CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
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Project Number
31301

Project Title
The Effects of Ocean Temperature on Aerosol Particle Absorption

Abstract

Objectives/Goals
Aerosols are liquid or solid colloidal systems suspended in the atmosphere and are crucial in establishing a radiative balance in the atmosphere, yet understanding of aerosols is considered #low# by the IPCC. Aerosols, largely through their role as cloud condensation nuclei, affect surface temperatures, the hydrological cycle, atmospheric heating, global dimming and air quality, This project seeks to study the effect that ocean temperatures may have on aerosol particle absorption and contends that higher temperatures will lead to an increased rate of particle absorption.

Methods/Materials
To study this effect, a chamber was built to measure concentration as a function of time. The pressure in the chamber would be slowly increased and then rapidly decreased to form a #cloud#. The light scattered by the cloud was then measured on a solar cell. Since optical density of a cloud is directly proportional to the concentration of aerosol particles, voltage readings are directly proportional to particle concentration. Meanwhile, water in the chamber was kept at a constant temperature throughout the run. Runs of the experiment were conducted at 13o, 15o, 17o and 19o Celsius for 2 hours.

Results
Three runs were taken at each temperature. At 19o C, the voltage readings dropped most quickly, an average of .3v per 20 minutes in the first hour. At 17o C, absorption was slightly slower, with average decreases of about .2v every 20 minutes. The absorption of particles was more sustained at 13o and 15o C, where the average decrease in voltage rarely exceeded .1v. Another interesting measurement is the first time at which there was no change in voltage between clouds. There was a clear decreasing trend at higher temperatures, indicating faster absorption.

Conclusions/Discussion
The quicker absorption observed at higher water temperatures would theoretically lead to a decreased concentration of aerosol particles in the lower levels of the troposphere, leading to higher surface temperatures, poorer water quality, more light at the surface of the earth and increased flooding and drought. It is important to realize that this project was a simplification of the environment and therefore some error was inherent, particularly in cloud formation. Further research could involve studying the effects on the size of particle absorbed and researching if trends continue at lower temperatures.

Summary Statement
My project studied the effects of rising ocean temperatures on the absorption of aerosol particles by the ocean.

Help Received
I consulted with Dr. Haflidi Jonsson of the Naval Postgraduate School about my experimental design and he provided me with some equipment.