

# PAN-TROPICAL ALOS/PALSAR MAPPING IN SUPPORT OF FOREST CARBON TRACKING

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– COMIFAC REGIONAL WORKSHOP –  
MONITORING CARBON STOCKS AND FLUXES IN THE  
CONGO BASIN

# Project Overview

## ◆ WHRC

- Josef Kellndorfer, Wayne Walker, et al.
- Alessandro Baccini, Nadine Laporte, Scott Goetz,

## ◆ Support

- Gordon and Betty Moore Foundation
- Google.org
- David and Lucile Packard Foundation
- NASA / SPOT Image/Planet Action (Data)
- Software: ITTVIS/SARMAP, ESRI, Definiens

## ◆ Key partners/collaborators:

- JAXA / Kyoto and Carbon Science Team
- SARMAP
- ASF / AADN
- Boston University

## ◆ Coordination with GEO FCT/Clinton CMC

## ◆ Potential collaborators in this room?





# Pan-tropical Mapping – Project Objectives

## I. Mapping/Monitoring Forest Cover

Leads: KelIndorfer, Walker

- 2007 high-resolution (15-m), cloud-free, pan-tropical ALOS/PALSAR radar mosaic.
- 2007 baseline map of pan-tropical forest cover as a first step toward PALSAR-based annual/periodic deforestation and forest degradation assessments.

## II. Mapping Above-ground Biomass/Carbon Stocks

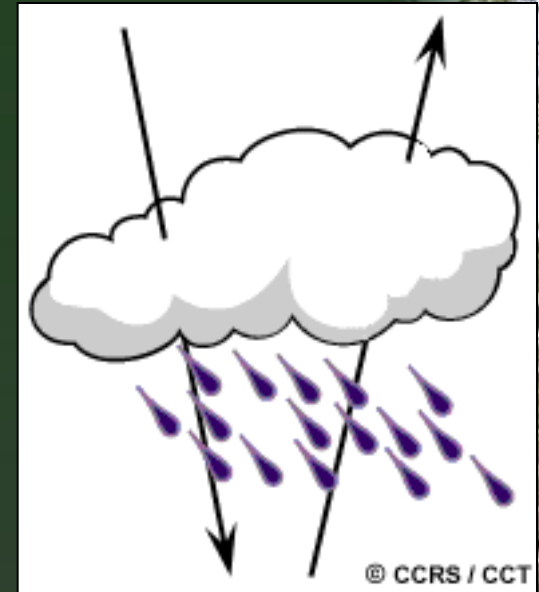
Leads: Baccini, Laporte, Goetz

- 2005/06 medium-resolution (500-m) above-ground biomass/carbon map derived from MODIS, GLASS LiDAR and field observations. Fusion with PALSAR is being investigated.



# Contributions of Imaging RADAR to Forest Monitoring

- ✓ Cloud, dust, haze and smoke penetration
- ✓ All-weather and day/night image acquisition
- ✓ Sensitivity to 3-D forest structure

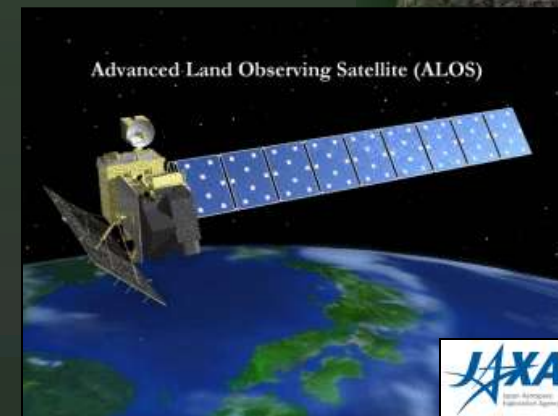


RADAR has the potential to provide for wall-to-wall tropical forest monitoring over very narrow (sub-annual) time frames.

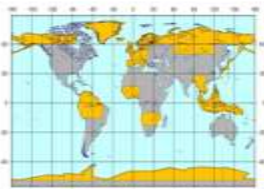
# Contributions of ALOS/PALSAR to Forest Monitoring

## Advanced Land Observing/Phased Array L-band SAR

- Operational since November 2006 (4th year of global mapping)
- First polarimetric L-band sensor on a free-flying satellite
- 10-20 meter resolution
- High geolocation accuracy (9.3 meters)
- Life expectancy 8+ years (planned for 3)
- First-of-its-kind systematic global observation strategy
  - Annual coverage of all major forest biomes



