Visualizing anthropogenic methane plumes from the California Methane Survey

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AVIRIS-NG for CH$_4$ plume mapping

Thorpe et al., 2014, 2016, 2017
Thompson et al., 2015, 2016
AVIRIS-NG for CH$_4$ emission flux quantification

Calculate Integrated Methane Enhancement (IME, kg CH$_4$) for radii ($r_c$)

Wind speed (HRRR reanalysis)

Instantaneous emission flux (kg/hr)

Annual emission flux (kg/hr)

Duren et al., 2019
**California Methane Survey**

- AVIRIS-NG flights funded by the California Air Resources Board (CARB) and California Energy Commission (CEC)
- Targeting CH$_4$ hotspots from the energy, agriculture, and waste management sectors
Methane Source Finder data portal

• Publicly available: https://methane.jpl.nasa.gov/
• Developed under NASA’s ACCESS and CMS programs to explore CH$_4$ data
• Data includes:
  • Remote sensing (AVIRIS-NG imaging spectrometer CH$_4$ plume results; Thorpe et al., 2017)
  • Surface monitoring (in situ towers for CH$_4$ flux inversions for the LA basin; Yadav et al., 2019)
  • Bottom up CH$_4$ emissions inventories (EPA)
  • Infrastructure database (potential CH$_4$ sources; Carranza et al., 2018)
• Goals:
  • Provide CH$_4$ dataset to a diverse range of stakeholders to improve understanding of regional CH$_4$ emissions
  • Provide opportunities for mitigation
Methane Source Finder: LA Basin CH$_4$ hotspots
LA Basin CH$_4$ from energy sector
LA Basin CH$_4$ from energy sector
LA Basin CH$_4$ from landfill
San Joaquin Valley CH₄ emissions
San Joaquin Valley CH₄ from energy sector
San Joaquin Valley CH$_4$ from dairy digester
Methane Source Finder facilitates stakeholder engagement

CA Methane Survey

Energy sector

Energy sector

Waste management sector

Dairy groups

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Methane Source Finder facilitates mitigation
California Methane Survey scientific findings

1) Multiple revisits of facilities permitted assessment of persistence:
   • Oil & gas, dairy: 20-35% (mean) persistence
   • Landfills: 100% persistence

2) Emissions were calculated for 564 methane point sources

3) Estimated emissions from methane point sources in California:
   • 0.618 TgCH$_4$ yr$^{-1}$ (95% confidence 0.523-0.725)
   • Equivalent to 34-46% of 2016 methane inventory

4) Super-emitter activity occurs in every surveyed sector (10% of point sources contributed ~60% of point source emissions)
Future work: AVIRIS-NG CO₂ and CH₄ (complete carbon footprint)

Cusworth et al., in prep