P1-21 Long-Range Transport of Aerosols and Clouds observed by Lidar in the Canadian High Arctic

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1 Introduction

For over 20 years, many scientific groups have investigated the characteristics of arctic tropospheric aerosols, such as their seasonal variation, chemical composition, and size distribution. But because these aerosols have been investigated largely from the chemical point of view and by making ground-level measurements, limited information about their spatial distribution is available.

In 1993, a Mie-scattering-polarized lidar system was installed to get data with good spatial and temporal resolutions at Eureka, Canada (80.0° N, 86.0° W). We had been operated to observe arctic aerosol layers and clouds during winter seasons from 1993-94 to 1997-98. The authors have discussed two methods for classifying arctic aerosol layers and clouds observed during the polar night and have reported both spatial and optical information on aerosols and clouds defined by these methods. In this work, we discuss the long-range transport of arctic aerosol layers and clouds observed in the free troposphere with using calculated isentropic back trajectories.

2 Trajectory analysis

To discuss the long-range transport of the arctic aerosol layers and clouds that reached Eureka at altitudes greater than 2000 m above sea level, ten-day isentropic back trajectories of them were calculated by using isentropic back trajectory model developed by Sakai at STE Laboratory of Nagoya University. The lower limit of the calculation,2000 m above sea level, was chosen in above sea level, was chosen in consideration of the elevation of surrounding mountains and the top of the Arctic inversion layer. Isentropic back trajectories were calculated using the objective analysis data of the Japan Meteorological Agency. To calculate the isentropic trajectories, the date, time, and an altitude of arctic tropospheric aerosols observed by the lidar were given. The isentropic trajectory calculation was stopped under the following conditions: when the altitude corresponding to the potential temperature is lower than that of the land- or sea-surface, or when an airmass is under the unstable stratification.

3 Results

We assume that these points, where the track altitudes in these trajectories were lowest, are near the source regions of arctic aerosol layers and clouds and investigated about the points statistically. Figure 1 shows the frequency of occurrence of them over the range of the latitudes and longitudes. Most of the points where the track altitudes in the trajectories of arctic tropospheric aerosol layers were lowest were at latitudes higher than 60° N and were near the coast of or over the Arctic Ocean. The points where the track altitudes in the trajectories of clouds were lowest were not only at higher latitudes but also lower latitudes.

Most trajectories through which arctic tropospheric aerosol layers were transported were over the Arctic Ocean. On the other hand, the trajectories for clouds event were divided into eight transport groups by isentropic flow patterns. The results suggested that clouds were transported not only the oceans but also continentals

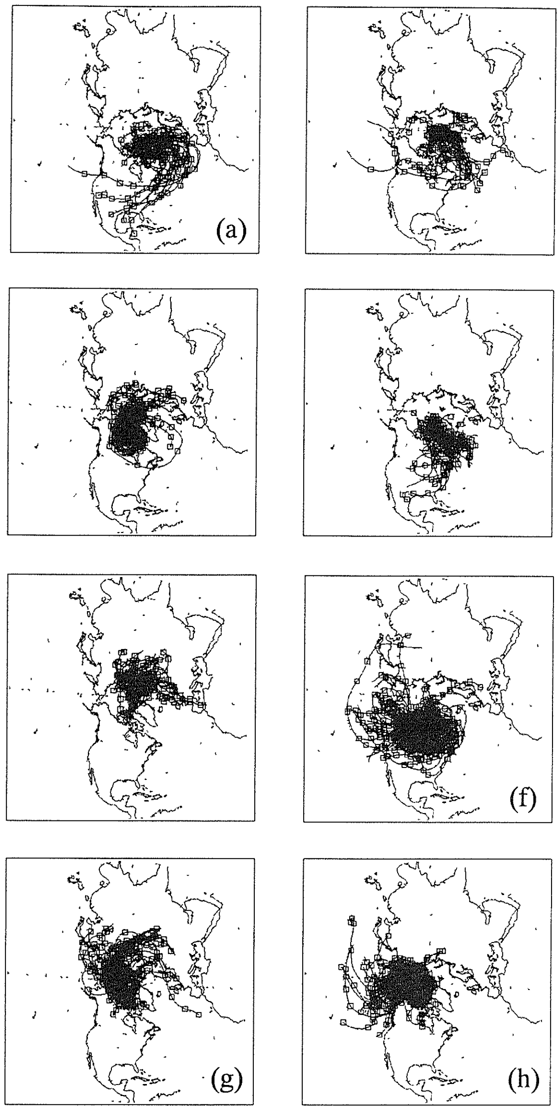

Figure 1. Eight isentropic flow patterns of cloud event observed during the five winter seasons from 1993-94 to 1997-98.

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