

# Development of an algorithm to estimate the aerosol vertical profile from Sky radiometer and Lidar measurements

<sup>1</sup>Rei Kudo, <sup>1</sup>Toshinori Aoyagi, and <sup>2</sup>Tomoaki Nishizawa

<sup>1</sup>Meteorological Research Institute, Japan Meteorological Agency

<sup>2</sup>National Institute of Environmental Studies

Correspondence to: Rei Kudo (reikudo@mri-jma.go.jp)

## Abstract

We have developed an algorithm to estimate the vertical profiles of refractive indexes and volume size distribution from the routine measurements of SKYNET (sky radiometer and dual wavelength polarization Mie lidar). Optical properties of aerosols such as extinction coefficient, single scattering albedo, and asymmetry factor are further evaluated from the derived refractive indexes and size distribution. The algorithm consists of two steps. In the first step, the refractive indexes (real and imaginary parts) at sky radiometer wavelengths (340, 380, 400, 500, 675, 870, 1020 nm) and the volume size distribution in the column are estimated from sky radiometer measurements. The size distribution is assumed to be bi-modal lognormal distribution. In the second step, the vertical profiles of the refractive indexes (real and imaginary parts) at lidar wavelengths (532, 1064 nm) and the size distribution are estimated from the attenuated back scatter measurements, and optical depth and single scattering albedo obtained from the results of the first step. The size distribution is also assumed to be bi-modal lognormal distribution. At each step, the aerosol parameters are estimated on the basis of the Maximum Likelihood Method. The developed algorithm was tested for vertically non-homogeneous profiles (e.g., dust in the upper layer). The vertical profiles of extinction coefficient, single scattering albedo, and asymmetry factor at 532 nm were well estimated but those at 1064 nm were not. The vertical profiles of the size distribution were also well estimated. We also developed the algorithm with HSRL (High Spectral Resolution Lidar) which is being developed in NIES. In the presentation, we will show the algorithm with HSRL, and the results for the actual observations of sky radiometer and Mie lidar.