National Aeronautics and Space Administration

EARTHDATA

Exploring Earth's Surface Through Remote Sensing

Earth Educators' Rendezvous
Monday, July 15, 2024, 1:30pm-4:00pm ET

Elizabeth R. Joyner, Earth Science Data Systems, Community Coordinator

Mike P. Taylor, NASA Landsat Communications and Public Engagement, Earth Outreach Scientist

Today's Schedule

1:30 - 2PM	Introductions, Goals, Housekeeping, IceBreaker
2-2:20PM	Introduction to Remote Sensing
2:20-3PM	STELLA
3-3:40PM	AppEEARS
3:40 - 4PM	Wrap Up & Share Out
4PM	Adjourn

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Welcome, Introductions, Housekeeping

Elizabeth & Mike

9 - 9:20 AM

Elizabeth Joyner

From SC

Marine Geologist

Government & NGO: NOAA, NASA, AGI

Elizabeth Joyner

Community Coordinator

AKA

Data Evangelist

Former Teacher & Researcher

Proud Wife and Mom of Two

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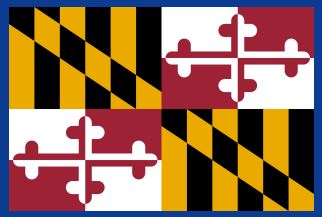
Mike Taylor

From Maryland



Husband,
Father of two,
GIS major

STELLA
Team Lead

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Enabling Earth Science Data to Serve Society

Earth Science to Action Strategy

Public Understanding & Exchange

- Put more scientific understanding into public sphere
- Deliver applied science to users
- Participate in multi-way info exchange
- Use input to inform subsequent work

Solutions & Societal Value

- Offer models, scientific findings and info through Open-Source Science principles
- Support climate services
- Provide science applications and tools to inform decisions

Earth System Science & Applied Research

- Grow scientific understanding of Earth's systems
- Develop predictive modeling for science applications and tools to mitigate, adapt and respond to climate change

Foundational Knowledge, Technology, Missions, & Data

- Technology innovation
- Earth observations missions
- Data collected from space, air and ground

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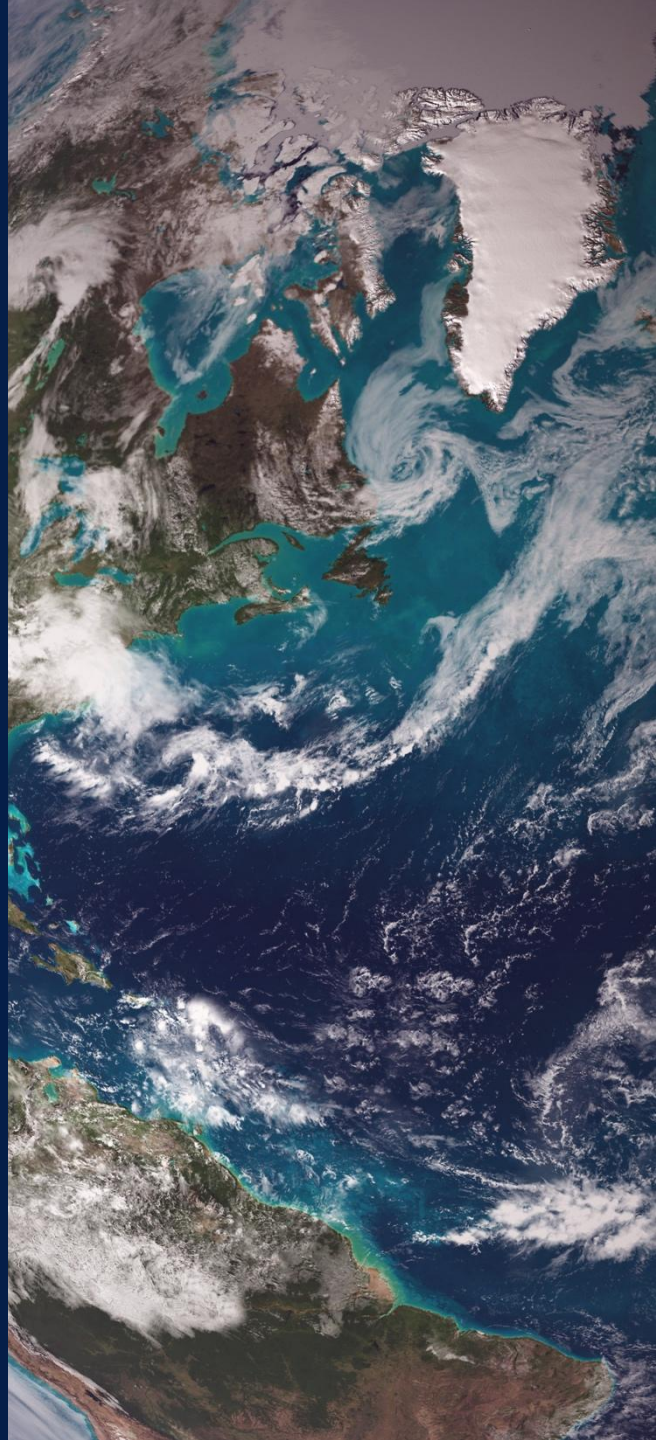
Credit: NASA

Outcomes

3.5 hours

1. ***Describe*** the basics of how remote sensing works and how this technology benefits humanity
2. ***Collect surface reflectance data using STELLA*** to evaluate how plants change over time and space
3. ***Explore*** the AppEEARS tool for accessing Landsat (and other) NASA data



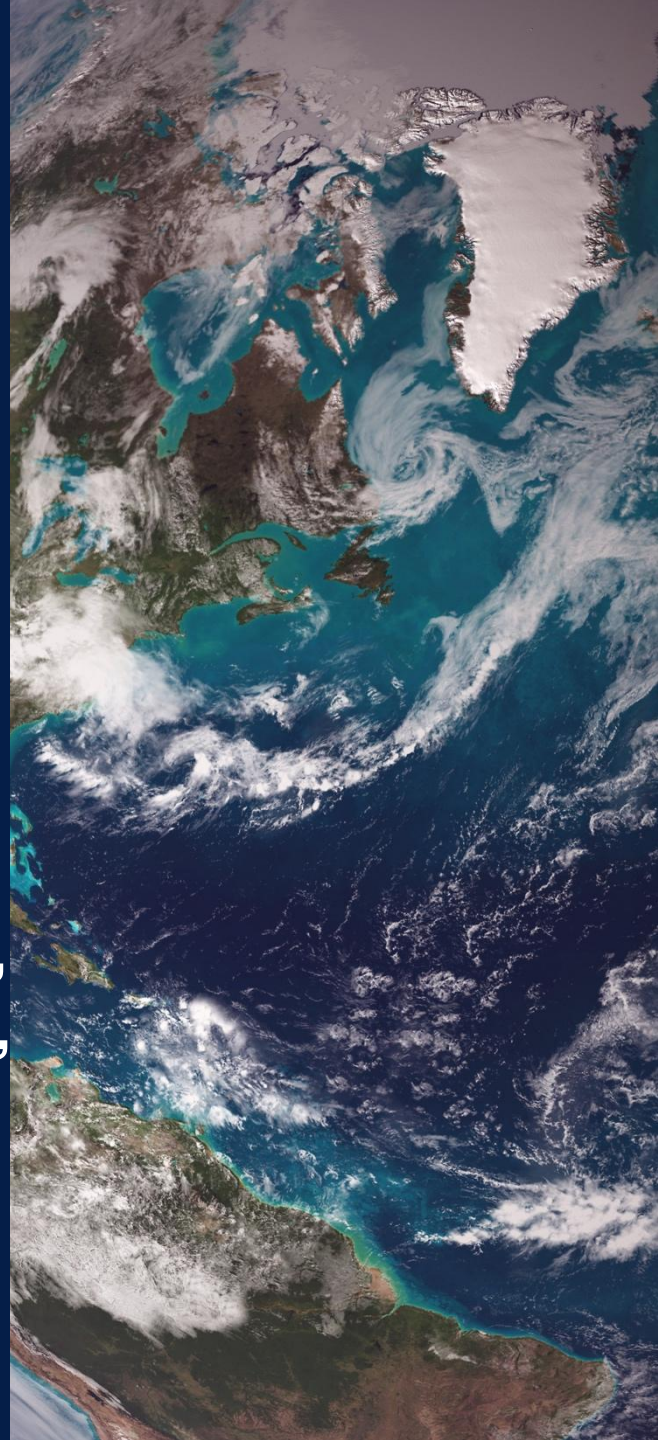
Resource Guide:

zenodo

Navigate to the most updated version.

Includes Agenda, Survey, Activities, Links, and more!

https://zenodo.org/records/12609217



Guidelines & Code of Conduct

- **Be respectful:** actively listen, stay in the present, be kind
- **Be inclusive:** create physical and social space for others to participate, welcome all, be aware of yourself, practice an open mindset
- **Be collaborative:** acknowledge that everyone brings something different, make assumptions explicit, be accountable of your own actions, respect intellectual property and data sovereignty
- **Be safe:** Avoid harmful behaviors and let us know if any occur
- **Be vocal:** Speak Up! If you want support or have a suggestion, please message Elizabeth at 757-771-2019. Anyone experiencing or witnessing behavior that constitutes an immediate or serious threat to public safety is advised to contact 911 or your local emergency number.

If you believe you are being or have witnessed harassment at this workshop:

- document the incident fully
- tell someone you trust
- report the incident to Elizabeth

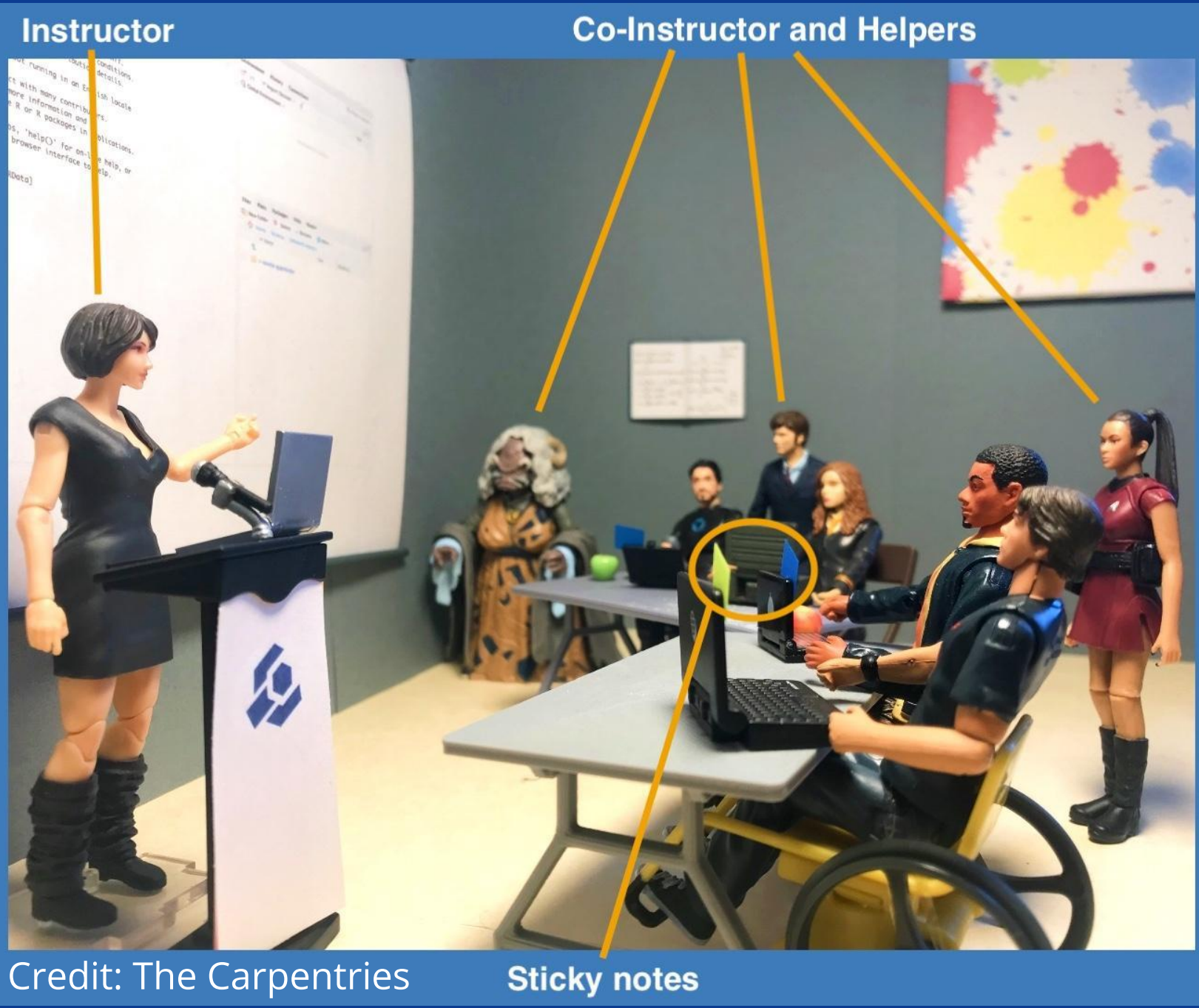
Getting Help with Tools during hands-on sessions:

I'm with you.

Let's go.

Slow down.

I need help.



Credit: The Carpentries

Positive Polarities:
Ice Breaker

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Credit: Divergent Science, LLC

Instructions

- Silently stand up
- Listen/watch for prompts from the facilitator
- Move to where you think you are along the “positive polarity”

There’s no right or wrong answer. This is your perception of yourself.

- Goal 1: Meet other people at the workshop
- Goal 2: Acknowledge and welcome the positive (differences) polarities at the workshop

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Credit: Divergent Science, LLC

Long distance<---> Short Distance

Left side of the room <--->Right side of the room

Prompt:
I traveled from a long distance or short distance

EARTHDATA

Credit: Divergent Science, LLC

Internal <---> External

Left side of the room <--->Right side of the room

Prompt:
I am an Internal processor (organize your thoughts inside your head) or external processor (organize your thoughts outside your head)

EARTHDATA

Credit: Divergent Science, LLC

Little Movement <---> Lots of Movement

Left side of the room <--->Right side of the room

Prompt:
I use little or lots of hand and body movements (also called gestures) when I am talking

EARTHDATA

Credit: Divergent Science, LLC

Comfortable <---> Uncomfortable

Left side of the room <--->Right side of the room

Prompt:
I am comfortable or uncomfortable with silence

EARTHDATA

Credit: Divergent Science, LLC

High <---> Low

Left side of the room <--->Right side of the room

Prompt:
I prefer high or low eye contact

EARTHDATA

Credit: Divergent Science, LLC

Adult <---> K-12

Left side of the room <--->Right side of the room

Prompt:
I primarily teach adult learners or those in k12 environments

EARTHDATA

Credit: Divergent Science, LLC

Long <---> Short

Left side of the room <--->Right side of the room

Prompt:
I prefer long or short emails

EARTHDATA

Credit: Divergent Science, LLC

Soft <---> Loud

Left side of the room <--->Right side of the room

Prompt:
I am soft or loud when I talk

EARTHDATA

Credit: Divergent Science, LLC

Reflection

Pair up with someone whom YOU DO NOT KNOW and take turns answering the prompts below.

Prompts:

1. What did you notice about yourself during the exercise?
2. What did you observe about others during the exercise?
3. How might these differences impact group communication and success?
4. Identify someone from your group to introduce yourselves and explain your answers to the questions above.

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Introduction to Remote Sensing

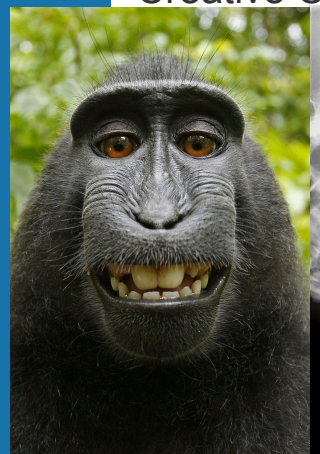
Mike Taylor

2-2:20PM

What is Remote Sensing?

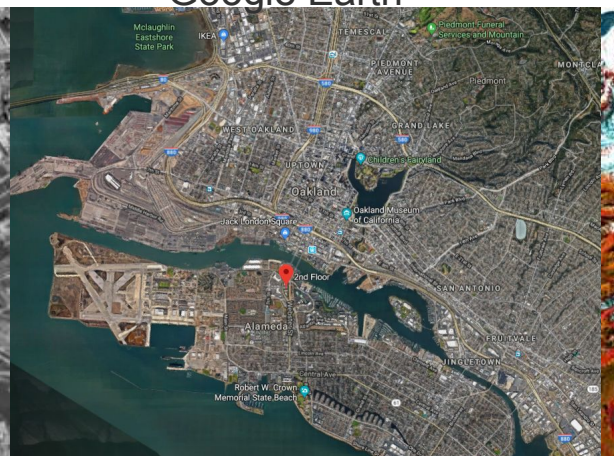
- Remote sensing is the technique of obtaining information from a distance.
- The most common remote sensing in our daily life – photography.
- In Earth science context, we often refer to satellite, airborne platforms, drones.

Creative Commons

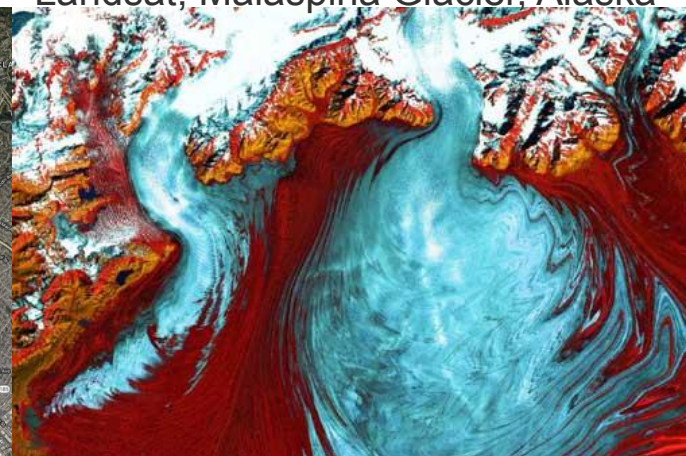


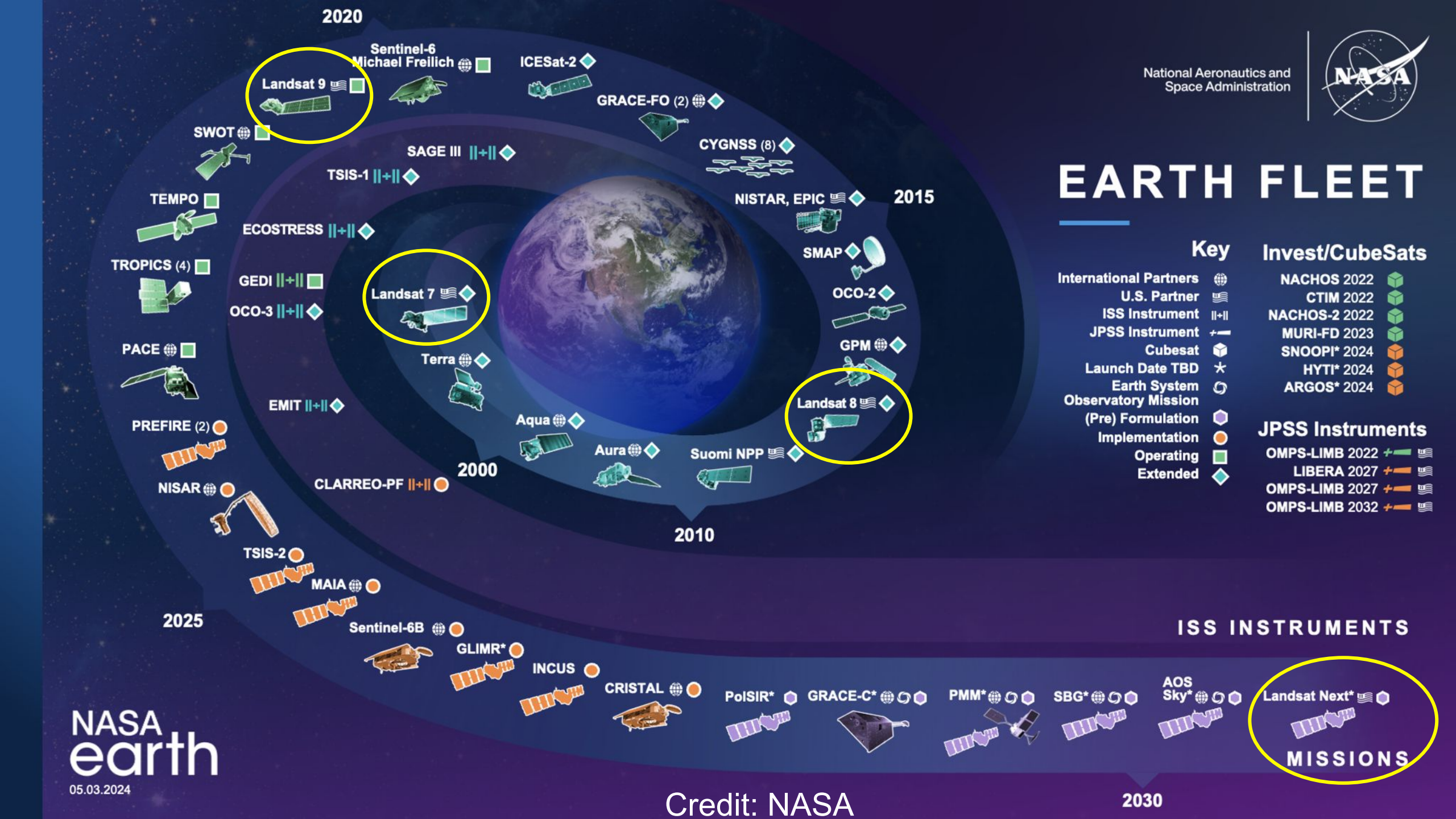
Army Corps Engineers

Google Earth



Landsat, Malaspina Glacier, Alaska




2020
Sentinel-6 Michael Freilich
ICESat-2
Landsat 9
GRACE-FO (2)
SWOT
CYGNSS (8)
SAGE III
TSIS-1
TEMPO
NISTAR, EPIC
2015
ECOSTRESS
SMAP
TROPICS (4)
GEDI
Landsat 7
OCO-2
OCO-3
GPM
PACE
Terra
EMIT
Landsat 8
PREFIRE (2)
Aqua
Aura
Suomi NPP
2000
NISAR
CLARREO-PF
TSIS-2
MAIA
2025
Sentinel-6B
GLIMR*
INCUS
CRISTAL
PolSIR*
GRACE-C*
PMM*
SBG*
AOS Sky*
Landsat Next*
MISSIONS
ISS INSTRUMENTS
2030
National Aeronautics and Space Administration
NASA
EARTH FLEET
Key
International Partners
U.S. Partner
ISS Instrument
JPSS Instrument
Cubesat
Launch Date TBD
Earth System Observatory Mission
(Pre) Formulation
Implementation
Operating
Extended
Invest/CubeSats
NACHOS 2022
CTIM 2022
NACHOS-2 2022
MURI-FD 2023
SNOOPI* 2024
HYTI* 2024
ARGOS* 2024
JPSS Instruments
OMPS-LIMB 2022
LIBERA 2027
OMPS-LIMB 2027
OMPS-LIMB 2032
NASA earth
05.03.2024

Credit: NASA

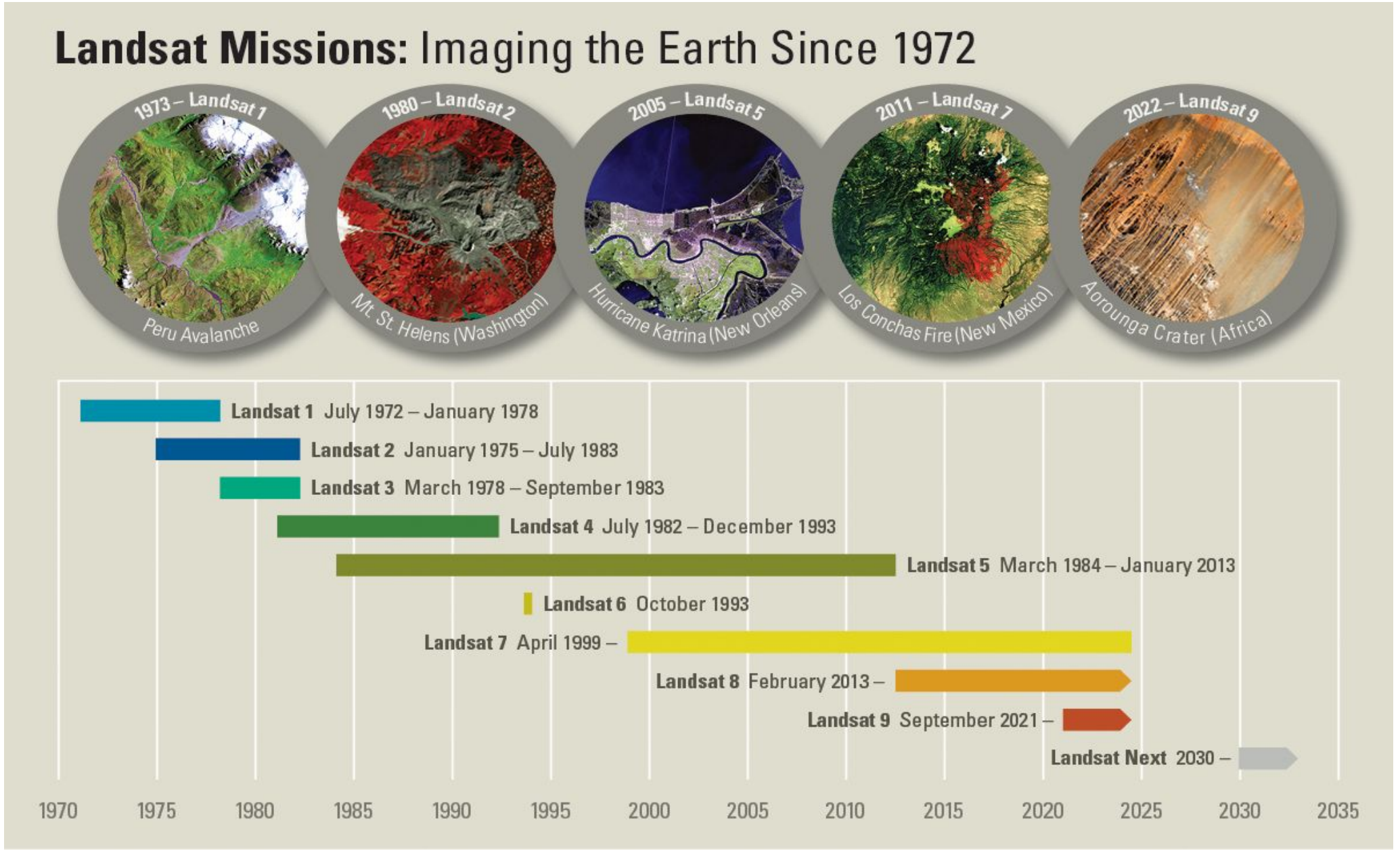
What Spatial Resolution Do I Need?