# ALOS/PALSAR Global Observation Strategy



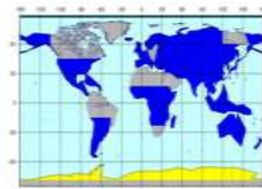
CYCLE\_27 / 27-Apr.-2009



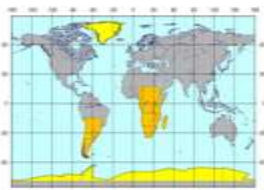
CYCLE\_28 / 12-Jun.-2009



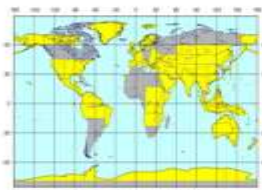
CYCLE\_29 / 28-Jul.-2009



CYCLE\_30 / 12-Sep.-2009



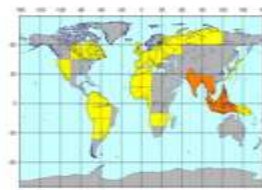
CYCLE\_31 / 28-Oct.-2009



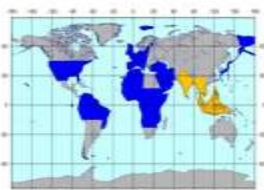
CYCLE\_32 / 13-Dec.-2009



CYCLE\_33 / 28-Jan.-2010



CYCLE\_34 / 15-Mar.-2010



CYCLE\_35 / 30-Apr.-2010

HH/HV HH Polarimetric



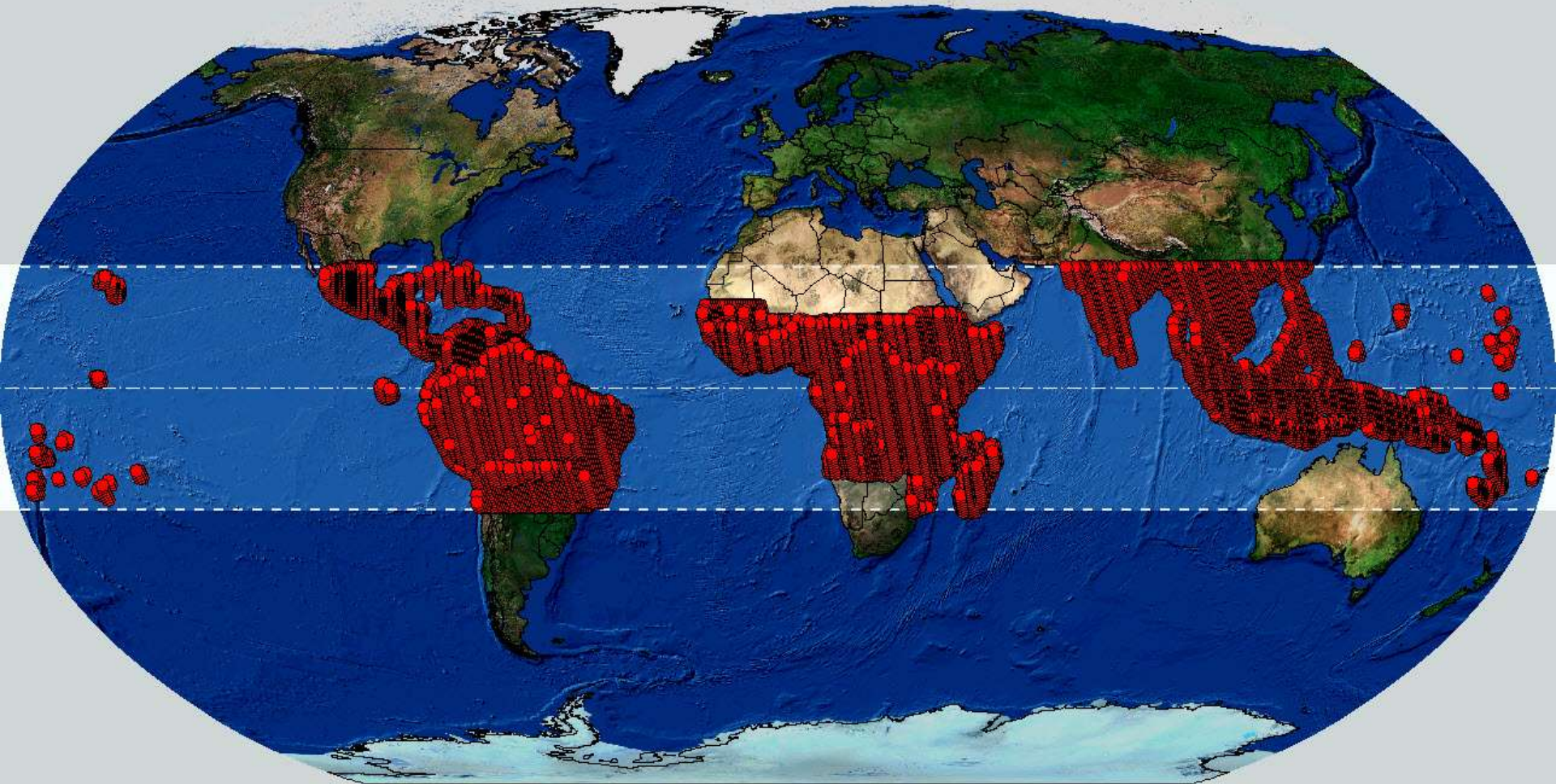
# Progress to Date

- ✓ Acquisition of 16,000+ 2007 ALOS/PALSAR scenes spanning the pan-tropical belt.
- ✓ Implementation of state-of-the-art spatial metadata database and processor capabilities for rapid inventory and processing of image data from PALSAR and other sources at continental scales.
- ✓ Completion of (preliminary) 2007 pan-tropical ALOS/PALSAR mosaic.
- ✓ Implementation of pan-tropical country capacity-building program.



