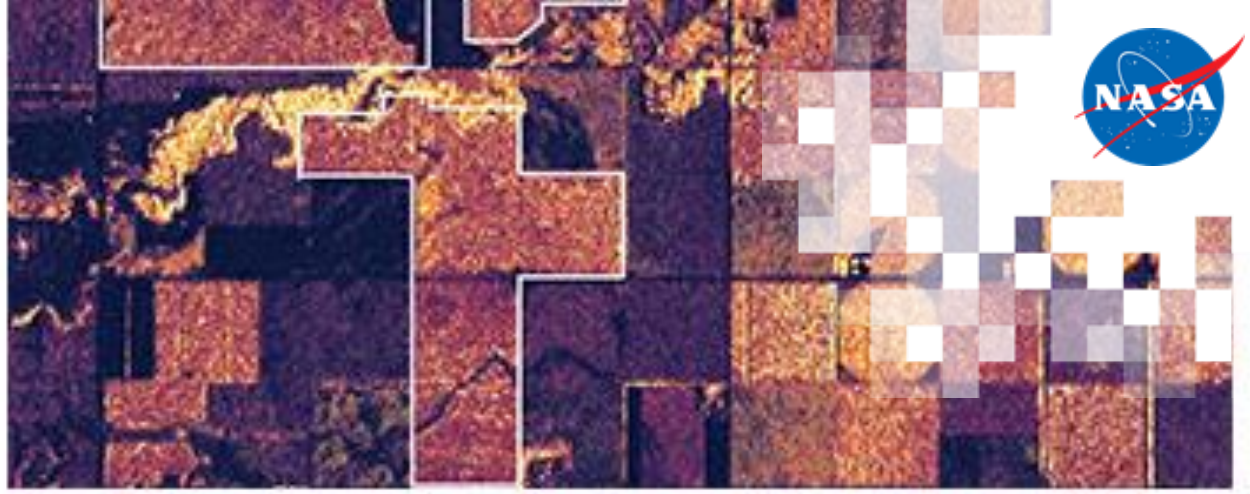
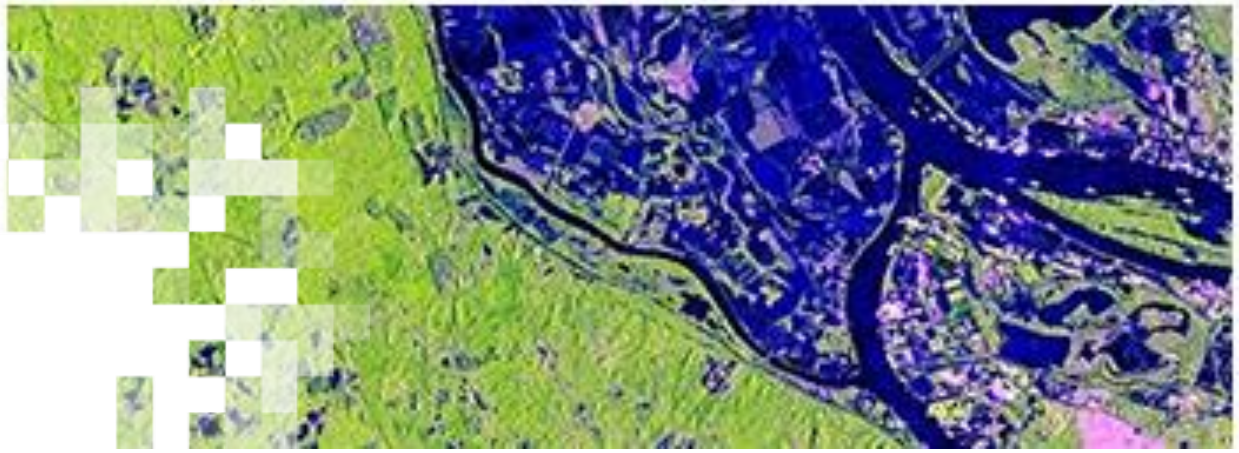
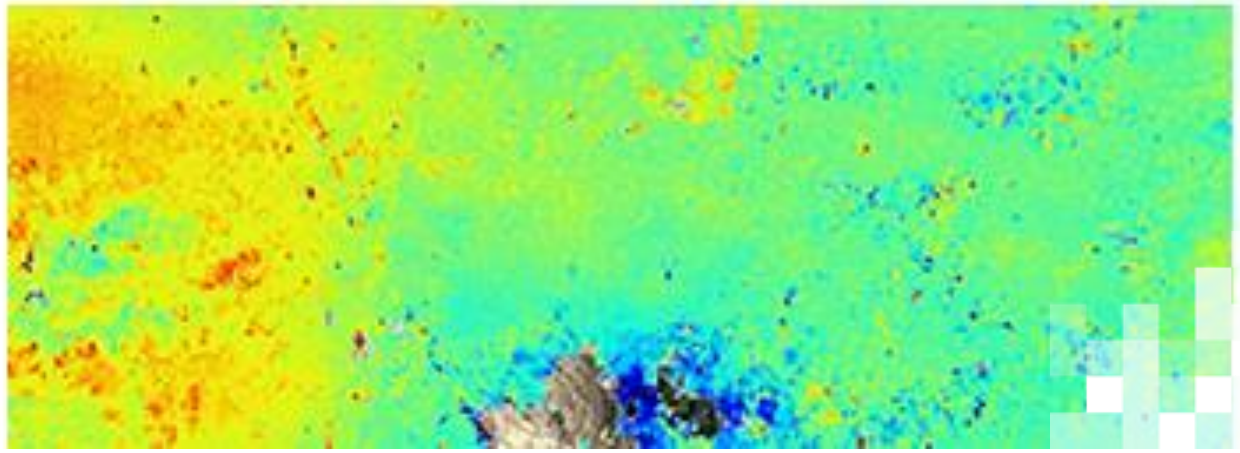






Harnessing NISAR: Next-Generation Radar Observations for Earth Applications

Session 2: NISAR Data Access and Tools

Franz Meyer, Alaska Satellite Facility, University of Alaska, Fairbanks; Heidi Kristenson, Alaska Satellite Facility; Anupama Sharma, National Remote Sensing Centre, ISRO; Erika Podest, Jet Propulsion Laboratory/California Institute of Technology

July 9, 2026

Training Outline

Session 1

An Introduction to NISAR

July 9, 2026

11:30 a.m. - 1:30 p.m. EDT

(1530-1730 UTC)

Session 2

NISAR Data Access and Tools

July 2, 2026

11:30 a.m. - 1:30 p.m. EDT

(1530-1730 UTC)

Session 3

Monitoring Earthquakes, Volcanoes, and Landslides with NISAR's InSAR Capability

July 16, 2026

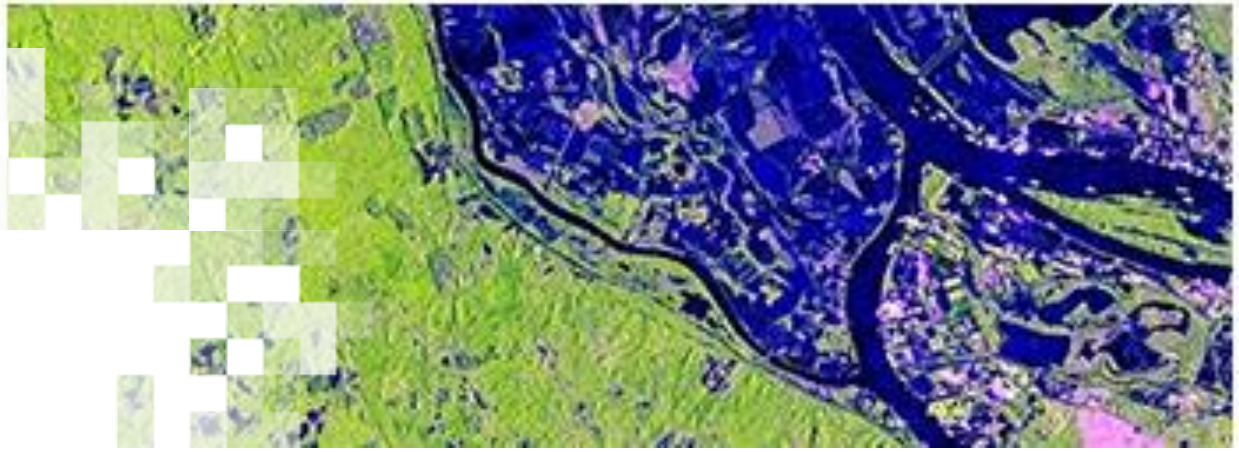
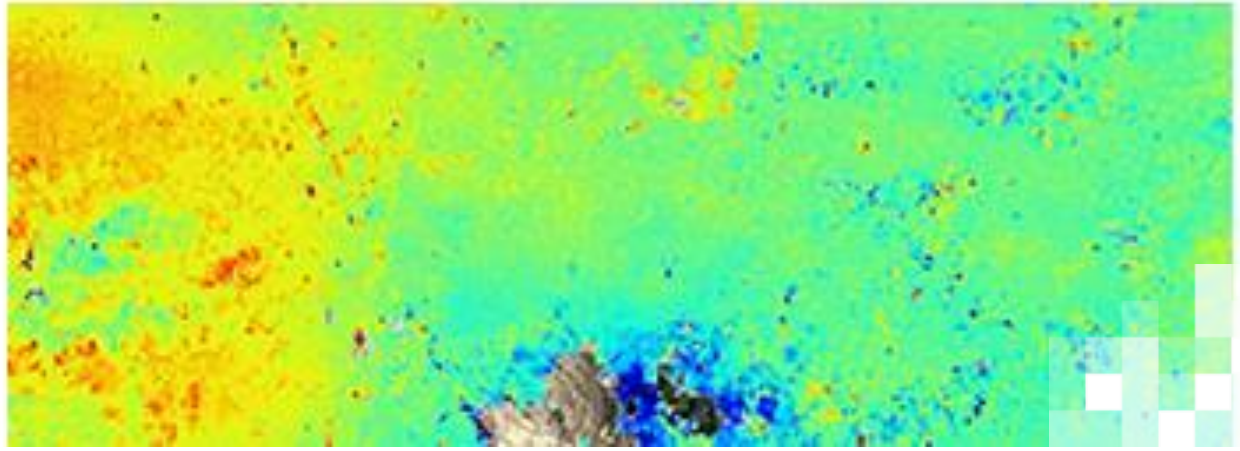
11:30 a.m. - 1:30 p.m. EDT

(1530-1730 UTC)

Homework

Opens July 16, 2026– Due Aug. 6, 2026 – Posted on Training Webpage

A certificate of completion will be awarded to those who attend all live sessions and complete the homework assignment by the given due date.

Session 2: NISAR Data Access and Tools

Session 2 Objectives

By the end of this session, participants will be able to:

- Identify where to access NISAR data
- Recognize the data format and tools for reading the data
- Apply tools for visualizing and analyzing NISAR data

How to Ask Questions

- To ensure we see your question, please locate the three dots ... to the bottom right of your training window.
- You will see a Slido/Q&A option. You may also see a standalone Slido tab or app.
- Please write your questions there and we will answer them during the Q&A session.
- We will try to respond all of the questions during the Q&A session after the webinar. The remaining questions will be answered in the Q&A document, which will be posted to the training website about a week after the training.

