

THE AIR QUALITY FORECASTING SYSTEM USING CMAQ IN KOREA

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1. INTRODUCTION

The modeling system using CMAQ was developed to forecast O_3 and PM10 in Korea. The meteorological model was MM5 and emission data were processed using SMOKE. The forecasting system was run in 4 nodes cluster PC with double CPUs. The system is now an initial stage to optimize the system configuration and estimate its performance by comparing with measurements at ambient air monitoring stations. The forecasting system and initial evaluation of the system will be presented and discussed in this paper.

2. MODELING PROCEDURE

The forecasting system using, SMOKE, MM5 and CMAQ were run with a configuration of two nested domains as shown in Figure 1. The horizontal resolutions were 30km over the Eastern Asia and 10 km over Korea peninsula. The number of vertical layers of MM5 and CMAQ were 22.

The emission rate for 30 km was estimated based on the Ace Asia emission data, and those of 10 km were calculated from the Korea emission data of CAPSS (Clean Air Policy Support System) of 2003. The VOC and PM-10 emission data were speciated to 11 CB-IV chemical species and 8 particulate species by using SMOKE system. The hourly biogenic emission data was prepared using GloBeis 2 and MM5 output data

The simulation was run over 30 days of June 1-30, 2004 and compared with measurements to test its performance .

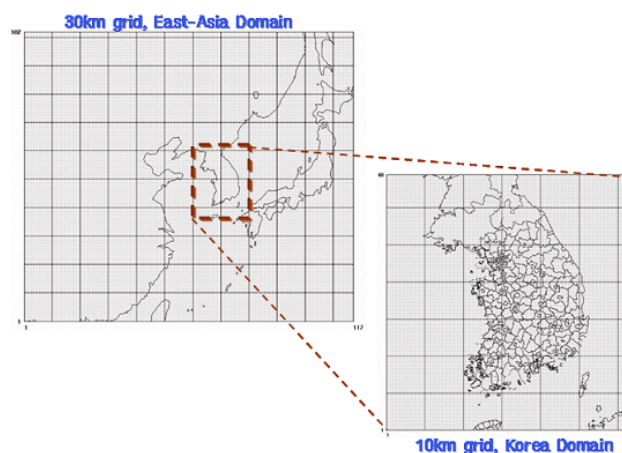


Fig. 1. The modeling domains of the forecasting system

3. RESULTS AND DISCUSSIONS

The anthropogenic emission rates in Korea are shown in Table 1. Those include point, mobile and area emission sources. The ratio of NO_x to VOCs is 0.63. The spatial distribution of emission rates were shown in Figure 2. The emission rate in urban area and industrial complex area are higher than the other regions due to large population density and industrial activities including mobile sources.

Table 1 Anthropogenic Emission rate in Korea
(2003, ton/year)

	SOx	NOx	CO	VOC	PM10
Point	309,780	336,206	55,251	129,924	17,007
Area	136,570	150,488	68,229	458,970	13,717
Mobile	52,661	680,634	734,472	141,759	39,397
Total	499,010	1,167,329	857,952	730,653	70,120

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The predicted distribution of O_3 and PM10 over Korea peninsula are shown in Fig. 3. Model predictions were compared with observed data of

ambient air quality monitoring stations located in Seoul Metropolitan Area in Fig.4.

The predicted diurnal patterns of O_3 were good in agreement with the measurements. The similar pattern was shown in NO_2 . The predicted PM_{10} , however, did not depict the diurnal cycles of observations and peak values of predictions were underestimated. There are on-going studies to improve the capacity of prediction of modeling system such as emission inventory, chemical speciation method and model parameters.

