The NISAR Mission Overview

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ber 2017, GlobBiomass Meeting

A NASA-ISRO SAR Mission Concept Inspired by the Decadal Survey

NASA-ISRO SAR mission concept
esses a broad range of US science and
cations objectives assigned in the 2007
dal Survey to the Tier 1 DESDynI Mission
nission is now a partnership between
A and ISRO, with many exciting “firsts”:
al-Frequency (L- and S-band) free-flyer
precedented coverage, resolution, and
mpling in time
w SAR technology to realize wide swath
O agreement to open data policy
jor mission-level, balanced, NASA-ISRO
tnership

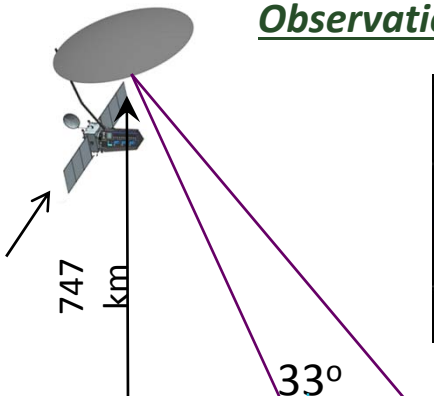
NISAR Concept Science Observation Overview

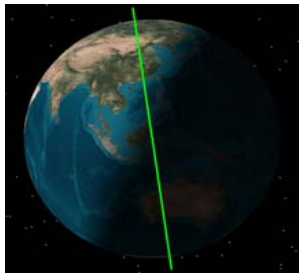
haracteristic:	Would Enable:
24 cm wavelength)	Low temporal decorrelation and foliage penetration
12 cm wavelength)	Sensitivity to light vegetation
AR technique with Swath > 240 km	Global data collection
try Dual/Quad)	Surface characterization and biomass estimation
xact repeat	Rapid Sampling
eters mode- nt SAR resolution	Small-scale observations
cience operations consumables)	Time-series analysis
control < 273 ds	Deformation interferometry
ntrol < 500 meters	Deformation interferometry
bservation duty	Complete land/ice coverage

