Status of the Brazil Data Cube Project

BRAZIL DATA CUBE

FUNDO AMAZONIA

Lubia Vinhas
lubia.vinhas@inpe.br

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BNDES MINISTÉRIO DA ECONOMIA MINISTÉRIO DO MEIO AMBIENTE
PÁTRIA AMADA BRASIL GOVERNO FEDERAL

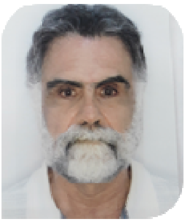
Brazil Data Cube – Equipe

Researchers


Karine Ferreira


Lubia Vinhas


Gilberto Queiroz


Ricardo Cartaxo


Thales Körting


Claudio Almeida


Gilberto Camara

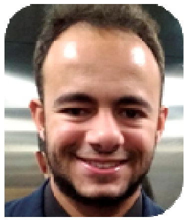

Ieda Sanchez


Leila Fonseca


Luis Maurano

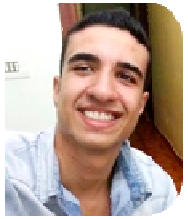
Post doc


Anderson Soares

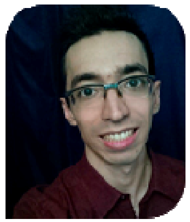

Michel Chaves

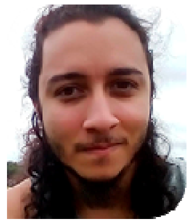

Michelle Picoli

Developers


Carlos Alberto Noronha


Jeferson Arcanjo


Raphael Costa


Rennan Marujo

