

NISAR Mission Status and Plans

LCLUC Science Team Meeting – Gaithersburg, MD – April 4, 2024



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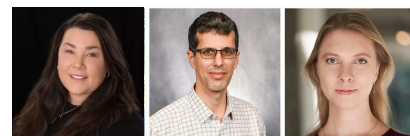
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Solid Earth



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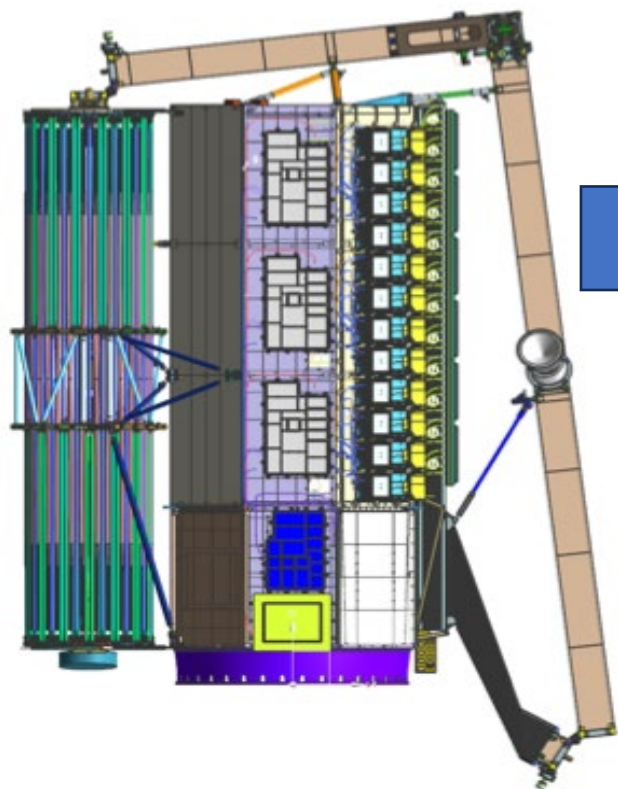
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NASA NISAR Science Team



