Weather and Meteorology
Sheet 1
Adiabatic Processes
The definition is:- A system where heat is neither added nor taken from a process.

The expansion and compression of gases are adiabatic .

Consider the bike pump if you compress the air with your finger over the end of the pump, an increase in temperature occurs, so if we have not added any heat it must have been caused by the compression of the gas.

Like wise
Releasing compressed gasses into the atmosphere say from a scuba cylinder . Very quickly the outlet of the cylinder will become extremely cold and frost will appear, so the air is taking heat out of the surrounding atmosphere.

Dry Air (unsaturated air)
Will cool at approximately 3º C / 1000ft
Or 1ºC / 100m
This is known as the **D.A.L.R.** Dry Adiabatic Lapse Rate.

Wet Air (saturated air)
Will cool at approximately 1.5ºC / 1000ft
Or .5ºC / 100m
This is known as the **S.A.L.R.** Saturated Adiabatic Lapse Rate.

If you think of if like this, air cools much faster than water, therefore the waterless air (dry) cools more for every thousand feet rise.

Standard Air
As per usual we have an I.S.A. international standard atmosphere to use as a reference.
The theoretical cooling is known as **E.L.R.** Environmental Adiabatic Lapse Rate
Will cool at approximately 2ºC / 1000ft
Or 2ºC / 300m

Barometric Pressure Settings
Imagine a column of air from the ground through into outer space, the weight the column pressing down on the earth varies with moisture content, and heat. The weight of this air is called 1 Bar or 1000 milli bars Slightly different is the international standard, set at a pressure of **1013.2 milli-bars**

Between the first ,and second world war a system of **Q** letters were devised to give different pressure settings.

The three main ones paragliders use are **Q.F.E** THINK OF IT AS **Q. Field Elevation**
And **Q.N.H.** THINK OF IT AS **Q. Nautical height Sea level**
Q.N.E. Std Pressure **1013.2 milli-bars**

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Pressure
REVISION
What is the standard Barometric pressure

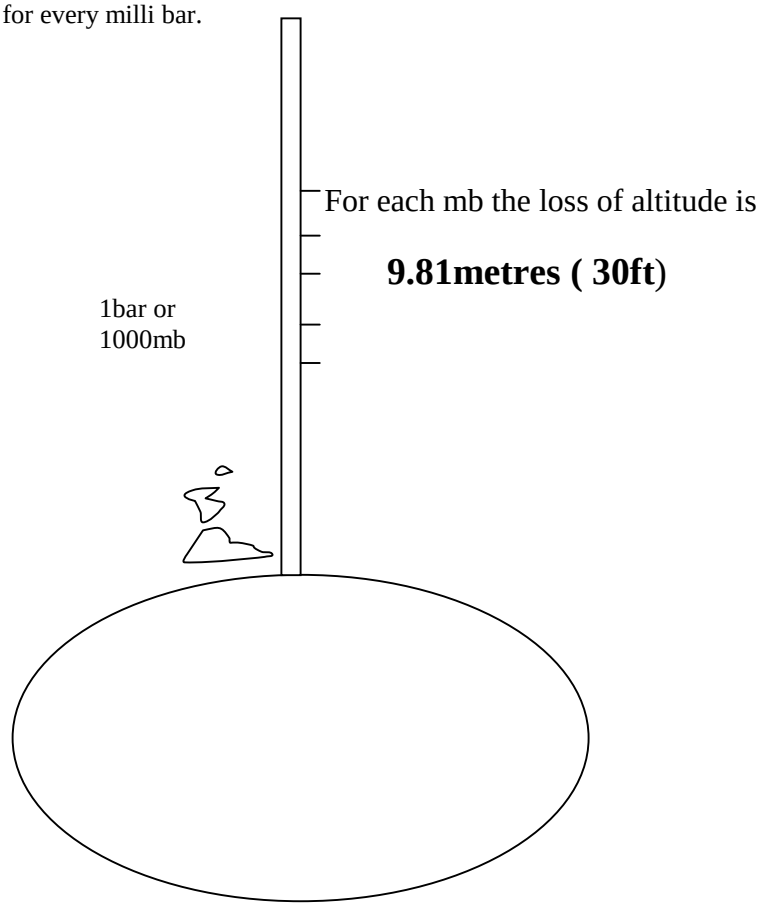
1013.2 mb.

