The U.S. Greenhouse Gas Center (US GHG Center)

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Background

❖ The U.S. GHG Center: What is it?

The US GHG Center is a multi-agency effort to facilitate coordination across federal and non-federal, domestic and international entities to integrate and enhance GHG data and modeling capabilities from the USG and non-USG sources for scalable impact. Together, such measurements can provide unique, multi-scale information about GHG that is valuable for both research and applications, serving user needs and providing societal benefits.

- Managed by NASA Headquarters, Earth Science Division.
- Implementing partners: NASA, EPA, NIST, and NOAA.

❖ GHG Center Portal

The portal will provide a curated collection of GHG datasets, workflows and visualizations, reflecting transparency and open source science principles in both data and methods. Capabilities will include:

- A prototype data catalogue
- Exploratory data analysis capabilities
- A collaborative science environment for data analysis and exploration
- An interactive visual interface for storytelling

Overall Approach to Addressing GHG

- Support implementation of the National GHG Strategy, following an iterative approach with expectation to integrate additional Federal and non-Federal capabilities in the future
- End-user driven, reliable delivery of mature GHG monitoring products and tools, enhanced support for stakeholder engagement
- Build off strong heritage of disciplinary programs, with strong focus on integrating atmospheric and surface measurements, representing human and natural processes that exchange carbon between atmosphere and surface biosphere, and including relationship with other gases (e.g., air pollutants)
- Leverage multiple vantage points and integrate results/knowledge through models to verify hypotheses & create products for community use
- Engage domestically and internationally (e.g., CEOS, WMO G3W, IG3IS, IMEO) through bilateral and multi-lateral engagement in measurement, modeling, research and stakeholder engagement

US GHG Center: VISION, MISSION, GOALS

VISION

Inspire and accelerate the use of Earth science data and information to increase confidence in setting, assessing, and meeting climate mitigation goals.

MISSION

Extend accessible and integrated GHG data and modeling capabilities from U.S. Government and non-public sources for scalable impact.

PURPOSE

Develop and enhance GHG data products that **meet user needs**;

Foster **collaboration** with networks of interagency, international, intergovernmental and private sector partners to co-develop and increase adoption of **impactful applications**;

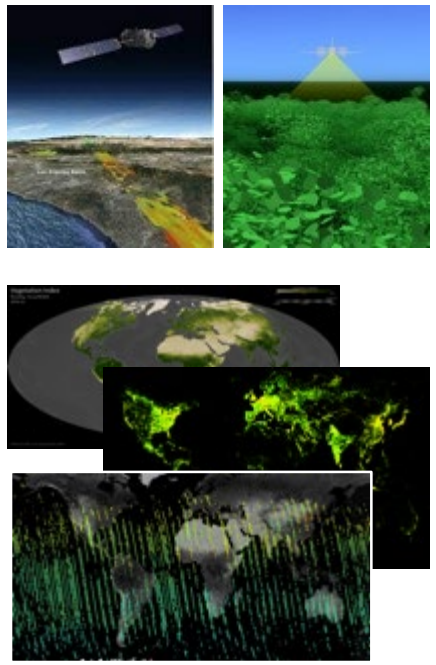
Promote **scientific innovation** and **transparency** by leveraging **advanced data systems** capabilities and **open source science** principles; and,

Establish **bidirectional knowledge transfer** and engagement with federal, state, local

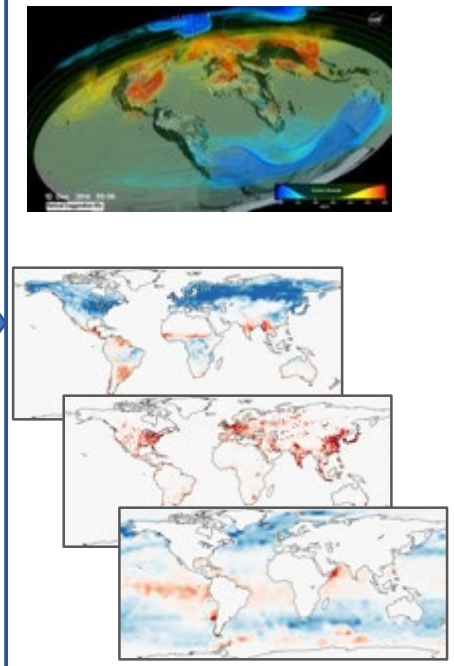
Data, Modeling Capabilities and Needs from Partner Agencies*

