



Characterizing large methane and CO₂ emissions from space with EMIT

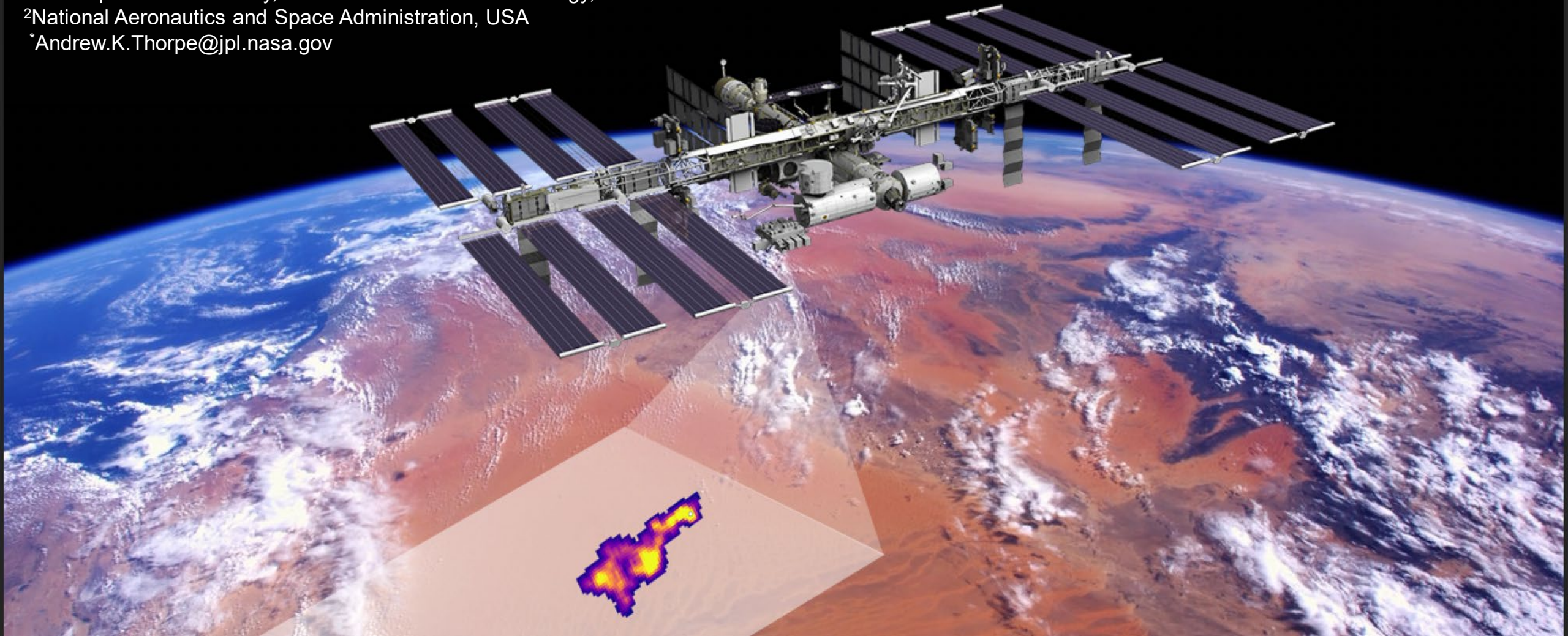
U.S. Greenhouse Gas Center contributions and future needs

Andrew K. Thorpe¹, Robert O. Green¹, David R. Thompson¹, Philip G. Brodrick¹, K. Dana Chadwick¹, Clayton D. Elder¹, Jay E. Fahlen¹, Adam M. Chlus¹, Claire Villanueva-Weeks¹, Willow Coleman¹, Claire Villanueva-Weeks¹, Amanda M. Lopez¹, Daniel J. Jensen¹, John W. Chapman¹, John R. Worden¹, Kevin W. Bowman¹, Argyro Kavvada², Shanna Combley²

