Remote Sensing of Particle Pollution over Baltimore

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Introduction

- Long-range transport of natural and anthropogenic particle pollution can impact local and regional air quality.
- Summer Canadian and Alaskan wildfires have produced consistent smoke transport to other parts of North America, such as the Great Plains, the Northeast, and the Mid-Atlantic.
- Ground and satellite remote sensing allows three-dimensional assessment of long-range transport of pollution.

Research Objectives

- Correlate ground-based air quality monitors, lidar, and satellite remote sensing retrievals
- Determine if particle pollution during the Summer of 2019 in the Baltimore-Washington metropolitan region is caused by local sources or long-range transport.

Motivation for the Study/Societal impacts

- Improvement of weather/air quality/wind (energy) forecasting
- All research related to air pollution is extremely important for human health, as we are constantly exposed.
- Study was motivated by "identifying what source groups and in what locations do policy makers need to focus" to reduce pollution.
- Identification of drivers of air quality episodes and how to communicate/motivate policy change.

Air Quality Remote Sensing Data Sources

- *UMBC CESON lidar station* (http://alg.umbc.edu/)
  - Monitors the vertical distribution of aerosols in the troposphere and planetary boundary layer.
- *NOAA STAR NESDIS Aerosol Watch* (https://www.star.nesdis.noaa.gov/smcd/spb/aq/AerosolWatch/)
  - Presents a combination of NOAA satellite observations and several aerosol data products
- *NOAA Hazard Mapping System Fire and Smoke Product* (https://www.ospo.noaa.gov/Products/land/hms.html)
  - Observes significant wildfire activity nationally
- *EPA Airnow Air Quality Index* (https://airnow.gov/)
  - Reports whether the outdoor air is clean or polluted based on values and color hues
- *AirNow Tech Hourly* $PM_{2.5}$ (https://www.airnowtech.org/data/)
  - Provides hourly nationwide $PM_{2.5}$ data.

Conclusions/Discussion

- Column Aerosol Optical Depth for both events show similar results. (*Figures 1, 2, and 3*)
- In parts of Canada and Alaska, there are wildfire events sending smoke-filled air to the Baltimore Washington metropolitan area. *(Figure 4)*
- As ozone and particulate matter concentrations increase, the air quality level goes from "good" to "moderate"; air quality conditions are acceptable, but some pollutants may provide a health concern to those who are unusually sensitive to air pollution *(Figure 5 and 6)*
- Further work would involve recalling the past decade of particulate matter measurements and correlating them to remote sensing observations to determine the frequency with which wildfire smoke may impact air quality in the Baltimore-Washington DC metropolitan area.

Reference

Dreessen, J., Sullivan, J. and Delgado, R. (2016), Observations and impacts of transported Canadian wildfire smoke on ozone and aerosol air quality in the Maryland region on June 9–12, 2015, Journal of the Air & Waste Management Association, 66:9, 842-862, DOI: 10.1080/10962247.2016.1161674

Wildfire Events

June 1, 2019 — July 9, 2019

UMBC CESON Lidar Station

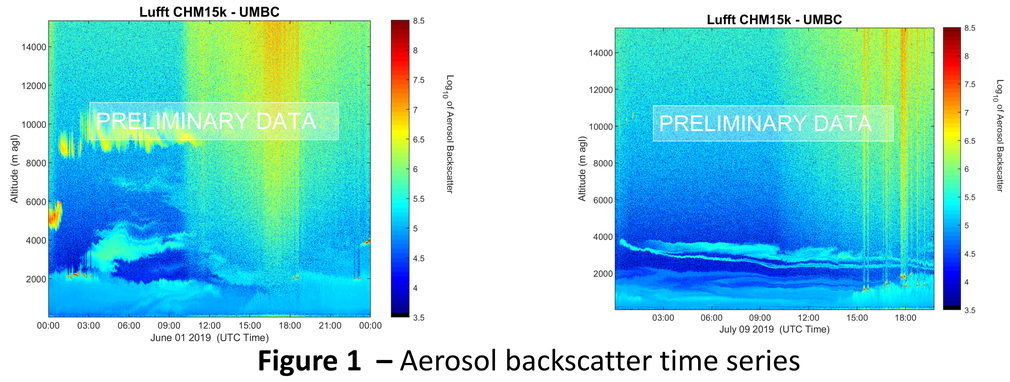

Figure 1 – Aerosol backscatter time series

NOAA STAR NESDIS Aerosol Watch True Color Image

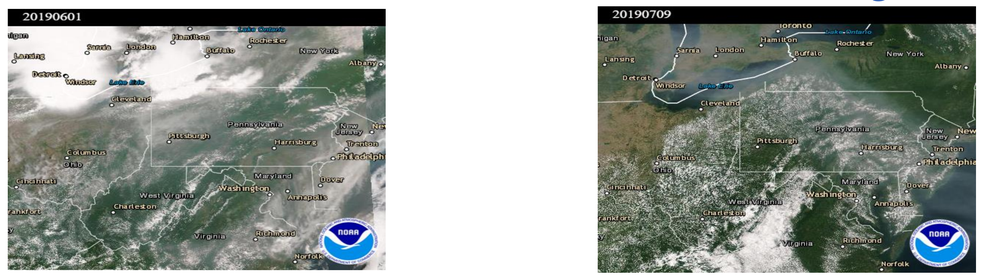

Figure 2 – VIIRS Layers (SNPP)

