K&C Phase 3 – Brief project essentials

Wide area forest monitoring of
Insular SE Asia and Guiana Shield

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Science Team meeting #16 – Phase 3 Kick-off
JAXA TKSC/RESTEC HQ, Tsukuba/Tokyo, October 17-21, 2011

Collaborators

- LAPAN: GEO-FCT National Demonstrators Borneo and Sumatra
- Guyana Forestry Commission: GEO-FCT National Demonstrator Guyana
- Wageningen University (CGI): EU Recover project in Guyana
- Amazon Conservation Team: ‘Karib Corridor’, Brazil
- SarVision
- Wageningen University (ESS-CC)

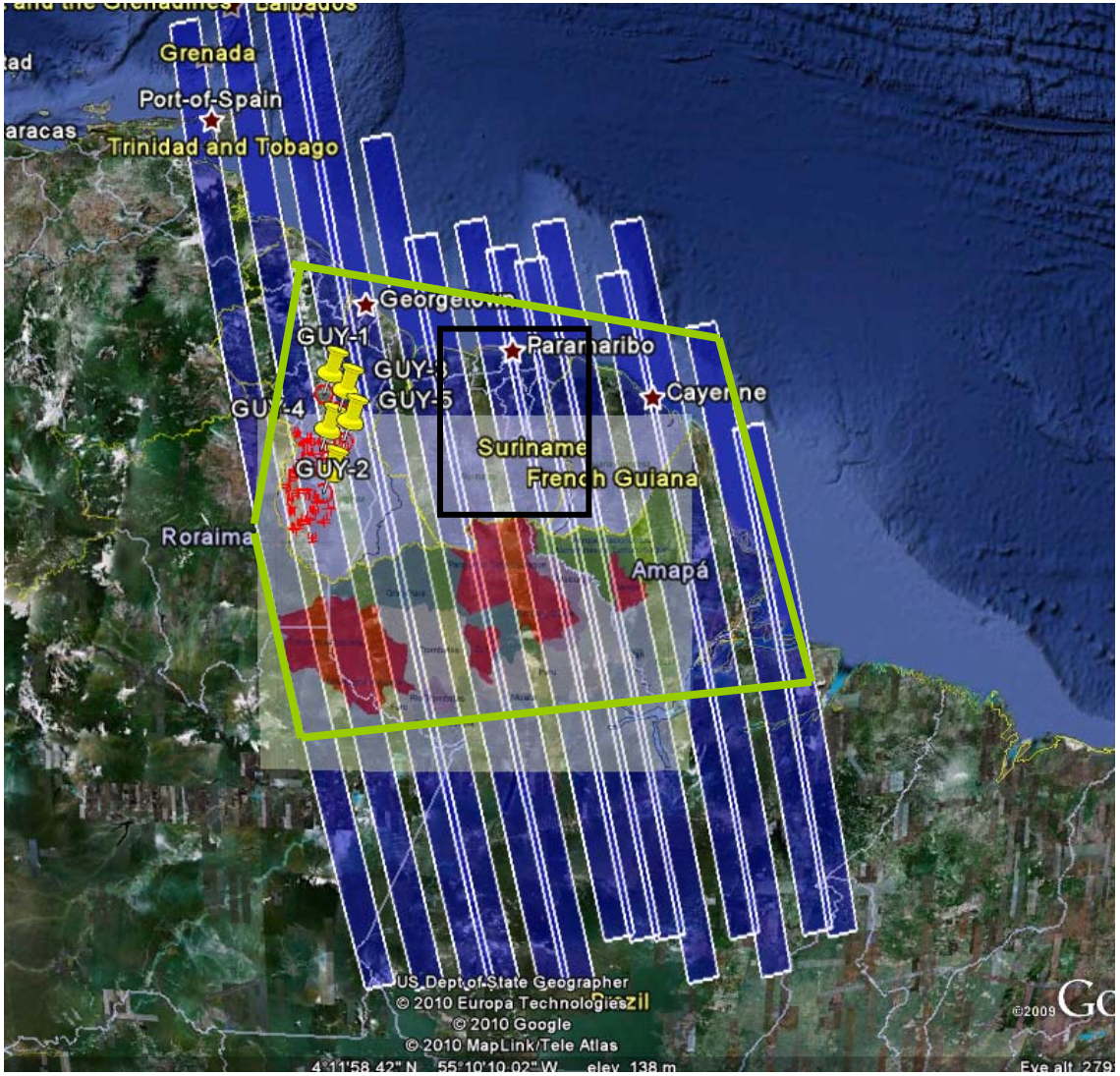
Project area(s)

Focus on two major biomes with persistent cloud cover:

- **Guiana Shield**, with focus on Guyana, Suriname, “Karib Corridor” and Colombia (including Choco)
- **Insular SE Asia**, with focus on Borneo, Sumatra and Papua (Indonesian part of New Guinea)


Guiana Shield
0 100 200 400 Kilometers
Extent of Guiana Shield
Pilot areas
Elevation
high
low
VENEZUELA
Orinoco
Meta
Caura
GUYANA
North Saramacca - Coppename mouth
Matavén
Iwokrama
Essequibo
Marowijne
SURINAME
FRENCH GUIANA
COLOMBIA
Branco
Jari
Oyapock
Trombetas
Iratapuru
Rio Negro
Japurá
Paru
BRAZIL
Amazon
© SarVision 2010

