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PINATUBO STRATOSPHERIC AEROSOL LAYERS OBSERVED ROUTINELY BY A 589nm LIDAR

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The eruption of Mt. Pinatubo in Philippines in June 1991 caused a significant increase in the stratospheric aerosol concentration. We performed preliminarily the measurement of stratospheric aerosol layers from June 1991 to October 1991 and have routinely observed those since November 1991 with a Nd:YAG laser pumped dye lidar above Tokyo Metropolitan University (TMU) at Hachioji, Tokyo (35.6°N, 139.4°E).

The specifications of our 589nm lidar are shown in Table 1. This lidar was originally designed for measurement of the mesospheric sodium layer. For this purpose, whenever it was good weather conditions for the lidar observations, we tried the observations of the mesospheric sodium and the stratospheric aerosol simultaneously and we inclined to perform the all night operations. Consequently, we could obtain many data of the stratospheric aerosol layer. This paper presents some characteristics of the Pinatubo stratospheric aerosol layers observed by the 589nm lidar.

Table 1 Specifications of the 589nm lidar.

Transmitter		
	Laser	Nd:YAG SHG pumped Dye
	Wavelength	589 nm
	Pulse energy	100 mJ
	Linewidth	2 pm (FWHM)
	Repetition rate	10 Hz
	Pulse length	6 ns
	Beam divergence	0. 2 mrad
Receiver		
	Telescope aperture	
	280mm (before Oct. 1992)	
	350mm (after Nov. 1992)	
	600mm (after Dec. 1993)	
	Field of view	0. 7 mrad
	Optical bandwidth	3.5 nm (FWHM)
Data acquisition		
	Method	Photon counting
	Range resolution	100m

Time variations of the integrated backscattering coefficient (IBC) above tropopause observed by the 589nm lidar after the eruption is shown in Figure 1. The data are smoothed by forming a sliding average. We can see the first peak of IBC in April 1992, the second peak of IBC in December 1992 and the third peak of IBC in January 1994. The time series of IBC between 15-17.5km and IBC between 17.5-30km are shown in Figure 2. We can see that most of the time variation of IBC occurred in altitude range of 15-17.5km. Correlation between IBC above the tropopauses and the tropopause altitudes from September 1992 to August 1993 is shown in Figure 3. Generally, it is known that the tropopause altitudes have remarkable seasonal variations in mid-latitude. Figure 3 suggests that the seasonal variations of the IBC are correlated to those of the tropopause altitudes.

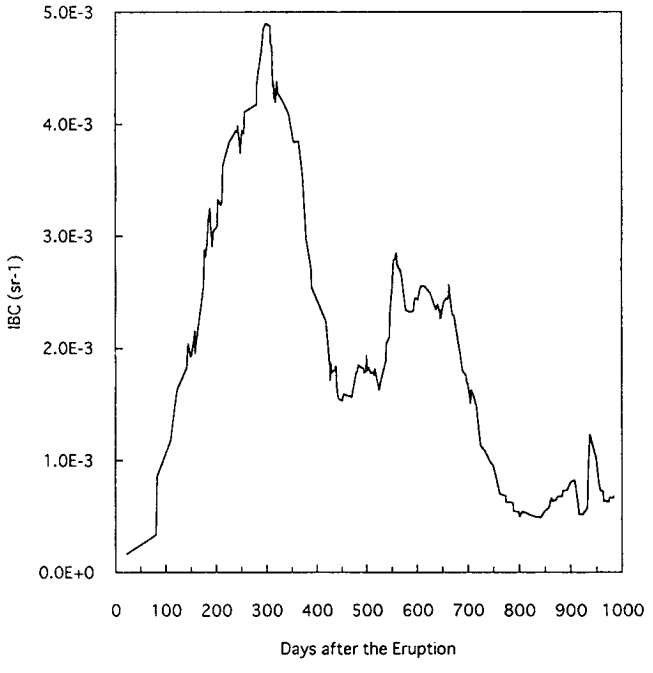

Fig. 1 Time variations of IBC above tropopause observed by the 589nm lidar after the eruption.

