



GLOBE Research Paper

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Abstract: In our research we questioned “Does car exhaust affect the Aerosol Optical Thickness (AOT) levels?” Our methods included taking measurements in front of the school and at the playground. We took three measurements on the Calitoo Sun Photometer. We used the Calitoos to gather data, and we then graphed this information in Excel which converted the Aeronet and Calitoo data into the same wavelength so that we were able to compare the points. We figured out that there was no substantial difference between Calitoo data and the Aeronet data. So we concluded that the car exhaust did not affect the AOT levels. As a result, the amount of cars in our parking lot during afternoon carpool was too small to make any significant difference in the Aerosol levels. If we were to experiment on this again we would use a handheld Optical Particle Counter to record the air contamination lower in the atmosphere.

Research Question: “Does car exhaust affect the AOT levels?” This question intrigued us because seeing that cars have an effect on global warming and they release aerosols, do all aerosols have an effect on the heating of Earth’s surface?

Introduction: Vehicles can have a large negative effect on the environment, mainly through pollution due to fuel consumption. They are believed to be increasing global warming, the gradual heating of the surface of Earth. But are they affecting the AOT, the aerosol optical thickness? Aerosol optical thickness is a measure of the elimination of sunlight by particles in the atmosphere through either absorption or scattering. Regulations have been set up to limit a vehicle’s emission of smog, soot, and other pollutants into the atmosphere, the first of which was established in January of 1995. Most of these arrangements were made to control hazardous air pollutants. So, is AOT affected by cars and if so how? Have the regulations helped to decrease this problem? If the problem has decreased, what change was made in the cars to do so? If not what can we do in the future to help change this or at least slow its effects.

Research Methods: To conduct our research we went to the front of the school and the playground, where we used the Calitoo Sun Photometer to record the AOT every time we went out. The blue wavelengths are 465 nanometers, the green are 540 nm, and the red are the 619 nm. After talking with Dr. Margaret Pippin, who helped us rethink our data and methods of measuring (She recommended to us that we should take

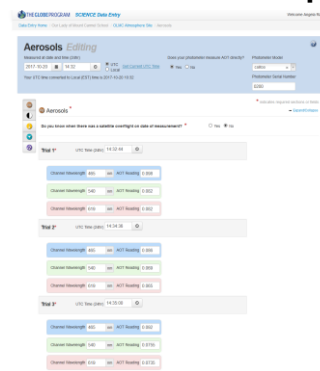
measurements in 2 different locations, the playground and the front of the school, before, during, and after carpool), we decided to compare our data with the Aeronet instrument at the NASA Langley Research Center which recorded the blue wavelengths as 440 nm, the green as 500 nm, and the red as 675 nm. We averaged the Calitoo trials in GLOBE, we retrieved, sorted it, and converted the Aeronet readings using the Angstrom Exponent



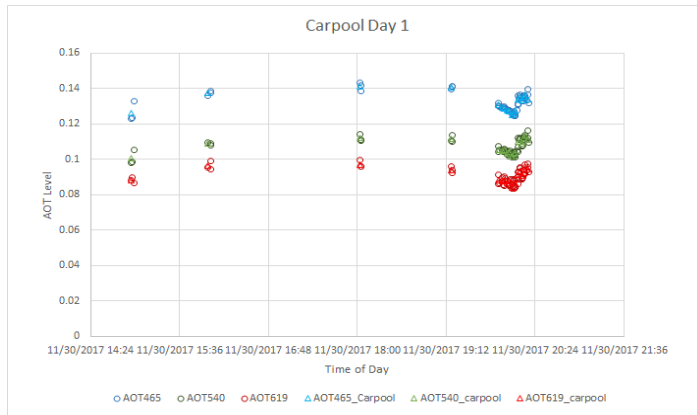
Calitoo - a photometer that is used to determine the rate aerosols in our atmosphere