National Aeronautics and Space Administration

NASA

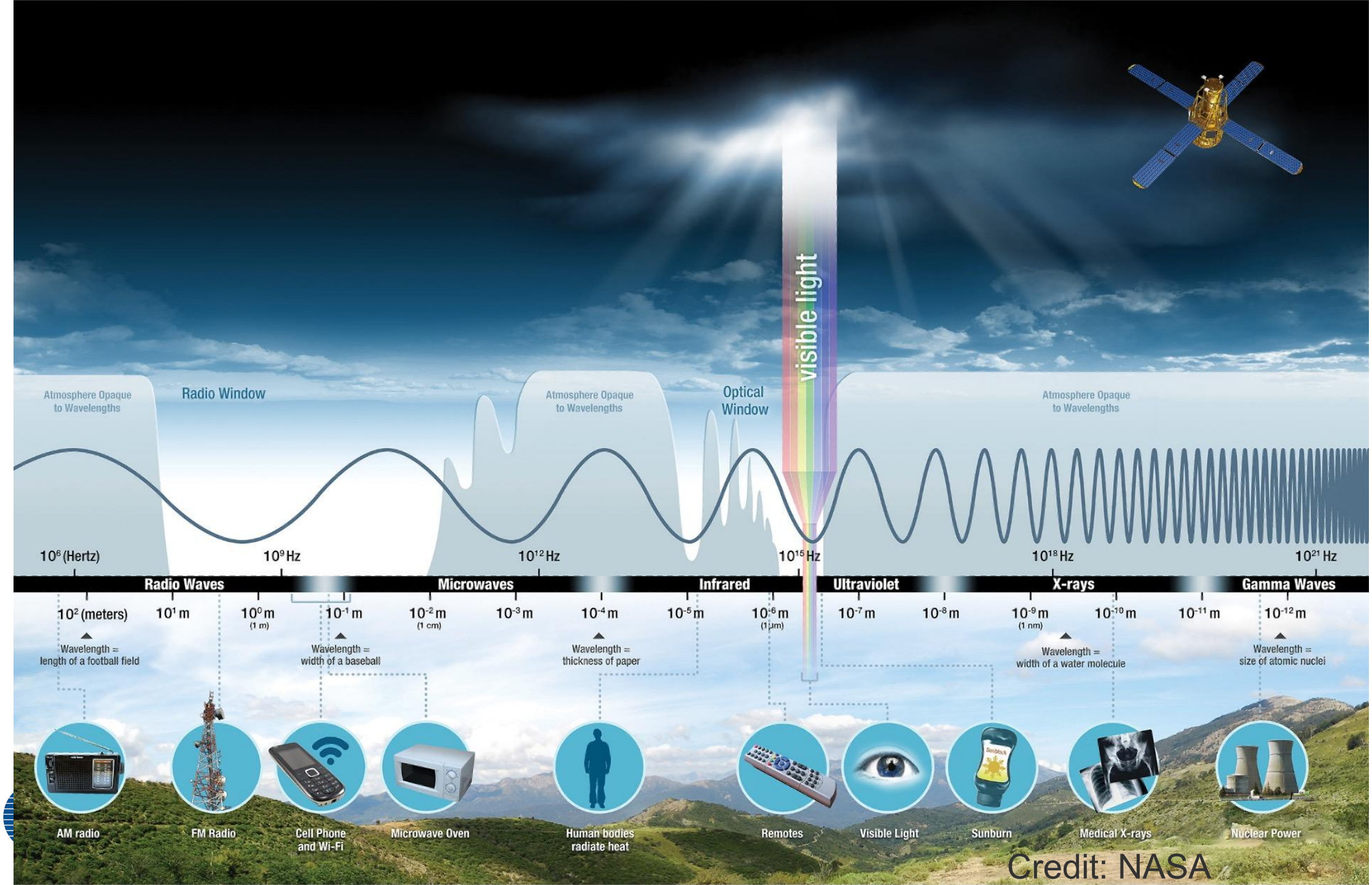
Spatial resolution is the area represented by a pixel. For example, in a 10-meter resolution dataset each pixel represents a 10 m by 10 m square on the ground.

Credit: NASA



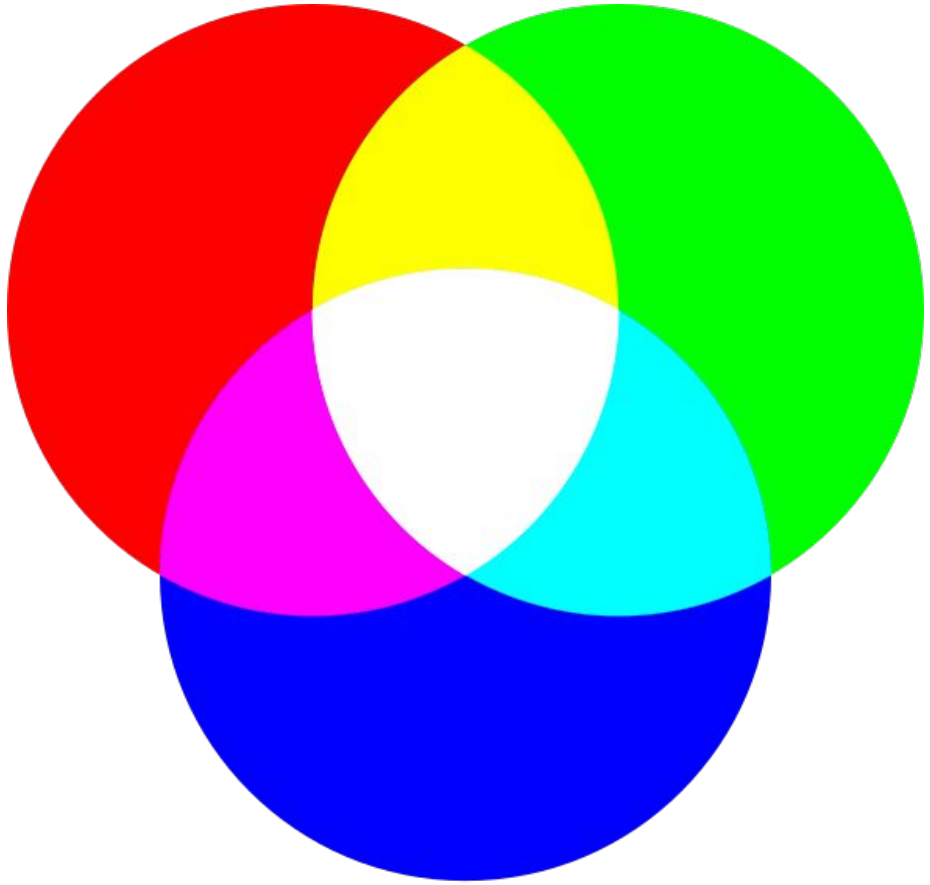
EARTHDATA

Credit: USGS


visible light
Atmosphere Opaque to Wavelengths
Radio Window
Atmosphere Opaque to Wavelengths
Optical Window
Atmosphere Opaque to Wavelengths
10^{6} (Hertz)
10^{9} Hz
10^{12} Hz
10^{15} Hz
10^{18} Hz
10^{21} Hz
Radio Waves
Microwaves
Infrared
Ultraviolet
X-rays
Gamma Waves
10^{2} (meters)
10^{1} m
10^{0} m (1 m)
10^{-1} m
10^{-2} m (1 cm)
10^{-3} m
10^{-4} m
10^{-5} m
10^{-6} m (1 μm)
10^{-7} m
10^{-8} m
10^{-9} m (1 nm)
10^{-10} m
10^{-11} m
10^{-12} m
Wavelength = length of a football field
Wavelength = width of a baseball
Wavelength = thickness of paper
Wavelength = width of a water molecule
Wavelength = size of atomic nuclei
AM radio
FM Radio
Cell Phone and Wi-Fi
Microwave Oven
Human bodies radiate heat
Remotes
Visible Light
Sunburn
Medical X-rays
Nuclear Power

