Hampton Roads Health & Air Quality

Monitoring Air Quality using MODIS and CALIPSO Data in Conjunction with Socioeconomic Data to Map Air Pollution in Hampton Roads, Virginia

Project Synopsis

Situated along Virginia's southeastern coast, the Hampton Roads region is a historic hub for coal storage and transportation. When inhaled, pollutants like coal dust can cause respiratory and cardiovascular issues, raising concerns among community members about the potential human health risks associated with coal dust and other particulate matter (PM) pollution. This project determined the feasibility of using NASA Earth observations—specifically Terra/Aqua Moderate Resolution Imaging Spectroradiometer (MODIS) and CALIPSO Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations (CALIOP) – to measure air particulates, map their distribution across the region, and identify air quality trends over time.

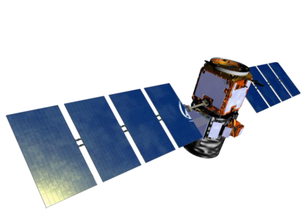
Objectives

- **Analyze** air pollution trends in Hampton Roads over the past ten years
- **Visualize** pollutant concentration, aerosol elevation, and health risk vulnerability
- **Determine** if stakeholders can use NASA Earth observations to enhance air quality measurements in the Hampton Roads region
- **Inform** the Tidewater Air Monitoring Evaluation Project's future decisions for PurpleAir sensor placement to improve future monitoring

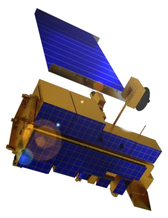
Project Partner

- Virginia Department of Environmental Quality

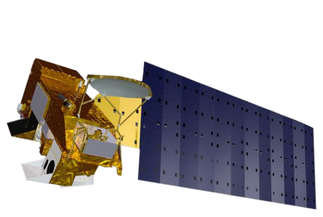
Earth Observations



CALIPSO CALIOP



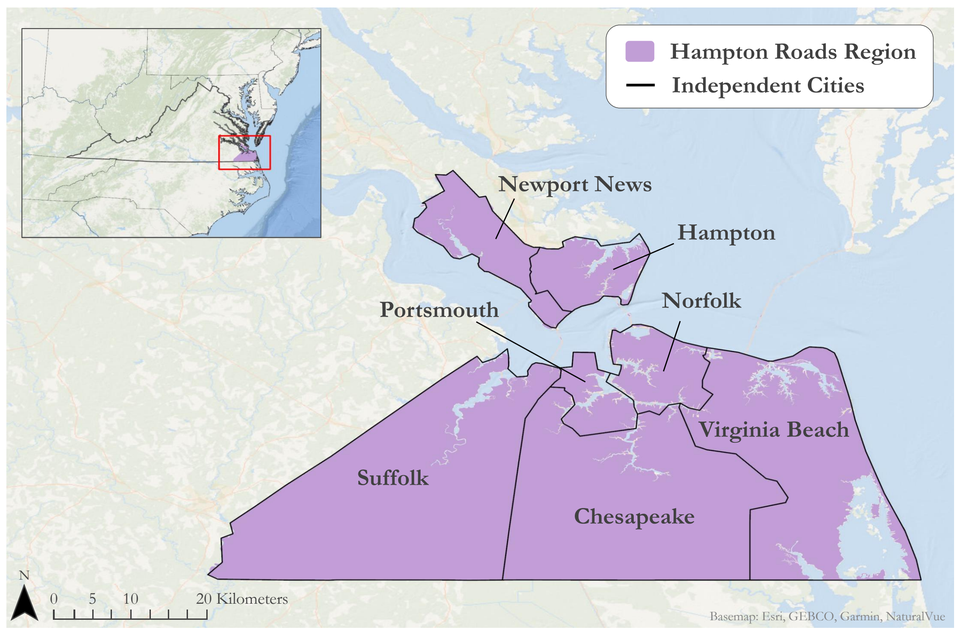
Terra MODIS



Aqua MODIS

Study Area

Study Period: January 2014 – May 2024



Team Members

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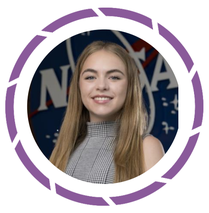
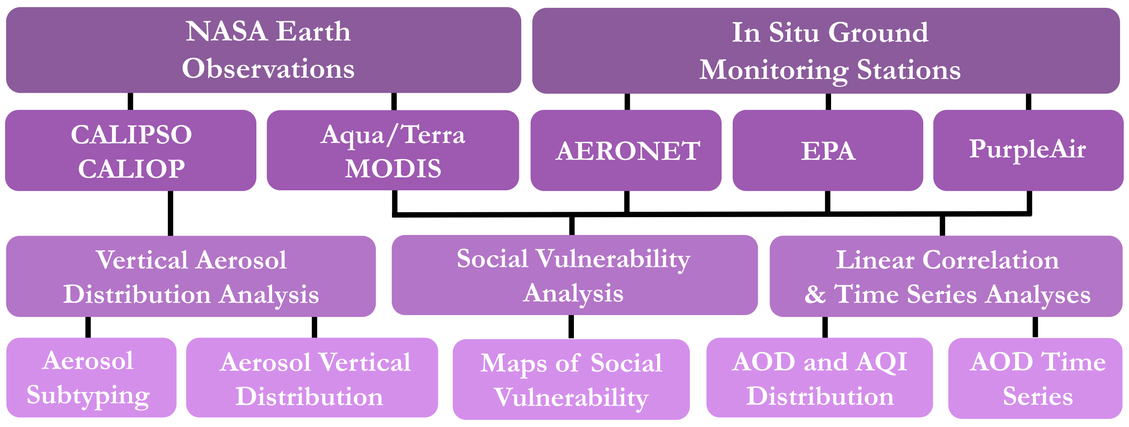


