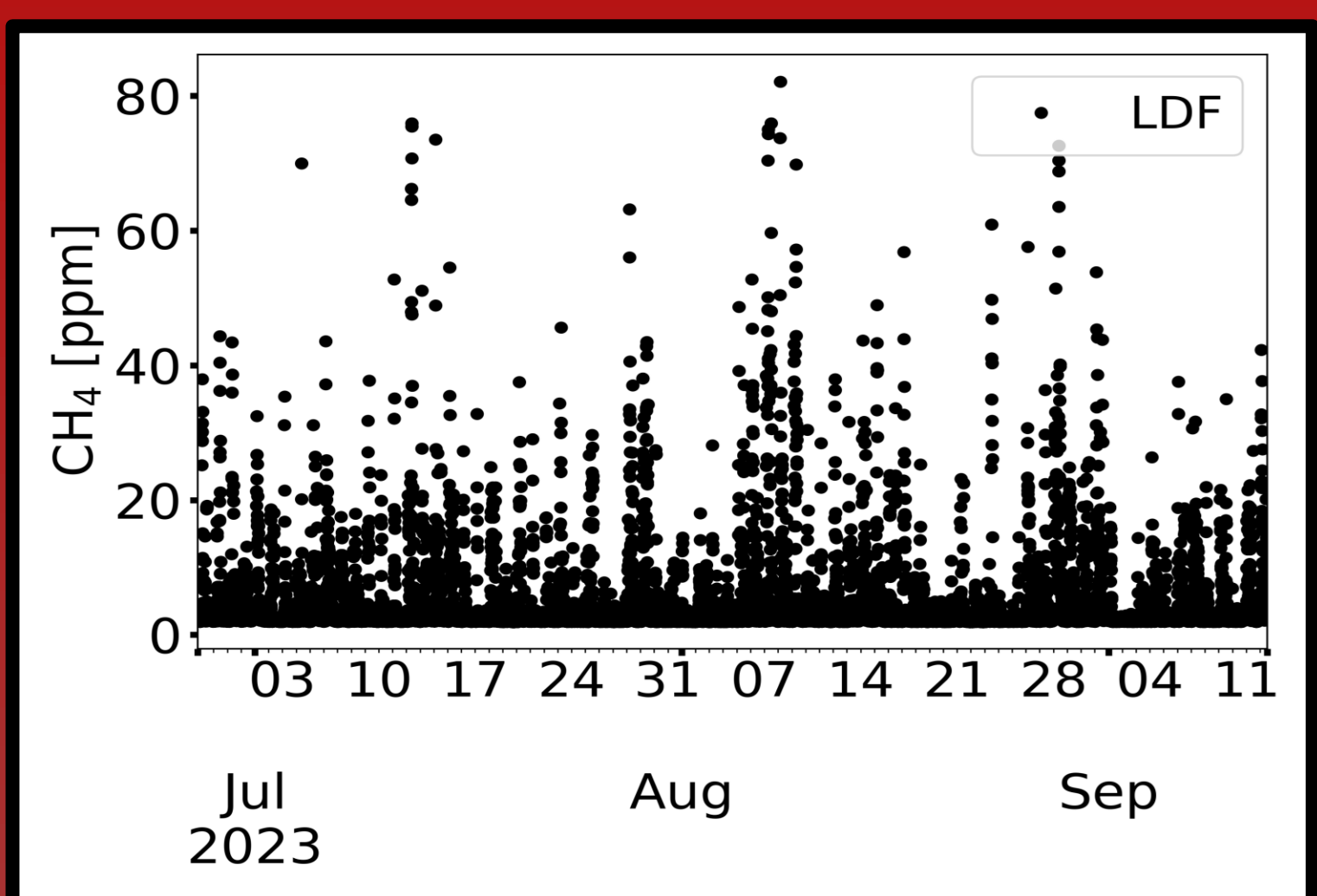


Constraining methane emissions across the Salt Lake Valley urban area

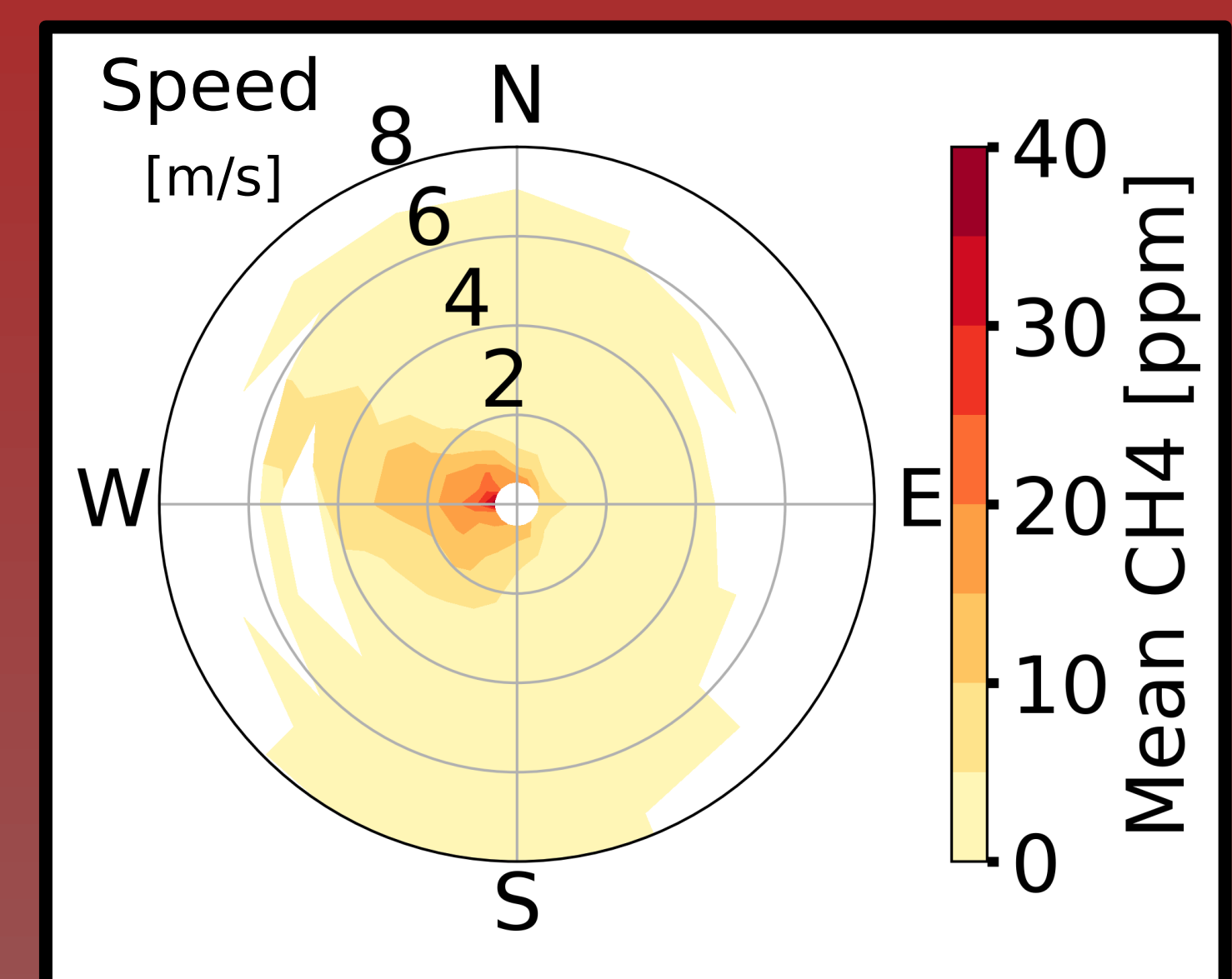
James K. Mineau (James.Mineau@utah.edu), John C. Lin, Derek V. Mallia, Logan Mitchell, Maria Garcia