U.S. GHG Center
Stakeholder Driven • Sustained Impact • Leverages Mature Capabilities across Partner Agencies

Earth Observations



Modeling



GHG Data and Information System

Research & Applications

Leverages ESDS/ VEDA capabilities

Test bedding of modeling, integration approaches

Standards & processes for thorough evaluation of new observations before transition

Advanced users

End User System (Front End)

Leverages ESDS/VEDA

Public-facing

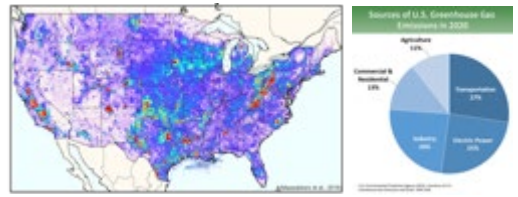
Curated, mature products representing consensus view

Science and non-science users

Enhanced help desk support

Demonstration Areas

Gridded Anthropogenic Emissions



Natural GHG Emissions

Detecting and Tracking High Emission Events

Improvement of modeling, observing techniques

Incorporation of stakeholder needs and feedback

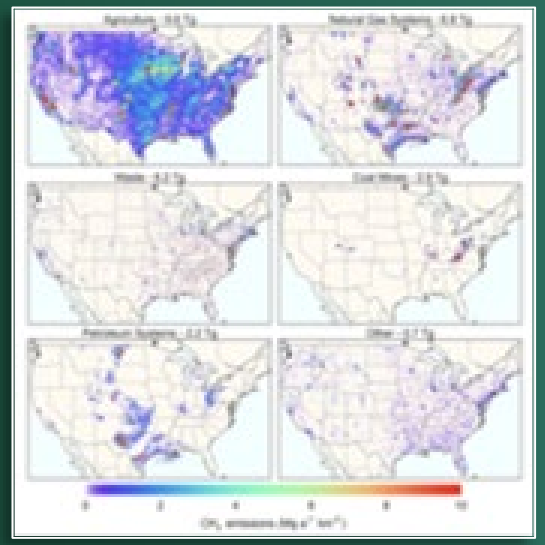
* Representative, but not comprehensive list

U.S. Greenhouse Gas Center

Use Cases

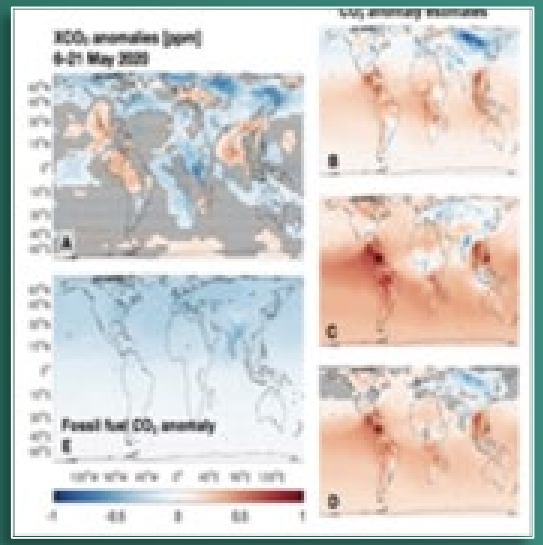
Upcoming Milestones

- **Fall 2023: Soft launch of Center, beta portal release**
- **Nov. 28, 2023: Targeted Stakeholder Workshop (hybrid virtual / in-person, Washington, D.C.)**



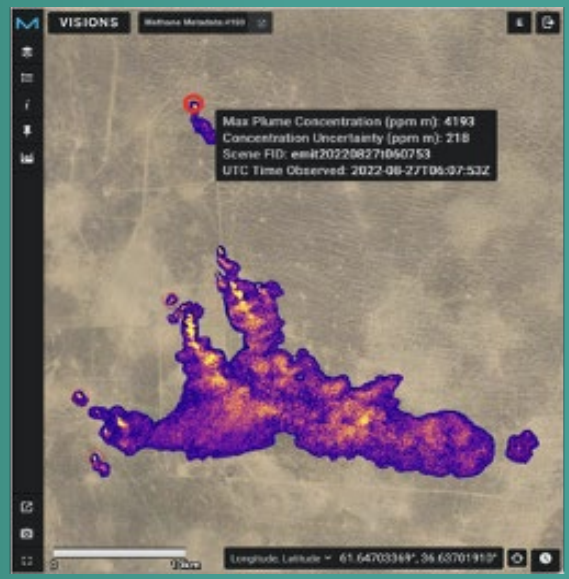
Credit: Maasakkers et al., Env. Sci. and Tech., 2016

Improve access and latency to gridding of anthropogenic CH_4 Inventory



Credit: Weir et al., Env. Res. Lett., 2022

Complement anthropogenic GHG emissions with natural GHG emissions and fluxes



Credit: EMIT Interim Open Data Portal

Identify, and quantify estimates from super emitting events, leveraging aircraft and satellite data.

