Methane and Carbon Dioxide Point Source Measurements Across Six Continents from the EMIT Imaging Spectrometer on the International Space Station and Contributions to the U. S. Greenhouse Gas Center

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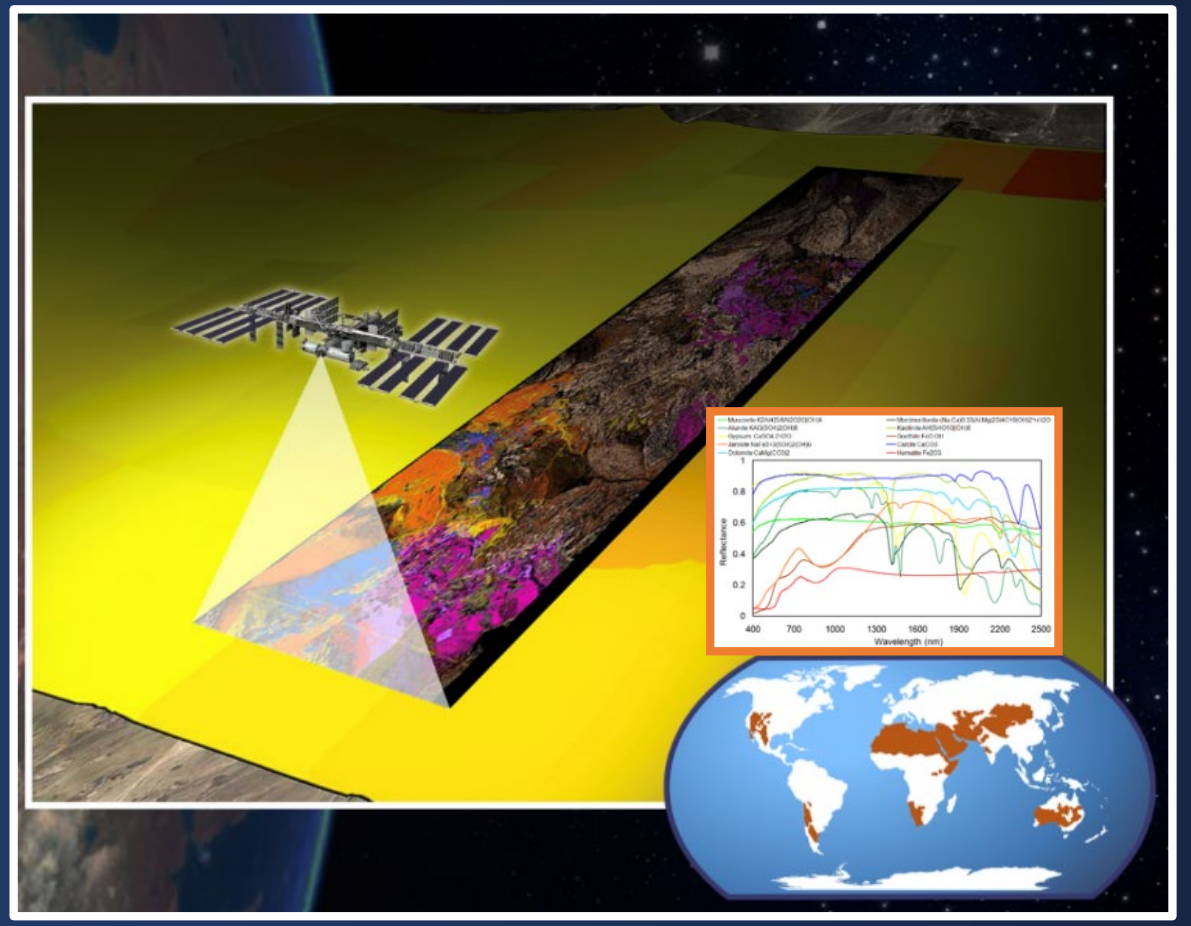
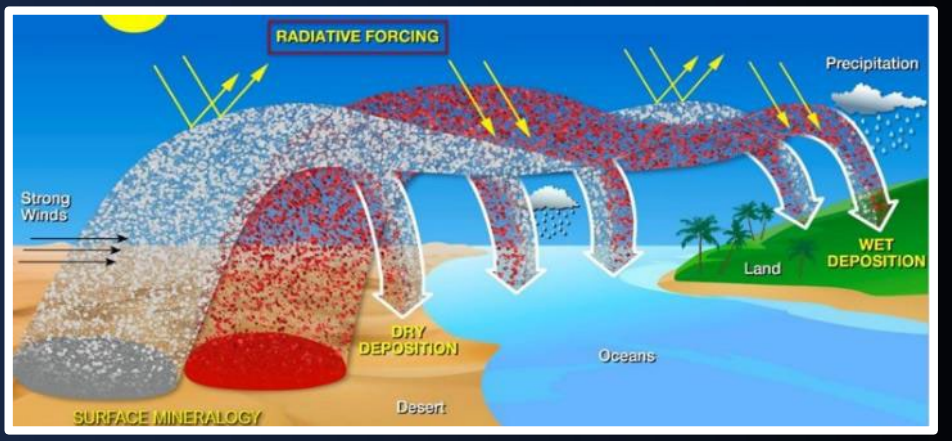
EMIT Mission: Climate, GHGs, Strategic Minerals…

Measuring Earth's surface minerals to improve climate model assessments and more



Knowledge of dust source mineral composition is poor, currently traced to 5000 surface sample.

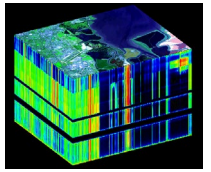


EMIT will deliver >1 billion new surface mineral observations to update advanced Earth System Models.

