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Characteristics of Aerosol Mass Scattering Efficiency in Seoul, Korea Using Long Term Measured Data

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1. Introduction

Effect of aerosols on the climate has drawn much attention in recent years due to their largely uncertain climate forcing(IPCC, 2001). Through scattering and absorption of solar radiation, aerosols directly affect visibility and climate through the modification of the Earth's energy balance. Thus, the aerosol scattering properties are required in evaluating the radiative forcing of aerosols(Yan 2007; Chow et al., 2006; Vrekoussis et al., 2005). This study focused on the seasonal, weekly, and diurnal variations of aerosol mass scattering efficiency based on continuous measurements of aerosol light scattering coefficient and particulate mass concentration in Seoul from January 1 to August 31, 2006.

2. Method

Ambient aerosol light scattering coefficient(Bsp) and $PM_{2.5}$ mass concentration were continuously measured form January 1 to August 31, 2006 in Seoul by using a nephelometer and a beta gauge, respectively. Ambient Bsp centered on 550nm wavelength was measured by model NGN-2 nephelometer(OPTEC, Lowell, USA). $PM_{2.5}$ mass was determined by a commercial E-bam beta gauge(Met One Instruments, Inc., Oregon, USA) which collects particles on filter tape. The instrument was operated at a flow rate of 16.7 LPM with a time resolution of 1 hour. Mass scattering efficiency(sp) is the ratio of Bsp to PM mass concentration. To reduce the humidity effect on aerosol light scattering coefficient, sp under ambient relative humidity less than 60% was used in this analysis. HYSPLIT(HYbrid Single-Particle Lagrangian Trajectory, NOAA/ARL) model was used to classify the air mass type.

3. Result and discussion

Figure 1 shows season variations of Bsp and $PM_{2.5}$ mass concentration in Seoul. Average ambinet Bsp was measured to be 195.8±212.4Mm^{-1}, 132.9±140.1Mm^{-1}, and 123.4±97.2Mm^{-1} in winter, spring, and summer, respectively while $PM_{2.5}$ mass concentration was 55.6 ±35.1μg m^{-3}, 51.4±42.9μg m^{-3}, and 34.9.4±28.4μg m^{-3}, respectively.

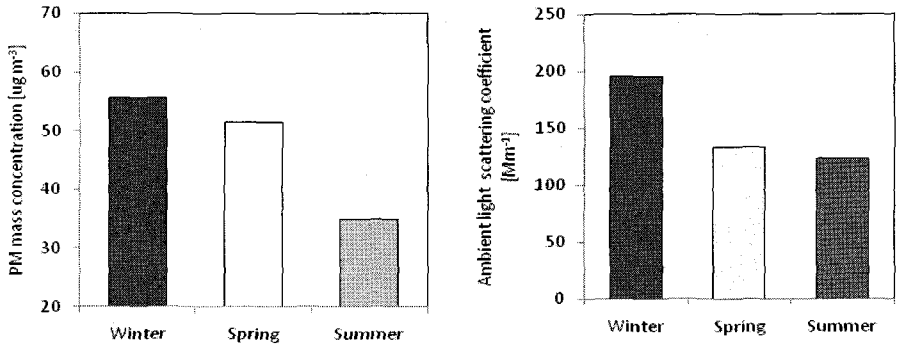

Fig. 1. Seasonal variation of $PM_{2.5}$ mass concentration(left) and aerosol light scattering coefficient(right) in Seoul from January 1 to August 31, 2006.

Figure 2 shows seasonal and weekly variations of aerosol mass scattering efficiency. Average aerosol mass scattering efficiency(σ_{sp}) were determined to be 3.2m^2 g^{-1}, 2.4m^2 g^{-1}, and 2.9m^2 g^{-1} in winter, spring and summer, respectively. Average sp was high in winter and low in spring. For weekly, average sp was generally high in weekday and low in weekend. Characteristics of aerosol mass scattering efficiency will be further discussed according to air mass type.

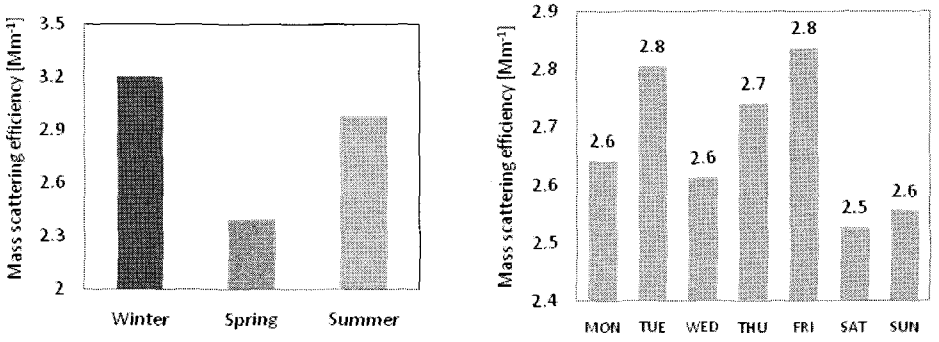

Fig. 2. Seasonal(left) and weekly(right) variations of aerosol mass scattering efficiency in Seoul from January 1 to August 31, 2006.

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