That means 1 Bar = 14.7lbs/sq ins 1mb =1000th of a bar

A column of air from sea level to the outer atmosphere exerts 1 Bar pressure on the surface of the earth
Therefore if you are high on a mountain the column of air is shorter and so will weigh less.

Question
If the Q.N.H. is 1007 mb , and take off is 1500ft A.M.S.L. will the pressure reading be more or less.

The length of the column is 1 bar divided into 1000 mb
We can calculate the drop in height for every milli bar.



Using the standard we can calculate the pressure loss, due to altitude .

1 milli-bar decrease in pressure = 30ft / 9.81 metres loss of height

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Pressure

This standard pressure is used to calculate the airways
So on the perfect day (1013.2 mb pressure) the airway above you FL 50 (5,000ft) is at 5,000ft

If the pressure drops 1003.2 mb 10 mb = 10 x 30 ft = 300ft FL 50 is 4,700ft above sea level

In Britain pressure can go below 998mb

When flying, as you approach an air field you need to know the local pressure especially if you are flying on instruments, as you will strike the ground when your altimeter tells you that you have 300 feet clearance.

This affects paragliding, flying Addingham Moorside, above this site the T.M.A. flight level is 3000 ft to 8000 ft, as the take off is 1260 ft, then we only have 1,740 ft above us before we show on Leeds Bradford radar.
If the pressure is low say 999mb what would be the height before we were in the controlled air space.

Winds

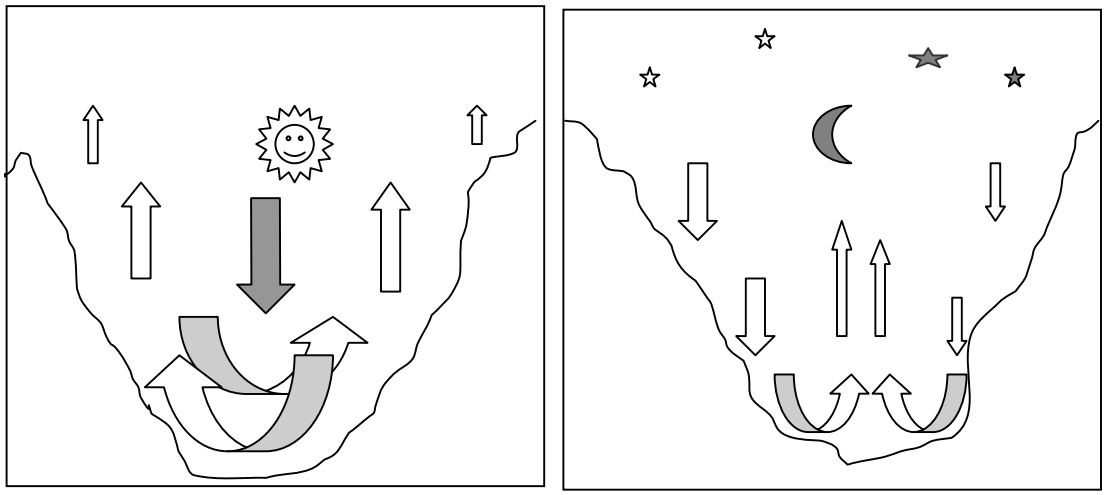
Anabatic winds

During the day the sun warms the air, thermals from the hill can cause sink in the middle of the valley.

Katabatic Winds

In the evening this is reversed the air on the hills cools and sinks to the middle meeting the air from the other side and can cause the middle of the valley to lift (Magic Lift)

Anabatic Day Katabatic Eveing



DAY EVENING

Foehn

Alpine winds that blow from the mountains to the plains. The air is dry and compresses as it warms can be full of sink and turbulent

