Product Delivery Report for K&C Phase 3

Bruce Chapman
Jet Propulsion Laboratory, California Institute of Technology

Science Team meeting #21 – Phase 3 Result Presentations
Kyoto Research Park, Kyoto, Japan, December 3-4, 2014

Co-investigators

- *Kyle McDonald*
- *Laura Hess*
- *Masanobu Shimada*
- *Ake Rosenqvist*
- *Ronnie Schroeder*
- *Sassan Saatchi*
- *Dan Clewey*
- *Mahta Moghaddam*
- *Thiago Silva*
- *Lisa Rebelo*
- *Bruce Forsberg*
- *Jorge Celi*

Project objectives

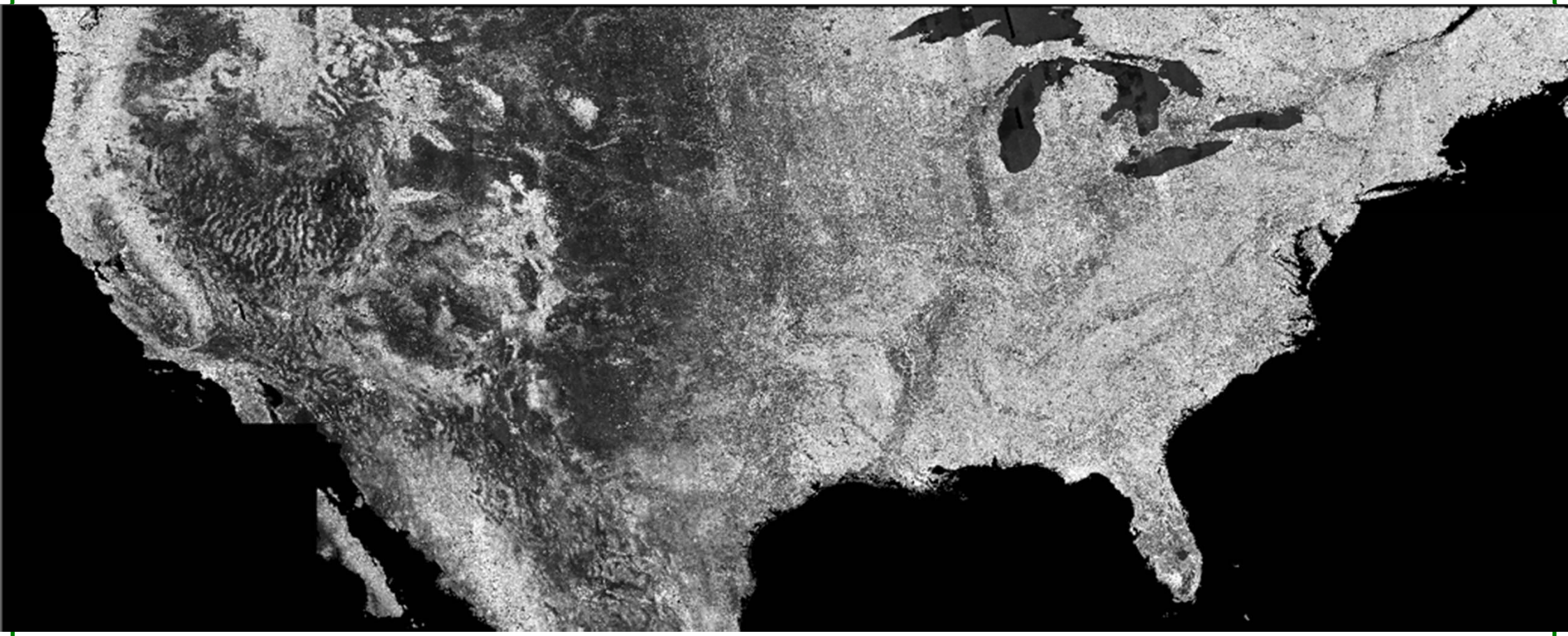
The proposed objectives:

- "..to orthorectify, calibrate and mosaic ALOS SCANSAR data. We will fill in gaps in coverage, correct calibration errors, and extend the temporal and geographic coverage of processed data…"
- Yes, data was orthorectified, calibrated and mosaicked over South America, the United States, Africa, and the USA.
- In addition, a wetlands classification for most of South America derived. Collaborators at USC produced wetlands maps of Alaska. Biomass for USA is being studied by Saatchi.

