National Aeronautics and Space Administration

Commercial Satellite Data Acquisition Program

Umbra SAR Principal Investigator Evaluation Summary

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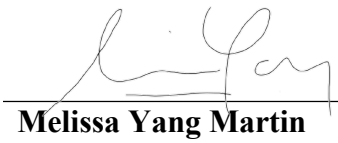

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Preface

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Abstract

The evaluation summarized in this report was conducted by Principal Investigators (PIs) funded by NASA's Commercial Satellite Data Acquisition (CSDA) Program. The purpose of evaluation is to determine the utility of the Umbra data for NASA Earth science research and applications community. The results of the evaluation help inform NASA program management on the ability of the data to further augment NASA science.

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Executive Summary

NASA's Earth Science Division (ESD) Commercial Satellite Data Acquisition (CSDA) program selected 13 principal investigators (PIs), along with their teams, via a call for proposals under the NASA Research Opportunities in Space and Earth Science (ROSES) solicitation, to evaluate commercial data from Umbra Lab Inc. (also referred to here as Umbra) as part of the first IDIQ on-ramp. Umbra develops and manages a constellation of X-band synthetic aperture radar (SAR) instruments that provide high spatial resolution, frequent revisit, and reduced data delivery latency views of the Earth's surface. Umbra data for this evaluation was also procured under an Open Data license which allows for Umbra data to be more widely distributed compared to other vendors under traditional government licenses in the CSDA program.

Evaluation teams were provided access to the Umbra archive of previously acquired scenes dating back to 2023. In addition to accessing archive data, CSDA evaluation teams were also able to task the Umbra constellation for new acquisitions. This tasking allowed several evaluation teams, especially those studying natural hazards, to test the utility of Umbra data in workflows that may be more time sensitive. Tasking also allowed evaluation teams to have the flexibility to acquire data in areas of interest that were experiencing change or responding to emergent environmental conditions (i.e., harmful algal blooms).

The Umbra evaluation kicked off with a first team meeting in September of 2024, and the team began to formulate their data needs. Delivery of initial imagery products requested by the researchers began in Fall of 2024. Researchers wrapped up their data requests in July 2025 and submitted final deliverables in August 2025. This synthesis report distills and integrates the findings of evaluation research reports commissioned by NASA for the Umbra evaluation. This report also includes recommendations that inform the way ahead for the CSDA Program.

The evaluations found several strengths and weaknesses of these data for use in NASA Earth system science and applications. Specifically, the strength of the Umbra data from a consensus of investigation teams in all disciplines was access to a very high spatial resolution X-band SAR satellite constellation. Investigators were very positive about the ability of the Umbra constellation to provide taskable access to high temporal repeat opportunities with quick turnaround. Umbra's imaging flexibility with a range of azimuth and incidence angles and the company's Open Data Program (https://umbra.space/open-data/), through which they make much of their data publicly available, were also noted by many PIs. All PI teams identified issues during this evaluation with Umbra geolocation, noting large and small geolocation errors in the data. They also encountered issues with the data formats, errors in the metadata, and a lack of technical documentation.

Overall, the evaluation supports the use of Umbra SAR data for NASA Earth science research and applications, where the data characteristics are compatible with the particular science objectives and use cases.

1. Background

NASA's ESD formalized the CSDA program in 2020, following the successful Private-Sector Small Constellation Satellite Data Product Pilot that concluded that year. The objective of the CSDA program is to identify, evaluate, and acquire commercial remote sensing data that supports NASA's Earth science research and application activities. As the Pilot transitioned into the sustained CSDA Program, new on-ramping opportunities were issued to bring additional vendors on board, with the goal of expanding the commercial partner base as the industry grows with new entrants and capabilities. NASA's ESD recognizes the potential impact commercial satellite constellations may have in encouraging and enabling efficient approaches to advancing Earth system science and applications development for societal benefit.

NASA moved into a sustainment phase for the vendors in Table 1 below, with data from these vendors made available to NASA and other government funded researchers, according to EULAs. More information can be found on the CSDA web site (https://science.nasa.gov/earth-science/csda/end-user-license-agreements/). The table below shows the vendors that NASA has engaged with starting with the Pilot project, through the IDIQ on-ramp 1.

Table 1. CSDA Evaluation Activities.

Evaluation Effort	Vendor	Type	Report Delivery
Pilot	Maxar	Optical	Apr 2020
	Planet	Optical	
	Spire	Radio Occultation	
On-ramp 2	Airbus U.S.	SAR	Oct 2023
	BlackSky	Optical	Jun 2024
On-ramp 3	GHGSat	Optical	Aug 2024
	Capella Space	SAR	Dec 2024
	ICEYE U.S.	SAR	Dec 2024
	GeoOptics	Radio Occultation	Oct 2024
IDIQ On-ramp 1	Umbra	SAR	Nov 2025
	PlanetiQ	Radio Occultation	Nov 2025

In this report, the vendor is evaluated on the accessibility of data, accuracy and completeness of metadata and documentation, promptness and quality of user support services, and usefulness of the data for advancing Earth system science research and applications.

Results from CSDA evaluations are available from the CSDA website. The final summary reports for all the reports through On-ramp 3 evaluations are available on the CSDA web site, as will IDIQ reports upon completion and review.

