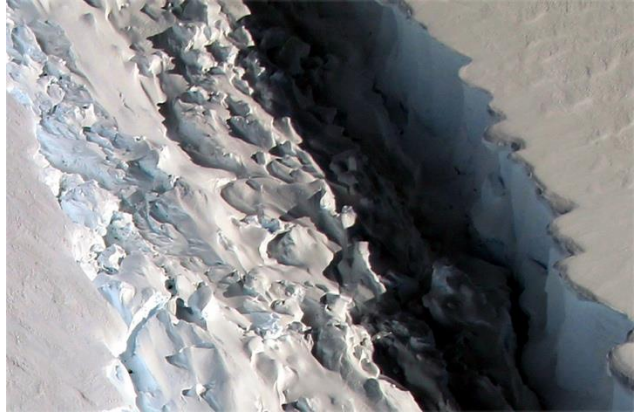





NISAR – NASA ISRO Synthetic Aperture Radar Mission

NASA Biodiversity and Ecological Conservation Team Meeting

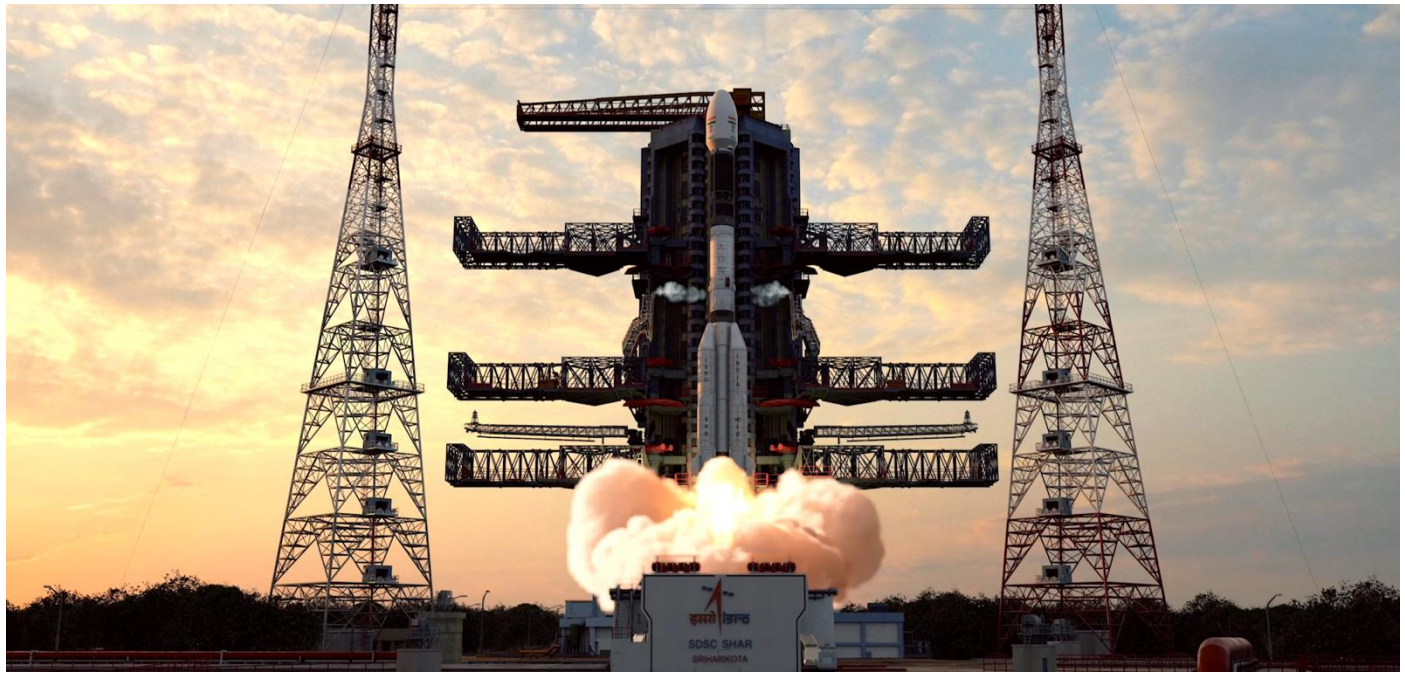
May 28, 2025 Washington D.C.

Dr. Gerald Bawden

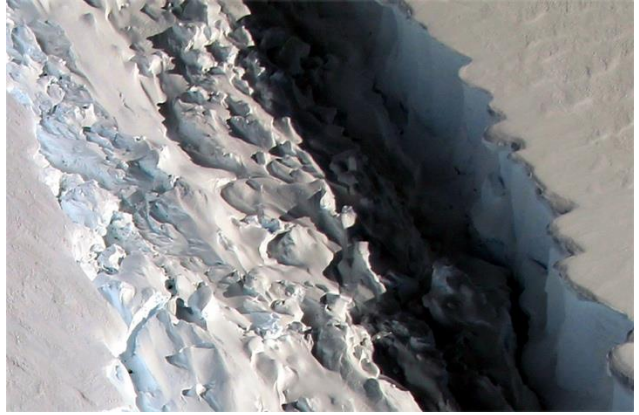
Program Scientist NISAR

NASA Headquarters

Gerald.Bawden@NASA.gov





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NISAR
NASA - ISRO SAR Mission

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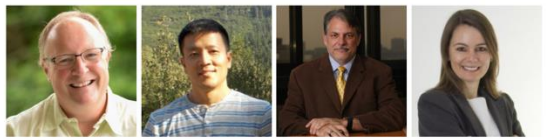

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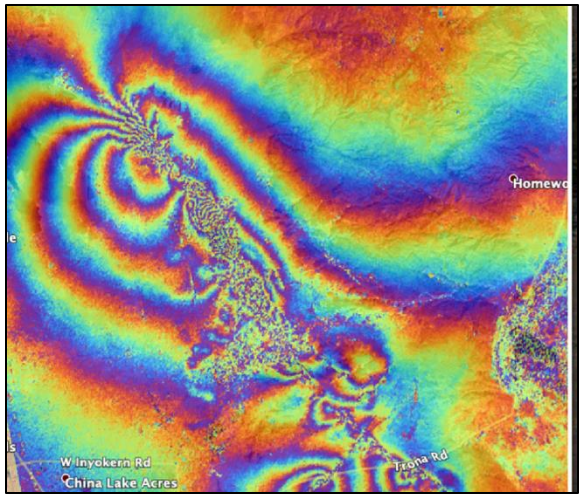
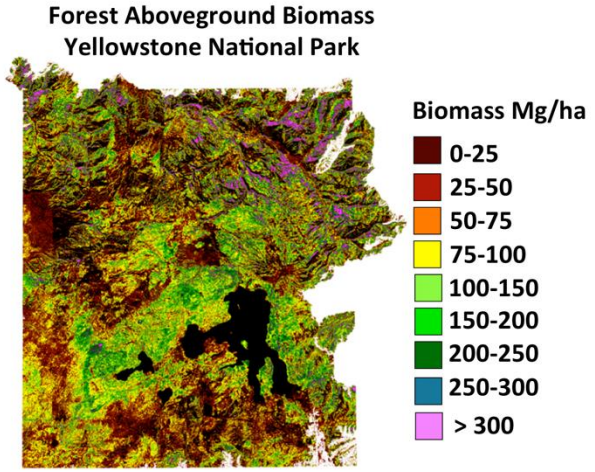
NISAR Level 1 Science and Applications Requirements

