# Characterization of aerosols and trace gases in Phimai, Thailand using MAX-DOAS measurements.

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We present the Multi-Axis Differential Optical Absorption Spectroscopy (MAX-DOAS) aerosol and trace gas measurements performed in Southeast Asia, at Phimai, Thailand (15.18˚N,102.56˚ E). Our MAX-DOAS instrument has been operating there since September 2014. Aerosol and trace gas vertical profiles were retrieved using the Japanese MAX-DOAS profile retrieval algorithm version 2 (JM2), a multi-component profile retrieval algorithm based on the optimal estimation method. The components retrieved are Aerosol Extinction Coefficient (AEC) at 357 and 476 nm and 6 trace gases ($NO_2$, $SO_2$, $O_3$, CHOCHO, HCHO and $H_2O$). The MAX-DOAS data of AEC and its vertically-integrated quantity, i.e., the Aerosol Optical Depth (AOD), were compared to those of the co-located AD-Net (Asian Dust and aerosol lidar observation network) LIDAR (Light Detection and Ranging) and SKYNET sky radiometer measurements, respectively. Aerosol measurements from all the three platforms showed similar seasonal variations with enhanced aerosol loading during the dry season (October-May). This enhancement was associated with biomass burning, which is a pronounced event in this region according to literature reports. This was further supported by satellite observations (MODIS), which show high correlations with MAX-DOAS data with an $R^2$ of 0.71. The seasonal variation of trace gases ($NO_2$, $SO_2$, $O_3$, CHOCHO, and HCHO) showed similar patterns with enhanced concentrations during the dry season, consistent with the influence of biomass burning. In the dry season, the CHOCHO/HCHO ratio was estimated to be 0.025±0.017, which is in the range of the literature values reported for rural sites. The Ozone Monitoring Instrument (OMI) tropospheric $NO_2$ data also showed similar seasonal variations but tended to be biased high by 27%. It is thus expected that such unique results from multi-component observations with MAX-DOAS will be useful for evaluating satellite data and models for the Southeast Asia region.

Keywords: MAX-DOAS, Aerosols, AOD

 