Landscape Guiana Shield, Brazil



Phase 2

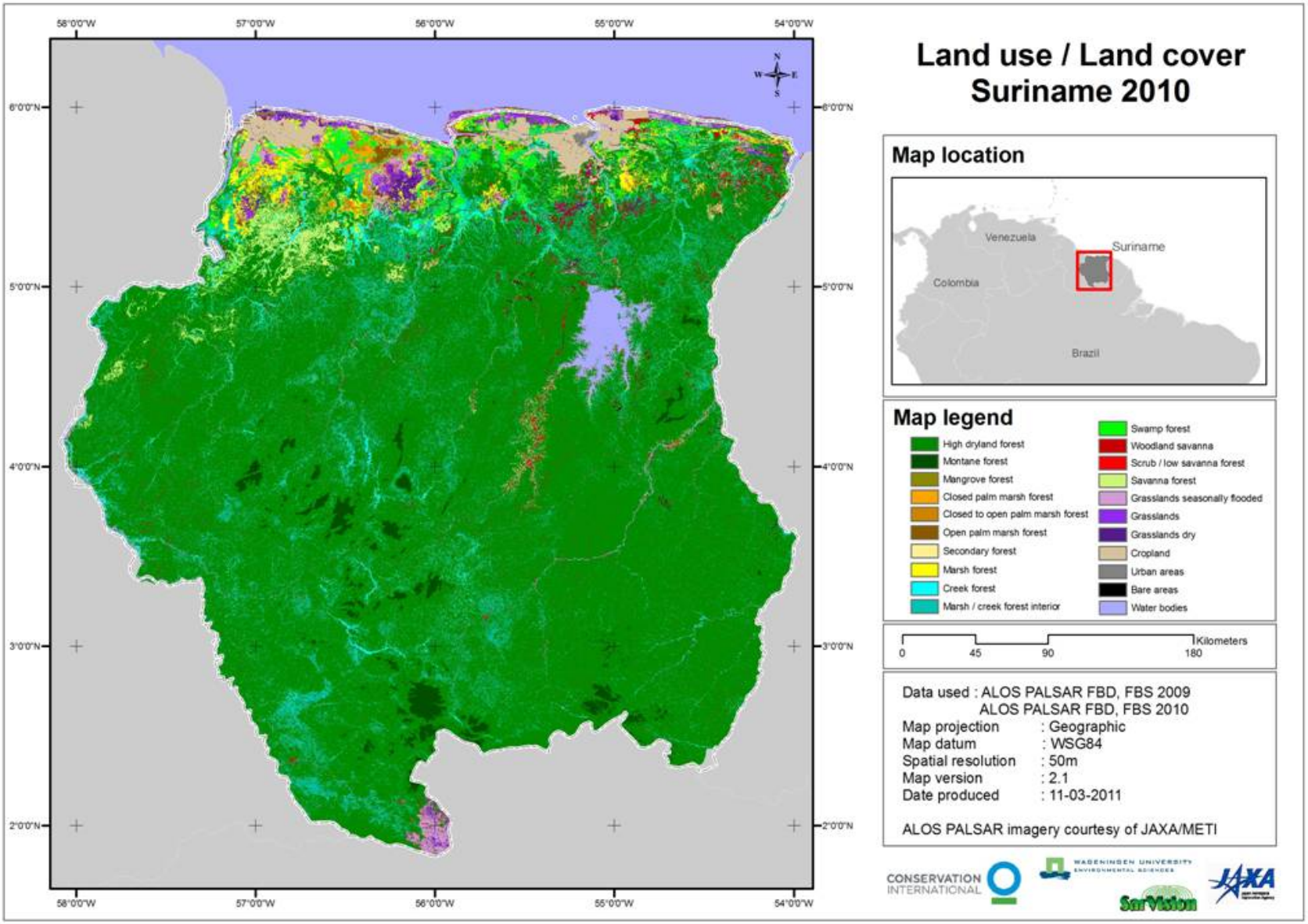
Phase 3

+ parts Colombia

ALOS

K&C Initiative

An international science collaboration led by JAXA



Land use / Land cover Suriname 2010

Map location

Map legend

- High dryland forest
- Montane forest
- Mangrove forest
- Closed palm marsh forest
- Closed to open palm marsh forest
- Open palm marsh forest
- Secondary forest
- Marsh forest
- Creek forest
- Marsh / creek forest interior
- Swamp forest
- Woodland savanna
- Scrub / low savanna forest
- Savanna forest
- Grasslands seasonally flooded
- Grasslands
- Grasslands dry
- Cropland
- Urban areas
- Bare areas
- Water bodies

0 45 90 180 Kilometers

Data used : ALOS PALSAR FBD, FBS 2009
ALOS PALSAR FBD, FBS 2010

Map projection	: Geographic
Map datum	: WSG84
Spatial resolution	: 50m
Map version	: 2.1
Date produced	: 11-03-2011

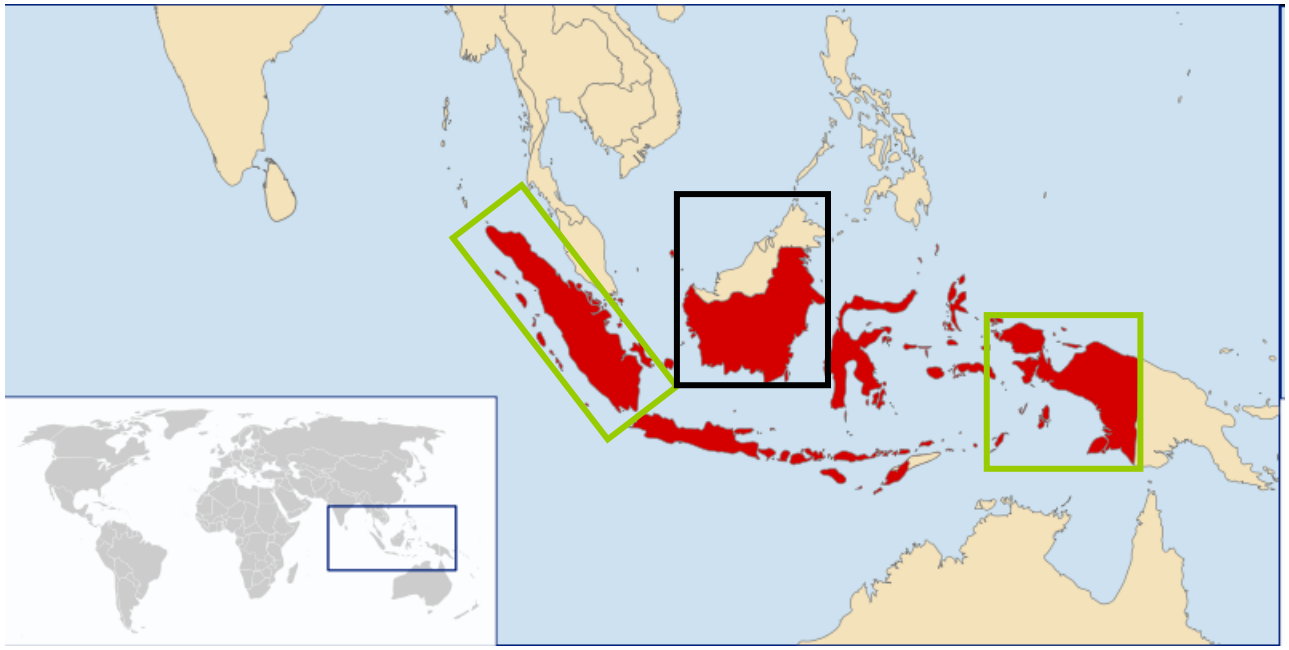
ALOS PALSAR imagery courtesy of JAXA/METI

