Evaluating In-Situ Aerosol Composition and Optical Properties Measurements from the 2023 AEROMMA Airborne Field Mission to Validate and Improve Satellite Data Products

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Abstract

One of the primary objectives of the Atmospheric Emissions and Reactions Observed from Megacities to Marine Areas (AEROMMA) 2023 campaign was to measure aerosol and trace gas properties to help evaluate and improve the performance of the TEMPO satellite. We will give an overview of the aerosol instruments onboard the NASA DC-8 aircraft and our progress in combining the in-situ aerosol microphysical, chemical, and optical measurements. There was a comprehensive suite of instruments on the aircraft, including aerosol size distribution (3nm–50um), aerosol chemical composition (from both single particle and aerosol mass spectrometers,), and aerosol optical measurements over the ultraviolet and visible wavelengths. Coupling with simultaneous gas-phase measurements of both inorganic and organic species, we will also examine the chemical evolution and transport of emissions from different megacities. The DC-8 aircraft also performed multiple vertical profiles that provided important points of comparison between the in situ and remote sensing measurements, such as direct comparison of column-integrated AOD, AAOD, SSA, and aerosol layer height between the in-situ and satellite-derived values. In addition to the satellite and ground-based remote sensing measurements, there was a NASA G-V aircraft with a down-looking, high-spectral-resolution lidar (HSRL), in patterns in the vicinity of New York, Chicago, and Los Angeles. The HSRL provided detailed information on extinction profiles at 355 and 532 nm, backscatter profiles at these wavelengths and at 1064 nm, and depolarization data at 1064 nm. These active remote sensing measurements at ambient RH conditions will be compared to the extinction calculations at ambient RH derived from our dry, in-situ aerosol measurements on the DC-8. The HSRL data are also used to derive aerosol types (e.g., smoke, dust, urban pollution, sea salt, and mixtures). The AEROMMA in situ composition and size distribution data will provide direct validation of the accuracy of these aerosol type retrievals.

Early Career Scientist

YES, I am an early career scientist.

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