

AMAZON MONITORING PROJECTS DEVELOPED BY INPE AMAZONIA AND ISSUES OF CLIMATE CHANGE

ALESSANDRA RODRIGUES GOMES

**TECHNOLOGIST AT NATIONAL INSTITUTE FOR SPACE RESEARCH – INPE
SPATIAL COORDINATION OF THE AMAZON - COEAM**



INPE: FROM DATA TO KNOWLEDGE



SATELLITES

Earth and Space Observation



LAND SYSTEMS

Satellite Control, reception and dissemination of spatial data



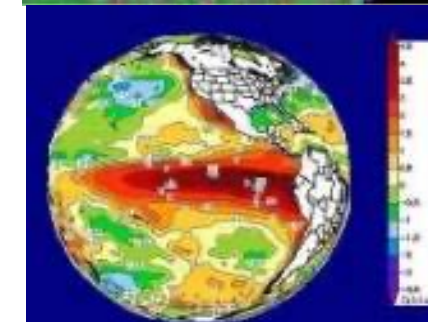
KNOWLEDGE GENERATION

R & D for Space and Environment

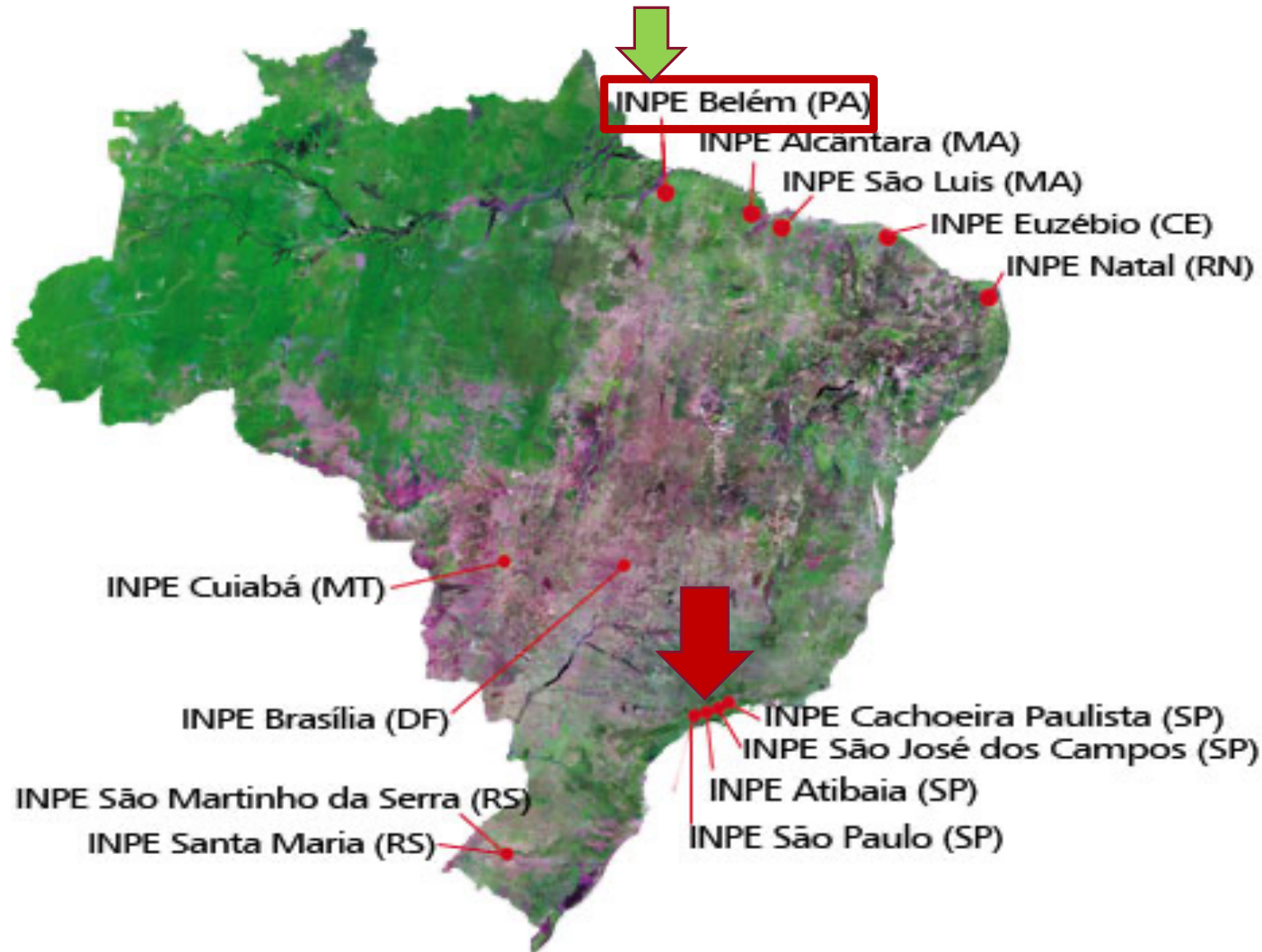


INFORMATION ACCESS

Products to society



FACILITIES OF INPE (BRAZIL)





Espace DEV

COEAM: PROJECTS DEVELOPED IN AMAZON REGION



www.inpe.br/cra



BRAZIL DATA CUBE



CAPACITY BUILDING IN SATELLITE FOREST MONITORING

DATA FROM 2010 - 2017



NORTH/CENTRAL AMERICA	SOUTH AMERICA	AFRICA	EUROPE	ASIA	OCEANIA
Professionals Trained: 37	Professionals Trained: 517	Professionals Trained: 114	Professionals Trained: 05	Professionals Trained: 65	Professionals Trained: 10
Countries: 16	Countries: 12	Countries: 20	Countries: 01	Countries: 14	Countries: 01
Projects: FAO - CARICOM - TCTP	Projects: CARICOM - TCTP - OTCA - FAO	Projects: COMIFAC - FAO - TCTP	Projects: FAO	Projects: FAO - TCTP	Projects: FAO

