A mesoscale analysis of the effects of idealized ice nuclei during austral spring in South America

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Populations of idealized ice nuclei (IN) have been modeled using the University of Wisconsin Non-hydrostatic Modeling System (UWNMS) to investigate the sensitivity of water vapor and ice concentrations and distributions to IN concentration, activation temperature, and location over a 60-hour period of time coincident with frontal and mesoscale convective activity in Amazonian springtime. The magnitude of positive and negative changes in both vapor and ice appear to be most dependent on the concentration and altitude of IN. For example, ice and vapor concentrations increase at high altitudes when a relatively small or high-altitude IN concentration is modeled. Vertical velocity and altitude play dominant roles in the spatial distribution of changes to water concentrations—higher altitude environments are more sensitive to the effects of IN and vertical velocity combined, and upward velocities are usually correlated with positive changes to vapor and ice. We will explain the mechanisms that cause these patterns with a view toward expanding the understanding of how the distribution of humidity in the upper troposphere/lower stratosphere may be impacted by aerosol.

Particulate matter optical properties and emission trends for gasoline and diesel vehicles

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Gasoline and diesel-powered motor vehicle emissions were measured at the Caldecott tunnel near San Francisco, California, during summer 2006. Measured emission rates for particulate matter ($PM_{2.5}$), black carbon (BC), and particle number (PN) were compared to previous measurements made at the same site. $PM_{2.5}$ mass emission factors decreased by 36±17 and 48±12% for gasoline (light-duty) and diesel (heavy-duty) vehicles, respectively, between 1997 and 2006. BC and PN emissions also decreased. In 2006, emission factors for BC and PN were measured from 226 individual heavy diesel trucks as they drove through the tunnel on a 4% uphill grade. BC emission factors were log-normally distributed, and there was minimal overlap between high-emitters of BC and PN. The absoprtion and extinction coefficients of tunnel aerosols were measured directly, and mass absorption efficiencies were calculated to be 9.1 and 5.1 m^2 per g BC for gasoline and diesel vehicle PM emissions, respectively. Corresponding values of single scattering albedo were 0.31±0.06 and 0.20±0.05.