Session 2 – Guest Instructors

Dr. Franz J. Meyer

Professor of Remote Sensing, UAF

Chief Scientist, ASF

Heidi Kristenson

Senior GIS Specialist

ASF

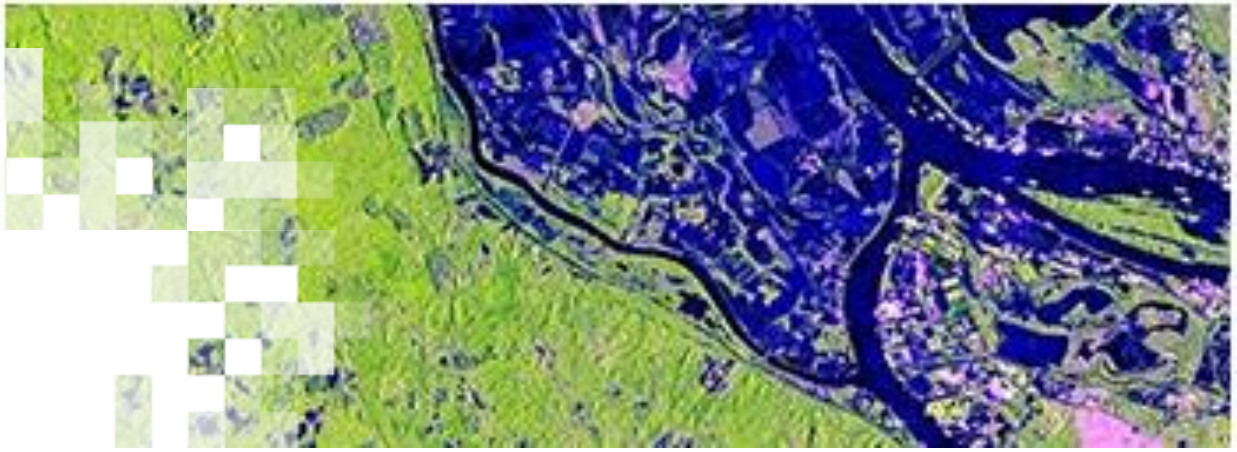
Anupama Sharma

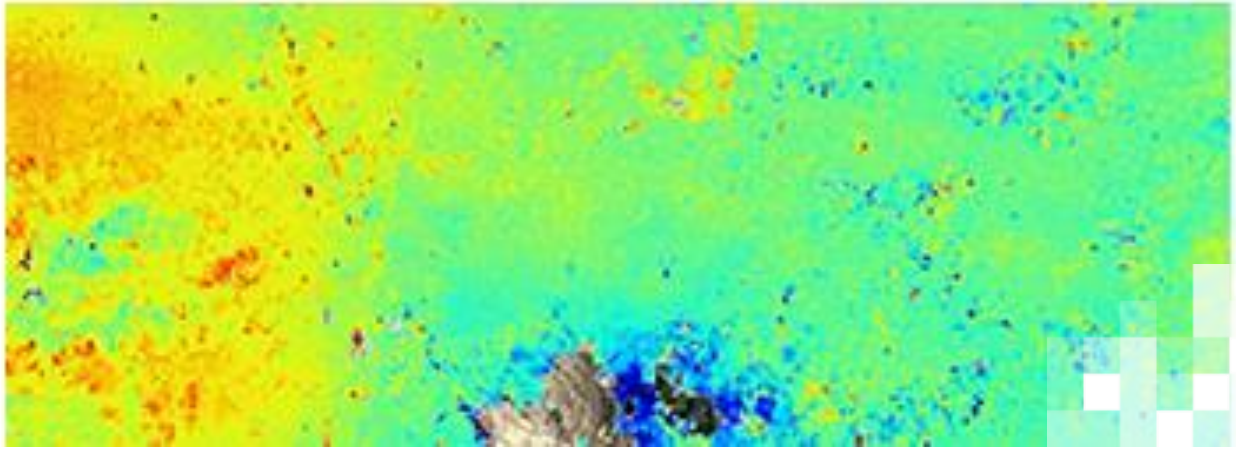
Group Lead, Data Dissemination & Workflow Automation Group

National Remote Sensing Centre, ISRO

Alaska Satellite Facility – Making Remote Sensing Data Accessible

- Remote Sensing Center Specializing in Synthetic Aperture Radar (SAR)
  - Operates NASA's Data Center for SAR data, hosting data dating back to 1978
    - From NASA missions and partner agency missions
  - Manages NISAR L-band data (processed by JPL)
  - Provides tools, services, and resources for working with SAR data
  - All datasets are free and open to the public



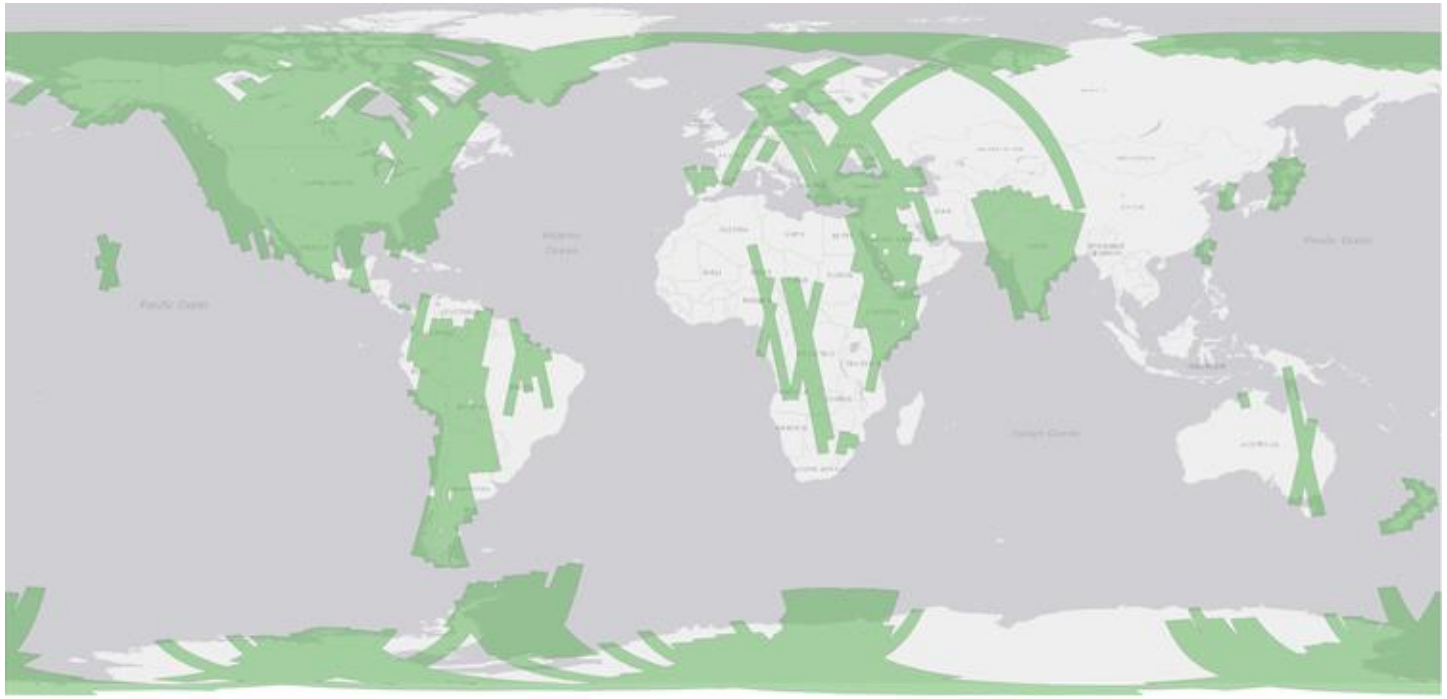


Data Availability and Accessibility

Current and Upcoming NISAR Data Availability

- Pre-calibration data is available
  - More than 100,000 products, acquired prior to Feb 2026
  - Pre-Calibration Product Known Issues

- Global Release of Forward-Processed data expected in July 2026
  - Check the NISAR Data User Guide – Available NISAR Data for updated information



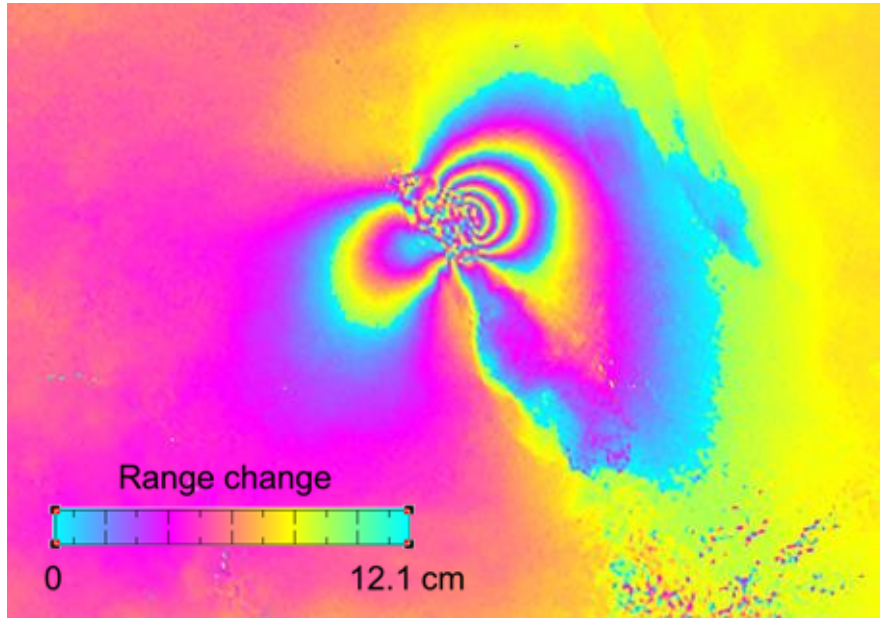
Spatial distribution of the archived pre-calibration NISAR data products, highlighted in green, included in the February 2026 data release

Level 1 and Level 2 NISAR Data Products

- **NISAR will offer typical SAR Level-1 data products, including:**
  - **RSLC** (Range-Doppler Single Look Complex) [Global]
  - **RIFG** (Range-Doppler Wrapped Interferogram); **RUNW** (Range-Doppler Unwrapped Interferogram); **ROFF** (Range-Doppler Pixel Offsets) [Cryosphere Regions]

- **Additionally, NISAR will offer a set of Level-2 Data Products**:
  - **GCOV** – **G**eocoded **Cov**ariance [Global]
    - Normalized radar backscatter layer for each polarization
  - **GSLC** – **G**eocoded **S**ingle **L**ook **C**omplex [Global]
    - Rapid interferogram generation through cross multiplication
  - **GUNW** – **G**eocoded **Unw**rapped Interferograms [Global]
    - Nearest-neighbor (generally 12-day) pairings
    - Coherence layers – useful for change detection
  - **GOFF** – **G**eocoded Pixel **Off**sets [Cryosphere Regions]
    - Nearest-neighbor pixel offset measurements