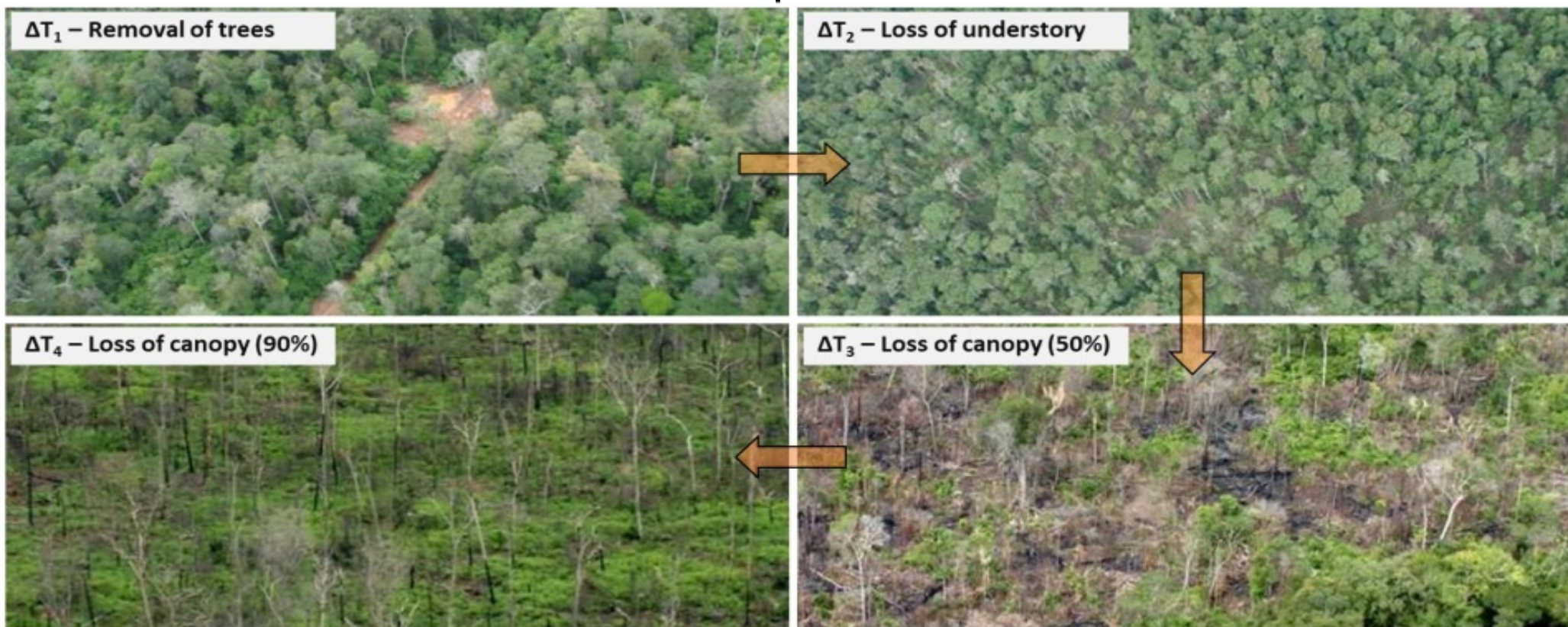




DETER Project

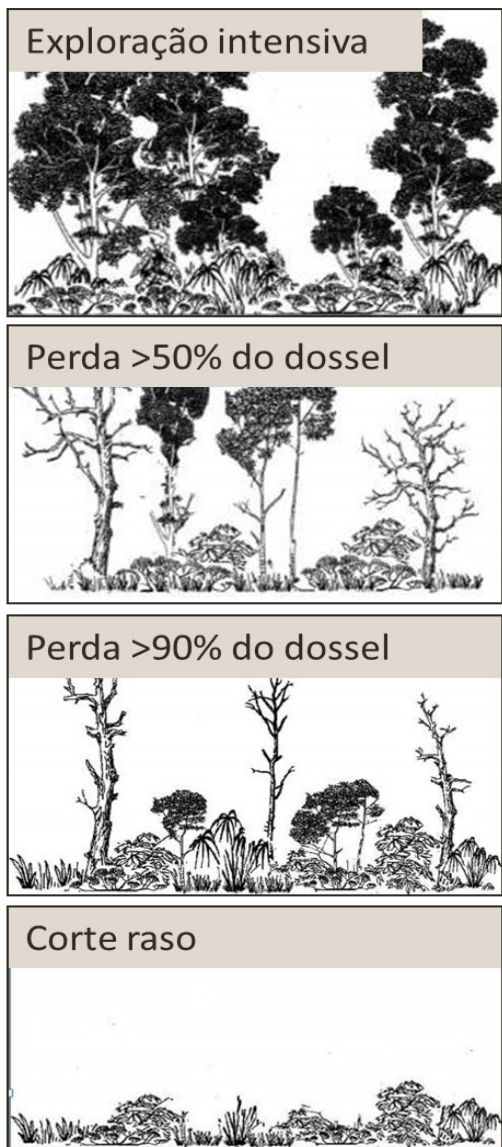
Deforestation and forest degradation

2004 – 2017: MODIS/Terra Aqua, 250m, minimum area > 25 ha
 2014 – today: WFI/CBERS-4, 4A e Amazonia, 64m, minimum area > 3





