Little Evidence for Significant Increases of CH_4 Emission in the U.S. over the Past Decade

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Recent studies on whether methane (CH_4) emissions from oil and natural gas (ONG) operations in the U.S. have significantly increased are still inconclusive. To provide observational evidence we carefully analyzed the *in situ* CH_4 measurements from the NOAA Global Greenhouse Gas Reference Network (GGGRN) for the best estimates of CH_4 trends for 2006-2016. Methane data from 11 aircraft sites and 9 surface/tower sites across the U.S. were included in this study. Variations of sampling frequencies in different seasons were taken into account for accurate trend detection. We found that most of our sites had similar CH_4 trends of ~ 6.5 ppb/yr, which was comparable with the recent global background CH_4 trend from Mauna Loa. By utilizing the vertical gradient (Planetary Boundary Layer relative to high altitude data), we have the ability to detect significant increase of surface emissions larger than 7-10% over the study period from most of our sites. However, statistically significant increase were only found at the Southern Great Plain site in Oklahoma (SGP, downwind of the Eagle Ford, Barnett Shale and Woodford ONG fields) and the Dahlen sites in North Dakota (DND, downwind of the Bakken ONG field), which indicated influences from regional ONG activities. Ethane (C_2H_6) measurements from SGP (C_2H_6 measurements were not available at DND) and propane (C_3H_8) measurements from both SGP and DND exhibited significant increasing trends. Linear correlations were well identified for surface C_3H_8 and CH_4 enhancements at SGP, relative to observations at higher altitudes. However, by applying the observed enhancement ratios of surface C_3H_8 /CH_4 and the C_3H_8 trends (as indicator for ONG emissions) on CH_4 trend estimates, we would infer much larger surface CH_4 trends than what we actually observed at these two sites. When using C_2H_6, i-pentane, n-pentane, or n-butane date, we also infer much larger surface CH_4 trends. We found that the fat-tailed distribution of these hydrocarbon data and the changing enhancement ratios over time are likely responsible. This discrepancy suggests that using a constant enhancement ratio is not likely a reliable approach to compute CH_4 emission trends from ONG.

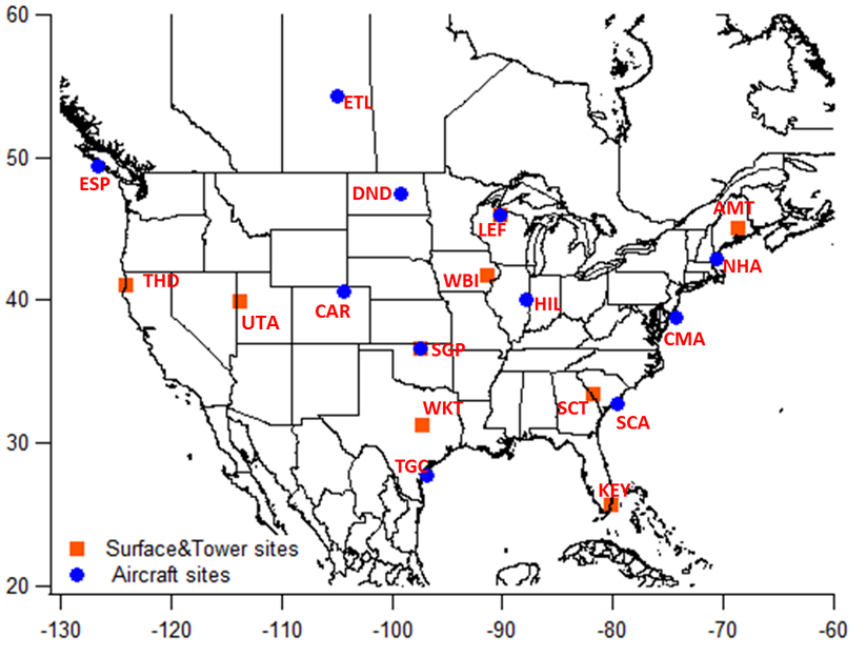

Figure 1. Long-term monitoring sites from the NOAA GGGRN.