Aerosol components retrieval in GRASP algorithm: advantages and limitations

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A concept of aerosol components retrieval from remote sensing was recently realized in the framework of the GRASP (Generalized Retrieval of Aerosol and Surface Properties) algorithm. The method is described in [1] and benefits from sensitivity of polarimetric (POLDER/PARASOL) or spectral and directional (AERONET) observations to aerosol complex refractive index. However, the algorithm infers the aerosol components directly from the measured radiances, without intermediate retrieval of refractive index, while the refractive indices of the components are predefined from literature. The aerosols in this methodology are assumed to be mixtures of hydrated soluble particles embedded with black carbon, brown carbon, iron oxide, and other non-absorbing insoluble inclusions. The volume fractions of these components are derived along with the conventional size distribution and the fraction of spherical particles.

The approach presents two main advantages: (i) it aims bridging to the quantities used in global chemical transport models; and (ii) it employs refractive indexes obtained by dedicated techniques and thus impose an additional physical constrain on their spectral dependance. The former is expected to improve retrievals of aerosol optical characteristics in general. The limitations of the approach reside in the way the aerosol components can be defined, which on one side is a proxy of aerosol chemical composition, but on the other are governed by remote sensing measurements sensitivity and instrumentation configuration.

Several studies were recently published aiming aerosol components global and regional climatology, and geophysical processes interpretations. The approach is also used in efforts on harmonization between aerosol characteristics assumptions in remote sensing and climate models. The presentation will overview the principles, illustrate results, discuss advantages and limitations, as well as the future plans.

References

[1] Li, L., Dubovik, O., Derimian, Y., Schuster, G. L., Lapyonok, T., Litvinov, P., Ducos, F., Fuertes, D., Chen, C., Li, Z., Lopatin, A., Torres, B., and Che, H.: Retrieval of aerosol components directly from satellite and ground-based measurements, Atmos. Chem. Phys., 19, 13409–13443, doi.org/10.5194/acp-19-13409-2019, 2019.

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