NISAR Co-Eruptive Interferogram, Ethiopia
11/22 - 12/04



Level 3 Products

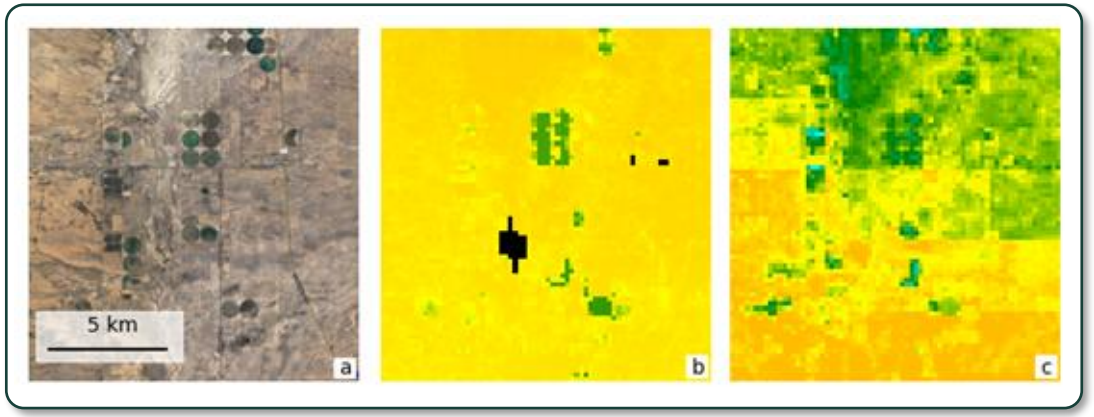
- **SME2 – Soil Moisture Retrievals**
  - Soil Moisture retrievals at 200-m pixel spacing from three independent algorithms
    - Multiscale Fusion Algorithm (DSG)
    - Physical Model Algorithm (PMI)
    - Time Series Ratio Algorithm (TSR)

Differing dependence on time series, ancillary data files, regularization

- **The Product Package Includes Additional Layers Useful to the Community**
  - 200m aggregated σ_0, all polarizations, all frequencies
  - Additional aggregated info (e.g., local incidence angle) and statistics
- **NISAR soil moisture product has an accuracy goal of 0.06 m3/m3 over unflagged areas with vegetation water content below 5 kg/m2.**

Soil Moisture Product Calibration/Validation

- **Pre-Launch**
  - SMAPVEX12 experiment in Manitoba, Canada
  - ALOS-2 imagery processed to simulate NISAR

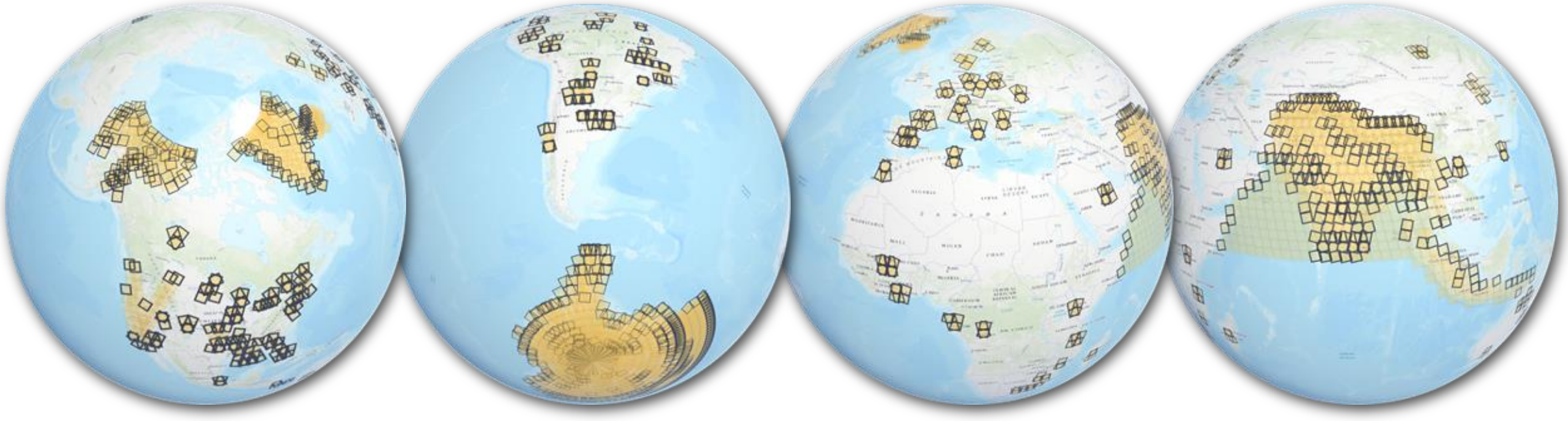


- **Post-Launch**
  - Sparse Network
    - Usually single station within 200m resolution element
    - Using all free and open soil moisture stations globally
  - Supersites
    - ≥3 semi-permanent instrumented stations within 200m
    - Feasibility for intensive temporary validation for 3 to 6 months
    - Efforts in India, U.S., and beyond

Data Available from ISRO

- All NISAR S-band data will be distributed through ISRO
- ISRO also distributes L-band data collected concurrently with S-band acquisitions
  - ISRO L-band may have slightly different values than products processed by JPL for NASA
  - Same file format as NASA's L-band products

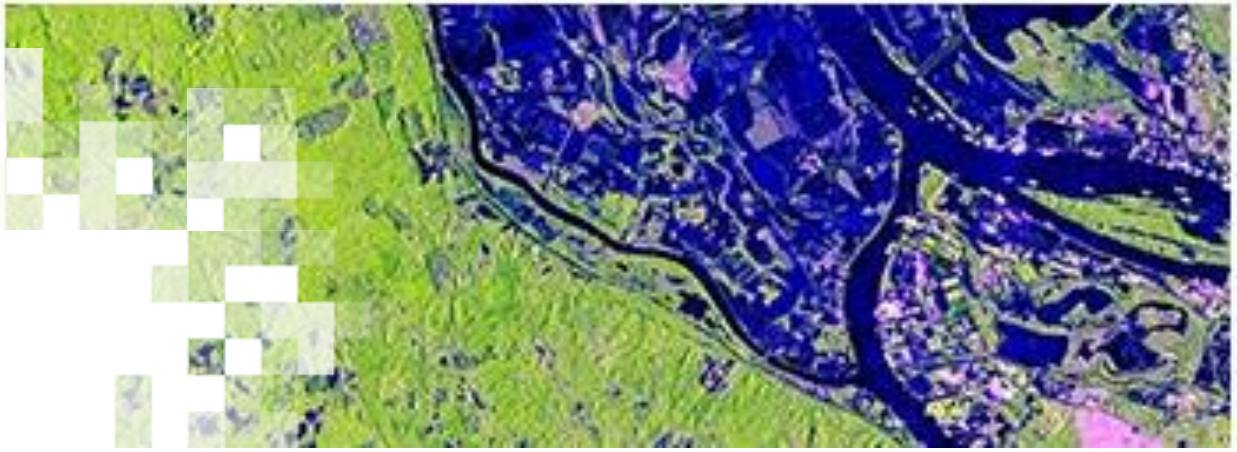
NISAR S-Band Data Coverage

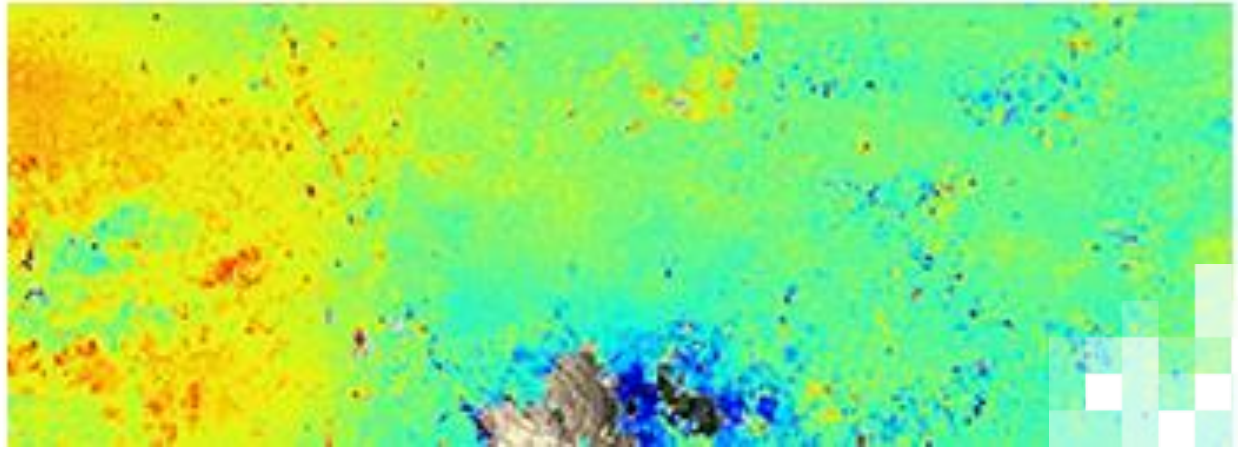


NISAR Observation Plan App

Bhoonidhi: ISRO's EO Data Hub

- **NISAR Information Page**: Details on NISAR specifications, observation plan, products, access mechanisms, science applications, and more.

