

MOMENT-BASED REPRESENTATION OF SULFATE AEROSOL IN THE EASTERN
UNITED STATES AND COMPARISON WITH OBSERVATIONS

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ABSTRACT

Atmospheric Sciences Division, Brookhaven National Laboratory, Upton, NY 11973 United States Accurate representation of aerosols in chemical transport models (CTMs) requires treatment not just of the mass of particulate matter but also the aerosol size distribution, which influences chemical and physical evolution, wet and dry deposition, and important properties such as light scattering. Most CTMs to date represent only aerosol mass, with aerosol evolution and properties represented according to some assumed size. Some models have assumed a functional form of the size distribution and allowed the parameters of this distribution to evolve. A few models have explicitly represented the aerosol loading as a function of size, but this approach requires a large number of bins and is subject to error from numerical diffusion. An alternative approach represents the size distribution through its low-order moments. This approach, which makes no a priori assumption on the shape of the distribution, is highly efficient in comparison with the sectional approach and is quite accurate in representation of aerosol properties. Here we report on incorporation of a six-moment microphysics module for sulfate aerosols in a host 3-D regional model, the Multiscale Air Quality Simulation Platform (MAQSIP). Model performance is evaluated by comparison with in-situ measurements of sulfate over the eastern US for a 40-day period in summer 1995 and aerosol size distributions at Great Smoky Mountains National Park, TN and Mount Mitchell State Park NC [S. Yu et al., JGR, submitted]. The sulfate model accurately represents the accumulation mode while underestimating the nucleation and coarse modes, the latter attributed to aerosol components other than sulfate, such as dust. This work makes a case for the accuracy, utility, practicality, and efficiency of moment-based methods for representing aerosol microphysical processes in large-scale chemical transport models.

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