CLOUDS

Formation and Types

Man has for centuries believed by studying and observing clouds it is possible to predict the weather for some time ahead.

Our forefathers, leading more rustic lives than we do today were very dependent on the weather and soon learned to read significant signs in the sky.

The majority of us today, however, live in towns and cities and are able to receive weather forecasts from the radio, TV and on-line so have never had to exercise our minds in this way.

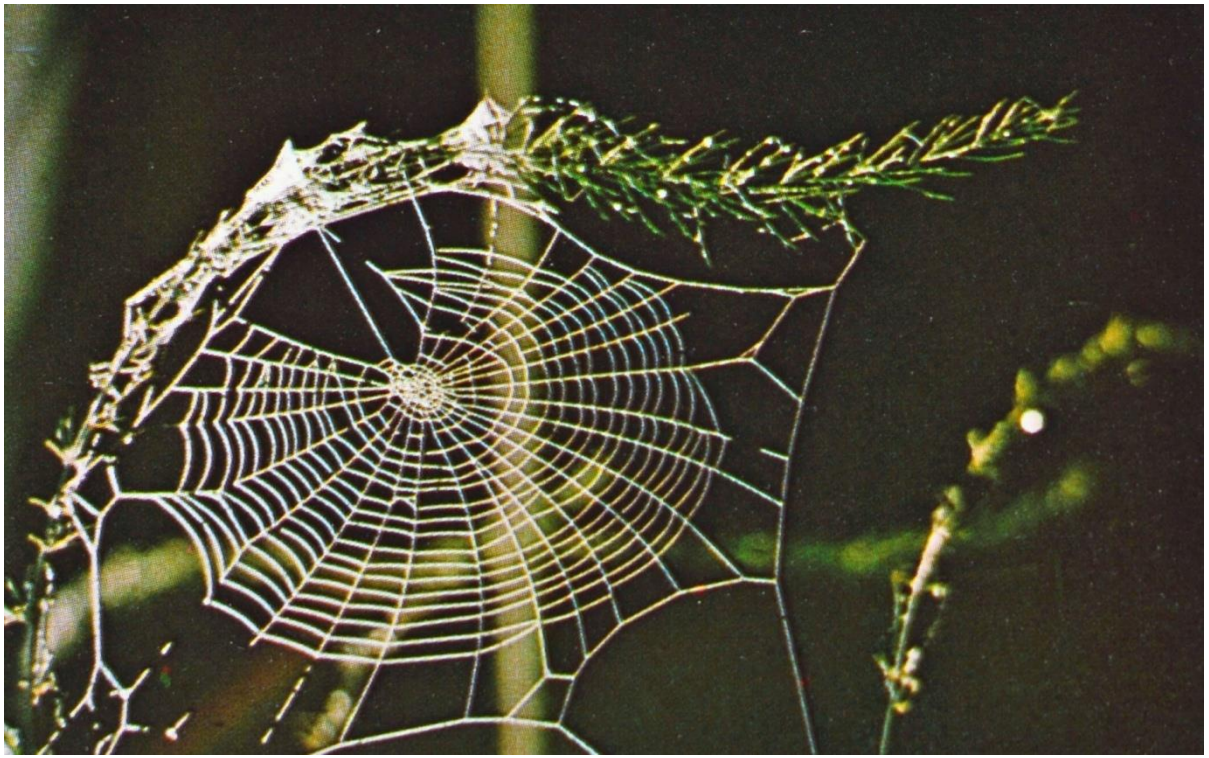
For yachtsman and sea fisherman however, being able to ‘read the sky’ and understand what weather it might bring is a very useful skill to develop.

This first presentation deals with how clouds form and their various types.....

In the lower levels of the atmosphere clouds consist of tiny droplets of water.

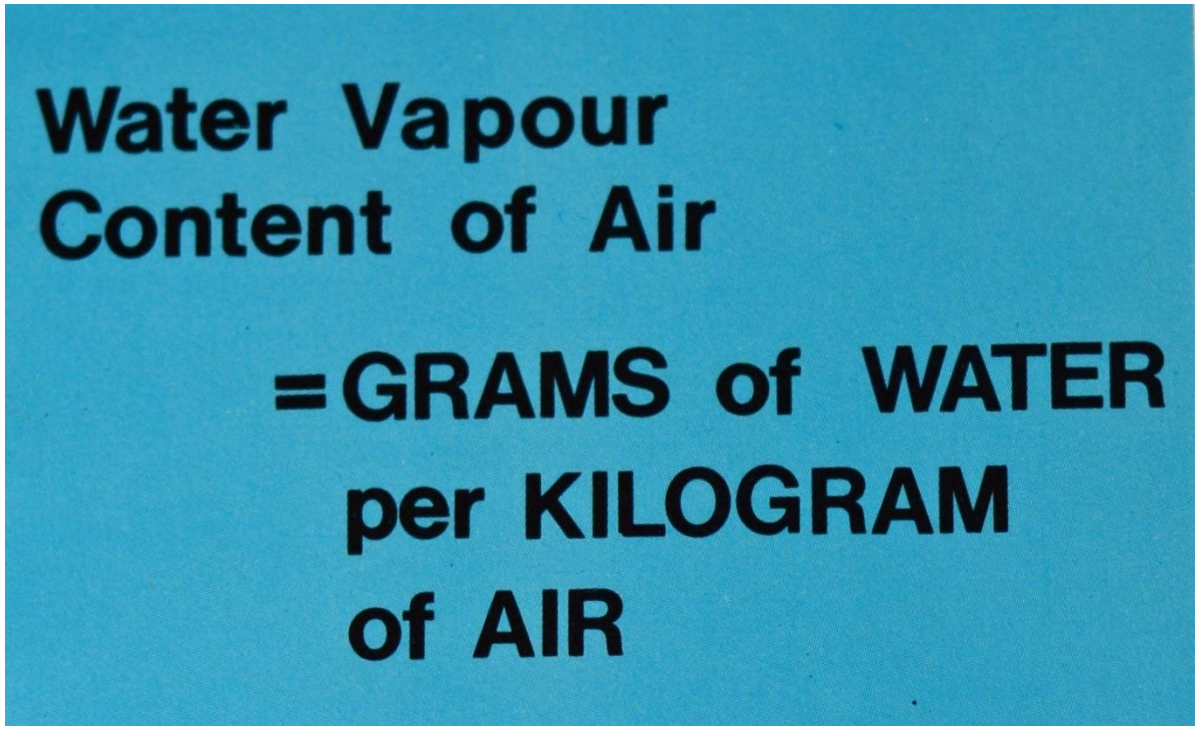
At ground level we call clouds ‘fog’ and when we fly through them in an aircraft, they look exactly like fog.