Partnership between NASA and ISRO

Dual frequency SAR

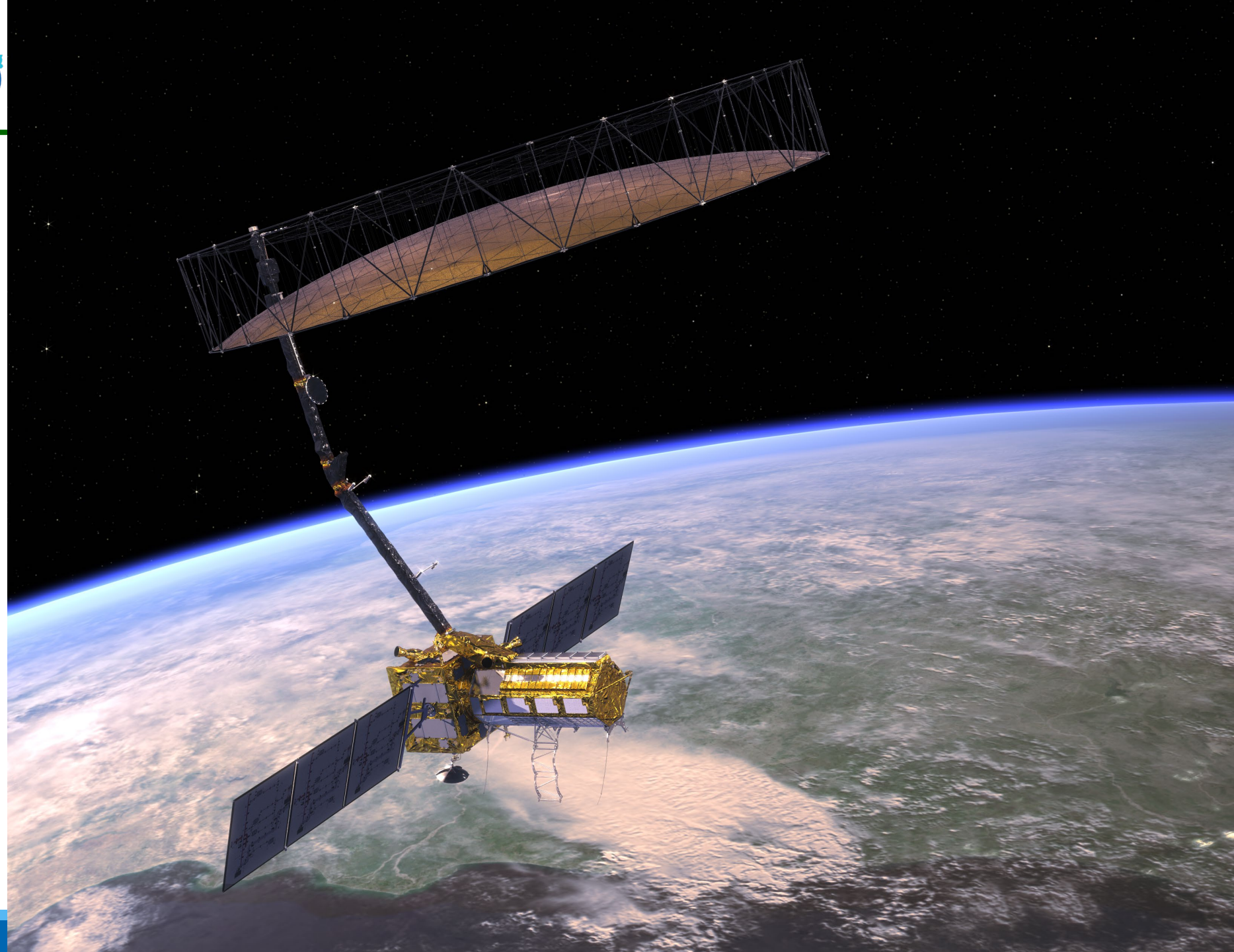
L-band – 24 cm

S-band – 10 cm

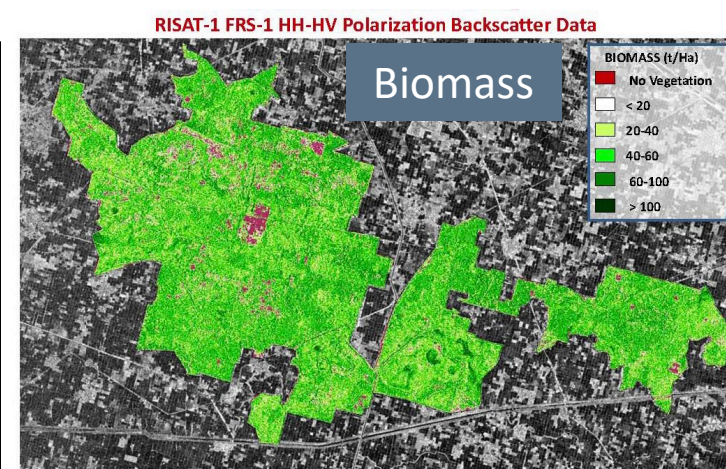
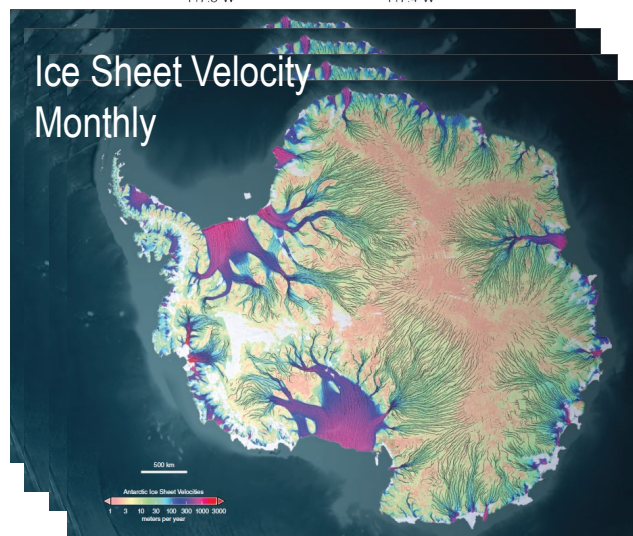
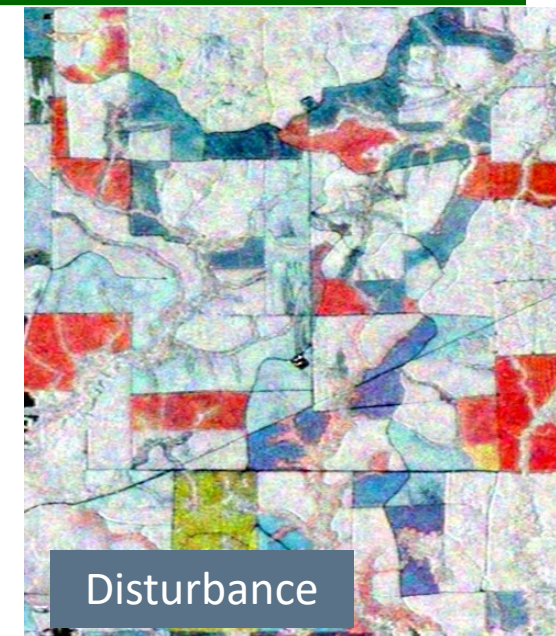
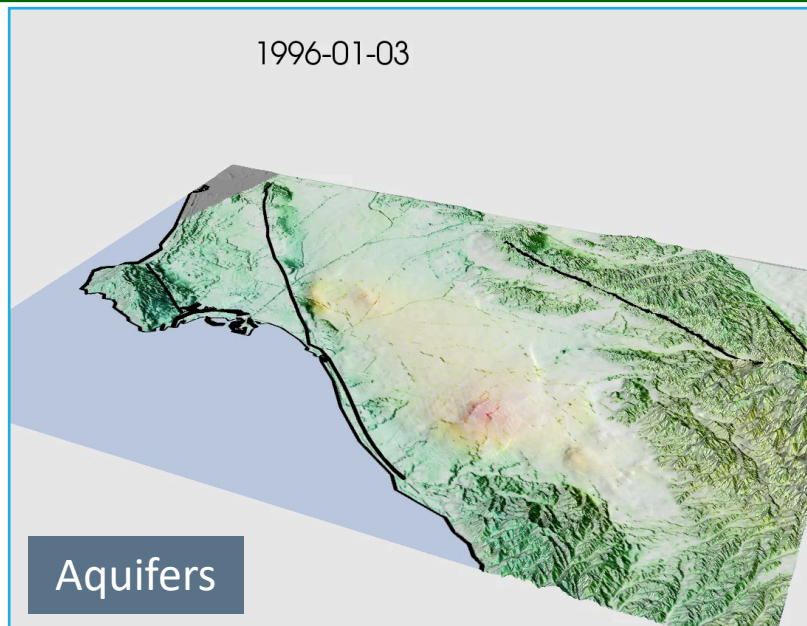
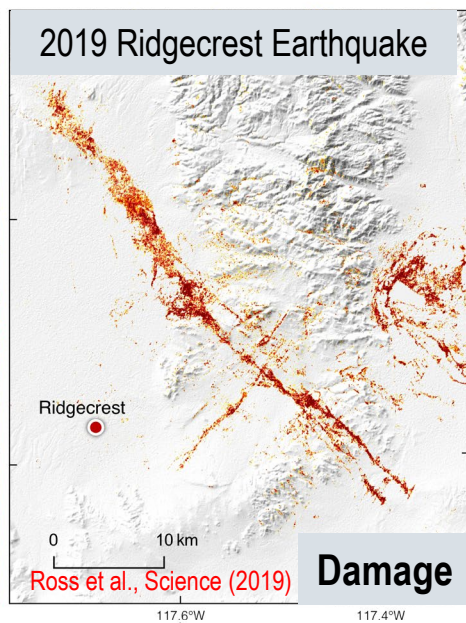
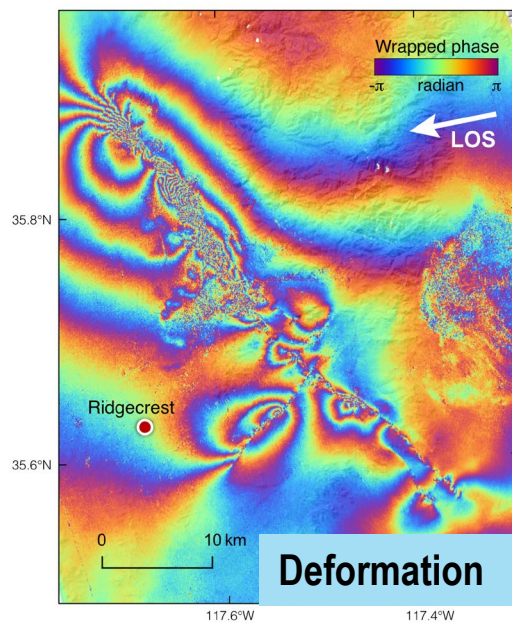
12 day exact repeat for
interferometry