Understanding the Cryosphere, Carbon, Catastrophic Change, Resource Management + more



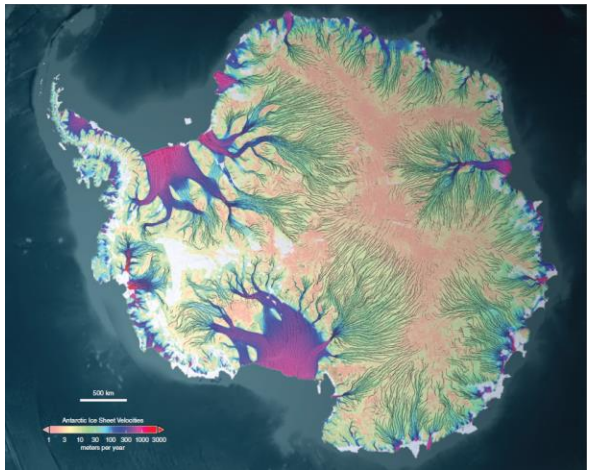
Measure ground movements to understand the forces causing earthquakes, volcanic eruptions, landslides, aquifer and reservoir variations

Solid Earth Deformation



Measure the dynamics of global woody aboveground biomass, the dynamics of major wetlands and agricultural systems

Ecosystem/Agriculture



Measure flow of Earth's ice sheets, glaciers, and sea ice to understand their interaction with the oceans, land surface, ecosystems and water

Cryosphere Dynamics

Provide priority data collection/downlink along with rapid processing and data dissemination for major anthropogenic and natural disasters, on a best-efforts basis

Disaster Response

NISAR
NASA - ISRO SAR Mission

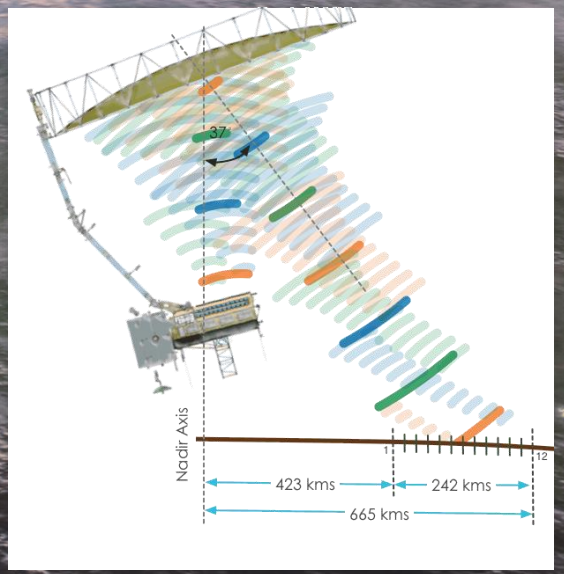
Partnership between NASA and ISRO

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

12-day exact repeat for interferometry

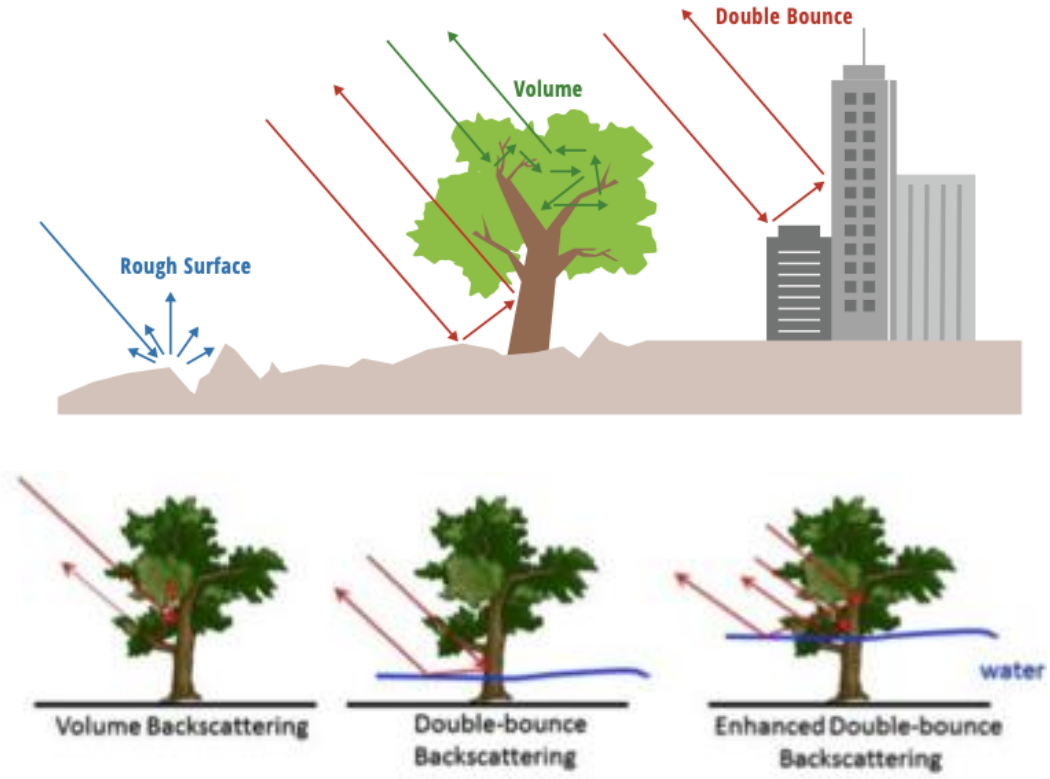
On average 6-day coverage with ascending and descending orbits