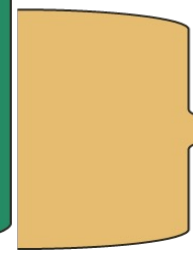
Projects: PRODES and DETER



time

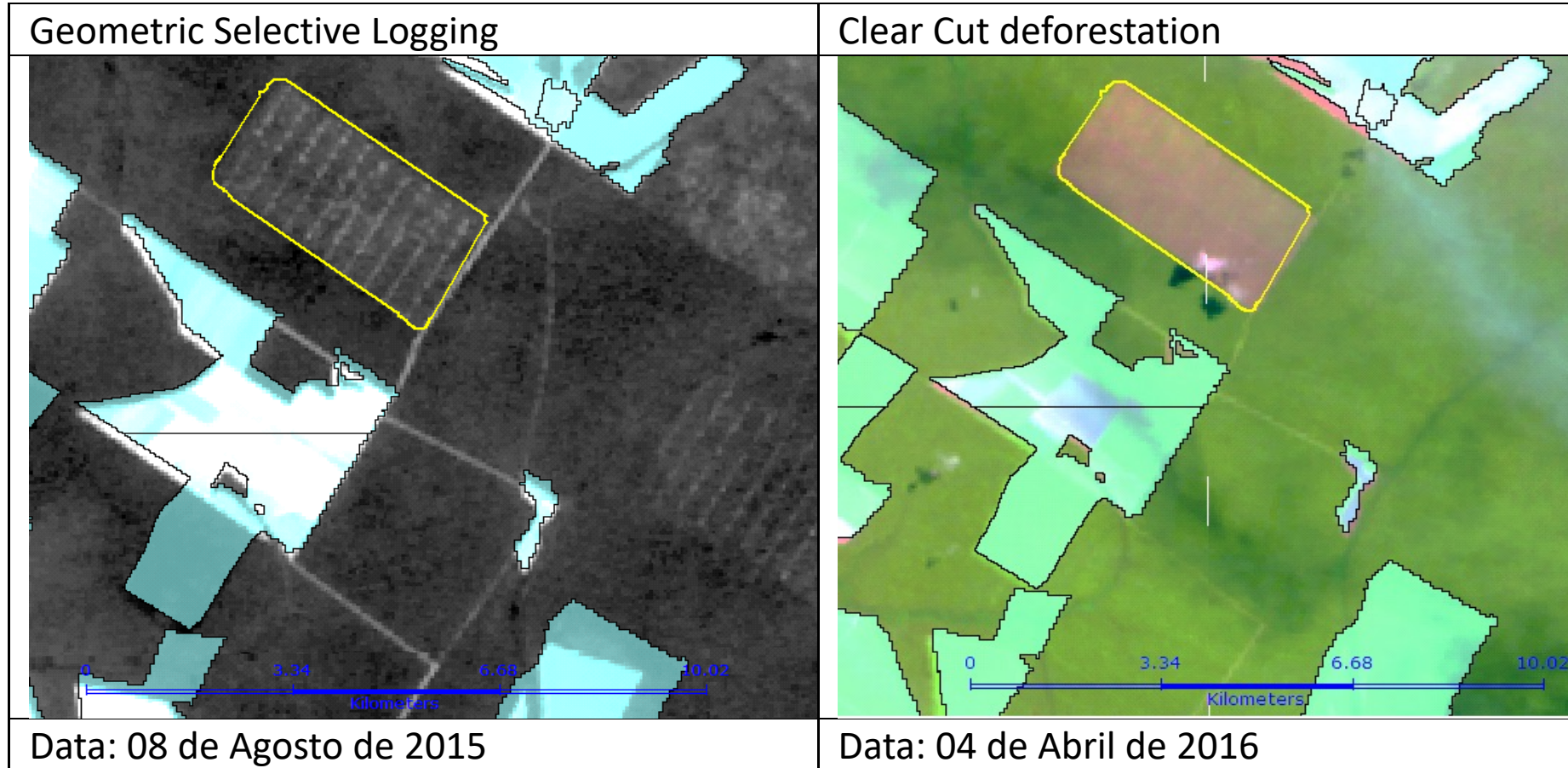


DETER
(deforestation process)

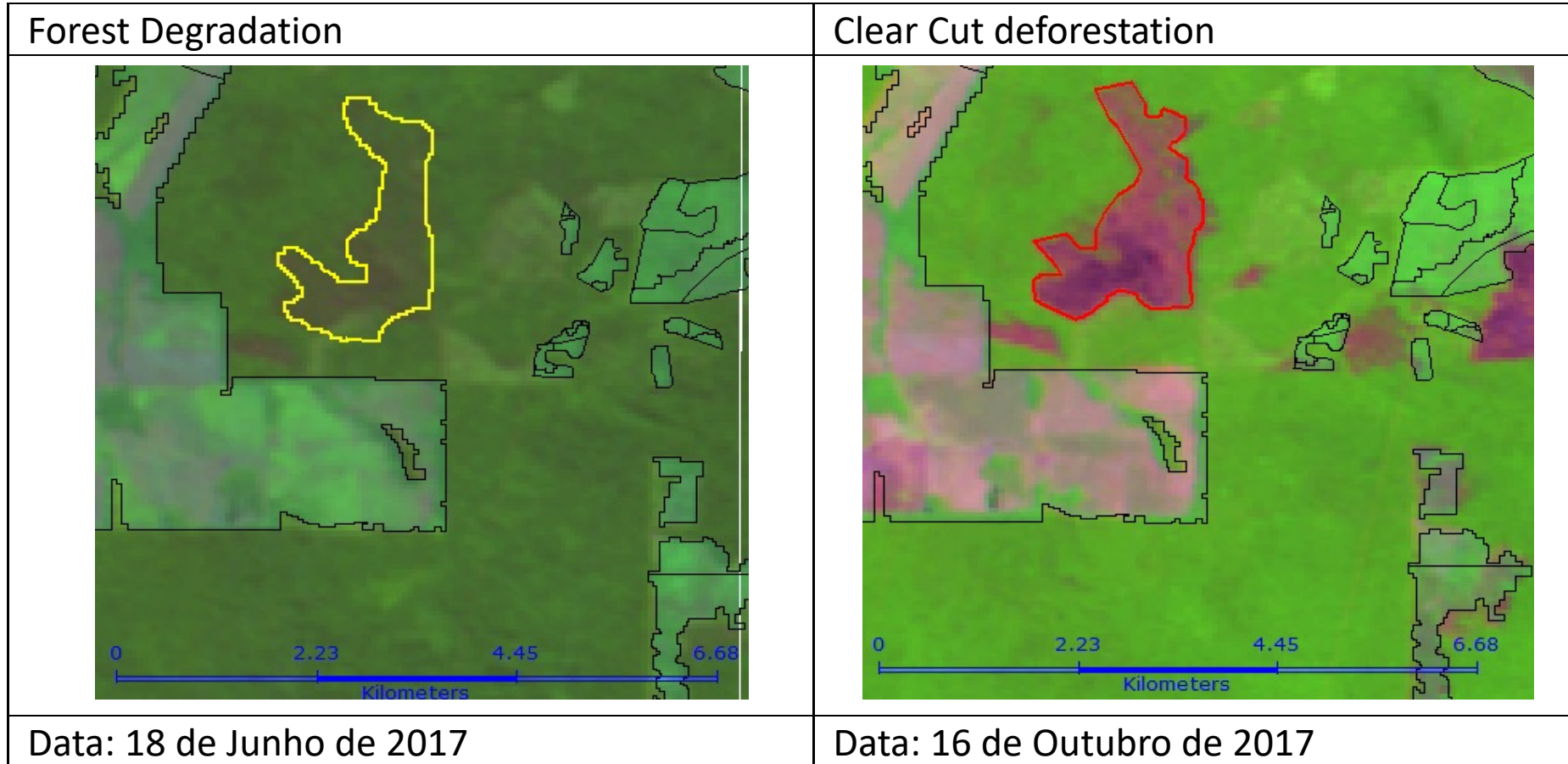


PRODES
(deforested)

