The U.S. GHG Center

Working to improve the quality, transparency, and accessibility of GHG information

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On behalf of a large NASA-wide and interagency team including (alphabetical):

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Earth Action Strategy – GHG Center

Virtuous Cycle

- User needs inform future activities, priorities

Stakeholder Engagement

- Identify needs for GHG, related information from diverse user groups
- Improve uptake of information

Data-driven Solutions

- Deliver GHG data using open source science principles
- Increase discoverability, interoperability

Integrated Modeling

- Improve reliability of model-based information through improved workflows, benchmarking, standardization

Foundational Observations

- Fill data gaps identified by users
- Improve trust in remote sensing data through coordinated calibration/validation

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Building Strategic Connections

Inclusive approach

Annual forums bring together hundreds of stakeholders from different communities

- 2nd Annual Stakeholder Forum ~ 280 participants.
- Hybrid format – focused on learning stations (posters/speed talks) and listening sessions (facilitated discussions)

Priorities for focused engagements

Deeper connections through thematic meetings, focused roundtables

- Ex: Ongoing engagement of states through U.S. Climate Alliance
- Ex: Presentations/side events at methane-focused oil and gas industry meetings
- Ex: Small roundtables convened in partnership with boundary organizations

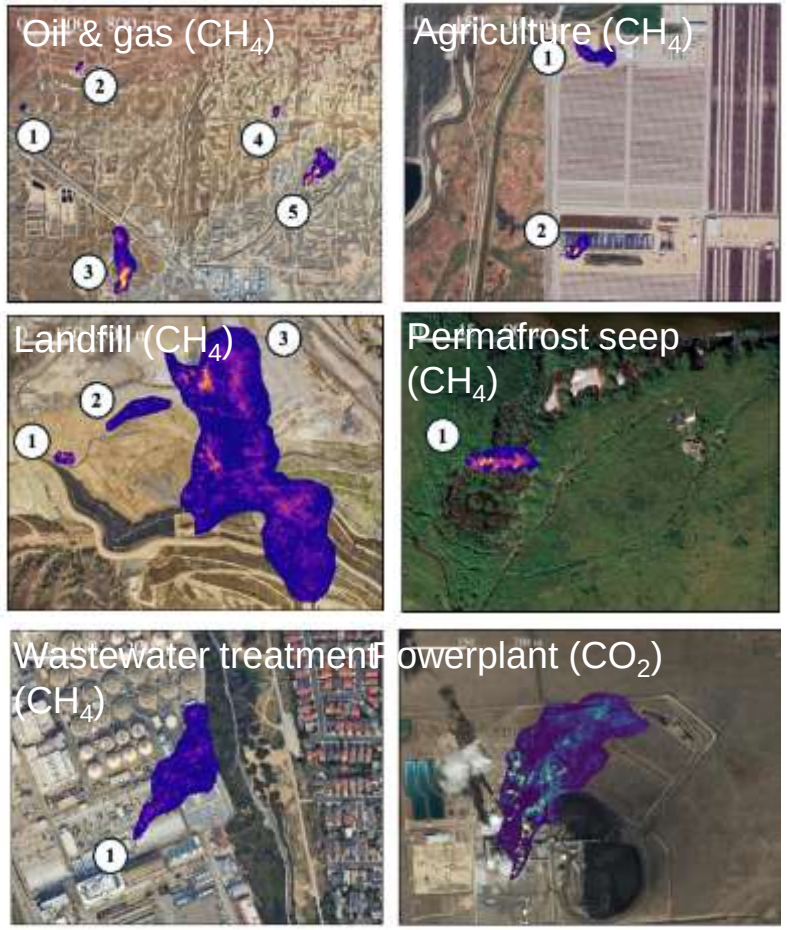
Co-development of measurement, modeling products based on feedback

Data products customized to user needs

- Ex: Work with specific states including Maryland, California, Colorado
- Ex: Coordination with private sector data service providers to increase interoperability, reduce overlap
- Ex: Coordinated delivery of GHG and flaring information to support energy modeling

