

Engineering Hydrology
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Lecture17
Forms of Precipitation

Hello all, welcome back. In the previous couple of lectures, we were talking about the water vapor dynamics and after that the amount of moisture present in the atmospheric column and different mechanism behind the formation of rainfall. Then we have seen the velocity with which the raindrop is falling onto the ground and corresponding intensity also we have seen. Some of the numerical examples related to those concepts also we have seen.

Now, let us move on to different forms of precipitation in this lecture. So, coming to different forms, usually when we talk about precipitation, everybody will be thinking of rainfall, because we all have experienced the rainfall, majority of us have experienced rainfall because in India most of the water which we are getting is from the rainfall. But in India itself we are experiencing other types of precipitations. Let us see what are the different types of or different forms of precipitation.

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Forms of Precipitation

➤ Different forms of precipitation

- Drizzle
 - ✓ Very small tiny droplets of water
 - ✓ They may not be able to measure
 - ✓ When the size becomes higher, rainfall will occur
 - ✓ Tiny liquid water droplets < 0.5 mm
 - ✓ Intensity < 1 mm/h (rate at which it is falling)
 - ✓ Settling velocity ≈ very low (floating state)

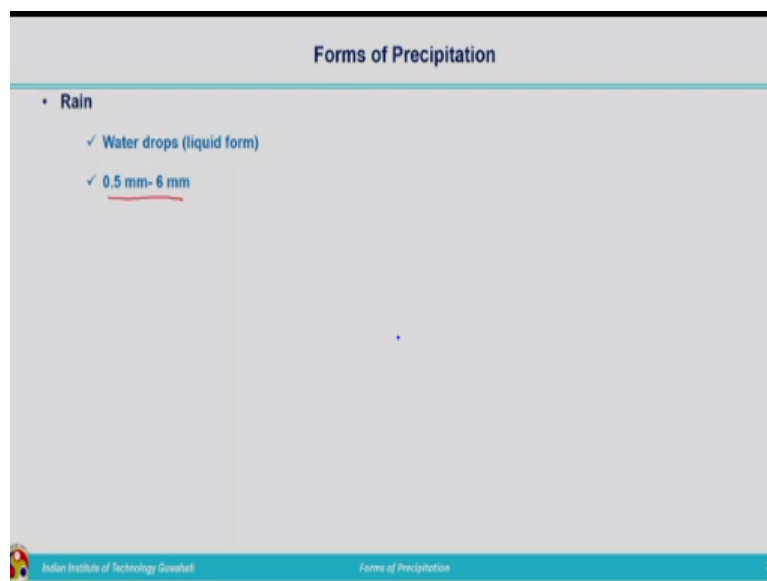
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So, the first one is drizzle. Drizzle, when it is in very small amount we will be telling, it is drizzling. So, in the similar way drizzle is very small tiny droplets of water. It is very small droplets which fall on the ground, which is in the atmosphere. That is very small tiny droplets of water which is very difficult to measure.

So, the size becomes higher when so many drizzle particles combine together. It combines together and form rainfall. So, when the size becomes higher, rainfall will be occurring. Otherwise we can experience that in the air. The size of liquid droplets will be approximately less than 0.5 mm. So, the size of these tiny droplets in the case of drizzle is less than 0.5 millimetres. That is why it is floating in air and the intensity of this drizzle will be less than 1 millimetre per hour.

So, that itself makes the measurement or the estimation of the quantity very difficult. So, rate with which it is falling is less than 1 millimetre per hour. And the settling velocity, settling velocity is nothing but the fall velocity or the terminal velocity which we have seen in the previous lecture. So, settling velocity is also very low that is why it will be in a floating stage in the air. So, that is about drizzle. Just understand that it is the very small tiny droplets of water.

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Now, second type is rain. Rainfall we know, we are experiencing that. In this case the drops are in the liquid form. So, water drops will be having around a diameter of 0.5 mm to 6 mm. 6 mm is the upper level. So, up to 0.5 mm we are classifying it as Drizzle, if the size is between 0.5 mm to 6 mm, we will be classifying it as rain.

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Forms of Precipitation

- Frost
 - ✓ When the temperature of the air near the earth's surface is below freezing
 - ✓ The liquid precipitation freezes when it comes in contact with the ground (ice thus formed is also known as glaze)
 - ✓ Specific Gravity of ice formed - 0.8-0.9
- Glaze
 - ✓ Ice coating formed on the exposed ground surface/objects
 - ✓ Ground is at cold state (0°C)
 - ✓ Rain or drizzle comes in contact with the ground

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Now, next one is Frost. From the name itself we are getting some idea what is meant by Frost. Frost is occurring when the temperature of the air near the earth's surface is below freezing. Sometimes near the ground surface the temperature will be very low. So that time what will happen, the precipitation which is falling on the ground will be freezing because of the lower temperature or the temperature closely near to the freezing temperature, the water droplets which are falling onto the ground will be freezing when it comes in contact with the ground.

So, what will happen? Those droplets will be converted to ice. Thus ice which is formed due to this process is termed as glaze. So, frost will be occurring when the ground surface is at a freezing temperature.