DEMONSTRATION AREAS

Demonstration Area: Human emissions, cyberinfrastructure

Use Case 1. *Improve access and latency to, gridding of anthropogenic CH_4 inventory*

Add. Interagency Opportunities. *Collaboration on low latency GHG, AQ emissions (e.g., through GRA²PES)*

International. *Make gridding tools open source, support capacity building in other countries, collaborating with State Department.*

REGIONAL

Demonstration Area: Natural sources/sinks, modeling and data assimilation

Use Case 2. *Complement anthropogenic GHG emissions with natural GHG emissions and fluxes*

Add. Interagency Opportunities. *Collaboration on quasi-operational modeling, development of consensus GHG products*

International. *Contribute to CEOS Strategy to Support the Global Stocktake and WMO IG3IS and Global Greenhouse Gas Watch initiatives.*

GLOBAL

Demonstration Area: Large emission events, Advancing measurement technology and cal/val

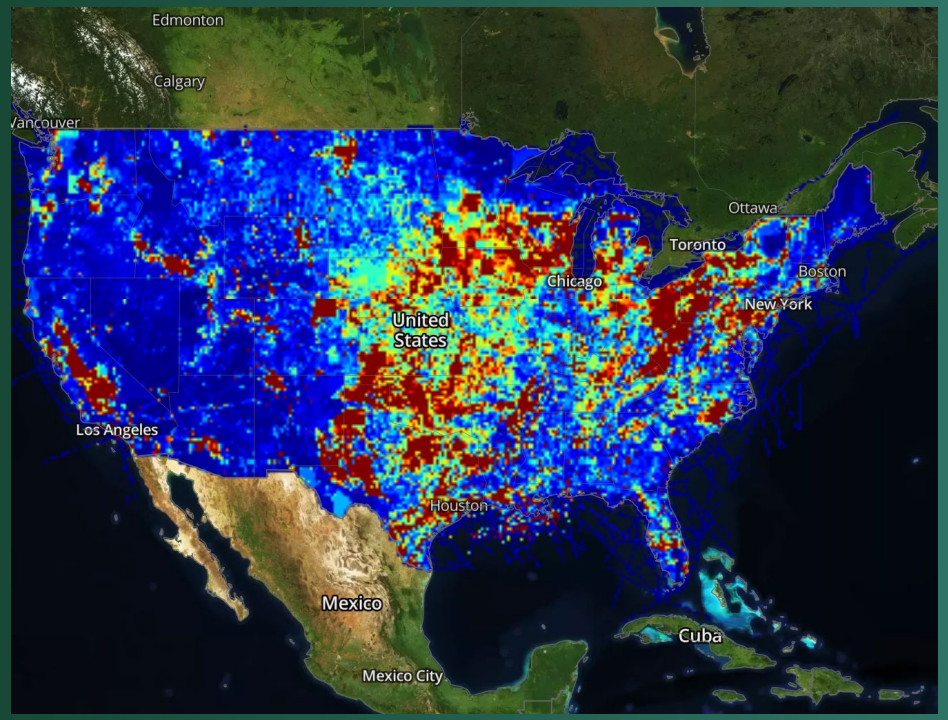
Use Case 3. *Identify and quantify emissions from large CH_4 leak events leveraging aircraft and satellite data*

Add. Interagency Opportunities. *Collaboration on cal/val standards, coordinated measurement deployments*

International. *Explore contributions to UNEP IMEO/MARS initiatives to enable timely access of satellite plume mapping data for large/transient emissions detection and inter-comparison of plume mapping instruments with emissions release.*