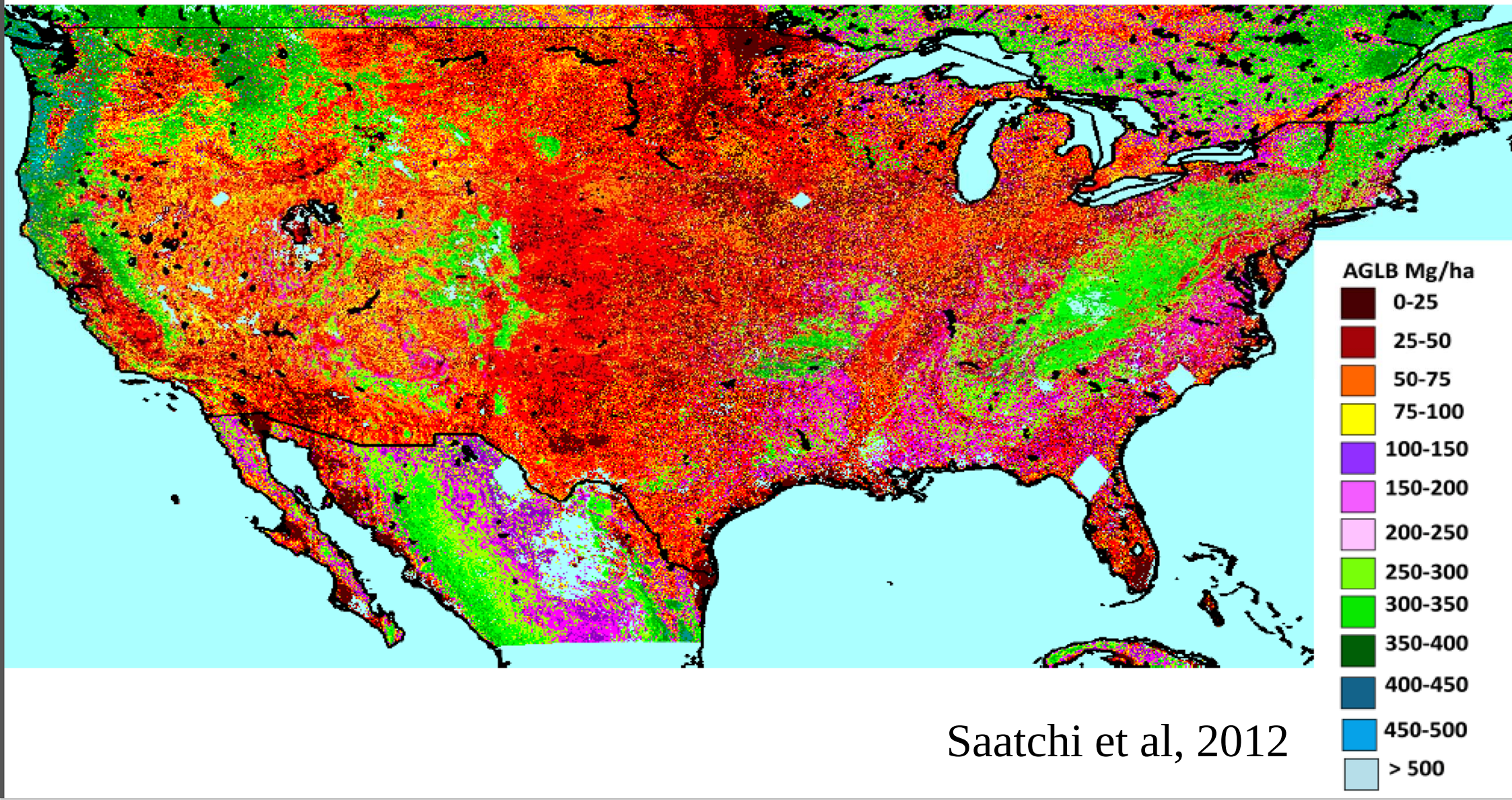
Results and significant findings

Describe project outcomes and significant findings

HH image mosaic



Preliminary Aboveground National Biomass Map



Saatchi et al, 2012

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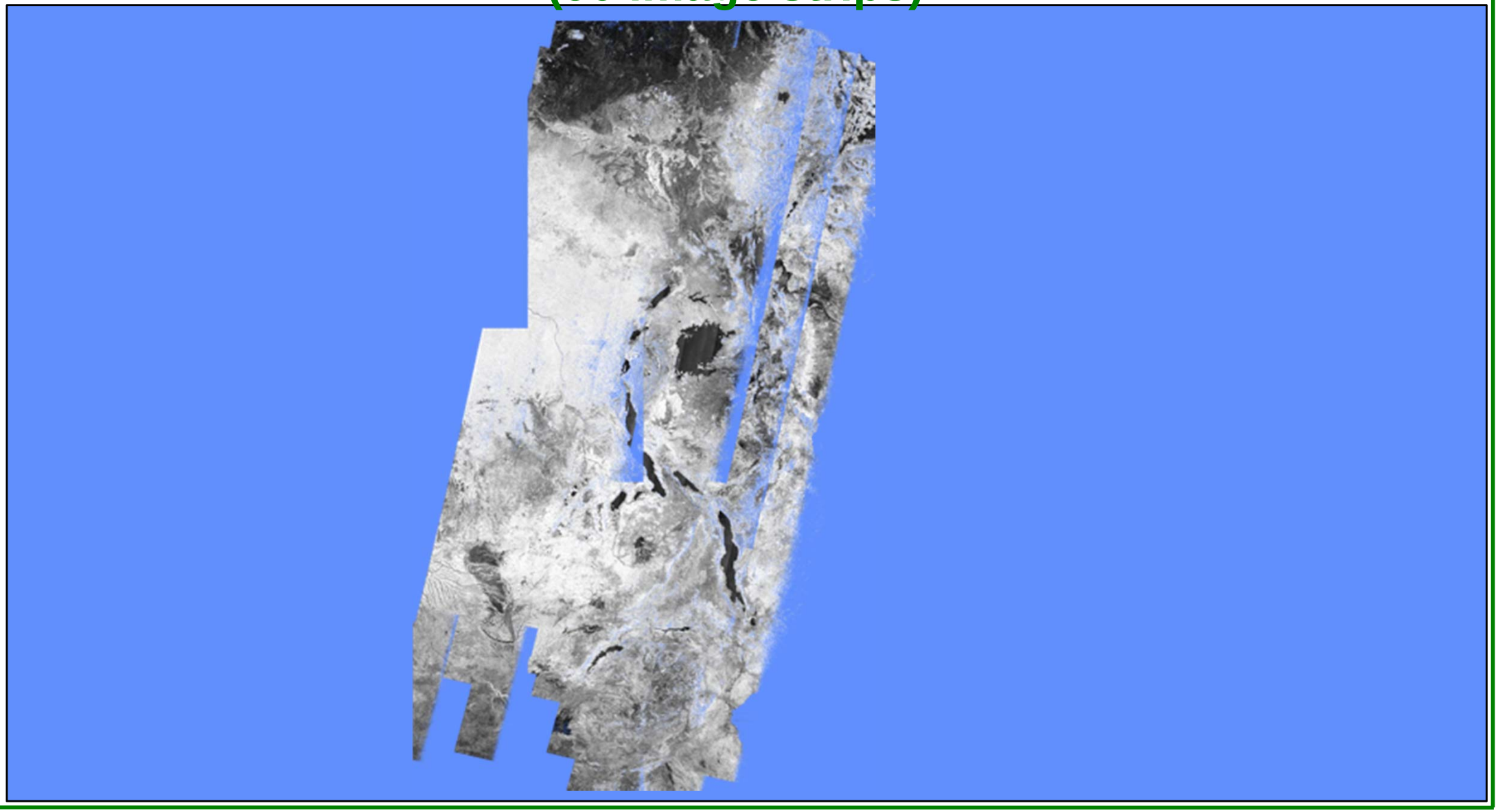
Africa image mosaic from ALOS PALSAR SCANSAR data (90 image strips)



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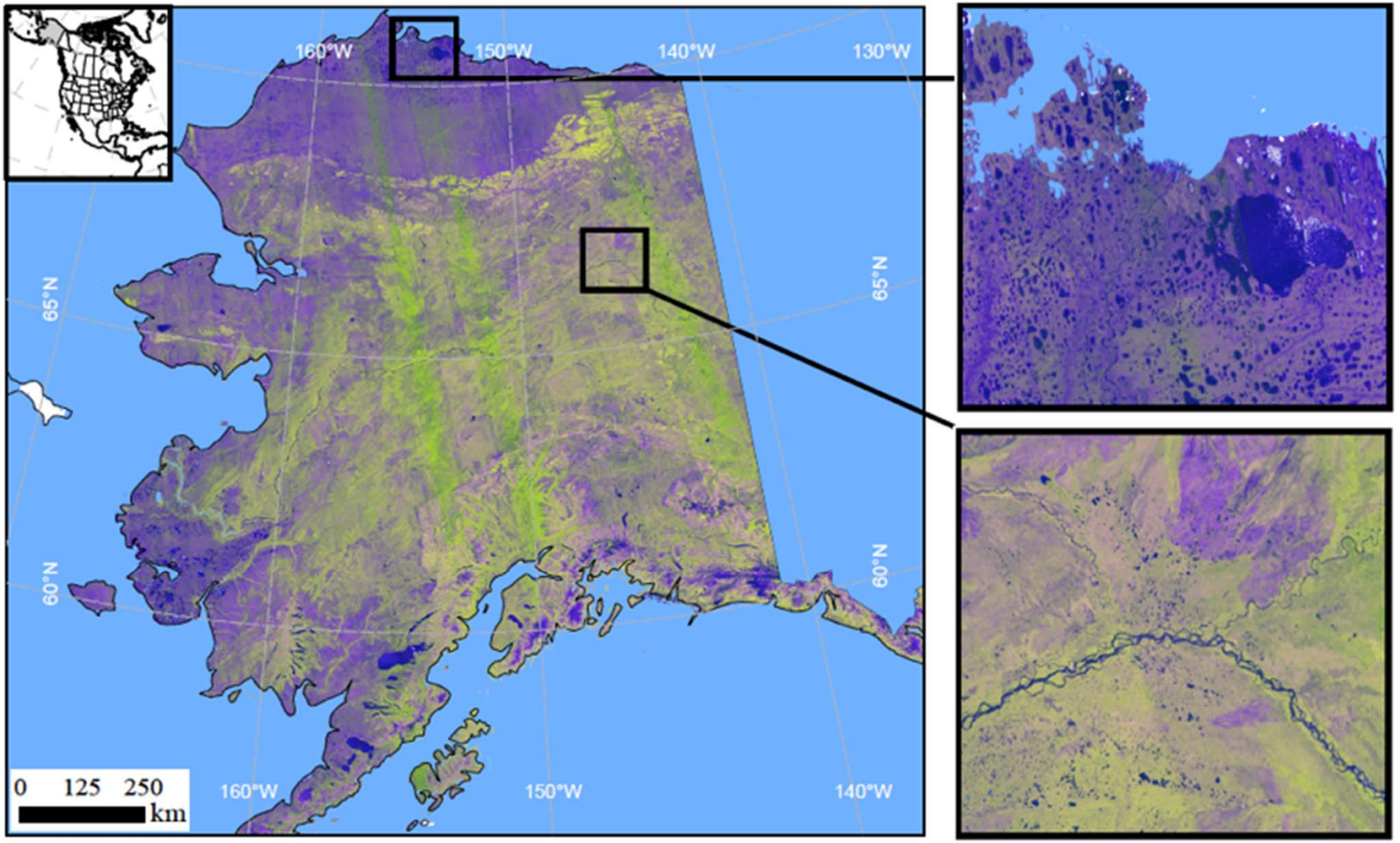
PALSAR dual pol image mosaic



Clewey et al, 2014

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Alaska Wetlands Map

NON-WETLAND
- Barren Land (BL)
- Deciduous Forest (DF)

WETLAND

Herbaceous

Moss/Lichen
- Palustrine (PML)

