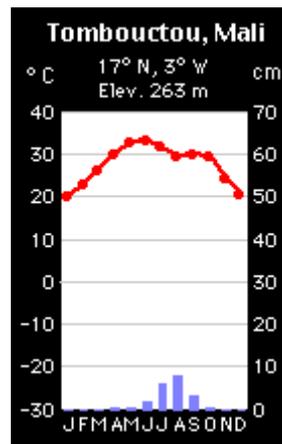
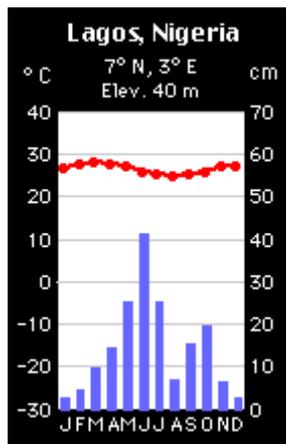
Towns A and B - all experience wet weather as they lie south of the ITCZ and are affected by the mT winds.

### You need to be able to describe and explain the effect of the ITCZ from climate graphs.

This is a good website to follow the path of the ITCZ through out the year. You can also click on individual towns and cities to see climate graphs which also show you how rainfall and temperature varies with the seasons.

<http://people.cas.sc.edu/carbone/modules/mods4car/africa-itcz/index.html>

I have taken two of the graphs from this site. Lagos would represent Town A on the above maps and Tombouctou would represent Town C.



### Describe the Graph - Say what you see and include figures in your answer!!

- Highest and lowest temperatures and temperature range.
- State the month with the highest rainfall and the month it fell.
- State the driest months.
- Are there any clear seasons i.e. wet / dry?
- Are there two rainfall peaks on the graph?

### Explaining the graph - Give reasons for the descriptions you have just picked out.

- Rainfall high - Because the town is underneath or south of the ITCZ and therefore affected by the mT winds
- Rainfall zero - Because the town is positioned north of the ITCZ and therefore affected by the cT winds.
- Two peaks on the graph - When the ITCZ is directly overhead as it moves north and then south again.