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GE5) Long-Range Transport Characteristics of Air Masses in Taean, Korea Using A Lagrangian Trajectory Model and Cluster Analysis Technique
Part 2. Chemical Compounds Characteristics of $PM_{2.5}$ Particle Related to Long-Range Transport Patterns

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1. INTRODUCTION

To investigate the characteristics of fine particles and the relationships between pollutant concentrations and long-range transport patterns in Asia area, continuous every 6-day sampling (case 1) and an intensive field sampling (case 2) had been carried out between March 1998 and July 1999 at Taean, Korea. Anionic (Cl^-, NO_3^-, SO_4^{2-}) and cationic (Na^+, NH_4^+, K^+, Mg^{2+}, Ca^{2+}) concentrations of $PM_{2.5}$ particle were analyzed. The major objective of this study is to investigate the relationships between the chemical compounds of $PM_{2.5}$ and the long-range transport patterns during intensive sampling period.

2. RESULTS and DISCUSSION

2.1. Summary of Sampling results.

The simple statistics of case 1, 2 and the Spearman Correlation Coefficient of case 1 & 2 for all ionic concentrations are obtained by using SAS (http://www.sas.com/). The results indicate that $[SO_4^{2-}]$ and $[NO_3^-]$ have good correlation with $[NH_4^+]$ beside they have a higher concentration than other ions. The correlation coefficients $[SO_4^{2-}]$-$[NH_4^+]$ are 0.92460 and 0.82932 for case 1 and case 2, respectively. Therefore, sulfate ammonium ($(NH_4)_2SO_4$) is the major pollutant material in $PM_{2.5}$.

2.2. The relationships between concentrations and atmospheric transport patterns

To investigate the relationships between ion concentrations in $PM_{2.5}$ and long-range transport patterns in the East Asia, it is necessary to find the transport patterns of back-trajectories, which will help us to establish source-receptor relation. In this paper, we will try to establish the relationships between the major chemical components (SO_4^{2-}, NH_4^+ and NO_3^-) and long-range transport patterns for case 2 (intensive sampling).

2.2.1. The relationships between higher concentrations and atmospheric transport patterns

Totally 8x6 (6 means six levels, same as part I) back-trajectories members were chosen out in accordance with high ionic concentrations $[(SO_4^{2-}] > 5g/m3$, $[NH_4^+] > 3g/m3$ and $[NO_3^-] > 2g/m3$, respectively. Seventy-five percent (75%) back-trajectory occurred in winter and spring, and almost all of the trajectories passed through Mongolia and China before arriving at Taean sampling site. We can get conclusion that a great amount of pollutant material and high-polluted air will be transported to the sampling site during winter and spring than any other seasons.

2.2.2. Case 2 (Intensive sampling) at 2000m AGL

To better understand the transport patterns indicated by the cluster-mean trajectories, cluster-membership plots were investigated to each cluster group. The members of group 4 and 5 (Intensive sampling) are exhibited in Fig. 1 (A-B) according to five cluster-mean trajectories obtained in Part I (this paper). All trajectories in group 1-4 totally accounted for 21 members

(21/32=62.625%) of the trajectories data. Moreover, all of them passed through Mongolia and China (northwest quadrant) before arriving at Taean. Group 5 includes 11 (34.375%) members with a notable "confusing" feature. All of these 11 back-trajectories changed direction near Taean before arriving at sampling site.

The imagines of average and summation concentrations of five groups of case 2 indicated not only that all five groups had same significant effects on sampling, but also that SO_4^{2-}, NH_4^+, and NO_3^- are the dominated components in $PM_{2.5}$ fine particles again.

3. SUMMARY

It can be concluded that (1) air masses arrived at Taean in winter and spring (November 1998 to April 1999) carried more pollutants than that in summer and autumn; (2) sulfate (SO_4^{2-}), ammonium (NH_4^+), and nitrate ion (NO_3^-) are the dominate chemical compounds in $PM_{2.5}$, and most of them were carried by air from north and northeast of China.

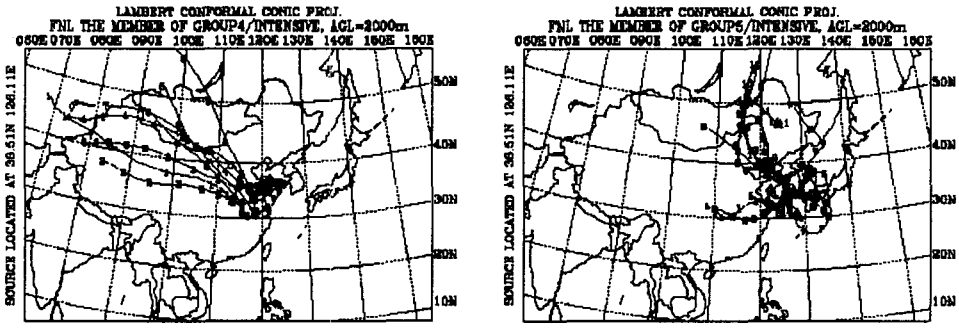

Fig. 1. The membership of group 4 and 5 during intensive sampling period (A: left/group 4, B: right/ group 5) according to five cluster-mean trajectories obtained in Part I (this paper).

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