The Fifth Senior Technical Managers' Meeting
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Evaluation of overall precision on wet deposition monitoring

1. Introduction

Quality assurance and quality control (QA/QC) plays a key role of wet deposition monitoring. Therefore, various QA/QC activities are performed in Acid Deposition Monitoring Network in East Asia (EANET). However, overall precision in the monitoring by parallel examination is not performed because of its difficulty.

Evaluation of overall precision by the parallel examination that contains all processes from a sample collection to analysis in wet deposition monitoring is very important, when knowing the validity of data. Actually, it is performed in other monitoring networks like National Atmospheric Deposition Program / National trends Network (NADP/NTN).

NC performed the parallel examination in all processes including sample collection, sample shipping, storage, and analysis using same type wet only samplers accepted in EANET at the Niigata-Maki national monitoring station (rural site).

2. Method

As shown in Fig. 1, three sets (A-C) of the same type wet only samplers (Ogasawara Keiki Co. Ltd. MODEL US-330) were collocated in the Niigata-Maki monitoring station. And daily sampling was performed in parallel.

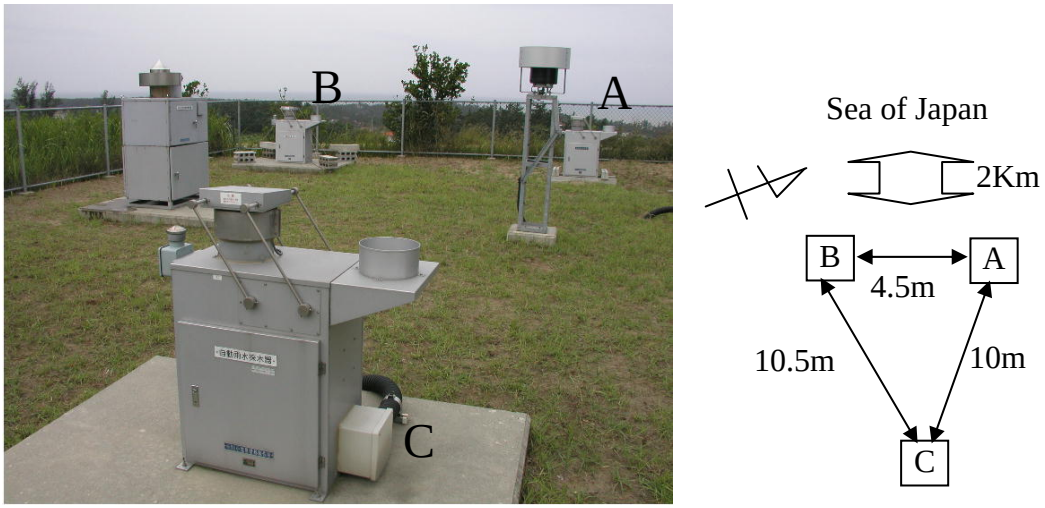

Fig.1 Collocated wet–only samplers at Niigata- Maki monitoring station

In consideration of seasonal change, the research carried out at 4 periods, 1st (July to August 2003), 2nd (November to December 2003), 3rd (February to March 2004) and 4th (May to June 2004).

Sample amount, pH (H^+), EC, and concentrations of major ions (SO_4^{2-}, NO_3^-, Cl^-, Na^+, NH_4^+, K^+, Ca^{2+}, Mg^{2+}) were measured for all samples.

Overall precision was evaluated by the median of relative standard deviation (MRSD) calculated from standard deviation (SD) and average of each data set.

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$$\mathrm{MRSD}\,(\%) = \mathrm{Median}\left| \frac{\mathrm{SD}\ (\mathrm{Ax},\ \mathrm{Bx},\ \mathrm{Cx})}{\mathrm{Average}\ (\mathrm{Ax},\ \mathrm{Bx},\ \mathrm{Cx})} \times 100 \right|$$

3. Results

48 data sets were obtained in total, 14 sets in 1st, 15 sets in 2nd, 11 sets in 3rd and 8 sets in 4th period.

MRSDs were summarized in Fig. 2. In the whole term, the maximum MRSD was 12.0% for Ca^{2+} and the minimum was 2.5% for NO_3^-. While MRSD for Ca^{2+} and K^+ were about 10%, other items were less than 7%.

