P1-28 Kosa Observation at Okayama with a Mie-Lidar in Spring 1999

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1 Introduction

KOSA, or Asian dust, is the phenomenon that dust of sand originating in Gobi desert, western district of China, is transported on the prevailing westerly to Japan, or across the Pacific. KOSA absorbs a great interest on a study of long distance transportation of tropospheric aerosols, since the phenomenon can be tracer of the dynamics of global atmosphere over Asia and Hawaii.[1]

We have been constructing a Mie LIDAR(MLO-II; Mie LIDAR at Okayama University II) for observation of KOSA since 1997. We have observed KOSA below the altitude of 4km by recording depolarization ratio. Range of the LIDAR was extended to 9 km because KOSA often climbs up to the ceiling of the troposphere. The MLO-II system has been improved in its range by adding multiple channels, each of which is switched as time elapses after the laser emission and adapts to the level of return signal. Consequently we caught return signal from aerosol which existed around the altitude of 9km.

Table 1 Specifications of MLO-II

Transmitter	
Laser	Nd:YAG
Wavelength	532nm(SHG)
Repetition rate	10Hz
Energy	70mJ/pulse
Emitting direction	0° azimuthal 45° elevation
Receiver	
Telescope	Schmidt Cassegrain
Diameter	0.35m
Field of view	1mrad
Bandwidth of filters	1.5nm at 532nm
Detectors	3 PMTs
Signal Processing	
Sampling rate	50MS/s
Averagings	4096shots

In this paper we describe the constitution of MLO-II and experimental results for KOSA on March 2, 1999.

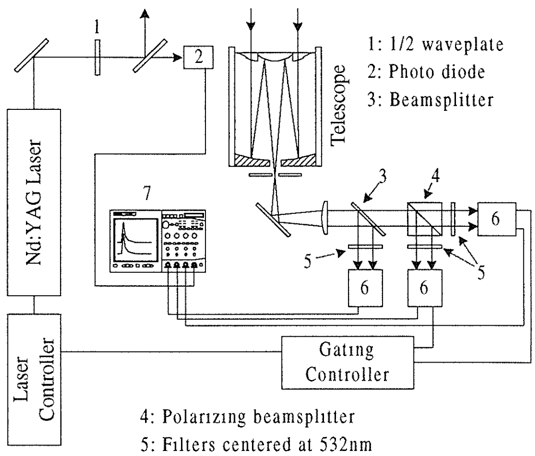

Figure 1 MLO-II system configuration

2 MLO-II: Mie LIDAR at Okayama University

Specifications and the configuration of MLO-II are shown in Table 1 and Fig. 1 respectively. Received beam is separated by the beamsplitter into two directions. One is fed into the near-channel and another into the far-channel. In the near-channel the beam is detected by a photomultiplier tube(PMT) having a lower sensitivity. Two channels for independent polarizations are prepared for the far channel. The polarizations are separated by a low-loss polarizing beam splitter, and PMTs are turned to have the maximum sensitivity, still blind over the period of 20μs just after the laser pulse emission by controlling the driving voltage of the dynode in the first stage. LIDAR signals from the PMTs are sampled and averaged over 4096 laser shots on a commercially available digital oscilloscope with 8-bit analog to digital converters, in which Windows 95 system is installed.

MLO-II is set up in a room on the fifth floor of a building and the laser beam is transmitted North with 45 degree of elevation angle through the room window.

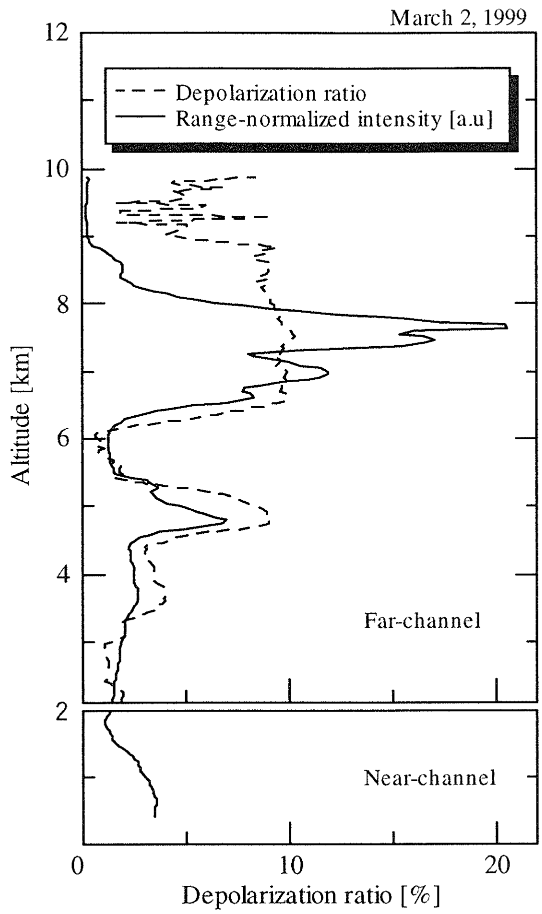

Figure 2 Range-normalized LIDAR signal and depolarization ratio observed on March 2 in 1999. The near-channel and the far are separated at the altitude of 2km.

3. Experimental results

Figure 2 shows one of the experimental results which is obtained March 2 in 1999 and presents range-normalized LIDAR signal and depolarization ratio. Two aerosol layers which have 10% of depolarization ratio are seen around the altitude of 5km and also between 7 and 9km. The two layers are convinced as KOSA through these traces, because KOSA phenomena are observed from March 2 through 4 over multiple locations in western Japan.

Rapid change is found in the depolarization ratio above the altitude of 9km of Fig.2. This is attributed to the decrease of return power and the lower SNR brought from it. Figure 2 shows the result of observation with 45° elevation angle. A plumb observation, therefore, allows us measuring up to 13km, the bound of the troposphere.

4. Conclusions

MLO-II was examined for the observation of KOSA floating in the troposphere. A function of automatic operation will be added to MLO-II which allows non-attended operation not only in the high-KOSA season but also yearly monitoring. Depolarization ratio in the near-channel is also planed for installation.

References

[1] T.Murayama *et al.*, "Lidar network observation of Asian dust(Kosa) in Japan" *Proc. of SPIE*, 15-17 Sept. 1998, Beijing, **3504**.

[2] K.Iokibe, H.Wei, O.Wada, R.Koga, "Measurement of Kosa at Okayama University with Laser Radar" 19th Japanese Laser Sensing Symposium, pp.93-94, 1998 (Japanese)