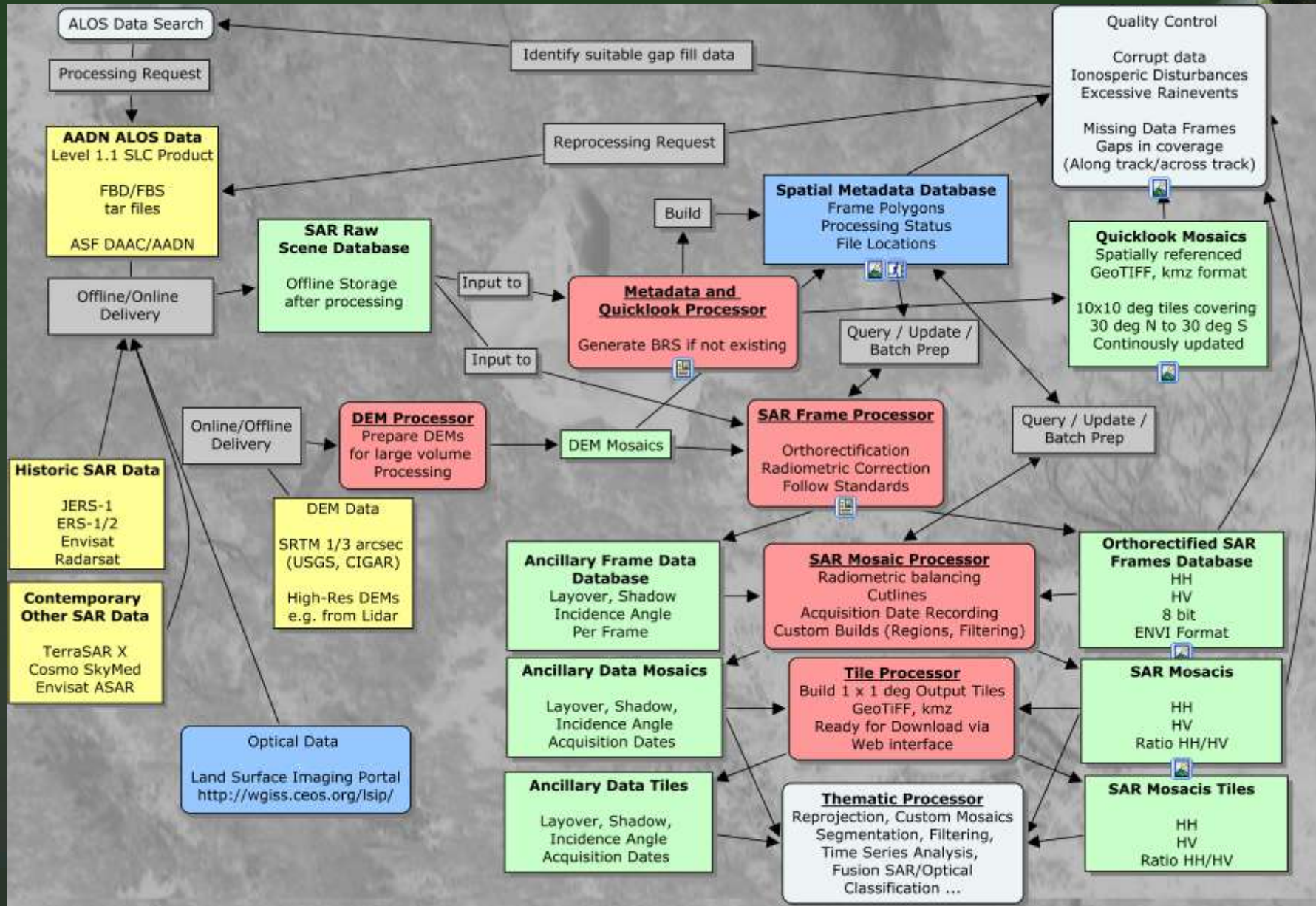


# ALOS/PALSAR Mosaic Development: 16,189 scenes

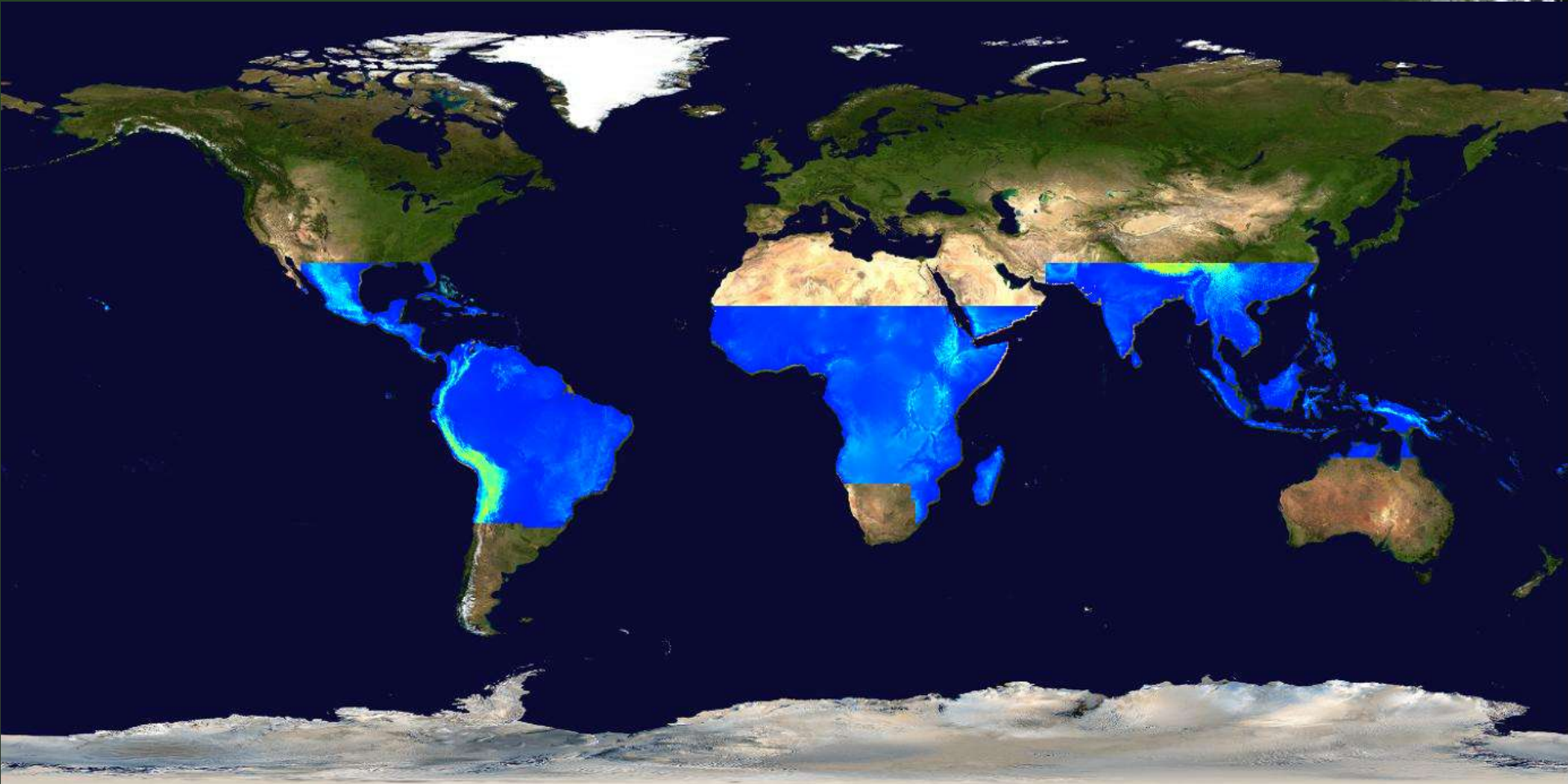




# State-of-the-art Processing Stream



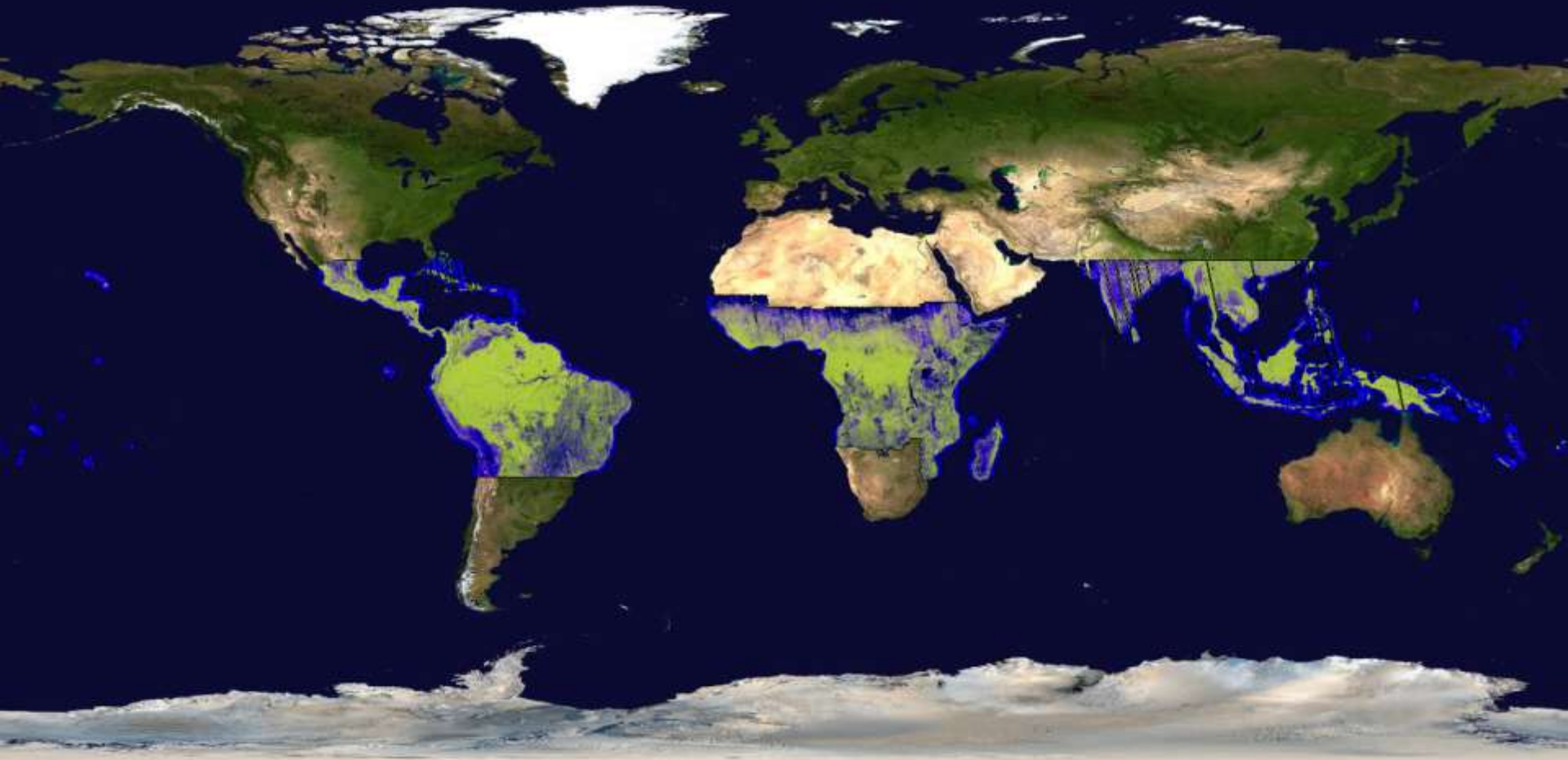
