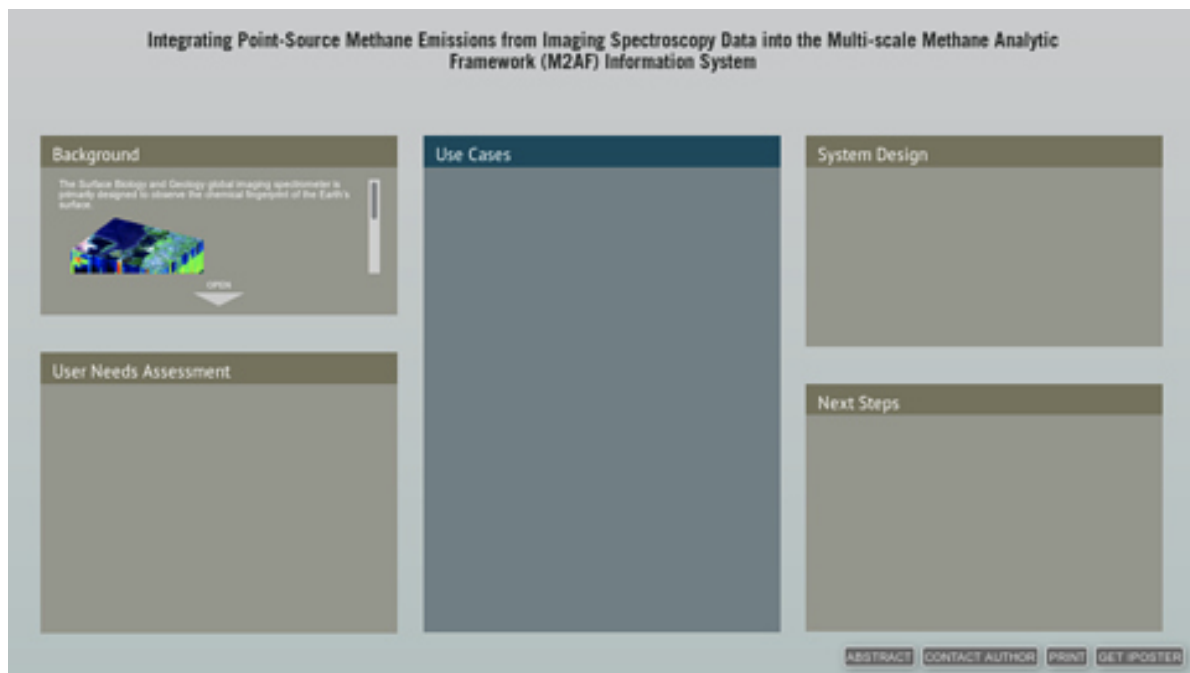


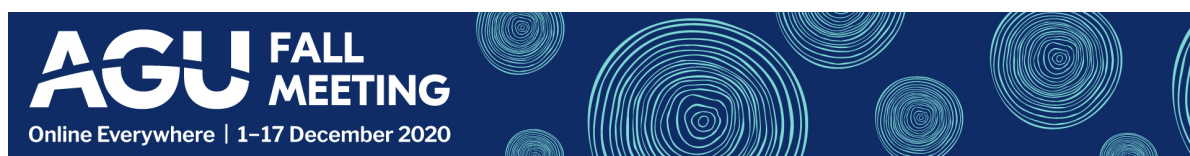
Integrating Point-Source Methane Emissions from Imaging Spectroscopy Data into the Multi-scale Methane Analytic Framework (M2AF) Information System



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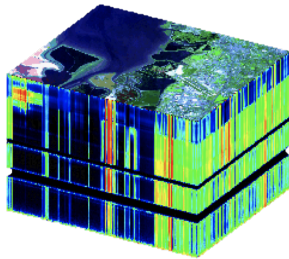
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PRESENTED AT:



