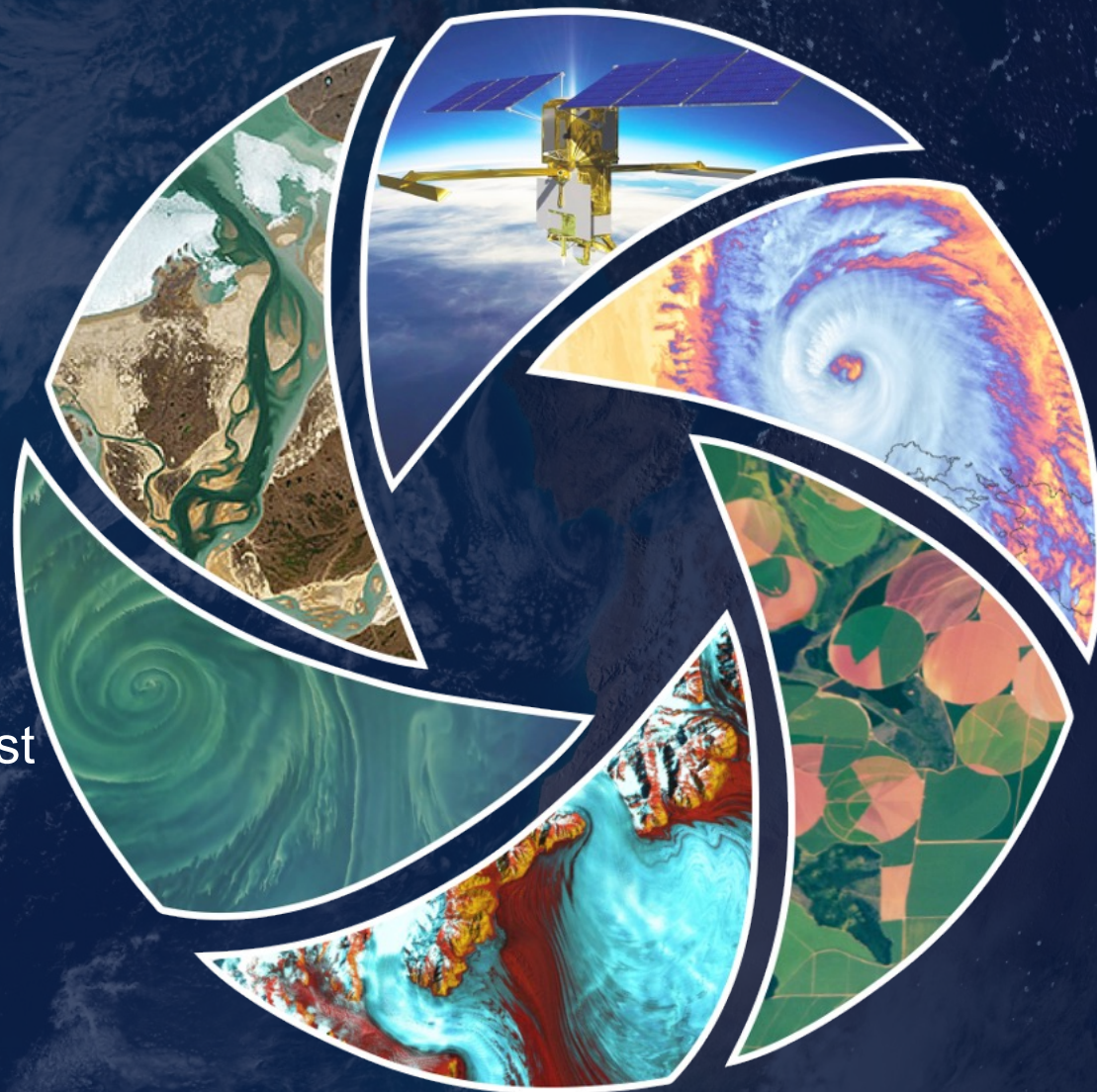


Commercial Smallsat Data Acquisition (CSDA) Program

May 2024

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Dana Ostrenga, NASA GSFC Project Manager

Earth Action Program
Science Mission Directorate
NASA





Overview

- Program Goals and Objectives
- Recent Changes - leadership
- Evaluation Process and Criteria
- Data Access and Use
- Science Research and Evaluation Cases
- Further Information and Contacts



Commercial Smallsat Data Acquisition (CSDA) Program Goals

The Commercial Smallsat Data Acquisition (CSDA) program was established by NASA's Earth Science Division (ESD) to identify, evaluate, and acquire commercial small-satellite (smallsat) data that support NASA's Earth science research and application goals.

<https://www.earthdata.nasa.gov/esds/csda/commercial-datasets>

Commercial Smallsat Data Acquisition (CSDA) Program Objectives



- Establish a continuous and repeatable process to onramp new commercial data vendors.
- Enable sustained use of purchased data for broader use and dissemination by NASA scientific community.
- Ensure long-term data preservation, access and distribution of purchased data and long-term access for scientific reproducibility.
- Coordinate with other US Government agencies and international partners on the evaluation and scientific use of commercial data.
- Compliance with 2003 US Commercial Remote Sensing Policy



Commercial Smallsat Data Acquisition (CSDA) Program Timeline



CSDA's tiered End User License Agreement (EULA) approach is modeled after National Reconnaissance Office (NRO) Geospatial Intelligence Systems Acquisition Directorate Commercial Systems Program Office (CSPO) common, standardized family of EULAs.

Three-Tiers of End User License Agreements (EULAs)

Authorized User Community	Type of EULA		
	Public Release	U.S.G. Plus	U.S.G.
U.S. Federal Government including: <ul style="list-style-type: none"> ○ U.S. State/Local/Tribal Government; Academia; Contractors and Grantees associated with Government Agency 			X
U. S. Federal Government, Foreign Civil Partners		X	X
Public Release	X	X	X

USG license is minimum level for CSDA
 Scientific Non-Commercial Use License

What is new?

Changes to Contracting Approach

- All new business is on-ramped via Indefinite Delivery Indefinite Quantity (**IDIQ**) process. We will issue competitive task orders for vendors to propose instead of sole source approaches.
- Vendors must improve data access options with both a **GUI and API**
- Two new vendors are being evaluated: **PlanetIQ and Umbra**
- **ROSES A.51** released 12/05/23 to support this evaluation
- Planning for next **Announcement-of-Opportunity** for new vendors in FY24, but it is budget dependent. No further details available at this time.

IDIQ Vendors

- Airbus DS Geo, Inc.
- Capella Space Corp.
- GHGSat, Inc
- Maxar Intelligence, Inc.
- Space Sciences and Engineering (doing business as PlanetIQ)
- Spire Global Subsidiary, Inc.
- Umbra Lab, Inc.

What is new?

The Program has moved from ESDS to Earth Action through which we continue to:

- Leverage the commercial sector's capabilities to augment or complement our existing product suites, particularly with higher spatial and temporal resolution data
- Provide the avenue to capitalize on rapid technological enhancements in the commercial space industry to enhance our own capabilities, providing cost efficiencies
- Increase inter-agency partnerships and support development of standardization and interoperability across data production

What is new?

Management and Personnel

- Program management has been moved to the Earth Action portfolio at NASA HQ (under Associate Director Tom Wagner)
- New Program Manager at NASA HQ – Melissa Martin
- New Project Manager (at the Project Office at NASA Goddard replacing Alfreda Hall) - Dana Ostrenga

Development of a new strategic plan

- TBD

What hasn't changed?

