



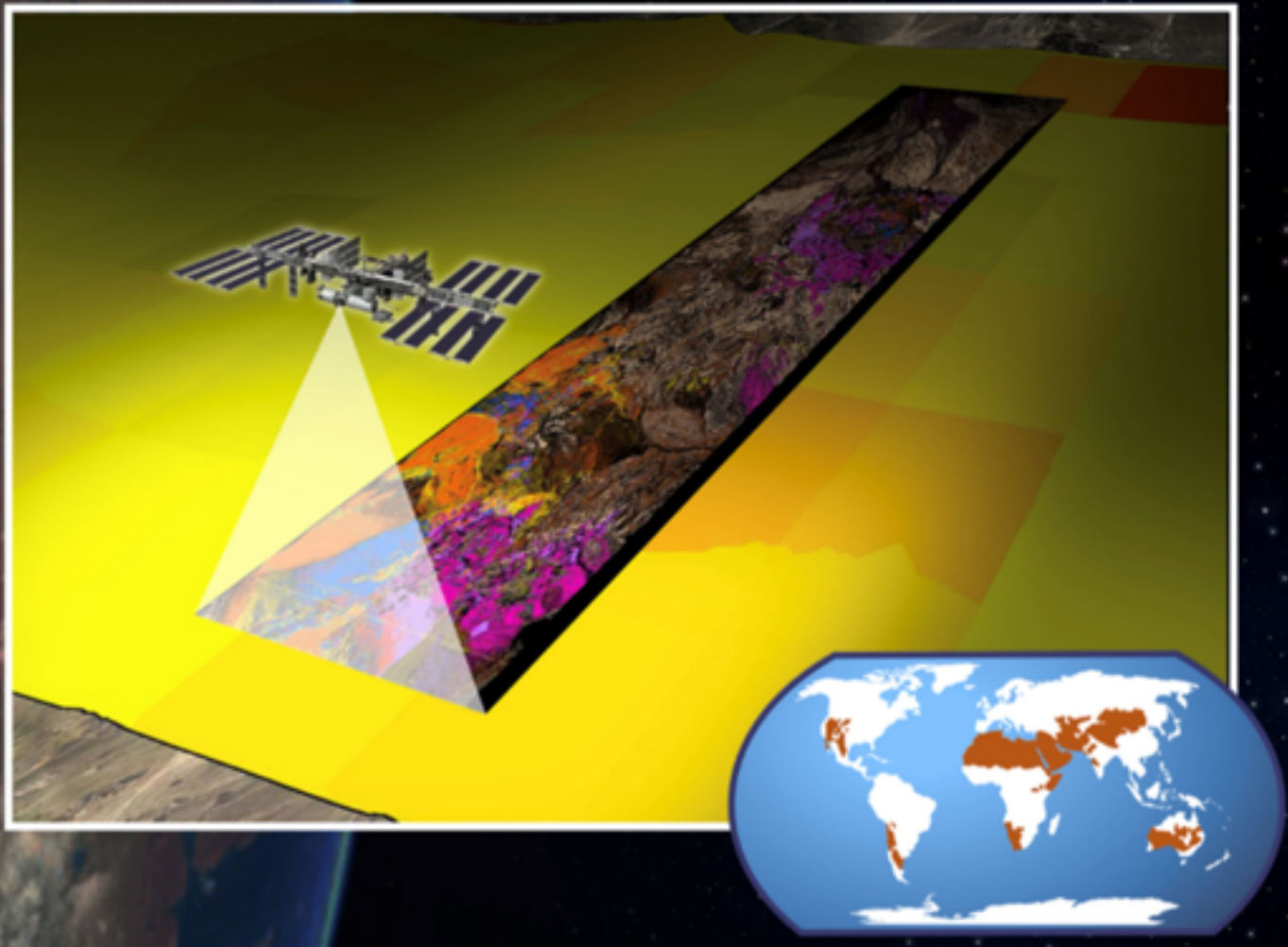
# EARTH SURFACE MINERAL DUST SOURCE INVESTIGATION (EMIT)

PERFORMANCE AND EARLY RESULTS FROM THE  
EARTH SURFACE MINERAL DUST SOURCE  
INVESTIGATION (EMIT)