The single droplets of water are too small to see.



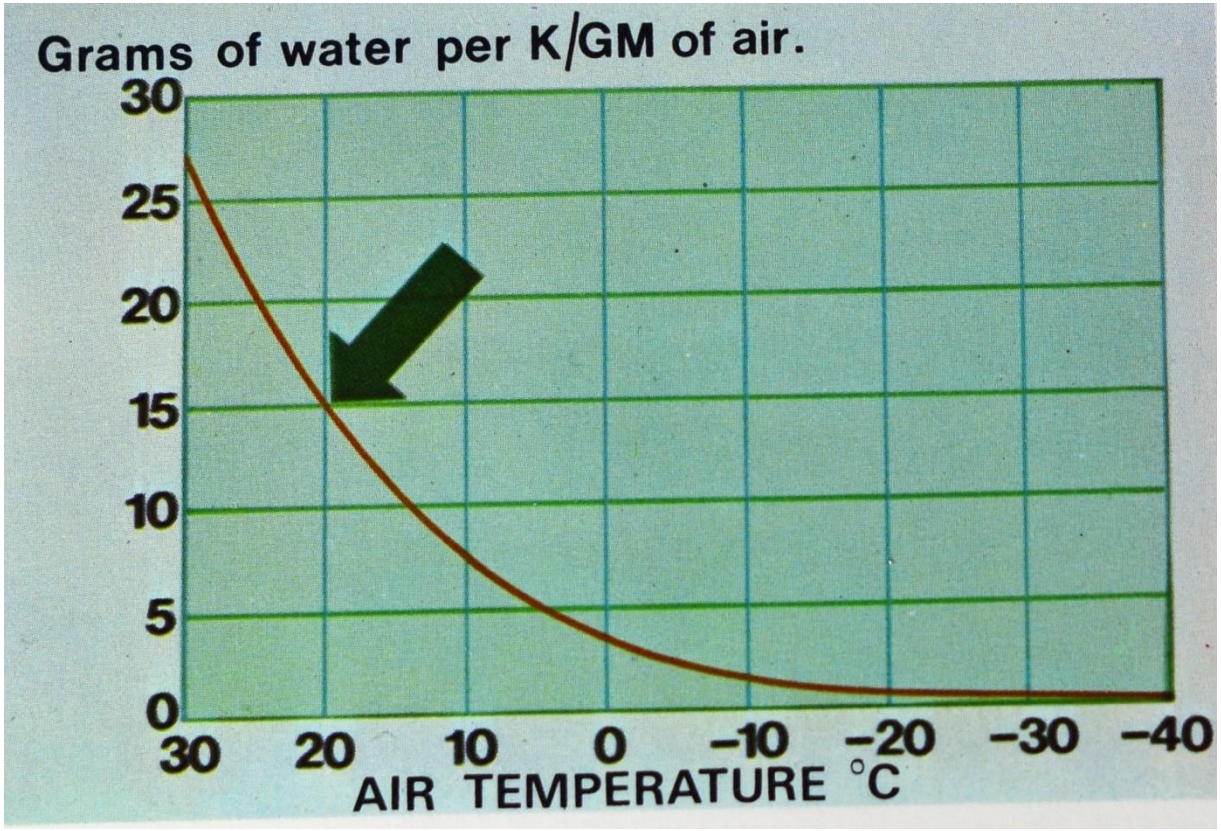
However when fog is moved by the wind past a cobweb, the web will collect some of the tiny drops. These shine in the sun like minute jewels.

But how do clouds form?