Salt Lake Valley Landfill



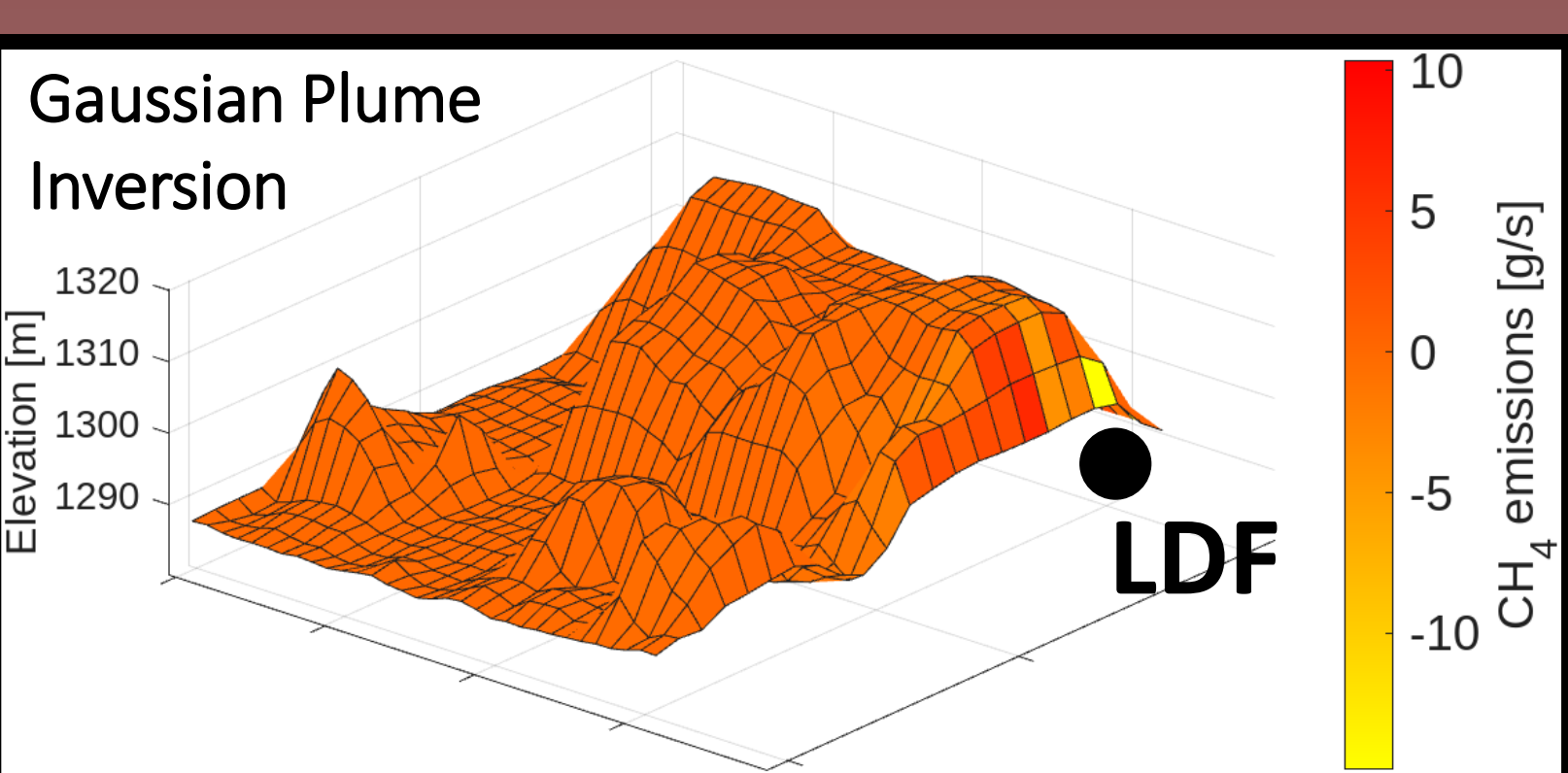
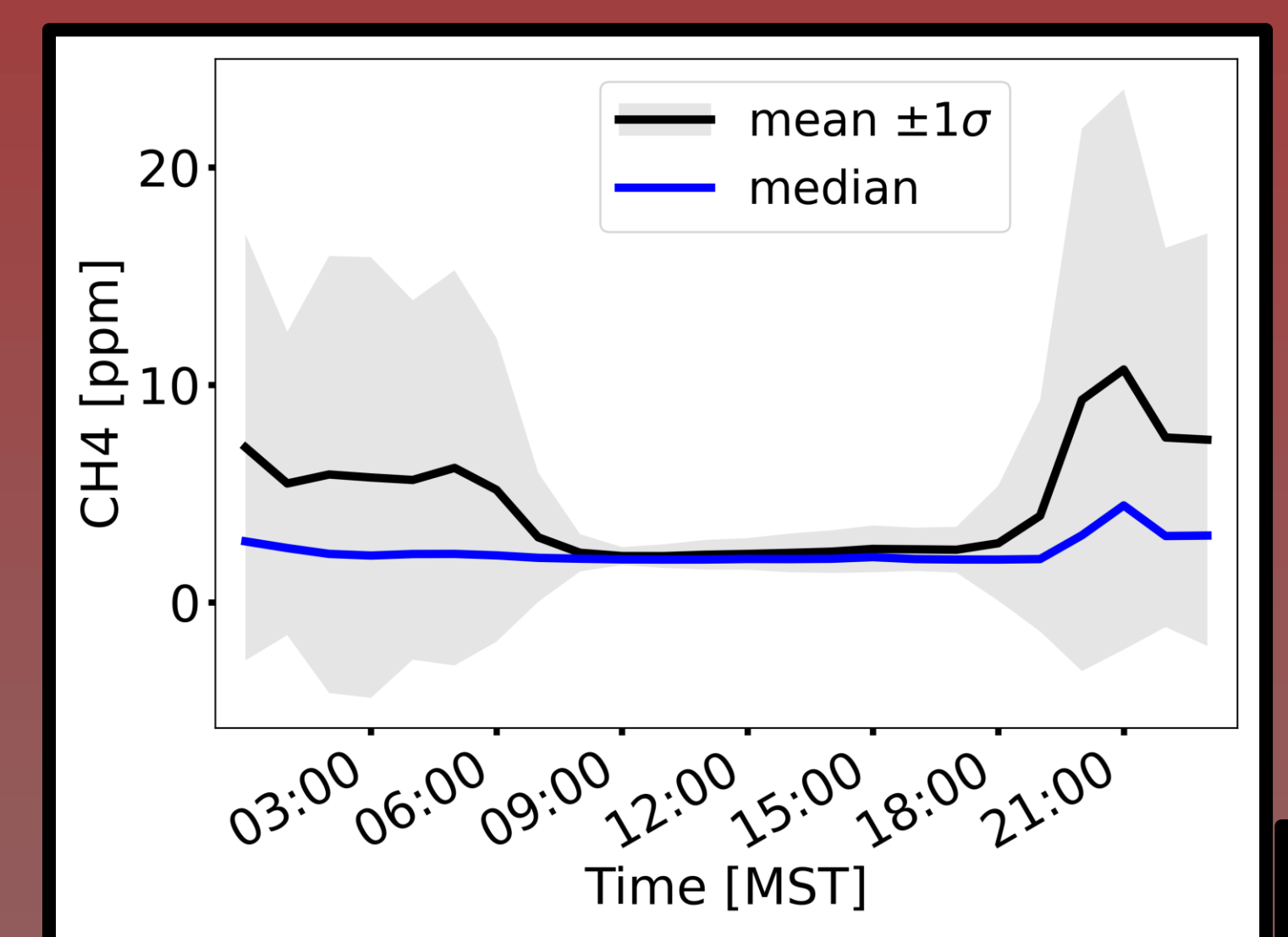
- CH₄ concentrations measured near urban landfill for 3 months
- Extreme magnitudes
- Preliminary attempts to invert spatial emissions