19 OCTOBER 2022

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AND TEAM

JET PROPULSION LABORATORY,  
CALIFORNIA INSTITUTE OF TECHNOLOGY





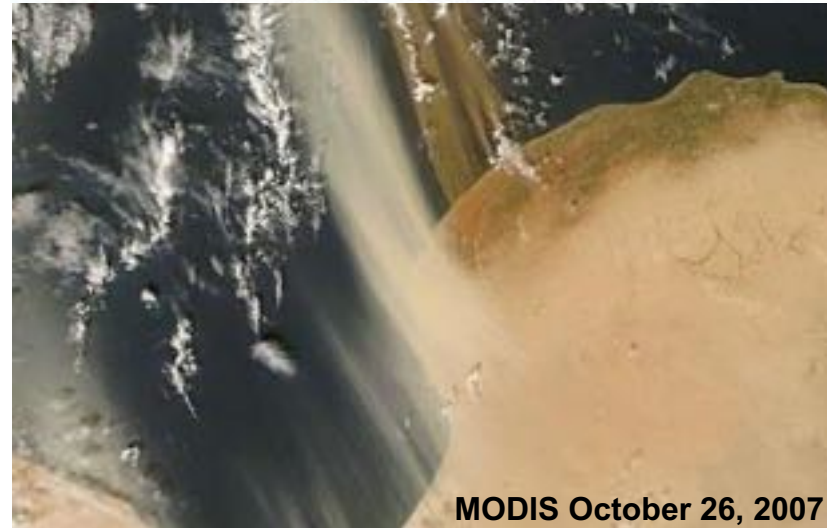
# EMIT Science Objectives and Approach



**23 June 2020 African Dust Storm reached the U.S.**



23 Jun 2020 12:06Z NOAA/NESDIS/STAR GOES-East GEOCOLOR



MODIS October 26, 2007

**1) Constrain the sign and magnitude of dust-related RF at regional and global scales.**

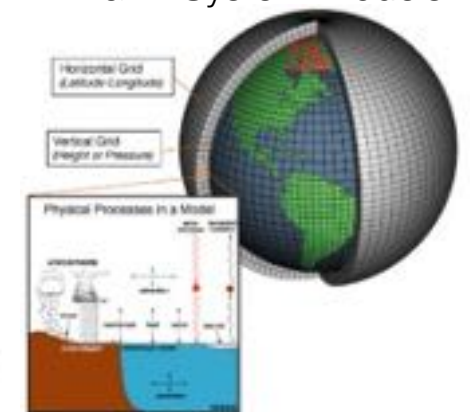
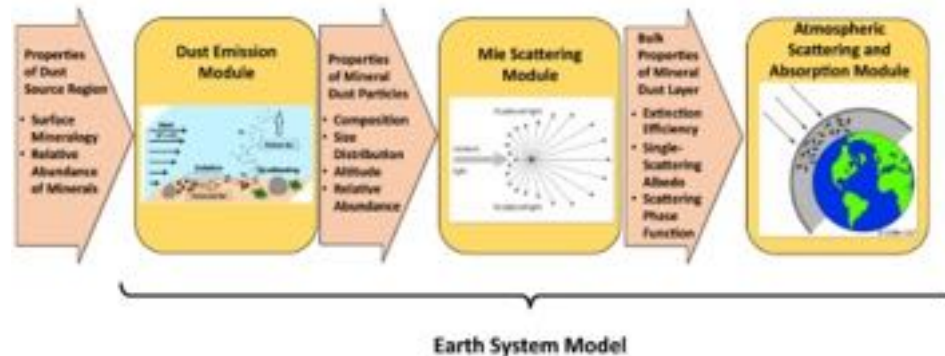
EMIT achieves this objective by acquiring, validating and delivering updates of surface mineralogy used to initialize Earth System Models.

**2) Predict the increase or decrease of available dust sources under future climate scenarios.**

EMIT achieves this objective by initializing Earth System Model forecast models with the mineralogy of soils exposed within at-risk lands bordering arid dust source regions.



Earth System Models

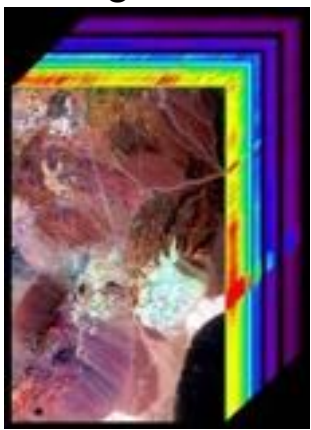


EMIT will deliver >1 billion new dust source observations to update advanced Earth System Models.

