1. Introduction

In this study, the Community Multiscale Air Quality (CMAQ) model is applied to simulate air quality in Houston during the 2006 Texas Air Quality Study (TexAQS) period (August 1 – October 15). Here, we compare CMAQ predictions with observed data from the Air Quality System.

2. Methodology

Air quality simulations were performed using CMAQv4.7.1 (Foley et al., 2010) and the new CMAQv5.0. Nested model simulations were conducted with a 4-km domain embedded within a 12-km eastern US domain. The 4-km domain covered central and eastern Texas.

Meteorological fields were developed from the WRF (version 3.3) model (Skamarock et al., 2008).

Anthropogenic emissions were obtained from the National Emissions Inventory (NEI 2005). However, all point source emissions in the NEI for Texas were replaced by the specialized emissions inventory prepared for the TexAQS study. Biogenic emissions were estimated using the Biogenic Emission Inventory System version 3.14 (Schroeder et al., 2005).

3. Results

The predicted and observed mean daily maximum 8-hr O\(_3\) over the monitoring network in Houston are presented in Figure 1. It is evident that the model predicts higher O\(_3\) when observed data levels are low and lower O\(_3\) when observed levels are high.

![Figure 1: A comparison of predicted and observed mean daily maximum 8-hr O\(_3\) in Houston](image1)

Model predicted mean diurnal NO\(_x\) and CO levels over the monitoring network in Houston are compared with observed data in Figure 2. Predicted NO\(_x\) and CO levels are much greater than the observed data.

![Figure 2: A comparison of predicted and observed mean diurnal NO\(_x\) levels in Houston](image2)

Three other simulations were performed: (1) different meteorological fields, (2) 50% reduction in NO\(_x\) emissions, and (3) 55% reduction in the boundary concentrations for O\(_3\). Model predicted diurnal variations in hourly O\(_3\) averaged over the monitoring stations in Houston are shown in Figure 4. Predicted O\(_3\) obtained with lower boundary values are much lower than those with lower NO\(_x\) emissions. Thus, boundary values play a dominant role on the predicted O\(_3\) for the inner domain pointing to the need to properly representing interactions of the Houston air-shed with regional scale O\(_3\) transport.

![Figure 4: Impact of lower NO\(_x\) emissions and lower boundary values on predicted O\(_3\) in Houston](image4)

4. Summary

- CMAQ model with the current estimates of NO\(_x\) and CO emissions simulates levels that are much greater than observed data.
- Model employing the current estimates of VOC emissions produce ethane levels that are much lower than observed data. Peak VOC levels present in the observations are missing in the predicted values.
- Boundary concentrations play an important role on the predicted O\(_3\) levels in the small domain.

5. References


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