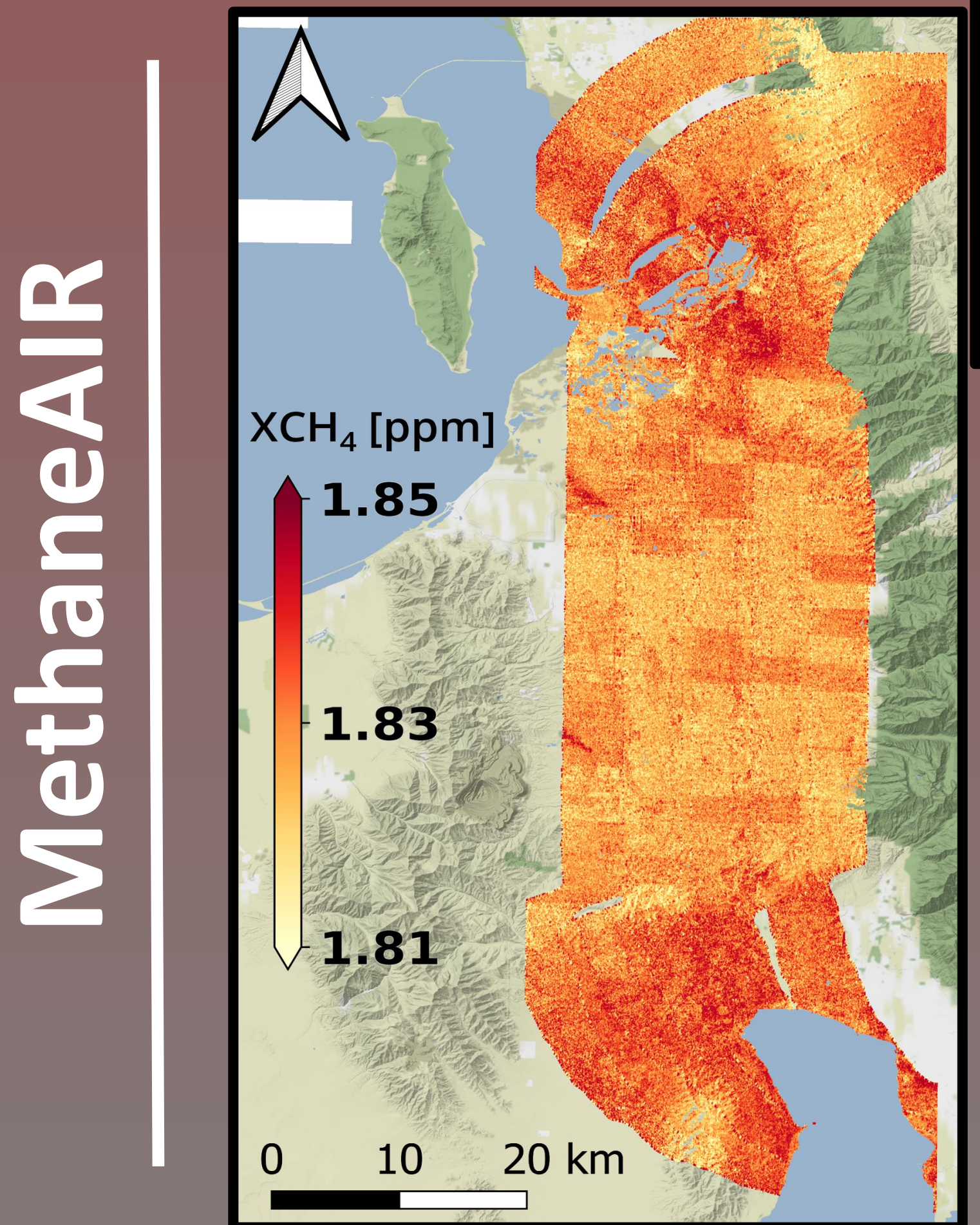
Above: Polar plot of average CH₄ concentrations - receptor is located to the East of the landfill

