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LIDAR OBSERVATION AT EUREKA IN CANADIAN HIGH ARCTIC

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<ABSTRACT>

In order to observe polar stratospheric clouds, PSC, and stratospheric aerosols, a lidar was installed in the Arctic Stratospheric Ozone observatory, AStrO, which had been constructed in Canadian high Arctic (80° N, 86° W) in late 1992, to monitor stratosphric change mainly related to the stratospheric ozone depletion. Heterogeneous reactions on the surface on PSCs are very important to understand the ozone depletion in Arctic stratosphere. The observation have been carried out since February 1993.

INTRODUCTION

Recently, environment problems such as global ozone depletion and ozone hole in Antarctic has been coming one of big interests. In Arctic area, large-scale ozone depletion as much as Antarctic ozone hole is not observed since the Arctic vortex does not grow so much. However, possibility of smaller-scale ozone depletion was pointed out and reported.

Polar stratospheric cloud, which appear in the polar stratosphere in polar night, is thought to be one of the reason of ozone depletion in Arctic and Antarctic region due to the heterogeneous reactions on the surface. Thus, it is very important to monitor the PSC in polar night and the lidar is the most suitable active sensor in the polar night.

The AStrO is located near Eureka weather station, where the operational upper air sounding and ozone flight are made for stratospheric ozone measurement. The location of the station is shown in Fig. 1.

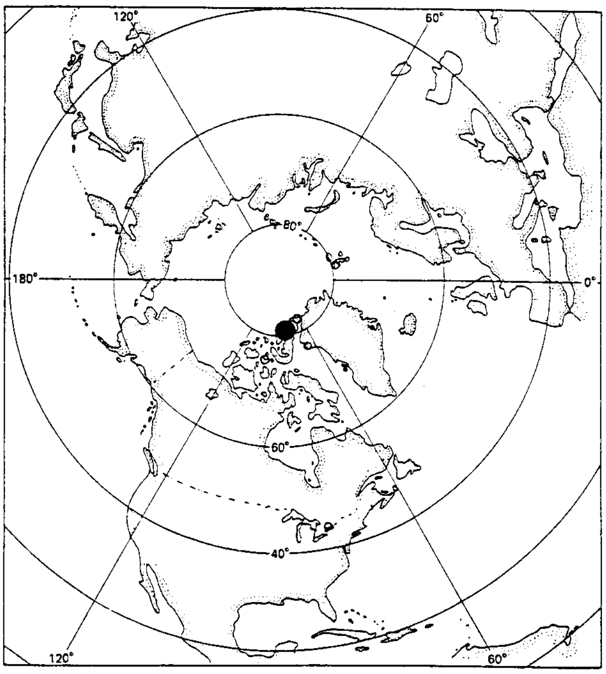

Fig. 1 Location of Eureka and AStrO

INSTRUMENTATION

The lidar system used in this research is composed of a compact Nd:YAG laser as transmitter and a Newtonian or Schmidt cassegrain telescope, cooled photomultiplier tubes and photon counter as the receiver. The system was designed to measure the backscatter and depolarization ratio on both fundamental and second harmonic wavelength of Nd:YAG laser. The characteristics of the system are shown in Table 1.

Period	Winter 1992-1993	Winter 1993-1994
Wavelength	1064 nm (F), 532 nm (SHG)	
Pulse Energy	550 mJ (F), 70 mJ (SHG)	390 mJ (F), 100 mJ (SHG)
Pulse Repetition	10 Hz	
Beam Divergence	0.2 mrad	
Telescope Diameter	500 mm	500 mm (F), 254 mm (SHG)
Telescope Type	Newtonian (F and SHG)	Newtonian (F), Schmidt Cassegrain (SHG)
Field of View	0.44 mrad	3.0 mrad
Polarization	P and S	
Gate Width	7.5m minimum	
Signal Processing	Photon Counting	

Table 1 Specifications of PSC Lidar

Some modifications have been made on December 1993, the beginning of the winter of 1993-1994, to adapt the severe environmental conditions in Arctic such as strong backscatter from near the ground by ice crystal and snow and large temperature variation.

OBSERVATIONAL RESULTS

The observation has been carried out since February 15, 1993. The both backscattering ratio and depolarization ratio profile observed on February and March 1993 are shown in Fig. 2. The range resolution of this plot is about 450m. The depolarization ratio here is not corrected for the depolarized component of atmospheric molecules.

The stratospheric aerosol layer originated from the 1991 Mt. Pinatubo volcanic eruptions can be seen in the Fig. 1. The layer above 15 km is largely varied comparing with the layer below. This variation corresponds to the relative position of polar vortex from Eureka.

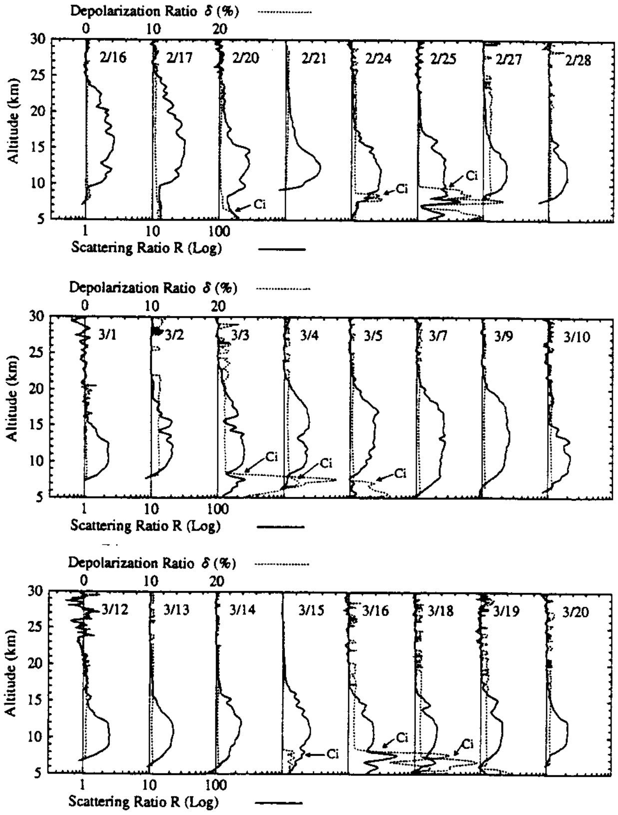

Fig. 2 Backscatter ratio and depolarization ratio profiles by PSC Lidar

The integrated backscattering coefficient, IBC, which shows the aerosols column density, was almost same as that of Tsukuba (36° N, 140° E). This means aerosols from the Mt. Pinatubo is well spread globally.

CONCLUDING REMARKS

The lidar observation of stratospheric aerosols have been carried out and the stratospheric aerosols from Mt. Pinatubo was observed. Lidar monitoring of the stratosphere is important to detect the stratospheric change and this research will be continued.

ACKNOWLEDGMENT

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