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OBSERVATIONS OF PINATUBO VOLCANIC CLOUDs AT WAKKANAI(45.4° N,141.7°E)

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1 Introduction

The eruption of Mt.Pinatubo on 15 June 1991 injected enormous amounts of volcanic materials into the stratosphere. The ejecta of 20 – 30 megatons [1] was expected to influence climate through radiative process by scattering and absorbing the solar and the terrestrial radiation , and ozone chemistry through reaction on the surface of sulfuric acid aerosols. For the quantification of these effects, we started lidar observations at Wakkanai Radio Observatory (45.4° N,141.7°E) of Communications Research Laboratory. Wakkanai is the most northern site in a lidar observation network [2] organized across Japan after the eruption of Pinatubo.

2 Lidar system

A Nd:YAG laser was originally used at the fundamental wavelength (1064 nm) which is more sensitive to aerosols than visible wavelength. Another Nd:YAG laser was added for the use at the second harmonic wavelength (532nm) in August 1992. Observations were alternately made at 1064nm and at 532nm in the period from August 1992 to August 1993, and the system was improved to work simultaneously at both wavelengths in September 1993. Backscattered photons collected with a 35cm-diameter Schmidt-Cassegrain telescope was sampled in 640nsec resolution (or 96m in height). The characteristics of the system are listed in Table 1.

Table 1. Characteristics of lidar at Wakkanai.

Transmitter		
Laser	Nd:YAG	SHG Nd:YAG
Wavelength	1064nm	532nm
Output	600mJ/pulse	150mJ/pulse
Repetition	10Hz	10Hz
Beam div.	0.1mrad	0.1mrad
Receiver		
Telescope	35cmϕ Schmidt-Cassegrain	
Detector	Cooled-PMT	PMT
H-resolution	96m	96m

3 Results

The lidar system was constructed at Koganei, Tokyo (35.7° N,139.5°E) and test obser-

vations were made there on 15 and 16 August 1991. The typical height profiles of the scattering ratio (=R) are shown in Fig.1. There are a small peak at z(height)=18km and a sharp peak at z=23km in the profiles at Koganei as other sites of the lidar network of Japan [2].

The first observation at Wakkanai on August 28 showed a lower peak but not sharp peak at upper altitude (Fig.1). The upper layer was first observed at z=22km on 9 October and grew up suddenly to merge in the lower layer on 11 October. The profiles of R showed large variability through October and November,1991 and the integrated backscattering coefficient (=IBC) on 22 October was in its maximum (see Fig.2). Until early October, large variations even in one night were observed. These facts indicate that the Pinatubo clouds were patchy in that period over Wakkanai (45.4° N), and are consistent with the observations of SAGE II which showed that the optical depth of the aerosols was highly inhomogeneous at 40° N through October [1].

After December 1991, the layer showed relatively stable profiles than before. The peak hight of R decreased from about 22km in late 1991 to about 17km in late 1992. Sedimentation of aerosols is gradually proceeding. Moreover, IBC became smaller in February and March 1993 and stable in low level after that.

The lower boundary of Pinatubo clouds sometime seems to connect with cirrus cloud near the tropopause and is difficult to be discerned from upper part of it.

In August 1992, we started observations at 532nm which is used in many sites. The observed values and variation of IBC at 532nm were similar to those obtained at other sites in similar latitude.

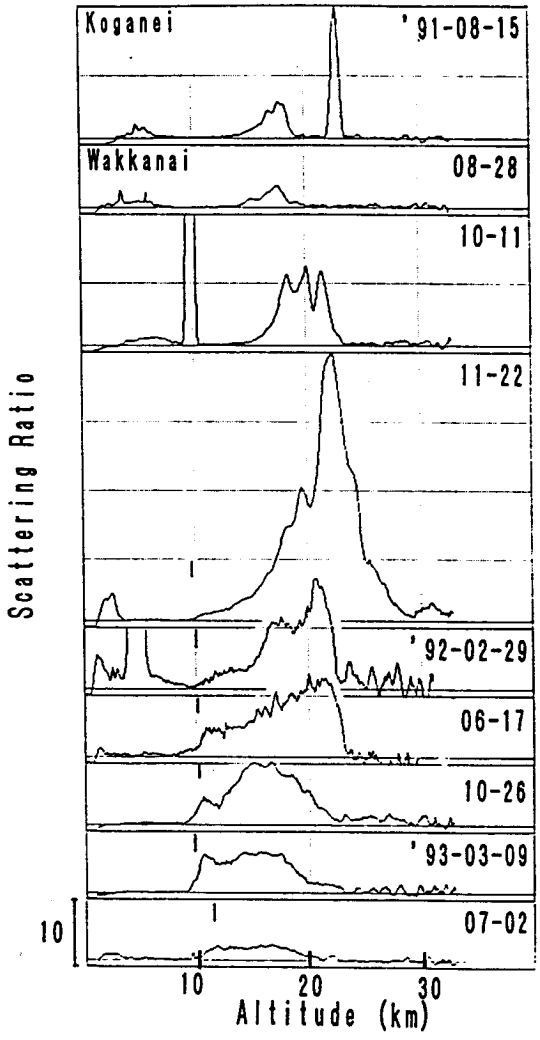

Fig. 1. Height profiles of scattering ratio of the Pinatubo clouds at 1064nm.

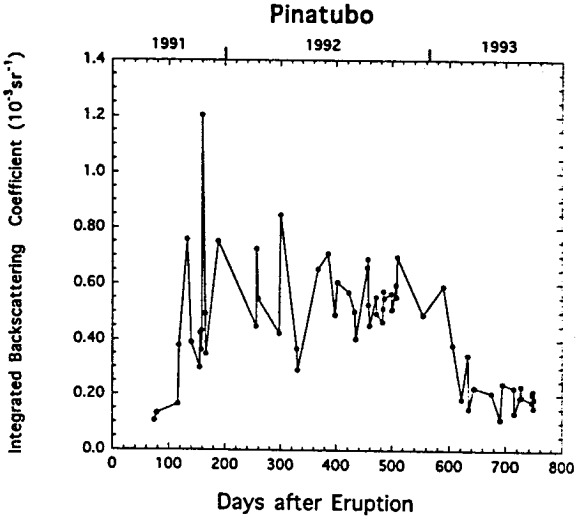

Fig. 2. Time variation of integrated backscattering coefficients at 1064nm.

4 References

1) McCormick, M.P., & Veiga, R.E. 1992, Geophys.Res.Lett., 19,155.

2) Uchino, O. et al. 1993, J.Met.Soc.Jpn., 71, 285.