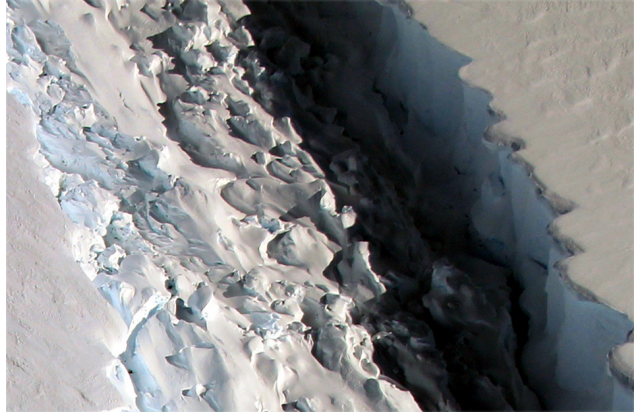
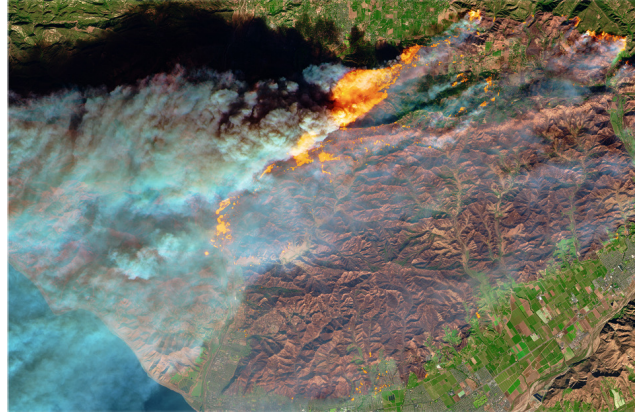


NISAR Mission Status and Plans

17th Annual Biodiversity & Ecological Conservation Team Meeting – Silver Spring, MD – May 8, 2024

Dr. Elodie Macorps

NISAR Mission Applications Lead

ESSIC-UMD / NASA GSFC

Elodie.Macorps@NASA.gov

NASA NISAR Science Team

Science Team Leadership

Gerald Bawden, NASA Program Scientist, Email
Paul Rosen, Project Scientist
Susan Owen, Deputy Project Scientist
Cathleen Jones, Applications Lead, Jet Propulsion Laboratory, Email

Paul Siqueira, Ecosystems Lead, University of Massachusetts, Email
Mark Simons, Solid Earth Lead, Caltech, Email
Ian Joughin, Cryosphere Lead, University of Washington, Email
Rowena Lohman, Soil Moisture Lead, Cornell, Email

Applications

Shanna McClain, NASA Program Applications Lead, Email
Batuhan Osmanoglu, Deputy Applications Lead, Email
Elodie Macorps, Mission Application Lead

Solid Earth

David Bekaert, Jet Propulsion Laboratory, Email
Adrian Borsa, University of California, San Diego, Email
Andrea Donnellan, Jet Propulsion Laboratory, Email
Zhong Lu, Southern Methodist University, Email

Franz Meyer, University of Alaska, Email
Howard Zebker, Stanford University, Email
Simon Zwieback, University of Alaska, Email

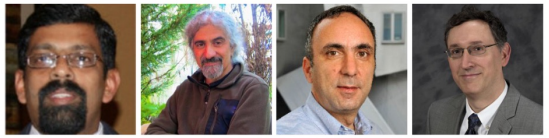
Cryosphere

Rick Forster, University of Utah, Email
Alex Gardner, Jet Propulsion Laboratory, Email
Sean Helfrich, NOAA, Email
Ben Holt, Jet Propulsion Laboratory, Email

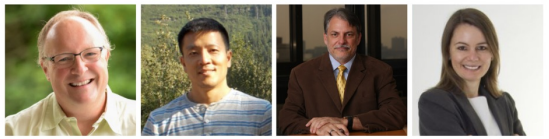
Eric Rignot, University of California, Irvine, Email
Bernd Scheuchl, University of California, Irvine, Email

Ecosystems

John Armston, University of Maryland, Email
Rajat Bindlish, Goddard Space Flight Center, Email
Bruce Chapman, Jet Propulsion Laboratory, Email
Michael Cosh, USDA, Email



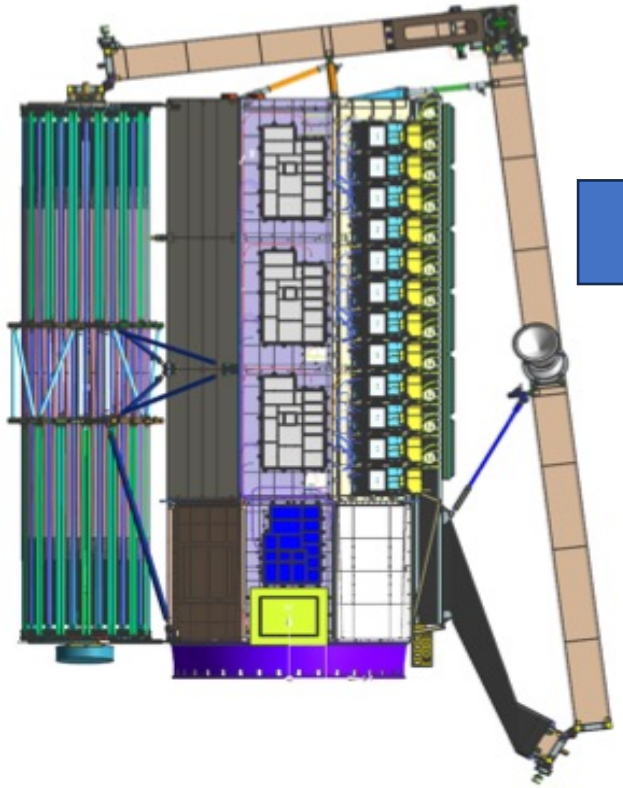
Narendra Das, Jet Propulsion Laboratory, Email
Ralph Dubayah, University of Maryland, Email
Dara Entekhabi, MIT, Email
Joel Johnson, The Ohio State University, Email



Josef Kellndorfer, Earth Big Data, Email
Seungbum Kim, Jet Propulsion Laboratory, Email
Kyle McDonald, The City College of New York, Email
Erika Podest, Jet Propulsion Laboratory, Email

Sassan Saatchi, Jet Propulsion Laboratory, Email
Nick Steiner, The City College of New York, Email

