Geophysical Research Abstracts
Vol. 16, EGU2014-4074, 2014
EGU General Assembly 2014

Does atmospheric aging of biogenic SOA increase aerosol absorption and brown carbon?

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The optical properties of organic aerosols are important in determining their radiative forcing and, subsequently, their impact on climate. Primary or secondary organic aerosols (SOA) from natural and anthropogenic emissions age via photochemical reactions of OH, NO_3, and O_3. Atmospheric aging of aerosols changes their chemical, physical, and optical properties. Of special interest is the possible formation of absorbing organic species or "brown carbon", which can lead to absorption and heating in the atmosphere, with important consequences to climate and air quality.

In this talk we will discuss possible formation pathways of brown carbon by aging of SOA, and its potential effect on radiative forcing. We employed a new broadband aerosol spectrometer that retrieves aerosol optical properties between 360 and 420 nm to probe the aging of biogenic and anthropogenic SOA in a flowtube and photochemical smog chamber. We will discuss the effect of photochemical aging on the optical properties of SOA that form from the ozonolysis of biogenic and anthropogenic VOCs, and subsequent reactions with ammonia with special emphasis on the change in their absorption. Nitration reactions of polyaromatic hydrocarbons that lead to increased absorption will also be presented.

Using the wavelength-dependent modified forcing equation we will provide estimates of the radiative impact of the aged biogenic SOA. Our calculation shows that the integrated radiative forcing suggest that the observed changes in refractive index due to photochemical ageing by NH3 reactions can lead to enhanced cooling by the aged aerosol.