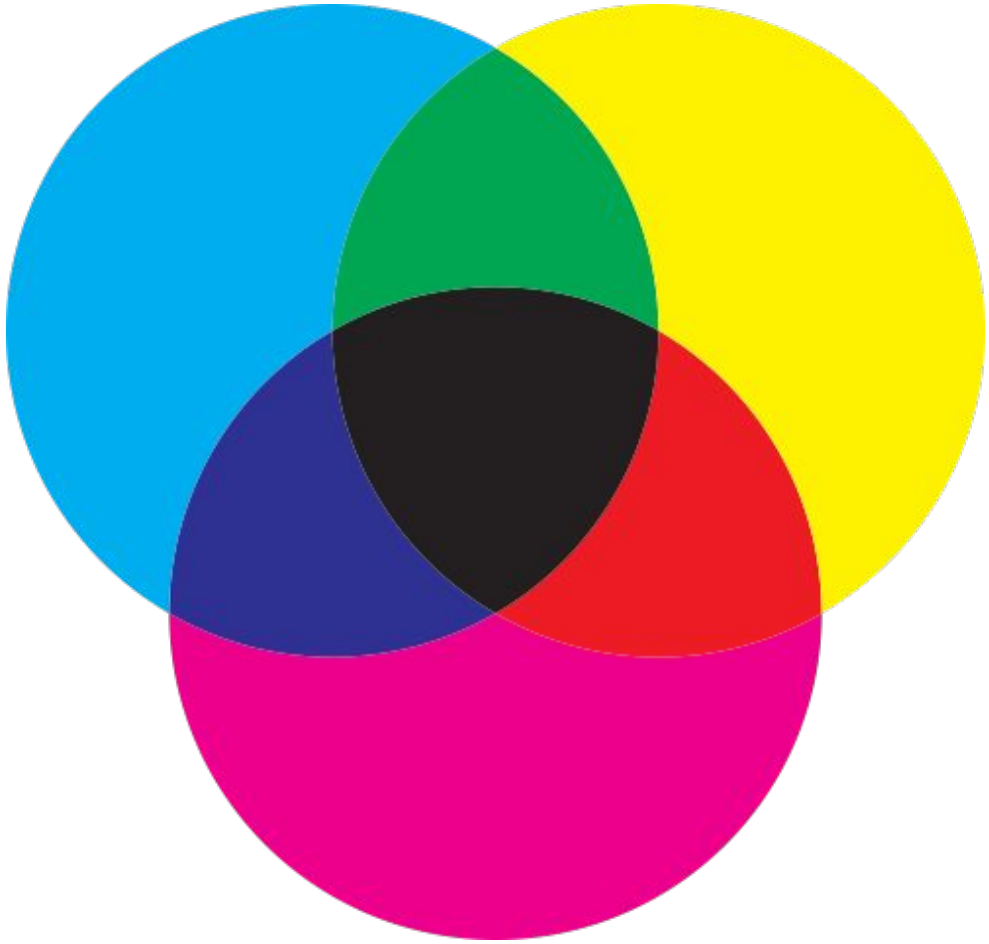
Credit: NASA

Light



Additive Color Mixing

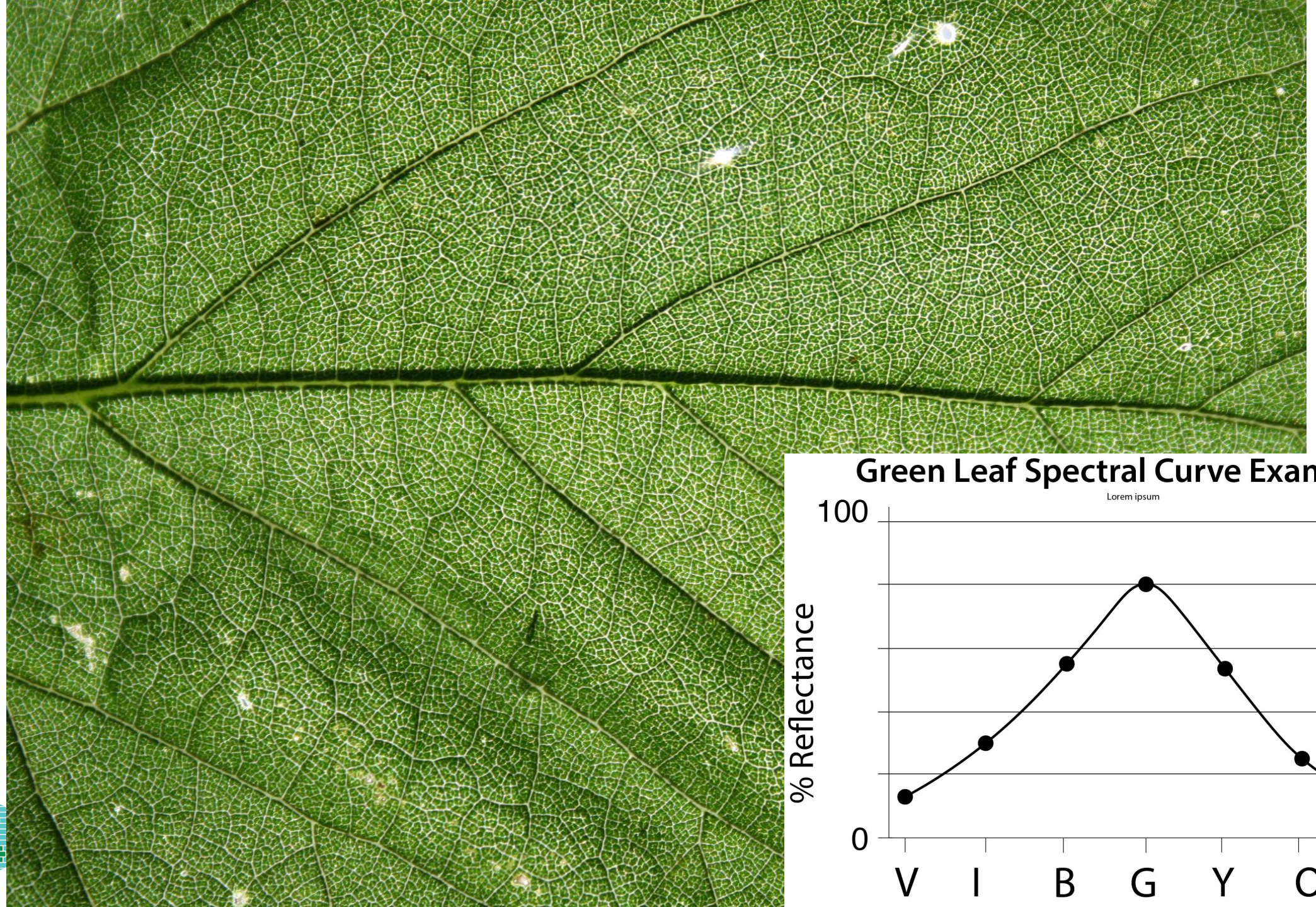
Paint

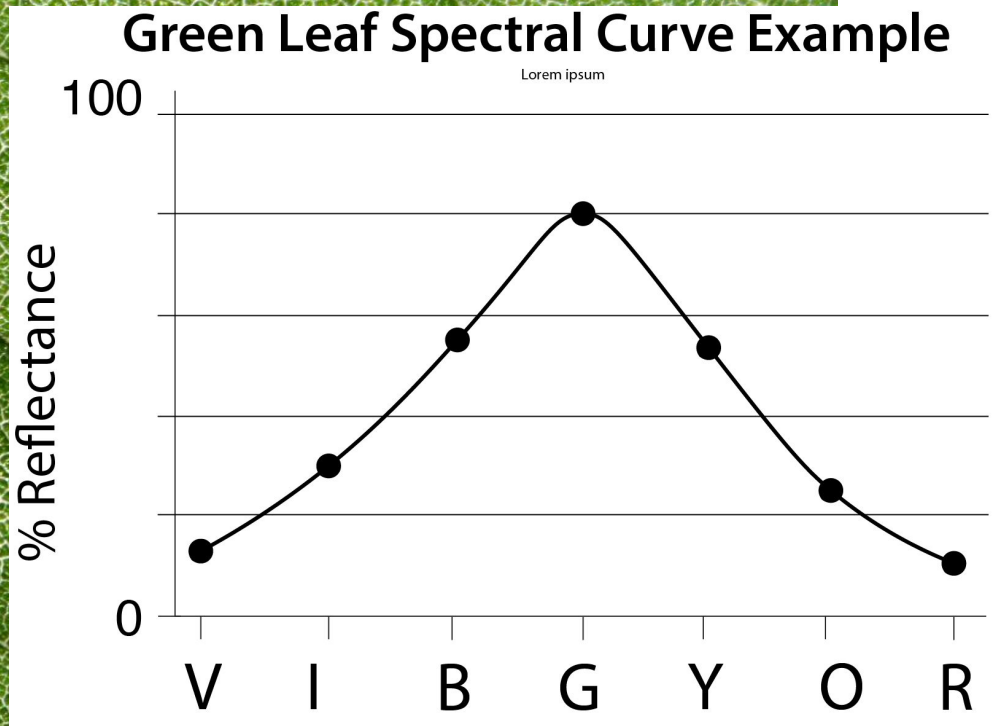


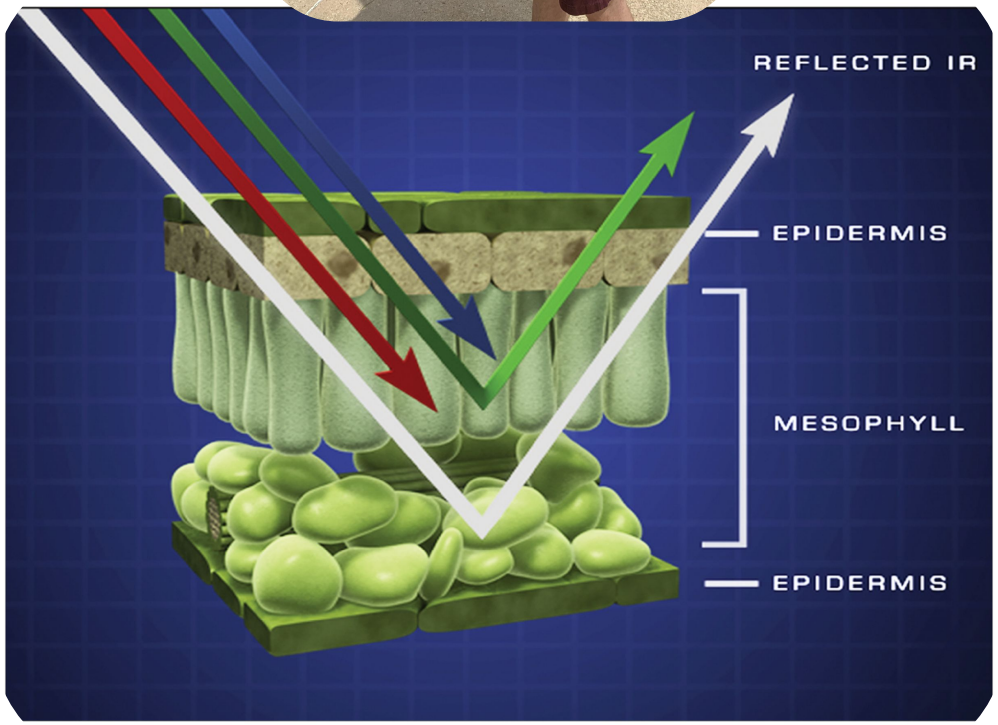
Subtractive Color Mixing

EARTHDATA

Credit: Wikimedia Commons

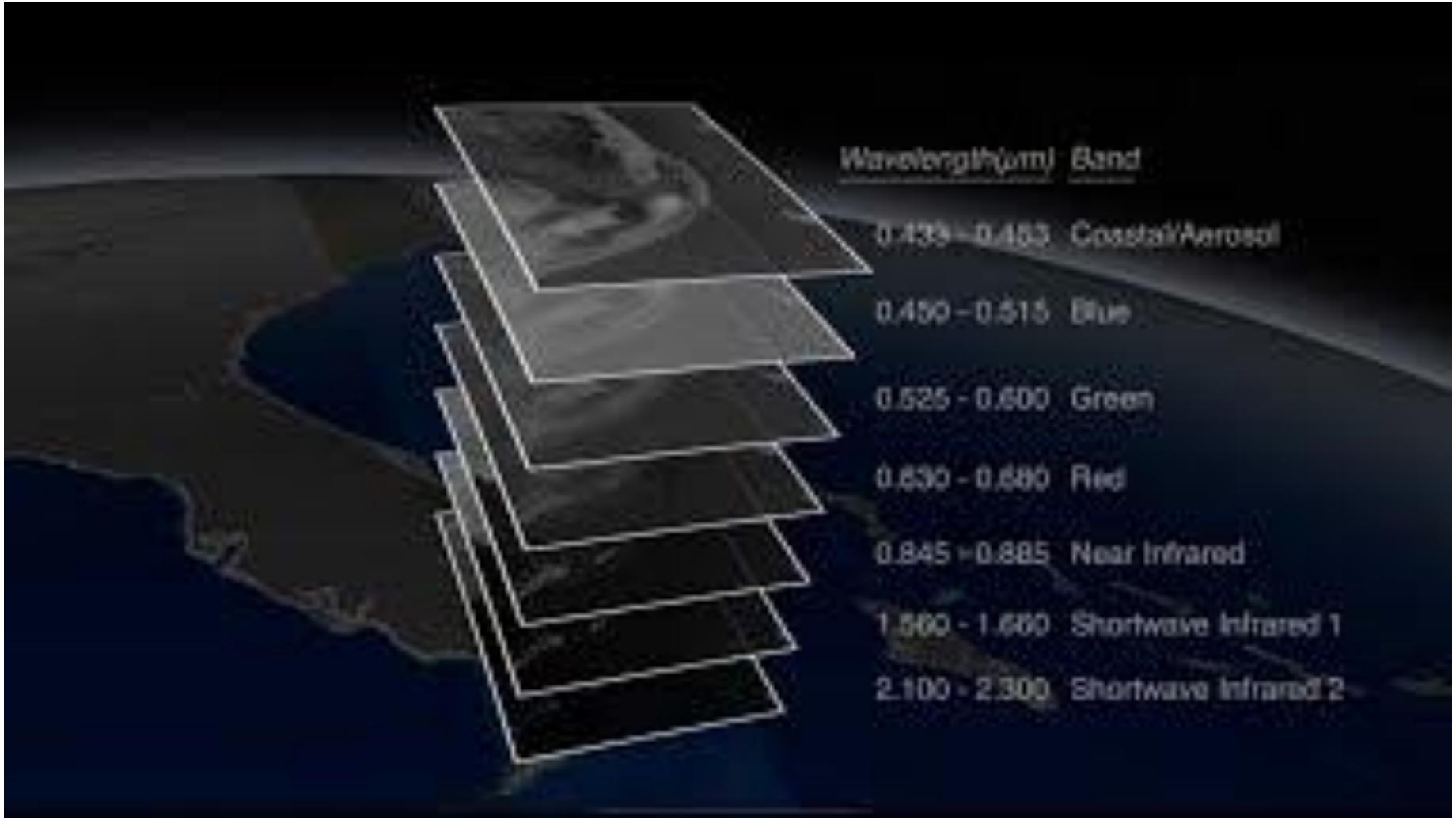



Green Leaf Spectral Curve Example
Lorem ipsum
100
0
% Reflectance
V
I
B
G
Y
O
R



Credit: NASA

Landsat Onion Skin



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Las Vegas Timelapse

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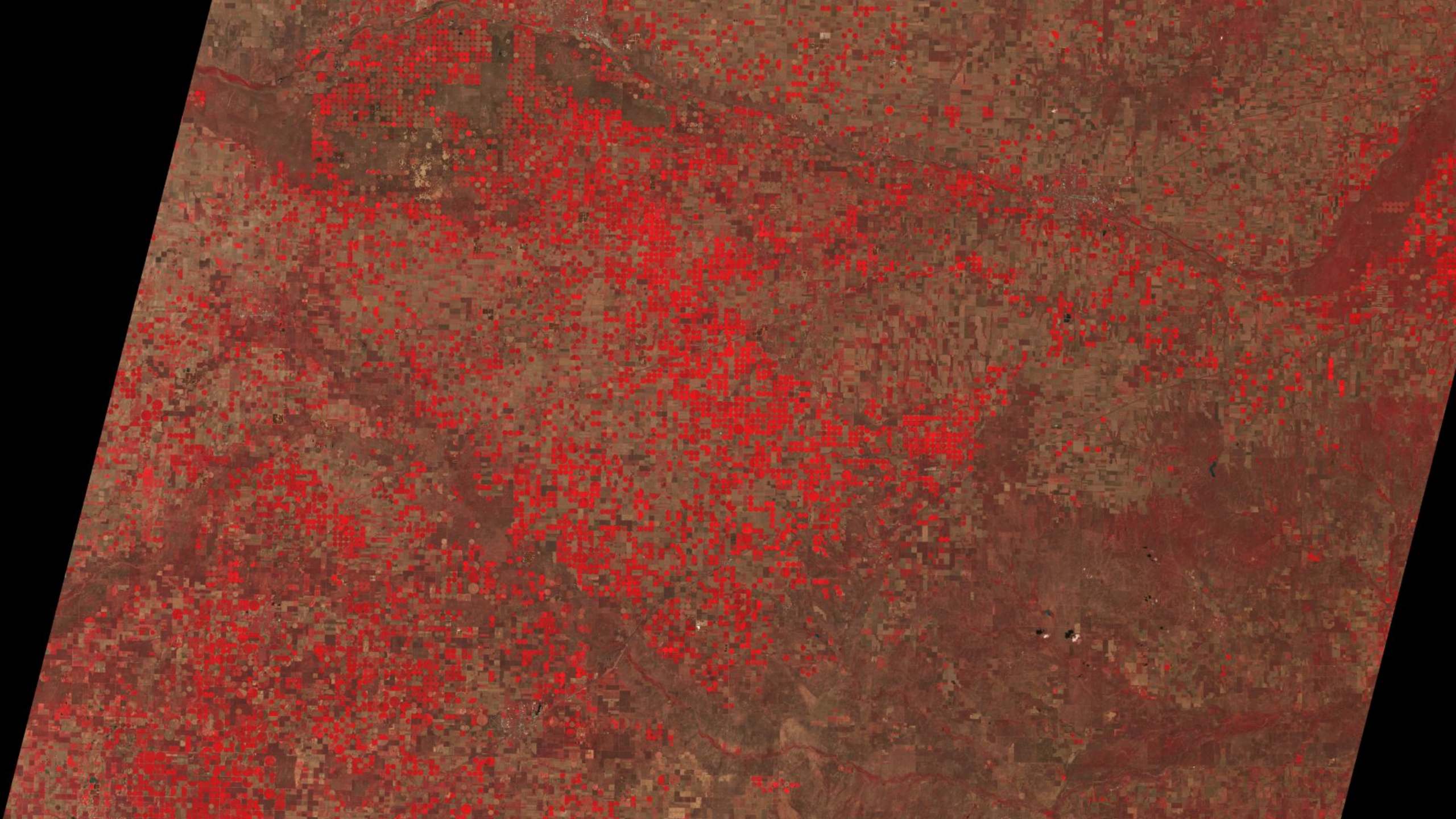

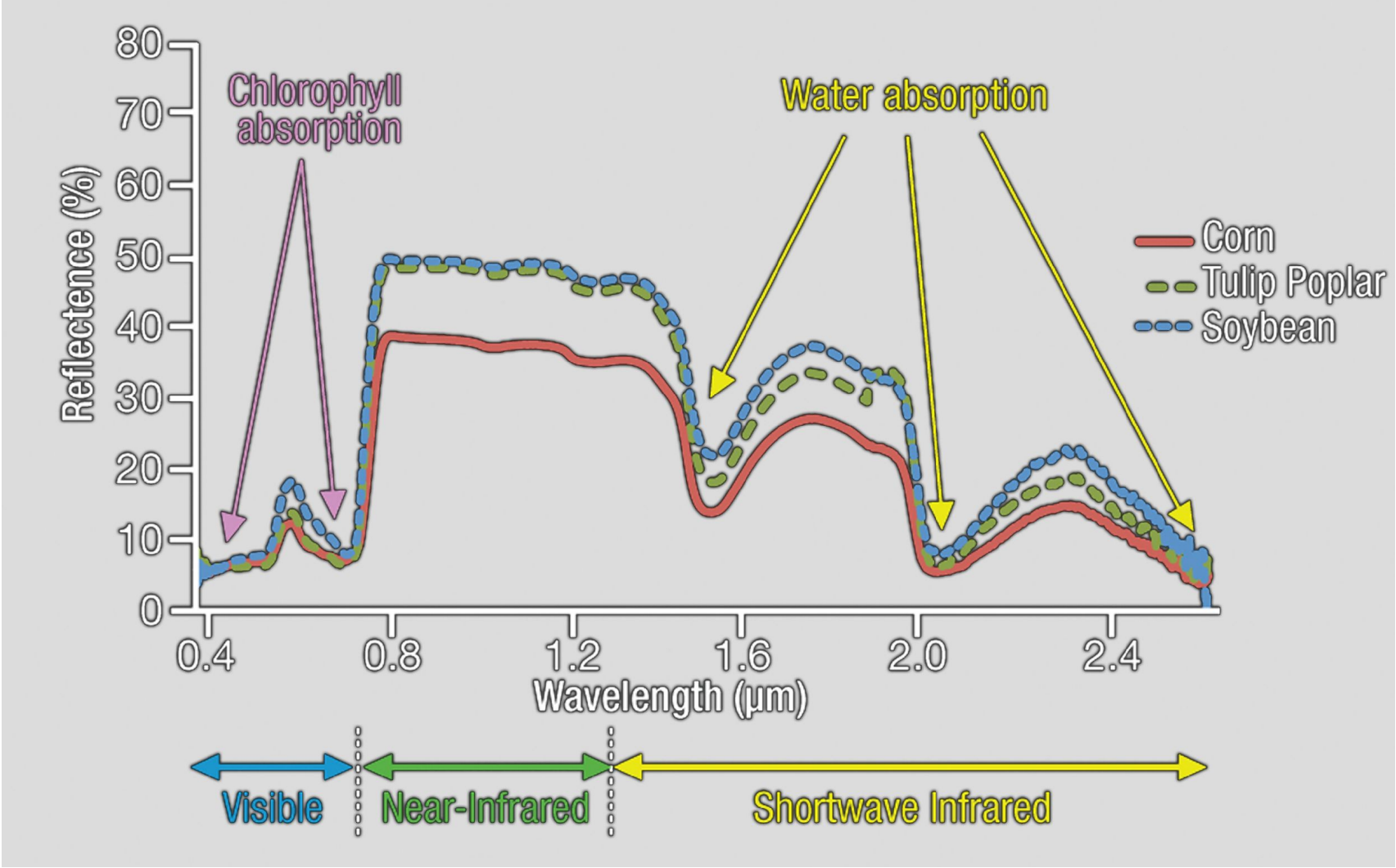
Chlorophyll absorption
Water absorption
Reflectence (%)
80
70
60
50
40
30
20
10
0
0.4
0.8
1.2
1.6
2.0
2.4
Wavelength (µm)
Corn
Tulip Poplar
Soybean
Visible
Near-Infrared
Shortwave Infrared

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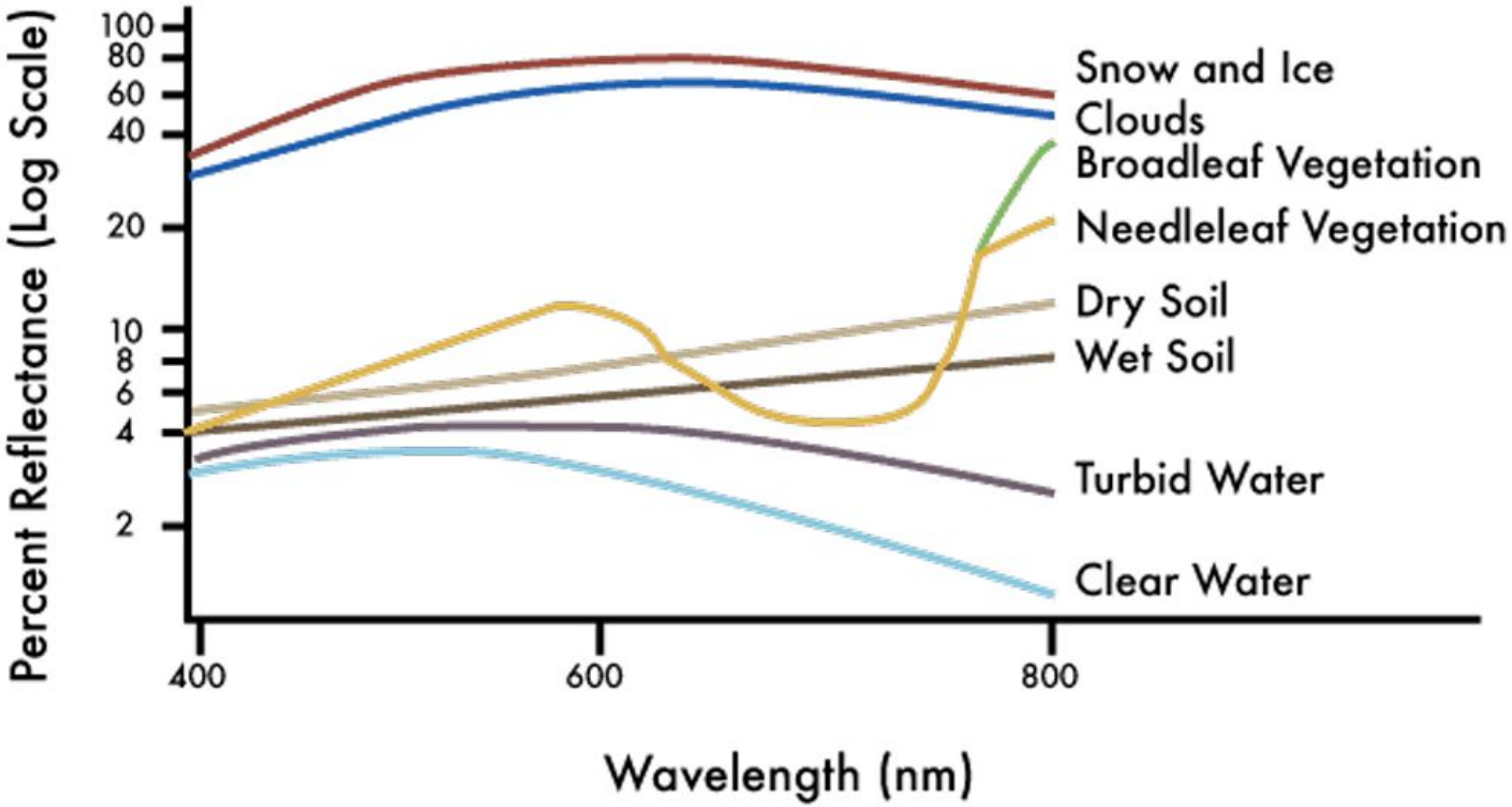
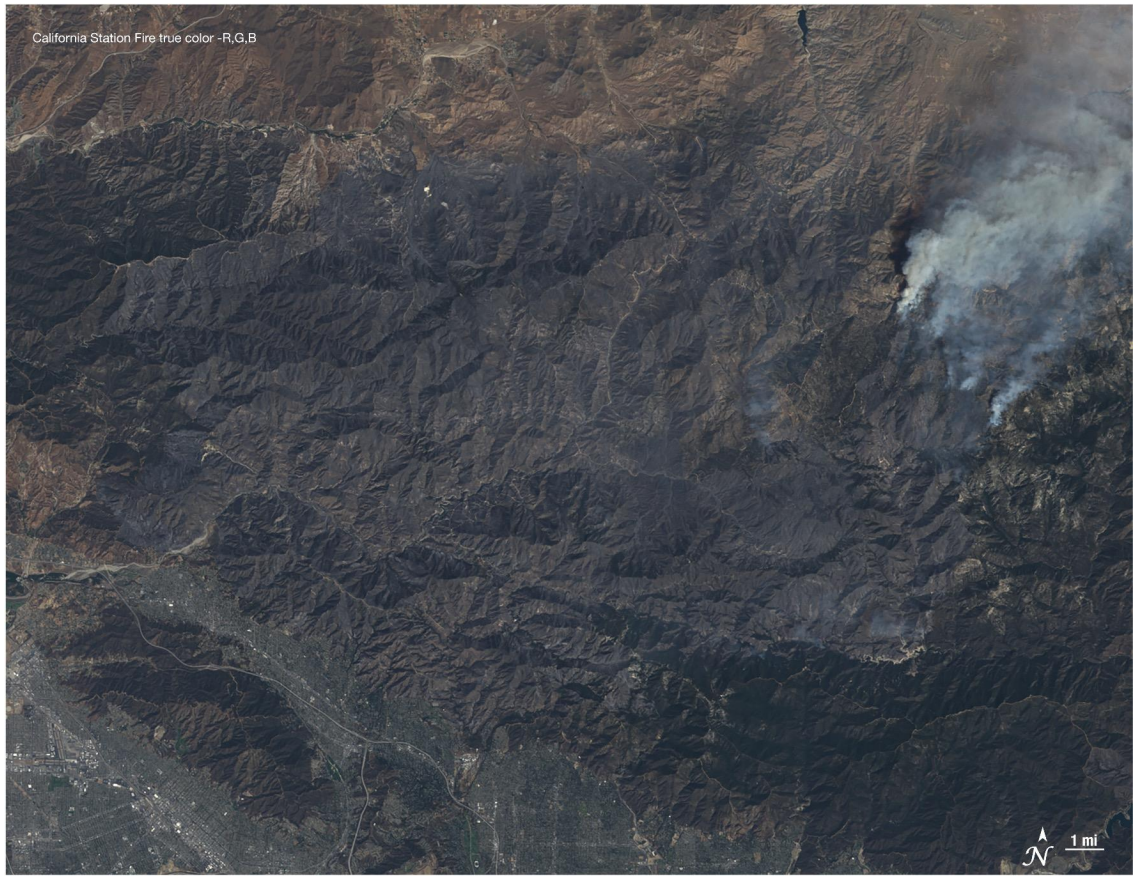
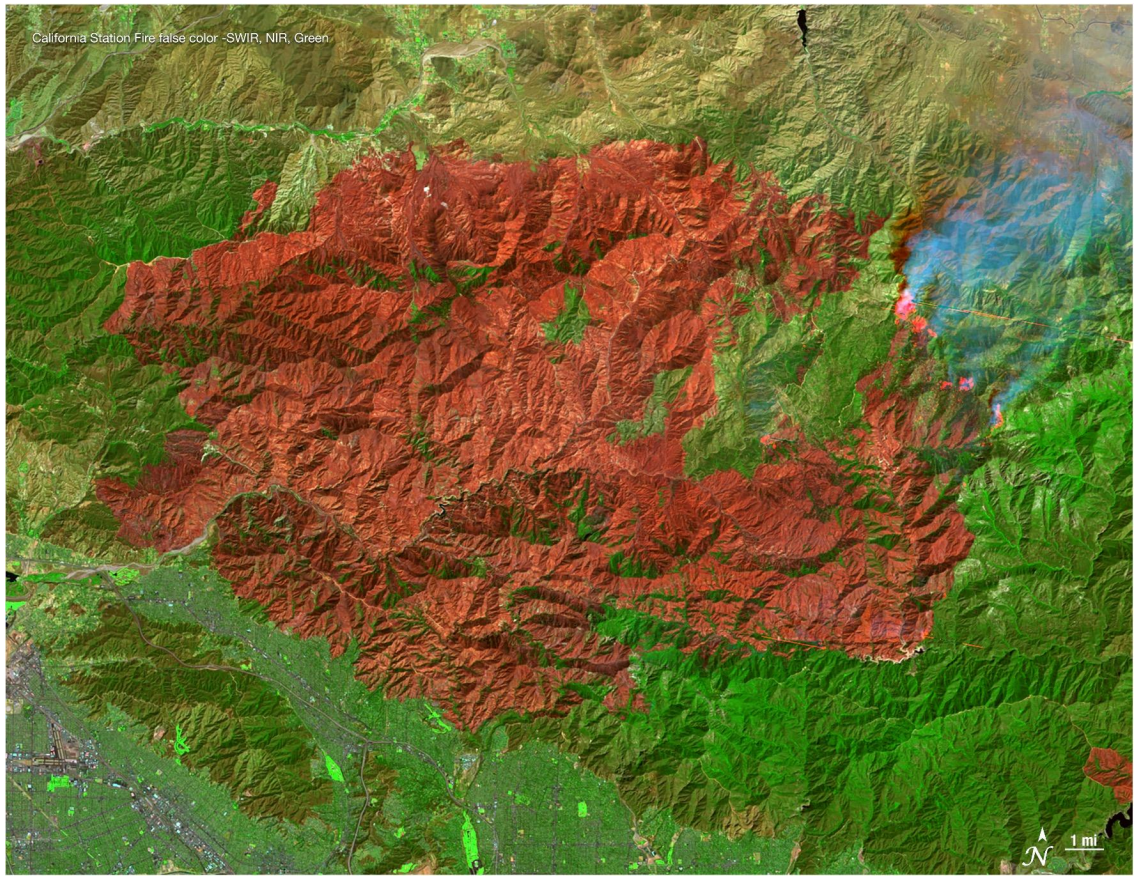

Percent Reflectance (Log Scale)
100
80
60
40
20
10
8
6
4
2
400
600
800
Wavelength (nm)
Snow and Ice
Clouds
Broadleaf Vegetation
Needleleaf Vegetation
Dry Soil
Wet Soil
Turbid Water
Clear Water

EARTHDATA





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Credit: NASA

Yellowstone Recovery from Fire

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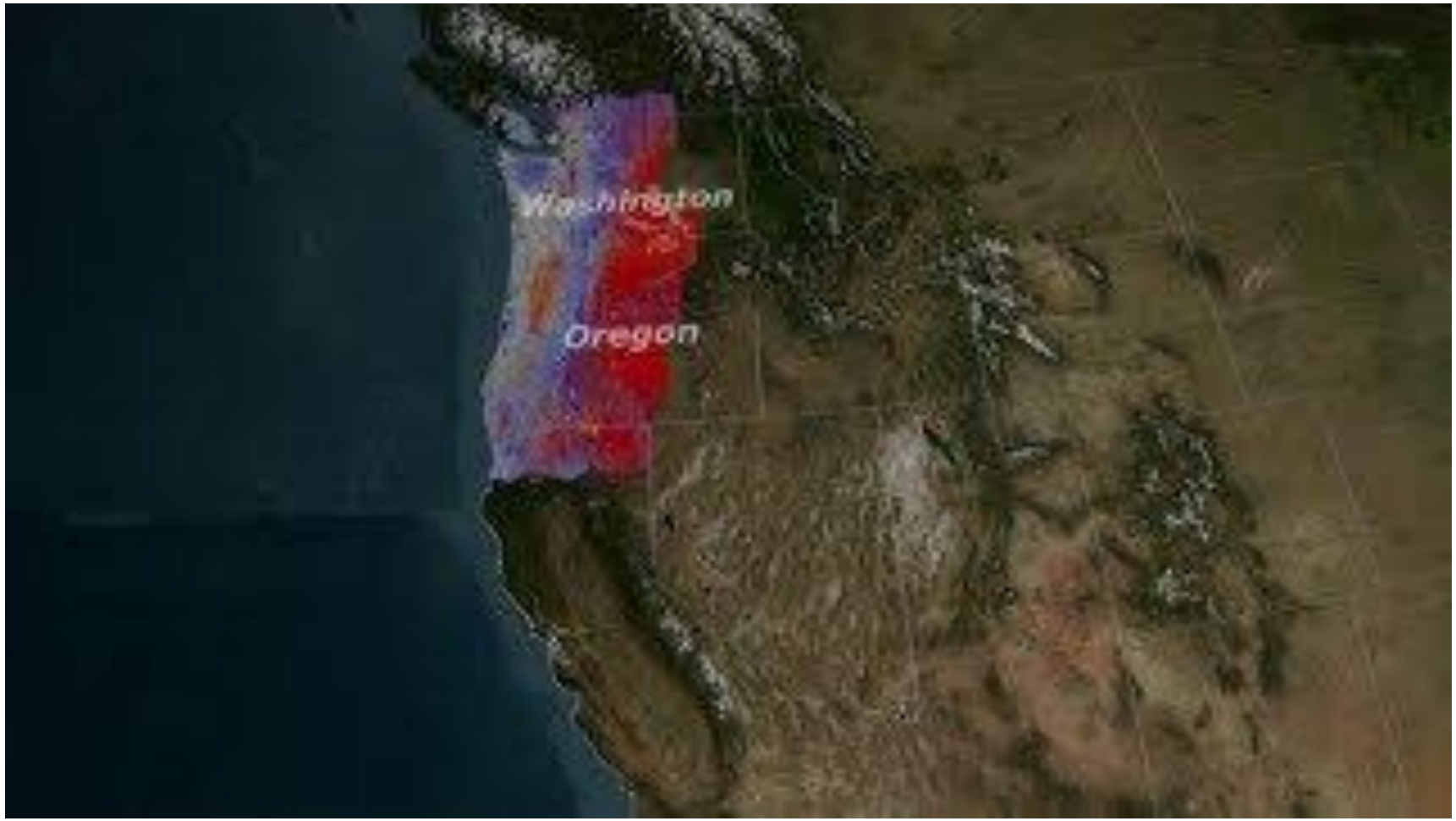
Data in Numbers



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Harmonized Landsat and Sentinel-2 data

- Landsat 8 and Sentinel-2 satellites have spectral and spatial similarities that make using their data together possible.
- When the data are used together observations can be more timely and accurate.
- HLS project is an effort to "harmonize" the data of the two satellite programs so that they can be more easily used in unison
- 2-3 day global surface reflectance coverage at 30 meters that removes residual differences between the sensors due to spectral bandpass and view geometry

https://hls.gsfc.nasa.gov/

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DATA IN HARMONY
NASA'S HARMONIZED
LANDSAT AND SENTINEL-2 PROJECT

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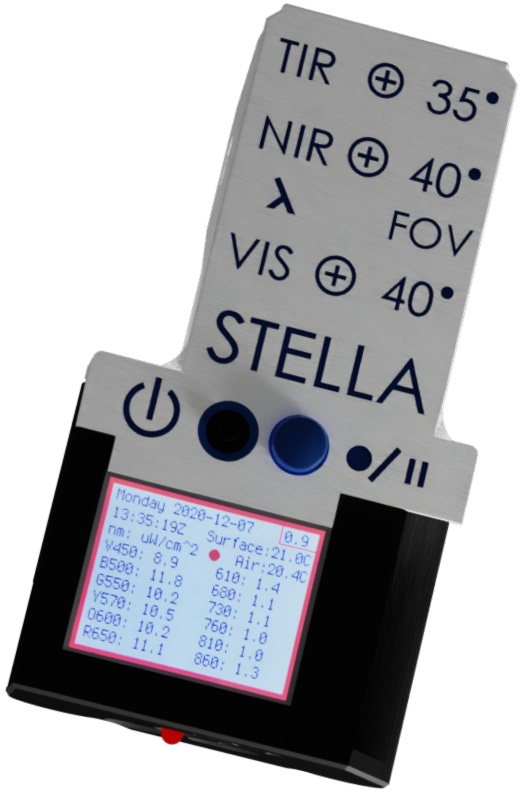
Introduction to STELLA

Mike Taylor

2:20-3PM



Landsat CPE Presents:

STELLA

Science and Technology Education for Land / Life Assessment

An instrument

for education, outreach, and engagement

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What is STELLA?