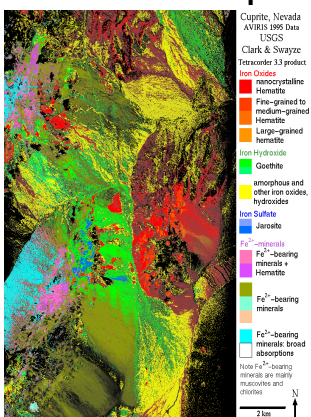


# From the ISS, EMIT uses Imaging Spectroscopy to Measure the Mineral Composition of the Earth's Arid Lands

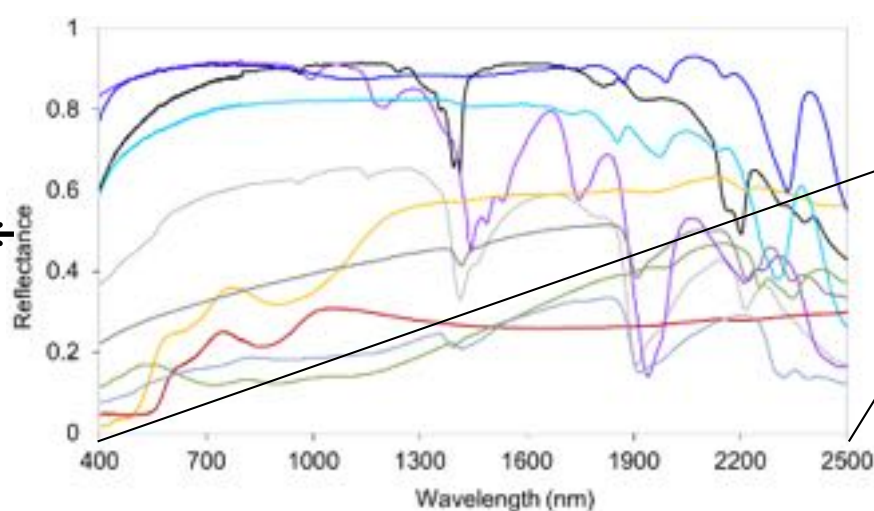
Calibrated Image Cube



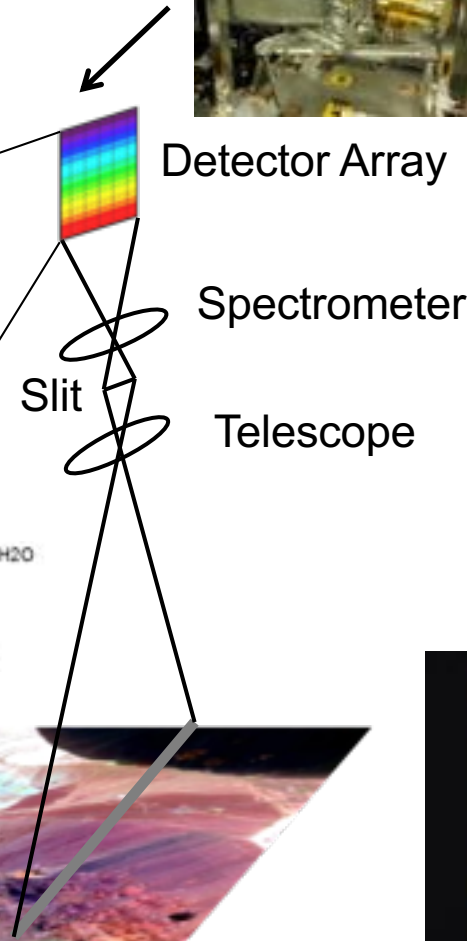
Mineral Map



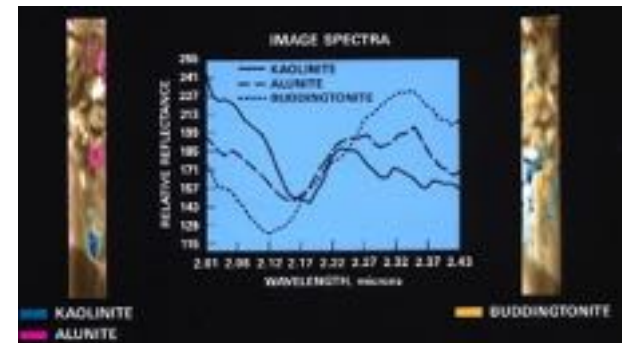
## Mineral Spectral Signatures



EMIT



1982 First Imaging Spectrometer (AIS)



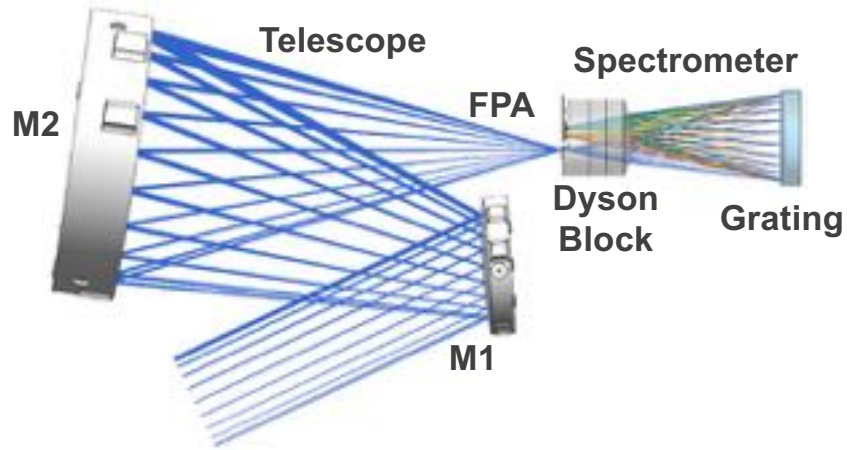


# The EMIT Imaging Spectrometer is State-of-the-Art (41 Months)

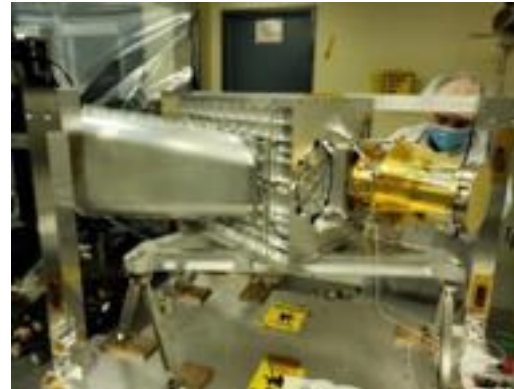
Decades of Lesson Incorporated: Signal-to-Noise Ratio, Uniformity, Coverage...