Near global land and ice coverage

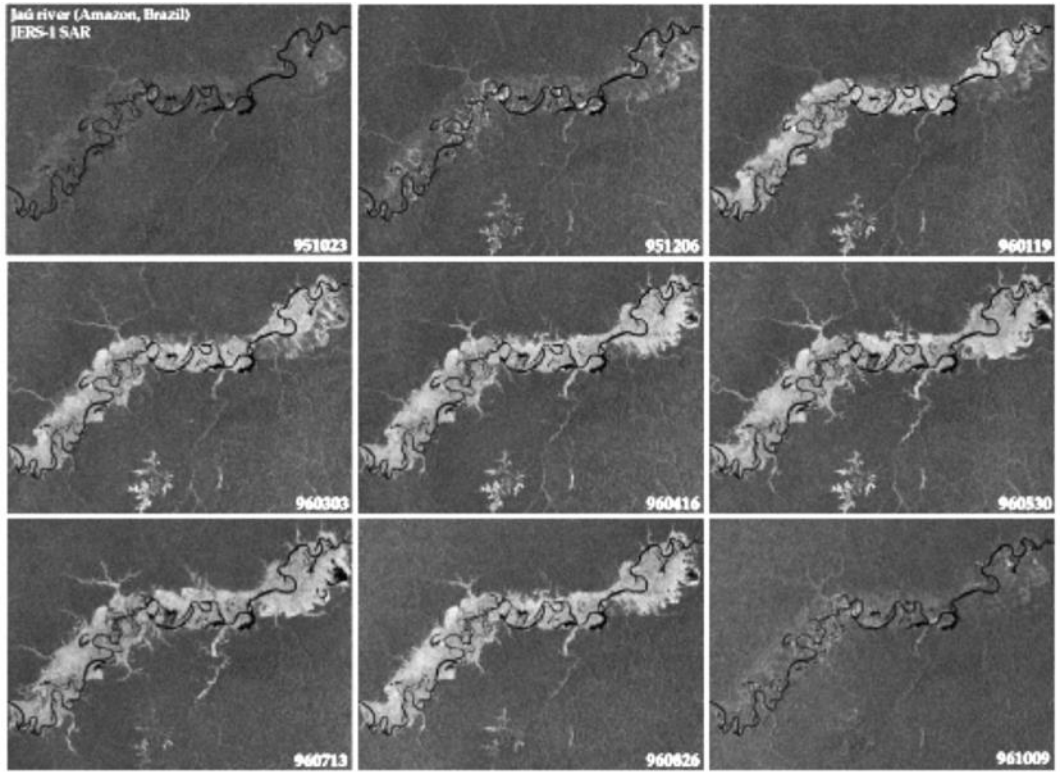


Vegetation Inundation Dynamics

L-band SAR observations are established as the most reliable tool for mapping vegetation and vegetation inundation



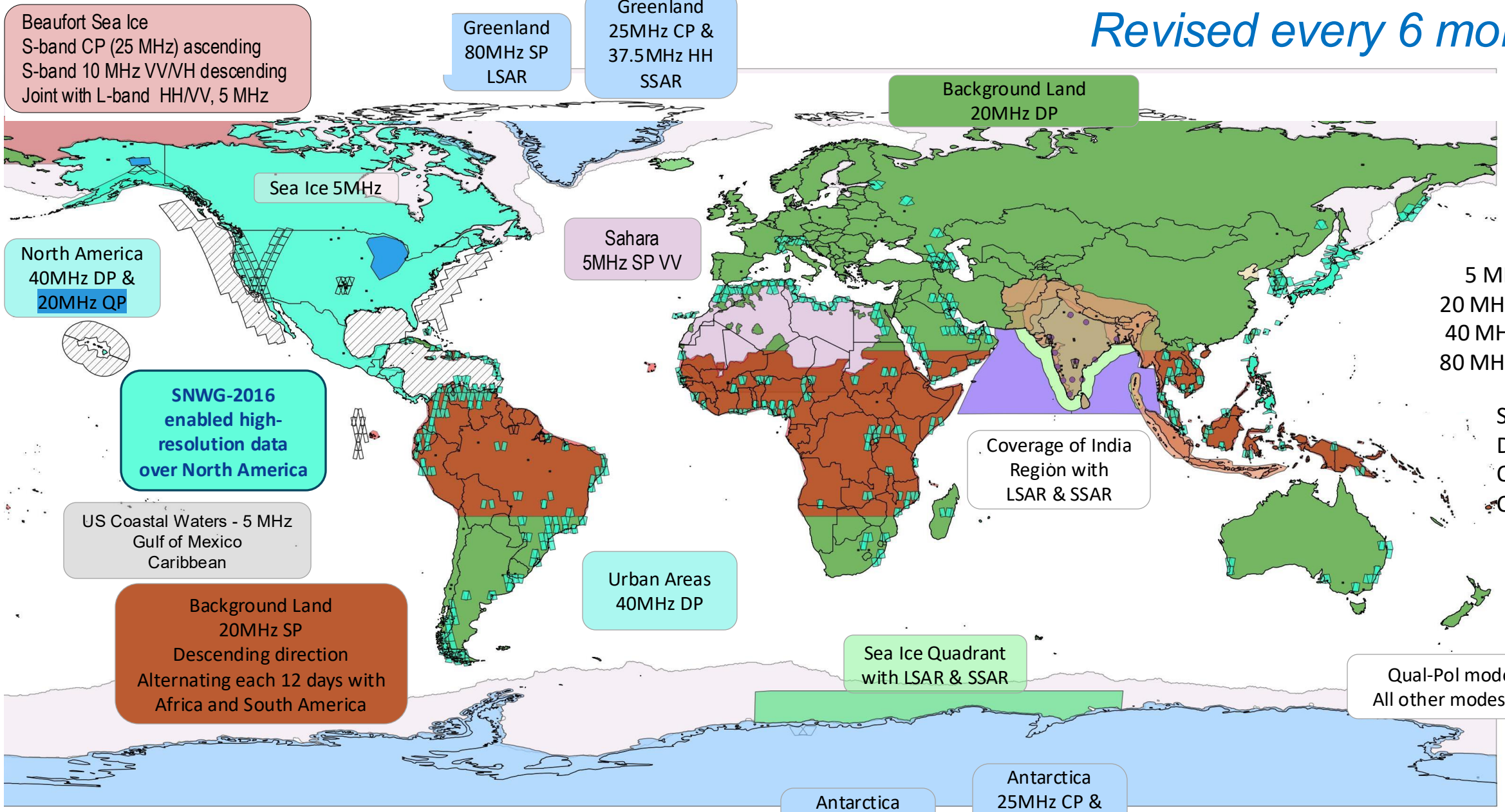
JERS-1 L-band SAR (HH only) data showing inundation dynamics for 1 year (Jau River, Brazil)



Rosenqvist et al, 1998.