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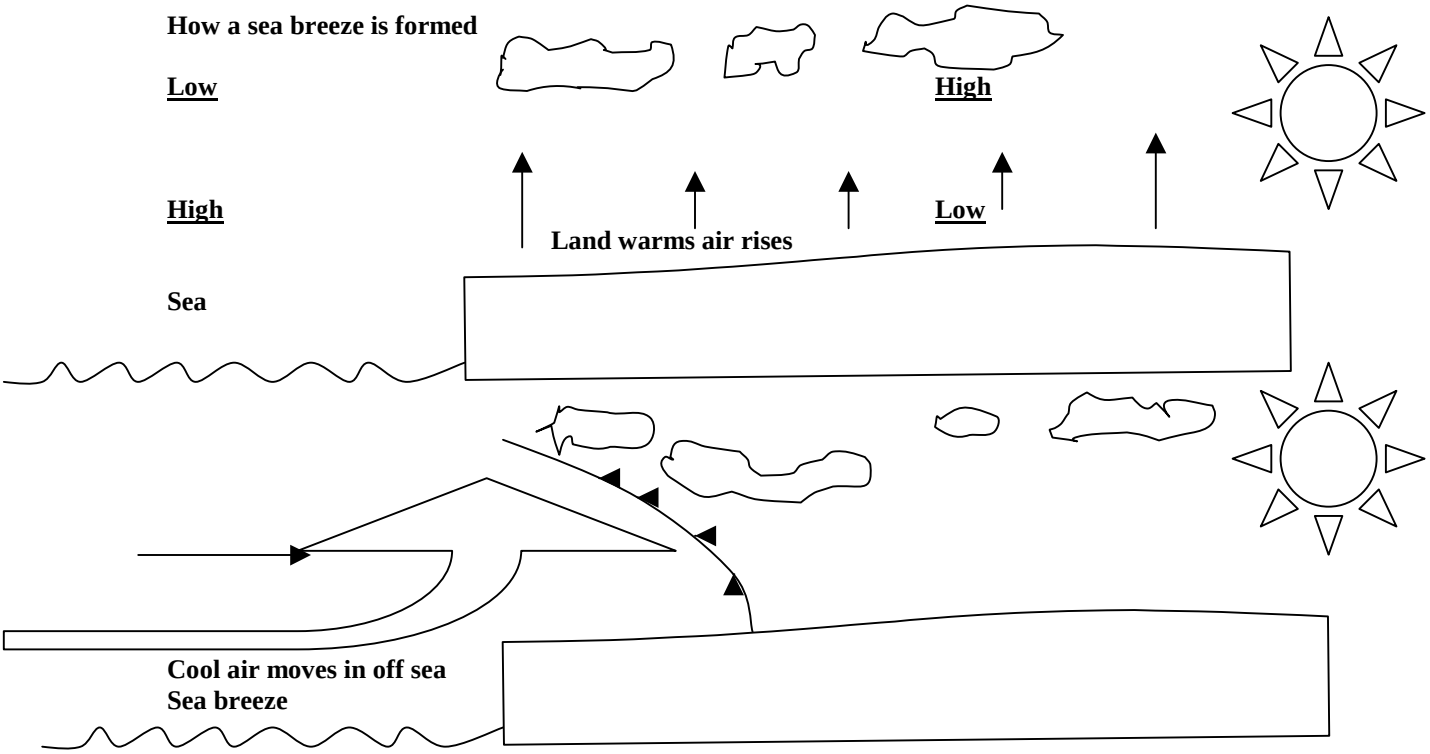
How a sea breeze is formed



Remember this process is reversed at night.

Isobars
An imaginary line connecting points of equal barometric pressure

Dew Point **the temperature at which condensation occurs.**

This can be used to roughly calculate cloud base,

Night time low (Temperature) - daytime high x 400 gives the cloud base.

e.g. 0º overnight 10º during day = 10 x 400 = 4,000ft cloud base

also dew point temp from day time high x 400

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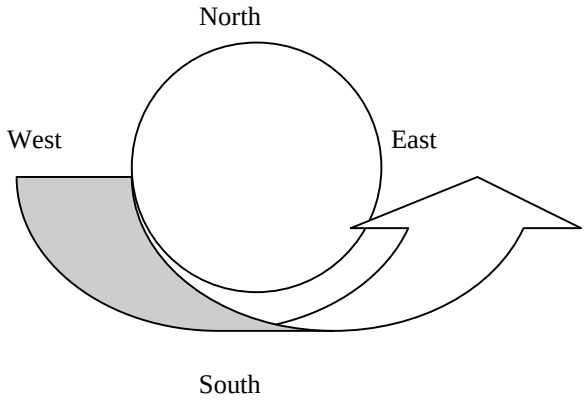
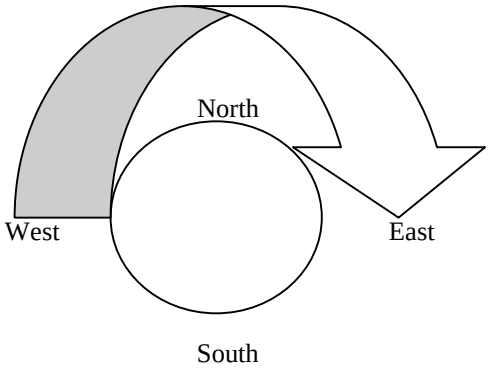
Wind Backing
The wind is said to back if:-



