

Super Fog and Fires



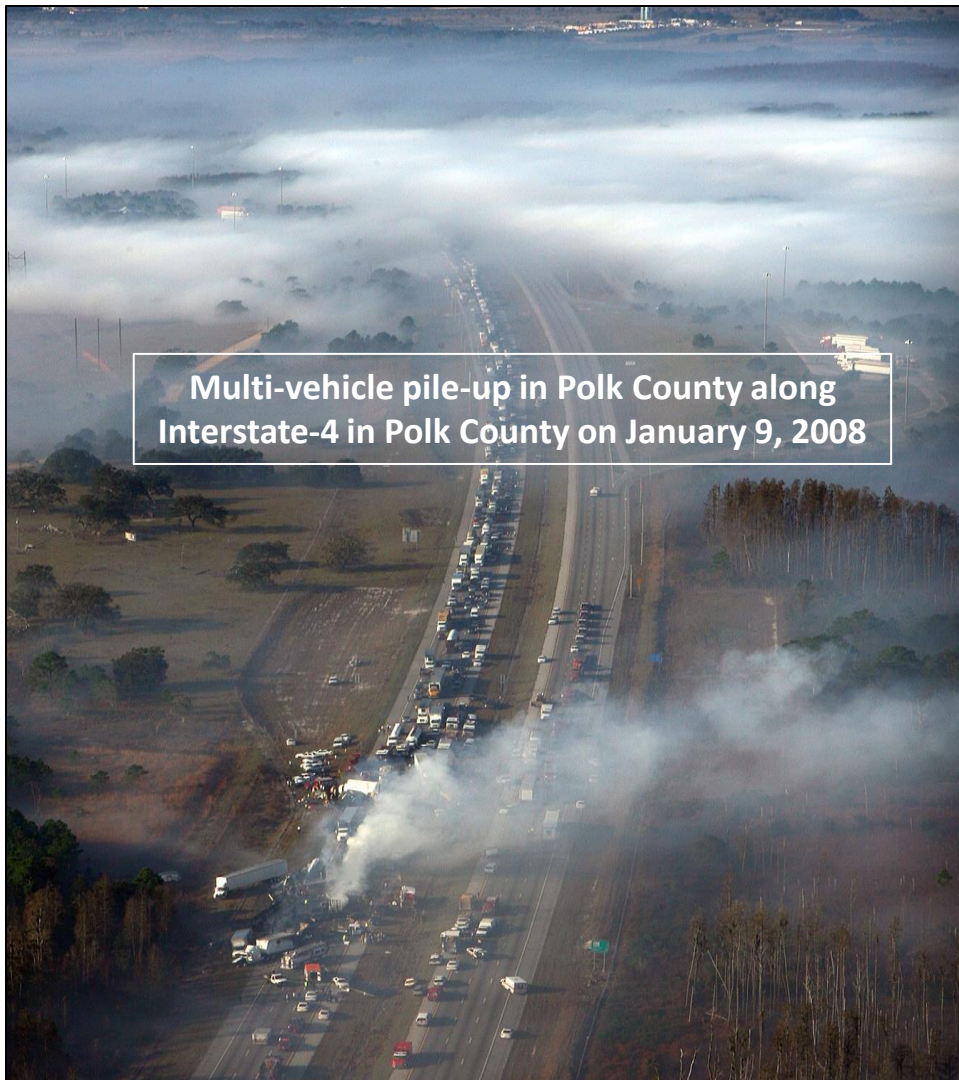
Tuesday, February 2, 2021

Presented by: Tony Hurt

What is super fog?