~6 day coverage with
ascending and
descending orbits

Near global land and ice
coverage

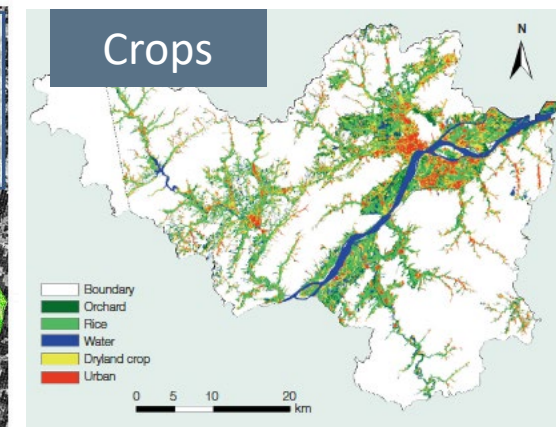


NISAR Will Enable New and Innovative Research Spanning the Earth Sciences: Climate, Carbon, and Catastrophes ++



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

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



Research and Analysis

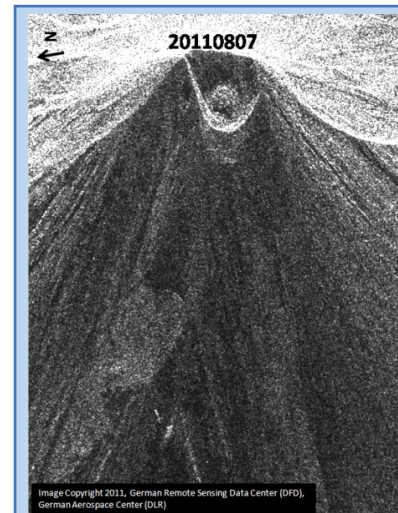
Earth Action/Applications

- Earth Surface and Interior
 - Geodetic Imaging / Natural Hazards
 - Space Geodesy
- Carbon Cycle & Ecosystems
 - Terrestrial Ecology
 - Land Cover/Land Use Change
 - Carbon Monitoring System
 - Ocean Biology
- Climate Variability & Change
 - High Mountain Asia
 - Physical Oceanography
 - Cryospheric Sciences
 - Sea Level Change Science Team
- Water and Energy Cycle
 - Terrestrial Hydrology
- Weather and Atmospheric Dynamics
 - Hurricane Science
 - Weather and Atmospheric Dynamics

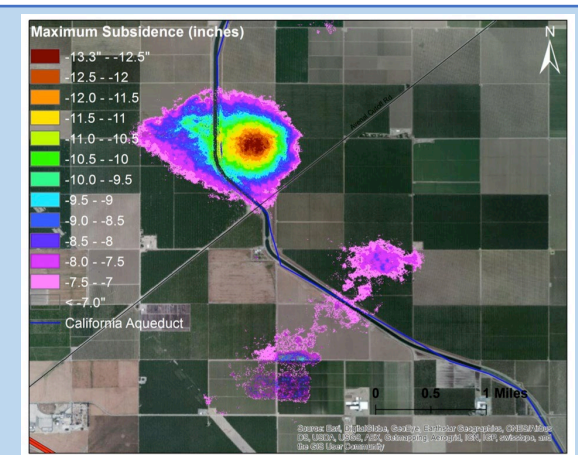
- Agriculture Applied Research
- Disasters
- Ecological Forecasting and Ecological Conservation
- Equity and Environmental Justice
- Public Health
- Socioeconomic Assessments and Benefits
- Water Resources
- Wildland Fires (Wildfires)
- SERVIR

Missing: Atmospheric Composition, Biological Diversity

Missing: Air Quality



Geohazards

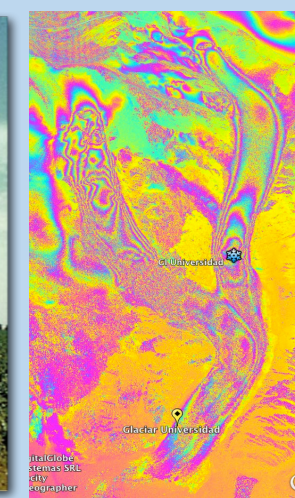


Infrastructure Stability

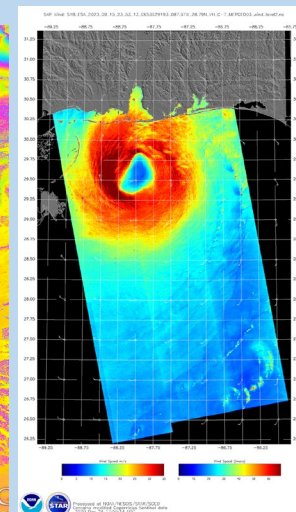
Aquifers



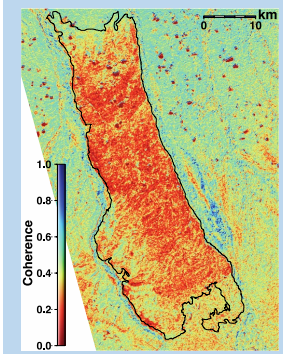
Glaciers



Hurricanes



Fire Scars & Permafrost



Greenland
80MHz SP
LSAR

Greenland
25MHz CP &
37.5MHz HH
SSAR

Oct. 2023 Observation Plan

Revised every 6 months

Beaufort Sea – Sea Ice Mode

Background Land
20MHz DP

Sea Ice 5MHz

North America
40MHz DP &
20MHz QP

Sahara
5MHz SP VV

RSLC
Posting

5 MHz ~ 25 x 5 m
20 MHz ~ 6.25 x 5 m
40 MHz ~ 3.12 x 5 m
80 MHz ~ 1.56 x 5 m

SNWG-2016
enabled high-
resolution data
over North America

US Coastal Waters - 5 MHz
Gulf of Mexico
Caribbean

Coverage of India
Region with
LSAR & SSAR

SP – Single Pol
DP – Dual Pol
QP – Quad Pol
CP – Cross Pol

Background Land
20MHz SP
Descending direction
Alternating each 12 days with
Africa and South America