¹Jet Propulsion Laboratory, California Institute of Technology, USA

²National Aeronautics and Space Administration, USA

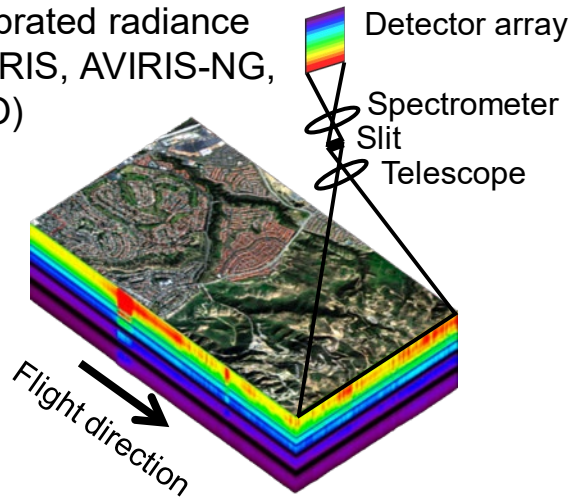
*Andrew.K.Thorpe@jpl.nasa.gov



NASA at the forefront of GHG mapping using imaging spectrometers

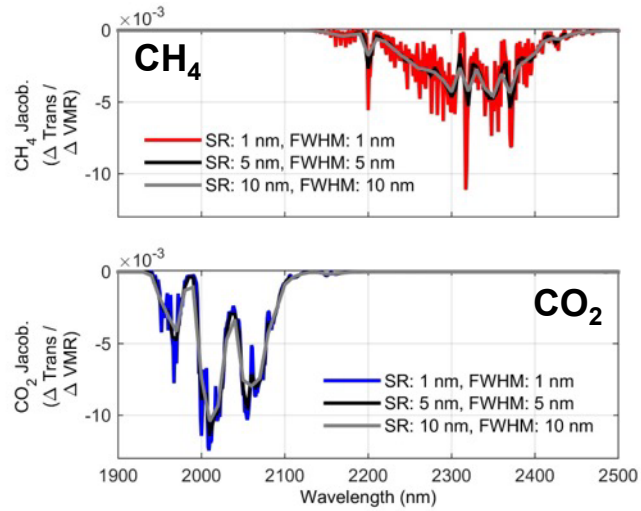


Calibrated radiance
(AVIRIS, AVIRIS-NG,
GAO)



