AIR QUALITY MODELING FOR URBAN JACKSON, MS REGION USING ULTRA HIGH RESOLUTION WRF/CHEM MODEL

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Abstract: Poor air quality has significant health, ecological, and economic consequences. Billions of dollars are spent each year to reduce air pollution in order to protect human health and the environment. Effective targeting of air pollution controls depends on having good scientific understanding of the types of sources and the regions contributing to air quality issues. Air quality management and planning are therefore necessary and more so in the future due to rapid urban development, vehicular traffic congestion, and growing energy consumption. Quantitative models of air quality are thus essential to provide an effective decision support system for planners and administrators. In this study, an attempt is made to simulate the air quality over Jackson, Mississippi region using an online WRF/Chem (Weather Research and Forecasting – Chemistry) model. WRF/Chem model has the advantages of the integration of the meteorological and chemistry modules with the same computational grid and same physical parameterizations and includes the feedback between the chemistry and physical processes. The model is designed to have three nested domains with the inner-most domain covering the study region with a resolution of 900 meters. The simulations were performed for three different days of June 2006 with the model being integrated for a continuous 30-hour period. The model simulated atmospheric flow fields and distributions of NO₂ and O₃ were evaluated for each of the three different time periods. The model simulated atmospheric fields of near surface temperature; humidity and wind flow were compared with observations from National Weather Service and NCEP (National Center for Environmental Prediction) Atmospheric Data Project (ADP) Global Upper air and Surface observation data set over the southeast United States. Similarly model simulated spatial distributions of NO₂ and O₃ are compared with observations from ground based air quality monitoring stations in the study region. The results show that the meteorological simulations and chemical species agree with corresponding observations. An important result of this study is the availability of model simulations at a very high resolution of 900 meters which can provide useful and significant information for planning and development of a decision support system through Geography Information System (GIS) integration. Some of the GIS based maps are presented for the Jackson, MS region.

Key words: air quality, modeling, WRF/Chem, urban pollution

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