# Processed Pan-tropical SRTM DEM Coverage



- Filled holes/corrected unsuitable no-data values
- Processed to overlapping tiles (oversampled, spline-smoothed) for rapid retrieval

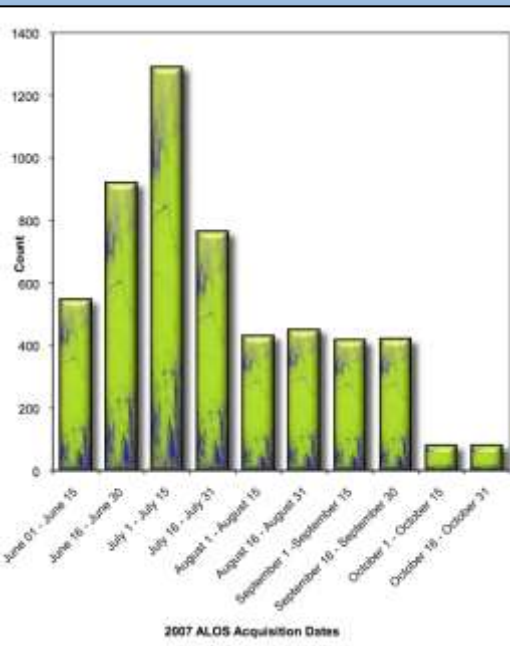
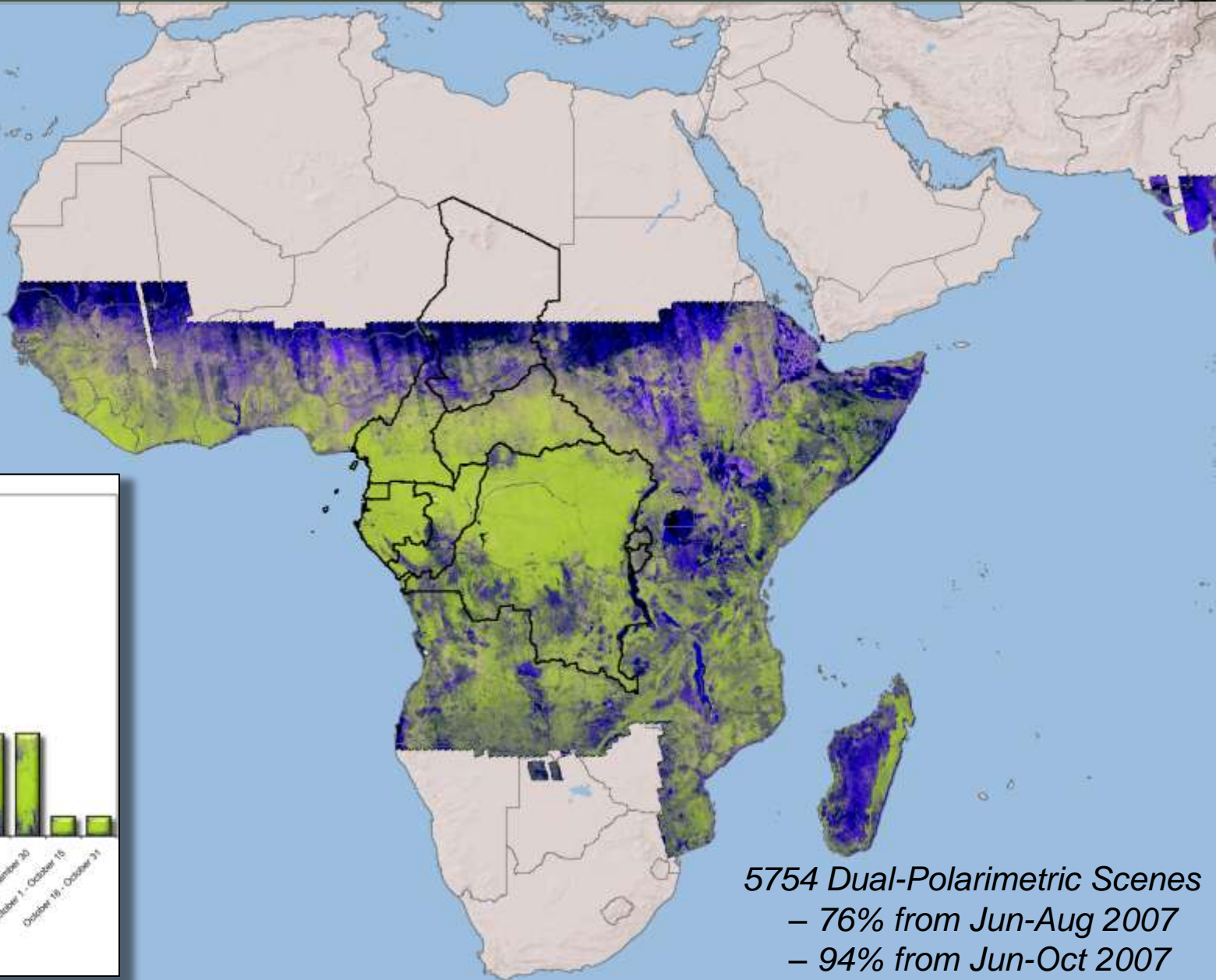


