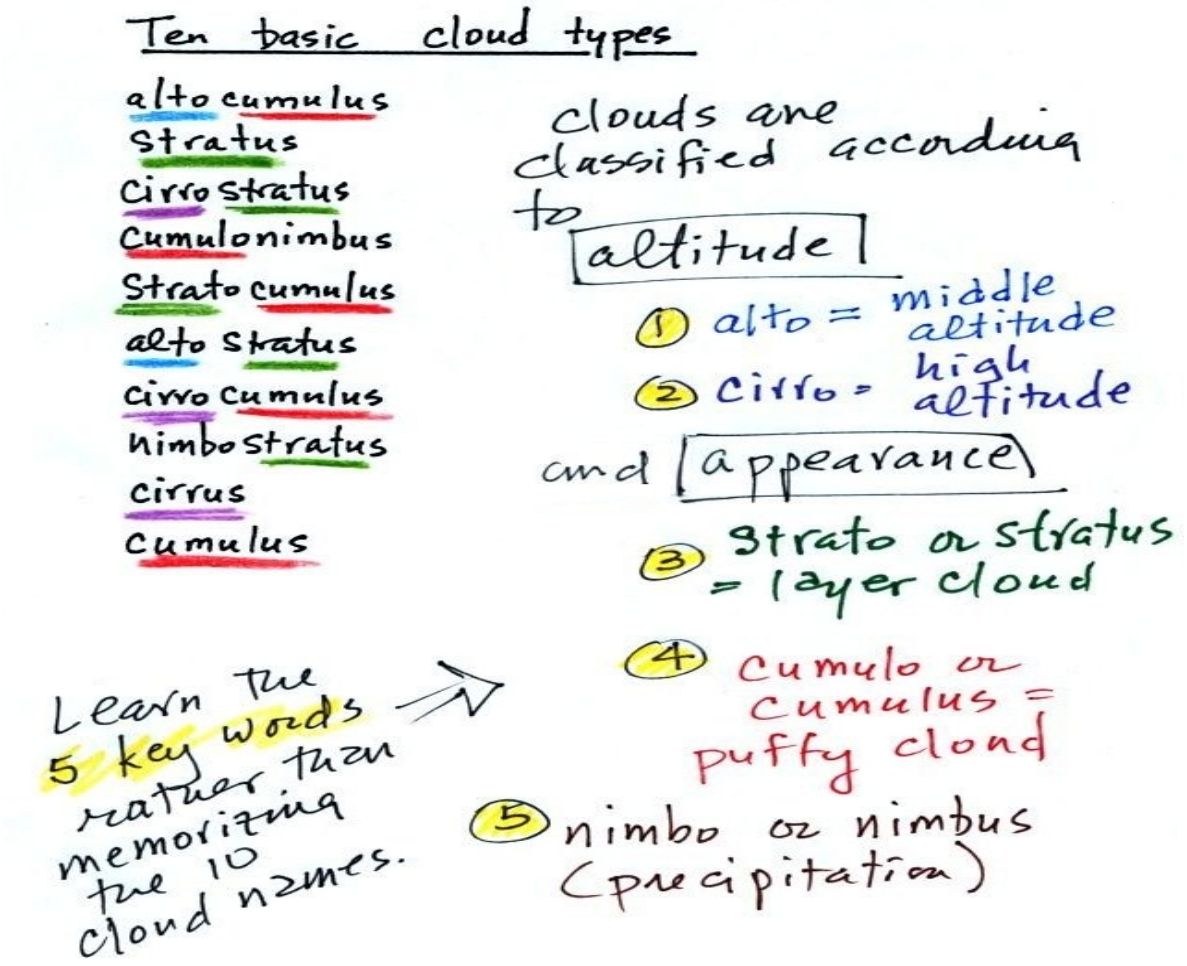
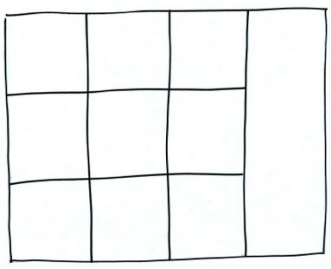
Module 8 - Lecture 22

This lecture will be devoted to learning how to identify and name clouds. The ten major cloud types that we will be concerned with are listed below. There is a smart and a not-so-smart way of learning these names. The not-so-smart way is to just memorize them because you will inevitably get them mixed up. A better way is to recognize that all the cloud names are made up of five key words which describe the cloud altitude and appearance.

