Advection and Radiation Fog

Definition

The term "fog" is typically distinguished from the more generic term "cloud" in that fog is low-lying and touching the ground. The moisture in the fog is often generated locally (such as from a nearby body of water in our case the Pacific ocean).

By definition, fog reduces visibility to less than 1 Nautical Mile, where as mist causes lesser impairment of visibility.

Fog forms when the difference between air temperature and dew point is less than 2.5 °C (4.5 °F). Dew Point is defined as the point to which air must be cooled to become saturated with water vapour.

Water vapour typically begins to condense on condensation nuclei like dust, ice, and salt in order to form clouds. Fog, like its higher cousin (cumulo) stratus, is a stable cloud deck which tends to form when a cool, stable air mass is trapped underneath a warm air mass.

Fog normally occurs at a relative humidity close to 100%. This happens due to increased moisture in the air, or falling ambient air temperature. Fog can form at lower humidity, and can sometimes fail to form with relative humidity at 100%. At 100% relative humidity, the air cannot hold additional moisture, therefore, the air becomes supersaturated when additional moisture is added.

Fog often creates light precipitation or drizzle. Drizzle occurs when the humidity of fog reaches 100%. This may happen when fog layer is lifted and cooled or when descending air presses it from above.

There are many types of Fog but in the Pacific Northwest the dominant fog is Advection and then Radiation. Other types of Fog are Precipitation Fog, Steam Fog, Upslope Fog, Valley Fog, Freezing Fog and Ice Fog. In our region of the Pacific Northwest we predominantly see **Radiation** and **Advection Fog**.

What is needed to form fog?

For fog to form there is a need for a very light wind. This makes sure that cool surface air will mix with the layers above and the layer within which water drops are present so that fog will form. If there is too much wind fog will not form but low stratus clouds are likely to develop.

Thus we need the following conditions for fog to form: a clear sky, very light winds, relatively high humidity and a stable atmosphere. These conditions are found in autumn and beginning of winter when the surface is already starting to cool and warm moist air may still be present. In spring, the same can happen when warm moist air moves in over a cold surface, low stratus and fog are very common.

In Pacific Rim National Park we often call August, “Fogust” because the cool moist air from the ocean meets the warm air from the land and forms a long coastal range of fog that is not easily burned off and only moves out with higher wind. The sea breeze is limited due to the land not heating quicker and bringing in a mid day wind. When the wind is light it keeps the conditions perfect for Advection Fog. The fog bank often stays on the boundary between the land and the ocean and will often move out to sea and then back again throughout the day and into the early evening.

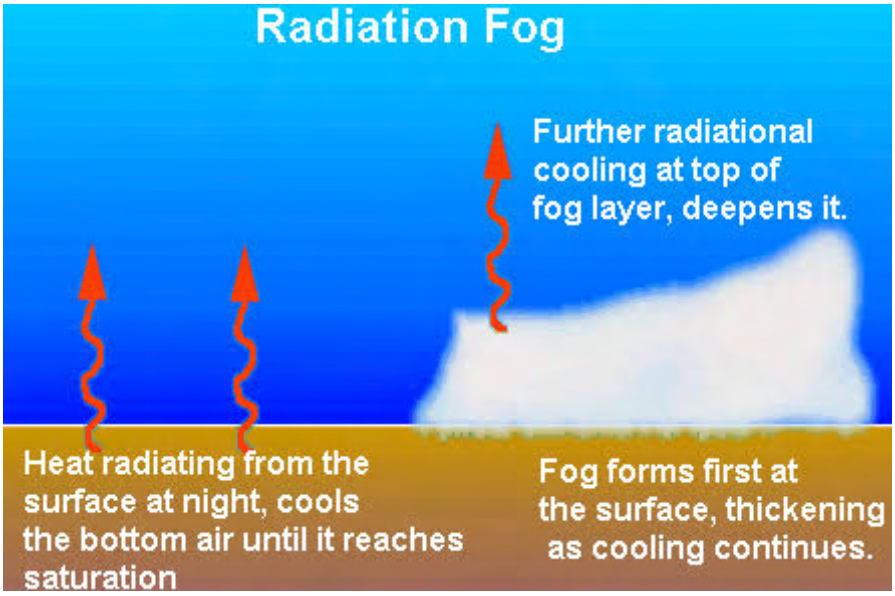
Advection fog occurs when moist air passes over a cool surface by advection and is cooled. It is most common at sea when moist air encounters cooler waters, including areas of cold water such as along the Pacific coast. A strong temperature difference over water or bare ground can also cause advection fog. Definition of Advection is “The transfer of a property of the atmosphere such as heat, cold or humidity, by the horizontal movement of air.

Strong winds often mix the air and can disperse and prevent advection fog. Advection fog along the Pacific Northwest coastline is propelled onto land by one of several processes. A cold front can push the marine layer coastward, which is most typical in the spring or late fall. During the summer months, a low-pressure trough produced by intense heating inland creates a strong pressure gradient, drawing in the dense marine layer.

After sunrise, the sun will start to heat up the friction layer at the top of the fog bank and this will start to mix the air even more and droplets at the top of the bank will begin to evaporate (demanding more latent heat) so that it will intensify in the first hour or so. After some time and when the heat of the sun has a chance to warm up the Earth, the fog bank will detach and will start to lift off in a few places and low stratus and or stratocumulus clouds are formed. In absence of sunshine (with a high altitude cloud layer) this fog persist throughout the day or until higher winds help with the mixing.

Fisherman about to get engulfed by Advection Fog.

Radiation fog is formed by the cooling of land after sunset by infrared thermal radiation, in calm conditions with a clear sky. The cooling ground then cools adjacent air by conduction, causing the air temperature to fall and reach the dew point, forming fog. In perfect calm, the fog layer can be less than a meter thick, but turbulence can promote a thicker layer. Radiation fog occurs at night, and usually does not last long after sunrise, but it can persist all day in the winter months, especially in areas bounded by high ground. Radiation fog is most common in autumn and early winter.



Advection Fog/Radiation Fog Comparisons

Characteristics

Characteristics	Advection Fog	Radiation Fog
Duration	Can last for several days	Generally short duration (< 24 hrs), often dissipating by afternoon
Intensity	Can range from thin to dense, but dense conditions may cover large area. Changes in intensity tend to be more gradual than with radiation events.	Varies with denser fog likely over open areas or near water bodies
Coverage	May be advected over large areas and across great distances	Typically remains in one place, patchy and localized
Depth	Varies with the boundary layer but tends to be deeper than radiation fog.	Varies with the depth of the radiation inversion. Can be as deep as advection fogs, but tends to be shallower as it is formed more by local factors
Time of day	Can form and advection fog into a region almost any time of day. Some tendency to develop in late afternoon or evening hours over coastal areas.	Tends to form late at night or in early morning hours. Can also form following precipitation that clears near or after sunset.