NISAR Would Uniquely Capture the Earth in Motion




Observation Geometry



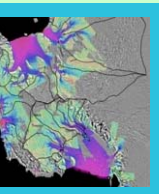


6 AM / 6 PM

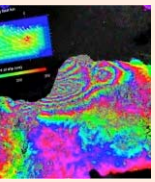
NISAR Mission Science Data Flow

sion Science

rbance; effects of
ate on habitats and CO_2

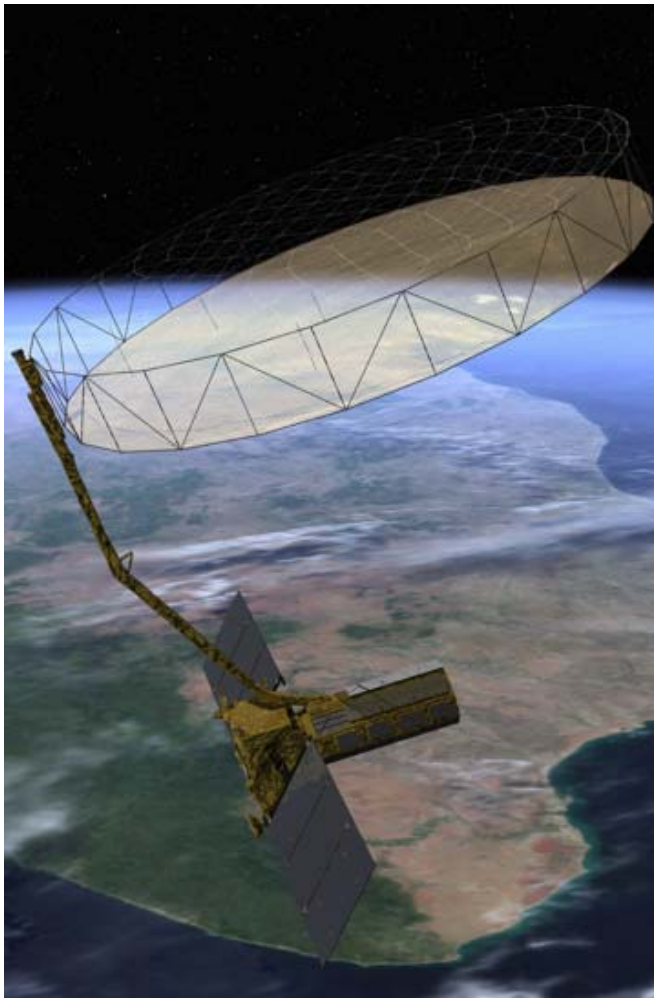


ickness; response of
climate change and sea

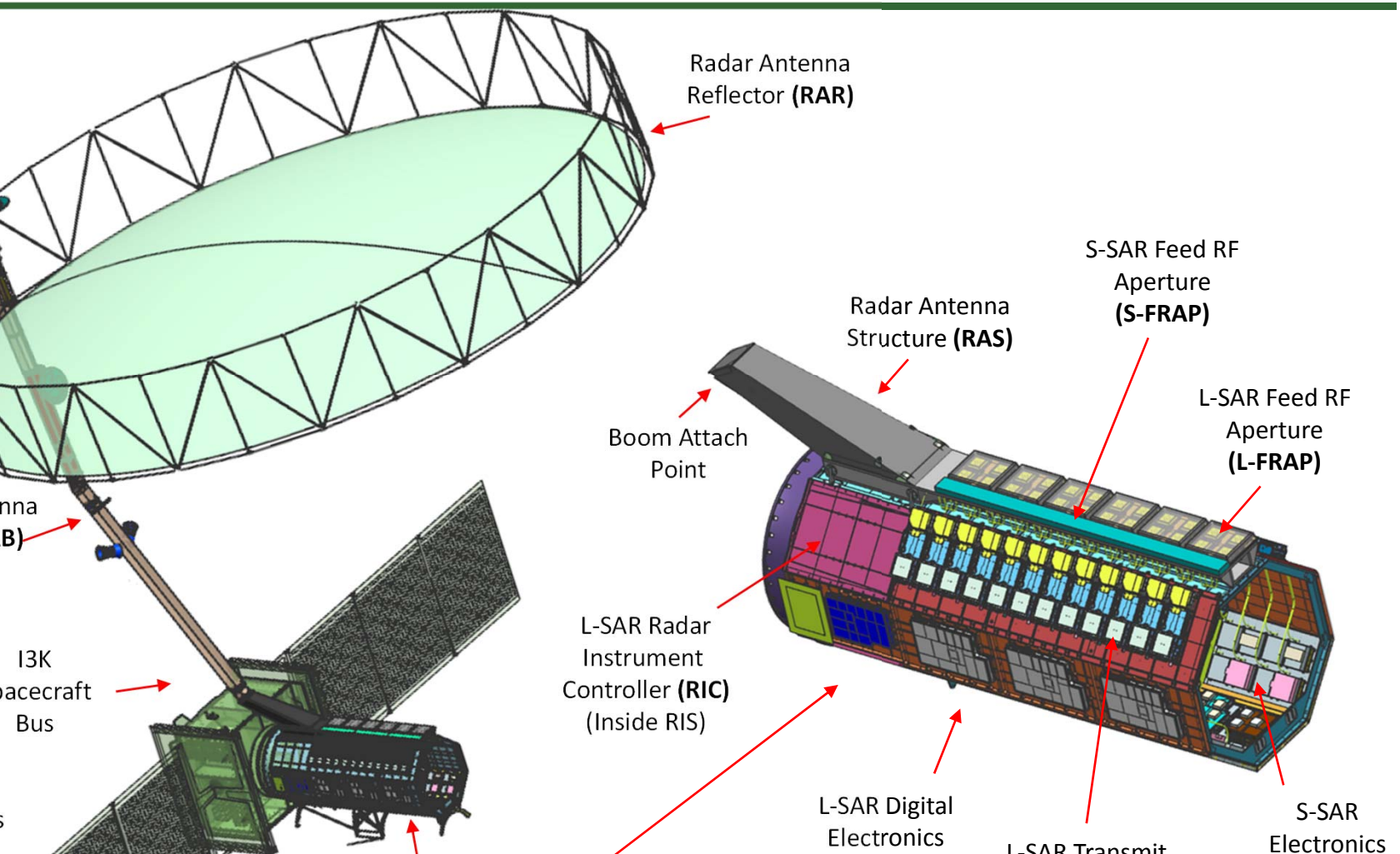


mation; geo-hazards;
e management

- Baseline launch date: No earlier than December 2020
- Prime Responisbilities
  - L-Band: JPL/Alaska Satellite Facility
  - S-Band: ISRO
- NASA 3.5 Gbps Ka-band telecom system to polar ground stations **(> 24 Tbits/day** downlink capability)
- Pushing 100TB/day science data
- 3 years science operations (5+ years consumables)
- All science data (L- and S-band) will be made available free and open, consistent with the long-standing NASA Earth Science open data policy



