CLOUDS

Formation & Classification

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What is Cloud

It is mass of tiny water droplets or ice crystals or both of size 20-60 micron suspended in the atmosphere

How Clouds Form

- Heating of Air near surface of the Earth
- Warmer air rises through the atmosphere like balloon is termed as air parcel when TP (Temperature of air parcel)> Ambient temperature (TA)
- The pressure upon it decreases as parcel rises
- Expansion of air parcel with increase in height and parcel start cooling
- Rising and Expansion continue untill TP= TA

- Eventually, temperature within a rising parcel may reach to its dew point
- Condensation begin
- Vapour condenses into droplets on microscopic dust particles in the atmosphere
- The presence of particle initiate condensation
- The particles called cloud condensation nuclei (CCN)
- CCN are made of common salt of ocean

Basis of Cloud Classification

- First by Luke Howard – 1803
- World meteorological organization – 1956
- It is classified on the basis of
  - Height of cloud
  - Colour
  - Shape and form

Cloud Classification

Four latin terms form the basis for the naming of clouds:

- **Cirrus** : fibrous or hair-like
- **Cumulus** : a heap or pile
- **Stratus** : a horizontal sheet or layer
- **Nimbus** : rain-bearing

The prefix **Alto** is used to indicate medium altitude clouds.

High Level:

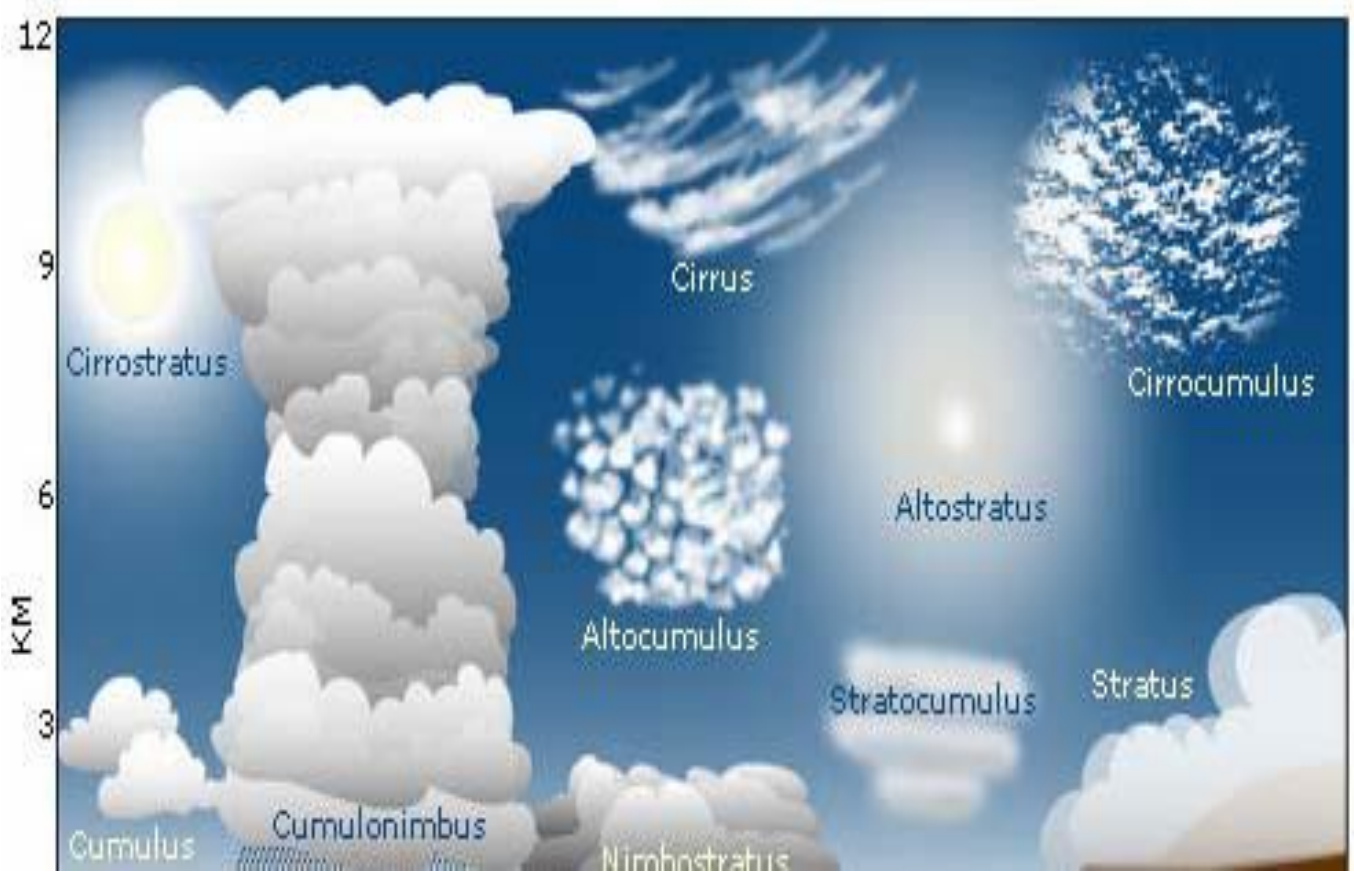
- Cloud base above 6000m
- Are all forms of cirrus (ice clouds)