Local Insights from AVIRIS

First AVIRIS-3 CH_4 and CO_2 paper

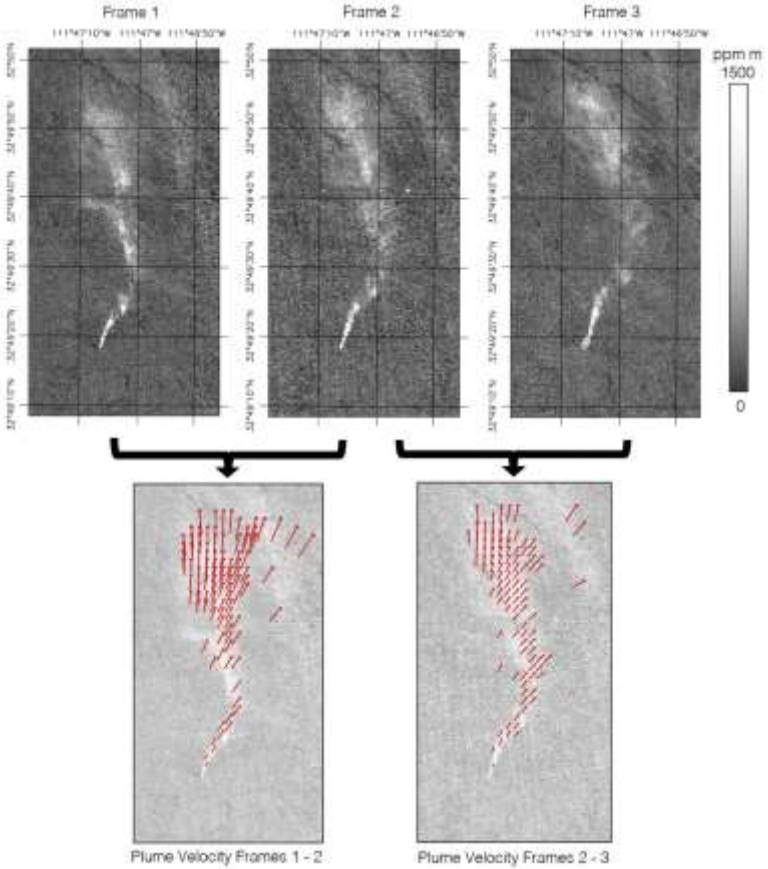


Willow Coleman, in revision

Data delivered through NASA Data Centers, EarthData search

Improvement of data processing pipeline supports low latency applications, analysis by public and private sector

New method for estimating plume velocity by changing aircraft pitch

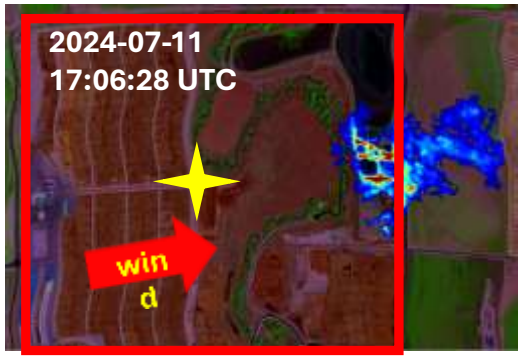


David Thompson, in revision

New insights through airborne coordination

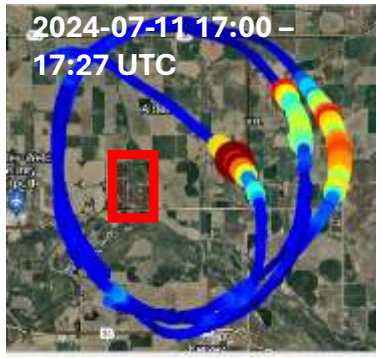
- Flights in Denver-Julesberg Basin with NOAA's AiRMAPS
- Coordination with Colorado Department of Public Health
- GHGSAT tasking – facility-scale emissions estimate comparisons