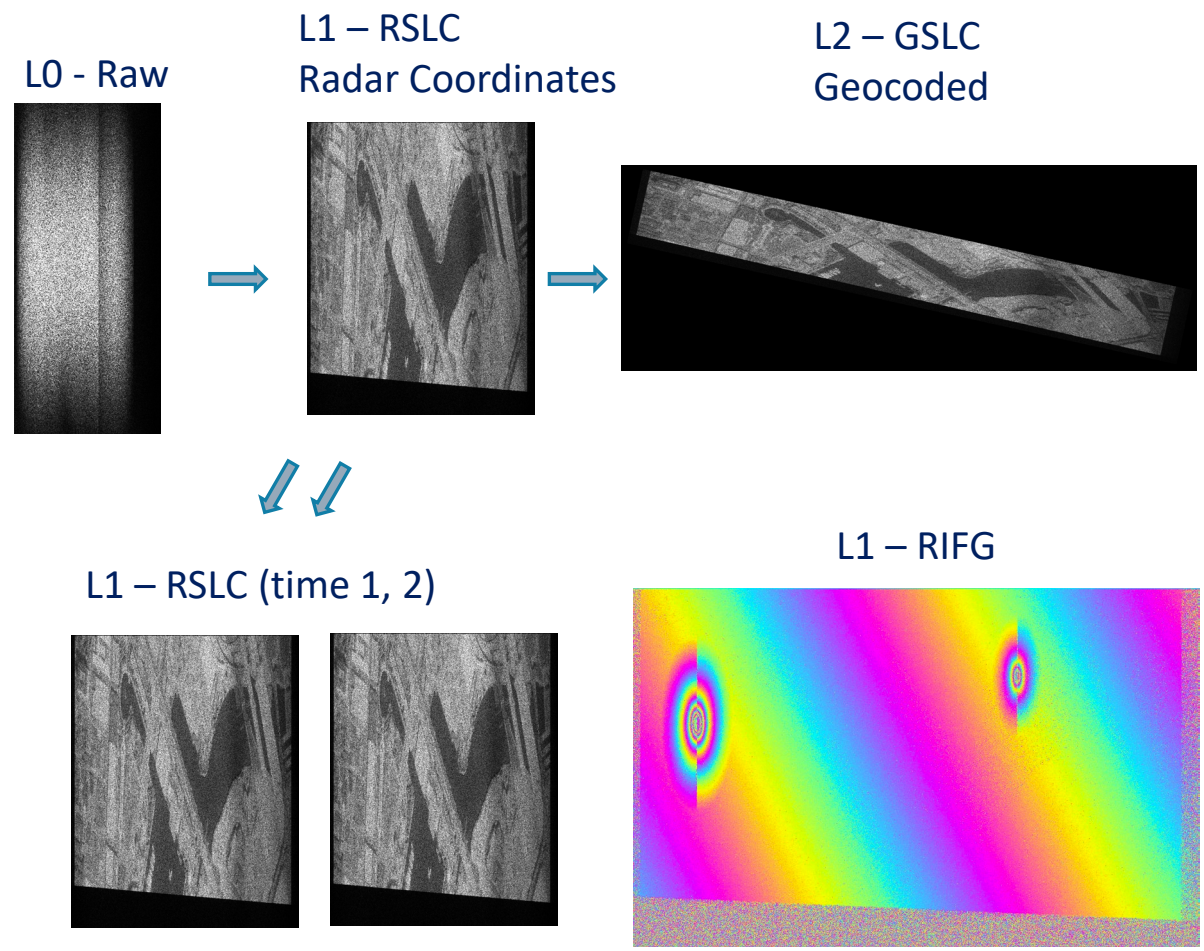
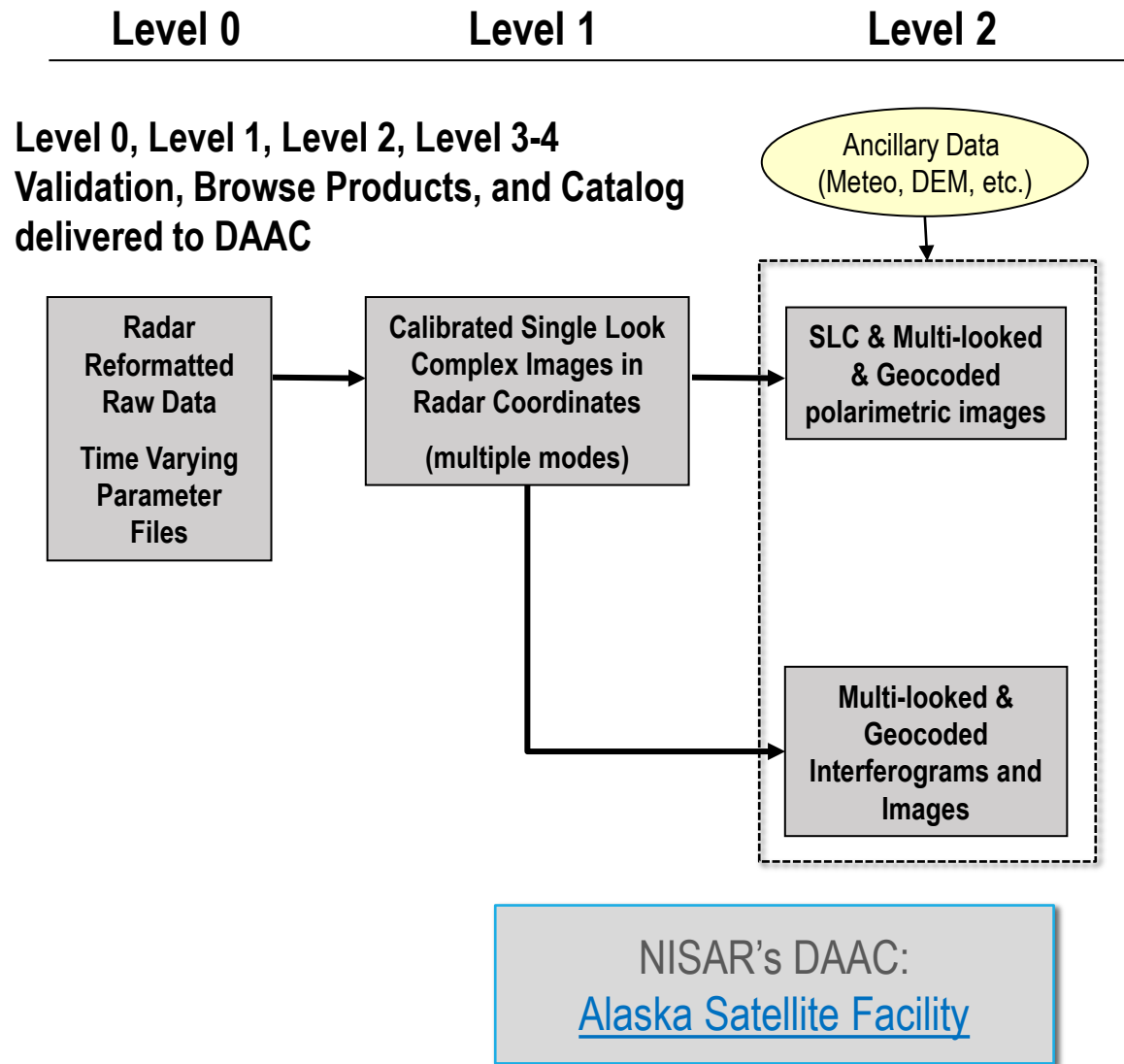
Urban Areas
40MHz DP

