

Jet Propulsion Laboratory
California Institute of Technology

The NASA-ISRO Synthetic Aperture Radar (NISAR) Mission

Terrestrial Ecology Applications and Data Access

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SERVIR Applied Sciences Team

Inputs by: Bruce Chapman, Paul Rosen, and Annemarie Peacock
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AmazonTech
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Acknowledgements



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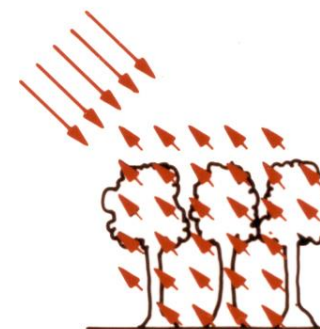


Cathleen Jones
NISAR Applications Lead

A joint SAR mission by NASA and ISRO

NISAR Characteristic:	Enables:
L-band (24 cm wavelength)	<ul style="list-style-type: none"> All weather Foliage penetration
SweepSAR technique with Imaging Swath > 240 km	Near-global data collection, including the entire tropics
Polarimetry HH + HV	<ul style="list-style-type: none"> Land cover mapping Biomass Estimation
12-day exact repeat	<ul style="list-style-type: none"> Change detection Disturbance mapping Changes in inundation

L- Band Wavelength



L-Band
24 cm



C-Band
5.5 cm

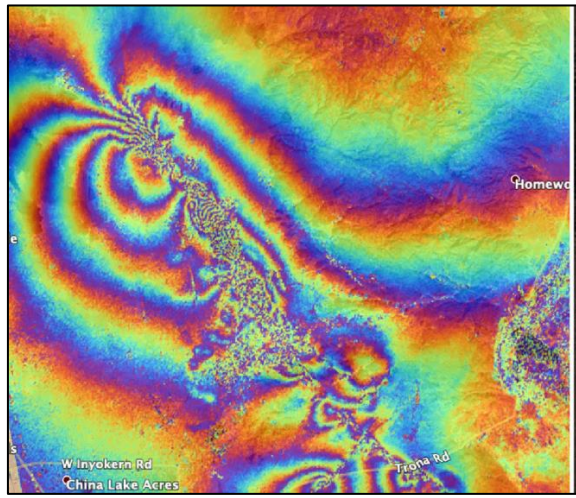
Key Scientific Objectives

- Understand the response of ice sheets and glaciers to climate change and the interaction of sea ice and climate
- Understand the dynamics of carbon storage and uptake in wooded, agricultural, wetland, and permafrost systems
- Improve knowledge for forecasts of earthquakes, volcanic eruptions, and landslides

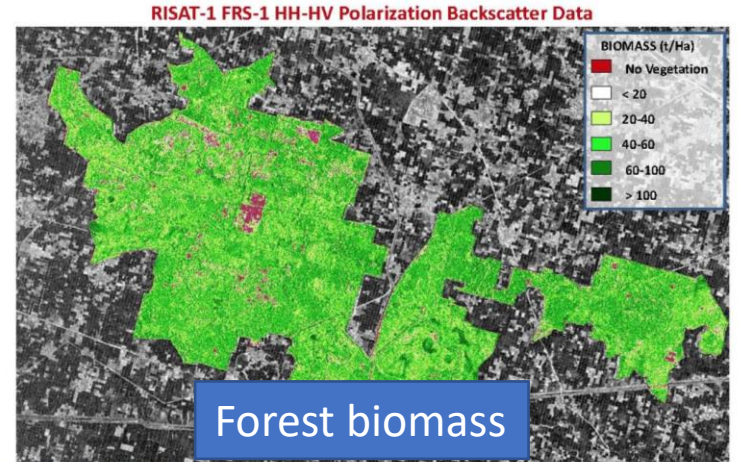
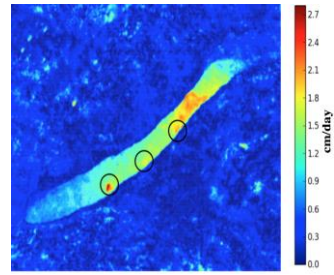
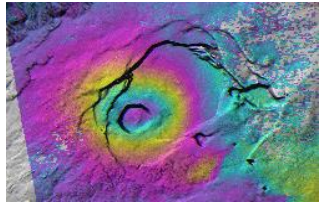
Key Applications Objectives

- Understand societal impacts of dynamics of water, hydrocarbon, and sequestered CO₂ reservoirs
- Enhance agricultural monitoring capability in support of food security objectives
- Apply NISAR's unique data sets to explore the potentials for urgent response and hazard mitigation