*NOAA STAR NESDIS Aerosol Watch AOD retrieval **

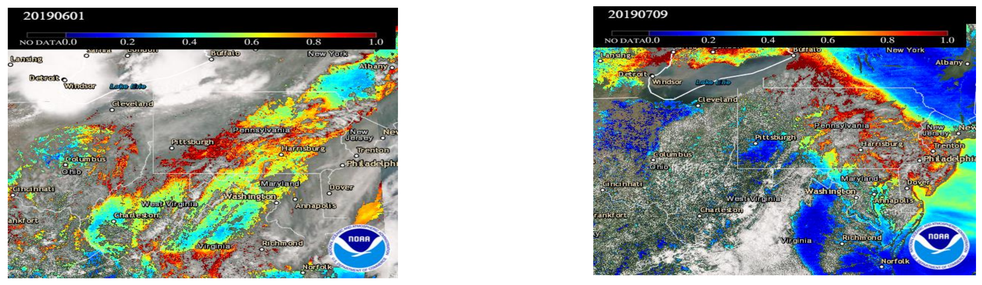

Figure 3 – VIIRS Layers (SNPP) *

NOAA Hazard Mapping System Smoke Product

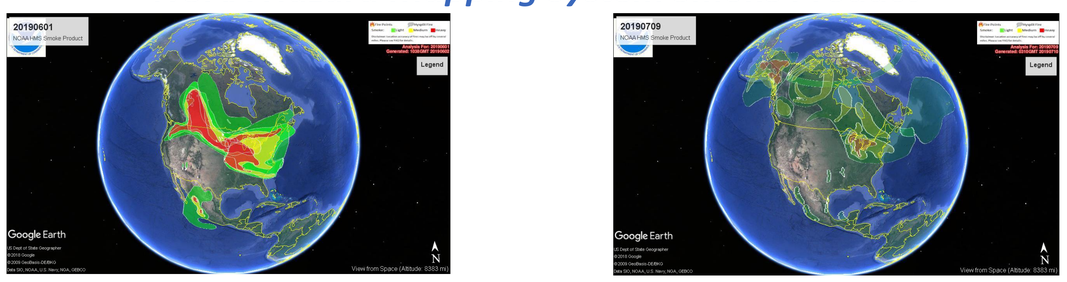

Figure 4 – Google Earth Image of Smoke Product

EPA Airnow Air Quality Index

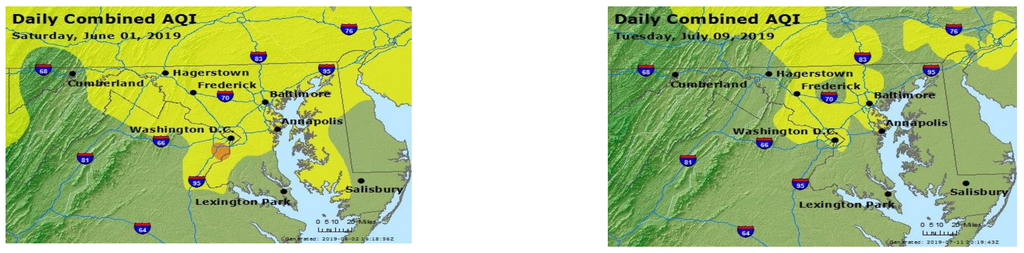

Figure 5 – Daily Combined AQI ($PM_{2.5}$ and Ozone)

AirNowTech Hourly $PM_{2.5}$

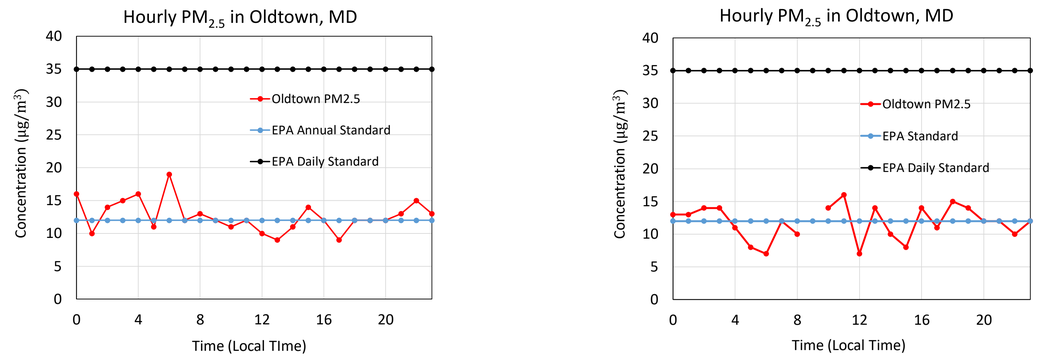

Figure 6 – Hourly Oldtown $PM_{2.5}$ Concentrations and U.S. EPA Annual and Daily Standard comparison

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