ABSTRACT
Aerosol radiative properties depend on the size and chemical composition of individual particles, but particle-level characteristics are not fully resolved in global models. I will describe two different particle-based methods for advancing aerosol representations in large-scale models. First, I will describe the application of a particle-resolved model, which is computationally too expensive for large-scale simulation, for benchmarking reduced aerosol representations and for parameterizing unresolved aerosol properties. Aerosol absorption is overestimated if diversity in particle composition is neglected, but the effects of composition diversity can be approximately represented by a parametric relationship derived from a series of particle-resolved simulations. Second, I will introduce a new sparse-particle model based on the quadrature method of moments, which is designed for use in large-scale atmospheric models. Cloud condensation nuclei activity of particle-resolved populations, which are comprised of 10,000 to 1,000,000 Monte Carlo particles, are accurately represented by an optimized set of only eight sparse particles. This study is a first step toward a new aerosol simulation scheme that will track multivariate aerosol distributions with sufficient computational efficiency for reliable global-scale simulations.

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Laura Fierce is an Assistant Atmospheric Scientist in the Climate and Environmental Sciences Department at Brookhaven National Laboratory. Her research focuses on improving the understanding of aerosol interactions with clouds and radiation. Dr. Fierce received her Ph.D. in Environmental Engineering from the University of Illinois at Urbana-Champaign, followed by a NOAA Climate & Global Change Postdoctoral Fellowship at Brookhaven National Laboratory. Through benchmarking studies using a detailed aerosol model, Dr. Fierce revealed that existing aerosol schemes in large-scale models are too simple to accurately represent climate-relevant aerosol properties. She is now developing the sparse-particle method for accurate and efficient simulation of complex aerosol size-composition distributions, while also conducting process-level studies for interpretation of atmospheric measurements.

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