

# Estimating methane emissions from underground coal and natural gas production in southwestern Pennsylvania

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## Background:

- Coal and natural gas production are a significant source of methane emissions into the atmosphere.
- Southwestern Pennsylvania is a hotspot for energy production, containing both the highest producing gas wells in the country as well as multiple underground coal mines.
- This combination of large methane sources produces a structured, easily-detectable plume of enhanced methane downwind.

## Analysis:

- Nineteen (19) aircraft transects were performed measuring methane downwind of coal and gas facilities in southwestern Pennsylvania.
- Continuous ethane observations from two (2) flights in the ACT-America campaign were used to attribute methane emissions to either the coal or gas sector.
- Methane emissions within a transport model were optimized to create a plume structure and magnitude that matched the observed methane plume.

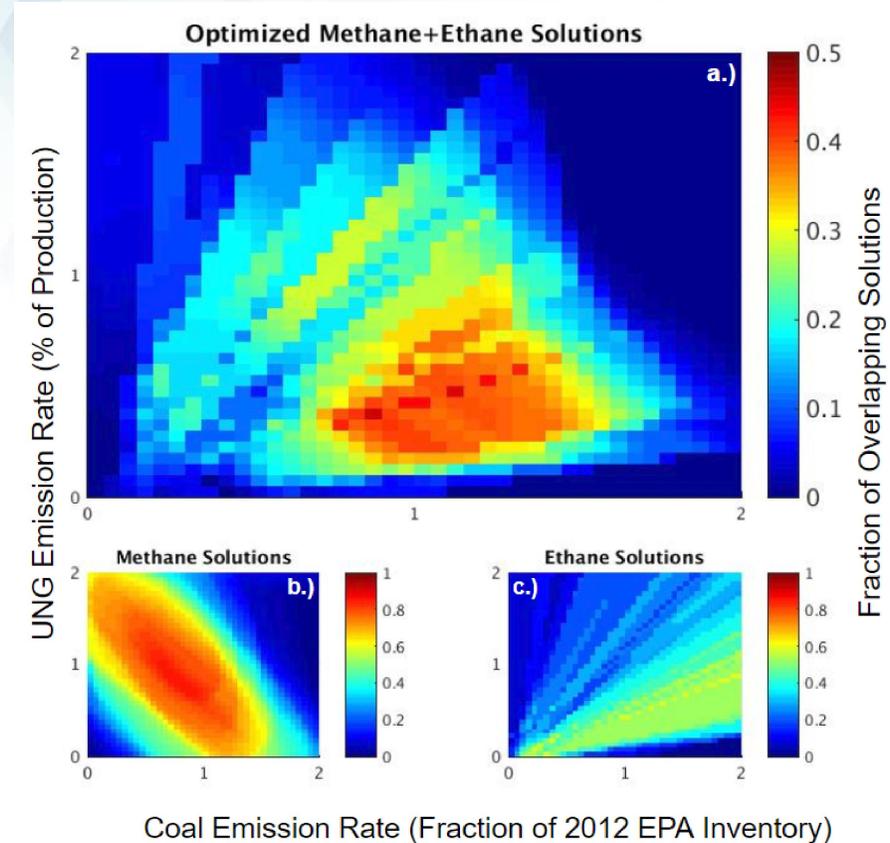


Figure 1: (a.) Fraction of total number of model simulations that fulfills both the methane and ethane optimization using different combinations of coal and gas emission rates for all of the 19 transects. (b.) Fraction of simulations that fulfills only the methane optimization. (c.) Fraction of simulations that fulfills only the ethane optimization.

## Findings:

- Methane emissions from unconventional gas wells in southwestern Pennsylvania are lower as a percent of production than values found from top-down studies performed in any other basin.
- Despite the low emission rate found in this study, total methane emissions from gas wells were 2 - 8 times larger than state inventory estimates.
- Methane emissions attributed to coal in this study are in line with EPA inventory estimates.

## Significance:

- This study shows the utility of using continuous ethane data as a method for source attribution.
- This study provides further evidence to a growing number of studies that bottom-up inventories are underestimating methane emissions from natural gas infrastructure.
- This study provides confidence in inventory estimates of methane emissions from coal
- This study indicates that high-producing wells have a less negative climate impact compared to low-producing wells.

# Data Products/Acknowledgements

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- UMD aircraft data can be found at [http://www.atmos.umd.edu/textasciitilde rammpp/archives/ArchiveFlightData.html](http://www.atmos.umd.edu/textasciitilde%20rammpp/archives/ArchiveFlightData.html).
- ACT-America aircraft data can be found at [https://daac.ornl.gov/cgi-bin/dataset/\\_lister.pl?p\\$=\\$37](https://daac.ornl.gov/cgi-bin/dataset/_lister.pl?p$=$37). NCEP Reanalysis data provided by the NOAA/OAR/ESRL PSD, Boulder, Colorado, USA, from their Web site at <https://www.esrl.noaa.gov/psd/>