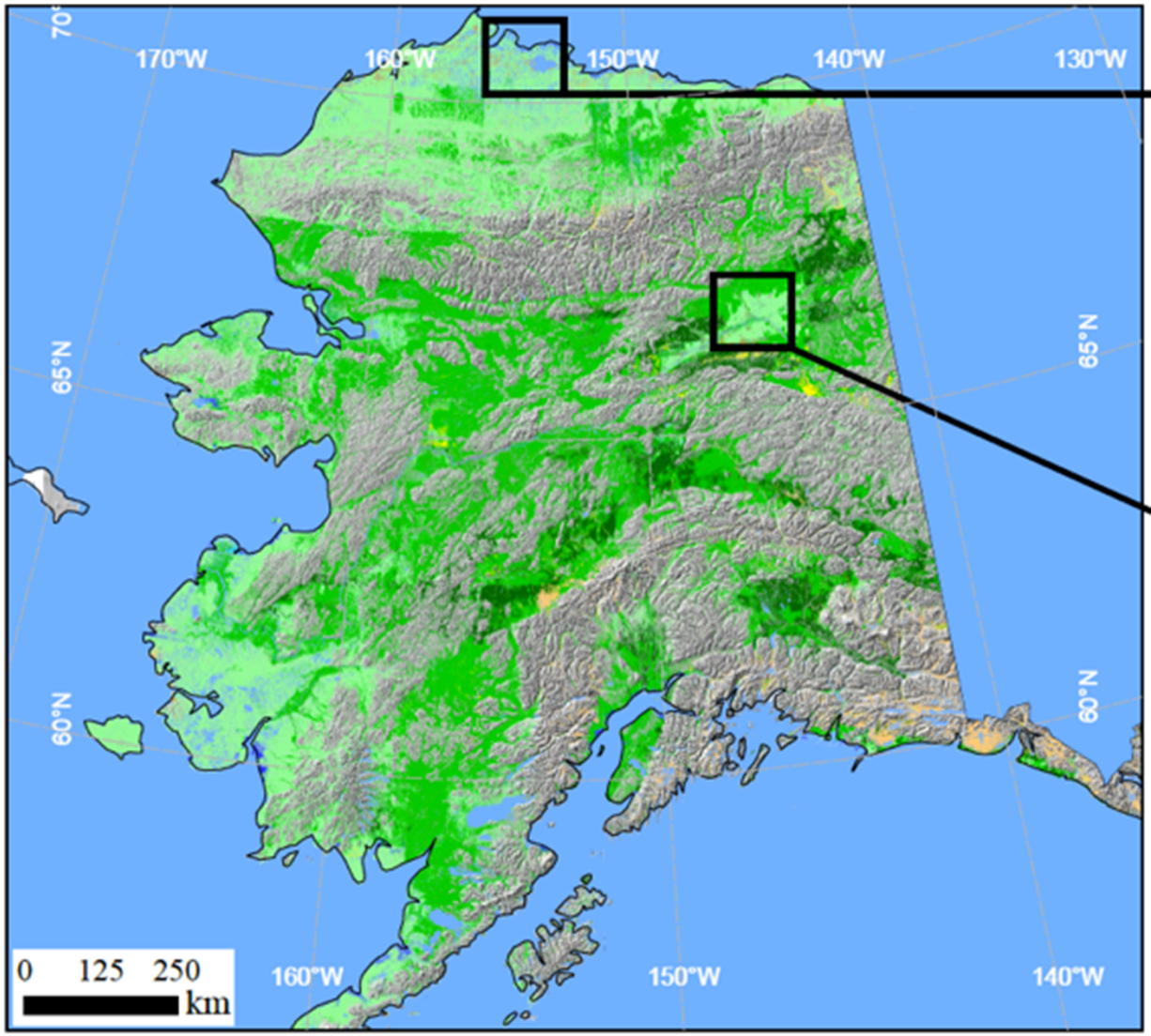
Emergent
- Estuarine (E2EM)
- Lacustrine (L2EM)
- Riverine (R EM)
- Palustrine (PEM)

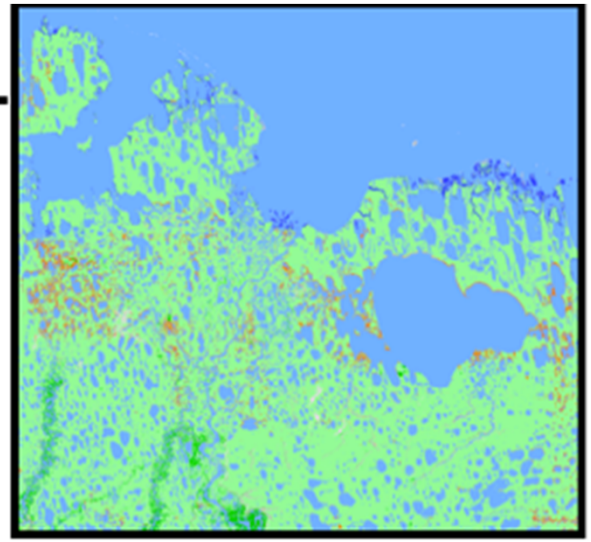
Woody

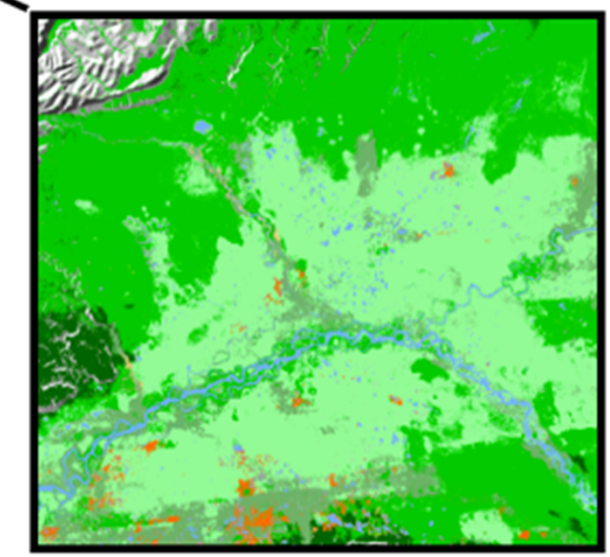
Scrub/Shrub
- Estuarine (E2SS)
- Palustrine (PSS)

Forested
- Estuarine (E2FO)
- Palustrine (PFO)

Non-vegetated
- Open water







Clewey et al, 2014

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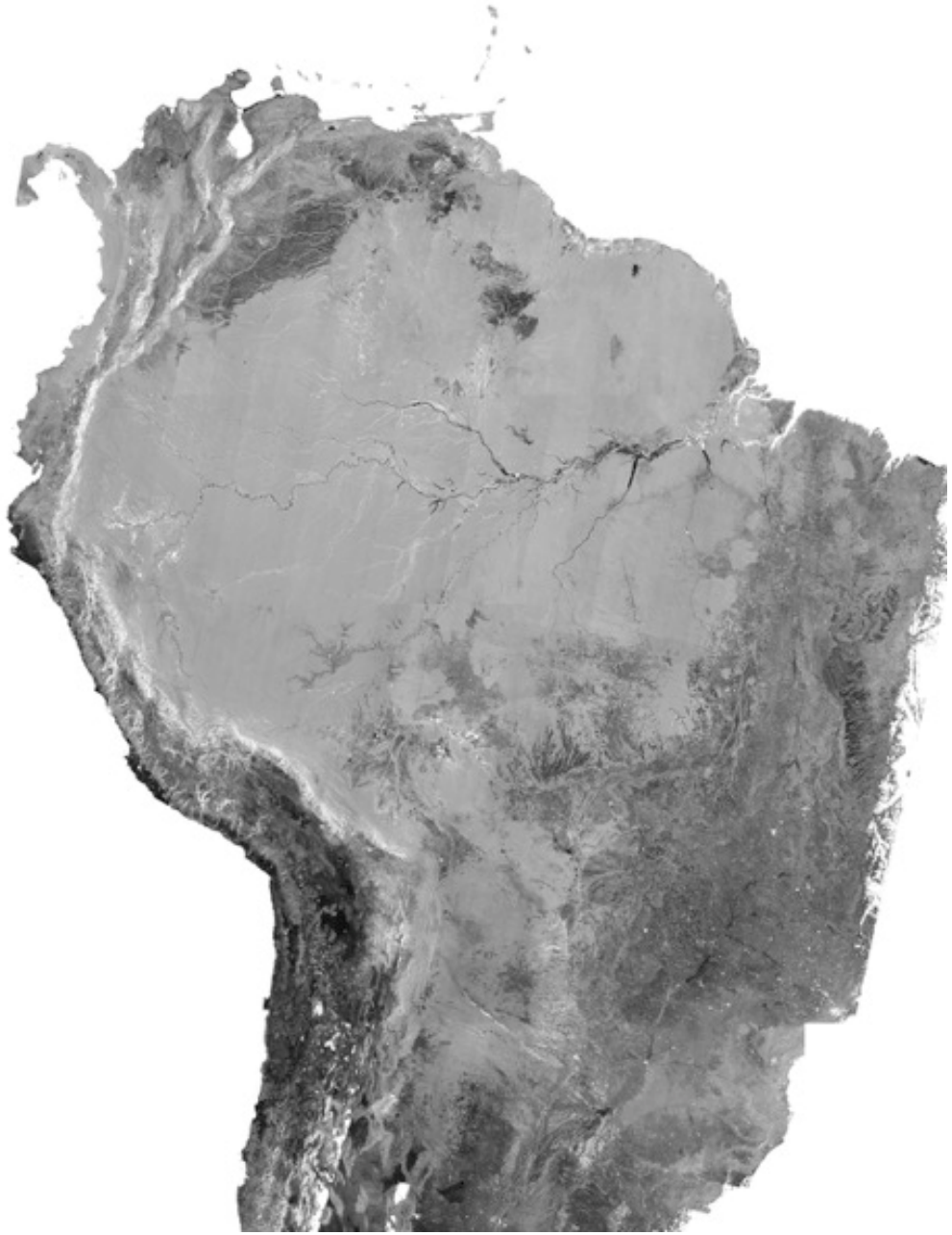