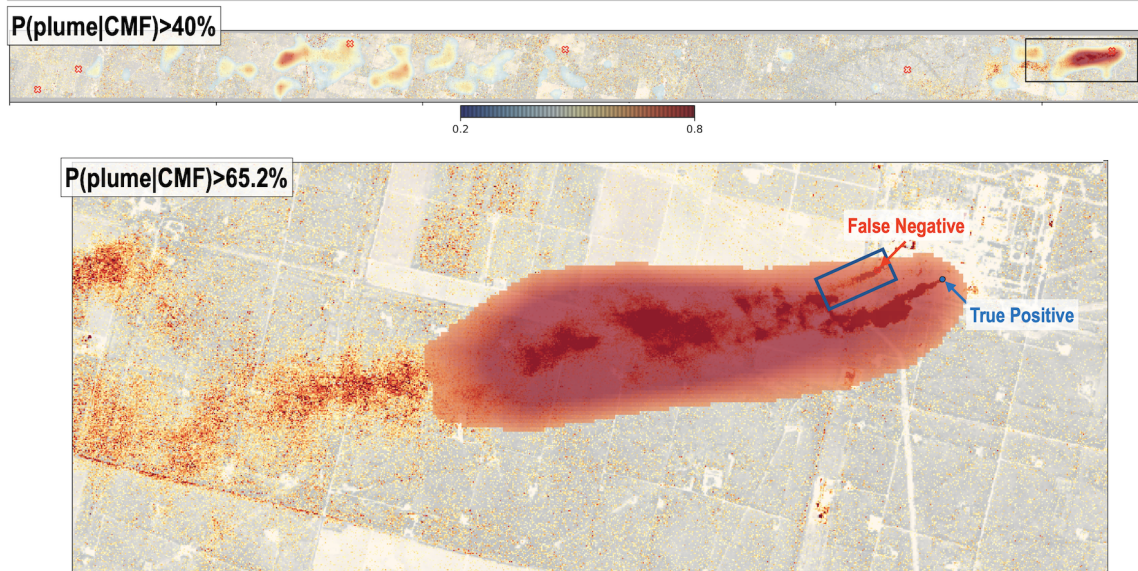
BACKGROUND

The Surface Biology and Geology global imaging spectrometer is primarily designed to observe the chemical fingerprint of the Earth's surface.

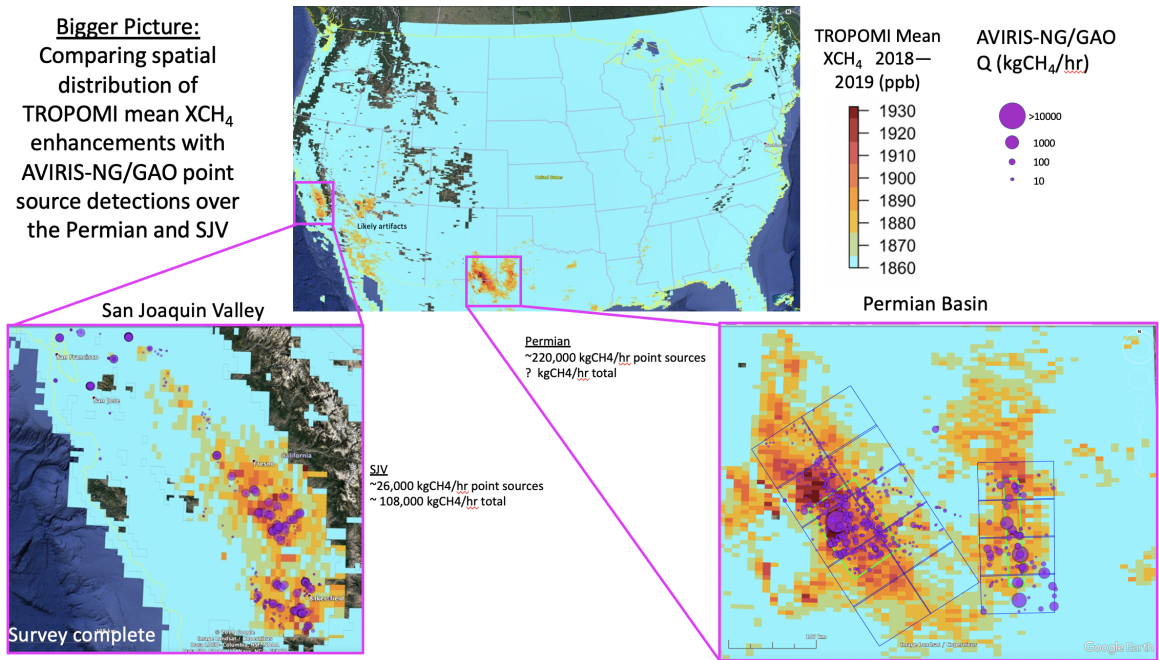


But visible to shortwave infrared imaging spectroscopy can also provide important atmospheric observations of methane point sources, highly concentrated emissions from energy, waste management and livestock operations.

