Emissions of CO_2, CO, and CH_4 from peat forest fires on Sumatra Island in non El-Niño year 2013

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We observed substantial enhancements of atmospheric trace gases and aerosols (CO_2, CH_4, CO, PM2.5, PM10, and black carbon) in summer of 2013, with continuous instruments onboard the NIES voluntary observing ships sailing in the Southeast Asia region. The enhancements were observed off the east coast of the Malay Peninsula and in the straits of Malacca along the shipping route, associated with prominent enhancements in CO. The 6-year climatology (2008 –2013) of the monthly mean CO mixing ratios in these areas shows the maximum in June, followed by moderate but relatively high values in following months of July and August. Our analysis combining in-situ measurements, satellite observations, and an air trajectory analysis showed that the observed enhancements were due mainly to the intensive biomass burnings that occurred in the central Sumatra. We examined the quantitative relationships between the observed CO_2, CO, and CH_4 during the CO enhancement events. Strong correlation was found between these gases, and the calculated emission ratios of CO/CO_2 suggested large contribution of peat forest fires to the observed enhancements (CO/CO_2 = 135 ppb/ppm). We determined the emission factors (EF) of CO_2, CO, and CH_4 from the peat forest fires using the emission ratios of CO/CO_2 and CH_4/CO_2, showing the EFs of 1722, 132.0, and 6.27 (g/kg) for CO_2, CO, and CH_4, respectively. These EFs were compared with those calculated from the current emission inventory (GFED version 4S), which are 1671, 144.5, and 11.95 (g/kg) for CO_2, CO, and CH_4 respectively. These EFs were consistent with each other except CH_4, suggesting that the EF used in GFED4S is overestimated for CH_4 from peat fires.

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