Low-cost education and outreach DIY instruments inspired by Landsat

Landsat 8

Credit: NASA

How did STELLA come about?

STELLA was derived from an activity using a spectrometer to introduce remote sensing concepts and Landsat

What is Landsat?

Landsat is joint program between NASA and the USGS that has been performing Earth observations operating since 1972. Currently there are two satellites deriving another complete observation of the Earth's surface every 8 days, Landsat 8 and 9.

Landsat Website:
landsat.gsfc.nasa.gov

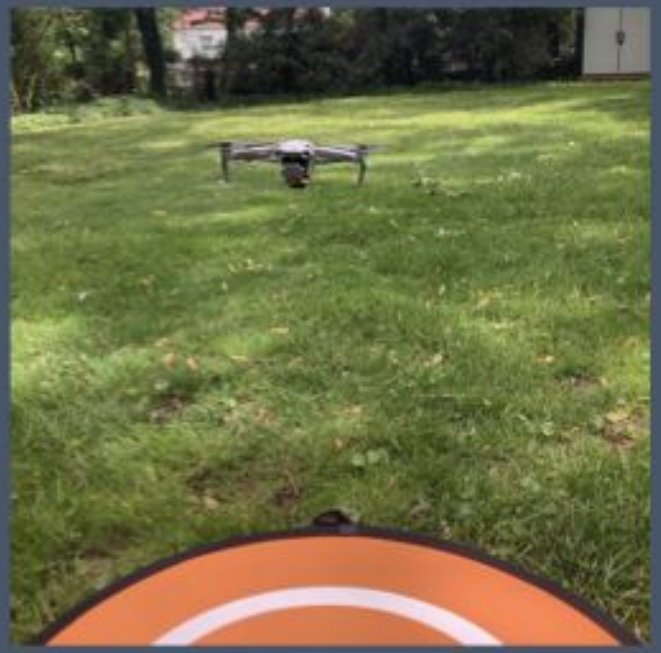
STELLA in the classroom

VT put together 5 STELLA's

GEOTed Drone Workshop 2023
Highschool & Community College Educators

Forest Photogrammetry Course in Spring 2023
Remote Sensing for Juniors and Seniors

STELLA on Drones



Mounted on a DJI Air 2s

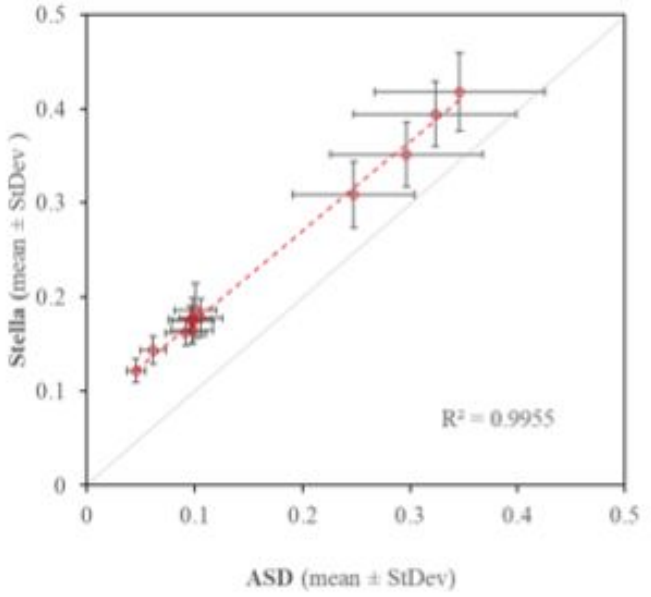
future drone accessories

VIRGINIA TECH

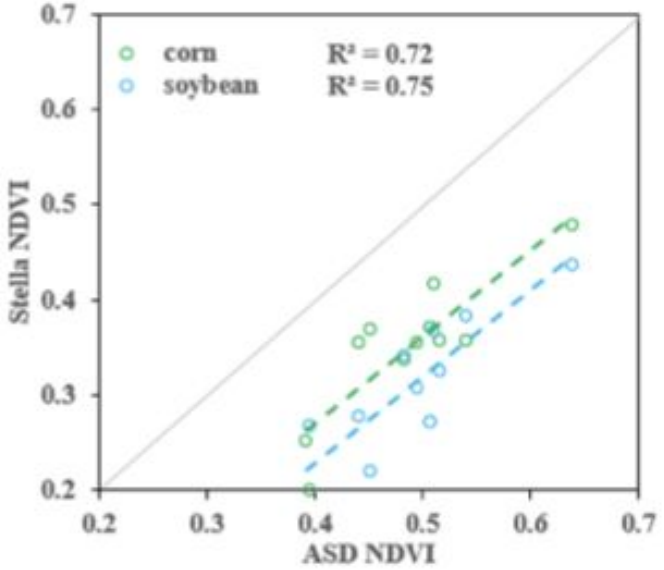
STELLA in the Field

GOALS:

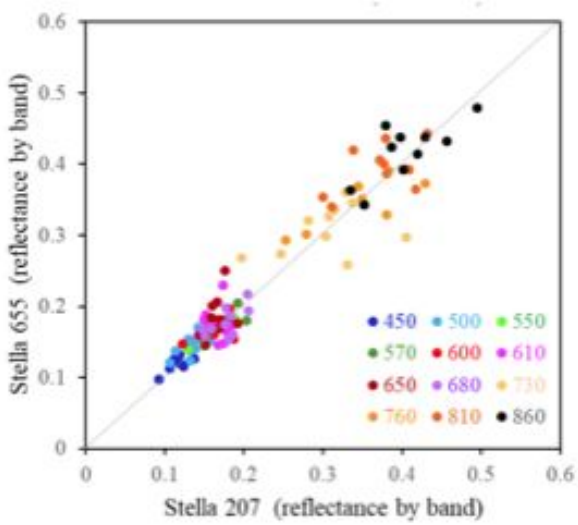
- **Evaluate how STELLA measurements compare to a field spectrometer**
- **Establish field protocols to measure with STELLA different canopies**



➢ Comparing Stella and ASD for crops, the results were strongly correlated



➢ Comparing NDVI between ASD and STELLA the results for soybean were slightly better (higher R^2)

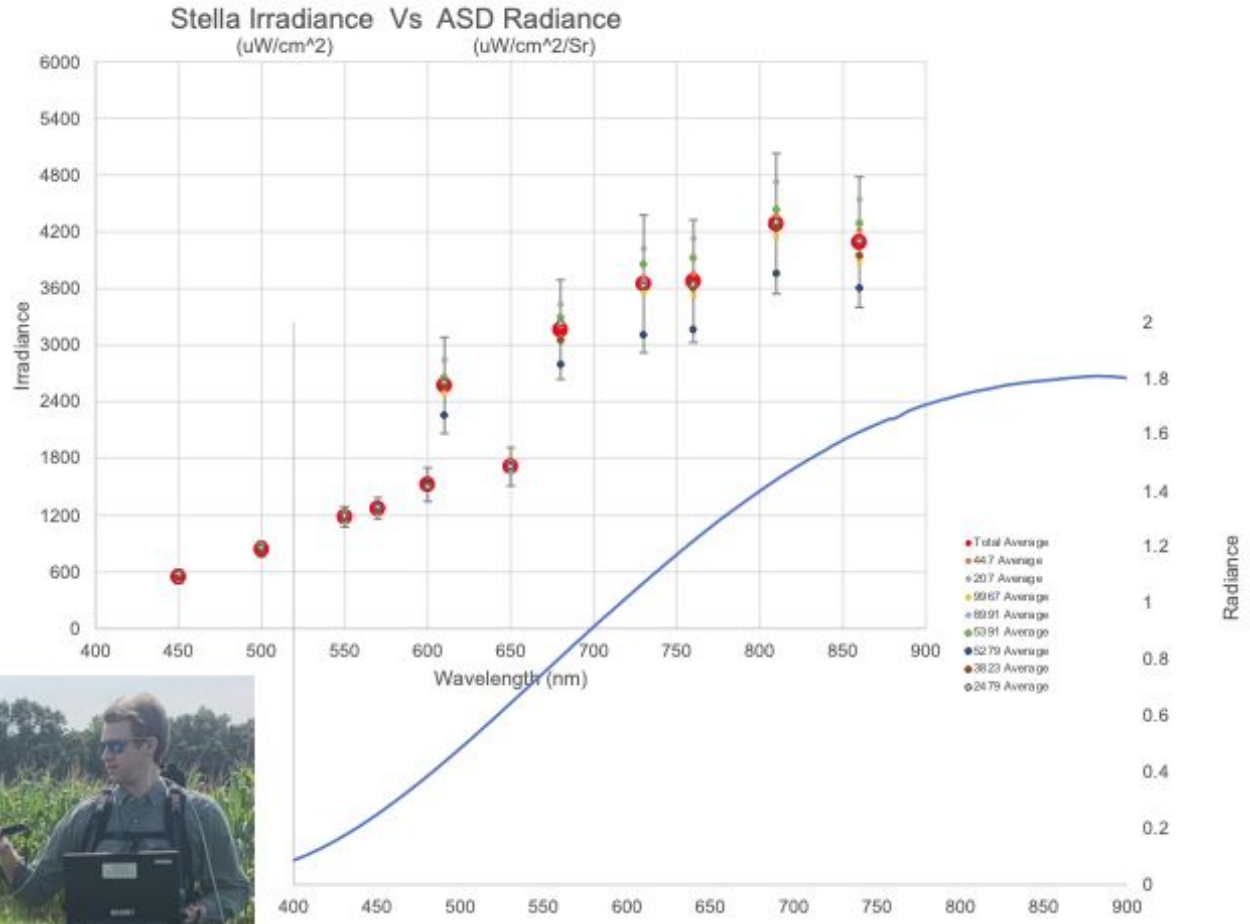


➢ Comparing two Stella instruments (207 and 655) we obtained comparable measurements for grass

CHALLENGES:

- Measuring diverse canopies
- Comparing data from instruments with a very different field of view
- Canopy diversity and movement
  - Others?
    - Additional experiments using diverse targets are needed

STELLA Calibration



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STELLA-AQ

(Science and Technology Education for Land / Life Assessment – Air Quality Edition)

Introducting the STELLA A(ir) Q(uality) instrument!

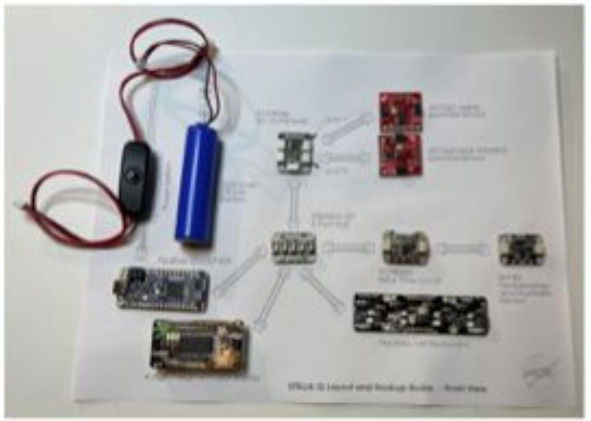
STELLA-AQ senses and records:

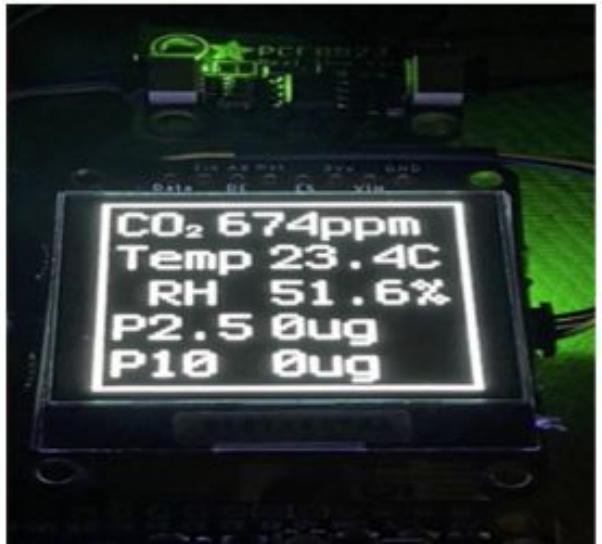
- Humidity, temperature, barometric pressure -- BME280
- CO2 concentration -- SCD-40
- Air Quality / Particulate Matter (PM) -- PMSA003I

STELLA-AQ is **modular** aka the instrument will function even if any of the three sensors are not present, allowing builders to reduce the cost by excluding individual sensors. `

$**204** parts cost, with all three sensors.

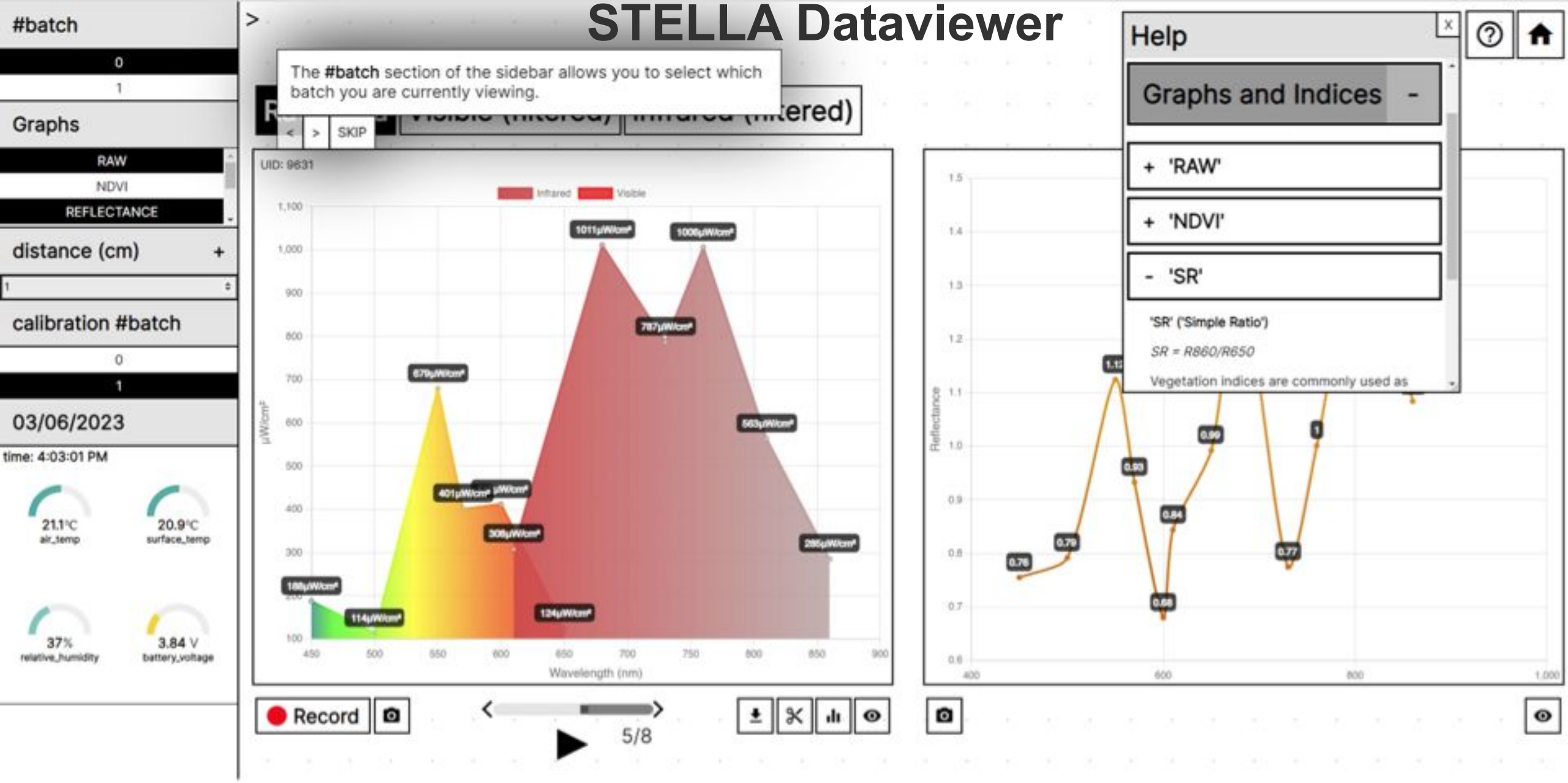
Open-source build instructions, material lists, and code available, including diagrams and a Github forum for additional user support.





E Landsat satellite data has been useful in estimating air quality, particularly in measuring particulate matter (PM) concentrations like PM10 and PM2.5 across various urban areas globally.

STELLA Dataviewer



- **Tutorial Sequence**
- **Improved Help Section**
- **Updated UI**

STELLA Instruments

STELLA-1.1

- 12 channels: 6 visible, 6 near infrared
- Infrared remote surface temperature
- Air temperature, humidity, pressure
- LiDAR and cuvette holder accessories
- Touchscreen display

STELLA-2.0

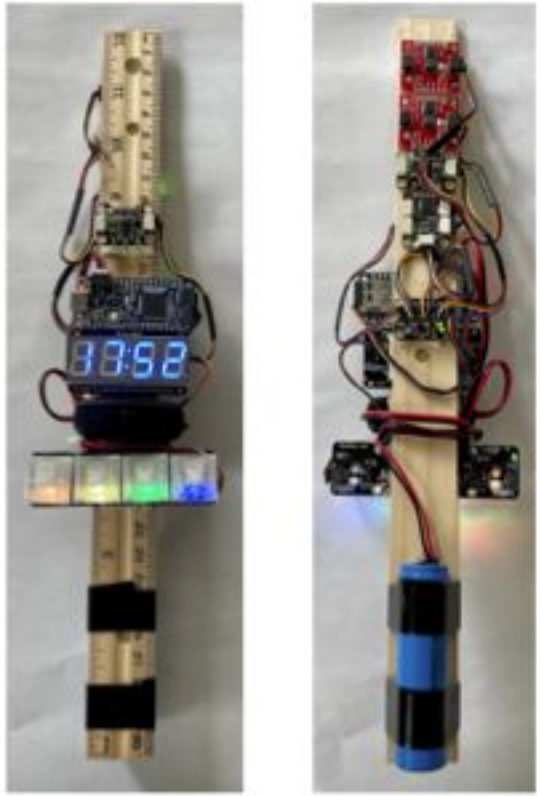
- 12 channels: 6 visible, 6 near infrared
- Infrared remote surface temperature
- Air temperature, humidity, pressure
- Bluetooth connects to smart phone
- 68 g bare mass, 112 g with housing

STELLA-1.2 — in development

- 18 channels: UV, visible, near infrared
- Infrared remote surface temperature
- Air temperature, humidity, pressure
- LiDAR and cuvette holder accessories
- Touchscreen display
- And much more

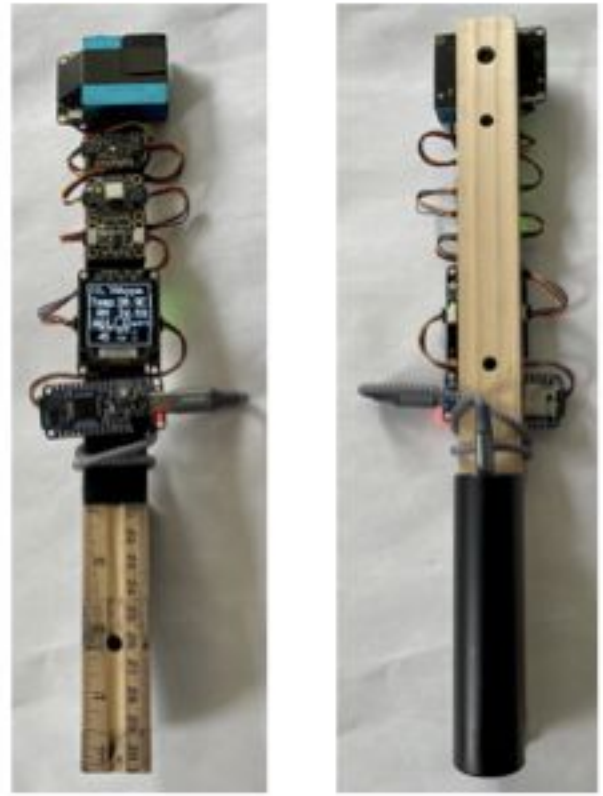
STELLA Instruments — Quick Connect Series
Plug-in connectors only, no soldering required

STELLA-Q1



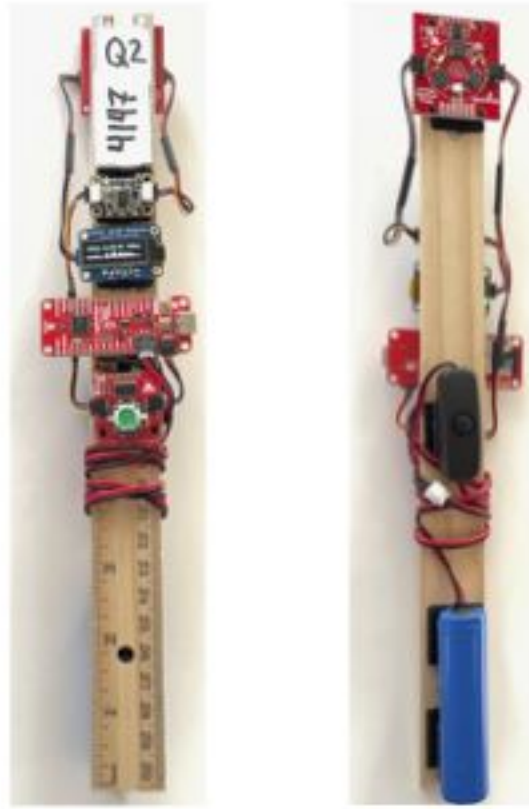
- 12 channels: 6 visible, 6 near infrared
- Air temperature, humidity, pressure

STELLA-AQ



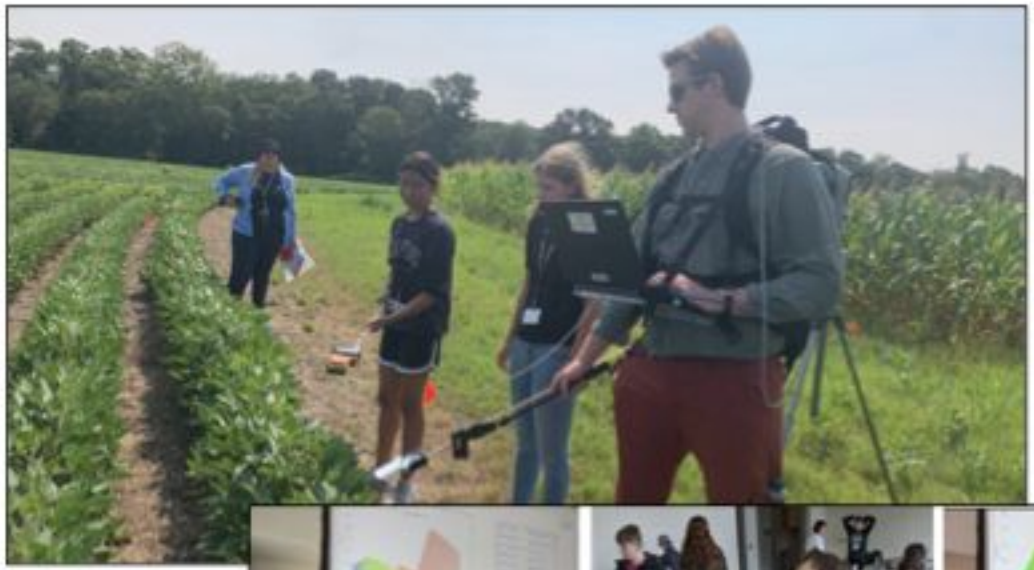
- CO_2 400 to 2000 ppm
- Particulate counter: PM1, PM2.5, PM10
- AQI_P, Air Quality Index for particulates
- Air temperature, humidity, pressure