LOCAL

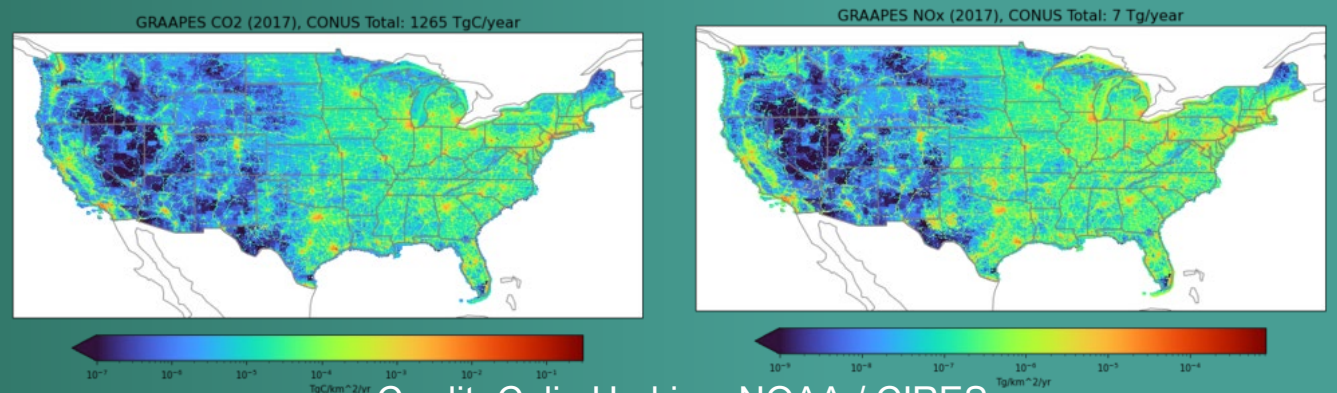
Demonstration Area 1: Human Emissions, Cyberinfrastructure



EPA Gridded Express 2020 - Total Methane Emissions

- The gridded EPA U.S. anthropogenic methane greenhouse gas inventory includes gridded maps of annual anthropogenic methane emissions (0.1°×0.1°) for the contiguous United States.
- Mapping human-caused sources of methane across the U.S. provides insight into source and emission trends. This geographic representation enables new comparisons between emission locations and includes methane estimates informed by atmospheric observations. The aim is to improve national and state-level methane emission estimates.

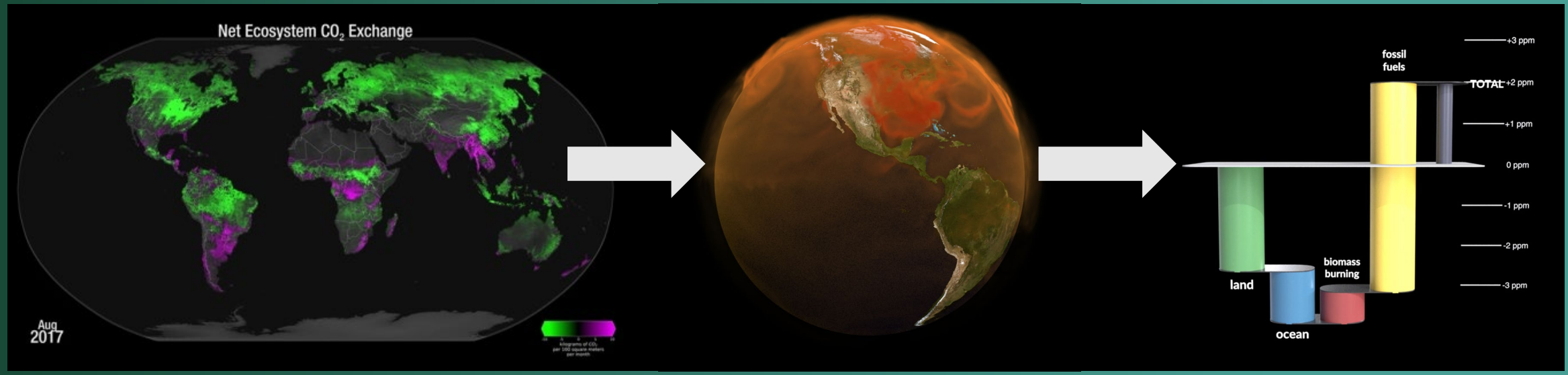
Collaboration on low latency GHG, AQ emissions (e.g., through GRA ^{2}PES)