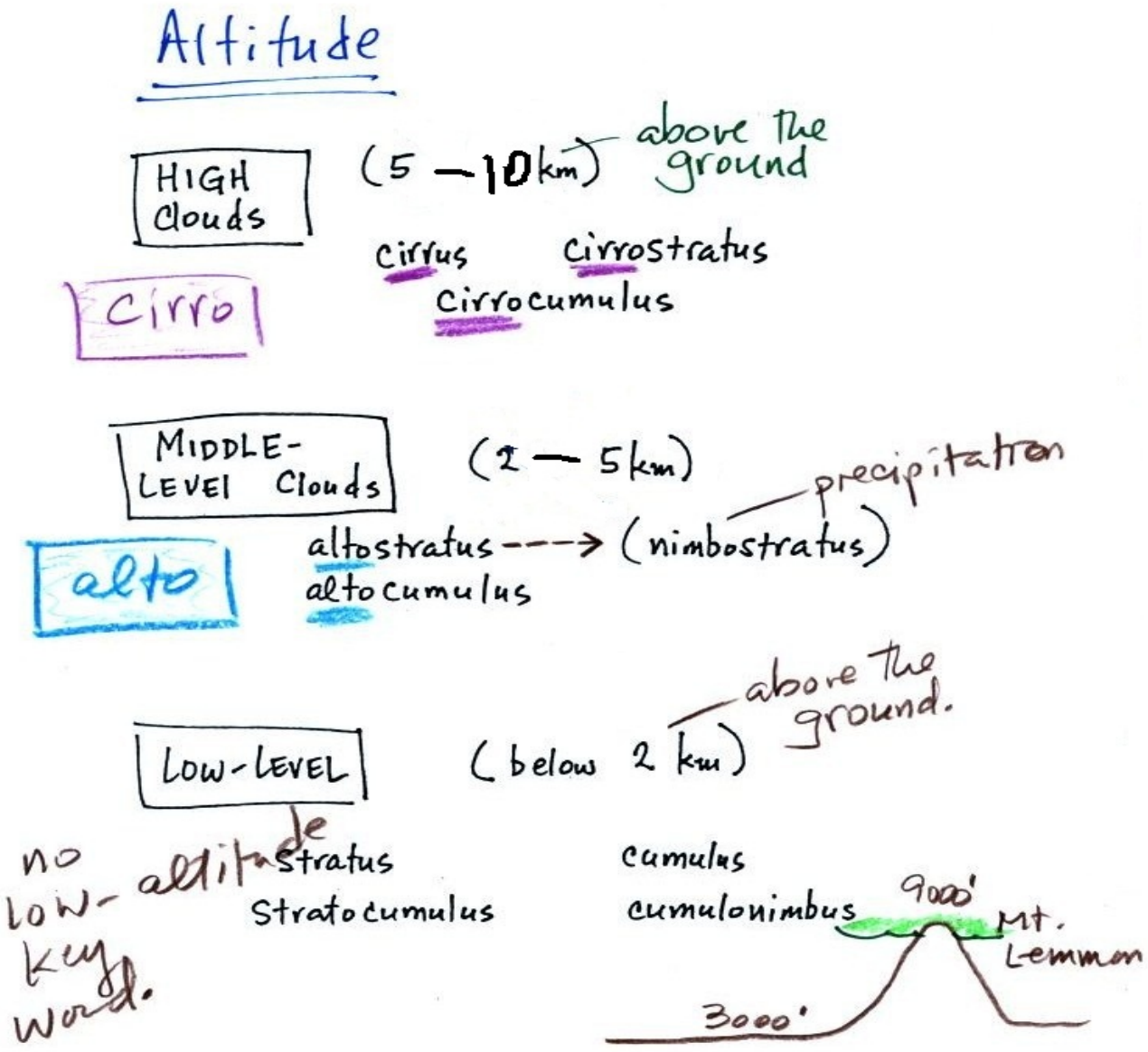


Each of the clouds above has a box reserved for it in the figure below. Drawing a figure like this on a blank sheet of paper is a good way to review cloud identification and classification.