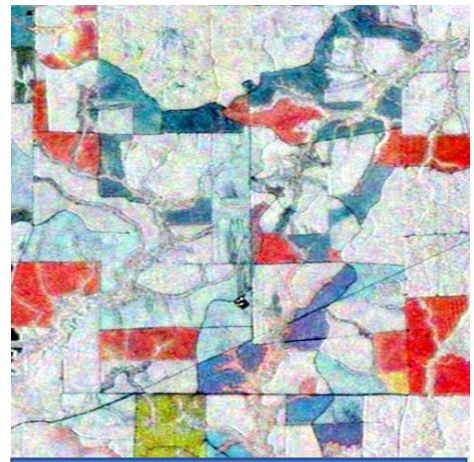
Deformation



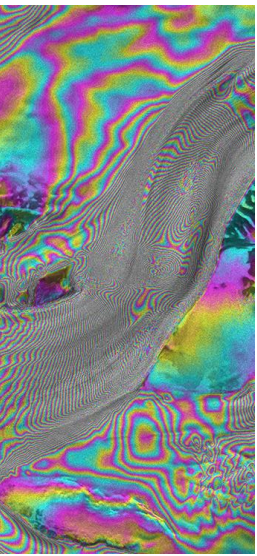
Area: Saraswati Plantation area, Kaithal Dist., Haryana
 (Dominant vegetation species: *Eucalyptus*, *Acacia*, *Prosopis Juliflora*)
 RISAT-1 Data: DoA: 23 Jun 2013 (Inc. Angle: 43 deg.)

Multi-Linear Regression Model:
 $Biomass = a + b * \sigma_{HH}^0 + c * \sigma_{HV}^0$

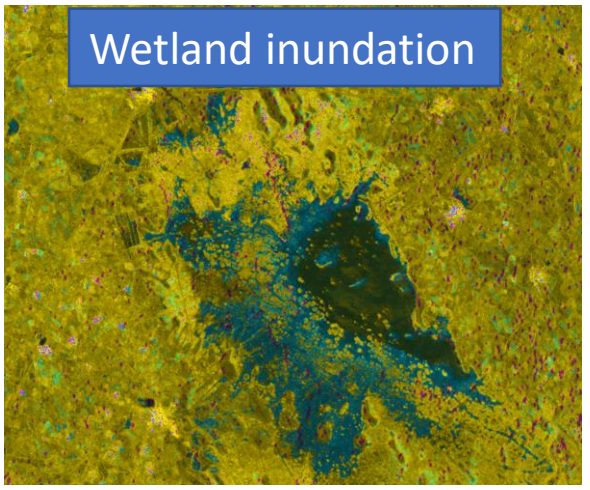
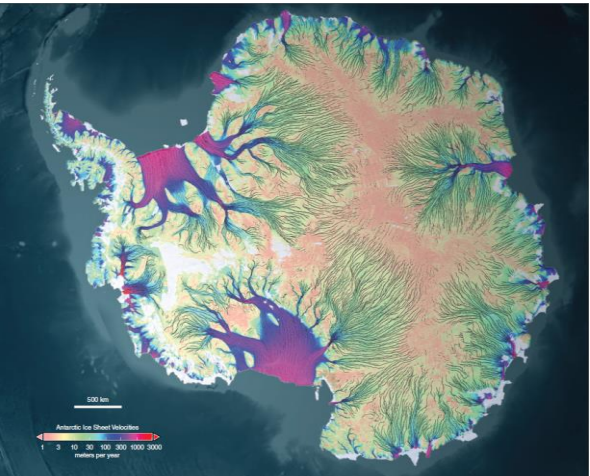
Ecosystems



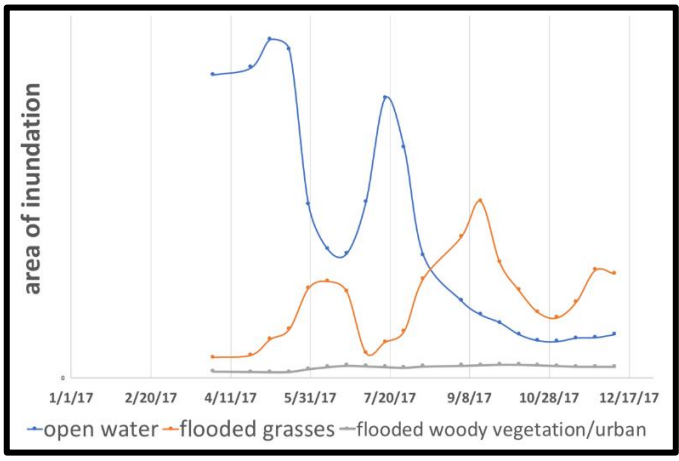
Forest disturbance and active crop area



Cryosphere

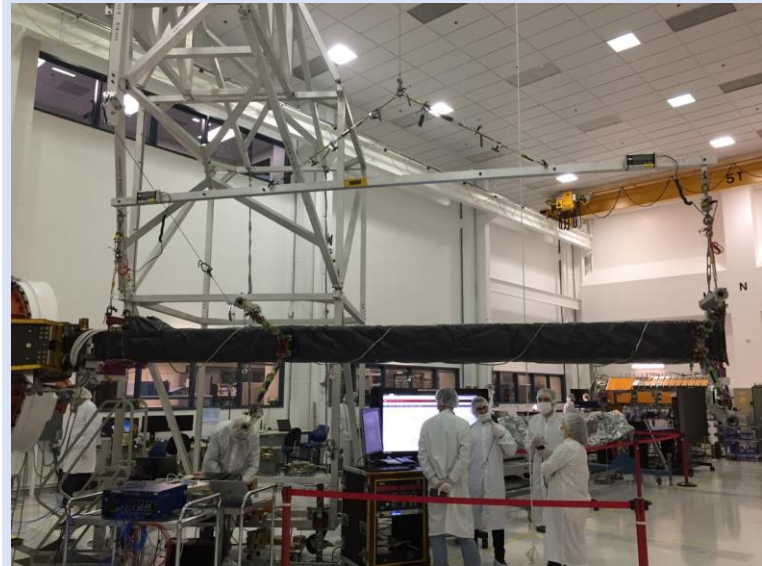


Preliminary results from Sentinel-1 C-band time series reveal dynamics of inundation extent.