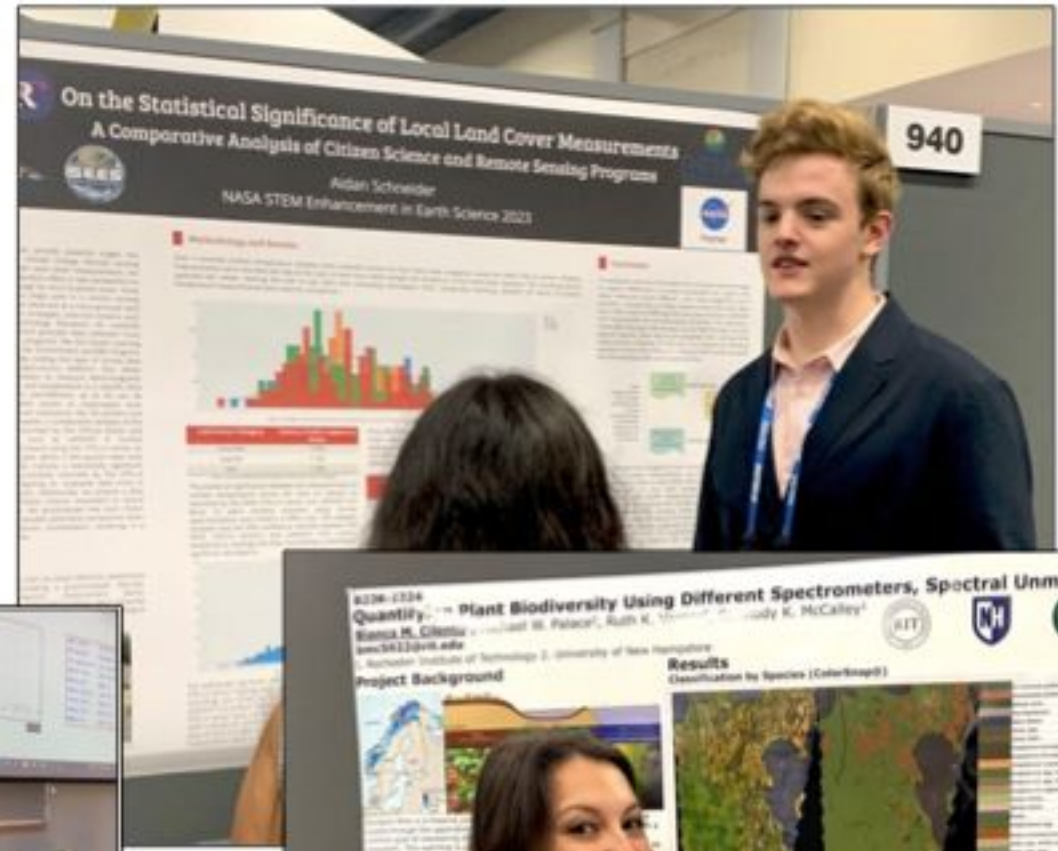
STELLA-Q2

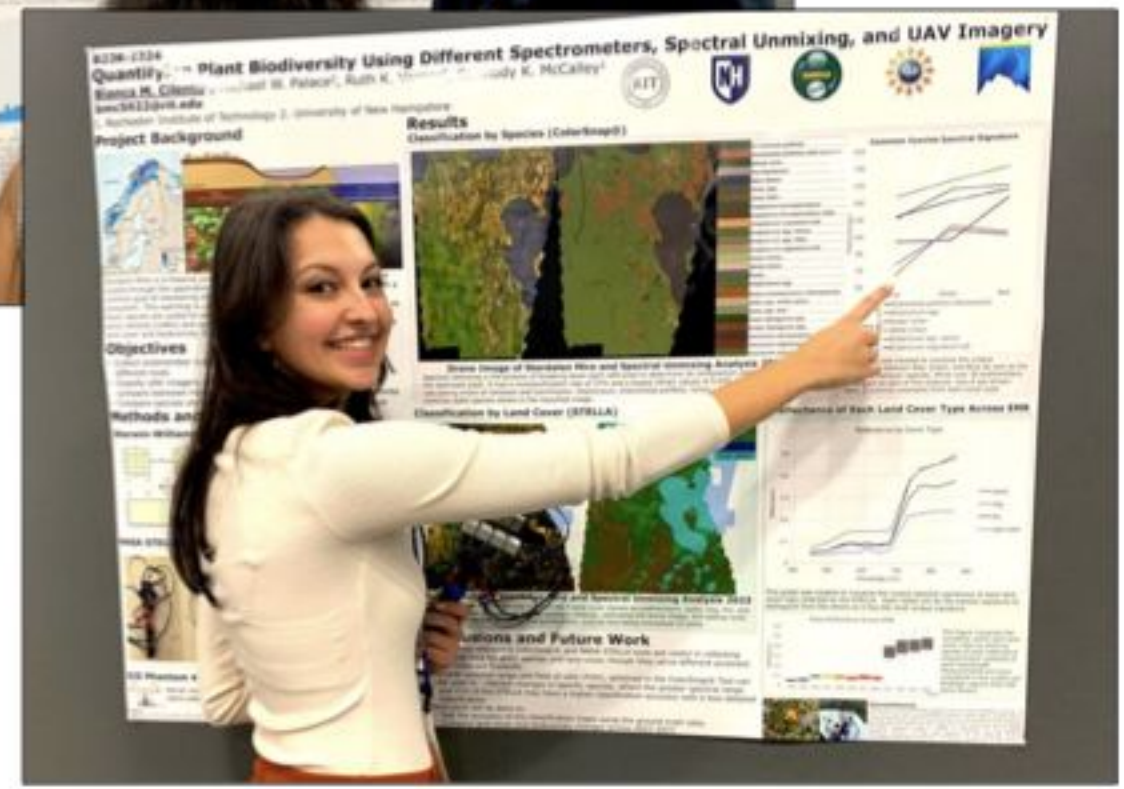


- 18 channels: visible, near infrared
- Live graphical display
- 410nm to 940nm
- Very low cost

A Few Uses




On the Statistical Significance of Local Land Cover Measurements
A Comparative Analysis of Citizen Science and Remote Sensing Programs
Aidan Schneider
NASA STEM Enhancement in Earth Science 2023
940


Plant Biodiversity Using Different Spectrometers, Spectral Unmixing, and UAV Imagery
Project Background
Results
Objectives

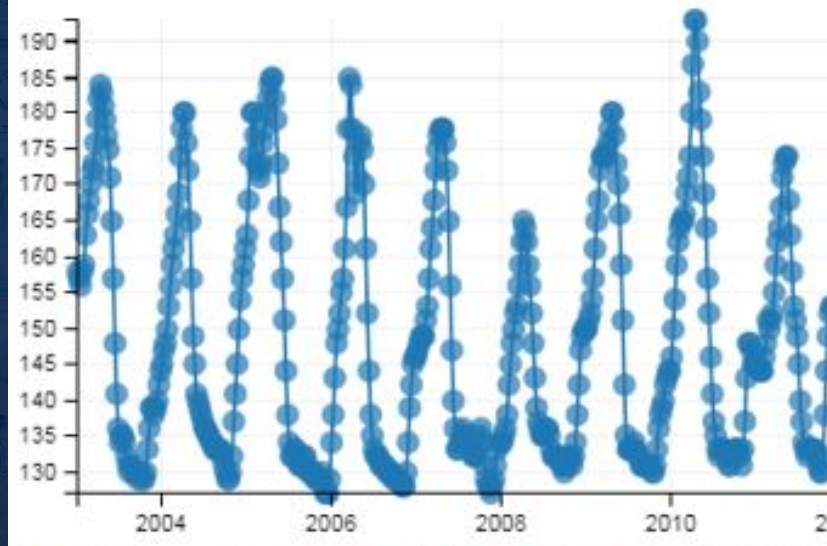
STELLA Website:
https://landsat.gsfc.nasa.gov/stella/

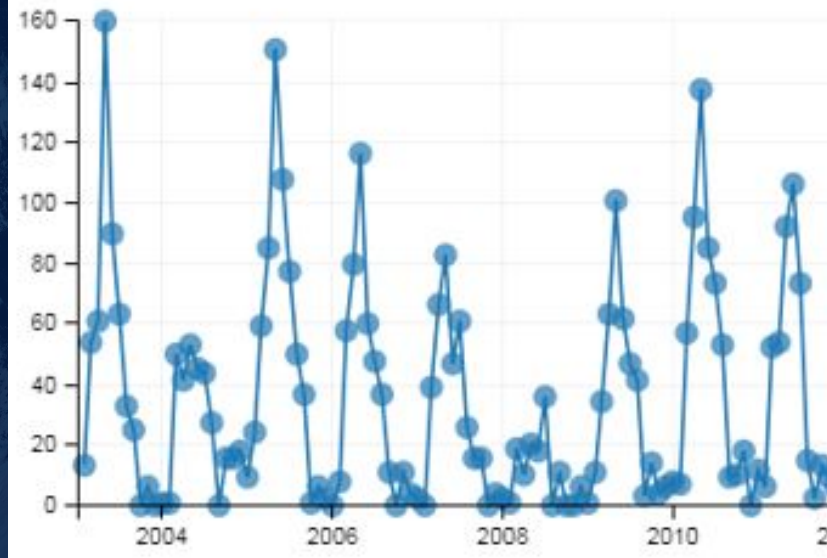
STELLA Forum:
https://github.com/STELLA-Landsat/STELLA/discussions

Introduction to AppEEARS

Elizabeth Joyner

3-3:40PM

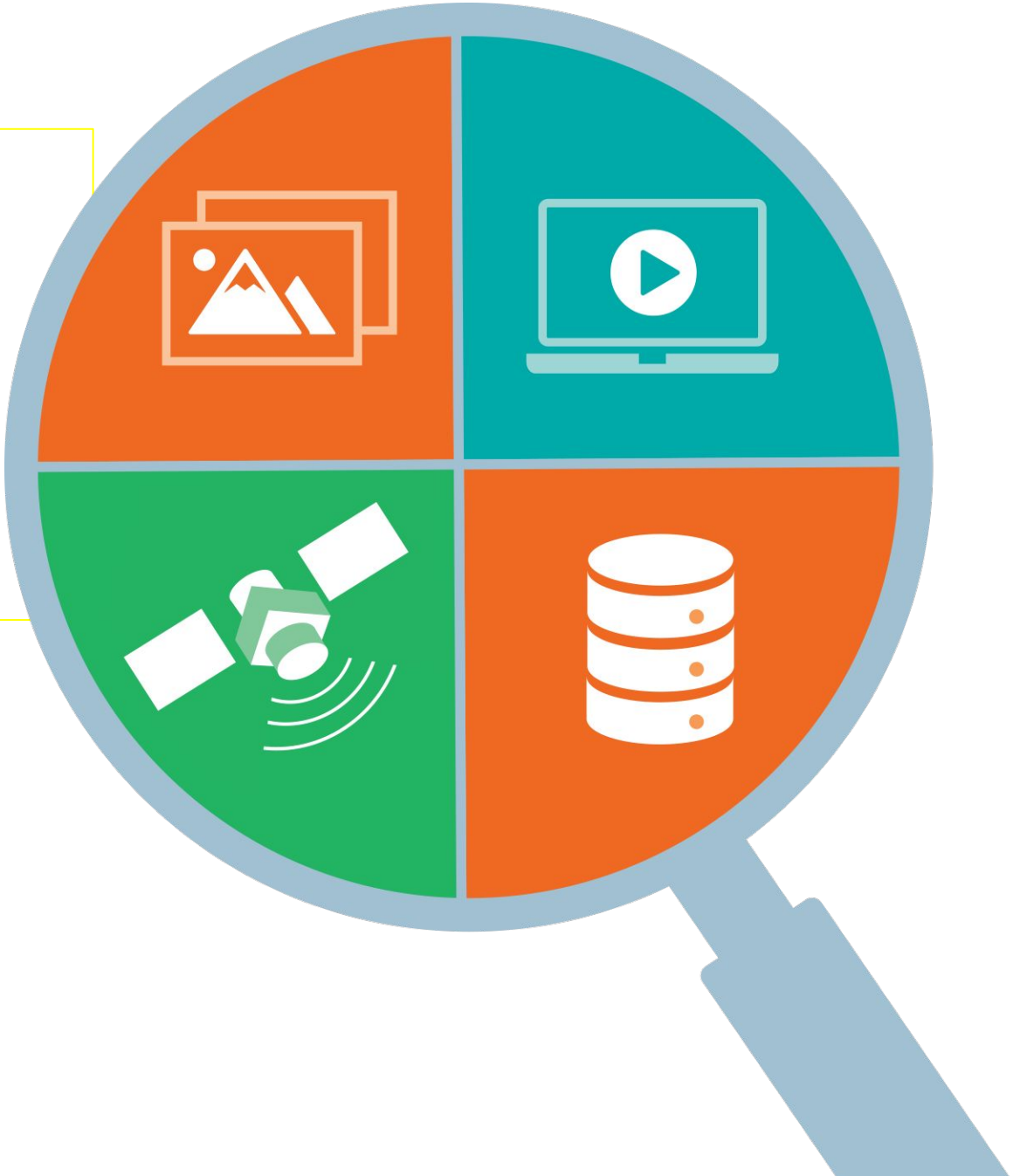




Credit: NASA/USGS

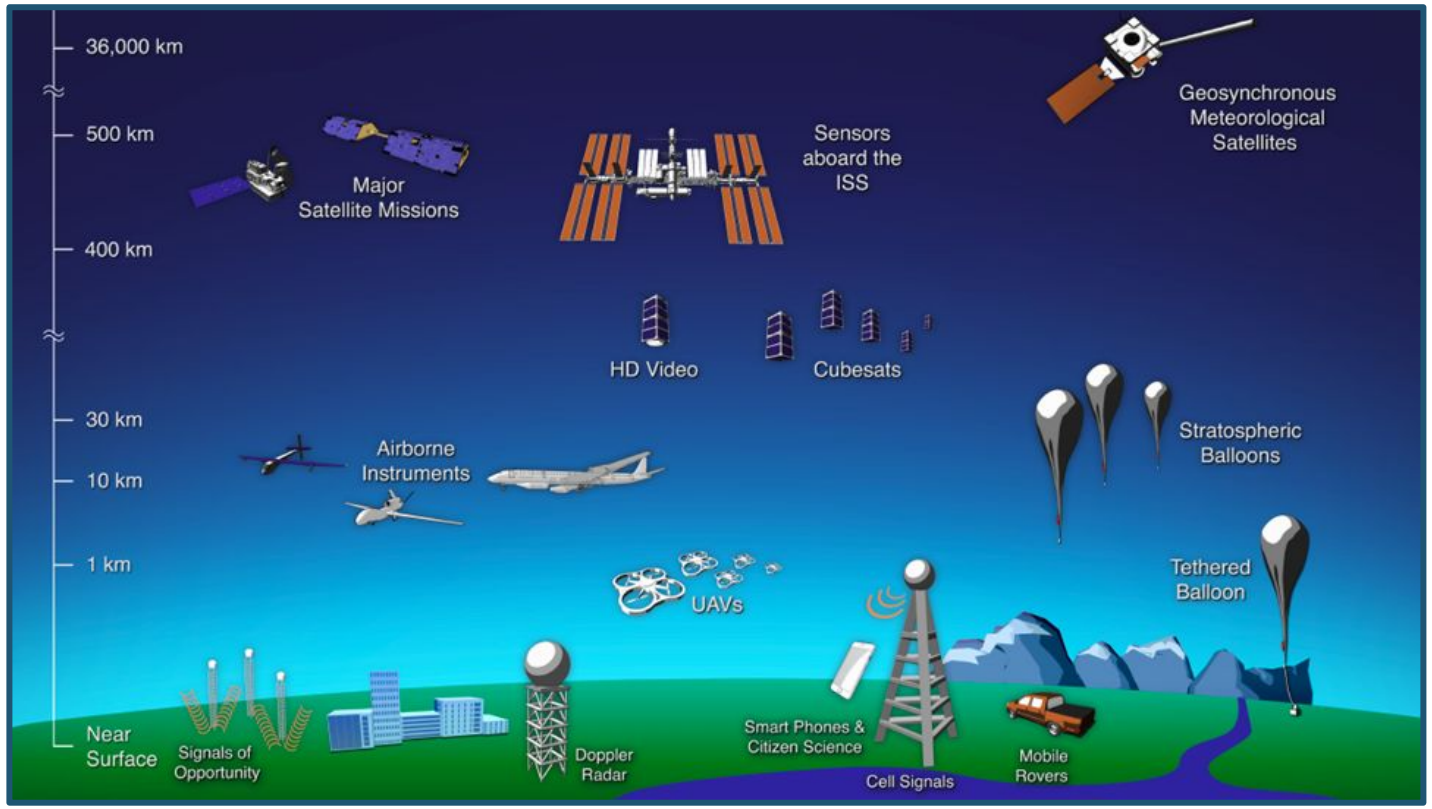
FINDABLE

- Where do you get data?
  - ***AppEEARS***
  - Worldview
  - Giovanni
  - Earthdata Search
  - Science Discovery Engine



EARTHDATA

Remote & In-Situ Earth Observations



Credit: NASA

How does NASA make science observations?

→ From Space, right…?

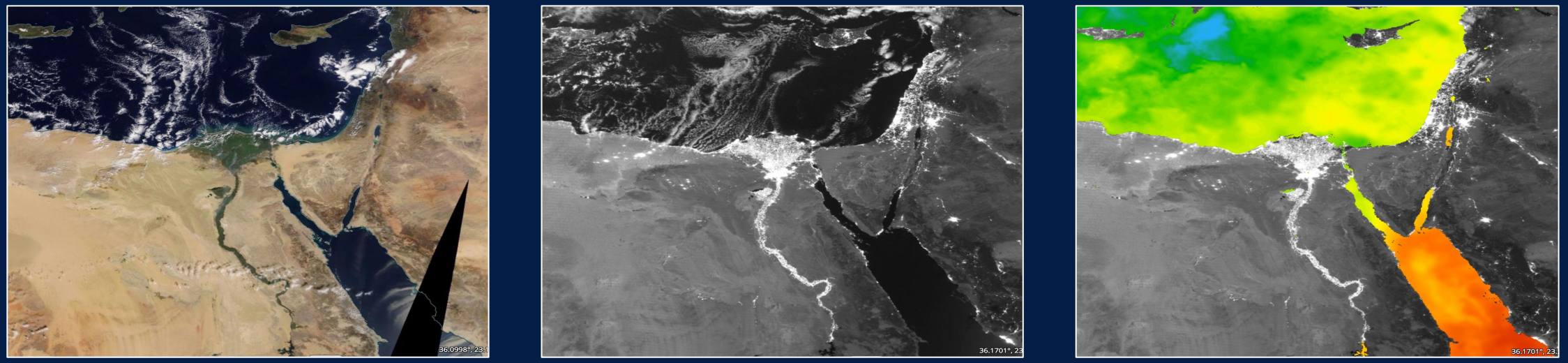
yes…

but *also* from:

Aircraft, UAS
Ships, R/Vs
Balloons
Vehicles
Ground networks
Ocean platforms

EARTHDATA

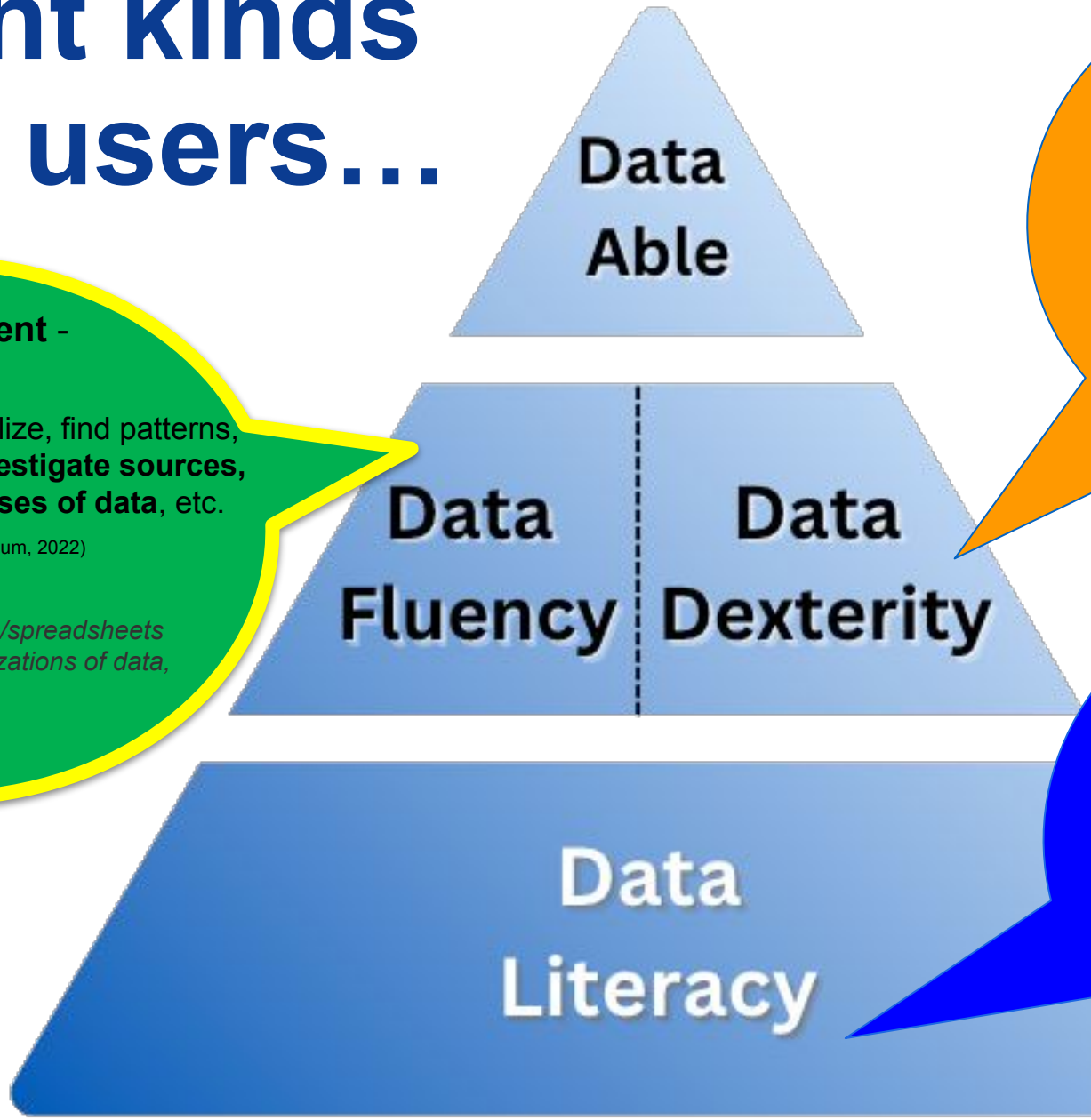

23:06:30



NASA’s Earthdata is the single largest repository of Earth science data in the world.

Credit: NASA

Different kinds of data users…



Data Fluent -

Ability to explore, visualize, find patterns, **identify problems, investigate sources, think about ethical uses of data**, etc.

(Concord Consortium, 2022)

I know how to:

- *Work with databases/spreadsheets*
- *Create maps, visualizations of data, dashboards, etc.*
- *Evaluate bias in data*

Data Dextrous

Ability to use diverse datasets to define and solve complex real-world problems, as well as **adapt** and **adopt existing and emerging technologies**.

(Rensselaer Polytechnic Inst, 2022)

I know how to:

- *program/code regularly*
- *work with data in the cloud*
- *develop technologies using open source resources*
- *analyze data in Jupyter Notebook or Google Colab*

Data Literate

Ability to collect, organize, visualize, analyze, interpret, and share data for yourself and other people to use and understand.