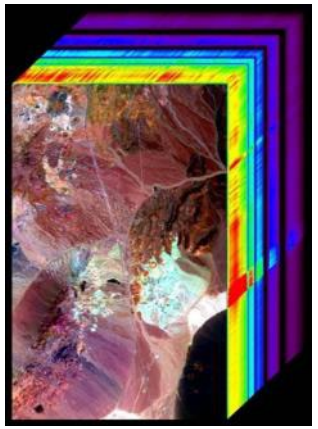
EMIT measurements provide knowledge of:

- Mineral dust climate impacts
- Strategic minerals (Lithium, rare earths, etc.)
- Wildfire Fuels, Risk, Severity, and Recovery
- Vegetation and Ecosystem Function & Diversity
- Coastal Ecosystem Processes and Algal Blooms
- Snowpack water resources, melting, and energy balance
- Water Quality and Sediment Loads
- Greenhouse Gas: Methane, Carbon Dioxide Pollution

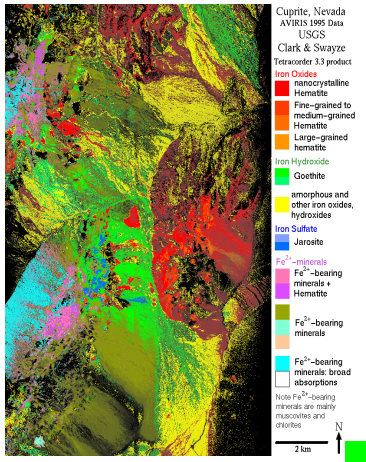
EMIT uses Imaging Spectroscopy to Measure the Mineral Spectroscopic Composition of the Earth's Arid Lands and More



Calibrated Image Cube

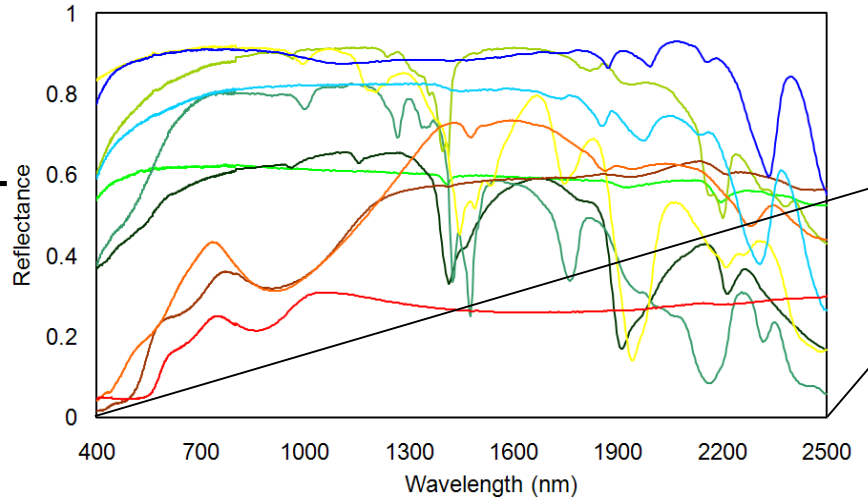


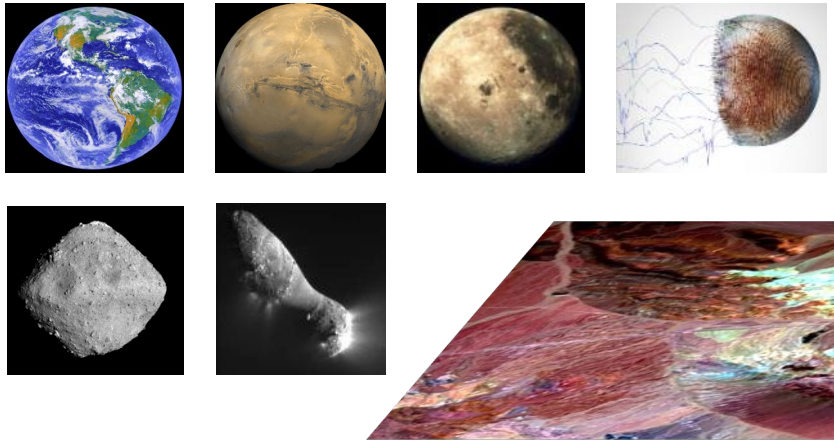
Material Map

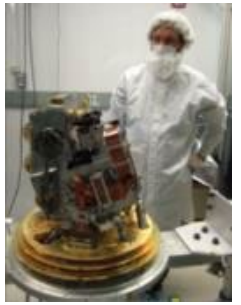


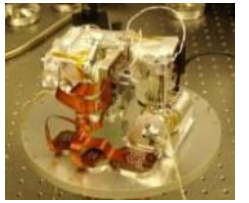
Quantifiable Units and Uncertainties

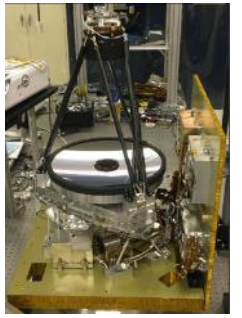
Minerals

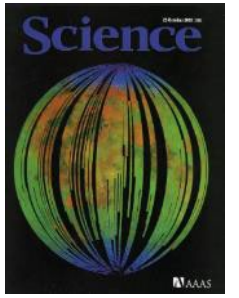










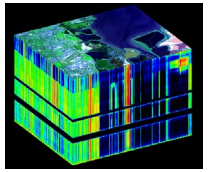


Each imaging spectrometer is different based on requirements and technologies.

