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PA30) 질산화가스와 아황산가스의 비를 이용한 대기오염 기여도 분석

Analysis of Air Pollutant Sources Contribution by using Ratio of Sulfur Dioxide Gas to Nitrogen Oxides Gas

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1. Introduction

We try to distribute air pollution sources at target area. The complex method is used to distribute air pollution sources. Most of people, However, want to simple indicator as standard for express air pollution source. In many area, air pollution is caused by different types of sources. The general type is point source, such as tall stack of power plants and oil refineries stacks. A second type is areal source, such as local industry and transportation. In this aspect, the ratio of sulfur dioxide to nitrogen oxides (RSN =SO_2/NOx) is an indicator of air pollution source. the role of this ratio is to show the characteristics at target area of the relationship the point and the areal source.

For classification of air pollution source types, a number of researcher use the various methods. For instance, Nirel and Dayan (2001) use the CART(Classification And Regression Tree) for classification of air pollution source types. Our study apply their results to classification of air pollution source in our site. Burrows *et al.* (1994) study decision-tree statistical analysis and prediction of summer season maximum surface ozone for the Vancouver, Montreal, and Atlantic regions of Canada by using CART. Their results are similar to the observation of surface ozone.

The goal of this study is the estimation of point and areal source affection in rural area where is KGAWO (36°.32′, 126°.19′). Our site is located in west of Korean peninsular. So our site have a good condition for estimating the effect of transported air from ocean and land. As the use of the RSN, we simply and effectively estimate about different air pollutant source types. If we study about this RSN application, we need to use statistic method for exact contribution of the point and area source.

2. Measurement and Method

We have instruments that are ML 9850 for SO_2 and ML 9841A for NO_x. This study use the data from 1999 to 2001 years at KGAWO. the SO_2 analyzer is an ultraviolet(UV) fluorescence spectrometer designed to continuously measure low concentrations of SO_2 in ambient air.

Nirel and Dayan (2001) estimate RSN as indicator of air pollution source. They used regression tree model for attribution of SO_2 and NO_x concentration. The most famous regression model is CART model. So, the factors that affect RSN are studied using four regression model that is used the CART techniques: a binary regression tree in original scale, a tree in logarithmic scale, data partition produced by a combination of two trees, and a linear regression model. All model have similar relative prediction error, with the combined partition best highlighting the source of variability in RSN: (a) very low values (interquartile range of ([0.12~0.48]) are associated with traffic, (b) low values ([0.43~1.00])are attributed to the power plant and daytime emissions of local industry, (c) medium values ([0.74~1.90]) are associated with local industry emissions during cooler hours of day and refinery emission mainly on slow wind episodes, and (d) high

Table 1. Degrees of air pollution source by Nirel and Dayan (2001).

RSN	0.12~0.48	0.43~1.0	0.74~1.90	1.07~4.30
degrees	very low value	low value	medium value	high value
Source	traffic	the power plant and daytime emission of local industry	local industry emissions during cooler hours of day and refinery emission mainly on slow wind episodes	refinery emissions during moderate to fast wind episodes

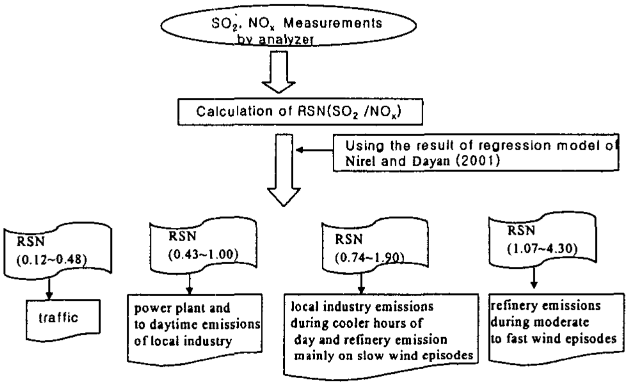

Fig. 1. Flow charter for estimating the distribution of air pollutant sources at KGAWO.

values([1.07~4.30) are attributed refinery emissions during moderate to fast wind episodes. We used the result of Nirel and Dayan (2001) for estimation of air pollution source. Table 1 is the degrees of air pollution source by Nirel and Dayan (2001). Fig. 1.
is flow Charter for estimation of SO_2 and NO_x attribution at our site. Also, we look for the backward trajectory of high RSN by using HYSPLIT model for exact direction of transported air mass. If we know the trajectory of air mass in high RSN, we will estimate the distribution of air pollutant sources in long transported air mass.