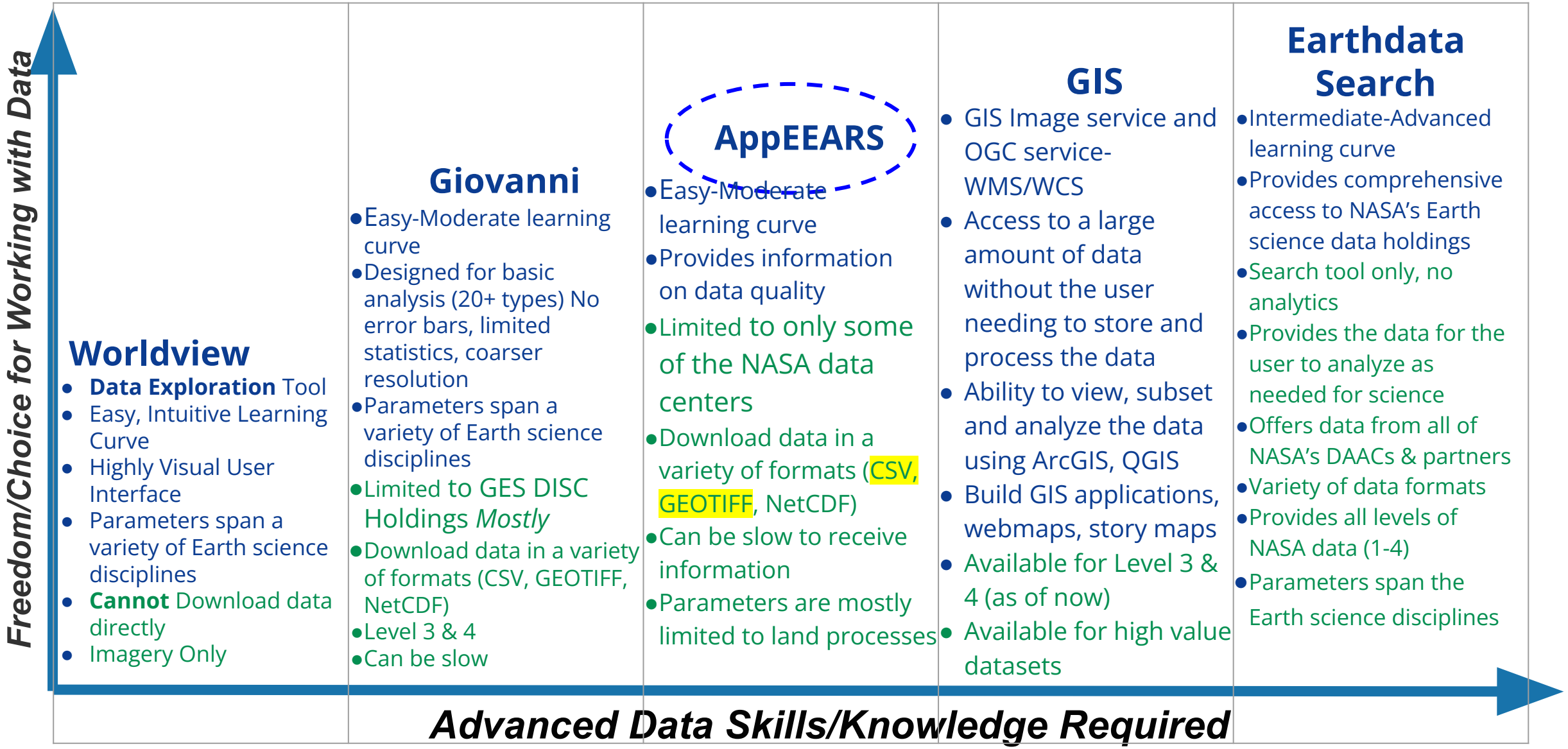
(Dataspire, 2021)

I know how to:

- *Collect data*
- *Summarize data*
- *Create graphs/charts of data*
- *Find trends and identify outliers*
- *Ask questions and identify insights in the data*

1 Question

Common NASA Tools & Their Characteristics



Worldview

- **Data Exploration** Tool
- Easy, Intuitive Learning Curve
- Highly Visual User Interface
- Parameters span a variety of Earth science disciplines
- **Cannot** Download data directly
- Imagery Only

Giovanni

- Easy-Moderate learning curve
- Designed for basic analysis (20+ types) No error bars, limited statistics, coarser resolution
- Parameters span a variety of Earth science disciplines
- Limited to GES DISC Holdings *Mostly*
- Download data in a variety of formats (CSV, GEOTIFF, NetCDF)
- Level 3 & 4
- Can be slow

AppEEARS

- Easy-Moderate learning curve
- Provides information on data quality
- Limited to only some of the NASA data centers
- Download data in a variety of formats (CSV, GEOTIFF, NetCDF)
- Can be slow to receive information
- Parameters are mostly limited to land processes

GIS

- GIS Image service and OGC service-WMS/WCS
- Access to a large amount of data without the user needing to store and process the data
- Ability to view, subset and analyze the data using ArcGIS, QGIS
- Build GIS applications, webmaps, story maps
- Available for Level 3 & 4 (as of now)
- Available for high value datasets

Earthdata Search

- Intermediate-Advanced learning curve
- Provides comprehensive access to NASA's Earth science data holdings
- Search tool only, no analytics
- Provides the data for the user to analyze as needed for science
- Offers data from all of NASA's DAACs & partners
- Variety of data formats
- Provides all levels of NASA data (1-4)
- Parameters span the Earth science disciplines

EARTHDATA

Land Processes Distributed Active Archive Center

Access remote sensing data through point and or area samples of your choice

EARTHDATA

Access remote sensing data through point and or area samples of your choice

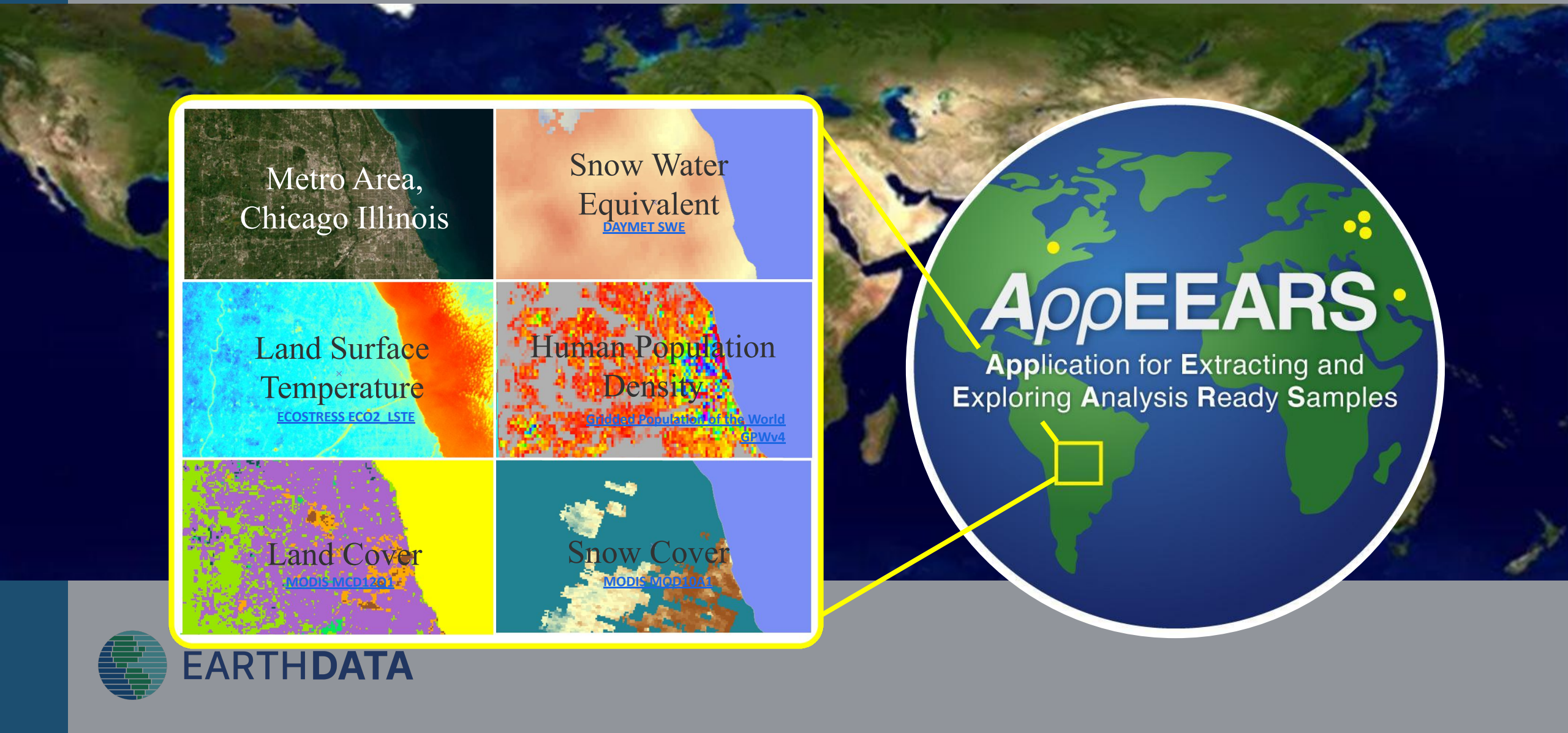
EARTHDATA

Access remote sensing data through point and area samples of your choice while avoiding challenging dataset nuances

No file naming conventions, Grids, Tiles, or Julian dates

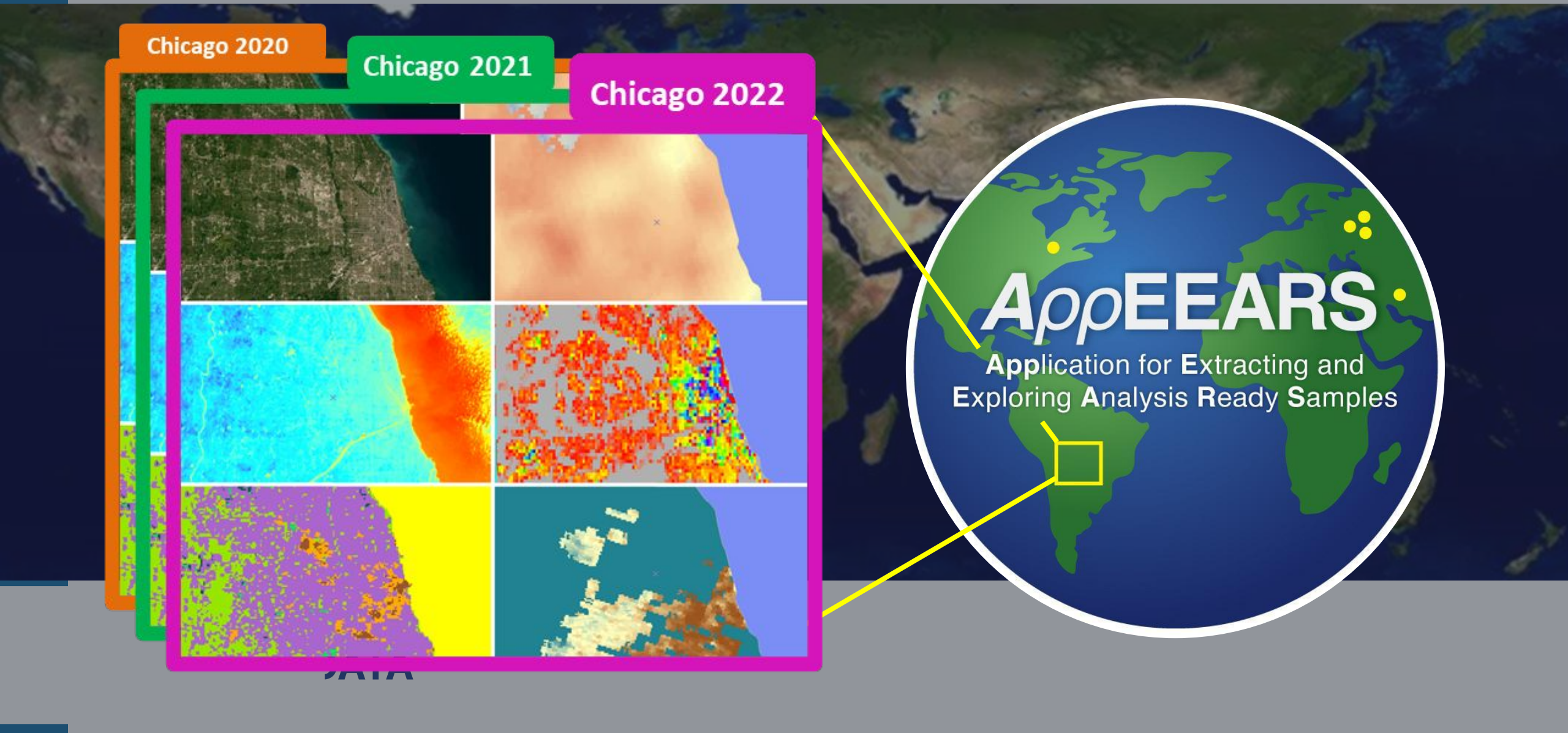
EARTHDATA

Subset multiple datasets simultaneously



EARTHDATA

Subset multiple datasets and years simultaneously



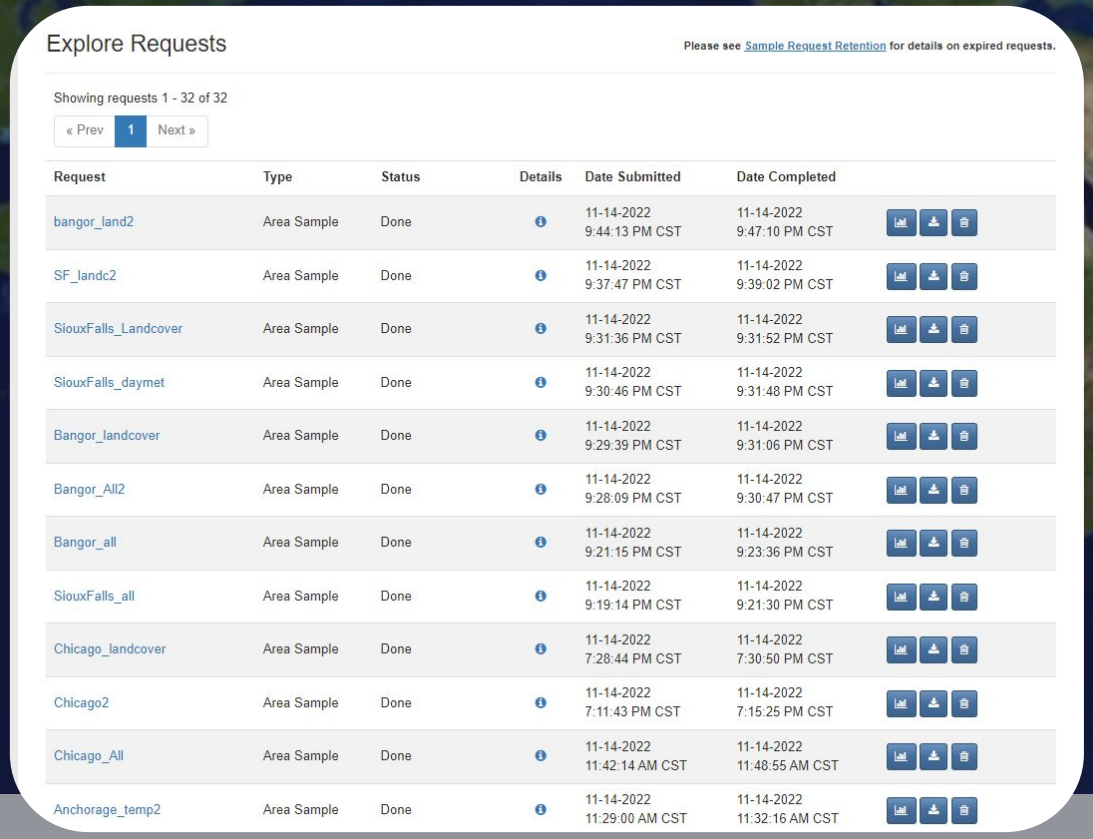
Subset multiple datasets, years, and locations simultaneously

EARTHDATA

Choose a projection and file type that works for you!

EARTHDATA

Keep track of and revisit your requests (for years)

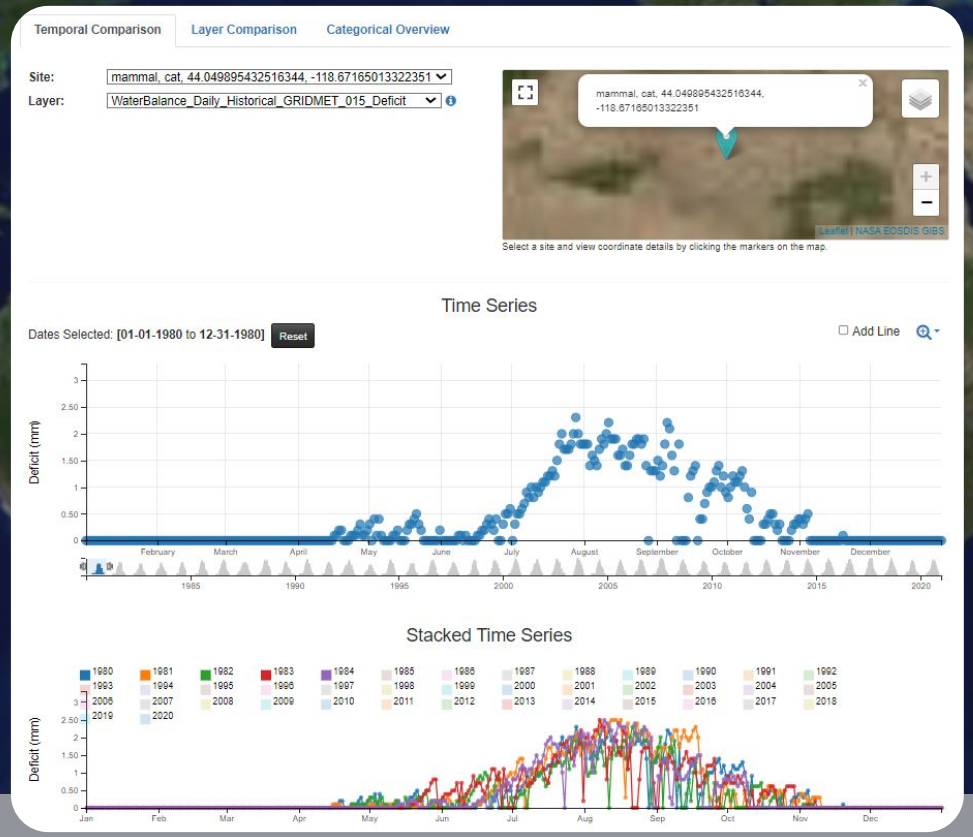


AppEEARS

Application for Extracting and Exploring Analysis Ready Samples

EARTHDATA

Explore your data prior to download

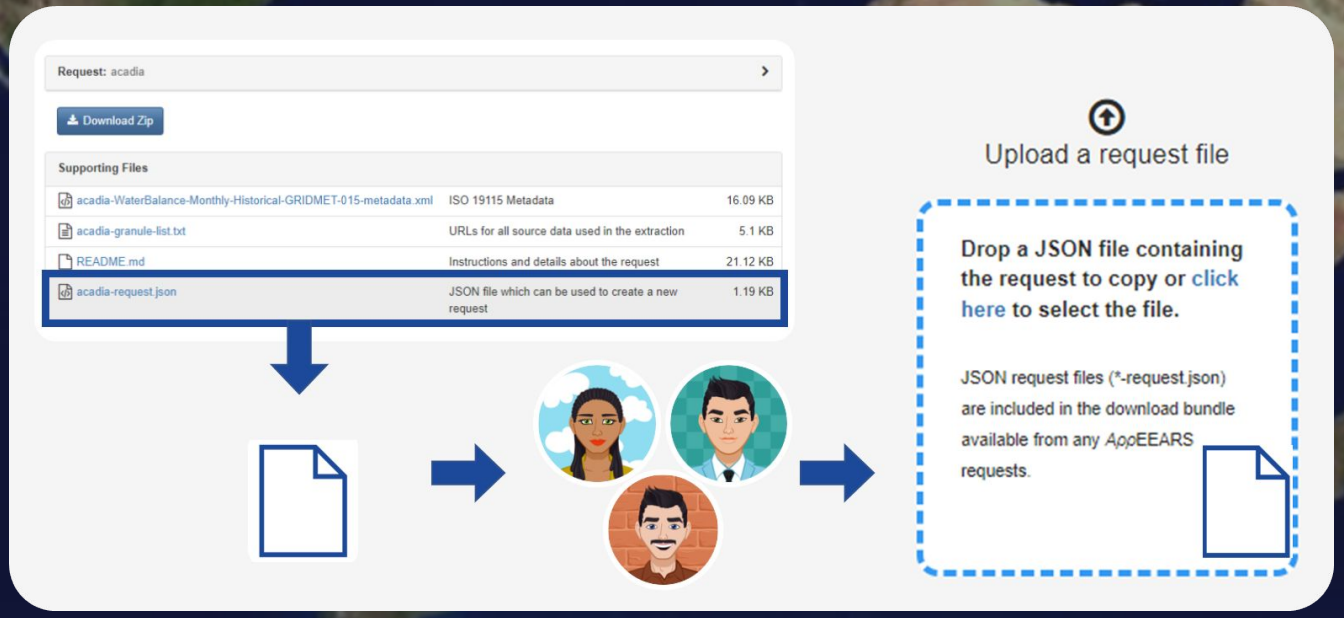


AppEEARS

Application for Extracting and Exploring Analysis Ready Samples

EARTHDATA

Share your requests with friends and colleagues



AppEEARS

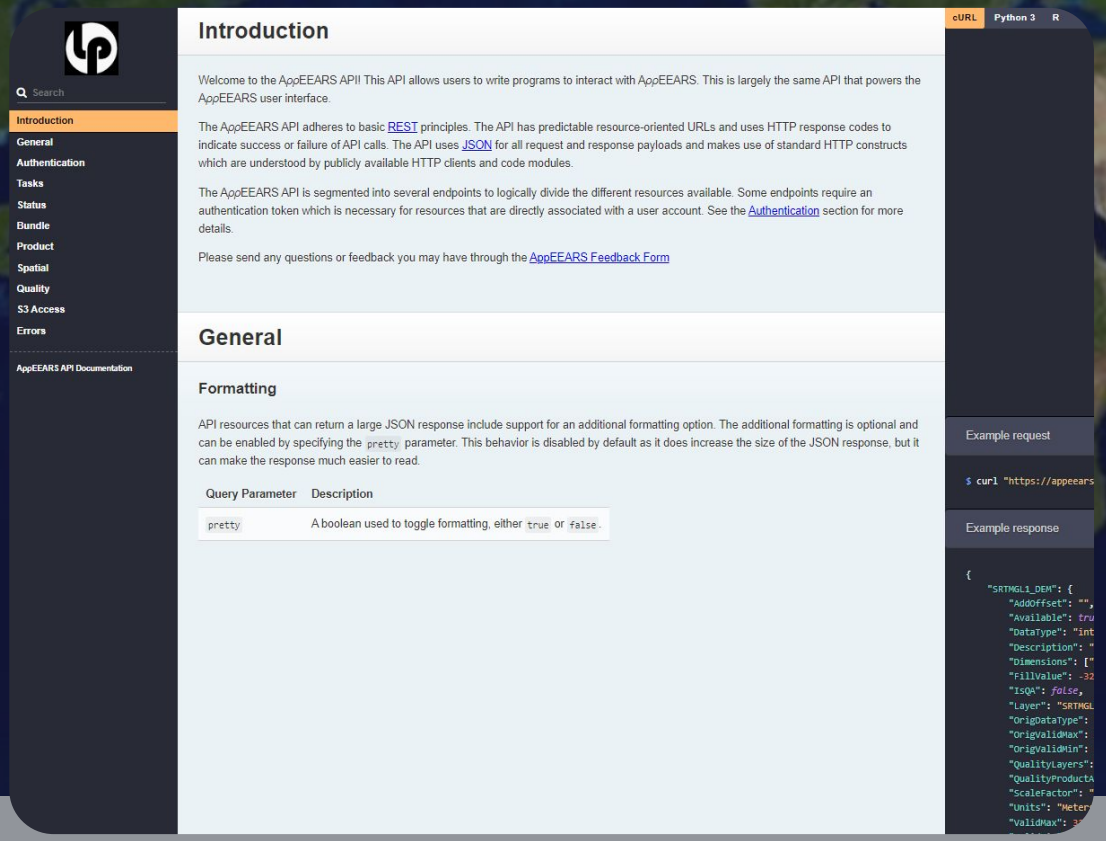
Application for Extracting and Exploring Analysis Ready Samples

EARTHDATA

Missions supported

EARTHDATA

Use the **API** for programmatic access



EARTHDATA

Use and co-develop R and Python resources for the AppEEARS **API**

EARTHDATA

USE CASE

Arnie, natural resource planner for Temple University, Philadelphia, PA

Arnie was tasked to evaluate the green spaces around the campus to reveal changes and infer long-term trends of vegetation. Arnie must develop a proposal that includes a projection for campus beautification projects. Arnie heard of AppEEARS as a way to access NASA and USGS data for quick download and decided to use the AppEEARS tool.

