Attributing and quantifying methane emissions in a megacity

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Methane (CH_4) couples climate and air quality

- *2nd-most important greenhouse gas (GHG) and a short-lived climate forcer with complex sources*
- *ozone precursor important globally [Fiore et al., 2002]*

3 of 4 source sectors highlighted in the **President's Climate Action Plan – Strategy to Cut Methane Emissions** are located in the Los Angeles Basin:

- *landfills*
- *coal mines*
- *agriculture*
- *oil and gas systems*

1/4 of California CH_4 comes from the Los Angeles megacity, but **top-down assessments suggest substantial shortfalls** in existing inventories of CH_4 in Los Angeles:

35-57% [*Wunch et al.,* 2008] *30%* [*Hsu et al.,* 2009]

***CSD** led the **2010 CalNex field project;** one goal was to improve the California GHG emissions inventory*




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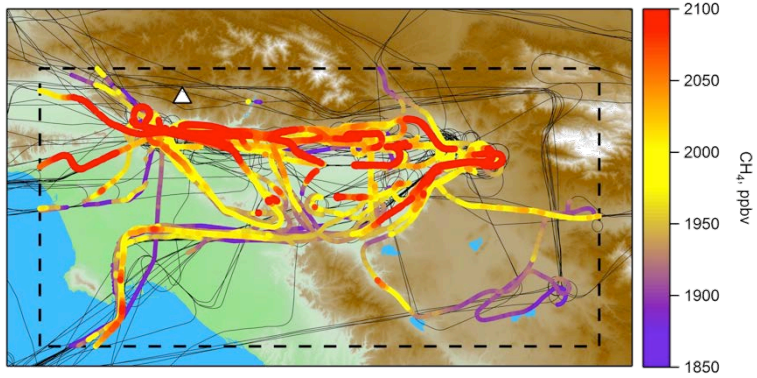
1. Methane emissions from Los Angeles derived from observations still greater than expected from inventories

- *Wennberg et al.* [2013] reported a 50% CH_4 inventory shortfall, *Peischl et al.* [2013] reported 33%

- NOAA P-3 data show few individual CH_4 sources stand out in L.A. Basin; instead, CH_4 enhancements indicate a complex mix of sources

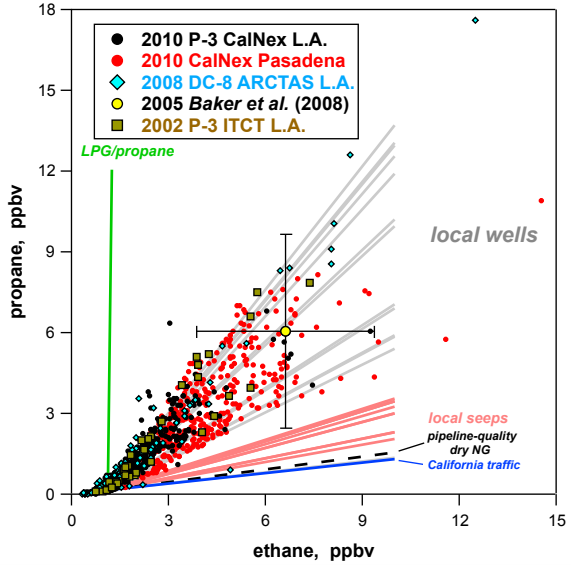
Los Angeles Basin



2. CSD used light alkane source fingerprints to determine sources of CH_4 in Los Angeles

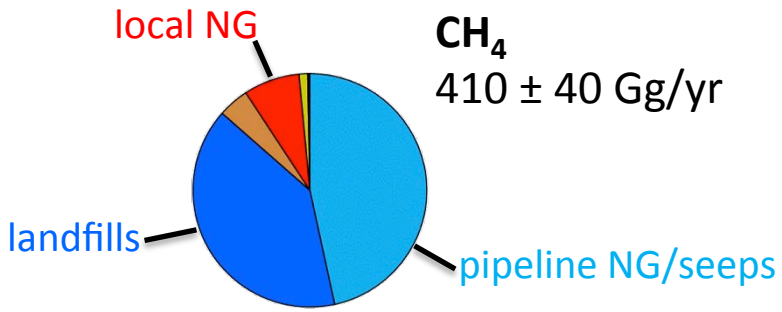
- the suite of C_2–C_5 alkane data provides essential information to attribute CH_4 emissions to sources

  - *e.g.*, atmospheric data indicate local wells are a significant source of propane and ethane to the L.A. atmosphere



3. Methane source apportionment used to critically evaluate California's GHG inventory

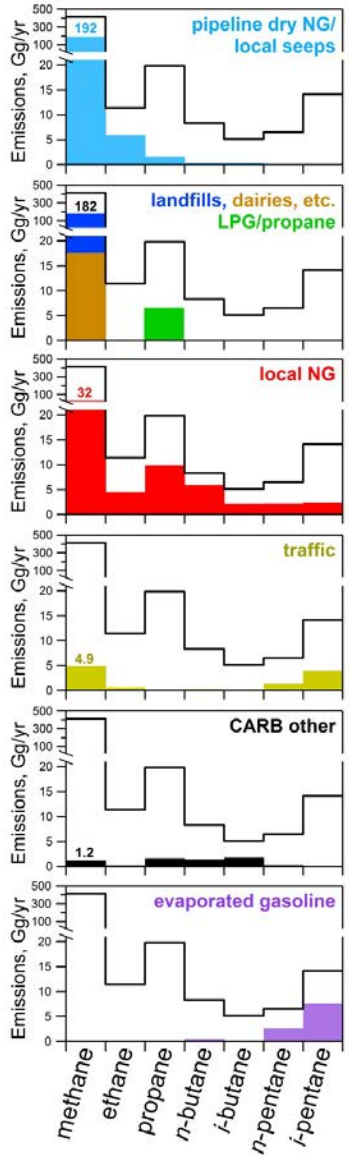
- The majority of CH_4 is due to leaks from **pipeline dry natural gas (NG)/local seeps** and **landfills**



- Leaks from **pipeline dry NG/local seeps** and **local NG** account for the top-down vs. bottom-up discrepancies in CH_4

- Model-independent attribution of CH_4 to specific sources

- Generally applicable to other regions and cities



4. Future CSD applications:

- technique applied to **SENEX** & **SONGNEX** data sets to distinguish methane emission contributions from oil production, natural gas production, and natural gas distribution

A possible technique for the world's cities:

Required measurements:

CH_4
C_2–C_5 alkanes } provides a relative attribution to identify which sources to focus on first

● whole air sample

Requirements:


Nominal sampling strategy:
New York City example

This apportionment technique is a powerful tool that can be used in future field studies and by other organizations to provide a benchmark for future top-down analyses