Implications of methane emissions in China based on multi-site observation in 2012-2013

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Methane (CH4) as the most important non-CO_2 greenhouse gases has attracted enduring concerns about their emission sources and budgets. As China's significant role in the emission of non-CO_2 greenhouse gases, extensive studies have been conducted in China for bottom-up estimation of anthropogenic methane emissions, yet limited field observations are available especially in the urban area as an independent check of the available emission inventories. In this study, we carried out field measurements concurrently at 14 sampling sites, including 8 urban sites and 6 regional background sites, for two years over China throughout 2012-2013. Whole air samples were collected by 1-liter stainless steel canisters and analyzed for mixing ratios of methane and other trace gases including nonmethane hydrocarbons (NMHCs) and CO by gas chromatography (GC-FID) or by a pre-concentrator followed by GC-MSD/FID/ECD determination. Observed average concentration of methane was 2001 ppb during the campaign in 2012-2013, with the highest occurring in Sichuan Basin and lowest in the northwest China. Unlike those in the global background sites where the highest levels of methane occur in winter and the lowest in summer, the patterns of methane monthly means varied from site to site during our campaign in China, indicating their differences in source contributions. The potential emission sources were inferred by using typical diagnostic ratios of NMHCs (e.g. methane-to-ethane ratios) and by correlations of methane with tracers of different sources, such like CO and methyl chloride. In addition, with multi-site observation data of methane and CO, we attempt to constrain methane emissions in China with available emission data for CO.