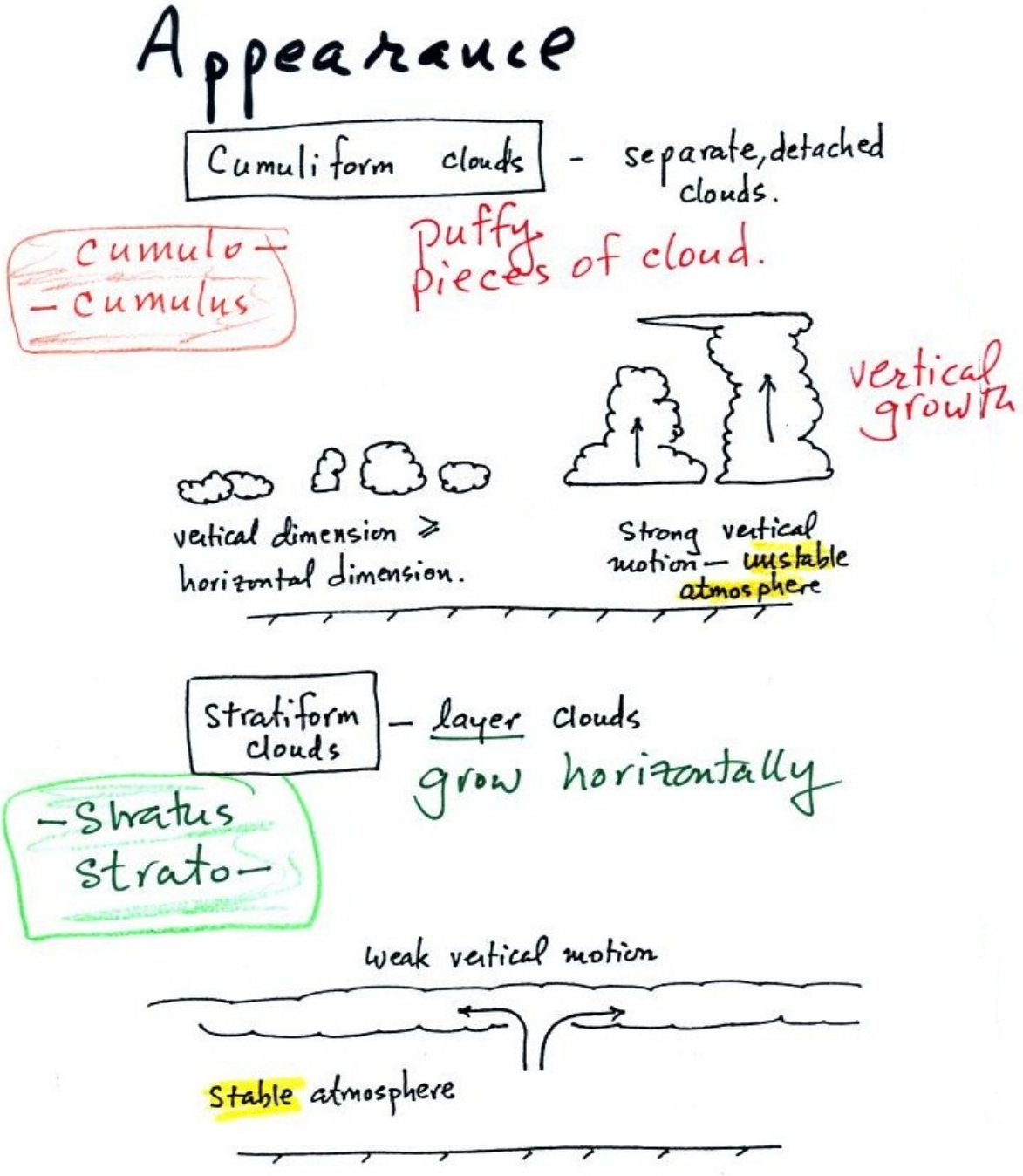
Clouds are classified according to the altitude at which they form. It is very hard to look up in the sky and directly determine a cloud's altitude. You will need to look for other clues to distinguish between high and middle altitude clouds. We will learn about some of the clues when we look at cloud pictures and discuss individual cloud types later in this lecture.

Clouds are grouped into three altitude categories: high level, middle level, and low level. **Cirrus or cirro** identifies a high altitude cloud. There are three types of clouds found in the high altitude category. **Alto** identifies a middle altitude cloud. There is no key word for low altitude clouds, which have bases that form 2 km or less above the ground. North of Tucson, the summit of Mt. Lemmon in the Santa Catalina Mountains is about 2 km above the valley floor. Low altitude clouds will have bases that form at or below the summit of Mt. Lemmon.

