How Do Aerosols Vary in Different Regions?

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How do Aerosol Levels Vary in Different Regions?

Research Question

What are aerosols? Aerosols are molecules that are suspended in the atmosphere. Aerosols are composed of gas and tiny liquid and solid microscopic particles that exist in the atmosphere. Aerosols cooperate with the earth’s climate in two different ways, directly and indirectly. As a direct effect, the aerosols can scatter the sunlight and prevent some of it from reaching the earth’s surface. As an indirect effect, in the lower atmosphere and modifies the size of the cloud particles. It changes how those clouds absorb and reflect the sunlight and produce precipitation. This affects the temperature on earth because the sunlight that should have come through the atmosphere is being reflected off the aerosols. Since the sunlight is being reflected, the Earth is not getting as much heat as it would if the aerosols would not have reflected the sunlight because the Earth gets its heat from the sunlight ("Atmospheric”, 2015).

By knowing what the main factors are that affect aerosols and knowing about how aerosols can affect the earth’s climate, a way to help reduce the amount of aerosols in the atmosphere can be found. Because the aerosols vary in size, amount, and length of time the aerosols remain in the air, it is difficult to predict the total effect the aerosols have on climate. Often linked to respiratory health problems, aerosols need to be studied more and more data needs to be collected and analyzed to determine and predict the aerosol effect on the weather and climate as well as the atmospheric conditions on the aerosols. Since aerosols change so much regarding location due to industry, it would be helpful to compare aerosol amounts in different locations and also to look at land usage to determine the relationship of atmospheric conditions and aerosols.
HOW DO AEROSOL LEVELS VARY IN DIFFERENT REGIONS?

The Earth has many factors that affect the aerosols. A few of the main factors that affect aerosols are climate, temperature, clouds, and humidity. The climate affects the aerosols by the amount of sunlight, and that determines the temperature. If it is humid outside that means that the aerosols in the air are sticking together but aerosols are not causing the humidity. Equipment that is used to get an understanding of aerosols in the atmosphere and the possible causes are the barometer, sling psychrometer, and sun photometer. The barometer is a field instrument used to measure atmospheric pressure. The barometer is a type of meter and is normally used for forecasting weather and determining altitude. The sling psychrometer is a psychrometer that gets flung around in circles in the air until the reading of the wet bulb reaches a certain level and then compared with the air temperature to calculate relative humidity. The psychrometer is used to measure the relative humidity. The sun photometer is a device that measures the wavelength of sunlight which is used to calculate the aerosol optical thickness. Aerosol optical thickness is the limit to which aerosols prevent the transmission of light by either absorbing light or scattering it. Some say that the sun photometer is a sun-tracking unit (Team, GLOBE, 2014).

Problem Statement

This experiment focuses on the question: How do aerosol levels vary in different regions?

Hypothesis

If the aerosol optical thickness is tested at Ecole de Sahorre in France, Collège Georges Brassens in France, Collège Jules Valles in France, Collège Marguerite de Navarre in France, Crestwood High School in Michigan, and St. Francis Xavier in Pennsylvania, then the aerosol optical thickness would be lower, allowing more sunlight to filter through at St. Francis Xavier in Pennsylvania because France has some factories and industries that cause pollutants in the air
and Michigan has a lot of industries. Therefore both places have a higher level of pollution which would make the aerosol optical thickness higher meaning less sunlight is able to come through than in Pennsylvania which has fairly good air quality because it is not near any major cities or big industries.

**About the Experiment**

This experiment is designed to test the aerosol optical thickness. The independent variable is the location where the aerosol optical thickness is tested. The dependent variables are the levels of aerosol optical thickness, relative humidity, surface temperature, current temperature, barometric pressure, sky clarity, clouds. The control of the experiment are the measurement techniques (GLOBE Protocols) and the dates.

**Introduction**

Aerosols are released from the Earth's surface naturally through sea salt, dust, and emissions from trees and plants, and also as an effect of human actions as seen in Figure 1. “They can be created and modified by chemical processes in the atmosphere and they are constantly cycled among the Earth's oceans, atmosphere, and biosphere” (Team, ESRL). Aerosols play a large part in the Earth’s climate. There are three main types of aerosols that affect the Earth’s climate: volcanic aerosols, desert dust and human-made aerosols.
The first type of aerosol that affects Earth’s climate is volcanic aerosols. Volcanic aerosols are a result of when a volcano erupts. The volcanic eruption has the potential chance of exposing sulfate or volcanic aerosols into the air (“Atmospheric”, 2015). Sulfate aerosols are solid particles of the solution sulfate. Volcanic aerosols form in the stratosphere. After the volcanic aerosols form, the aerosols stay in the stratosphere for about two years. Volcanic aerosols absorb longwave radiation emitted by Earth’s surface (“Atmospheric”, 2015).

