



Introduction

- Clouds are formed when warm air rises is cooled as it rises to cooler parts of the atmosphere.
- There are three types of clouds. Stratus (ceiling like clouds), Cumulous (Large puffy clouds) and Cirrus (wispy)
- Cloud droplets form when moisture collects on aerosol particles called condensation nuclei (dust, sea salt, Sulfur Oxides). Rain droplets are formed when cloud droplets become dense enough that gravity pulls them towards the ground.

Aerosol Cloud Droplet Rain Droplet

Introduction cont...

- Aerosols are created by forest and grassland fires, volcanoes, and industrial wastes.
- Global Dimming hypothesizes that increased amounts of aerosols will result in less sunlight and less rain.
- Two major experiments have tested the Global Dimming Theory. Gerald Stanhill and Shabtai Cohen (2001) produced data sets showing decreased sunlight. A Colorado experiment (Current) has observed that storms passing over metropolitan areas produced far less rain and snow than less polluted systems.
- Global Dimming could have a balancing effect on Global Warming by reducing the amount of radiation in our atmosphere.

Hypothesis

- Increased pollution will increase the density of the cloud resulting in less sunlight breaching through the cloud.
- Increased pollution will result in less downward moving cloud particles (rain).

Methods


To construct a cloud chamber I am building a contraption which models the cooling of warm air particles. Using pure Isopropyl alcohol (99%) and dry ice, I can create cloud particles. To ensure that these particles remain contained I have constructed a contraption which holds the alcohol at the top of a clear plastic box, and a sheet of metal which is cooled by dry ice which sits underneath. (Shown below)

Methods Continued

The clouds are created by heating alcohol particles at the top of the contraption, which then fall and are super-cooled by the dry ice.

- The first two trials had no pollution present.
- The next two trials had aerosol pollution (Secret Deodorant) present. The first trial I used 3 sprays and the second trial I used 6 spray.
- The final trial I tested was blowing cigarette smoke into the chamber.

I filmed each of my trials to be able to analyze the precipitation rates of the cloud particles in each trial or speed at which a particle falls and the density of the clouds which were created. In addition I used observatory data to make conclusions about the clouds density and the amount of light that could get through each cloud.




I filmed each of my trials to be able to analyze the precipitation rate of the cloud particles in each trial (or the speed at which a particle falls) and the density of the clouds which were created.

In addition I used observatory data to make conclusions about the clouds density and the amount of light that could get through each cloud.




QuickTime™ and a YUV420 codec decompressor are needed to see this picture.

Trial 1: No pollutants




QuickTime™ and a YUV420 codec decompressor are needed to see this picture.

Trial 2: 3 Sprays of Aerosol




QuickTime™ and a YUV420 codec decompressor are needed to see this picture.

Trial 3: 6 sprays of Aerosol



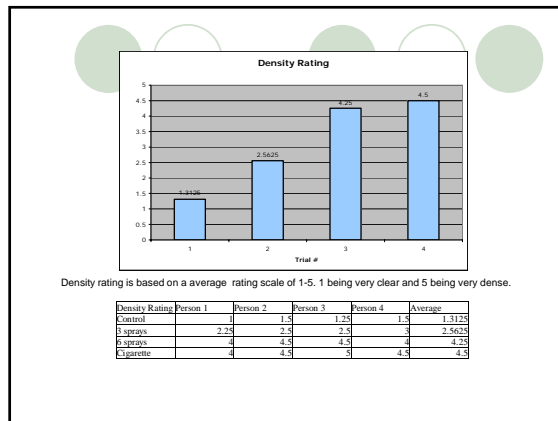
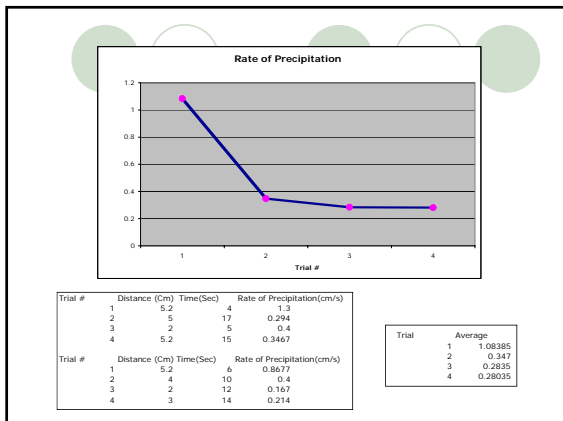
QuickTime™ and a YUV420 codec decompressor are needed to see this picture.

Trial 4: Cigarette Smoke



OBSERVATORY DATA

1. The first two trials resulted in very disperse cloud particles that were very active. The cloud particles fell straight down towards the bottom very quickly.
2. The first aerosol trial created more misty, dense clouds than without pollution. The particles movement was a suspended rotation in the air, but the downward movement was very slight.
3. The second aerosol trial created denser particles than either of the two previous trials. I observed less rotation and an almost complete suspension of the particles in the air.
4. The final trial resulted in the most dense clouds. The particles actually moved slightly upwards and appeared to be moving away from the ground. Along the surface it appeared hazy, and often times I witnessed "plumes" of clouds.



Conclusions

- Excessive amounts of condensation nuclei (aerosol particles) caused each cloud to be more dense, visible and the particles more suspended. From my study I can conclude that pollution decreases the rate of precipitation and causes more dense clouds.
- Decreased rates of precipitation could mean that if our environment continues to be polluted by our factories, automobiles, accessories and natural sources, our climate may shift dramatically. More clouded areas of the world could become drier, changing the weather patterns worldwide.
- According to my study, the changes would include less rain and much thicker clouds that remain aloft for longer periods of time.

Future Studies

- In future studies I believe that the tests that I conducted in my contraption, need to be done on a larger scale.
- Studies like the current one in Colorado, which is measuring the amount of moisture in snowflakes are vital to determining how our climate will change in the coming years
- I believe that these tests should be conducted in many areas throughout the world since weather conditions differ in all parts of the world.
- Finally I believe that if I were to re-do my experiment I would put more emphasis on getting more concrete data (i.e.: more trials, better footage, more precise measurements)