1.030 Effects of Transboundary Peat-forest Smoke on Acidity of Receptor Urban PM2.5 in Maritime Continent.

Early Career Scientist

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Abstract:

This is the first multi-year study in the Maritime Continent, Southeast Asia demonstrating that transboundary peat forest (PF) burning smoke lessens acidity of PM$_{2.5}$ in an urban receptor environment. Acidity of more than 450 urban PM$_{2.5}$ (daily 24-hour) samples collected during 2011–2015 were investigated by coupling chemical characterization with thermodynamic Extended Aerosol Inorganics Model (E-AIM) simulation. The average in-situ pH (pH$_{IS}$) increased by 30% from 1.2 in non-smoke dominant (NSD) PM$_{2.5}$ to 1.6 in smoke dominant (SD) samples, and elevated up to 2.4 during an episodic smoke event in June 2013, demonstrating that transboundary PF smoke increased alkalinity of urban PM$_{2.5}$. Enhancement in particulate ammonium (1.7 – 2.1 folds), outweighing the increment in sulfate (1.2 – 1.6 folds), was the dominant factor increasing alkalinity in SD and episodic PM$_{2.5}$. The increased ammonium in PM$_{2.5}$ was concurred by surged concentrations in gaseous ammonia during SD and episodic period; the concentration of NH$_3$(g) was enriched up to 8.5 folds of NSD periods, larger than the increment in other acidic gases (SO$_2$, HNO$_3$, and HCl). Statistical analyses demonstrate that a minimum of 86 NSD samples are required to show inorganic ionic concentrations differing from 117 SD samples at a power (confidence) of 90%. Nevertheless, such sample sizes remain insufficient, rendering biased lower pH$_{IS}$ as if PF smoke acidified urban PM$_{2.5}$. Our results also show that >100 NSD PM$_{2.5}$ samples are needed to represent local environment as a proper baseline, which is critical for assessing impact of transboundary PF smoke on receptor urban environment in the Maritime Continent.