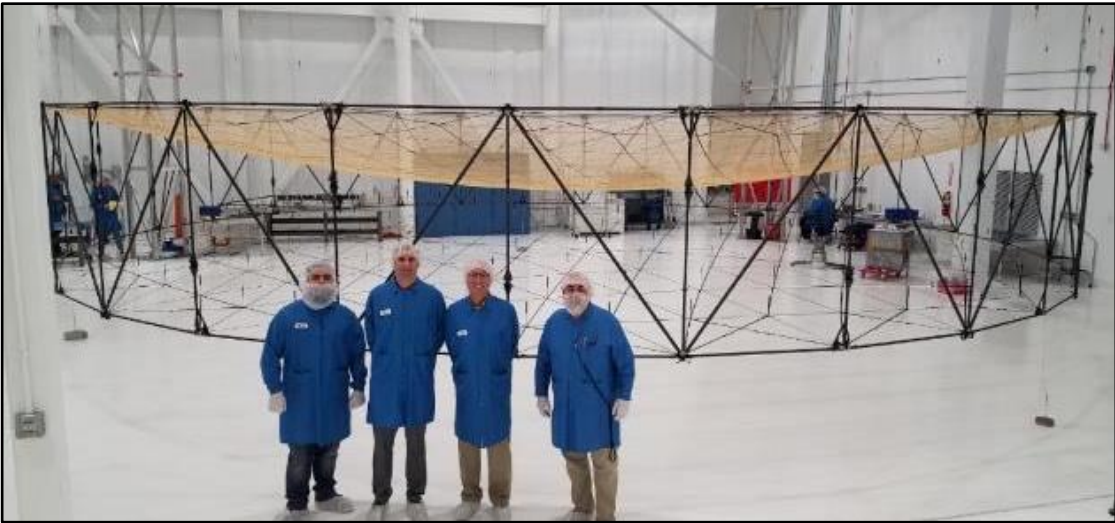




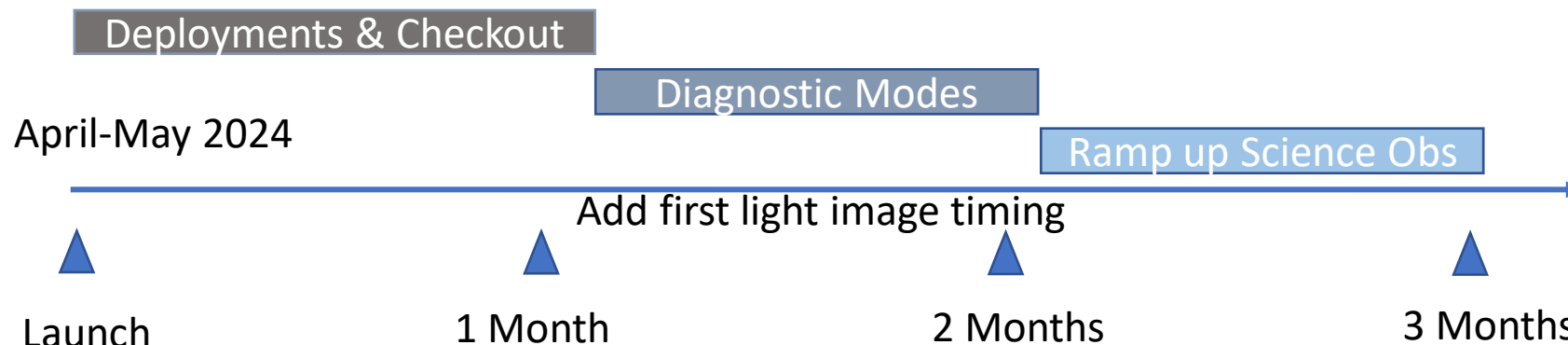
Lower Boom is Integrated, Completed Successful Flight-Like Deployment