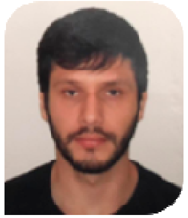
Brazil Data Cube – Team

Management

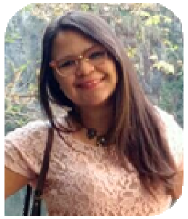
Luciana Mamede

PhD students

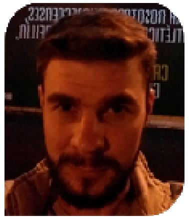
Alber Sanchez



Leonardo Vieira



Lorena Santos

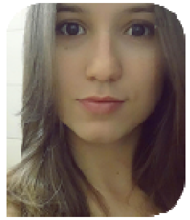


Lucas Oldoni

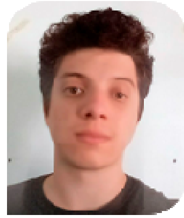
Rolf Simões

Vitor Gomes

Master students



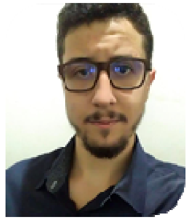
Fabiana Zioti



Felipe Souza

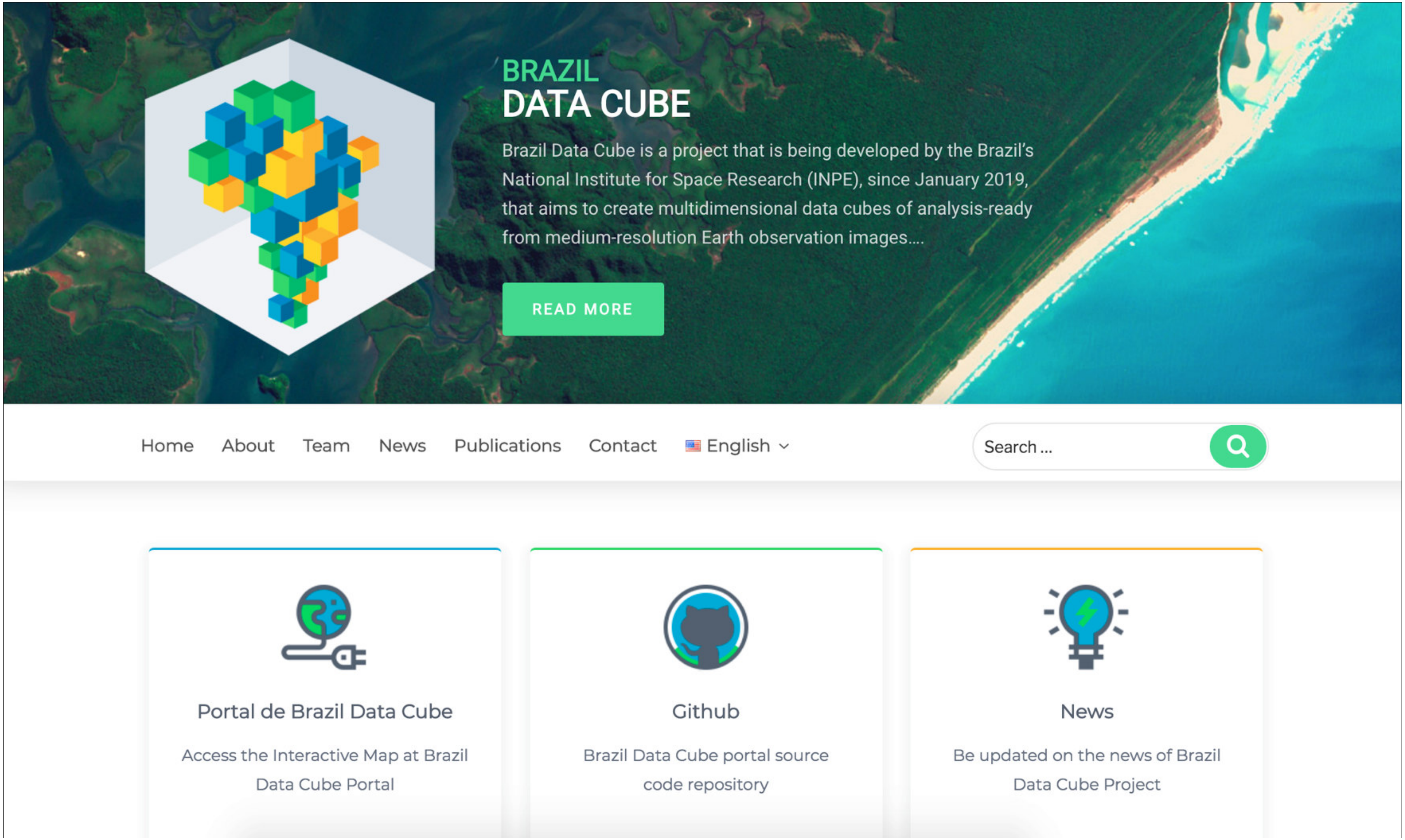
Gabriel Sansigolo

Matheus Zaglia



Rafael Mariano

www.brazildatacube.org



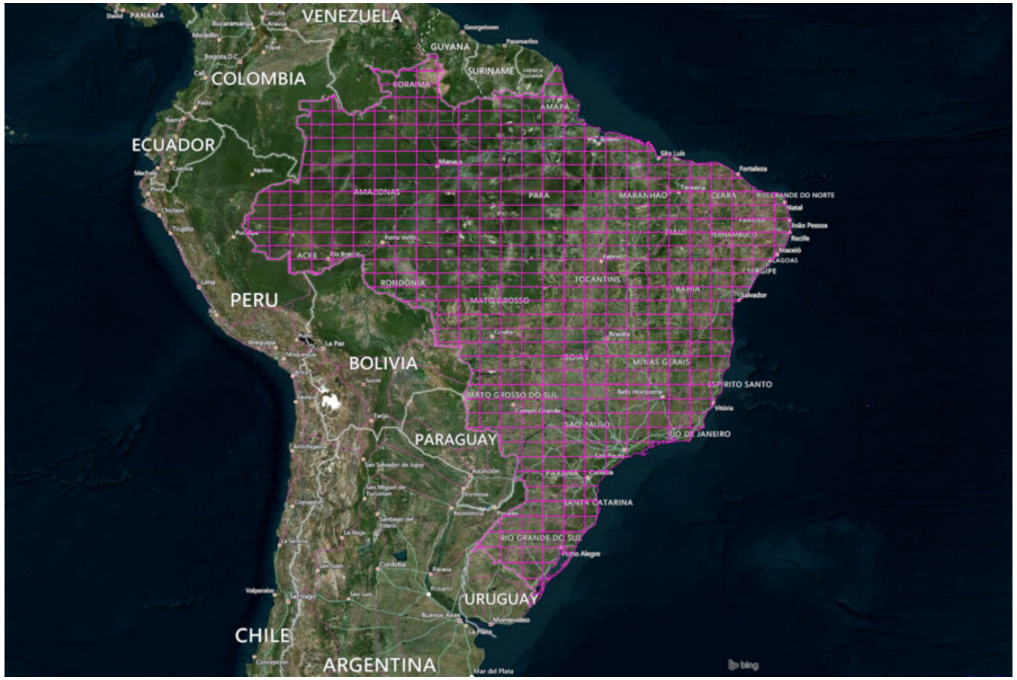
Brazil Data Cube – Objectives

(1) Create Analysis-Ready Data (ARD) from medium-resolution remote sensing images (10 to 30 meters) for all Brazilian territory, including images from Landsat, CBERS, and Sentinel.