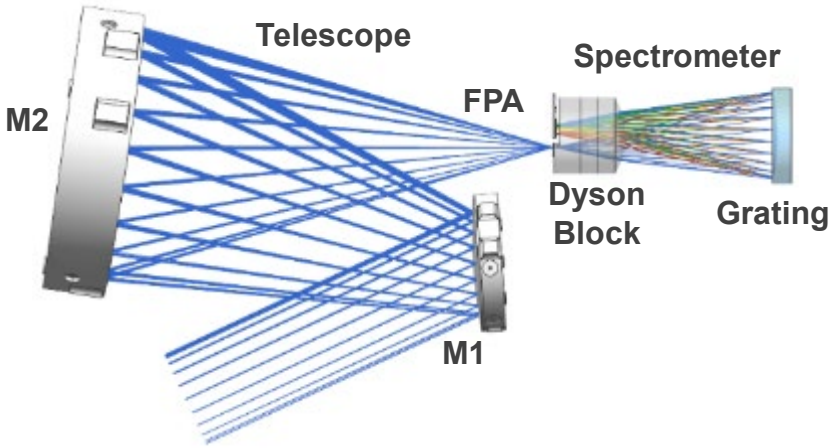
Three decades of NASA Imaging Spectrometers. Google Scholar >35,000 results on "AVIRIS"

The EMIT Imaging Spectrometer is State-of-the-Art (41 Months)

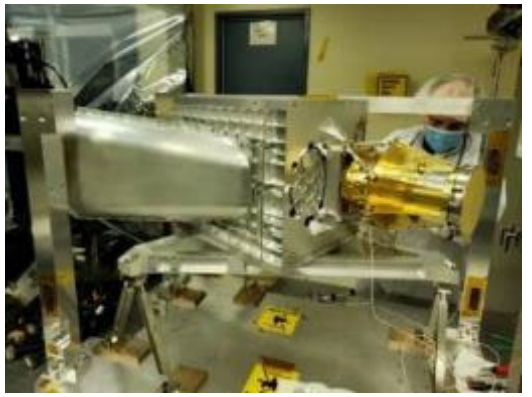
Decades of Lesson Incorporated: Signal-to-Noise Ratio, Uniformity, Coverage…



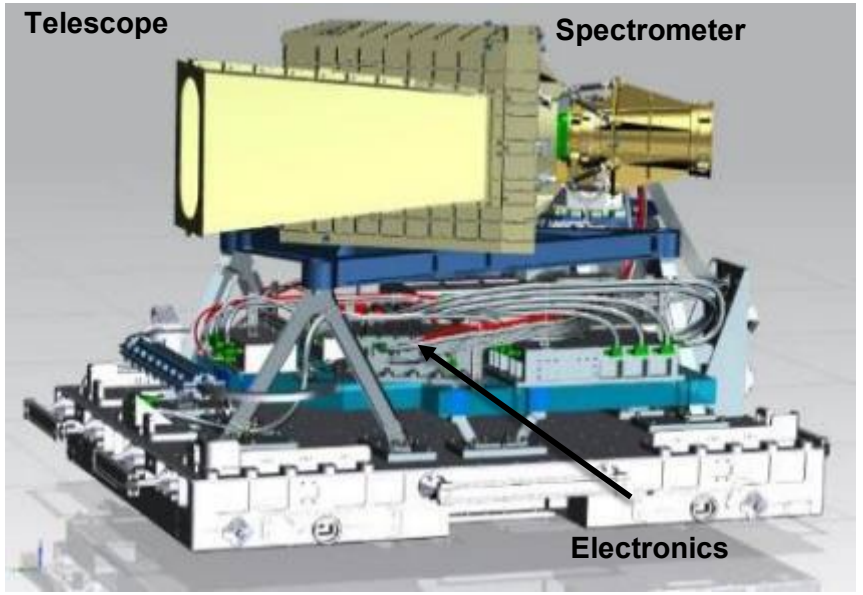
Optically Fast F/1.8 Dyson Imaging Spectrometer