- Focus on evaluating and acquiring data to support NASA's scientific & applications work.
- Some previous vendors continue under their Blanket Purchase Agreements (BPAs).
- Data access portals and vendor-specific licensing continues. <https://www.earthdata.nasa.gov/esds/csda/commercial-datasets>
- Evaluation process to determine usefulness of data has proven successful and continues, we will continue to improve the process.

NASA has 5 vendors with continuing BPAs

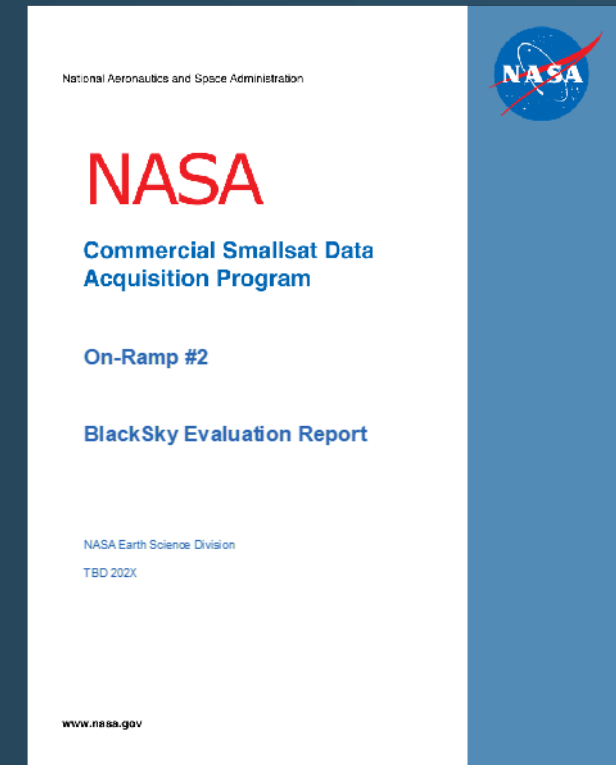
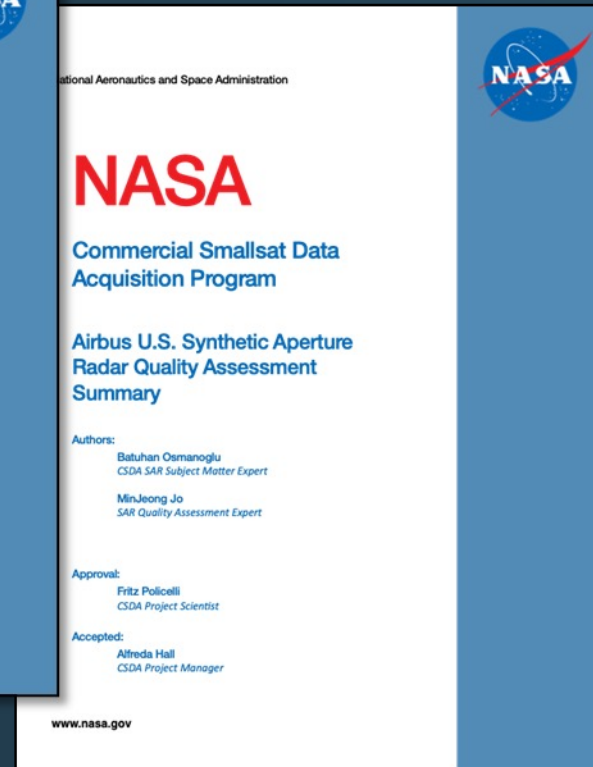
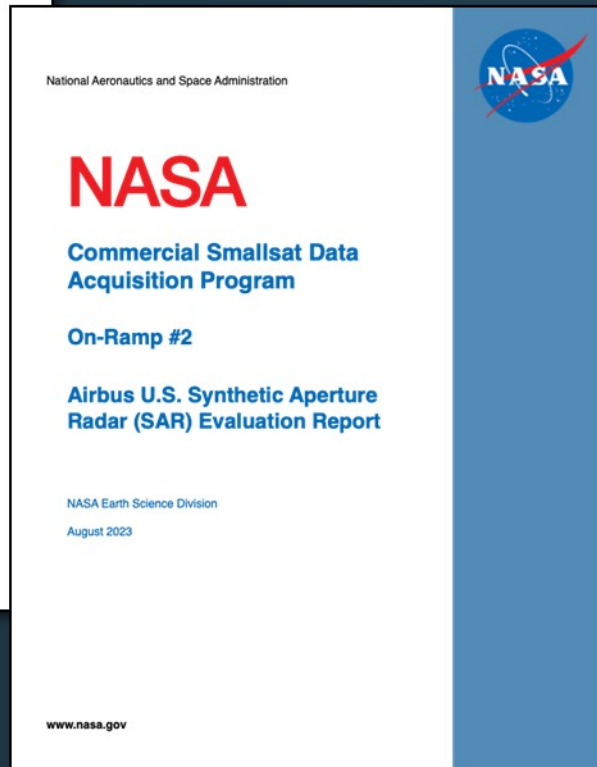
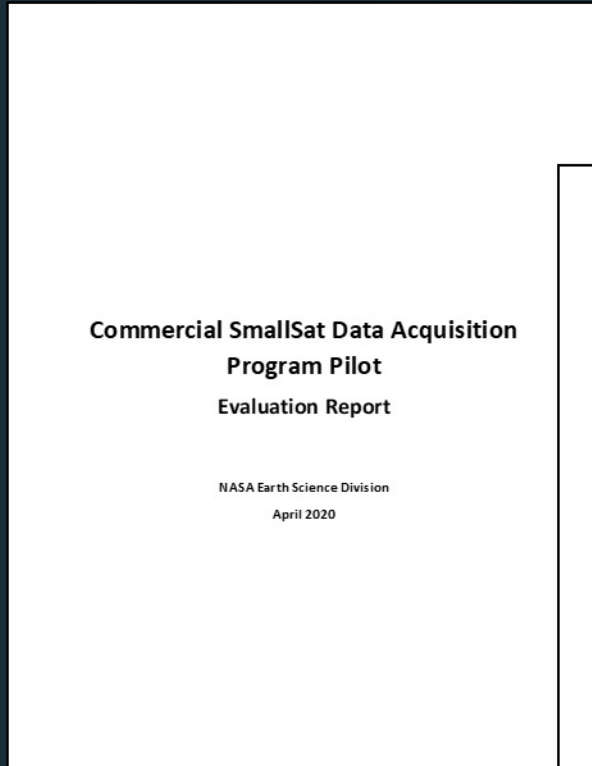
- Planet
- Airbus US
- ICEYE US
- GeoOptics
- Spire

Evaluation Criteria

1. Accessibility of vendor supplied imagery and data
Ease and efficiency of search, discover, and download from vendor systems.
2. Accuracy and completeness of metadata
Accuracy and completeness of metadata provided by vendor.
3. Quality of User Support Services
Availability, responsiveness, and technical expertise required to answer PI inquiries.
4. Usefulness of data for advancing Earth system science research and applications
Ability of data to support Earth system science research and applications activities.
5. Quality of vendor supplied imagery and/or data
Data attributes such as geolocation accuracy, radiometric accuracy, and platform intercalibration. Data quality evaluation will use the ESA-NASA Evaluation Guidelines.