Medium Level:

- Cloud base -2000-6000m

Low level:

- Cloud base below 2000m (within boundary layer)


12
9
6
3
KM
Cirrus
Cirrostratus
Cirrocumulus
Altostratus
Altocumulus
Stratocumulus
Stratus
Cumulonimbus
Cumulus
Nimbostratus

Cirrus Clouds (Ci)

- Cirrus clouds are the highest of all clouds and are composed entirely of ice crystals.
- Cirrus clouds are precipitating clouds, although the ice crystals evaporate high above the earth's surface.
- The crystals, caught in 100-150 mph winds create
- wisps of cloud.

Fast Facts:
Typical Altitude: 16,500-45,000 ft.
Location: Worldwide
Precipitation: None that reaches ground
Composition: Ice crystals
Formation: Fall streaks of ice crystals in upper troposphere winds

High-Level Clouds

Cirrus (Ci): White, delicate, fibrous in appearance. Forms in patches or narrow bands. May for comma-shaped streaks or “mare’s tails” (cirrus uncinus)

Cirrus clouds are formed entirely of ice crystals. These grow and evaporate slowly, leading to soft edges to clouds.

Cirrocumulus (Cc)

Fast Facts:

- Typical Altitude: 16,500-45,000 ft.
- Location: Worldwide
- Precipitation: None that reaches ground
- Composition: Ice crystals
- Formation: Cloudlets formed by choppy winds and high moisture levels in upper troposphere

Cirrocumulus clouds are usually a transitional phase
between cirrus and cirrostratus clouds.

Cirrostratus (Cs)

- Cirrostratus clouds are difficult to spot and appear as a pale, milky lightening of the sky.
- Cirrostratus clouds never block out the sun completely, but rather produce a variety of optical clouds

Fast Facts:

- Typical Altitude: 20,000-42,000 ft.
- Location: Worldwide
- Precipitation: None
- Composition: Ice crystals
- Formation: Spreading and joining of cirrus clouds

Medium Level Clouds

Fast Facts:

Typical Altitude: 2,000-3,000 ft.

Location: Worldwide (except in Antartica, where it's too cold)