IMPORTANCE OF DETER PROJECT CONTINUOUS MAPPING OF LAND COVER CHANGE



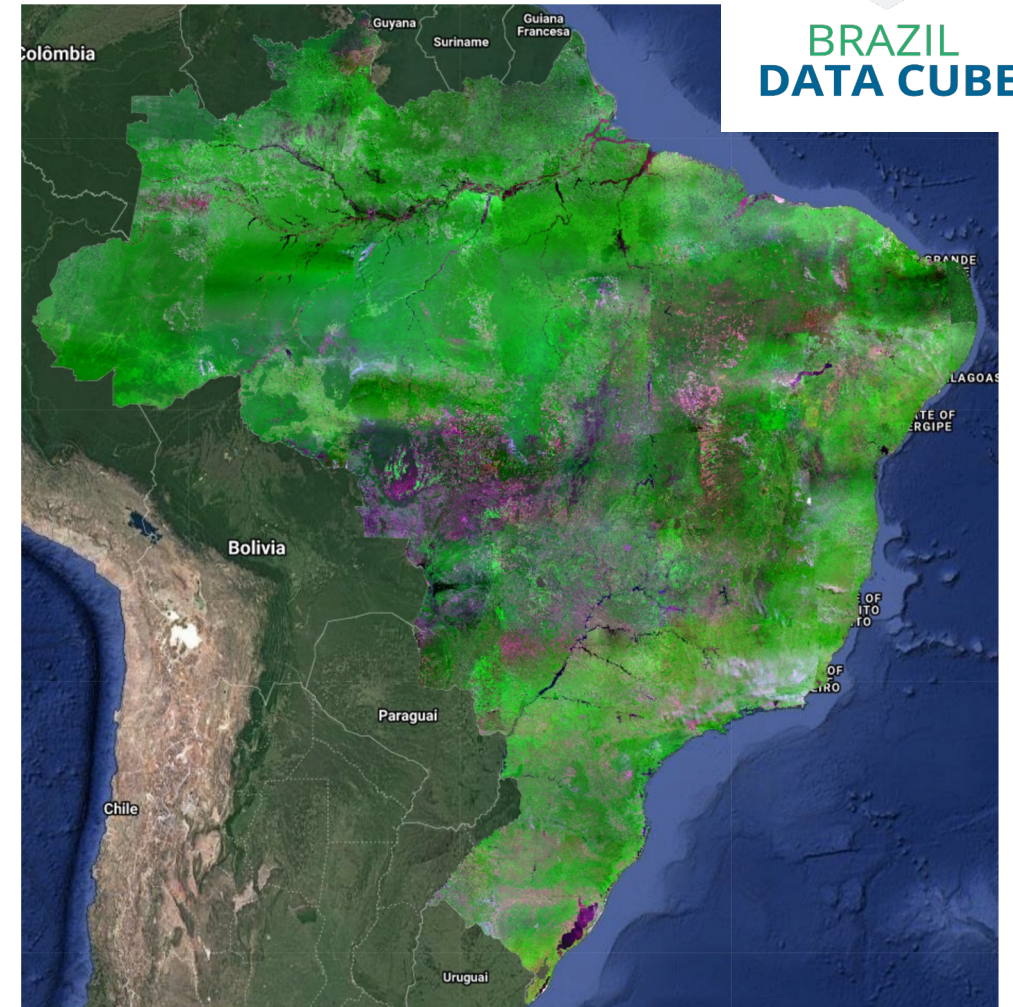
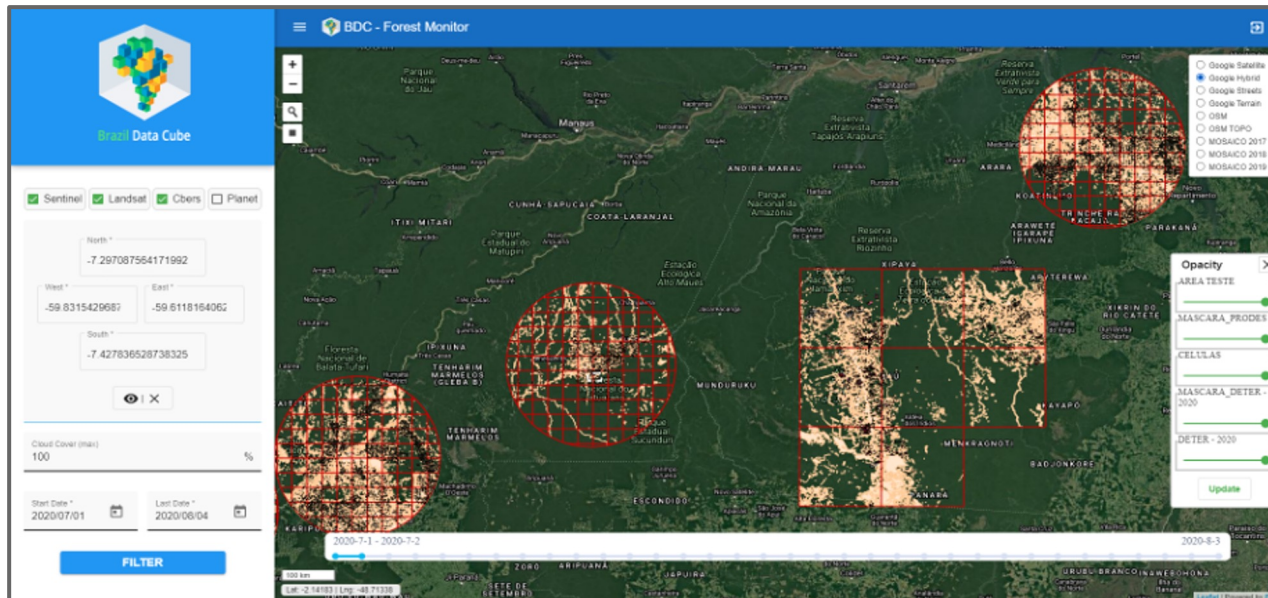
IMPORTANCE OF DETER PROJECT CONTINUOUS MAPPING OF LAND COVER CHANGE





Technological innovation for the environmental monitoring projects of INPE

Forest Monitor - **DETER** Intenso
Service to visualize big Earth observation data on AWS

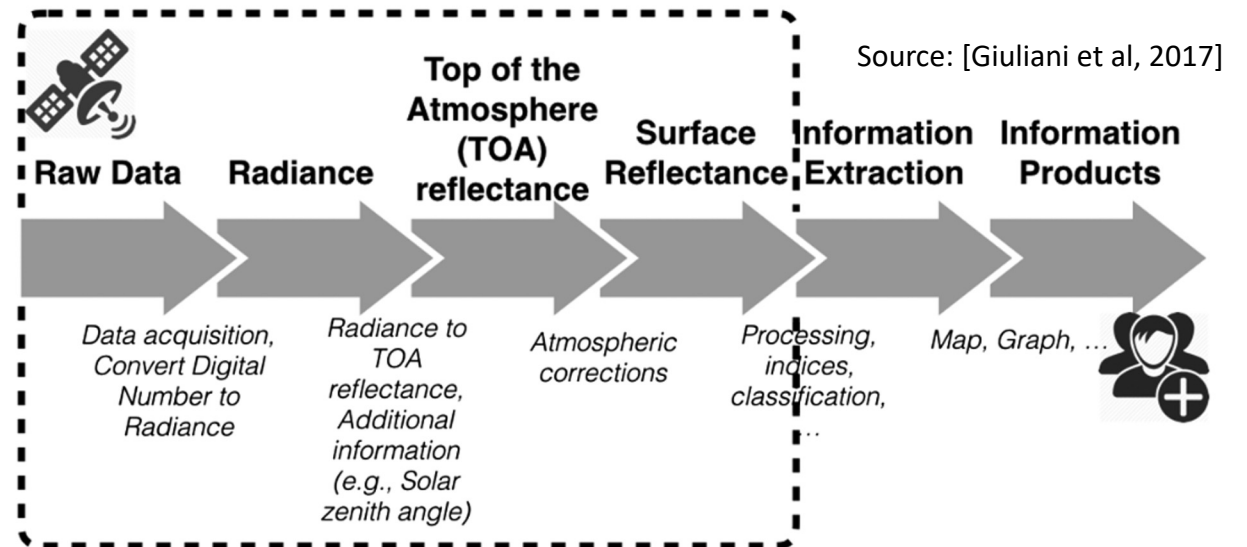


Mosaics – selection of the best pixels (free of clouds or cloud shadow) for periods