Think of the clock
If the wind moves from South East when you are at say Semer water and goes East the wind is said to be BACKING.

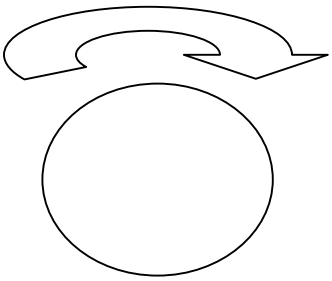
Veering



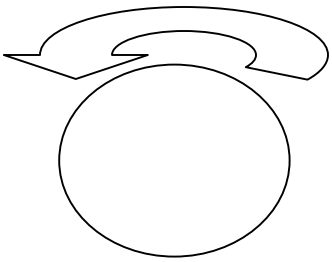
Remember veering is just the reverse.
If the wind is Westerly and you are on weather fell , and it goes to North West the wind is said to be **VEERING**

Buy Ballot's Law

With your back to the wind the low pressure is on your left hand side



High pressure.



Low pressure.

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Meteorology

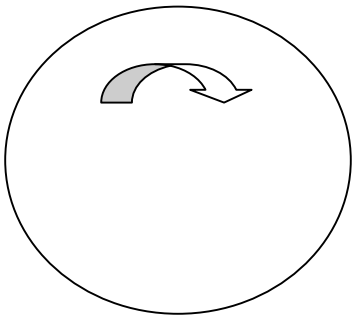
High Pressure **Anti- Cyclone** **Clockwise**

Auntie's clock is high on the wall.

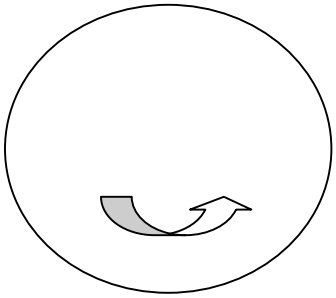
Low Pressure **DEPRESSION (Cyclone)** **Anti-Clockwise**