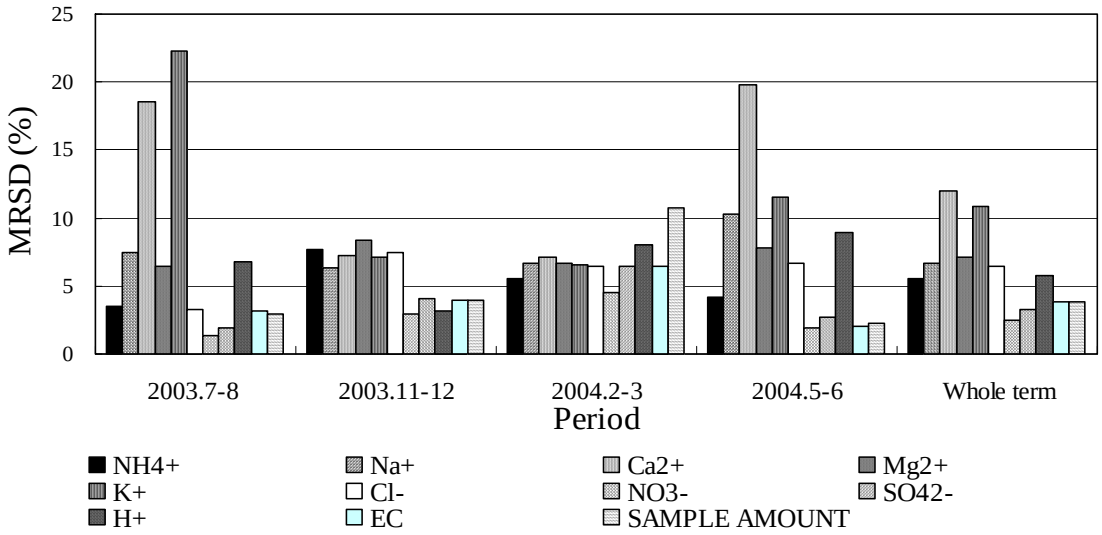

Fig.2 MRSD for concentration of ions, EC and sample amount in each period

The MRSDs of Ca^{2+} and K^+ in 1st and 4th period were higher than that in other seasons. Contamination in the process from collection to analysis seemed to be effective in the periods because concentration of K^+ and Ca^{2+} were relatively low. The relation between concentration

of each components and the MRSD in 1st period is shown in Fig. 3. As the concentrations were lowered, the deviations became higher. When the median of concentrations were more than 7 μmol/l such as SO_4^{2-} and NO_3^-, the MRSDs were less than 5%. The MRSD of summer seems to be dependent on the concentration of components. Such a tendency is similarly reported by NADP/NTN.

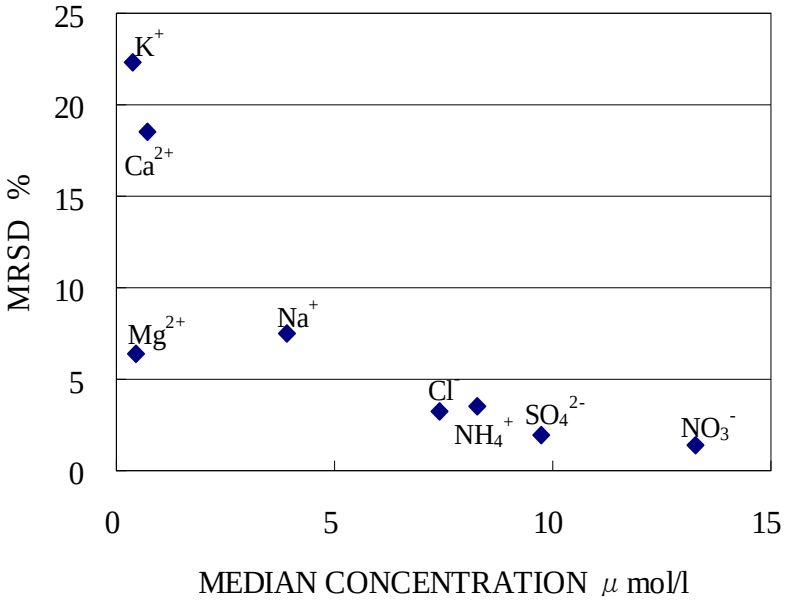

Fig.3 Relationship between MRSD and concentrations of each component in 1st period (July to August 2003)

On the other hand, since the concentrations of all components were high in winter, it was thought that there was relatively low influence of contamination. As for the concentration of SO_4^{2-} and NO_3^-, however, MRSDs became higher than that in summer. One of the possible causes was considered that the fluctuation of collection efficiency was effective in winter due to hard weather condition. In addition to this, small precipitation amount was also effective in winter.

It was clarified that overall precision was depend on the concentration of components in summer and the weather condition in winter. These results may be useful for data evaluation, especially for data analysis of daily monitoring. Although it is difficult to perform this research in the other monitoring sites, it is considered that high MRSD may be obtained in remote sites, which are characterized by low concentration of components and strong wind.

4.References

Adopted at 2nd ISAG meeting of Acid Deposition Monitoring Network in East Asia, 2000, Technical Documents for Wet Deposition Monitoring in East Asia.

M. A. Nilles, j. D. Gordon and L. J. Schroder, 1994, The precision of wet atmospheric deposition data from National Atmospheric Deposition Program / National Trends Network sites determined with collocated samplers, Atmospheric environment 28, 1121-1128.