Influence of Lidar Depolarization on GRASP Retrieval: Insights from Izaña Observatory.

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Atmospheric aerosols play a multifaceted and crucial role in Earth's climate. They influence the climate directly by scattering and absorbing solar radiation and indirectly by interacting with other atmospheric elements like clouds, thereby altering radiative forcing. Consequently, accurately characterizing their physical and optical properties is essential. In this context, sun-lunar-sky photometers are sensitive to the quantity, size, shape, and morphology of aerosols, yet they lack sensibility to their vertical changes. In contrast, while elastic lidars are highly effective at profiling aerosols vertically, they are sometimes limited in their ability to provide extensive details on certain aerosol characteristics without relying on a priori information. Nonetheless, the integration of depolarization channels in elastic lidar systems has significantly enhanced their functionality, providing new information about aerosol properties through the changes in the polarization state of light. Located at an elevation of 2,373 meters on the island of Tenerife, Spain (28.3ºN; 16.5ºW), the Izaña Observatory is usually under dust-laden air masses throughout most of the summer due to seasonal transport [1]. Equipped with a CIMEL CE376 lidar with two attenuated backscatter and depolarization channels at 532nm and 808nm, alongside an AERONET station, the observatory serves as an ideal site to analyze Saharan dust physical and optical properties. The objective of this study is to evaluate various methodologies using the GRASP algorithm (Generalized Retrieval of Atmospheric and Surface Properties [2]), which allows the joint of both lidar and sun-lunar-sky photometers measurements to obtain the aerosol properties in the atmospheric column and the vertical. Specifically, this work aims to investigate how the inclusion or exclusion of volume depolarization profiles influences the accuracy of retrieving Saharan dust properties.

References

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[2] Dubovik et al. (2021): *A Comprehensive Description of MultiTerm LSM for Applying Multiple a Priori Constraints in Problems of Atmospheric Remote Sensing: GRASP Algorithm, Concept, and Applications.* Front. Remote Sens. 2:706851. doi: 10.3389/frsen.2021.706851.

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