P1-19 Observation of Aerosols and Clouds in the West Pacific with a Mie Scattering Lidar on the Research Vessel Mirai: Preliminary Report of M99-K1 Experiment

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Shipborne Mie scattering lidar observation of aerosols and clouds have been started this year using Mirai. The purposes of the observation are to obtain global distribution and optical characteristics of aerosols and clouds which are used in the climatological study and in the study on the data reduction algorithms and data utilization methods for spaceborne lidars.

The first observation was carried out in M99-K1 voyage (February -March 1999). The lidar observation was carried out during the whole voyage in a latitude range of +25 to -10 degrees. In this paper, we report the results during a period from February 17 to March 9, 1999. The ship track for this period is shown in Fig.1. The ship was in a lattitude band of +9 to -8 degrees.

The lidar enploys a compact flashlamp pumped second-harmonics Nd:YAG laser. Mie scattering at 1064 nm and 532 nm, and depolarization ratio at 532 nm were recorded. Figure 2 shows a temporal variation of vertical profile. The range-corrected lidar signal at 532 nm is indicated with a gray scale. Diurnal variation of boundary layer is not significant as seen in Fig.2. Low clouds are frequently observed at the top of the planetary boundary layer. Cirrus clouds are also frequently observed in an alutitude range of 10 to 15 kilometers.

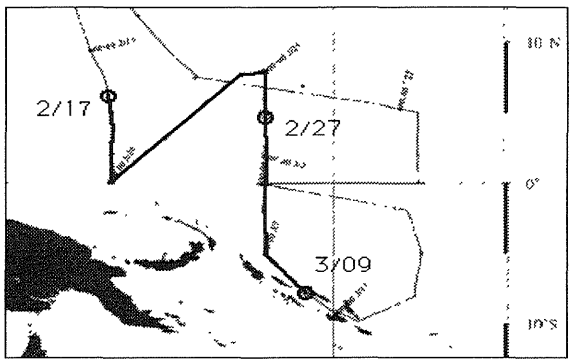

Fig. 1 Ship track during the observation period reported in this paper.

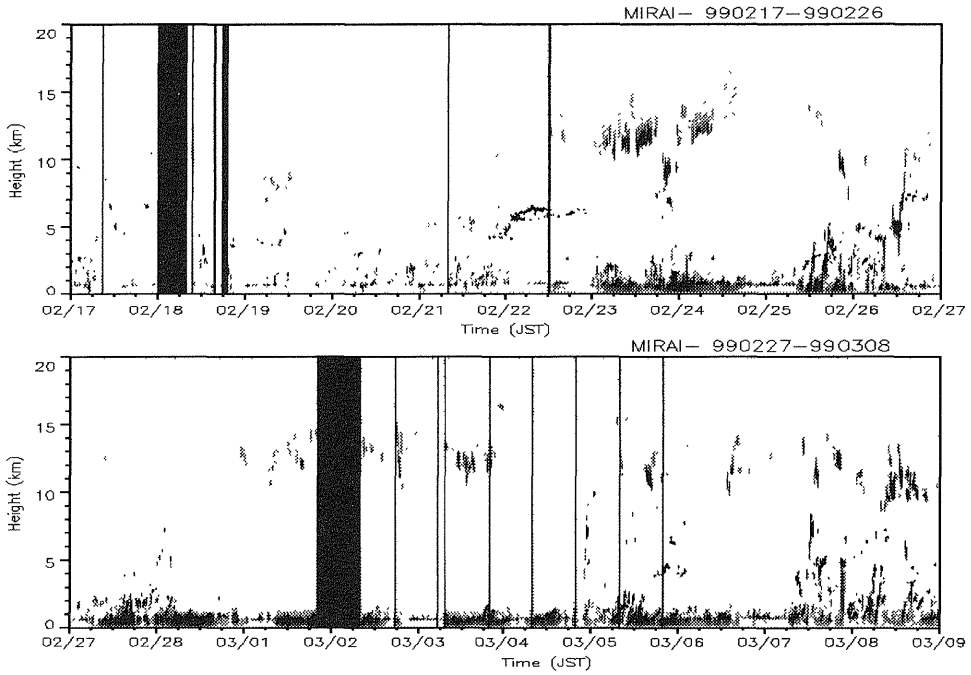

Fig.2 Temporal variation of range-corrected lidar signal at 532 nm.

