Condensation and associated process

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Condensation is simply the change of water vapour into Liquid State Condensation is the reverse process of evaporation.

The temperature at which condensation takes place is called dewpoint. The dew point can be any point with respect to moisture content of the air. when dew point is below 0°c it is referred to as frost point temperature

Condensation occurs through two processes adiabatic and diabatic process.

⊙ Diabatic processes -

A process that involves the exchange of heat with the surroundings. In diabatic processes the dew point can be reached by -

i) Loss of heat by radiation called radiation Cooling
ii) Contact with cold surface (conduction) called contact cooling
iii) The movement of air across a cold surface (advection) called advection cooling.

⊙ Adiabatic processes! -

The change of temperature in a gas which experiences compression (leading to heating) and expansion (leading to cooling) without any exchange of heat does not enter or leave the system.

Condensation forms due to diabatic cooling (Ground forms)! -

Most forms of condensation in the atmosphere result from the air being cooled in some way or the other Condensation near the ground level results from contact cooling, advection cooling and radiation cooling. A number of weather phenomena result from condensation occurring at ground level.

• Dew :-

Dew is the moisture deposited in the form of water droplets on the surface of vegetation and other objects located near the ground Level

It forms when nocturnal terrestrial radiation causes heat loss from the Earth's surface thereby cooling the lowest layer of the atmosphere below dew point leading to condensation

Dew forms under some favourable conditions such as calm air, low wind speed, high relative humidity near the surface and clear sky heat loss from for its cooling

• Frost :-

When the temperature falls below freezing point, frost forms. If the cooling is not too severe only the ground and the air immediately in contact with it will reach 0°c and this causes ground frost

• Air frost :-

An air frost occurs when the temperature of a whole layer of air near the ground also falls below freezing point

• Hear Frost :-

A silvery-white deposit of ice crystals formed on surfaces cooled below freezing point by radiation. It may result from the freezing of dew or by the direct Sublimination of ice crystals from water vapour in the atmosphere when temperatures are less than 0°c

• Rime :-

Rime is a deposit of white opaque ice crystals formed by the freezing of supercooled water droplets on to the surfaces having temperature below 0°c

It grows on the windward side of the surface especially, on sharp edges by impaction of the droplets drift past in the wind

① Haze :—

i. Caused by smoke and dust particles.
ii. Low humidity, Less than 75%.
iii. Visibility is Less than 2 km.

② Mist :—

i. Occurs in wet air, relative humidity is over 75%.
ii. Visibility is between 1-2 km.
iii. Forms cloud at ground level

③ Fog :—

i. A mist becomes a fog when the visibility is reduced to below one kilometre.
ii. Occurs in the lower strata of atmosphere as a sort of dense ground cloud
iii. Fogs are formed due to different causes and so, there are different types of fog one produced by cooling and the other by evaporation

① Fog produced by cooling :—

1. Radiation fog :—

Radiation fog occurs under conditions of clear night skies, Light winds humid air mass near the ground and dry air above. Under these circumstances, the ground cools Once the ground has become sufficiently cooler than the moist air immediately above it, the moist layer absorbs less radiation than it emits and cools. Ultimately, it becomes ~~stand st~~ saturated and produces fog

2. Advection fog :—

Advection fog results from the horizontal motion of the air over a colder surface, either land or sea. When a horizontally moving warm air blows over a cool surface, it cools below its dew point. Advection fog also occurs along the mixing of cold.

and warm ocean currents, eg. Newfoundland coast where warm Gulf-Stream and cool labrador current meet. Japanese coast where Oyashio and kuroshio meet. off the peruvian coast and along western coast of Africa.

ii. Warm air blows over a cold ocean current, leading to fog formation also called Sea fog

iii One form of advection fog is valley fog. In this case, the air that has cooled (and thus became denser) during the night drains into a vally from surrounding hill sides. Condensation then takes place, and the valley fills with fog.

3 Upslope fog :—

Upslope fogs form when the air near the ground is cool enough so that it will not rise and it is moist enough so that when it moves upward upslope it can cool to the due point. As the air starts moving upslope along hillsides or mountain slopes, it undergoes cooling and eventually reaches saturation. Any further ascent of the saturated air produces fog called upslope fog

② Fog formed by evaporation :—

1 Frontal fog :—

Frontal fog, formed by evaporation, forms after it has been raining for hours. During that time the falling raindrops evaporate into the air beneath the clouds until the air is moistened to saturation. As the rain drops, through the air they evaporate and fill the air with water vapour. The warm drops fill the cooler air with more vapour than it can hold producing fog.

They are formed by convergence of two contrasting air masses (warm and cold air masses) along a line. Such fogs are formed in temperate regions.

2. Steam fog :—

Steam fog also called arctic sea smoke, and is very much similar to the steam that is produced by breathing out on a very cold day. It is formed over only water bodies or wet surface, which are very cold in relation to the wind

The ground forms of condensation such as dew, mist and fog, all result because of diabatic cooling. The most effective cause of condensation, however, is the dynamic process of adiabatic cooling.

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