AAAR TUTORIAL SESSIONS

MONDAY, OCTOBER 20, 2008

Second Session: 10:00 AM – 11:40 AM (cont'd)

8 AEROSOL NUCLEATION: BRIDGING SUBNANOSCALE PROCESSES TO GLOBAL-SCALE CLIMATE CHANGE

Fangqun Yu, Department of Earth and Atmospheric Sciences, State University of New York at Albany, Albany, NY

Abstract: Nucleation, the molecular process that drives the formation of new particles in the nanometer size range, is a key source of the atmospheric aerosol. Nanoparticles that grow to the sizes of cloud condensation nuclei contribute to the aerosol indirect radiative forcing of the climate system. Exposure to high concentrations of nanoparticles can lead to adverse health effects. A clear understanding of the physical and chemical processes and parameters controlling aerosol nucleation is thus crucial for assessing future climate change, and a range of health and environmental impacts associated with airborne particulates. Topics to be covered in this tutorial will include: (1) Nucleation fundamentals: A historical overview; (2) Recent advances in atmospheric nucleation (quantum-mechanical investigation of molecular interactions relevant to nucleation, measurements of prenucleation clusters, multiple-instrument characterization of nucleation events, and kinetic nucleation models); (3) Well-constrained case studies of particle formation and growth in the atmosphere; (4) Nucleation rate parameterizations suitable for multidimensional simulations; (5) Global modeling and observations of atmospheric nucleation; (6) Nucleation and climate change (aerosol indirect radiative forcing, positive and negative climate feedback mechanisms, and links between solar variability and climate change).

Fangqun Yu is a faculty member at the State University of New York at Albany. He has earned degrees from Peking University and the Chinese Academy of Sciences, and a PhD in atmospheric sciences at UCLA. Yu's research focuses on the fundamental theory of nucleation mechanisms, the development and application of nucleation models, the analysis of field and laboratory measurements related to particle formation, and the global implications of aerosol nucleation for climate change, air quality, and health impacts. He has published about 50 peer-reviewed scientific journal papers.

Third Session: 1:00 PM – 2:40 PM

9 ATMOSPHERIC-SURFACE EXCHANGE: DRY DEPOSITION AND RESUSPENSION

Cliff I. Davidson, Departments of Civil and Environmental Engineering/Engineering and Public Policy, Carnegie Mellon University, Pittsburgh, PA

Abstract: This tutorial reviews current understanding of aerosol exchange between the atmosphere and surfaces, focusing on the interacting processes of dry deposition and resuspension. First, the process of dry deposition is described physically and mathematically, considering the three sequential steps aerodynamic transport, boundary layer transport, and interaction with the surface. Second, the process of resuspension is described, including some newly developed models. Finally, a number of important measurement techniques for dry deposition and resuspension are summarized. These include direct measurements of material accumulated on surfaces as well as methods of inferring the flux using atmospheric data.

Cliff I. Davidson is a professor in the Department of Civil and Environmental Engineering and the Department of Engineering and Public Policy at Carnegie Mellon. He is the founding director of the Center for Sustainable Engineering at that university. He received his BS in electrical engineering from Carnegie Mellon and MS and PhD degrees in environmental engineering science from the California Institute of Technology.