Instrument Physical Layout



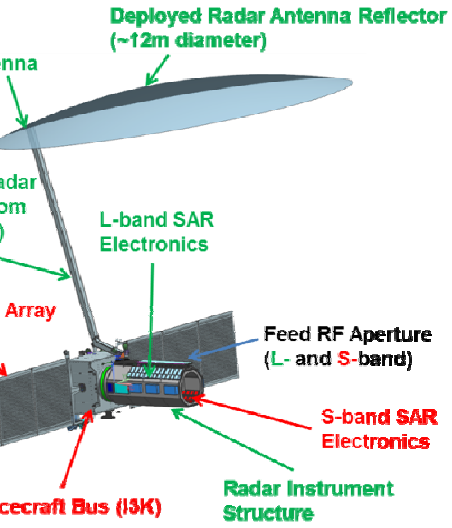
NISAR Science Team
Pre and Post April 2016

ember	Affiliation in 2016	Area*	2012-2016	2016-2019
elung	University of Miami	SE/AT		Member
Bawden**	NASA	SE/HY	Member	
Borsa	Scripps Institution of Oceanography	SE/HY		Member
hapman	Jet Propulsion Laboratory	EC		Member
ubayah	University of Maryland	EC	Lead	
gl	University of Wisconsin	SE	Member	
ding	Jet Propulsion Laboratory	SE		Member
Forster	University of Utah	CR		Member
d H. Hager	Massachusetts Institute of Technology	SE	Lead	Member
n Holt	Jet Propulsion Laboratory	CR	Member	Member
n Jones	Jet Propulsion Laboratory	AP		Lead
hin	University of Washington, Applied Physics Laboratory	CR	Lead	Lead
llndorfer	WHRC / Earth Big Data LLC (from 2016)	EC/AP	Member	Member
Lohman	Cornell University	SE		Member
u	Southern Methodist University	SE	Member	Member
Monaldo	National Oceanic and Atmospheric Administration	CR/OC		Member
eyer	University of Alaska, Fairbanks	CR/AP	Member	Member
w Pritchard	Cornell University	SE	Member	
hot	University of California, Irvine	CR	Member	Member
Saatchi	Jet Propulsion Laboratory	EC	Member	Member
mard	Jet Propulsion Laboratory	EC		Member
mons	California Institute of Technology	SE/AP	Member	Lead
ueira	University of Massachusetts, Amherst	EC	Member	Lead

