4.103 Impact of biogenic emissions of organics from a cool-temperate forest on aerosol optical properties retrieved from a Sky Radiometer.

Early Career Scientist

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Abstract:

Terrestrial biogenic emissions of organics can affect the optical properties of atmospheric aerosols and thus impact climate change. Large uncertainties exist in how the abundance and chemical composition of biogenic organic aerosols affect the absorbing/scattering characteristics of aerosols. Filter measurements of submicron water-soluble aerosols were made within a canopy of Tomakomai Experimental Forest, a cool-temperate forest site in northern Japan. In order to elucidate the impact of biogenic emissions of organics on aerosol optical properties, the filter-based chemical data were compared with the aerosol optical depth (AOD) and single scattering albedo (SSA) retrieved from a Sky Radiometer at the same site simultaneously obtained with the filter-based samples from June to December 2015. In order to investigate a linkage between the filter-based aerosols and the Sky Radiometer data, the data were selected for periods when the vertical transport was dominant based on local wind data.
The AOD exhibited a distinct seasonal variation similar to that of the total soluble mass (TSM) in the filter-based submicron aerosols, which showed increase in summer and autumn. In summer, sulfate accounted for 60% of TSM, which was linked to an increase of SSA (>0.95) suggesting more scattering characteristics of aerosol particles above the forest canopy. On the other hand, the SSA in autumn decreased (SSA=0.90–0.95), suggesting more absorbing characteristics. The decrease of SSA was associated with the increase in the mass fraction of water-soluble organic matter (WSOM, 70% of TSM). The majority of WSOM in autumn is attributable to emissions of α-pinene from the forest floor, and the subsequent formation of biogenic secondary organic aerosols (BSOA). The result indicate that α-pinene-derived SOA, mostly originated from the forest floor, can decrease SSA in autumn, which has a potential to reduce the negative radiative effect on a regional scale.