12m Deployable Reflector



Completed Successful "Run-for the Record" Deployment

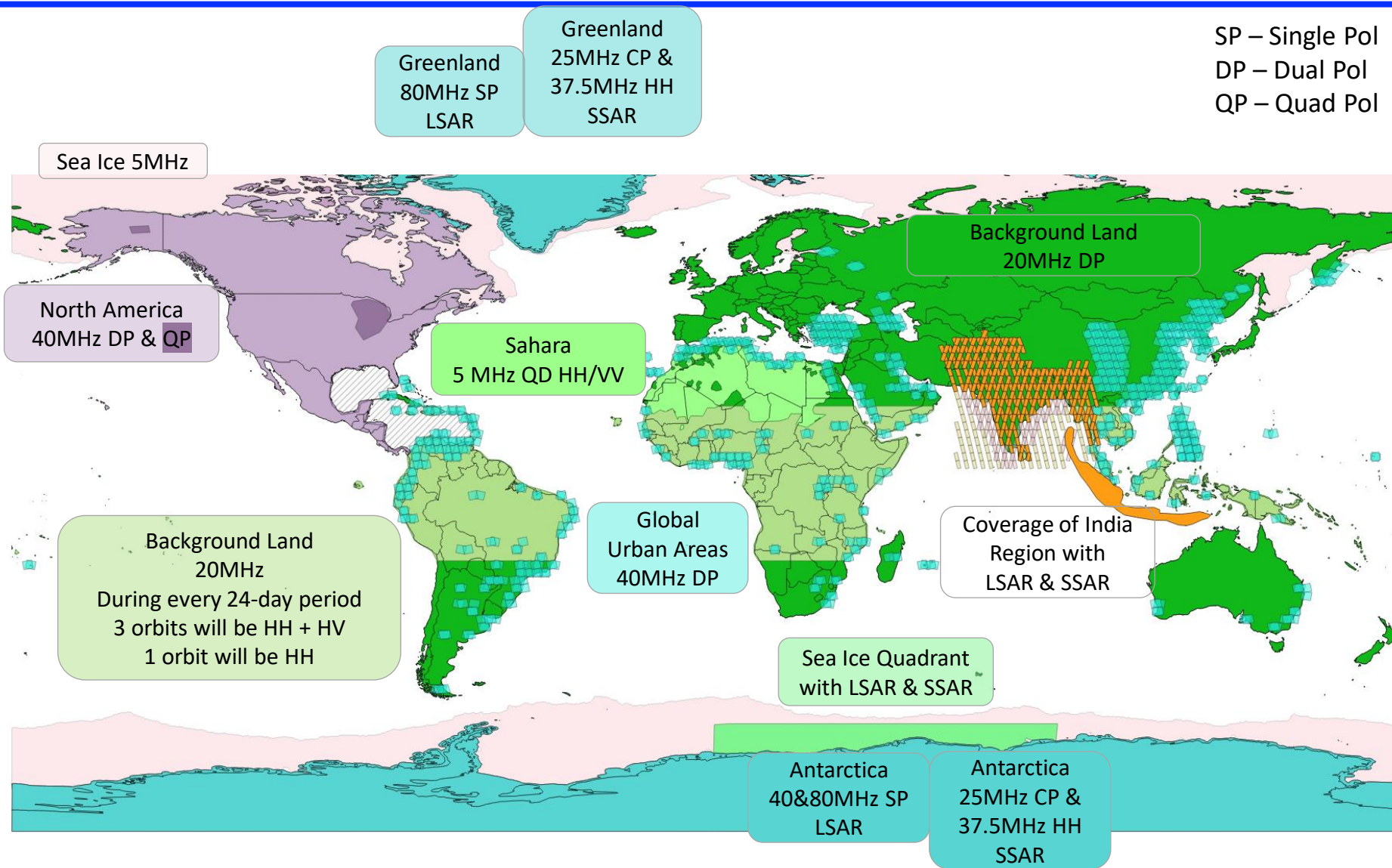


- Science data starts becoming available 3 months after launch
- Data will be available to the science community for evaluation through the Alaska Satellite Facility DAAC
- Exact dates of commissioning observations continue to evolve, and will be adjusted based on execution successes (earlier or later)

<https://asf.alaska.edu/>



Current Observation Plan Revised every 6 months

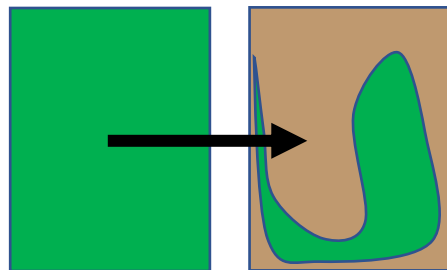




- ArcGIS Online page has the 240 x 240 Km planned swaths
- Ascending and descending orbits
- 12-day repeat

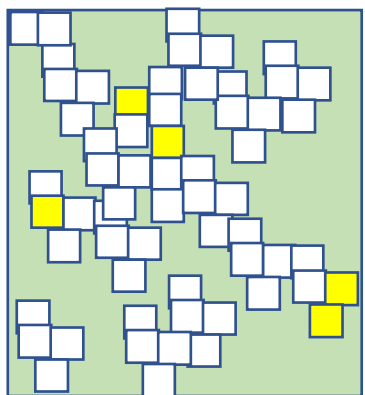
<https://nasa.maps.arcgis.com/apps/webappviewer/index.html?id=3ec81e1c6439470e9dee31dbd600afe1>

