Simultaneous observations by sky radiometer and MAX-DOAS for characterization of biomass burning plumes in central Thailand in January-April 2016

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The first intensive multi-component ground-based remote sensing observations by sky radiometer and Multi-Axis Differential Optical Absorption Spectroscopy (MAX-DOAS) were performed simultaneously at the SKYNET/Phimai site located in central Thailand (15.18˚N, 102.56˚E) from January to April 2016. The period corresponds to the dry season associated with the intense biomass burning (BB) activity around the site. The near-surface concentration of formaldehyde (HCHO) retrieved from MAX-DOAS was found to be a useful tracer for absorption aerosols from BB plumes, when BB was the dominant sources of HCHO and absorption aerosols over other sources. As the HCHO concentration tripled from 3 to 9 ppbv, the ratio of gaseous glyoxal to HCHO concentrations in daytime decreased from ~0.04 to ~0.03, responding presumably to the increased contribution of volatile organic compound emissions from BB. In addition, clear increases in aerosol absorption optical depths (AAODs) retrieved from sky radiometer observations were seen with the HCHO enhancement. At a HCHO of 9 ppbv, AAOD at a wavelength of 340 nm reached as high as ~0.15±0.03. The wavelength dependence of AAODs at 340-870 nm was quantified by the absorption Ångström exponent (AAE), providing evidence for the presence of brown carbon aerosols at an AAE of 1.5±0.2. Thus, our multi-component observations around central Thailand are expected to provide unique constraints for understanding physical/chemical/optical properties of BB plumes.

Keywords: Biomass burning, HCHO, CHOCHO, aerosol, sky radiometer, MAX-DOAS