NASA JPL
AVIRIS-3



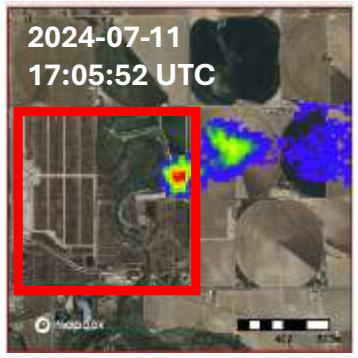
1121 kg /hr

NOAA
Twin Otter



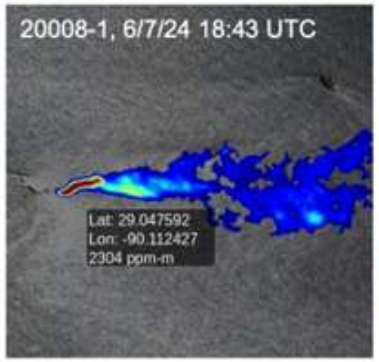
1821 kg/hr

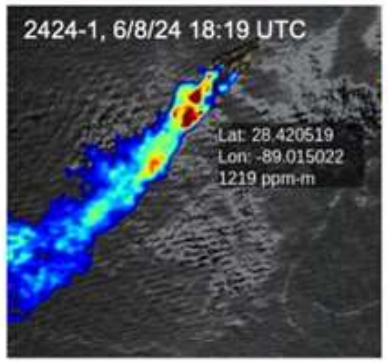
GHGSat

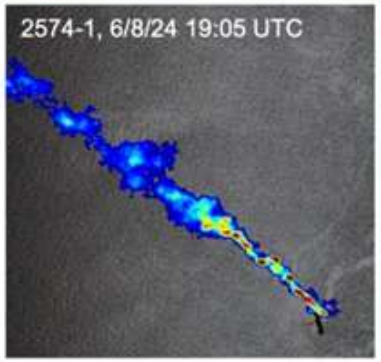


1135 kg /hr

- SCOAPE-II – partnership with BOEM
- Shipborne AQ measurements augmented with GHG observations, coordinated glint flights, tasking







Do you believe in ... MAGEQ?

Mid-Atlantic states provide natural resources that support energy independence, timber and lumber jobs, and $400 billion in manufacturing. States and local communities work with businesses to ensure that resources and work force continue to thrive in coming decades.

The U.S. Greenhouse Gas Center supports these efforts by providing trusted, observation-based data that decisionmakers and businesses need to demonstrate their ability to support growing global energy demands while reducing emissions. The Mid-Atlantic Gas Emissions Quantification (MAGEQ) campaign is designed to fill data gaps identified by public and private sector stakeholders and to increase efficiency by leveraging assets across the federal government.

New Space

MethaneSAT

CARBON MAPPER

GHGSAT

Measurement comparisons allow new data providers to demonstrate quality of their services, improve ability to serve customers

Data Service Providers

WattTime

CROSSWALK LABS

GTI ENERGY

AERSCAPE

State, City Government

Maryland Department of the Environment

NC DEPARTMENT OF NATURAL AND CULTURAL RESOURCES

DEQ Virginia Department of Environmental Quality

Collaboration with state and local governments informs flight planning and deployment of ground-based sensors

Airborne observations combines with AI to help users assess value of nature-based solutions and support coastal resiliency