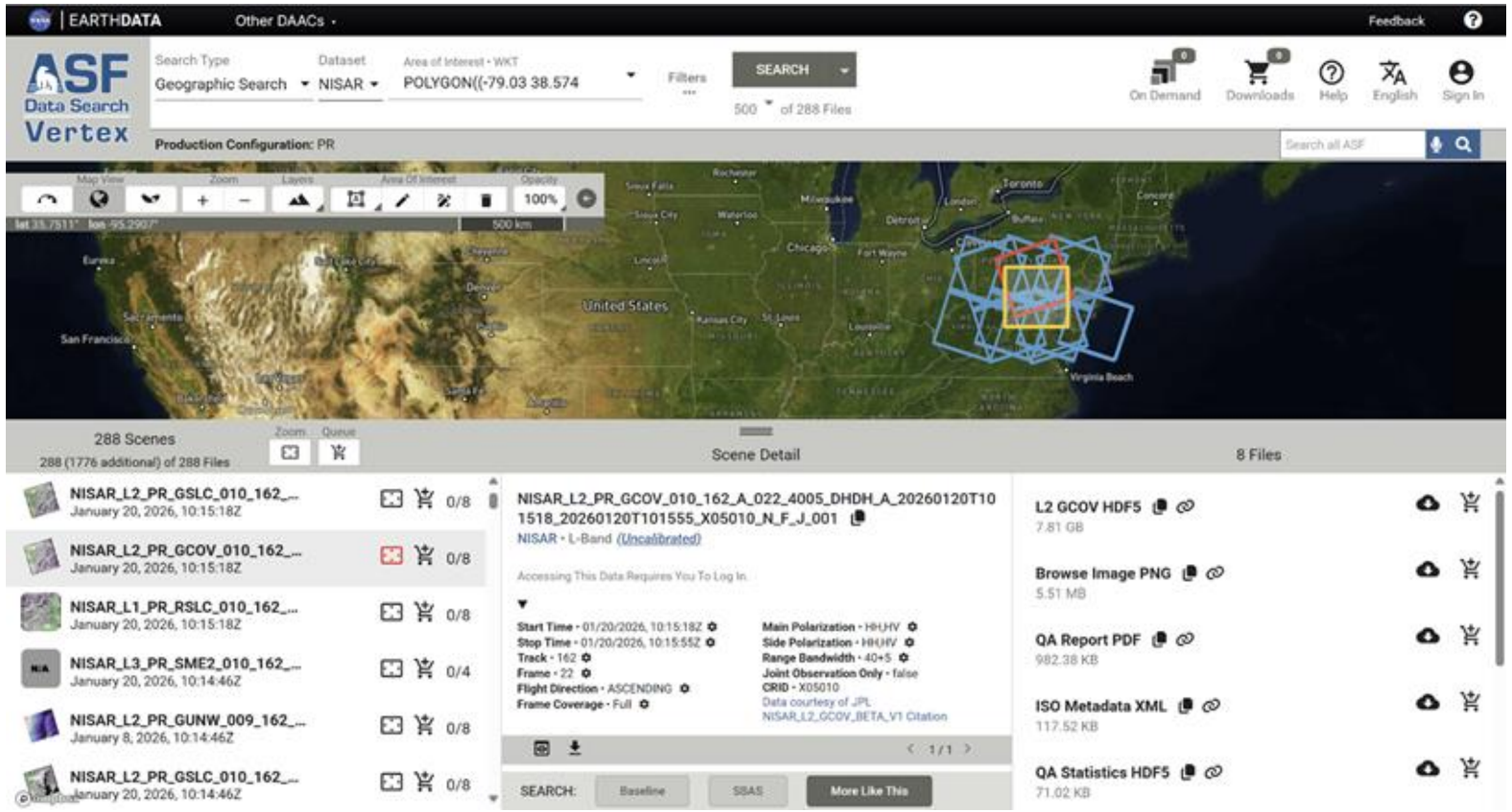




Data Discovery and Access

Vertex

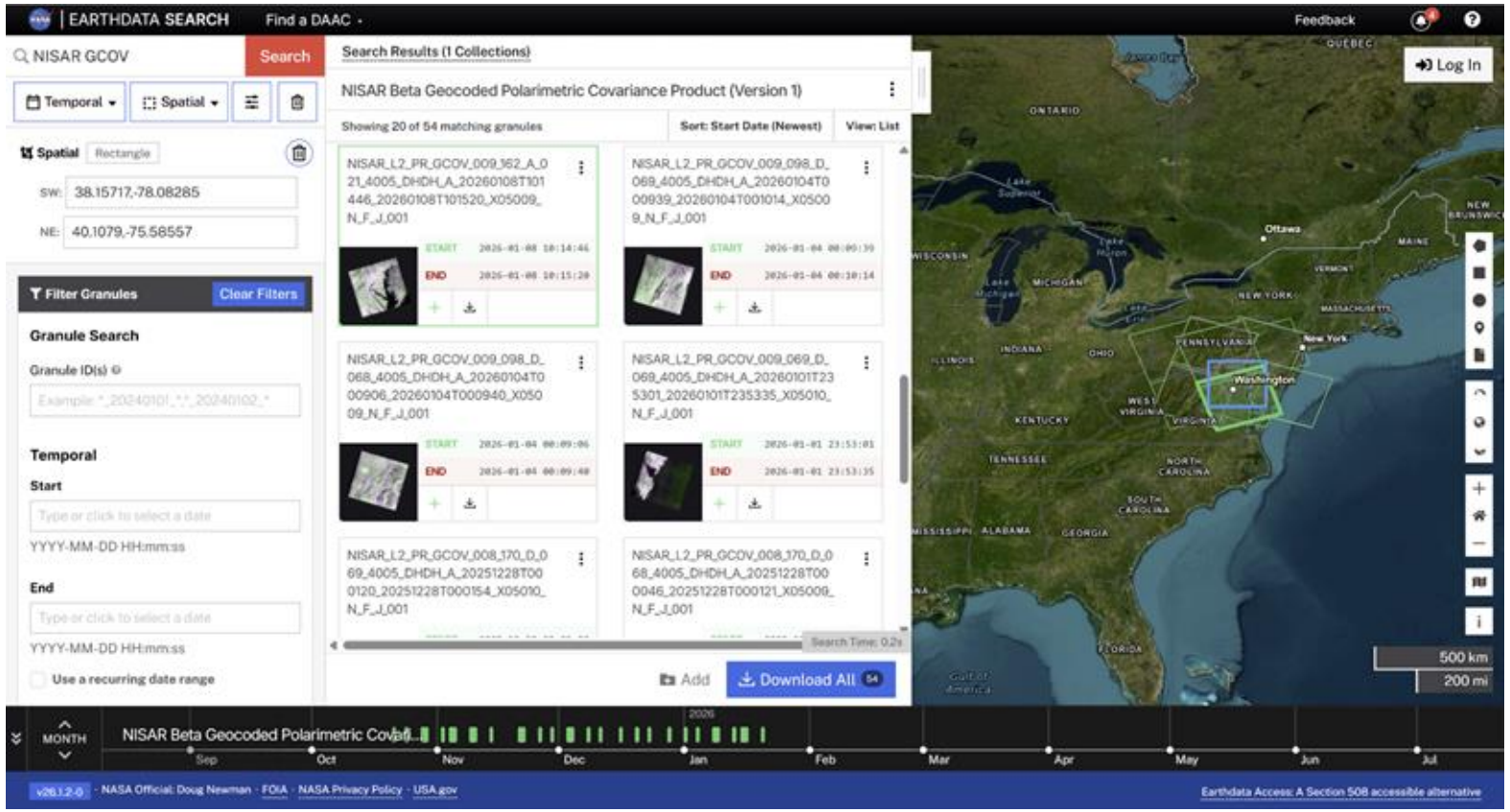
Explore and Access ASF's Archive of SAR Data



- Filters customized to SAR dataset search parameters
  - Polarization
  - Orbit Direction
  - Product Types
  - Acquisition Modes
- View all available products from a mission in the same search results
- asf_search Python Package

Earthdata Search

Explore and Access All of NASA's Earth Science Data



- Search for any dataset in the Earthdata system
- Built-in support for Harmony data transformation tools
- [earthaccess Python Package]

Bhoonidhi

Bhoonidhi
ISRO's EO Data HUB
भूनिधि
इसरो इओ डाटा हब
nrsc
Explore
Archives
PI Actions
Utilities
Login
Help
Search-Criteria
Search-Results
Cart
Area of Interest
Location
Polygon
Shapefile
KML / KMZ
Events
Mapsheet
Date range
04 May 2026
03 June 2026
Filters (Optional)
Open/Priced
Resolution
Imaging Spectrum
Satellite
Sensor Type
Products
Themes
Satellite-Sensor (select max 10)
Disabled / Unavailable for the selected date range
OpenData_DirectDownload
OpenData_OnOrder
Priced
Advanced Filters
Submit
FEEDBACK
Tell us what you think
N 22° 20' 58" E 52° 17' 42"
Latitude: 22.3494 Longitude: 52.2949
Browsers supported: Firefox 60+, Chrome 78+, Edge 18+, Opera 64+
About Us
Help
Terms&Conditions
Disclaimer
FAQ
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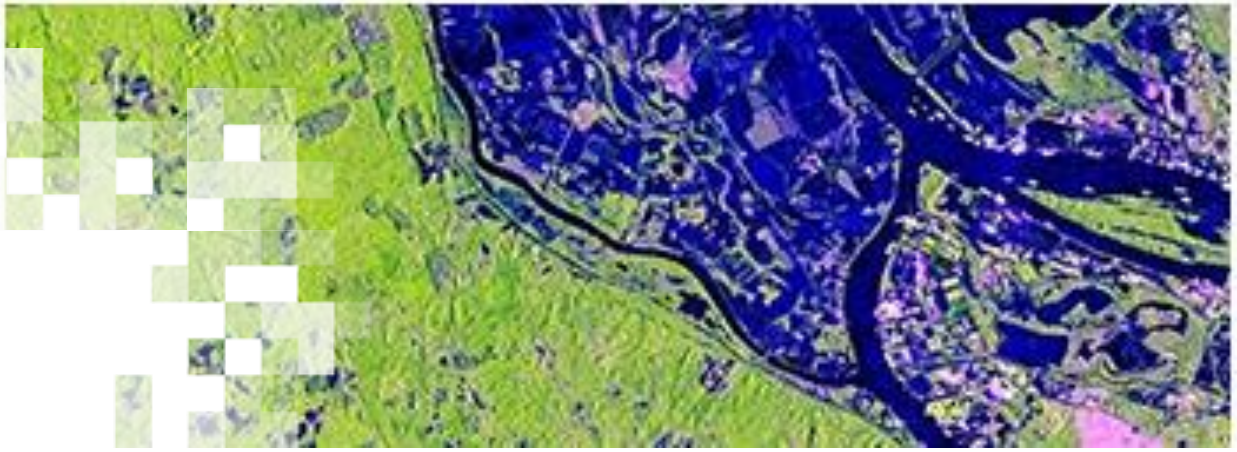
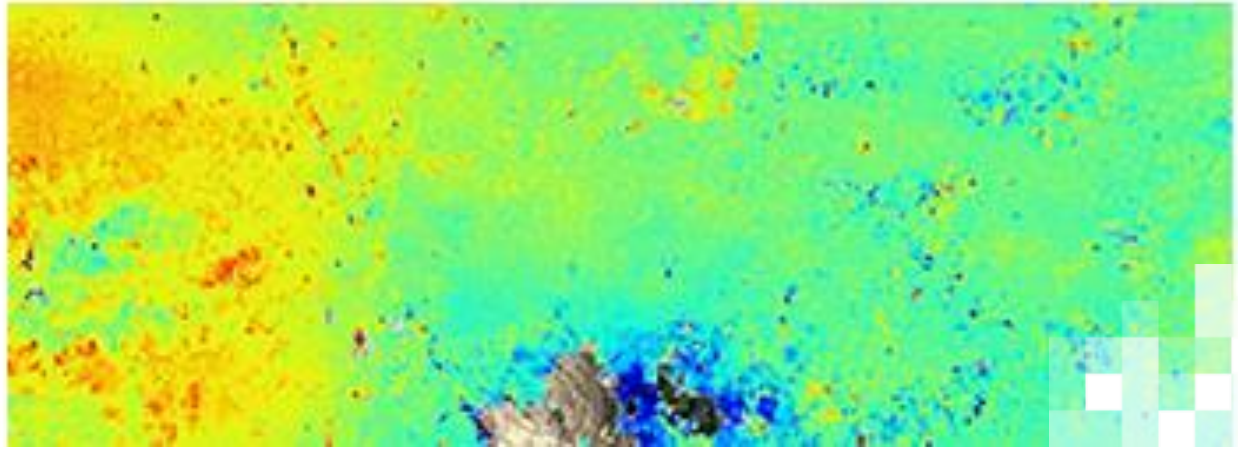
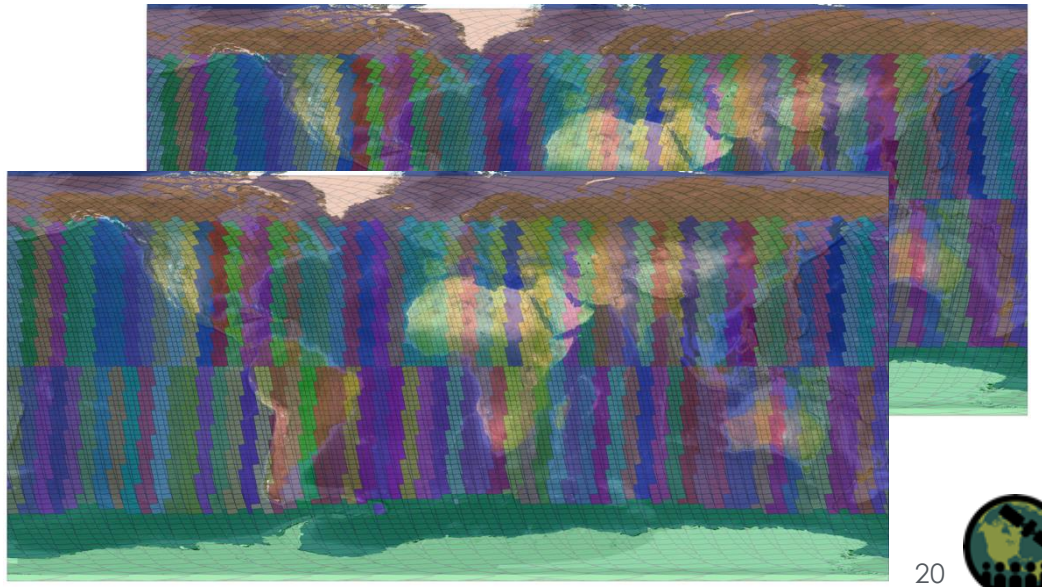




