

## Lidar Network Observations of Tropospheric Aerosols

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### ABSTRACT

In the East Asian region, various kinds of aerosols such as mineral dust, air-pollution aerosols, biomass burning smoke, coexist, and it is important to understand the effects of these aerosols on climate and the environment. Continuous observations of the three-dimensional distribution and optical characteristics of aerosols with a network of lidars provide useful information for studying emission, transport, change of characteristics during transport, deposition, etc.

We started continuous observation with a compact automatic Mie scattering lidar in 1996 at NIES in Tsukuba in a research project on the effect aerosols in the global warming. In 2001, we constructed lidars in Beijing and Nagasaki and started network observations with the lidars at the three locations. The network has been expanded in the research programs and international cooperation. Currently, we are operating the lidars at 23 locations in Japan, Korea, Mongolia, and Thailand. Most of the lidars are operated in the research program on Asian dust. The lidars in Toyama, Nagasaki, Matsue, Niigata, and Tokyo were constructed by Ministry of the Environment of Japan in the Asian dust monitoring program. Some of the lidars are allocated in the radiation observation network GEOSS/SKYNET. All of the lidars in the NIES lidar network, except for some stations in China, participate in the GAW Aerosol Lidar Observation Network (GALION).

The lidar used in the network is two wavelength (1064nm, 532nm) Mie-scattering lidar having a depolarization ratio measurement function (532 nm). The lidar uses a commercial flash lamp pumped Nd:YAG laser as a light source. The output power at 1064 nm (532 nm) is 20 mJ (20 mJ). The receiver telescope diameter is 20 cm. Polarization components of received light at 532 nm are separated with a polarization prism and detected with two photomultiplier tubes (PMTs). Received light at 1064 nm is detected with an avalanche photodiode (APD). Signals from the PMTs and APD are digitized with 12-bit analogue-to-digital converters and recorded on a hard disk of the data acquisition PC.

The lidars are operated continuously regardless of weather. In the continuous observation, 5-min averaged lidar profiles are measured every 15 minutes. Consequently, 96 sets of profiles are obtained per day. The data from the on-line stations are transferred to NIES and processed in real time to derive the attenuated backscatter coefficients and the extinction coefficients for non-spherical and spherical aerosols. The data are used in the real-time monitoring of Asian dust as well as in the studies of regional air pollution and climate change.