The second type of aerosol is the desert dust. It plays one of the most important roles in the Earth’s climate because it is one of the most prominent tropospheric aerosols. The desert dust aerosols are made up of tiny minerals and dirt. The minerals and dirt become aerosols by
getting blown off the ground and into the air. Desert dust aerosols are normally found in drier areas in the world than the tropical areas. In September 1994, a study observed that there was more desert dust aerosols in Africa than in Florida (Mann, 2015). The reason why there are more desert dust aerosols in Africa than Florida is because Africa is drier and has deserts, where Florida does not.

The third type of aerosols are human-made aerosols. Human-made aerosols are aerosols that come from everyday human activities. The major factors are from burning oil and coal, and from burning in the tropical forests while most aerosols reflect radiation, carbon soot absorbs it, trapping heat. Before the industrial revolution, the amount of human-made aerosols was smaller than what the number is today (“Atmosphere”, 2015). The average number of aerosols is higher in the northern hemisphere because that is where the industrial activity is based. The human-made aerosols are usually able to stay in the air for about three to six days (Mann, 2015). The sulfate aerosols stay about three to five days in the atmosphere. The reason why sulfate aerosols stay in the air is because the aerosols do not absorb sunlight, instead the aerosols reflect the sunlight, which causes the amount of sunlight to decrease when trying to reach the Earth’s surface.

**Research Methods**

**Materials**

- Sun photometer (Model RG8-435)
- Sling psychrometer
- Barometer
- Thermometer
○ Filled with non-toxic, safe liquid alloy

● Digital Multi-Day Max/Min Thermometer

● Thermo-Hygrometer

● Cloud viewer

  ○ Paper with different types of clouds on it and a cutout in the middle to be used to determine all different types of clouds that are in the sky

● Digital clock/watch

  ○ Shows hours, minutes and seconds

Procedures (taken from GLOBE Aerosol Protocols)

I. Clouds
   A. Hold cloud viewer up to sky, observe the number and different types of clouds.
   B. Repeat in all directions of the sky and also contrails.
   C. Record data in logbook.

II. Sky
   A. Determine the clarity of the sky from these choices: unusually clear, clear, somewhat hazy, very hazy, extremely hazy.
   B. Choose one and record in logbook.
   C. Determine the color of the sky from these choices: deep blue, blue, light blue, pale blue, milky.
   D. Choose one and record in logbook.

III. Temperature
   A. Read the thermometer.
   B. Write temperature in logbook.
   C. Check the Digital Multi-Day Max/Min Thermometer.
   D. Record the minimum and maximum temperature in logbook.

IV. Aerosols
   A. Take Sun photometer, turn it on and select the “T” setting and record this voltage.
   B. Select the green Channel.
   C. Face the Sun and point the Sun photometer at the Sun.
   D. Adjust the device until the sunlight passes through the small opening on to the back and line up the sun shadow circle with the small blue circle on the device is visible.
E. Once the readings stabilize record the value into the logbook.
F. Also record the time at which the voltage was observed as accurately as possible.
G. While still pointing the Sun photometer at the Sun, cover the opening with finger to block all light from entering.
H. Take the voltage reading and record this as the dark voltage reading in logbook.
I. Select the red Channel and repeat steps C-H.
J. Repeat steps B-I at least 4 more times and record all results into logbook.

V. Relative humidity
A. Take the sling psychrometer and dip the wet bulb in water for 30 seconds.
B. Set the sling psychrometer at a right angle and rotate the frame for 60 seconds.
   1. Note make sure the frame is rotating around 2-3 times per second.
C. After 60 seconds stop rotating the instrument and note the wet and dry bulb temperatures.
D. Use the slide rule calculator to calculate the % of relative humidity.
   1. To calculate, first locate the wet bulb temperature on the relevant scale.
   2. Use the inner frame to slide and align the dry temperature with the wet bulb temperature.
   3. Read the % relative humidity from the center scale at the location of the arrow.
   4. Record result in logbook.