NASA – ISRO Partnership – Concept to Reality



NISAR
NASA - ISRO SAR Mission

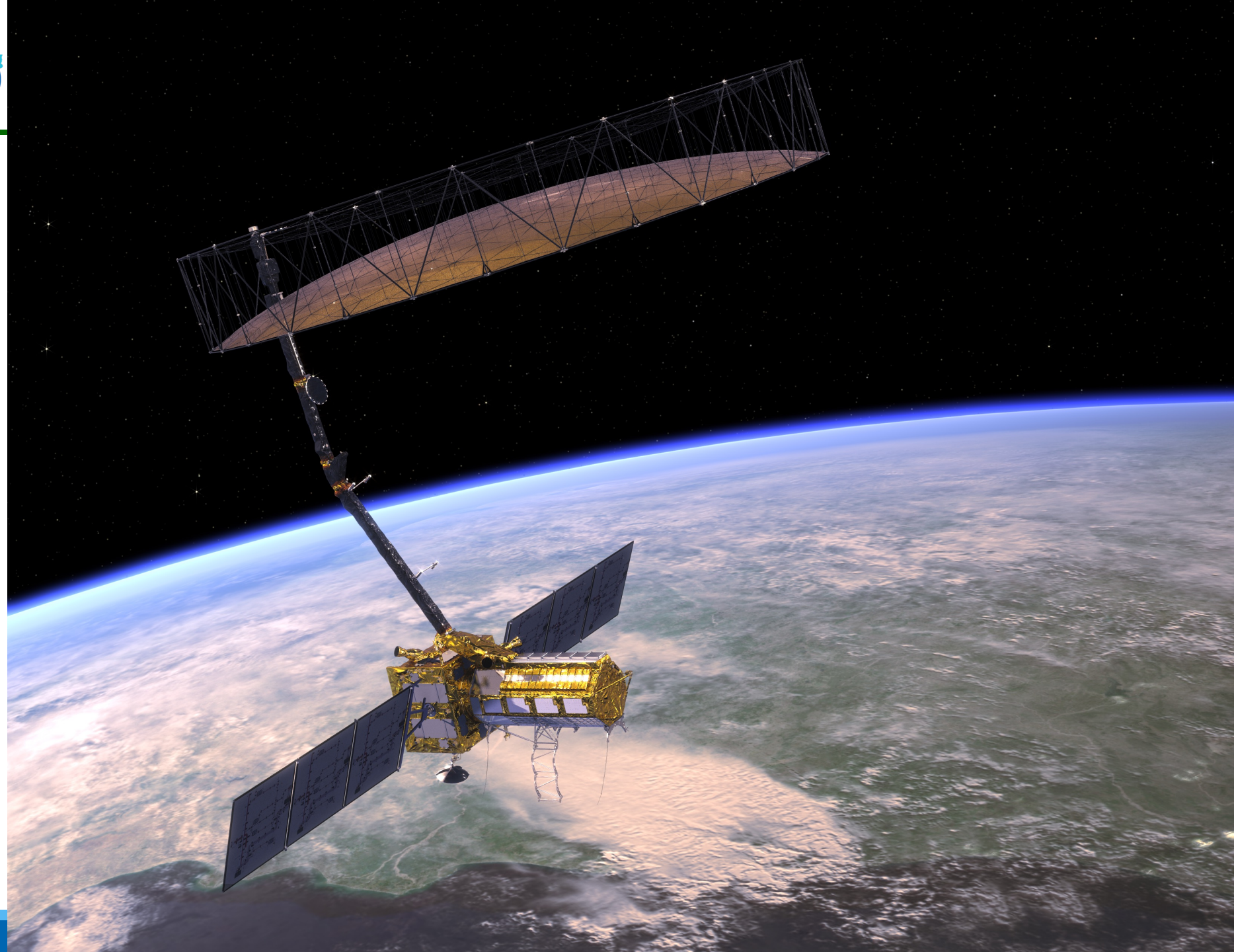
Partnership between NASA and ISRO

Dual frequency SAR
- L-band – 24 cm
- S-band –10 cm

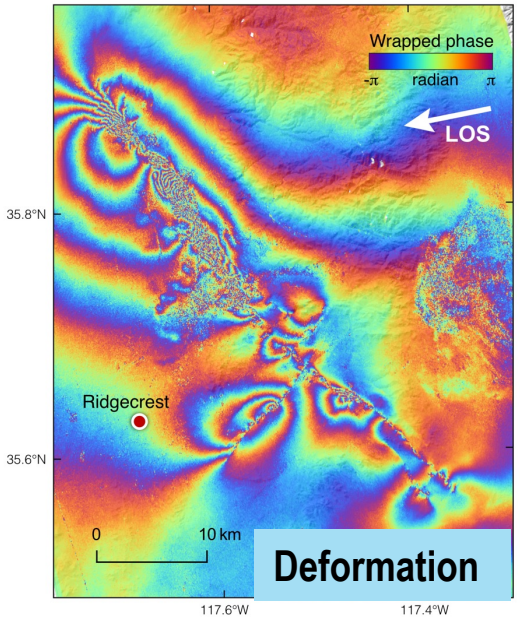
12 day exact repeat for interferometry

~6 day coverage with ascending and descending orbits

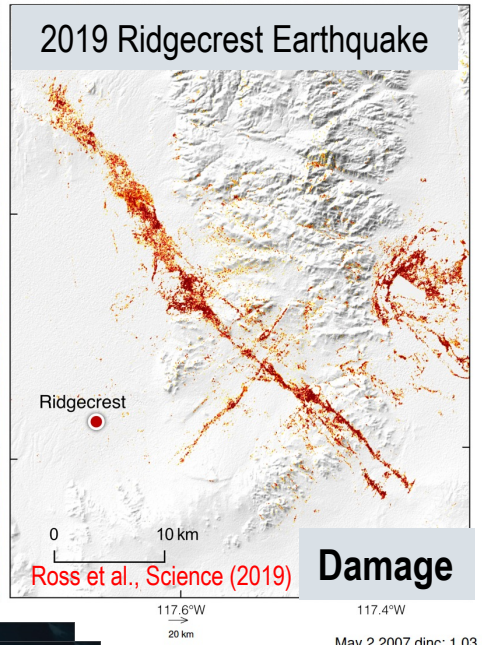
Near global land and ice coverage



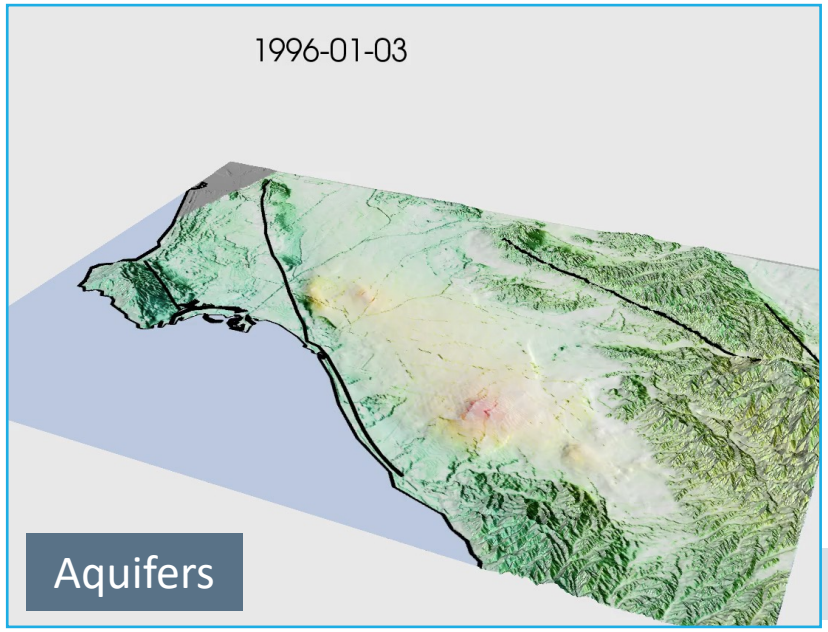
NISAR Will Enable New and Innovative Research Spanning the Earth Sciences: Climate, Carbon, and Catastrophes ++



