Using Methane Observations to derive Top-down Estimates of VOC and NOx Emissions from Oil and Gas Production in the Uinta Basin

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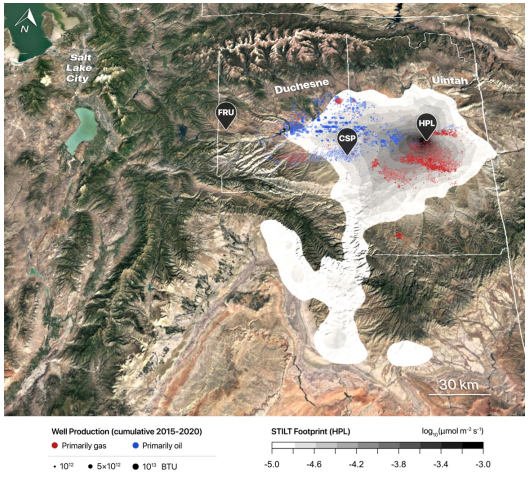
Motivation

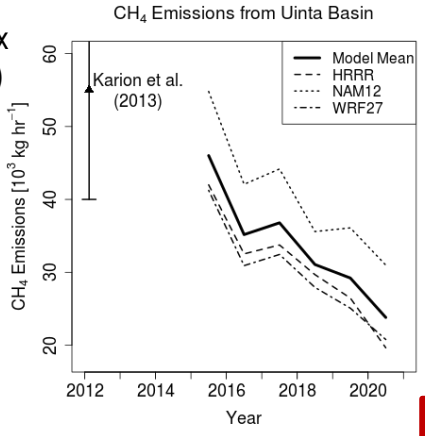
- Quantify emissions of precursors (VOC & NOx) that contribute to ozone production
- Leverage co-located observations of methane (CH_4) and top-down estimates of Basin-wide methane emissions



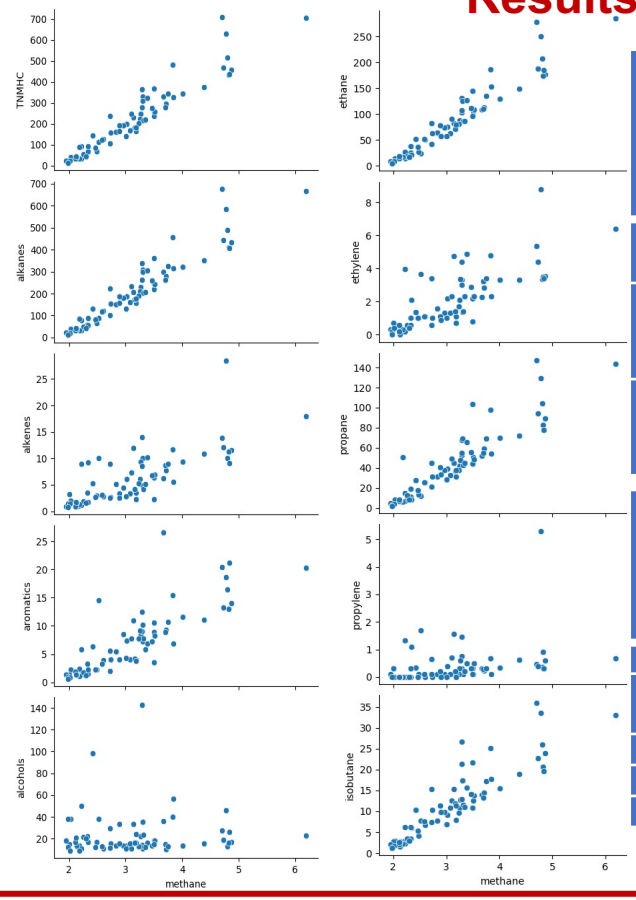
Reproduced from (Lin et al., 2021)

Methodology

1) Measure methane, VOC, and NOx at same Uinta Basin site (Horsepool)
2) Calculate the slopes between enhancements in methane with enhancements in the target species (VOCs, NOx)
3) Multiply slopes (from winter 2019-2020) by 2017 methane emissions (to match 2017 inventory year)
4) Arrive at emissions of the target species



Results



	Whole-Basin NO_X emissions (kg h^{-1})	Whole-basin VOC emissions (kg h^{-1})
This study (2017)	234	17968
Regulatory 2017 inventory	1272	10638
Ahmadov et al., 2015	431	19108

	Whole-Basin emissions (kg h^{-1})	% of total
Alkanes	9255	82.5%
Alkenes+acetylene	226	2.0%
Aromatics	296	2.6%
Alcohols	897	8.0%
Carbonyls	547	4.9%

Takeaway: 2017 regulatory inventory appears to overestimate NOx emissions, but underestimate VOC emissions over Uinta Basin

Cited References

Ahmadov, R. et al. (2015), Understanding high wintertime ozone pollution events in an oil- and natural gas-producing region of the western US, Atmos. Chem. Phys., 15(1), 411–429, doi:10.5194/acp-15-411-2015.
Lin, J. C., R. Bares, B. Fasoli, M. Garcia, E. Crosman, and S. Lyman (2021), Declining methane emissions and steady, high leakage rates observed over multiple years in a western US oil/gas production basin, Sci. Rep., 11(1), 22291, doi:10.1038/s41598-021-01721-5.

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