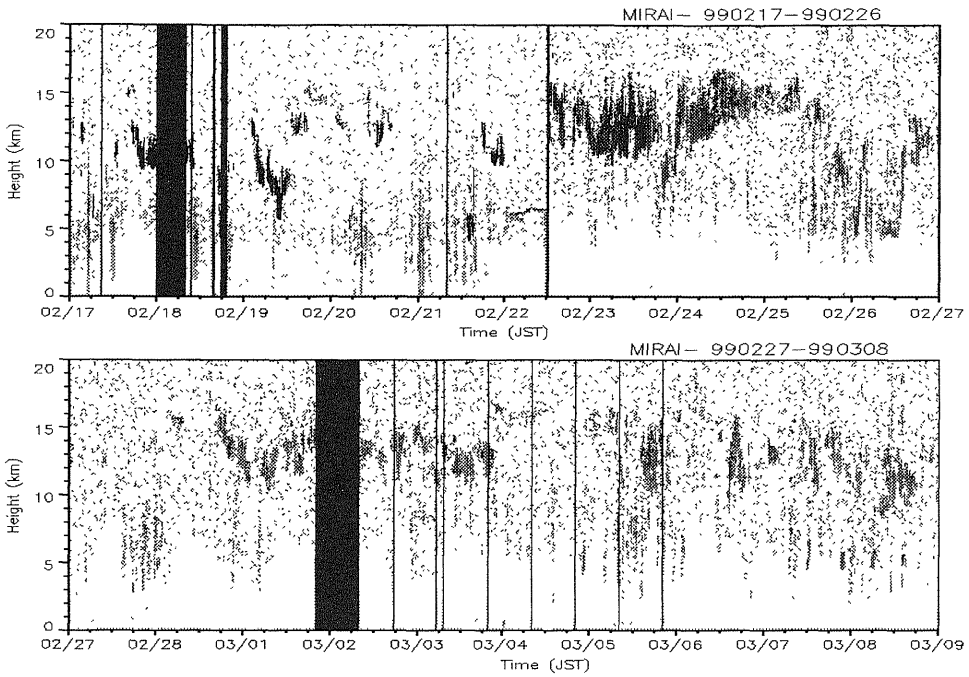

Fig. 3 Depolarization ratio at 532 nm

Figure 3 shows depolarization ratio at 532 nm. Relative value is indicated with a gray scale. High depolarization ratio was observed at cirrus clouds. Detailed analysis with a calibration is required to discuss the depolarization ratio of marine aerosols.

Boundary layer aerosols are detected at both 532 nm and 1064 nm. Figure 4 shows a ratio of the signal at 1064 nm to the signal at 532 nm. The gray scale in Fig. 4 indicates the ratio normalized at the value for water clouds where the wavelength dependence of backscatter is small.

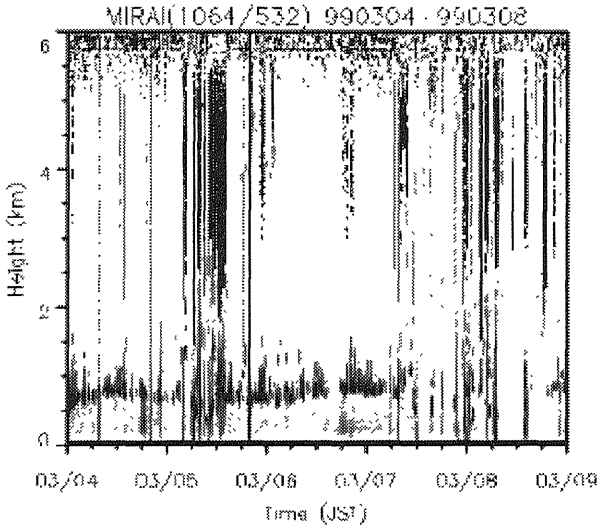

Fig. 4 Rratio of the lidar signal at 1064 nm to 532 nm.

The wavelength dependence of aerosol backscattering was estimated from Fig. 4. Beta(1064 nm)/Beta(532 nm) was 0.25 to 0.4. Angstrom index was consequently estimated to be 2 to 1.3. The result is consistent with the value for the maritime tropical aerosol model of the Optical Properties of Aerosols and Clouds (OPAC) software package.[1)]

Wavelength dependence of extinction coefficient is estimated from the lidar data and the S1 values (extinction-to-backscatter ratio) calculated with OPAC. S1 is approximately 47 at 1064 nm, and 25 at 532 nm. (Note that the wavelength dependence is very different from that for continental aerosols.) Alpha(1064 nm)/Alpha(532 nm) obtained was 0.47 to 0.75, and the index for the wavelength dependence of extinction is 1.1 to 0.4. This result is consistent with the result of the NOAA/AVHHR analysis reported by Higurashi and Nakajima.[2)]

References

1) M. Hess, P. Koepke, and I.Schult : Optical Properties of Aerosols and Clouds: The Software Package OPAC, Bull. American Meteorol Soc. **79**, 831-844 (1998)

2) A. Higurashi and T. Nakajima : Development of a Two Channel Aerosol Retrieval Algorithm on Global Scale Using NOAA / AVHRR. J. Atmos. Sci., **56**, 924-941 (1999).