# 2007 Pan-tropical ALOS/PALSAR Mosaic

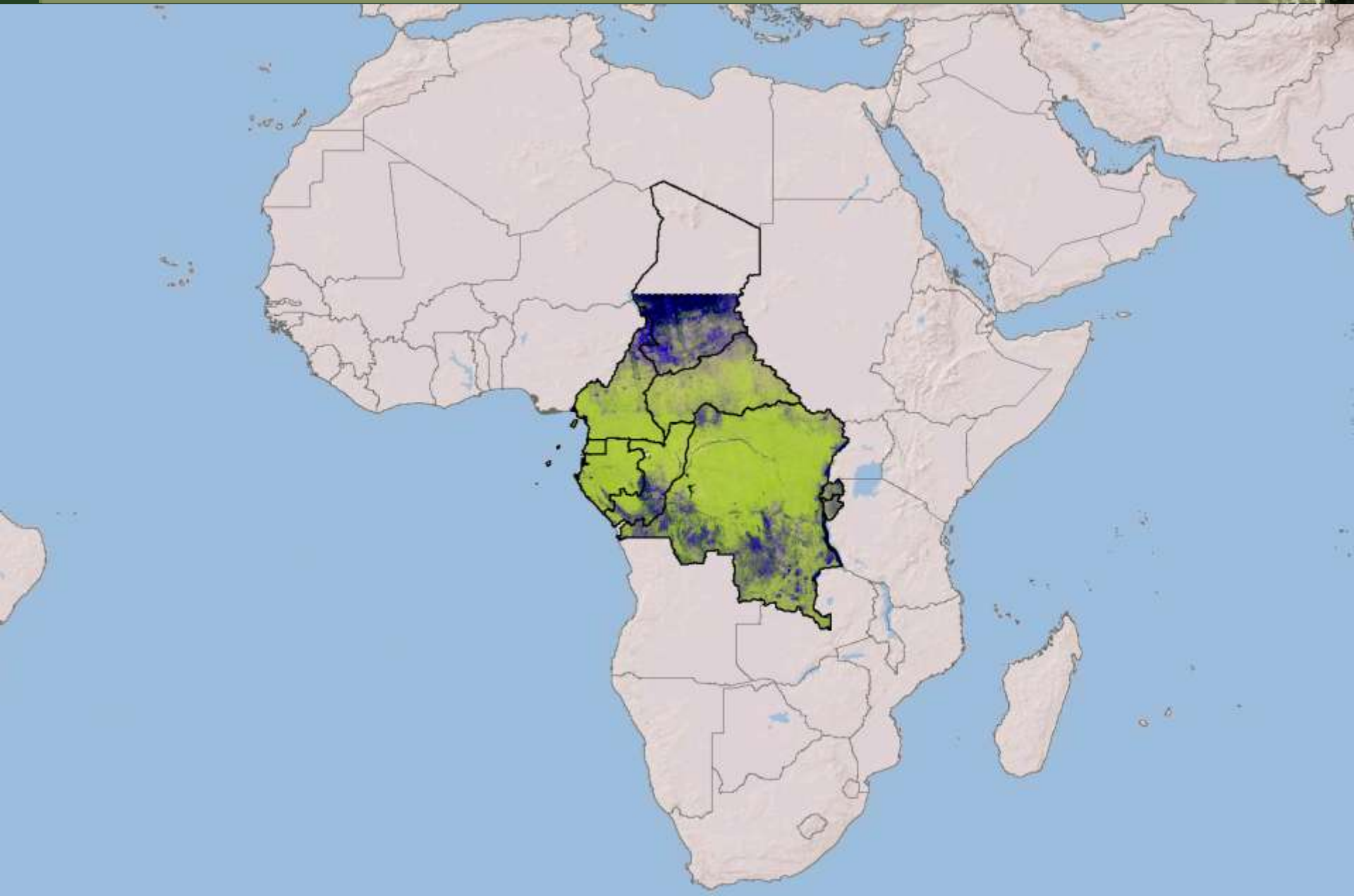




# ALOS/PALSAR: AFRICA

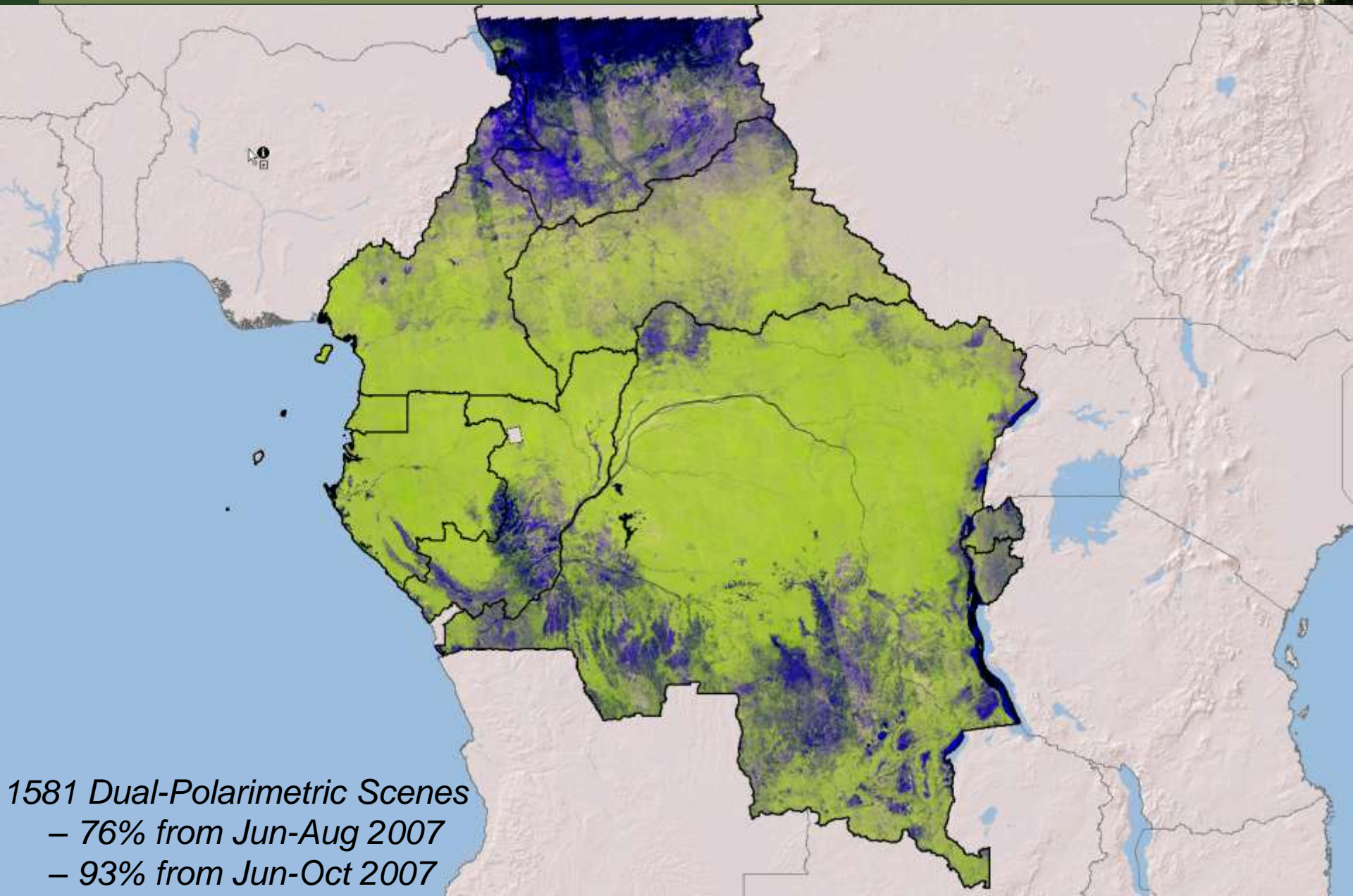


# ALOS/PALSAR: AFRICA





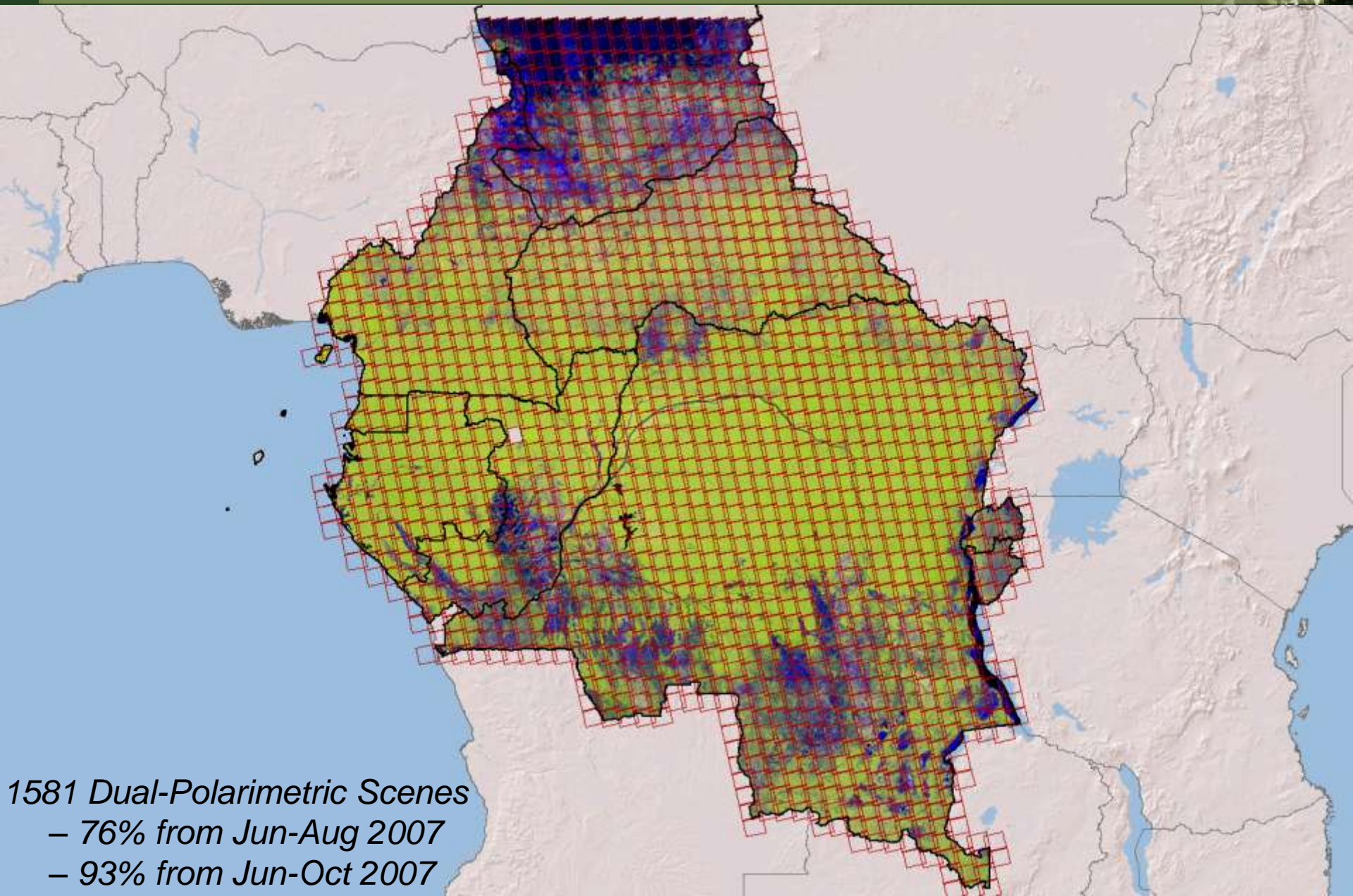
# Pan-tropical Mapping – 2007 ALOS/PALSAR Mosaic



*1581 Dual-Polarimetric Scenes*  
– 76% from Jun-Aug 2007  
– 93% from Jun-Oct 2007



# Pan-tropical Mapping – 2007 ALOS/PALSAR Mosaic



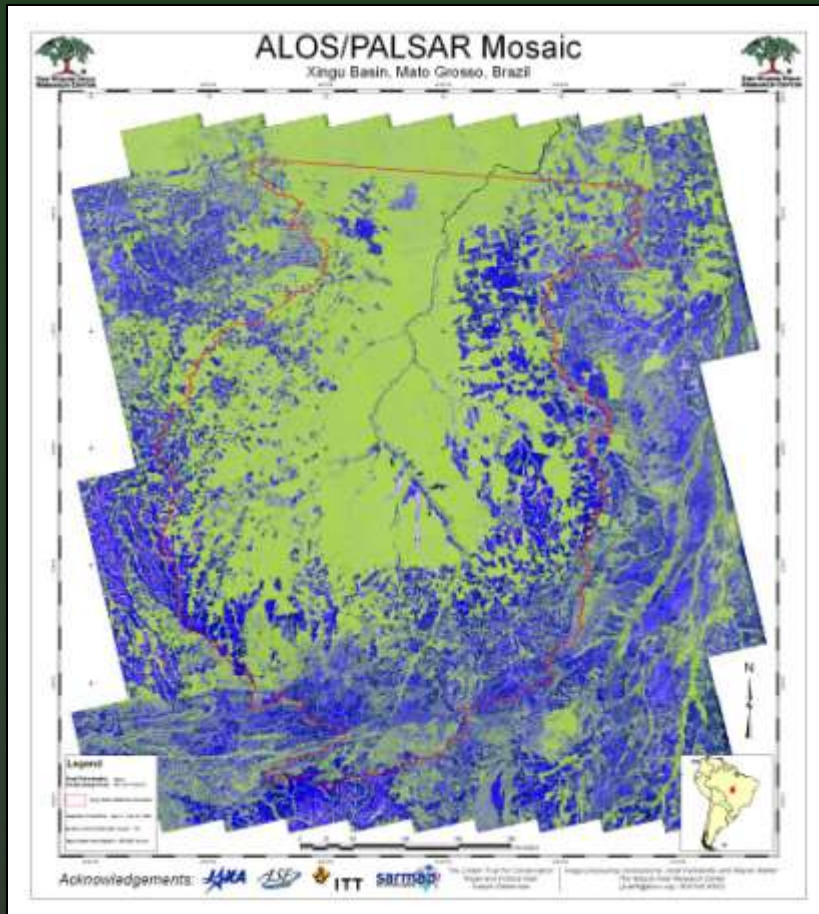
*1581 Dual-Polarimetric Scenes*  
– 76% from Jun-Aug 2007  
– 93% from Jun-Oct 2007



