

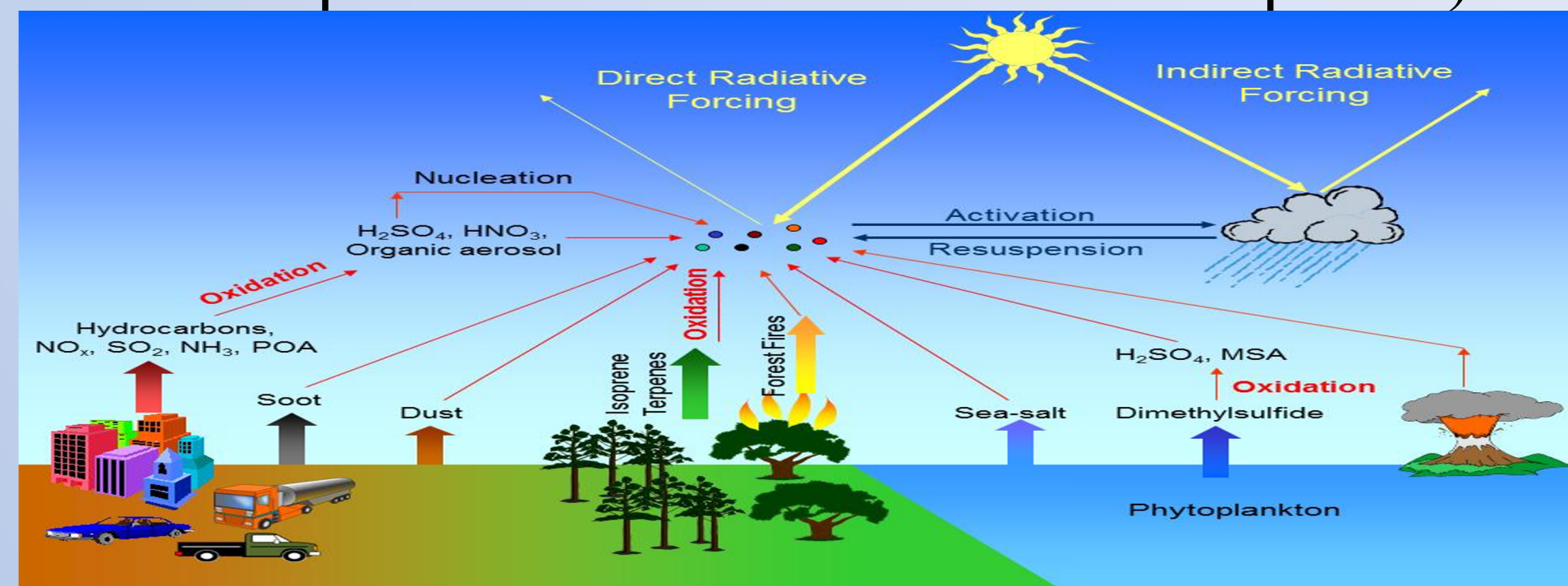
Global Impact of Aerosol Emission During Covid-19

