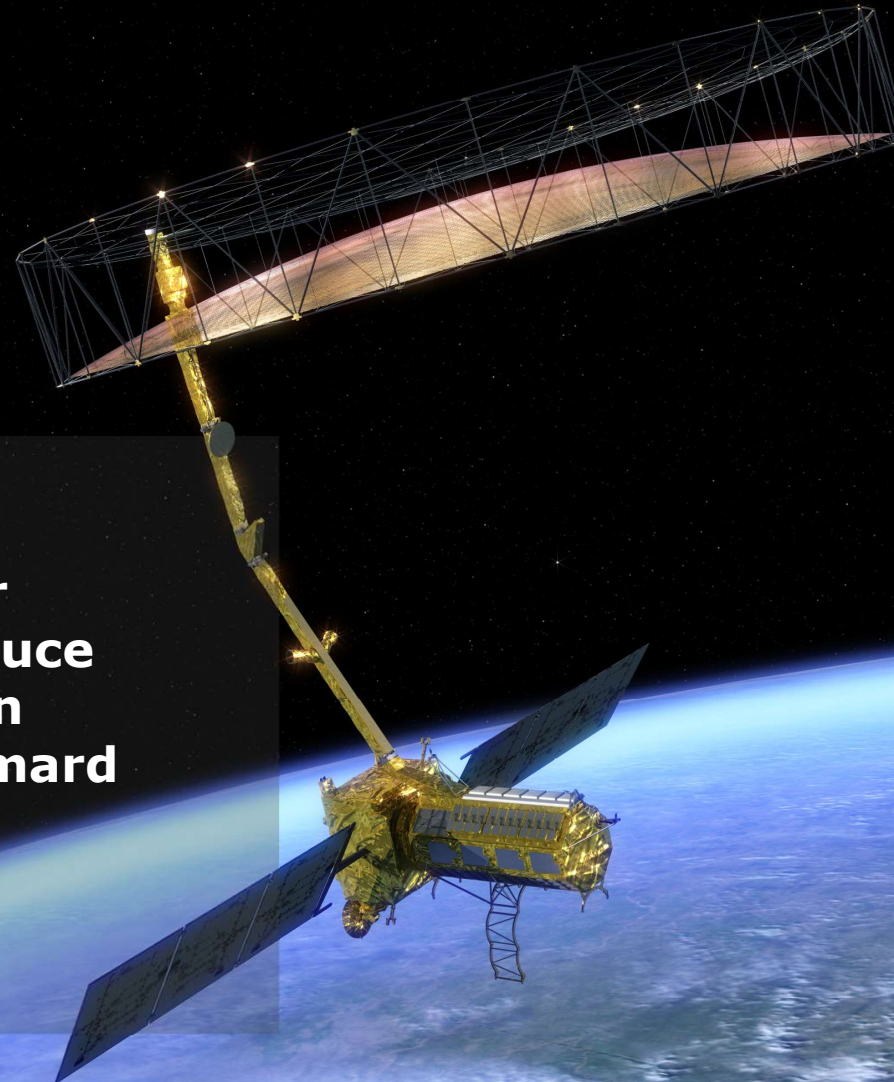


The NISAR Mission



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Quick Overview

JAXA KC25



NASA-ISRO SAR : NISAR

Partnership between NASA and ISRO

L-band and S-band SAR

Polarimetric (standard mode: HH and HV)

Bandwidth: from 5 MHz to 80 MHz

Split spectrum to correct for ionosphere

All data will be made available free and open

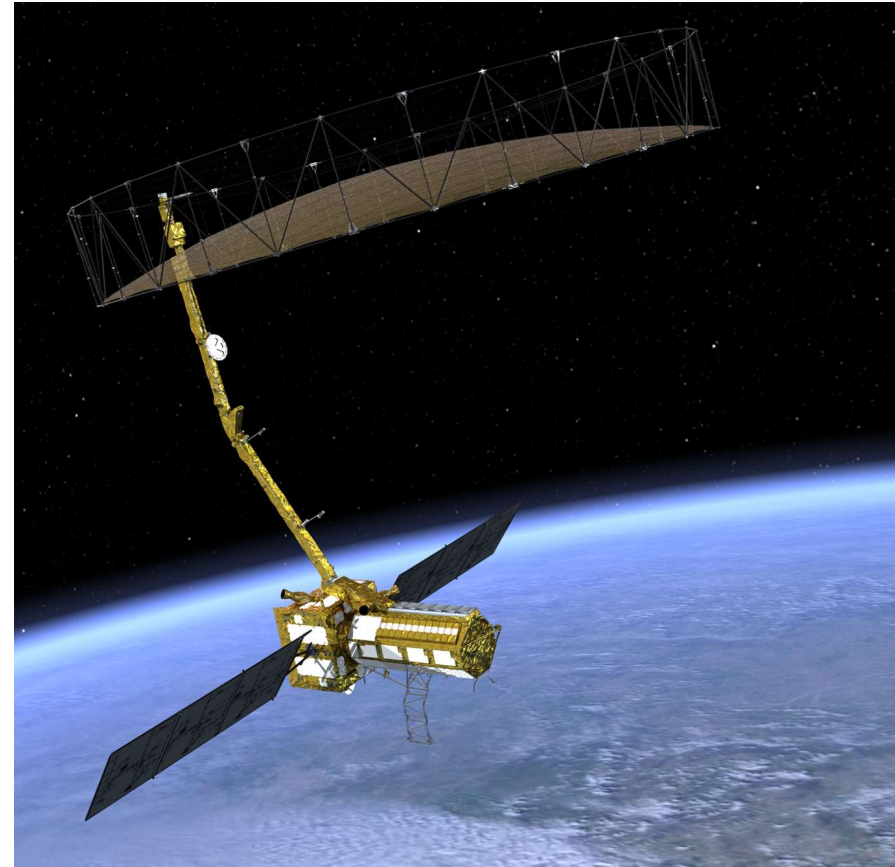
Wide swath SweepSAR mode, global coverage
at 12 day repeat

