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A study on the cause of seasonal PM10 concentration differences using an alaysis of meteorological factors and process analysis from CMAQ in Busan, Korea

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The high concentration of PM10 has become a major ambient environmental problem in Korea. The concentration of PM10 is believed to be influenced by the emission of air pollutants and meteorological factors. Korea has four distinct seasons and each season has the unique weather conditions including synoptic meteorological patterns. Furthermore, the concentrations of PM10 are different seasonally in Korea. This study was aimed at revealing the reason for differences in seasonal PM10 concentration with regard to meteorological factors and the results of process analysis in CMAQ. The target area in this study is Busan located in the southeast coastal area of the Korean peninsula. In Busan there are 19 automated air quality monitoring stations. The annual average concentration of PM10 excluding the yellow dust period was 47 μg m-3 in Busan in 2010, less than the Korean air quality annual PM10 standard of 50 μg m-3. The seasonal average concentration of PM10 showed 50, 48, 46, and 43 μg m-3 in spring, winter, fall, and summer, respectively. On the day of the highest daily average PM10 concentration for each season we conducted numerical simulation to understand meteorological parameters and analyze the process of PM10 productions using the WRF/SMOKE/CMAQ mesoscale model system. The 20th of May, 22th of June, 14th of November and 1st of December were selected in 2010. The Weather Research and Forecasting(WRF) is the meteorological model and the Community Multiscale Air Quality(CMAQ) is the chemistry and transport model. The Sparse Matrix Operator Kernel Emissions(SMOKE) is also used for emissions data processing. The spatial resolution of the numerical model was 1 km in this study. The synoptic meteorological pattern, mixing height, relative humidity, wind speed, and surface temperature were considered to be the meteorological factors. Process analysis was used in CMAQ to assess and quantify the contributions of the physical and chemical processes to the concentration of PM10. These processes included emissions of primary chemical species, chemical reactions, horizontal transports, vertical transports, cloud processes and dry deposition. The result of process analysis in CMAQ was that the horizontal or vertical transports were the major processes of the PM10 production. The purpose of this study was to clarify the causes of PM10 production in relation to the seasons.