CONSERVATION INTERNATIONAL

WAGENINGEN UNIVERSITY ENVIRONMENTAL SCIENCES

SarVision

JAXA



Phase 2

Phase 3

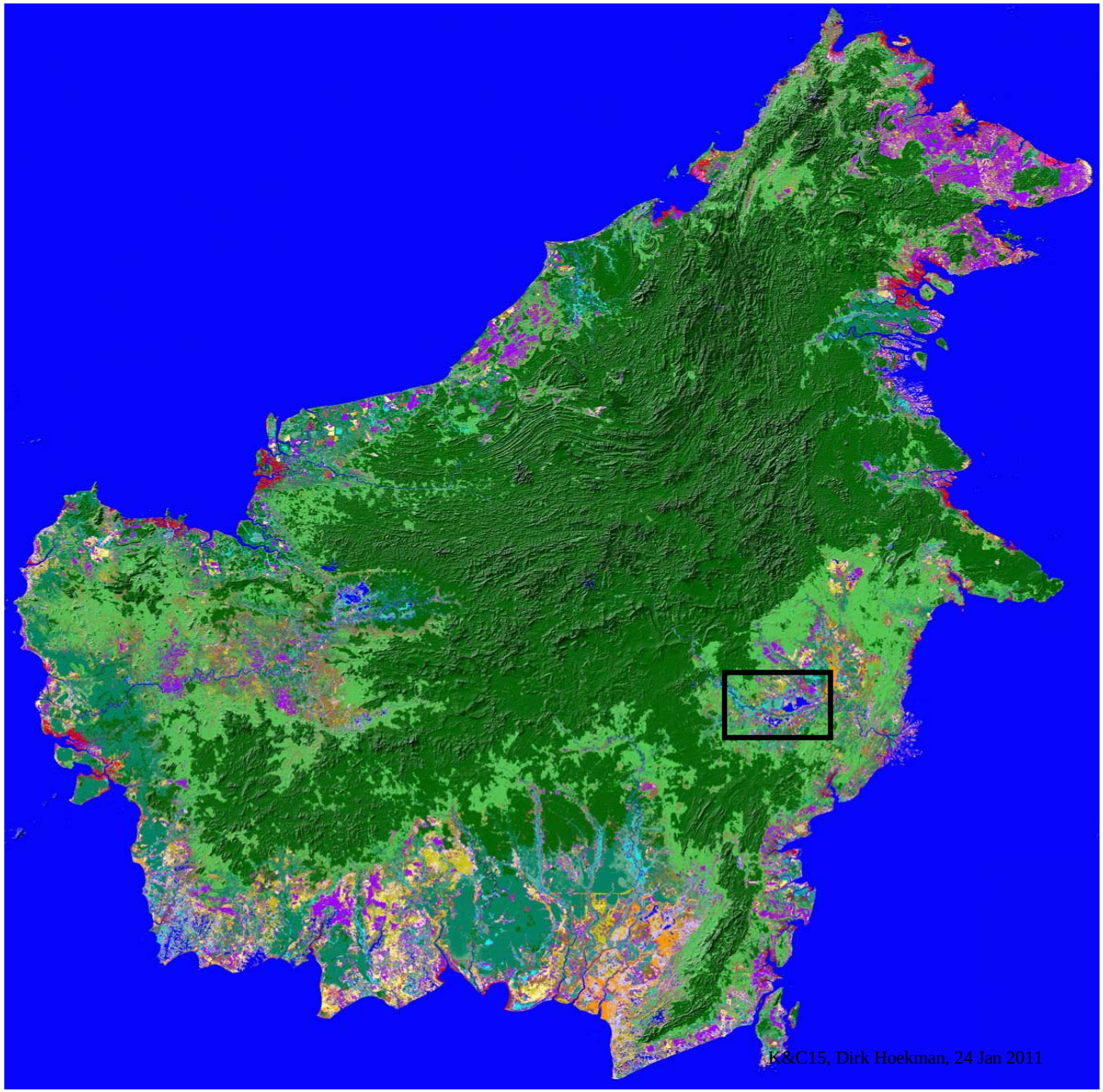
Wide area SAR mapping methodology: *Phase 2 Map result*

ALOS PALSAR 2007

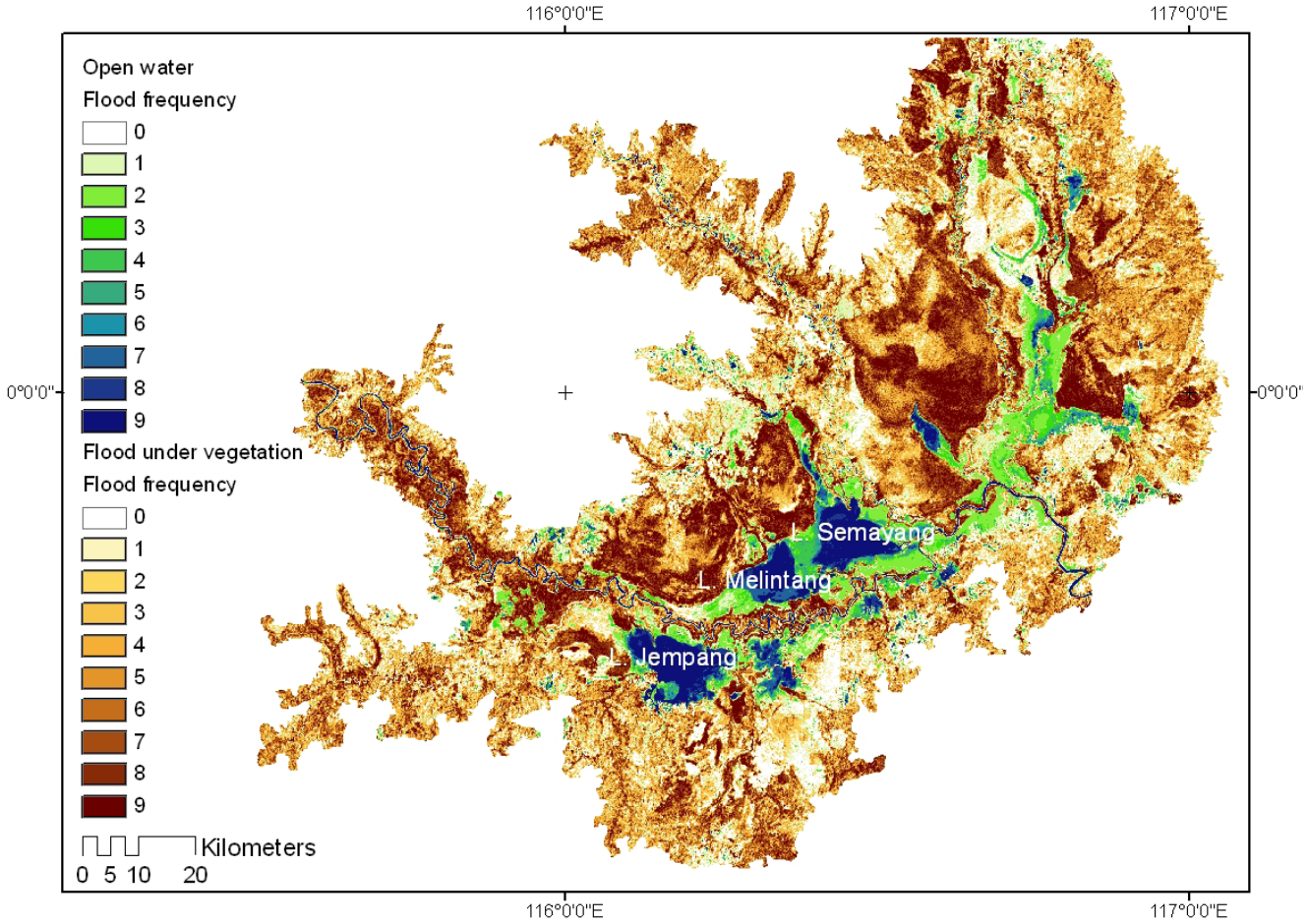
LULC classification Borneo

(shaded relief version)

- Lowland forest
- Riverine forest
- Swamp forest
- Mangrove forest
- *Nipah* mangrove forest
- Peat swamp forest (pole)
- Peat swamp/riverine shrub
- Forest mosaics/degraded
- High shrub
- Medium shrub
- Ferns / grass
- Grassland
- Cropland (upland)
- Cropland (irrigated)
- Plantations (oil palm)
- Tree cover, burnt
- Water bodies
- Layover /Shadow
- No strip coverage
- Mountain forest



Flood frequency map derived from PALSAR ScanSAR images 2008/2009.



