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Outstanding Student & PhD candidate Presentation contest

Dust optical properties in the Ultraviolet (UV)

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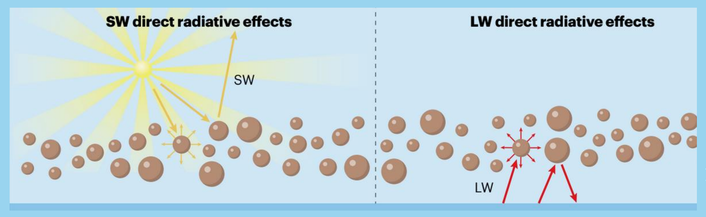
Direct interactions

Dust can directly interact with radiation either by scattering or by absorbing it.



Kok et al., 2023 [1]

Single Scattering Albedo (**SSA**) is a key parameter for characterizing aerosol direct interaction with radiation. It is defined as the ratio of scattered radiation to total extinction (i.e., scattering + absorption). Lower SSA values indicate a greater contribution of absorption.

UV solar radiation

UV radiation represents the shortest-wavelength—therefore highest-energy—portion of the solar spectrum. It plays a critical role in public health. Prolonged human exposure to solar UV may result in acute and chronic health effects on the skin, eye and immune system [2].

References:

[1] Kok, J. F., Storelvmo, T., Karydis, V. A., Adebiyi, A. A., Mahowald, N. M., Evan, A. T., He, C., & Leung, D. M. (2023). Mineral dust aerosol impacts on global climate and climate change. Nature Reviews Earth & Environment, 4(2), 71–86. https://doi.org/10.1038/s43017-022-00379-5

[2] Blumthaler, M. (2018). *UV monitoring for public health*. *International Journal of Environmental Research and Public Health, 15*(8), 1723. 10.3390/ijerph15081723.

The goal of this work is to retrieve the SSA of mineral dust aerosol for 5 wavelengths inside the UV-A spectral range

Input

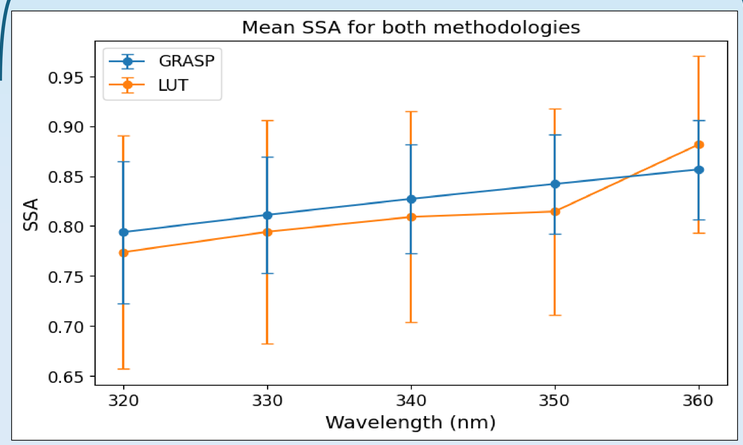
Brewer Spectrophotometer
Global and Direct Irradiances, Aerosol Optical Depth and Total Ozone Column from dust dates candidates.

Methodology

- **Look-Up Table (LUT) retrieval**: Radiative Transfer Models are used to create LUTs to find the value of the studied magnitude (SSA) that matches the measurement, hence retrieving it.
- **GRASP retrieval**: An inversion algorithm is employed to retrieve aerosol microphysical and optical properties from radiometric measurements, such as Brewer irradiance observations.

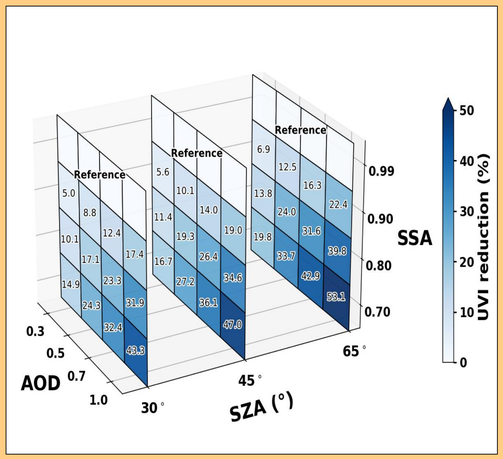
Results

Single Scattering Albedo in the UV-A (320-360nm)

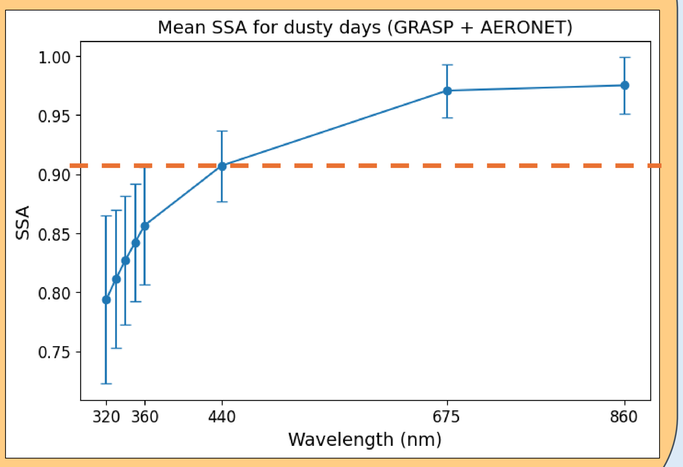


The mean value for each selected wavelength is presented for all considered dust event candidates. The results show partial agreement; however, GRASP exhibits more consistent behavior and a smaller standard deviation.

Conclusions



- Two different methodologies agreed on the retrievals of the dust SSA in the UV-A spectral range.
- Dramatic increase in radiation absorption as the wavelength decreases further into the UV region.
- Extrapolation from closest available AERONET wavelength (440 nm) implies an overestimation of >0.05 units of SSA.



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