Evaluation Reports

Upcoming:



<https://www.earthdata.nasa.gov/esds/csda/evaluations>

Vendor Status

Data purchased and available for community use

Planet

Spire

MAXAR
(NASA and NGA-purchased via NGA NextView license)

Additional data available

DEGIS

EarthDEM
(2 m digital elevation model for non-polar regions (60 S to 60 N). A derived product from stereo pairs of Maxar data via NextView license)

Data evaluation complete

BlackSky *

AIRBUS US

*Final Report pending

Data evaluation underway

GHGSat

GeoOptics

Capella Space

ICEYE US

Data evaluation to be initiated

PlanetIQ

Umbra Lab

Surface

GNSS

Radar

GHGs

DEM

Data Access and Use

Access

- Access through NASA ESDIS, where approaches currently vary with vendors...
<https://www.earthdata.nasa.gov/esds/csda/commercial-datasets>
- Eligibility to download is validated through grant license or NASA email – validation and additional download support by NASA CSDA MSFC team.

Limits on data use

- No research limits under licenses
- No publication limits in contract statements of work (Maxar has an additional permission step)
- Sharing of data limits exist – eg cannot put data out on FTP
- Sharing of derived data products not limited if manipulated in a nonreversible way
- **Licensing is for science use only—restricted from use for Operations**

User Access Request and Verification

- All prospective users are subject to authorization prior to approving any data distribution request
- **Provide basic information: Name, Email, Funding Affiliation, Grant / Contract Number**
- Agree to the vendor specific *science use* EULA
- <https://csdap.earthdata.nasa.gov/signup>

The screenshot shows a web form for user access request and verification. The form is divided into several sections with labels on the left and input fields on the right. The sections include:

- Earthdata User name:** A text input field with a note: "No Earthdata profile? Register for a new profile through the Earthdata Data Explorer. If you don't already have one, you can register here."
- Title:** A dropdown menu.
- First Name*:** A text input field.
- Last Name*:** A text input field.
- Email Address*:** A text input field with a note: "Please provide a non-governmental or institutional email."
- Position:** A text input field.
- Affiliation / Supporting Institution*:** A text input field with a note: "Please request all acronyms or abbreviations. For example: University of Alabama in Huntsville or Lockheed Space Flight Center."
- Government Funding Agency*:** A dropdown menu with "Bureau of Land Management" selected.
- Department:** A text input field with a note: "Please request all acronyms or abbreviations. Examples include anomaly observations and programs or subagency of the supporting institution."
- Are you a US Government Civil Servant?*** Radio buttons for "Yes" and "No" (selected).
- Please provide the Grant or Contract Number under which this work will be performed*:** A text input field with a note: "A grant or contract number is required unless you are a Civil Servant." There are also buttons for "Grant or Contract Number", "Grant Start Date (Optional)", and "Grant End Date (Required)". A green button labeled "No contract grant" is also present.
- Research Area*:** A dropdown menu.
- Please provide a detailed description of how you will use the data*:** A large text area.
- Select Vendor(s)/Product*:** A list of checkboxes for various vendors and products: Mission (NASA only), Mission - WorldView 4 (NASA only), Mission (ECOSTRESS, FURSA only), EarthDEM, Teledyne Brown Engineering, Inc., Planet, Cypris Cabbel, Inc., and Alphas U.S. A note below reads: "For additional details or example data, please see the CS2A Program commercial data and frequently asked questions website."
- I have read the Non-Disclosure Agreement(s) and End User License Agreement(s) above and agree to follow all policies and guidelines contained.*** A checkbox that is checked.
- Scientific use only by Licensed Users of the data products pursuant to a NASA-related, U.S. Government funded, and/or U.S. Government-authorized research investigation established through a NASA Research Announcement or similar public notice of opportunity, and performed for the sole purpose of conducting experiments, evaluation, research, and/or development, including basic and applied research under a Government Science Program. Scientific use is not intended for the development of commercial products or services and does not include activities funded or sponsored by non-governmental organizations or activities outside of U.S. Government.** A checkbox that is checked.
- I have read the Scientific Use Definition and acknowledge data acquired through the CS2A Program will be used in accordance with the definitions as specified in the End User License Agreement(s)*** A checkbox that is checked.

Data Access varies by Vendor

Vendor	Data Products	Who is authorized	Where to get the data	EULA
Planet Labs, Inc	PlanetScope, RapidEye	U.S. Federal Civil Agency funded researchers	Planet Explorer	Planet Expanded EULA
	SkySat		SDX	
Spire Global, Inc	GNSS-R and -RO	U.S. Government funded researchers	SDX	Spire USG EULA
Teledyne Brown Engineering, Inc.	DESI	U.S. Government funded researchers	TCloud	DESI EULA
Maxar	WorldView 1-3, GeoEye, QuickBird	NASA funded researchers	CSDA Maxar Request Form; Earthdata Cloud	Commercial Data/Imagery EULAs Fact Sheet
	WorldView 4			Maxar EULA
	IKONOS			NextView License
Polar Geospatial Center	EarthDEM	U.S. Government funded researchers	SDX	Commercial Data/Imagery EULAs Fact Sheet
Airbus U.S.	TerraSAR-X, TanDEM-X, PAZ	U.S. Government funded researchers	SDX	Airbus U.S. USG EULA.

CSDA Data Holdings & Smallsat Data Explorer (SDX)

Menu

Faceted Search Options

Filters

Apply

SAR
Collection Type

4 M km²
Area of Interest

Aug 1st, 2021 — Aug 31st, 2021
Date

0 — 50
Resolution range

Single Look Slant Range
Complex, Geocoded Ellipsoid
Corrected, +1
Product type

All
Instrument Mode

All
Orbit Direction

Results

Item (grouped by)	Title	Type	File Size	Actions
> TDX1_SAR_SSC_____HS_S_SRA_20210813T233936_20210813T233937	25 assets	6 distinct types	282.2 MB total	
> TDX1_SAR_SSC_____HS_S_SRA_20210814T114438_20210814T114439	25 assets	6 distinct types	279.2 MB total	
> TDX1_SAR_SSC_____SM_S_SRA_20210818T234858_20210818T234906	25 assets	6 distinct types	2.0 GB total	
> TDX1_SAR_SSC_____SM_S_SRA_20210818T234858_20210818T234906	25 assets	6 distinct types	2.5 GB total	

Nothing selected.

Get Download Script

Download Inventory

Smallsat Data Explorer

Data Download

CSDA Smallsat Data Explorer (SDX) with thumbnails from Airbus U.S. displayed

Web application to search, discover, and download NASA acquired commercial data

Available archive [increase since last year]

Planet* - 2.7 M km² [2.2 M km²]

Spire - 78 TB [31.65 TB]

EarthDEM - 13.8 TB [0 TB]

Airbus U.S. - 4.1 TB [4.1TB]

*Only SkySat data available through SDX

<https://csdap.earthdata.nasa.gov/explore/>

Data Search

<https://search.earthdata.nasa.gov/search>

The screenshot displays the NASA EarthData Search interface. At the top, the NASA logo and 'EARTHDATA' are visible, along with a search bar and navigation links like 'Find a DAAC', 'Feedback', and 'Earthdata Login'. The main header reads 'EARTHDATA SEARCH'. On the left, a sidebar contains filters for 'Filter Granules', 'Granule Search', 'Temporal', 'Day/Night', and 'Data Access'. The main content area shows 'Search Results (1 Collections)' for 'PlanetScope Satellite Imagery 3 Band Scene'. Below this, a grid of six granule cards is displayed, each with a thumbnail, a 'START' time, and an 'END' time. At the bottom of the grid are 'Add' and 'Download All 52' buttons. On the right, a satellite map of the Indian Ocean region is shown with various countries labeled. At the bottom, a timeline for the month of August is visible, with a red bar indicating the search results for the 'PlanetScope Satellite Imagery 3 Band Scene' collection.

