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Lidar, Sunphotometer and Aircraft Observations of Urban Aerosols during the DISCOVER-AQ Mission

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The Deriving Information on Surface Conditions from COlumn and VERtically Resolved Observations Relevant to Air Quality (DISCOVER-AQ) Mission is a five-year multisite experiment to better understand the relationship between satellite measured variables (columnar) with surface concentrations, required for air quality assessment and regulation. The first DISCOVER-AQ experiment was held in the Baltimore-Washington urban corridor during July 2011 and involved eleven lidars and two aircraft to provide the vertical profiles needed to close the vertical column with surface measures. One of these lidars was a downlooking High Spectral Resolution Lidar (HSRL) flying at greater than six kilometers altitude. In addition, over 40 sunphotometers were employed on a grid to add to the horizontal dimension during the DRAGON experiment, running concurrently. Comparison of the extinction profiles with ground based retrievals from elastic lidars shows quantitative agreement. The lidar derived height of the PBL shows variability in both spatial and temporal extent through the region. Variability in aerosol optical depth conforms to gradients that are primarily affected by the proximity to the Chesapeake Bay which affects wind flow, PBL height and humidity profile. Closing on a relationship between AOD and surface PM is improved with consideration of hygroscopic growth of the aerosol as a function of height, which is expected to be dependent on aerosol speciation. Comparison of the DRAGON AERONET data with the NOAA GOES Aerosol and Smoke Product (GASP) shows that when the data is aggregated over a month the spatial agreement in AOD between sunphotometers and GASP is excellent. Overall, DISCOVER-AQ provides a significant opportunity for evaluation of the column radiometric properties of aerosols against models and theory.