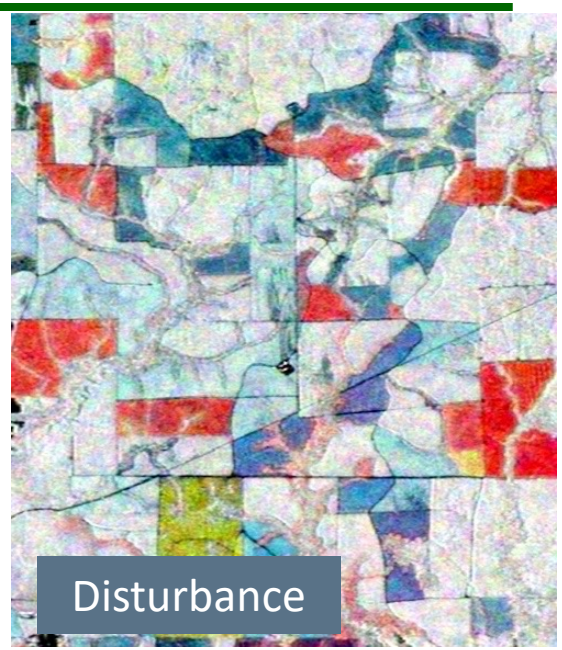
Deformation



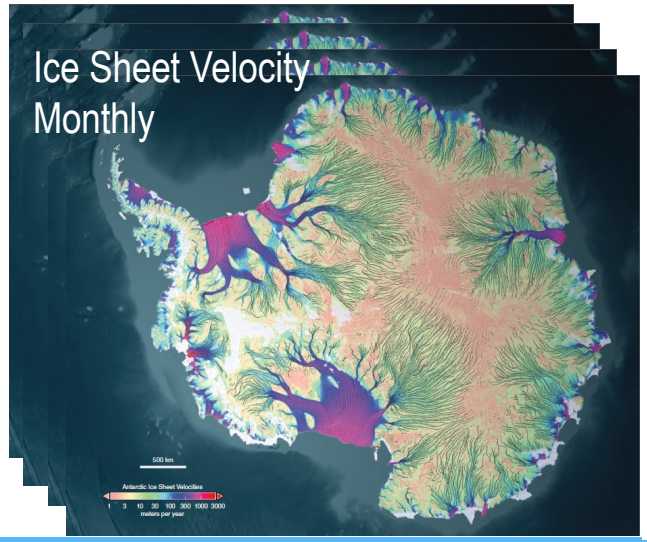
Damage

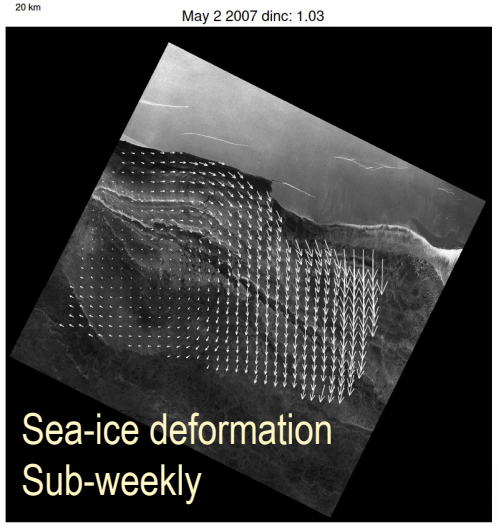


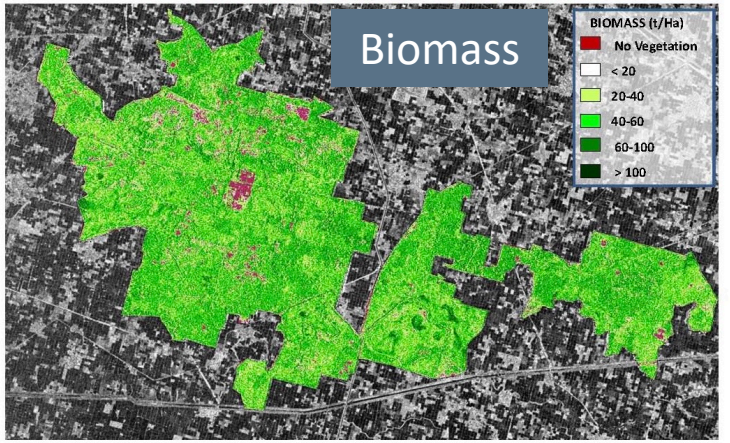
Aquifers



Disturbance



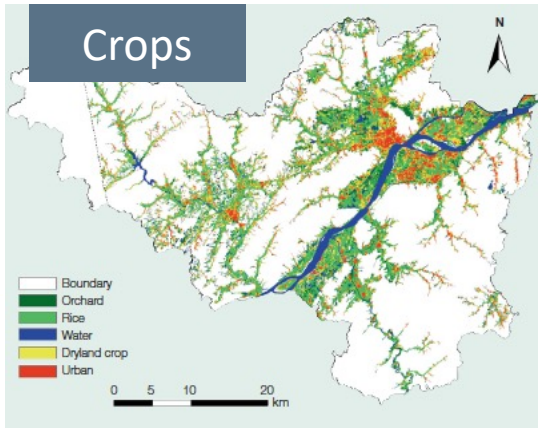




Area: Saraswati Plantation area, Kaithal Dist., Haryana
(Dominant vegetation species: *Eucalyptus, Acacia, Prosopis Juliflora*)
RISAT-1 FRS-1 Data: DoA: 23 Jun 2013 (Inc. Angle: 43 deg.)

Multi-Linear Regression Model:

$$\text{Biomass} = a + b * \sigma^{o}_{HH} + c * \sigma^{o}_{HV}$$



NISAR Science and Earth Action

Understanding Climate, Carbon, and Catastrophic Change
Resource Management + More

Research and Analysis

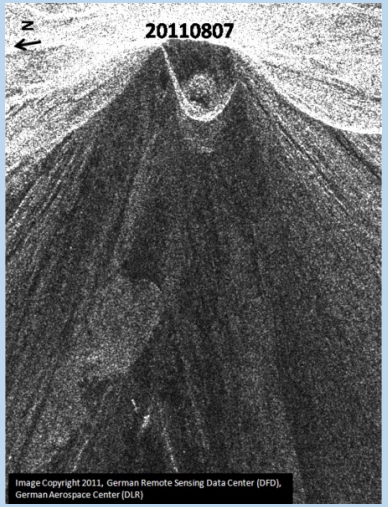
- Earth Surface and Interior
  - Geodetic Imaging / Natural Hazards
  - Space Geodesy
- Carbon Cycle & Ecosystems
  - Terrestrial Ecology
  - Land Cover/Land Use Change
  - Carbon Monitoring System
  - Ocean Biology
- Climate Variability & Change
  - High Mountain Asia
  - Physical Oceanography
  - Cryospheric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