Sea Ice Quadrant
with LSAR & SSAR

Qual-Pol modes are Fixed
All other modes are Dithered

Antarctica
40&80MHz SP
L-SAR

Antarctica
25MHz CP &
37.5MHz HH
S-SAR



Level 0

Level 1

Level 2

Level 0, Level 1, Level 2, Level 3-4
Validation, Browse Products, and Catalog
delivered to DAAC

Radar
Reformatted
Raw Data
Time Varying
Parameter
Files

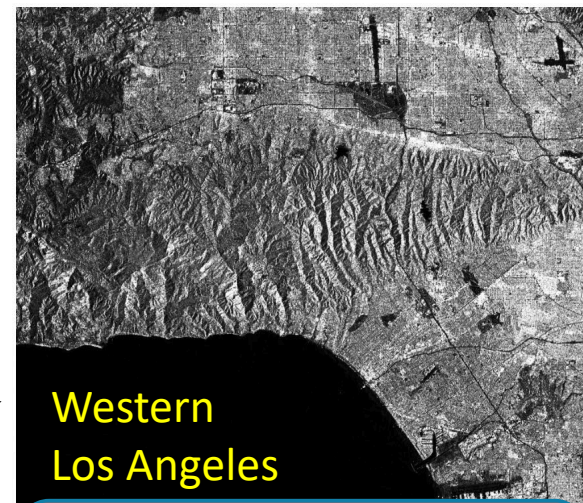
Calibrated Single Look
Complex Images in
Radar Coordinates
(multiple modes)

Ancillary Data
(Meteo, DEM, etc.)

SLC & Multi-looked
& Geocoded
polarimetric images

Geocoded **RTC** products (HH,
HV) can be analyzed as
another “optical” band

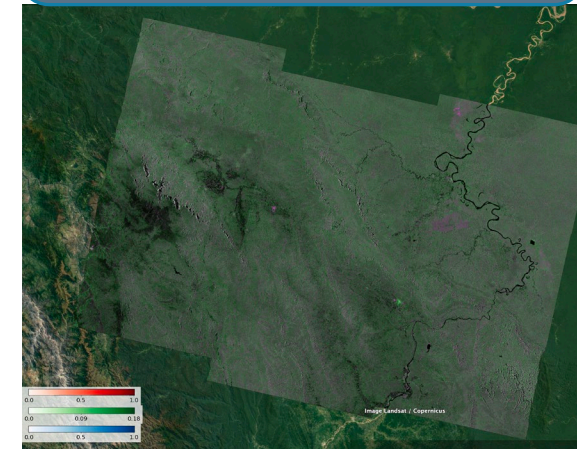
NISAR’s DAAC:
[Alaska Satellite Facility](#)



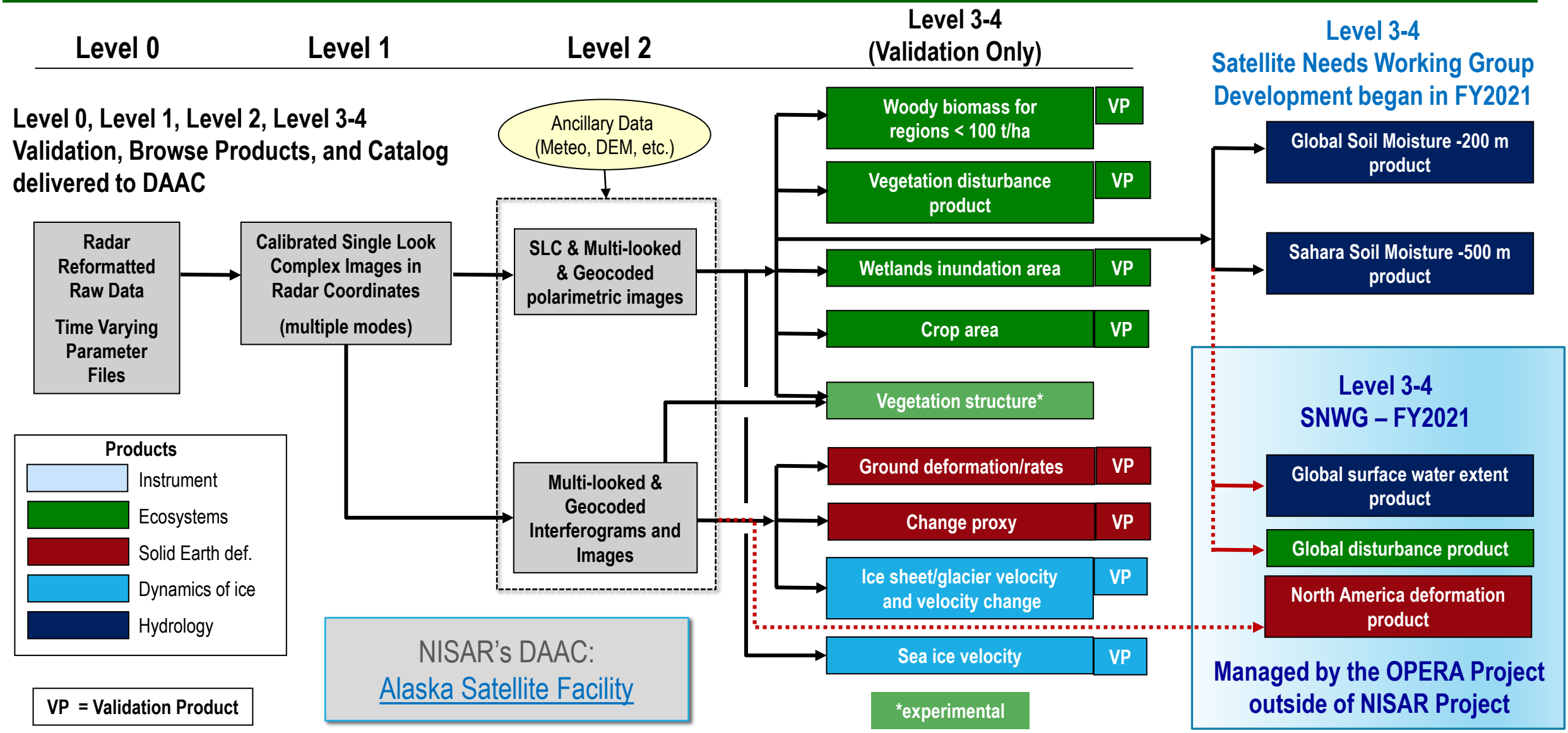
**Western
Los Angeles**
Geocoded Covariance (GCOV)
Simulated NISAR from
Sentinel-1 data