South America

ALOS SCANSAR multi-temporal image mosaic

Generated from 323 SCANSAR image strips*
Data from late 2006 to mid 2010.
Often 10 or more images per pixel

Orthorectified
Terrain calibrated

*Typically 350km x 3000km at 90 m resolution
1 million km^2 each

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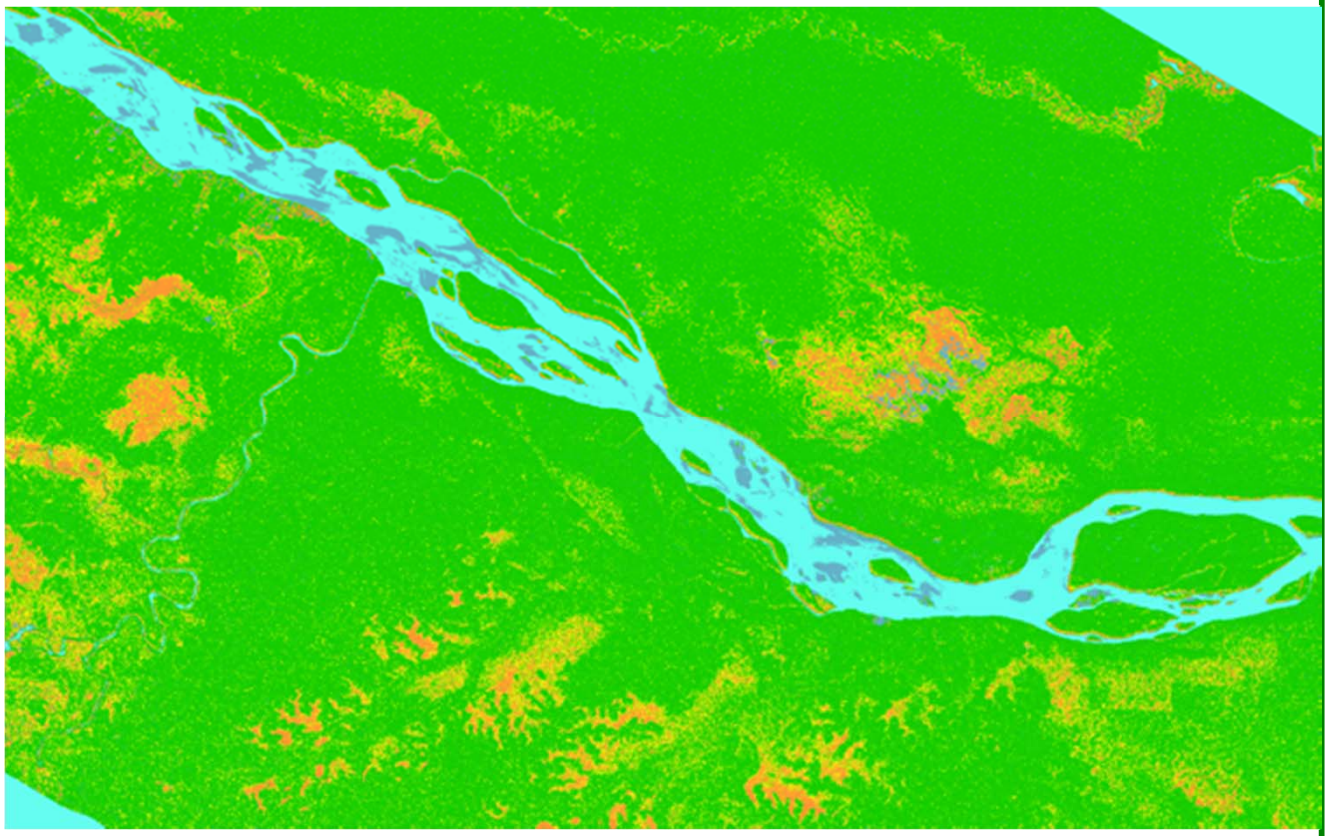
Classification of UAVSAR data over Napo River in Peru (2013)

Vegetation inundation state determined along two transects within 2 days of UAVSAR data acquisition

Classification derived from Van Zyl decomposition of L-band Quad Pol data UAVSAR

Classification verified along field transects

This image spans incidence angles from 20° to over 60° (as determined from the SRTM DEM)



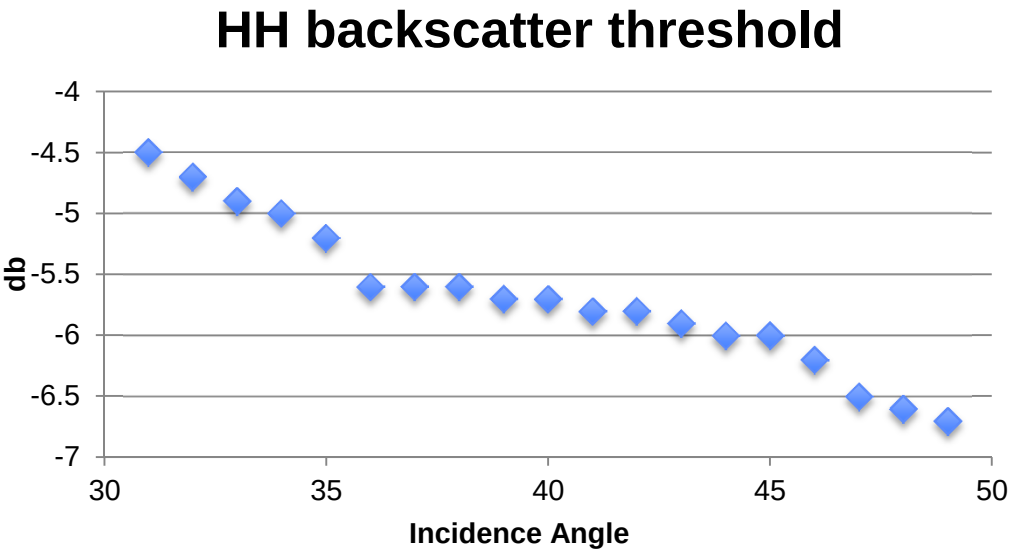
UAVSAR Inundation Classification : Green: not inundated
Yellow and Orange: inundated vegetation
Light and Dark Blue: open water/bare ground