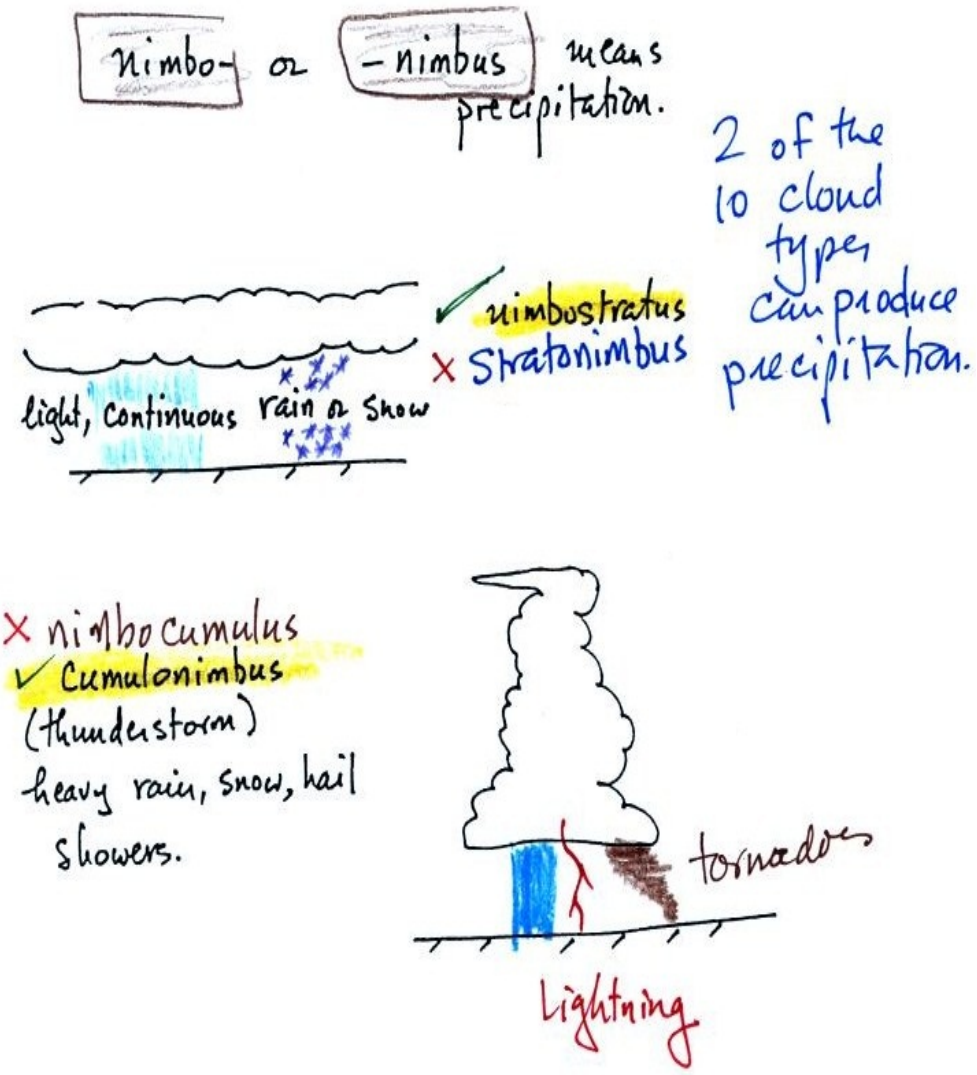


Clouds are also classified according to their appearance. There are two key words for appearance. Clouds can be patchy or puffy (or lumpy, wavy, or rippled) in their appearance. These are **cumuliform** clouds and will have cumulo or cumulus in their name. In an unstable atmosphere cumuliform clouds will grow vertically. Strong thunderstorms, cumulonimbus clouds, can produce severe and dangerous weather conditions.

Stratiform clouds grow horizontally and form layers. They form when the atmosphere is stable. You'll find strato or stratus in the cloud name. **Cirrus** clouds are considered to be a third type of cloud appearance.



The last key word, **nimbo or nimbus**, means precipitation. Only two of the ten cloud types are able to produce significant amounts of precipitation. Nimbostratus (Ns) clouds tend to produce fairly light precipitation over a large area. Cumulonimbus (Cb) clouds produce heavy showers over localized areas. Thunderstorm clouds can also produce hail, lightning, and tornadoes. Hail would never fall from an Ns cloud.