NISAR Instrument Housing

NISAR Concept Observatory & Work Share

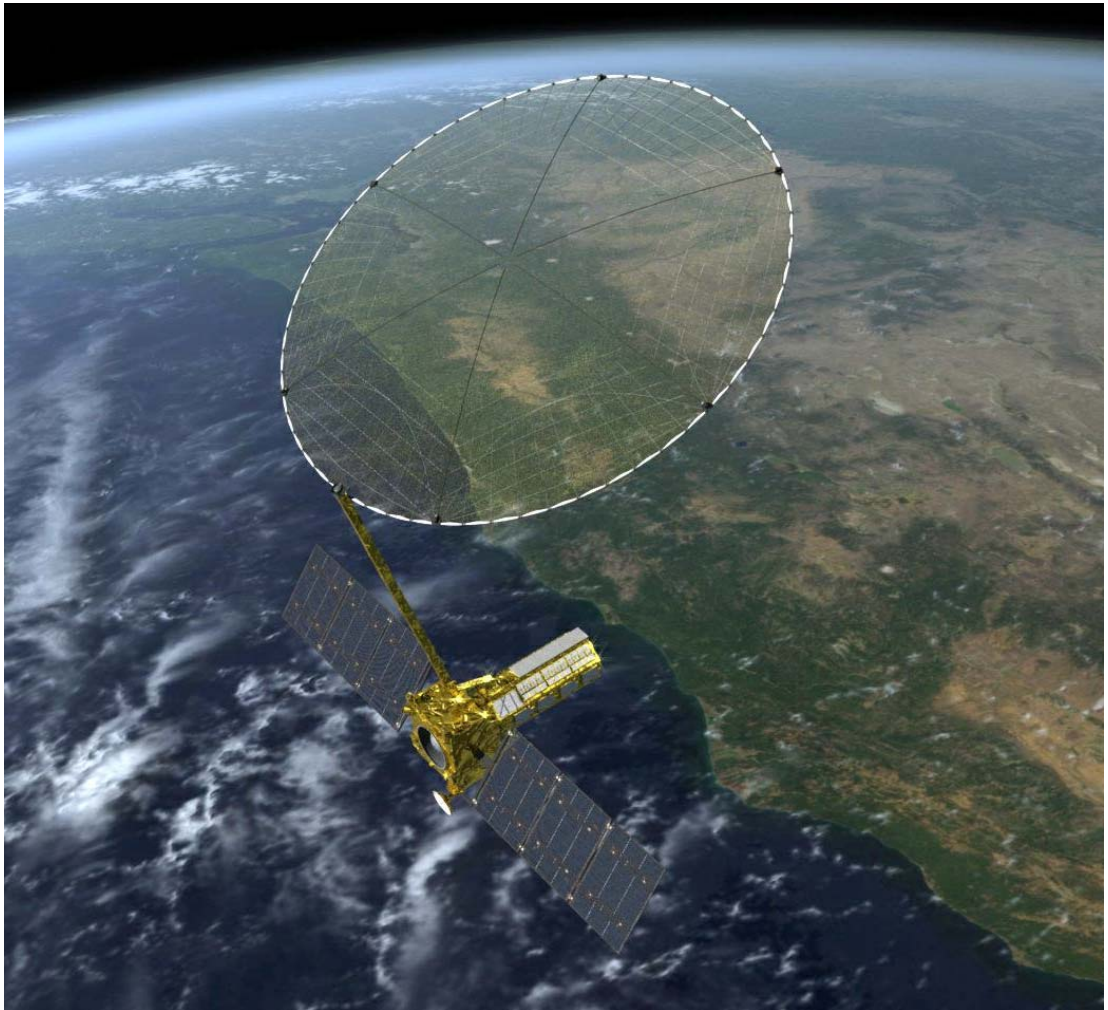
On-Orbit Configuration



GSLV Mark-II

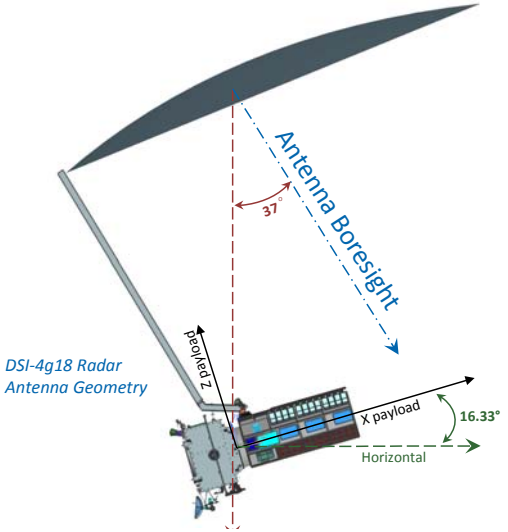
ISRO

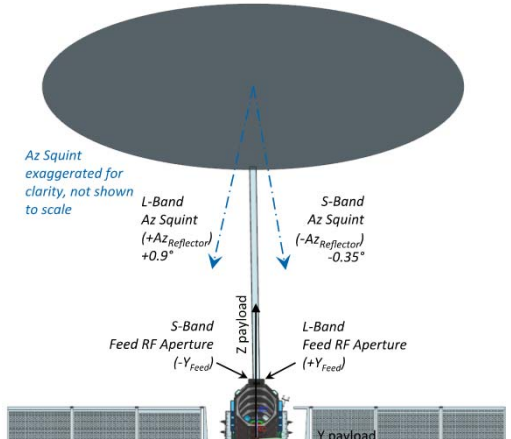
NASA



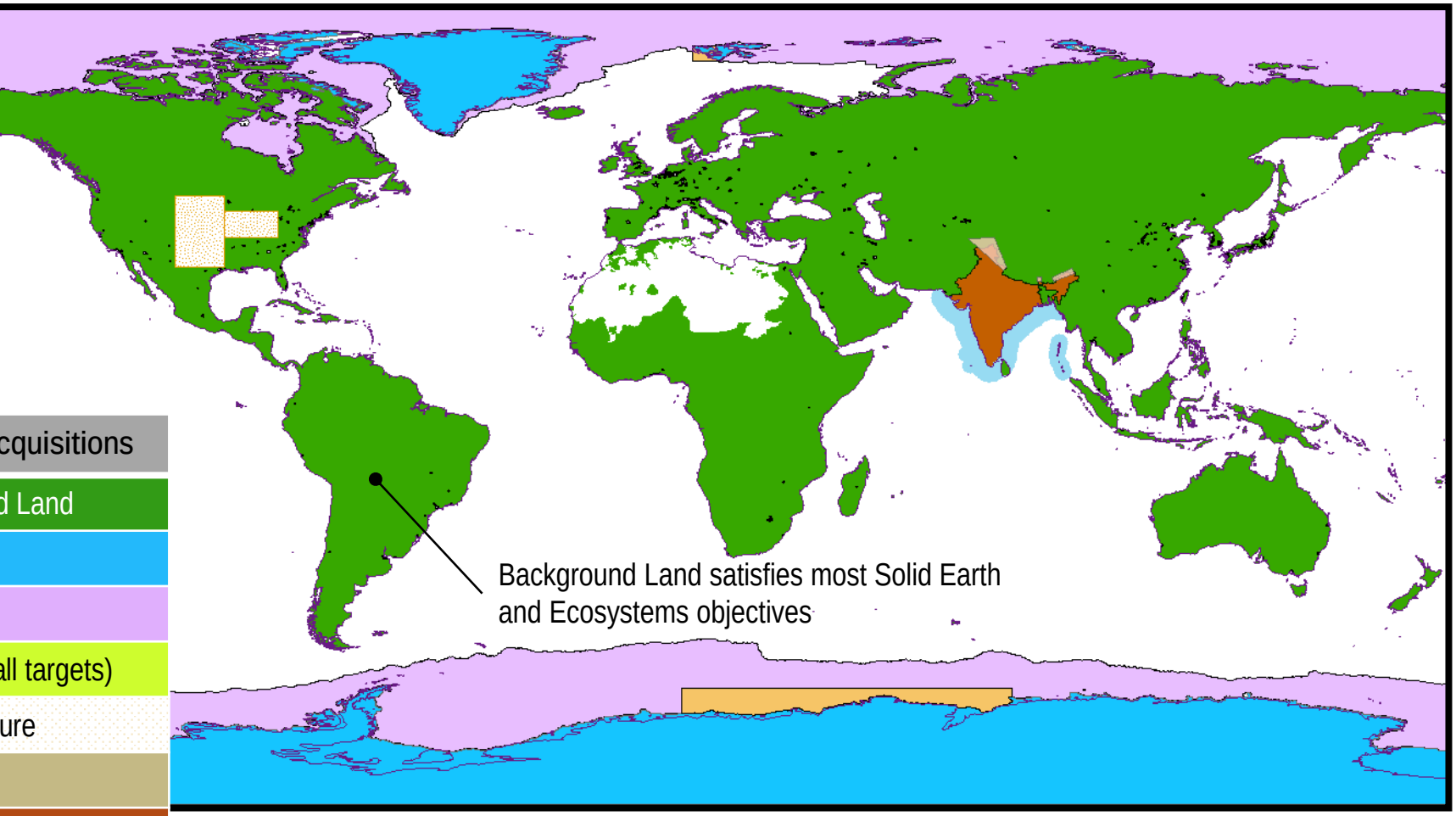
L-SAR Instrument Features

- looking L-band Synthetic Aperture Radar
- rimetry for classification and Biomass
- eat pass interferometer for deformation
- ght Orbit and Pointing Control
- ght phase stability over imaging time
- Spectrum for ionosphere mitigation
- i-beam Array fed Reflector to achieve a 240 swath
- weepSAR timing and Digital Beam Forming to duce ambiguities and preserve resolution / looks
- Dithering to fill transmit interference gaps
- mless mode transitions to minimize data loss