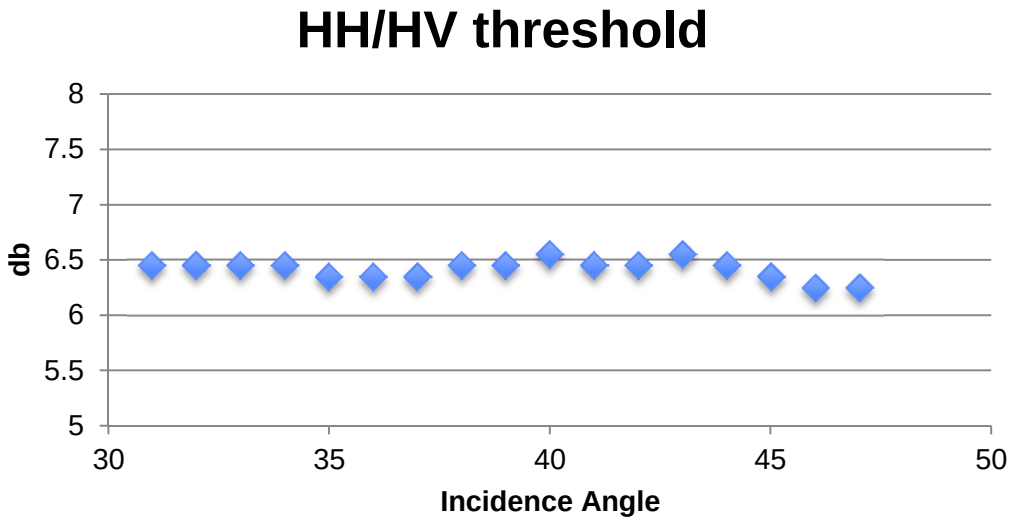
UAVSAR data acquired March 31, 2013

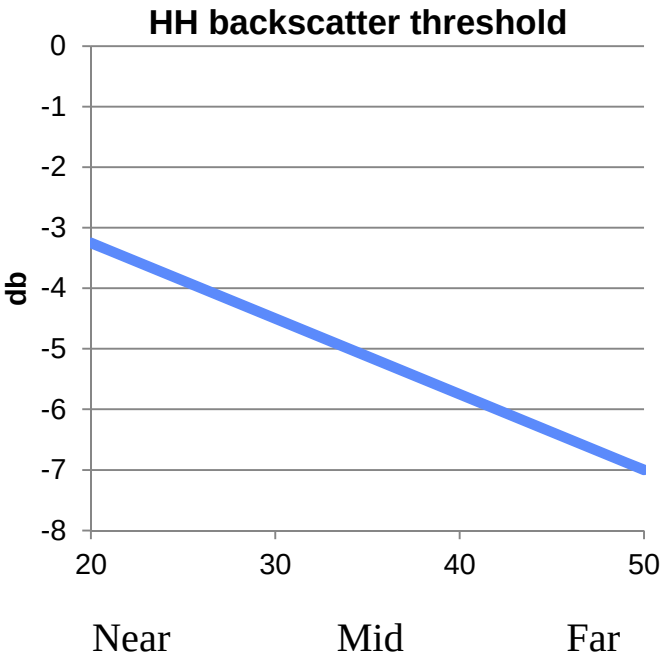
Chapman et al, "Validation of forested inundation extent revealed by L-band polarimetric and interferometric SAR data", IGARSS 2014, Quebec, Canada July 2014

Classification of subsets of quad pol data: HH only and HH / HV

If we compare the reference classification from the quad pol data, with HH-only and HH/HV only, we can estimate classification thresholds versus incidence angle that would produce consistent classification results.

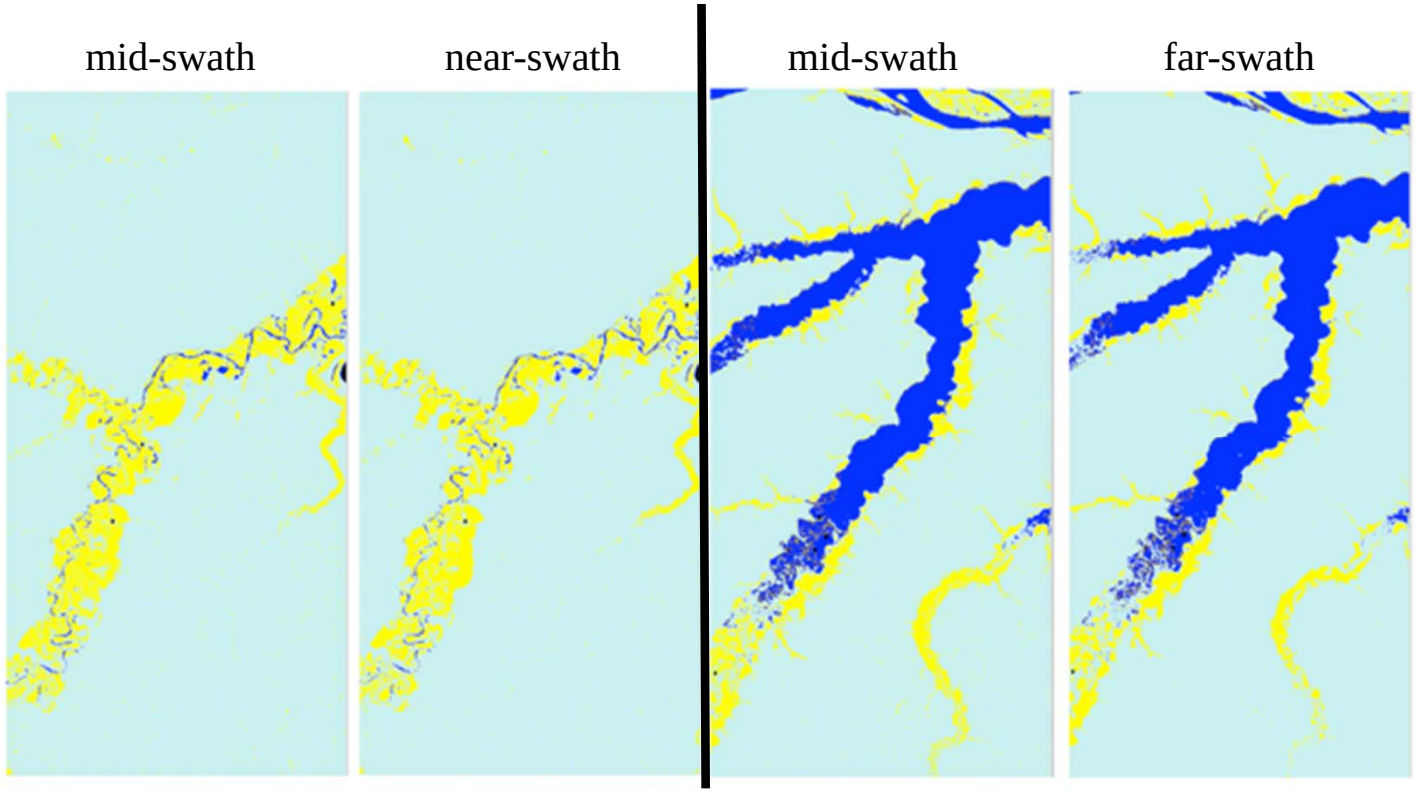






A variable backscatter threshold was implemented to account for incidence angle that is consistent with the UAVSAR results

This linearly varying backscatter threshold was qualitatively verified by examining classification results for ScanSAR passes that were acquired 5 days apart, but where the swaths overlapped.



Multi-temporal data acquisitions should improve accuracy

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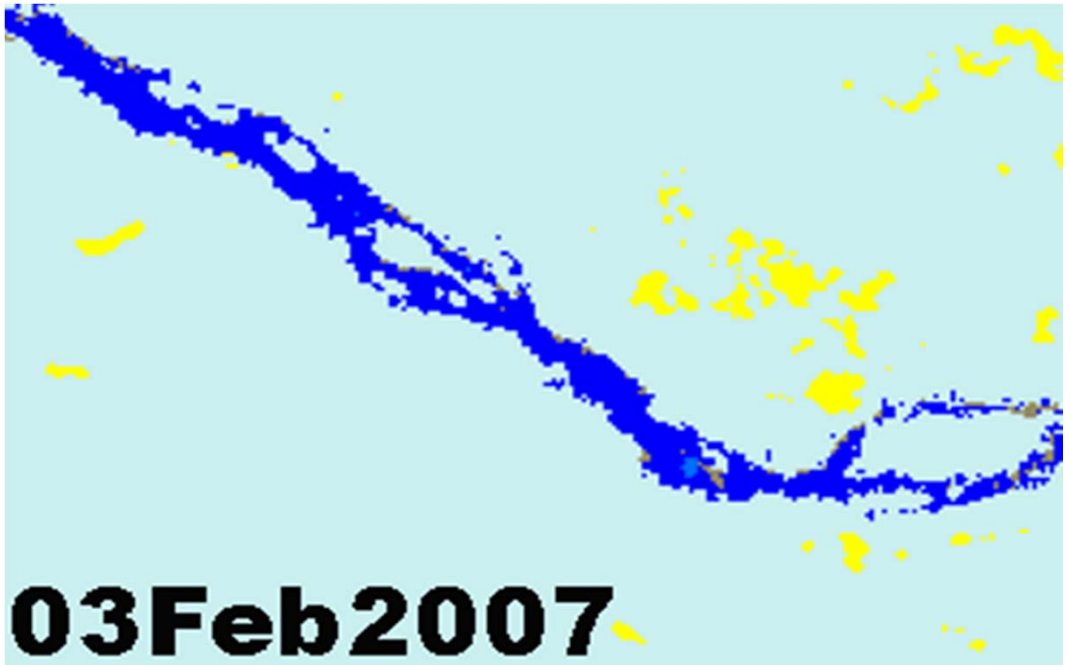
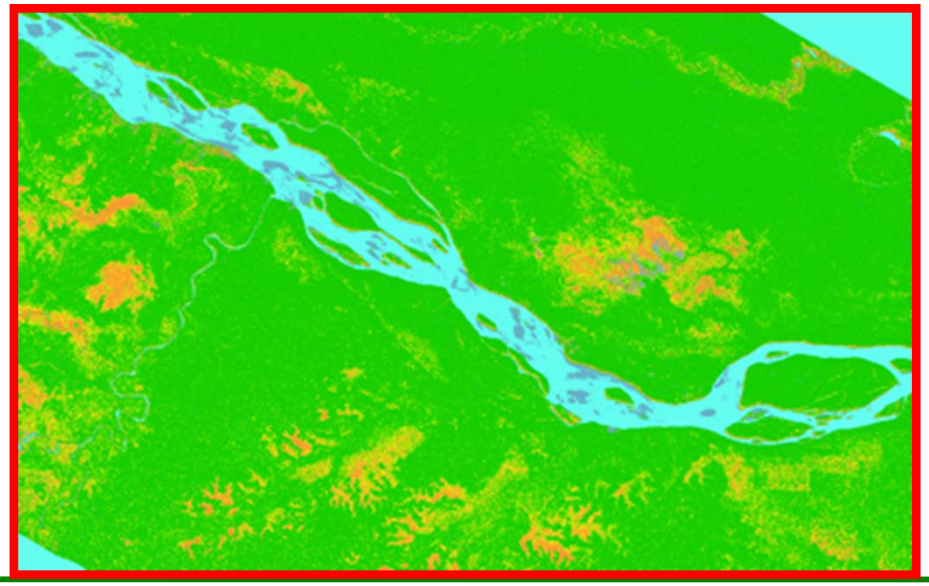
100 m HH-only ALOS Scansar Imagery

