Progress on inversion algorithm development for multi-angle polarimetric aerosol retrievals using AirMSPI

Feng Xu[a,*], Gerard van Harten[a], David. J. Diner[a], Oleg Dubovik[b], and Yoav Schechner[c]

[a]*Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA91109, USA*
[b]*Laboratoire d'Optique Atmosphérique, CNRS/Université Lille-1, Villeneuve d'Ascq, France*
[c]*Viterbi Faculty of Electrical Engineering, Technion – Israel Institute of Technology, Haifa, Israel*

[*]*Presenting author (fengxu@jpl.nasa.gov)*

The Airborne Multiangle SpectroPolarimetric Imager (AirMSPI) was developed for NASA by the Jet Propulsion Laboratory to advance our understanding of the climate and air quality impacts of aerosols, clouds, and the interactions between aerosols and clouds. It performs multi-angle observations of a target area between ±67° off nadir. Imaging is made in eight spectral channels in the UV–NIR (355–935 nm), three of which (centered at 470, 660, and 865 nm) are polarimetric.

For a coupled retrieval of aerosol properties and surface reflectance, an efficient and flexible algorithm has been developed to fully capture the information content of polarimetric observations. Spatial correlation in aerosol properties is utilized to reduce the retrieval parameter space and mitigate the ill-posedness of inversion, as well as to develop a PC based fast radiative transfer model to capture variations of radiation field across an image [1]. Our retrieval imposes constraints on spatial variations of aerosol microphysical properties, spectral variations of the Bidirectional Polarization Distribution Function and angular shape of the Bidirectional Reflectance Distribution Function [2]. Retrievals were tested using remote sensing data AirMSPI acquired in recent field campaigns including the Studies of Emissions and Atmospheric Composition, Clouds and Climate Coupling by Regional Surveys, the Imaging Polarimetric Assessment and Characterization of Tropospheric Particulate Matter, and the Aerosol Characterization from Polarimeter and Lidar campaigns. Validation of retrieved aerosol properties (e.g., aerosol optical depth, single scattering albedo and size distribution) were performed using coincident ground-based measurements by AERONET (NASA/GSFC) in the presence of various types of aerosols (e.g., smoke aerosols, non-spherical dust aerosols, and non-absorbing aerosols) with low to moderately high loadings.

References

[1] Xu, F., D. J. Diner, O. Dubovik, and Y. Schechner 2019: A correlated multi-pixel inversion approach for aerosol remote sensing. *Remote. Sens.* (submitted).

[2] Dubovik, O., M. Herman, A. Holdak, *et al.*, 2011: Statistically optimized inversion algorithm for enhanced retrieval of aerosol properties from spectral multi-angle polarimetric satellite observations. *Atmos. Meas. Tech.* **4**, 975–1018.

Preferred mode of presentation: Oral