Diagram

HIGH PRESSURE



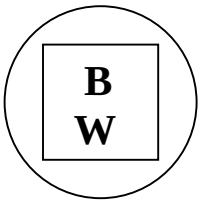
LOW PRESSURE



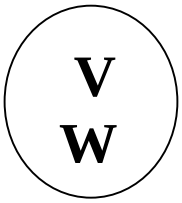
Wind Veering

If the wind is northerly at ground level at 2,000ft it veers **Clockwise.**

As the warm front approaches the wind BACKS



When a Warm front passes the wind VEERS



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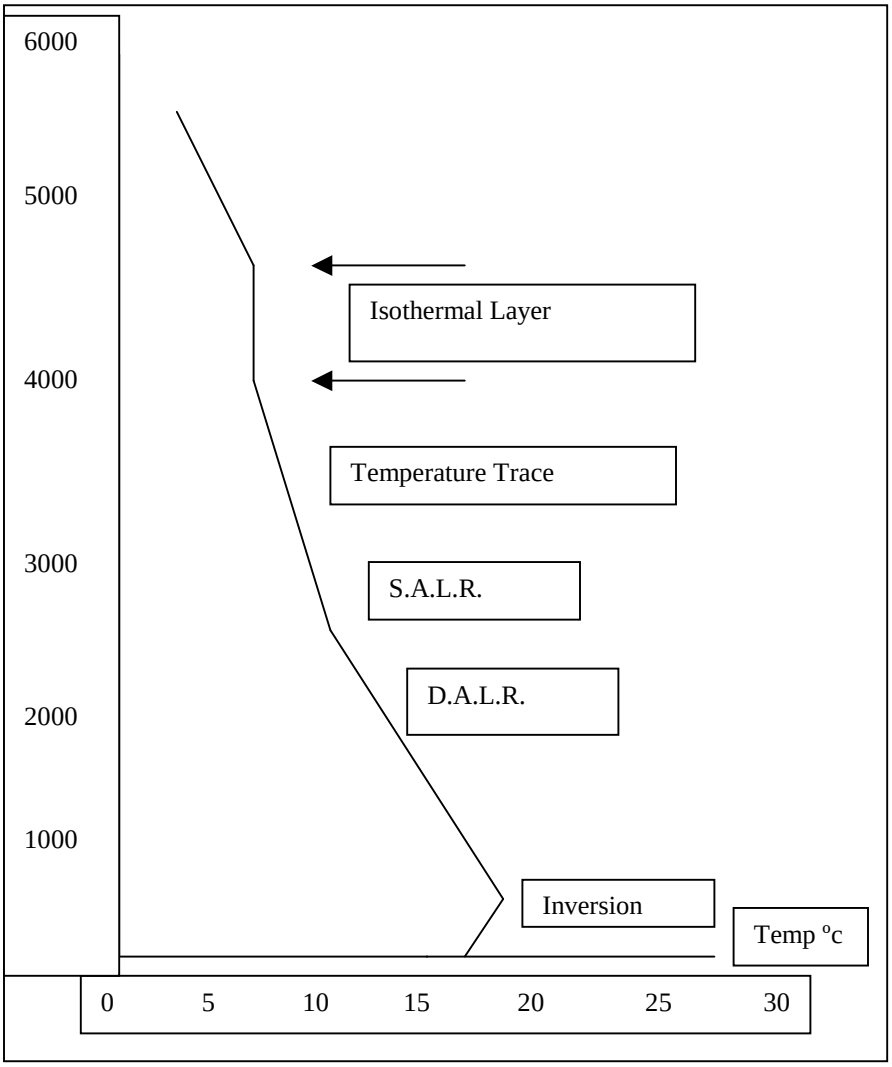
Lapse Rate Graph

D.A.L.R. The Dry Adiabatic Lapse Rate
The rate at which the dry air cools with altitude **3º C per 1,000 ft**

S.A.L.R. The Saturated Adiabatic Lapse Rate
The rate at which saturated air cools with altitude **1.5ºC per 1,000ft**

E.A.L.R. The Environmental Adiabatic Lapse Rate
The theoretical standard **2ºC per 1,000ft**
Lapse Rate



Inversions

In an inversion the temperature increases with altitude.
As the thermal rises it meets a layer of warmer air, this prevents the thermal rising and traps it.
In an isothermal layer the temperature stays the same even though you are climbing in altitude.

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Fog and Mist

There are 4 general types of fog

Advection also called Sea Fog
Warm moist air over cool land or water, common when snow is on the ground.
Common over the ocean/sea

Radiation
Thin fog formed when heat radiates from the ground **at night** cooler than the moist air above, not thick burn's off in the morning

Up-slope Fog or Orographic Cloud
Moist Air rising up a mountain slope cools expands and condenses

Precipitation Fog
When rain or snow passes through a cool band of air it condenses

2 Ways air rises.

Being heated
This causes the air to become less dense, so it rises.

or passing over raised ground such as a hill, or a mountain where it is blown aloft.