Proposed NISAR
Mode-Specific Science Targets in Observation Plan



- Each colored region represents a single radar mode chosen to

Proposed NISAR Science Observing/Operations Modes
Blanket Land and Ice Coverage Every 12 Days

ervation strategy employs a small subset of possible modes

vation Strategy	L-band		S-band		Culling Approach	
e Target	Mode+	Resolution	Mode	Resol.	Sampling	Desc Asc
ound Land	DP HH/HV	12 m x 8 m			cull by lat	
e	SP HH	3 m x 8 m			cull by lat	
e Dynamics	SP VV	48 m x 8 m			s = 1 p	
Areas		6 m x 8 m			s = 1 p	
iculture	QP HH/HV VV/VH				s = 1 p	
yas			CP RH/RV		s = 1 p	
griculture					s = 1 p	
oastal Ocean			DP HH/HV or VV/VH		s = 1 p	

NISAR Ecosystem Science requirements that must be quantitatively validated over Cal/Val sites

NISAR project shall measure aboveground woody vegetation biomass ually at the hectare scale (1 ha) to an RMS accuracy of 20 Mg/ha for of areas of biomass less than 100 Mg/ha.

NISAR project shall measure global areas of vegetation disturbance at ctare resolution annually for areas losing at least 50% canopy cover a classification accuracy of 80%.

NISAR project shall measure inundation extent within inland and stal wetlands areas at a resolution of 1 hectare every 12 days with a sification accuracy of 80%.

NISAR project shall measure crop area at 1 hectare resolution every 3 ths with a classification accuracy of 80%.

Possible objectives of a Cal/Val element

rdinate systematic ecosystem observations for validation of space-
e science requirements

milar to groups dedicated to Cal/Val of space-borne remote sensing instrument
rformance, but focused on validation of ecosystem science products derived
m remote sensing data

omote systematic standards for field data collections

omote free and unrestricted distribution of field data (or sharing mechanisms)

ordinate between space/science agencies and flight projects the locations of
presentative and shared Cal/Val sites

ordinate validation activities at globally distributed Cal/Val sites

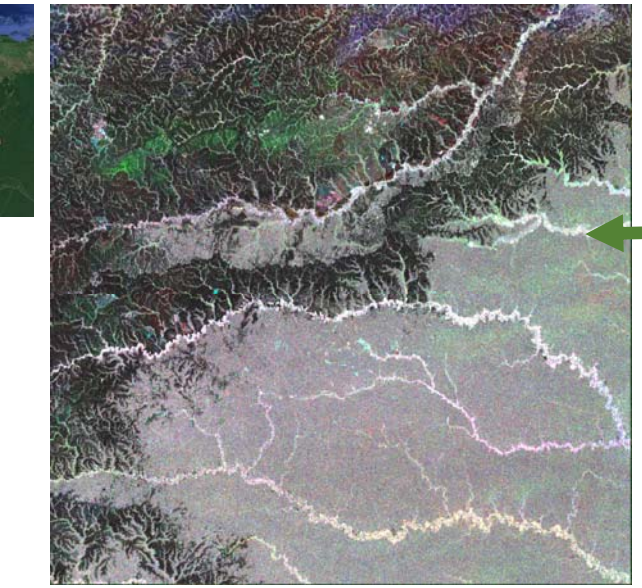
ordinate between space agencies and flight projects the collection of
osystem-related in-situ field measurements, airborne remote sensing data and
ace-borne remote sensing data at Cal/Val sites.

omote long term ecosystem monitoring at Cal/Val sites

cilitate collaboration through an international joint effort coordinating
osystem Cal/Val activities

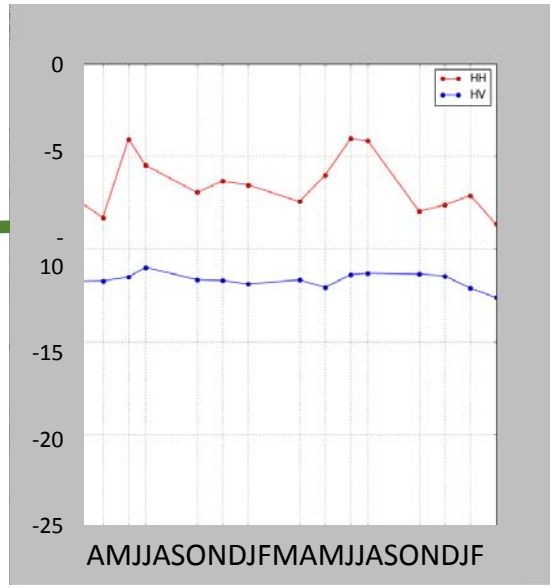
Riparian Flooding from ALOS-2 L-Band ScanSAR

