COLLABORATORY TO ADVANCE METHANE SCIENCE

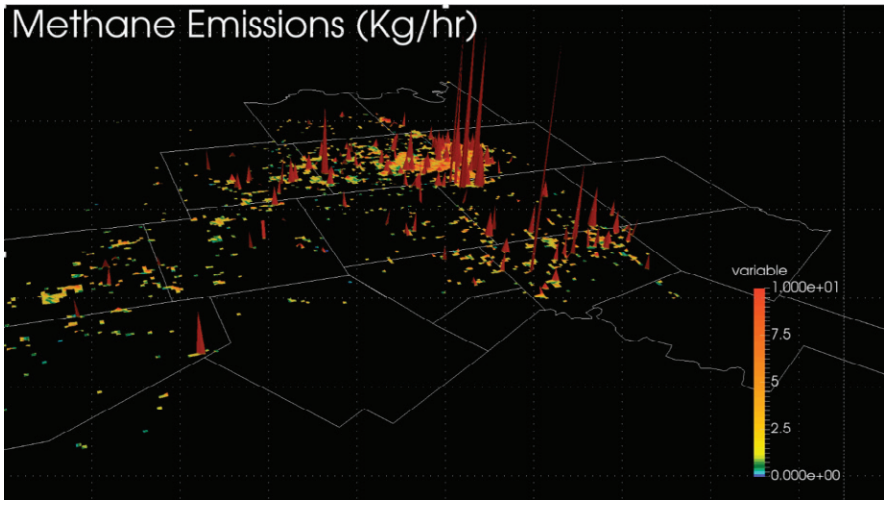
SCIENTIFIC INSIGHTS

THE METHANE EMISSION ESTIMATION TOOL (MEET):

A Model for Developing Fine Scale Spatial and Temporal Methane Emission Estimates for Oil and Gas Basins

With support from the **Collaboratory to Advance Methane Science (CAMS)**, the University of Texas and Colorado State University have developed a new community modeling tool for constructing inventories of methane emissions from oil and gas operations. The development of this tool was driven by the need to reconcile methane emission measurements and commonly available emission estimates. Measurement methods estimate methane emissions over a wide range of time scales from seconds to hours or longer, while current emission inventory methods typically estimate long-term emissions aggregated over large numbers of emission sources and over periods of months to years. This mismatch between inventories and observations, coupled with the complex spatial and temporal patterns of the emissions, makes direct comparison between observations and emission estimates problematic.

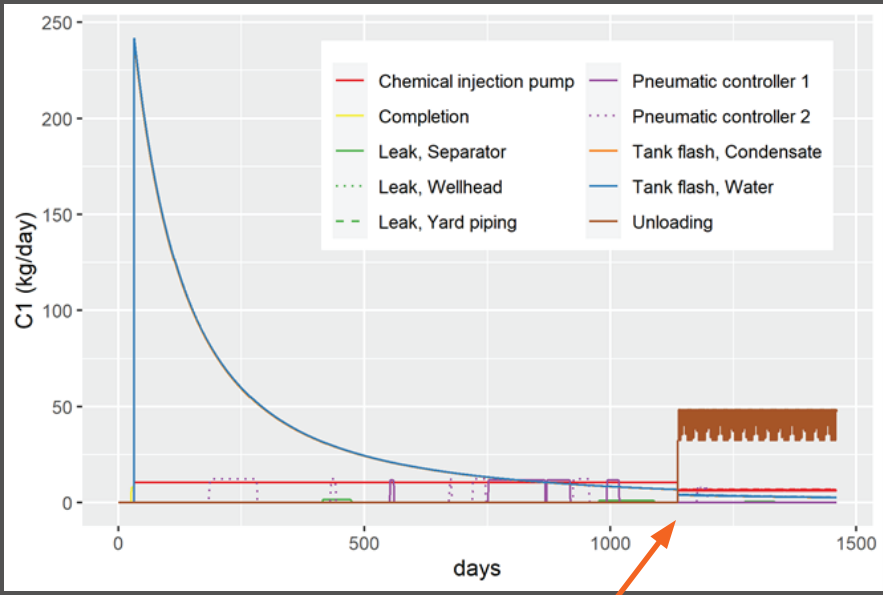
The **Methane Emission Estimation Tool (MEET)** is a high time resolution and spatially resolved emission model that bridges the gap between the spatial and temporal scales of observations and inventories. The model simulates both long-term variability, such as the production declines of unconventional wells, and short-term variability, such as the cycling of compressors or well pad liquid separators. The model also captures the sequencing of emissions and utilizes empirical distributions to capture highly skewed data that underlie emission factors.



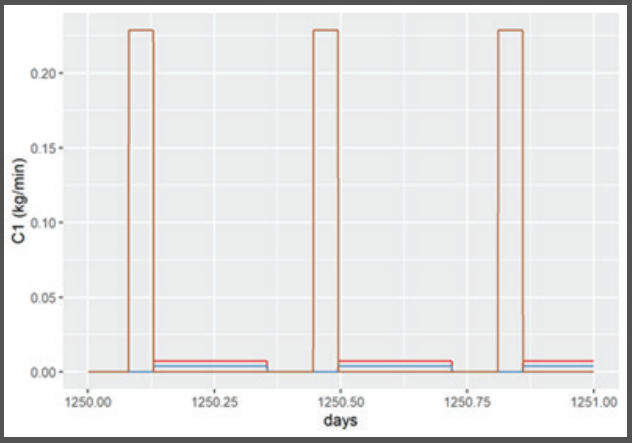
The MEET software includes modules for well sites and for gathering and boosting stations. The software also includes an emission composition tool, which allows users to account for variability in the composition of emissions between emission sources. Software features include:

- The ability to select custom emission factor and activity factor data, drawn from libraries of quality assured, harmonized data sets, or from data provided by the user.
- The ability to assess the potential impact of mitigation technologies.
- The ability to generate emission estimates for other light alkanes (ethane, propane, butanes) co-emitted with methane.
- The ability to aggregate emissions at multiple spatial and temporal scales.
- The ability to estimate uncertainties in the emission estimates.
- Community access.

MEET models methane emissions at multiple time scales, characterizing emission temporal evolution and intermittency in emissions



MEET models daily average methane (C1) emissions at a well site from a chemical injection pump, pneumatic controllers, leaks, uncontrolled tank flashes and liquid unloadings over 4 years (1460 days); tank flashes decline over time as production declines; leaks occur and are repaired; pneumatic controllers shift between normal and abnormal emission modes, and unloadings (for gas well liquids) begin after 3 years.



MEET can also model at time scales as short as one second; at day 1,250 of the four-year simulation, gas well liquid unloadings have begun and the site alternates between relatively high emissions due to the unloadings (0.27 kg/min for 60 minutes, three times per day leads to approximately 50 kg/day), much lower emissions when the well is producing but not unloading, and zero emissions when the well is shut in prior to unloading.

Beta versions of the software have been tested by both the development teams and CAMS sponsors. The software will be broadly released when published in the scientific literature. The journal *Environmental Science & Technology* published the emission composition tool in February 2021, and an open access version of the paper is available at: https://pubs.acs.org/doi/abs/10.1021/acs.est.0c05925

Additional software modules are anticipated to be broadly available in the coming months.

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