Photochemical and Dark Ageing of Organic Aerosols

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Abstract: Atmospheric aerosols significantly affect air quality, visibility, and global climate. Organic compounds make up a significant, and often dominant, fraction of the atmospheric particulate matter. Primary organic aerosol is emitted in the atmosphere by various sources, and secondary organic aerosol is produced directly in the atmosphere as a result of a complex sequence of reactions that start with the oxidation of volatile organic compounds and end with the condensation of the low-volatility products into particles. What makes the representation of organic aerosols in climate and air quality models challenging is their astonishingly high degree of chemical complexity. Furthermore, the chemical composition of organic aerosols continuously changes as a result of various "ageing" processes, such as photolysis, hydrolysis, oligomerization, oxidation, and other reactions involving aerosol constituents and atmospheric gases. This presentation will examine the role of condensed-phase photochemical processes in the aerosol ageing, i.e., processes initiated by absorption of solar radiation by an organic compound within a particle or cloud/fog droplet. We will also discuss "dark" ageing processes, which occur without any involvement of solar radiation and free radicals, and result in the formation of compounds with unusual properties, such as organic compounds capable of absorbing visible radiation (so called "brown carbon").