Sensitivity analysis of polarimetric remote sensing of atmospherically-processed brown carbon aerosol

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Biomass burning is an important emission source for brown carbon (BrC) aerosol, which has been shown to significantly modulate regional atmospheric radiative forcing by strongly absorbing in the near-UV solar spectra. These particles could also affect cloud microphysical characteristics due to their solubility in a liquid medium. Multiangle spectropolarimetric remote sensing techniques have been found great use in improving the characterization of columnar properties of the atmospheric BrC including its composition and particle vertical distribution [1].

Freshly emitted BrC aerosol has been shown to quickly undergo atmospheric processing resulting in changes of its optical and physicochemical properties on time-scales ranging between minutes to hours [2]. Current remote sensing retrieval algorithms fail to take into consideration parameterizations of BrC aerosol microphysical properties during atmospheric processing. In this study, we propose forward modeling to quantitatively analyze the sensitivity of remote sensing parameters to changing BrC aerosol properties as a function of atmospheric processing. We track the evolution of BrC aerosol after emission by configuring the atmospheric layers in numerical model with aerosols of different aging stages. By doing this, the spectropolarimetric pattern of BrC aerosol will be tracked over a long time-scale. The validation of our forward modeling results will be made with observational data collected by the Jet Propulsion Laboratory's Airborne Multiangle SpectroPolarimetric Imager (AirMSPI).

References

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[2] Sumlin, B. J., A. Pandey, M. J. Walker, R. S. Pattison, B. J. Williams, and R. K. Chakrabarty, 2017: Atmospheric photooxidation diminishes light absorption by primary brown carbon aerosol from biomass burning. *Environ. Sci. Technol. Lett.* **4**, 540–545.

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