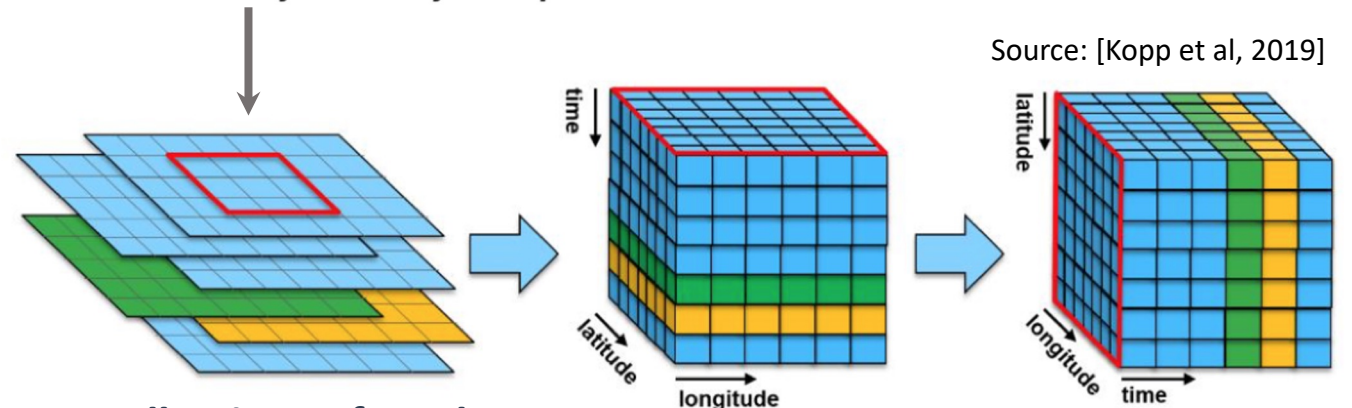
OBJECTIVES – DATA CUBE PROJECT

(1) Analysis-Ready Data (ARD) of medium-resolution satellite images for Brazil: CBERS-4 Landsat 8 Sentinel 2.

(2) Multidimensional data cubes.



Analysis Ready Data production



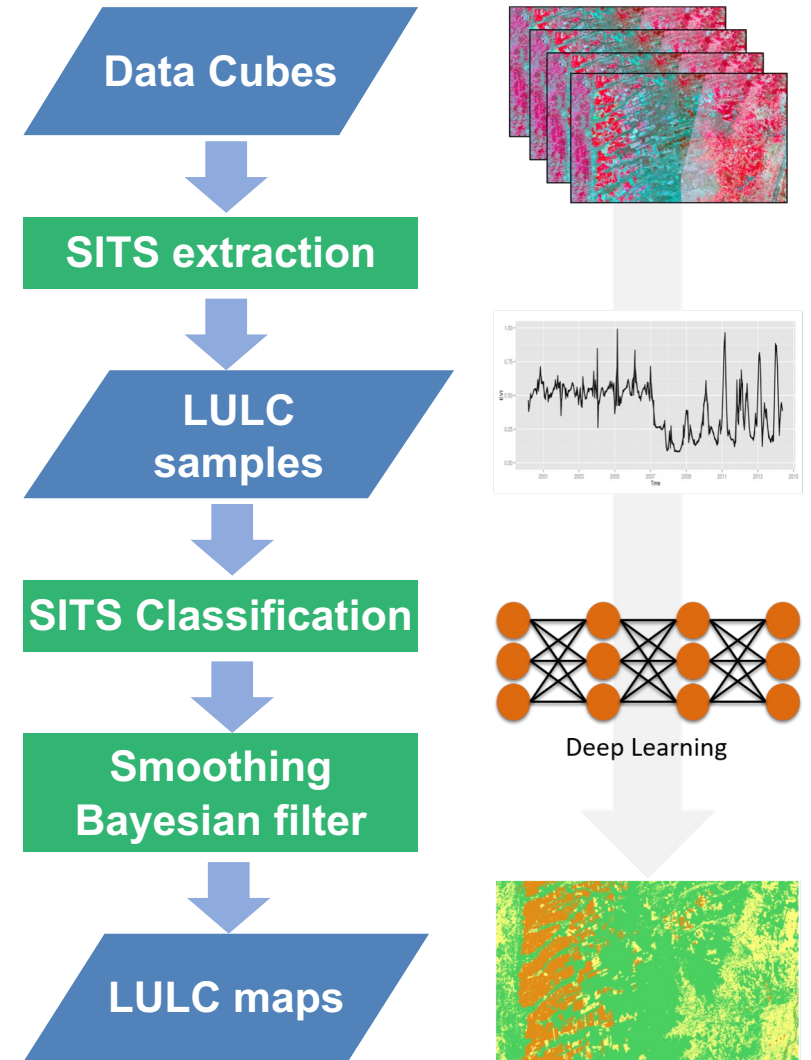
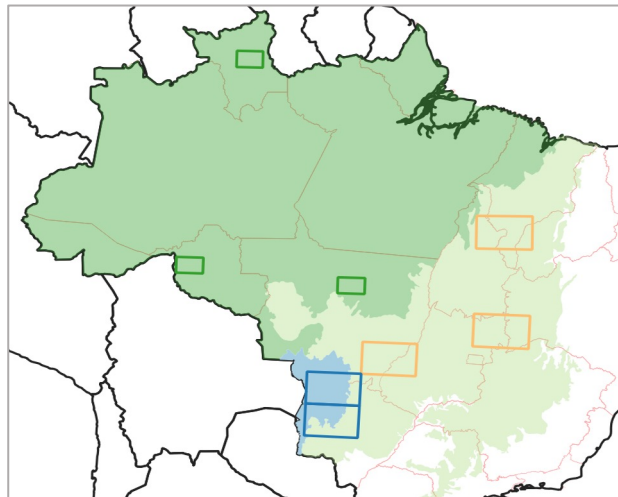
Collections of Earth observation satellite images – ARD