RGB 07-Jul-15 / -3-Jul-16 / 31-Jul-16



Backscatter Temporal Signal

12-Apr-15 to 26-Feb-2017

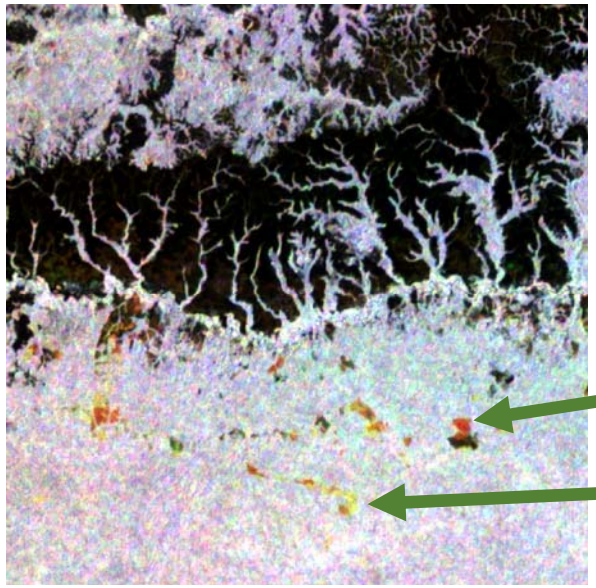


ALOS-2 ScanSAR 1degree tile N04W072 (upper left corner)

ogging Detection from ALOS-2 L-Band ScanSAR

GB 24-May-15 / 10-Apr-16 / 26-Feb-17

L-HV



Backscatter Temporal Signal

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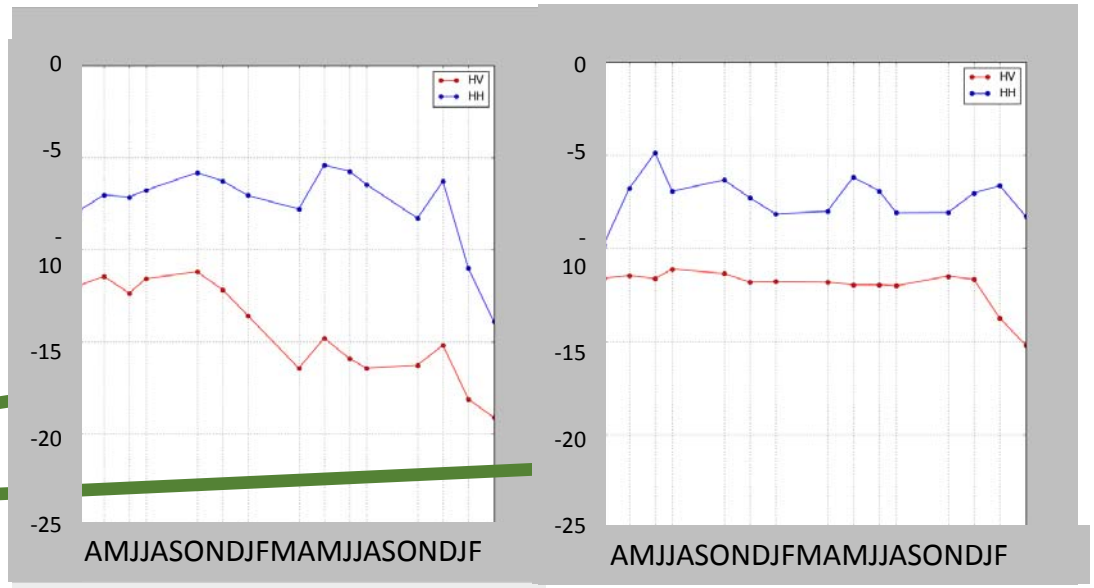

ALOS-2 ScanSAR 1degree tile N04W072 (upper left corner)

NISAR Outlook

AR passed its Program Design Review (PDR) in June 2016

AR is currently in Phase C: Subsystem developments and instrument otyping

AR will provide a rich time-series of data globally for science and ications research on land and ice

project is engaging other agencies and science constituencies to ore other possible observations and benefits (e.g. coastal oceans)

pe of high-level science products from project itself is limited – NASA ng on research community to develop products as driven by science ds

Thanks

more questions:

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