LIDAR DEPOLARIZATION MEASUREMENT AT TWO WAVELENGTHS (532NM AND 1064NM) IN ASIAN DUST EVENT

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ABSTRACT

We have simultaneously measured Asian dust in spring, 2006 by using two wavelengths (532 nm and 1064 nm) depolarization channels of ACA lidar and then analyzed the wavelength dependence. The measured depolarization ratio at the 1064 nm channel is relatively larger than the depolarization ratio at the 532 nm channel and not dependent on the wavelength. The ratio of depolarization ratio between the 1064 nm and the 532 nm is dependent on the mixing status of spherical particle and dust aerosol. In the condition of the dust aerosol is dominant, the lowest value of the ratio of depolarization ratio is 1.3 (20% of 532 nm depolarization ratio) and in the case of mixed aerosols, is 3.6 (6.0% of 532 nm depolarization ratio, respectively. The developed system of two wavelengths depolarization channels show high stability for the long term operation.

1. INTRODUCTION

The Asian dust invade to Korean peninsular in every spring season were frequently generated in the area of Mongolia and Taklimakan desert and then transported over the inner continental area and sea-side industrial complex area of china. It is known that the mineral dust is mixed with air pollution gases. Because of the shapes of the aerosols in the condition of the mixing can be defined as the non spherical mineral dust particles and spherical particles or gases, we can distinguish them by the depolarization ratio from the backscattering lidar measurements.

To analyze the transport route of the dust aerosol, direct measurement of the depolarization ratio by lidar is necessary to know the distribution status of the dust with the air-pollution aerosols and gases. In the AD-Net, several two wavelengths (532nm and 1064nm) Mie scattering lidars with 532nm polarization channel have been operated continuously [1]. The method to estimate the contribution of the dust and the spherical aerosol on the calculation of the backscattering coefficient was published[2],[3]. And the research on dust aerosol characterization inferred from lidar polarization at two wavelength was submitted[4].

In this research, the simultaneous measurement results of analysis on the measurements of the dust events on spring, 2006 by using the two wavelengths (532nm and 1064nm) depolarization channels are to be reported.

2. ACA LIDAR SYSTEM

Fig.1 show a block diagram of ACA lidar system[5]. The system as a one package unit consisted of transmitter and receiver modules. After the installation in March, 2002, continuous measurements of the aerosol and cloud have been done with the operation rate more than 85% during last few years.

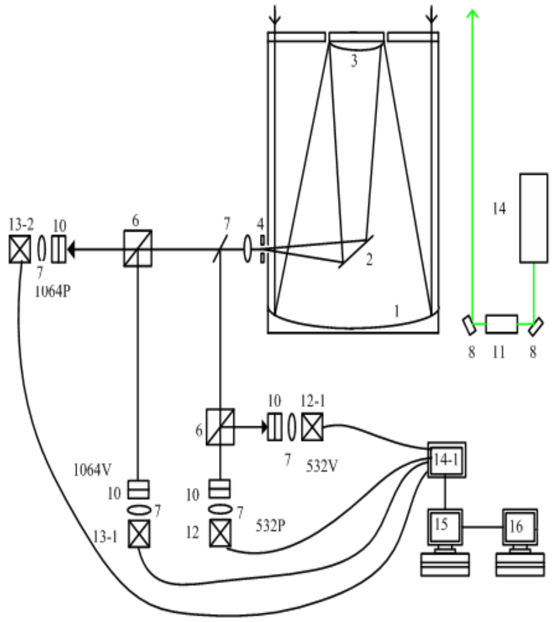


Fig. 1. Block diagram of ACA Lidar system

1. main mirror, 2. telescope reflection mirror, 3. secondary mirror, 4. Iris, 6. polarization 7. focusing lens, 8. transmitter reflection mirror, 10. interference filter, 11. beam expander, 12. PMT 13. APD, 14.ND:YAG laser, 14.1 Digital OSC, 15. PC1, 16. PC2

The lidar system use the Second-harmonic Nd:YAG laser and 30cm diameter telescope. The Nd:YAG laser output is 65mJ@532nm, 190mJ@1064nm. The receiving system has four polarization channels that are 532V/532P and 1064V/1064P with PMT and APD for the 532 nm and 1064 nm channels respectively. For the depolarization alignments, the polarizing beam splitter (PBS) is used only for the separate of the polarization (V and P) and additional polarizer to purify the polarization of the receiving beam is not used. By the adjustment of the incident beam to the PBS, positions of the polarization axis is aligned to transmitted beams. Before the experiments, using the linear polarization sheet that was located at front of the dual-polarization optics, the sensitivity of the polarization channel is adjusted.

We adjust the polarization axis to be a parallel to the detection gain by rotate the polarization sheet that is relatively different about 45 degree with the polarization axis.

3. RESULTS AND DISCUSSION

Fig. 2 show the Time Height Indication(THI) of range corrected backscattered intensity during the period of Asian dust occurred in spring, 2006. During a period of March 29-April 9, six events of the Asian dust occurred (March 28, March 31-April 1, April 2- April 3, April 5, April 7 (00:00-06:00), and April 7 (12:00)-April 9.