Geocoded radiometric
terrain correction (**RTC**: GSLC)
collected Sentinel-1 data



NISAR Science Data Analysis and Archive Approach



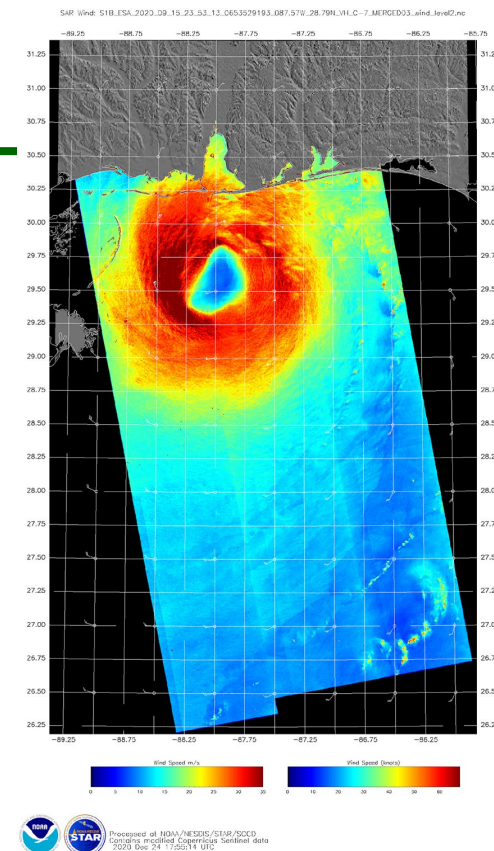
NISAR Level 1 Science Requirements, Baseline:

- f) In support of response to major natural or anthropogenic disasters, the mission system shall be capable of providing revised scheduling for new acquisitions within 24 hours of an event or an event forecast notification and delivering data within 5 hours of being collected, and shall exercise this capability on a best efforts basis.*

Key Considerations for Urgent Response for NISAR

- **Tasking:** The collection of data over the target
 - NISAR will collect data over all land and all ice targets. Ocean disasters such as oil spills and hurricanes may not be covered with the science mission.
- **Downlink prioritization:** First recorded-first downlinked, unless identified as Urgent Response (UR)
 - Most NISAR data will be downlinked within 5-7 hours from collection. *In most cases, UR will be ~2 hours quicker than with standard downlink priority*
- **Ground system data/product processing:** UR data/products will be processed to a lower quality to improve latency and will be replaced with science quality products once generated

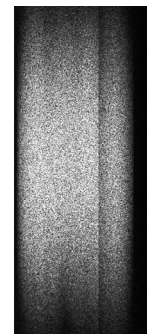
Hurricane Sally, and computed Radii of maximum wind, 34 knots, 50 knots, and 64 knots



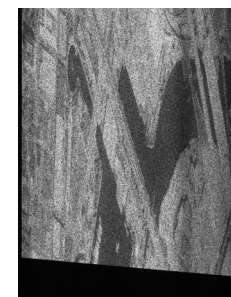
Science Data System Products Latency

Products	Requirement	Current Best Estimate	Urgent Response
L0	24 Hours	12 Hours	2 Hours
L1	9 Days	1 Day	4 Hours
L2	9 Days	2 Days	6 Hours

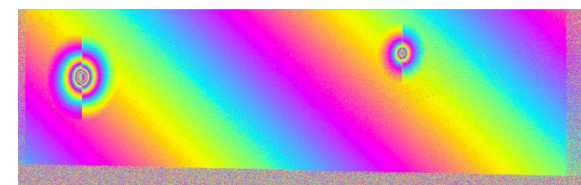
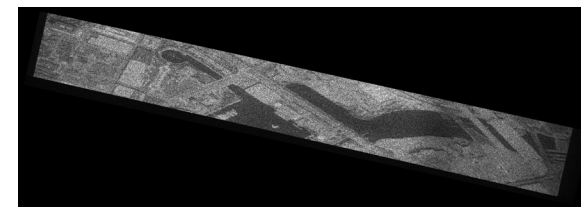
L0 - Raw



L1 - RSLC



L2 - GSLC



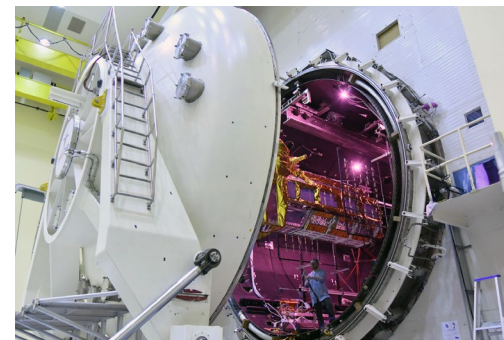
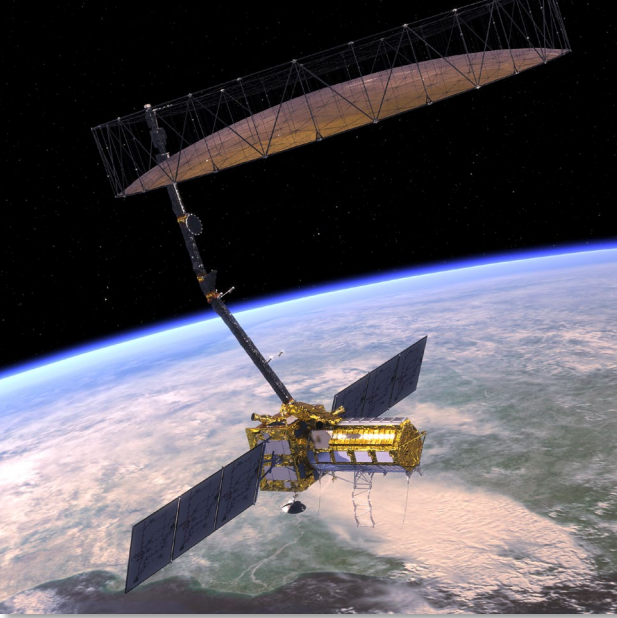
- Science Data System is sized to produce this data within 1 day latency
- Limiting factor is receiving all the ancillary files, specifically the Medium accuracy Orbit Ephemeris from GNSS