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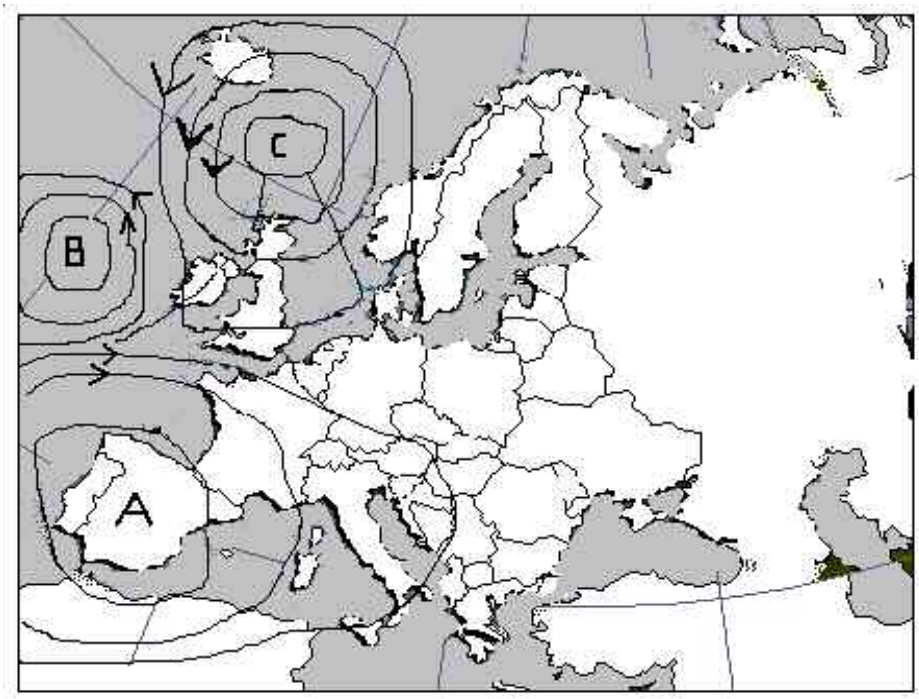
From top map
What direction is the wind in Southern Wales
What is the direction of the wind in Sicilly
Is weather system ‘A’ High or Low pressure
‘B’ High or Low pressure
‘C’ High or Low pressure
.Which of the weather systems are anti-cyclonic
Which of the systems are depressions



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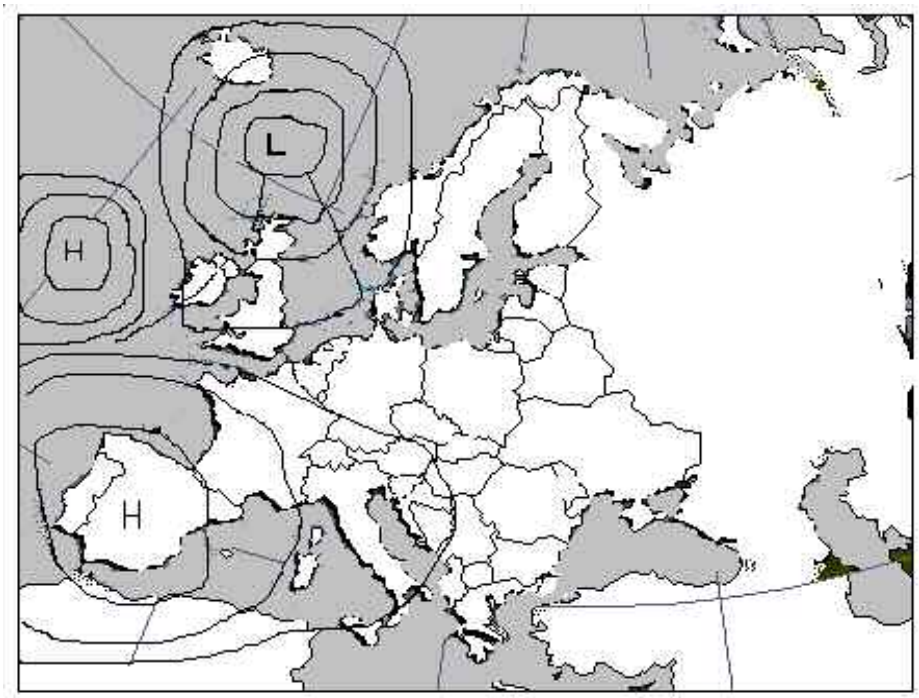
From map B.
Put in the arrows that would give the wind direction on the pressure systems
What would be the wind direction in Southern Scotland
Write down which system is Anti-cyclone and which is depression.



