Cloud

From Wikipedia, the free encyclopedia.

This article is about clouds in meteorology. For the musical concept of clouds, see Cloud (music).

A variety of cloud formations

A **cloud** is a visible mass of condensed water droplets or ice crystals suspended in the atmosphere above Earth's (or another planetary body's) surface.

The condensing water vapor forms small droplets of water (typically 0.01 mm [1] (*http://www.geog.ucsb.edu/~joel/g110_w03/chapt06/cloud_drops/agburt_06_01.jpg*)) or ice crystals that, when surrounded with billions of other droplets or crystals, are visible as clouds. Clouds reflect all visible wavelengths of light equally and are thus white, but they can appear grey or even black if they are so thick or dense that sunlight cannot pass through.

Clouds on other planets often consist of material other than water, depending on local atmospheric conditions (what gases are present, and the temperature).

Contents

Cloud formation and properties

Clouds form in areas where moist air cools, generally by rising. This can happen

- along warm and cold fronts,

- where air flows up the side of a mountain and cools as it rises higher into the atmosphere (orographic uplift),
- and when warm air blows over a colder surface such as a cool body of water.

The actual form of cloud created depends on the strength of the uplift and on air stability. In unstable conditions convection dominates, creating vertically developed clouds. Stable air produces horizontally homogeneous clouds. Frontal uplift creates various cloud forms depending on the composition of the front (ana-type or kata-type warm or cold front). Orographic uplift also creates variable cloud forms depending on air stability, although cap cloud and wave clouds are specific to orographic clouds.

Cloud properties (mostly, their albedo and rain-out rate) are strongly dependent on the size of the cloud droplets and the manner in which these particles coalesce. This is in turn affected by the number of cloud condensation nuclei present in the air. Because of this dependence, and lack of global climatological observations, clouds are difficult to parametrise in climate models and a bone of contention within the global warming debate. Condensation of steam in liquid water or ice happen initially around some kinds of micro-particles of solid matter called hub of condensation or freezing. At this stage the particles are still very small and collisions and aggregation can't be the principal factors of growth. What happens is called the "Bergeron principle". This mechanism stands on the partial pression of ice saturation being lower than liquid water, which means that in a midst where coexist ice crystals and droplets of water supercool.

Cloud Classification

Clouds are divided into two general categories: layered and convective. These are named stratus clouds (or stratiform, the Latin *stratus* means layer) and cumulus clouds (or cumiloform, *cumulus* means piled up). These two cloud types are divided into four more groups that distinguish the cloud's altitude. Clouds are classified by the cloud base height, not the cloud top.

High clouds (Family A)

These form above 16,500 feet (5,000 m), in the cold region of the troposphere. They are denoted by the prefix *cirro-* or cirrus. At this altitude water almost always freezes so clouds are composed of ice crystals. The clouds tend to be wispy, and are often transparent.


Clouds (from above)

Clouds in Family A include:

- Cirrus
- Cirrus uncinus
- Cirrus Kelvin-Helmholtz
- Cirrostratus
- Cirrocumulus
- Cumulonimbus with mammatus
- Cumulonimbus with pileus
- Contrail

A *contrail* is a long thin cloud which develops as the result of the passage of a jet airplane at high altitudes.

Middle clouds (Family B)

These develop between 6,500 and 16,500 feet (between 2,000 and 5,000 m) and are denoted by the prefix *alto-*.

They are made of water droplets, and are frequently supercooled.

Clouds in Family B include:

- Altostratus
- Altostratus undulatus
- Altocumulus
- Altocumulus undulatus
- Altocumulus mackerel sky
- Altocumulus castellanus
- Altocumulus lenticularis

Low clouds (Family C)

These are found up to 6,500 feet (2,000 m) and include the stratus (dense and grey). When stratus clouds contact the ground they are called fog.

Clouds in Family C include:

- Stratus
- Nimbostratus
- Cumulus humilis
- Cumulus mediocris
- Stratocumulus

Vertical clouds (Family D)

These clouds can have strong upcurrents, rise far above their bases and can form at many heights.

Clouds in Family D include:

- Cumulonimbus (associated with heavy precipitation and thunderstorms)
- Cumulus congestus
- Pyrocumulus
- Cumulonimbus incus
- Cumulonimbus calvus
- Cumulonimbus with mammatus

Cumulonimbus clouds showing strong updrafts.

Other clouds

A few clouds can be found above the troposphere; these include nacreous and noctilucent clouds, which occur in the stratosphere and mesosphere respectively.

Colors of clouds

The question of cloud color is a fascinating one, and tells much about what is going on inside a cloud.

Clouds form when water vapor rises, cools, and condenses out of the air as microdroplets. These tiny particles of water are relatively dense, and sunlight cannot penetrate far into the cloud before it is reflected out, giving a cloud

its characteristic white color. As a cloud matures, the droplets may combine to produce larger droplets, which may themselves combine to form droplets large enough to fall as rain. In this process of accumulation, the space between droplets becomes larger and larger, permitting light to penetrate much farther into the cloud. If the cloud is sufficiently large, and the droplets within are spaced far enough apart, it may be that very little light which enters the cloud is able to be reflected back out before it is absorbed. (Think of how much farther one can see in a heavy rain as opposed to how far one can see in a heavy fog.) This process of reflection/absorption is what leads to the range of cloud color from white through grey through black. For the same reason, the undersides of large clouds and heavy overcasts appear various degrees of grey; little light is being reflected or transmitted back to the observer.

Other colors occur naturally in clouds. Bluish-grey is the result of light scattering within the cloud. In the visible spectrum, blue and green are at the short end of light's visible wavelengths, while red and yellow are at the long end. The short rays are more easily scattered by water droplets, and the long rays are more likely to be absorbed. The bluish color is evidence that such scattering is being produced by rain-sized droplets in the cloud.

A more ominous color is the one seen frequently by severe weather observers. A greenish tinge to a cloud is produced when sunlight is scattered by ice. A cumulonimbus cloud which shows green is a pretty sure sign that someone is about to experience heavy rain, hail, strong winds, and possibly tornados.

Yellowish clouds are rare, but may occur in the late spring through early fall months during forest fire season. The yellow color is due to the presence of smoke.

Red, orange, and pink clouds occur almost entirely at sunrise/sunset, and are the result of the scattering of sunlight by the atmosphere itself. The clouds themselves are not that color, they are merely reflecting the long (and unscattered) rays of sunlight which are predominant at those hours. The effect is much the same as if one were to shine a red spotlight on a white sheet. In combination with large, mature thunderheads, this can produce blood-red clouds. The evening before the Edmonton, Alberta tornado in 1987, Edmontonians observed such clouds - deep black on their dark side, and intense red on their sunward side. In this case, the adage "red at night, sailor's delight" was clearly incorrect.

See also

- Nephology
- Cloud albedo
- Cloud feedback
- Cloud base
- Cloud forcing
- Fog
- Precipitation
- Coalescence
- Tornado
- Hurricane
- Monsoon
- Thunderstorm
- Weather lore

External links

- Australia Severe Weather: cloud classification system (*http://australiasevereweather.com/photography/*) Lots of photos. Click on the thumbnail to get a bigger image.
- Chitambo Clouds – Clouds and other meteorological phenomena (*http://www.chitambo.com/clouds/*) -

photographs and information on different types of clouds

Retrieved from "http://en.wikipedia.org/wiki/Cloud"

Categories: Meteorology | Weather