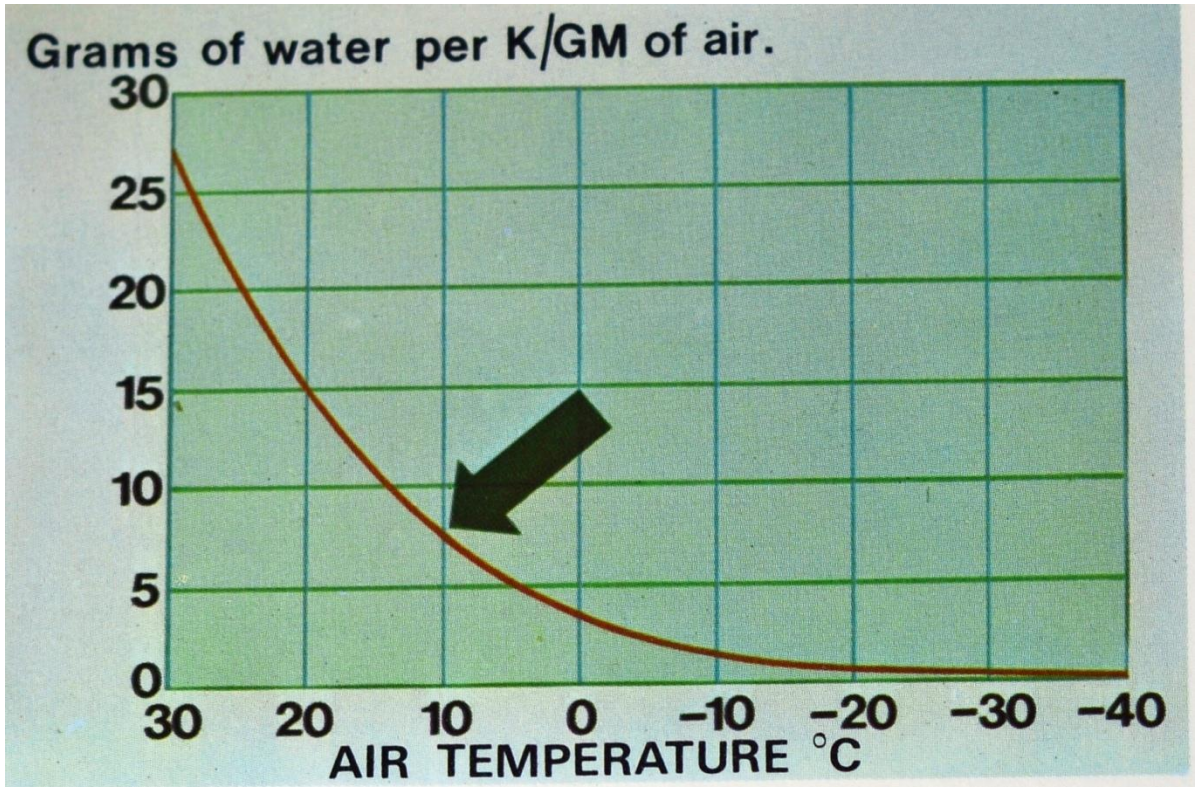


Air can absorb water-vapour and the amount it absorbs increases as the air is warmed.

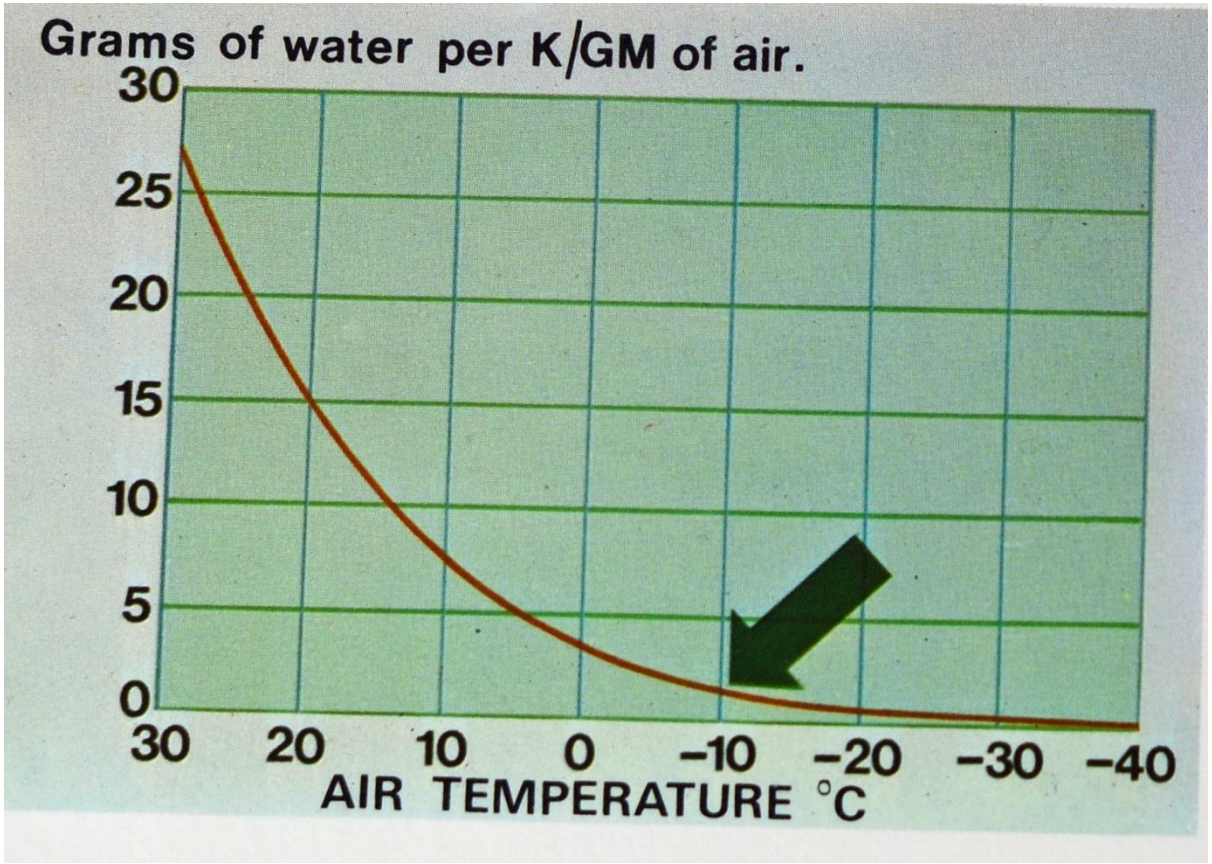
The water vapour content of air is measured as grams of water per kilogram of air.



From this graph, you will see that air at 20 degrees, on a summer's day, can absorb a maximum of 15 grams of water per kilogram of air before becoming saturated .



At 10 degrees temperature the air can only absorb half that amount.