VI. Barometric pressure
A. Take Barometer and allow it to adjust for 5 minutes.
B. After five minutes read barometric pressure and record levels in logbook.
C. Set the barometer by matching the gold needle to the black needle with the dial.

VII. Surface temperature
A. Point the Thermo-Hygrometer at the ground.
   1. Make sure there is no shadow where reading is being taken.
B. Hold down button for 5 seconds to take reading.
C. Record reading in logbook.
Figure 1: Map showing locations of Aerosol optical thickness data collection sites. Map created by researchers but generated by Google My Maps.

Screenshot 1: This shows the data entry dates on the GLOBE database.
**Data Results**

<table>
<thead>
<tr>
<th>Date</th>
<th>Temp</th>
<th>Max. Temp</th>
<th>Min. Temp</th>
<th>Sky Color</th>
<th>Sky Clarity</th>
<th>Type of Clouds</th>
<th>Relative Humidity (dry bulb/wet bulb)</th>
<th>Barometric Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/13/17</td>
<td>7.7</td>
<td>18.1</td>
<td>2.5</td>
<td>Pale blue</td>
<td></td>
<td>19 contrails/l short lived/2 persistent non spreading/11 persistent spreading</td>
<td>Sling was broken</td>
<td>1035</td>
</tr>
<tr>
<td>1/19/17</td>
<td>8.3</td>
<td>14.3</td>
<td>3.5</td>
<td>Light blue/pale blue</td>
<td>Clear</td>
<td>n/a</td>
<td>25/25</td>
<td>1019</td>
</tr>
<tr>
<td>1/26/17</td>
<td>11.7</td>
<td>15.3</td>
<td>-1.6</td>
<td>Deep blue</td>
<td>Occasional clouds</td>
<td>Stratocumulus</td>
<td>12/10</td>
<td>997</td>
</tr>
<tr>
<td>2/6/17</td>
<td>7.2</td>
<td>10.1</td>
<td>-6.4</td>
<td>Blue, milky in the distance</td>
<td>No clouds</td>
<td>n/a</td>
<td>10.5/8</td>
<td>1021</td>
</tr>
</tbody>
</table>

Figure 2: Data from St. Francis Xavier in PA from 1/13, 1/19, 1/26, and 2/6
<table>
<thead>
<tr>
<th>Measurement number-date</th>
<th>Universal time (hour:minute:second)</th>
<th>Max. voltage in sunlight</th>
<th>Dark voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-1/19/2017 (green)</td>
<td>14:36:04</td>
<td>0.37</td>
<td>0.003</td>
</tr>
<tr>
<td>1-1/19/2017 (red)</td>
<td>14:38:09</td>
<td>0.441</td>
<td>0.004</td>
</tr>
<tr>
<td>2-1/19/2017 (green)</td>
<td>14:40:22</td>
<td>0.34</td>
<td>0.003</td>
</tr>
<tr>
<td>2-1/19/2017 (red)</td>
<td>14:42:12</td>
<td>0.454</td>
<td>0.004</td>
</tr>
<tr>
<td>3-1/19/2017 (green)</td>
<td>14:43:56</td>
<td>0.439</td>
<td>0.003</td>
</tr>
<tr>
<td>3-1/19/2017 (red)</td>
<td>14:45:31</td>
<td>0.432</td>
<td>0.004</td>
</tr>
<tr>
<td>4-1/19/2017 (green)</td>
<td>14:46:49</td>
<td>0.451</td>
<td>0.003</td>
</tr>
<tr>
<td>4-1/19/2017 (red)</td>
<td>14:48:03</td>
<td>0.43</td>
<td>0.004</td>
</tr>
<tr>
<td>5-1/19/2017 (green)</td>
<td>14:49:29</td>
<td>0.447</td>
<td>0.003</td>
</tr>
<tr>
<td>5-1/19/2017 (red)</td>
<td>14:50:59</td>
<td>0.437</td>
<td>0.004</td>
</tr>
</tbody>
</table>