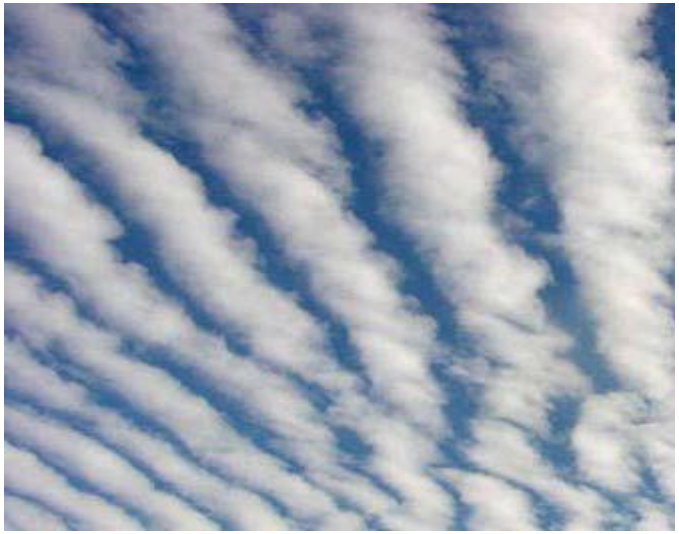
Precipitation: Generally none, except for brief showers from congestus

Composition: Liquid water

Formation: Thermal convection currents

Altocumulus (Ac)

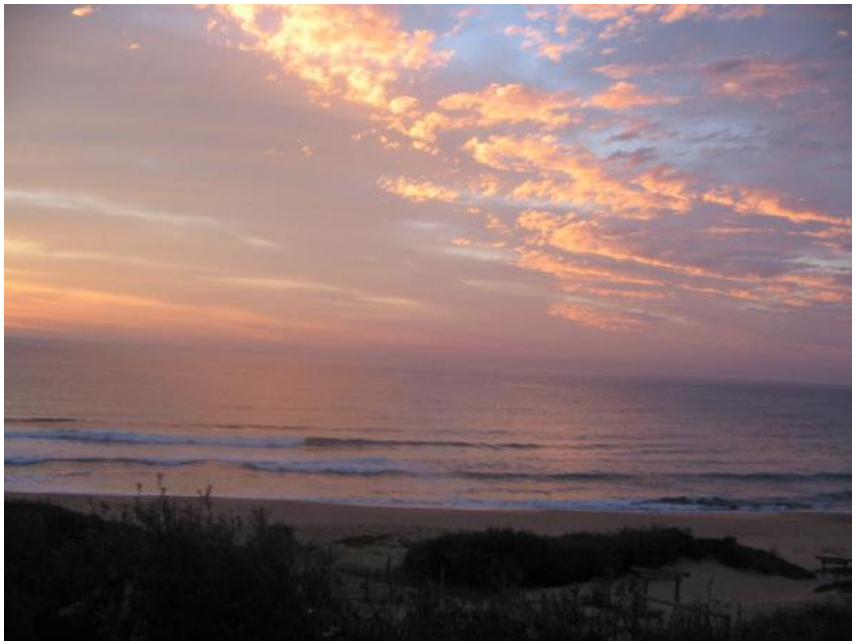
- **Since altocumulus clouds are high in the sky, they are generally above the influence of thermals, and form very differently from cumulus and stratocumulus clouds, who share similar names.**



Fast Facts:

- Typical Altitude: 6,500-18,000 ft.
- Location: Worldwide
- Precipitation: Very occasional light rain
- Composition: Mostly liquid water, may also contain ice crystals
- Formation: Mid-level atmospheric disturbances and wave propagation (from e.g. – mountains)