Data acquired ascending and descending

>26 Tbits/day downlink

Launch December 2011/January 2022

Visit nisar.jpl.nasa.gov for more information





NISAR Mission at a glance

- Four Level-1 Disciplines
 - *Ecosystems*, • *Ice Sheets*, • *Solid Earth Dynamics*, • *Applications*
- Left-looking only mission
- 240 km swath using SweepSAR
- Dominant observing mode is L-band dual-pol, 10 m resolution
- 26Tbits/day data downlink, enables up to 100TB/day science data volume

- NISAR is a requirements driven mission.
- NISAR repeat-observations used to reduce soil moisture and speckle effects in the data.





Level 1 Science Requirements Need to be met to

Measure time-varying displacements over Earth's land and ice-covered surfaces with an average sampling capability of 6 days at 100-m scale; displacement error shall be less than 20 mm over any 12-day interval.

Measure sea ice velocities on a 5 km grid every 3 days for both Arctic and Antarctic sea-ice cover; velocity error shall be less than 100 m/day.

Measure time-varying displacements over Earth's land and ice-covered surfaces with an average sampling capability of 6 days at 100-m scale; displacement error shall be less than 20 mm over any 12-day interval.

Map aboveground woody vegetation biomass and its disturbance and recovery globally at the hectare scale with an accuracy of 20 Mg/ha for areas of biomass less than 100 Mg/ha.

Seasonally map global cropland and inundated areas with a classification accuracy of 80% at hectare scale.

In support of response to major natural or anthropogenic disasters, the mission system shall be capable of scheduling a new acquisition within 24 (TBR) hours of the event and delivering data within 5 (TBR) hours of being collected.