1.1 IDIQ On-Ramp 1

NASA selected seven companies to provide commercial data in support of the agency's Earth science research, among which Umbra Lab Inc. was awarded an Indefinite Delivery Indefinite Quantity (IDIQ) contract as part of the CSDA program's initial Request for Proposal (RFP) solicitation in October 2023. The contract serves as a flexible method for NASA to acquire data from commercial sources that support NASA's Earth science research and application activities. An emphasis is placed on data acquired by commercial satellite constellations, affording the means of complementing NASA's Earth observation data with higher resolutions, increased temporal frequency or other novel capabilities.

This contract aims to provide a cost-effective means to complement the suite of Earth observations acquired by NASA and other U.S. government agencies, as well as international partners and agencies. NASA requires end user license agreements to enable broad levels of dissemination and shareability of the commercial data. There is a set of government-defined license tiers associated with all contracts and task orders awarded for scientific non-commercial use. The vendors evaluated during the first IDIQ on-ramp are listed in Table 2.

Table 2. Vendor and sensor information for IDIQ 1 (satellite numbers shown reflect status during the evaluation).

Vendor	Sensor Type	Temporal Coverage	Spatial Coverage	Satellites	Bands	Spatial Resolution
PlanetiQ	GNSS-RO	2021 - present	Global	3	L – Band	100-200 km horizontal, 100-200 m vertical
Umbra	SAR	Nov 2018 – present	Global	5	X - Band	0.25 m to 2 m

1.2 Umbra Imaging Capabilities and Products Evaluated

1.2.1 Constellation

Umbra operated a constellation of 5 satellites during the CSDA evaluation period. These satellites acquired data in Spotlight mode for the duration of the evaluation. A second mode, Scan, was added to the available products halfway through the evaluation.

1.2.2 Products

Umbra offered two different imaging modes, Spotlight and Scan. The Spotlight mode was available during the entire evaluation and had multiple variations of it available. Scan mode became available in the last half of the evaluation and only had one variation. Table 3 details the various products offered by Umbra during this evaluation.

Table 3. List of all Umbra products obtained during the CSDA evaluation period.

Product	Scene Size	Resolution	Data Formats
0.25 m Spotlight, 1-2x Looks	5 km x 5 km	0.25 m	CPHD, SICD SIDD, GEC
0.35 m Spotlight, 1-3x Looks	5 km x 5 km	0.35 m	
0.5 m Spotlight, 1-4x Looks	5 km x 5 km	0.5 m	
0.5 m Long Dwell Spotlight, 8x Looks	5 km x 5 km	0.5 m	
1.0 m Spotlight, 1-4x Looks	5 km x 5 km	1.0 m	
1.0 m Long Dwell Spotlight, 8x Looks	5 km x 5 km	1.0 m	
1.0 m Extended Dwell Spotlight, 10x+ Looks	5 km x 5 km	1.0 m	Same as above, CSI, & GIF
Scan mode, 2.0 m	8 km x 100 km	2.0 m	CPHD, SICD, SIDD, GEC

1.2.3 Tasking

The evaluation teams had access to both new tasking acquisitions and archived Umbra data. The majority of the PIs selected to obtain data for their evaluations through new tasking opportunities. Umbra's Canopy platform, shown in Figure 1, provided the user interface to Umbra data. Canopy provided self-service access for the evaluation PIs to search archived Umbra as well as view and schedule acquisition opportunities for their science and applications. Canopy's functions are available through both a web interface and application programming interface (API).

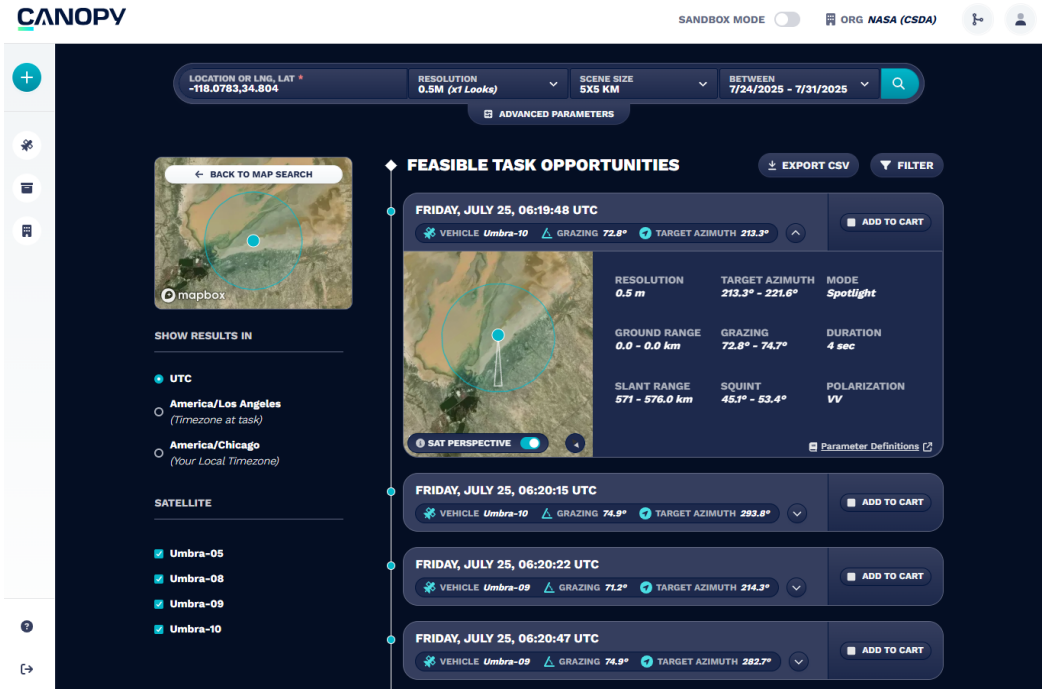

Figure 1. A screenshot of the Canopy interface, showing here the Image products and tasking tiers.