While you are still learning the cloud names you might put the correct key words together in the wrong order (stratonimbus instead of nimbostratus or nimbocumulus instead of cumulonimbus).

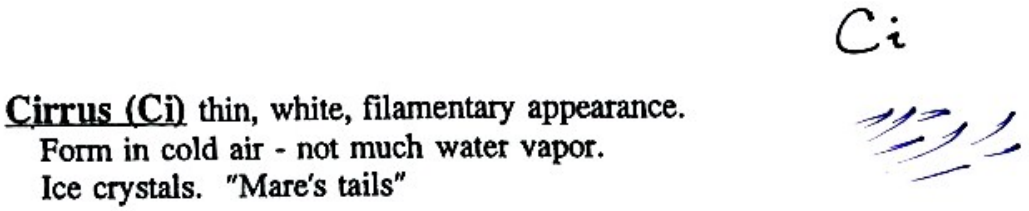
✓ Stratocumulus
✗ Cumulostratus

✓ Cumulonimbus
✗ Nimbocumulus

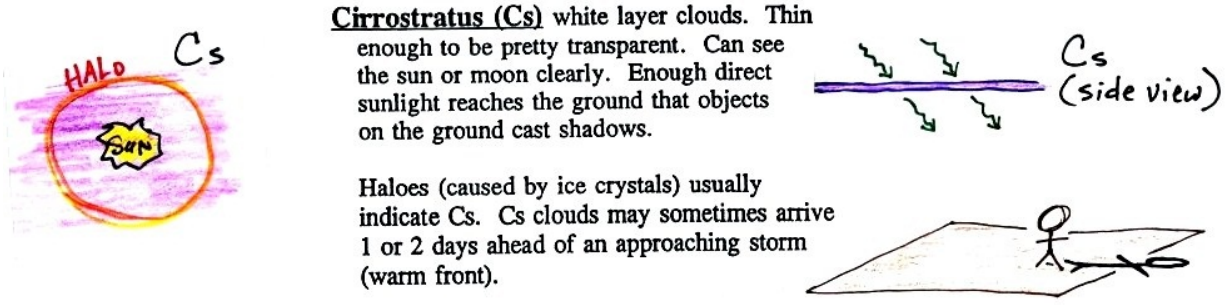
Next we will look at some of the identifying characteristics of most of the 10 cloud types. It would be helpful to have a look at some actual pictures of the various cloud types in addition to the drawing and written descriptions below. A good source of cloud pictures can be found at the following link: http://www.nws.noaa.gov/os/brochures/cloudchart.pdf

High Altitude (Cirrus) Clouds

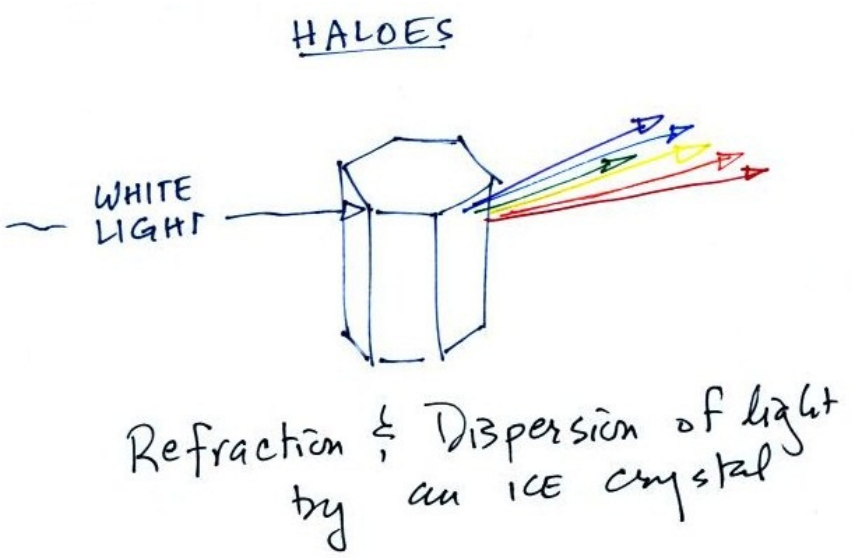
High altitude clouds are thin because the air at high altitudes is very cold and cold air cannot contain much moisture. In other words, the saturation mixing ratio for cold air is very small. These clouds are also often blown around by fast, high altitude winds. **Cirrus (Ci)** clouds are filamentary, which means "stringy" or "streaky". If you imagine trying to paint a Ci cloud you would dip a small pointed brush in white paint and brush it lightly across a blue colored canvas.



