Lidar observations of aeolian dust at Fukuoka in the spring of 2003

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Although the aeolian dust, which is injected into free troposphere over the inland of China by Asian dust storms, are frequently observed at Japan and the frequency of detection is getting higher recently, the effect of aeolian dust on the variation of climate and atmospheric environment has not yet been understood sufficiently. One of the reasons is the lack of sufficient observations of spatial and temporal distribution of the aeolian dust. We have performed the lidar observation of tropospheric aerosol in order to investigate the spatial and temporal variations of aerosols in the height range where they are transported through. Particularly, we made intensive observation of tropospheric aerosols in the spring season.

Our lidar system consists of YAG laser (the wavelengths of 1064, 532, 355 nm) as sources of light, two receiving telescopes(the diameters are 30 cm and 50 cm) and a detecting system with six channels (signals of parallel and perpendicular components to the polarization of laser light of 532 nm, total components of 1064 nm, 355 nm respectively, and Raman signal from Nitrogen molecules, etc). The measurement for 355nm by Analog method will be started in this spring.

In the observation from March to April, last year, we frequently detected the optically thin dust layers with increment of depolarization ratio (values of scattering ratio were 1.2-1.6 with depolarization ratio of 1.4-5.7%) in the height range between 3 and 10 km in the free troposphere. And in late March and early April, we detected some optically thick dust layers (values of scattering ratio were higher than 4) in the lower troposphere.

On April 13, we detected some layers with very large enhancement in both scattering ratio (4-10) and depolarization ratio (15-20%) from the ground to about 6 km, that is, from the mixing layer to the middle free troposphere. The series of observational data obtained from 20:00 LT on April 13 to 00:00 LT on April 14 showed that an increases of both scattering ratio and depolarization ratio above about 4km height was followed by the increase at the lower altitude. The result of daily rawin sonde observation by Fukuoka metrological observatory showed the inversion layer appeared at the height of about 1km at about 20:30 LT on April 13. Figure shows the time variations of (a) aerosol's extinction, (b) depolarization ratio at heights of 600 m and 3 km, respectively , observed by lidar. And (c) the time variations of aerosol particle concentrations in 6 size ranges, which were obtained by the optical particle counter (OPC) on the ground at same time. Both the extinction and depolarization at 3 km height increase gradually form 16 LT on April 13 to 02 LT on April 14, while their time variations at 600 m height show the rapid increase from 22 LT on April 13 to 00 LT on April 14. The aerosol concentrations on the ground in the fours bigger size ranges at radius bigger than 1.0 micro m show the incensement from 23 LT, followed by the increment of both the extinction and depolarization ratio at 600 m, when the aerosol concentrations in size range smaller than 0.5 micro m show the decrease. We also could see the different time variation of dust layer at different altitude in the mixing layer.

We will show mainly the result of observations in the spring, 2003 and discuss the comparison with results of last spring.

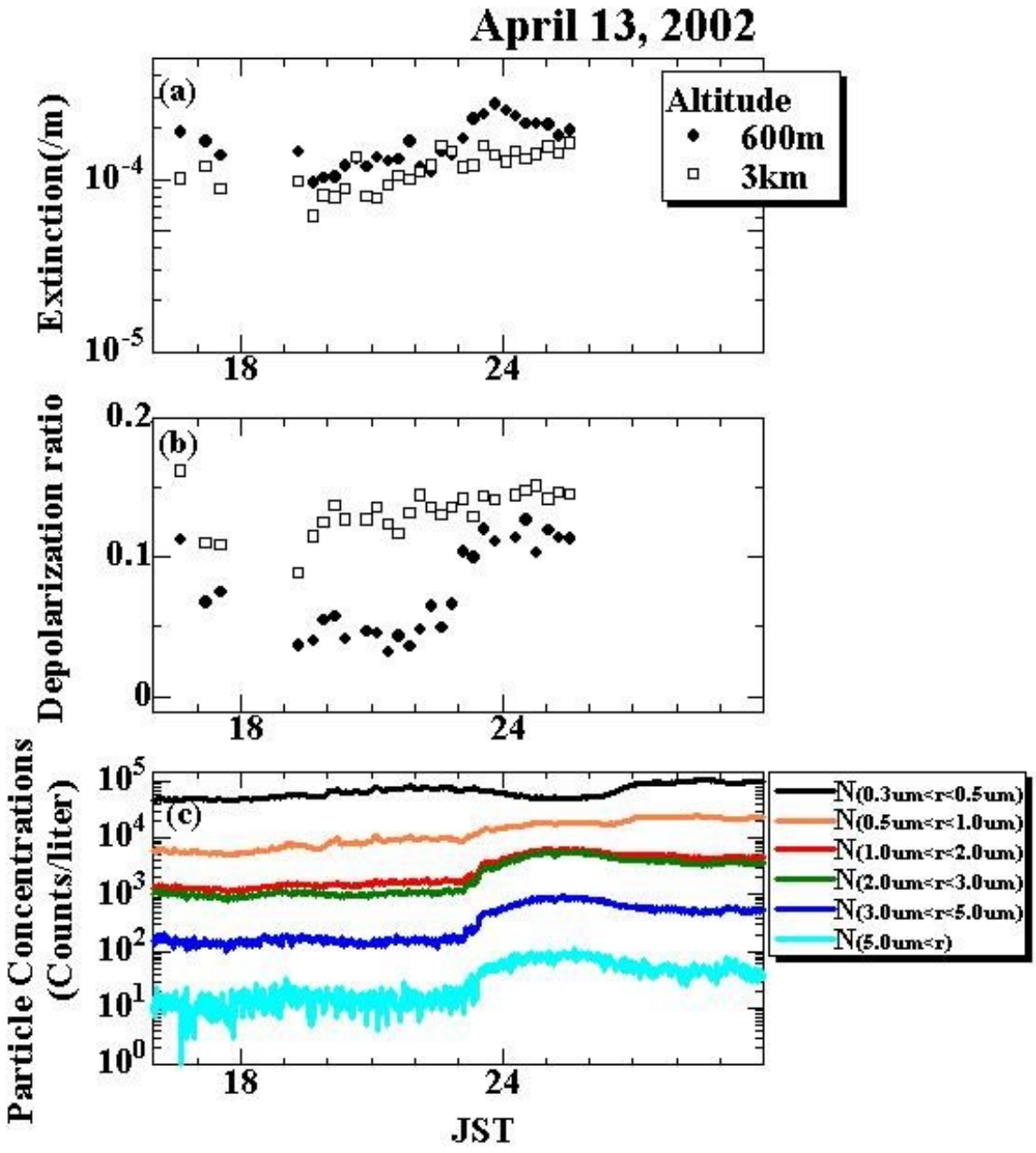

Figure. The time variations of (a) aerosol's extinction, (b) depolarization ratio by lidar and (c) particle concentration by OPC on the ground observed on April 13, 2002.