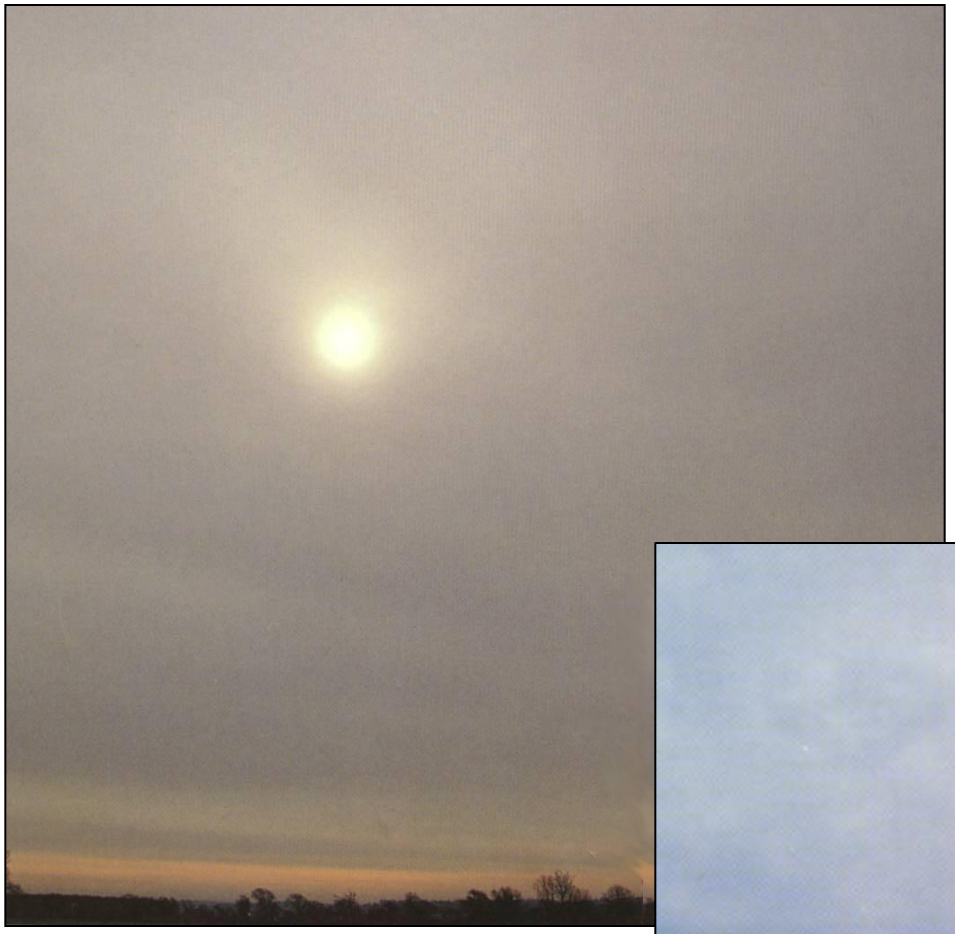
Altostratus Clouds



Fast Facts:

- Typical Altitude: 6,500-16,500 ft.
- Location: Worldwide, common in middle latitudes
- Precipitation: Occasional light rain, snow
- Composition: Both liquid water, and ice crystals
- Formation: Usually formed from the thickening and lowering of a cirrostratus cloud on its way to becoming a nimbostratus cloud

Altostratus (As)



A greyish sheet of cloud, may be fibrous or uniform in appearance. Thin enough in parts to make out the sun, but no halo.

Low-Level Clouds

Cumulus (Cu): Brilliant white to grey, dense detached clouds. Forms clumped or heaped (cauliflower-like) shapes, usually with sharp outlines and flat base. Field of Cu often have bases all at same (lifting condensation) level.

Stratus (St)

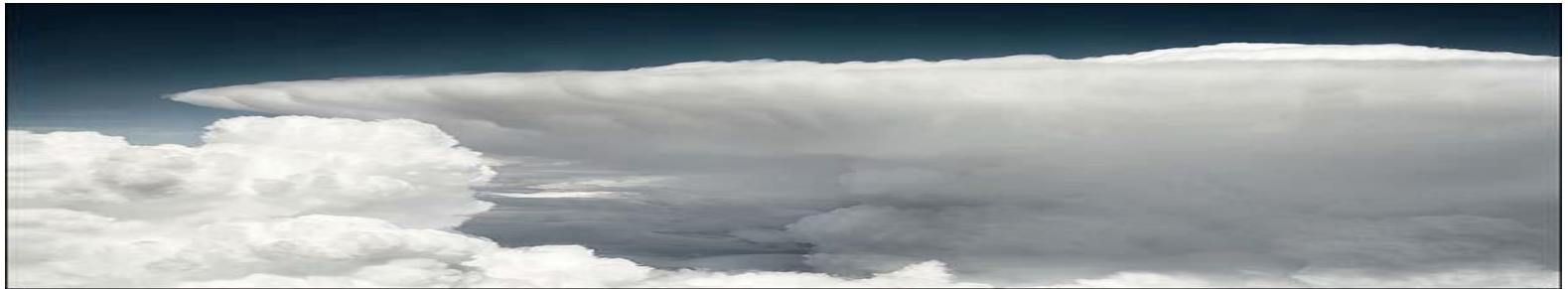
- Stratus clouds are the lowest forming and are often called fog or mists when they are earth-bound
- Stratus clouds are formed when a large air mass cools at the same time (e.g. – a warm air parcel drifts into or above a cooler region)