A **cirrostratus (Cs)** cloud is a thin uniform white layer cloud (not purple as shown in the figure) covering part or all of the sky. Cirrostratus clouds are so thin you can often see blue sky through the cloud layer. Haloes are a pretty sure indication that a cirrostratus cloud is overhead. If you were painting Cs clouds you would dip a broad brush in white paint (diluted perhaps with water) and then paint evenly across the entire canvas. Note the two views show you looking through the cloud at the sun (left) and from the side (right) to emphasize how thin these high altitude layer clouds are.

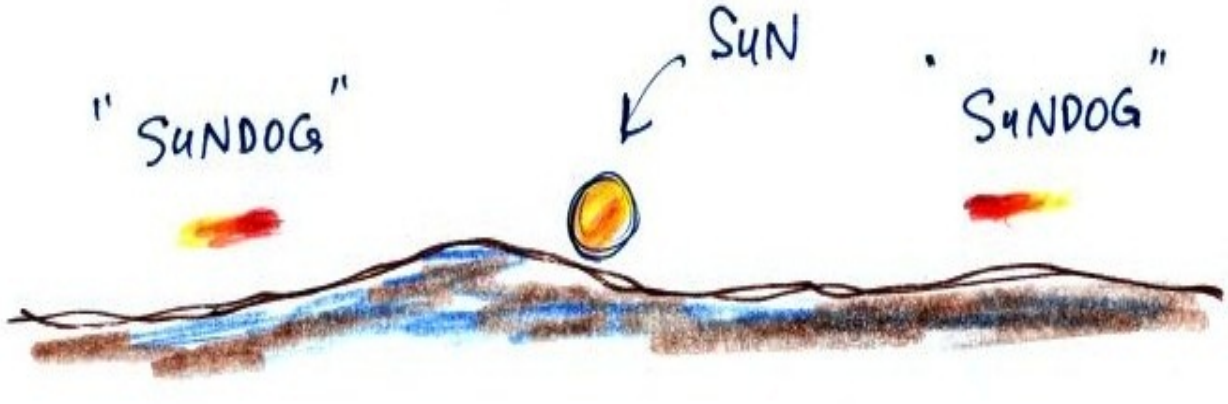


Haloes are produced by white light entering a 6 sided ice crystal is bent (refraction). The amount of bending depends on the color (wavelength) of the light (dispersion). The white light is split into colors just as light passing through a glass prism. This particular crystal is called a column and is fairly long.



This is a flatter crystal and is called a plate. These crystals tend to all be horizontally oriented and produce sundogs.

A sketch of a sundog is shown below. Sundogs are patches of light seen to the right and left of the rising or setting sun. They are fairly common.



Cirrus and cirrostratus clouds are fairly common. **Cirrocumulus (Cc)** clouds are a little more unusual. To paint a Cc cloud you would dip a sponge in white paint and press it gently against the canvas. You would leave a patchy, splotchy appearing cloud (sometimes you might see small ripples). It is the patchy (or wavy) appearance that makes it a cumuliform cloud.

Cirrocumulus (Cc) very small patches or ripples of cloud. Uniform white color, not thick enough to have grey shading. Not as common as two other cirrus type clouds.

At sunset, Cc clouds may resemble the scales on a fish - "mackerel sky"

Cc

Middle Altitude (Alto) Clouds

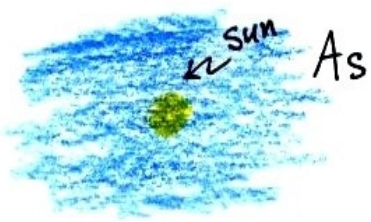
Because it is hard to accurately judge altitude, you must rely on the cloud element size to determine whether a cloud belongs in the high or middle altitude category. Middle altitude clouds appear to be about thumbnail size. **Altocumulus (Ac)** clouds are quite common. The cloud elements in Ac clouds appear larger than cirrocumulus clouds because they are closer to the ground.

Cc

Ac

Altocumulus (Ac) separate cloud elements about the size of your thumbnail when you hand is held at arm's length. May have grey shading.

