3D3) CMAQ모델을 이용한 서해안지역 도시의 대기질 특성 연구

Characteristics Analysis of Ambient Air Quality in a West-coastal City of Korea Using CMAQ Modelling System

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1. Introduction

A multi-level nested air quality modeling system was developed by coupling the meso-scale meteorological model MM5 and the community multi-scale air quality model CMAQ. The modeling system was then applied to assess the effect of emissions on the air quality in the west-coastal area in 2004-2006. The emission source was driven from the Clean Air Policy Support System of the Korea National Institute of Environmental Research(CAPSS), which is a 1km×1km grid in South Korea. After input data verification, the coupled modeling system was implemented to simulate the spatial distribution of the pollutants concentration. Comparing with the monitoring data, the result gained from using the models indicates that the simulating values are close to the actual monitoring values. So the study proved that with correct model, MM5-CMAQ model system could more correctly display concentration distribution of the air pollutants. It was good foreground for MM5-CMAQ to be used in atmospheric pollution simulation.

2. Methods

With the modeling system, three dimensional meteorological fields for the MM5 inputs are obtained from the National Center for Environmental Prediction(NCEP) global 1°×1° re-analysis data. The data are available every six hours. For CMAQ, the anthropogenic emissions of nitrogen oxides, carbon monoxide, volatile organic compounds (VOCs) and sulfur dioxide are obtained from the emission inventory specially prepared to support the projects of the Clean Air Policy Support System of the Korea National institute of Environmental Research (CAPSS). A three-level nested modeling domain will be established, with spatial resolutions of 36km×36km in the outer domain, 12km×12km in the middle domain, and 4km×4km in the inner domain, respectively. Outer layer simulation range includes middle and eastern China, Mongolia, Korea and Japan region, etc. Fig. 1 shows three nested domains for MM5 model.

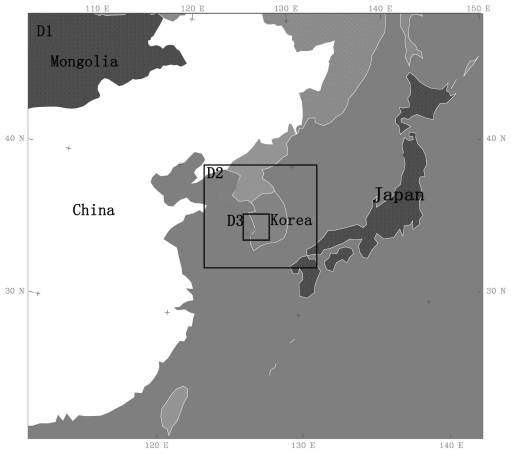

Fig. 1. Three nested domains for MM5 model.

The MM5 meteorological models was used to simulate the atmospheric circulation, providing meteorological inputs for the CMAQ(Shuiyuan Cheng et al., 2007). CMAQ was used in the study to

simulate and analyse characteristics of air pollution and the impact of pollutant emission on concentration in a west-coastal city of Korea.

3. Results and Discussion

In our research, six monitoring sites(automated air quality monitoring stations) were set up in west-coastal city(Gunsan) and adjacent inland city(Jeonju) of Korea. In order to evaluate accuracy of model system, the results from the MM5-CMAQ model were compared with measured data from these six air quality monitoring stations located within the Jeonbuk province.

Fig. 2 shows the spatial distributions of CMAQ simulated O_3 concentrations in May 29, 2006. It displays generally higher O_3 concentrations in eastern coastal and northeastern China. Especially in east coastal cities of China, ozone concentration of many areas more than 80ppb, because of the eastern China are mostly located in the well-developed industrial cities areas and densely populated. Thus, it can examine the impacts of various emission sources on the ambient concentrations of air pollutants in the study area.

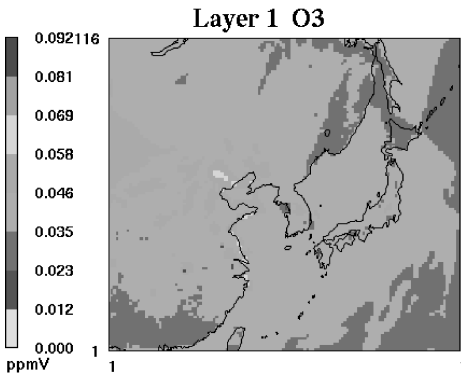

Fig. 2. Spatial distributions of MM5-CMAQ simulated O_3 concentrations.

We have used the MM5 mesoscale meteorological model and the CMAQ for performing the simulations. The model simulates quite well the observed general trend and spatial distribution characteristic concentrations of gaseous pollutants. It will be significant of using the model for further study of air pollution control strategies.

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