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Multi-vehicle pile-up in Polk County along Interstate-4 in Polk County on January 9, 2008

Image credit: Orlando Sentinel, Copyright 2008

- Super fog is described as a mixture of smoke, moisture from smoldering organic material, and fog lowering visibility below three meters (Achteemeier, 2003).
- Super fog is so dense in some cases that you would not be able to see your own hand in front of your face.
- **Super fog creates very hazardous driving conditions.**

How clouds form



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A quick reminder on how clouds form will help in understanding super fog

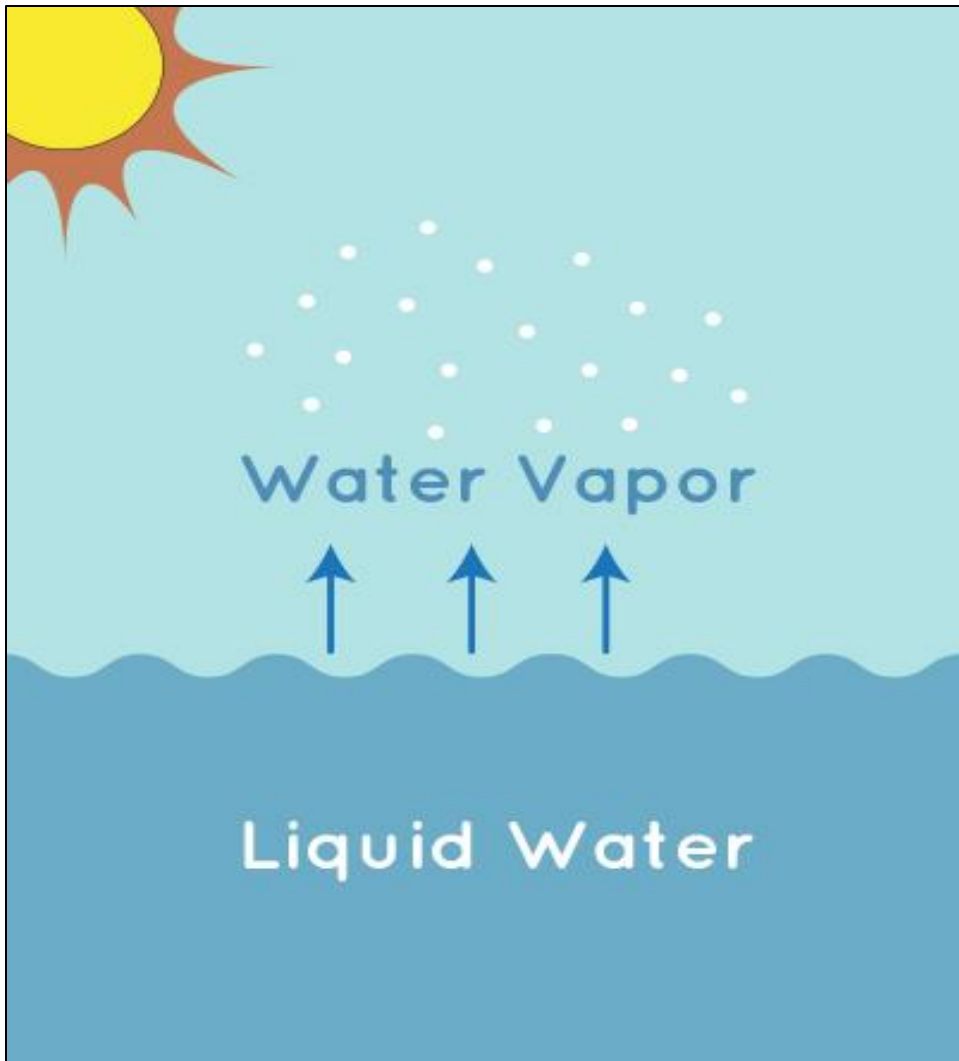


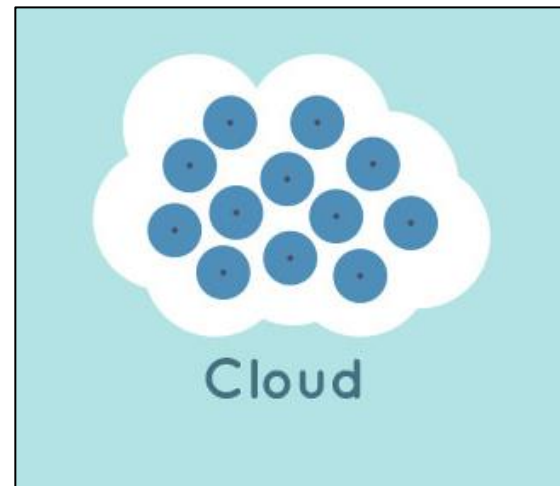
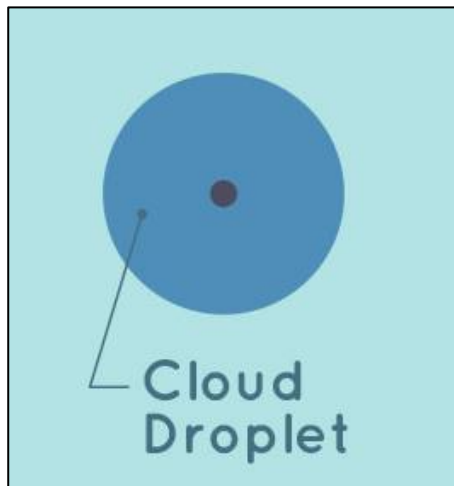
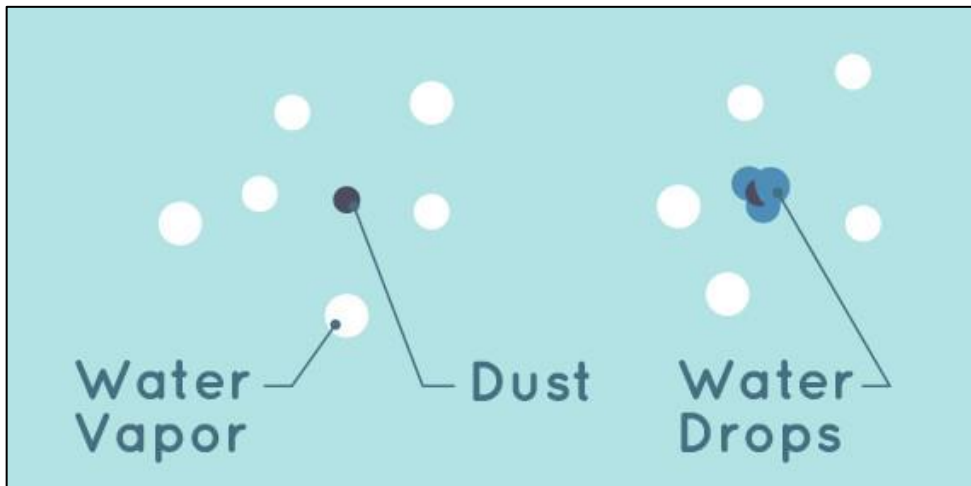
Image credit: NASA/JPL-Caltech/Alex Novati

- Heat causes some of the liquid water – from places like oceans, lakes and rivers – to change into an invisible gas called water vapor.
- This also applies to humid air over land.
- This process is called evaporation and it's the start of how clouds are formed.

How clouds form



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1. Dust, ash, or other particles floating in the air provide surfaces for water vapor to turn into water drops or ice crystals.
2. The tiny drops of water condense on the particles to form cloud droplets.
3. Clouds are made up of a bunch of cloud droplets bundled together with raindrops

Image credit: NASA/JPL-Caltech/Alex Novati

Clouds and fog... Is there a difference?



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Image credit: NASA/Ben Smegelsky

- Typically we think of clouds as being elevated up in the sky
- However, when conditions are right, a cloud can form at ground level, too. Then it's called "fog."
- If you've ever walked through fog, you've walked through a cloud.

