Temporal Variability in Methane at Indianapolis with Implications for the Urban Methane Flux Estimates

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As natural gas extraction and use continue to increase, the need to quantify methane (CH_4) emissions, a powerful greenhouse gas (GHG), has grown. Large discrepancies in Indianapolis CH_4 emissions are observed when comparing inventory, aircraft mass-balance, and tower inverse CH_4 emissions estimates. The Indianapolis Flux Experiment (INFLUX) tower network is utilized to investigate these discrepancies between bottom-up and top-down CH_4 emission assessments. The INFLUX network includes 9 towers currently hosting continuous, highly-calibrated CH_4 mole fraction measurements to examine the temporal variability in 2012-2016 CH_4 at Indianapolis (see Figure). Three major reasons that may be responsible for the above-mentioned discrepancy are identified: (1) a highly-variable and spatially non-uniform U.S. continental CH_4 background with changes up to 150 ppbv, (2) temporal variability in anthropogenic urban CH_4 sources and (3) an influence of unknown CH_4 sources. To address the first issue, we propose a method for identifying the days with a regionally uniform CH_4 background. With regard to the second issue, we recommend temporal consistency when aircraft mass-balance and tower inverse methods are compared. For the third concern, we investigate the ways to approximate the impact of the unknown sources on the CH_4 flux estimates. Work continues to quantify the implications for total city CH_4 emissions given the regional and local CH_4 temporal variability.

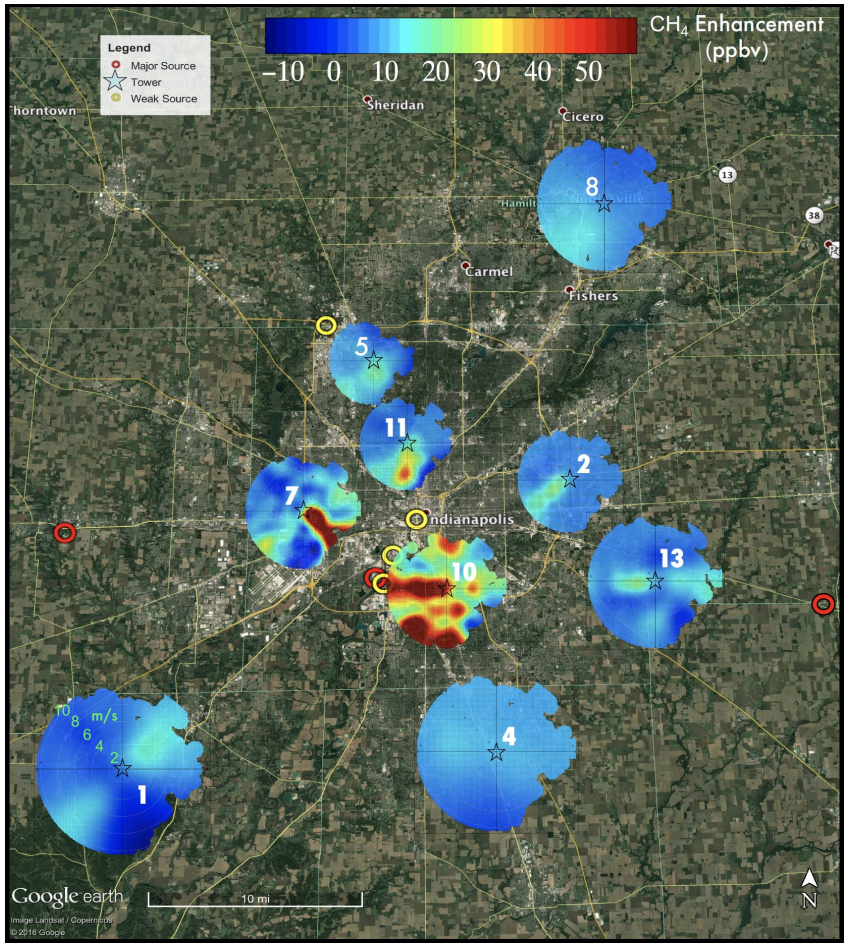

Figure 1. CH_4 enhancements (calculated by subtracting CH_4 background from the tower measurements) using 1500-2200 UTC data for the full year of 2015 as measured by the INFLUX tower network. Bivariate polar plots show CH_4 enhancements as a function of wind direction (degrees) and wind speed (m/s).