Using the Data

Data Format Considerations

- **HDF5 Format**
  - Specific NISAR HDF5 Format
    - Coordinate system encoded using NetCDF CF conventions
    - May need to use NetCDF drivers instead of HDF5 drivers
  - Cloud-Optimized
    - Can stream data into memory
      - asf_search
      - earthaccess
    - Access specific data from a NISAR file instead of downloading the whole file
- **File Size**
  - Large spatial footprint (240 km swaths)
  - Many datasets packaged together
- **Projections**
  - All data beyond 60 degrees latitude are in polar stereographic coordinates



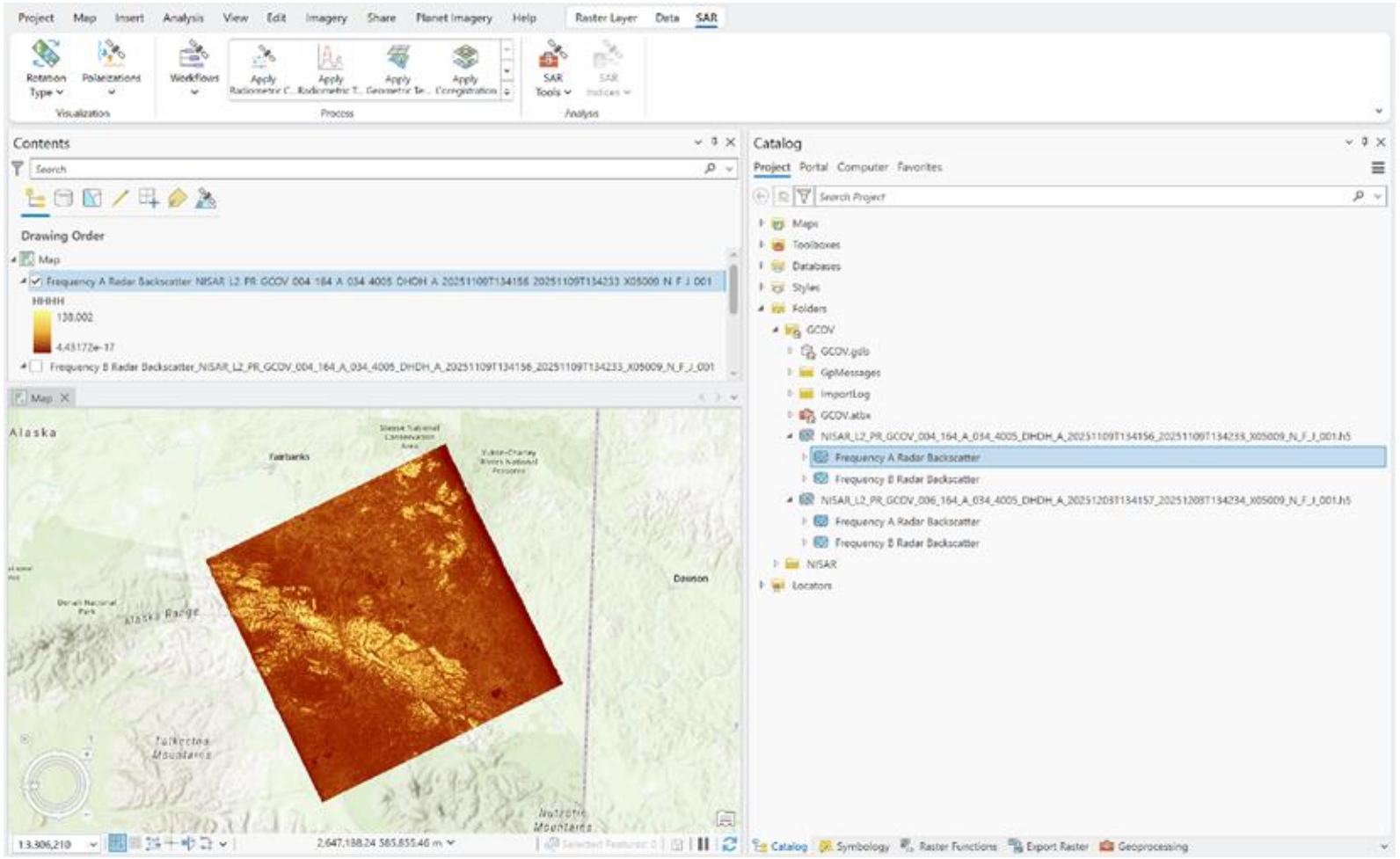
Software Platforms

- **GIS Software**
  - ArcGIS Pro
    - NISAR HDF5 data format supported from version 3.4 (November 2024)
    - Additional support for NISAR GCOV products added in version 3.7 (May 2026)
  - QGIS
    - Workarounds required to view the data in QGIS
    - JPL is developing a GDAL driver for NISAR – not yet available in main GDAL distribution

- **Programmatic Packages**
  - ISCE3 — Software package used by the NISAR mission
  - PLAnT-ISCE3 — Wrapper for ISCE3 for easier use of ISCE3 functions
  - GMTSAR — Commonly used SAR processing package, now supports NISAR products
  - openSEPPO — Open-source tools from Earth Big Data for working with NISAR data

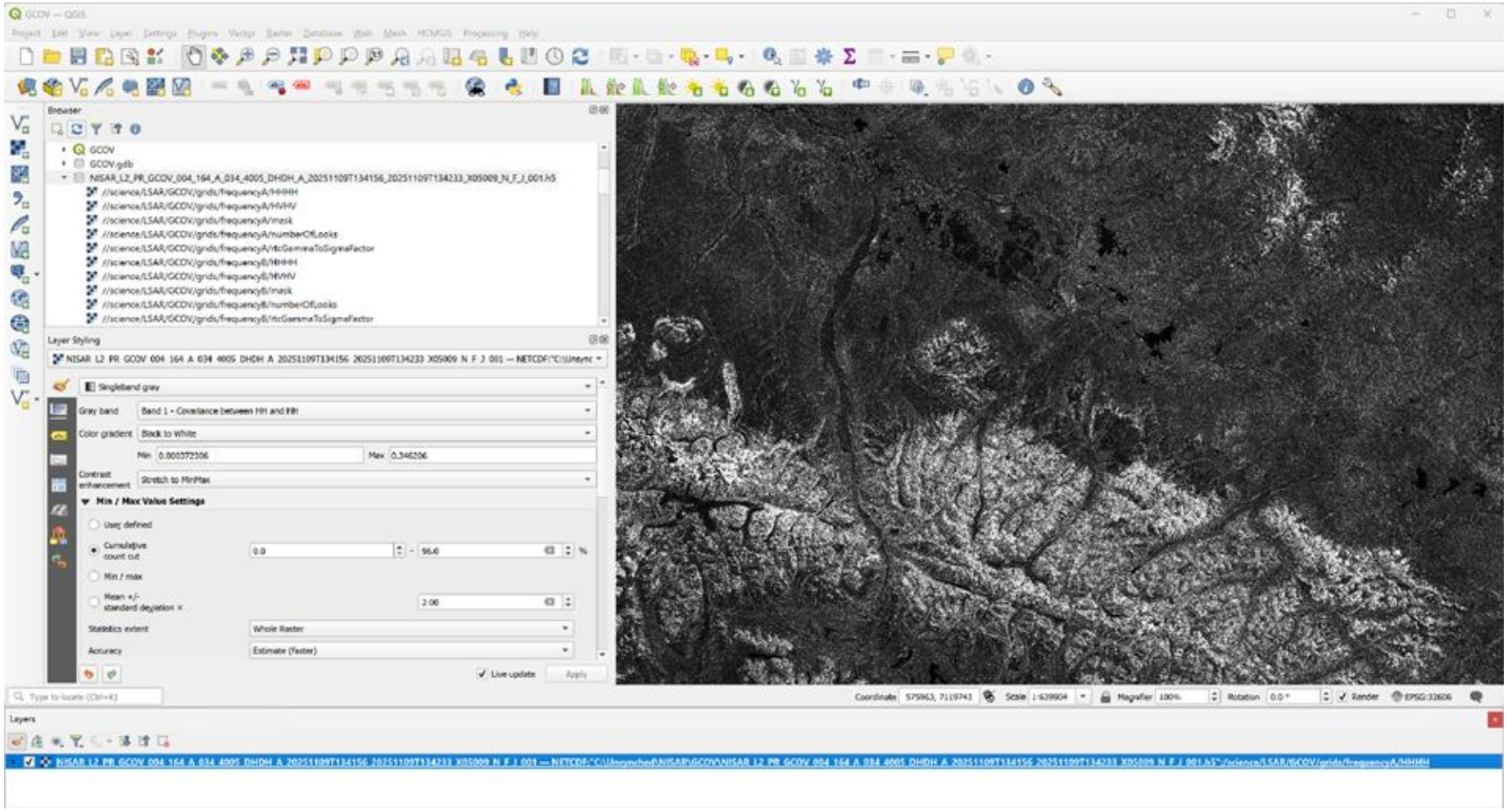
ArcGIS Pro

- NISAR in ArcGIS Pro 3.4+
- NISAR in ArcGIS Pro 3.7



QGIS

- Demo Video
- Exploring Sample Data with QGIS Tutorial



Where to Work With NISAR Data

- NASA is committed to supporting your use patterns whether you want to work in the cloud or on your local machine!

High-Bandwidth Data Download Capabilities

10PB/ month

ASF DAAC supports distribution of up to 10PBs per month.

AWS

Get Started with the Cloud

OSL

ASF OpenScienceLab

More info at:
https://opensciencelab.asf.alaska.edu/

NASA OpenScapes

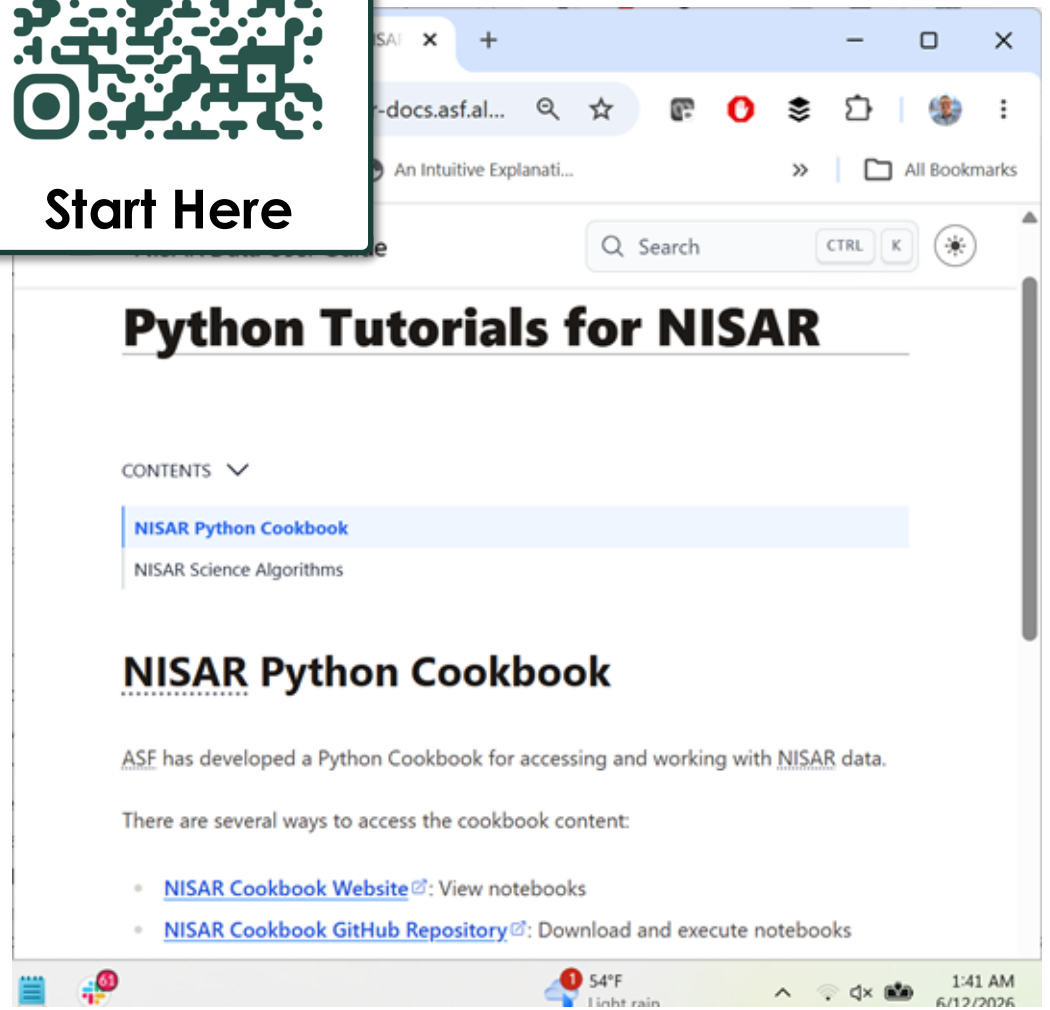
More info at:
https://nasa-openscapes.github.io/

