

# **Course: Basics of Environmental Engineering (Climatology)**

**Week 8**

**Main topic: Cloud**

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## CLOUDS

- ❖ visible masses of condensed water vapor suspended in the atmosphere

- ❖ Refer to visible aggregations of water droplets or ice crystals suspended in the atmosphere

Visible masses of condensed water vapor suspended in the atmosphere



# Cloud formation

When air rises due to increase in temperature the pressure being less it expands and cools until temperature is equalized.

- Some example of cloud formation picture





## Cloud formation

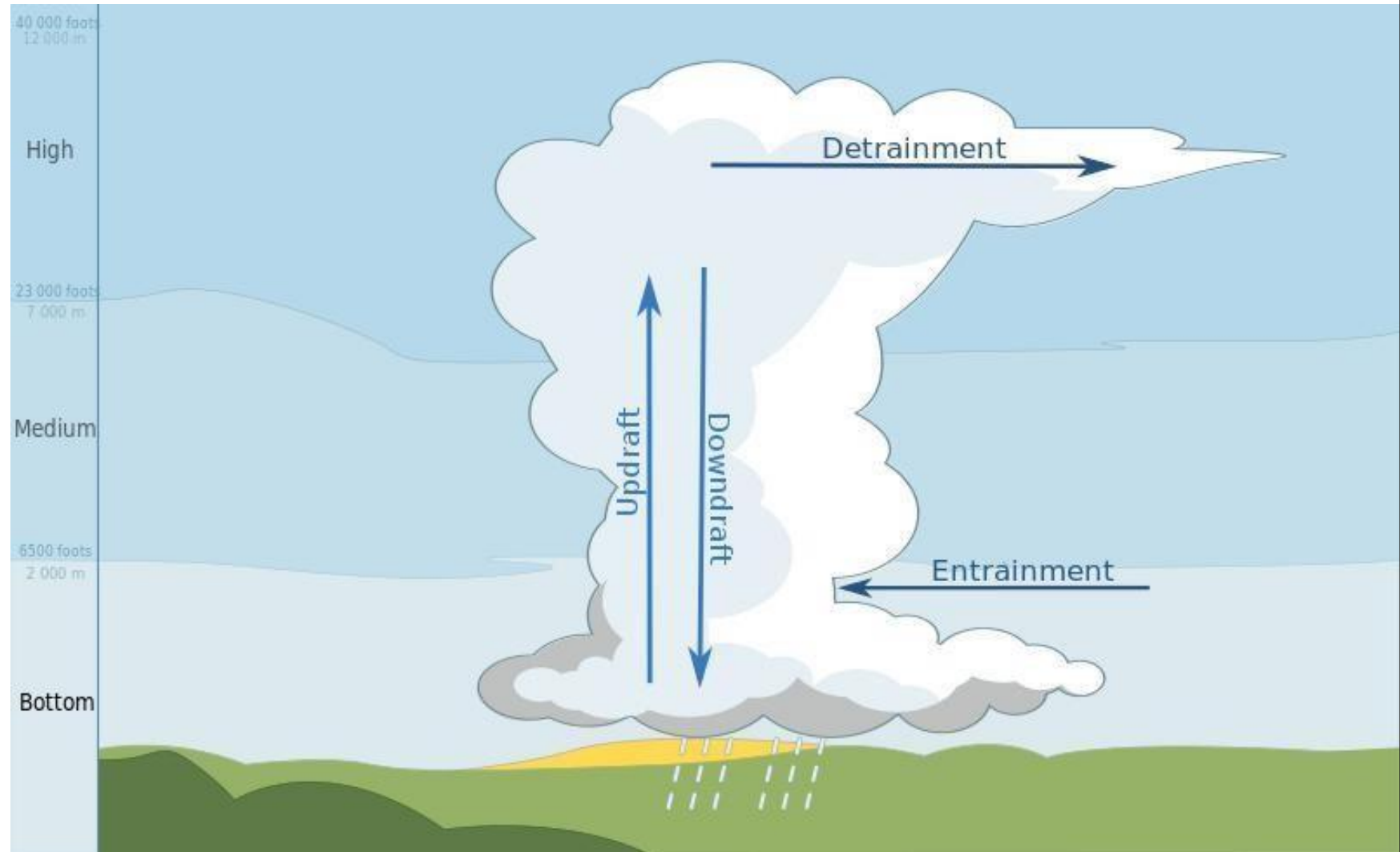
When cooling reaches the saturation point, water vapor condenses and clouds are created. There are two other circumstances under which clouds can arise.

when a cooler air current comes into contact with a warmer one.