Nature-based solutions

The Nature Conservancy

American Forests

World Resources Institute

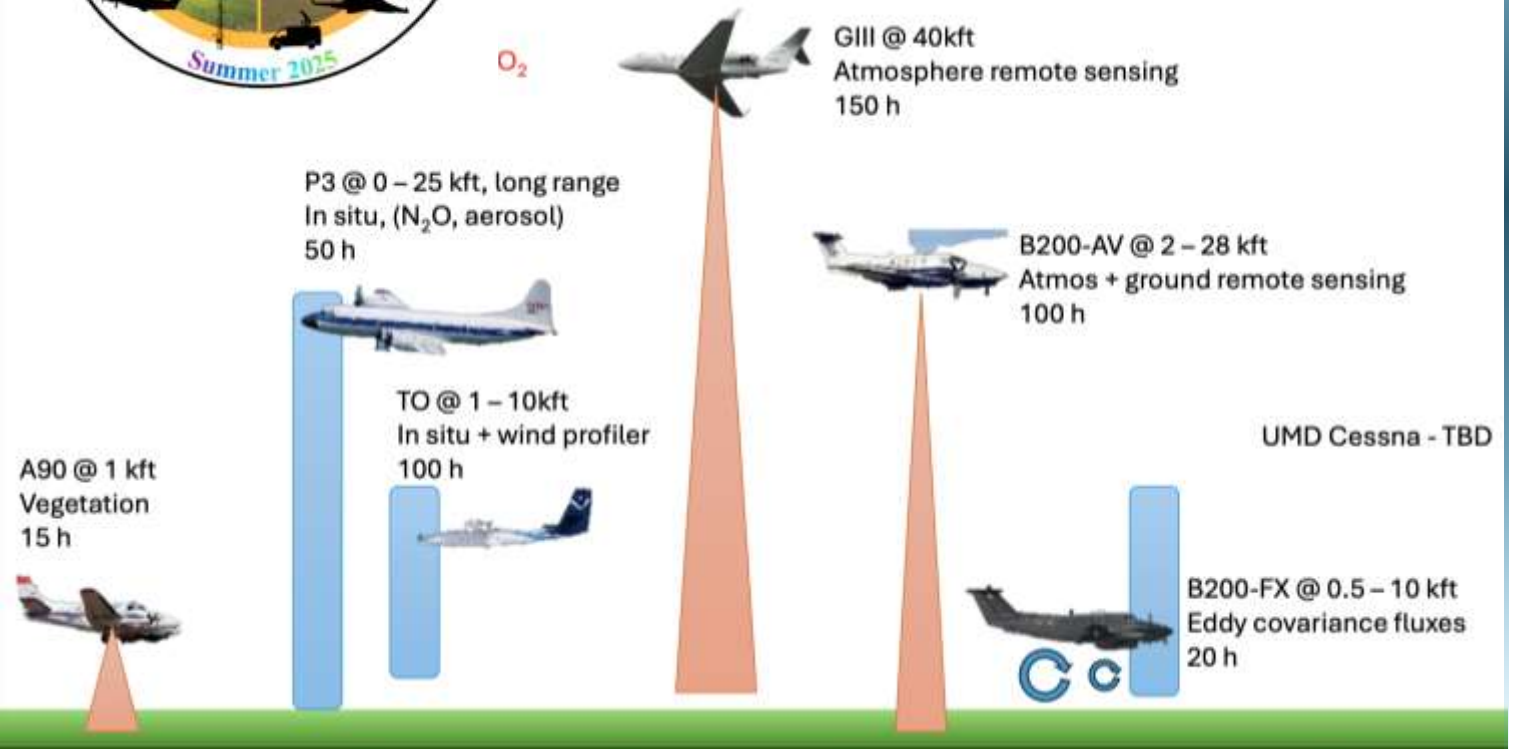
NIST National Institute of Standards and Technology U.S. Department of Commerce

NASA

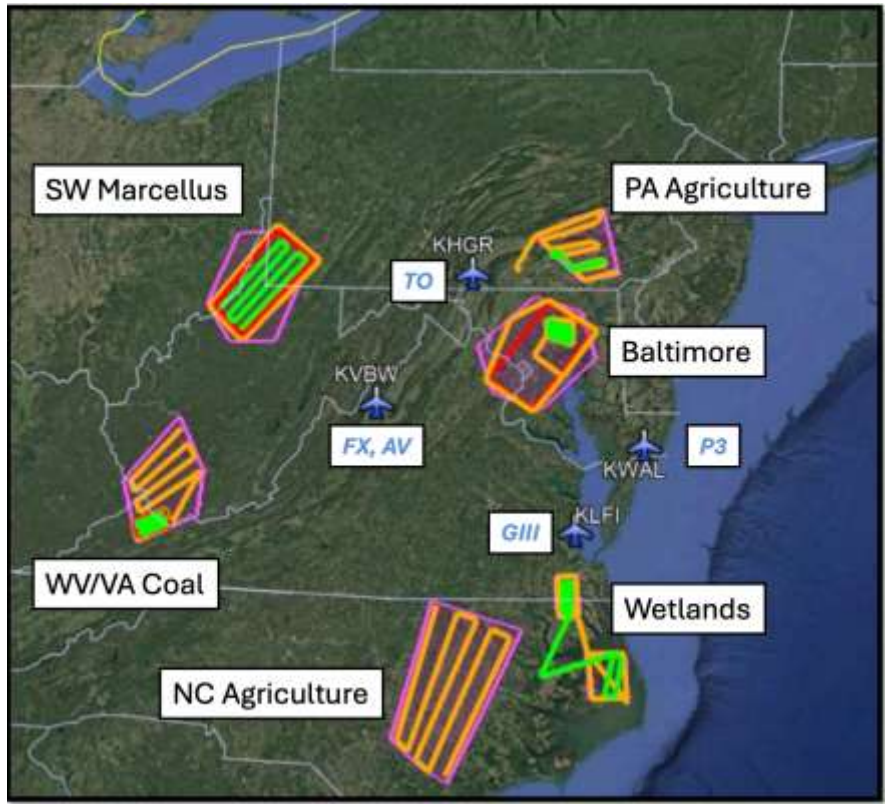
NOAA

MAGEQ: Expanding airborne coordination in the Mid-Atlantic

MAGEQ brings together 6 research aircraft with complementary GHG measurement techniques
Goal: Demonstrate emissions estimation techniques in priority regions – urban, wetland, agricultural, and petrochemical