3. Result and Discussion

Fig. 2 is mean contribution of RSN at KGAWO from 1999 to 2001. The very low value(0.12~0.48) of RSN is about 49~52% contributed at KGAWO. That mean KGAWO is 49~52% affected by traffic related air pollutant sources. The low value(0.43~1.00) of RSN is about 9~15% and the medium value(0.74~1.90) of RSN is about 1~6% and the high value(1.07~4.30) of RSN is about 1~3% contributed at KGAWO. The results represent each air pollutants sources contribution(the air pollutant source types are referred to Table 1). The undefined contribution is about 32% by using this method.

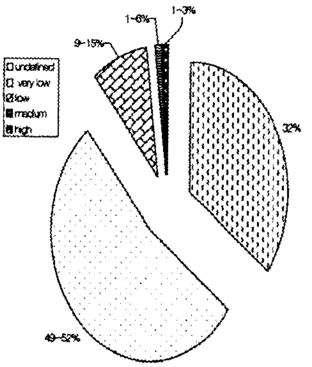

Fig. 2. The mean contribution of RSN in KGAWO from 1999 to 2001.

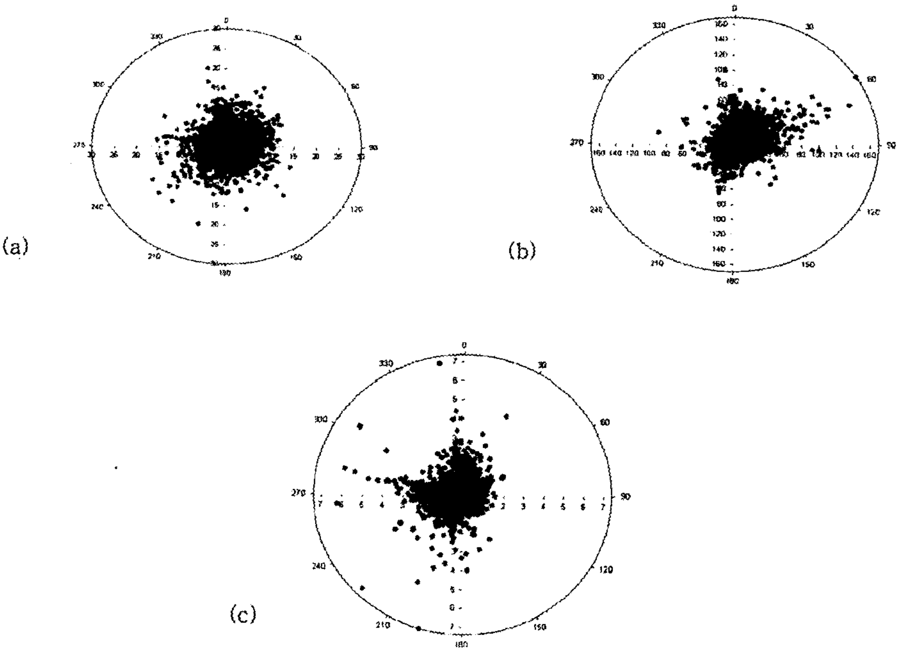

Fig. 3. Distribution of (a) SO_2 concentration, (b)NO_x concentration, and (c) RSN by wind sector at KGAWO.

Fig. 3(a) is the distribution of SO_2 concentration by the wind sector from 1999 to 2001. Totally, the high SO_2 concentration is not clearly showed the concentration pattern by wind sectors. But the concentration in western wind sector is relatively higher than that in eastern wind sector. Especially, the frequency number of high concentration in $180^\circ \sim 270^\circ$ is highest in wind sectors. we estimate that the high SO_2 concentration is induced to power plant in eastern wind sector and transported air pollutant sources from China in western wind sector. Fig. 3(b) is the distribution of NO_x concentration by the wind sector from 1999 to 2001. The frequency number of high concentration in $0^\circ \sim 90^\circ$ is much higher than that of another wind sectors. That result clearly show the urban area is located at northeastern areas of our site. Fig. 3(c) is the distribution of RSN by wind sector from 1999 to 2001. The distribution clearly show the effect from China air pollutant sources more than anything else. The most of the high RSN values are occurred to the northern, western, and southern wind sectors. Especially, the highest RSN value existed in western wind sector. The highest RSN value is induced to high SO_2 concentration and low NO_x concentration.

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