Detection of Forest disturbance



Accuracy: > 50% disturbance at ha scale, **annual product**

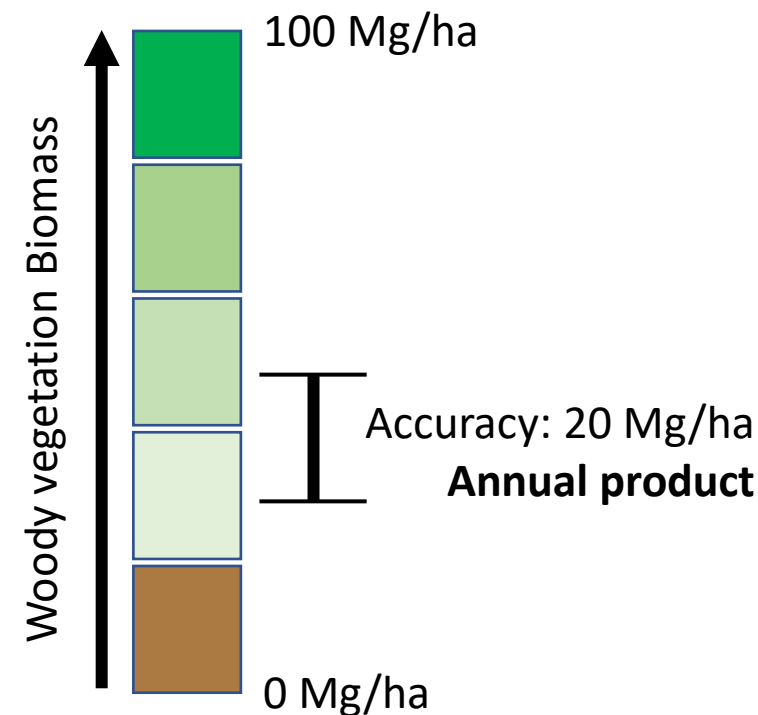
Active agricultural crop area



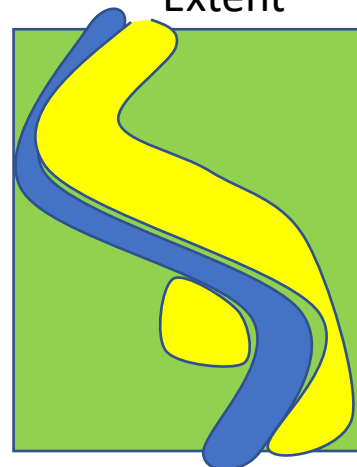
Accuracy: 80% at 1 ha resolution **every 3 months**