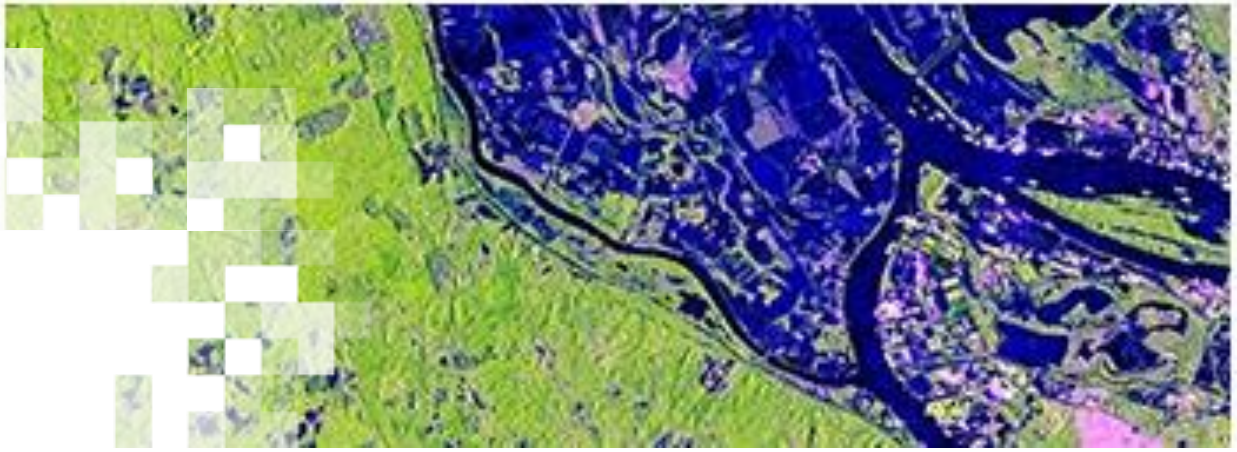
Programmatic Workflow

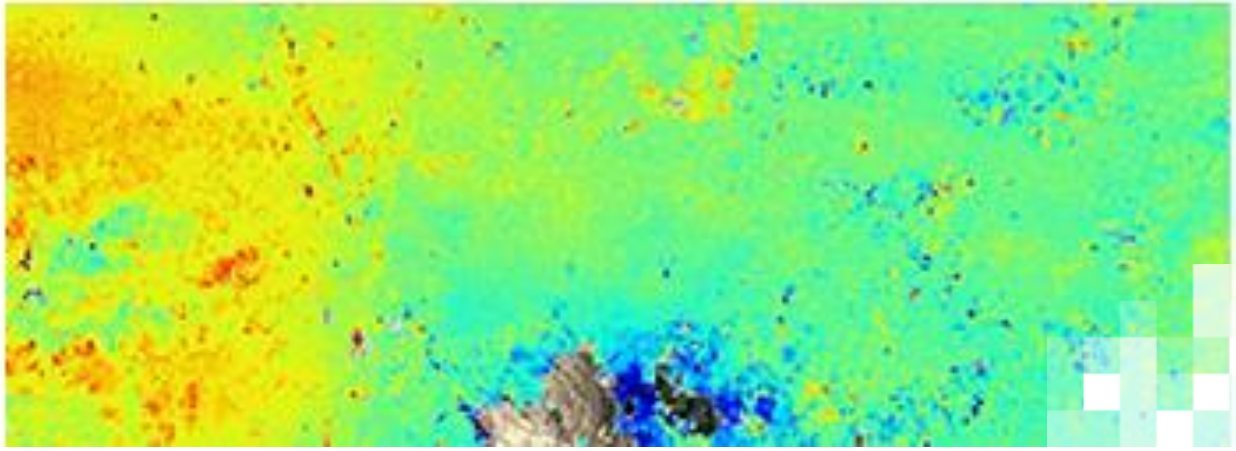
- The NISAR community is working on making a growing number of cookbooks for programmatic data use available.
- Links to these workflows are available through the NISAR Data User Guide.

- **In the following we will showcase:**
  - Where to find NISAR tutorials
  - Who should consider using these workflows
  - Where and how these tutorials can be run
  - We will run a sample workflow to demonstrate use

Start Here





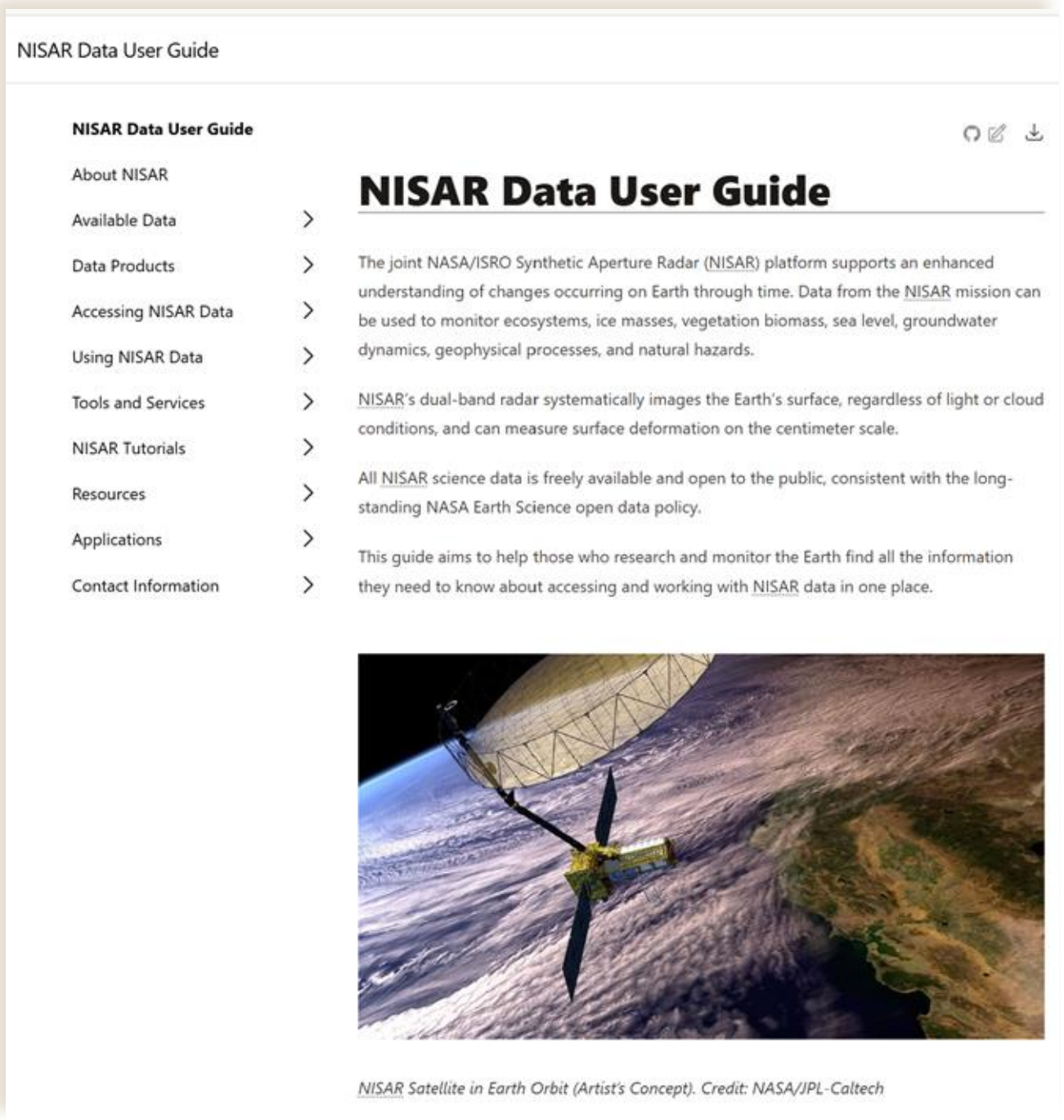


Tools and Services

NISAR Data User Guide

[NISAR Data User Guide]

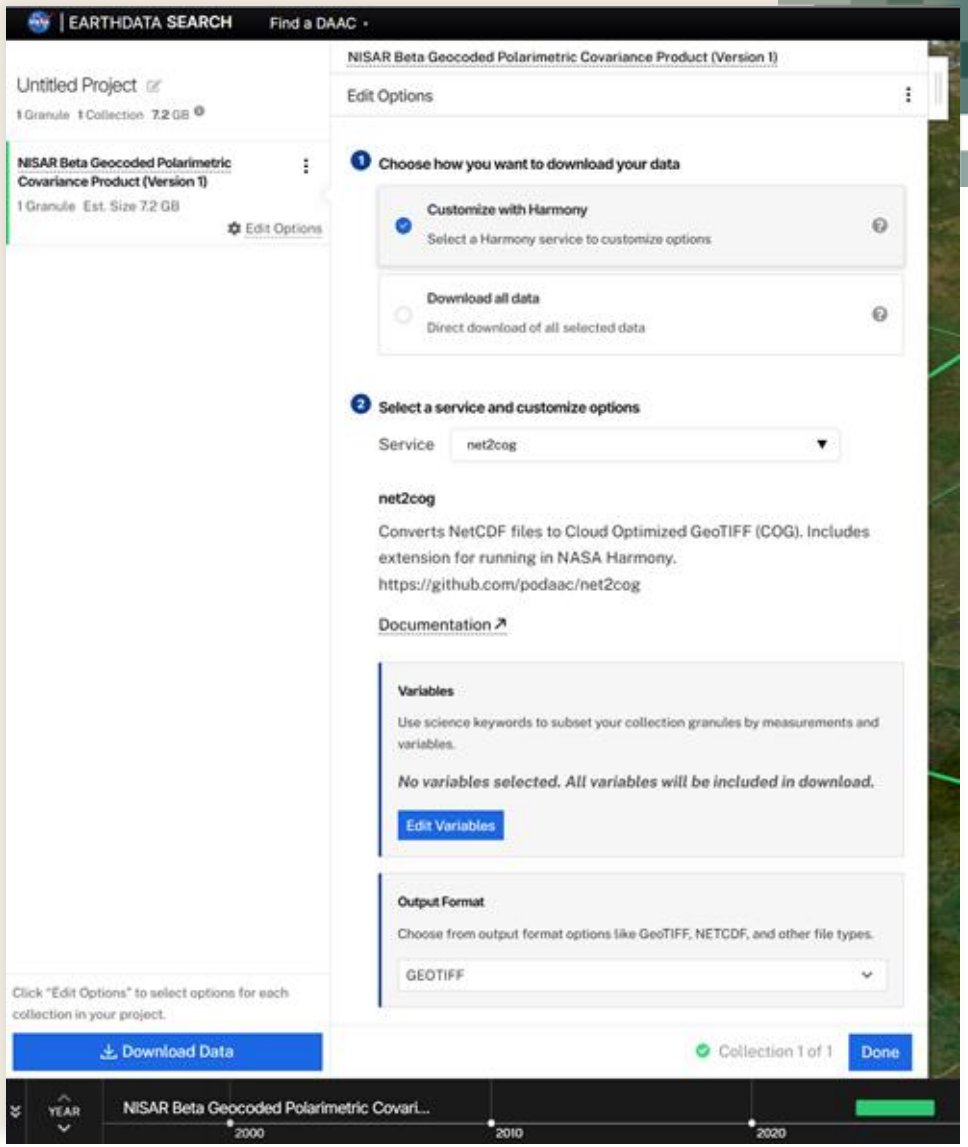
- Information Clearinghouse
  - Find what you need to know to work with the data
  - Guidance and tutorials
  - Links out to existing content from many trusted sources
  - Living document
    - Frequently updated with additional content
    - [Roadmap]



