Spatial patterns and source attribution of CH4 emissions in an urban airshed to regional/global methane budgets

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Urban areas are increasingly recognized as a globally important source of methane to the atmosphere; however, the methane budget of urban sources is not yet well constrained in global models. Recent atmospheric measurements in Los Angeles, California, USA, suggest that more than one third of the city's methane emissions are unaccounted for in bottom-up inventories. We collected on-road atmospheric measurements of methane and a suite of complementary trace gases across the Los Angeles Basin during June 2013 to quantify fine-scale structure of methane variability within the Basin. We targeted known methane emitters and representative land cover across the Basin as reference points.

Roughly half of local methane enhancement over the study area was associated with concentrated hotspots of atmospheric methane, with the remainder present in well-mixed urban air. Non-hotspot measurements of atmospheric methane exceeded background atmospheric levels. We used sites with known methane emitters to determine the relationship between methane and co-emitted gases from those emission sources. We then used the ratios determined for biogenic and thermogenic (fossil) sources to calculate the contributions of these two processes to atmospheric methane from unknown hotspots and in the well-mixed urban airshed. Known methane sources were comprised of half biogenic and half thermogenic. Unknown sources were 15% biogenic and 85% thermogenic. The atmospheric methane concentration in the well-mixed air was only 5% biogenic. In total, we determined that more than two-thirds of local methane within the Los Angeles Basin urban airshed was “leakage” released from thermogenic sources.