Optical Bench

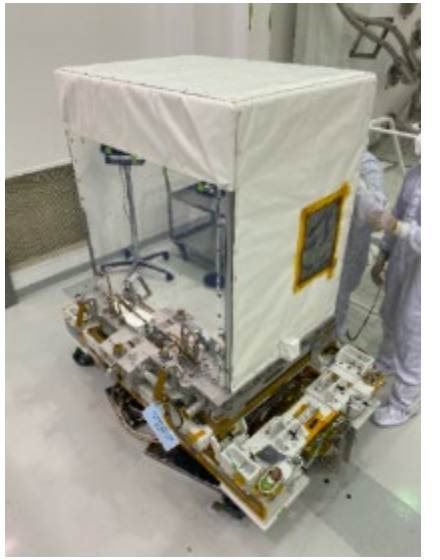


Alignment

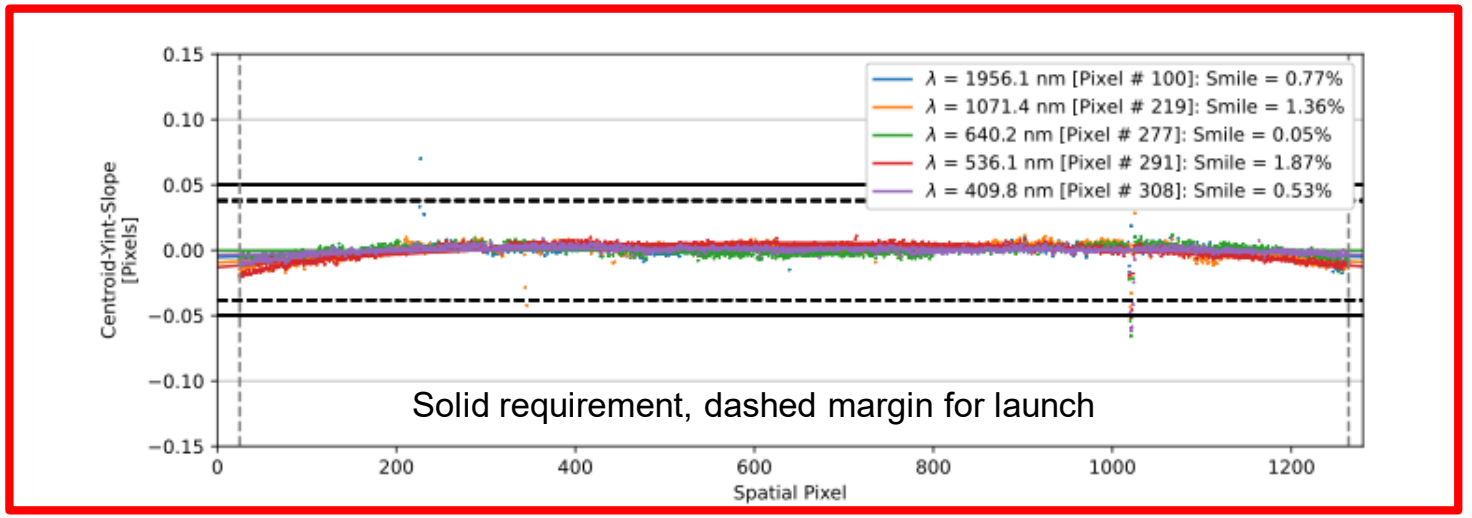


On the ExPA

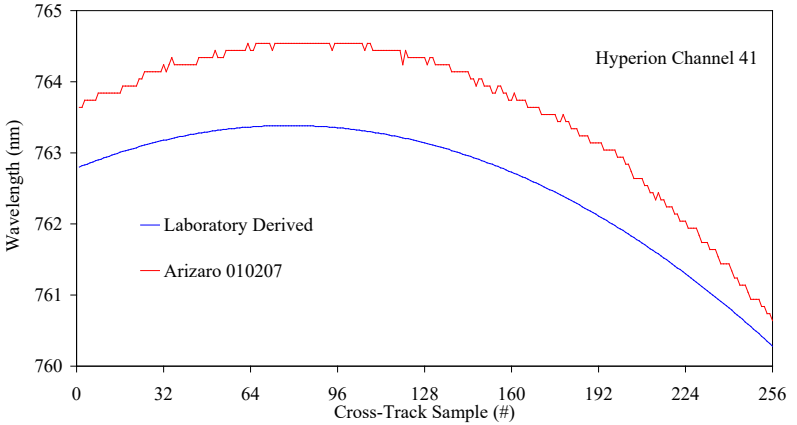
Complete at JPL



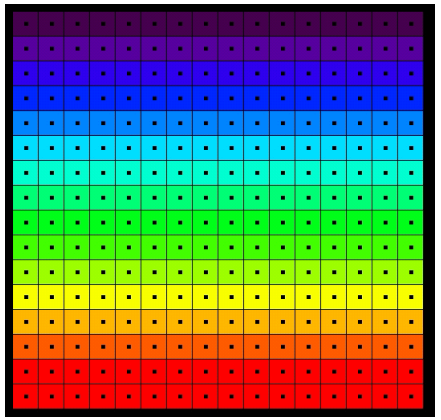
EMIT Alignment is Excellent: Achieved <2% versus Requirement <10% Non Uniformity



Hyperion Earth > 40%



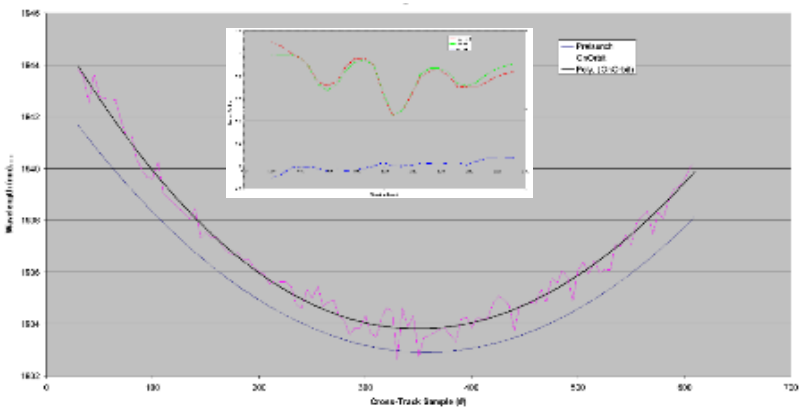
Laboratory and on orbit determination (red)



Requirement

EMIT has effectively 1240 parallel spectrometers. With this alignment each spectrometer has the same spectral calibration at better than 2%. This alignment enables the most advanced spectroscopic algorithms of the type used by EMIT.