Altostratus (As) clouds are thick. You will probably not see a shadow if you look down at your feet. The sun may or may not be visible through the cloud. The figure below shows you looking through the cloud (left) and viewing the cloud from the side (right).



As

Altostratus (As) gray cloud layer (thicker than Cs). Sun may be visible through thin As but will appear blurred or fuzzy. Diffuse light, not much direct sunlight - objects on the ground do not cast shadows.

As

If an altostratus cloud begins to produce precipitation, its name is changed to **nimbostratus (Ns)**. These clouds are a little lower and thicker than an altostratus cloud.

Nimbostratus (Ns) gray cloud layer producing precipitation. Precipitation usually fairly light, continuous, and may cover large area.

Thick As may resemble and eventually become Ns.

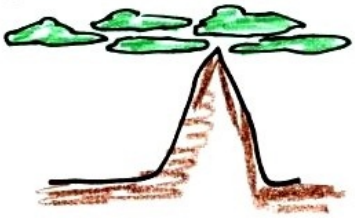
Fragments of cloud sometimes seen below Ns are called stratus fractus or "scud."

Ns

Low Altitude Clouds

Because they are closer to the ground, the separate patches of **stratocumulus (Sc)** are about fist size. The patches of Ac, remember, were about thumb nail size. This cloud name is a little unusual because the two key words for cloud appearance have been combined.

Sc



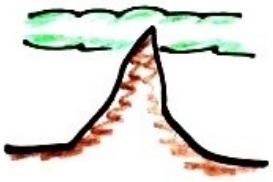
Stratocumulus (Sc) separate patches of cloud or waves of cloud with widths about the size of your fist.

Common low cloud type - "catch-all" category.

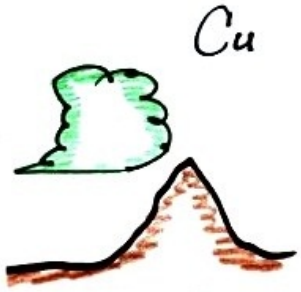
Stratus (St) clouds, viewed here from the side, are usually thick enough to completely hide the sun.

St

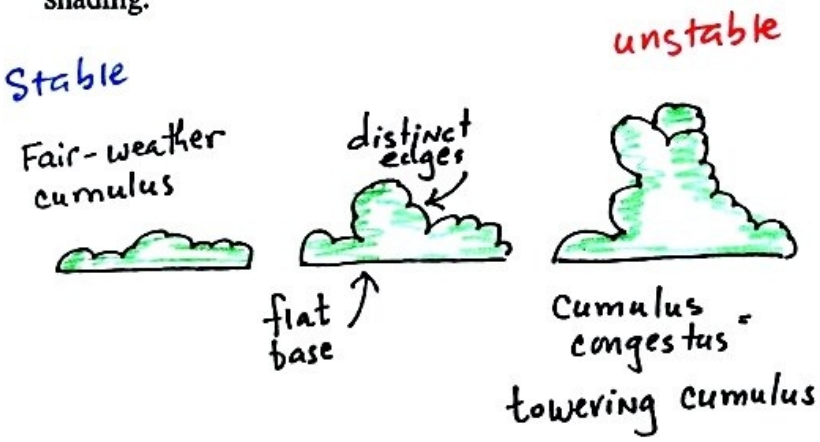
Stratus (St) gray layer cloud. Thick enough to completely hide the sun from view.



Cumulus (Cu) clouds come with different degrees of vertical development. The fair weather cumulus clouds do not grow much vertically at all. A cumulus congestus cloud is an intermediate stage between fair weather cumulus and a thunderstorm.



Cumulus (Cu) separate clouds resemble balls of cotton. Low enough and close enough to the ground to have a clear 3-D appearance and grey shading.