Figure 4: Aerosol levels from 1/19/17 taken at St Francis Xavier in PA

<table>
<thead>
<tr>
<th>Measurement number-date</th>
<th>Universal time (hour:minute:second)</th>
<th>Max. voltage in sunlight</th>
<th>Dark voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-1/26/2017 (green)</td>
<td>14:35:02</td>
<td>0.907</td>
<td>0.003</td>
</tr>
<tr>
<td>1-1/26/2017 (red)</td>
<td>14:36:23</td>
<td>0.918</td>
<td>0.004</td>
</tr>
<tr>
<td>2-1/26/2017 (green)</td>
<td>14:37:00</td>
<td>0.905</td>
<td>0.003</td>
</tr>
<tr>
<td>2-1/26/2017 (red)</td>
<td>14:38:17</td>
<td>0.861</td>
<td>0.004</td>
</tr>
<tr>
<td>3-1/26/2017 (green)</td>
<td>14:38:57</td>
<td>0.904</td>
<td>0.003</td>
</tr>
<tr>
<td>3-1/26/2017 (red)</td>
<td>14:39:41</td>
<td>0.908</td>
<td>0.004</td>
</tr>
<tr>
<td>4-1/26/2017 (green)</td>
<td>14:40:30</td>
<td>0.923</td>
<td>0.003</td>
</tr>
<tr>
<td>4-1/26/2017 (red)</td>
<td>14:41:22</td>
<td>0.893</td>
<td>0.004</td>
</tr>
</tbody>
</table>
HOW DO AEROSOL LEVELS VARY IN DIFFERENT REGIONS?

<table>
<thead>
<tr>
<th>Measurement number-date</th>
<th>Universal time (hour:minute:second)</th>
<th>Max. voltage in sunlight</th>
<th>Dark Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>5-1/26/2017 (green)</td>
<td>14:42:19</td>
<td>0.916</td>
<td>0.003</td>
</tr>
<tr>
<td>5-1/26/2017 (red)</td>
<td>14:42:59</td>
<td>0.911</td>
<td>0.004</td>
</tr>
</tbody>
</table>

Figure 5: Aerosol levels from 1/26/17 taken at St Francis Xavier in PA

<table>
<thead>
<tr>
<th>Measurement number-date</th>
<th>Universal time (hour:minute:second)</th>
<th>Max. voltage in sunlight</th>
<th>Dark Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2/6/2017 (green)</td>
<td>14:31:02</td>
<td>0.843</td>
<td>0.003</td>
</tr>
<tr>
<td>1-2/6/2017 (red)</td>
<td>14:31:47</td>
<td>0.859</td>
<td>0.004</td>
</tr>
<tr>
<td>2-2/6/2017 (green)</td>
<td>14:32:33</td>
<td>0.845</td>
<td>0.003</td>
</tr>
<tr>
<td>2-2/6/2017 (red)</td>
<td>14:32:59</td>
<td>0.861</td>
<td>0.004</td>
</tr>
<tr>
<td>3-2/6/2017 (green)</td>
<td>14:33:43</td>
<td>0.851</td>
<td>0.003</td>
</tr>
<tr>
<td>3-2/6/2017 (red)</td>
<td>14:34:09</td>
<td>0.865</td>
<td>0.004</td>
</tr>
<tr>
<td>4-2/6/2017 (green)</td>
<td>14:34:56</td>
<td>0.853</td>
<td>0.003</td>
</tr>
<tr>
<td>4-2/6/2017 (red)</td>
<td>14:35:25</td>
<td>0.864</td>
<td>0.004</td>
</tr>
<tr>
<td>5-2/6/2017 (green)</td>
<td>14:35:57</td>
<td>0.861</td>
<td>0.003</td>
</tr>
<tr>
<td>5-2/6/2017 (red)</td>
<td>14:36:28</td>
<td>0.864</td>
<td>0.004</td>
</tr>
</tbody>
</table>

Figure 6: Aerosol levels from 2/6/17 taken at St Francis Xavier in PA
Screen shot 3: This shows the aerosol data for our location using the GLOBE Visualization System.

**Discussion**

Data was recorded in logbook over about a four week experimentation period. Each trial was recorded in the logbook. The data was placed into a Google sheets spreadsheet. The four weeks of data were analyzed and graphed in a bar graph. On 1/19/17 the average AOT Green wavelength for St. Francis Xavier was 0.2254, for Crestwood High School was 0.2779, and for Ecole de Sahorre was 0.0977. The average AOT Red wavelength for St. Francis Xavier was 0.2166, for Crestwood High School was 0.2381, and for Ecole de Sahorre was 0.0867. On 1/25/17 the average AOT Green wavelength for St. Francis Xavier was 0.0761. The average AOT Red wavelength for St. Francis Xavier was 0.0821. On 1/26/17 the average AOT Green wavelength for St. Francis Xavier was 0.0625, for Collège Georges Brassens was 0.1322, for Collège Jules Valles was 0.0854, and for Collège Marguerite de Navarre was 0.0457. The average AOT Red wavelength for St. Francis Xavier was 0.0754, for Collège Georges Brassens...
was 0.0957, for Collège Jules Valles was 0.0630, and for Collège Marguerite de Navarre was 3.3581. On 2/06/17 the average AOT Green wavelength for St. Francis Xavier was 0.1066, and for Crestwood High School was 0.437. The average AOT Red wavelength for St. Francis Xavier was 0.1034, and for Crestwood High School was 0.3542. On March 3, 2017 the average AOT Green wavelength for St. Francis Xavier was 0.0854, and for Ecole de Sahorre it was 0.0597. The average AOT Red wavelength for St. Francis Xavier was 0.1107, and for Ecole de Sahorre was 0.0650. All data was measured in AOT units and analyzed using Google Sheets.