(2) Model these ARD data sets as multidimensional data cubes with three or more dimensions that include space, time and properties.

(3) Use, propose, and develop novel methods and **big data technologies** to store and process data cube sets. Use them to analyze and extract land use and cover information, using **image time series analysis**, **machine learning**, and image processing methods.

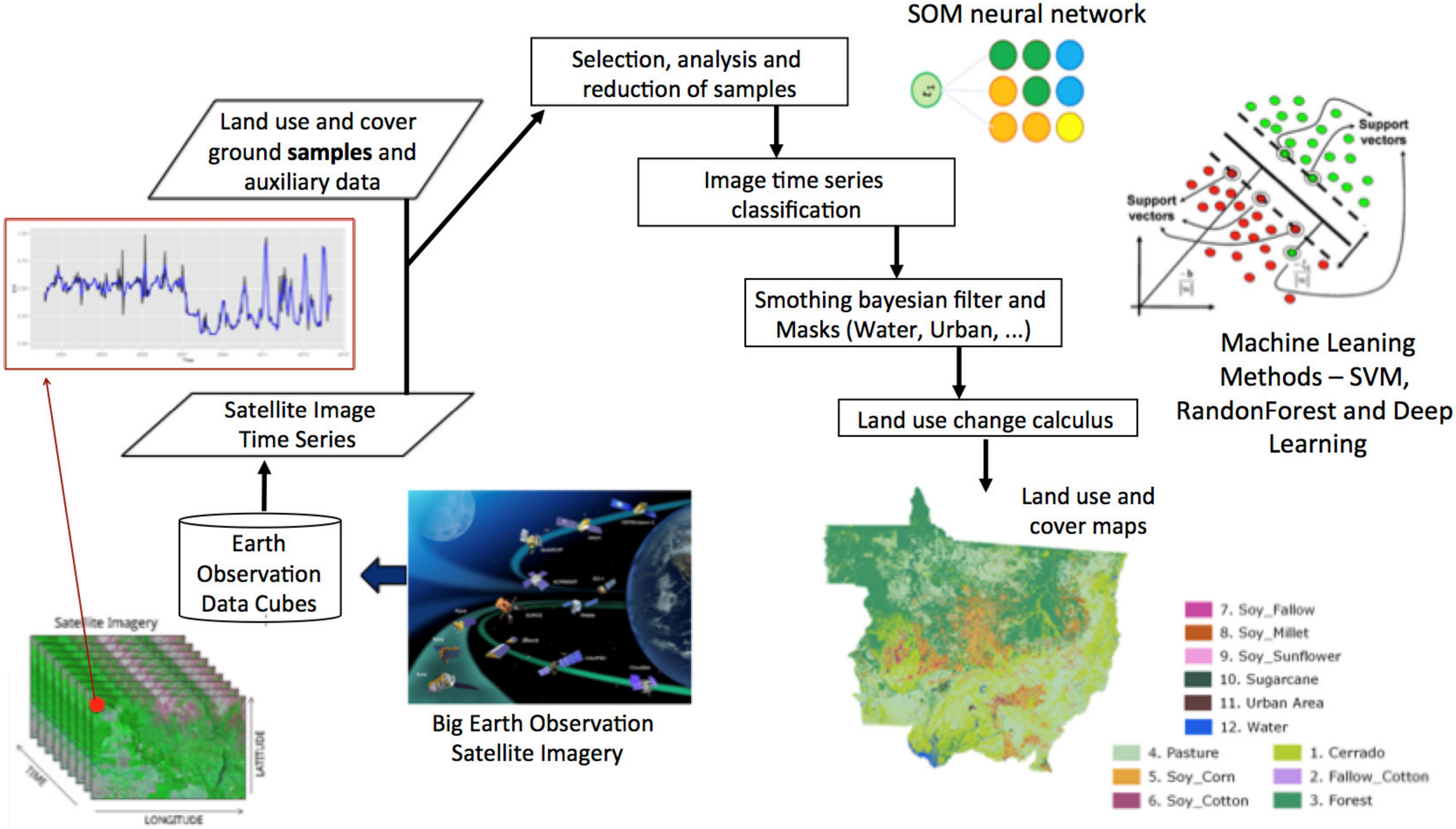
(4) Create **land use and cover information** for Brazil using the data cubes and methods developed in this project.



Grid at 1:250,000 scale => 560 tiles of 1 x 1.5 degree (approximately 110 x 165 km on the equator) and LongLat projection (EPSG 4326).

