

Fusing surface and satellite-derived PM observations to determine the impact of international transport on coastal PM_{2.5} concentrations in the western U.S.

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Motivation and Project Statement:

While domestic sources of emissions are the primary cause of air pollution in the U.S., the international flow of air pollution into the U.S. contributes to observed concentrations of criteria pollutants such as ozone and particulate matter < 2.5 micrometers in diameter (PM_{2.5}). The impact that international transport of air pollution has on our ability to attain air quality standards or other environmental objectives in the U.S. has yet to be fully characterized. The goal of this project is to use long-term aerosol optical depth (AOD) measurements from the Advanced Very High Resolution Radiometer (AVHRR) satellite to determine the impact of international transport of air pollution on PM_{2.5} concentrations in coastal areas of the western U.S. Fusing this satellite dataset with PM_{2.5} observations and meteorological parameters from the National Centers for Environmental Prediction (NCEP) reanalysis enables a temporal and spatial extrapolation of the existing monitoring network. Quantifying the spatial gradients and trends in PM_{2.5} affected by international transport will help local and regional areas understand how background levels of these pollutants may affect their ability to achieve the National Ambient Air Quality Standards and long-term visibility improvement goals.

Potential steps:

- 1) Identify U.S. PM_{2.5} sites within or adjacent to AVHRR grids
- 2) Generate relationships between AVHRR AOD and surface PM_{2.5} at each site
- 3) Analyze time series of satellite-derived surface PM_{2.5} (including trends by month, quarter, and annual averages)
- 4) Quantify and characterize spatial processes and correlations
- 5) Using 3-hr wind direction at 10-meters height derived from the NCEP North American Regional Reanalysis, segregate trend analysis by onshore/offshore/mixed wind direction to isolate the impacts from international transport
- 6) Identify any spatial gradients in the long-term trends in AVHRR AOD (potentially after accounting for surface wind speed) in the Pacific Ocean to determine the origin/spatial extent of international transport

Data sources:

AVHRR AOD:

<https://www.ncdc.noaa.gov/cdr/atmospheric/avhrr-aerosol-optical-thickness>

US PM_{2.5}:

<http://www3.epa.gov/airdata/>

NCEP North American Regional Analysis:

<http://www.esrl.noaa.gov/psd/data/gridded/data.narr.monolevel.html>

Surface wind speed-AOD relationship:

<http://www.atmos-meas-tech.net/5/377/2012/amt-5-377-2012.pdf>