Draft Coordinated Flight Plans

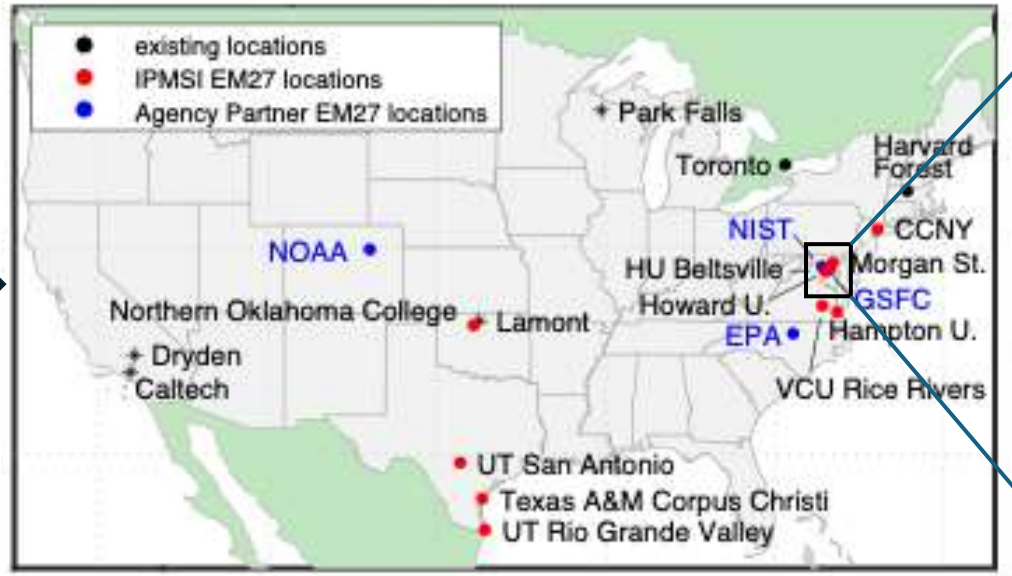


- Flights coordinated with ground networks, mobile facilities, and satellite tasking
- Late June through July 2025 … stay tuned

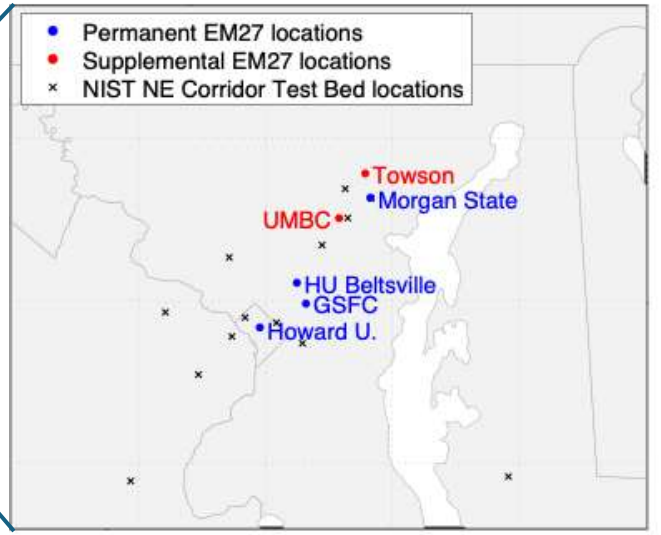
Expanding coverage of ground-based remote sensing