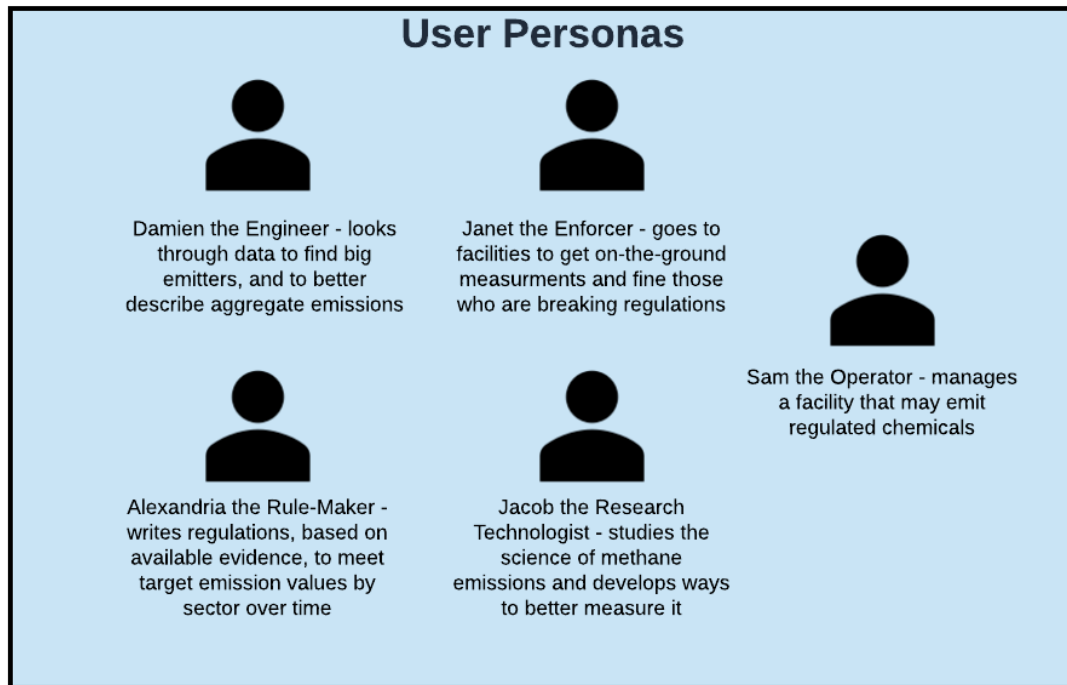
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Relating these point-source observations to greenhouse gas inventories and coarser, regional methane observations from sensors like the European Space Agency (ESA) TROPOMI will contribute to reducing uncertainties in local, regional and global carbon budgets:



TARGET USERS



USE CASES

Use Case 1: Connect Plume Observations to Infrastructure

End Points

- Scan a large area for hotspots to look at in more detail
- Search for a specific facility
- Search for the largest fugitive emissions (largest methane plumes)

Objectives

- Look at plume flux and location versus facility location
- Gather more details about a facility to determine whether any action needs to be taken
- See methane data-over-time for this facility to understand plume persistence