**Optically Fast F/1.8** Dyson Imaging Spectrometer



Optical Bench



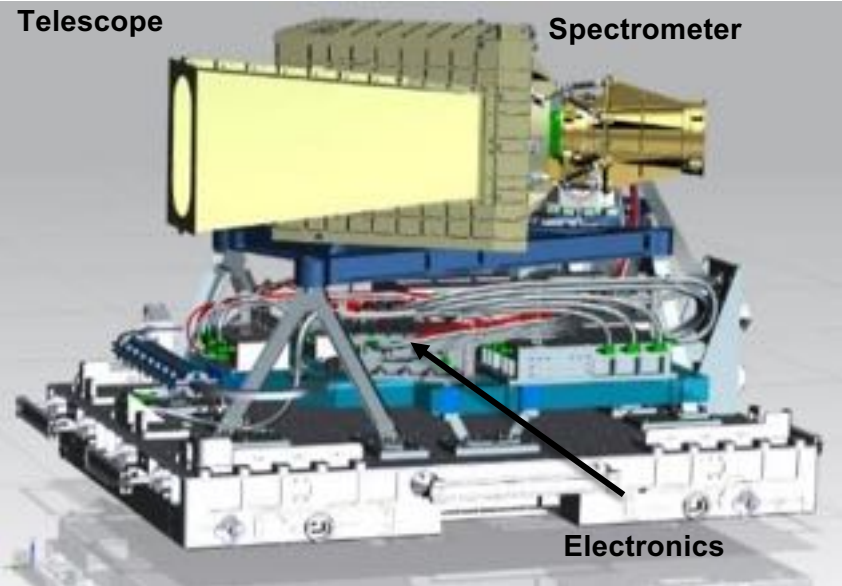
Alignment



On the ExPA



Complete at JPL

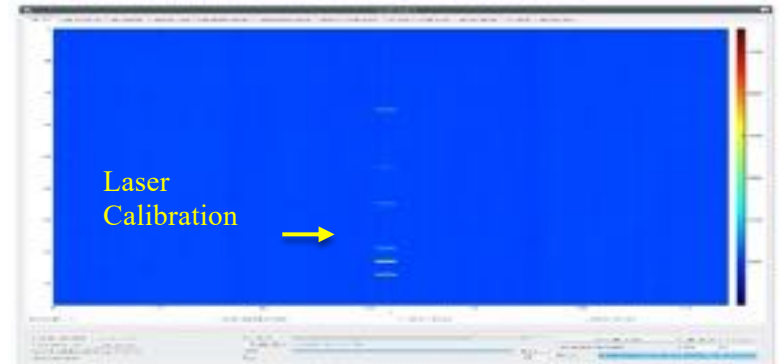




# EMIT Aligned and Calibrated for Science



Live EMIT Spectra with Dr. Christine Bradley  
EMIT Optic Lead 20210817

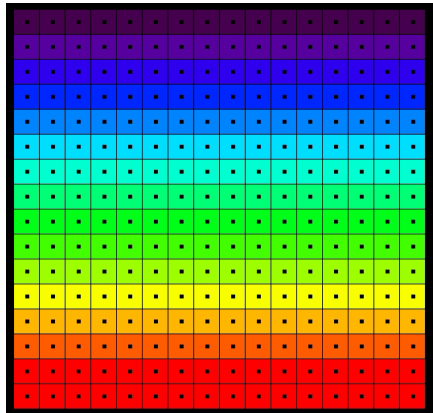
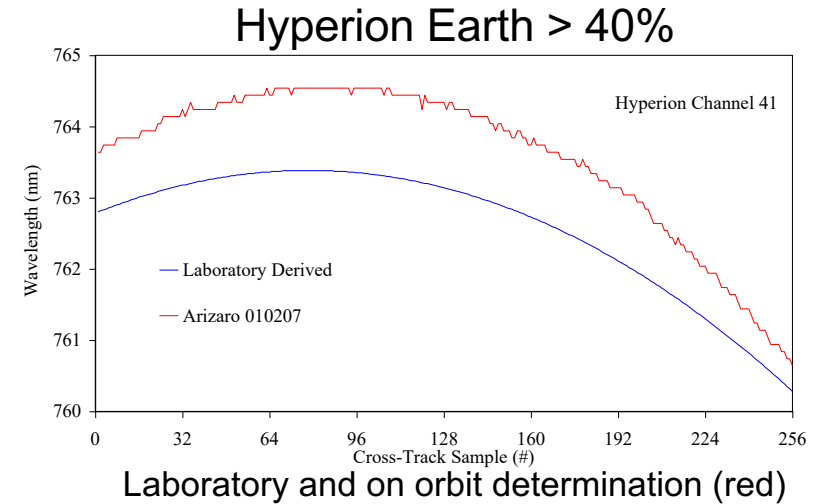
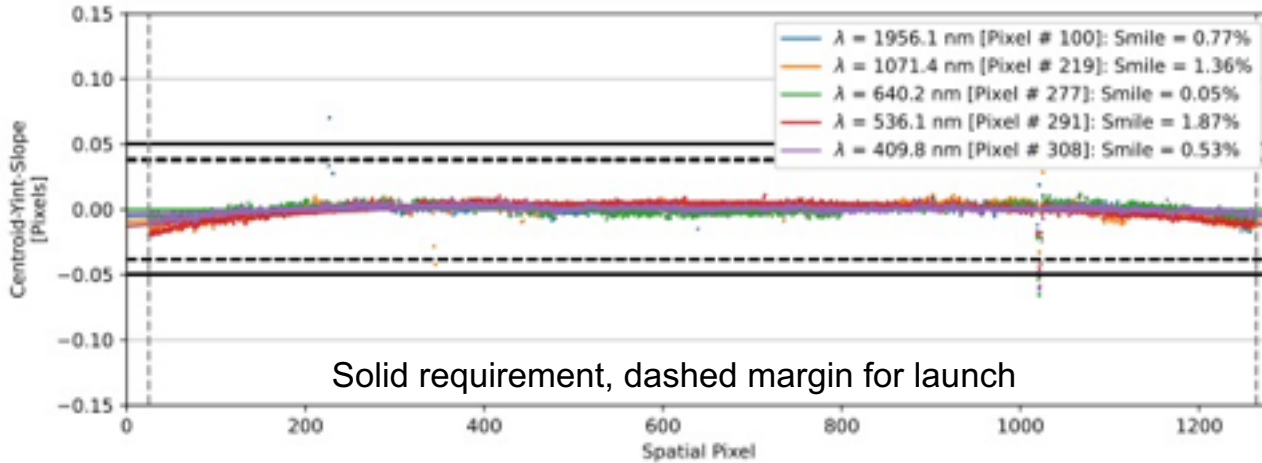


Spectral and spatial response functions for alignment and calibration.



# EMIT Alignment is Excellent

## Achieved <2% versus Requirement <10% Non Uniformity



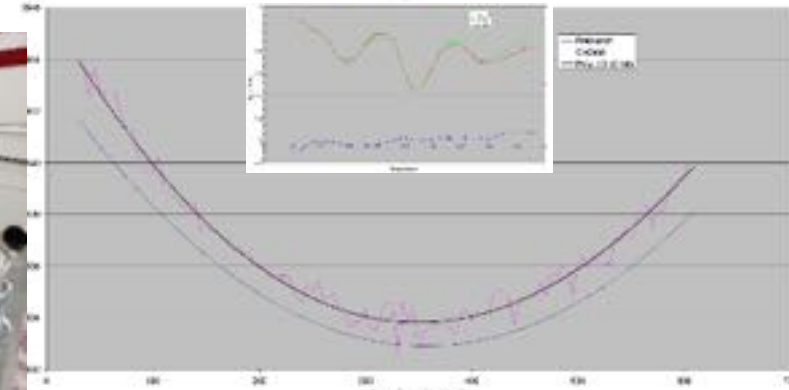
Requirement

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.

### EMIT Earth < 2%



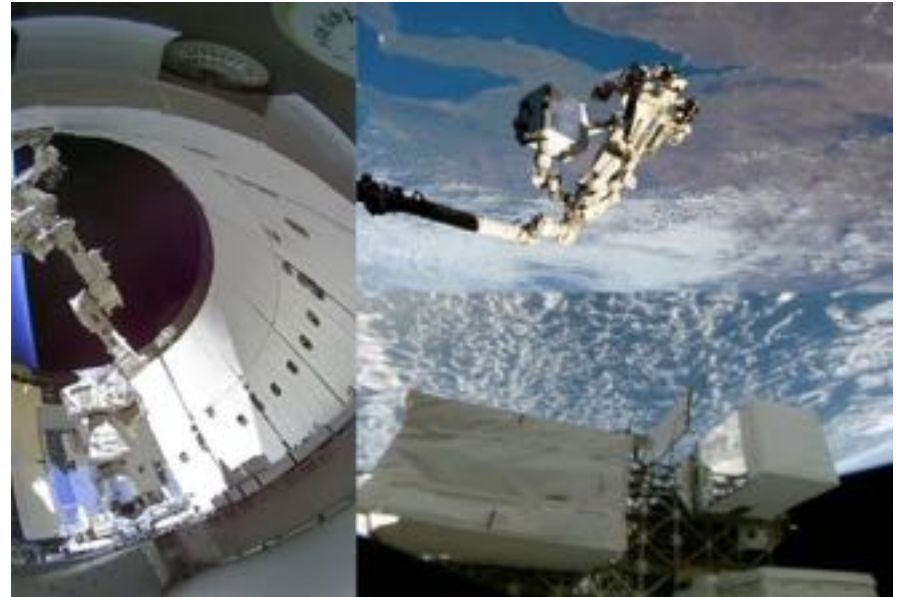
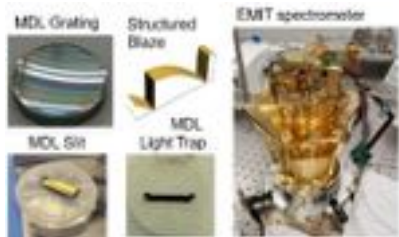
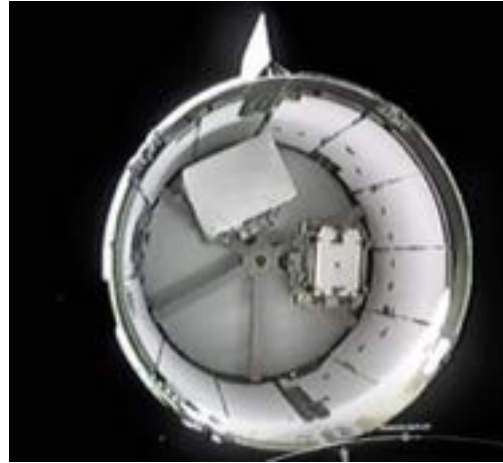
### CRISM Mars > 100%