Missing: Atmospheric Composition, Biological Diversity

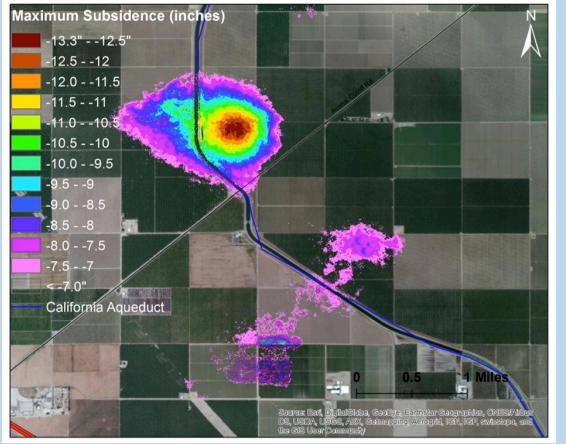
Earth Action/Applications

- 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: Air Quality



Geohazards

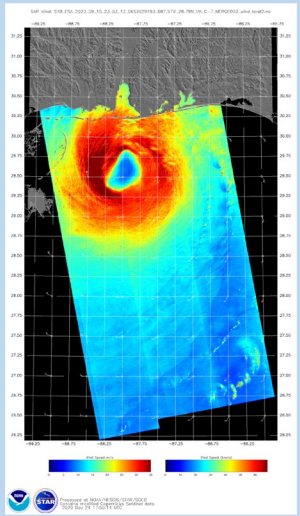


Infrastructure Stability

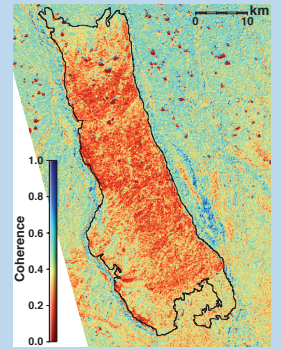
Aquifers

Glaciers

Hurricanes



Fire Scars & Permafrost

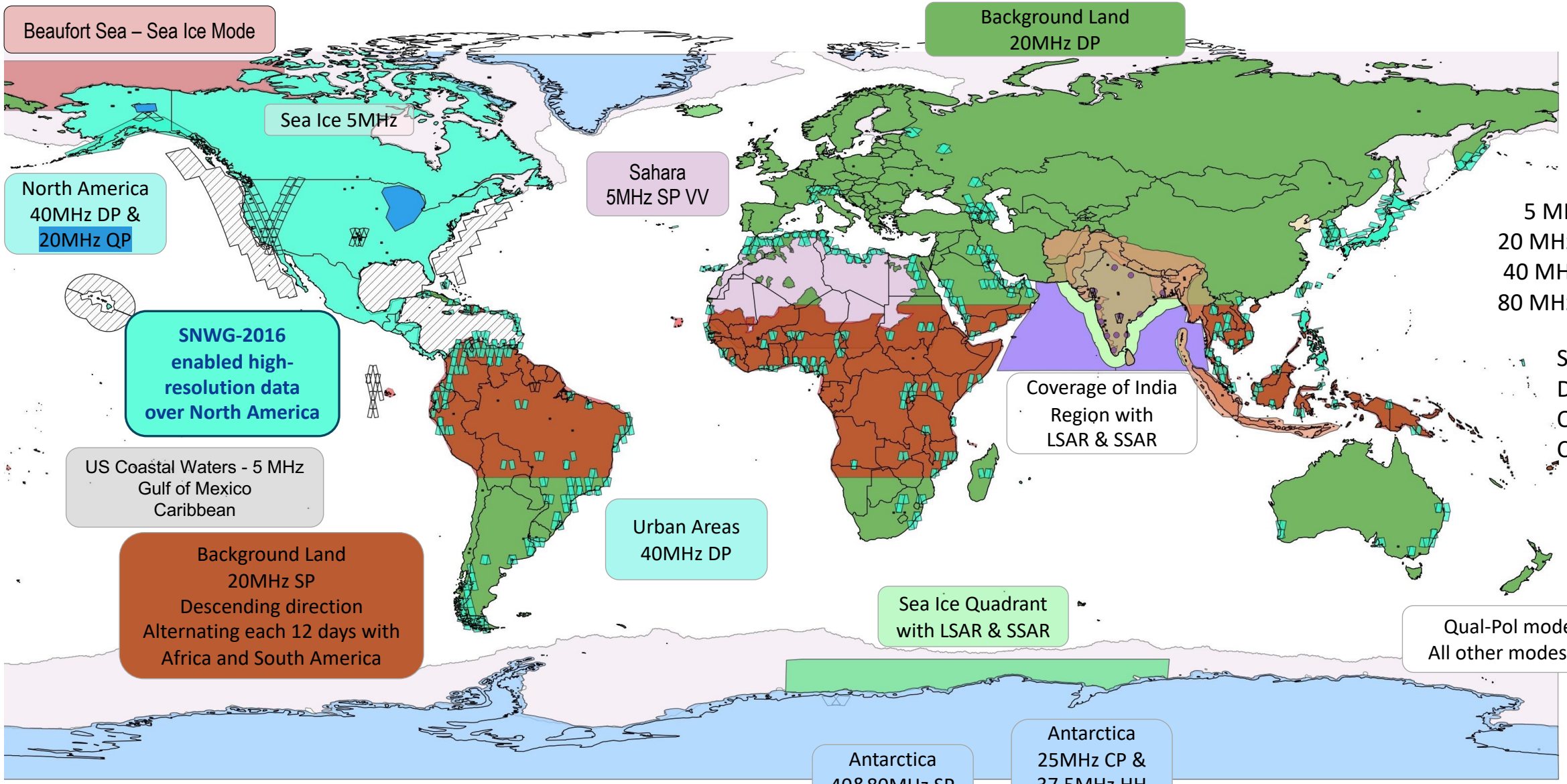


Oct. 2023 Observation Plan
Revised every 6 months

NISAR NASA - ISRO SAR Mission

Greenland 80MHz SP LSAR

Greenland 25MHz CP & 37.5MHz HH SSAR

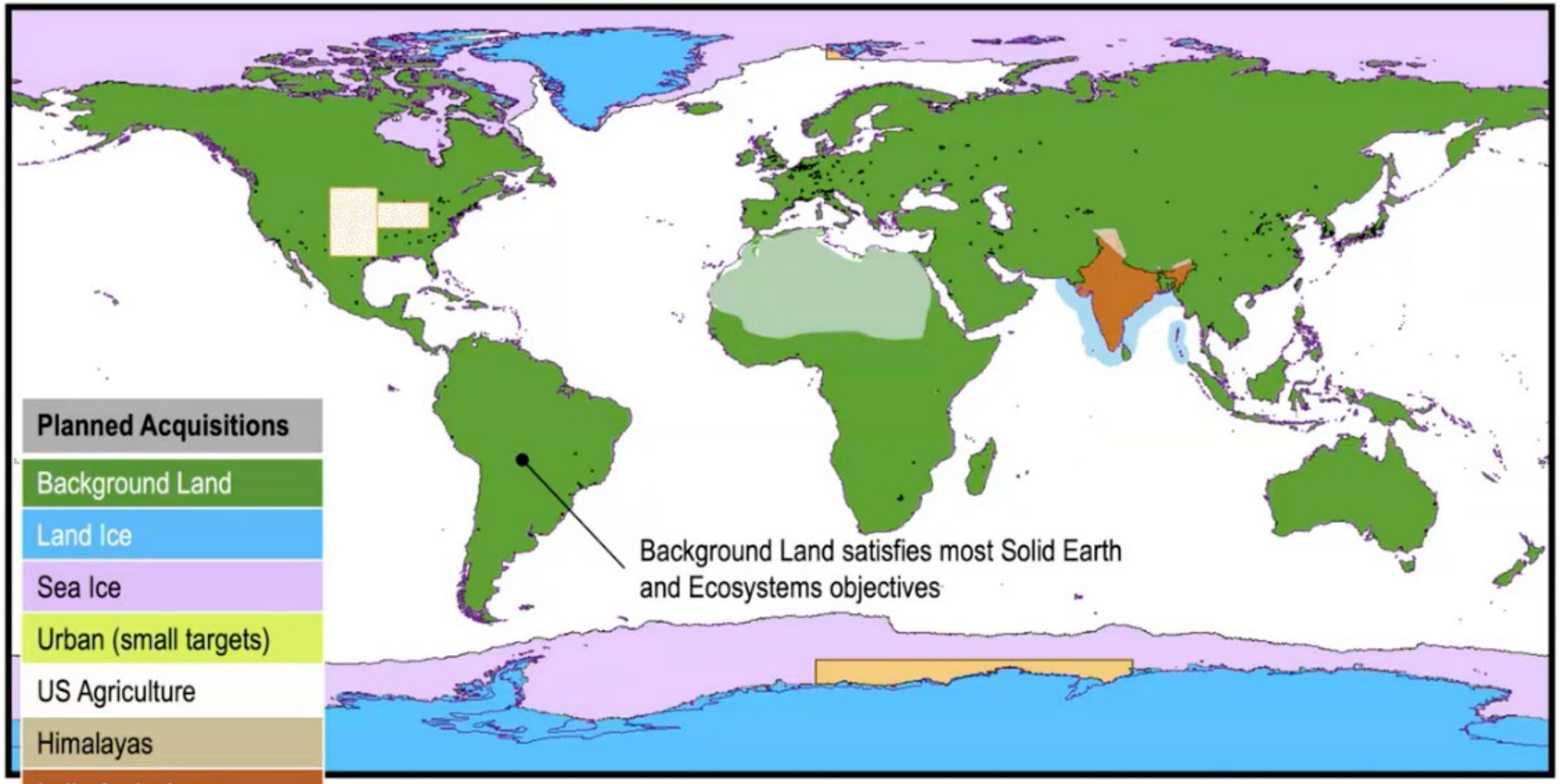


RSLC Posting

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

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

Mode-Specific Science Targets in Observation Plan

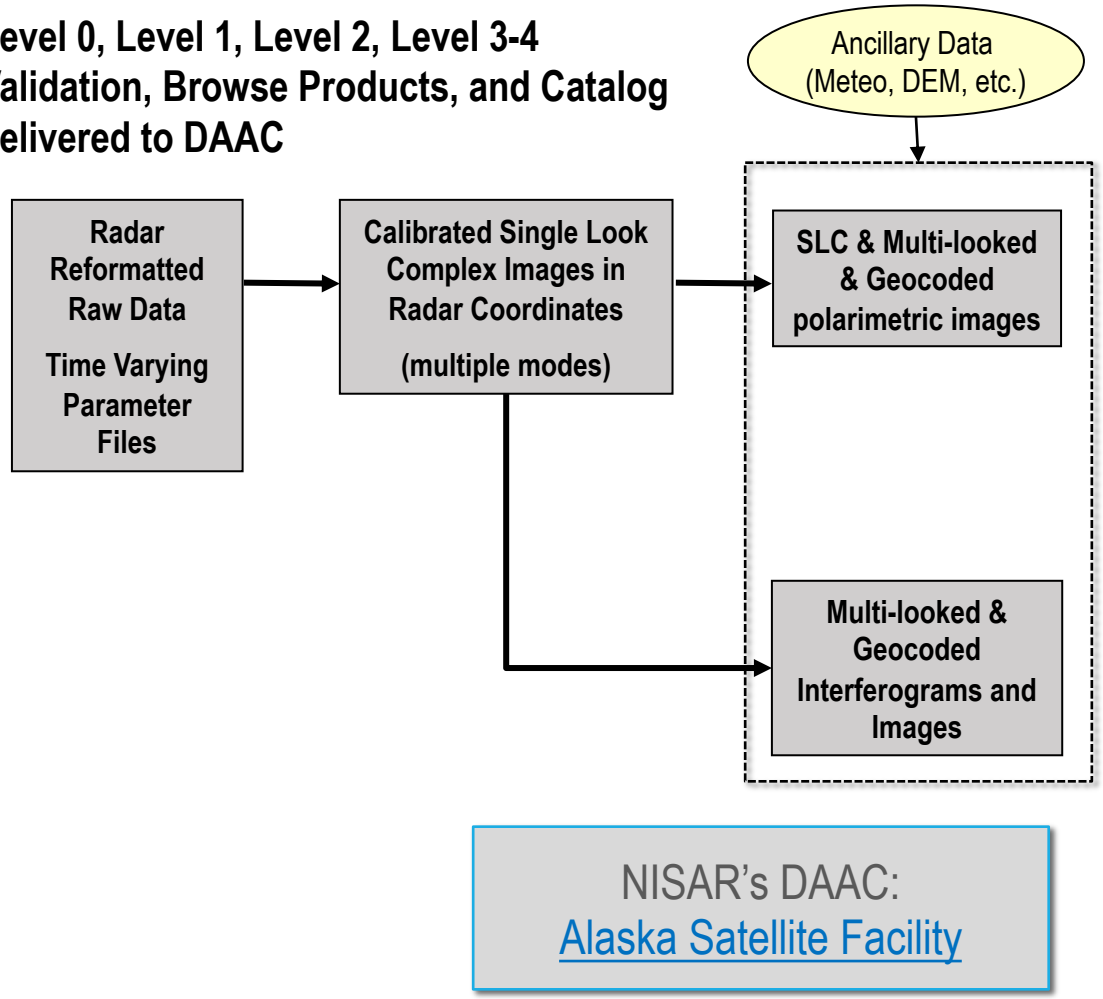


US-Quad-pol collection is likely to occur for the states of: Illinois, Michigan, Ohio & parts of Alaska

NISAR Level 0, 1, & 2 Product Overview

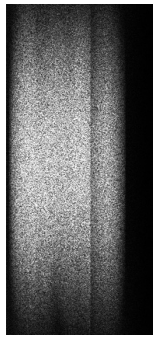
Level 0 **Level 1** **Level 2**

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

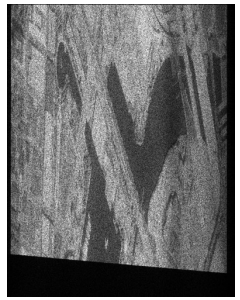


NISAR's DAAC:
Alaska Satellite Facility

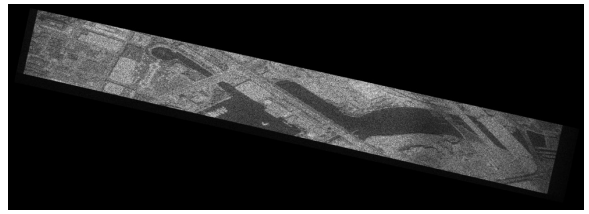
L0 - Raw



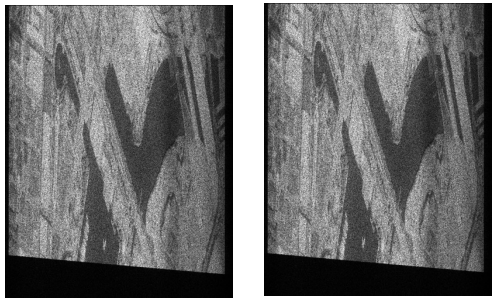
L1 – RSLC
Radar Coordinates



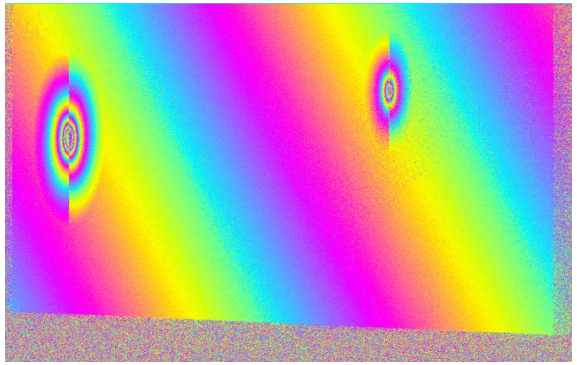
L2 – GSLC
Geocoded



L1 – RSLC (time 1, 2)



L1 – RIFG



NISAR L2 SAR Products

Level 0	Level 1	Level 2

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

Ancillary Data (Meteo, DEM, etc.)