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan 19</td>
<td>0.2779</td>
<td>0.2381</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.0977</td>
<td>0.0867</td>
<td>0.2254</td>
<td>0.2166</td>
</tr>
<tr>
<td>Jan 25</td>
<td>0.0761</td>
<td>0.0821</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.0761</td>
<td>0.0821</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jan 26</td>
<td>0.1322</td>
<td>0.0957</td>
<td>0.0854</td>
<td>0.063</td>
<td>0.0457</td>
<td>3.3581</td>
<td></td>
<td></td>
<td></td>
<td>0.0625</td>
<td>0.0754</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feb 6</td>
<td>0.437</td>
<td>0.3542</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.1066</td>
<td>0.1034</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mar 3</td>
<td>0.0585</td>
<td>0.065</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.0854</td>
<td>0.1107</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 7: Data table showing the average AOT for all sites, in green and red wavelengths, for 1/19/17, 1/25/17, 1/26/17, 2/6/17 and 3/3/17.
Figure 8: Average AOT for Crestwood High School, in green and red wavelengths, for 1/19/17, 1/25/17, 1/26/17, 2/6/17 and 3/3/17.

Figure 9: Average AOT for Collège Georges Brassens, in green and red wavelengths, for 1/19/17, 1/25/17, 1/26/17, 2/6/17 and 3/3/17.
Figure 10: Average AOT for Collège Jules Valles in green and red wavelengths, for 1/19/17, 1/25/17, 1/26/17, 2/6/17 and 3/3/17.
Figure 11: Average AOT for Collège Marguerite de Navarre in green and red wavelengths, for 1/19/17, 1/25/17, 1/26/17, 2/6/17 and 3/3/17. It appears that the red wavelength may be an outlier.

Figure 12: Average AOT for Ecole de Sahorre in green and red wavelengths, for 1/19/17, 1/25/17, 1/26/17, 2/6/17 and 3/3/17.
Figure 13: Average AOT for St. Francis Xavier in green and red wavelengths, for 1/19/17, 1/25/17, 1/26/17, 2/6/17 and 3/3/17.
Figure 14: Data Table showing each location’s total average AOT, in green and red wavelengths over the whole testing period.

![Total Average AOT](image)

Figure 15: This is the total average AOT for all locations and the standard deviation for schools with more than one data set. the crestwood, ecole, list standard deviations

**Conclusion**

This experiment focuses on the aerosol levels in different regions. The results of the experiment partially supported the hypothesis that states if the aerosol optical thickness is tested at Ecole de Sahorre in France, Collège Georges Brassens in France, Collège Jules Valles in France, Collège Marguerite de Navarre in France, Crestwood High School in Michigan, and St. Francis Xavier in Pennsylvania, then the aerosol optical thickness would be lower, allowing more sunlight to filter through at St. Francis Xavier in Pennsylvania because France has some
factories and industries that cause pollutants in the air and Michigan has a lot of industries. Therefore both places have a higher level of pollution which would make the aerosol optical thickness higher meaning less sunlight is able to come through than in Pennsylvania which has fairly good air quality because it is not near any major cities or big industries. St. Francis Xavier and Ecole de Sahorre had the lowest AOT out of all the data collected. Crestwood High School had the highest AOT overall out of all the data collected, not including the outliers. If the outliers are included, then Collège Marguerite de Navarre would also have a higher AOT. The results show that on 1/19/17 the average AOT Green wavelength for St. Francis Xavier was 0.2254, for Crestwood High School was 0.2779, and for Ecole de Sahorre was 0.0977. The average AOT Red wavelength for St. Francis Xavier was 0.2166, for Crestwood High School was 0.2381, and for Ecole de Sahorre was 0.0867. On 1/25/17 the average AOT Green wavelength for St. Francis Xavier was 0.0761. The average AOT Red wavelength for St. Francis Xavier was 0.0821. On 1/26/17 the average AOT Green wavelength for St. Francis Xavier was 0.0625, for Collège Georges Brassens was 0.1322, for Collège Jules Valles was 0.0854, and for Collège Marguerite de Navarre was 0.0457. The average AOT Red wavelength for St. Francis Xavier was 0.0754, for Collège Georges Brassens was 0.0957, for Collège Jules Valles was 0.0630, and for Collège Marguerite de Navarre was 3.3581. On 2/06/17 the average AOT Green wavelength for St. Francis Xavier was 0.1066, and for Crestwood High School was 0.437. The average AOT Red wavelength for St. Francis Xavier was 0.1034, and for Crestwood High School was 0.3542. On March 3, 2017 the average AOT Green wavelength for St. Francis Xavier was 0.0854, and for Ecole de Sahorre it was 0.0597. The average AOT Red wavelength for St. Francis Xavier was 0.1107, and for Ecole de Sahorre was 0.0650. The independent variable is the location where the
How do aerosol levels vary in different regions?