Above: Timeseries of atmospheric CH₄ concentrations

Below: Diurnal cycle of methane at Landfill

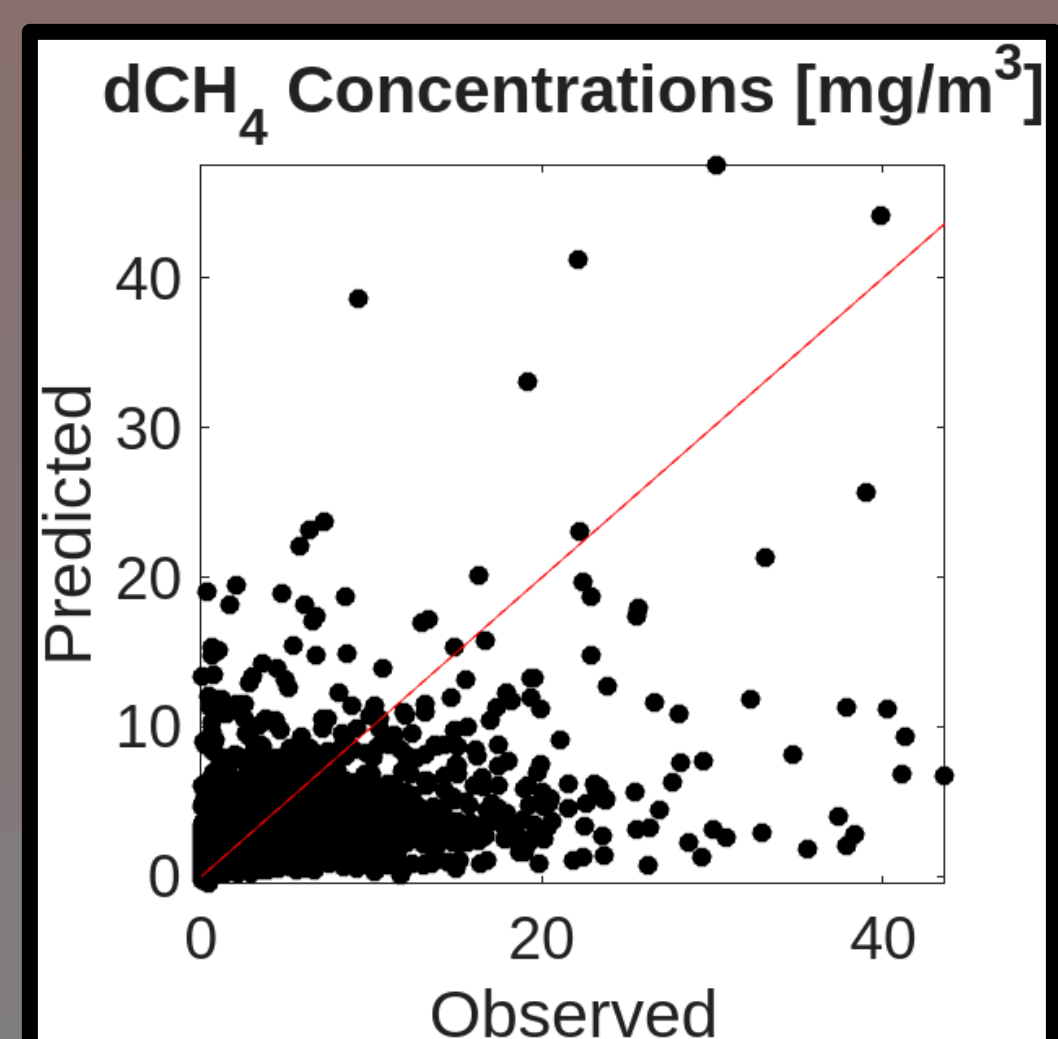


- ### Gaussian Plume Inversion
- Invert continuous data from a single receptor using a gaussian plume model
 - Regularized with a flat *a priori* model
 - Preliminary result: Need more receptors - too underdetermined



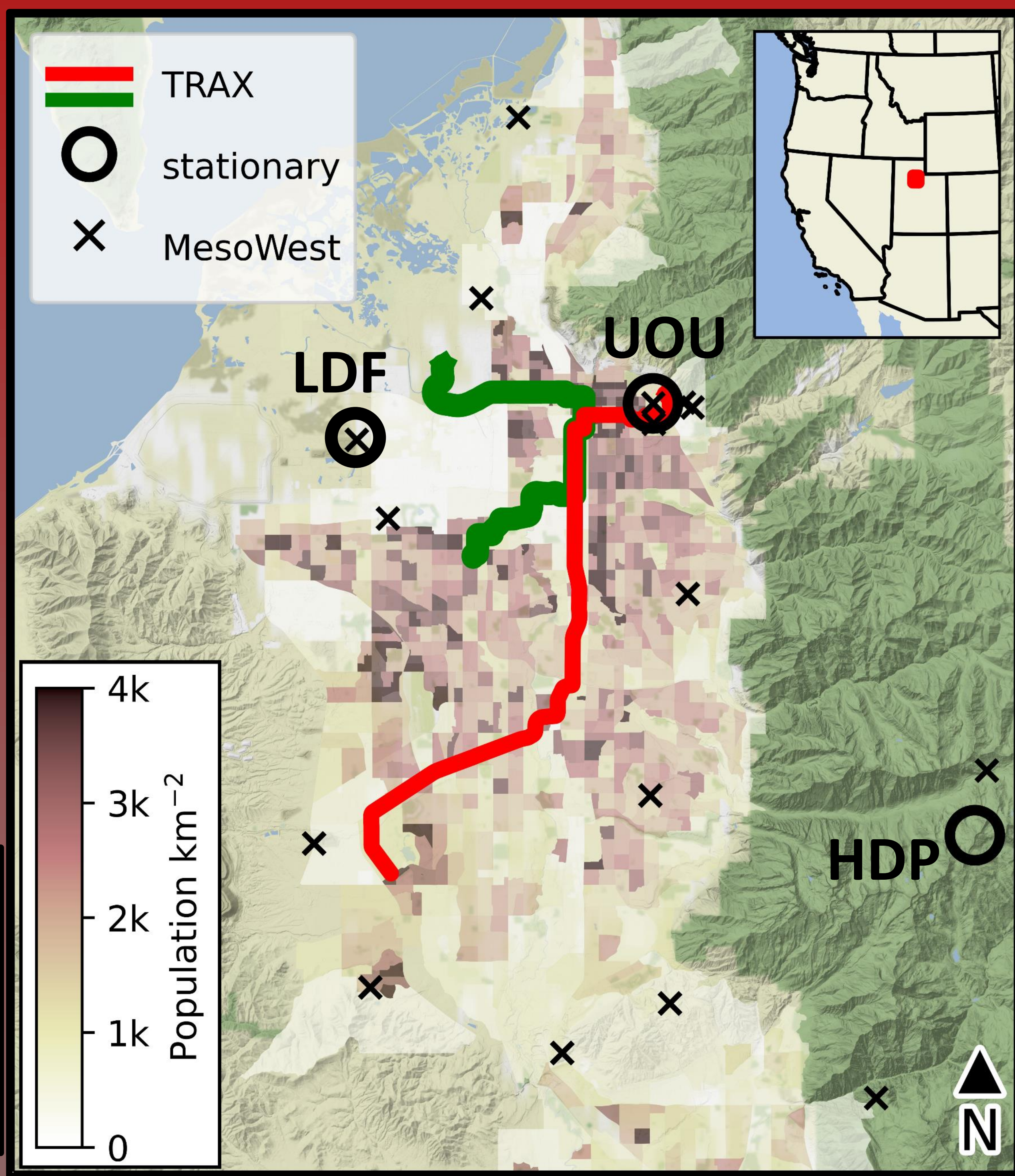
MethaneAIR

MethaneAIR flights from August 2021 over SLV. Additional processing to be done. Evident are landfill plumes as well as diffuse emissions in North Salt Lake near refineries and wetlands