Radar Reformatted Raw Data

Time Varying Parameter Files

→ **Calibrated Single Look Complex Images in Radar Coordinates**

(multiple modes)

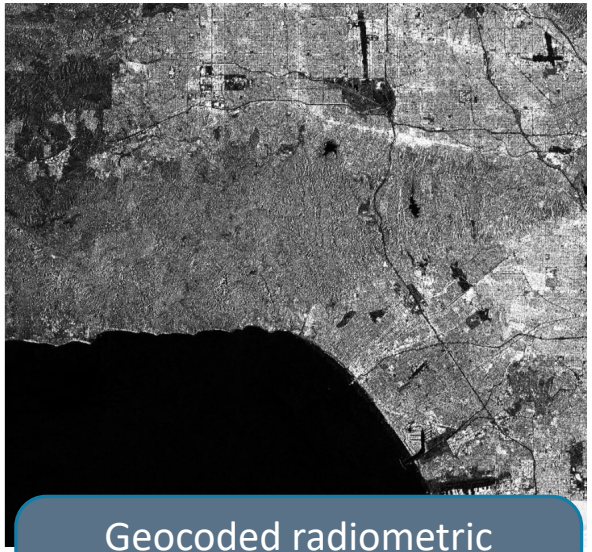
→ **SLC & Multi-looked & Geocoded polarimetric images**

→

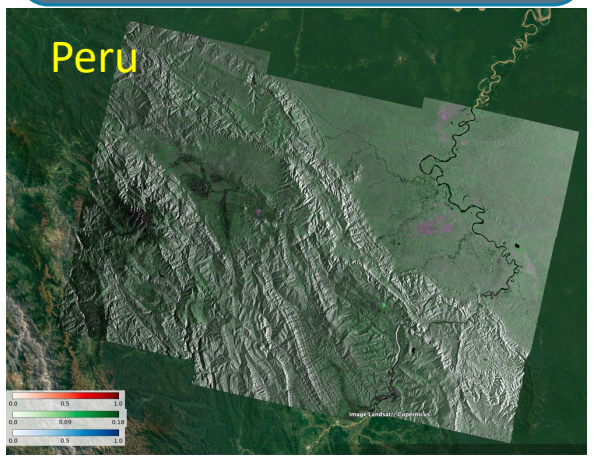
Geocoded RTC products (HH, HV) can be analyzed as another "optical" band