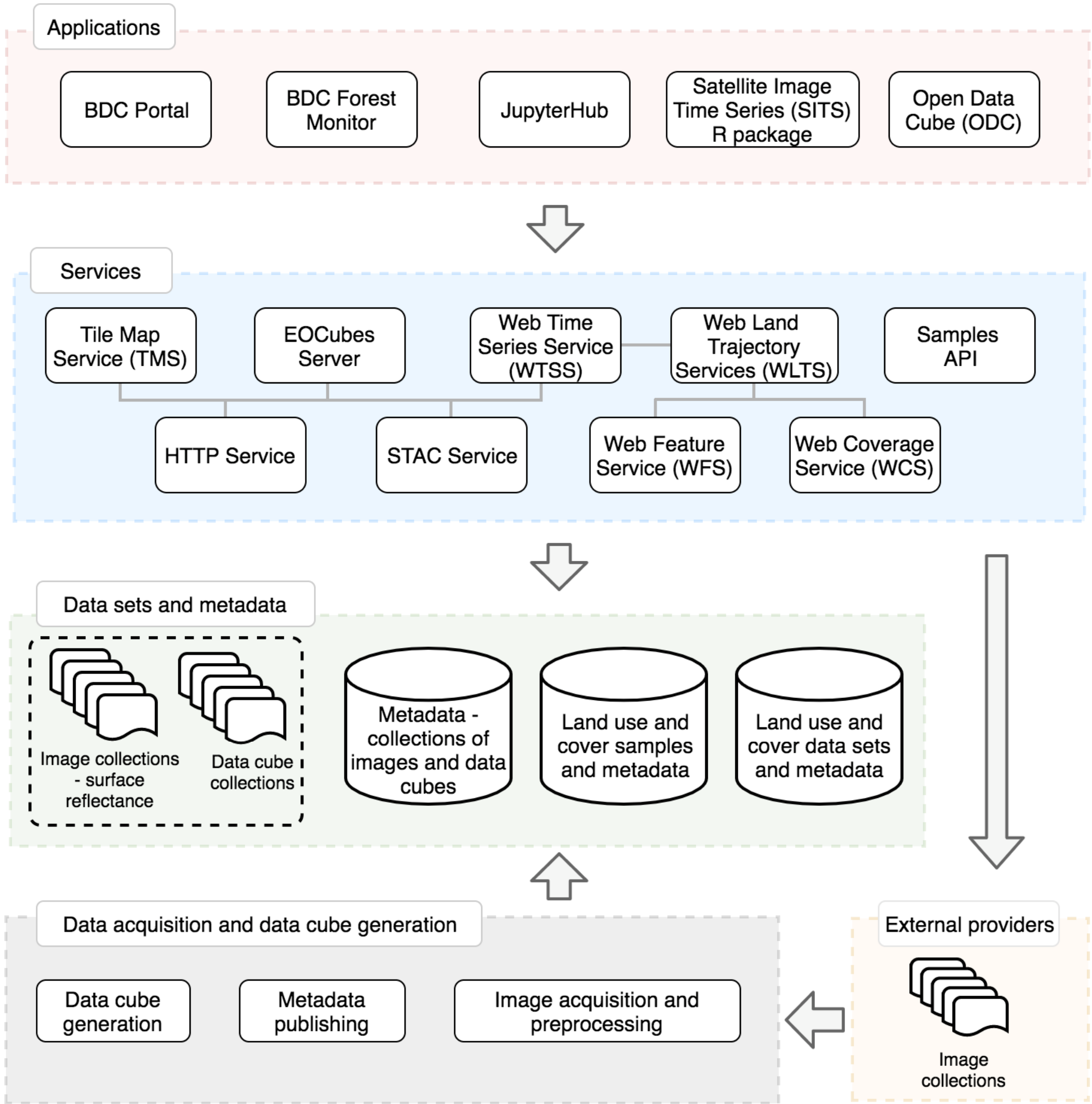
Satellite-Sensor	NS	SS	DV by Year	Period	DV for the Period
CBERS4-MUX	927	300 MB	4.1 TB	2015 to 2021	28.7 TB
CBERS4-AWFI	-	1.8 GB	5.6 TB	2015 to 2021	39.2 TB
Landsat8-OLI	410	1 GB	9 TB	2017 to 2021	45 TB
Sentinel 2A/2B-MSI	1039	1.3 GB	99 TB	2017 to 2021	495 TB
Total	–	–	**117.7 TB**	-	**607.9 TB**