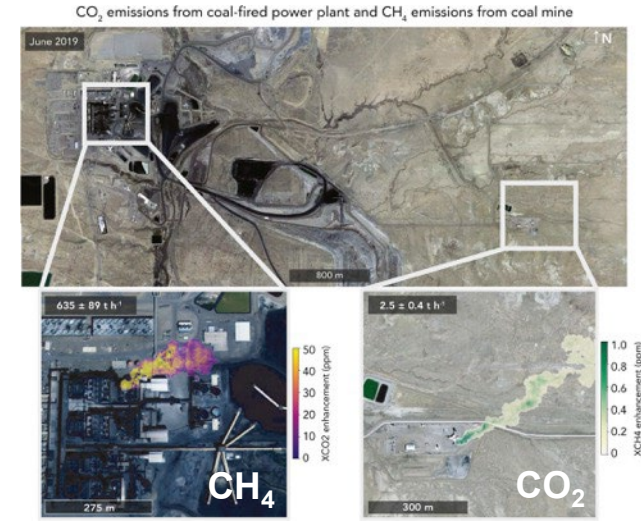
GHG
retrievals &
emissions
estimates

*Thorpe et al.,
2014*
*Thompson et
al., 2015*
*Duren et al.,
2019*

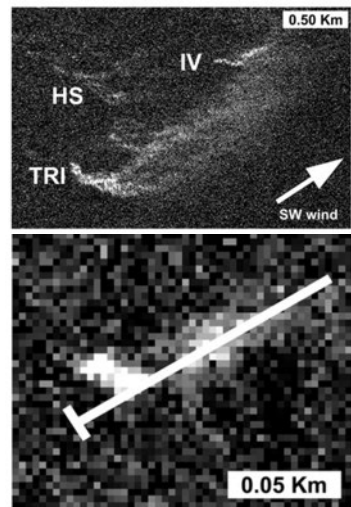


GHG
plume
location &
emissions

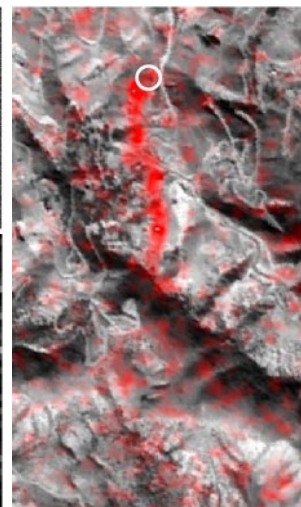
*Cusworth
et al., 2021*



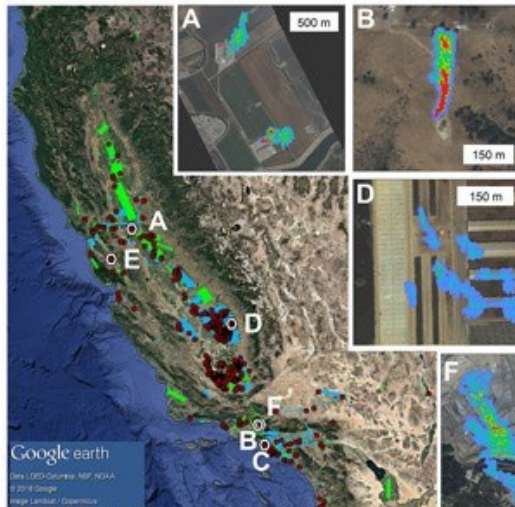
2008, AVIRIS CH₄
Thorpe et al., 2013



2016, Hyperion CH₄
Thompson et al., 2016



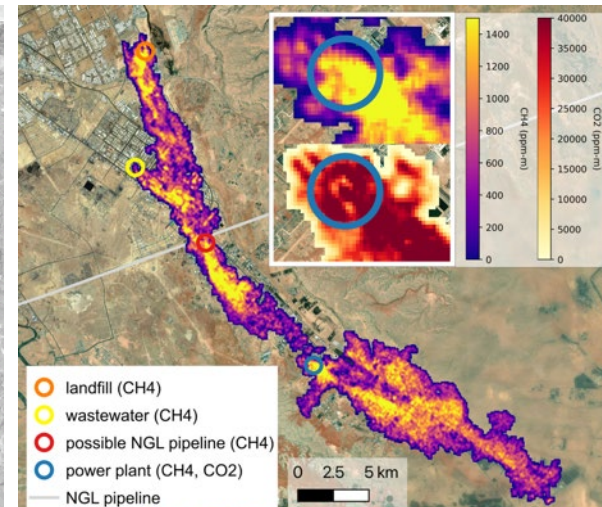
2016, AVIRIS-NG CH₄
Duren et al., 2019



2019, AVIRIS-NG/GAO CH₄
Cusworth et al., 2021



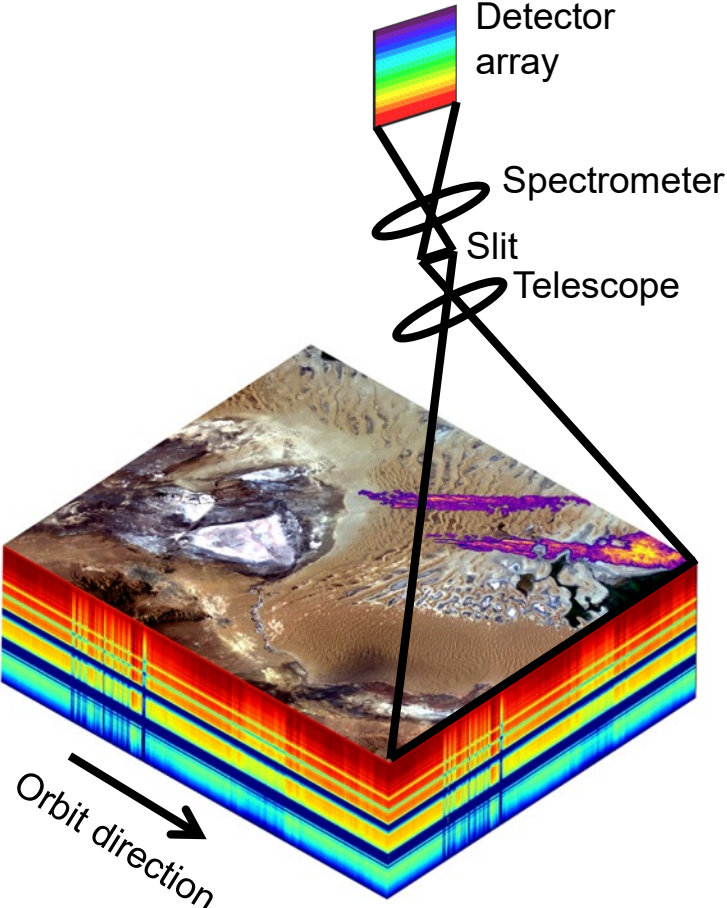
2022, EMIT CH₄ & CO₂
Thorpe et al., in press