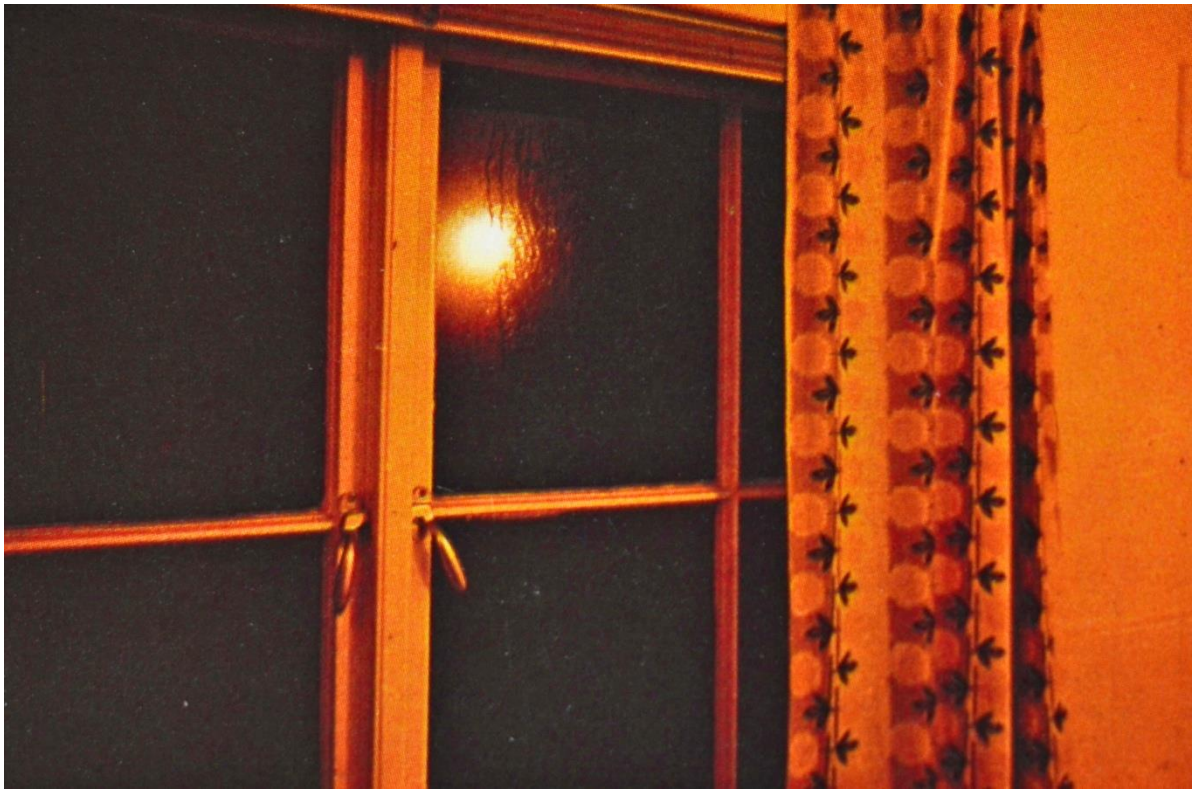


The temperature on a showery summer‘s day is minus 10 degrees at 10,000 ft and the air can absorb only one tenth of the amount of water (1.5 grams) before being saturated .

When the air is saturated and then cooled, condensation takes place. Lets look at some everyday examples.

The very hot air from a kettle of boiling water is heavily charged with water-vapour.

As it meets the cooler air of the room, it cools and the water-vapour condenses into droplets, visible as steam.



In the bathroom, air over the hot bathwater absorbs moisture and heat.

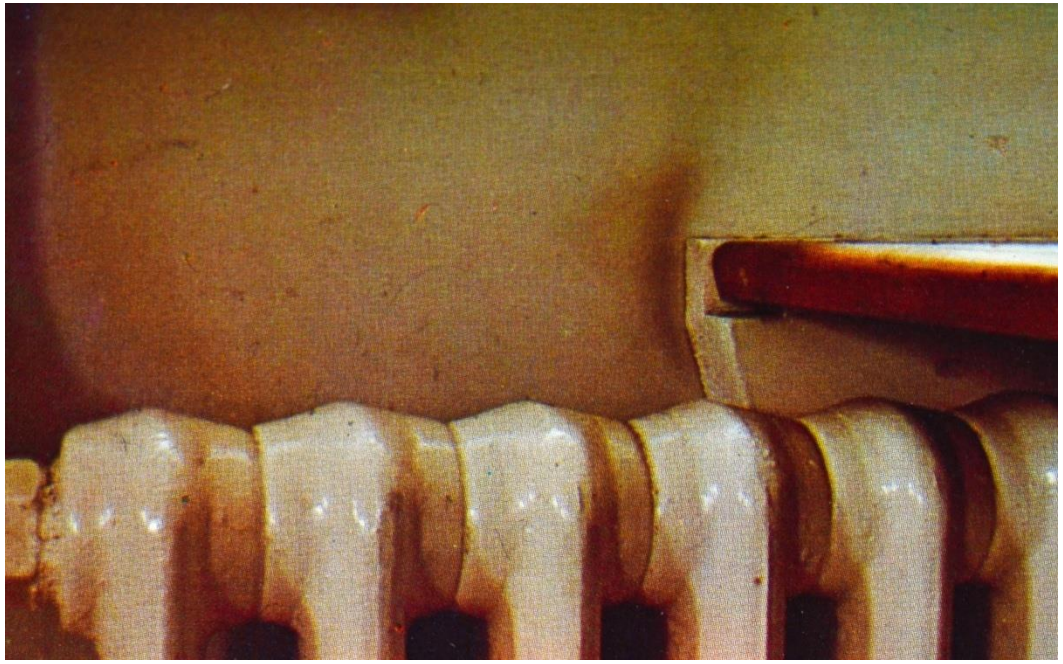
The air rises and moves away from the bath.