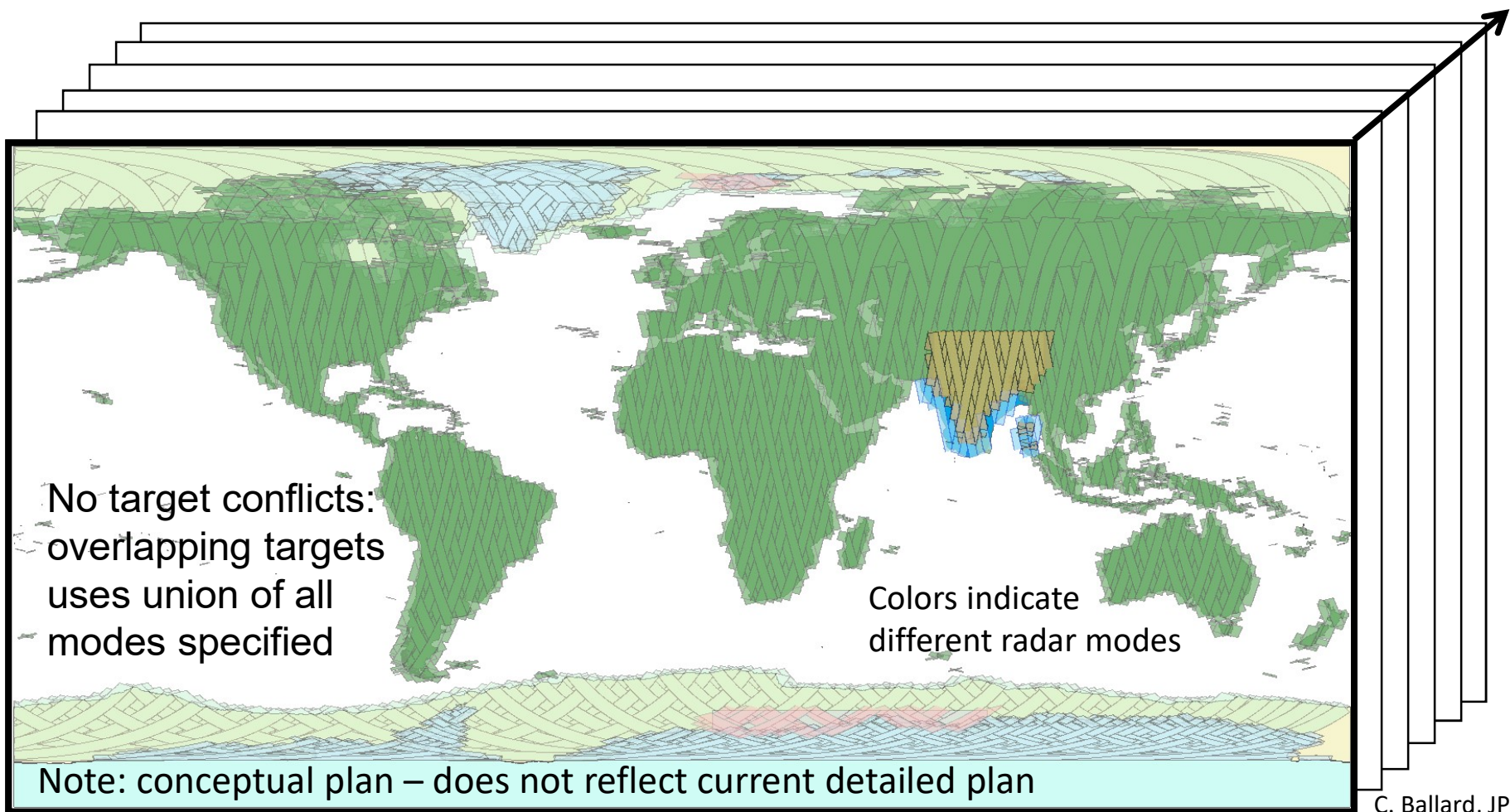
Level 2 Science Requirements

Requirement	Baseline Mission					
	2-D Solid Earth Displacement	2-D ice Sheet & Glacier Displacement	Sea Ice Velocity	Biomass	Disturbance	Crop, inundation area
Resolution	100m	100 m	5km grid	1 ha	1 ha	1 ha
Accuracy	3.5 (1+SQRT(L)) mm or better, 0.1 km < L < 50 km, over 70% of areas of interest	100 mm or better over 70% of fundamental sampling intervals	<100 m/day over 70% of areas	20 Mg/Ha for areas of biomass < 100 Mg/ha	80% for areas losing > 50% canopy cover	80% classification accuracy
Sampling interval	12 days or better, over 80% of all intervals, < 60 day gap over mission	12 days or better	3 days, Arctic and Antarctic	Annually	Annually	12 days
Coverage	Land areas predicted to move faster than 1 mm/yr, volcanoes, reservoirs, glacial rebound, landslides	Global ice sheets and glaciers	Arctic and Antarctic sea ice	Global areas of woody biomass cover	Global areas of woody biomass cover	Global areas of crops and wetlands
Duration	36 months	36 months	36 months	36 months	36 months	36 months