# GEO-FCT: Xingu Basin, Mato Grosso, Brazil

Data Acquisition: 8 June-22 July 2007

Number of Scenes: 116



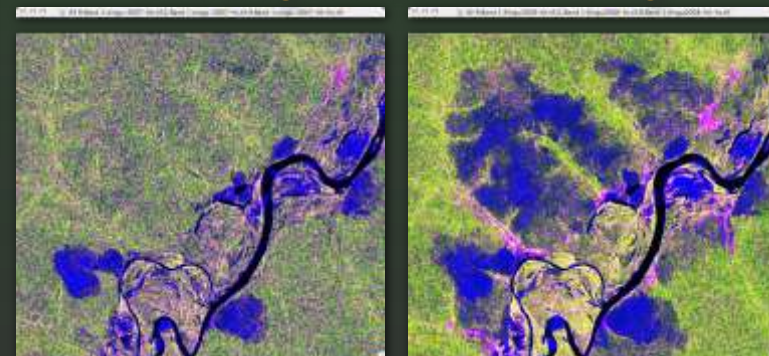
## Deforestation Monitoring



2007

2008

## Fire-Degradation Monitoring



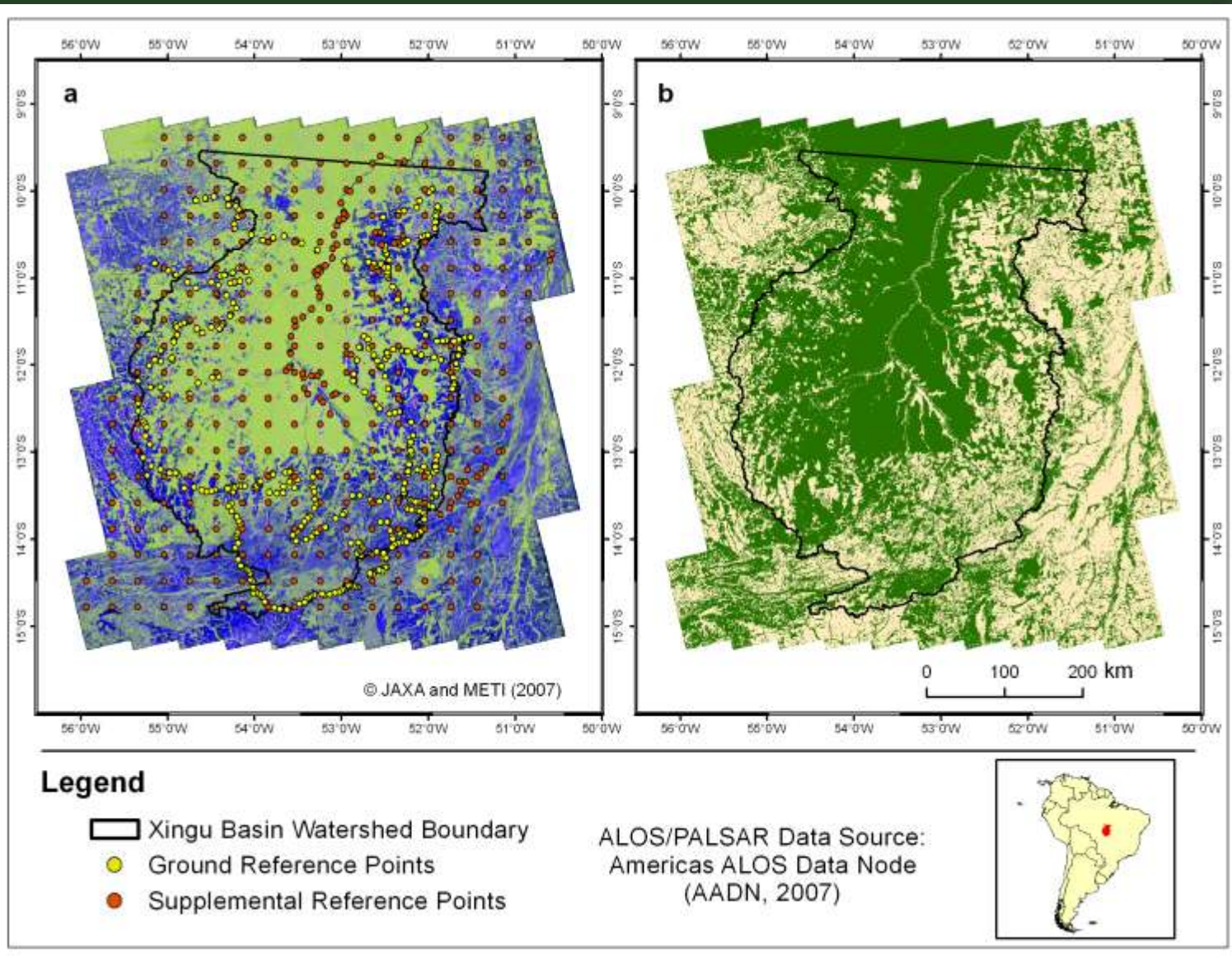
2007

2008



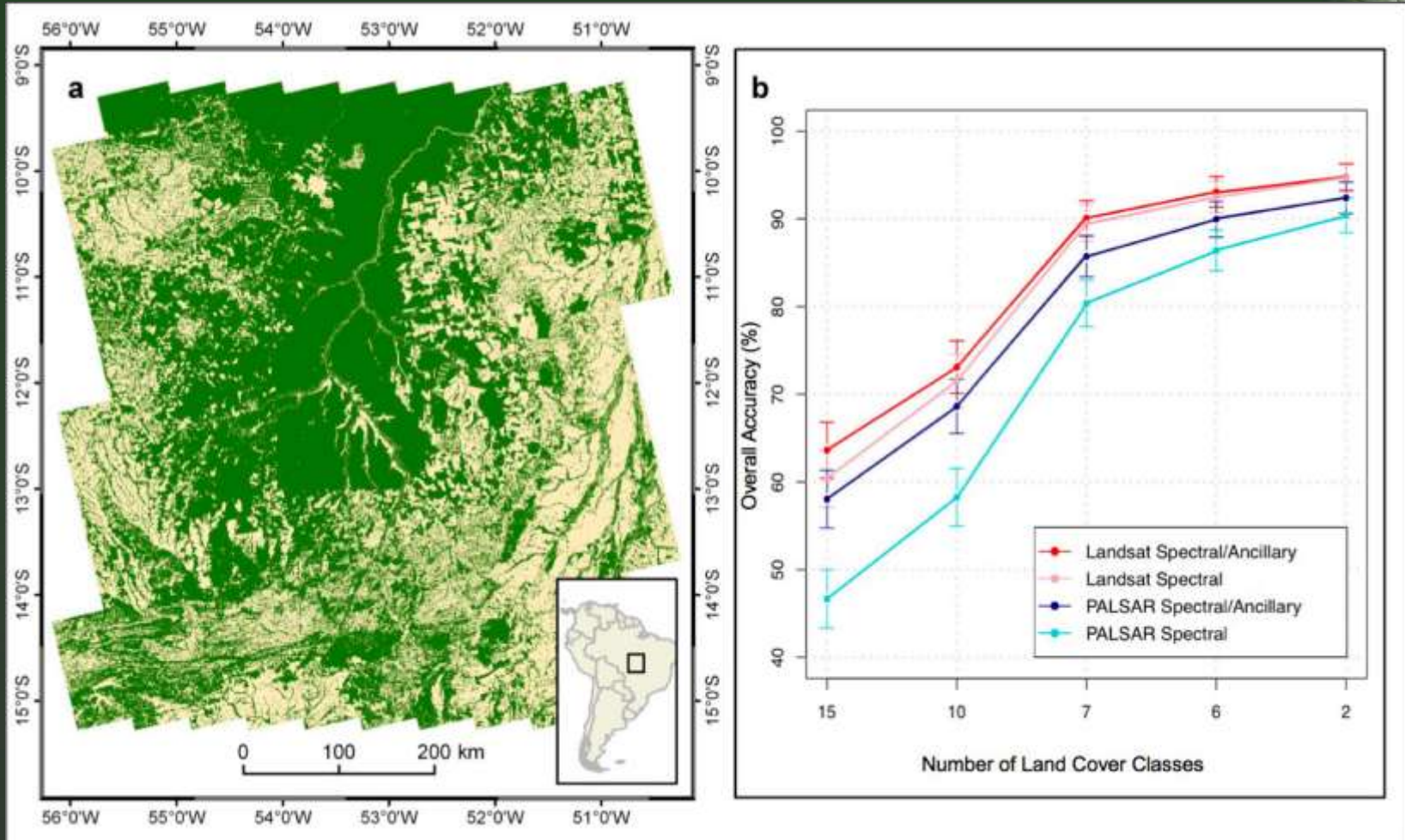


# GEO-FCT: Xingu Basin, Mato Grosso, Brazil





# GEO-FCT: Xingu Basin, Mato Grosso, Brazil



# Building Capacity in Forest Measurement and Monitoring

## I. Pan-tropical Forest Scholars Program:

10 scholars/7 countries: Bolivia, Colombia, Democratic Republic of Congo, Lao PDR, Uganda, Viet Nam, and Zambia.

## II. Technical workshops in Forest Measurement/Mapping:

*Latin America (Ecuador, Colombia, Bolivia) –*

Indigenous representatives from COICA / CONFENIAE / OPIAC / CIDOB  
80 participants/3 countries

