



# CALIFORNIA STATE SCIENCE FAIR 2007 PROJECT SUMMARY

<b>Name(s)</b> Alec D. Simpson	<b>Project Number</b> <b>J0724</b>
<b>Project Title</b> <b>Simulation of Ultraviolet Radiation Attenuation at the Earth's Surface</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b> The project seeks to determine atmospheric conditions that affect the intensity of UVA and UVB at the earth's surface. Four test conditions are simulated: 1. unaffected atmosphere (control), 2. water vapor attenuation (Treatment 1), 3. carbon dioxide gas attenuation (Treatment 2), 4. dry aerosol (Treatment 3). The goal is to determine the relative attenuation of each treatment against the control.</p> <p><b>Methods/Materials</b> A custom-built simulation chamber utilized. The chamber was instrumented using the following instrumentation and software: Vernier UVA probe, UVB probe, light sensor, carbon dioxide gas sensor, barometer, relative humidity sensor, temperature probe, Lab-Pro USB interface, Logger-Pro 3 software, and laptop computer. Three custom treatment sources utilized to dispense carbon dioxide, water vapor, and a dry aerosol (talc). For each test condition a fully instrumented chamber was used. For the given test conditions, the sensor data was recorded and computer files developed for detailed analysis. After each experimental trial, the chamber was shut down and data was evaluated. Each trial was replicated five times. After all experimental trials were completed, detailed comparisons were made to determine the relative effects. Using these results, an attempt was made to relate the findings to the earth's naturally occurring atmospheric attenuation.</p> <p><b>Results</b> The UVA was attenuated by water vapor an average of 48.94% less than the control. The range for the UVA attenuated by water vapor was 46.75% to 53.99%. The UVB attenuated by water vapor on average 22.33% and had a range of 18.30% to 25.81%. The UVA was attenuated by carbon dioxide on average of 30.45% and had a range 23.43% to 34.81% The UVB when attenuated by carbon dioxide an average of 30.12% and had a range of 19.25% to 40.19%. The dry aerosol (talc) attenuated the UVA an average 7 % and had a range of 3.25% to 11.04%. The UVB was attenuated by dry aerosol an average of 12.53% to 0%.</p> <p><b>Conclusions/Discussion</b> The experimental results show that water vapor had the largest attenuation effect on UVA. Carbon dioxide gas had the next greatest effect on UVA and the largest effect on UVB. The dry aerosol (talc) had the least effect on UVA and UVB. An attempt was made to relate these findings to the known earth's atmospheric attenuation.</p>	
<b>Summary Statement</b> I sought to determine how UVA and UVB radiation is attenuated in the earth's atmosphere through experimental simulation.	
<b>Help Received</b> Dr. John C. Howe provided the motivation for my looking at a problem in atmospheric physics as well as on-going mentoring. My parents provided on-going encouragement and support.	