NISAR Systematic Observations Designed to Capture Earth's Dynamics

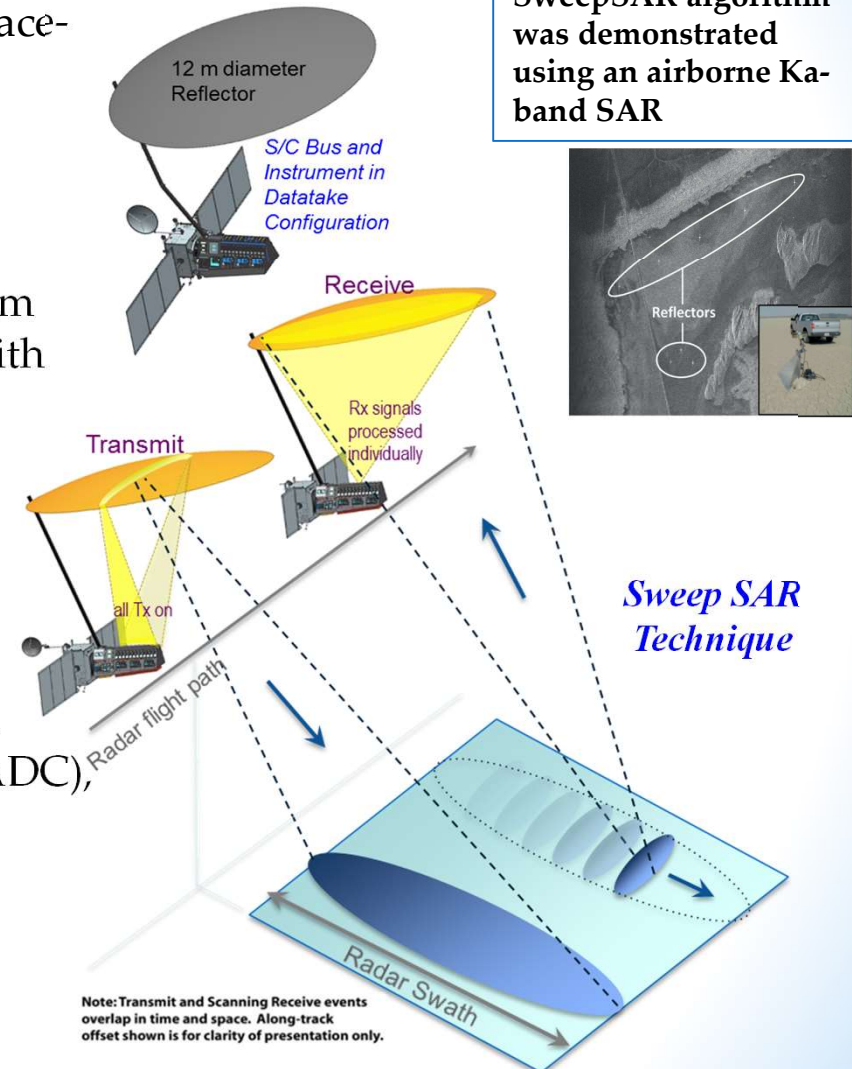


12-day regular sampling on ascending and descending to the extent possible



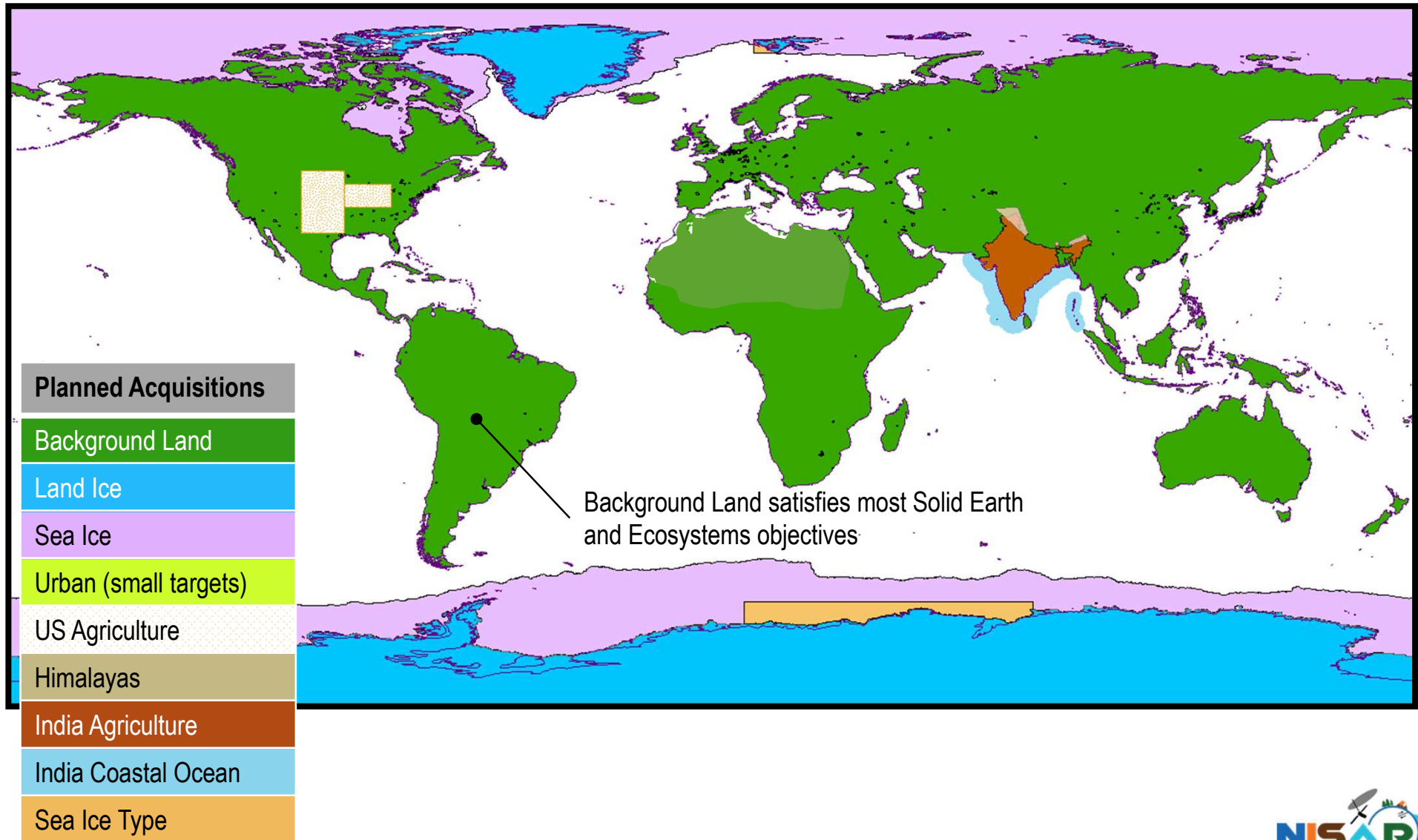
Radar Payload Concept

- World's first dual frequency (L- and S- band) spaceborne SweepSAR
- Repeat pass interferometry
- Fully polarimetric SAR capability
- Array-fed reflector (boresight at ~37 degrees from nadir, transmitting a fan beam, and receiving with multiple pencil beams)
 - Shared reflector for both L- and S-bands
 - Separate L- and S-band feeds
 - Incidence angles: 30 – 42 degrees
- Observatory pointing control +/- 273 arcsec
- Active front-end electronics, high efficiency T/R module, high rate analog-to-digital converter (ADC), and on-board processing