- Fast Facts:
- Typical Altitude: 0-6,500 ft.
- Location: Worldwide, but especially common around coasts and mountains
- Precipitation: No more than light drizzle
- Composition: Liquid water
- Formation: Advective or radioactive cooling

Cumulonimbus (Cb)

- **Three critical conditions for cumulonimbus formation: Ready supply of warm, moist air, which rises at speeds of up to 25-70 mph**
- **Tropospheric winds need to increase considerably with height to encourage it to slant forward**
- **The atmosphere around the cloud needs to be "unstable" – no temp. inversions here**

- Fast Facts:
- Typical Altitude: 2,000-45,000 ft.
- Location: Common in tropics and
- temperate regions, rare at poles
- Precipitation: Heavy downpours, hail
- Composition: Liquid water throughout, ice crystals at the top
- Formation: Upwardly mobile cumulus congestus clouds (thermals)



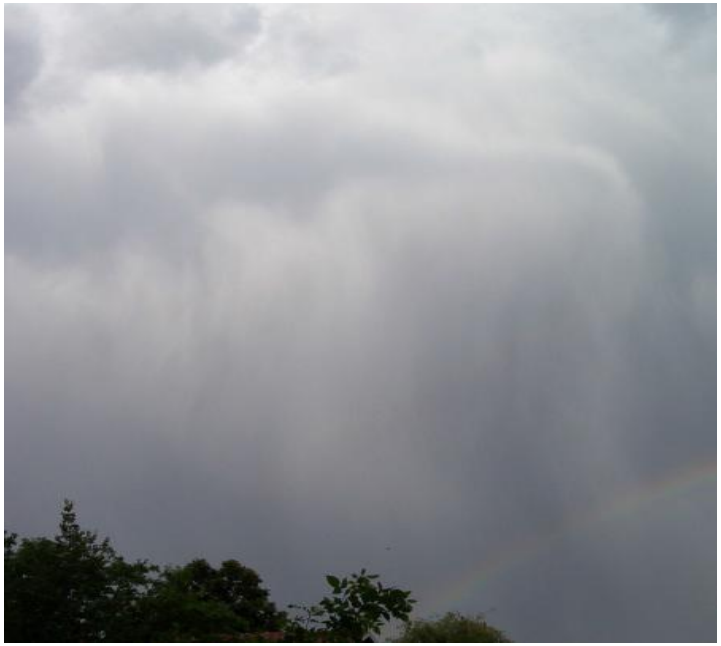
Stratocumulus (Sc)

- Similar to cumulus clouds in form and composition,
- stratocumulus clouds are textured and puffy, but also joined into a semi-continuous layer
- Stratocumulus clouds usually form from cumulus or stratus clouds

Fast Facts:

- Typical Altitude: 2,000-6,500 ft.
- Location: Worldwide – very common
- Precipitation: Occasional light rain, snow
- Composition: Liquid water
- Formation: Spreading and joining of cumulus clouds below a temperature inversion, wind turbulence in a stratus layer

Nimbostratus (Ns)



The nimbostratus cloud has no species or varieties.
It is a thick, wet blanket with a ragged base caused by the continual precipitation

Fast Facts:

- Typical Altitude: 2,000-18,000 ft.
- Precipitation: Moderate to heavy rain or snow, which is generally steady and prolonged
- Composition: Liquid water, raindrops snowflakes and ice crystals
- Formation: Usually formed from the thickening and lowering of a altostratus cloud

