

Simulation of Particulate Matter Distribution over Iowa Using the WRF-CHEM (The Weather Research and Forecast Model with Chemical Processes)

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The Weather Research and Forecast Model with chemical processes (WRF-CHEM) was used to simulate the transport of particulate matter with diameter less than 2.5 micrometers (PM_{2.5}) over Iowa. These forecasts were compared to surface monitor measurements of PM_{2.5} concentration and measurements of aerosol optical depth from the MODIS (Moderate Resolution Imaging Spectroradiometer) sensor. Several episodes of high PM_{2.5} concentrations during the years 2000-2003 were examined. A Box Model was used to estimate the relative size of transport processes to emissions and particulate mass tendency.

Simulations of atmospheric conditions demonstrated overall satisfactory agreement with observed data, suggesting the WRF-CHEM could be used to simulate pollution movement and mixing. The average linear correlation coefficients between simulated and measured PM_{2.5} concentrations for three cases examined more closely were found to be greater than those reported in the literature. Satellite and surface observations appeared to be in reasonable agreement with model predictions. Nevertheless, various uncertainties in PM simulation have been identified. Substantial underforecasting of surface PM_{2.5} concentration was found. The Box Model budgets for particulate matter revealed relatively large residual components.

Results of the present research may serve as a basis for further work with WRF-CHEM on the dispersion of other pollutants (e.g., nitrogen compounds) and the contribution from adjacent states.