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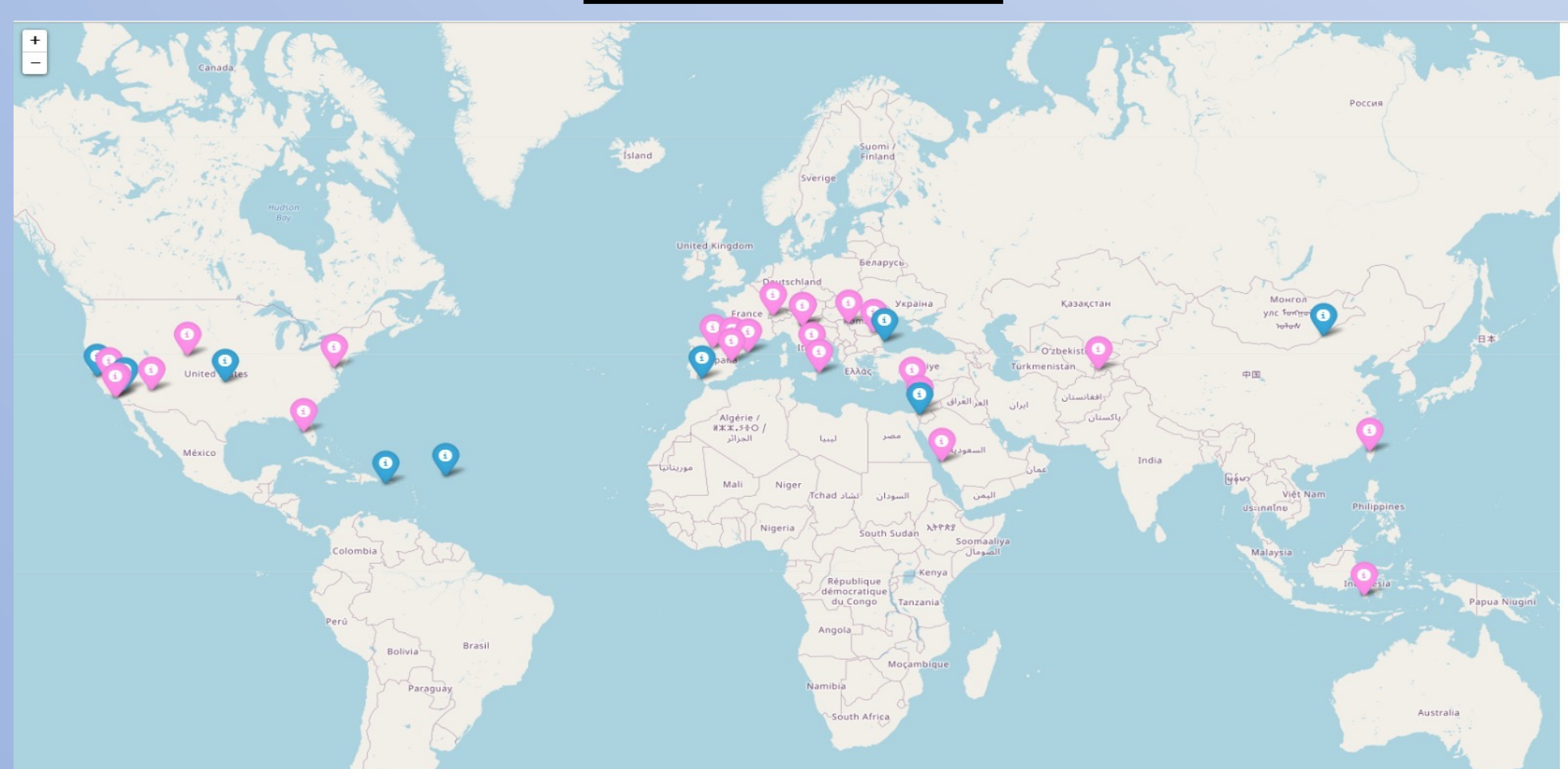
Introduction

- Aerosols can directly be emitted to the atmosphere or formed from gases that end up in the atmosphere
- Aerosols can occur naturally (dust from a desert, sea salt from an ocean, gases blasting out of volcanoes or from a forest fire.)and anthropogenically(fossil fuel combustion, fertilizer production and wastewater disposal.)
- On the other hand, Aerosols contribute to climate by reflecting light space, thus cooling the planet
- During the Covid 19 period, there was a huge reduction in fossil fuel combustion due to slow down of industrial production and lesser need of



This study will focus on the impact of reducing vehicle emissions and the effect on Aerosol Optical depths (AOD) due to the Covid 19 pandemic.