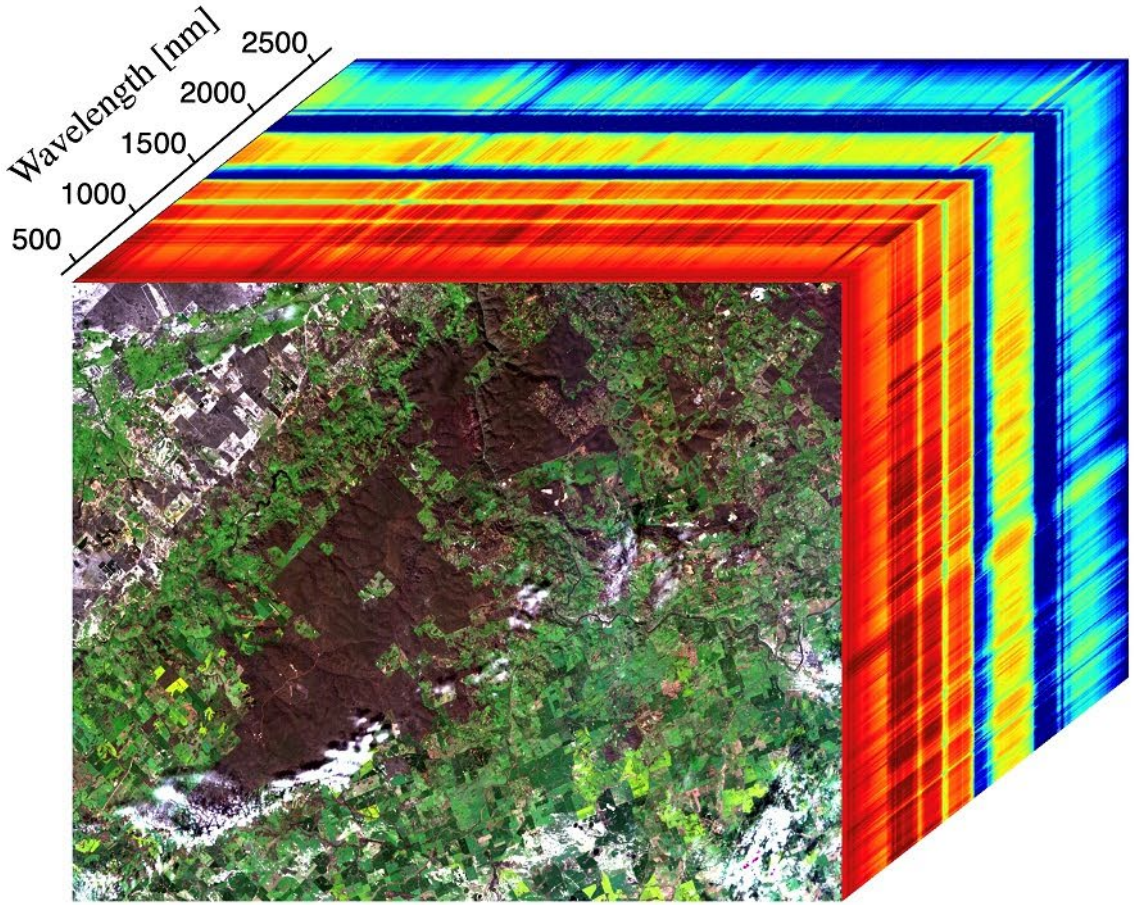
CRISM Mars >100%

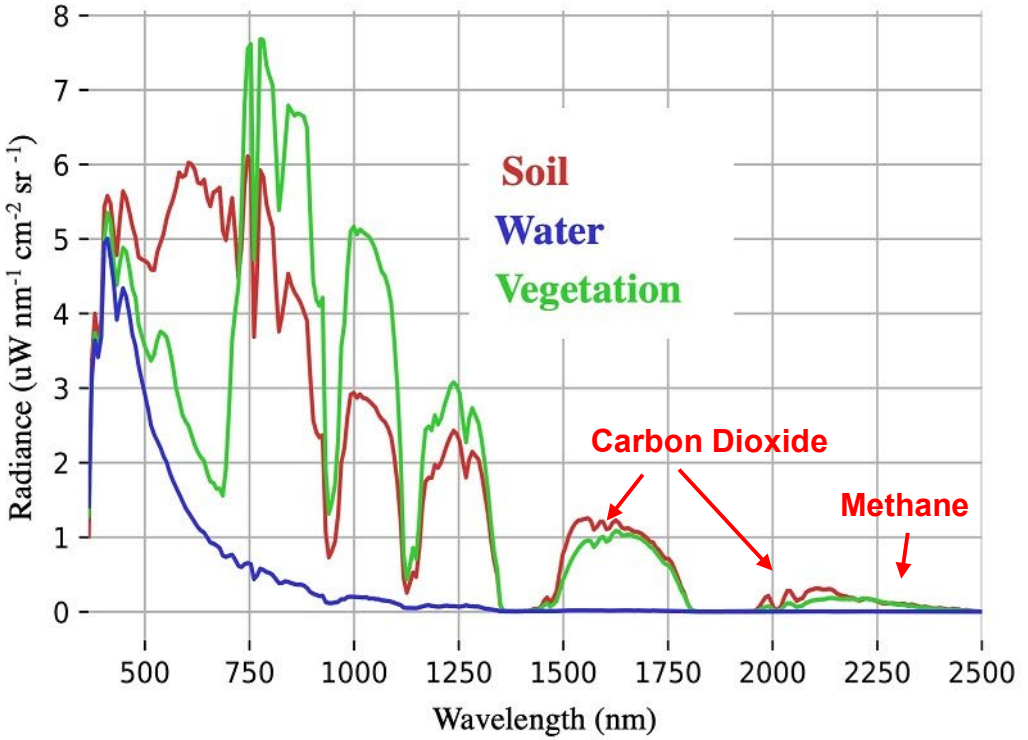


Laboratory and on orbit determination (red)