NISAR L-SAR Observation Plan

Revised every 6 months



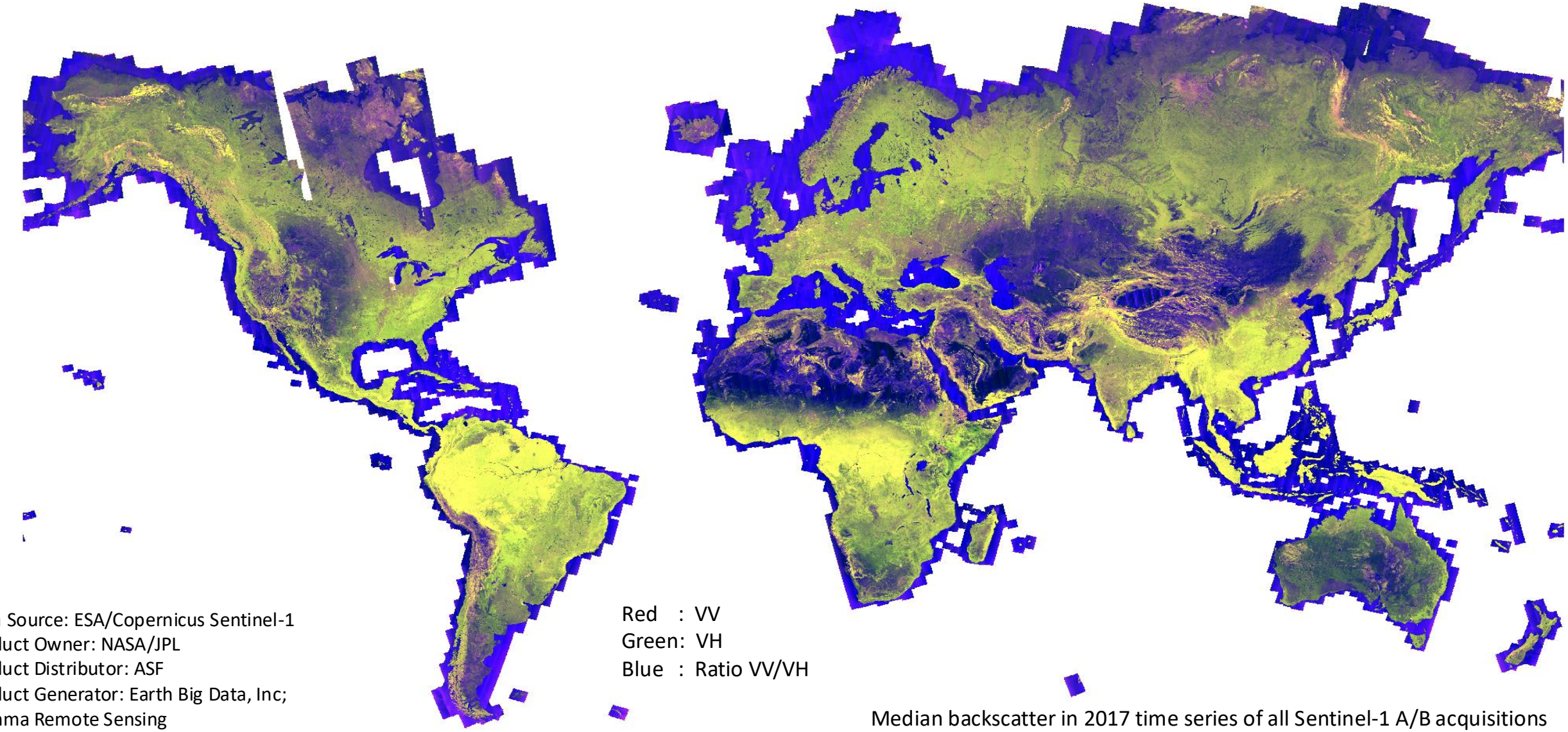
RSLC Posting

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

2017 Sentinel-1 C-band Backscatter of Earth

NISAR will image the Earth twice every 12 days



Red : VV
Green: VH
Blue : Ratio VV/VH

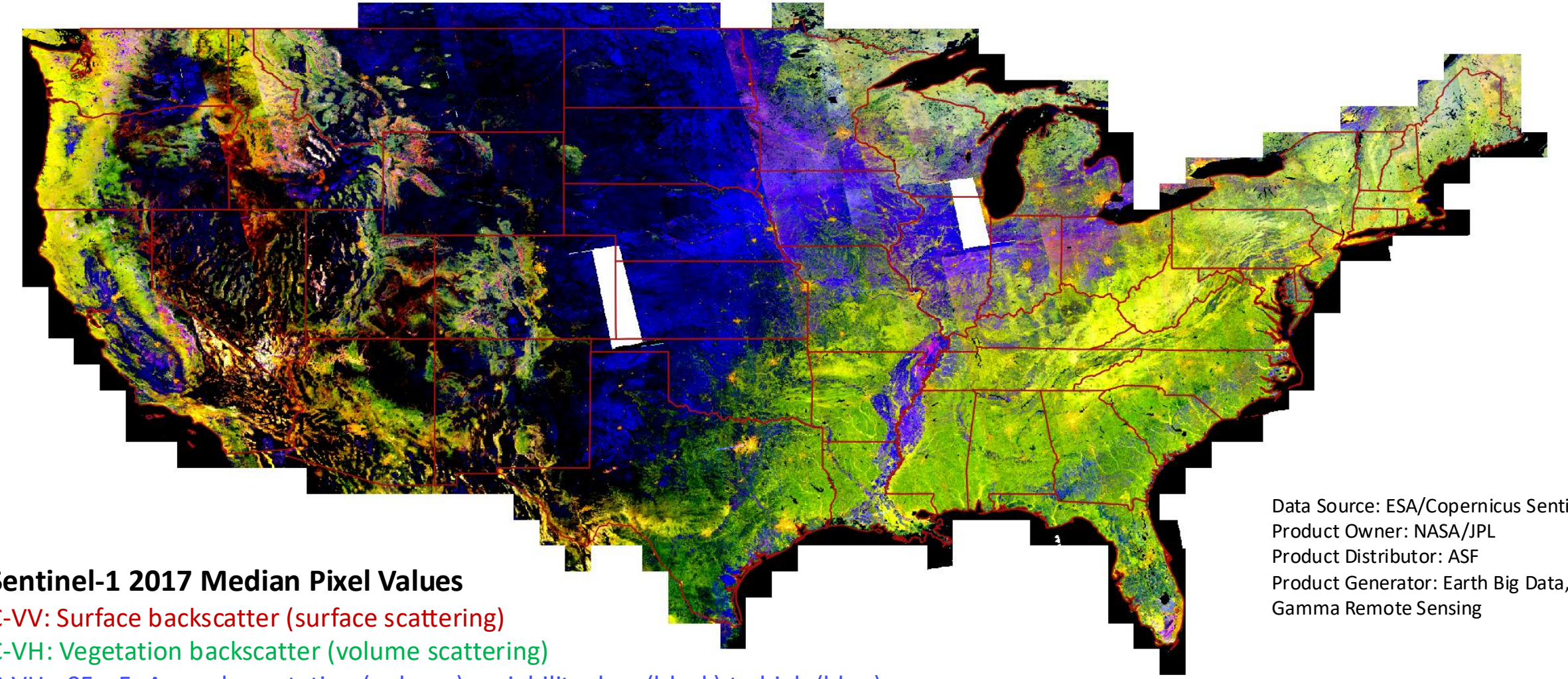
Data Source: ESA/Copernicus Sentinel-1
Product Owner: NASA/JPL
Product Distributor: ASF
Product Generator: Earth Big Data, Inc;
Gamma Remote Sensing

Median backscatter in 2017 time series of all Sentinel-1 A/B acquisitions

SAR Tracks Land Surface and Vegetation Variability

Denser vegetation in the East and bare Earth in the West

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



Sentinel-1 2017 Median Pixel Values

C-VV: Surface backscatter (surface scattering)

C-VH: Vegetation backscatter (volume scattering)