The specific gravity of ice thus formed is around 0.8 to 0.9. That is glaze in detail let us see, that is the ice coating formed on the exposed ground surface or exposed objects. When we go out, we are having so many objects outside and also exposed ground surface is there, the temperature near to the ground is approximately 0 degree Celsius or near to these exposed objects. So, when the rainfall or water droplets fall on these ground surface or these exposed objects, which is at 0 degree Celsius, it will be converting to solid phase. So, rain or drizzle when comes in contact with the ground surface or these objects which are at very low temperature will be converted to ice, that ice formation is termed as glaze. So, Frost and glaze are almost same thing.

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The slide is titled "Forms of Precipitation" and lists three types of precipitation with their characteristics:

- **Mist**
 - ✓ Small droplets suspended in air
- **Fog**
 - ✓ Mist with visibility of less than 1 km
- **Dew**
 - ✓ Condensation of water vapor on a surface whose temperature is below dew point temperature of the surrounding air

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Now, next one is mist. Mist is a small droplet suspended in air and coming to fog, fog is same as mist, mist with visibility less than 1 kilometre. Sometimes, during the foggy days or when there is a lot of mist, when we drive, we won't be able to see a longer distance, we won't be able to move ahead. So, if the visibility is less than 1 kilometre, then we will be calling it as fog. So, mist and fog can be considered to be the same.

Now, coming to dew. Dew, you might have experienced on the grass and the leaves near to the ground surface, small tiny droplets on the grass. So, condensation of water vapor on a surface whose temperature is below dewpoint temperature of the surrounding air. Ground surface temperature is less than or below the dew point temperature, what will happen? These water vapor will be converted to liquid. So, condensation of water vapor will be taking place thus forming small water droplets that is what is dew, on leaves and grass we can see this phenomenon.

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The slide is titled "Forms of Precipitation" and lists the following characteristics of snow:

- ✓ Solid form of precipitation
- ✓ Occurs at high altitudes
- ✓ Density 0.06-0.15 g/cm³
- ✓ It can be of two different types
 - Similar to cotton- it just floats
 - Similar to sand particles
 - Himalayan Regions

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Now coming to snow, snow is the solid form of precipitation. Certain parts of India, especially Himalayan region is experiencing snowfall, not all over India. So, this is the solid form of precipitation. So, it occurs at high altitudes, snowfall is occurring at higher altitudes. Density of snow is around 0.06 to 0.15 grams per centimetre cube. So, when we hear the name snow some visual idea we are getting.

So, it can be of two different types, similar to cotton, cotton type texture we feel when we see them. So, similar to cotton and it just floats in the air, it will be floating in the air. And the second one is like sand particles. So, the second one which is of the kind of sand particles, it will be accumulating. So, these are seen in the Himalayan regions.

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The slide is titled "Forms of Precipitation" and is divided into two sections: Sleet and Hail. Each section contains a list of characteristics.

- Sleet**
 - ✓ Consists of transparent, globular solid grains of ice
 - ✓ formed by the freezing of rain drops falling through a layer of sub-freezing air
 - ✓ Occurs near the earth's surface in the air
 - ✓ Very harmful because of the ice coating on the ground
- Hail**
 - ✓ Most dangerous form of precipitation
 - ✓ In the form of lumps of ice balls of various shapes and sizes
 - ✓ Generally > 8 mm
 - ✓ Very harmful form of precipitation

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And then coming to the next type of precipitation, that is termed as sleet. Sleet consists of transparent globular solid grains of ice. So again, it is a kind of solid form of precipitation. It is a globular solid grain. Transparent means within the raindrops, ice drops, within that air will be entrapped. It is formed by the freezing of raindrops falling through a layer of sub-freezing air.

So, raindrop is falling, falling down. As it passes through an air mass which is at a sub-freezing air. So, that time what will happen these raindrops will be entrapped with air and it will be converted to solid form. It occurs near the Earth's surface. That is it is in the formation which is happening in the air only, but it happens very close to the ground surface. These ice coatings on the ground are very harmful.

Now, next one is hail. This is a very dangerous form of precipitation. So, the most dangerous form of precipitation out of all, which we have seen now, and in this, it will be in the forms of ice or ice balls of various shapes and sizes. When it falls on the ground, ice blocks having different sizes will be falling on the ground.

Generally, it is of greater than 8 mm. We have seen if it is up to 6 millimetres, we'll be classifying it as rain. So, the size of these ice balls will be greater than, that is the rainfall is in the liquid form, this is in the solid form. The size of these blocks or solid ice crystals or ice balls are greater than approximately 8 millimetre and beyond that. So, you can imagine the size of the solid which is falling on the ground, and it is really a dangerous form of precipitation. So, it is a very harmful form of precipitation.

So, these are the different forms of precipitation; drizzle, rain, hail, sleet, mist, dew but majority of the precipitation which we are experiencing is in the form of rainfall. So, we need to understand the properties of rainfall in details, we need to have an idea or estimation of rainfall and we need to have an idea about how this can be measured, because that is very important. Based on the available rainfall, we will be quantifying how much water is falling onto the ground.

So, in the next lecture, we will see in detail about rainfall. Precipitation in general consists of all these forms of precipitation, but in detail we will be studying rainfall only, the measurement, estimation, all those related to rainfall. Other forms, even though we are experiencing all these in India, at different parts of India, we are getting majority parts of water due to rainfall only. So, we need to have a deeper idea about rainfall that we will see in the next lecture. So, these parts I have taken from the textbook of Subramanya Engineering Hydrology and Ven T Chow and others Applied Hydrology. So, here I am stopping today's lecture. Thank you.