Methodology for Developing MAIR Informed State-Level Estimates: Integrating MAIR Regional Level Estimates with Additional Measurement-Based Estimates

In June through October of 2023, MethaneAIR (MAIR), a specially equipped jet aircraft chartered by Environmental Defense Fund, flew over 30 flights covering areas accounting for over 70% of all U.S. onshore oil and gas production. The resulting emissions rates and emissions intensities, for the specific flight domains flown, were shared online at https://www.methanesat.org/project-updates/new-data-show-us-oil-and-gas-methane-emissions-over-four-times-higher-epa-estimates. Though MethaneAIR covered the majority of production in the United States, low production oil and gas regions can still contribute substantial emissions.[1] Therefore, in order to estimate emissions for an entire state, emissions for areas outside of those surveyed by MethaneAIR must still be accounted for.

The EI-ME is a measurement-based, spatially explicit inventory of US oil and gas methane emissions.[2] EI-ME compiles previously reported ground-based facility-level methane emissions measurements in the major US oil- and gas-producing basins for well sites, natural-gas compressor stations, processing plants, crude-oil refineries, and pipelines. These measurements are combined with spatially explicit activity data to estimate each facility's total methane emissions for the year. This process generates a mean estimate of annual national methane emissions resolved at 0.1° × 0.1° spatial scales. This spatially explicit inventory can be segmented for various spatial domains.

To estimate methane emissions for an entire state, MethaneAIR data was combined with EI-ME results for 2023 activity data. EI-ME estimates were extracted for the areas in each state exclusive of the flight domains that MethaneAIR flew. These estimates were added to MethaneAIR totals to sum to total state emissions. This simple summation was done instead of extrapolating MethaneAIR emission intensities to unsurveyed regions because the unsurveyed regions frequently had much higher percentages of low production facilities, which are expected to have a different loss rate than high production regions.

We consider these initial set of estimates based on MethaneAIR data to be illustrative while we wait for the systematic characterization from MSAT—which will capture larger spatial domains and with higher measurement frequency. While the current set of estimates are based on total regional emissions estimated by MAIR, future updates may also be able to leverage the data within the sampled regions. The spatial distribution from Methane/AIR and MethaneSAT could in some cases provide additional insights in terms of emissions by facility type (for example, assessing in more detail the difference in emissions between high-producing and low-producing regions within the sampled domains).

[1] https://egusphere.copernicus.org/preprints/2024/egusphere-2024-1402/
[2] https://essd.copernicus.org/articles/16/3973/2024/essd-16-3973-2024.html