Accuracy of Ecosystem Requirements

Biomass

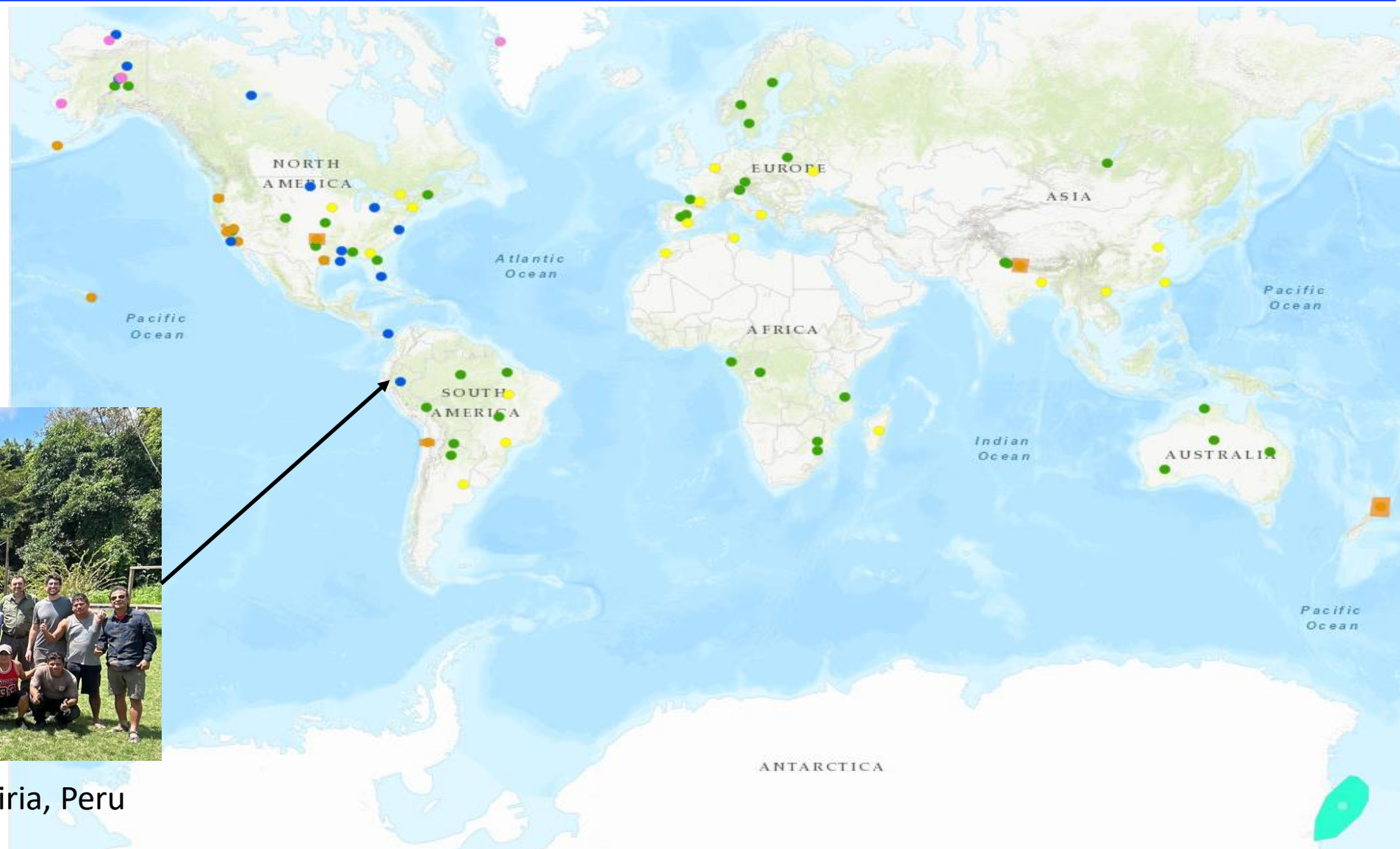


Wetland inundation Extent

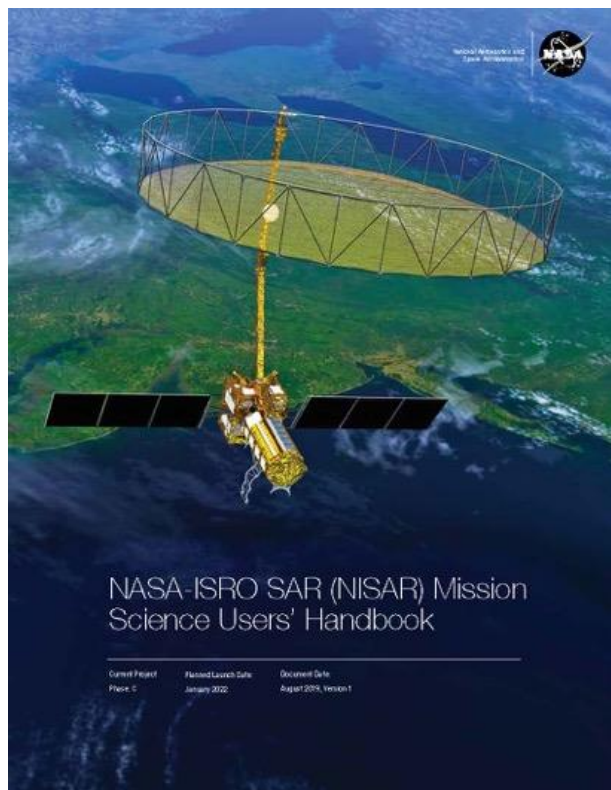


Accuracy: 80% at 1 ha resolution **every 12 days**

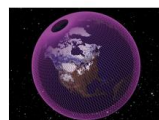
- Ecosystems - Biomass
- Ecosystems - Crop Area
- Ecosystems - Inundation
- Solid Earth
- Solid Earth - Permafrost
- Cryosphere



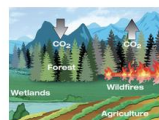
Field work in Pacaya Samiria, Peru



Featured Documents



Science Handbook



Science White Papers

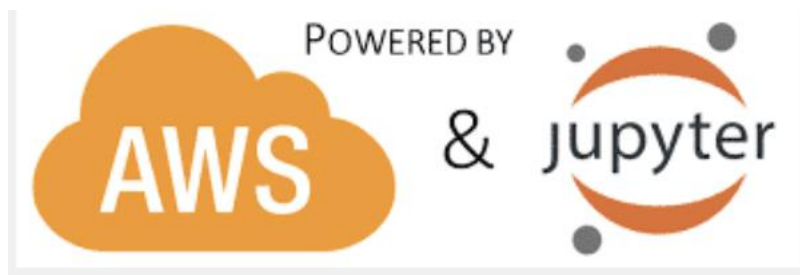


Applications White Papers

- Receive invitations to events to learn about the mission and the data
- Showcase your work on the NISAR website
- Join moderated EAs-Only discussions via Slack
- Join quarterly EA telecons where you can present your work, receive feedback, and discover opportunities for collaboration