NISAR is 99.99% Completed and Tested



Launch
has
been
delayed

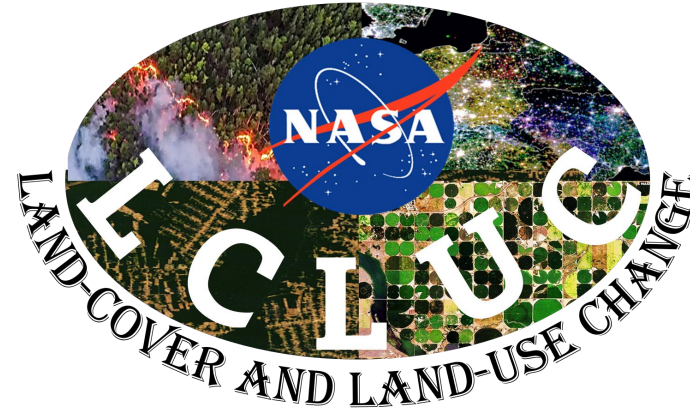
- NISAR was completely integrated in India before a radar reflector's thermal risk was identified
- The reflector was removed and returned to California
- Reflector will return to India, reintegrated, and tested before launch.
- First light images 2-3 months after launch
- Science operations 3 months after launch
- Global products to Level 2 will be fully and openly available to the global community
- NISAR data/products @ Alaska Satellite Facility
- Go to NISAR and ASF webpages for more information on how to get ready for NISAR
 - <https://nisar.jpl.nasa.gov/>
 - <https://asf.alaska.edu/>





<http://nisar.jpl.nasa.gov>

Thank You



NISAR
Community of Practice
& Early Adopters



Dr. Gerald Bawden
Program Scientist/Manager
NISAR/SDC/UAVSAR/OASIS/
OPERA/ASF

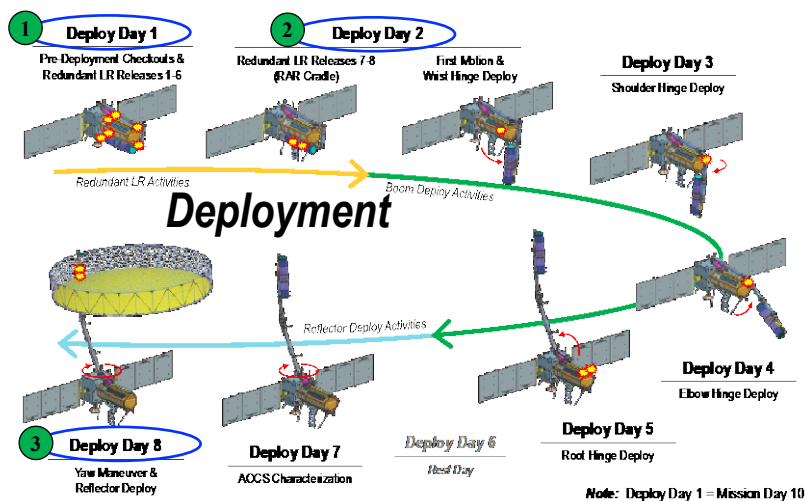
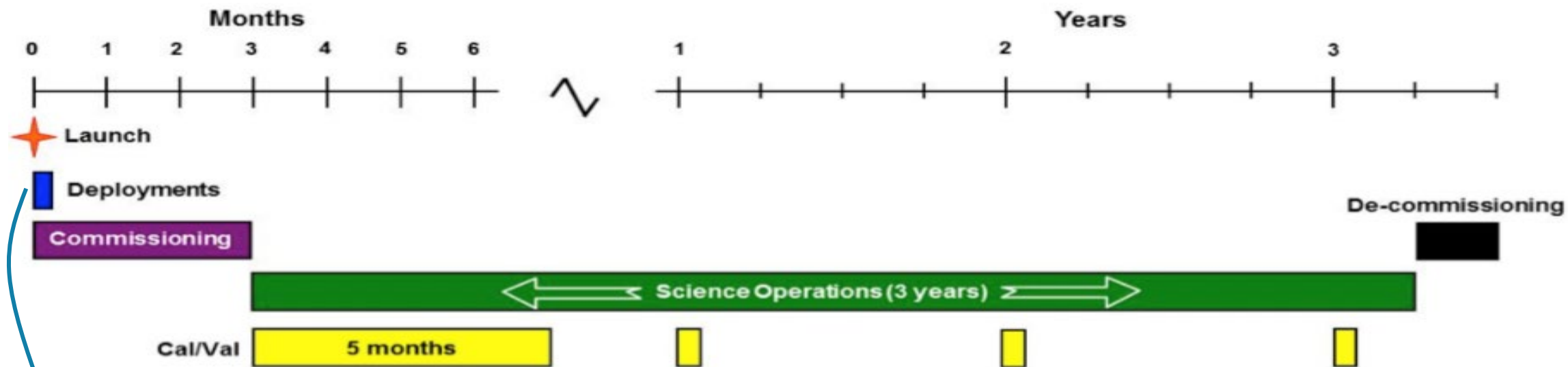
NASA Headquarters
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Backup Slides



What happens after launch?