Eventually it meets much cooler surfaces such as a window.

The air is rapidly cooled and some of the water-vapour is deposited on these surfaces – to such an extent that the droplets form little rivulets.

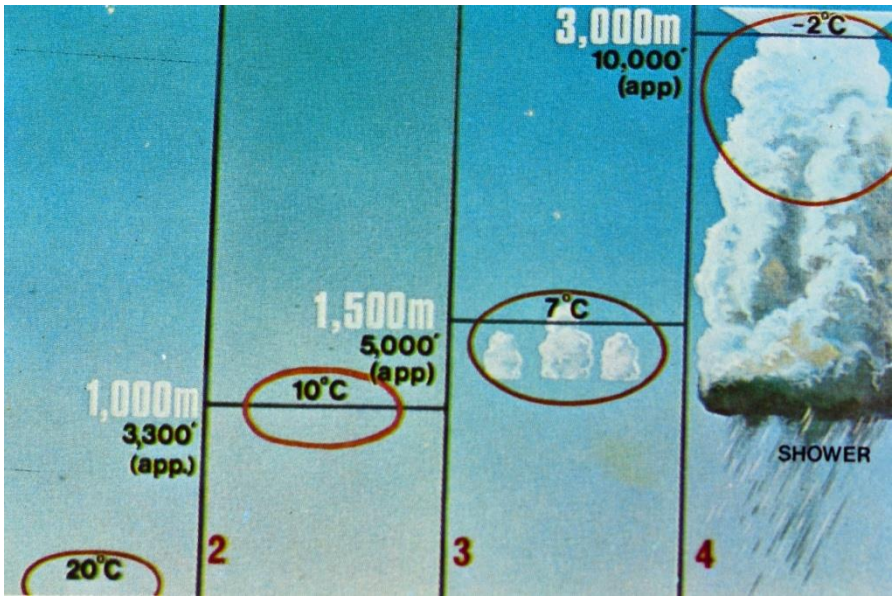
Similarly, when the air on a warm day comes into contact with the colder grass, it condenses and deposits water-vapour as tiny drops of dew on the grass.

The temperature at which condensation of water-vapour in the air occurs is called the ‘dew-point’.



Hot air rises, and although we cannot see it.

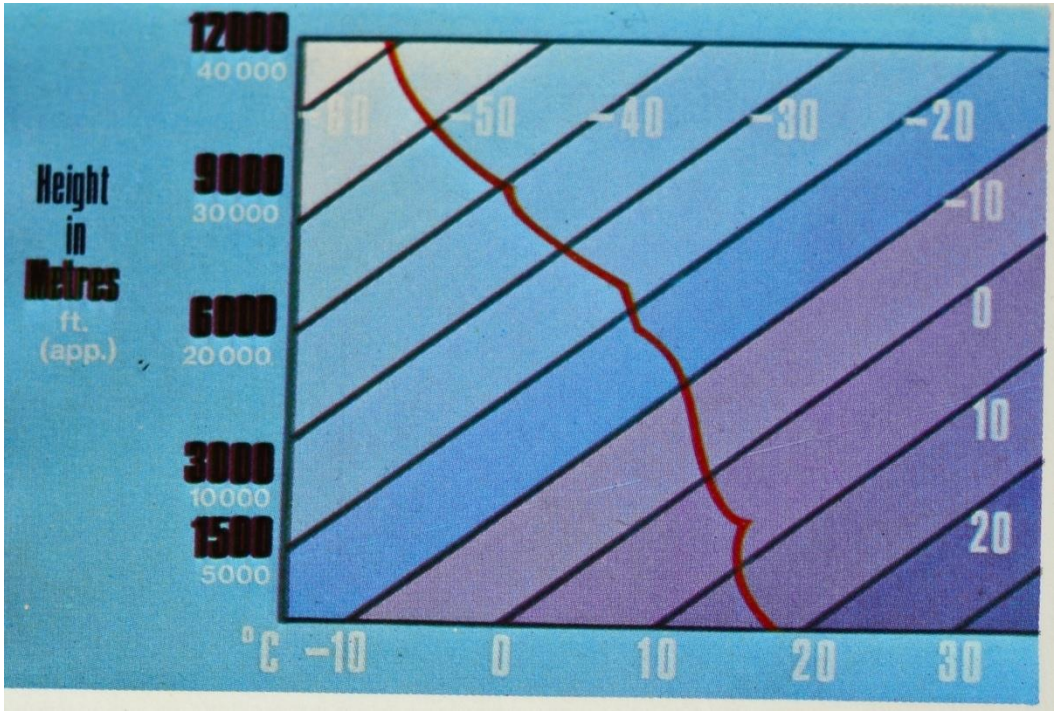
Proof is provided by the dark streaks of particles of dust carried upwards by the heated air rising from the radiator.....and is deposited on the wall and paintwork around the shelf-support.



Thus, (1) when some half saturated air at 20 degrees rises, by the time it reaches 1,000m (2) it cools to 10 degrees and is then approaching saturation.

If it rises further, (3) it cools more, some condensation occurs and small puffs of cloud form. At 3,000m, (4) nearly all its water-vapour turns onto cloud droplets to form a big, heaped cumulus cloud.