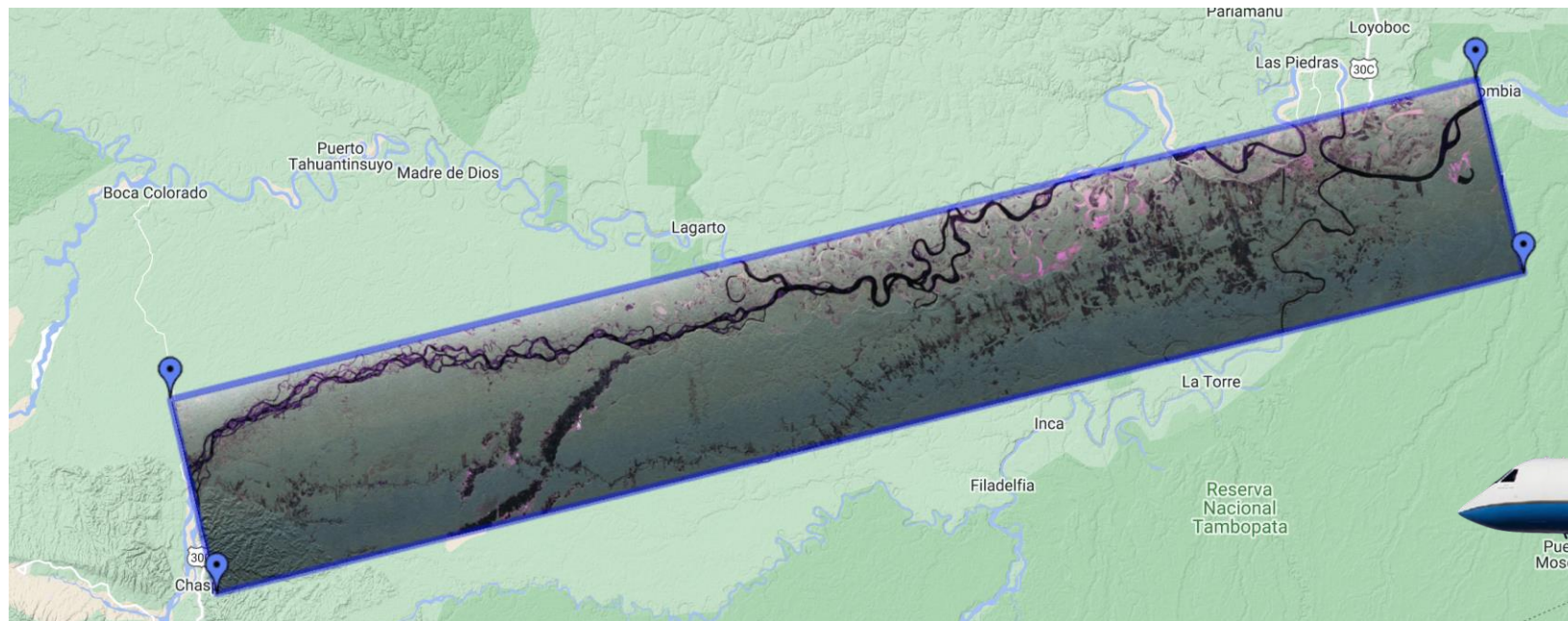
<https://nisar.jpl.nasa.gov/engagement/early-adopters/>

- 4.4 TB/day average data volume for L-band observations
- OpenScienceLab provides support for accessing NISAR granules in the cloud
- Users can sign up now and review functionality with existing SAR data (Sentinel-1 and ALOS/PALSAR)



<https://opensciencelab.asf.alaska.edu/>

NISAR Sample Data



Simulated NISAR data from 2014 UAVSAR observations over Madre de Dios, Peru



<https://uavsar.jpl.nasa.gov/cgi-bin/data.pl>

<https://uavsar.jpl.nasa.gov/science/documents/nisar-sample-products.html>



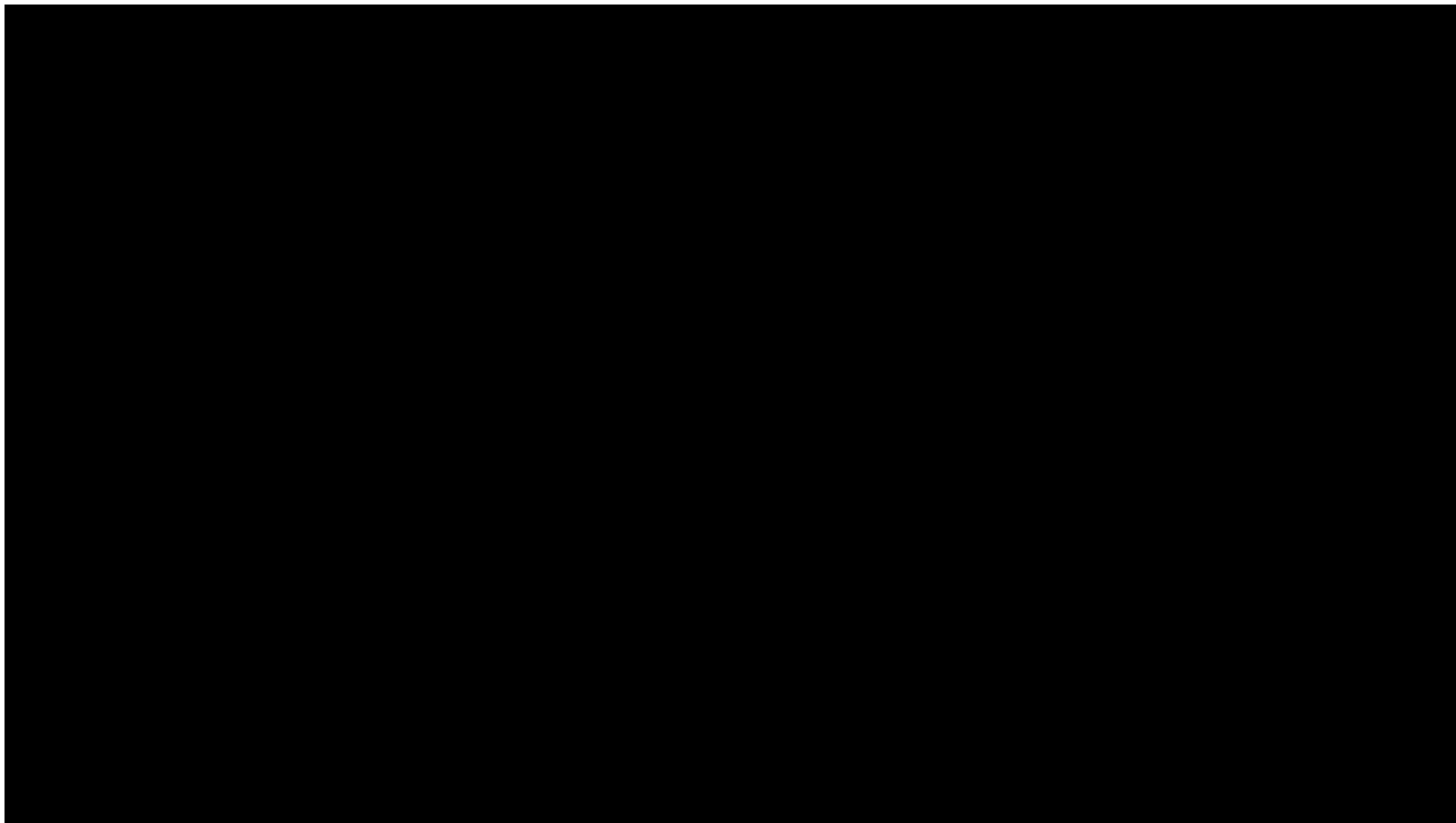
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Backup Slides