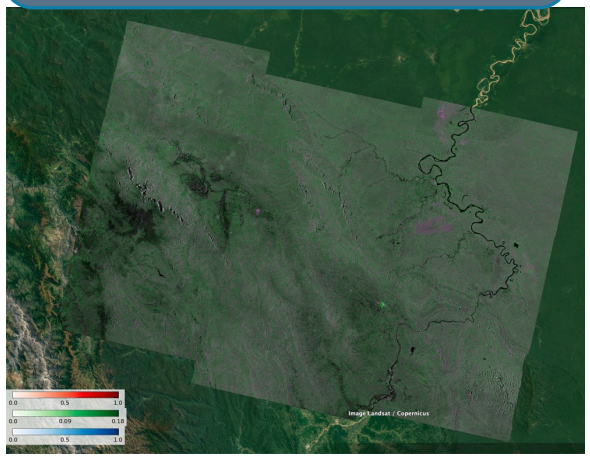
NISAR's DAAC:
Alaska Satellite Facility

Geocoded Covariance (GCOV) Simulated NISAR from Sentinel-1 data

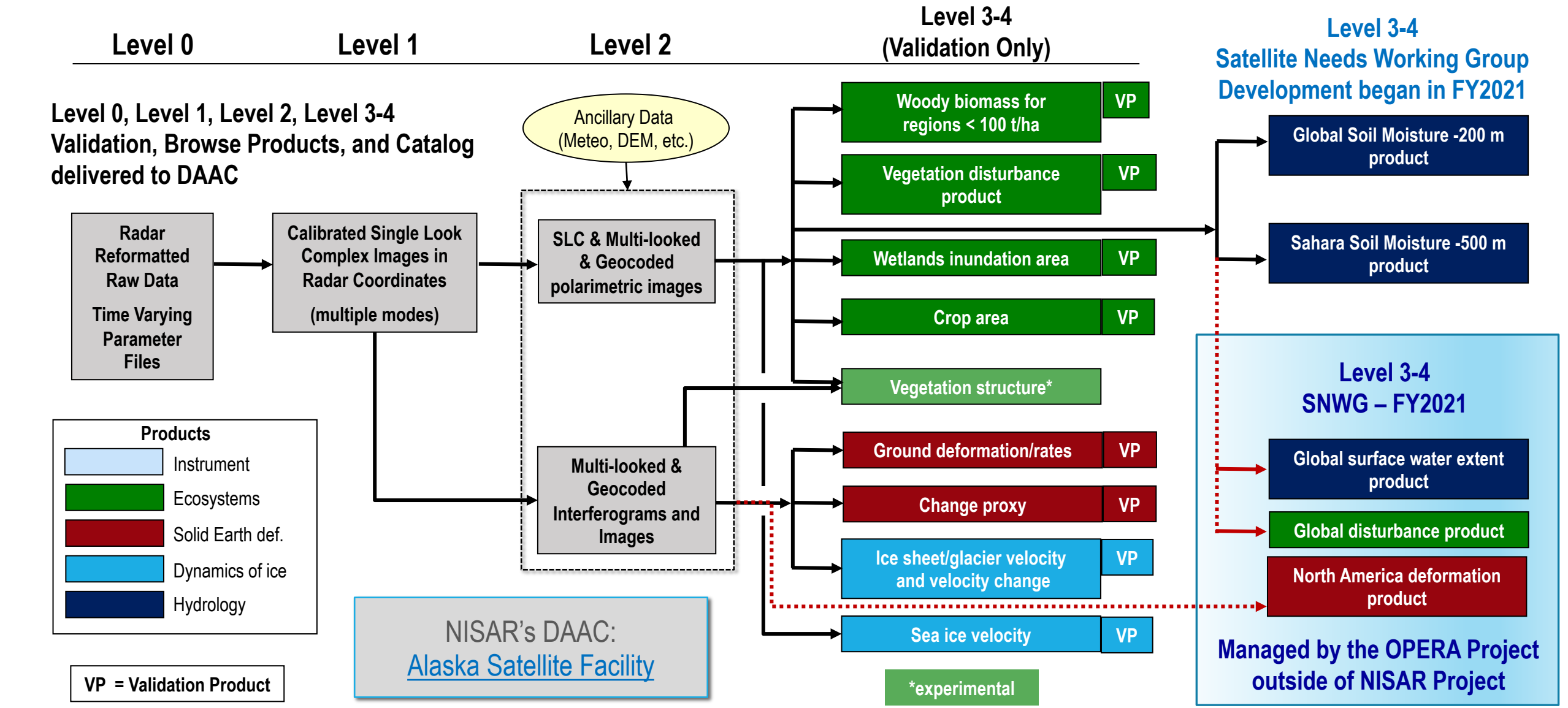


Geocoded radiometric terrain correction (RTC: GSLC) collected Sentinel-1 data





NISAR Science Data Analysis and Archive Approach

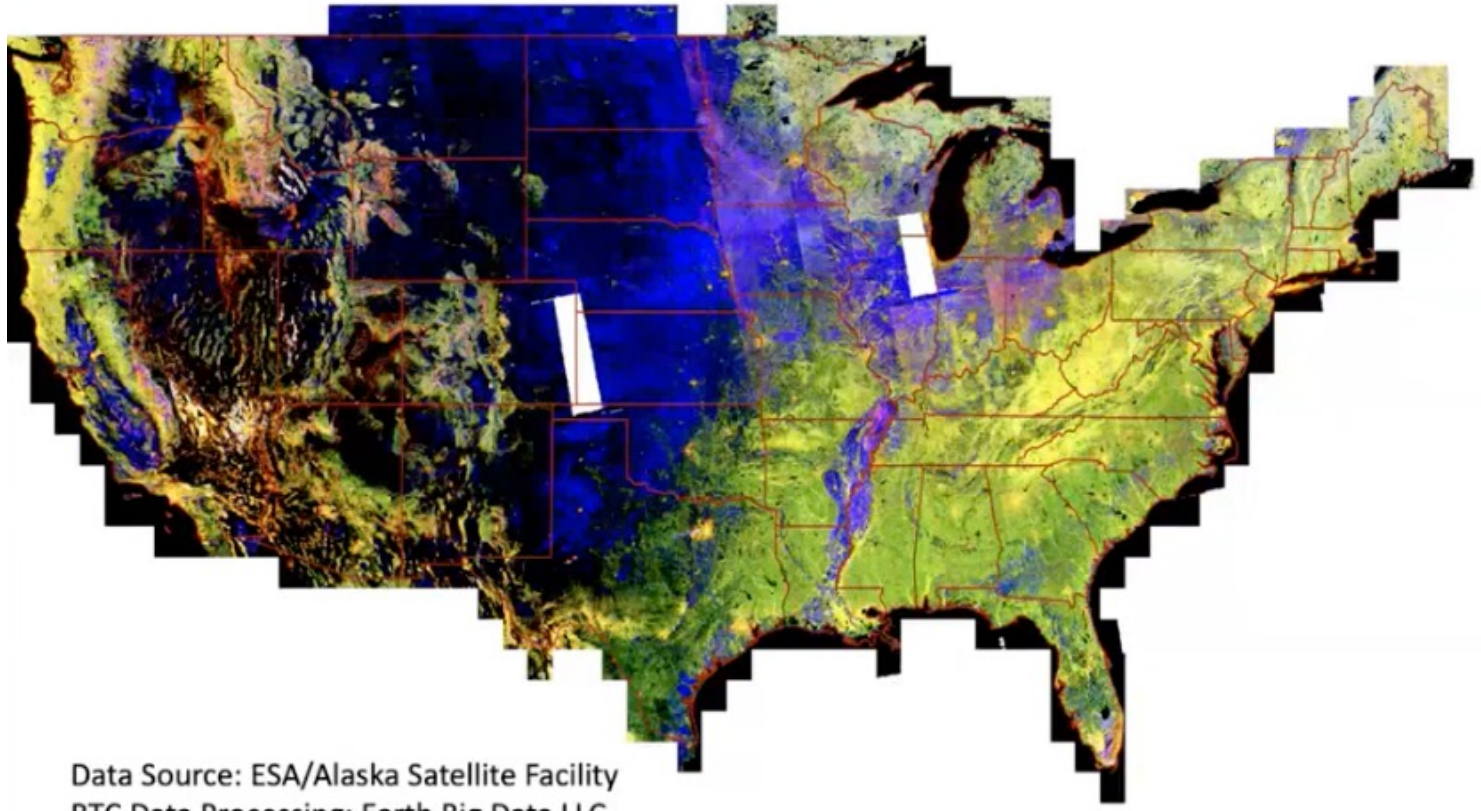


Time Series !

- Metrics of SAR backscatter over an observation time series (e.g., annual, season can be used to monitor agricultural activity.

C-VV Median / C-VH Median / C-VH p95-p5

Sentinel-1 2017, Ascending Near over Far Range



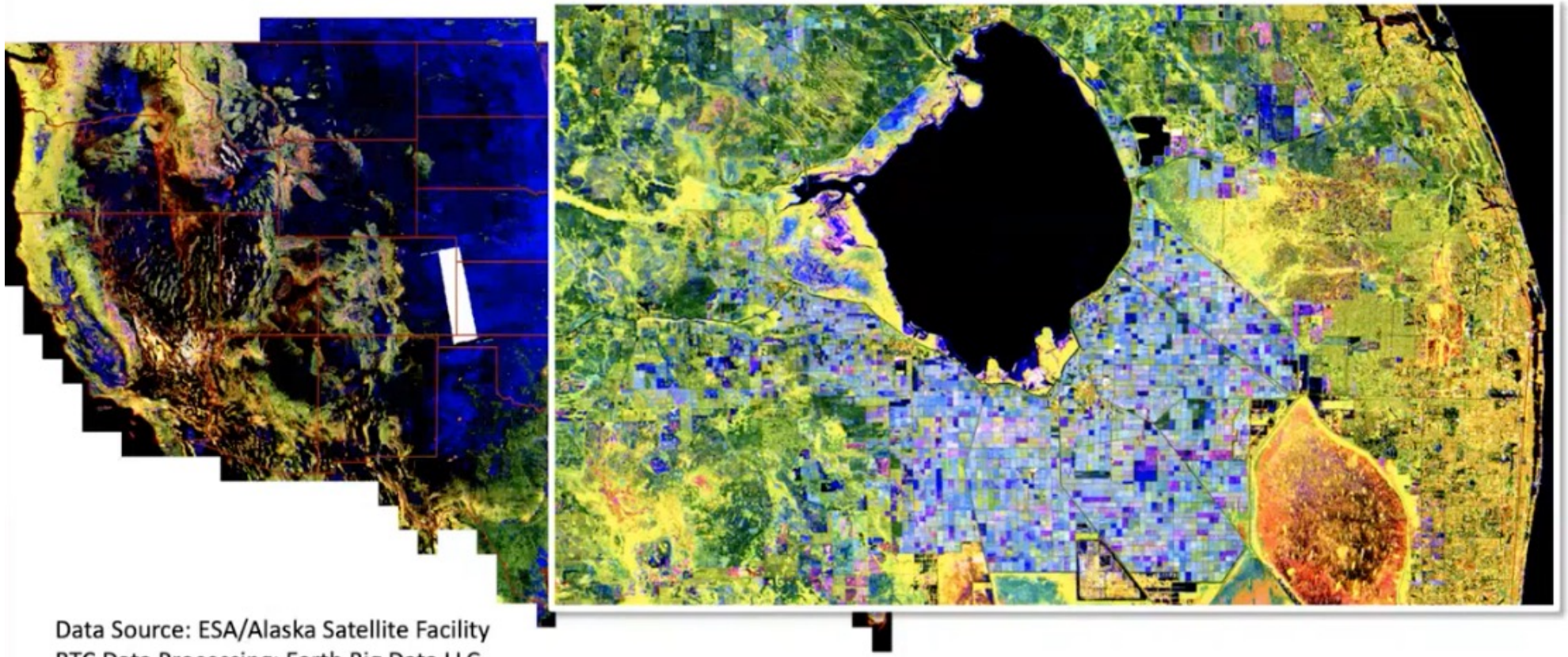
Data Source: ESA/Alaska Satellite Facility
RTC Data Processing: Earth Big Data LLC
Mosaicking and Visualization: Earth Big Data LLC

Time Series !

- Metrics of SAR backscatter over an observation time series (e.g., annual, season can be used to monitor agricultural activity.