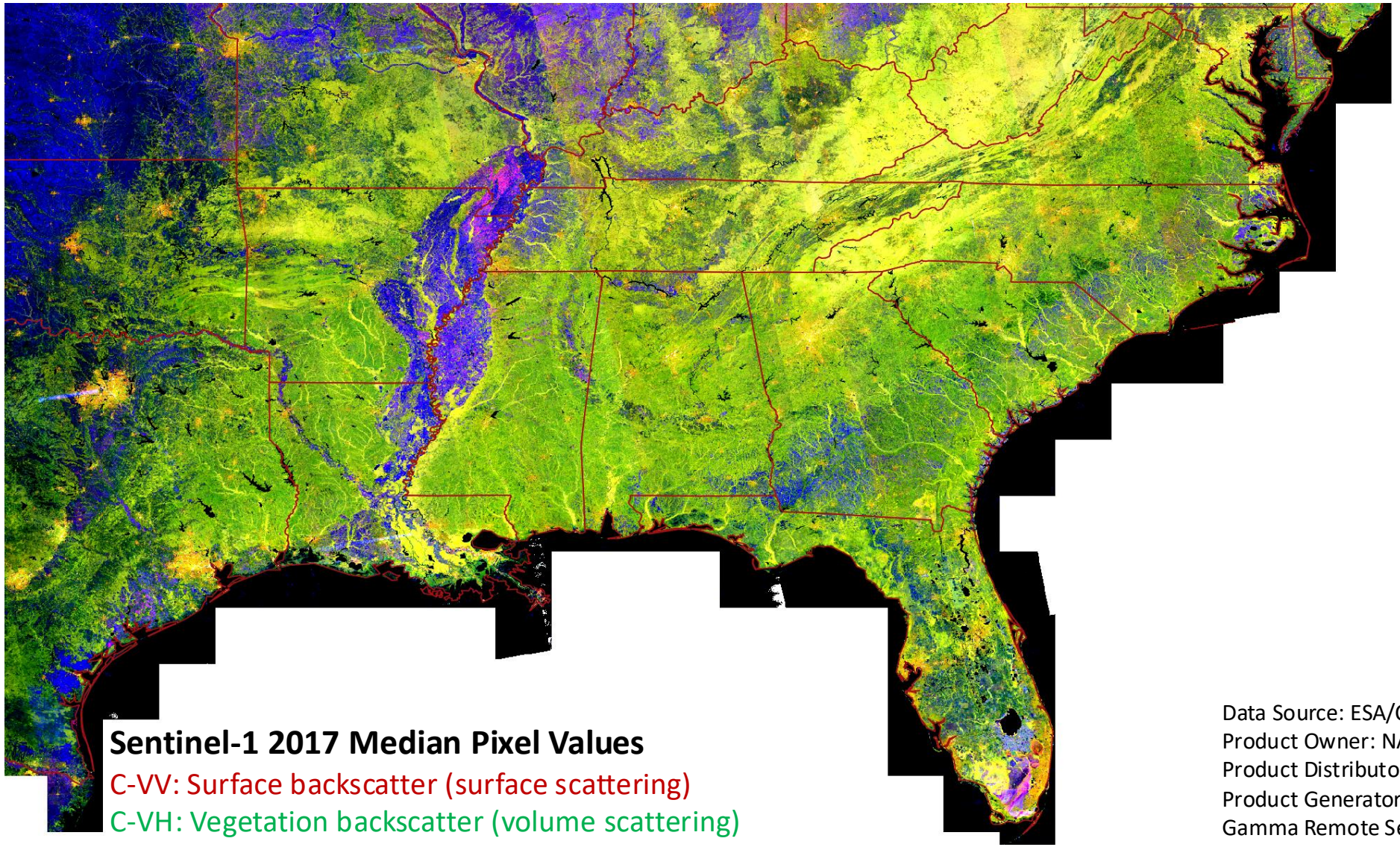
C-VH p95-p5: Annual vegetation (volume) variability: low (black) to high (blue)

Data Source: ESA/Copernicus Sentinel-1
Product Owner: NASA/JPL
Product Distributor: ASF
Product Generator: Earth Big Data, Inc; Gamma Remote Sensing

Median backscatter in 2017 time series of all Sentinel-1 A/B acquisitions

Vegetation and Agriculture Variability Along the Mississippi River

Tree stability along the Gulf and East Coast States



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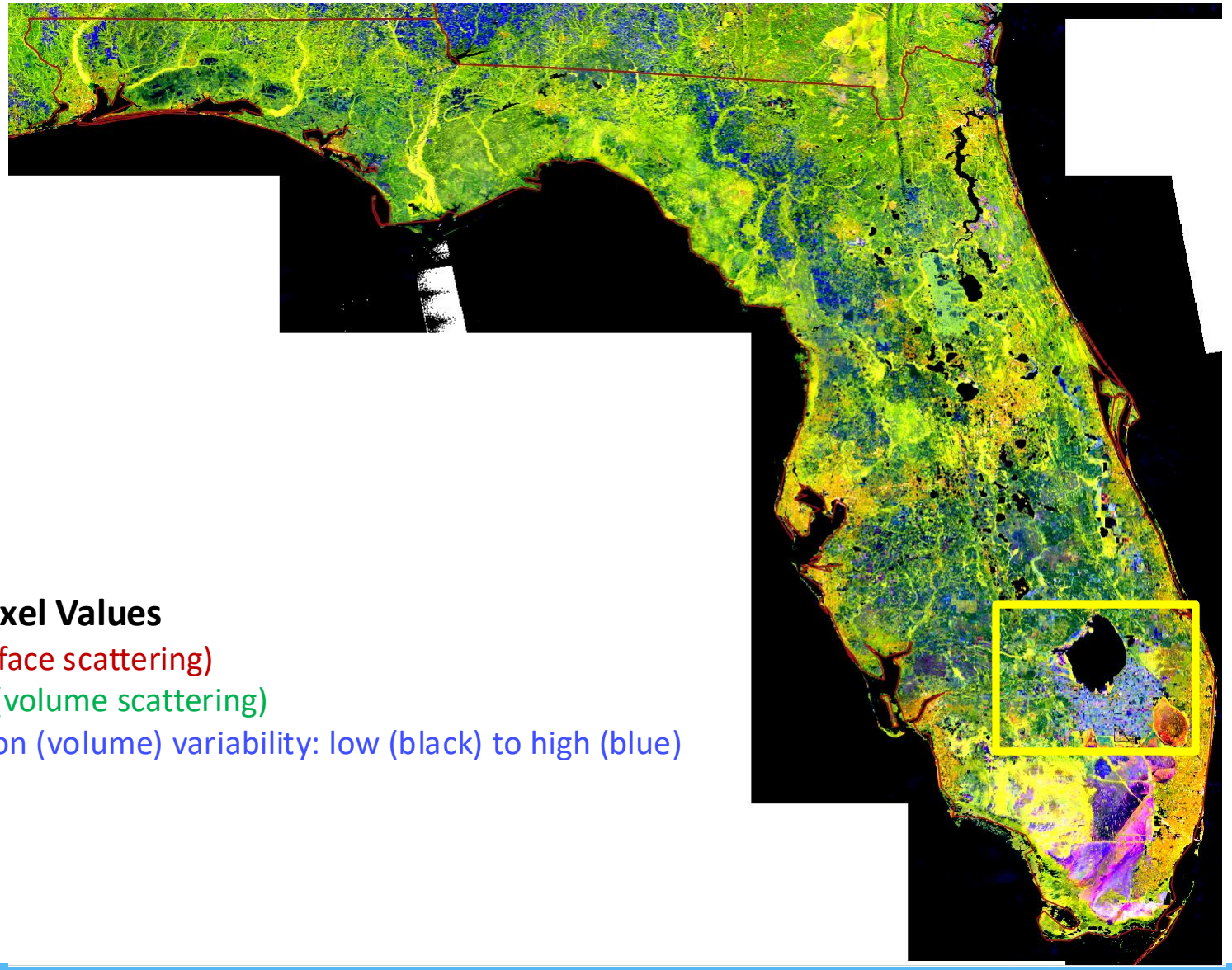
Variable Vegetation Environments Across Florida