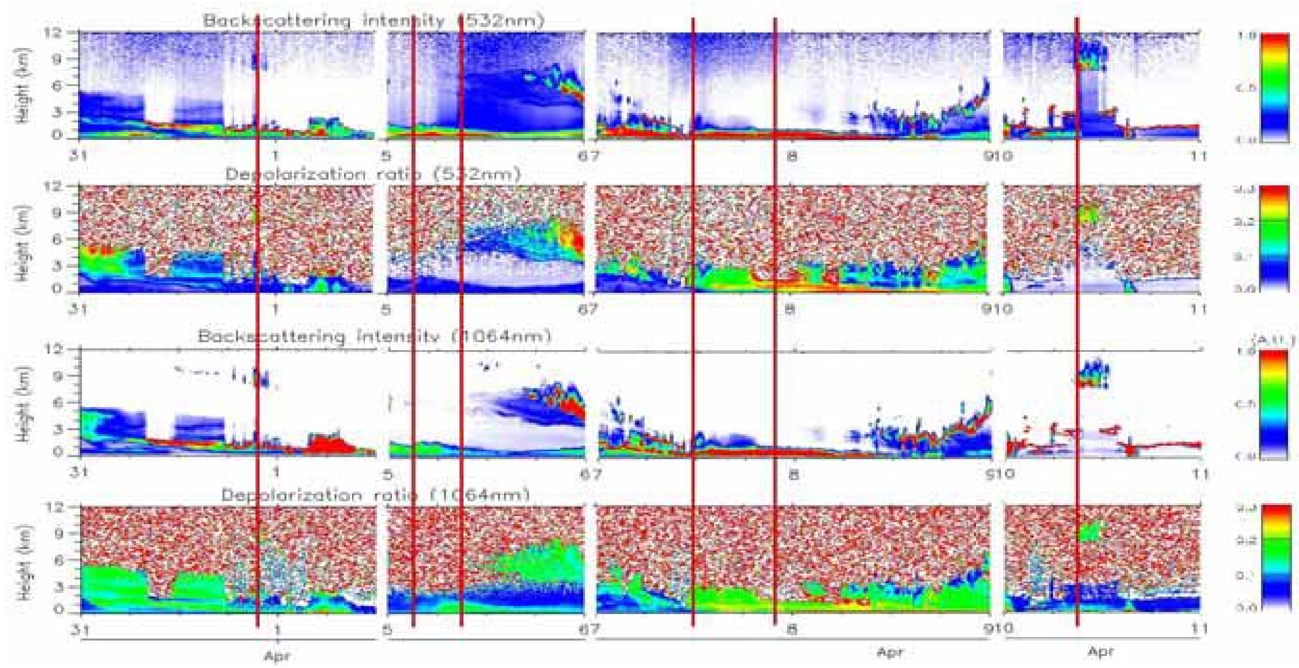
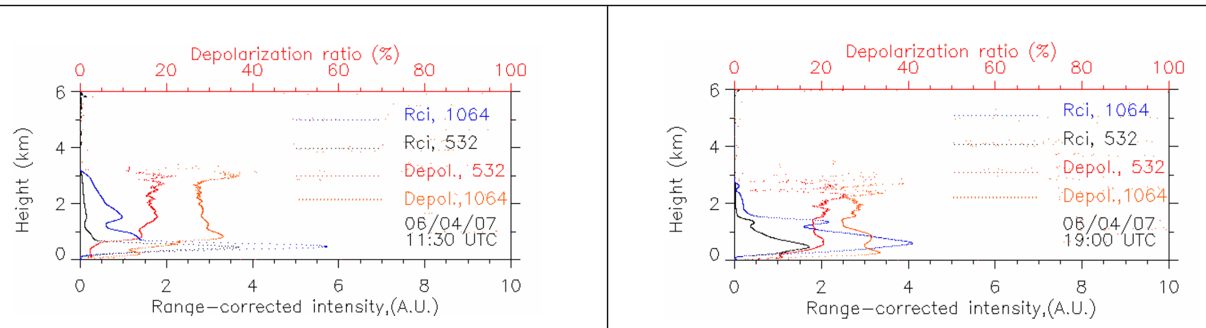


Fig. 2 Backscattering intensity and Depolarization ratio indicated by THI



(a)

(b)