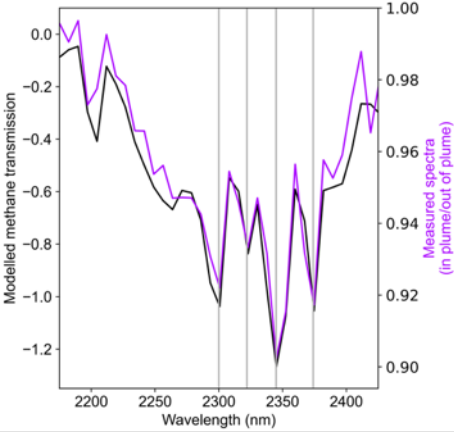
2023, AVIRIS-3 CH₄
California



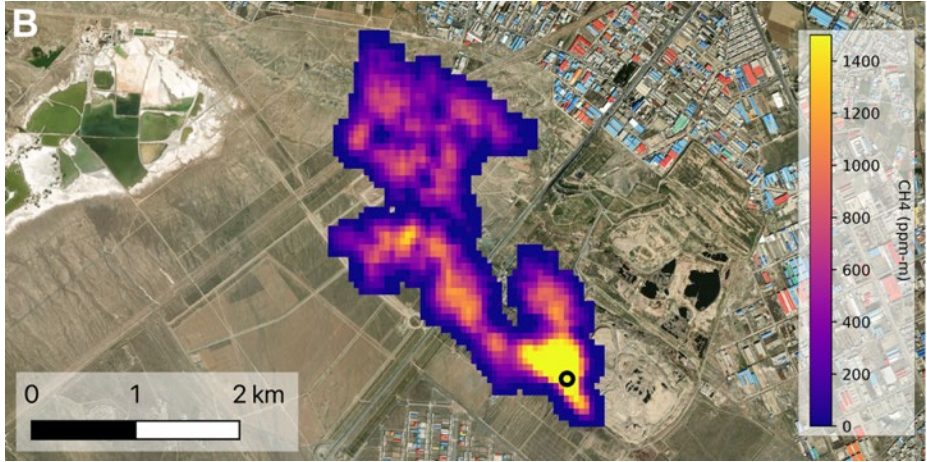
EMIT measures CH₄ and CO₂ spectral fingerprints



CH₄ spectral fingerprint from EMIT radiance data

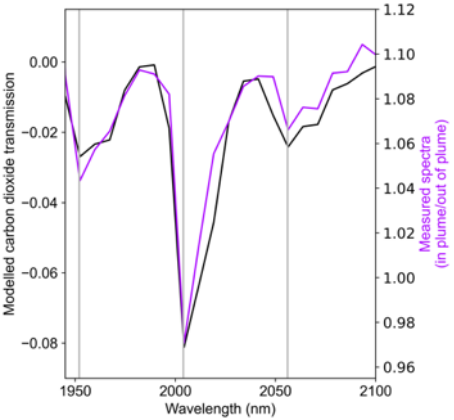


CH₄ from landfill (Iran)

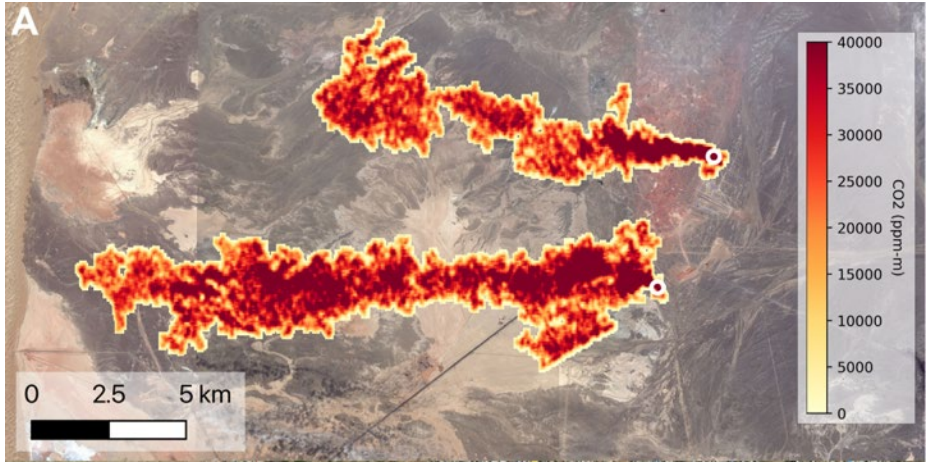


Thorpe et al., in press

CO₂ spectral fingerprint



CO₂ from power plants (China)