CLOUD OBSERVATION

- Surface based observations

  -division of the sky by eye in to 8-10 parts and estimate the cloud coverage

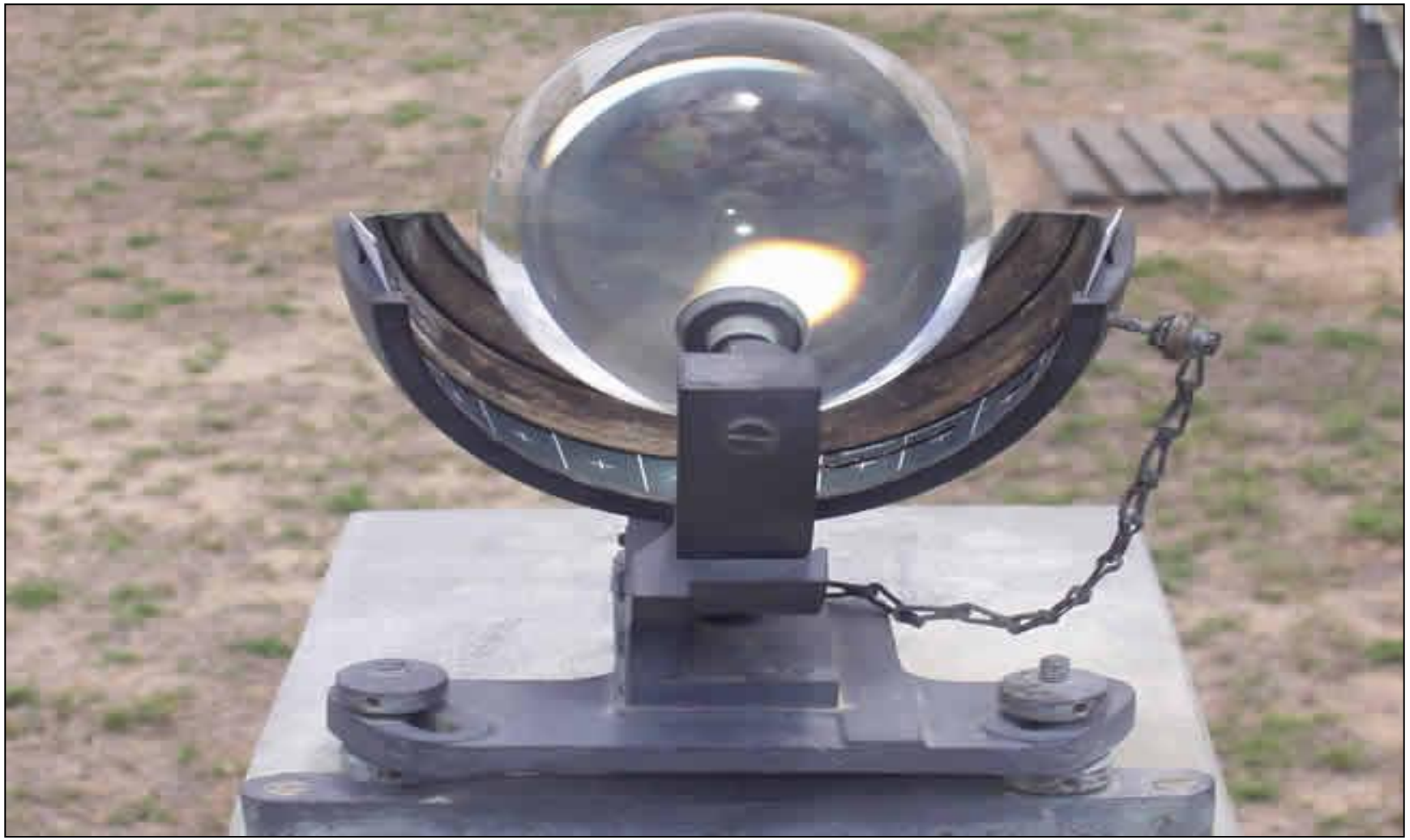
Clear sky - 0-5% cloud cover