Temple University, Philadelphia, PA
Credit: Steven-L-Johnson, no changes

EARTHDATA

Hands On Activity

Location: Temple University

Instrument: Landsat 8

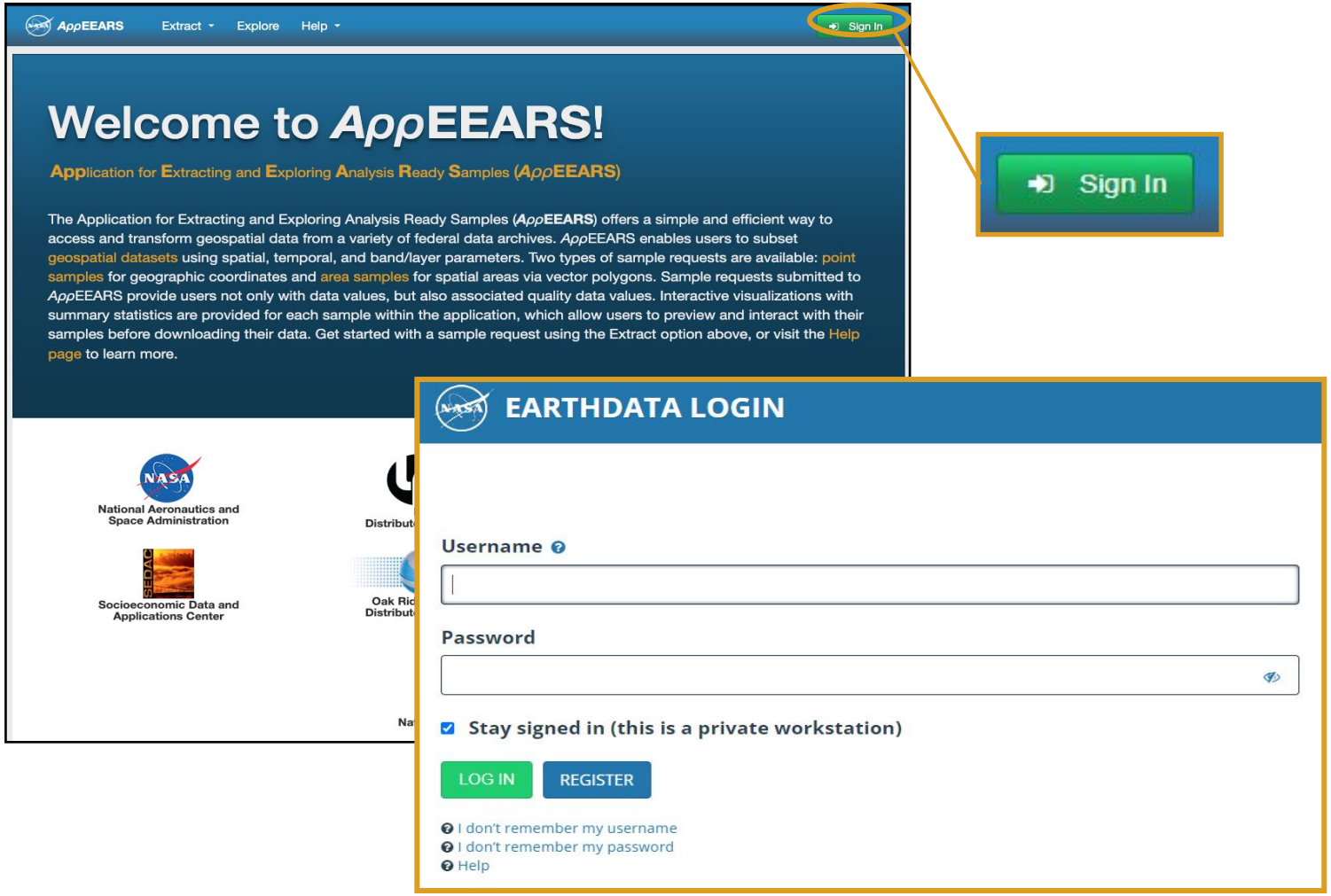
Data: Surface reflectance data band combination 5, 4, 3

Visualization:

- Area extraction (Temple University footprint)
- Point extraction for greenspaces of interest
- Temporal and Spatial Subsetting
- Optional: Data from multiple datasets and missions (e.g., weather-related data)

EARTHDATA

Get Started

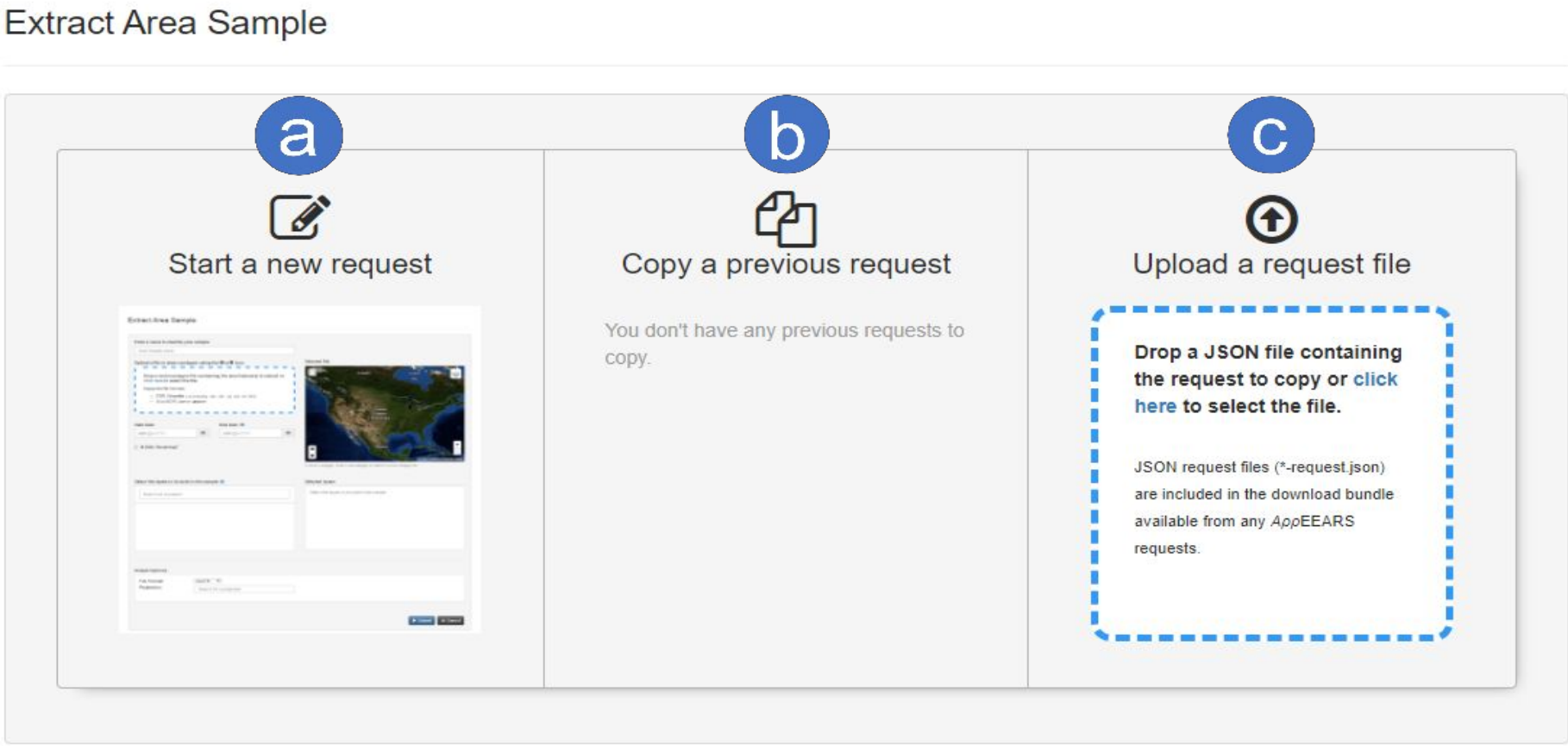


EARTHDATA

Explore AppEEARS

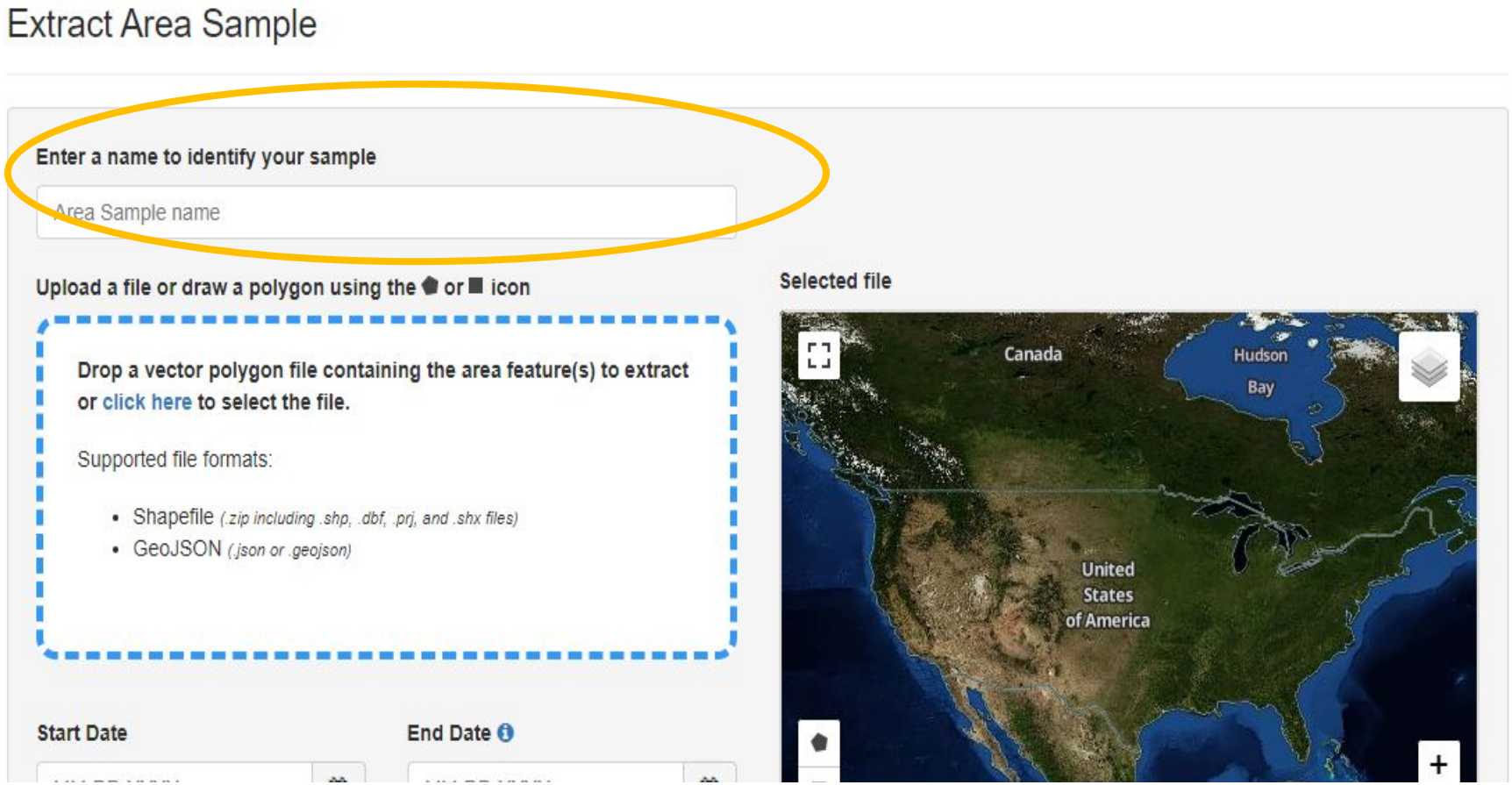
EARTHDATA

Create an Area Request



EARTHDATA

Create an Area Request



EARTHDATA

Create an Area Request

Extract Area Sample

Enter a name to identify your sample

Area Sample name

Upload a file or draw a polygon using the ⬟ or ■ icon

Drop a vector polygon file containing the area feature(s) to extract or click here to select the file.

Supported file formats:

- Shapefile *(.zip including .shp, .dbf, .prj, and .shx files)*
- GeoJSON *(.json or .geojson)*

d

Selected file

To clear a polygon, draw a new polygon or upload a vector polygon file.

Start Date

MM-DD-YYYY

End Date

MM-DD-YYYY

☐ **Is Date Recurring?**

Select the layers to include in the sample

Search for a product

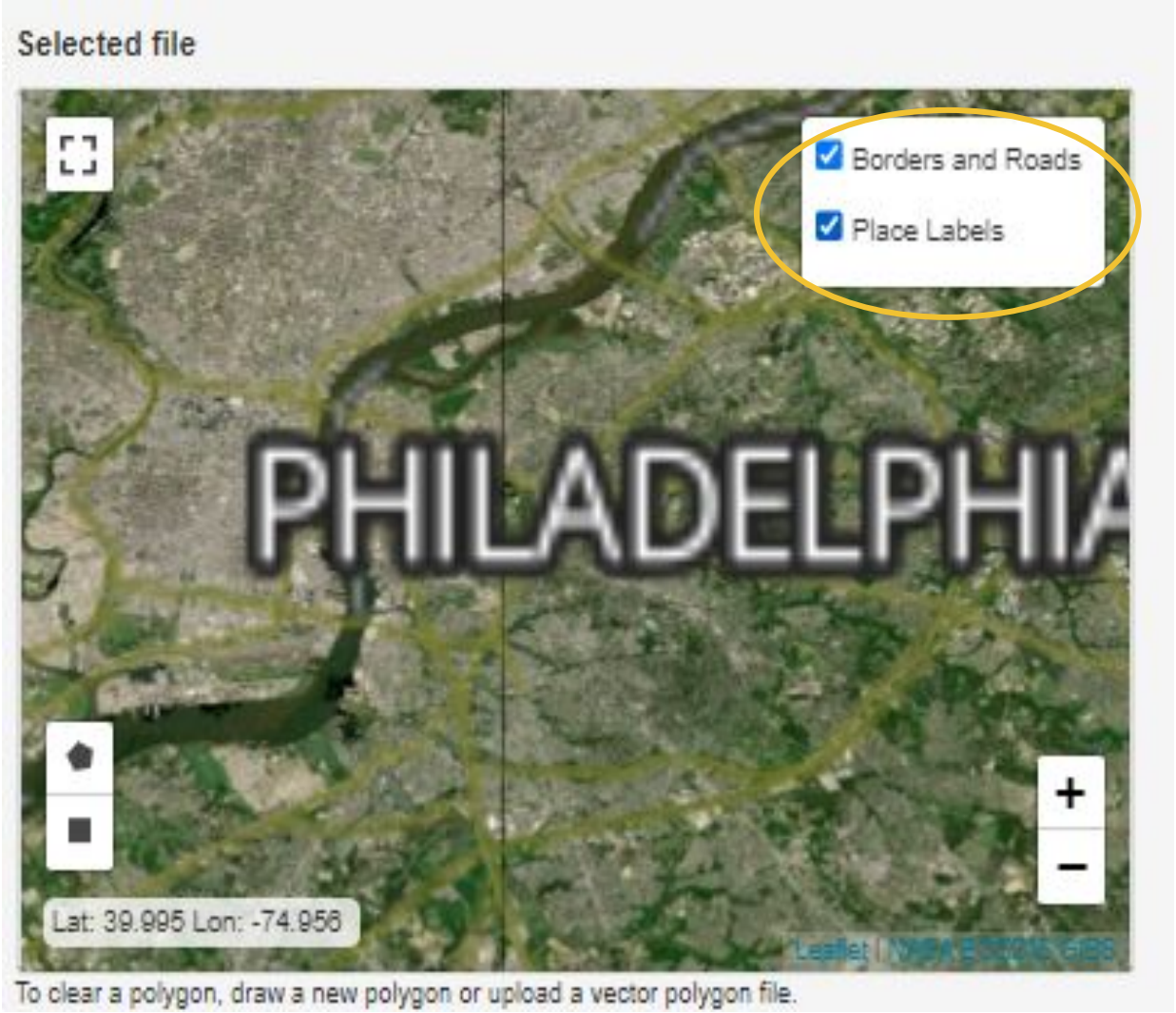
Selected layers

Select the layers to include in the sample

Create an Area Request

EARTHDATA

Create an Area Request



EARTHDATA

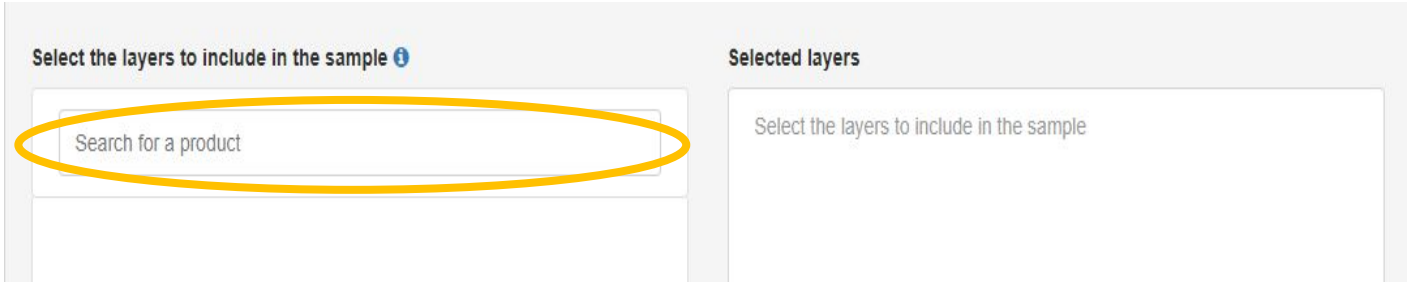
Setting Requirements

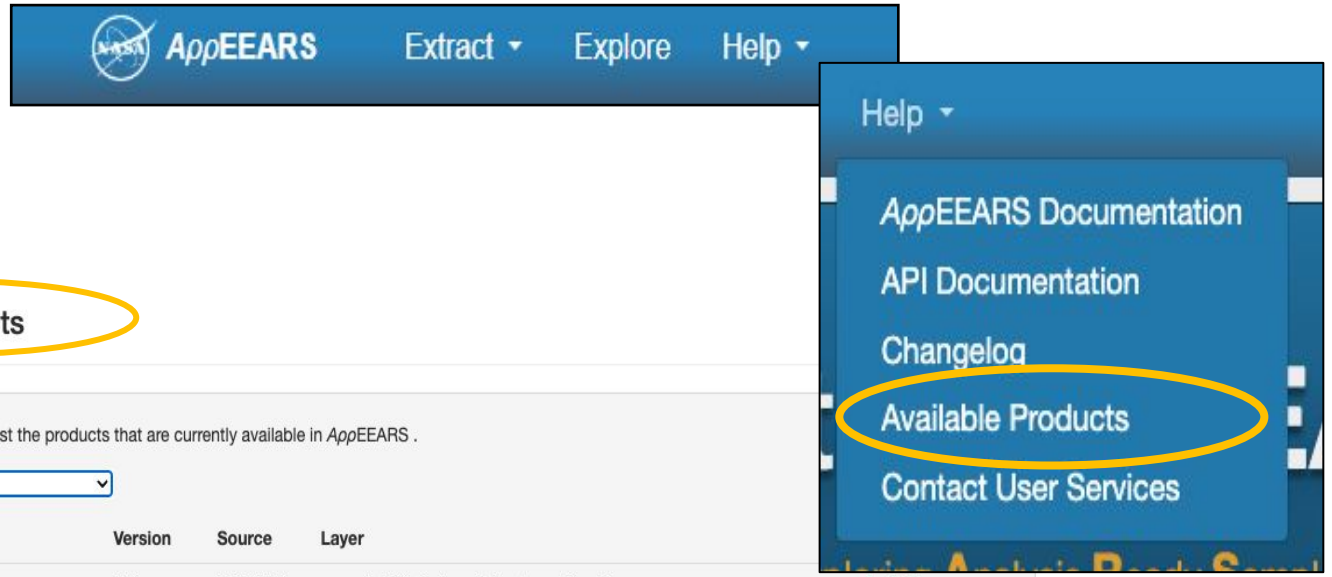
Date Requirements

EARTHDATA

Setting Requirements

Dataset Requirements





Select *Landsat ARD Landsat Collection 2 ARD Surface Reflectance - Landsat 8 L08.002, 30m, 16 Day, (2013-03-18 to Present).*

Landsat 8 Band Characteristics & Uses

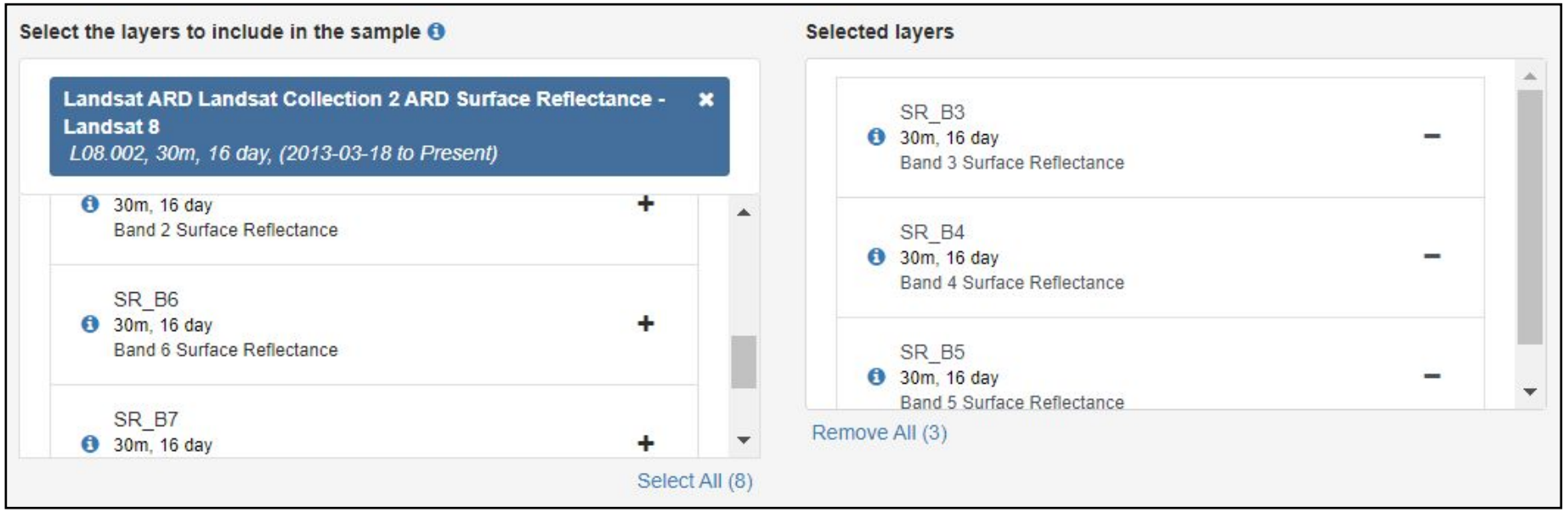
Band	Wavelength (μm)	Description	Common Uses of this Band	Spatial Resolution
Blue (2)	0.450 - 0.51	Blue Light	from vegetation	30 m
Green (3)*	0.53 - 0.59	Green Light	Vegetation health, land cover classification, plant vigor	30 m
Red (4)*	0.64 - 0.67	Red Light	Vegetation, vegetative slopes, natural color composites	30 m
Near-Infrared NIR (5)	0.85 - 0.88	Reflected Near-Infrared	Plant health assessment, biomass estimation, shorelines	30 m

