Characteristics of Diurnal Cycle of Gaseous (CO, NO_x, O_x) and Particulate Matters (PM1, $PM_{2.5}$ and PM_{10}) Concentrations at a Coastal City

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Mass concentrations of PM-$_{10}$, PM-$_{2.5}$ and PM-$_1$ and the distribution of particle size from 300 nm to 20 μm diameters were investigated at Gangwon Regional Meteorological Administration at Gangneung city in the eastern coast of Korea by equipping GRIMM aerosol sample from October 26 through 29, 2003. On October 26, before heavy dust particles were not detected at the city, hourly concentrations of PM_{10}, $PM_{2.5}$ and PM_1 were generally very low less than 40 $\mu g/m^3$ and showed a typical pattern such as high concentrations of PM near 0900 LST (beginning time of office hour) due to the increase of gaseous and particulate matters emitted by vehicles on the road through fuel combustion under the increase of traffic density and their maximum concentrations at 1800 LST (ending time of office hour) due to the increase of gaseous and particulate matters on the road and the operation of heating boiler from resident area. Simultaneously, much shrunken nocturnal surface inversion layer less than daytime convective boundary layer at the city could also cause the increase gaseous and PM concentrations. On the other hand, their low concentration was detected near noon due to the development of convective boundary layer, which particles could be uplifted to the top of the boundary layer. On October 27, when yellow sand transported from China to the city was detected at the city, high concentrations of PM_{10}, $PM_{2.5}$ and PM_1 were 60.59 $\mu g/m^3$, 26.92 $\mu g/m^3$, 19.63 $\mu g/m^3$ were at 0900 LST and after 0900 LST, the PM concentrations continued to increase under the influence of dust transportation from China into the city, resulting in higher and higher PM concentrations over than 60 $\mu g/m^3$ of PM10. their maxima were detected with 154.57 $\mu g/m^3$, 93.19 $\mu g/m^3$ and 76.05 $\mu g/m^3$ at 1700 LST around the ending time of office hour or sunset time, respectively. After 1700 LST, dust transportation from China to the city became weak under stronger westerly surface wind to the sea and PM concentrations gradually decreased under the decrease of traffic density on the road and the cease of its operation after a couple of hours' operation of boiler in the resident area, even though the development of

nocturnal surface inversion may make a contribution to the increase of PM concentrations.

During the dust storm period, hourly distribution of CO and NO_x concentrations showed a similar hourly variation tendency of PM10, PM2.5 and PM1 concentrations, but Ox concentration show an opposite tendency to the PM concentrations, without much sensitive variation to others. When PM_{10}, $PM_{2.5}$ and PM_1 had maximum concentrations at 1700 LST, CO and NO_x had also maximum concentrations of 1700 ppb and 111 ppb, respectively one hour later, 1800 LST. It implies that the increases of emitted gaseous like NO_x and CO from vehicles on the street and combustion gases from boiler operation for nighttime heating in the resident area could make a great contribution to the increase of PM concentrations. Hourly variation patterns of CO, NO, and NO_x were very similar each other. However, daytime O_3 concentration is high due to photochemical reactions of O_3 from NO_x, but oppositely it concentration at night is generally low due to the convert of O_3 into NO_x. After sunset, even though nocturnal surface inversion is much shrunken than daytime convective boundary layer, CO and NOx concentrations rapidly decrease due to the decrease of traffic density on the road, similarly to the PM concentrations. . However, after midnight to 0200 LST, O_3 concentration rapidly increased to 50 ppb. It might be affected by O_3 folding from lower troposphere to the ground surface.

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