2. Evaluation Process and Criteria

NASA ESD selected 13 projects (Appendix A) to perform the Umbra utility and quality evaluation. Researchers spanned five of NASA's six Research and Analysis Program focus areas, including Climate Variability and Change, Weather and Atmospheric Dynamics, Water and Energy Cycle, Carbon Cycle and Ecosystems, and Earth Surface and Interior (Figure 2, left). The selected projects also fell within multiple Applied Sciences Program elements, now part of NASA's Earth Action Program, including disasters and resilience, water resources, agriculture and wildland fires (Figure 2, right).

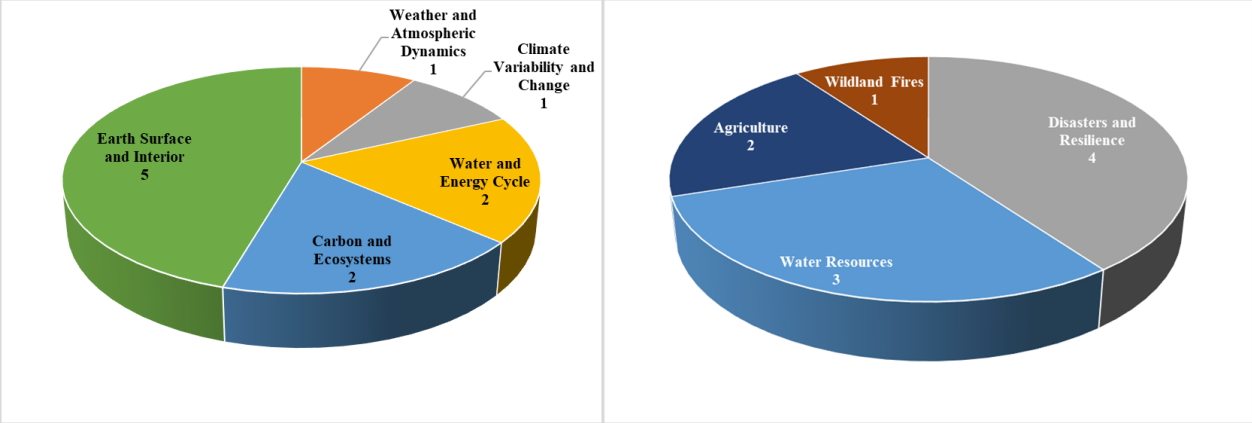

Figure 2. Proportion of scientific focus areas of evaluators in NASA's Research and Analysis Program, left. b) Proportion of focus areas of evaluators in NASA's Earth Action Program, right.

NASA ESD also selected additional research teams specializing in calibration and geolocation to independently assess the radiometric calibration and geolocation accuracy of the vendor-provided imagery. The evaluation PIs were required to submit regular updates, a final report and attend monthly discussions to ensure they had sufficient information and data access to complete their evaluation. Appendix A provides a listing of the research projects contributing to the Umbra evaluation.

2.1 Evaluation Criteria

The CSDA program provided evaluators the following categories for reporting on their findings from the Umbra data evaluation for both the quality and utility of the data.

A. *Access, Metadata and Support*
   I. Accessibility of vendor supplied data
      The ease and efficiency with which data can be searched, discovered, and downloaded from vendor systems.
   II. Accuracy and completeness of metadata
      The accuracy and completeness of metadata that accompanies the imagery and data provided by the vendor.
   III. Quality of support services, including documentation
      The availability, responsiveness, and technical expertise required to answer PI inquiries.

B. *Usefulness of the data for advancing Earth system science Research and Applications*

The ability of vendor-supplied data to support Earth system science Research and Applications

C. *Quality of Vendor Supplied data*
The quality of data attributes, such as radiometric calibration, geolocation accuracy, and platform intercalibration.

2.2 Program Activities

The evaluation was facilitated by conducting periodic reviews and surveys, and monthly PI all-hands meetings. The project timeline is depicted in Figure 3.

