Geophysical Research Abstracts
Vol. 13, EGU2011-2280-1, 2011
EGU General Assembly 2011

Optical particle sizing in vertically inhomogeneous turbid media

Alexander Kokhanovsky and Vladimir Rozanov
Institute of Remote Sensing, University of Bremen, D-28334 Bremen, Germany(alexk@iup.physik.uni-bremen.de)

Current operational aerosol and cloud retrieval algorithms are based on the assumption that cloud or aerosol layers can be represented as vertically homogeneous media, which is never the case due to various physical reasons, including the existence of temperature and humidity vertical gradients, gravitational settling, etc. The effective radius (ER) of particles is determined matching observed and calculated reflectances at a particular wavelength in the near infrared region of electromagnetic spectrum, where many condense media (including water) absorb light. For this the optical thickness of the medium must be known and its value is determined using measurements in the visible. The strength of absorption is governed by the size of the particles. Therefore, in principle one can derive the ER from the near – IR radiance measurements. The main problem is due to the fact that the derived size depends on the wavelength of the probing light. This is because many turbid media (and clouds in particular) are vertically inhomogeneous and light of different wavelengths penetrate to different depths inside the clouds. The use of channels, where particles are less absorptive, enables remote sensing of comparatively deep layers, while at the wavelengths, where light absorption is strong, only particles in the vicinity of the boundary can be probed. Clearly, due to the existence of the vertical profile of the effective radius (see, e.g., Zhang et al., 2010), different volumes of clouds are probed and different radii are derived depending on the wavelength used in corresponding measurements. The problem can be solved if from the very beginning not the singe ER but the profile of the ER is sought. In this work we explore this opportunity using measurements at the wavelengths of 0.865, 1.2, 1.6, and 3.7 microns common to several currently operating radiometers. We find that the problem can be solved at least in the case of linear profiles of the effective radius. The respective retrieval scheme based on the concept of weighting functions is introduced and discussed in detail. Further enhancements of the technique are possible if multi-angular polarimetric measurements are performed.

References

Zhang, S., H. Xue, and G. Feingold, 2010: Vertical profiles of droplet effective radius in shallow convective clouds, Atmos. Chem. Phys. Discuss, 10, 30971-30998.