Band Combination	Name	Common Applications of this Band Combination Application	Sample Display
5-4-3	Color Infrared (CIR)/ NIR False Color	Vegetation/Forest/Wetland health (highlight healthy vegetation (appears bright red); commonly used for measuring disturbed ground	

Setting Requirements

Dataset Requirements

A. SR_B5 (L08.002)
B. SR_B4 (L08.002)
C. SR_B3 (L08.002)



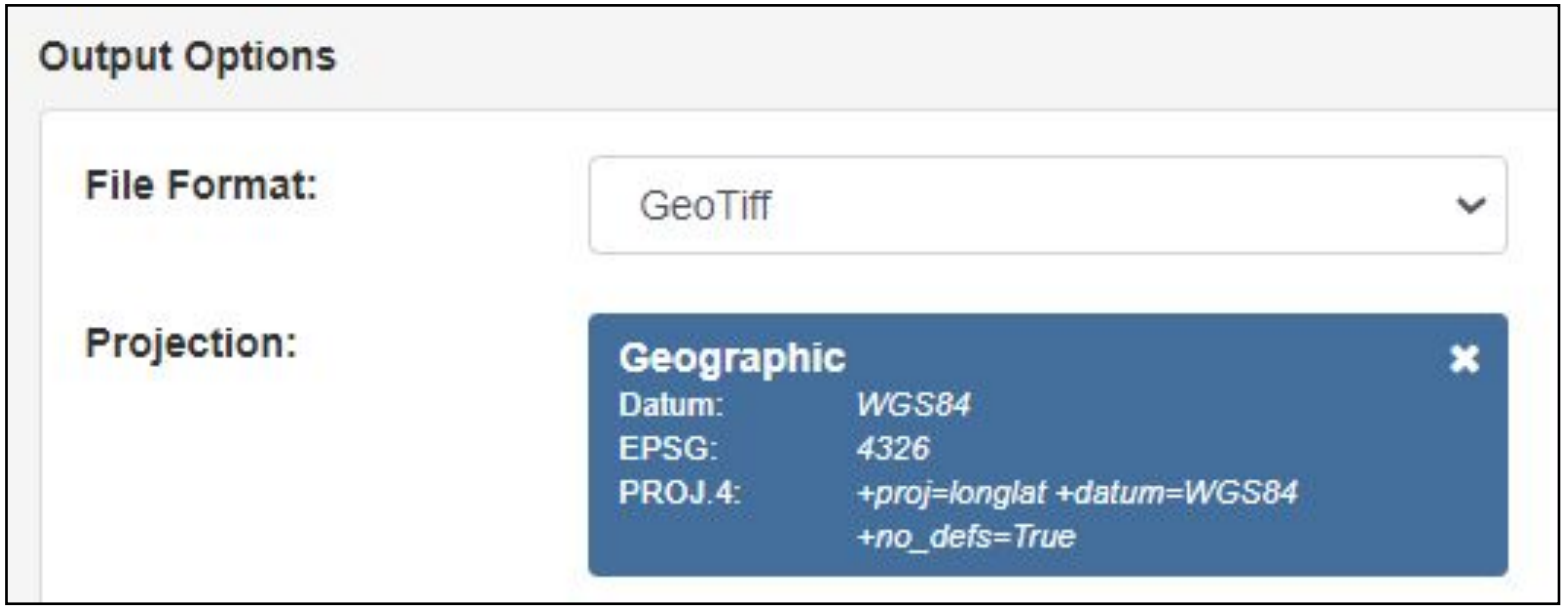
EARTHDATA

Setting Requirements

Dataset Requirements

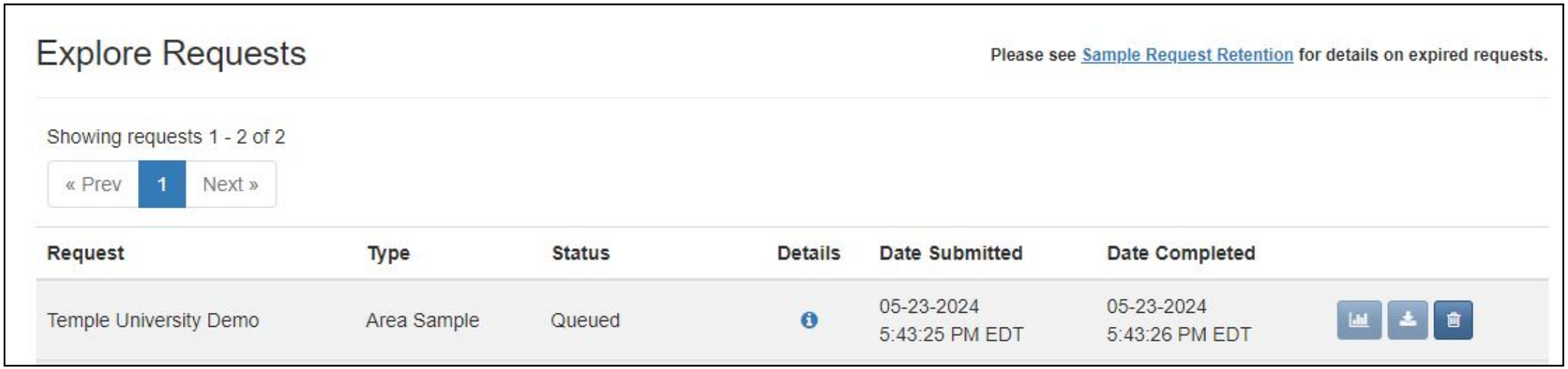
Select GeoTIFF for **File Format.**

Select Geographic for **Projection.**



EARTHDATA

Setting Requirements

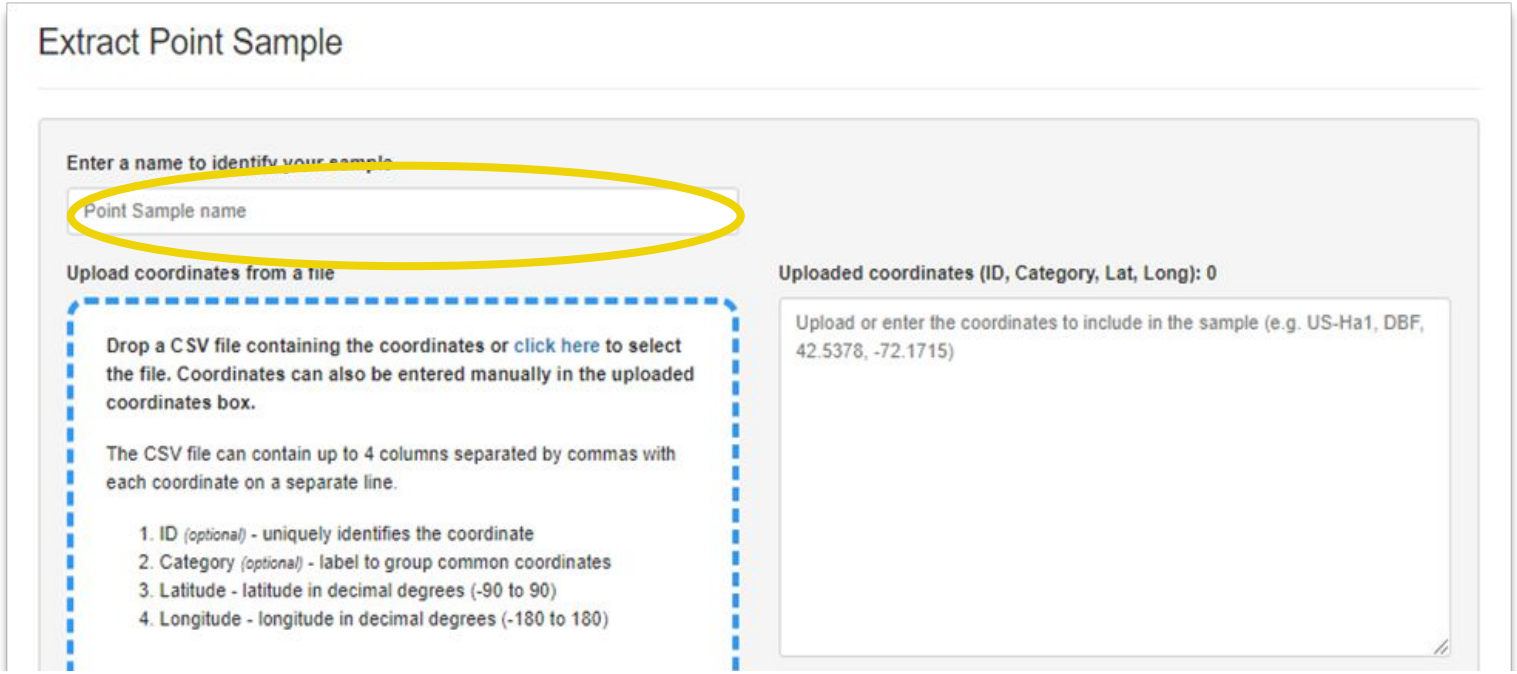


EARTHDATA

Manage, Explore, and Download the Results

1. **You will get an email when the request is complete.** At this time, access the **Explore Request** page to review, interact with, and explore the data.
2. Once the status of your request displays **Done**, users will have a variety of options available:
    i. Click the **View** icon  to view and interact with your results.
3. Click on the **Request** dropdown option at the top of the page to view the sample extraction details (e.g., Date Range, Product/Layers, Input Shapefile, Output File Format/Projection and Request ID).
    - Users have visualizations to explore data: (Note: visualizations are not publication-quality visualizations but are available for quick insights before downloading data.)
        - **Layer Stats Tab**
    - The Download Icon  to download the results (.zip).
        - There are a couple of ways to download the data
            - Visit the Explore Screen, select the dropdown for the Request. Click the Download button 
            - Or visit the Explore navigation and select **Explore Requests**, and select the download  icon.
        - The Download Area Sample page contains two sections:
            - Supporting Files
            - The sample request output GeoTIFF or NetCDF-4 files

Create a Point Request



EARTHDATA

Setting Requirements

Date Requirements: 07/01/2013 to 07/01/2023

EARTHDATA

Setting Requirements

Spatial Requirements:

1. Insert the coordinates of your AOI in one of the following methods:
   a. Upload or drop a CSV file containing lat/long coordinates.*
   b. Manually enter the coordinates of your AOI in the right hand box under "Uploaded Coordinates". Inputs must be entered so that each row represents a single site and each column is separated by a comma.*
   If you do not know the coordinates of green spaces for Temple University, consider using the following:

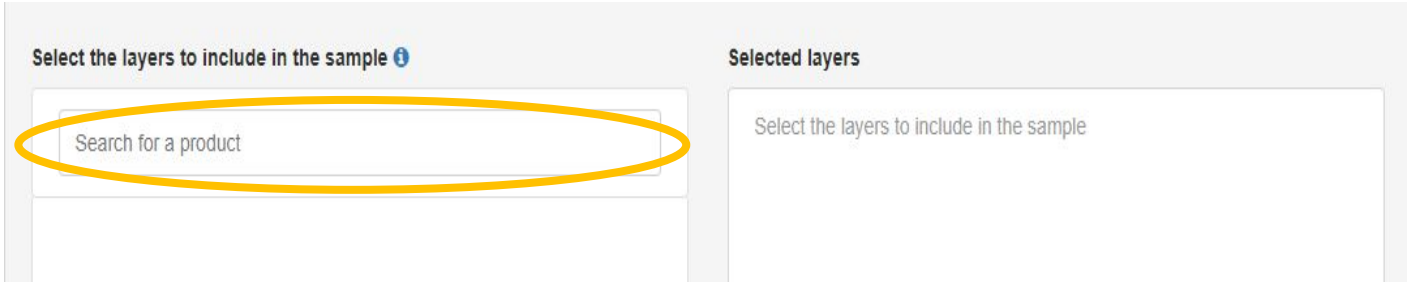
Zoom to your AOI on the map box (bottom right), select the **Point icon Map** point draw icon and then click on a location. (Note: You may not be able to zoom to your AOI at the resolution necessary.

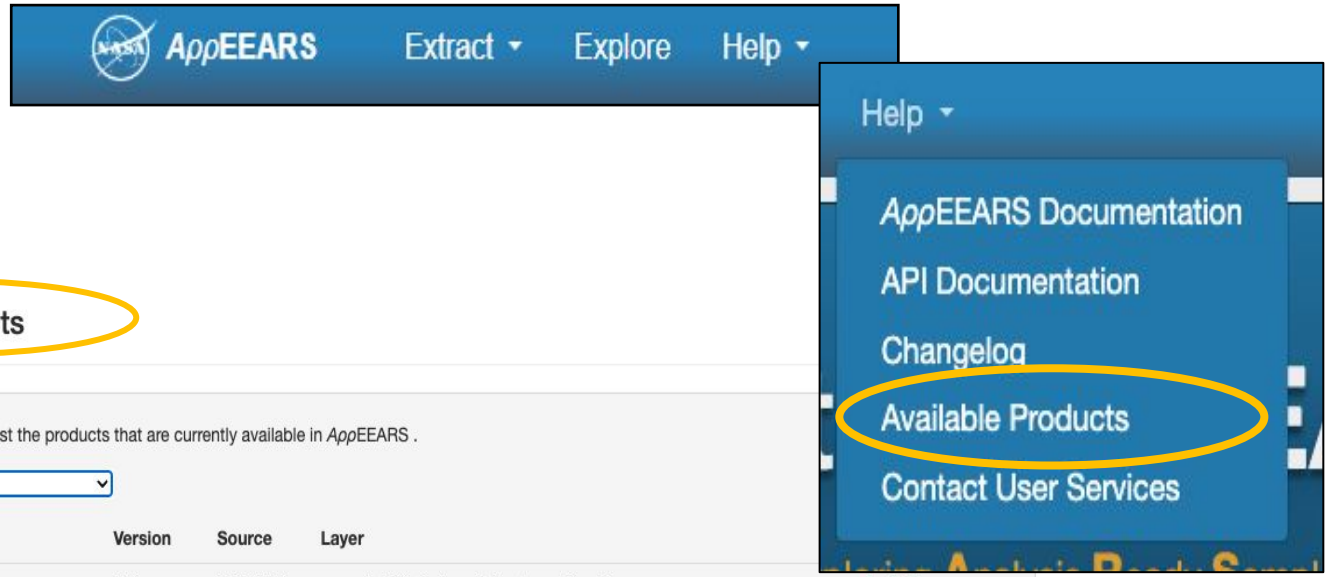
Name of Green Space	Coordinates
Beury Beach	39.981588, -75.154273
1828 N Park Ave	39.980904, -75.156423
1801 N Broad St	39.981212, -75.154050
2001-59 N 13th St	39.983620, -75.153837

EARTHDATA

Setting Requirements

Dataset Requirements





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A. SR_B5 (L08.002)
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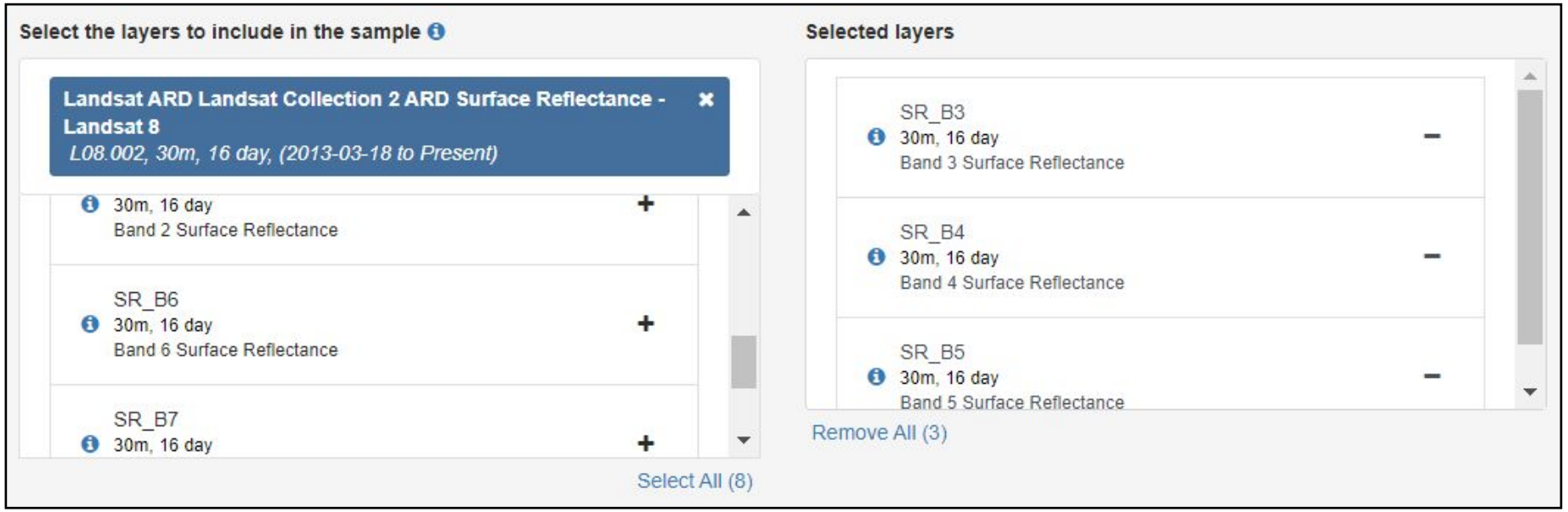
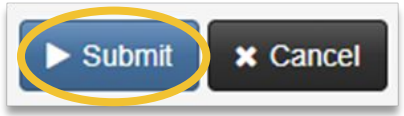
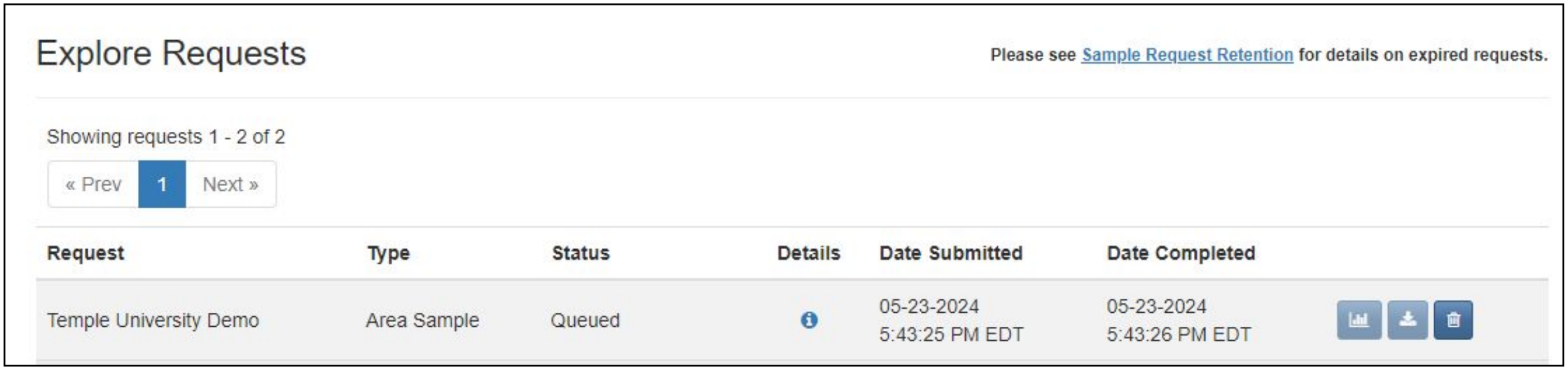
C. SR_B3 (L08.002)





EARTHDATA

Setting Requirements



EARTHDATA

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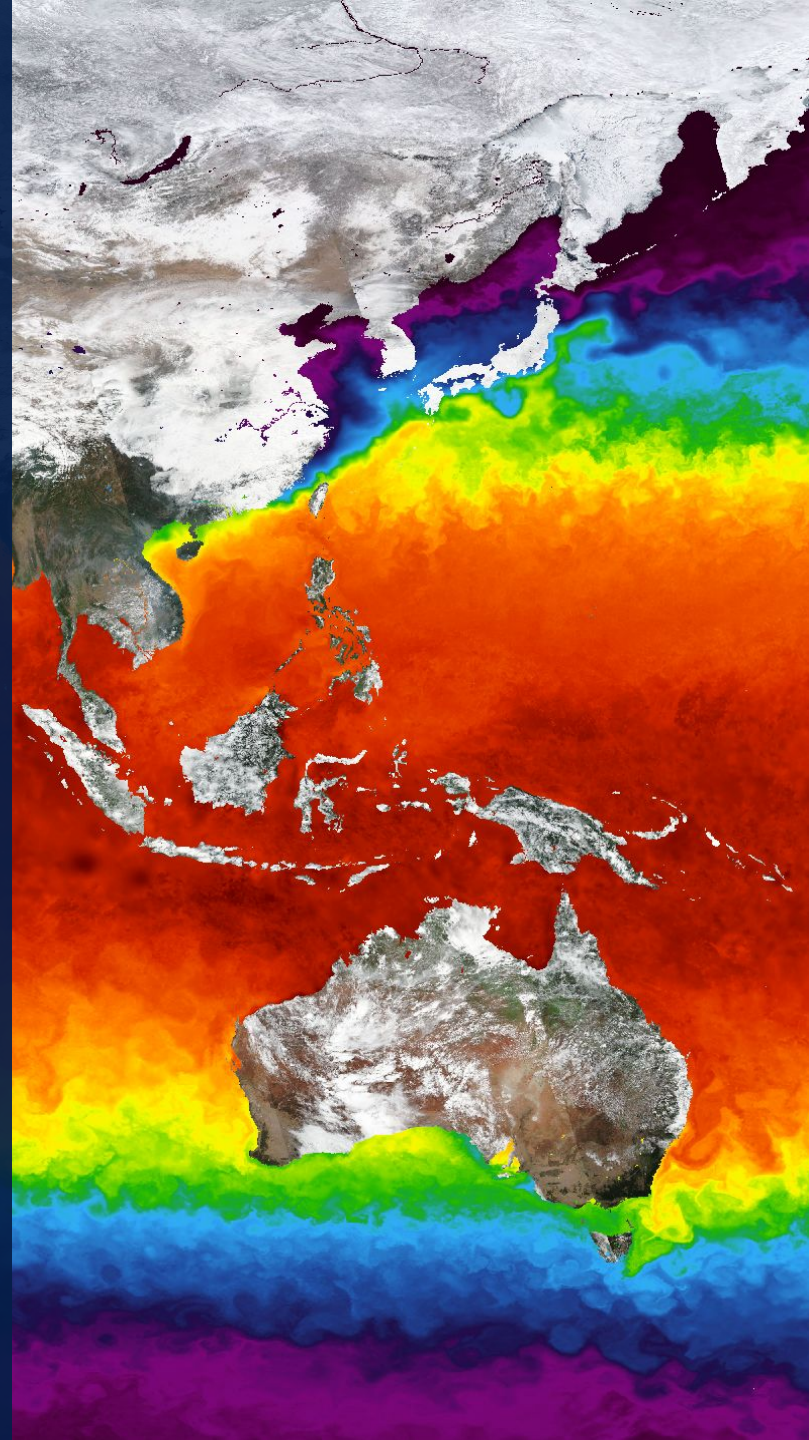
    - Users have visualizations to explore data: (Note: visualizations are not publication-quality visualizations but are available for quick insights before downloading data.)
        - **Temporal Comparison Tab**
            - **Time Series Plot**
            - **Stacked Time Series Plot**
    - The Download Icon  to download the results (.zip).
        - There are a couple of ways to download the data
            - Visit the Explore Screen, select the dropdown for the Request. Click the Download button 
            - Or visit the Explore navigation and select **Explore Requests**, and select the download  icon.
        - The Download Point Sample page contains 3 sections:
            - Bundle zip file
            - Supporting Files
            - The sample request output CSV files

Wrap Up

Elizabeth Joyner
3:40 - 4PM



Credit: NASA/USGS

Returning Home

Want More Training? Connections?

- ARSET
- Earthdata Newsletter and Social Media
- Earthdata Webinars

EARTHDATA

Take-Home Points

- NASA has the largest repository of the Earth and environmental data in the world including Landsat
- NASA has a variety of data and resources to help inform decision makers about vegetation and other environmental conditions.
- STELLA provides students with connection real-world remote sensing tools and data to make the learning personal
- NASA's data web apps and tools are not all created the same and are designed with different kinds of features and users in mind.
    - NASA Earthdata provides users access to the entire NASA repository.
- Users have support when they return home.

EARTHDATA

earthdata.nasa.gov

Thank you!