Aspect ratio distributions of atmospheric aerosol particles and their effects on skylight polarization

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Atmospheric aerosol particles modify the radiative energy budget of the earth–atmosphere system by scattering and absorbing solar radiation. Considering that particle morphology is of vital importance to how electromagnetic radiation is scattered by a single particle and that light scattering is affected by the shape distribution of volume particles, quantitative knowledge about various non-spherical aerosol shapes gets more and more attention in modelling aerosol volumetric optical properties [1,2]. The shape distribution, expressed as aspect ratio distribution, is derived as the normalized number of the occurrence of aspect ratios of a large sample of individual particles. An *a priori* fixed shape distribution of dust particles has widely been applied in the inversion of aerosol particle properties based on measurements collected with sun-sky radiometers. This dust particle shape distribution derived from laboratory measurements shows obvious different features compared to the results obtained by direct microscopic observations of aerosol particle samples captured in the natural atmosphere [2].

In this talk, we employ the model of polydisperse randomly oriented spheroids and use a fluorescence microscope to measure the aspect ratio distribution of atmospheric aerosol particles. The effects of different directly microscope-measured and indirectly inversion-based aerosol shape distributions on the radiance and polarization distributions of the skylight in the celestial hemisphere are discussed based on numerical simulations. The results suggest that using representative particle shape distributions obtained by direct microscopic observations of aerosol samples captured in natural atmosphere could improve the retrieval of aerosol shape parameter [3].

References

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