EMS Annual Meeting Abstracts
Vol. 13, EMS2016-537-1, 2016
16th EMS / 11th ECAC

Detailed Contributions of Foreign and Domestic Emissions to Particulate Matter over South Korea Forecasted with WRF and UM models

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South Korea is under the influence of very high (> 100 ug/m3 as daily average) particulate matters (PM) episodes. To identify the culpability (e.g. foreign vs domestic and each emission sector) of high PM concentrations, chemical transport modeling studies with prognostic meteorological inputs are often utilized. Therefore, it is critical to examine the effects of meteorological inputs to a chemical transport model on the estimation of PM contribution.
For this study, we utilized two experimental air quality forecasting (AQF) systems; (1) the Weather Research and Forecasting (WRF) – the Community Multi-scale Air Quality (CMAQ) system, and (2) the Unified Model (UM) - CMAQ system. We used the identical emission inventories, Model Inter-Comparison Study for Asia for foreign emissions and Clean Air Policy Support System for domestic emissions, respectively. To estimate contributions of major emission sectors to South Korea PM, we applied brute force method with perturbed emissions of industrial, residential, power plant, and transportation sectors in foreign countries and South Korea.
Our annual evaluation for PM forecast exhibits around 70% accuracy for daily averaged mass concentrations. However, the forecasting accuracies of some major individual PM species are not as good as that of the total PM mass concentrations, especially when high PM episodes were observed. We found that WRF estimated higher wind speeds compared to UM. This meteorological difference was deemed to cause appreciable differences in PM compositions and relative contributions simulated with WRF and UM models. In this study, first we check how similar relative contributions of foreign and domestic emissions on South Korea PM are estimated when different meteorology models are applied to AQF systems. Secondly rough revisions on primary PM and its precursor emissions will be examined utilizing the evaluation of modeled PM to the observations and results of the relative contributions.