How fires affect cloud/fog formation



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Image credit: NASA

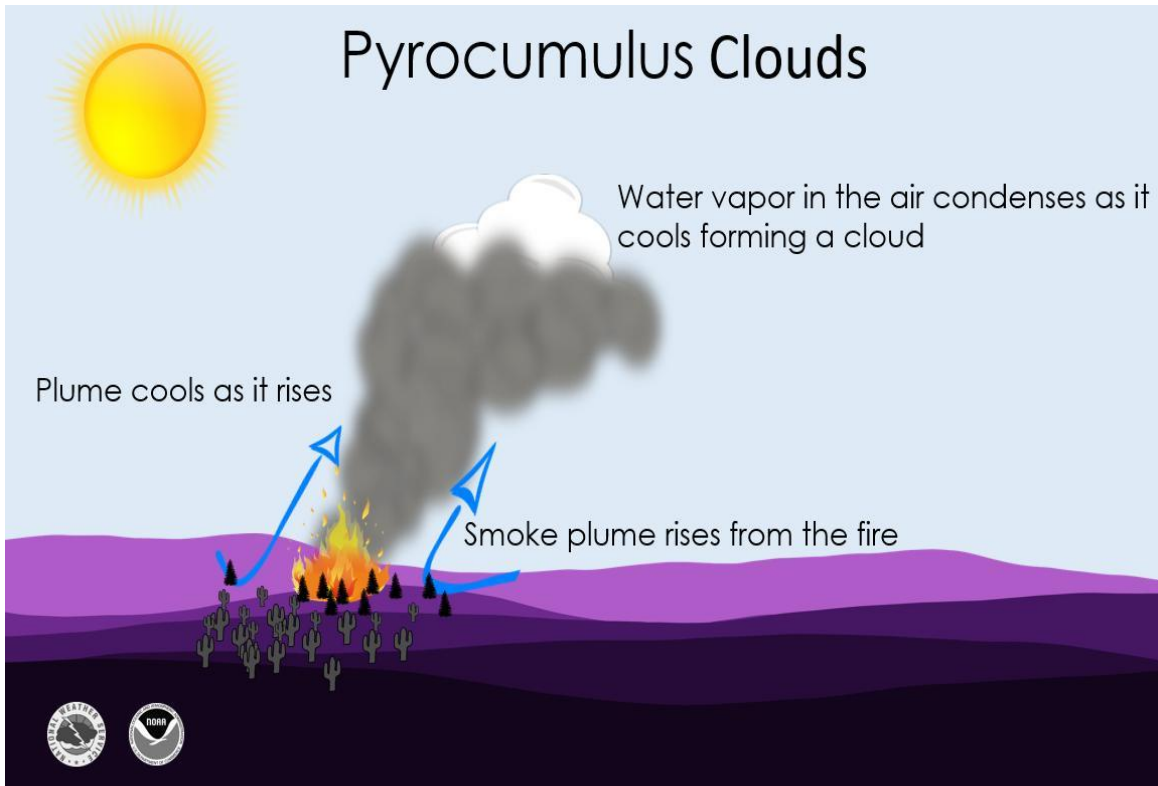
- As mentioned earlier, air holds lots of tiny particles such as dust and pollen.
- Air also carries particles such as ash, soot, and smoke, which occur with fires.
- These particles increase the number of particles in the air that allow water vapor to form clouds and fog.

Atmospheric stability implications



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Unstable atmosphere (\uparrow) vs Stable atmosphere (\downarrow): Which is conducive for Super Fog?