Inundated vegetation in the Everglades



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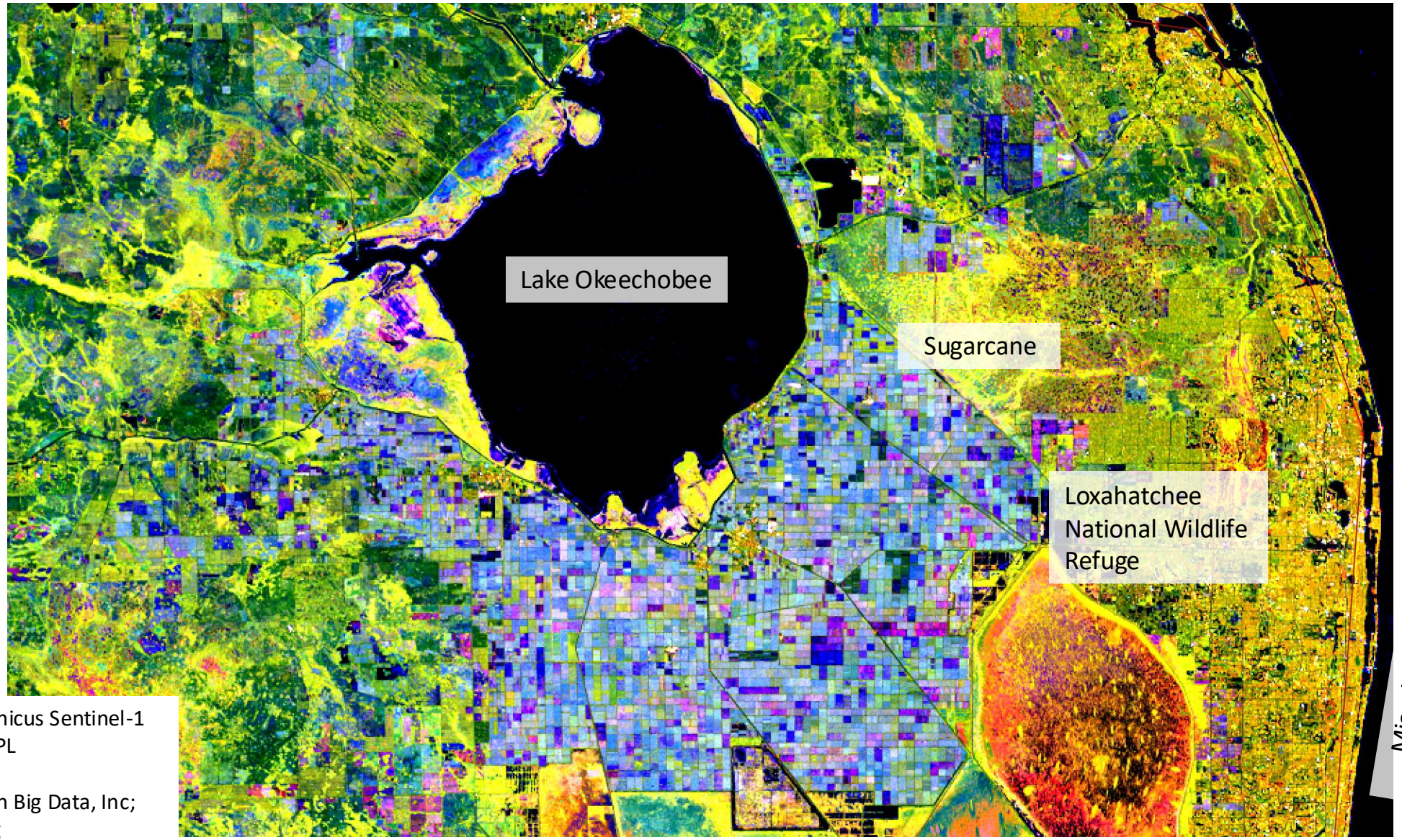
Data Source: ESA/Copernicus Sentinel-1
Product Owner: NASA/JPL
Product Distributor: ASF
Product Generator: Earth Big Data, Inc;
Gamma Remote Sensing

A Diverse Ecosystem in Southern Florida

Inundated vegetation in the Everglades in Orange



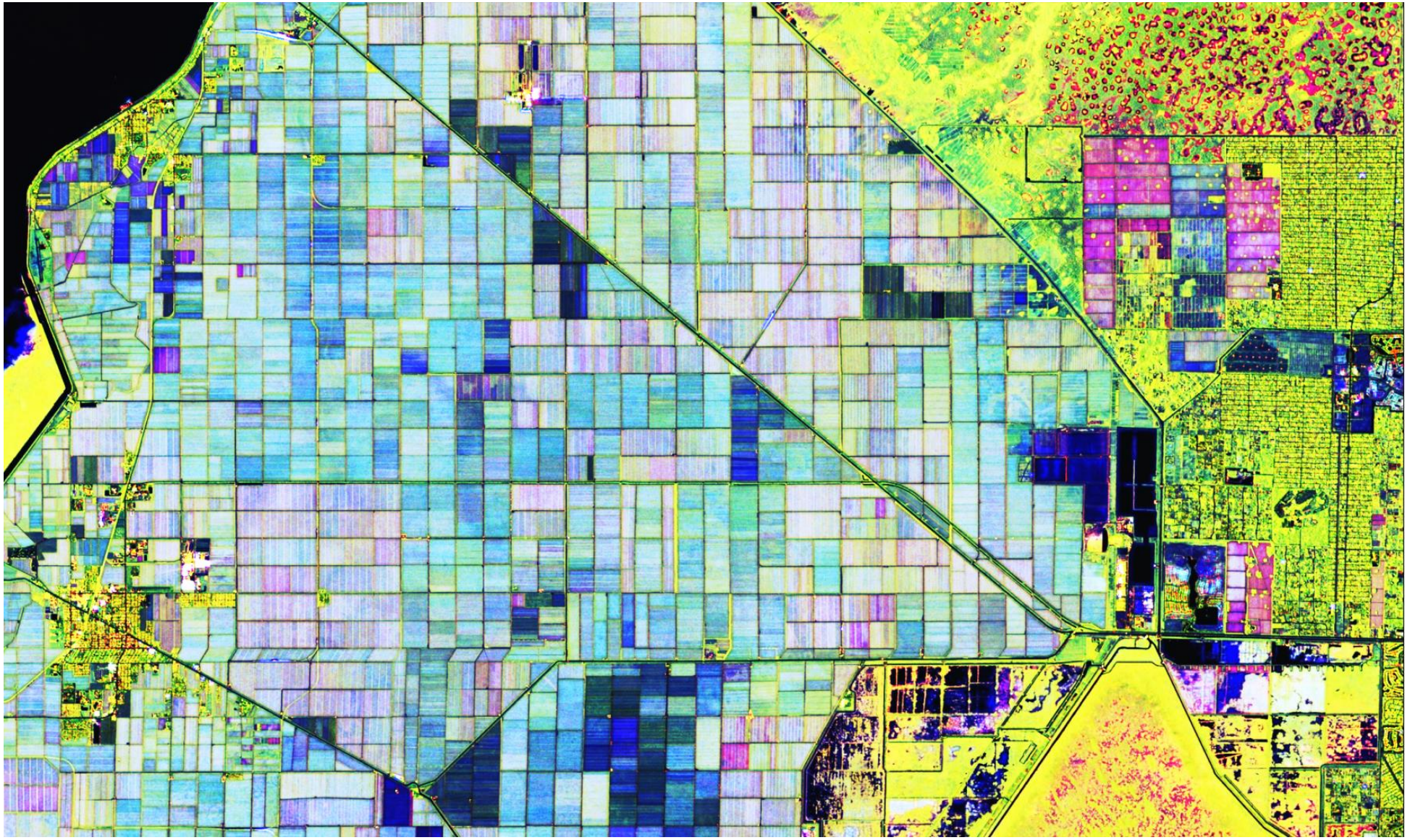
Sentinel-1
2017
Surface
Vegetation – trees
Annual vegetation