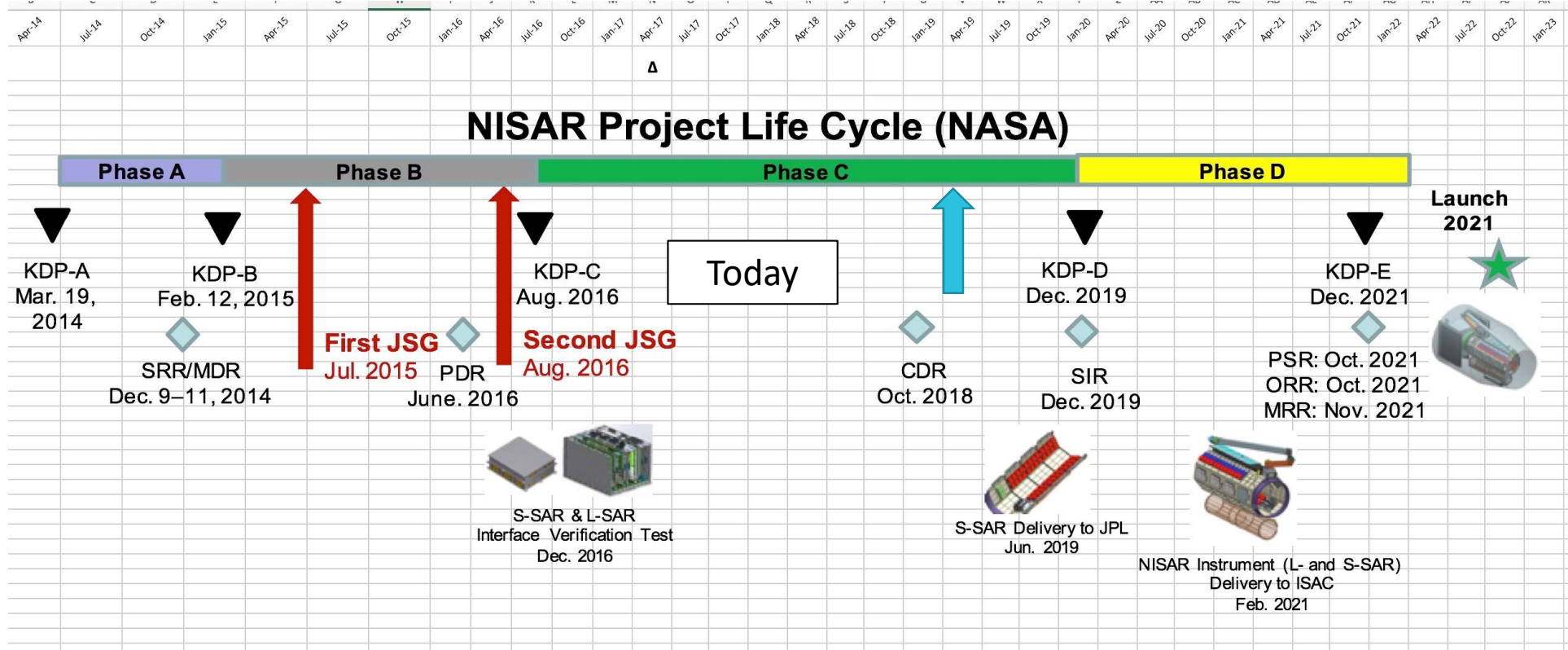


Mode-Specific Science Targets in Observation Plan





Individual Activity & Timeline

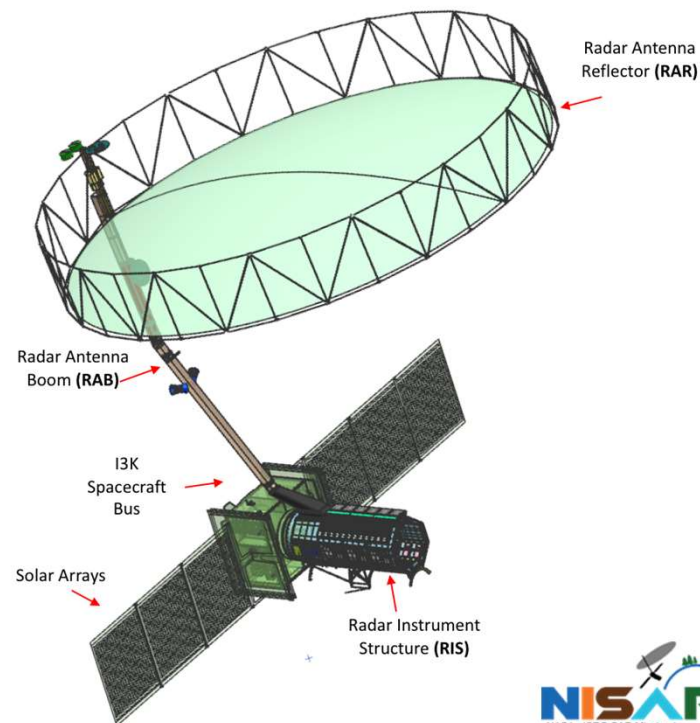
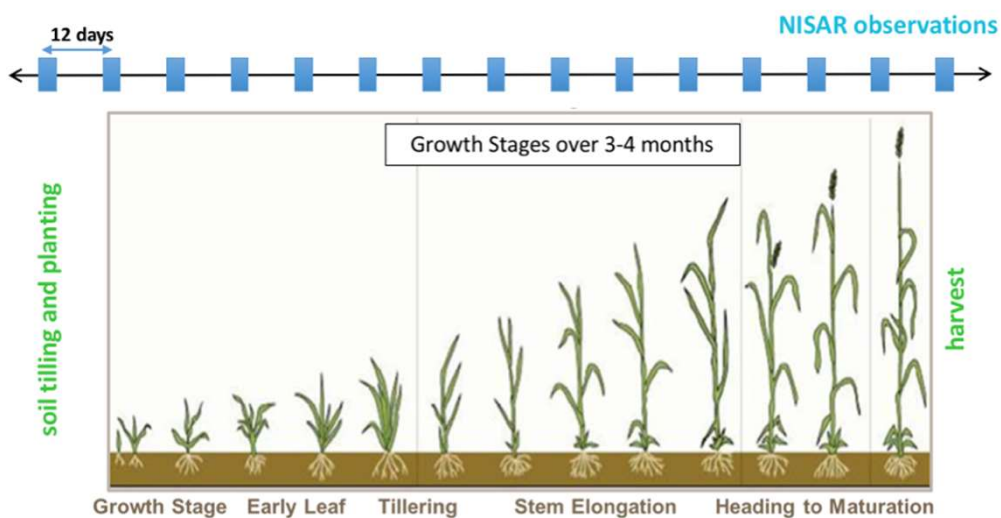


NISAR Development: Ecosystems

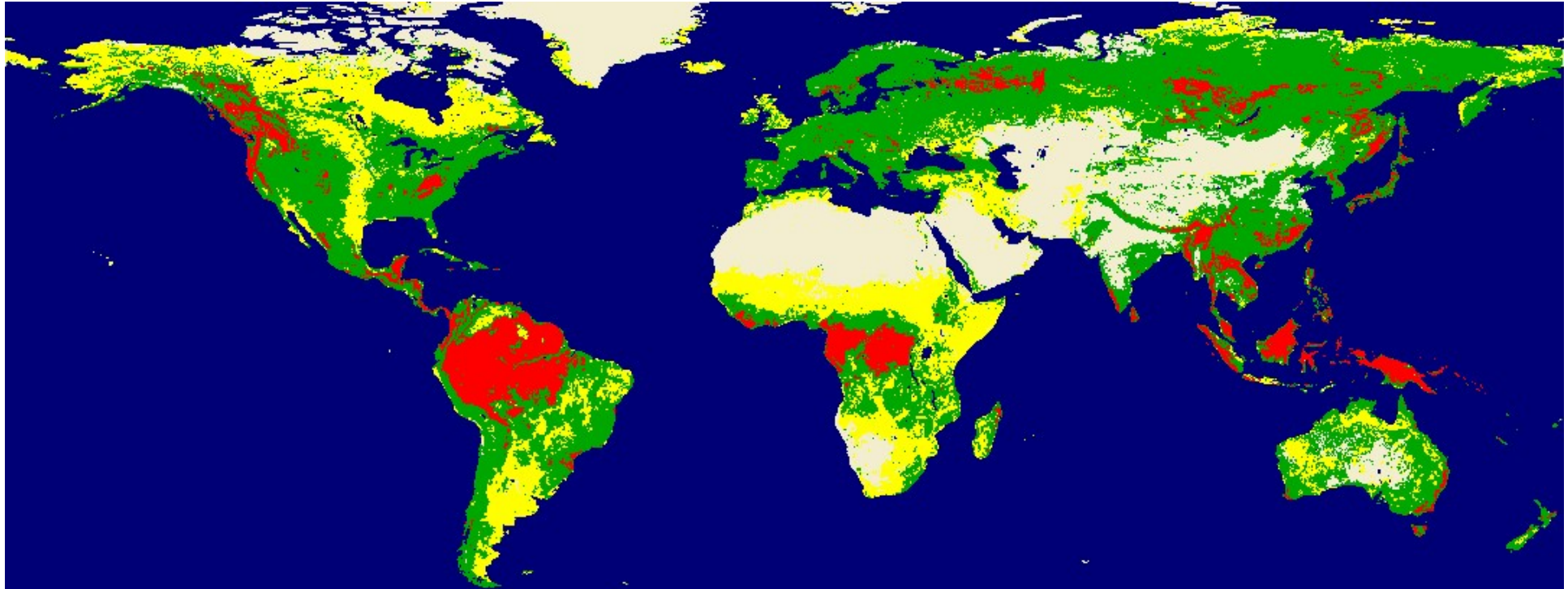
- Biomass
- Disturbance
- Inundation
- Agriculture



Dense-time series of L-band data (dual-pol)



NISAR Biomass areas (< 100 tons/ha)



The global distribution of regions dominated by with woody biomass < 100 Mg/ha



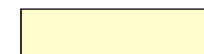
Regions with
AGB < 100 Mg/ha
50% of area