Current TCCON, long-term EM27s

Long-term sites with addition of new instruments



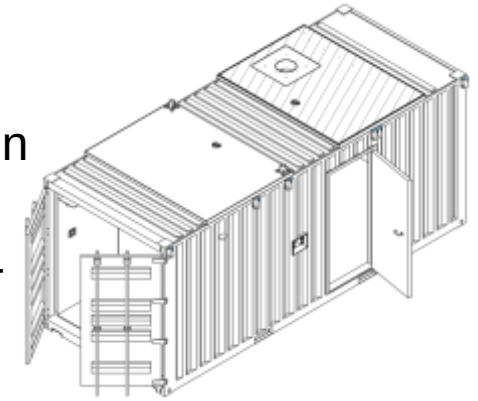
DC/Baltimore Measurement Hub



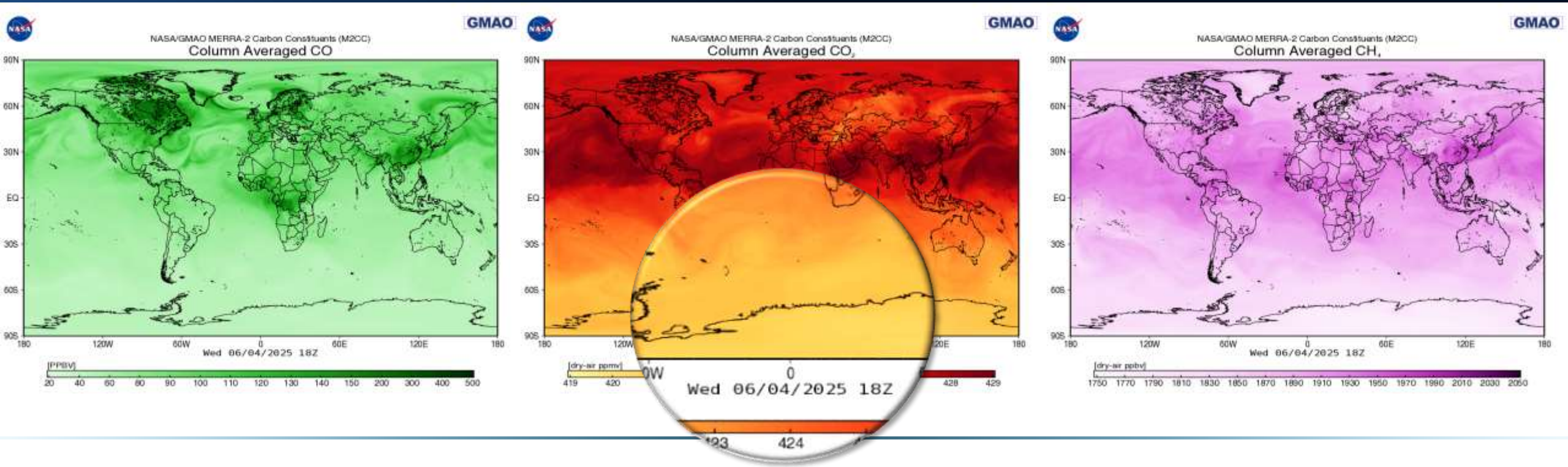
- **Goal:** Engage universities, students while expanding cal/val in under-observed parts of the U.S.
- NASA Goddard-led network adds 10 EM27/SUNs at universities, ~4 deployed with partners
- EM27 deployments begin in summer 2025, with all instruments deployed in the following year.

Anchored by GSFC TCCON

- Lab based on Caltech design - delivery in June.
- Measurements operational - end of 2025.



Operational GEOS global products

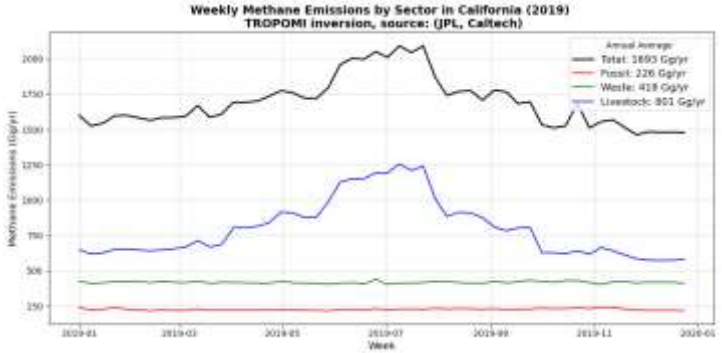


- GEOS concentration monitoring system leverages NASA weather, air quality, and ozone heritage
- Now delivering 3D concentration fields ~1 week behind real time based on assimilation of OCO-2 XCO_2 and TROPOMI CO, CH_4
- Processing includes operational land flux prior
- More from **Brad Weir** – 2nd to last of the meeting!!