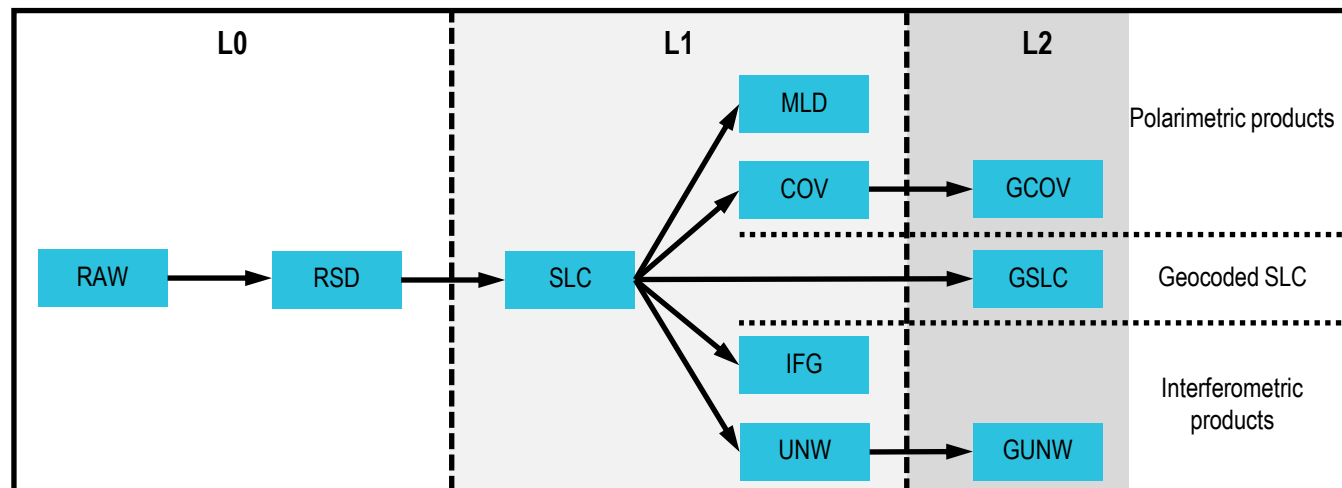


Countdown to NISAR Here before you know it!



Current Launch Planned Date: January 30, 2024

- Ingest **35 Tbits (4.4 TB)** of raw data per day on average
- Automatically generate L-SAR L0a, L0b, L1, and L2 science products (> **70TB/day**)
 - Generate S-SAR L0 science product for data downlinked through NASA Ka-band
- Perform bulk reprocessing twice during mission
 - 8 months of data after L2 product validation at 4x rate
 - 12 months of data at end of mission at 3x rate
 - Anticipate assessing additional processing / reprocessing options before launch
- Sample products derived from UAVSAR data, processed like NISAR, are available
 - <https://uavsar.jpl.nasa.gov/science/documents/nisar-sample-products.html>
- Open source (github) ISCE3 software already available, support these workflows and products



- Calibration of the NISAR imagery is completed through internal testing of the instrument and by observing targets on the ground with known properties.
- Multiple measurement requirements across **three science disciplines** must be validated by comparing NISAR science products or results against **“Truth”** (usually measured on the ground)

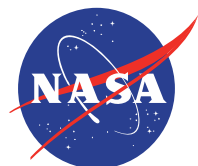


- The NISAR science team is developing the **NISAR science products or results** that will demonstrate NISAR can meet its science requirements.
 - The **“Truth”** products are often produced by the science community at large.
- Validation data - other than commercial or otherwise restricted products (that will be referenced to their source) - will be publicly and freely available either at a DAAC or other long term data facility



- GPS coordinates from GNSS stations to derive surface velocity and displacement
- GPS coordinates from sea ice buoys.
- Forest biomass derived from airborne LIDAR and field measurements of forest characteristics, GEDI forest height and biomass
- Selected UAVSAR quad pol and repeat pass InSAR data
- Water level to interpolate inundation extent
- Crop surveys to identify crop type, planting/harvest dates
- Soil moisture measurements
- Very high-resolution optical satellite data





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