Regions with
AGB > 100 Mg/ha
50% of area



Regions with
AGB < 20 Mg/ha
50% of area



Regions with
No woody
vegetation



Open
Water

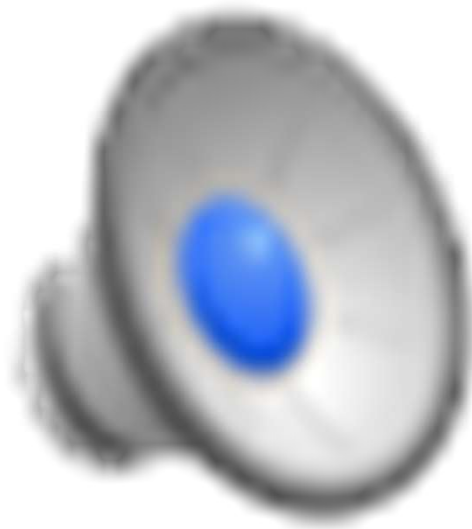




Disturbance Monitoring with Time Series

Time Steps
0 2006-12-04
1 2007-01-19
2 2007-03-06
3 2007-07-22
4 2007-10-22
5 2008-01-22
6 2008-03-08
7 2008-04-23
8 2008-06-08
9 2008-07-24
10 2008-09-08
11 2008-10-24
12 2009-01-24
13 2009-03-11
14 2009-07-27
15 2009-09-11
16 2009-10-27
17 2010-03-14
18 2010-04-29
19 2010-06-14
20 2010-07-30
21 2010-09-14
22 2010-12-15
23 2011-01-30
24 2011-03-17

L-Band HH Backscatter



Cerrado Area, Brazil
ALOS PALSAR DATA from
2006 to 2011



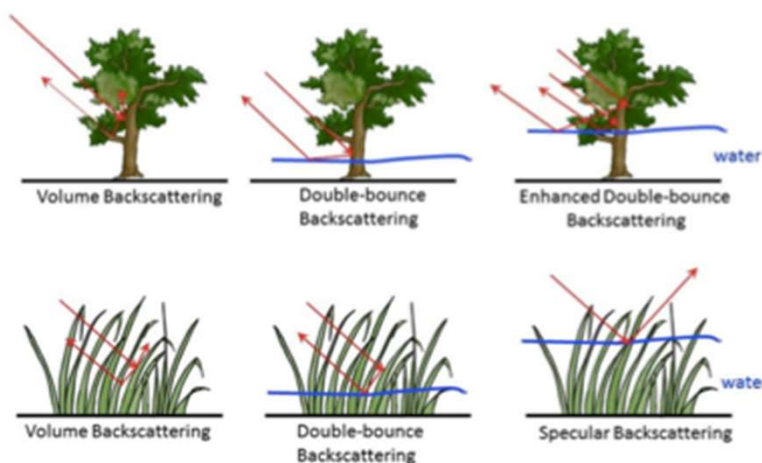
Abrupt drop in
Backscatter

Gradual drop in
Backscatter

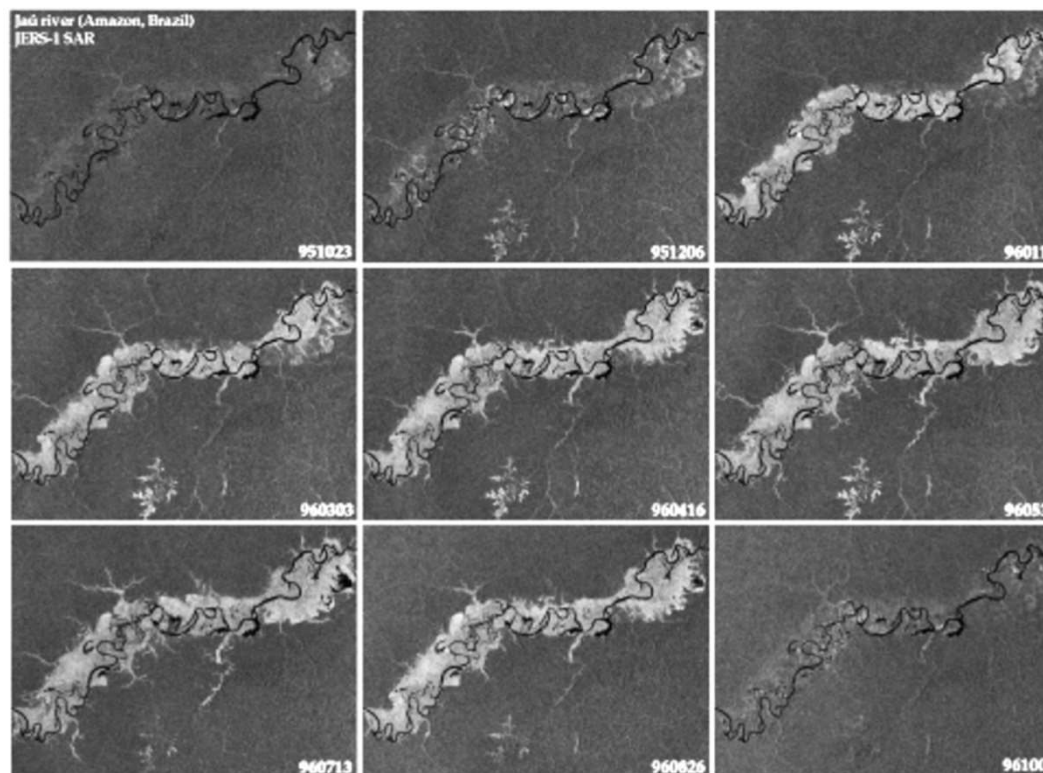
Periodic patterns from
seasonal flooding