Sidney Hipp

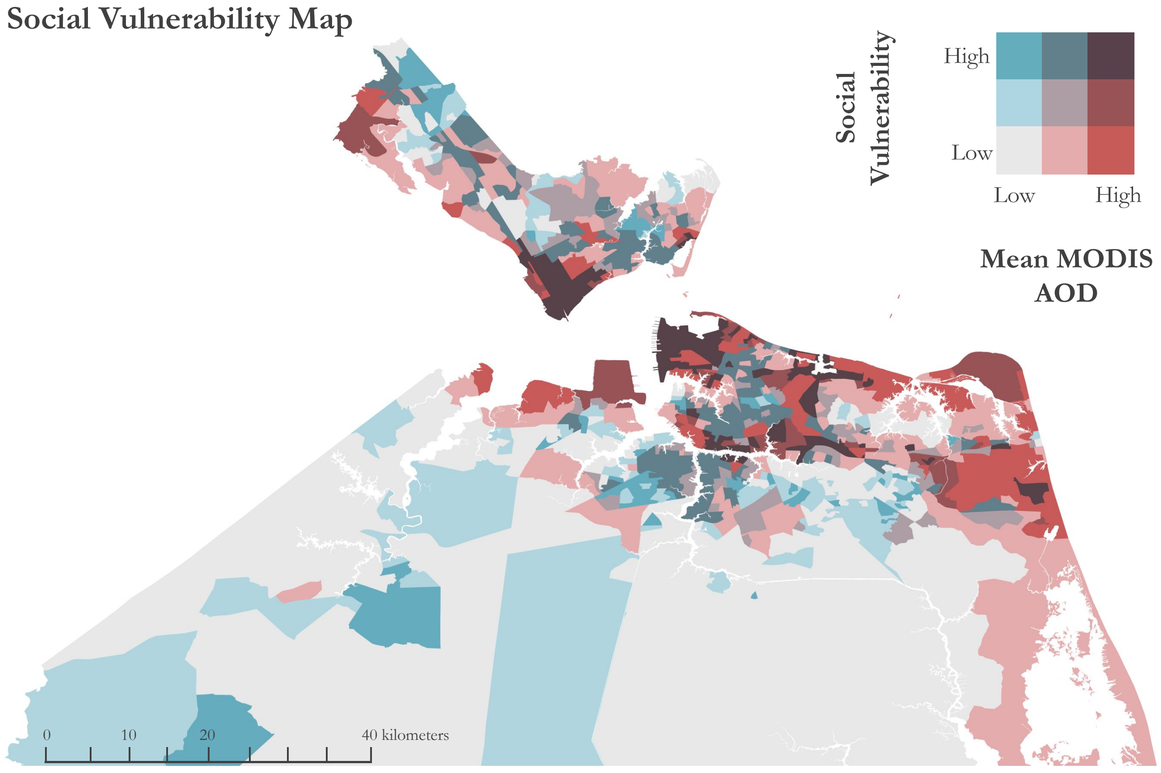
Piper Coleman

Methodology

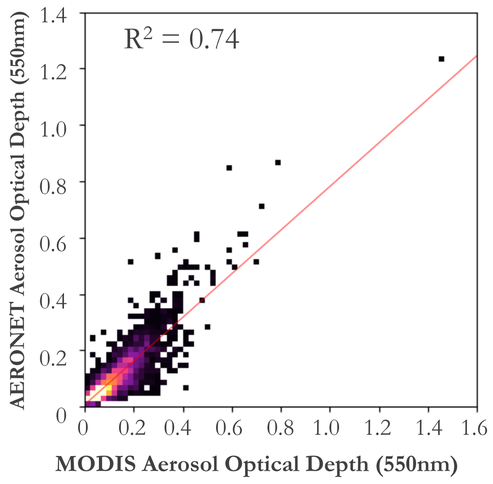


Results

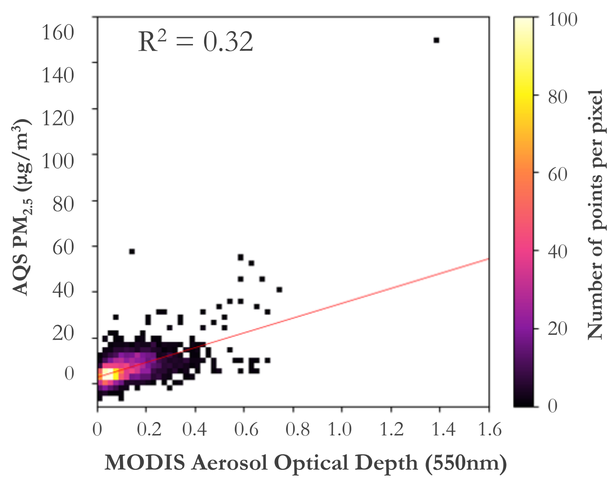
Social Vulnerability Map



MODIS Validation with AERONET AOD



MODIS Validation with EPA $PM_{2.5}$



Conclusions

- Aqua/Terra MODIS total column Aerosol Optical Depth (AOD) measurements can be used to understand spatial air pollution trends across Hampton Roads.
- MODIS AOD measurements can be used in conjunction with sociodemographic data to inform the Virginia Department of Environmental Quality's PurpleAir sensor placements.
- AOD is a low confidence proxy for measuring ground-level $PM_{2.5}$ in Hampton Roads, which has generally low air pollution.

Acknowledgements

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