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Indirect Climate Impacts of Smoke: Interactions between Biomass Burning Particles and Warm and Cold Clouds

Biomass burning is a significant source of carbonaceous aerosol in many regions of the world. When present, biomass burning particles may affect the microphysical properties of clouds through their ability to function as cloud condensation nuclei (CCN) or ice nuclei (IN). I will review our group's recent measurements of the CCN and IN characteristics of biomass burning particles performed on laboratory-generated aerosols during the Fire Lab At Missoula Experiments (FLAME). We combusted a variety of fuels, primarily from the United States, and found large fuel-to-fuel variations in particle properties. Our measurements showed that most of the submicron particles emitted were CCN active at supersaturations less than 1%, and thus can readily participate in cloud formation and undergo wet deposition. We also found measurable concentrations of IN in about half of our experiments. In a subset of these, the IN concentrations were large enough to perturb ice nuclei concentrations, and thus influence cloud glaciation, on regional scales.

Dr. Sonia Kreidenweis is a Professor of Atmospheric Science at Colorado State University. Her research focuses on characterization of the physical, chemical and optical properties of atmospheric particulate matter, and the effects of the atmospheric aerosol on visibility and climate. She has conducted field studies in several U.S. National Parks to establish the sources and characteristics of particulate matter responsible for visibility degradation, with a recent focus on the impacts of prescribed and wild fires. ongoing laboratory and field studies have investigated the role of particles and of individual compounds found in particulate matter in the nucleation of cloud droplets and ice crystals. Prof. Kreidenweis is a Past President of the American Association for Aerosol Research. She received her B.E. in Chemical Engineering from Manhattan College and her M.S. and Ph.D. in Chemical Engineering from the California Institute of Technology.