C-VV Median / C-VH Median / C-VH p95-p5

Sentinel-1 2017, Ascending Near over Far Range

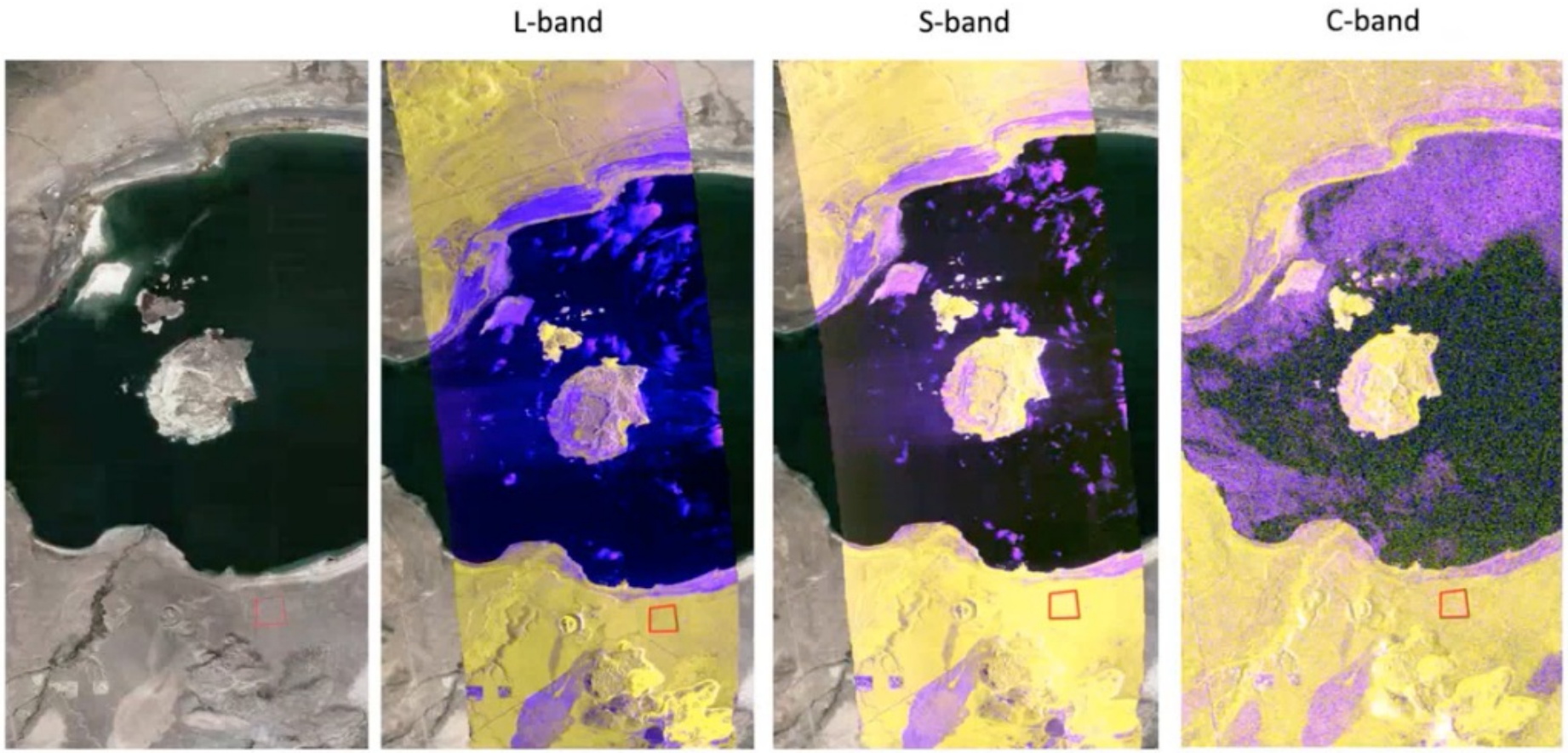


Data Source: ESA/Alaska Satellite Facility
RTC Data Processing: Earth Big Data LLC
Mosaicking and Visualization: Earth Big Data LLC

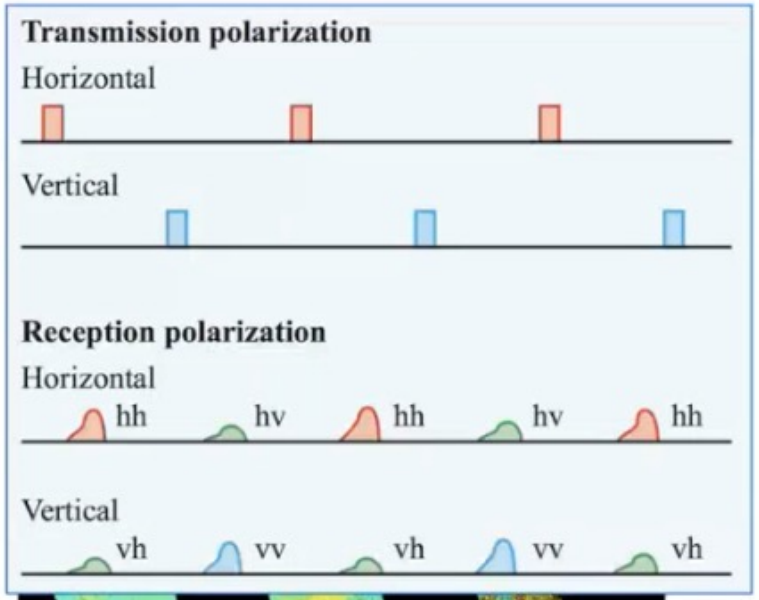
Multifrequency !

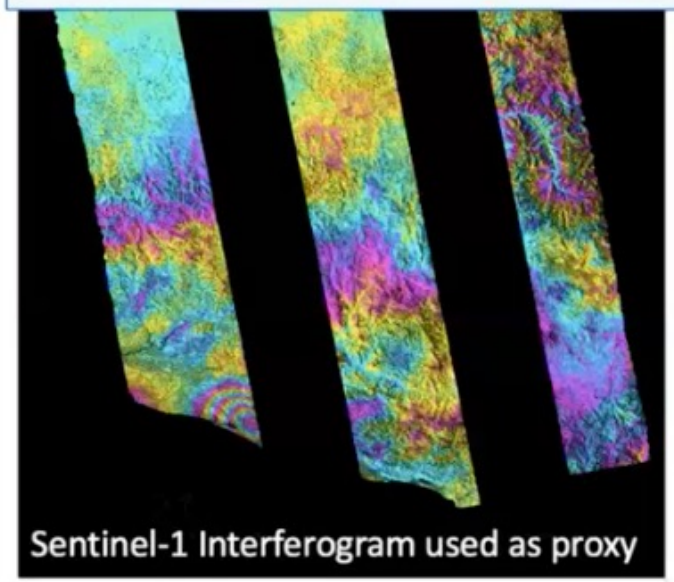
Scale [dB] (-30 to -10, -35 to -15, **4 to 12**)

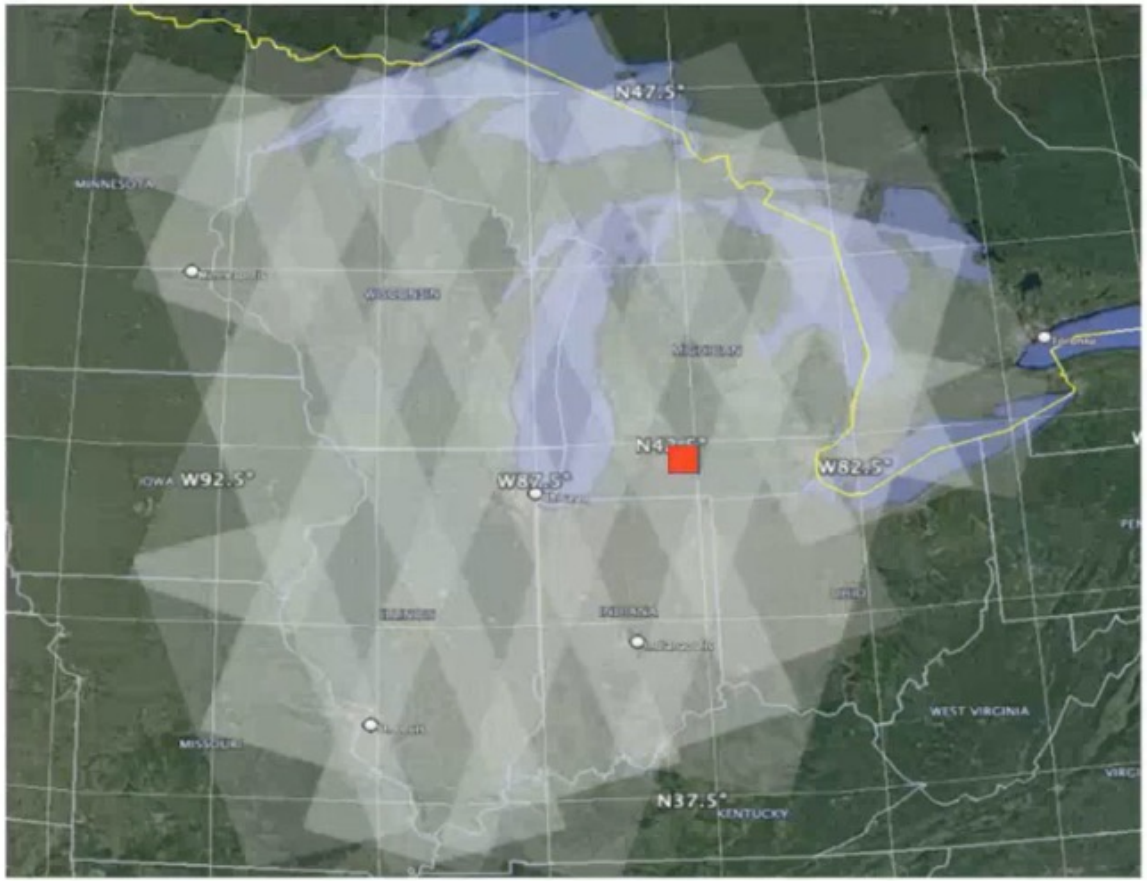
False color image: |VV|, |HV|, |VV/HV|



Quad-Pol Data Collections !