LAND ATMOSPHERE INTERACTIONS RESEARCH

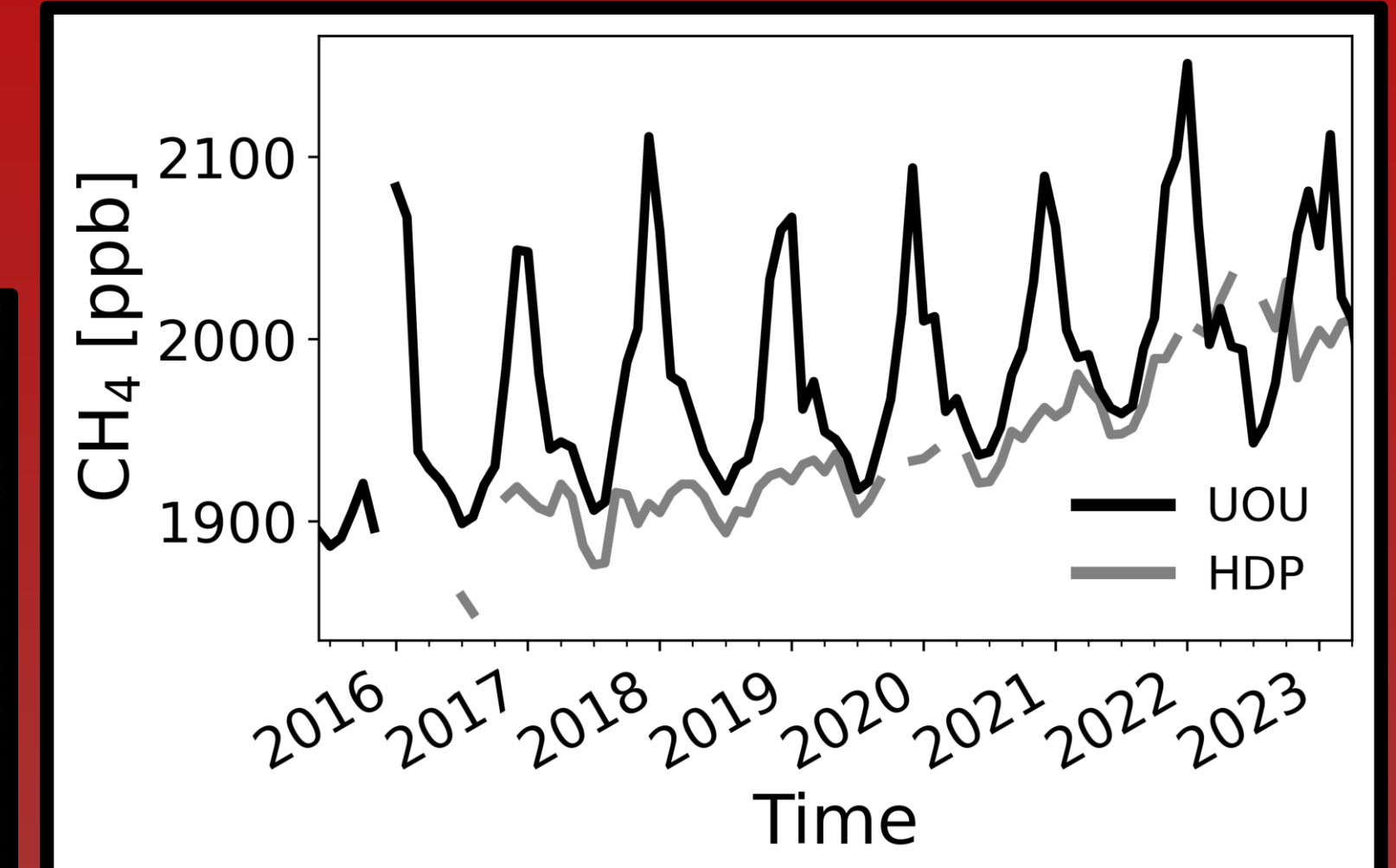
UNIVERSITY OF UTAH



TRAX

- Average spatial CH₄ concentrations along light-rail line
- Hotspots observed with otherwise near-background levels
- Large spatial coverage provides needed constraint

