Characteristics of Atmospheric CO_2 and CH_4 at the Shangdianzi Regional Background Station in China

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Atmospheric carbon dioxide (CO_2) and methane (CH_4) have been continuously measured at the Shangdianzi regional background station (SDZ) in China from 2009 to 2013. Based on the influences of local surface wind and long-distance transport, the observed records were flagged into locally influenced, Beijing-Tianjin-Hebei (BTH) influenced, and Russia, Mongolia, and Inner Mongolia autonomous region (RMI) influenced. ~ 81.4% of CO_2 and ~75.6% of CH_4 mole fractions were flagged as locally representative, indicating that the atmospheric CO_2 and CH_4 at SDZ were strongly influenced by local sources and sinks. Cluster analysis of back trajectories proved that the atmospheric CO_2 and CH_4 were influenced by air masses from northwest (RMI) or from south and southeast (BTH). The CO_2 and CH_4 mole fractions in BTH are always higher than in RMI, with the largest difference of 11.5 ± 0.3 ppm for CO_2 and 102 ± 1 ppb for CH_4 in July. The annual growth rates of CO_2 and CH_4 in BTH are 3.8 ± 0.01 ppm yr^{-1} and 10 ± 0.1 ppb yr^{-1}, respectively, which are apparently higher than those of the RMI and the global means. The long-term trends of CO_2 and CH_4 in BTH are deviating from those in RMI, with ratios of ~1.0 ppm yr^{-1} for CO_2 and ~2 ppb yr^{-1} for CH_4, indicating the strength of CO_2 and CH_4 emission in Beijing-Hebei-Tianjin plain increased more than 20% every year.

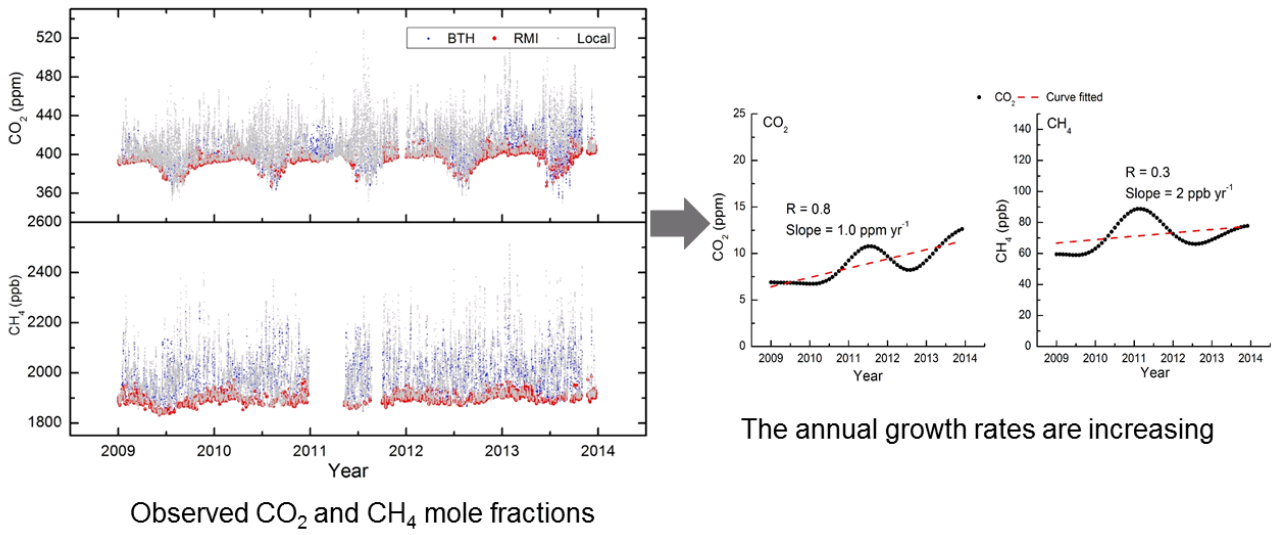

Figure 1. Shangdianzi Station (SDZ) in northeast China. Left: Observed CO_2 and CH_4 mole fraction. Right: The annual growth rates are increasing.