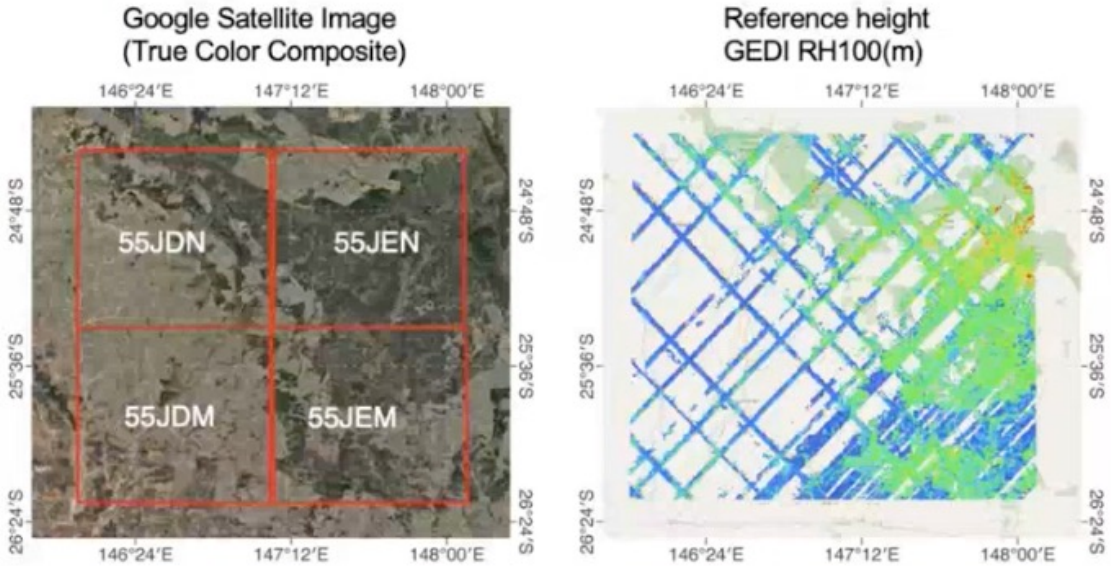


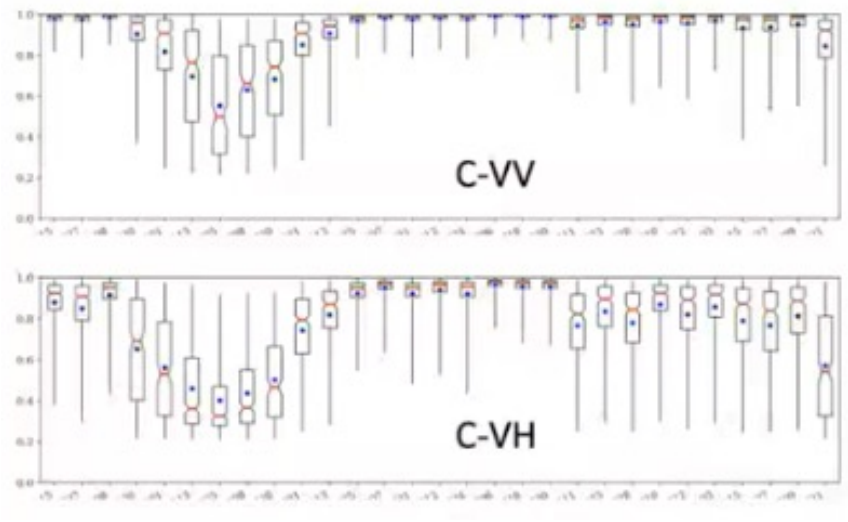


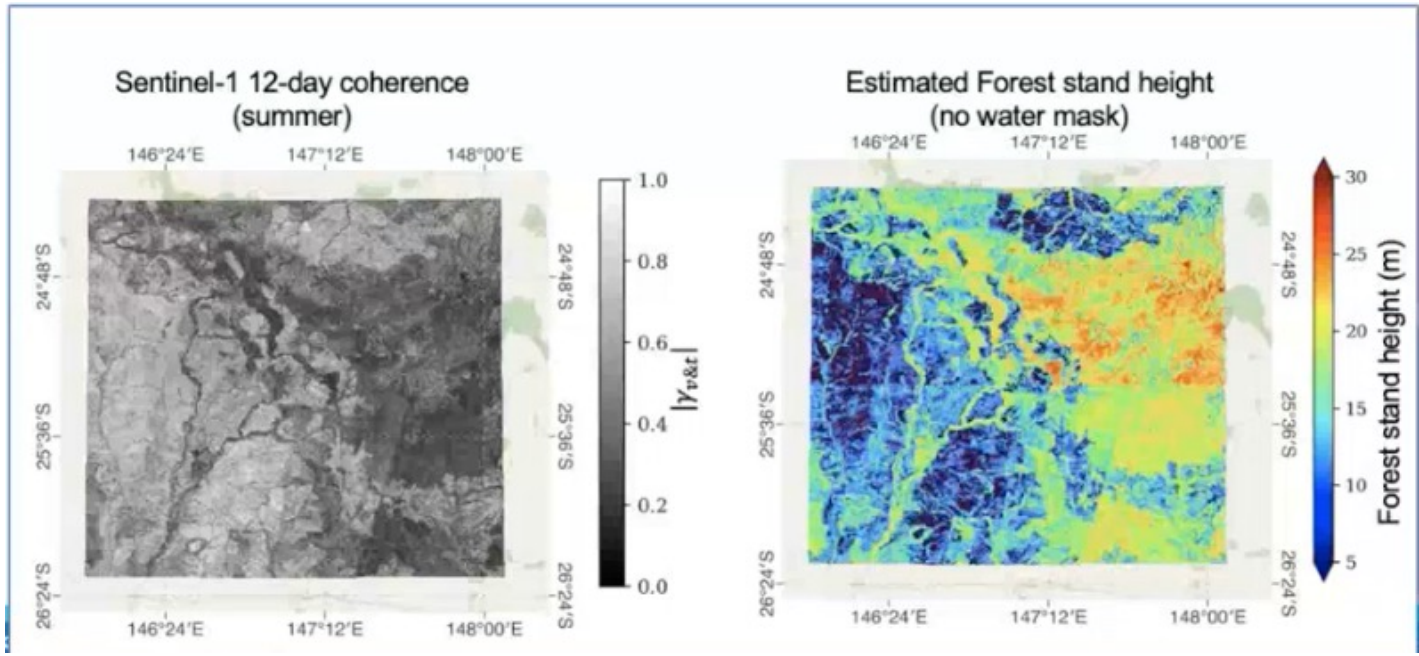


Michigan State Agriculture cal/val site indicated in Red

Interferometry !







NISAR Ecosystems Take-home message

- Dependable time-series (2 observations every 12 days)
- High resolution (~20m),
- Dual-polarized (HH, HV)
- Ground-projected data will be co-registered to a fixed grid
  - making time series analysis will be very simple
- Available over all land surfaces, globally

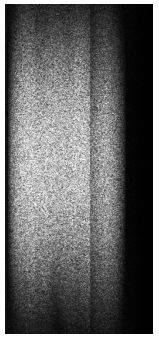
will change the way that we use data for Ecosystems

- Learning how to work with data in the cloud will be an important skill to develop

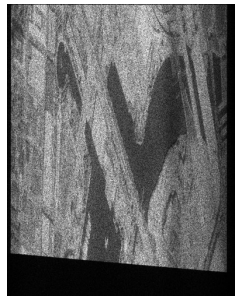
Science Data System Products Latency

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

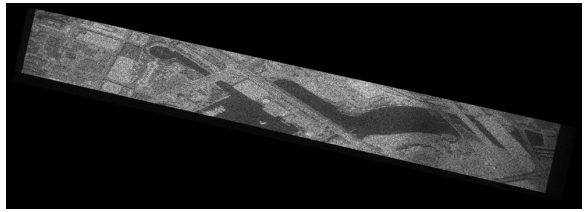
L0 - Raw

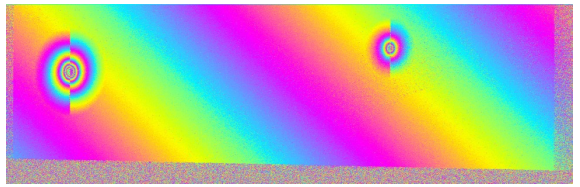


L1 - RSLC



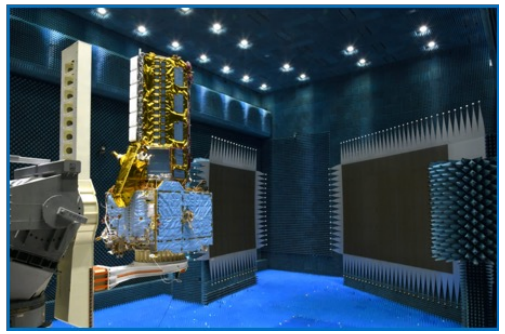
L2 - GSLC

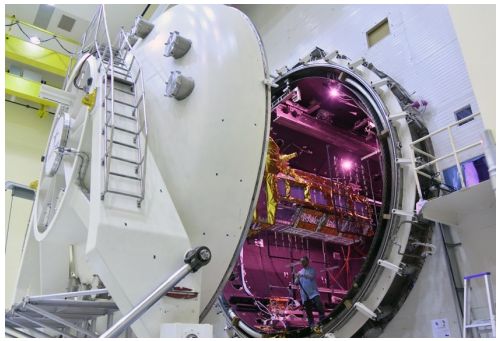




- Science Data System is sized to produce this data within 1 day latency
- Limiting factor is receiving all the ancillary files, specifically the Medium accuracy Orbit Ephemeris from GNSS

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/

Open-Source Science for NISAR

- Open data – per NASA data policy – at the Alaska Satellite Facility DAAC
  - Pre-launch Sample products: https://uavsar.jpl.nasa.gov/science/documents/nisar-sample-products.html
  - Post-launch Science products
  - *NISAR will be two times larger than the current EODIS Archive.*
- 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
  - ARSET and other courses: https://nisar.jpl.nasa.gov/resources/sar-education-resources/
- Free cloud computing resources for NASA subscribers

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

http://nisar.jpl.nasa.gov

Thank You

NISAR
Community of Practice
& Early Adopters

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