This was achieved in 2 versus 6 planned cycles

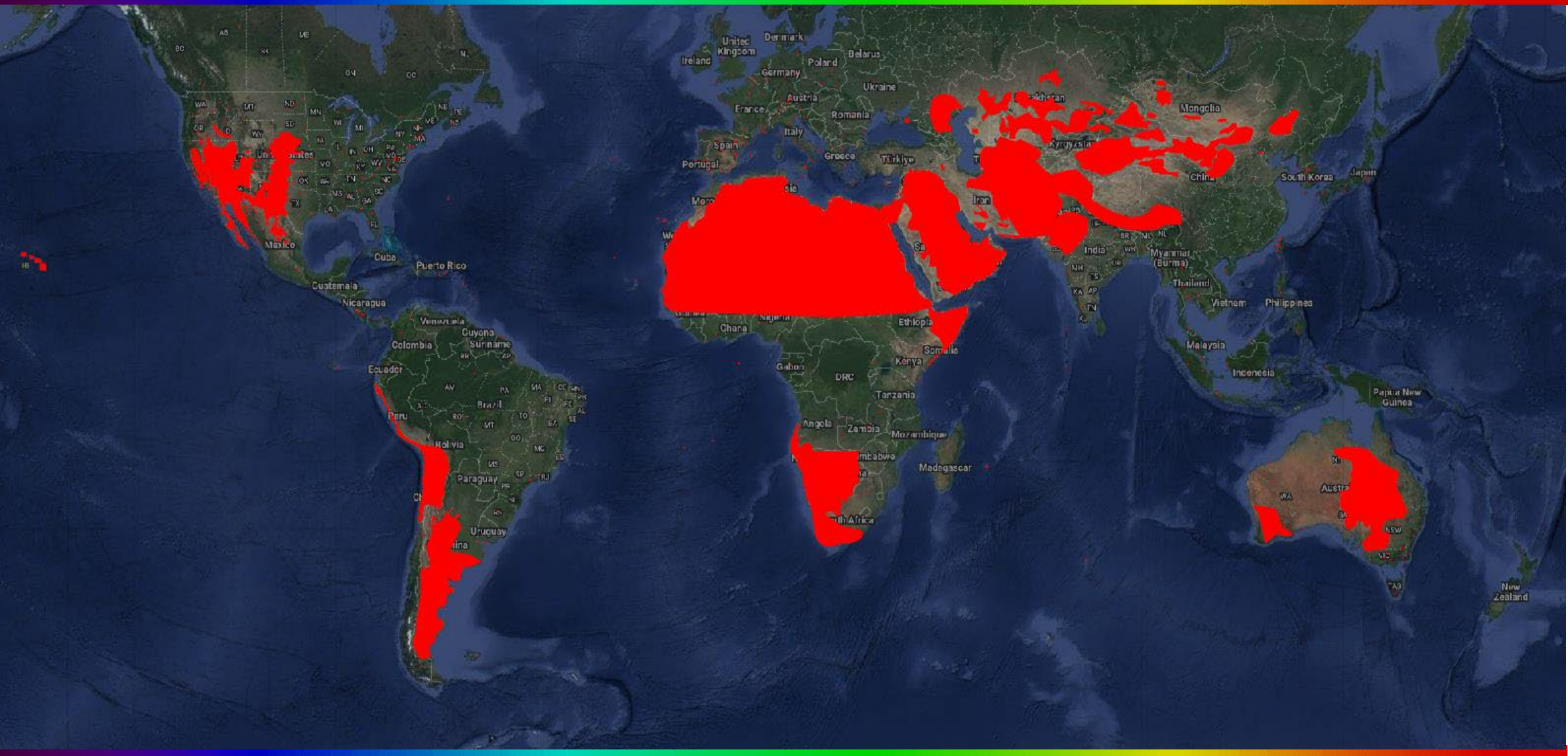
EMIT First Spectral Light 15:21 UTC, 28 July 2022
North of Perth, Australia





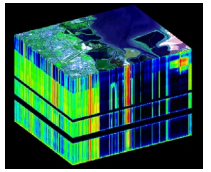
Spectral, radiometric, spatial, and uniformity characteristics meet or exceed expectations.

