

Characteristics of Carbonaceous Aerosol in Northern Thailand during the Biomass Burning Season

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Biomass burning activities are common across the globe and are the dominant source of carbonaceous aerosol particles. Consequently, biomass smoke aerosol exerts significant adverse effects on human health, air quality, and climate. South-East Asia is a particularly important source region of biomass smoke. The most common forms of biomass combustion in this part of the world are open burning of agricultural residues, land clearing fires, and residential use of biofuels for cooking and heating.

In this study, which is part of the 7-South East Asian Studies (7-SEAS) 2013 campaign, particulate matter (PM_{2.5} and PM₁₀) samples were collected at a high-altitude (1530 m asl) location in northern Thailand. Besides various physical and optical aerosol measurements, detailed chemical speciation of the PM samples included the quantification of molecular source tracers for biomass burning (i.e., the anhydrosugars levoglucosan and mannosan), along with other carbonaceous species, and functional group analysis. Meteorological parameters, air mass back trajectories, and fire counts from satellite observations were used as well to assess the source types and source regions of the carbonaceous particles.

High PM levels, associated with significantly enhanced smoke tracer concentrations, were observed during several haze episodes. Local biomass burning activities in form of combustion of agricultural residues in the surrounding area of the sampling site were identified as one of the PM sources, while regional scale transport of biomass smoke from the active fire regions in the neighboring countries (especially Myanmar) was found to be another major source. Diagnostic ratios of specific molecular tracers were used to constrain the biomass types, suggesting a mix of different biofuels, including wood and agricultural residues, which constitute an important regional source of carbonaceous aerosol.