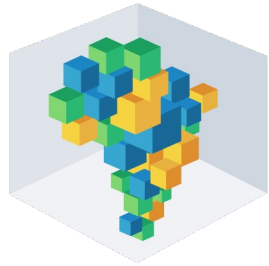
Data cubes – four-dimensional array

OBJECTIVE – DATA CUBE PROJECT

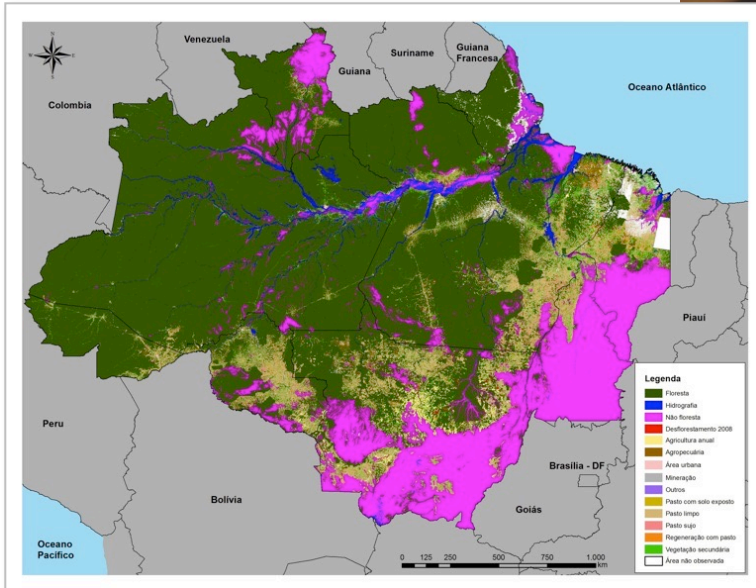
(3) Big data technologies, image time series analysis and machine learning methods

(4) Land use and cover classification





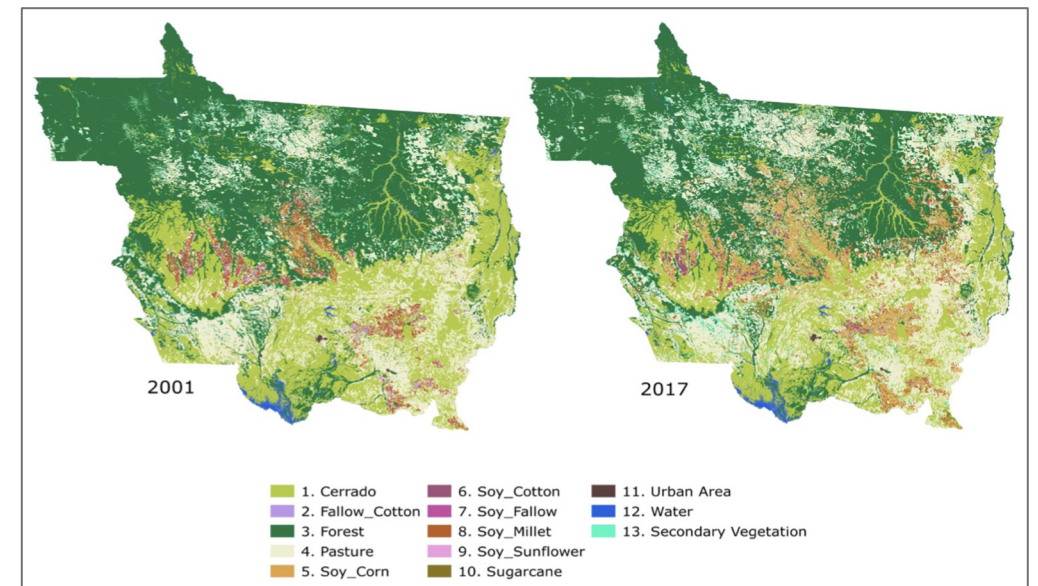
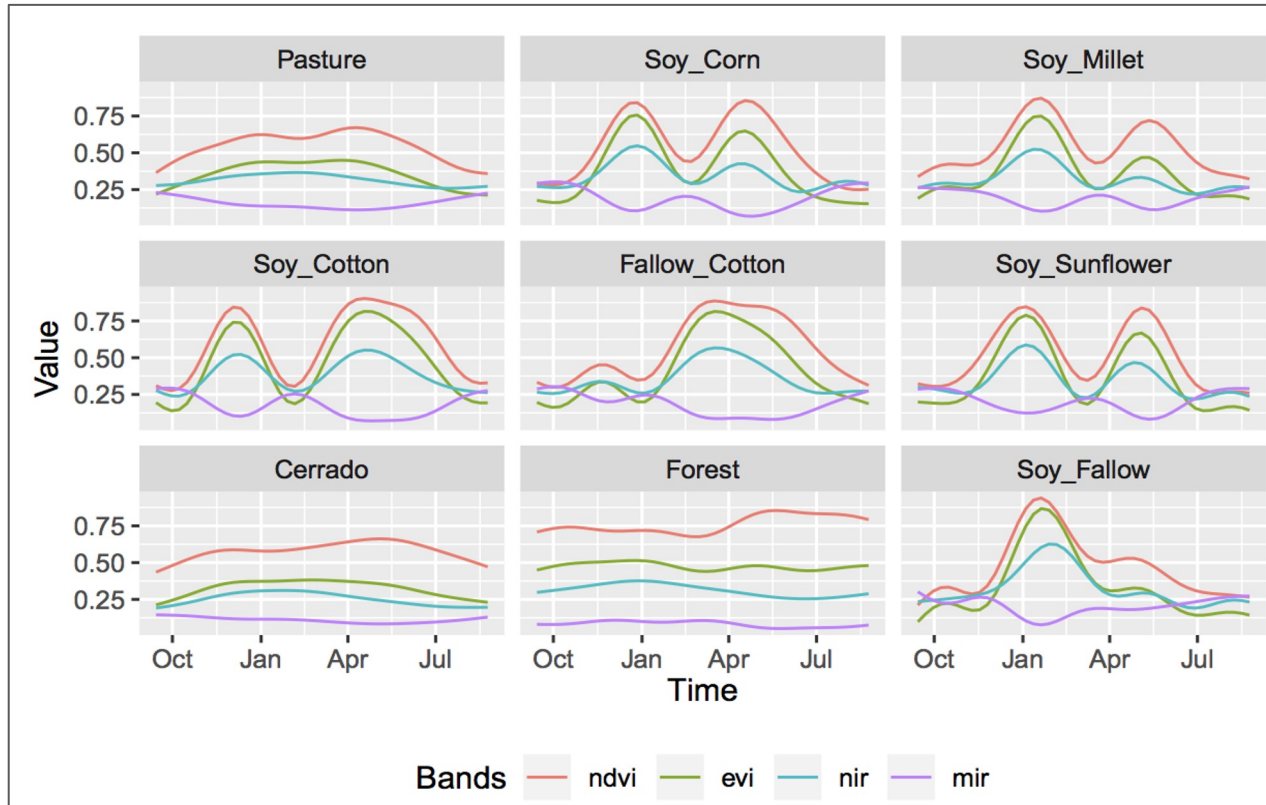
BRAZIL
DATA CUBE



- 19 classes of land use land cover
- TerraAmazon System and BDC Techniques
- INPE & Embrapa partnership for TerraClass Amazonia
- Perspectives:
 - INPE + IBGE + Embrapa = TerraClass Brasil
- Data available: 2004 – 2008 – 2010 – 2012 – 2014
- Next maps: 2018 – 2020 – 2021 – 2022