WORLD METEOROLOGICAL ORGANIZATION

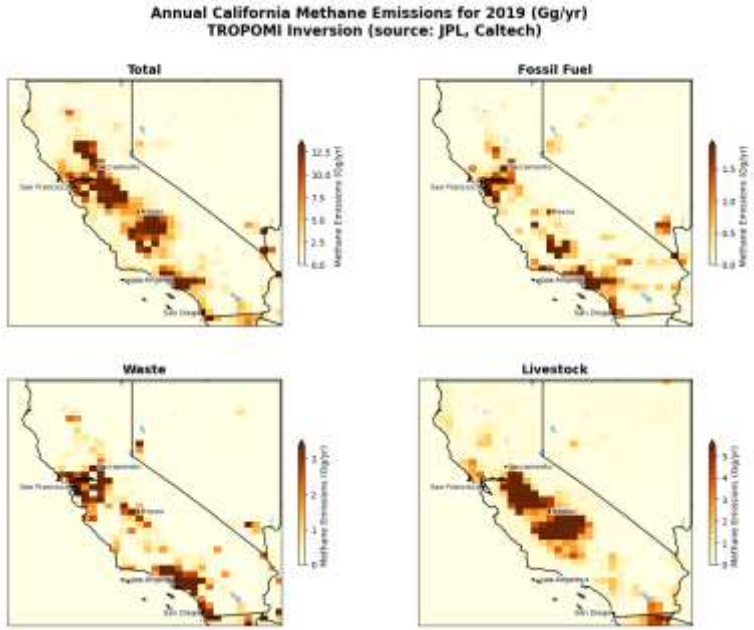
Multi-scale solution prototypes

Example: California sectoral emissions



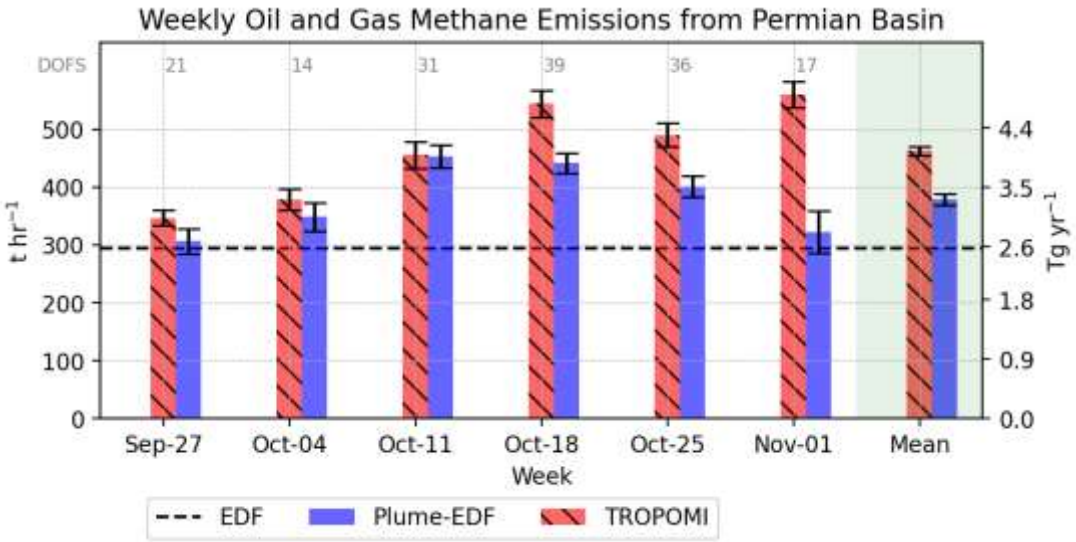
Regional TROPOMI inversions at weekly scale, provide details on sectoral emissions in California

Ongoing collaboration with California Air Resources Board, provides baseline for integrating city, facility level emissions estimate