*Africa (Uganda) –* Government and NGO technicians  
40 participants/7 countries

*S.E. Asia (Viet Nam) –* Government and NGO technicians  
30 participants/7 countries

**TOTAL:**

**160 participants/17 countries**





# Capacity-building Workshops on Three Continents



*Viet Nam 2009*



*Uganda 2008*



*Bolivia 2009*

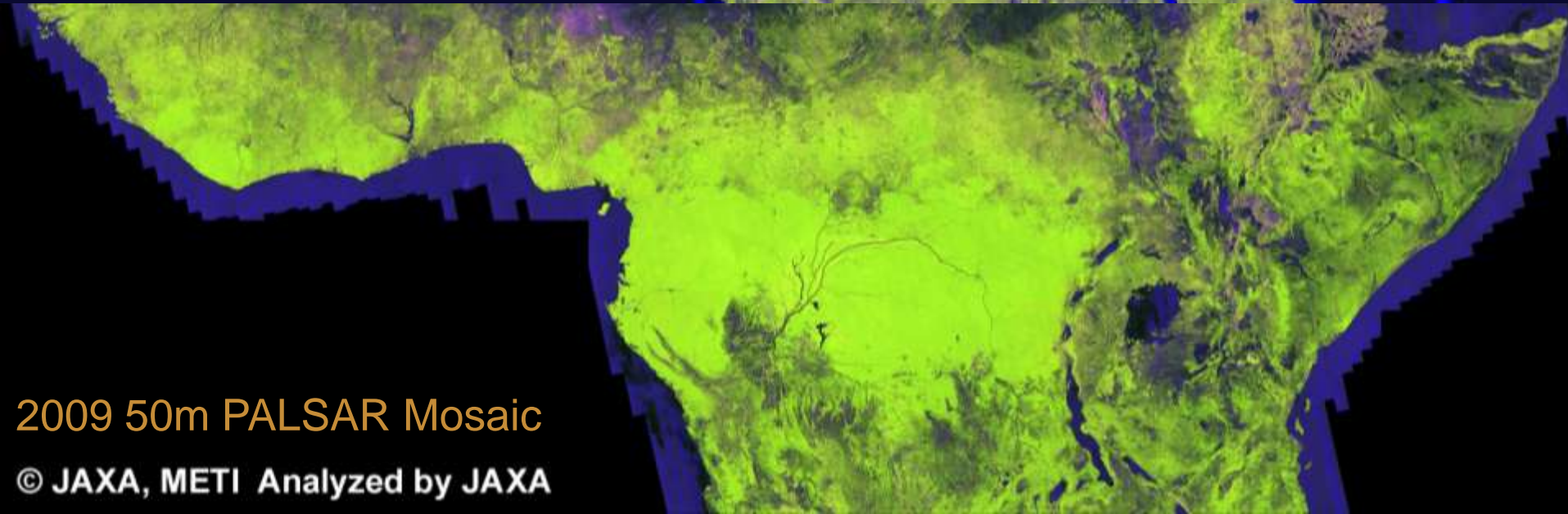
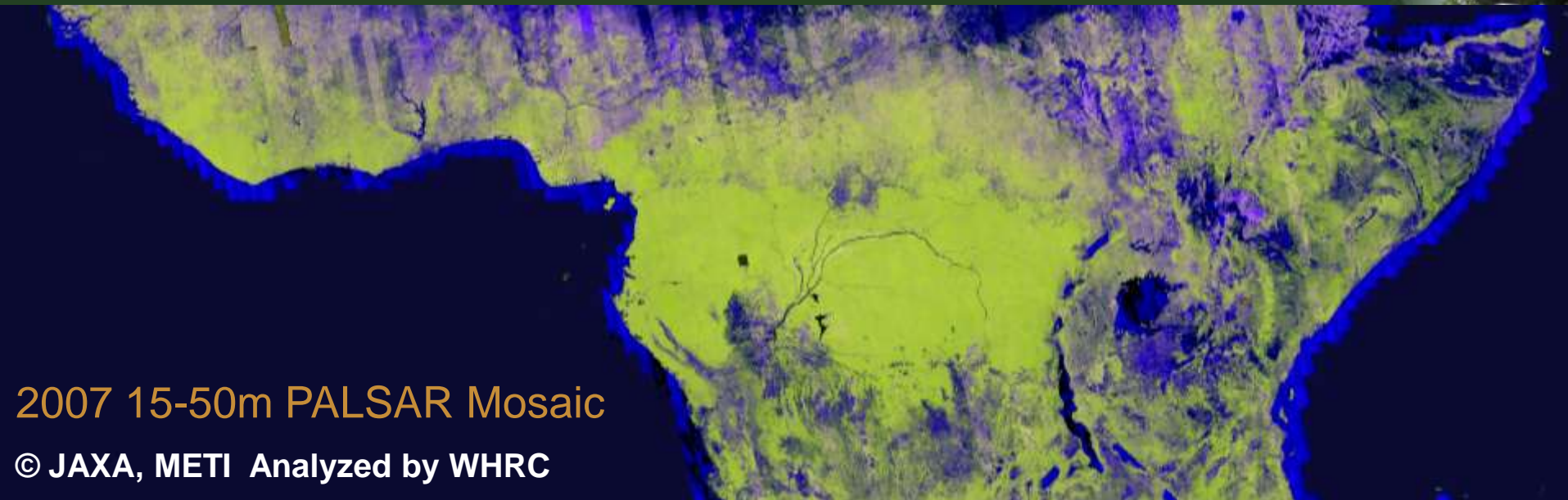


# Current and Future Work

- ✓ Complete 2007 baseline map of pan-tropical forest cover.
- ✓ Following recent JAXA release of the 2009 50 m PALSAR mosaic, begin work on a two-year (2007-2009) pan-tropical map of forest change.
- ✓ Investigate possible fusion of PALSAR data with MODIS, GLAS LiDAR, and field observations as part of our ongoing pan-tropical carbon stock mapping effort.
- ✓ Continue to build pan-tropical country capacity building program.