Aerosol optical thickness is tested. The dependent variables are the levels of aerosol optical thickness, relative humidity, surface temperature, current temperature, barometric pressure, sky clarity, clouds. The control of the experiment is the measurement techniques (GLOBE Protocols) and the date. Therefore the revised hypothesis would be: If the aerosol optical thickness is tested at Ecole de Sahorre in France, Collège Georges Brassens in France, Collège Jules Valles in France, Collège Marguerite de Navarre in France, Crestwood High School in Michigan, and St. Francis Xavier in Pennsylvania, then the aerosol optical thickness would be lower, allowing more sunlight to filter through, at St. Francis Xavier and Ecole de Sahorre because France has some factories and industries that cause pollutants in the air and Michigan has a lot of industries. Therefore both places have a higher level of pollution which would make the aerosol optical thickness higher meaning less sunlight is able to come through than in Pennsylvania which has fairly good air quality because it is not near any major cities or big industries. Also, since Ecole de Sahorre is up in the Pyrenees Mountains the elevation is so high that either it is above all the pollution or the wind patterns might have affected the particles in the air because the location is on top of a mountain and the wind blew it away from site location.

Challenges faced in this experiment were many. It was difficult to organize around the busy high school schedules and commitments, sports events, and collecting and analyzing data from around the world. If this project were to be redone, there would be data for every date, and every location because right now there is not enough data to give an accurate picture. There would need to be data collected for months, ideally years, to get an accurate picture, but the trends seen so far give an interesting picture that requires more monitoring to determine what is actually happening. Unfortunately, there was no control over what location had what data on
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certain dates. This project is important to the real world because the air quality is important for people’s health, a safer environment, addressing climate change and less particles in the air. In the future learning more about Beer's Law dealing with aerosol optical thickness and Rayleigh scattering might be beneficial. Since learning about exponential and logarithmic functions is a new concept, being more comfortable with this before the calculations are made from the AOT and percent transmission values would be better. That is why the values calculated through the GLOBE data server were used. When data was initially entered, an important part was missed, making the data inaccessible with ADAT and the GLOBE Visualization System. In the future, data would be checked even more carefully to avoid this problem.

All of the procedures were done together -collecting data, researching, and retrieving data from the Globe data base. Maddie created the graphs and tables, and also worked on the board and the research paper. Lucy entered the data in the tables, wrote everything in the logbook, and assisted with the board and research paper. The roles each of us had support each other because the workload was very equalized, it worked around our time schedules, and helped with each other’s specialties such as Maddie with the graphs and Lucy with the logbook.

Global and local communities are impacted because air quality affects humans in many ways if the air quality is bad it can lead to sickness and lung diseases. Less particles in the air provide for a safer environment and help to address climate change. Industry and farming practices can also have a significant impact on aerosol levels. If the air quality is good then the humans take in the healthy air and have better health and breathing.

Since the data was collected locally and internationally it coincides with international collaboration. The data collection advantages were viewing the levels from the website and
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comparing the air quality internationally. It shows that the data was from multiple countries, the ADAT system was used so we could get a better understanding of the air quality from different countries.

All photographs, graphs and tables were taken/made by the researcher, unless otherwise cited.
Works Cited


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