Methods



Map for all our Sites

- To investigate the emissions of aerosols during Covid-19, data from the following Aeronet website was used with the following criteria :
"https://aeronet.gsfc.nasa.gov/cgi-bin/site_info_v3".
- 1)Data had to be collected in January of 2019 or earlier
- 2) Data collection had to end in September 2020 or later
- 3) Data had to be at least 30% of the days over this range.
- Google mobility data was used to estimate the impact of the lockdown on aerosol production since Google mobility measures transportation patterns when people use their phone to drive. For this study, driving to the workplace was analyzed due to being a predictable and common occurrence. "<https://www.google.com/covid19/mobility/>".
- A linear regression was used to estimate the amount of AOD variability that can be explained by changes in driving patterns

Results

Does reduction of daily vehicle circulation due to pandemic restrictions on people, reduce AOD numbers

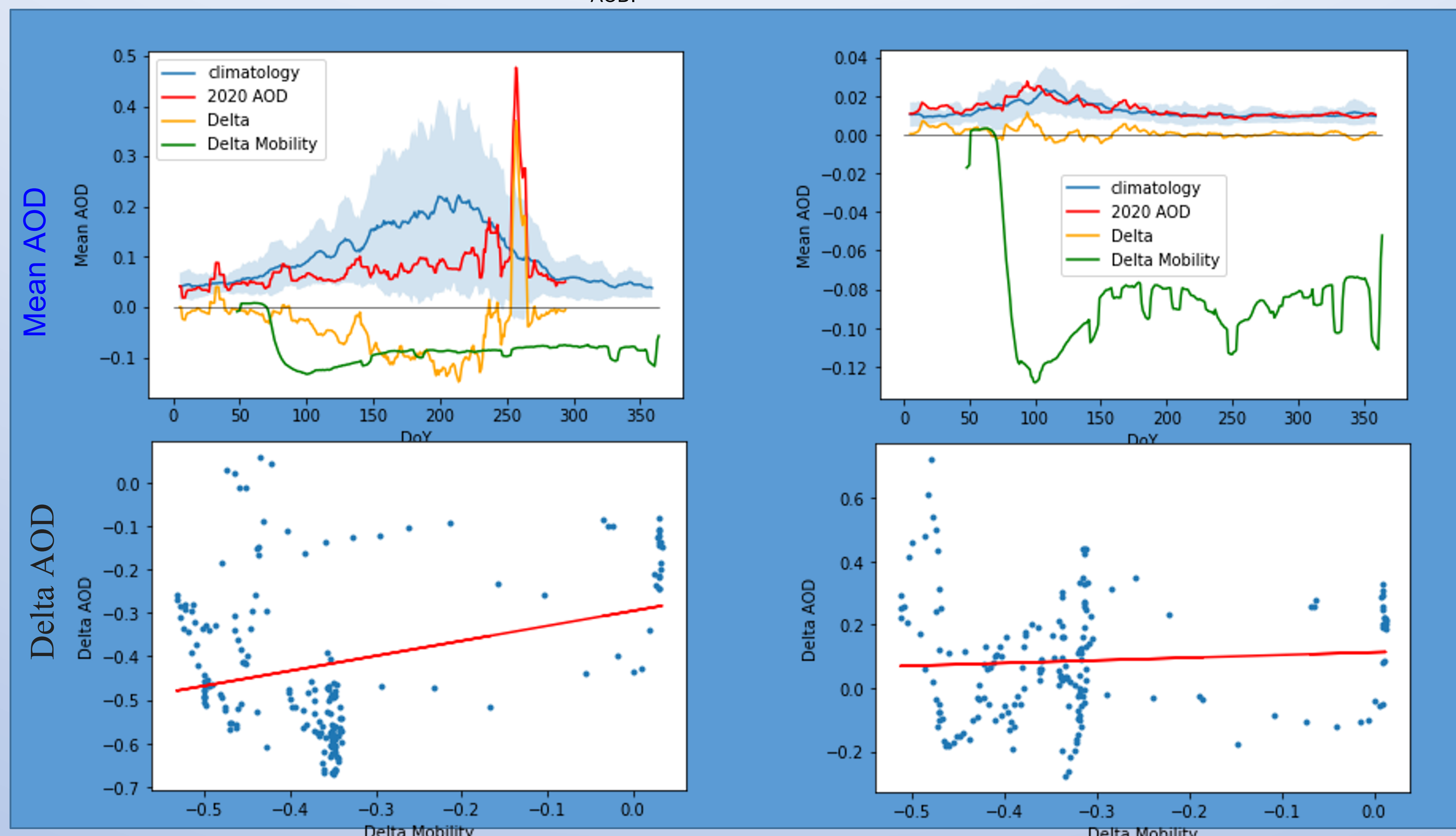
Urban Sites

Site/Urban	Change in AOD during COVID	R ²	Coefs
AAOT/ Italy	12.9 %	0.23 %	-0.10761202
Aras_de_los_Olmos/Spain	-75.4 %	47.33 %	-2.65744914
Barcelona/Spain	46.1 %	15.9 %	-0.84270604
Caltech/ California	29.9 %	44.71 %	1.61012691
Dushanbe/Tajikistan	17.6 %	7.9 %	0.40538614
Fresno/California	20.6 %	11.7 %	0.51818242
GSFC/Greenbelt, Maryland	44.7 %	9.31% 0.34495063	0.34495063
KAUST_Campus/ Saudi Arabia	10.89 %	2.7 %	0.41186698
Magurele/ Romania	8.13 %	11.25 %	-1.08622049

Rural Sites

Site /Rural	Change in AOD	R ²	Coefs
ARM_SGP/Oklahoma	15.66 %	1.5 %	-0.27478494
El_Arenosillo/Marzagón	-4.4 %	8.4 %	-0.68812501
Galata_Platform/Bulgaria	-2.9 %	5.67 %	-1.12784193
Goldstone/desert in California	13.88 %	5.25 %	0.85293054
La_Parguera	-8.32 %	0.77% -0.41012432	-0.41012432
Mauna_Loa/volcano in Hawaii island	-7.32 %	0.45 %	0.08504497
NASA_Ames/California	1.24 %	51.87 %	2.62293322
Palencia	6.1 %	2.75 %	1.16845465
Rexburg_Idaho/Idaho	-16.8 %	33.08 %	-4.65706674
SEDE_BOKER/ desert in southern Israel	-0.71 %	16.8 %	-0.97009097

- coefficient tells you how much the AOD changes with a change in mobility data
- R² tells you how much of the variance, or change, in AOD is explained by the mobility data.
- Black presents the decrease in AOD when fossil fuel combustion did not seem Adamant factor.
- Blue shows the reduction in AOD when fossil fuel combustion seems Adamant factor.