Credit: Colin Harkins, NOAA / CIRES

Demonstration Area 2: Natural Sources and Sinks, Modeling and Data Assimilation

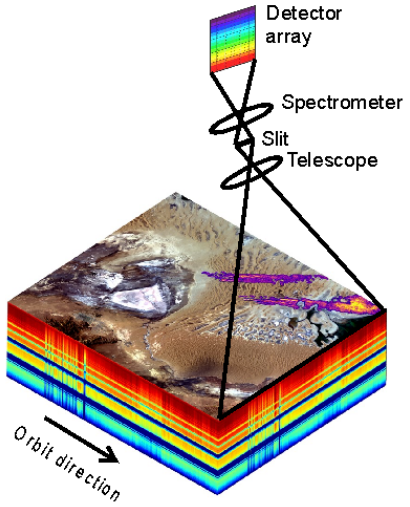
Improved bottom-up estimates **Refinement through atmospheric DA** **Improved GHG budgets**



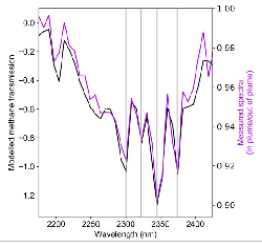
1. Improved delivery, quality, and resolution of natural source and sink estimates
2. Monitoring and early warning of changes in sources and sinks
3. Evaluation and refinement of source and sink observations using top-down constraints
4. Contribution to coordinated standards for model intercomparison and evaluation
5. Develop future workforce to ensure sustainability of model-based products

Demonstration Area 3: Large Emission Events, Expanding GHG Cal/Val

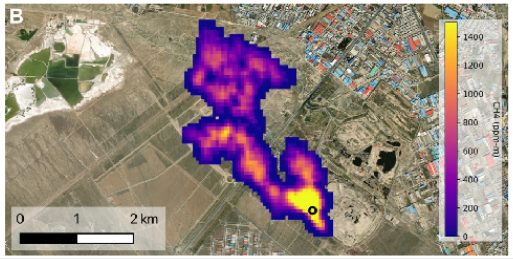
EMIT measures CH_4 and CO_2 spectral fingerprint



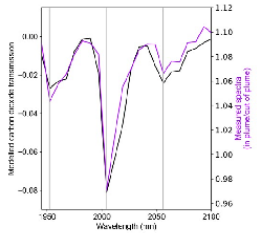
CH_4 spectral fingerprint from EMIT radiance data



CH_4 from landfill (Iran)

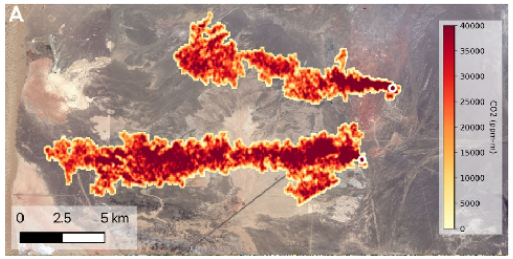


CO_2 spectral fingerprint



Thorpe et al., submitted

CO_2 from power plants (China)



GHG retrievals	*Thorpe et al., 2014* *Thompson et al., 2015*
GHG emissions	*Duren et al., 2019* *Thorpe et al., 2021*

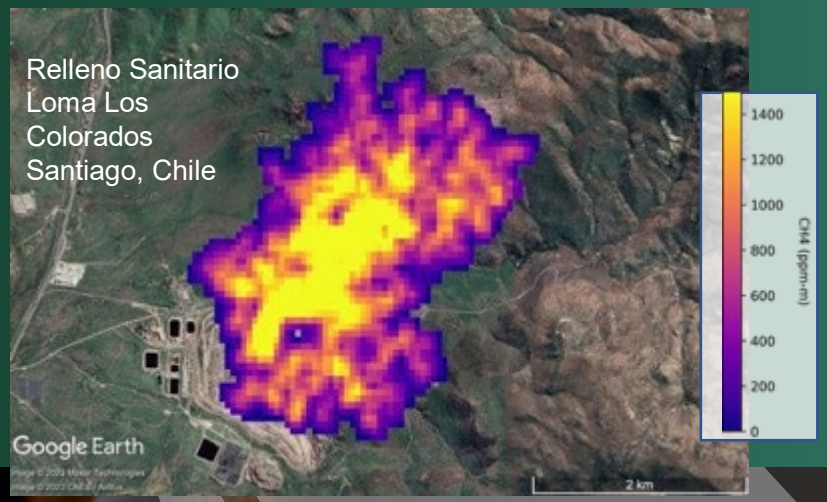
Locations of methane plumes observed with EMIT

