Atmospheric Aging of Soot Aerosols

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Soot from incomplete combustion of fossil fuels represents a significant fraction of primary atmospheric aerosols. Because of the high absorption cross-section of BC over a broad range of the solar spectrum, soot contributes significantly to climate change by direct radiative forcing and is the second most important climate-warming agent after carbon dioxide. Atmospheric aging considerably modifies the chemical and physical properties of BC, making them largely independent of the aerosol origin. Aging of BC aerosol occurs through coagulation with other aerosols or by multi-phase interaction with organic and inorganic vapors formed from photochemical oxidation of primary pollutants. BC aerosols may be more absorptive and exerts a higher positive direct radiative forcing. The ability of BC to absorb visible light may be considerably enhanced when BC particles are coated by transparent materials. The increase in light absorption caused by coatings is likely accompanied by an even larger increase in light scattering, which partially compensates the positive forcing of the light absorbing BC core. Currently, the mechanisms responsible for BC aging in the atmosphere remain poorly understood. In this talk, laboratory results and field measurements will be presented to quantify aging of soot particles and the associated changes on their properties, including morphology, hygroscopicity, and optical properties. The implications of soot aging on their impacts on air quality, weather, human health, and climate will be discussed.