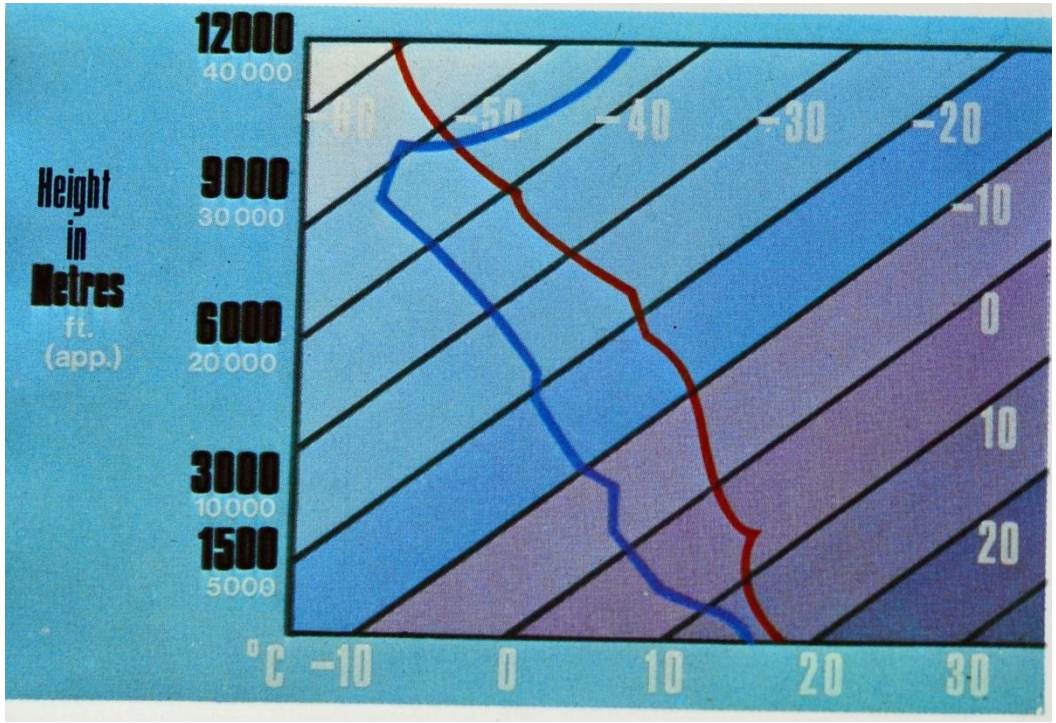
This is how cloud form.



This graph shows the air temperature measured at various heights on a warm day in August.

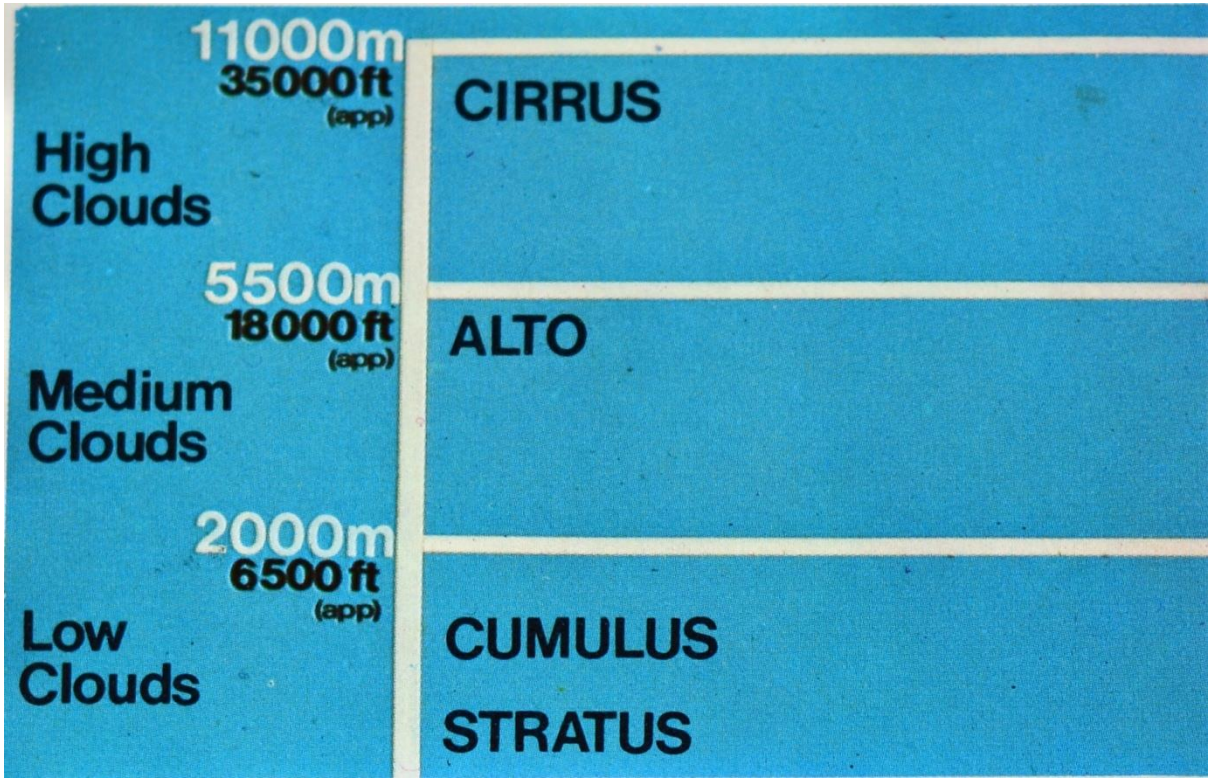
Because the air at 3,000ft is relatively warm, the rising warmer surface air will only cool to the same temperature as the warm air above, and so stop rising to a cooler level.

Thus no cloud will form.