When seawater-laden air crosses a cold surface

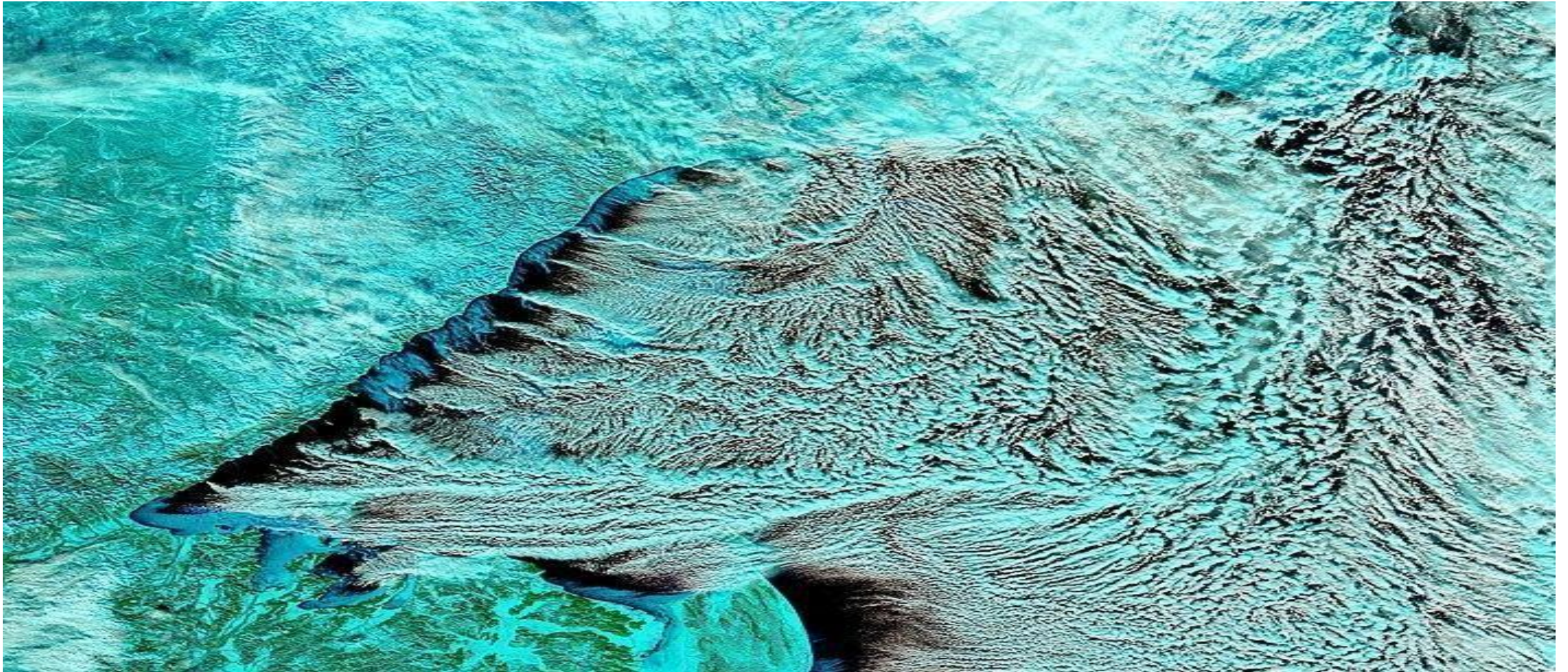


**1. When a current of warm air strikes one that is cooler.**



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## **2. When moist air from sea blows over a cold land.**



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# Types of clouds

- Cumulus Clouds
- Stratus Clouds
- Stratocumulus Clouds
- Altocumulus Clouds
- cumulonimbus clouds

- Different types of clouds can signal upcoming weather patterns.
- **Cumulus clouds** are white and signal good weather while
- **cumulonimbus clouds** indicate thunderstorms.
- **Stratus clouds** are grey and bring overcast or foggy conditions.
- **Stratocumulus clouds** are lumpy and can bring light rain or drizzle.
- **Alto cumulus clouds** have a rippled appearance and can signal atmospheric disturbances.
- each cloud type can help us prepare for upcoming weather conditions.

# Cumulus clouds



# Cumulonimbus clouds



# Clouds Stratus



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# Stratocumulus clouds



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# Alto cumulus clouds



# **Basic Types of clouds**

**Cirrus (Ci)**

**Cumulus**

**Stratus(St )**

**Nimbus**

## Cirrus (Ci)

Cirrus, which means 'curl', is distinguished by

- its veil-like fibrous or feathery structure.

This is the tallest kind of cloud,

- with an altitude of roughly 7 to 12 kilometers
- (20–35 thousand feet) in the tropics.

# **Stratus(St )**

- The word cumulus refers to a heap or spherical mass.

This cloud has a flat base and a circular top.