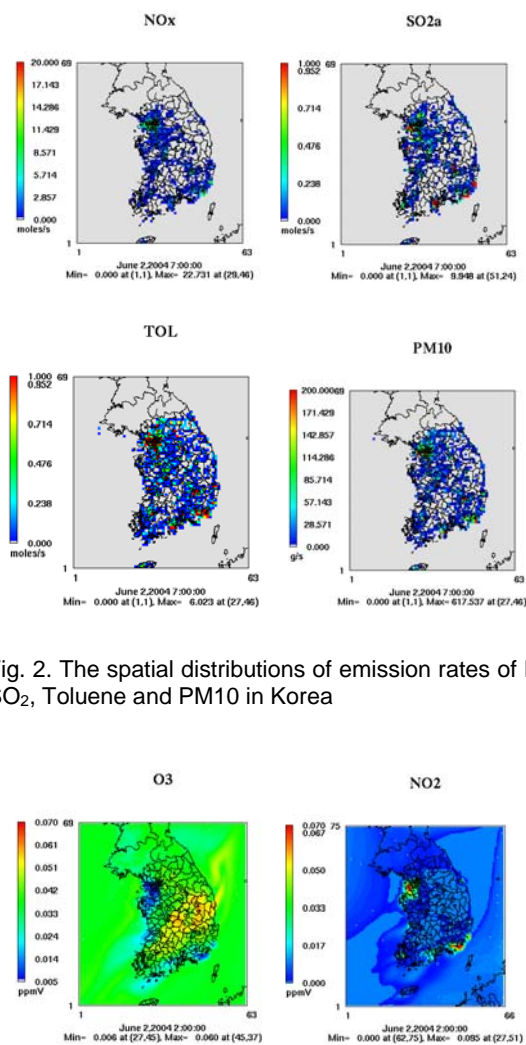


Fig. 2. The spatial distributions of emission rates of NO_x , SO_2 , Toluene and PM_{10} in Korea

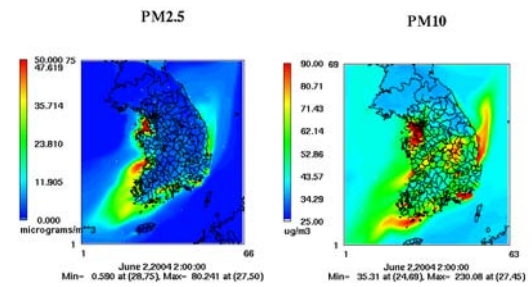


Fig. 3. The maps of predicted O_3 , NO_2 , $PM_{2.5}$ and PM_{10} .

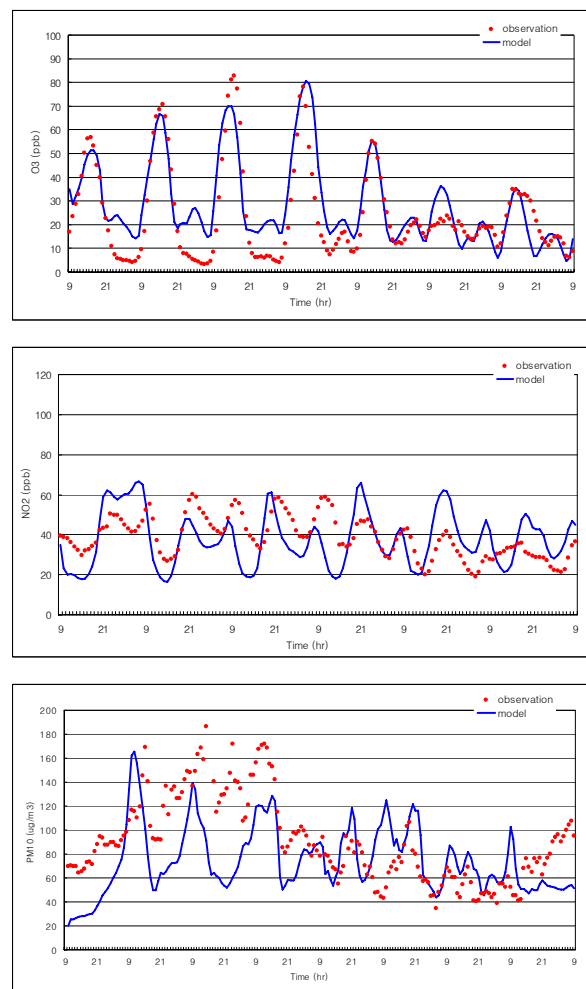


Fig.4 Comparison of predicted O_3 , NO_2 and PM_{10} with measurements at Ambient Air Quality Monitoring Stations.

4. CONCLUSIONS AND FUTURE WORKS

The air quality forecasting system using CMAQ was developed in Korea. The initial test showed that general performance of the model for O₃ and NO₂ was acceptable but the PM10 prediction underestimated peak values. The future work should be focused on the improvement of emission inventory including spatial and temporal allocations and chemical speciation. The system will be further tested against the measurement before using in real-time forecasting.

5. ACKNOWLEDGEMENTS

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6. REFERENCES

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