Scattered cloud cover - 5-55%

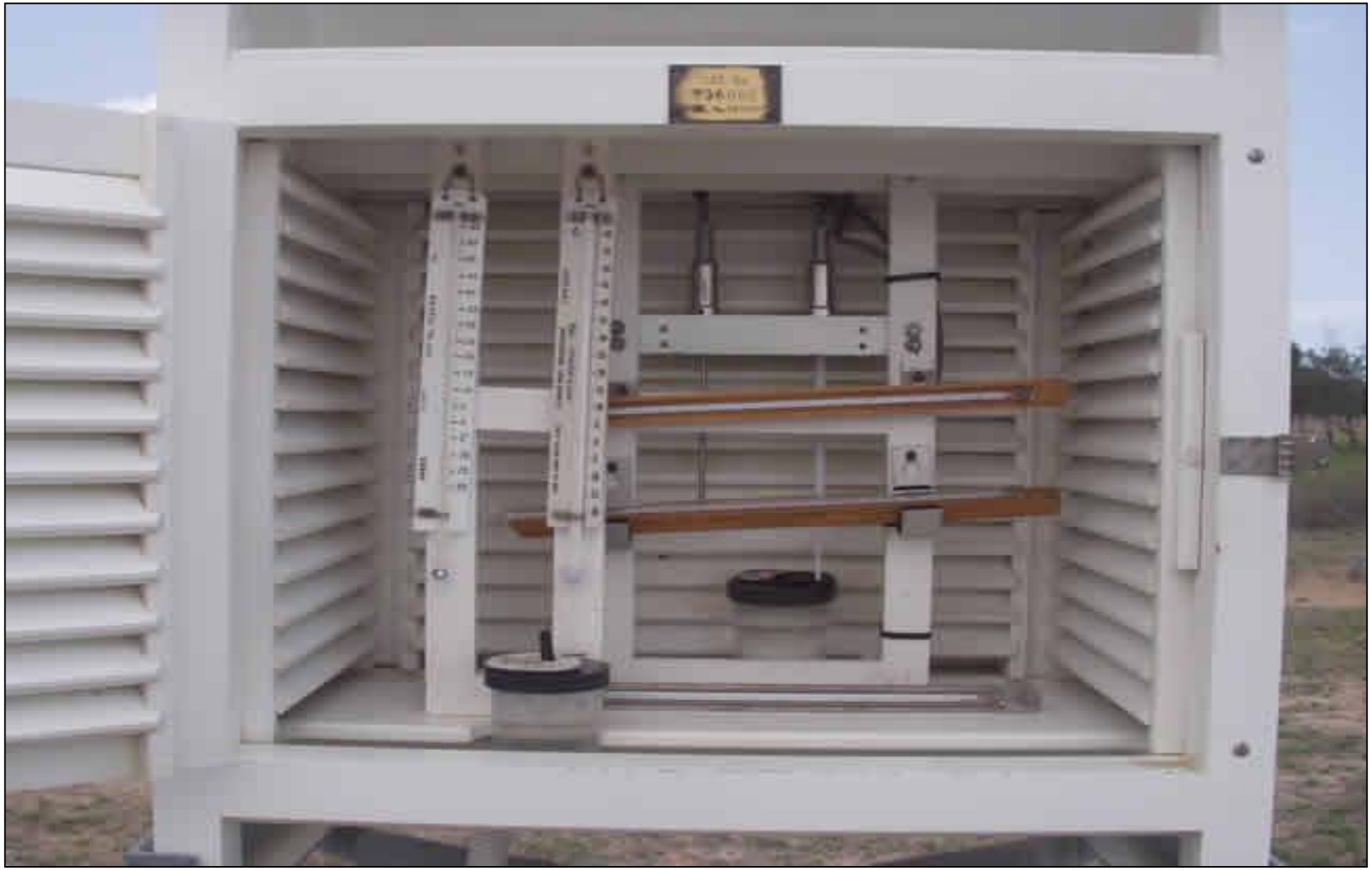
Broken cloud cover - 55-95%

Overcast - 95-100%

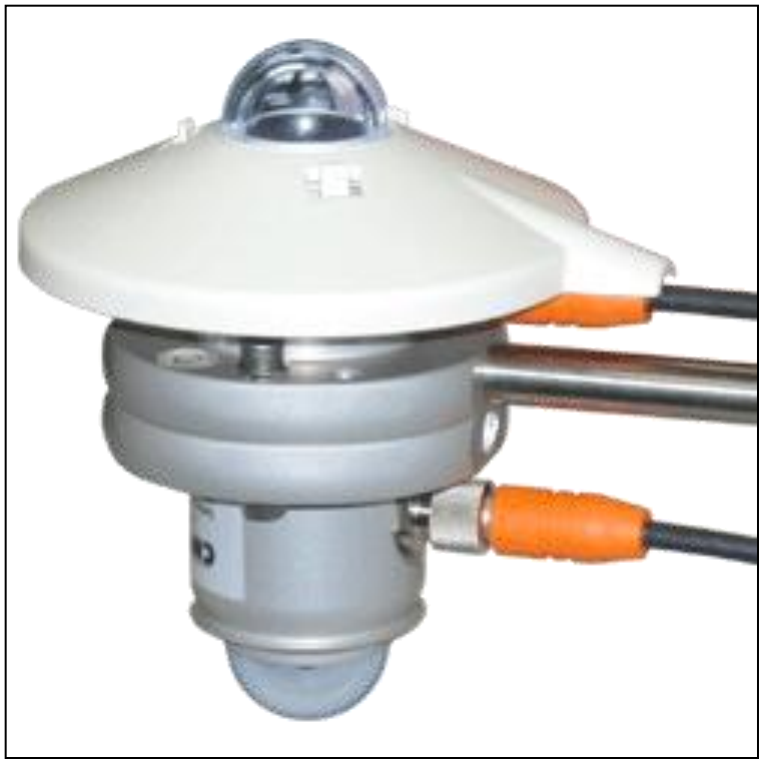