Use Case 2: Chart and Download Data for Further Analysis

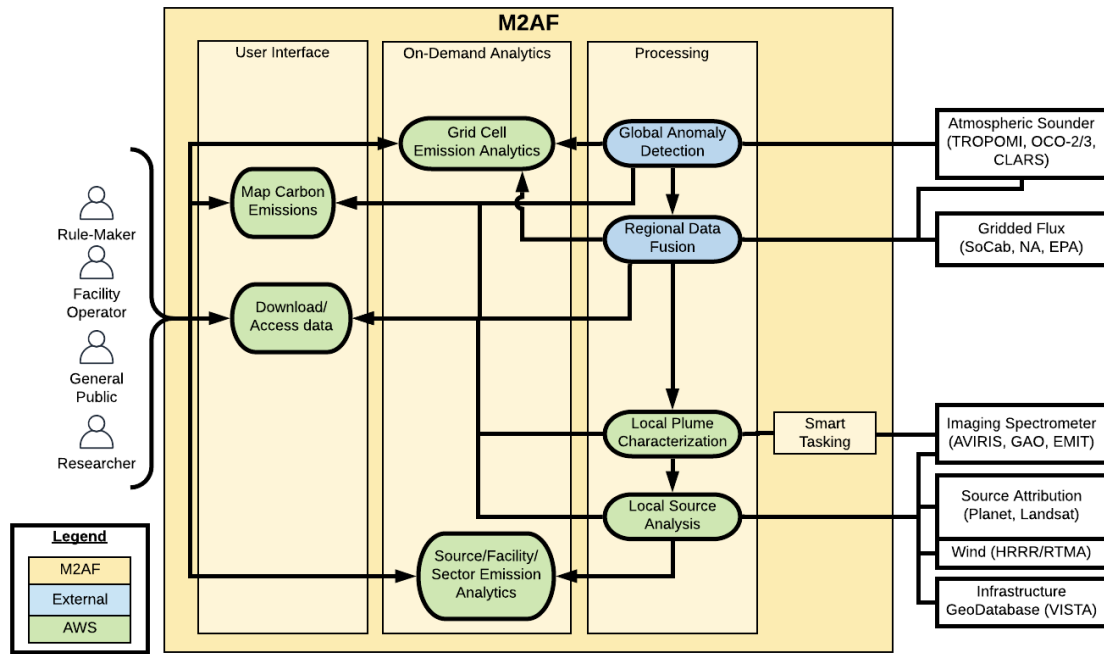
End Points

- View and find an interesting part of the map
- Look at summary histograms or tabulations of methane emissions of regions or sectors

Objectives

- Understand emissions by sector
- Evaluate concentration of super-emitters in a particular sector or region
- Download full or partial dataset (depending on what is seen in the charts) for custom analysis

To meet these Use Cases, the Multi-scale Methane Analytic Framework (M2AF) enables users to perform the following functions (ovals) in a hybrid cloud-on premise data platform:



SYSTEM DESIGN

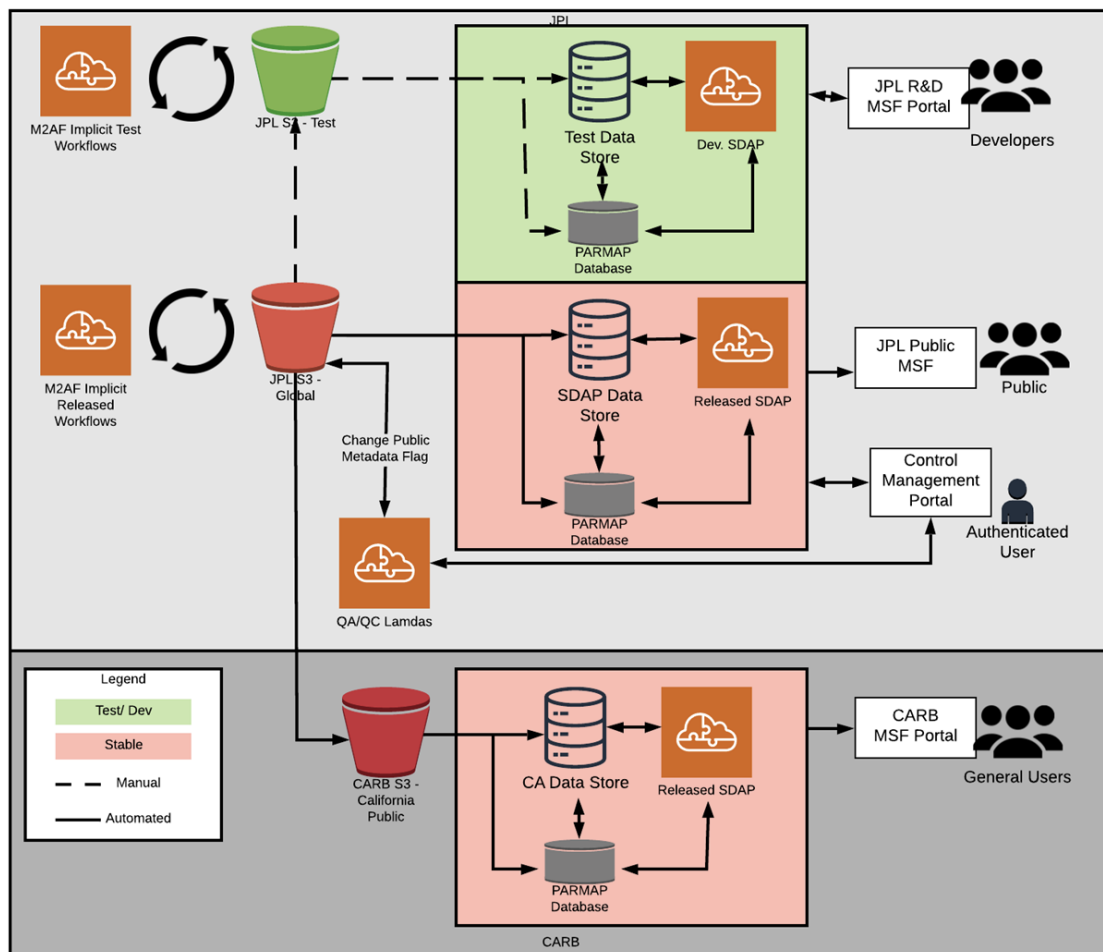
Our system is a collaboration with the California Air Resource Board (CARB)