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



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



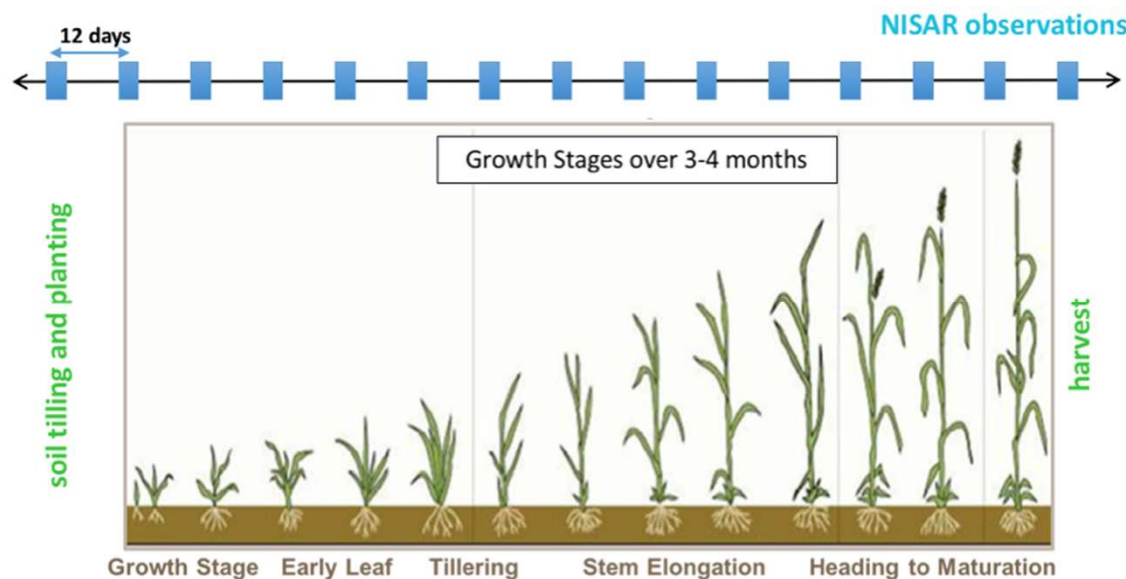
- Existing L-band SAR satellites have limited coverage and observations to accurately capture the spatial extent and temporal variations of inundation over wetlands.
- NISAR plans to acquire minimum of dual-pol data globally over all wetlands twice per 12 day orbit cycle will contribute significantly to understanding wetland hydrology and the impacts of climate variations

Rosenqvist et al, 1998.

Monitoring Global Crop Area

NISAR frequent L-band & S-band SAR observations and spatial resolution will allow monitoring crop areas globally

- Crops cover 11% of the Earth's land surfaces and are expanding regionally in response to climate change and food security.
- Identification of crop area is a precursor to crop classification and allows basic monitoring of agricultural resources and outputs.
- Changes in observed radar backscatter from NISAR time series data throughout the growing season is an indicator of active landcover management & crop area.



L-band Observation of Croplands





Take Home Messages

- NISAR will collect 30-60 dual-pol images per year over most land surfaces
- Ecosystems are driven by the hydrologic cycle.
 - In terms of biomass, disturbance and agricultural area, this is the dominant source of error
- NISAR Ecosystems benefits greatly by field campaigns and cal/val sites that monitor soil moisture, vegetation condition, and biomass
- NISAR is set to launch in late 2021/early 2022. Data to be distributed freely
- Currently developing plans for
 - Cal/Val
 - Algorithm Theoretical Basis Documents (ATBDs)
- NISAR is developing partners for cal/val



NEWS IN FOCUS



JASON EDWARDS

Antarctica's vast ice sheet and surrounding sea ice will be monitored by the NISAR satellite.

EARTH SCIENCE

Arctic scientists iced out by radar mission

US-India satellite will focus on the Antarctic, upsetting some researchers who study northern ice.

NISAR makes news in Nature magazine!
Hot off the press: [February 7, 2019](#)

Article is about NISAR being a left-looking only mission

Q: is all publicity, good publicity?
A: article is less critical than its title let's on.

BY ALEXANDRA WITZE

18 | NATURE | VOL 566 | 7 FEBRUARY 2019





Science User's Handbook



- Comprehensive Document completed to describe Mission, Science Objectives, ATBDs, and Cal/Val Plan
- Obtain at <http://nisar.jpl.nasa.gov>





Questions?