Long-Term Analysis

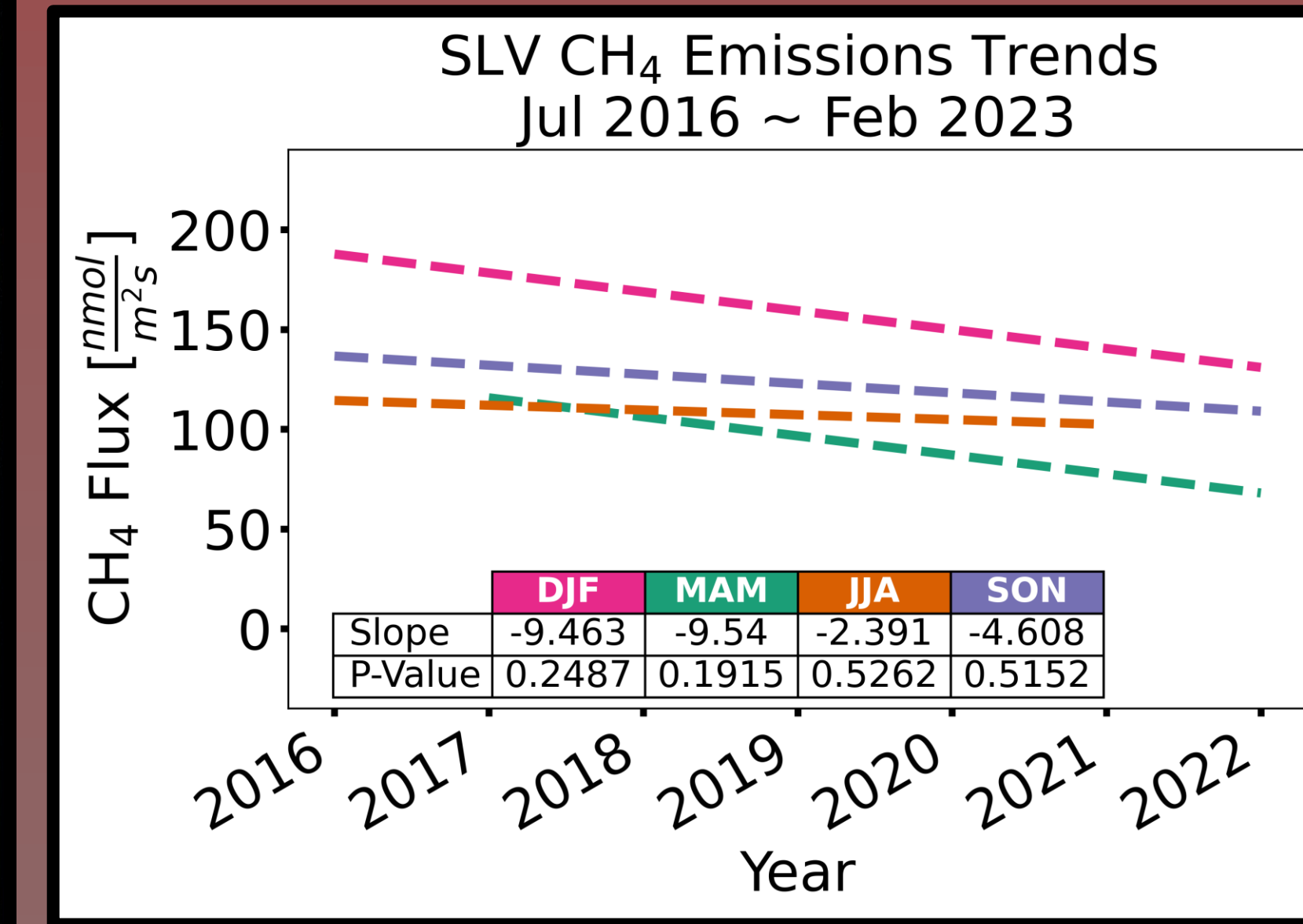
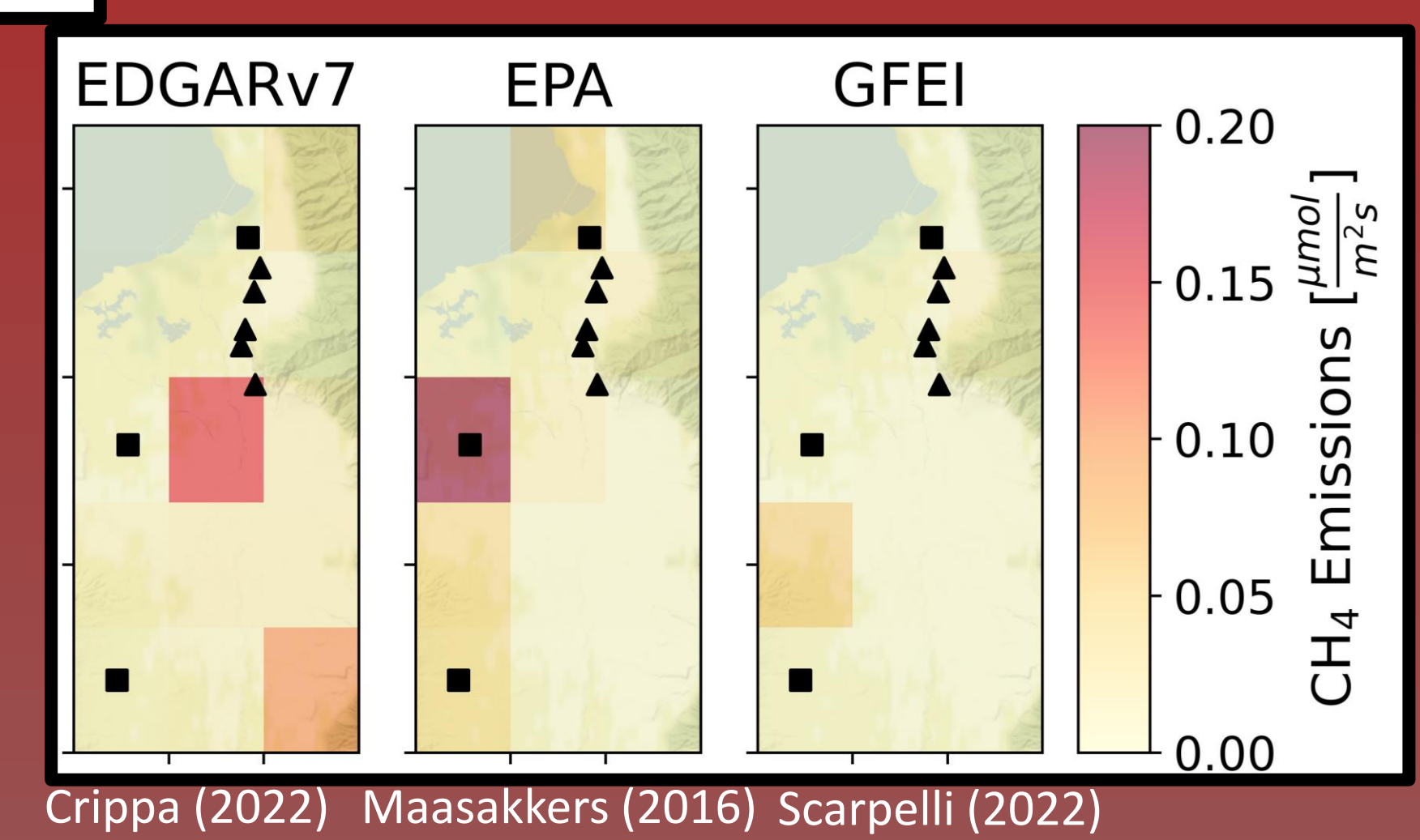