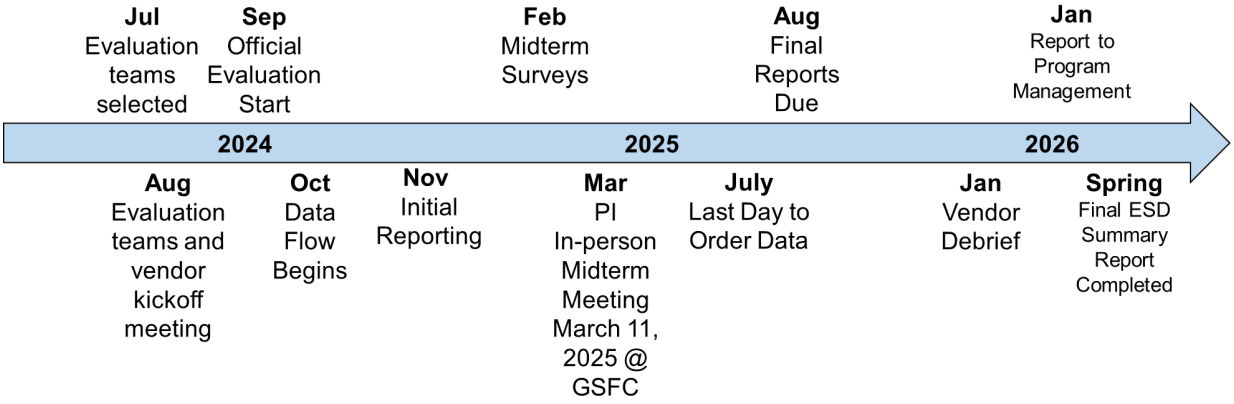

Figure 3. Timeline of Umbra evaluation activities during the assessment period.

2.3 Meetings, Periodic Reviews and Surveys

There were four main scheduled meetings – a PI kick-off meeting, a vendor kick-off meeting, a midpoint hybrid meeting, and a final debrief. All evaluation PIs were required to participate in periodic reviews and report on the usefulness of the data and current research progress. The PIs were asked to submit quad charts and complete surveys in November 2024 and February 2025. An in-person midterm meeting was held in March 2025 at Goddard Space Flight Center that allowed the PIs to share preliminary results. The PIs were required to submit a final report, a final ranking of Umbra for each of the 5 CSDA evaluation criteria, and a science highlight slide on their science or application using Umbra data. All reports and surveys have been synthesized in this final summary report.

2.4 Monthly Technical Interchange Meetings

Monthly video conference calls were set up to facilitate technical interchange among the evaluation team members to provide updates and to resolve issues related to data access, quality, completeness, or processing. Participants were asked to identify issues and share information they believed might be relevant to others. The conference calls were an effective means of ensuring the timely identification of and response to any issues that might arise, such as questions about data processing, delivery, or tasking issues. The monthly team tag-up meetings also allowed the CSDA staff an opportunity to gather and relay issues from the PI projects to the vendors to accelerate problem-solving.

3. Key Findings

The evaluation was focused on assessing the utility of Umbra data for advancing NASA's Research &Analyusis science focus areas and Applied Science program elements.

The Umbra data sets that were evaluated were acquired through a Public Release End User License Agreement (EULA) and were available only to the science team during the period of the evaluation. Following the evaluation period and debriefing to Umbra, the data were made available to the public through the CSDA Satellite Data Explorer (SDX). The Umbra imagery and constellation are described in Tables 2 and 3, with evaluation criteria outlined in section 2.1. The key findings address the objectives of the evaluation and are described in the following sections.

3.1 Data Access, Metadata and Customer Support

Data Access

The evaluation rated Umbra data access to be very good. Evaluation PIs found the Canopy interface overall to be user friendly, straightforward, and intuitive. The PIs also commended Umbra for the ease of searching within Canopy for archived data and for viewing upcoming new acquisition opportunities over an area of interest with advanced search filters. The need to expose additional information (i.e., satellite orbit direction, satellite look direction) for data within the archive as well as upcoming tasking opportunities was common feedback provided by the teams. The evaluation teams also recommended that Umbra provide additional technical documentation on how grazing and azimuth angles are used for tasking opportunities. When tasking opportunities are missed, the PIs would have liked the ability to re-task with similar geometries, and to have good, automated feedback when new tasking opportunities fail or are otherwise unable to be collected.

Customer Support

Umbra provided responsive customer service during the evaluation period. Umbra usually was able to get back to PIs on questions or inquiries within 24 hours. Communication between the evaluation PIs and Umbra representatives was usually via email and Slack channel that CSDA set up for the evaluation. The PI teams felt that Umbra could have provided better access to support for the more highly technical questions that were asked. Inquiries that were more technical in nature often had much longer response times, if they were ever answered. A couple of the PI teams noted the lack of a ticketing system to track customer support issues to be a significant shortcoming of the Canopy interface.

Metadata and Documentation

The evaluation PIs found Umbra's metadata and documentation to be good. The evaluation PIs were satisfied with the STAC schema that is used for metadata as well as the documentation for this schema that is available through Canopy. At the beginning of the evaluation, Umbra was transitioning to the STAC schema for their metadata, and thus some data were distributed with inconsistent formats. The vendor was able to rectify this issue during the evaluation and all data obtained during this evaluation have consistent STAC schema. The PIs found the Umbra Product Guide to be a good starting place for vendor documentation, but desired to have more technical

documentation such as ATBDs. Specifically, the evaluation PIs would have liked to see more documentation on how products were generated, how geocoding was performed, and information about radiometric calibration.