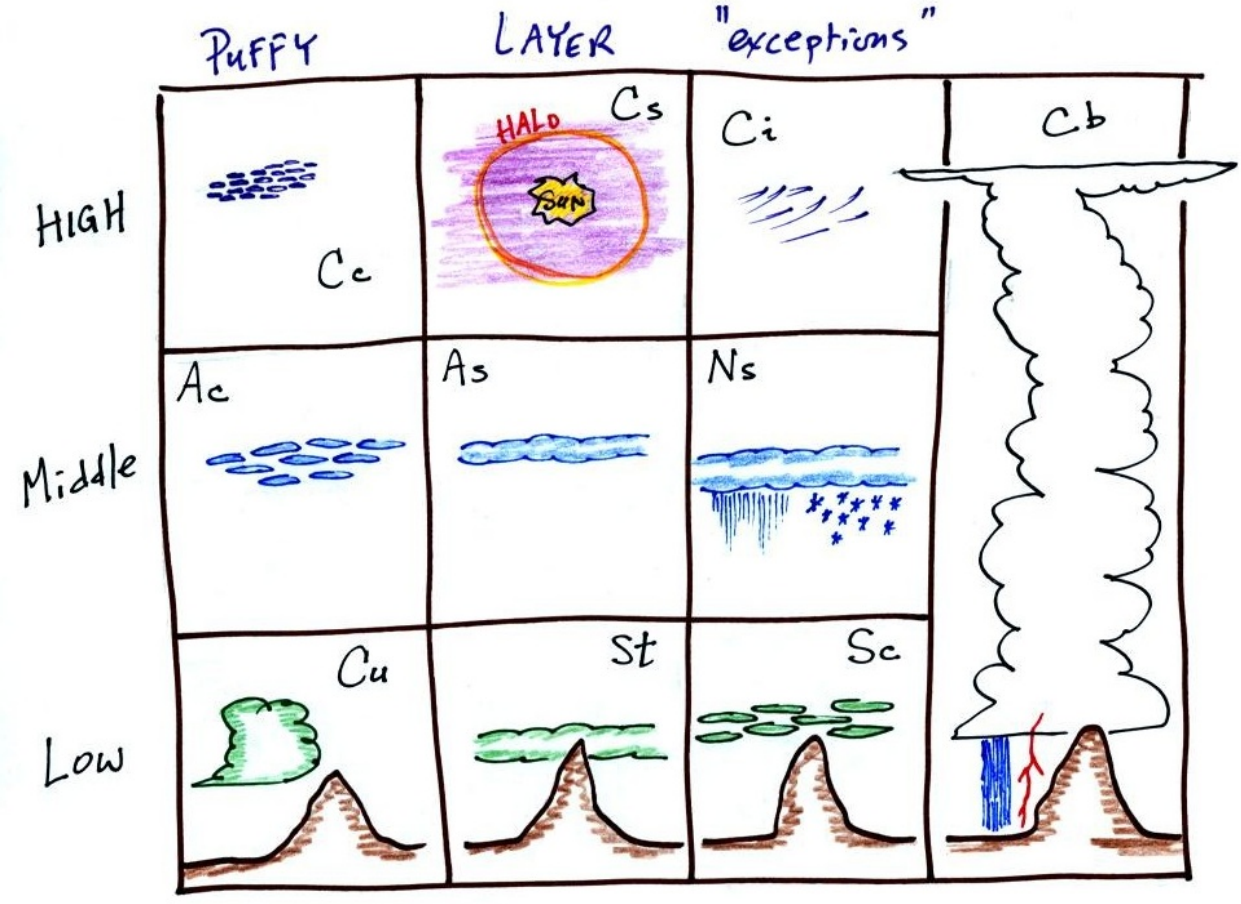
Cumulonimbus clouds have many distinctive features including a flat anvil top and lumpy mammatus clouds that are sometimes found on the underside of the anvil. Cold dense downdraft winds hit the ground below a thunderstorm and spread out horizontally underneath the cloud. The leading edge of these winds produces a gust front (dust front might be a little more descriptive). Winds at the ground below a thunderstorm can exceed 100 MPH, which is stronger than most tornadoes.

The top of a thunderstorm is cold enough to be composed of just ice crystals while there are water droplets at the bottom of the cloud. In the middle of the cloud, both water droplets and ice crystals exist together at temperatures below freezing. We will see that this mixed phase region of the cloud is important for precipitation formation and the generation of lightning.

Here is one final feature to look for at the bottom of a thunderstorm. Cold air spilling out of the base of a thunderstorm is just beginning to move outward from the bottom center of the storm (below left). The cold air has moved further outward and has begun to get in the way of the

updraft (below right). The updraft is forced to rise earlier and a little ways away from the center of the thunderstorm. Note how this rising air has formed an extra lip of cloud. This is called a shelf cloud.

Here is the completed cloud chart.



Here is a link to a succint cloud ID chart (http://wvscience.org/clouds/Cloud_Key.pdf) of the 10 basic cloud types by Dr. Tina Cartwright, State Climatologist of West Virginia. I highly recommend that you study it along with the material in this lecture.