SIMULATING THE EFFECT OF CLIMATE CHANGE ON US AIR QUALITY USING MM5/SMOKE/CMAQ

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Global warming, population growth, and land use change are closely interrelated forces that may cause significant changes in air quality. Temperature change affects boundary layer meteorology, chemical reaction rates and regional weather features. In addition, higher temperatures can increase emissions from both biogenic and anthropogenic sources. To assess the impacts of global changes on US regional air quality, we employ a comprehensive numerical modeling approach where a regional air quality modeling system (MM5/SMOKE/CMAQ) is coupled with a global climate model (NCAR/DOE PCM) and a global chemistry model (NCAR MOZART2). The coupled modeling system is used in a multi-scale scheme such that outputs from the global model are fed into the regional model, and the regional model performs nested simulations down to urban levels. The regional simulation is performed using nested domains ranging from 36 km at the US continental scale to 4 km urban scales. The regional simulations are centered in the Pacific Northwest and the northern Midwest.

To investigate changes in future air quality, we established a base case simulation and several future year sensitivity scenarios. The base year result represents current contemporary conditions for the period in 1990 – 2000. The emissions inventory for the base year includes anthropogenic emissions from the National Emissions Inventory (NEI) database, fire emissions estimates and modeled biogenic emissions. For the effects of climate change and its related changes, future year conditions will be simulated for the year centered around 2050. The future year simulation will contain changes to model inputs including projected anthropogenic emissions inventory, future year fire emissions estimates accounting for changes in fire regimes and land management scenarios, and future year biogenic emissions estimates accounting for changes in vegetation and land use. This three-year large-scale modeling project is beginning in 2003 and this presentation will emphasize the overall approach and include preliminary results from the modeling systems.

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