DEVELOPMENT AND APPLICATION OF A COMPUTATIONALLY-EFFICIENT MADRID 2 FOR SIMULATING SECONDARY ORGANIC AEROSOL

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1. INTRODUCTION

Simulating organic aerosols posts a challenge in aerosol and climate modeling due to the complicated physical and chemical processes associated with their formation and fate. The Model of Aerosol Dynamics, Reaction, Ionization, and Dissolution 2 (MADRID 2) that has been incorporated into the U.S. EPA Models-3/Community Multiscale Air Quality (CMAQ) (referred to as CMAQ-MADRID 2) uses a mechanistic representation for secondary organic aerosol (SOA) formation that simulates an external mixture of hydrophilic and hydrophobic aerosols. However, MADRID 2 is computationally expensive in its original formulation, limiting its 3-D applications.

2. SUMMARY

A box model version of MADRID2 that is computationally efficient (reducing the total CPU cost by 60 to 97% with less than 20% deviation from benchmark results) (referred to as MADRID 2-FAST) has been recently developed for long-term 3-D model simulations and real-time air quality forecasting. In this study, MADRID2-FAST is being implemented into CMAQ (referred to as CMAQ-MADRID 2-FAST). Both CMAQ-MADRID 2 and CMAQ-MADRID 2-FAST are being applied to the 1999 Southern Oxidants Study episode for the period of 12-28 June 1999 with a 32-km horizontal resolution. The simulated concentrations of chemical species (e.g., ozone (O_3), fine particles ($PM_{2.5}$), and PM chemical composition) will be compared with the observations from several routine monitoring networks and special field studies. The accuracy and computational efficiency of CMAQ-MADRID 2-FAST will be evaluated against CMAQ-MADRID 2.

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