Current Arid Land Target Mask Through November 2023

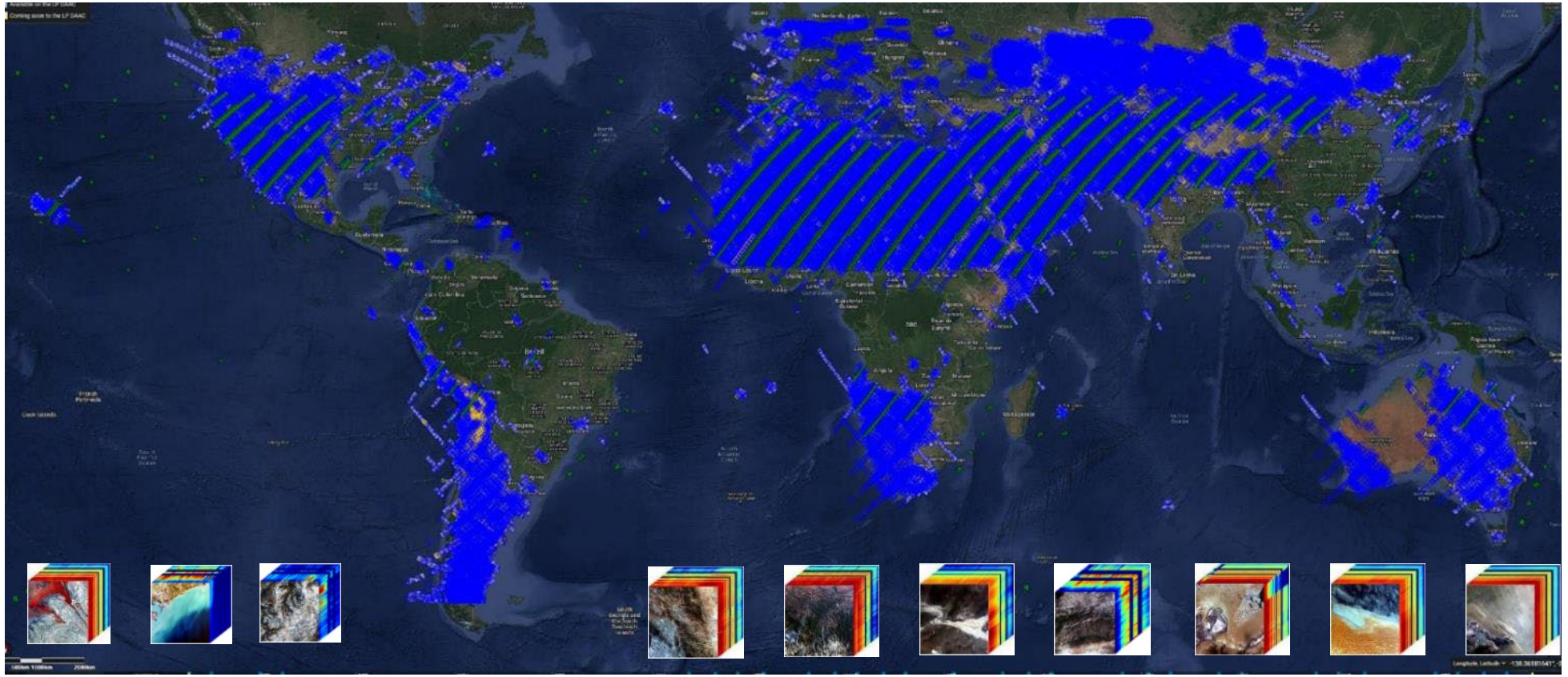


EMIT Measurements

https://earth.jpl.nasa.gov/emit/data/data-portal/coverage-and-forecasts/

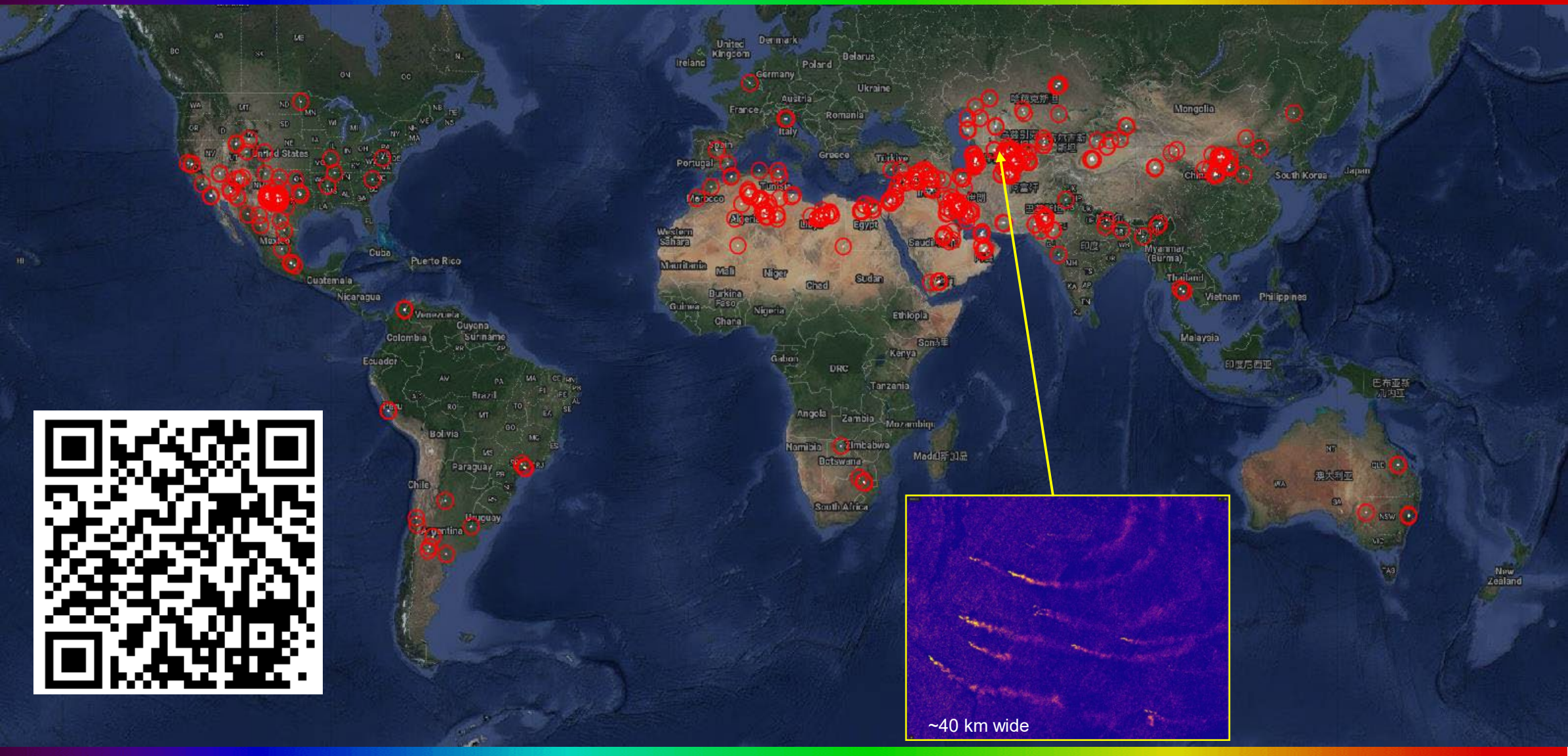


- Over 50,000 scenes collected (Radiance, Reflectance, Minerology, Global Maps)
- Over 200,000 files / 80 TB of data delivered to users from NASA LP DAAC
- Typical deliveries within one week of acquisition (2 month requirement), and within two days after downlink