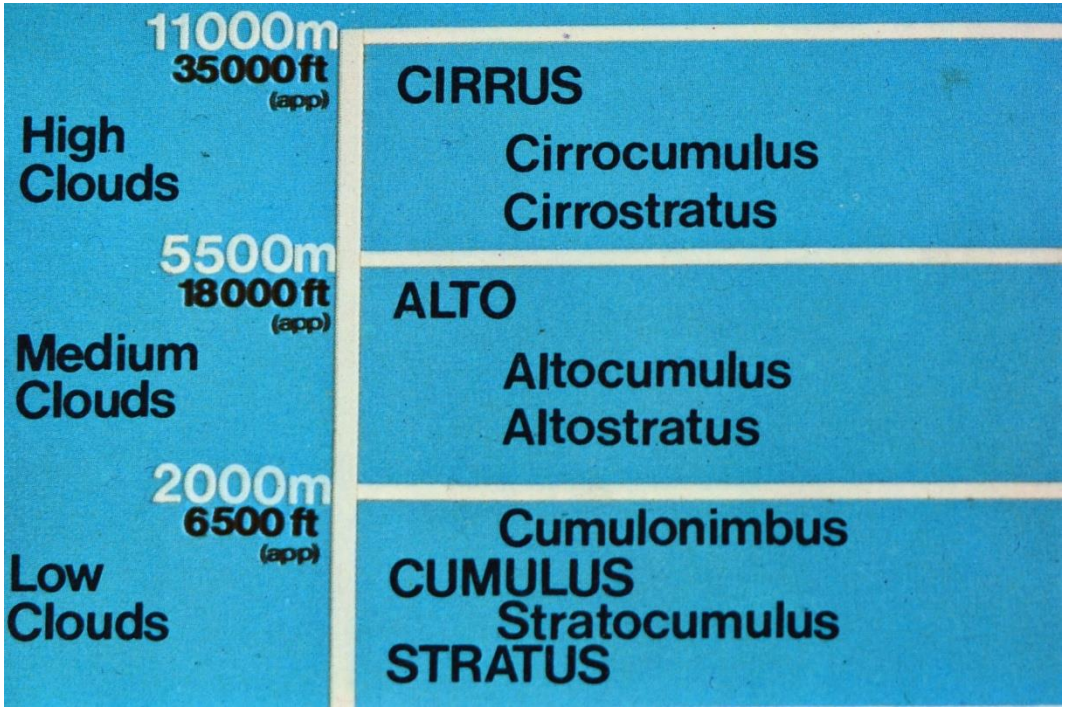
Now we have added the air temperature at various heights on a cool, showery day. Because the air is much colder above, the warmer surface air will continue rising to great heights, cooling and forming clouds as it goes.

When it is very cool high up, big thunderclouds can form and grow to great heights. A mass of water droplets forms and these join up to give the heavy rain of thunder showers.



Cloud names are based on their shape and height and their Latin names are used by weathermen the world over.

They are divided into 3 distinct levels. The highest clouds are at the **Cirrus** level. Medium level clouds are in the **Alto** region and the lowest levels we find the base of the **Cumulus** (heaped) and **Stratus** (layered) clouds.



These basic words are often combined and sometimes others are added to give more exact definitions of the shapes, heights and special features of clouds.

Stratocumulus describes heaped layers and cumulus is combined with **Nimbus** (Latin for rain) to give **Cumulonimbus** (heaped rain clouds).

From these examples you can work out the types of clouds described by the other name combinations on the chart.

Here are some **Cumulus** or heaped clouds

This picture shows **Altostratus** or the layer type of cloud at the middle levels.

This is **Cirrus** – the thread type of cloud seen at the highest levels

These small puffs of cloud, seen on a summer's day are called **'fair weather cumulus'** as they float lazily across the sky like small tufts of cotton wool.

But the small puffs often increase and grow into much larger clouds.

Note the flat bases to the clouds, because the rising warm air cools at the same rate and reaches the condensation level (the cloud base) at the same time.

This is large **cumulus**, still with flat bases, but now extending upwards to greater heights.

Here, the large **cumulus** shows many ‘turrets’ or ‘towers’ – showers are not far away.

The top of this very large **cumulus** is beginning to lose its heaped appearance.

It is reaching the **cumulonimbus** stage which means a shower will soon fall from its base.

When the top spreads out in the shape of an anvil it becomes a **cumulonimbu**s or a **thunder-cloud.**

Sometimes the sky is covered by a layer of featureless grey cloud, usually with a fairly uniform base.

This is **stratus** cloud.

On a windy day, the **stratus** layer often will break up around sunrise and sunset, showing tints of pink and red.

When a cloud layer develops rolls or rounded masses it is **stratocumulus** cloud.

If the sun is low in the sky, it will light up the rounded masses of **stratocumulus** cloud like this.

Altocumulus cloud is made up of globules or blobs of cloud.

You will remember we said all clouds in the middle level begin their names with **Alto**.

Here is another example of **altocumulus**.

It shows two levels and although the sun has set on the lower level cloud at about 10,000ft, it is still shining on the upper level cloud at 16,000ft.

This type of **altocumulus** is rather like the small cotton-wool puffs of low level **cumulus** we saw earlier.

Weathermen call it **‘altocumulus floccus’** because it looks like small tufts of wool or ‘flock’.

Showers of tiny snow crystals can sometimes be seen falling from **altocumulus floccus**.

Wind speed often increases with height and you can see how the falling showers trail behind the higher, faster-moving cloud.

This is **‘altocumulus castellanus’,** so called because the formation of the globules of cloud on the flat base look very like castle battlements.

In the evening, these long cigar-shaped clouds can often be seen.

These are called **‘altocumulus lenticularis’,** from their lentil or lens-shaped appearance.

Here the globules of **altocumulus** are beginning to join up into a layer to become **altostratus** cloud.

This is **altostratus** though which a watery sun can be seen.

It usually means the approach of rain and it is re-named **nimbostratus** as soon as rain begins to fall from it.

These fine, hair-like streaks of cloud are **cirrus** clouds, commonly called **‘mares tails’** because they resemble the tails of white horses.