Classification from 100m Scansar imagery



Blue – open water
Yellow – inundated vegetation



UAVSAR reference classification based on van Zyl decomposition (2013)

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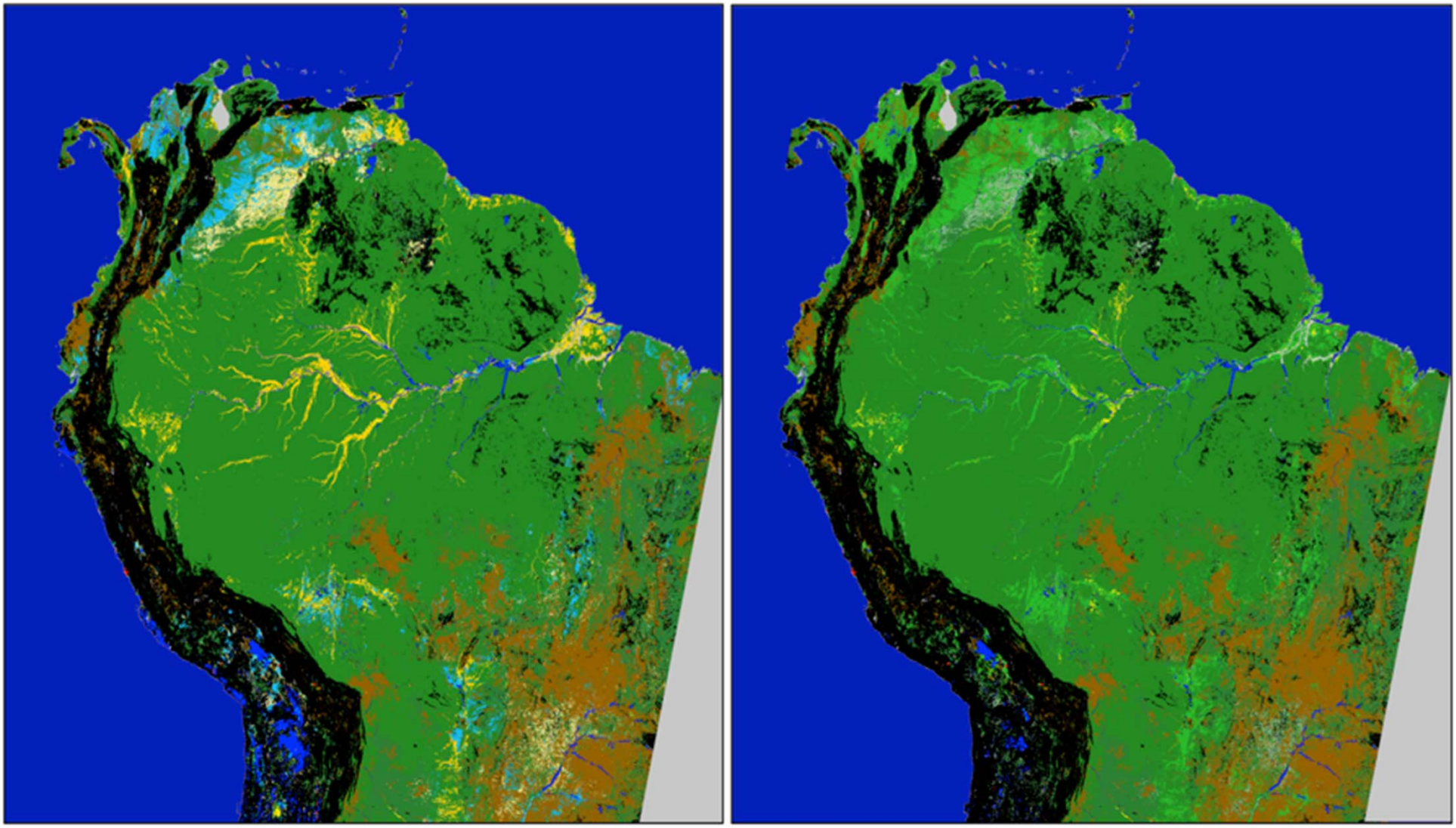
Maximum/Minimum inundation from ALOS ScanSAR