Search Results (1 Collections)

PlanetScope Satellite Imagery 3 Band Scene CSDA

This collection is made available through the [NASA Commercial Smallsat Data Acquisition \(CSDA\) Program](#) for NASA funded researchers. Access to the data will require additional authentication. [More Details](#)

Showing 20 of 52 matching granules Sort View

Granule ID	START	END
PSScene3Band-20210821_010023_1026	2021-08-21 01:00:23	
PSScene3Band-20210818_215700_1053	2021-08-18 21:57:00	
PSScene3Band-20210818_004931_55_1063	2021-08-18 00:49:31	
PSScene3Band-20210817_010959_80_2426	2021-08-17 01:09:59	
PSScene3Band-20210815_004741_1003	2021-08-15 00:47:41	
PSScene3Band-20210815_004739_1003	2021-08-15 00:47:39	

Search Time: 0.5s

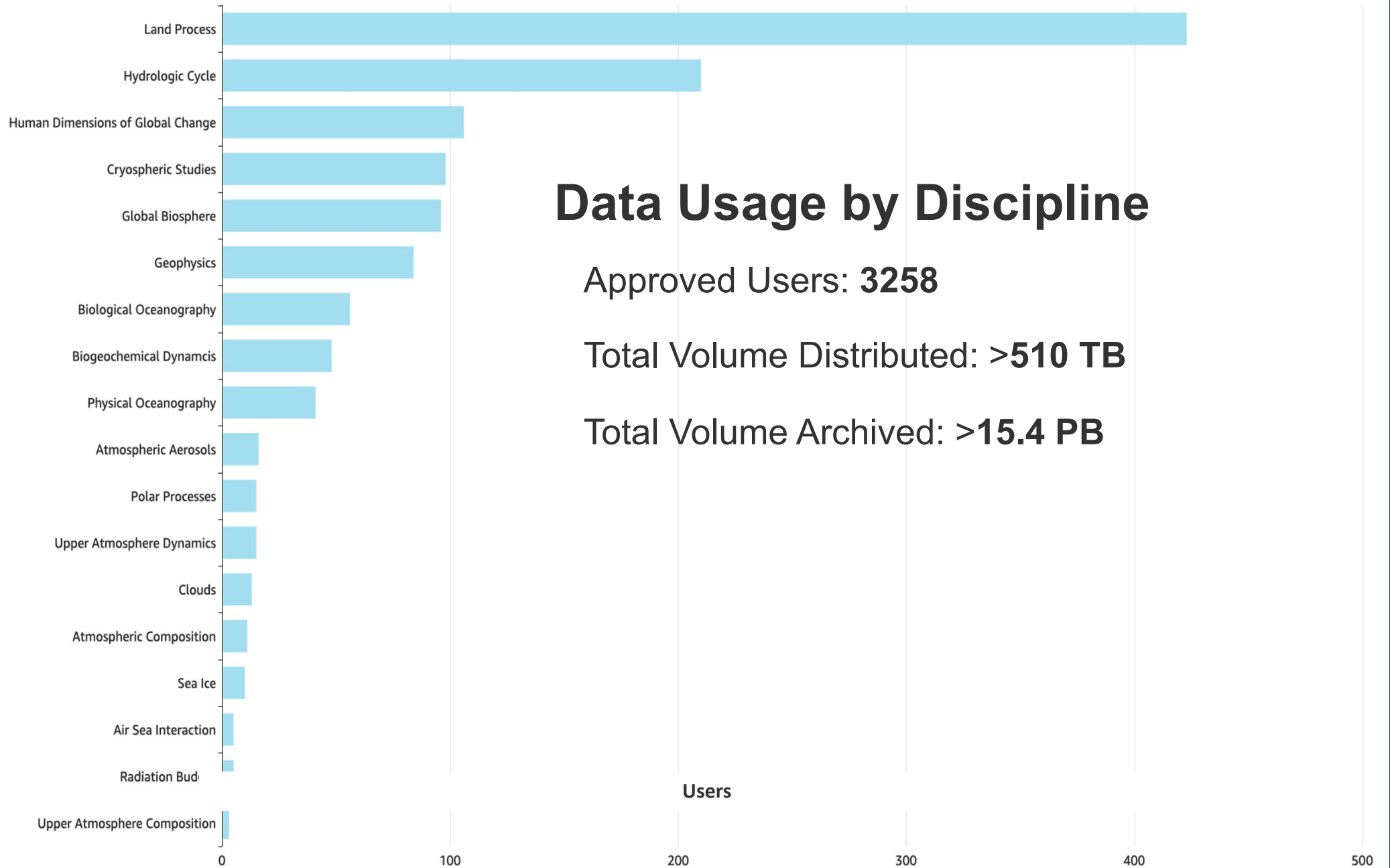
[Add](#) [Download All 52](#)

PlanetScope Satellite Imagery 3 Band Scene

UAT | v1.158.3 | NASA Official: Stephen Berrick · FOIA · NASA Privacy Policy · USA.gov Earthdata Access: A Section 508 accessible alternative