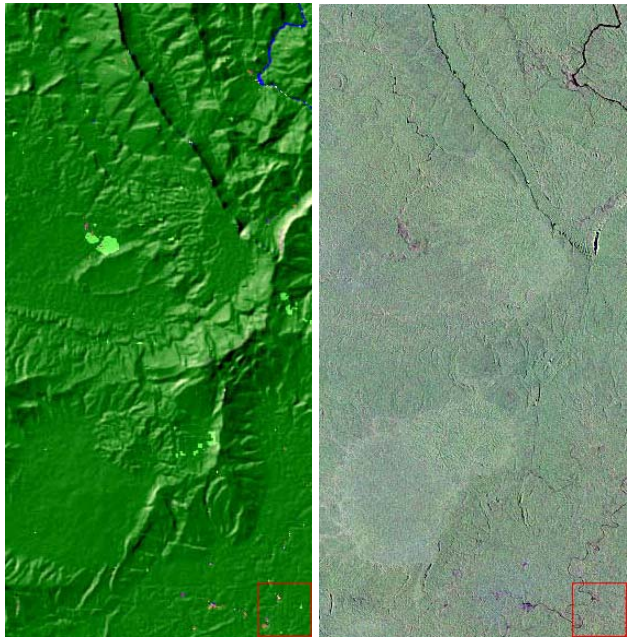
Flood frequency mapping of the middle Mahakam lowland area using satellite radar, 2011, H. Hidayat, D. H. Hoekman, M. A. M. Vissers, and A. J. F. Hoitink (subm. *Hydrol. Earth Syst. Sci*.)

Project objectives and schedule

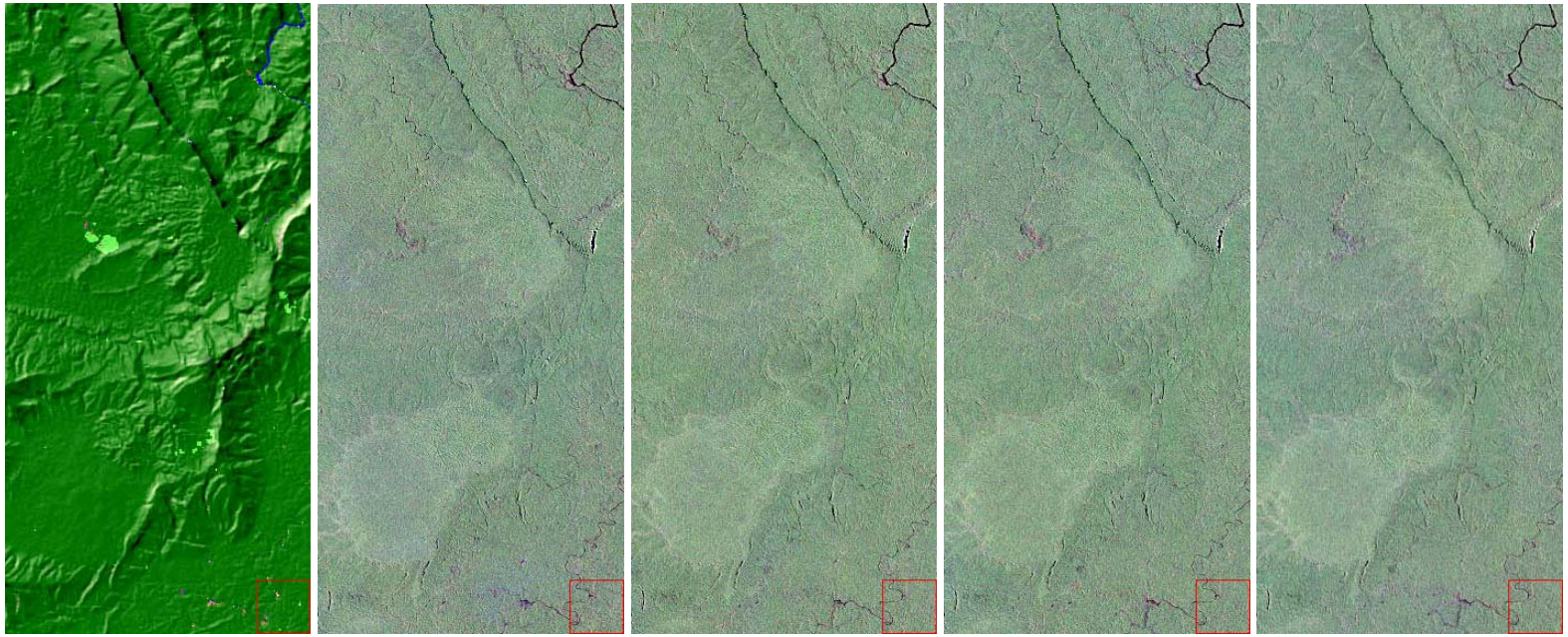
Primary objectives

The project primarily aims to develop techniques to improve time-consistency (and avoid error propagation) over wide areas.

