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Size-resolved source apportionment of ambient particles by positive matrix factorization at Gosan background site in East Asia

J. S. Han[1], K. J. Moon[1], S. J. Lee[1], Y. J. Kim[2], S. Y. Ryu[2], S. S. Cliff[3], and S. M. Yi[4]

[1]Department of Air Quality Research, National Institute of Environmental Research, Environmental Research Complex, Kyeongseo-dong, Seo-gu, Incheon, 404-170, Republic of Korea

[2]ADvanced Environmental Monitoring Research Center (ADEMRC) at Gwangju Institute of Science and Technology (GIST), Oryong-dong, Buk-gu, Gwangju, 500-712, Republic of Korea

[3]The DELTA Group (DAS), University of California, Davis, CA, USA

[4]Department of Environmental Health, Seoul National University, Yongun-dong, Jongno-gu, Seoul, 110-799, Republic of Korea

Abstract. Size- and time-resolved aerosol samples were collected using an eight-stage Davis rotating unit for monitoring (DRUM) sampler from 29 March to 29 May in 2002 at Gosan, Jeju Island, Korea, which is one of the representative background sites in East Asia. These samples were analyzed using synchrotron X-ray fluorescence for 3-h average concentrations of 19 elements consisting of S, Si, Al, Fe, Ca, Cl, Cu, Zn, Ti, K, Mn, Pb, Ni, V, Se, As, Rb, Cr, Br. The size-resolved data sets were then analyzed using the positive matrix factorization (PMF) technique in order to identify possible sources and estimate their contribution to particulate matter mass. PMF analysis uses the uncertainty of the measured data to provide an optimal weighting. Fifteen sources were resolved in eight size ranges (0.07~12 μm) and included continental soil, local soil, sea salt, biomass/biofuel burning, coal combustion, oil heating furnace, residual oil fired boiler, municipal incineration, nonferrous metal source, ferrous metal source, gasoline vehicle, diesel vehicle, copper smelter and volcanic emission. PMF analysis of size-resolved source contributions showed that natural sources represented by local soil, sea salt and continental soil contributed about 79% to the predicted primary particulate matter (PM) mass in the coarse size range (1.15~12 μm). On the other hand, anthropogenic sources such as coal combustion and biomass/biofuel burning contributed about 60% in the fine size range (0.56~2.5 μm). The diesel vehicle source contributed the most in the ultra-fine size range (0.07~0.56 μm) and was responsible for about 52% of the primary PM mass.

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