Metrics

Research Area for Approved Users



Data Usage by Discipline

Approved Users: **3258**

Total Volume Distributed: **>510 TB**

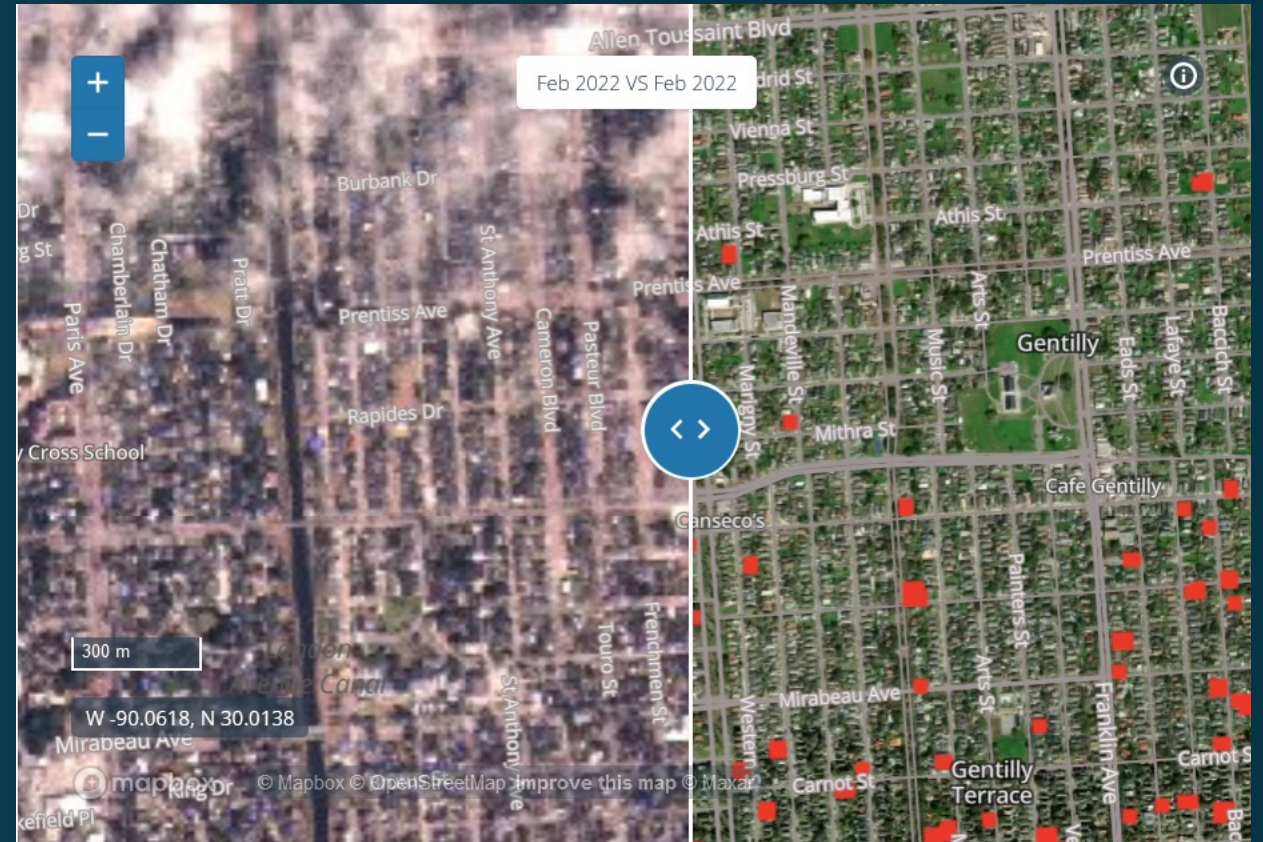
Total Volume Archived: **>15.4 PB**

An aerial photograph of a vast, dark blue-grey ice sheet or glacier. The surface is highly textured with numerous small, repetitive patterns, likely due to ice flow or wind erosion. A prominent, wide, and deep crevasse system runs diagonally across the center of the image, creating a sharp shadow and a distinct change in the surface texture. The overall lighting is dim, giving the scene a somber and majestic appearance.

CSDA Science Results

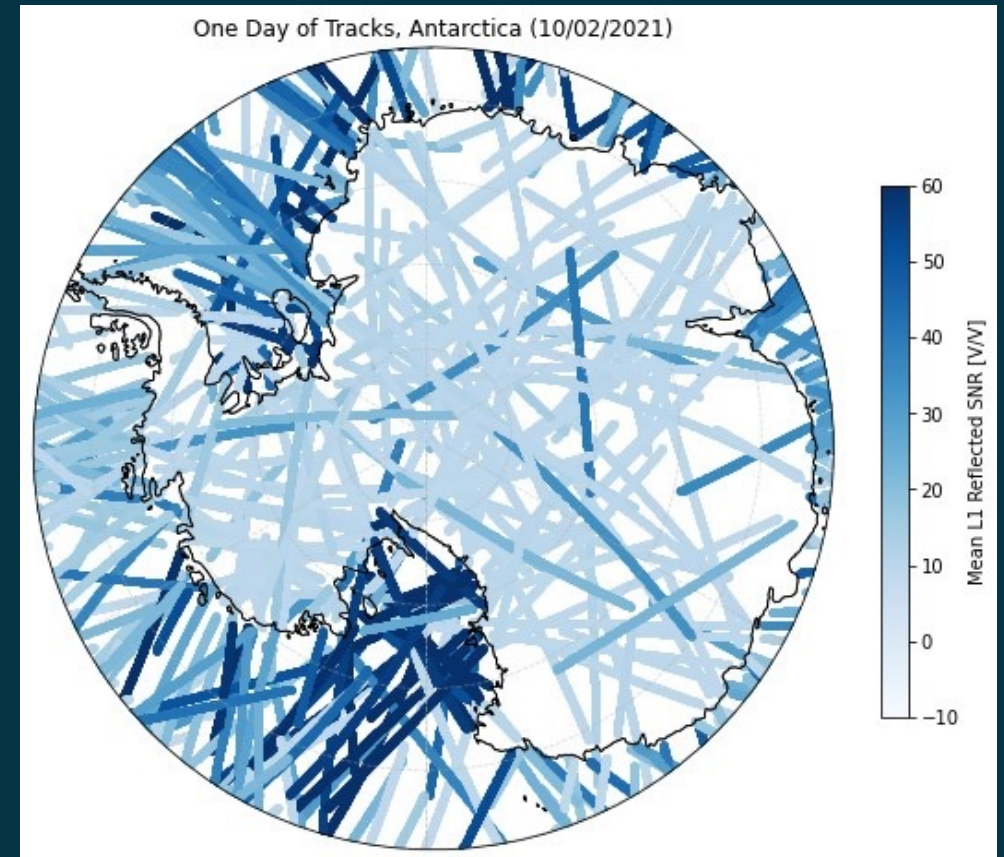
Blue Tarp Detection

- September 20, 2017: Hurricane Maria
- August 29, 2021: Hurricane Ida
- Lives were lost, homes and businesses damaged or destroyed, wide-spread regions flooded, and electrical power grids rendered useless.
- Using machine learning with high-resolution data from Planet, the team "uncovered" the number of blue tarps deployed in the disaster-struck regions.
- The footprint of damaged construction as a percentage of the total original footprint.



Spire GNSS-R data for Land Ice Mapping

- Land ice is an early-stage application for GNSS-R, with potential for widespread use
- Surface roughness measurements
- Precision altimetry
- Identified empirical thresholds for sufficient coherency for altimetry.
- Identified a seasonal trend



Credit – Jade Morton, U. Colorado



CSDA Tree Carbon Work in Semi-Arid Africa

DA Science Results

- CSDA developed machine learning methods to map individual trees across 10,000,000 km² of semi-arid Africa north of the equator and south of the Sahara Desert at the 50 cm scale;
- Converted tree crowns into leaf, wood, and root carbon for 10 B trees with a carbon uncertainty of $\pm 20\%$ at the tree, hectare, or square km level;
- A “viewer” was developed to enable our data to be used at the tree level; &
- This work will advance restoration work such as the Great Green Wall.

Our “Viewer”
from Tucker et
al. 2023 *Nature*

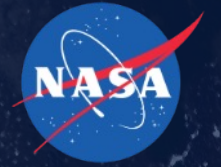


From Brandt et al. 2020 *Nature* and Tucker et al. 2023 *Nature*

Summary

- Commercial Smallsat Data Acquisition Program continues into the foreseeable future.
- New data is being purchased under the IDIQ framework.
- Scientific evaluation process is working well and continues.
- Planning for next Announcement-of-Opportunity for new vendors in FY24, but it is budget dependent. No further details available.
- Looking in FY24 to develop a program data strategy and requirements, as well as building on inter-agency relationships.

Accessing and Requesting Commercial Smallsat Data FAQ:
<https://earthdata.nasa.gov/esds/small-satellite-data-buy-program/faq-commercial-data>



Contact Us

General Programmatic or Evaluation Questions

- HQ Program Manager/Scientist: Dr. Melissa Martin @ melissa.yang@nasa.gov

Commercial provider procurement questions

- Project Manager: Dana Ostrenga @ dana.ostrenga@nasa.gov

Data access and management

- Aaron Kaulfus @ aaron.s.kaulfus@nasa.gov

Project Scientist

- Fritz Policelli @ frederick.s.policelli@nasa.gov

<https://earthdata.nasa.gov/esds/csdap>

Commercial Smallsat Data Acquisition (CSDA) Program

For further information:

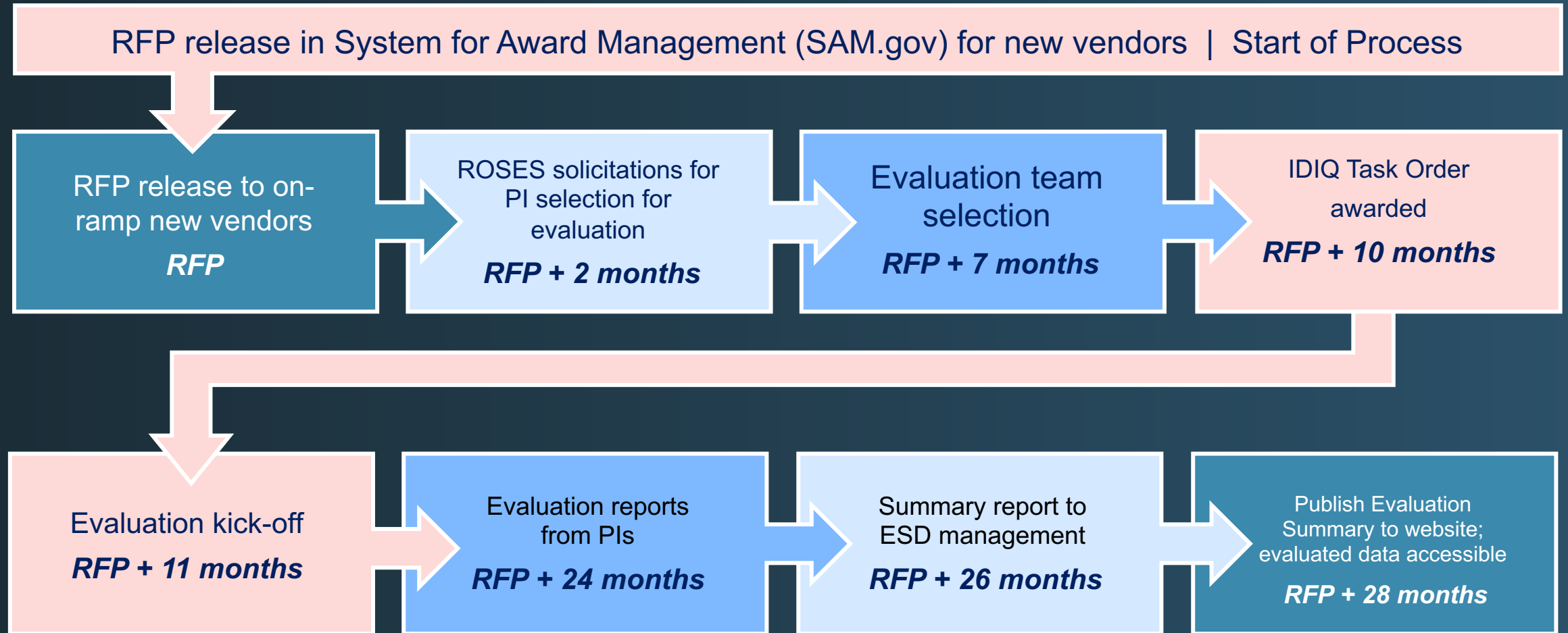


<https://earthdata.nasa.gov/csda>



Backup

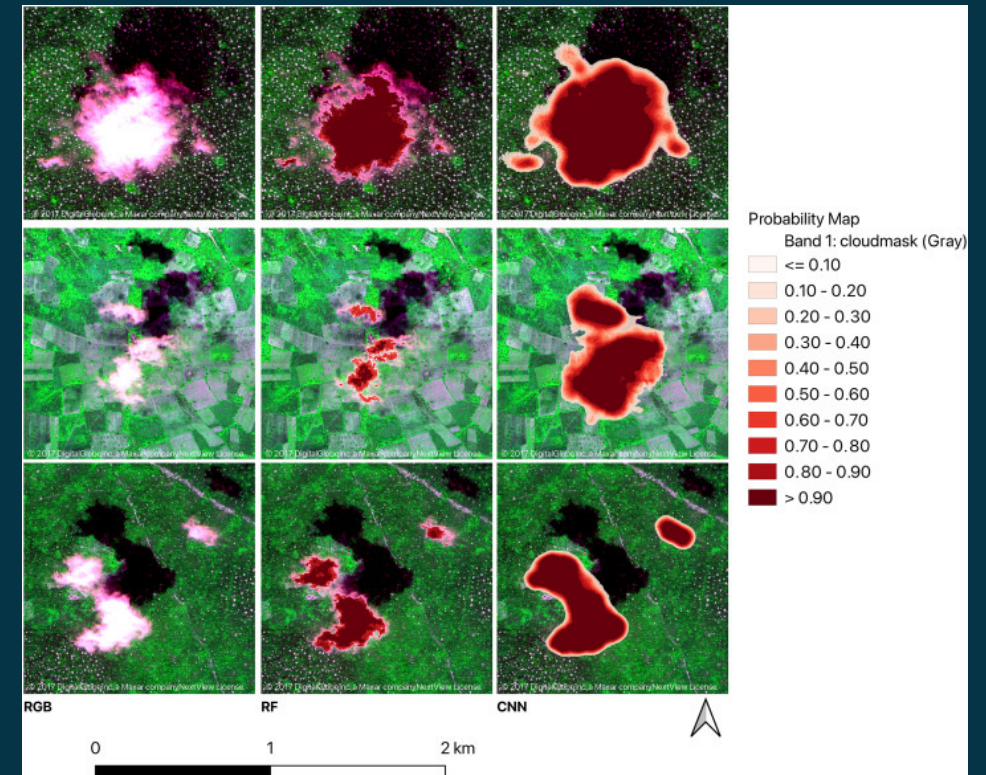
Evaluation Process for New Vendors



Note: approximate times

Optimizing WorldView-2, -3 Cloud Masking Using Machine Learning Approaches¹

- Detection of clouds is one of the first steps in pre-processing remotely sensed data
- The CNN Machine Learning model
 - was able to generalize consistently through both space and time.
 - has a superior overall accuracy of 94.9%, 6.4% higher than the RF.
 - is robust to seasonality effects over a 12-year period
 - is robust enough to leverage diversified location-time training.
- Further investigation is required to assess effectiveness in mid/high latitudes.



True color (red, green, blue) WorldView imagery overlain with Random Forest (RF) and Convolutional Neural Network (CNN) probability maps (left to right). The red mask shows the probabilities for each model's classification of cloud pixels. The higher the probability, the more confident the model is in classifying the pixel as cloud. CNN outperforms RF in identifying cloud edges on both dense (top) and thin (middle) clouds. © 2017 DigitalGlobe, Inc., a Maxar company, NextView License.

1. Caraballo-Vega, J. A.; Carroll, M. L.; Neigh, C. S. R.; Wooten, M.; Lee, B.; Weis, A.; Aronne, M.; Alemu, W. G.; Williams, Z. Optimizing WorldView-2, -3 Cloud Masking Using Machine Learning Approaches. *Remote Sensing of Environment* **2023**, *284*, 113332. <https://doi.org/10.1016/j.rse.2022.113332>.