EMIT alignment was achieved in 2 versus 6 planned cycles

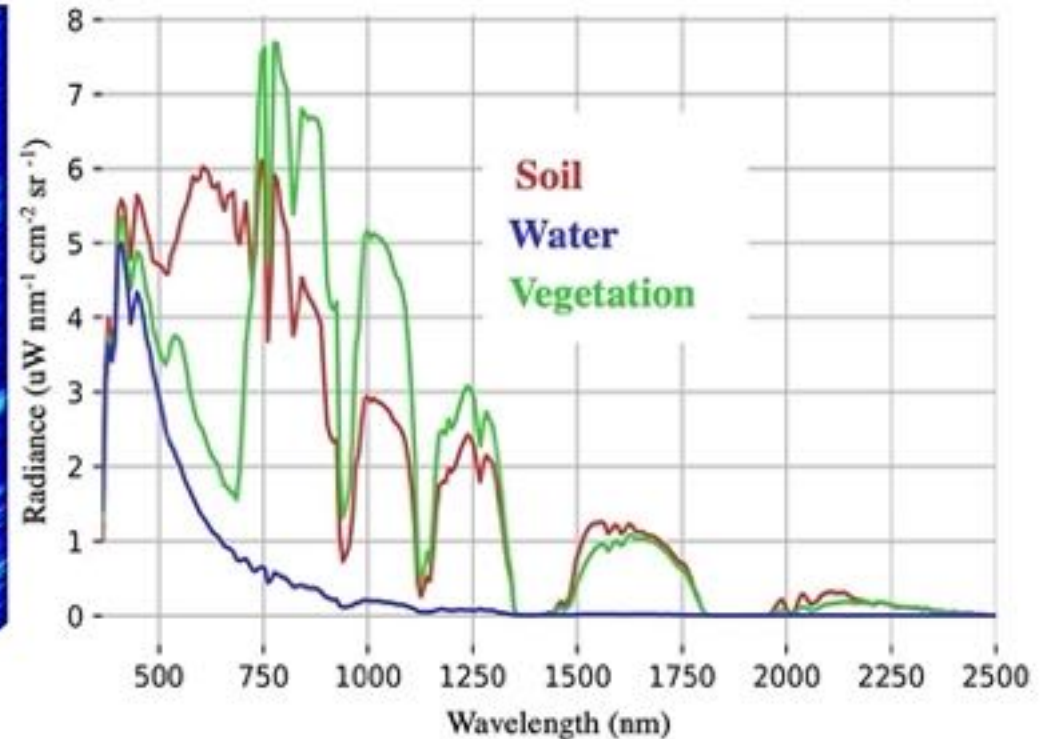
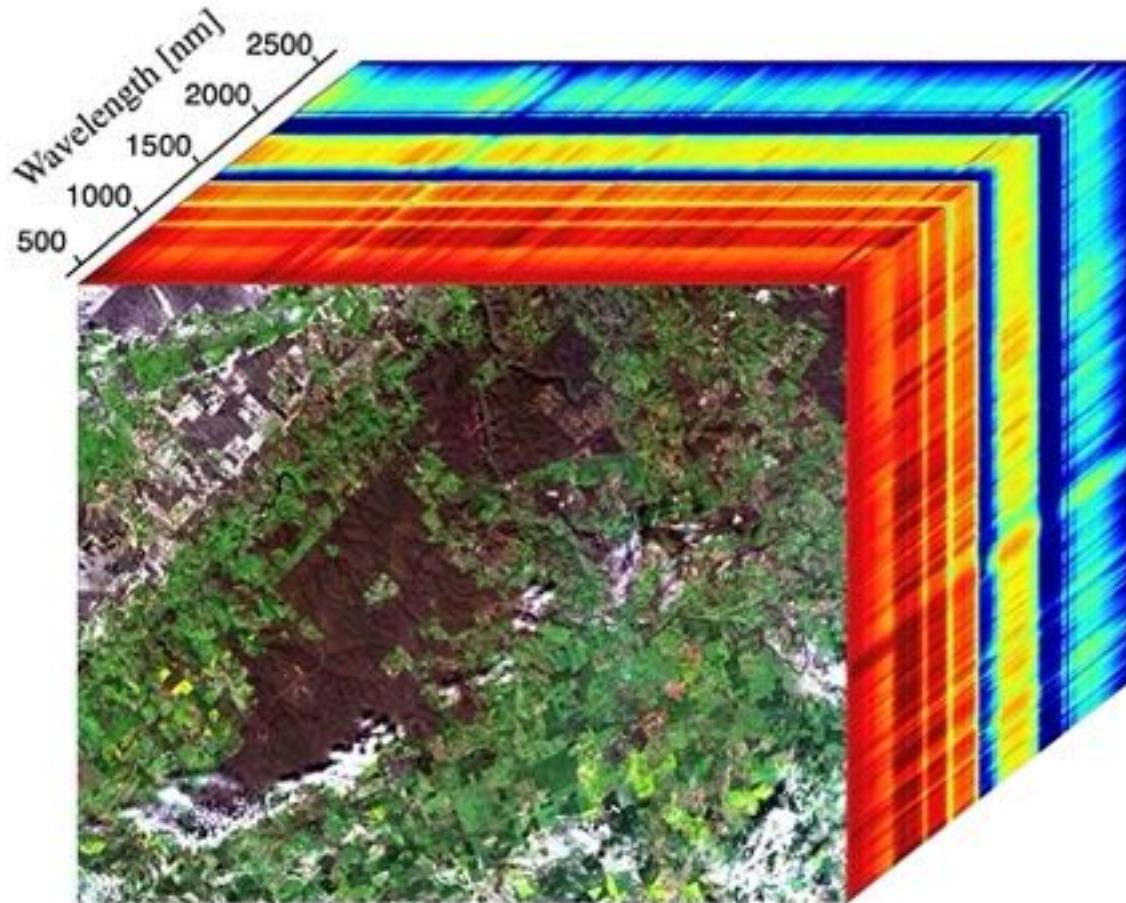


