Retrieval of aerosol properties from multi-angular POLDER polarimetric observations

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Multi-angular polarimetric imagers are widely considered as the instruments that can provide most of the requisite information about global and regional properties of aerosol. Indeed, combined simultaneous spectral, angular, and polarimetric measurements of atmospheric radiation should maximize the sensitivity of observations to detailed aerosol properties. Numerous theoretical studies concluded that multi-angular polarimetry can provide accurate characterization of aerosol with accuracy sufficient for many important applications. Nevertheless, the overall volume of polarimetric observations of the atmosphere remains small compared to that of photometric observations. Furthermore, the currently available polarimetric observations are mostly considered as useful datasets for understanding the potential of polarimetry and for designing future missions rather than as aerosol information for specific climatological and environmental applications. This situation is undoubtedly the result of the general complexity of polarimetric observations and the retrieval theory. Polarimetry is highly sensitive to a large number of atmospheric parameters, and accounting adequately for all these sensitivities in the retrieval algorithm is very demanding, especially in satellite applications wherein large volumes of data have to be processed. Therefore, the need to develop more robust algorithms for deriving aerosol properties from polarimetry has been clearly identified by the satellite community. As a result, several highly optimized algorithms have recently been developed and demonstrated to provide enhanced aerosol retrievals from satellite polarimetry [1].

The main objective of this presentation is to discuss the achievements and challenges in providing the accurate and complete aerosol retrievals from polarimetric observations. Specifically, 18 months of POLDER-1 and -2 and nine years of POLDER-3 observations have recently been processed with the GRASP algorithm [2,3] and provided to the community. In-depth analysis, validation, and comparison with other data will be provided.

References

[1] Dubovik, O., Z. Li, M. I. Mishchenko, *et al*., 2019: Polarimetric remote sensing of atmospheric aerosols:instruments, methodologies, results, and perspectives. *J. Quant. Spectrosc. Radiat. Transfer* **224**, 474–511.

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[3] 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.

Mode of presentation: Invited