User Access Request and Verification

- All prospective users are subject to authorization prior to approving any data distribution request
- **Provide basic information: Name, Email, Funding Affiliation, Grant / Contract Number**
- Agree to the vendor specific *science use* EULA
- <https://csdap.earthdata.nasa.gov/signup>

The image shows a web form for requesting user access to NASA Earth Data. The form is titled "Earthdata User Access" and includes the following sections:

- Title:** A dropdown menu with "None" selected.
- First Name*:** A text input field.
- Last Name*:** A text input field.
- Email Address*:** A text input field with a note: "Please provide a non-governmental or institutional email."
- Position:** A text input field.
- Affiliation / Supporting Institution*:** A text input field with a note: "Please request all acronyms or abbreviations. For example: University of Alabama in Huntsville or Lockheed Space Flight Center."
- Government Funding Agency*:** A dropdown menu with "Bureau of Land Management" selected.
- Department:** A text input field with a note: "Please request all acronyms or abbreviations. Examples include anomaly observations and programs or subagency of the supporting institution."
- Are you a US Government Civil Servant?*** Radio buttons for "Yes" and "No" (selected).
- Please provide the Grant or Contract Number under which this work will be performed*:** A text input field with a note: "A grant or contract number is required unless you are a Civil Servant." There are also buttons for "Grant or Contract Number", "Grant Start Date (Optional)", and "Grant End Date (Required)". A green button labeled "No contract grant" is visible.
- Research Area*:** A dropdown menu.
- Please provide a detailed description of how you will use the data*:** A large text area.
- Select Vendor(s)/Product*:** A list of checkboxes for various vendors and products: Mission (NASA only), Mission - WorldView 4 (NASA only), Mission (ECOSTRESS, FURSIA only), EarthDEM, Teledyne Brown Engineering, Inc., Planet, Cypris Cabbel, Inc., and Alphas U.S. A note below reads: "For additional details or example data, please see the COSA Program commercial data and frequently asked questions website."
- I have read the Non-Disclosure Agreement(s) and End User License Agreement(s) above and agree to follow all policies and guidelines contained.*** A checkbox that is checked.
- Scientific use only by Licensed Users of the data products pursuant to a NASA-initiated, U.S. Government-funded, and/or U.S. Government-authorized research investigation established through a NASA Research Announcement or similar public notice of opportunity, and performed for the sole purpose of conducting experiments, evaluation, research, and/or development, including basic and applied research under a Government Science Program. Scientific use is not intended for the development of commercial products or services and does not include activities funded or sponsored by non-governmental organizations or activities outside of U.S. Government.** A checkbox that is unchecked.
- I have read the Scientific Use Definition and acknowledge data acquired through the COSA Program will be used in accordance with the definitions as specified in the End User License Agreement(s)*** A checkbox that is unchecked.

Data Access varies by Vendor

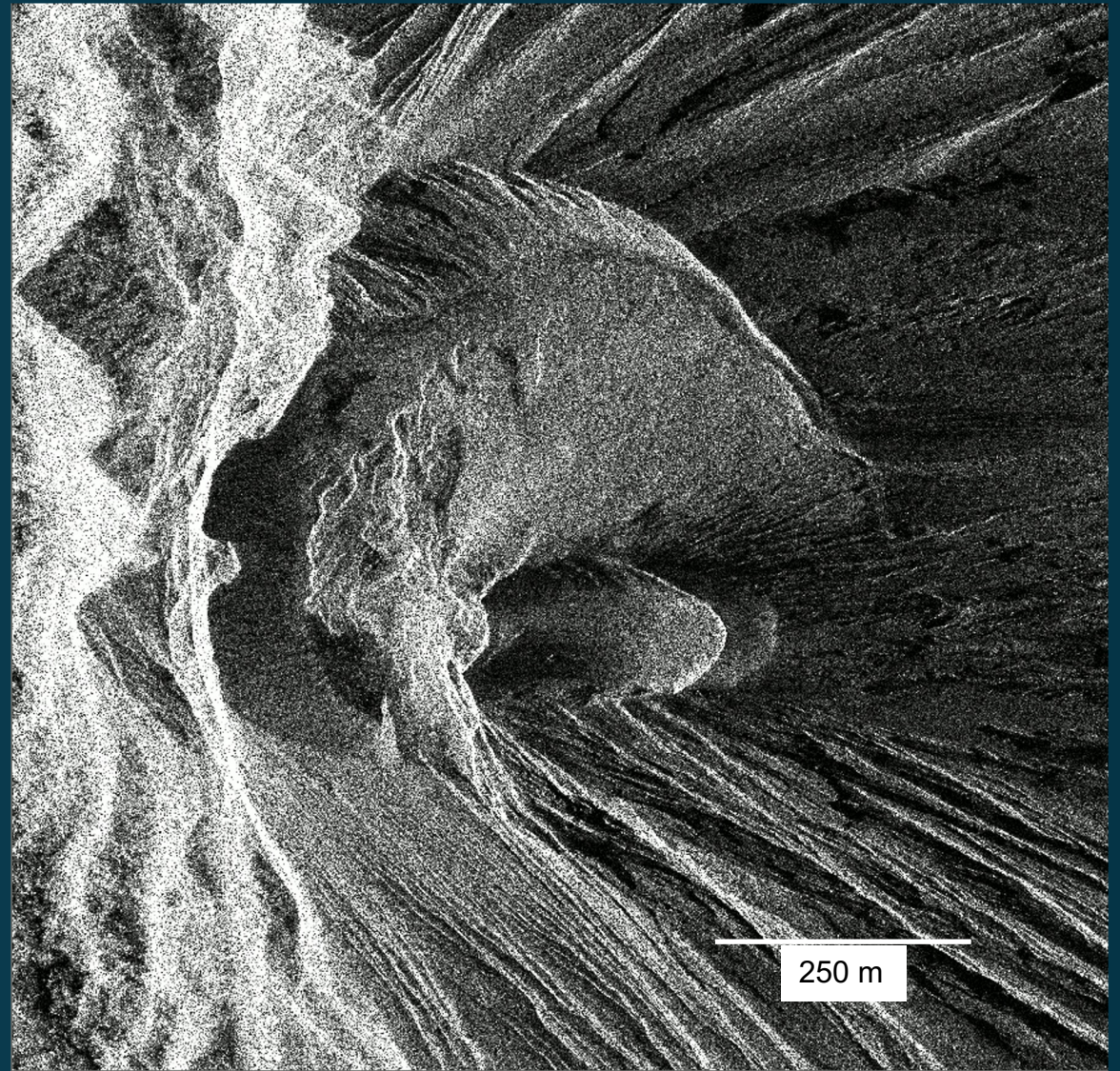
Vendor	Data Products	Who is authorized	Where to get the data	EULA
Planet Labs, Inc	PlanetScope, RapidEye	U.S. Federal Civil Agency funded researchers	Planet Explorer	Planet Expanded EULA
	SkySat		SDX	
Spire Global, Inc	GNSS-R and -RO	U.S. Government funded researchers	SDX	Spire USG EULA
Teledyne Brown Engineering, Inc.	DEGIS	U.S. Government funded researchers	TCloud	DEGIS EULA
Maxar	WorldView 1-3, GeoEye, QuickBird	NASA funded researchers	CSDA Maxar Request Form; Earthdata Cloud	Commercial Data/Imagery EULAs Fact Sheet
	WorldView 4			Maxar EULA
	IKONOS			NextView License
Polar Geospatial Center	EarthDEM	U.S. Government funded researchers	SDX	Commercial Data/Imagery EULAs Fact Sheet
Airbus U.S.	TerraSAR-X, TanDEM-X, PAZ	U.S. Government funded researchers	SDX	Airbus U.S. USG EULA.



Lewotolok, Indonesia lava flow and explosion crater
Jan-Jul 2021 Spotlight mode



22-day pair in S. California, showing coherence and signals in agricultural fields and clear signal at geothermal plant.