Stakeholders will be able to access methane plume results using the US GHG Center portal

Demonstration Area 3: Large Emission Events, Expanding GHG Cal/Val

AVIRIS-NG CH_4 from landfill (1/13/23)

EMIT CH_4 from same landfill (1/19/23)



Direct comparison of EMIT results with near coincident measurements from airborne surveys (e.g., AVIRI-NG, AVIRIS-3)

SARP

NASA STUDENT AIRBORNE RESEARCH PROGRAM
NATIONAL SUBORBITAL RESEARCH CENTER

Portable EM27/Sun Instruments

Opportunities for interagency & international collaboration **on expanded ground-based GHG cal/val network, expanding workforce through collaboration with MSIs**

US GHG Center Stakeholders

Partner: An organization that actively co-develops the capability to achieve sustained use and sustained benefit from greenhouse gas observations and modeling for the US GHG Center.

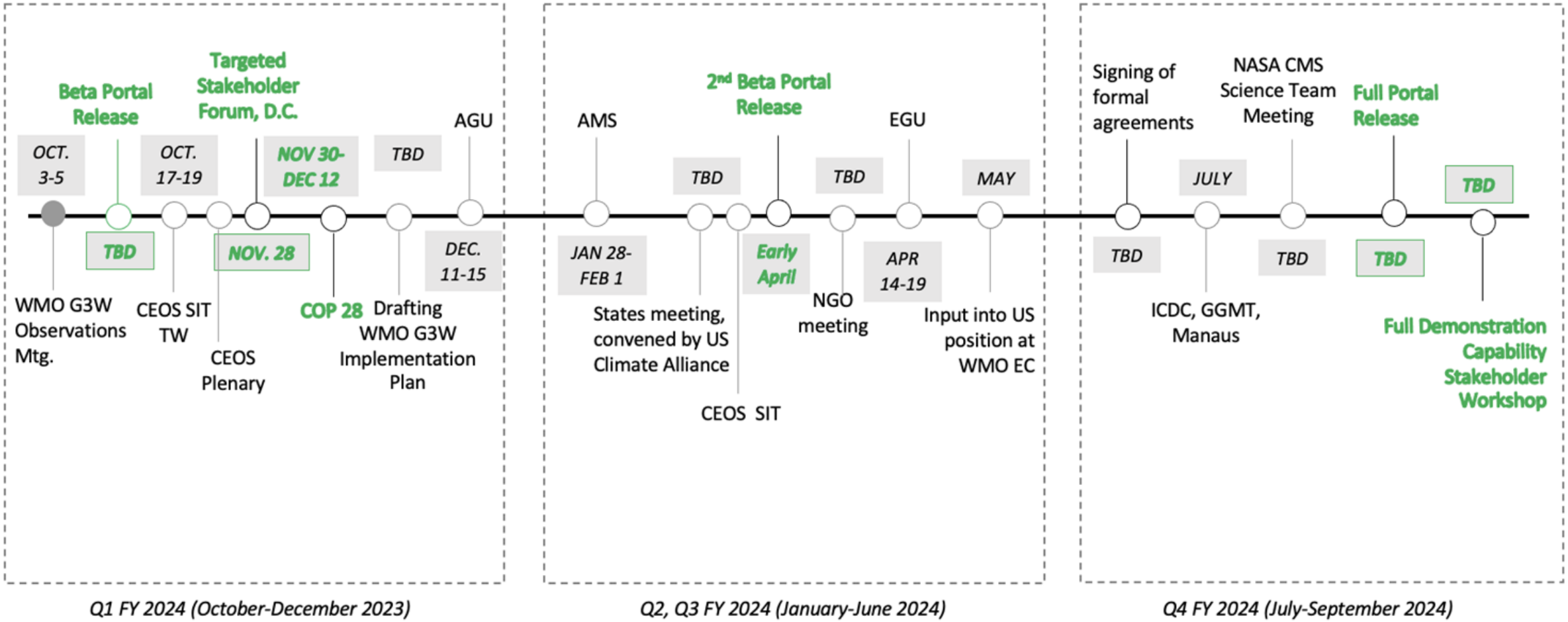
Implementing Partners

Discussions with Stakeholders *

Future targeted engagement*

*Representative examples

[DRAFT] U.S. Greenhouse Gas Center: Public-Facing Milestones, FY24



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Thank you!

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