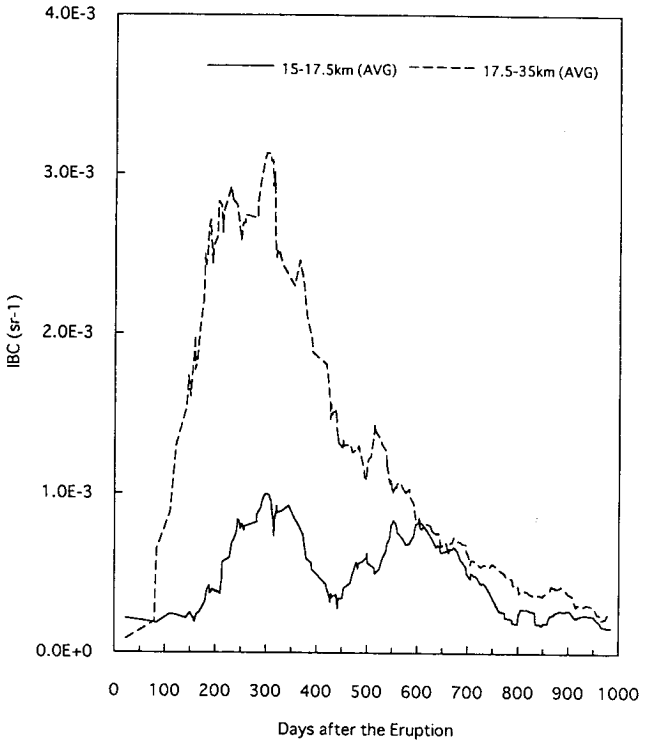

Fig. 2 Time variations of IBCs between 15-17.5km and IBCs between 17.5-30km.

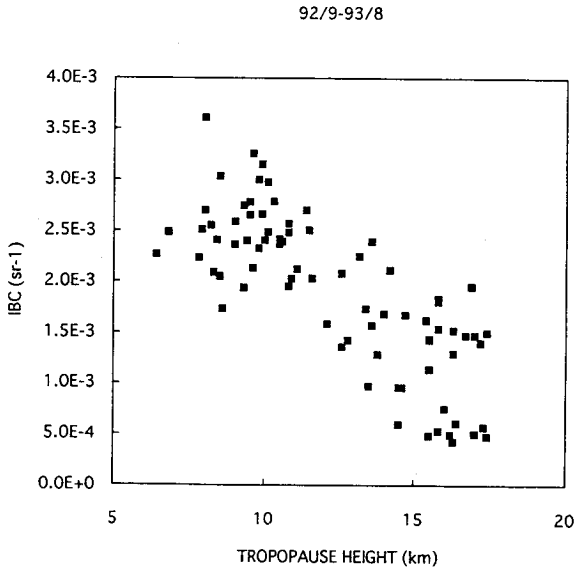

Fig. 3 Correlation between IBCs above the tropopauses and the tropopause altitudes from September 1992 to August 1993.

Recently we can only observe a little content of the Pinatubo aerosol by the 589nm lidar, however, we have sometimes observed the thin (about 1km FWHM) layers of the stratospheric aerosol during several days. These layers appear usually at 22-25km altitude. An example of these layers is shown in Figure 4.

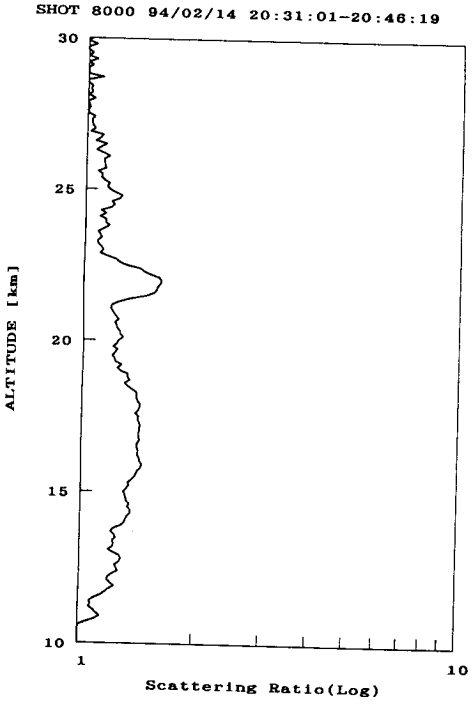

Fig. 4 An example of the thin layer of the stratospheric aerosol.