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THE ABILITY OF LEAF LITTER DEBRIS TO INITIATE ICE PHASE FORMATION IN THE ATMOSPHERE.

Koehler, Kirsten
Department of Atmospheric Science, Colorado State University

Sonia M. Kreidenweis
Department of Atmospheric Science, Colorado State University, Fort Collins, CO 80523-1371, USA

Paul J. DeMott
Department of Atmospheric Science, Colorado State University, Fort Collins, CO 80523-1371, USA

Alex Guenther
Atmospheric Chemistry Division, National Center for Atmospheric Research, Boulder, CO 80307, USA

Ray Fall
Department of Chemistry and Biochemistry, University of Colorado, Boulder, CO, 80309

Biological sources are an important contribution to the overall global aerosol burden and can be the main source of aerosols in the absence of human activities. Recently, studies are providing quantitative understanding of the contribution of biogenic particles to the total aerosol loading, both in terms of particle number and particle mass. Although ice nuclei (IN) particles typically represent less than 1 in 106 of atmospheric aerosol particles, IN are crucial in initiating ice formation at temperatures warmer than -40C, where homogeneous ice nucleation cannot occur. Sources of IN include dust particulates, metal oxides from metal works, combustion products, and it has been suggested that ice nucleation active (INA) bacteria contribute importantly to ice formation in the atmosphere. Studies have suggested that bacterial and other biological IN are particularly efficient at initiating ice formation at warmer temperatures, the most effective being capable of ice formation at -2 to -5. INA bacteria tightly adhere to the leaf surface but leaf litter is a significant source of IN. Accurately representing the role of bacteria in ice formation is particularly important in modeling studies of regions where anthropogenic contributions are expected to be minimal, such as the Amazonia region.

While in most previous experimental studies on the role of bacteria to initiate ice formation, the bacteria are studied in liquid suspensions, or on the surface of a filter or other surface exposed to cold temperatures at ice supersaturated relative humidity (RH) conditions, in this study we are using the Colorado State University Continuous Flow Diffusion Chamber (CFDC) to examine the ability of the particles to initiate the ice phase as an dry-dispersed aerosol. Leaf litter debris from plant types expected to contain high numbers of IN, such as tea plants, is mixed with bronze beads contained within a fluidized bed. As the mixture fluidizes the bronze beads serve to agitate the leaf litter and remove the bacteria and other biological material from the leaf surface, while being too heavy to escape the bed. Thus, only the biological material is aerosolized. Since the leaf litter is not suspended in water, the potential for the biological particles to be contaminated with small amounts of impurities in the water is eliminated. Particles larger than ~1 μm are removed using an impactor to yield a polydisperse, submicron distribution of biological material. The CFDC then exposes the particles to temperatures between ~-5 to -40C and RH from ice supersaturation to several percent above water saturation. Ice nucleation results will be presented as a function of temperature and required RH for ice formation.