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Lidar With Multiple Field-Of-View Receiver To Determine Aerosol Size-Distribution

LIU, Yutong[1*] ; YABUKI, Masanori[1] ; TSUDA, Toshitaka[1]

[1]Research Institute for Sustainable Humanosphere, Kyoto University

Knowledge of aerosol size distribution is essential for human health studies, because small particles are able to penetrate lung tissues, thus increasing the risk of bronchitis or of lung diseases. Optical remote sensing techniques such as lidar are effective for monitoring aerosols with high temporal and spatial variations. Aerosol instruments that use light with UV, VIS, and near-IR wavelengths have been used to effectively detect particles with diameters comparable to the wavelength. However, to quantitatively estimate the shape of the particle number-size distribution, more information is required with respect to small particles in the size range of sub-micrometer and below.

Conventional lidar employs very small field-of-view (FOV) for profiling aerosol distribution, and thus simply detects single scatter in the direction opposite to that of incident light. Multiple scattered signals are influenced not only by aerosol distribution along the laser path, but also by the size of aerosols. In this study, depolarization UV lidar with a multiple FOV receiver was used for detecting such multiple scattering effects in order to obtain more quantitative information concerning particle-size distribution. Considering the advantage of high scattering cross section for small particles, we employ a UV laser of 266 nm or 355 nm. A program-controlled mechanical FOV selector is used for a receiver system that can change the FOV from 0.1 mrad to 12.4 mrad. In the presentation, we introduce a retrieval method for aerosol size distribution using this feature and show preliminary results from field measurements by the multiple FOV lidar.

Keywords: Lidar, Aerosol