# EMIT: Launch, Docking, and Installation (14, 16, 24 July)





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



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

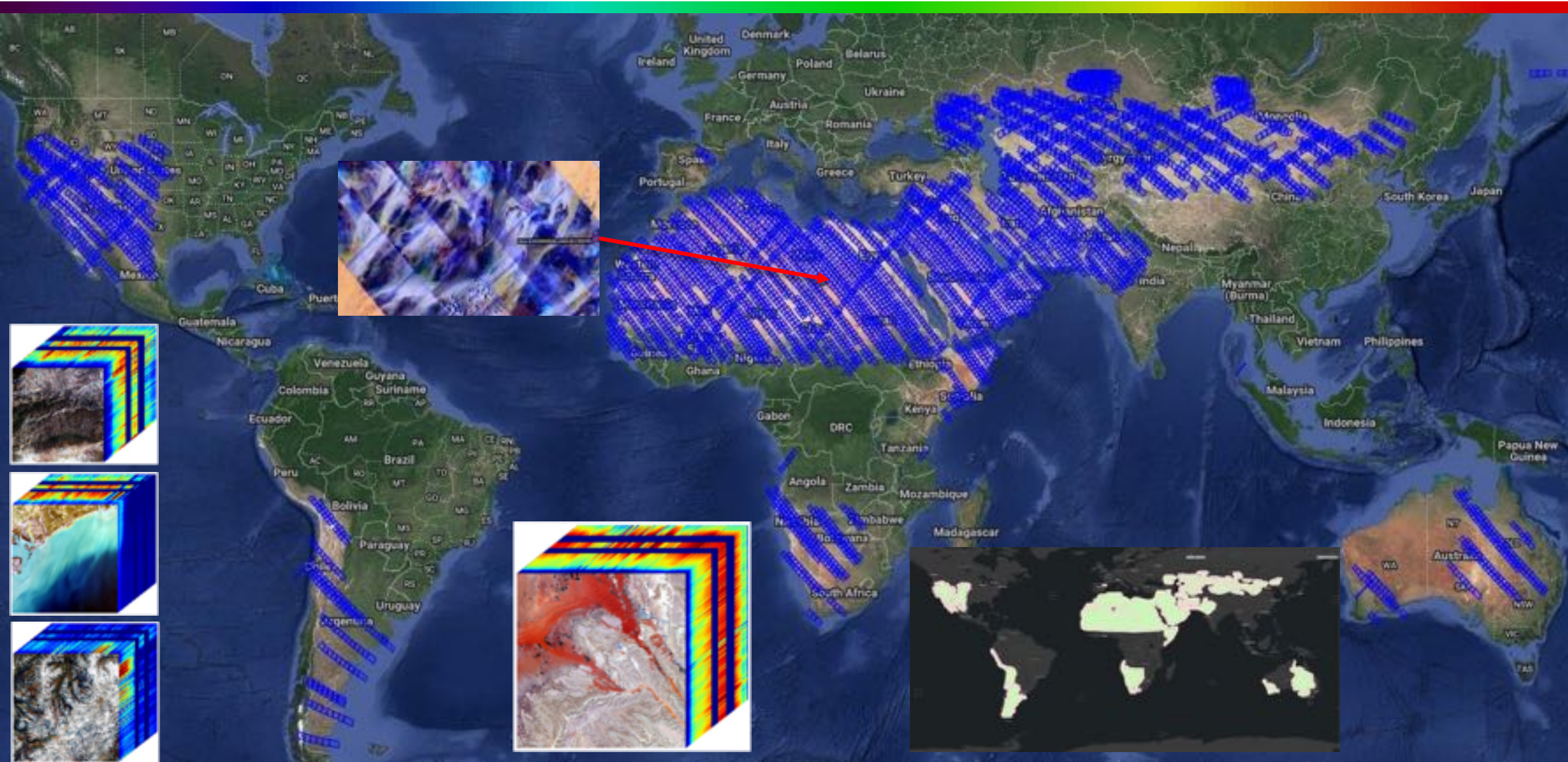