3.2 Data Utility for NASA Science

The utility of Umbra data differs among the Earth science focus and application areas. In general terms, the usefulness of the data is high in most remote sensing studies, however the application of these data for long-term global studies is limited by the spatial and temporal extent of the data in the Umbra archive. In addition, due to the small Umbra footprint size (5 x 5 km), and other factors, very few images were found in the Umbra archive that could meet many of the investigators' time and space requirements for science evaluation over their study domains. This necessitated tasking for most of the evaluation teams. To simplify the results of the evaluations, the reporting is grouped into Earth Surface and Interior and Cryosphere, Ocean, and Terrestrial science investigations (see Appendix A).

3.2.1 Earth Surface and Interior and Cryosphere

Principal investigators found the very high spatial resolution of the Umbra Spotlight mode to be advantageous for research and applications in the Earth Surface and Interior and Cryosphere research and applications areas. The sub-1 m spatial resolution provided PIs detailed information that is not available from coarser publicly available SAR datasets. The evaluations within these thematic areas were focused on volcanic hazard assessment, sea and lake ice monitoring as well as the monitoring of ice sheets and glacier dynamics. The rapid tasking and delivery of the Umbra constellation was also praised by PIs and evaluation teams within these focus areas, especially for those needing to assess the rapidly changing conditions of an active volcano, monitoring changes in the location of sea ice, and observing rapid changes to the surface of glaciers.

Geolocation seemed to be the biggest weakness in the Umbra data that the PIs in these focus areas identified. Geolocation errors ranged from a few meters to horizontal offsets greater than 50 meters. Investigators in this focus area also noted that they would like to see improvements to Canopy in order to build better time series. The PI teams found that larger ranges in incidence, target azimuth, and squint angles made it difficult to try to build time series that required consistent viewing geometry. They also discovered that it was difficult to re-task previously acquired acquisitions in Canopy to build a time series. They found the technical documentation to be "scattered in several locations" on the Umbra web site and within Canopy. The team suggested that Umbra work to create a central location where all documentation is stored and made available in various formats (website, PDF, etc), and that more documentation be added.

All evaluation PIs in this group did note that while Umbra does not currently offer interferometric SAR (InSAR) products, they would benefit greatly if these types of products were developed and offered by Umbra. The evaluation teams indicated that if high-level InSAR products were added it would significantly increase the research and applications that would be possible with such high spatial resolution data.

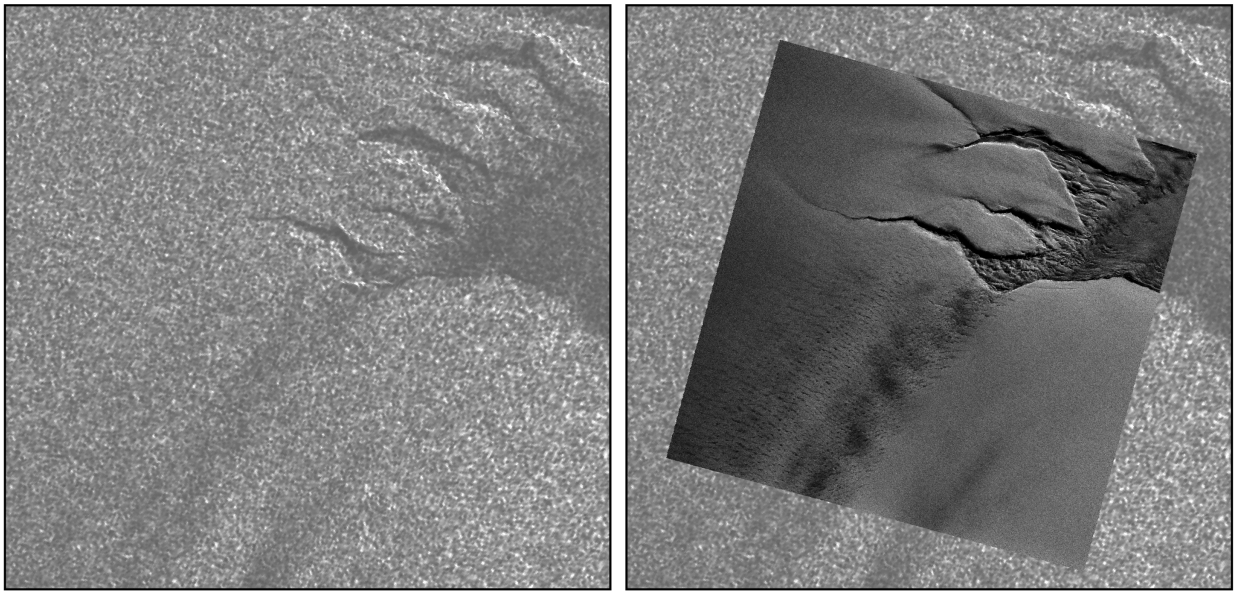

Figure 4. Sentinel-1 10-meter image showing a part of the Larsen Ice Shelf on October 27, 2024. (b) The same area was acquired by Umbra on the same date. Sub-meter Umbra SAR data provided additional information and details related to cracks as well as about mélange (a mixture of sea ice and glacier ice) filling larger cracks.