Pandey et al., 2024 EST

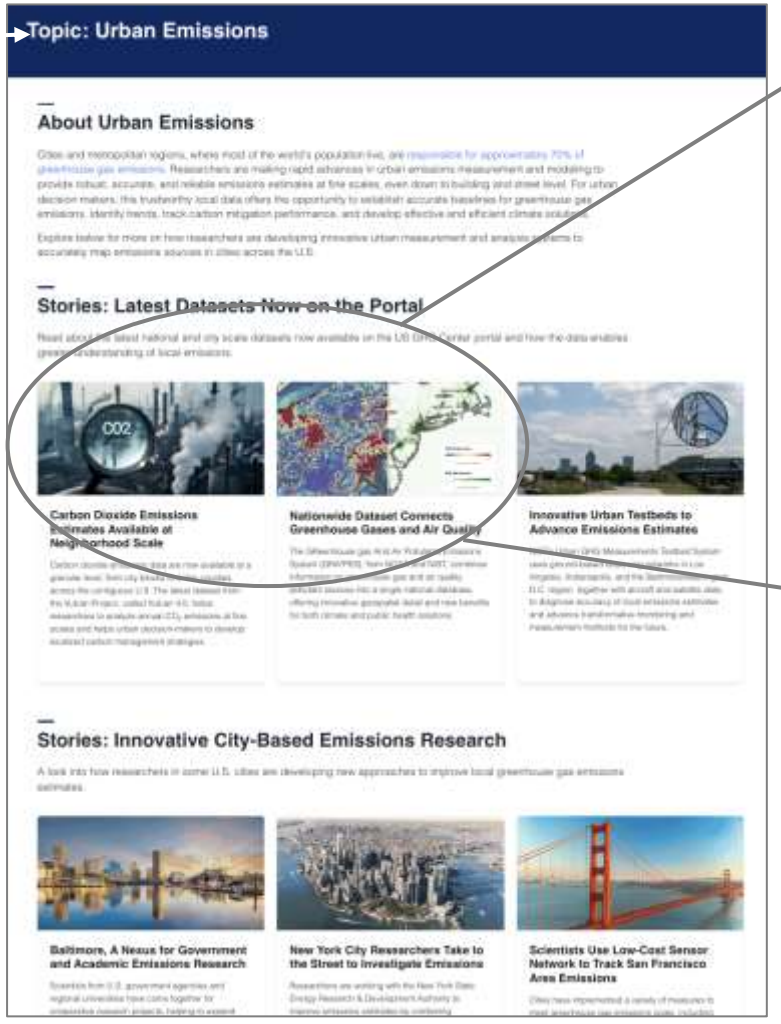
Example: Permian oil and gas emissions

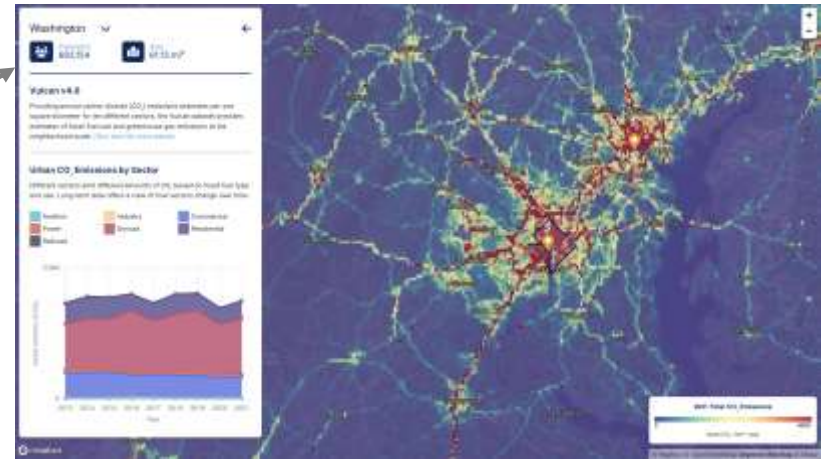


- New methods for combining plume scale obs from AVIRIS with regional TROPOMI inversions
- Assimilation of AVIRIS data provides additional temporal information on EDF inventory (dashed line, prior)
- Combination of observations provides additional constraint on point/area sources

Focus on non-technical users

Example: Portal 1.5 Urban Data Portal Release





- **Portal 1.5**: Evolution from catalog-focused approach to emphasis on analysis ready data, tools. Expanded written content illustrates use cases.
- **Portal 2.0**: Content organized by sector, geographic decision-making scale. Focus on interoperability with NASA, partner data services.

Summer School for Inverse Modeling

CIRA/Colorado State University, Fort Collins, CO

Field trip to NOAA sampling site at Niwot Ridge, CO

- **Goal:** Instruct students in atmospheric “inverse” techniques in order to capitalize on dramatic increase in gas concentration data and grow new cohort of “inverse modelers”
- 50% lectures and 50% “hands on” examples with code on real problems via Jupyter Notebooks
- Leverages GHG Center data catalog, interactive hub environment
- Volunteer instructors from multiple government agencies, universities, and NGOs
- SSIM-GHG 2024 outcomes: Hosted 30 students and 10 instructors for 2 weeks. Students have started their own regular research telecon for early career researchers
- SSIM-GHG 2025: July 8-18, 2025 in Fort Collins including

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