# EMIT Early Coverage from the ISS

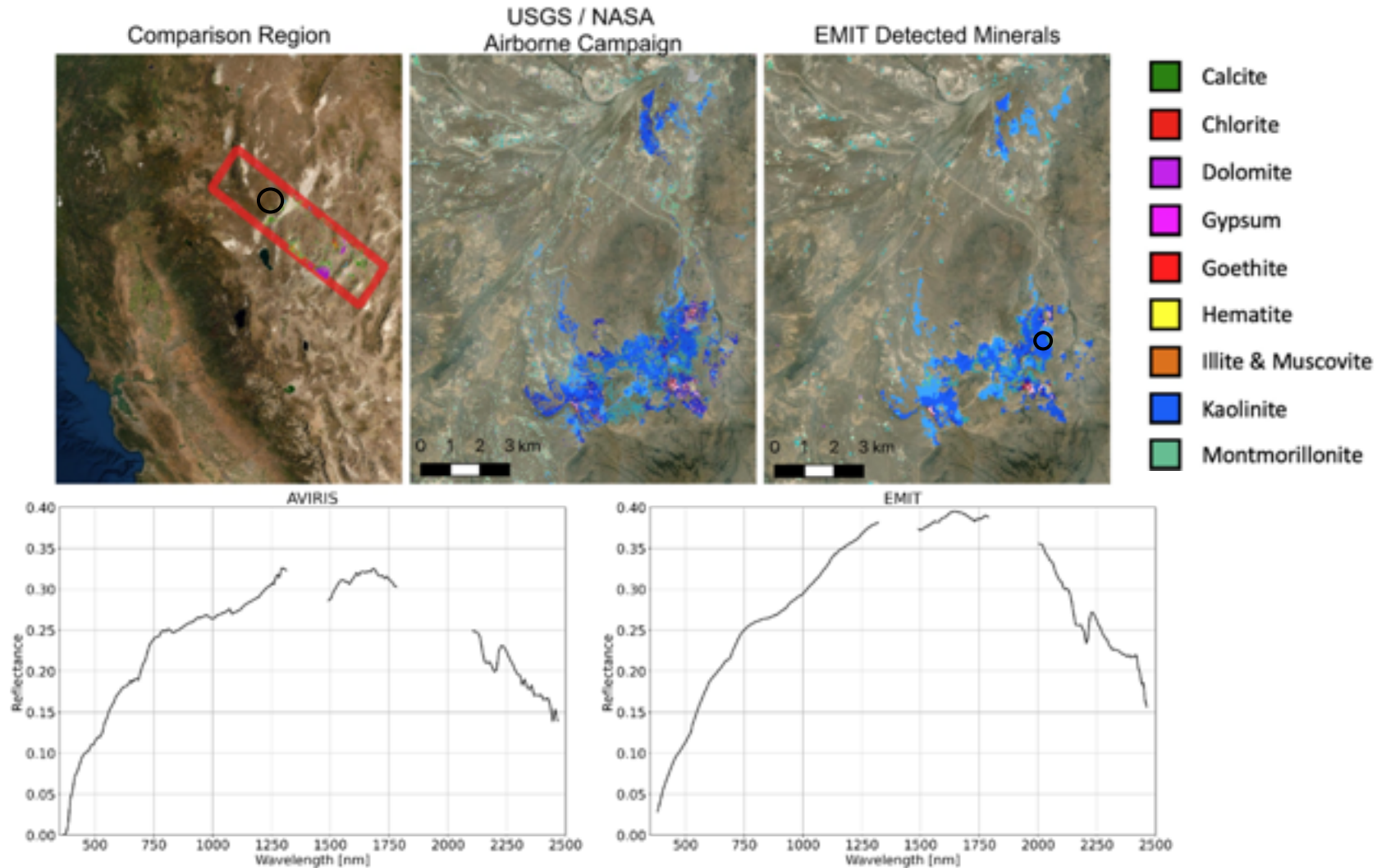


Multiple Observations are Needed to have Cloud Free/Usable Measurements

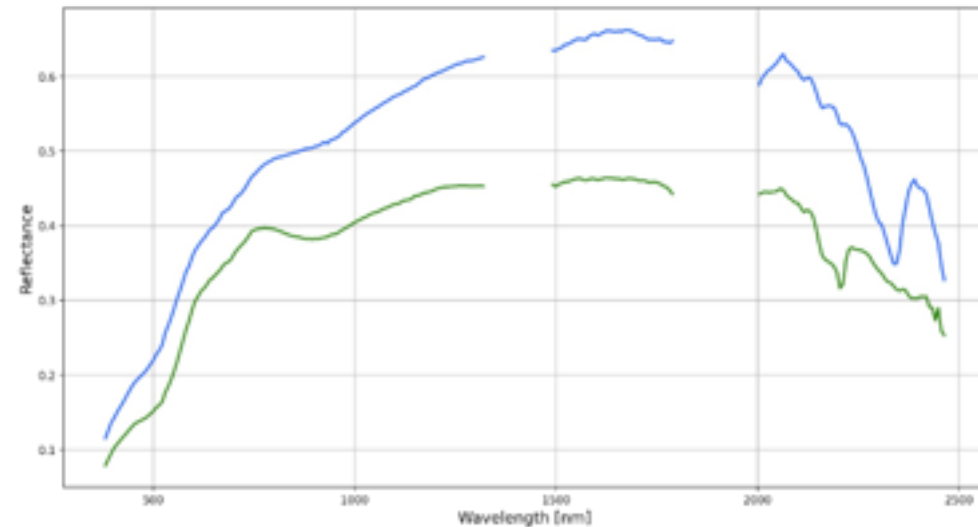
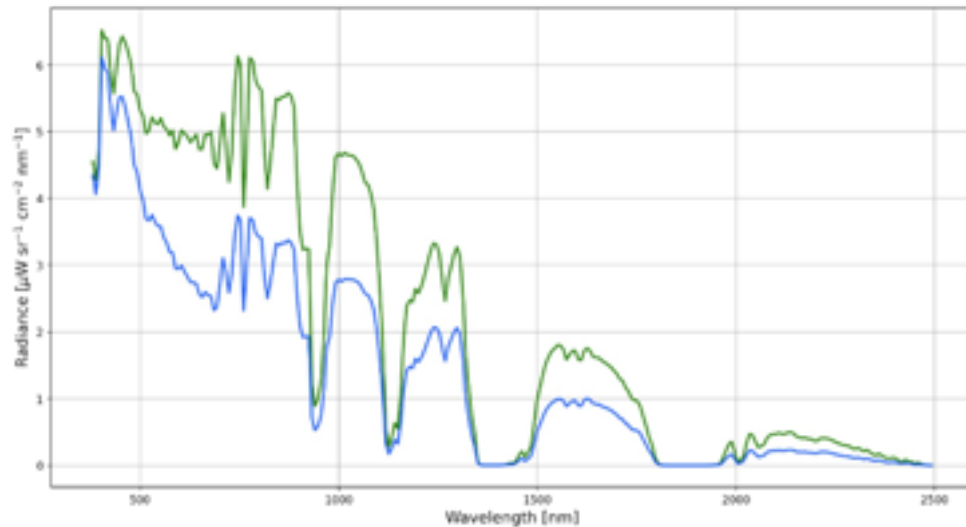
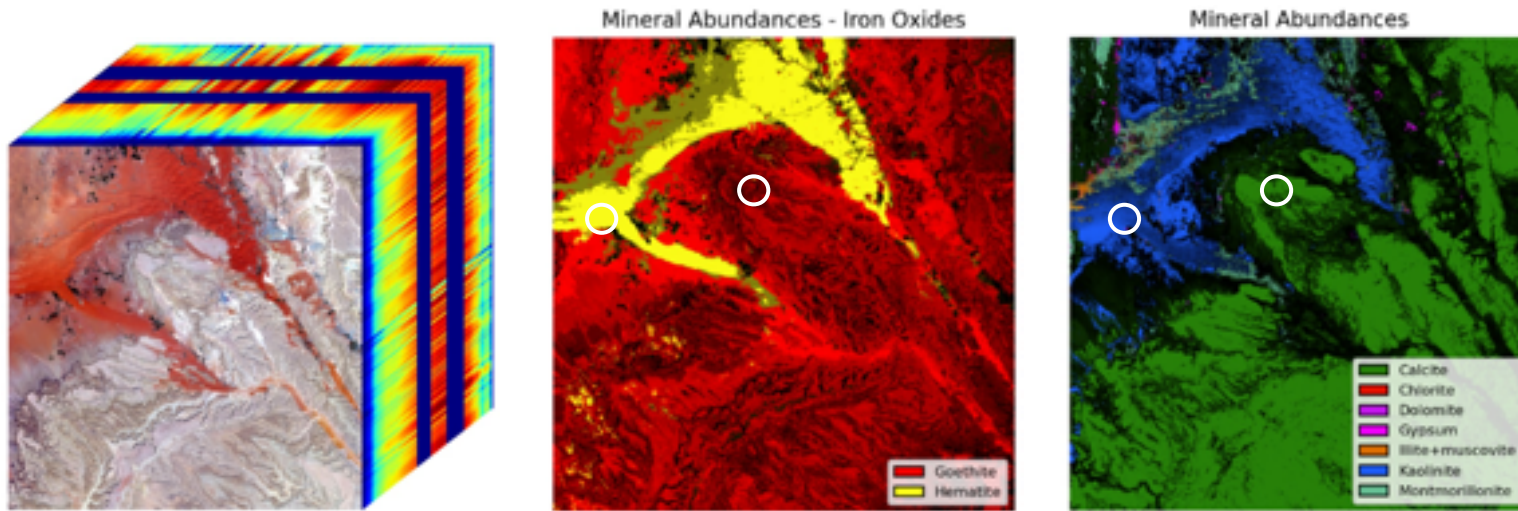