Harmony Services

Earthdata's Data Transformation Tool

- NISAR GCOV Dataset Subsetting
  - Extract just the dataset(s) you want from the HDF5 in Cloud-Optimized GeoTIFF (COG) format
  - Available in Earthdata Search
  - Coming soon to Vertex
- NISAR GCOV spatial subsetting (in development)
  - Clip the extracted dataset to a defined extent (Q4 2026)
  - Clip the full HDF5 file to a defined extent (2027)

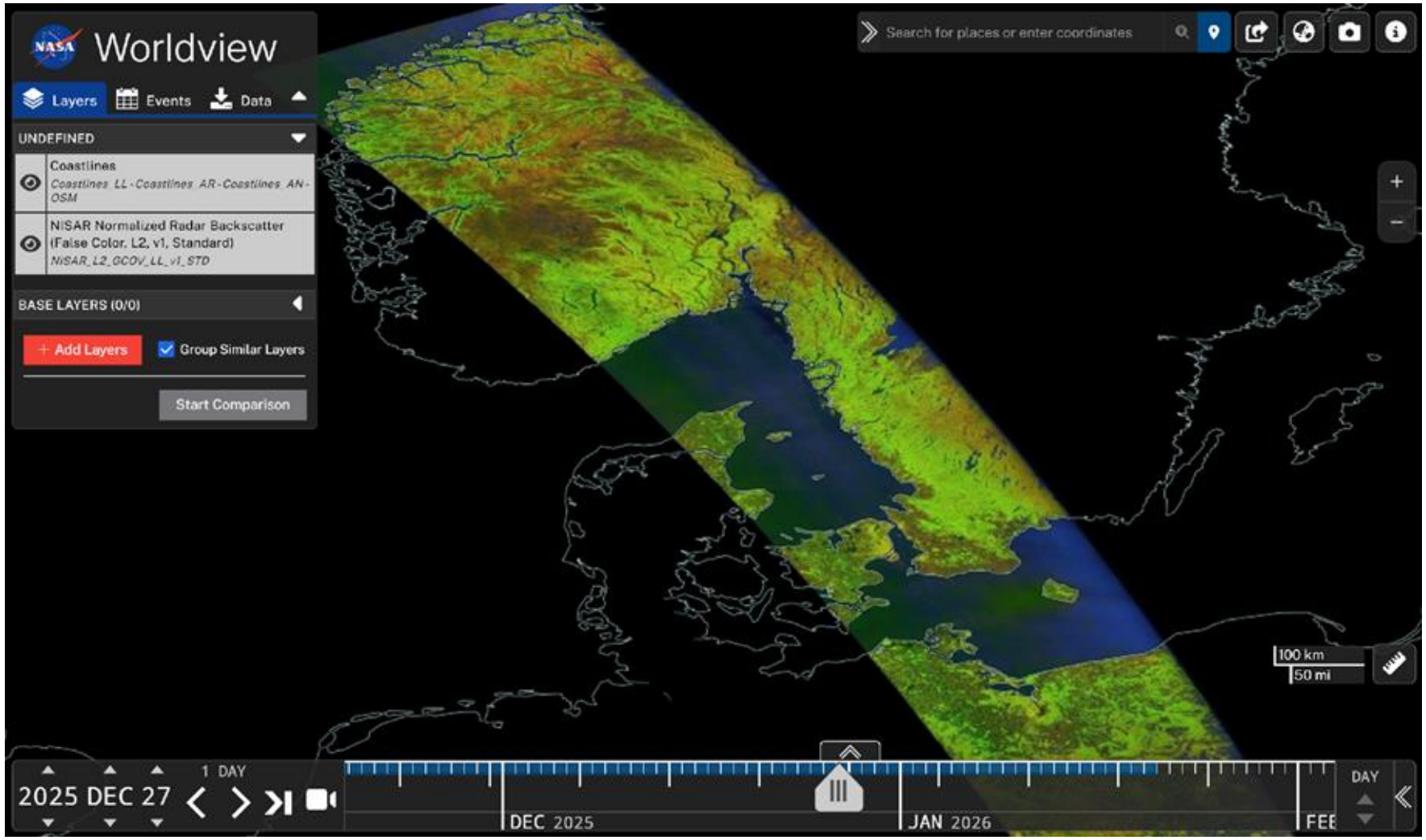


- Development Roadmap

Worldview

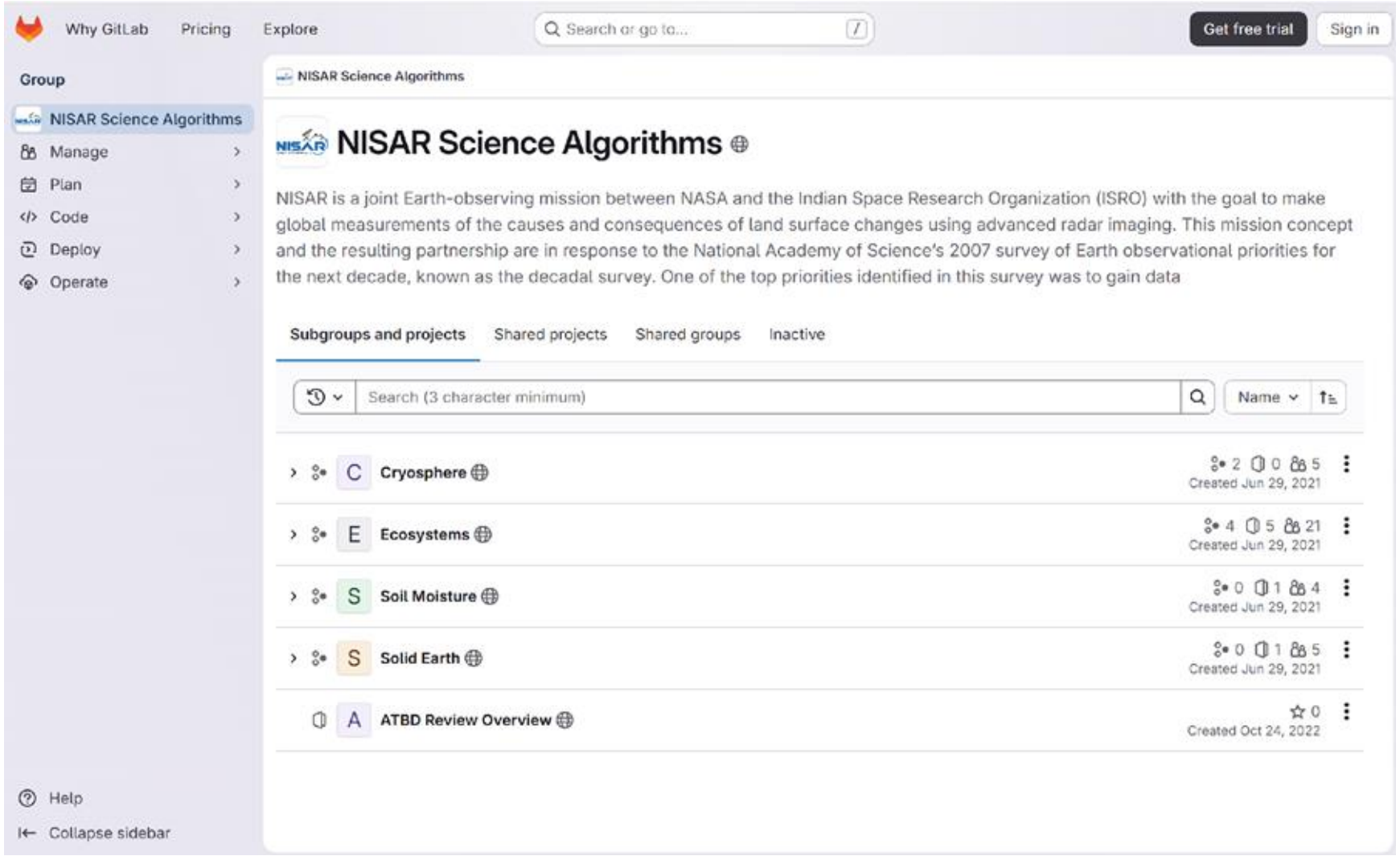
[Worldview]

- NASA's Earthdata visualization platform
- Daily NISAR GCOV mosaics
  - Available once [calibrated data has been released]
- Orbit tracks available now