Often, this type of **cirrus** moves rapidly from the west. All **cirrus** clouds consist of tiny ice-crystals as the air at this level (20 – 30,000 ft) is well below freezing.

This is another example of **cirrus**, with the cloud extending across the sky in long streaks.

Sometimes **cirrus** can be seen in tangles masses like this.

When it is in this formation there is very little wind.

A layer of high cloud with little form or structure is called **cirrostratus**.

Its minute ice-crystals are often prism-shaped causing refraction of the sun's rays producing a halo around the sun.

Cirrostratus does not always cover the sky.

Here it finishes with a sharp edge leaving clear blue sky beyond.

There are a few puffs of **cumulus** below it.

These cloudlets of ice-crystals are formed in lines of small globules and are called **cirrocumulus.**

The long white steak is a condensation trail of ice-crystals left behind by the exhaust of an aircraft in the very cold regions above **cirrocumulus**.

Here is some **cirrus** cloud and several condensation trails.

When some **cirrus** is present, aircraft condensation trails will often persist and occasionally grow into long, broad masses of **cirrus** themselves.

Cirrostratus will sometimes extend across the sky in long narrow bands, usually moving rapidly along the line in which the bands are lying.

These are typical bands of cloud associated with the **jet stream** – the name given to the narrow band of winds of at least 100 knots at 30,000ft or higher.

Although because of perspective the cloud lines seem to converge towards the horizon, hey are actually in parallel bands.

Jet streams mark the boundary between warm and cold air masses.

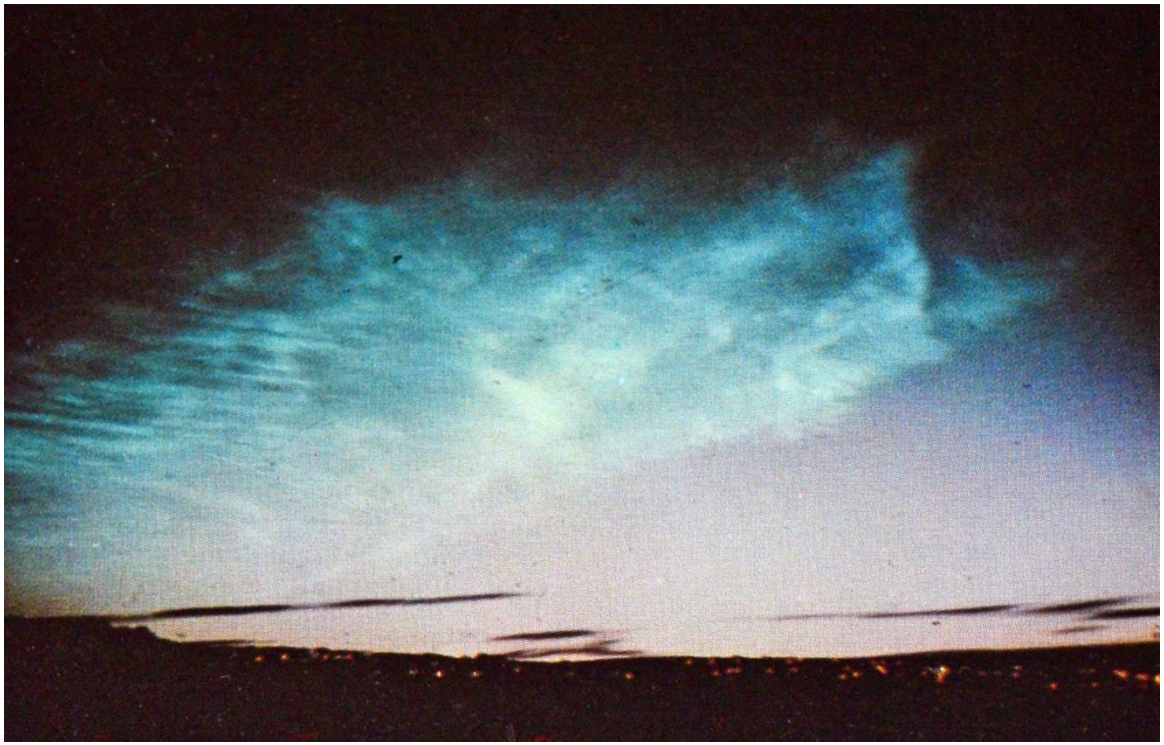
Here, a thin line or funnel of cloud is hanging from the base of a thunder cloud.

These funnel clouds are like miniature tornadoes, whirling and twisting as they drift along at the rear of the parent cloud.

Occasionally, one more intense than these occurs, snapping off trees and leaving a trail of wreckage.

Cumulus clouds can sometimes be seen extending across the sky in a long line, usually moving in the direction of the line.

This formation is called a **cloud lane**.



This is **noctilucent** cloud which can be seen only from about an hour after sunset to an hour before sunrise in the summer months.

It glows a silvery or bluish-white against the dark night sky.

Measurements show that it forms 50 miles up (almost in space) and has no association with our weather.

Bands of **cirrocumulus** or **altocumulus** are occasionally coloured pink, green, purple or brown in patches due to refraction of sunlight.

These coloured patches are called **iridescent** clouds and are seen near to the sun.

In addition to the halo, a number of over rings of coloured light can sometimes be seen when **cirrostratus** is present.

Here, small brighter patches of light can be seen above the sun and there is a bright spot of light to the right of it. This is called a **‘mock sun**’.

‘Red sky at night – shepherd’s delight’
‘Red sky at morning – shepherd’s warning’

This is one of the oldest of all weather forecasts and a red sky at morning does often foretell the approach of wet weather.

A closer study of clouds will reveal many other signs which will give you a very good idea of the weather to come.

In the next presentation we explore these in more detail.