Ensuring transparency for datasets and algorithms

Data processing

Level 0:
• EMIT raw measurements¹

Level 1B:
• Calibrated radiance & geolocation¹
• DOI: 10.5067/EMIT/EMITL1BRAD.001

Level 2:
• Methane concentration maps²
• DOI: 10.5067/EMIT/EMITL2BCH4ENH.001

— Scientist review

Level 3:
• Methane and CO₂ plumes²
• DOI: 10.5067/EMIT/EMITL2BCH4PLM.001

Planned Level 4:
• Emission rate estimates

Open science repositories:

¹<https://github.co/emit-sds>

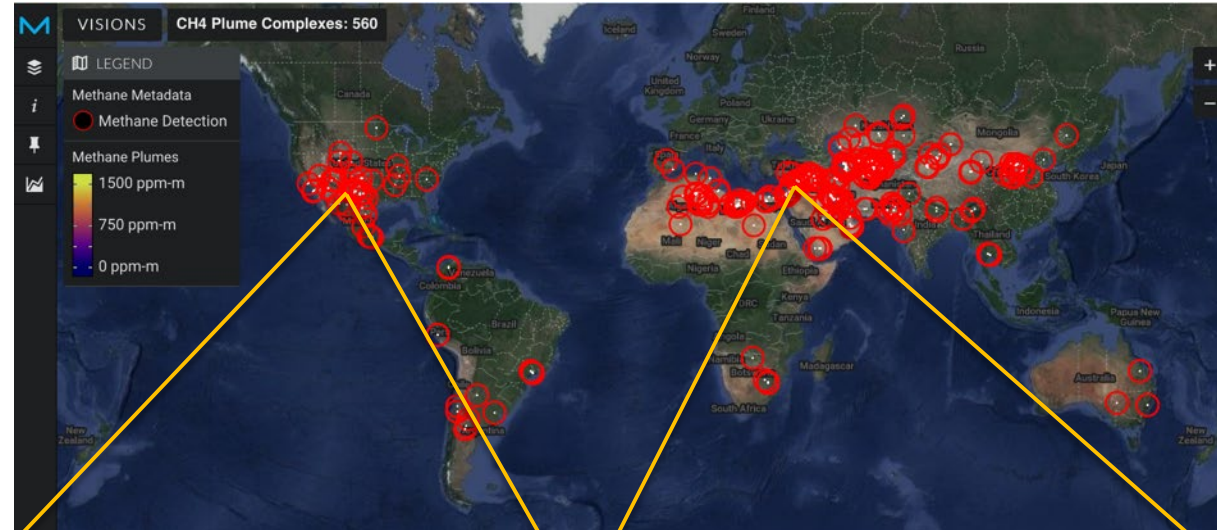
²<https://github.com/emit-sds/emit-ghg>

³<https://github.com/NASA-AMMOS/MMGIS>

Visualizing results

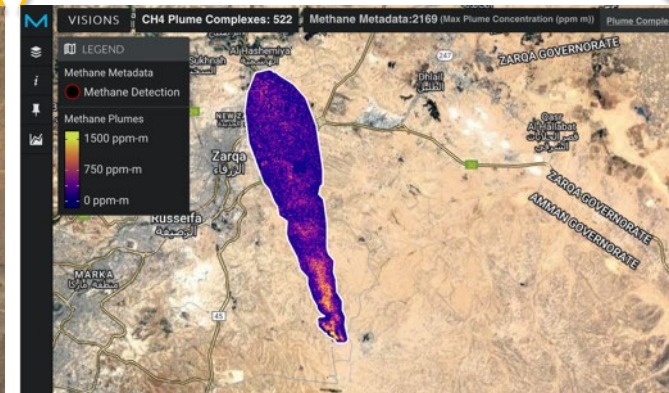
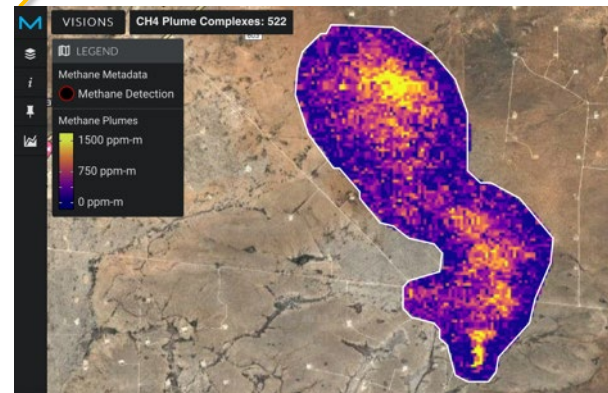
EMIT VISIONS open data portal³

