Synergy of lidar and polarimetric observations using GRASP algorithm for enhanced aerosol characterisation

Anton Lopatin[a,*], Oleg Dubovik[b], Gregory Schuster[c], Tatyana Lapyonok[b], Pavel Litvinov[a], Benjamin Torres[b], David Fuertes[a], Daniel Perez-Ramirez[d], Fabrice Ducos[b], Yevgeny Derimian[b], and Yana Karol[a]

[a]*GRASP S.A.S., 59830, Bachy, France*
[b]*Laboratoire d'Optique Atmosphérique, UMR8518, CNRS – Université Lille 1, Villeneuve d'Ascq, France*
[c]*NASA Langley Research Center, Hampton, VA 23681, USA*
[d]*Atmospheric Physics Group, Andalusian Center for Environmental Studies, University of Granada, Granada, Spain*

[*]*Presenting author (anton.lopatin@grasp-sas.com)*

Currently, many experiments targeting comprehensive characterization of the atmosphere use coordinated observations by both lidar and polarimeters in order to obtain important complimentary information about aerosol properties. The passive observations by multi-angular polarimeters show sensitivity to the columnar aerosol properties but are significantly limited to describe the vertical structure of the atmosphere. Polarimetric observations combined with advanced inversion techniques [1] are commonly used for deriving the information about aerosol microphysics including aerosol particles shape, size distribution, and complex refractive index. In a contrast, lidar observations of atmospheric responses from different altitudes to laser pulses emitted are designed to provide accurate profiling of the atmospheric characteristics. However, the interpretation of the lidar observations generally relies on the assumptions about aerosol type and loading. Here we present the recent advancements in the Generalized Aerosol Retrieval of Atmospheric and Surface Properties (GRASP) algorithm [1,2] that simultaneously inverts coincident lidar and polarimetric observations and derives a united set of aerosol parameters that includes both columnar and vertically resolved properties. Such synergetic retrieval results in additional enhancements in derived aerosol properties [3] because the backscattering observations by lidar including elastic, Raman and depolarization add some sensitivity to the columnar properties of aerosol, while radiometric observations provide sufficient constraints on aerosol type and loading that generally are missing in lidar signals.

As the GRASP algorithm realizes a very general and unified approach to the remote sensing observations treatment [1] a deep synergy between active and passive instruments could be achieved, providing demanded data for enhanced understanding of global distribution of aerosol properties. For example, the potential and limitations of synergetic processing of existing and next generation space borne lidars and polarimeters are discussed.

References

[1] Dubovik, O., *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.

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