# **Quadrant II – Transcript and Related Materials (Notes)**

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#### Notes

## <u>Cloud</u>

- A cloud is aggregation, or grouping, of moisture droplets and ice crystals that are suspended in the air.
- They ae great enough in a volume and density to be visible to the naked human eye.

## How do cloud forms?

- A result of condensation of water vapor above the surface of the Earth.
- They are formed as a result of the process of convection, wherein warm air rises in the atmosphere and eventually cools down.
- This cooling takes place at a rate of 10°C per km. As the warm air cools, the invisible water vapor present in it condenses to form liquid cloud droplets.

- The entire process depends on a range of factors, including the prevailing weather conditions and the amount of moisture in the air.
- In fact, more the amount of moisture in the air, lower is the cloud base, as condensation occurs at a lower altitude.

# **Types of Cloud**

- Clouds can exist at various elevations between the sea level (fog, mist) and 13,700 meters (45,000 feet) above sea level.
- <u>Clouds are usually classified by altitude and shape</u>. They come in three basic forms viz.,
  - 1. Flat : horizontal in nature, called Stratiform.
  - 2. Puffy: vertical in nature, called *Cumuliform.*
  - 3. Wispy: high altitude, composed of ice crystal, labelled as *Cirroform*.

The WMO International Atlas of clouds has given a ten- fold of classification are as under:

- Low Clouds (from the surface upto 2,000m): Stratocumulus, nimbostratus, cumulus (heap), cumulonimbus, stratus (layer), nimbus (rain-bearing).
- *Medium clouds* (from 2,000m to 6,000m): altocumulus, altostratus.
- *High Clouds* (above 6,000m): Cirrus, cirrostratus, cirrocumulus

# Characteristics of Clouds.

**1.** High-level clouds:

High-level clouds occur above about 20,000 feet and are given the prefix "cirro." Due to cold tropospheric temperatures at these levels, the clouds

primarily are composed of ice crystals, and often appear thin, streaky, and white (although a low sun angle, e.g., near sunset, can create an array of color on the clouds). The three main types of high clouds are cirrus, cirrostratus, and cirrocumulus. Cirrus clouds are wispy, feathery, and composed entirely of ice crystals. They often are the first sign of an approaching warm front or upper-level jet streak. Unlike cirrus, cirrostratus clouds form more of a widespread, veil-like layer (similar to what stratus clouds do in low levels). When sunlight or moonlight passes through the hexagonal shaped ice crystals of cirrostratus clouds, the light is dispersed or refracted (similar to light passing through a prism) in such a way that a familiar ring or halo may form. As a warm front approaches, cirrus clouds tend to thicken into cirrostratus, which may, in turn, thicken and lower into altostratus, stratus, and even nimbostratus. Finally, cirrocumulus clouds are layered clouds permeated with small cumuliform lumpiness. They also may line up in "streets" or rows of clouds across the sky denoting localized areas of ascent (cloud axes) and descent (cloud-free channels).

## **2.** Mid-level clouds:

The bases of clouds in the middle level of the troposphere, given the prefix "alto," appear between 6,500 and 20,000 feet. Depending on the altitude, time of year, and vertical temperature structure of the troposphere, these clouds may be composed of liquid water droplets, ice crystals, or a combination of the two, including supercooled droplets (i.e., liquid droplets whose temperatures are below freezing). The two main type of mid-level clouds are altostratus and altocumulus. Altostratus clouds are "strato" type clouds (see below) that possess a flat and uniform type texture in the mid levels. They frequently indicate

the approach of a warm front and may thicken and lower into stratus, then nimbostratus resulting in rain or snow. However, altostratus clouds themselves do not produce significant precipitation at the surface, although sprinkles or occasionally light showers may occur from a thick altostratus deck. Altocumulus clouds exhibit "cumulo" type characteristics (see below) in mid levels, i.e., heap-like clouds with convective elements. Like cirrocumulus, altocumulus may align in rows or streets of clouds, with cloud axes indicating localized areas of ascending, moist air, and clear zones between rows suggesting locally descending, drier air. Altocumulus clouds with some vertical extent may denote the presence of elevated instability, especially in the morning, which could become boundary-layer based and be released into deep convection during the afternoon or evening.

#### **3.** Low-level clouds:

Low-level clouds are not given a prefix, although their names are derived from "strato" or "cumulo," depending on their characteristics. Low clouds occur below 6500 feet, and normally consist of liquid water droplets or even supercooled droplets, except during cold winter storms when ice crystals (and snow) comprise much of the clouds. Cloud Classifications and Characteristics By Ted Funk Science and Operations Officer Cirrostratus clouds (above) Cirrocumulus clouds (above) Cirrus clouds (above) Altostratus clouds (above) Altocumulus clouds (above) Stratus clouds (above) Stratocumulus clouds (above) The two main types of low clouds include stratus, which develop horizontally, and cumulus, which develop vertically. Stratus clouds are uniform and flat, producing a gray layer of cloud cover which may be precipitation-free or may cause periods of light precipitation or drizzle. Low stratus decks are common in winter in the Ohio Valley, especially behind a storm system when cold, dismal, gray weather can linger for several hours or even a day or two. Stratocumulus clouds are hybrids of layered stratus and cellular cumulus, i.e., individual cloud elements, characteristic of cumulo type clouds, clumped together in a continuous distribution, characteristic of strato type clouds. Stratocumulus also can be thought of as a layer of cloud clumps with thick and thin areas. These clouds appear frequently in the atmosphere, either ahead of or behind a frontal system. Thick, dense stratus or stratocumulus clouds producing steady rain or snow often are referred to as nimbostratus clouds. In contrast to layered, horizontal stratus, cumulus clouds are more cellular (individual) in nature, have flat bottoms and rounded tops, and grow vertically. In fact, their name depends on the degree of vertical development. For instance, scattered cumulus clouds showing little vertical growth on an otherwise sunny day used to be termed "cumulus humilis" or "fair weather cumulus," although normally they simply are referred to just as cumulus or flat cumulus. A cumulus cloud that exhibits significant vertical development (but is not yet a thunderstorm) is called cumulus congestus or towering cumulus. If enough atmospheric instability, moisture, and lift are present, then strong updrafts can develop in the cumulus cloud leading to a mature, deep cumulonimbus cloud, i.e., a thunderstorm producing heavy rain. In addition, cloud electrification occurs within cumulonimbus clouds due to many collisions between charged water droplet, graupel (icewater mix), and ice crystal particles, resulting in lightning and thunder.

#### **Summary**

- <u>Note to remember</u>: 1)Cirro-: curl of hair, high; 2) Alto-: mid; 3) Strato-: layer; 4) Nimbo-: rain, precipitation; and 5) Cumulo-: heap.
- Cloud cover is an important component of understanding and predicting the weather.
- Not only does cloud cover impact sky conditions and inform precipitation predictions, it also helps regulate the temperature that occurs in a region.