- The red presents an increase in AOD.



- GSFC/Greenbelt, Maryland**
- Urban
- The nearest city Washington, DC.(pop.4500000)
- It 20 Km
- Coefs is 0.34495063
- R² is 9.3%

- Mauna_Loa/volcano located in Hawaii island**
- Rural
- The nearest city Honolulu (pop.800000)
- It 312.213 Km
- Coefs is 0.08504497
- R² is 0.5%

Discussion

- The drop of aerosol emission has been attributed to the reduction in fuel combustion. A regression test was carried to analyze how much aerosol signal was due to transportation. Mobility data supported that some urban centers experienced reduction in aerosols according to the Aeronet results, which can be attributed to lockdown.
- When coefs are positive, it signifies that there is a change due to driving.The data analysis shows that the Coefs in the cities are higher than in rural areas.
- There was a change in the AOD at GSFC in Maryland during the lockdown period, showing that vehicle emissions explain 9.3% of the reduction in aerosols. In Mauna Loa which is more remote, the AOD did not decrease during the covid pandemic despite changes in driving. Thus, we conclude that vehicle emissions do not contribute substantially to AOD at Mauna Loa
- There are more reasons which may have caused the reduction in aerosol emissions in some remote areas other than driving. Transportation alone doesn't explain the drop in the aerosol

Conclusion/Future Work

- We found evidence of decreased AOD at 22 sites out of 39 analyzed. This suggests AOD has not been significantly affected by decrease in transportation could have decreased due to changes in anthropogenic activity during the pandemic.
- The hypothesis seems to be partially supported due to some countries experiencing a reduction in AOD. However, due to having limited data availability, the increase in AOD experienced by the countries highlighted in red cannot be explained.
- To develop the hypothesis, additional data is needed.

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Acknowledgment

I would like to thank Dr. Erik Larson for providing guidance and assistance throughout this project. I would also like to thank Alicia Christensen, Anne Gold, Rebecca Batchelor, and Dana Francesca Stamo for helpful development workshops. RECCS Program is funded by the National Science Foundation . (grant number EAR 1757930).