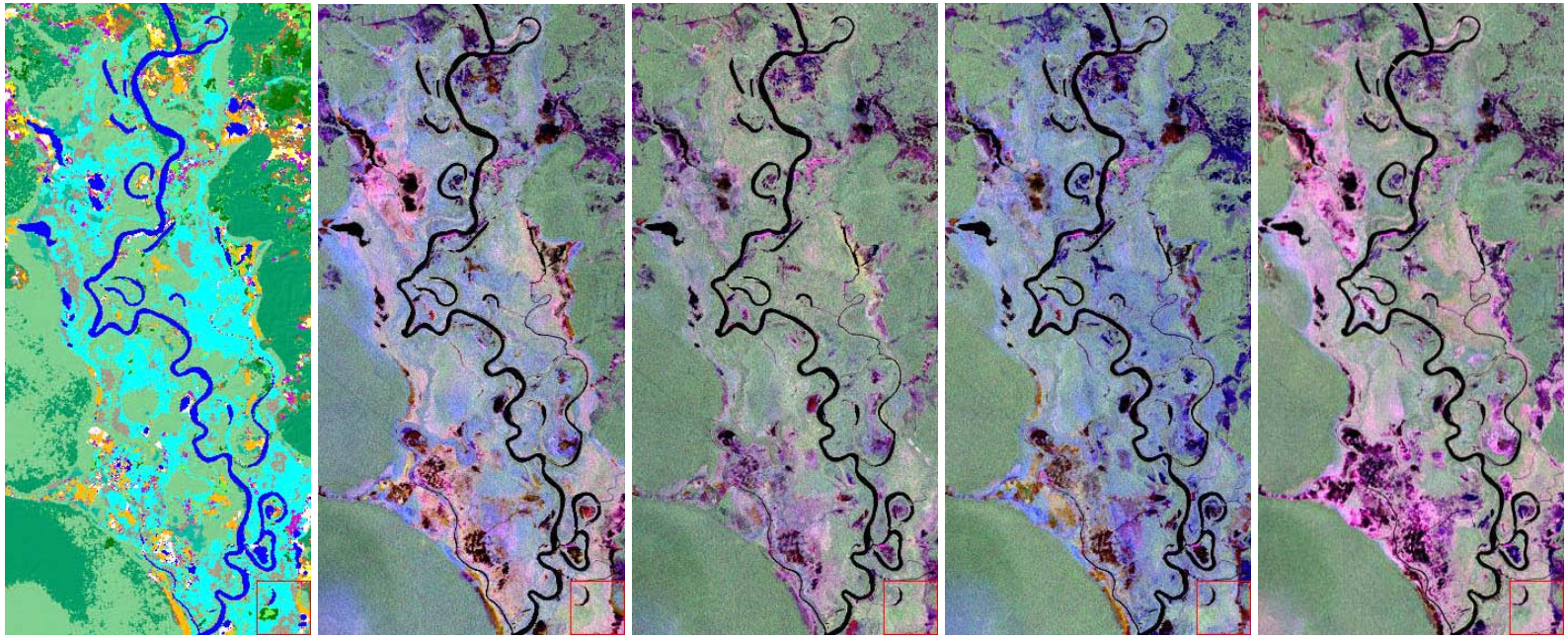
This includes the automated adaptation of radar signatures to changing environmental conditions and the use of ScanSAR data to support classification in dynamic and irregularly inundated areas.



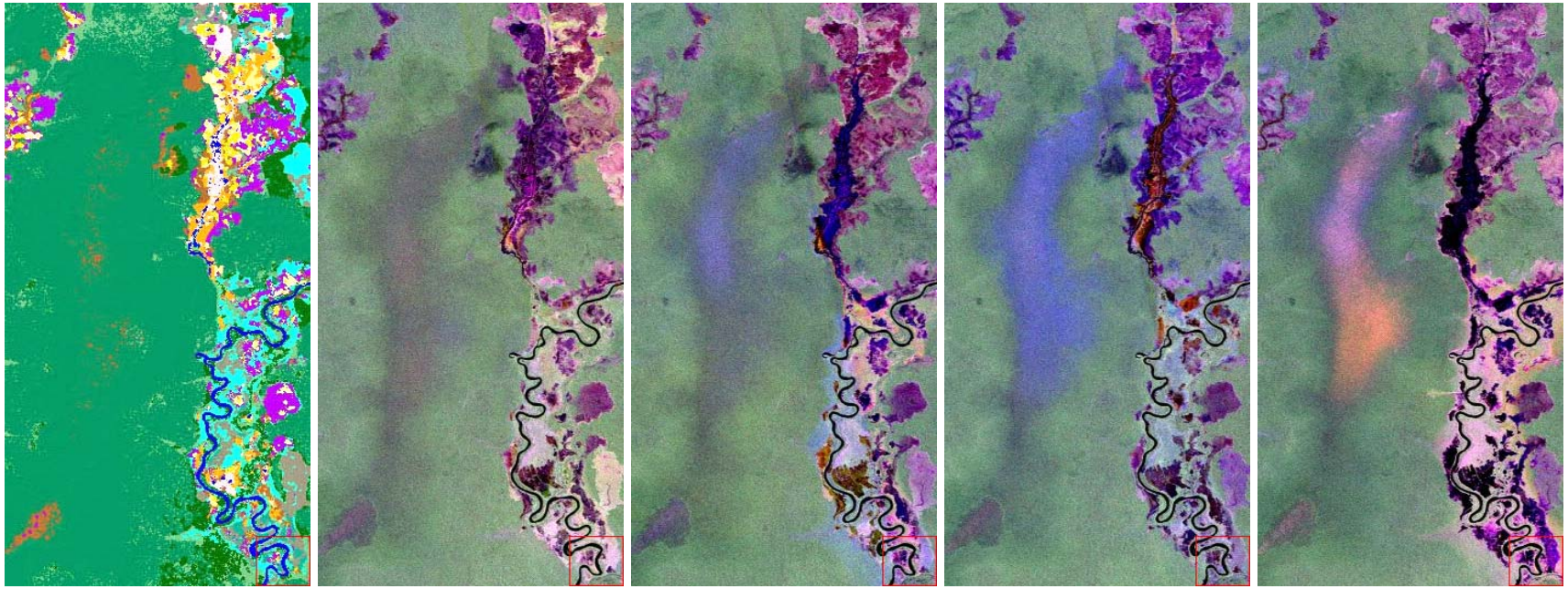
Forest. From left to right: map 2007, radar (FBS-FBD) mosaics 2007.



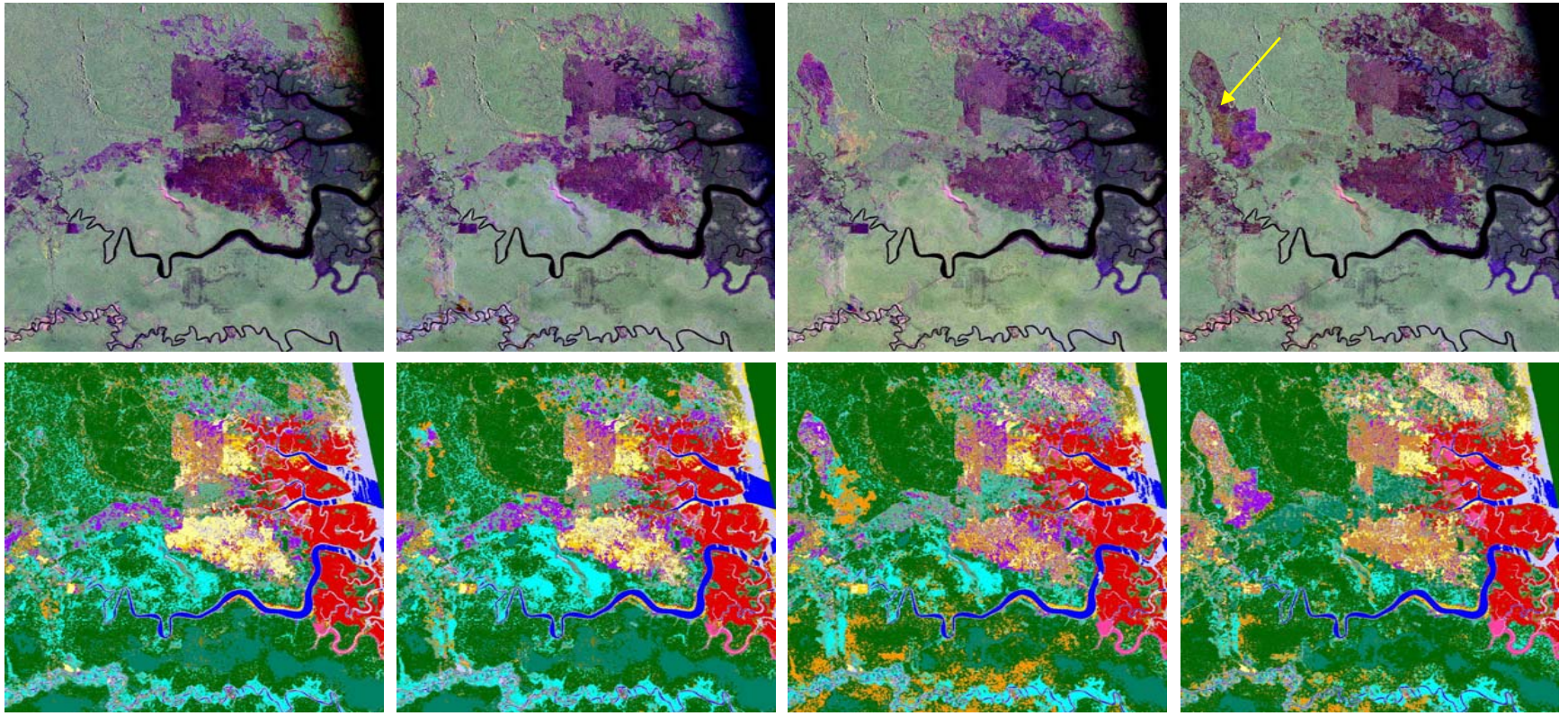
Forest. From left to right: map 2007, radar (FBS-FBD) mosaics 2007, 2008, 2009 and 2010. The forest areas feature very stable backscatter levels from year to year.