3.2.2 Ocean Science

Evaluation teams associated with ocean science and applications found both strengths and weaknesses with Umbra data obtained during this evaluation. The very high spatial resolution from Umbra data allowed for various ocean surface features (e.g. marine oil slicks, floating matter/debris) to be detectable as well as the observation of very fine scale changes to coastlines. As with the previous focus area, the Ocean science related evaluation teams also found issues with Umbra geolocation, with errors noted by these teams ranging from tens to thousands of meters, particularly in the Geo-Ellipsoid Corrected (GEC) data products. This group of PIs also suggested modifications to the radiometric calibration to improve the normalized radar cross section to a 0.5 to 1.0 dB accuracy. Additionally, PIs noted the high instrument noise floor within the Umbra constellation, and X-band SAR in general, limits the detection of dark features on the ocean surface.

The evaluation teams in this focus area also commented that the small scene size offered in Umbra Spotlight mode limited the aerial extent that could be analyzed for floating matter and debris. One PI evaluated the Scan mode product and noted that while it was better in terms of allowing a bigger spatial area to be observed, many acquisitions would still be needed to fully observe larger areas of interest.

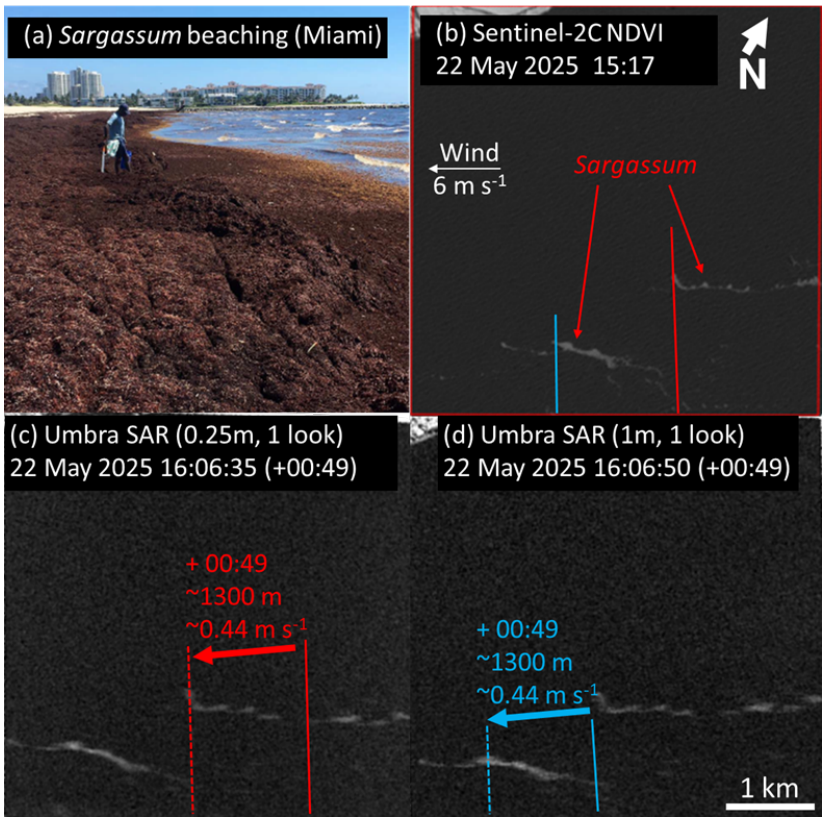

Figure 5. a) Sargassum can negatively impact coastlines. Offshore Sargassum is typically observed using (b) high resolution passive imagery (grey streaks). (c-d) Umbra SAR data observe the same features in a variety of collection modes. Red and blue lines show the position of the leading edge of Sargassum slicks during the initial optical data collection (panel b), while the dotted lines show these same features during SAR collection (49 minutes later).

3.2.3 Terrestrial

The third group of PI –led evaluation teams focused on monitoring changes to the Earth's land surface. The PIs in this group evaluated Umbra data on topics such as soil moisture, landslides, crop phenology, water mapping, wildfire impact, and earthquake damage mapping. The PIs in this group once again praised the very high spatial resolution that Umbra offers. Such high resolution makes it possible to observe fine scale surface changes, detect damage to individual structures, and delineate flood waters in complex terrain. The investigations in this group also found the ability to rapidly task new acquisitions to be a highly valuable as one PI noted the ability to task and receive imagery in under 3 hours for several wildfire case studies.

Once again, geolocation accuracy was found to be a weak point of the Umbra data among this group of evaluation PIs. The investigation teams documented geolocation errors ranging from ~8 meters to over 300 meters, with a couple of the PIs hypothesizing that some of the errors may be related to approximations used in Umbra's GEC processing (Umbra's Product Guide). This group would like to see Umbra provide a better process for selecting squint and azimuth angles for new acquisitions to improve the generation of time series data. Nearly half the PIs in this group noted that adding a cross-polarization channel would increase the benefits to any Umbra users that monitor agriculture, surface vegetation status, and changes to the land surface.