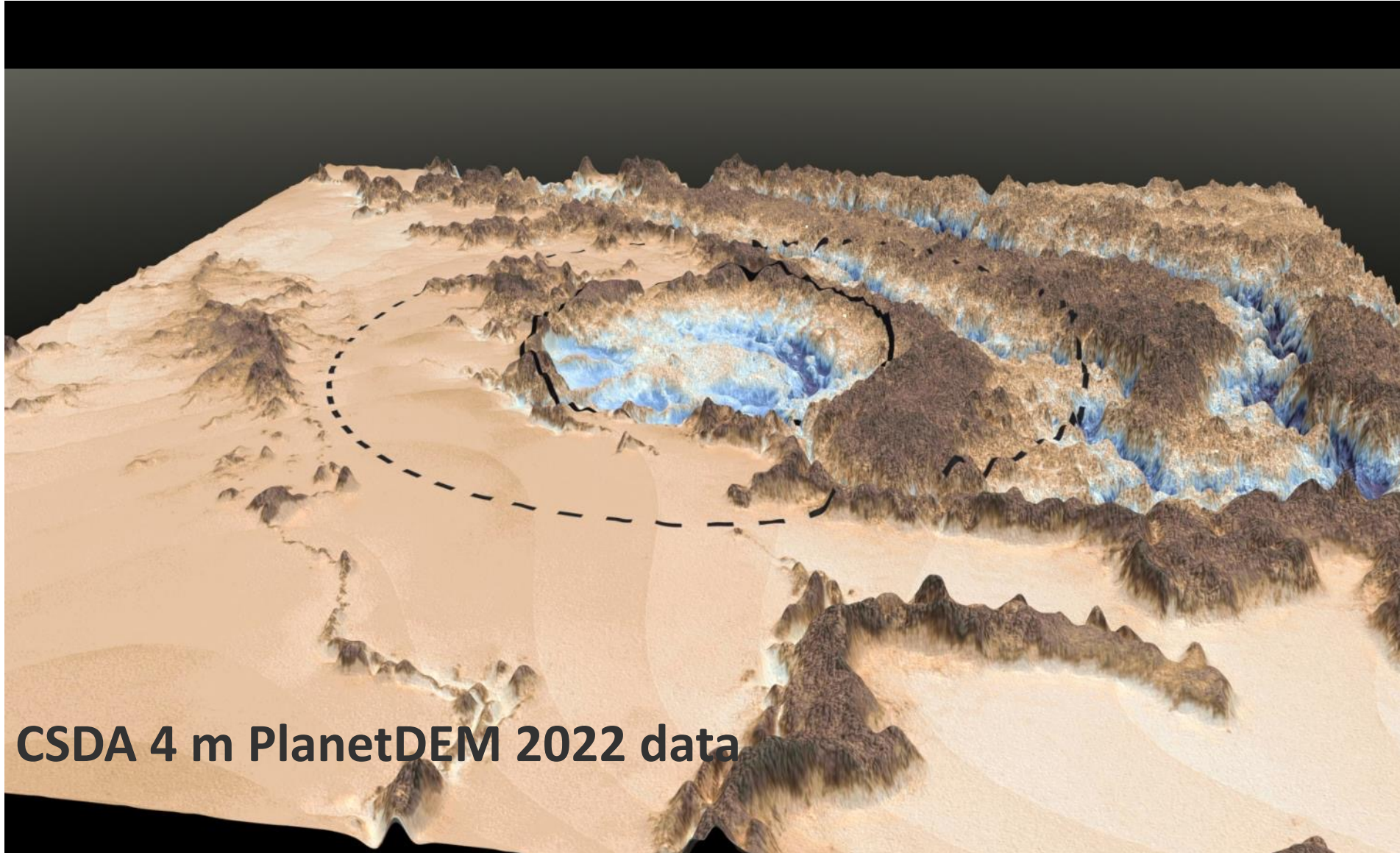
CSDA Planet DEMs

Hyper-spatial 4 m data to compliment 2 m DEMs

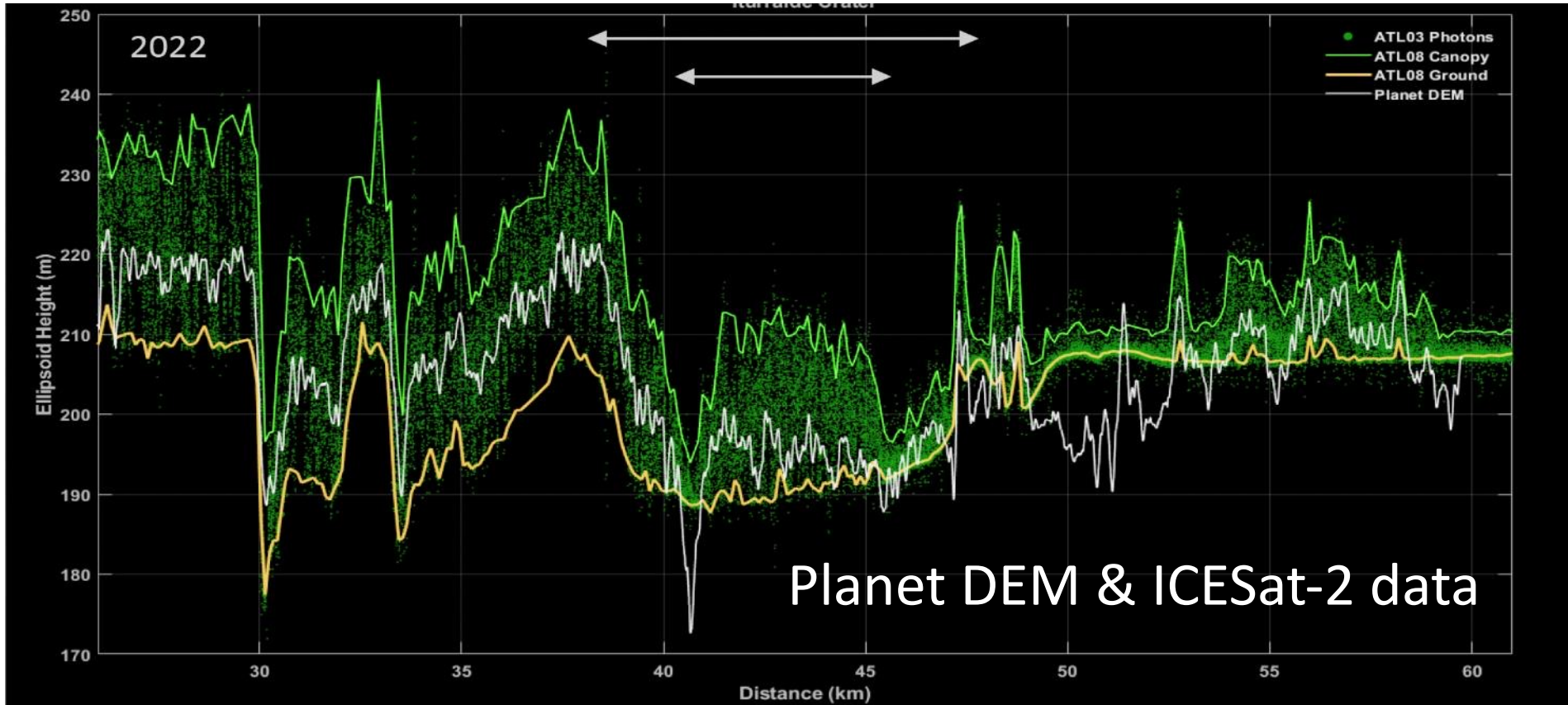


CSDA Planet DEMs

Iturralde Bolivia: Inner Ring 8 km; Outer Ring 17 km



CSDA Planet DEMs



Iturralde Crater

- ICESat-2 overpasses in 2022, 2021, 2020 and 2019 were found
- the averaged Planet DEM (Summer 2020-2022) is used
- the perceived inner and outer rings are highlighted