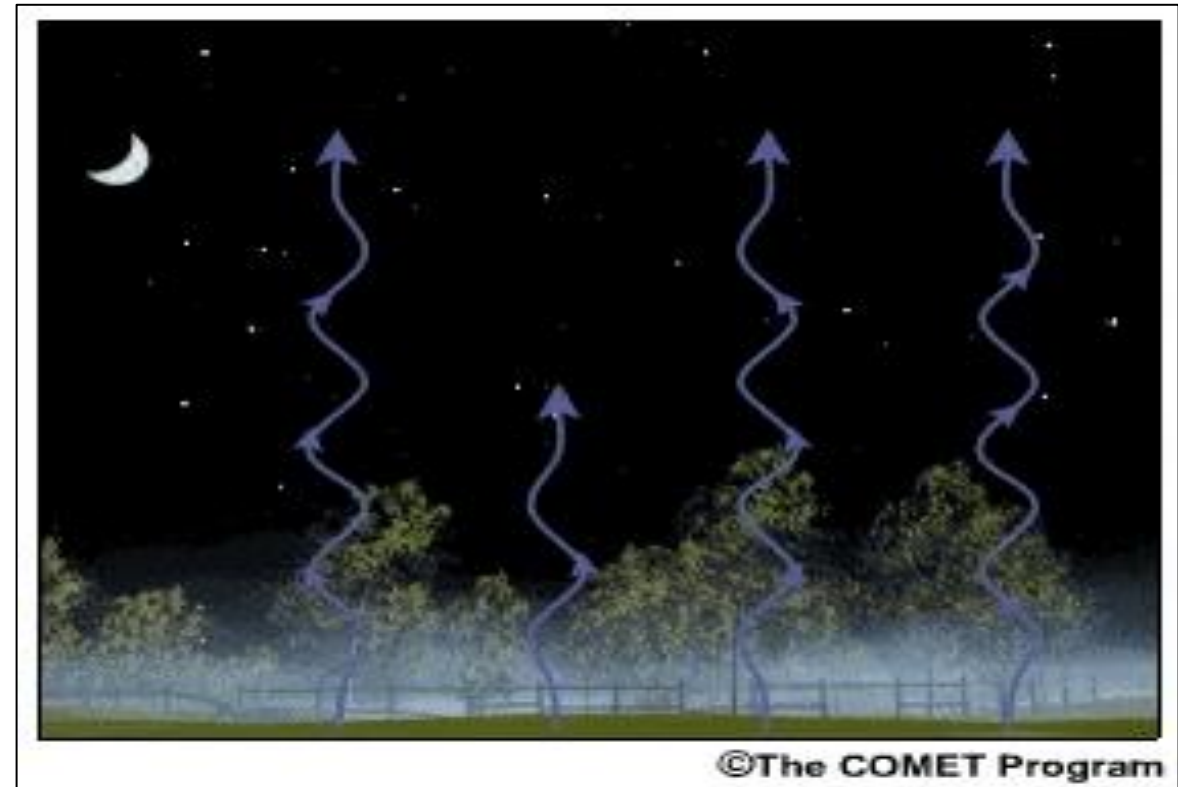
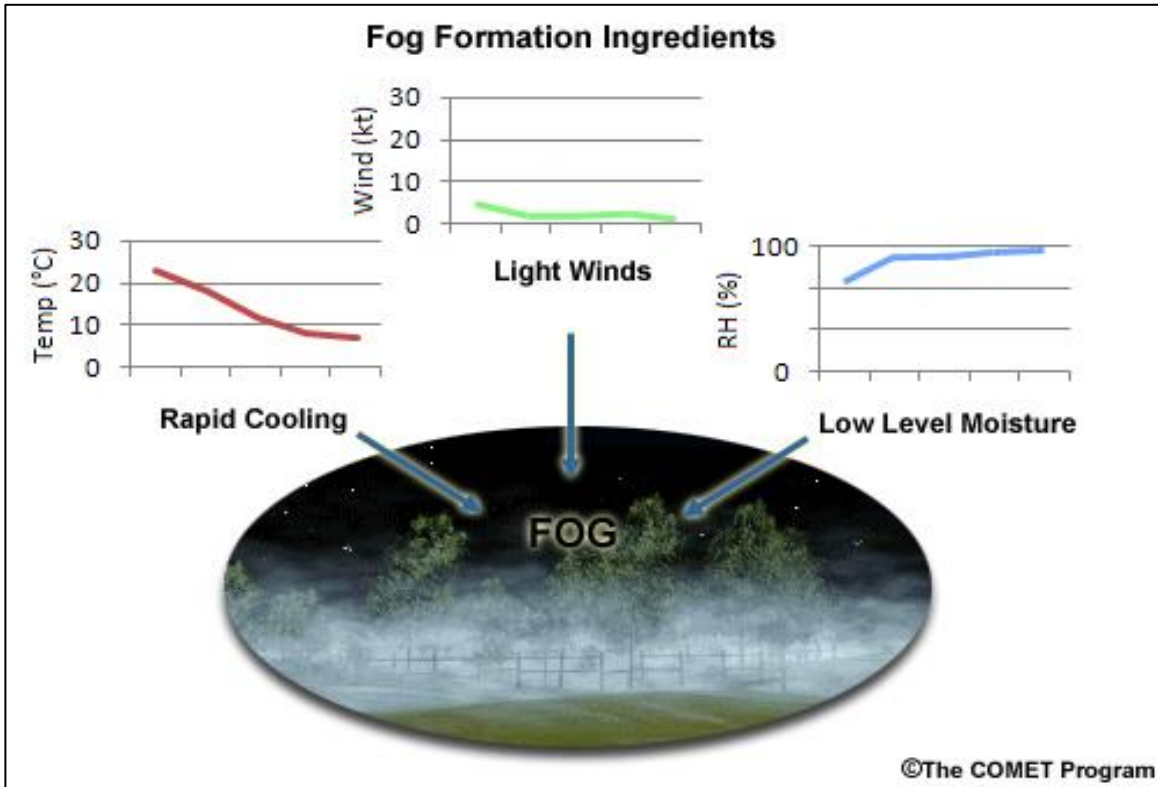
- An **unstable** atmosphere allows smoke/ash particles to rise vertically into the sky
 - Pyrocumulus clouds often form from heat/smoke originating from a fire
- Since the particles rise away from the ground, **super fog is not favored**
 - However, thunderstorms with increased lightning threat often exist