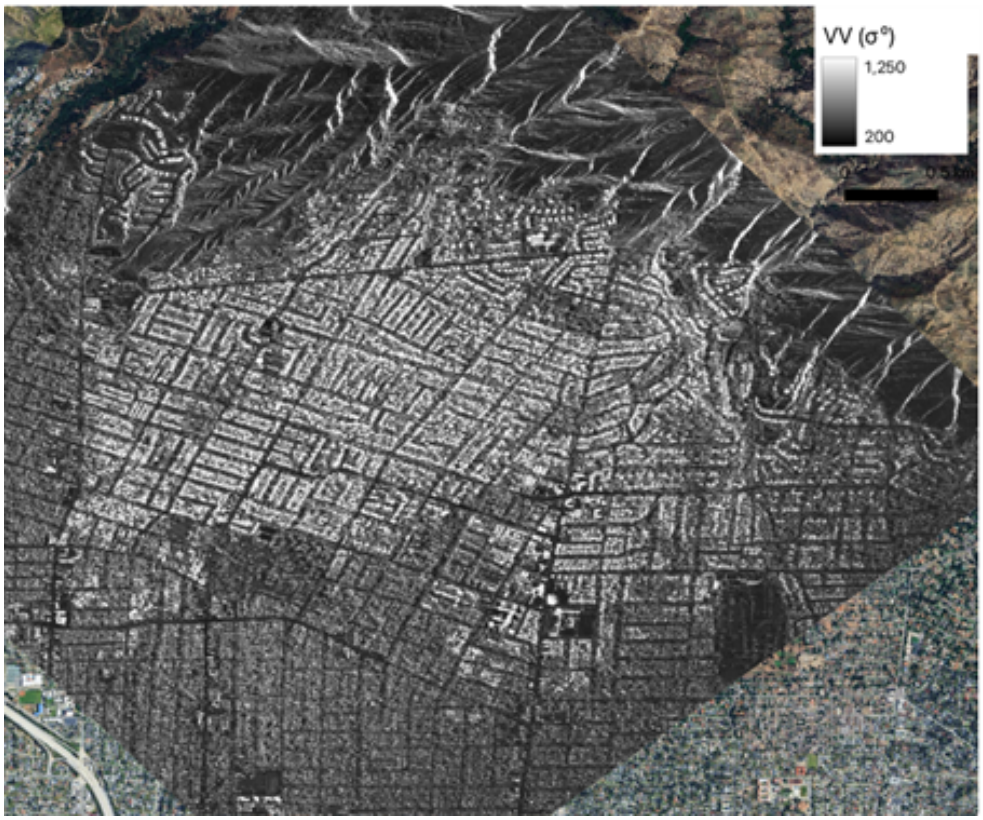

Figure 6. Umbra data was acquired following the Eaton Fire in January 2025. The image shows structural damaged buildings appearing brighter than undamaged buildings.

3.3 Data Quality

All the evaluation teams noted geolocation issues of the data during their evaluations. The magnitude of these errors varied greatly from just a few meters to hundreds of meters in error. These large errors were especially challenging for evaluation teams that were looking at applications along coastlines or in urban areas as the poor co-registration of the data made it difficult to assemble useful time series for monitoring and change detection.

Radiometric issues were noted during the evaluation as well. The radiometric issues were mainly confined to calibration factors being inaccurate and the GEC products not scaling correctly.

The quality of the Umbra imagery was also evaluated independently by subject matter experts (SMEs) with expertise in the assessment of radiometric and geometric quality of SAR imagery suitable for scientific research. The complete quality assessment is provided in a separate report, *Commercial Satellite Data Acquisition Program Umbra Radiometric and Geometric Quality Assessment Summary*.

A summary of the results of SME quality assessment is presented in the quality matrix provided in Figure 7.