GeoPortal TerraClass: <https://www.terraclass.gov.br/>

The potential of image time series analysis and machine learning to produce land use and cover information from big Earth observation data



Land use and cover maps for Mato Grosso State in Brazil from 2001 to 2017, Scientific Data, 2020 (Simoes et al., 2020)

Image time series NDVI, EVI, NIR, MIR - agriculture year
 MODIS – MOD13Q1 Product / Method – SVM (Support Vector Machine)

BRAZIL DATA CUBE AND PROGYSAT

INPE – RESEARCHES TEAM

Karine Ferreira

Gilberto Queiroz

Alessandra Gomes

Claudio Almeida

DEVELOPERS and OTHER RESEARCHERS

Diego Silva (IRD Consultant)

Rennan Marujo

Rafael Costa

Rogério Flores

IRD – Researchers related

Tilbault Catry

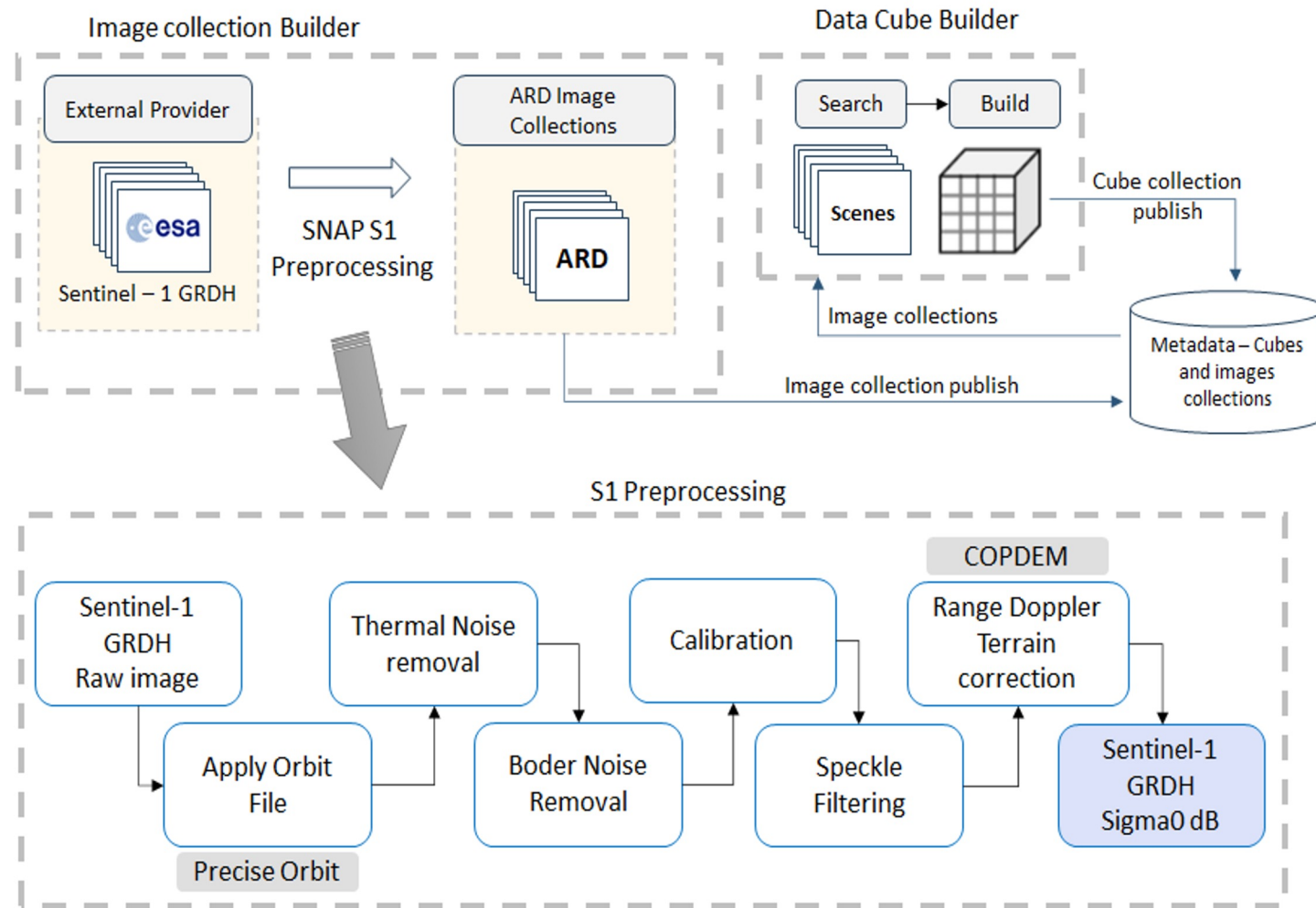
Marie Paule-Bonne

Loïc Marie-Louise

Jean François Faire

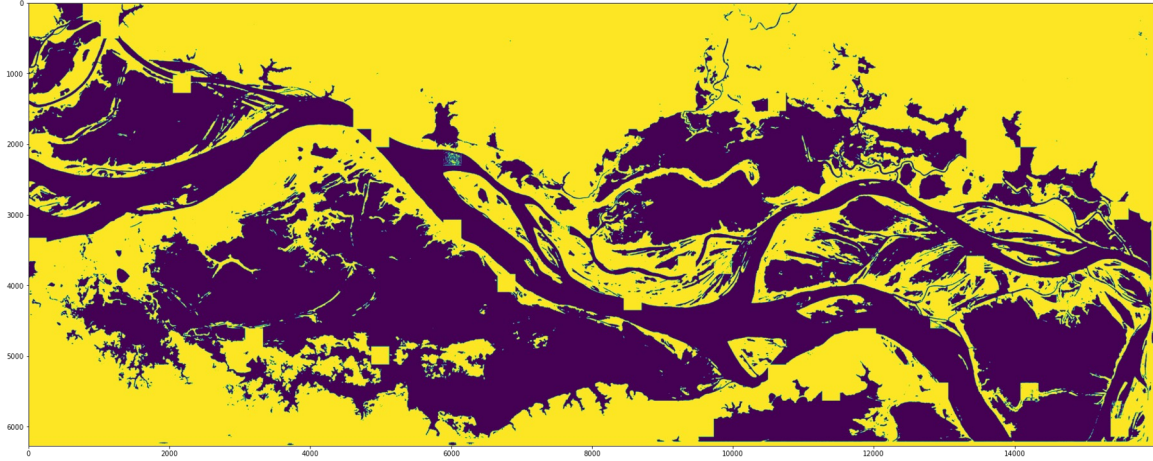
Christophe Charron

SENTINEL I DATA CUBES: DATA ACQUISITION AND PREPROCESS

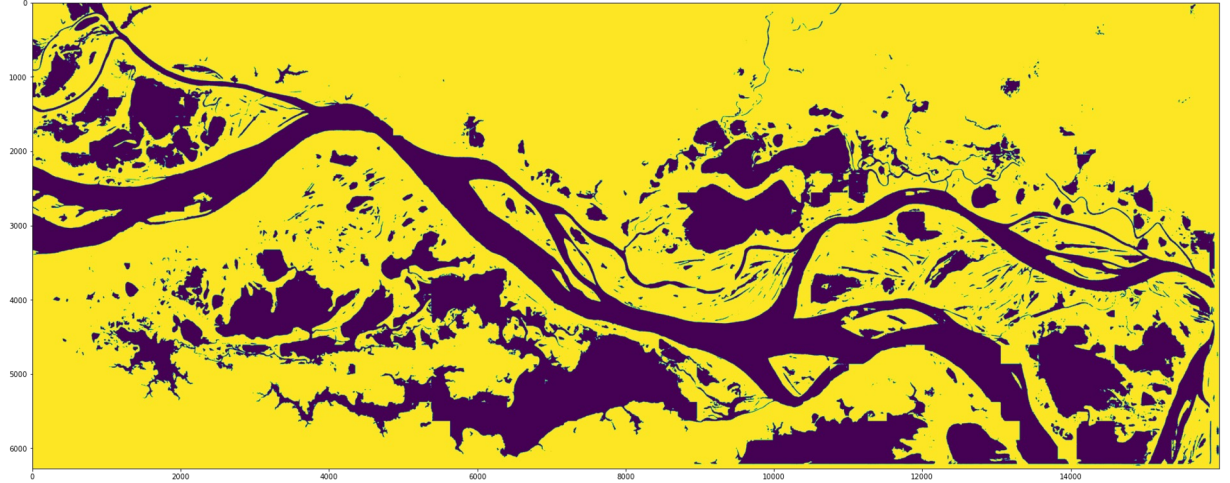


STUDY CASE – FIRSTS RESULTS

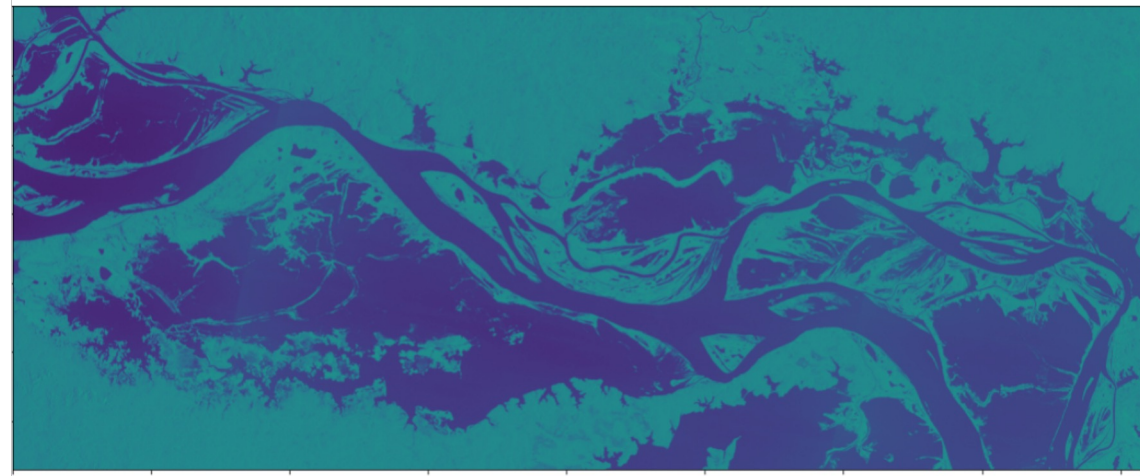
Jaccard Index
> 93%



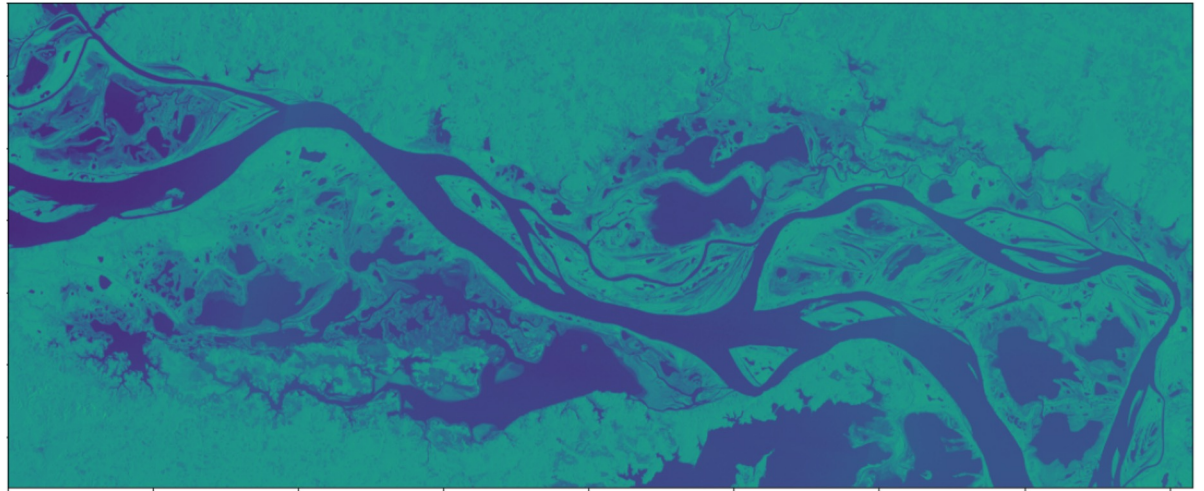
High Water



Low Water



Jaccard Index
> 97%



PERSPECTIVES PROGYSAT AND INPE

BRAZIL DATA CUBE PROJECT

Continuing studies and tests with Sentinel-1 for water bodies

Analyze possibilities for other thematic applications



CAPACITREE PROJECT

Capacity Building with related issues:

BDC, satellite monitoring projects and others themes



RELATION BETWEEN MONITORING PROJECTS AND CLIMATE CHANGE

- In **DETER Project** case, warnings of degradation and forest exploration allow the control of deforestation with the correct detection helping the surveillance and contributing to reducing the emission of greenhouse gases to the atmosphere; PRODES and TerraClass projects allows Brazil to estimate greenhouse gas emissions related to land use land cover changes
- **PRODES** measures areas that have been anthropized, responsible for a large part of the emission related to land use and cover, and **TerraClass** maps areas where natural vegetation is returning (secondary vegetation) and serves to absorb part of the emissions

These projects provide a basis for carrying out studies related to environmental preservation policies, territorial planning and various other aspects related to land cover



CONTACTS

alessandra.gomes@inpe.br

claudio.almeida@inpe.br

karine.ferreira@inpe.br

gilberto.queiroz@inpe.br