- ~7 years of observations
- Urban center
- High elevation background

$$CH_{4bg} = \text{average}(\text{quantile}(CH_{4HDP}))$$

$$dCH_4 = CH_{4obs} - CH_{4bg}$$

- Limited urban understanding
- Coarse inventories
- Missed refineries

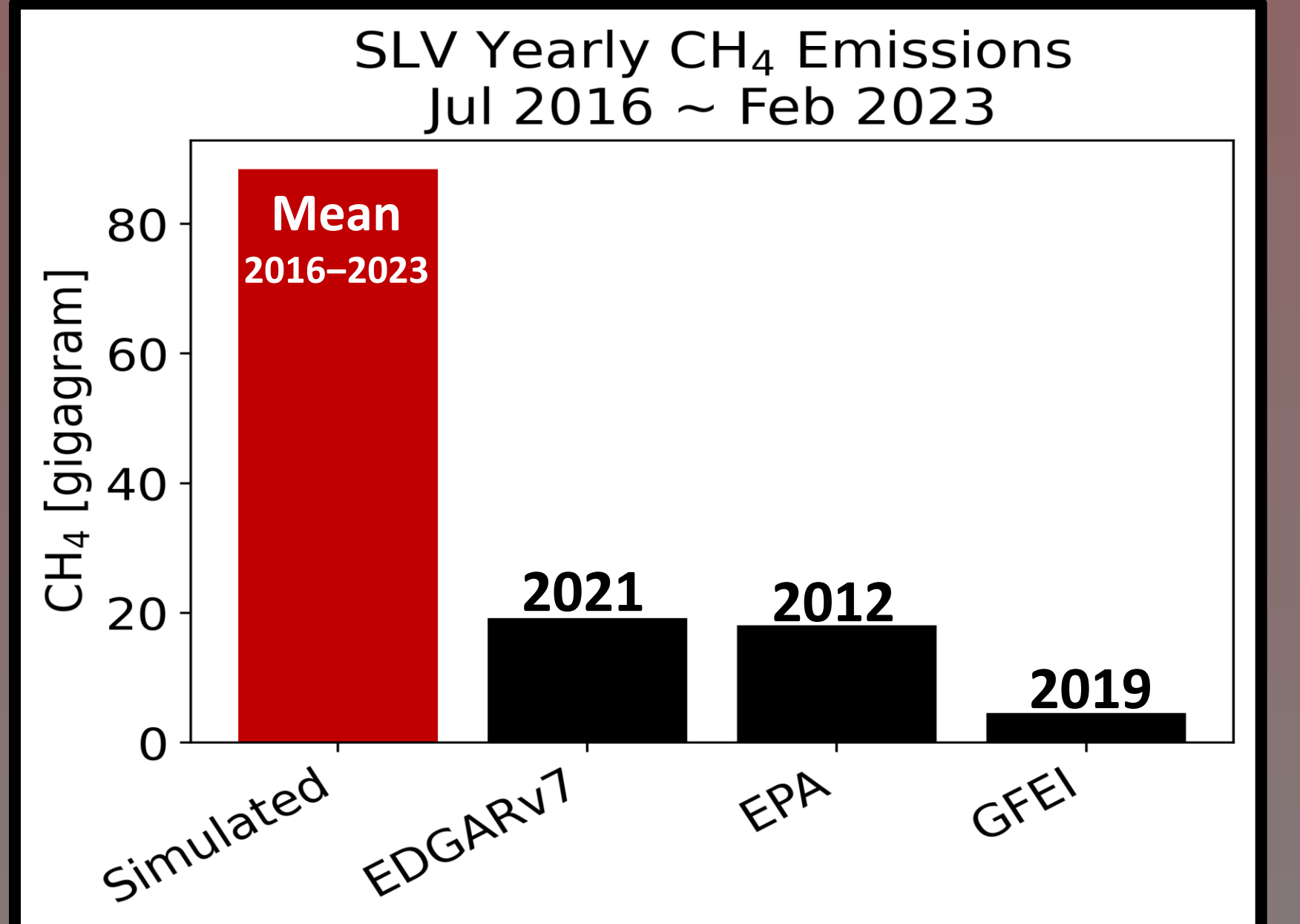


$$\Phi = \frac{dCH_4}{\sum_i f_i}$$

dCH_4 - CH₄ Enhancements
 f - footprint
 i - grid cell
 Φ - valley-avg emissions

- HRRR driven STILT (Lin 2003)
- Afternoon hours
- Valley averaged emissions
 - Lin et al. 2021
- No significant trend

- ~40% of the Uinta Basin
 - Lin et al. 2021
- ~2.4x Indianapolis
 - Jones et al. 2021
 - similar size (~2 million)
- 50% of CO₂ emissions in SLV over 20 years
- Inventories severely underestimate



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