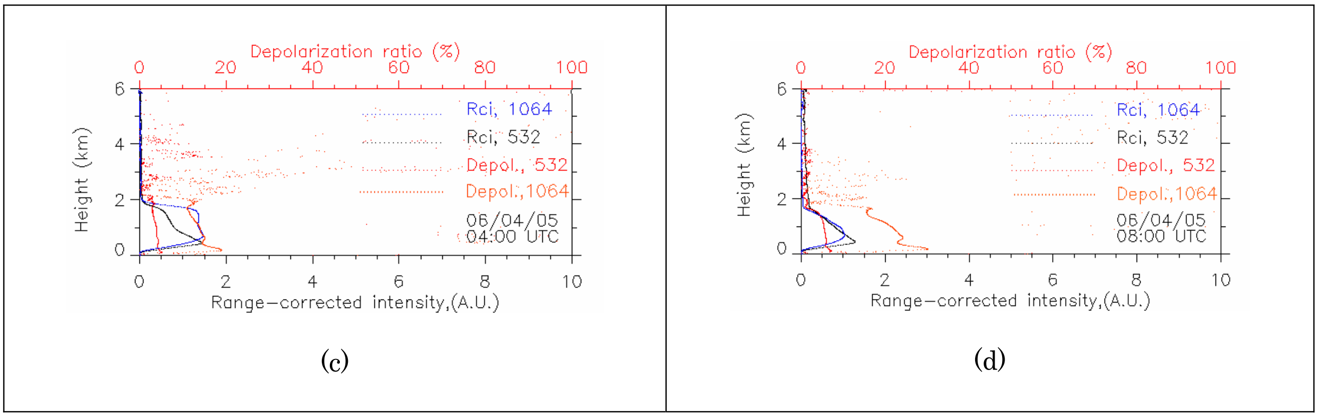


Fig. 3 RCI Profile of dust (Fig. a and b) and non dust (Fig. c and d)

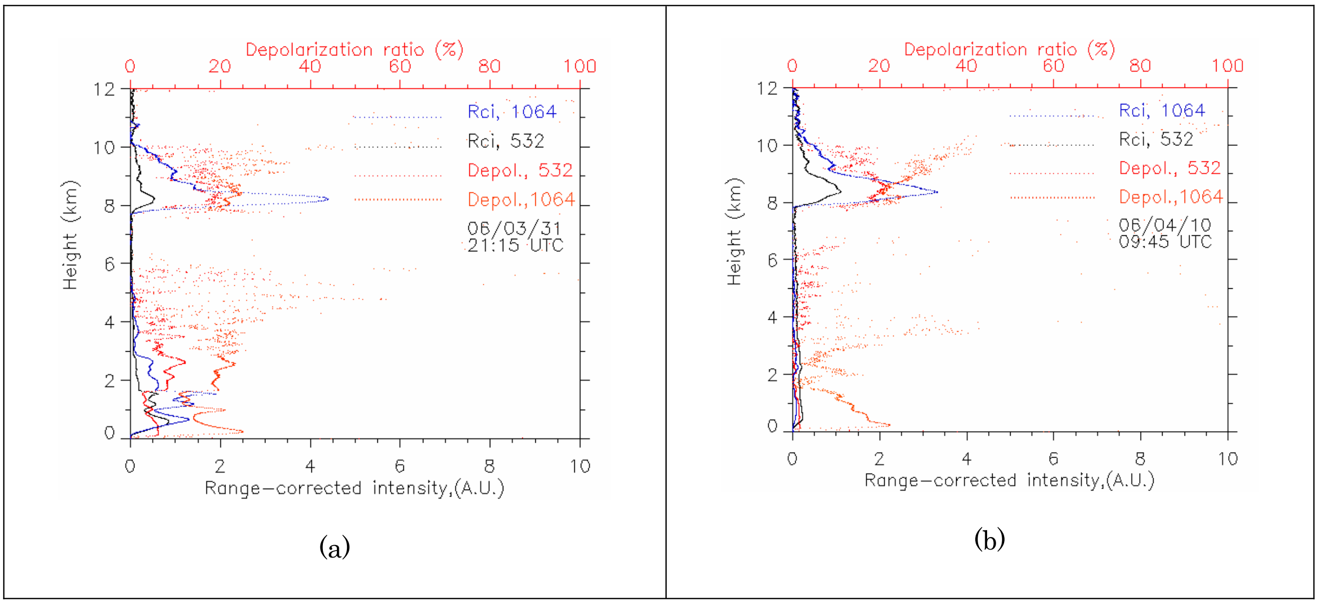


Fig. 4 RCI Profile of cloud in non dust

Fig.3 shows the typical RCI profiles of dust aerosol and mixed aerosols at April 7(11:30, 19:00) and April 5(04:00, 08:00). In the case of the dust aerosol is dominant, the ratio of depolarization between the 1064 nm and 532 is 1.3-2.2 at 20%-15% of 532 nm depolarization ratio. In the case of mixed aerosols, the ratio of depolarization ratio is 3.6-4.0 at 6.0%-3.0% of 532 nm depolarization ratio. This result show that the ratio of the depolarization ratio is strongly dependent on the state of mixed aerosols and coincide with the result of previous research [4]. From this research, we hope that the possibility of characterization of aerosols can be increased. Fig.4 show the typical RCI profiles of cloud during the mixed aerosol at March 31(21:15) and April 10(09:45). The ratio of depolarization ratio by the cloud at 8-10 km is 1.0-2.0 and is relatively lower than the values by the dust aerosols. The depolarization ratio at 1064 nm are increased when the intensity of the cloud are weak. However, in the lower altitudes of 0.5-3.0 km, the ratio of depolarization are more than 4.0-10.0 and similar with the cases of dust aerosol.

4. REFERENCES

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