Light scattering by atmospheric particles: From fascinating details to a challenge in space-based greenhouse gas retrievals

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Atmospheric aerosol particles and cloud constituents scatter and absorb solar radiation. These effects can be taken into account in radiative transfer considerations but that requires models for the optical properties of these particles for the relevant wavelengths. Atmospheric particles are rich in sizes, morphology and composition, which is often necessary to consider in their optical models. These particles affect also retrievals of other atmospheric constituents through changes in the light paths. While these effects may have been previously neglected, they are becoming increasingly important as retrieval accuracy requirements increase.

My talk in this workshop addresses this wide topic from three perspectives. First, I will give a brief overview on the optical modeling of atmospheric aerosol particles, with an emphasis on non-spherical particles and modeling their optical properties. Second, I will talk about solving light scattering by large, absorbing particles using ray optics with a consideration for inhomogeneous waves. This method is directly applied to atmospheric ice crystals in the near-infrared wavelengths. Third, I will introduce the importance of considering aerosol effects in space-based greenhouse gas retrievals with practical examples using retrievals from the Nasa Orbiting Carbon Observatory -2.