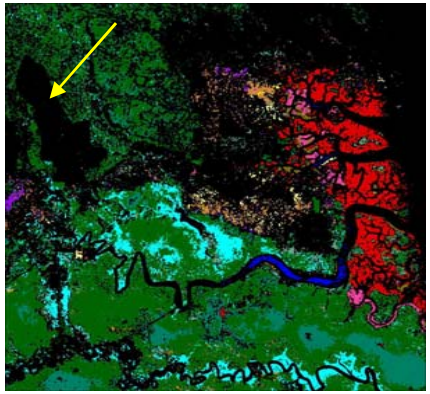


Floodplain. From left to right: map 2007, radar mosaics 2007, 2008, 2009 and 2010. Floodplain backscatter is very dynamic. Blue tints hint to pronounced flooding in the wet season and pink tints to pronounced flooding in the dry season. Some areas stay green which is a sign of no significant flooding during both the FBS and FBD radar observations

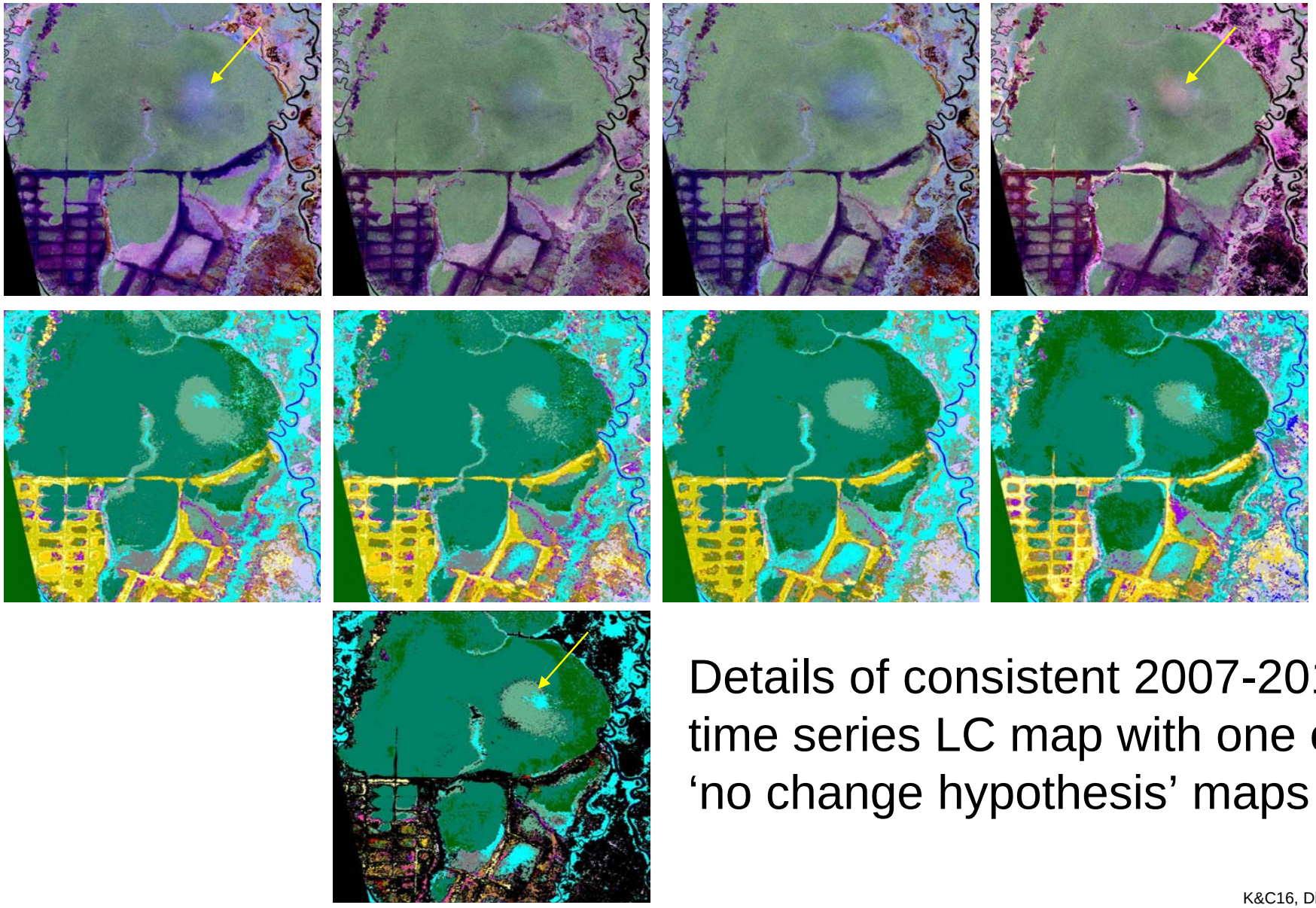


Peat swamp forest and floodplain. From left to right: map 2007, radar mosaics 2007, 2008, 2009 and 2010. The backscatter dynamics in the *padang* (or central) regions of the peat swamp forest is high and shows major inter-annual variation related to flooding events.





Details of consistent 2007-2010 time series LC map with one of the ‘no change hypothesis’ maps



Details of consistent 2007-2010 time series LC map with one of the ‘no change hypothesis’ maps

System will be used for automated interpretation at 25 m resolution of (individual) Fine Beam standard images (also from PALSAR-2), in the context of the dynamical behaviour observed over Borneo during the lifetime of the PALSAR-1.