Data Source: ESA/Copernicus Sentinel-1
Product Owner: NASA/JPL
Product Distributor: ASF
Product Generator: Earth Big Data, Inc; Gamma Remote Sensing

Sugarcane Crops in Southern Florida

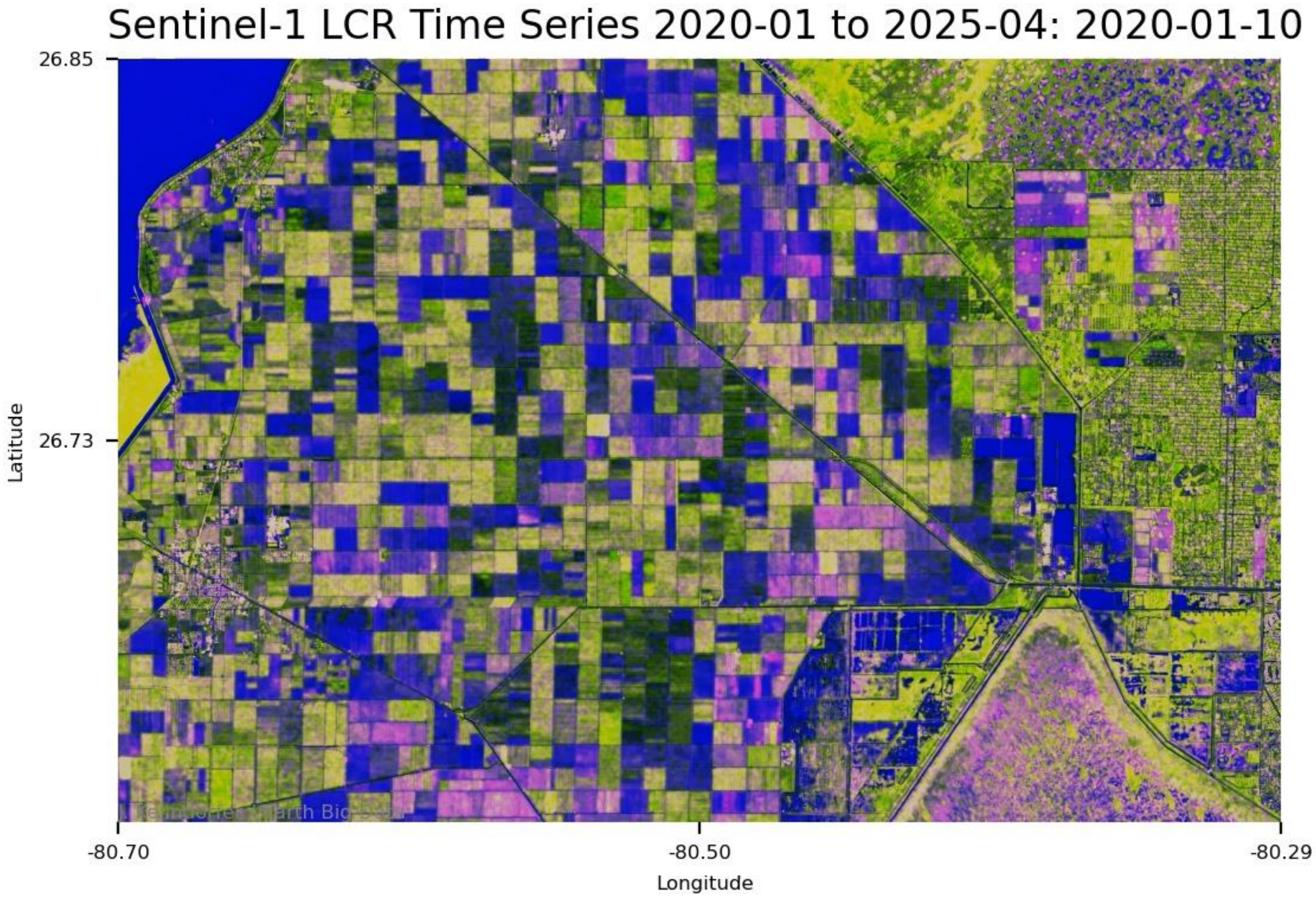
2020-01-01 to April 2025

Sentinel-1
2017
Surface
Vegetation – trees
Annual vegetation



Sugarcane Crops in Southern Florida

2020-01-01 to April 2025



Data Processing and Animation:
J. Kellndorfer, Earth Big Data LLC

Messages from the NISAR Science Team to the Biodiversity Diversity Science Team

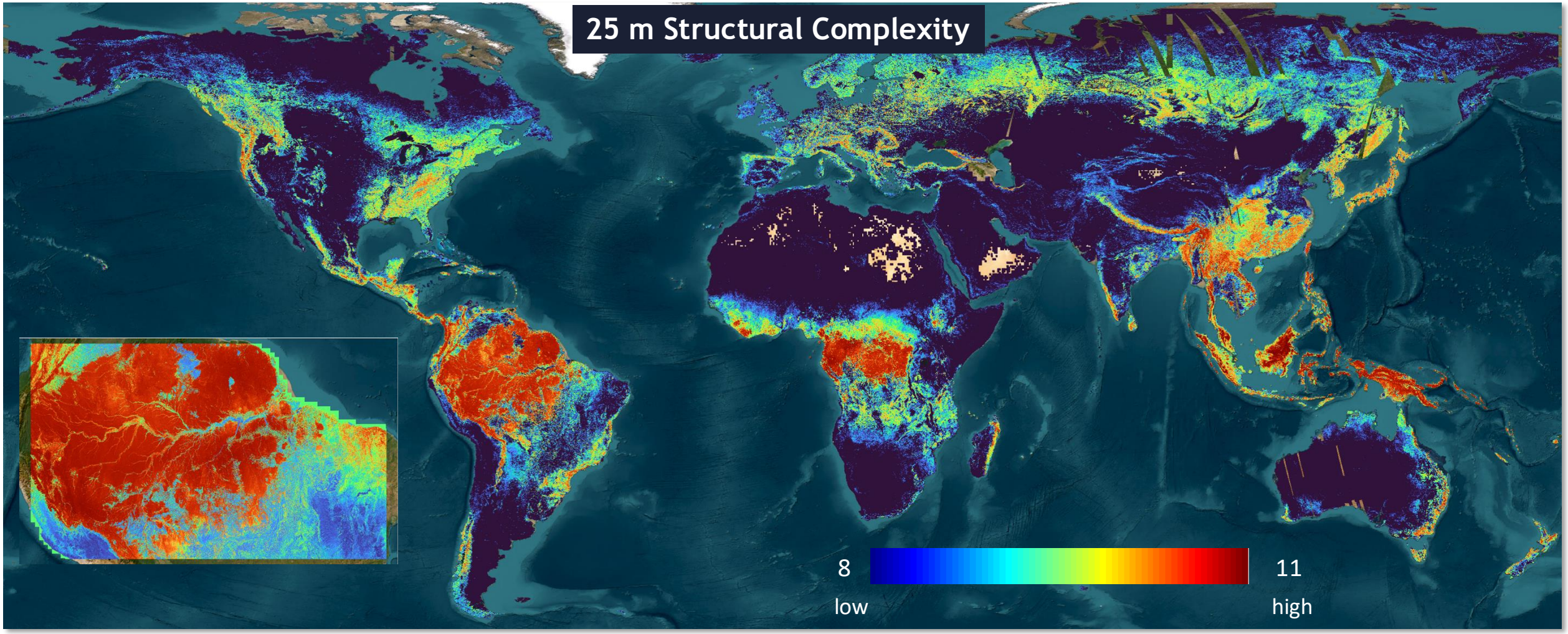
Time series, time series, time series: No other mission looks that deep into ecosystems (L-band canopy penetration) at such temporal frequency. NISAR will provide an invaluable and novel data set to study habitat dynamics when we are sensitive to vegetation structure and moisture (soil and vegetation) and inundation dynamics.