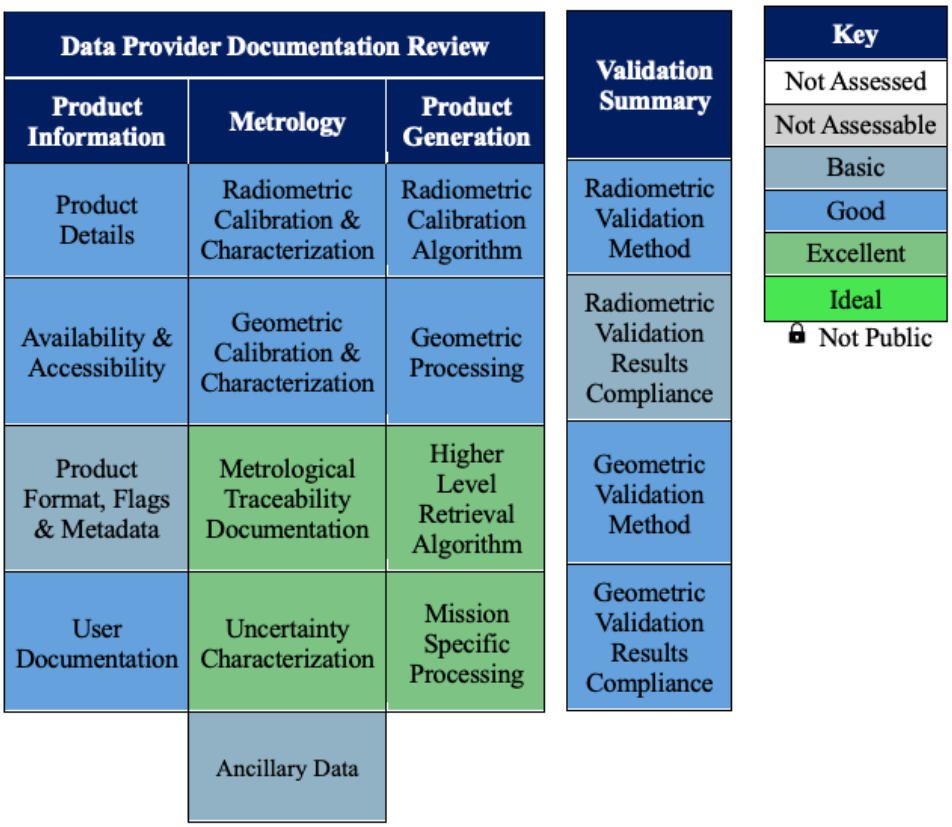

Figure 7. Summary Cal/Val Maturity Matrix from the Umbra Synthetic Aperture Radar Quality Assessment.

4. Recommendations

The overall recommendations were positive for the Umbra data following this one-year evaluation period. However, the evaluations teams, spanning multiple thematic research and application areas, all had concerns regarding Umbra's geolocation, with some geolocation errors exceeding 100s of meters, especially with the geocoded products. Additionally, the teams were concerned with the difficulty encountered when trying to create dense times series of data with similar viewing geometries. Also of concern was the lack of higher-level technical documentation, as well as the high noise floor of the Umbra data, potentially limiting its utility for certain applications. On the positive side, Umbra was highly rated on their ability to rapidly task new acquisitions and download the data in a matter of hours after acquisition in some cases. All the PIs noted the significant advantages of the very high spatial resolution imagery provided by Umbra, offering detailed views of processes not available from agency SAR observation capabilities the PIs are used to. The combination of traditional NASA and other Earth observations with data provided by Umbra could be a great complement to further monitoring near-real time conditions on the Earth's surface.

5. Conclusions

A year-long evaluation of Umbra data products was conducted by 13 PIs and evaluation teams. The evaluation determined that Umbra would be able to provide data to complement NASA's existing Earth observation capabilities. The biggest benefit that was identified during the evaluation was the very high spatial resolution imagery that Umbra can acquire to provide detailed views of on-going processes and changes that cannot be seen by traditional SAR satellite Earth observation sources. Umbra's effective tasking capabilities and interface allowed evaluators the opportunity to demonstrate their ability to task acquisitions and acquire imagery with rapid turnaround not traditionally available from larger missions. The Umbra support team proved to be responsive and helpful during the evaluation. The evaluation did identify a couple of key areas of potential improvement that would be beneficial to users. These areas include:

- Increased technical documentation and advanced user guides on Umbra's processing of the data and the algorithms used to generate products (i.e. ATBD).
- Improvements to the geolocation of the Umbra products. Evaluation teams had different experiences in the magnitude of geolocation errors with some being just a few meters and others off by upwards of 100s of meters.
- Several evaluation teams also noted that an increase in SAR collection capabilities such as additional polarizations and interferometric capabilities would expand the number applications that Umbra data could complement.

Overall Umbra Space provides high resolution SAR data that is complementary to existing NASA and ESA capabilities and addressing these areas of improvement would substantially improve the application and utility of its data to the NASA Earth Science community.

Appendix A. Listing of Evaluation Research Projects

Earth Surface and Interior and Cryosphere	
Evaluating Umbra Synthetic Aperture Radar Observations for Global Volcano Hazard Assessment and Mitigation	**Matthew Pritchard,** Cornell University
UMBRA constellation SAR data for cryosphere research – evaluation for CSDA	**Bernd Scheuchl**, University of California Irvine
Next-generation cryosphere research with the Umbra X-band SAR constellation	**Scott Henderson,** University of Washington
Ocean	
Tracking Sea Level Rise in American Samoa with Ultra-High-Resolution SAR Imagery: An Umbra Feasibility Study	**Stacey Huang,** University of Maryland, Baltimore County
All-weather monitoring of the variability of surface water and lake ice in a changing climate	**Mary Ruth Keller,** John Hopkins University
Evaluation of the daily to sub-daily evolution of ocean eddies and slicks	**Cathleen Jones,** Jet Propulsion Laboratory
Detection of Various Floating Matters Using Umbra X-Band SAR	**Brian Barnes,** University of South Florida
Terrestrial	
Evaluating Umbra High-Resolution SAR Data for Sustainable Water Management Practices and Flood Inundation Forecasts	**Hyongki Lee,** University of Houston
Evaluating Umbra Space High-resolution Data for low-latency multi-hazard Damage Mapping Practices	**Pietro Milillo,** University of Houston
L-UMBRAjack: Assessing Umbra SAR Data for Application to Landslides and Similar Hazard Events	**Franz Meyer,** University of Alaska Fairbanks

Evaluating the Sensitivity of Finer Spatial Resolution SAR Time Series to the Phenologies of Multiple Crops using UMBRA X-Band Products	**Geoffrey Henebry,** Michigan State University
Assessment of Geometric and Radiometric Quality of the Umbra Data for Soil Moisture and Active Wildfire Mapping	**Seungbum Kim,** Jet Propulsion Laboratory
Embracing CSDA-Supported Spaceborne SAR Data in NASA FireSense Airborne Campaign	**Taejin Park,** NASA Ames Research Center