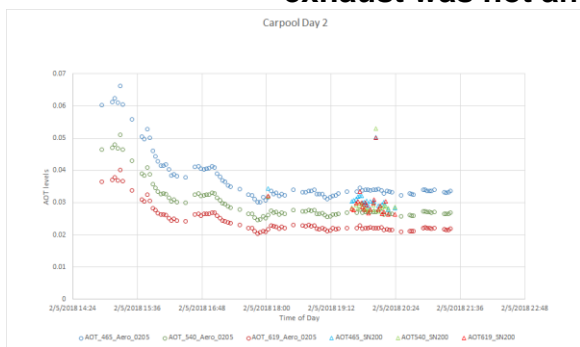
Aeronet-a research grade instrument used by NASA to also measure the aerosols in our atmosphere



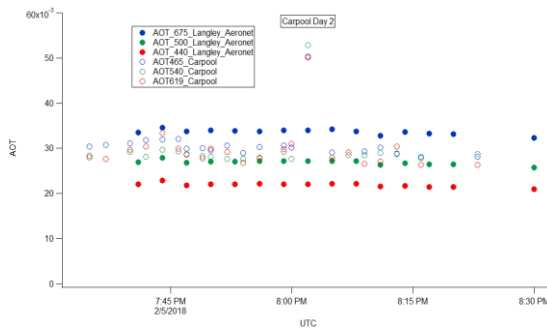
Results: When we finished taking measurements we graphed the points and compared them with the Aeronet data. While comparing we noticed that the exhaust caused no substantial difference between the Aeronet readings and our readings with the Calitoo's and that our points were right in there with them too. As a result the amount of cars in our lot was too small and the time was too short to make any significant difference on the aerosols in the air.



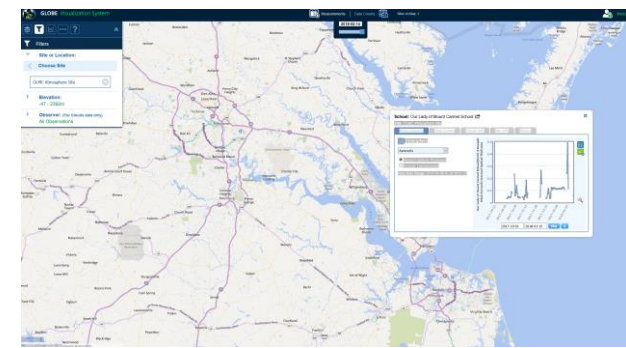
The data recorded by Alexis and the data recorded by NASA were fairly similar. This lead us to believe that the car exhaust was not affecting the AOT levels.



This was our 2nd day of taking measurements and it also showed that our measurements were fairly close again.



This is a close up of the second day measurements where it was all of the dots were close together and it showed that when all of the AOT wavelengths the particles were larger than NASA's.



Discussion: The interpretation of the results was that the car exhaust didn't affect the aerosols in our air. The possible source of error was that we might have not been in the right area that the car exhaust was going to. There might not have been enough cars to have an effect on the aerosols in the air. The last time we went out we saw that not a lot of people had exhaust coming out of their cars. That could be the reason that the aerosol levels didn't go up. Our results did not support our hypothesis. We said that the car exhaust would affect the aerosols in our air. The first day that we went to do measurements the Calitoo measurement went up a little, but we checked with Aeronet and their measurements were even higher than ours. Then the next time we went out, our measurements were close to Aeronet. We might not have seen dirtier results because the Calitoo Sun Photometer measures the aerosols in the atmosphere and there were not enough particles to spread up through the atmosphere.

Conclusion: In conclusion, we have found that car exhaust does not affect the aerosol levels during carpool. Our measurements were obtained by Alexis Beavers, who acquired consistent AOT readings from a couple of different days. These readings corresponded with Aeronet, so we can therefore conclude that our information is accurate and reliable. A possible explanation for this lack of change could be that the car exhaust being emitted by the vehicles is cleaner, or better on the environment. Other possibilities could include that the allotment of time was too short, there were not enough vehicles, or that our measurements need to be taken in a different location. If we were to research this again, we would use the Optical Particle Counter. This instrument measures the air right in front of you.