Measurement of Volatile Organic Compounds Using Trigger Sampling in Southeast Asia During Biomass Burning Season

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Biomass burning (BB) has long been suggested as one of the primary sources in perturbing atmospheric chemistry and composition in both regional and global scale. Wildfires and prescribed fires lead to high levels of PM and trace gases, including carbon monoxide (CO), greenhouse gases, and volatile organic compounds (VOCs). This study investigates the characteristics of VOCs during a major BB season in Southeast Asia. The trigger sampling technique was used to collect 30 whole air samples at Doi Ang Khang (DAK, 19.93°N, 99.05°E, 1536 m), northern Thailand, in March, 2014. Carbon monoxide was used as the target gas for triggering due to its specificity to burning activities. The trigger sampling was devised by setting a CO concentration threshold of approximately 1 ppmv to capture supposedly significant burning plumes. These samples were subsequently analyzed in-lab by gas chromatography/mass spectrometry/flame ionization detection (GC/MS/FID) and cavity ring down spectrometry (CRDS) for VOCs and greenhouse gases, respectively. To pose a contrast to the BB VOCs, 53 sample data collected in Taipei (TPE, within 24.95 – 25.11°N, 121.45 – 121.65°E), northern Taiwan, in February 2012 were used. Although the average concentration of total VOCs measured at DAK (69.5 ppbv) was only about 69% that of the TPE samples (101.5 ppbv), significant contribution from ketones (>20%) was found within the BB samples compared to those collected in urban traffic environment (~2%), revealing a possible pathway to produce oxygen-rich species or secondary organic aerosols (SOA). Halogenated compounds were also measured in these BB air samples, showing an enhanced level of 173.8 pptv (+21.4%) CH_3Cl during the study period. Ethyne was found to exhibit high correlation with CO (R2 = 0.84) due possibly to their common origin. The ratio of ethyne/CO was calculated to be 3.91 ppbv/ppmv in this study, indicating a distinct signature of initial emissions of BB in the Southeast Asia region.

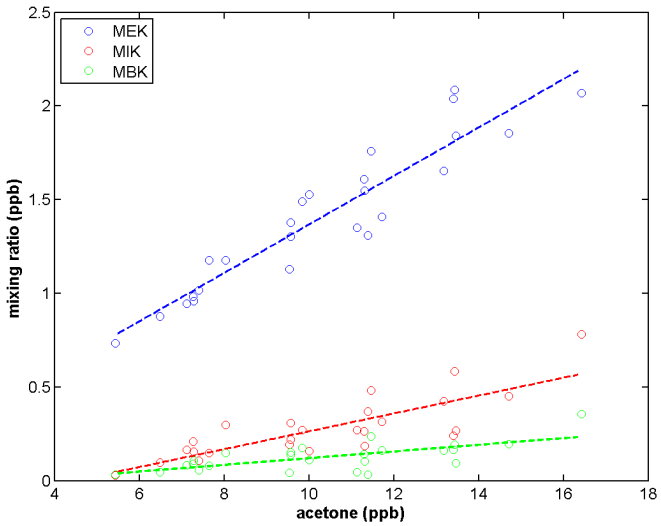

Figure 1. The BB VOC ratios observed at Doi Ang Khang, Thailand (DAK) in March, 2014.