- Three-month Commissioning Phase
 - ~Day 23: ISRO begins data takes/NASA begins radar tests
 - ~Day 35: Diagnostic/joint mode testing, pre-calibration
 - ~Day 41: Achieve Science Orbit @747km
 - ~Day 55: Begin first light image acquisitions
- Day 90: Begin science operations
- Five-month Cal/Val Phase overlaps with Science Ops
- Periodic Cal/Val throughout mission

- Open data – per NASA/ISRO data policy – at the Alaska Satellite Facility and NRSC Archive Centers
 - Pre-launch Sample products: <https://uavsar.jpl.nasa.gov/science/documents/nisar-sample-products.html>
 - Post-launch Science products
- Open Source Software – SDS and data processing code available for download
 - InSAR Scientific Computing Environment, Enhanced Edition (ISCE3): <https://github.com/isce-framework/isce3>
- Open Source Science algorithms for science products
 - Jupyter notebooks available for download: <https://gitlab.com/nisar-science-algorithms>
- Open Source Training Opportunities
 - Jupyter notebooks in cloud training environments at Alaska Satellite Facility OpenScienceLab
 - Earthscope (formerly UNAVCO) ISCE3 mintpy training
 - ARSET and other courses: <https://nisar.jpl.nasa.gov/resources/sar-education-resources/>
- Free cloud computing resources for NASA subscribers

Given the bringing them to cloud by developing straightforward and user-friendly cloud-based workflows

Early Adopters & Community of Practice

Community of Practice

are individuals or organizations that can be public or private, Federal or local entities, and can have a local, national or international scope for their application.

Early Adopters (Science or Applications)

are individuals, teams, and organizations who

- have a clearly defined need for NISAR data
- have an existing application that can benefit from NISAR and
- are capable of applying their own resources to demonstrate the utility of NISAR data for their application.

Early Adopters provide important feedback to the NISAR team regarding which NISAR data products meet the needs of their applications.

Become and Early Adopter

to learn about the NISAR mission and its data, and to join quarterly telecons to present your work, receive feedback and discover opportunities for collaboration!

Apply Here!

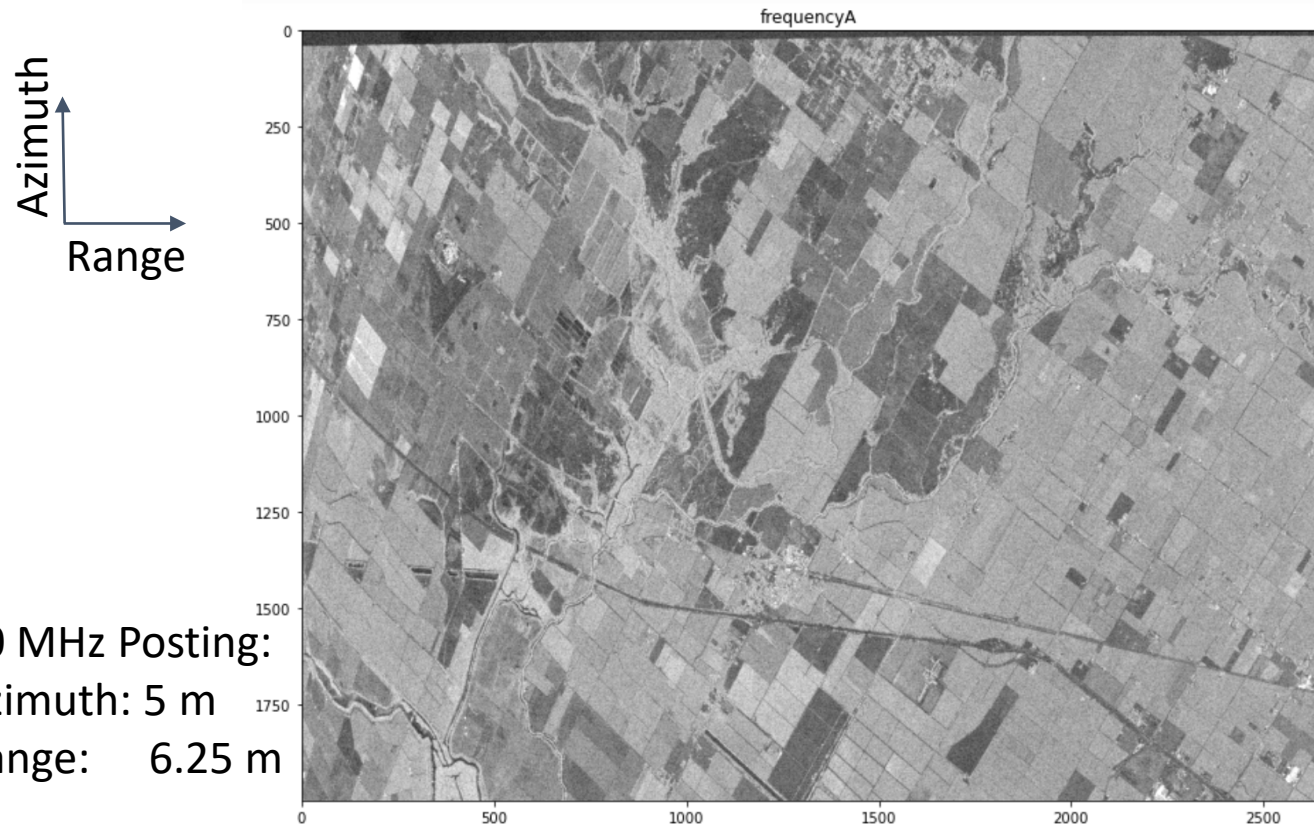
<https://nisar.jpl.nasa.gov/engagement/application-sign-up>



RSLC Data layers

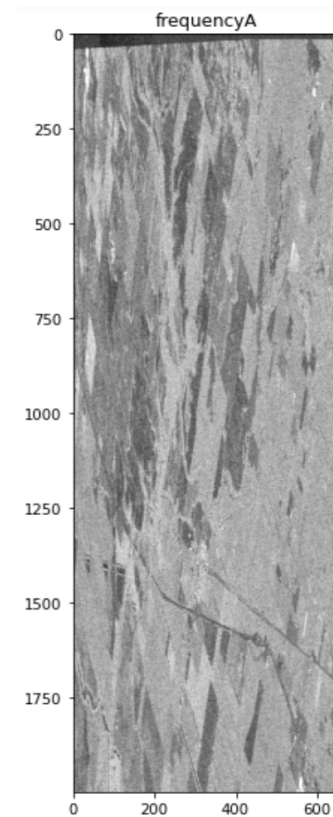
Example of **NISAR-like** RSLC data simulated from **UAVSAR** L-band acquisition (NISAR simulated products)

Frequency A / 20 MHz



20 MHz Posting:
Azimuth: 5 m
Range: 6.25 m

Frequency B / 5 MHz



Azimuth Pixels (Length):
Same for 5 MHz and 20
MHz SLC

5 MHz Posting:
Azimuth: 5 m
Range: 25 m

Range Pixels (Width) of 20 MHz SLC is 4X the 5 MHz SLC