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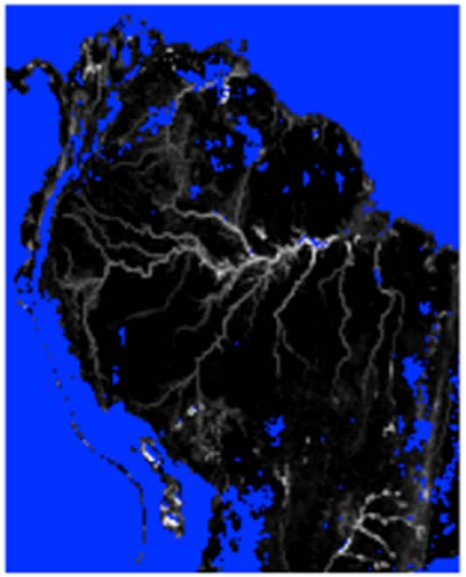
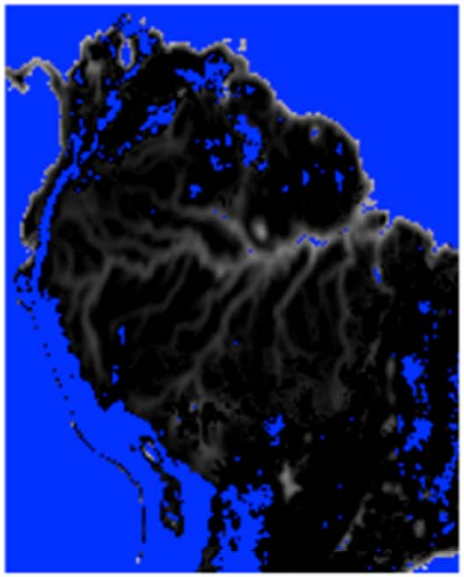
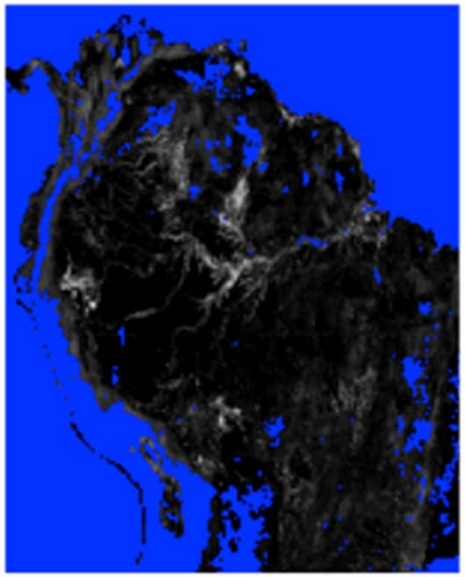
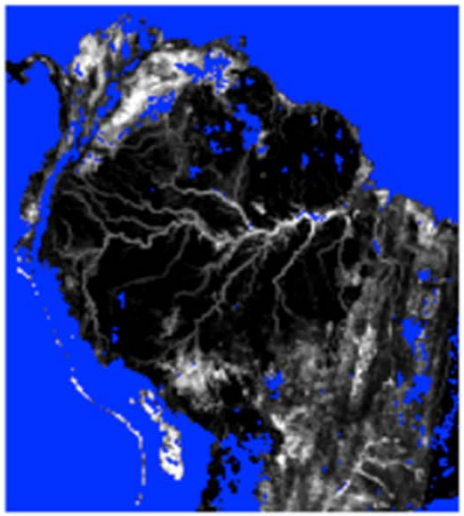
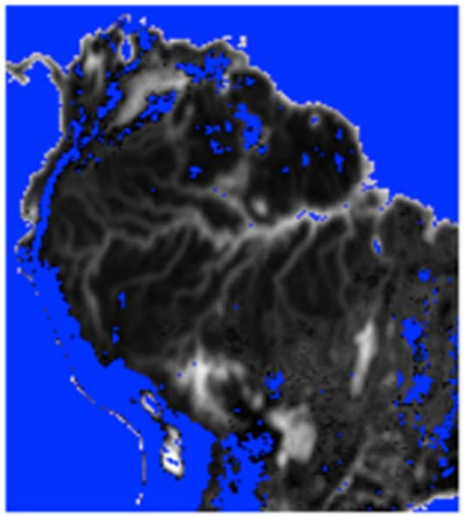
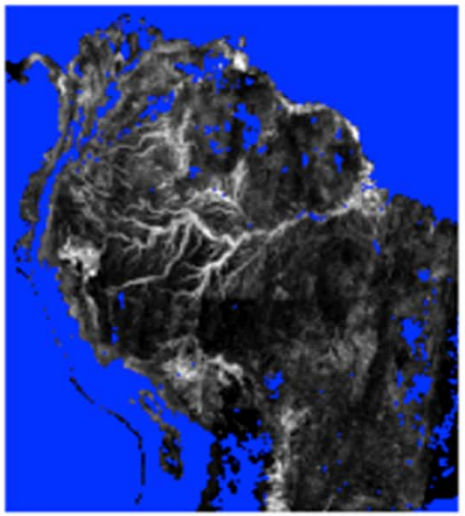
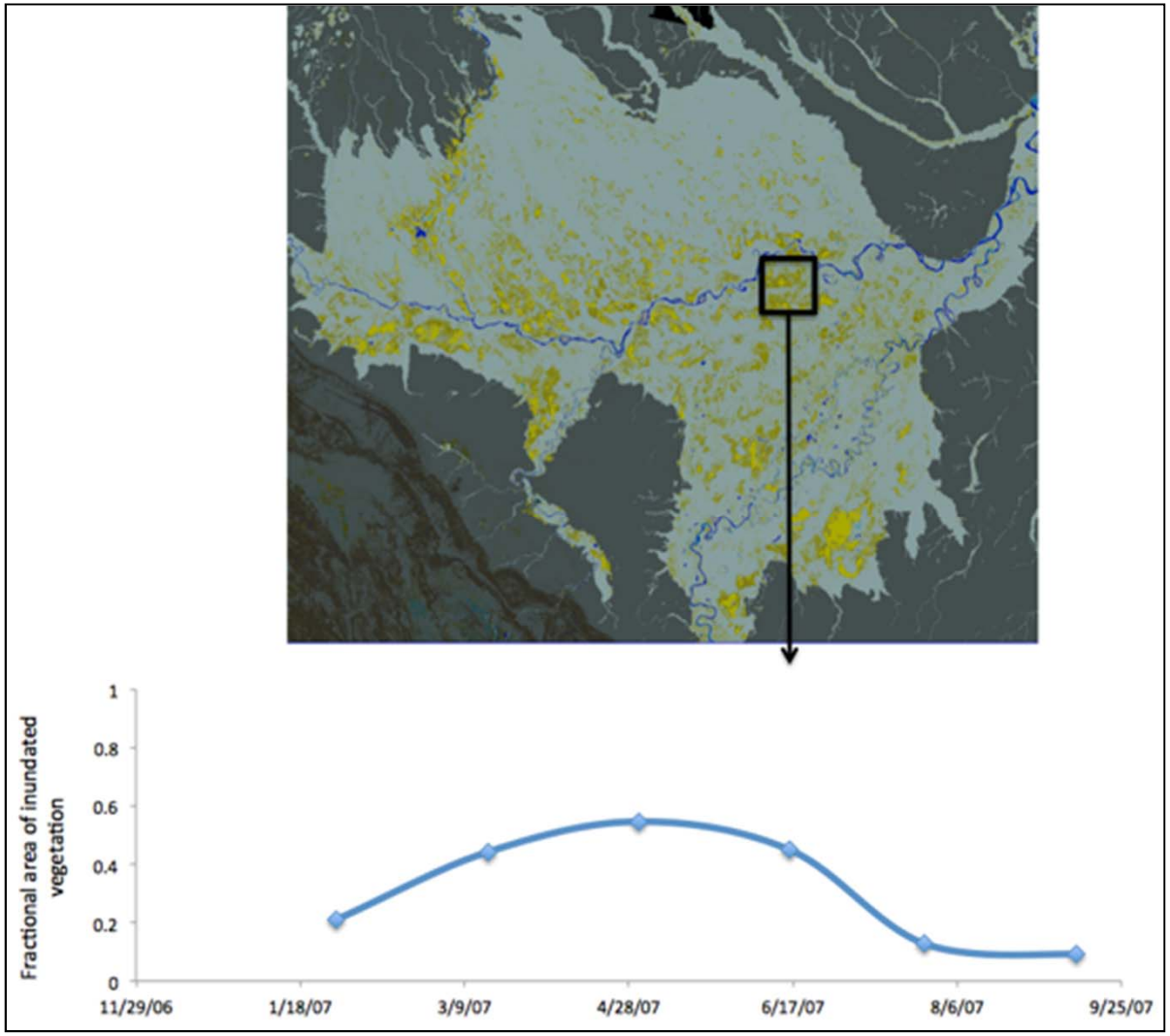
Comparison of fractional open surface water area from coarse resolution sensors with ALOS SCANSAR open surface water fraction and inundated vegetation fraction

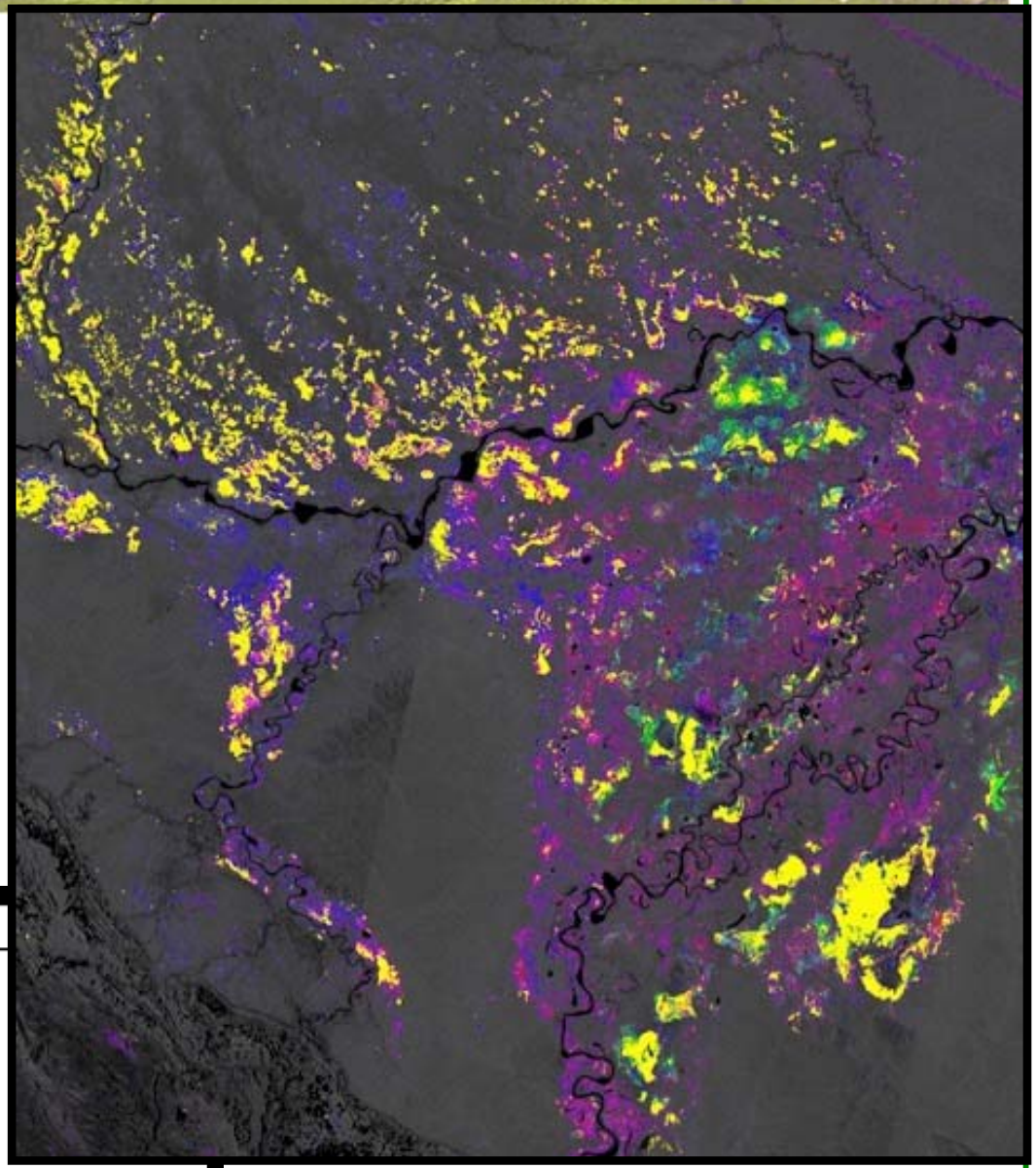
	Fractional open surface water area	Open water from ALOS ScanSAR classification	Inundated vegetation from ALOS ScanSAR classification
Minimum			
Maximum			

