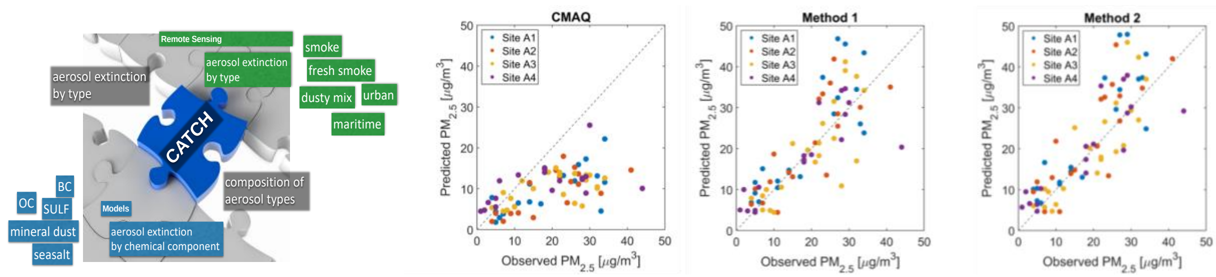

Improving the accuracy of ground-level fine aerosol concentration estimates by using novel remote sensing techniques

More than 80% of people living in urban areas that monitor air pollution are exposed to air quality levels that exceed WHO limits. Ambient air pollution, made of high concentrations of fine particulate matter, $PM_{2.5}$, is the greatest environmental risk to health-causing more than 3 million premature deaths worldwide every year. $PM_{2.5}$ include pollutants such as sulfate, nitrates and black carbon, which penetrate deep into the lungs and into the cardiovascular system, posing the great risks to human health. While all regions of the world are affected, air pollution levels are rising most in many of the world's poorest cities. Regional and global air pollution/climate models are typically used for the air quality assessments. Conventionally, these models get validated prior to their usage through air quality measurements that are done at the surface through ground-based monitors. However, the accurate measurements of fine particles rely on expensive equipment, reducing the extent of spatial monitoring, particularly in the developing world.

Satellite remote sensing for surface air quality has developed rapidly over the past decade, with numerous attempts to link Aerosol Optical Depth (AOD) with surface $PM_{2.5}$ concentration. The current work advances the demonstrated relationship between the AOD and surface $PM_{2.5}$ by introducing High Spectral Resolution Lidar (HSRL)-derived aerosol types (urban, smoke, fresh smoke, dust/dusty mix, and maritime/polluted maritime) as a constraint for particle chemical composition. By quantifying the linkages between the aerosol types and their relative chemical composition (i.e., fractional contribution of sulfates, nitrates, black carbon, organics, sea-salt and dust), the current method aims to improve surface $PM_{2.5}$ model predictions.

The remote sensing component of the proposed study is from HSRL aerosol types retrieved during Discover-AQ (Deriving Information on Surface conditions from COlumn and VERtically Resolved Observations Relevant to Air Quality) Washington Corridor (BWC) campaign. The modeling component is the EPA's CMAQ (Community Multiscale Air Quality) Model. The linkage between the remotely sensed and the modeled data is provided by CATCH (Creating Aerosol Types from CHemistry) - a recently developed algorithm that that takes model-predicted data on aerosol microphysics and chemical composition and generates aerosol types similar to that retrieved by HSRL. The data from the ground monitoring stations in the BWC region will be used for the model performance evaluation in prior and posterior simulations.

The proposed study is relevant to NASA strategic goals and objectives as it uses the data collected during the NASA airborne campaign in conjunction with the surface measurements and the air quality modeling. The new methodology proposed here will also benefit the future satellites by providing a stronger link between remote sensing and surface PM2.5 concentration, and air quality models by providing a new constraint (in addition to the surface monitoring stations) that can be successfully used over the regions with few or no ground stations.

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