<https://earth.jpl.nasa.gov/emit/data/data-portal/Greenhouse-Gases/>

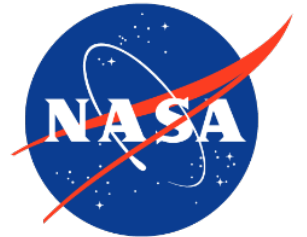


CH₄ from U.S. oil&gas

CH₄ from Jordan landfill



US Greenhouse
Gas Center
Beta site launch
shortly

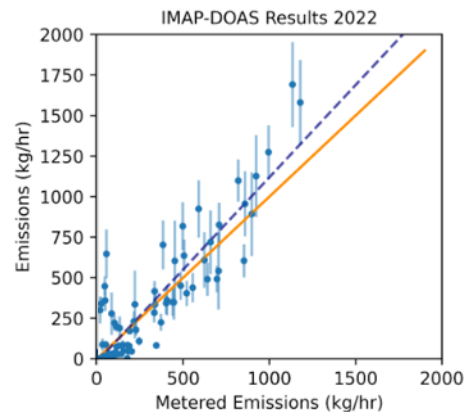
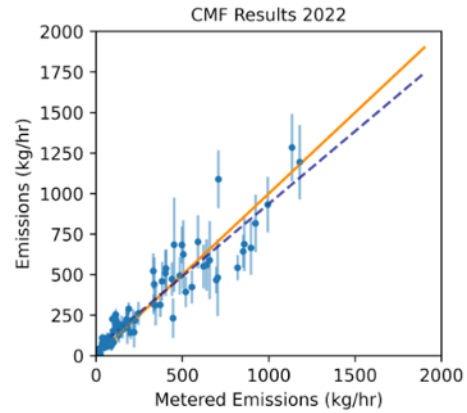


Calibration, validation, data standards

Controlled CH₄ release experiments (EMIT and AVIRIS-3)

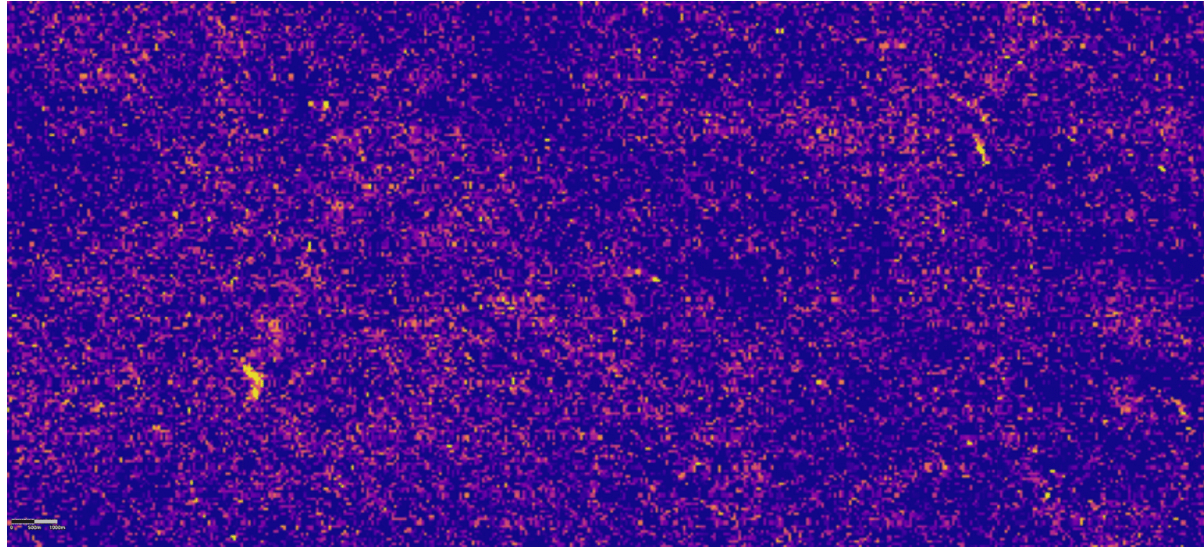
GAO controlled release funded and processed by Carbon Mapper

Ayasse et al., in revision



Intercomparison between instruments (EMIT to AVIRIS-3, OCO-3, etc.)

Coincident EMIT and AVIRIS-3 CH₄ observations in the Permian Basin



Development of data standards to improve quality and utility of point source data