ALOS ScanSAR estimated inundation dynamics for box shown, showing fractional total inundation versus time.



Pacaya-Samiria, Peru

Observed inundation duration from 7 acquisitions in 2007



Relative Inundation Duration	Area
7 (Yellow)	6,939 km^2
6 (Light Green)	540 km^2
5 (Dark Green)	911 km^2
4 (Turquoise)	1,715 km^2
3 (Red)	2,952 km^2
2 (Pink)	4,778 km^2
1 (Dark Blue)	8,237 km^2

Deliverables –
Papers and reports

1. Published

- K&C Final Report – Phase 3, Chapman et al, March 2014.
- "Validation of forested inundation extent revealed by L-band polarimetric and interferometric SAR data", Chapman et al (IGARSS 2014, July 2014.

2. Submitted/in preparation

- "Detection and monitoring of inundation with Polarimetric L-band SAR", Chapman et al (AGU Fall meeting, December 2014)
- "Mapping regional inundation with spaceborne L-band SAR", Chapman et al *(Remote Sensing*, submitted November 2014)
- "High resolution mapping of vegetated wetlands in Alaska using ALOS PALSAR data", Clewey et al (*Remote Sensing*, submitted August 2014)
- "Remote Sensing of Water in Wetlands: Inundation patterns and extent" (submitted to The Wetlands Encyclopedia, January 2014).

Deliverables –

Data sets and Thematic products (mosaics, classification maps etc.)

1. Completed and Delivered to JAXA

- *ScanSAR mosaic - Northern South America*
- *ScanSAR mosaic – portion of Africa*
- *Dual pol mosaic – United States*

2. Completed, but not yet delivered

- *Wetlands classification of Northern South America*
- *Alaska wetlands map*

Products

Dataset description

- The delivered datasets will include classification results derived from ALOS PALSAR SCANSAR data acquired between 2006 and 2011. Also included will be validation data sets such as a multi-temporal average image mosaic, JERS-1 based wetland mask from 1995-1996, co-registered GLOBCOVER classification, SRTM height in meters, and maximum and minimum surface water fraction derived from combined active/passive microwave remote sensing.

- Each product has a pixel spacing is 3 arcseconds in Longitude and Latitude. Format will be Geotiff.

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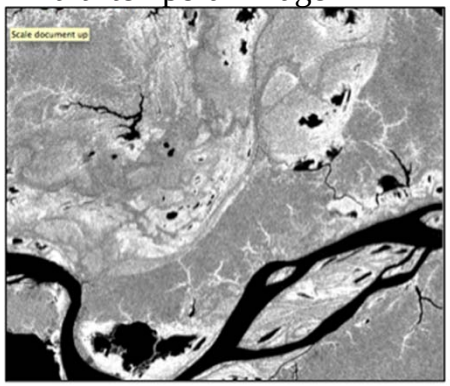
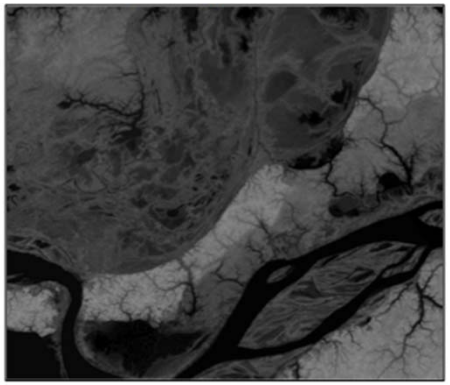
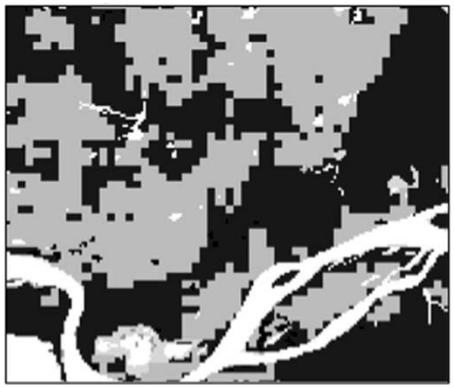
Multi-temporal image



SRTM DEM

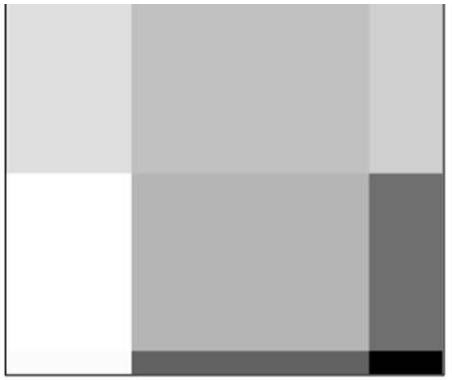


GEOCOVER



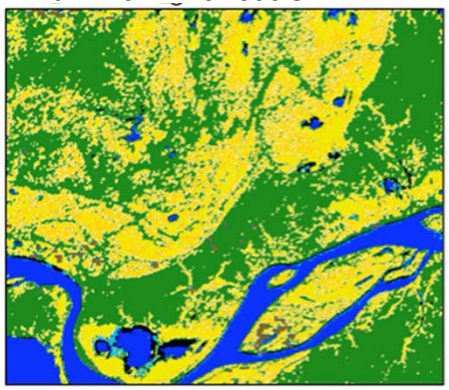
JERS-1 Mask

Minimum inundation fraction

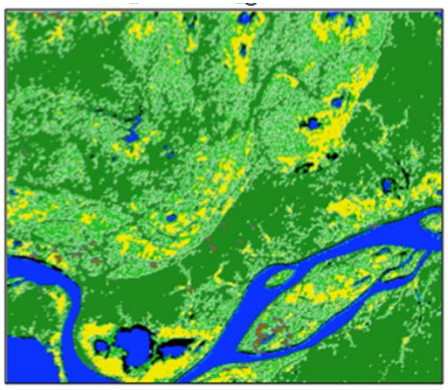


Maximum inundation fraction

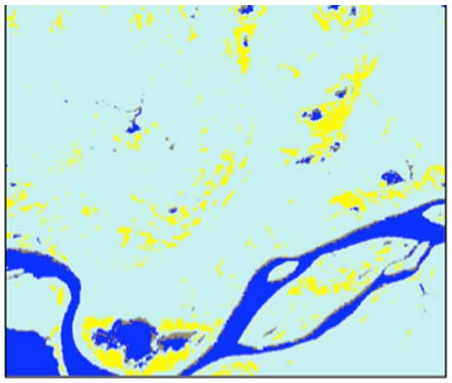
Maximum inundation



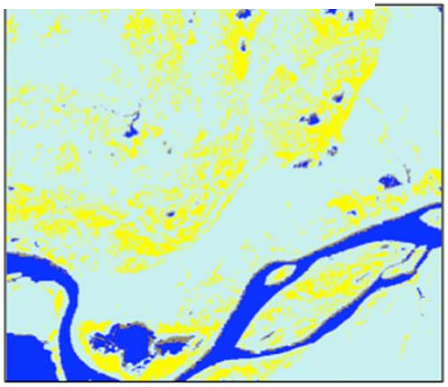
Minimum inundation



Inundation State – date 1



Inundation State – date 2



This research is undertaken within the framework of the ALOS Kyoto & Carbon Initiative. The ALOS data were provided by JAXA EORC.

Resources supporting this work were provided by the NASA High-End Computing (HEC) Program through the NASA Advanced Supercomputing (NAS) Division at Ames Research Center.

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