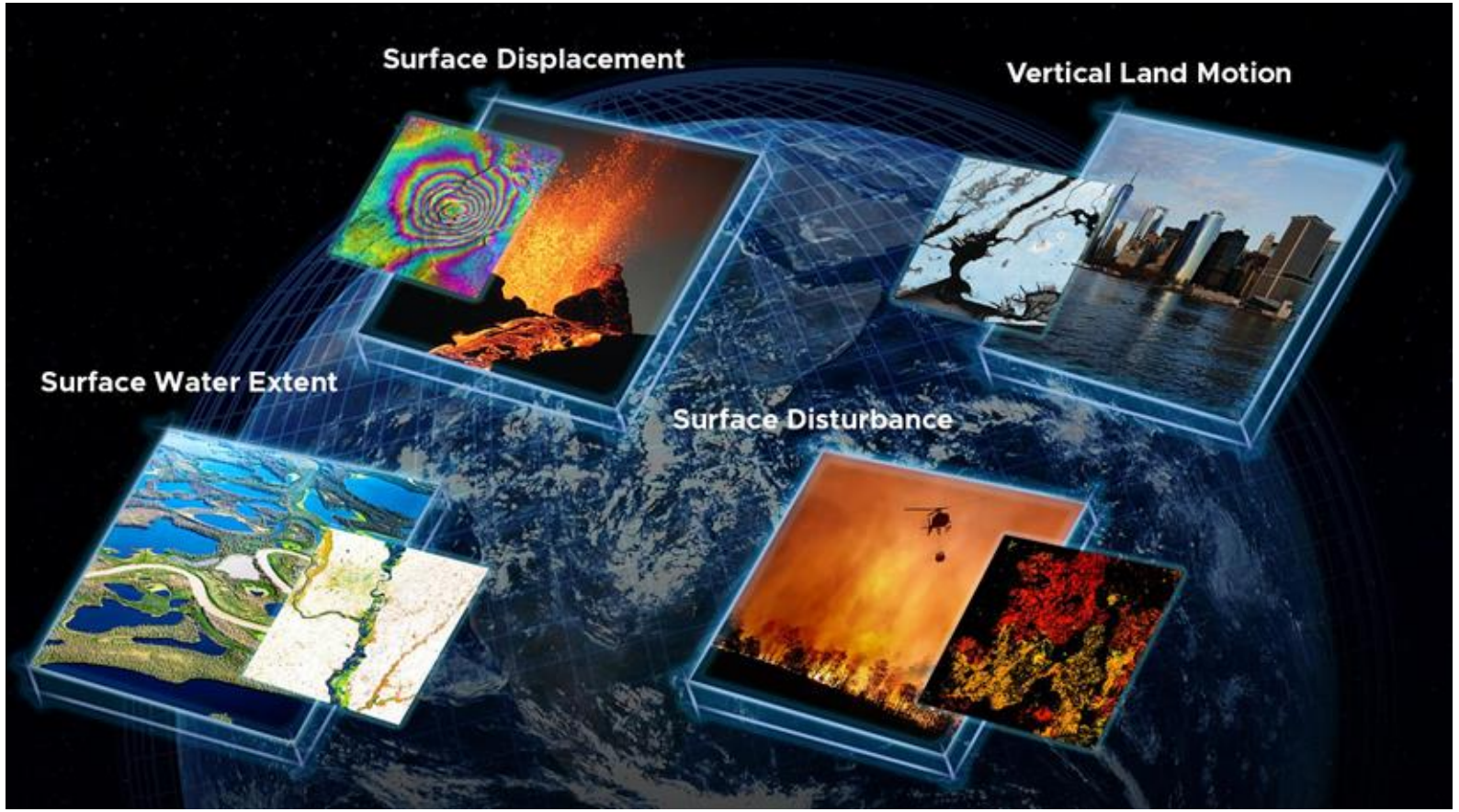
Level 3 Science Algorithm Notebooks

- [NISAR Science Algorithms GitLab]



Observation Products for End-users from Remote Sensing Analysis (OPERA)

- **OPERA Datasets:**
  - Funded by the **Satellite Needs Working Group**, responding to well-defined **end-user** needs.
  - **Free** and open, **low-latency**, **ready-to-use** data to support **disaster response**, **recovery**, **damage assessments**, and others.
  - Provide life/property-saving data and **actionable intelligence** for resilience and prosperity of our nation.



OPERA Products Derived from NISAR

Level-3 Products

- **Description:** Maps surface water using optical (HLS) and SAR imagery (S1, NISAR)
- **Coverage:** Near-Global
- **Temporal Resolution:** Every Few Days
- **Spatial Resolution:** 30 m
- **Product Record Begins**: Apr. 2023 (HLS), Sep. 2024 (S1)**, soon in 2026 (NISAR)**

Available now!

- **Description:** Maps vegetation disturbance using optical (HLS) and SAR imagery (S1)
- **Coverage:** Near-Global
- **Temporal Resolution:** Every Few Days
- **Spatial Resolution:** 30 m
- **Product Record Begins:** Feb. 2023 (HLS), Mar. 2026 (S1)

Available now!

- **Description:** Maps surface displacements in LOS (S1 and NISAR)
- **Coverage:** North America*
- **Temporal Resolution:** 6, 12, or 24 days
- **Spatial Resolution:** ≤ 30 m
- **Product Record Begins:** Apr. 2014 (S1), NISAR validated record.
- **Production Begins:** Dec. 2024 (S1), **soon in 2026 (NISAR)**

Available now!

- **Description:** Maps surface displacements in vertical + horiz. (S1 and NISAR)
- **Coverage:** North America*
- **Temporal Resolution:** 6, 12, or 24 days
- **Spatial Resolution:** ≤ 30 m
- **Product Record Begins:** Apr. 2014 (S1), NISAR validated record.
- **Production Begins:** Apr. 2028 (S1 + **NISAR**)

Available in 2028

Level-2 Products

- **Description:** S1 radar backscatter corrected for the topography. Basis for the DSWx-S1 products.
- **Coverage:** Near-Global
- **Spatial Resolution:** 30 m
- **Product Record Begins:** Oct. 2023

Available now!

- **Description:** Geocoded and coreg. SLC (S1, NISAR). Basis for all the DISP products.
- **Coverage:** North America*
- **Spatial Resolution:** ≤ 10 m
- **Product Record Begins:** Jul. 2016 (S1) and TBD (NISAR)
- **Production Begins:** Oct. 2023 (S1), TBD (NISAR)

Available now!

OPERA data is available through the SNWG Data Portal.

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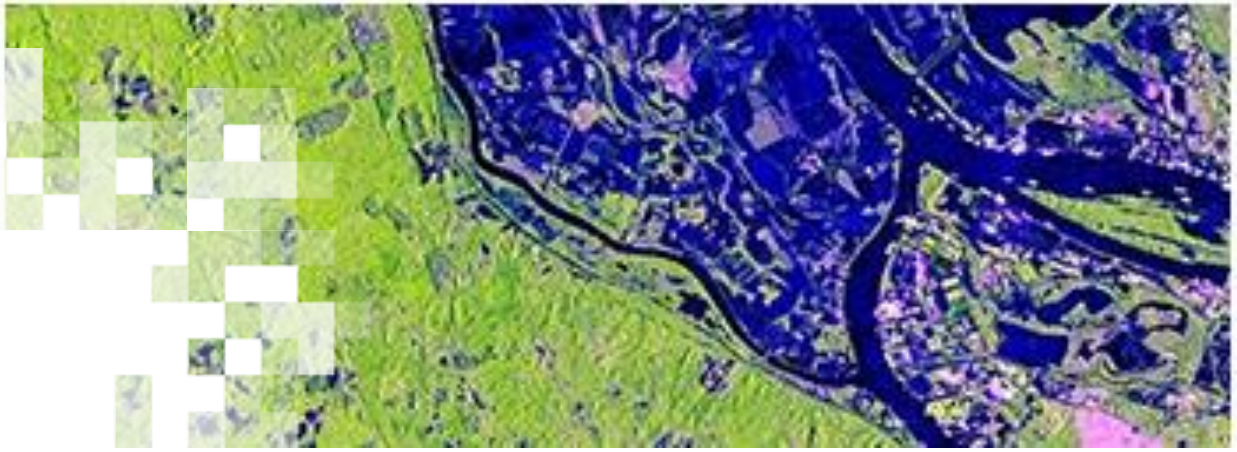
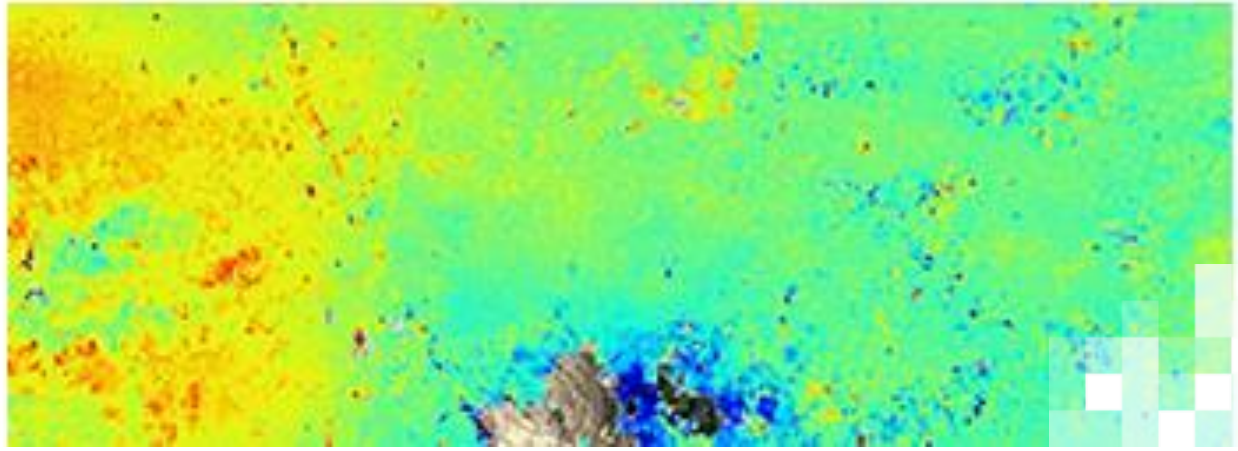
Resources

- NISAR Data User Guide
- Vertex – ASF Data Search portal
- Earthdata Search – Earthdata Data Search portal
- Bhoonidhi – Data Search portal from ISRO
- asf_search – ASF Data Search Python package
- earthaccess – Earthdata data access Python package
- NISAR in ArcGIS Pro 3.7 – StoryMap tutorial focusing on new NISAR GCOV support
- NISAR in GIS (ArcGIS Pro 3.4+) – StoryMap tutorial for working with NISAR data in ArcGIS Pro
- Using NISAR in QGIS – Tutorial Video from NISAR Data Access webinar
- ISCE3 – Software package used by the NISAR mission
- PLAnT-ISCE3 – Wrapper for ISCE3 for easier use of ISCE3 functions
- GMTSAR – Commonly used SAR processing package, now supports NISAR products
- openSEPPO – Open-source tools from Earth Big Data for working with NISAR data
- Worldview – Click **Add Layers** button to search for NISAR Normalized Radar Backscatter layer
- NISAR Science Algorithm GitLab – NISAR Level 3/4 Algorithm Notebooks





Summary

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- NISAR data are freely and openly available.
- L-band data can be accessed through the Alaska Satellite Facility (ASF), while S-band data, along with coincident L-band observations, are available through ISRO's Bhoonidhi platform.
- L-band provides near-global coverage every 12 days, whereas S-band observations are acquired primarily over India and selected science and calibration/validation sites outside India.
- NISAR data are distributed in HDF5 format.
- Level 2 products are geocoded, allowing them to be readily overlaid with other geospatial datasets.
- Open-source Jupyter Notebooks with algorithms for the mission's different science disciplines are publicly available.
- The only global Level 3 product generated by NISAR is soil moisture, with a spatial resolution of 200 m.
- The GCOV product is the geocoded geometrically terrain corrected backscatter data (gamma naught) and is the most suited for those new to radar and wanting to do ecosystem type studies (deforestation, biomass, agriculture, flooding, etc.)
- The GUNW product is the geocoded wrapped and unwrapped interferogram and is the best suited for those new to InSAR and wanting to do surface deformation/movement type studies.
- NISAR data can either be downloaded for local analysis or accessed and processed in the cloud, depending on your workflow.

Looking Ahead to Session 3

Monitoring Earthquakes, Volcanoes, and Landslides with NISAR's InSAR Capability

- Identify the NISAR InSAR Data Products and their characteristics
- Recognize the uses of the NISAR InSAR Data products and their uses and limitations
- Apply NISAR InSAR data to assess ground surface displacement due to earthquakes and landslides

Homework and Certificates

- **Homework:**
  - One homework assignment
  - Opens on Jul. 16, 2026
  - Access from the training webpage
  - Answers must be submitted via Google Forms
  - **Due by Aug. 6, 2026**

- **Certificate of Completion:**
  - Attend all three live webinars (attendance is recorded automatically)
  - Complete the homework assignment by the deadline

You will receive a certificate via email approximately two months after completion of the course.

Contact Information

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Thank You!