2007-2008	~normal years
2009	El Niño year
2010	very wet year

It is intended to increase system versatility by developing an interface for user defined legends (which may improve performance after more validation has been done)

System is generic and can be expanded with, or used for, other sensors.

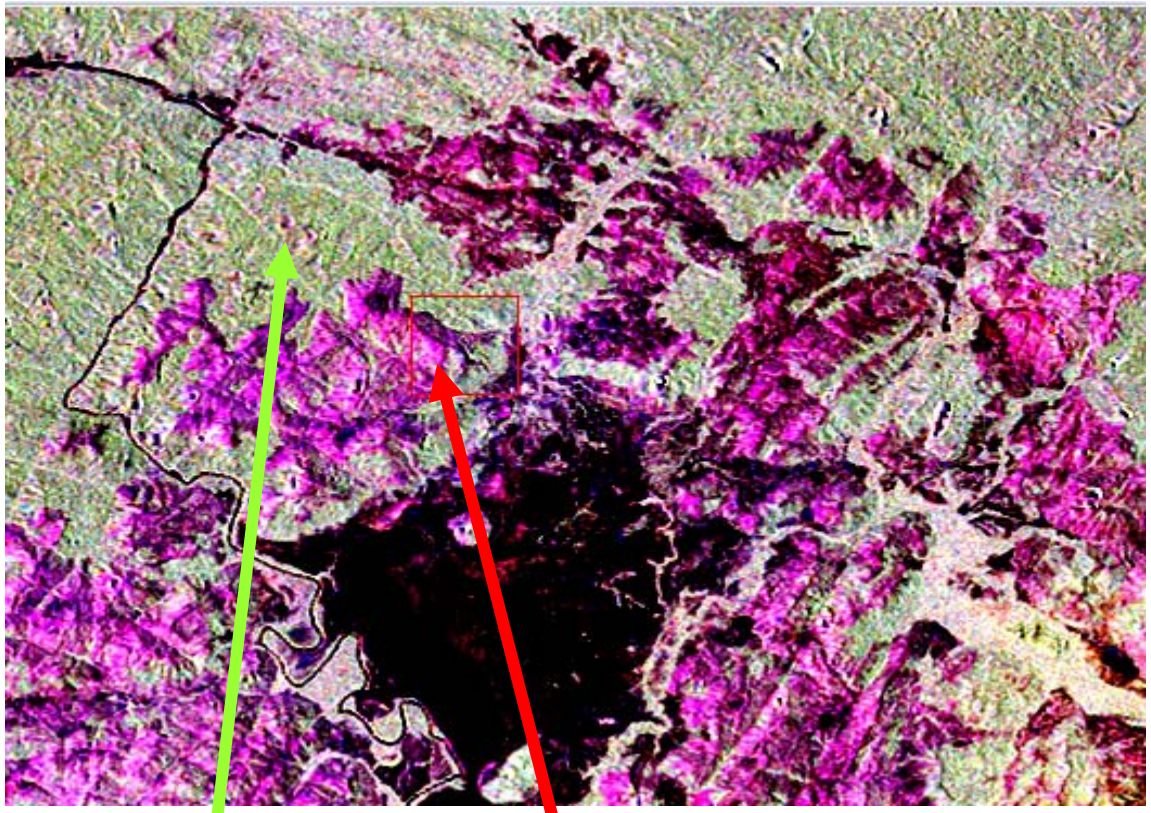
Main users may be LAPAN and Ministry of Forestry

Project objectives and schedule

Secondary objectives

To improve **classification** and **biomass stratification** accuracy (and spatial resolution) it is intended to address technical issues such as:

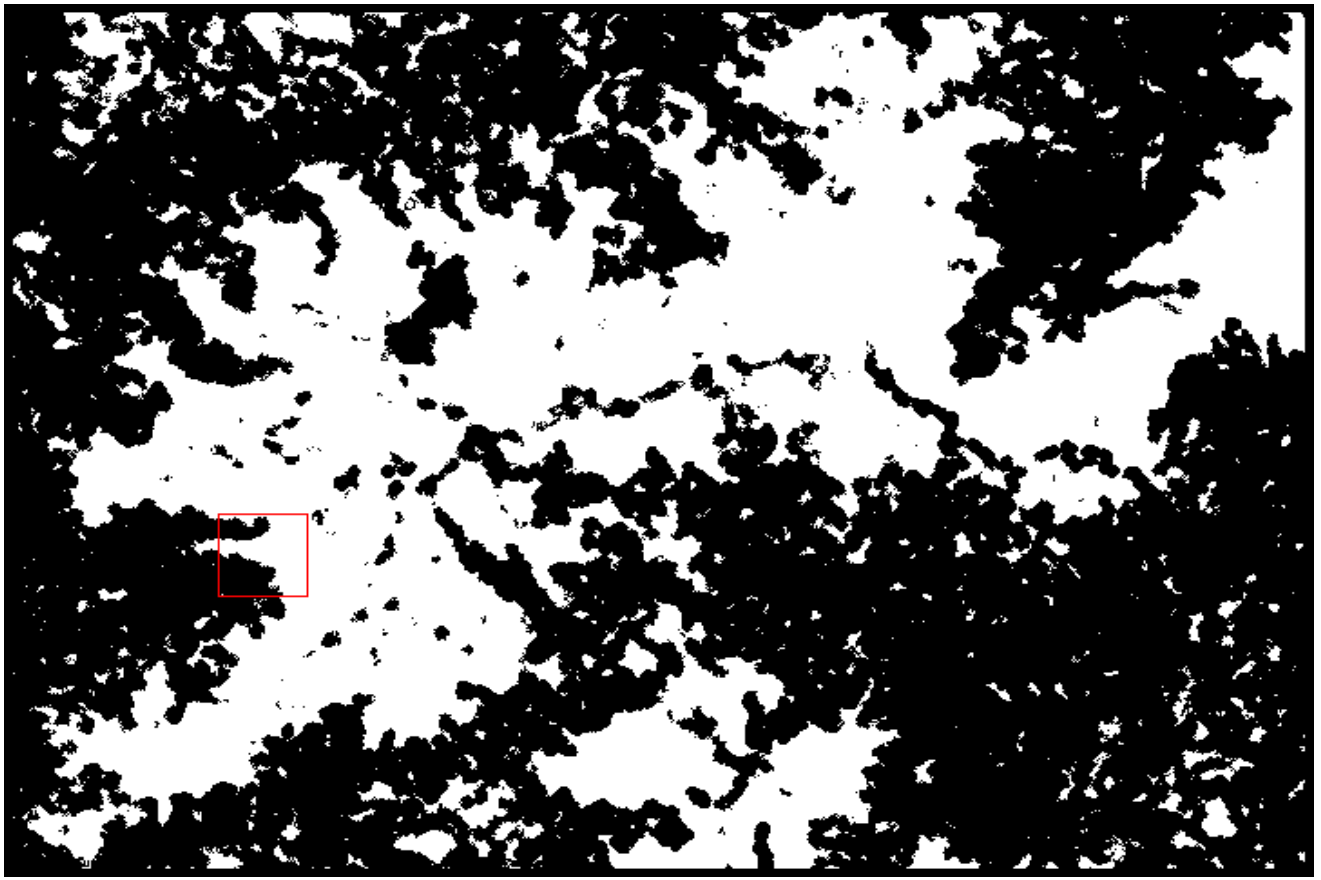
- Further development of slope correction by adaptation to terrain characteristics and handling micro-relief (below resolution SRTM)
- Study of the utility of texture (and preferably using 10 m mosaic data)
- Processing of denser time series and application of multi-temporal speckle filtering