# EMIT Mineral Validation with NASA AVIRIS Airborne and USGS Field Data



# Key Radiative Forcing Iron Oxides in Northern Africa





# EMIT is On Track to Achieve its Science Objectives with Margin

## Launch 14 July, First light 28 July



### Science Goal

Close the gap in our understanding of mineral dust heating or cooling of the Earth now and in the future.

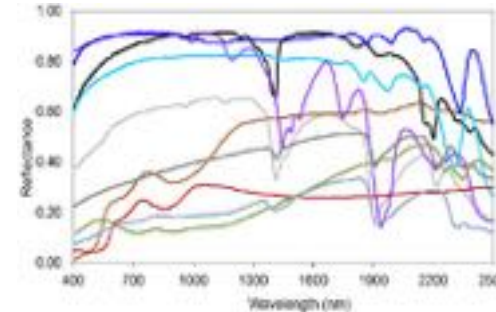
### Mineral Dust Emission



### Dust Source Regions



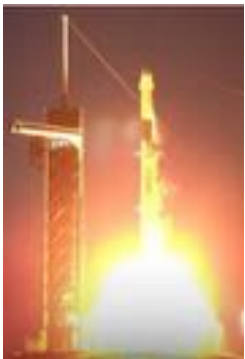
### Advanced Spectroscopy



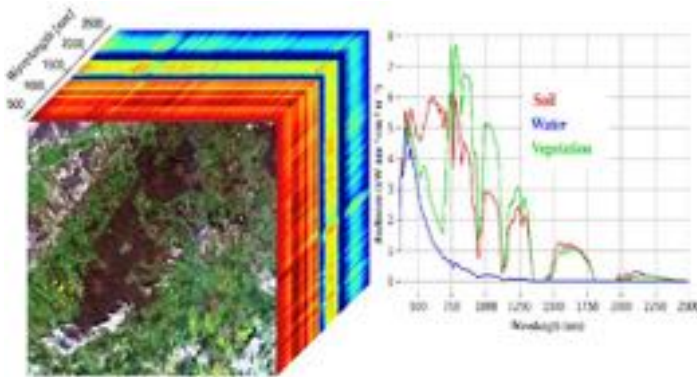
### Global Arid Land Mineral Composition



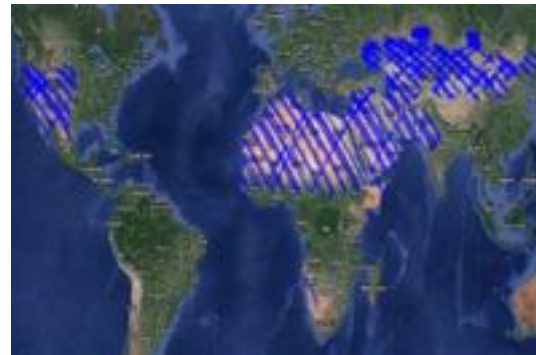
### Launch 14 July 2022



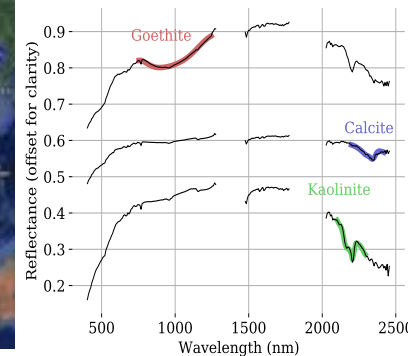
### First Light 28 July 2022 Meets or Exceeds all Expectations



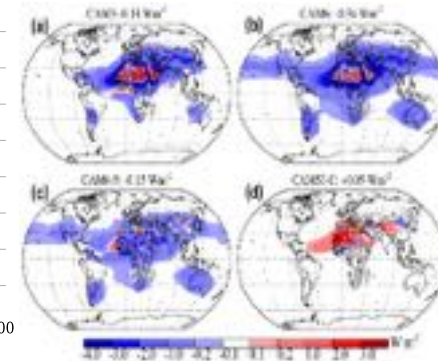
### Building Coverage EMIT to Achieve Science



### Mineral Mapping with EMIT Spectra



### Next Step Initialize Earth Models



### Science Objectives

- 1) Constrain the sign and magnitude of dust-related RF at regional and global scales.
- 2) Predict the increase or decrease of available dust sources under future climate scenarios.

Thank You  
Question?