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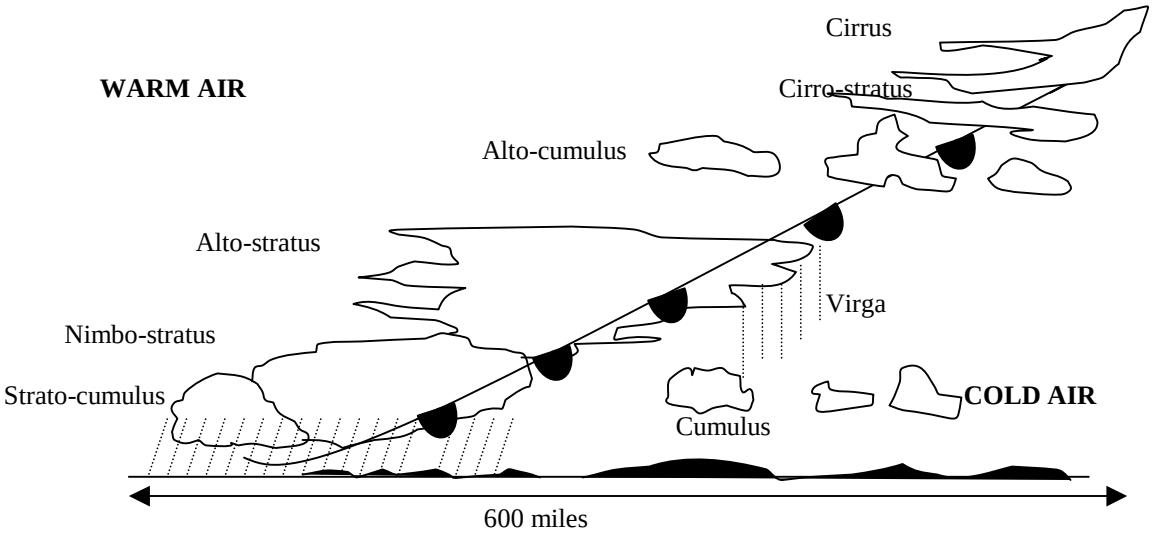
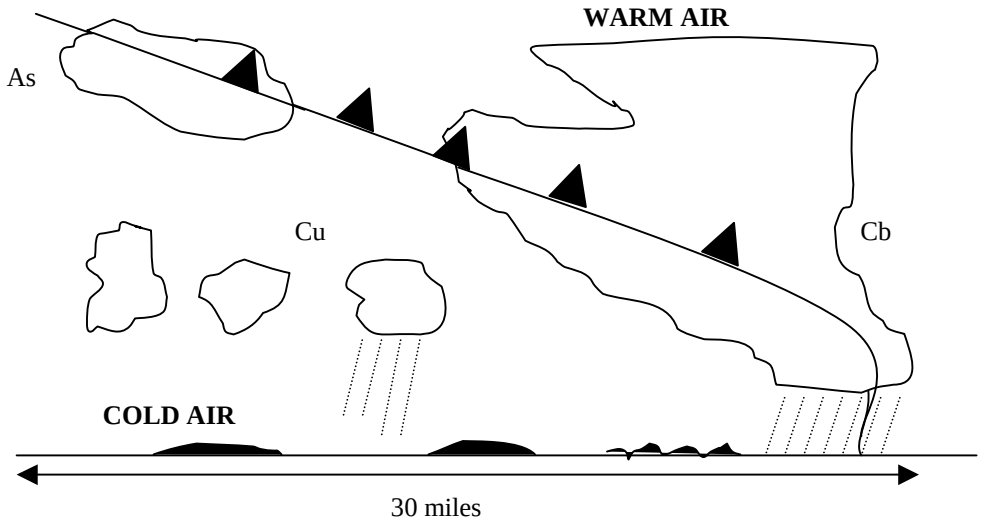
Clouds on a warm front



S.N.A.C.
Note Virga is rain that never makes it to the ground.

COLD FRONT



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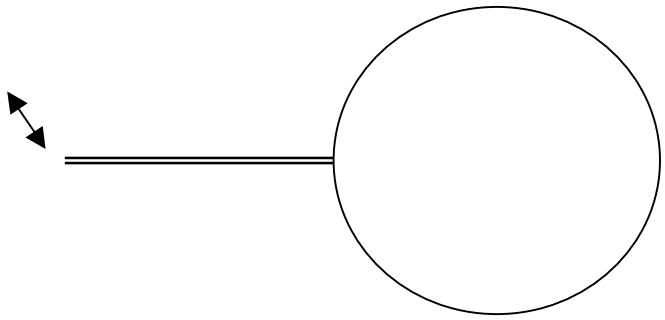
Varios .
Work by sensing the variations in pressure

In a flask variometer,
Air flows out of the flask as you gain altitude because the air outside is of a lower pressure
And air flows into the flask as you return to the ground, because the air inside is of a lower pressure



This function is caried out electronically in the modern Atlimeter / Variometer

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Weather and Meterology

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