Atmospheric stability implications



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Unstable atmosphere (\uparrow) vs Stable atmosphere (\downarrow): Which is conducive for Super Fog?



- A **stable** atmosphere prevents smoke/ash particles from rising vertically
 - Heat rises from the surface, forming a stable warm layer just above cooler surface air
 - Stable layer traps particles below it near the surface in cooler air, enhancing fog potential
- Since the particles remain near the ground, **super fog is favored**

Super Fog formation



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Reduces visibility to less than 10 feet

- As smoldering burns downward into increasingly wetter fuels, large amounts of water vapor are boiled off at high temperature.
- Upon reaching the surface, the hot, moist air cools rapidly, allowing the relative humidity to quickly go to 100% and the moisture to flash into a dense super fog.
- The super fog will persist if the surrounding air is already moist.

A tragic Florida example

Polk County, FL - Morning of January 9, 2008



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- Multi-car pile-up occurred in Polk County along Interstate 4 during the morning of January 9, 2008.
- 70 vehicles involved, resulting in five fatalities and 38 injuries.
- Prescribed burn from the previous day contributed to dangerous conditions leading to the pile-up.

Smoke combined with cool/stable night air to form super fog

A tragic Florida example

Polk County, FL - Morning of January 9, 2008



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Footage from above I-4 detailing extent of pileup and fog

Other smoke/fog accidents in Florida (Orlando Sentinel)

- March 8, 2000 -- Three killed, 21 injured during 22-vehicle crash on Interstate 10 near Wellborn (east of Tallahassee).
- June 2, 2000 -- One killed, 12 injured during 14-vehicle pileup on Interstate 95 in Brevard County near State Road 520
- May 28, 2001 -- One killed, 14 injured in 20-vehicle pileup on Interstate 4 in Polk County near Haines City.
- May 7, 2006 -- Two killed and two injured during five-vehicle crash on Interstate 95 in Brevard County near Port St. John.
- March 13, 2007 -- Five people killed, three injured during 11-vehicle pileup on Florida's Turnpike in Osceola County near Kenansville.

In Summary...



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- Super fog is **most common with cool/stable conditions and light winds**; typically with high pressure over area
- Super fog **severely restricts visibility**, generally less than 3 meters (10 feet).
- Super fog **creates very hazardous driving conditions**.

Questions? Comments?



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