- Satellite based observations (Global coverage)



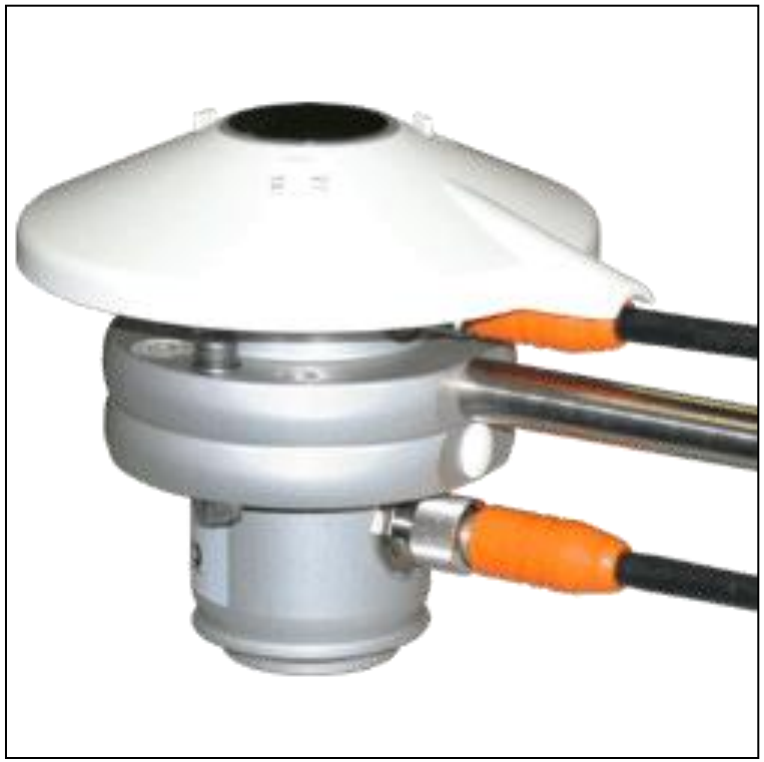
Sun shine recorder



Stevenson’s Screen Thermometer



Pyranometer – solar radiation



Pyrgeometer – infra red radiation