- It is woolly and bunchy.
- As a result of convection,
- this is visible during the summer.
- The height is dependent on the air's humidity in the atmosphere.

## **Stratus (St)**

The cloud appears to be a sheet.

This is the one that is lowest to the ground.

## **Nimbus (Nb)**

This looks dark and ragged.

Precipitation occurs from this cloud.

The prefix “Nimbus” means associated with precipitation and “Alto” means above normal height.

Combination of different primary clouds are referred with these clouds.

above-normal height, respectively.

These clouds are a combination of various fundamental clouds.

## **WMO Classification of Clouds**

- World Meteorological Organization (WMO) classified the clouds according to their height and appearance into 10 categories.
- From the height, clouds are grouped into 4 categories (family A, B, C, and D) as stated and there are sub-categories in each of these main categories.

## **Family A**

The clouds in this category are high.

The mean upper level is 12 kilometers in tropics

And sub-tropics. In this family there three sub- categories.

- 1.Cirrus
- 2.Cirrocumulus
- 3.Cirrostratus
- Family B
- The clouds in this category are middle clouds.

The mean lower level is 2.5 kilometers and the mean upper level is 7 kilometers in tropics and sub-tropics. In this family there are 2 sub- categories.

## **Family B**

These clouds fall under the intermediate cloud category.

In the tropics and sub-tropics, the mean upper level is seven kilometers,

and the mean lower level is 2.5 kilometers.

This family consists of two subcategories.

## **1-Altocumulus**

In these clouds water is present

Greyish or bluish globular masses

Looks like sheep back and also known as flock clouds or wool packed clouds

## **2-Alto-stratus**

In these clouds water and Ice are present separately.

At elevations of 6,500 to 20,000 feet, altostratus clouds occur.

They are thick, uniform, gray or blue-gray, and have the ability to block out the sun and moon.

has a grey or bluish color and resembles a fibrous veil. produces coronas and shadows

## **C Family**

There are lower clouds in this category. These clouds can reach a height of 2.5 kilometers above the ground in tropical climates.

Like lofty clouds, there are three subgroups in this family. Scattered cumulus (Sc)

Level (St)

Nimbostratus (Ns)

On sunny days, cumulus clouds, which resemble cotton clouds and are fluffy, are created by warm, humid air ascending into the sky. Towering cumulonimbus clouds, which may reach altitudes of over 50,000 feet, produce extreme meteorological phenomena like thunderstorms, lightning, and torrential rain.

- Impact of Clouds in our Environment
- Our environment is significantly impacted by clouds in the following ways

## Regulation of Climate

By absorbing heat from the sun and reflecting it back, clouds serve as a blanket to keep the earth warm and cool.

**Water Cycle:** Clouds are essential to the water cycle because they release rain or snow for plants and animals. Clouds are created when atmospheric water vapor condenses into droplets.

patterns of the weather

As weather indicators, clouds can indicate impending changes in the weather, such as thunderstorms. Weather events can be predicted and prepared for with the use of these patterns.

Agriculture: Cloud cover influences agriculture through controlling the quantity of sunlight that reaches the Earth's surface, offering shade, and impacting crop yields and plant growth.

By absorbing and eliminating pollutants through precipitation processes, air quality clouds affect the dispersion of air pollution and aid in air purification.

Cloud cover reduces sunlight availability and causes diffraction, which can be beneficial for some solar energy systems but reduces solar energy production.

## **Monsoons**

Several hypotheses exist to explain the monsoon, which gets its name from the Arabic term "Mausim," which translates to "Season."

The more practical hypothesis is the thermal one.

In India, there are two varieties of monsoons.

# Monsoons



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## **South-West monsoon(SW)**

- Between June and September, India, Nepal, Bangladesh, and Sri Lanka experience intense rainfall due to the seasonal South-West Monsoon which is essential for agriculture and water supplies

## **North- East monsoon(NE)**

- Rainfall from October to December is brought to Southeast Asia by the North-East Monsoon,
- sometimes referred to as the retreating monsoon or winter monsoon.
- This monsoon replenishes water supplies and promotes agriculture in the areas it affects.

## **Driving mechanisms of monsoon**

- 1. Differential heating of land and ocean masses causes temperature variations,  
resulting in air pressure differences.

This creates wind patterns, with land heating faster than the ocean, causing a pressure gradient and resulting in winds

2. The Coriolis effect, caused by Earth's rotation, alters wind direction, influencing the formation of rotating systems like cyclones and anticyclones.

3. Wind direction, intensity, and strength are greatly influenced by the moisture content of the air. Dry air sinks and produces high pressure areas, whereas suspended air rises and creates low pressure zones. Precipitation, weather patterns, and cloud formation are all influenced by moisture.

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