As we develop in a quasi-agile management framework using research and development funds

We have multiple builds that are integrated and synced.

The analytics platforms leverage the best of the open-source Apache innovator Science Data Analytics Platform (SDAP) and its light-weight derivative Parmap

We leverage the well-established Methane Source Finder (MSF) at <https://methane.jpl.nasa.gov> (<https://methane.jpl.nasa.gov>) as our User Interface



NEXT STEPS

December 2020

- Deploy SDAP,
- Integrate with MSF, and
- Define Quality Assurance/ Quality Control portal use cases
- Test plume point source statistics through MSF

June 2021

- Integrate regional implicit workflow and interface with super computer
- Develop Control Management Portal - QA/QC integration, super computer deployment, user authentication
- Test regional forward model and inversion statistics through MSF

December 2021

- Integrate global datasets
- Refine MSF and Control Management Portals based on user feedback
- Test global data layer statistics through MSF

February 2022

- Finish documentation
- Public, open-source release

ABSTRACT

The Surface Biology and Geology global imaging spectrometer is primarily designed to observe the chemical fingerprint of the Earth's surface. However imaging spectroscopy across the visible to shortwave infrared (VSWIR) can also provide important atmospheric observations of methane point sources, highly concentrated emissions from energy, waste management and livestock operations. Relating these point-source observations to greenhouse gas inventories and coarser, regional methane observations from sensors like the European Space Agency (ESA) TROPOMI will contribute to reducing uncertainties in local, regional and global carbon budgets. We present the Multi-scale Methane Analytic Framework (M2AF) that facilitates disentangling confounding processes by streamlining analysis of cross-scale, multi-sensor methane observations across three key, overlapping spatial scales: 1) global to regional scale, 2) regional to local scale, and 3) facility (point source scale). M2AF is an information system that bridges methane research and applied science by integrating tiered observations of methane from surface measurements, airborne sensors and satellite. Reducing uncertainty in methane fluxes with multi-scale analyses can improve carbon accounting and attribution which is valuable to both formulation and verification of mitigation actions. M2AF lays the foundation for extending existing methane analysis systems beyond their current experimental states, reducing latency and cost of methane data analysis and improving accessibility by researchers and decision makers. M2AF leverages the NASA Methane Source Finder (MSF), the NASA Science Data Analytics Platform (SDAP), Amazon Web Services (AWS) and two supercomputers for fast, on-demand analytics of cross-scale, integrated, quality-controlled methane flux estimates.