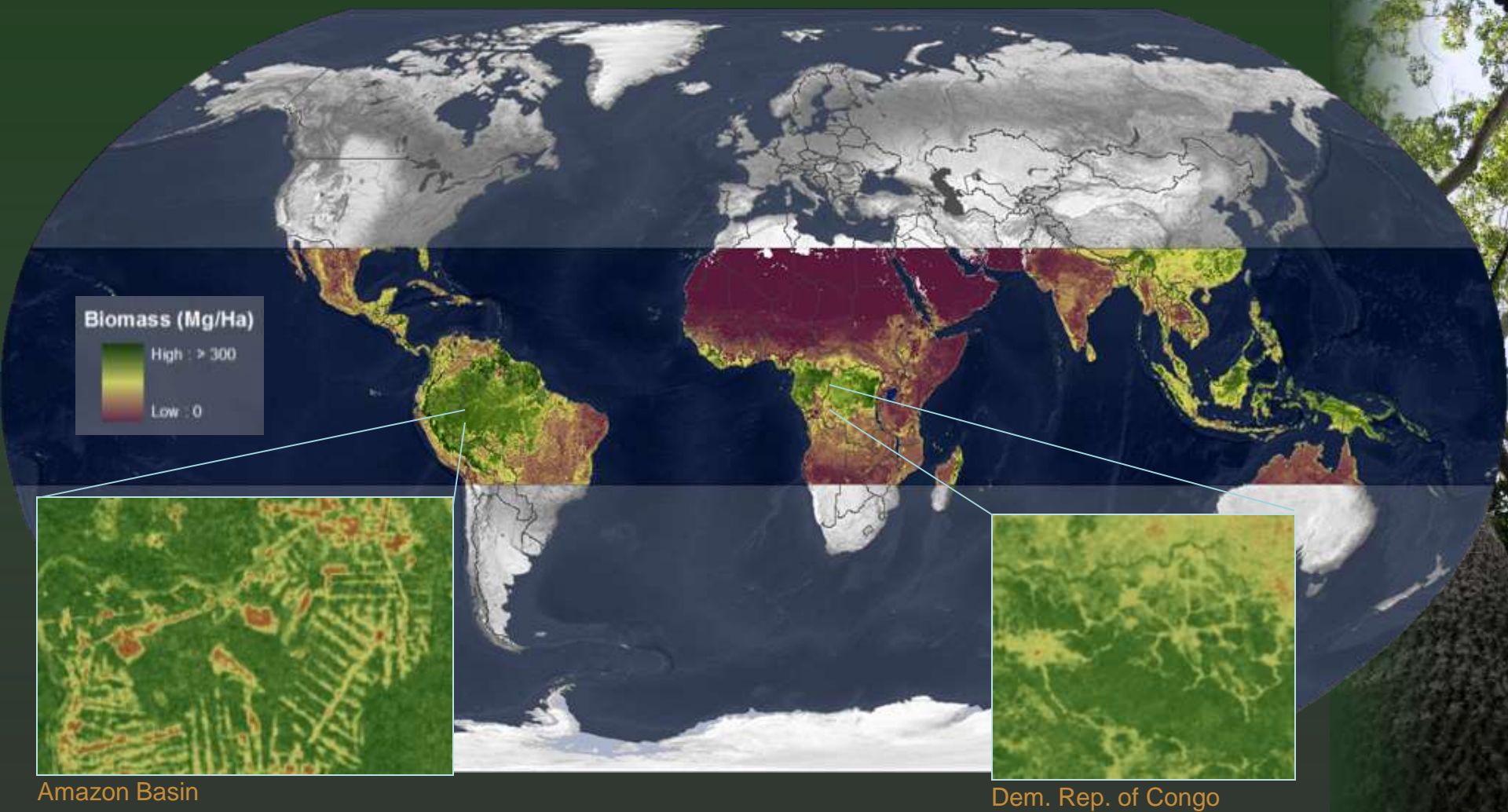
# 2007/2009 ALOS/PALSAR Mosaic





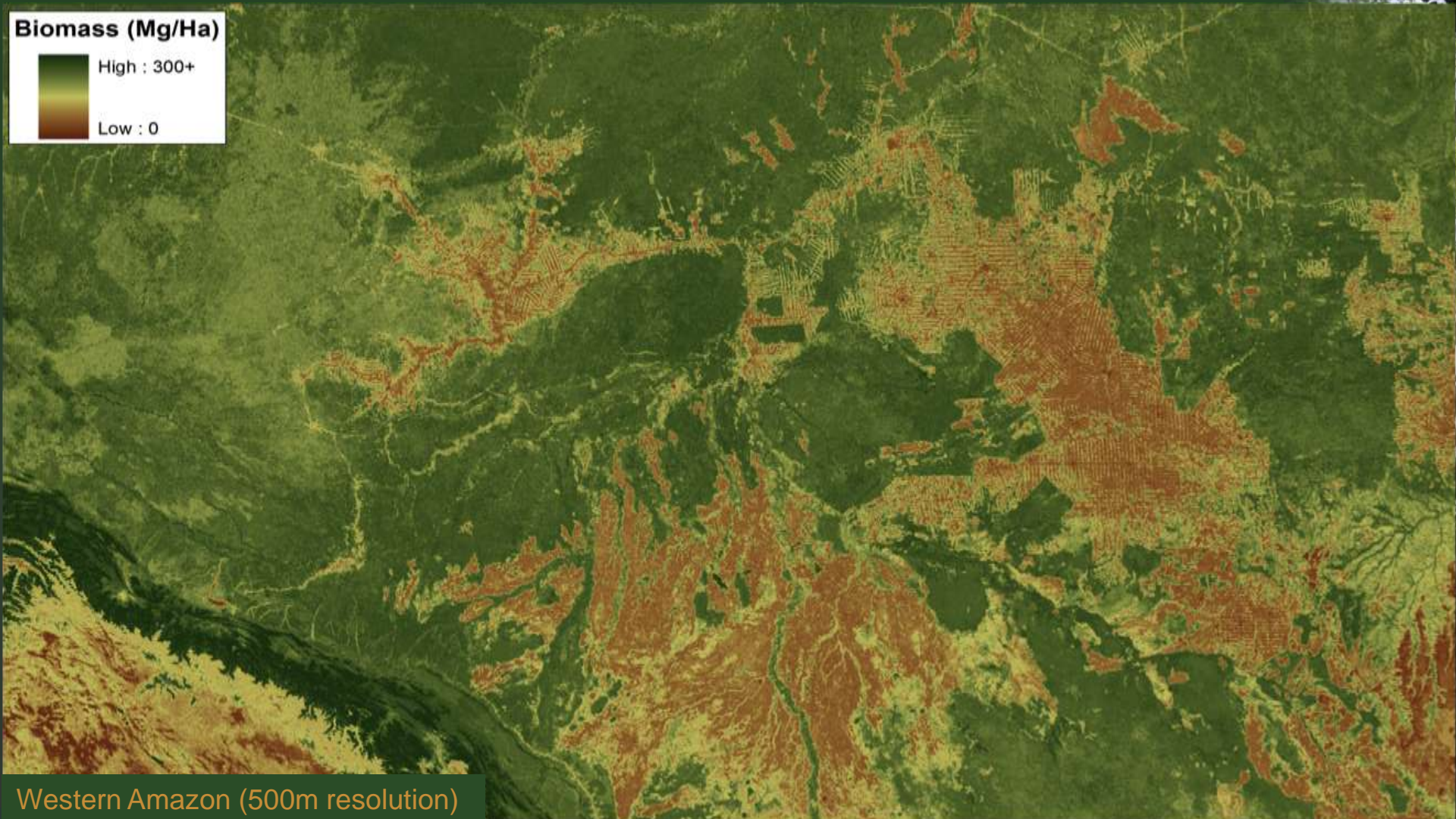
# 2005/2006 Pan-tropical Map of Forest Carbon

*Fusion of MODIS, GLAS LiDAR and Field Data*





# 2005/2006 Pan-tropical Map of Forest Carbon



Baccini et al., 2009, "Pan-Tropical Forest Carbon Mapped with Satellite and Field Observations," WHRC, COP15, <http://www.whrc.org>



# Conclusions

- ✓ ALOS/PALSAR is a key sensor to move international agreements on tropical forest management forward by providing annual, globally consistent, cloud-free monitoring capabilities.
- ✓ ALOS/PALSAR will provide a science baseline for a long-term L-band SAR data record.
- ✓ WHRC is well positioned to work with COMIFAC countries and the international community on furthering the use of SAR for forest monitoring applications.
- ✓ WRHC is eager to work with partners to assist nations in the development of robust forest MRV strategies.



*Merci!*

Further information can be found at:  
[www.whrc.org/pantropical](http://www.whrc.org/pantropical)