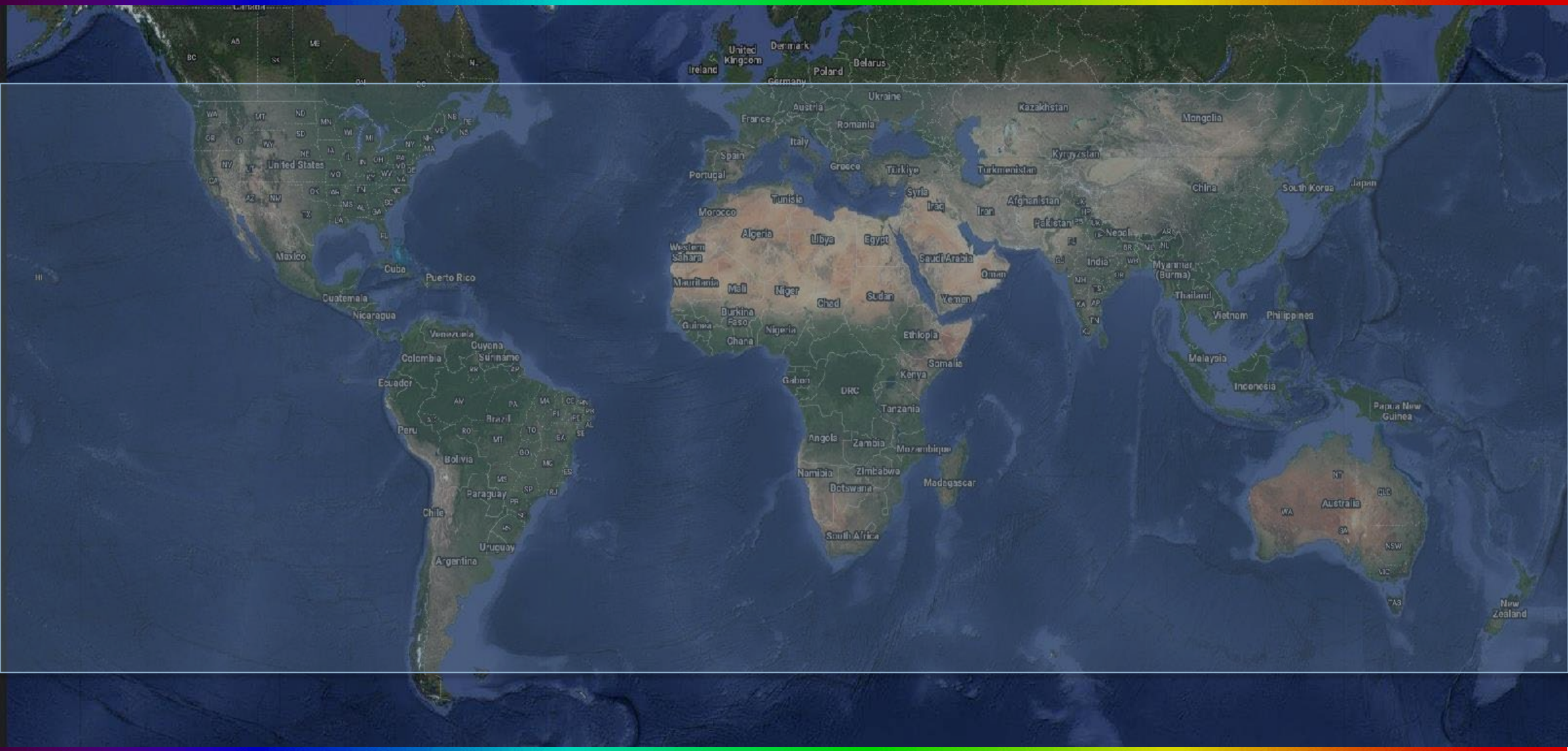


Hundreds of Methane Plumes

Supporting the U. S. Greenhouse Gas Center

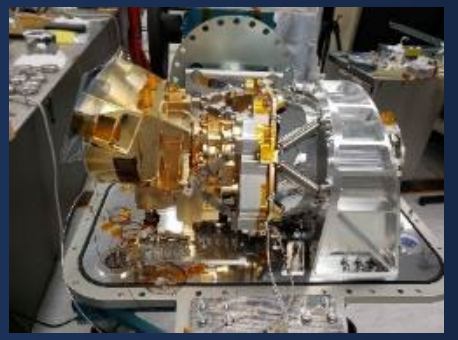


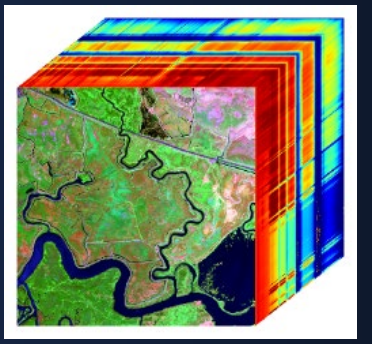
EMIT Future Potential Observations Below the ISS Orbit in an Extended Mission

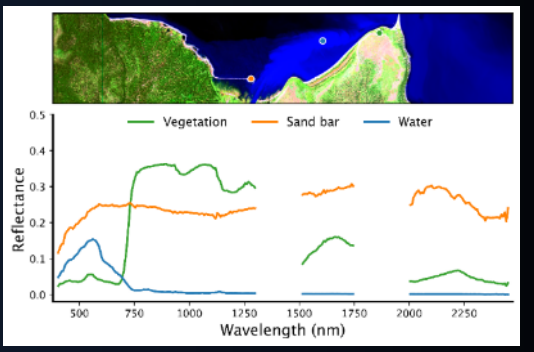


AVIRIS-3 State-of-the-Art Earth System and CH_4 Measurement

Parameter	AVIRIS-3
Swath samples	1240
Swath angle	40° FOV
Ground sample distance (GSD)	0.3-20 m
SNR @ 2200 nm	>1200







First flights began in July 2023; CH_4 plumes have been observed across emission sectors