Slope correction

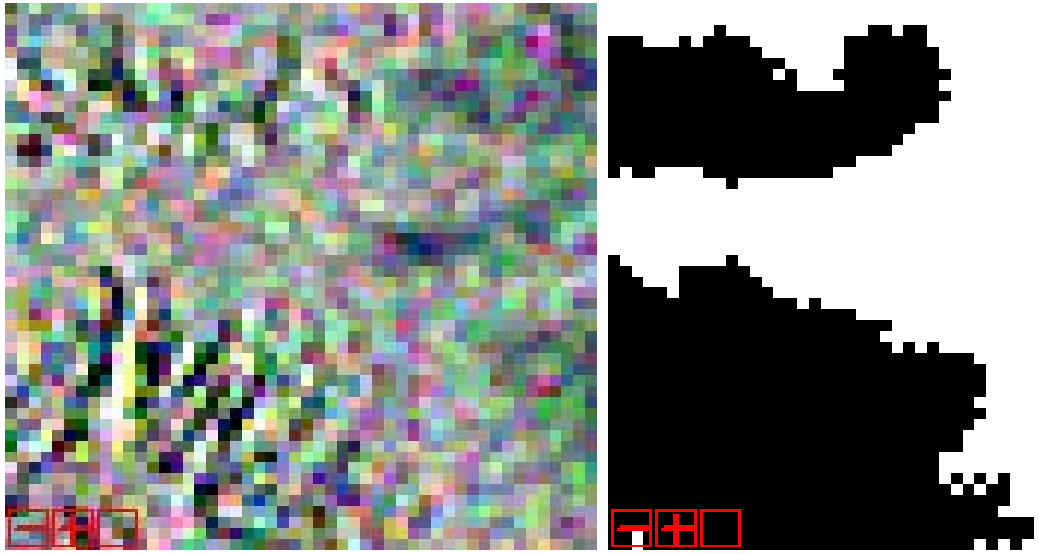
Initial step: isotropic opaque volume scattering model (applicable for forests)

Followed by: higher order pre-processing levels (for example in savannah areas)



Borneo, Central highlands

Flat plain with swamps and floodplains at 1000 m altitude surrounded by mountains with short and steep slopes



Pixels forming the black & white patterns have offsets (of 3-4 dB) induced by micro-relief (short steep hill slopes not visible in SRTM)

These values can be corrected to a large extent, which considerably improves the accuracy of classification and biomass stratification

Project objectives and schedule

Relation to the K&C thematic drivers (**CCC**)

Development of UNFCCC REDD+ agreements and the Ramsar convention require the availability of credible and regularly updated spatial information on forest, forested wetlands and land use/cover (change) at the local to national levels**.**

Persistent cloud cover in tropical rain forest areas, in particular in areas such as Insular SE Asia and the Guiana Shield, severely limits the practical use of optical satellite observation.

Monitoring land cover change on an annual basis requires consistent year-to-year mapping.

Contribution to operational national MRV systems, such as INCAS in Indonesia.

Support to GEO-FCT and GFOI (focus Indonesia, Guyana and Colombia)

Project objectives and schedule

Project milestones

A. Consistent time series of wide area land cover maps for Insular SE Asia (Borneo, Sumatra and Papua; 2007-2011) and Guiana Shield (2007/2009-2011); First results Borneo 2012; Sumatra 2012; Papua 2012; Suriname 2012, Brazil-Karib 2013; Guyana and Colombia 2013

B. Decadal change maps using JERS-1 mosaics (together with A)

C. Biomass stratification maps and deforestation hot spots maps for pristine dryland mixed forest in the Guiana Shield; Suriname 2012; Brazil-Karib 2013; Guyana and Colombia 2013

D. Biomass stratification Borneo 2012

Support to JAXA's global forest mapping effort

Our team carries out research in two tropical forest biomes since the early 90s, and is active in the development of operational monitoring systems in consultation with local governments and environmental NGO's.

Both study areas comprise important mangrove complexes (and as such can contribute to the K&C Mangrove Watch).

Development of biomass stratification, classification and monitoring products and legends based on FBD/FBS/ScanSAR strip data. Similar products made on the basis of standard 10/25m FBD and 100m ScanSAR mosaics (either by JAXA and/or our team) will be compared with the products based on strip data.

Development of techniques for denser time series and higher resolutions (preparation for PALSAR-2)

Support to JAXA's global forest mapping effort

Ground truth shared with JAXA

Borneo. Field data reports from campaigns in West-Kalimantan (2010), East-Kalimantan (2010), and several future campaigns.

Borneo. Field data reports from campaigns in Mawas (2011, and onwards). This is one of the dense time series analysis sites of GEO-FCT (BOR-3).

Sumatra. Field data reports from campaigns in Harapan (2010, and onwards). This is one of the dense time series analysis sites of GEO-FCT (SUM-2).

Papua. GPS-tagged oblique aerial photography of Mamberamo (2007).

Support to JAXA's global forest mapping effort

Ground truth shared with JAXA

Suriname. GPS-tagged oblique aerial photography (2010) (~1500)

Colombian Amazon. Landscape ecological maps of the Araracuara test site, indicating forest structure and biomass

Guyana. Field work data are expected to become available in the framework of the EU Recover project. Additional data may become available through collaborator GFC in the framework of GEO-FCT.

Brazil, Karib corridor. This is a very sparsely populated area of 17m ha comprising very large indigenous reserves and parks along the borders with French Guiana, Suriname and Guyana, and is part of the Guiana Shield. Field observations made for REDD projects by local indigenous tribes are expected to become available through collaborator ACT.

Meeting with Kaxuyana, April 2010

Fieldwork in Karib corridor, Guiana Shield, Brazil

Deliverables

- Techniques for consistent time series of w2w land cover mapping; Including technical improvements for slope corrections, dense time series and texture.
- Scientific papers
- Consistent annual w2w land cover and biomass stratification maps for Borneo, Sumatra, Papua, Guyana, Suriname, Karib corridor and Colombia
- Comparison between strip based products, mosaic based products and JAXA thematic products.
- Ground truth (continued effort to collect field and reference data)
- Progress and technical reports

Acknowledgement

This work has been undertaken within the framework of the JAXA Kyoto & Carbon Initiative. ALOS PALSAR data have been provided by JAXA EORC

Thank you