NISAR will collect consistent data on every orbit regardless of the conditions: "day or night, rain or shine, longitude or latitude. The collection modes are fixed to the region and will not likely change over the mission.

Given that there is a strong correlation between biodiversity and the hydrological cycle, **NISAR's longer wavelength is sensitive to the presence (and absence) of water in living materials** like trees, peatlands, and in seasonally flooding forests. Sensitive more than other technologies, such as optical data (just about all optical data) and other microwave sensors (e.g. Sentinel, and commercial X-band systems). Hence, through its consistent observations, we will have insight into this hydrologic cycle, and following, the biodiversity.

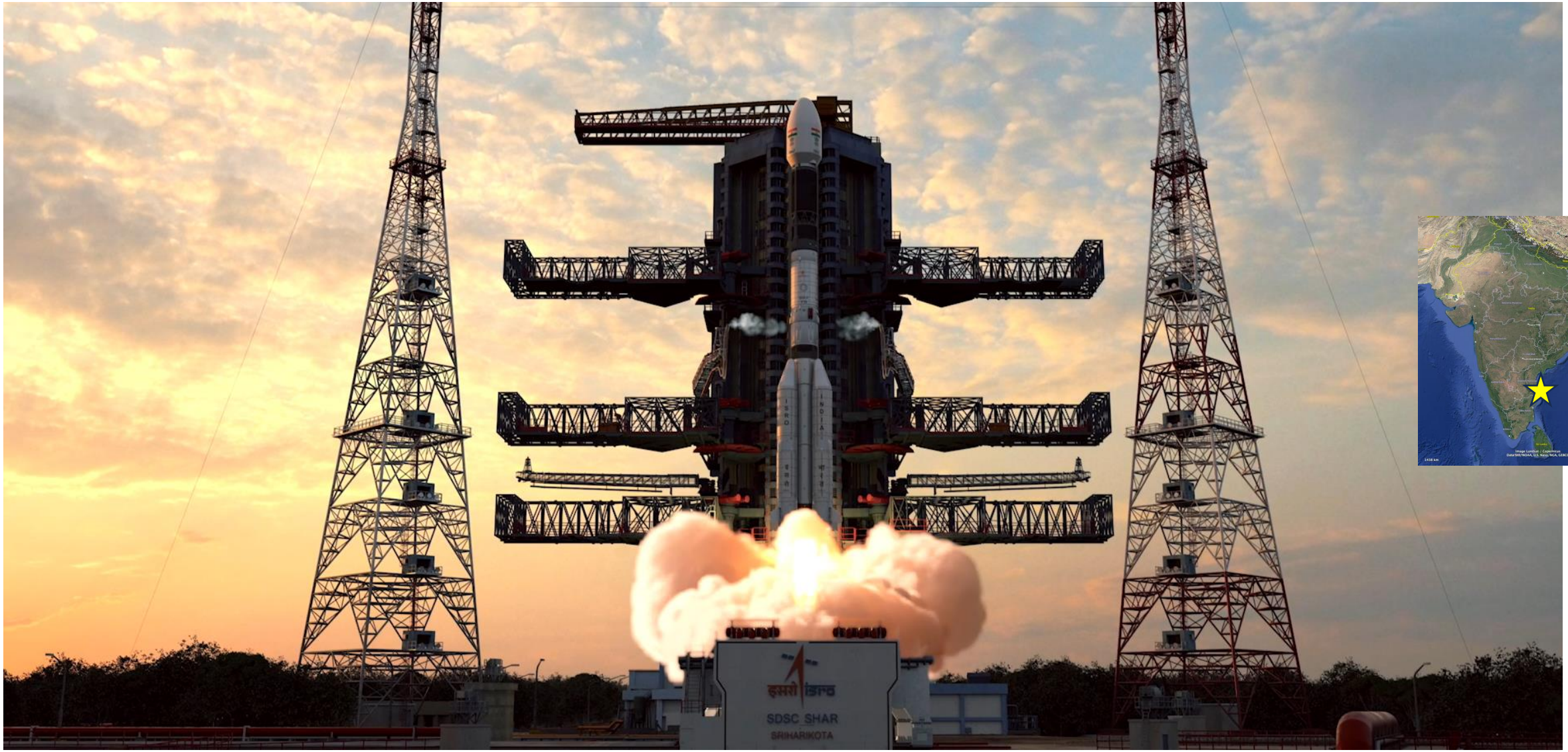
DESDynI ➔ NISAR + GEDI: Mapping vegetation structure, is critical for biodiversity, especially for large animals, like birds and other woodland creatures. This is because they use the forests as habitats for sustenance, water and protection. Mapping where such habitats are, characterizing them and monitoring them over time will help us better understand their role in preserving biodiversity.

NISAR will Resolve Structural Complexity at High Spatiotemporal Resolution



Credit Ralph Dubayah

The NISAR Mission Is Ready to Launch from India this Summer



Thank You

Community of Practice & Early Adopters

Community of Practice
Anyone interested in NISAR

Early Adopters (Science or Applications)
Individuals, teams, and organizations who

- have a clearly defined need for NISAR data
- have an existing application that can benefit from NISAR

Early Adopters provide important feedback to the NISAR team.

Apply Here!

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

More on NISAR@
https://nisar.jpl.nasa.gov

Dr. Gerald Bawden

Program Scientist/Manager

NISAR/SDC/UAVSAR/OASIS/

OPERA/ASF

NASA Headquarters

All NISAR data free and open
@ https://asf.alaska.edu/