Overview

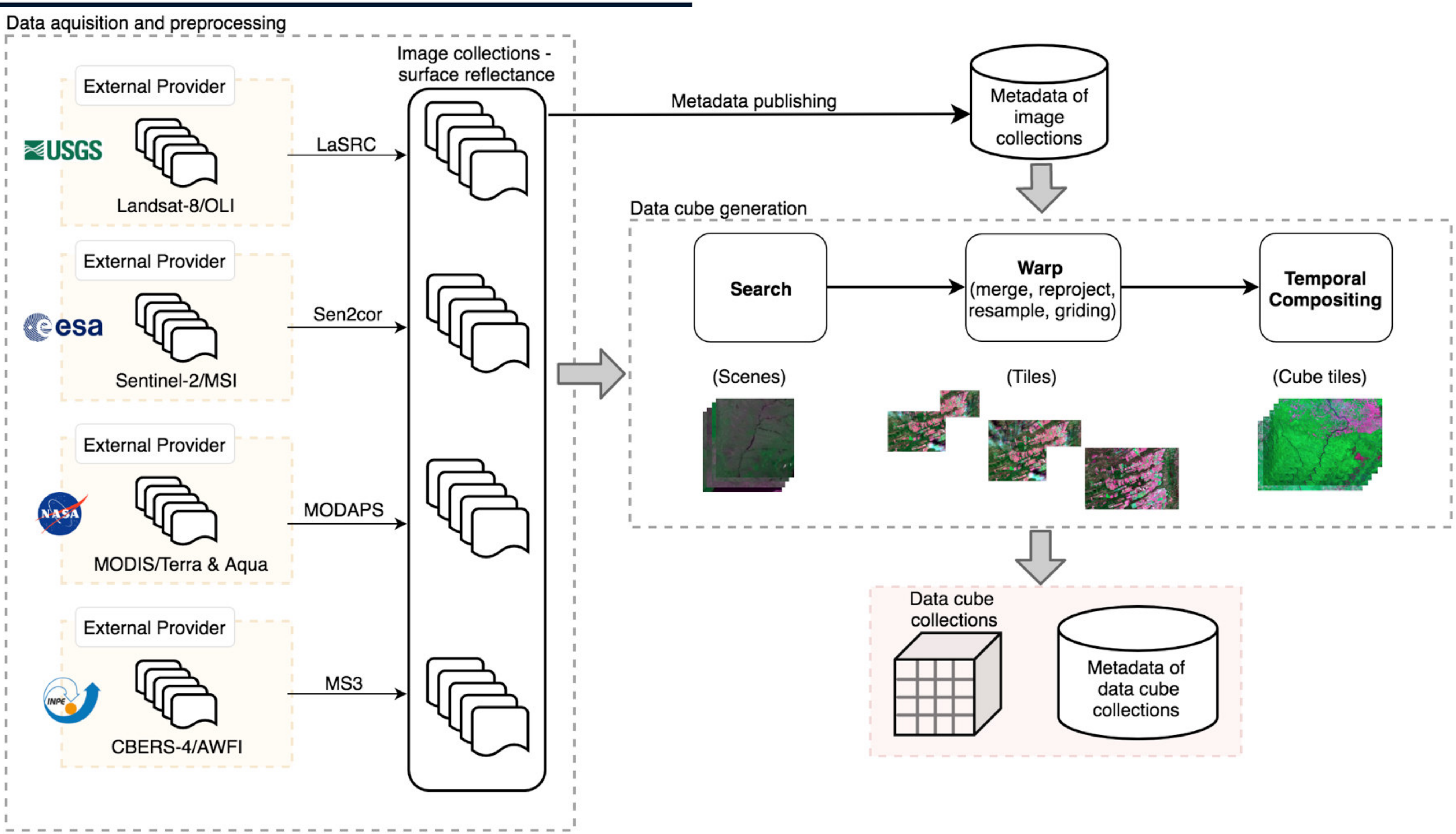


SOM neural network
Selection, analysis and reduction of samples
Land use and cover ground **samples** and auxiliary data
Image time series classification
Support vectors
Support vectors
Smothing bayesian filter and Masks (Water, Urban, ...)
Machine Leaning Methods – SVM, RandonForest and Deep Learning
Land use change calculus
Satellite Image Time Series
Land use and cover maps
Earth Observation Data Cubes
Satellite Imagery
TIME
LATITUDE
LONGITUDE
Big Earth Observation Satellite Imagery
7. Soy_Fallow
8. Soy_Millet
9. Soy_Sunflower
10. Sugarcane
11. Urban Area
12. Water
4. Pasture
5. Soy_Corn
6. Soy_Cotton
1. Cerrado
2. Fallow_Cotton
3. Forest

Software architecture

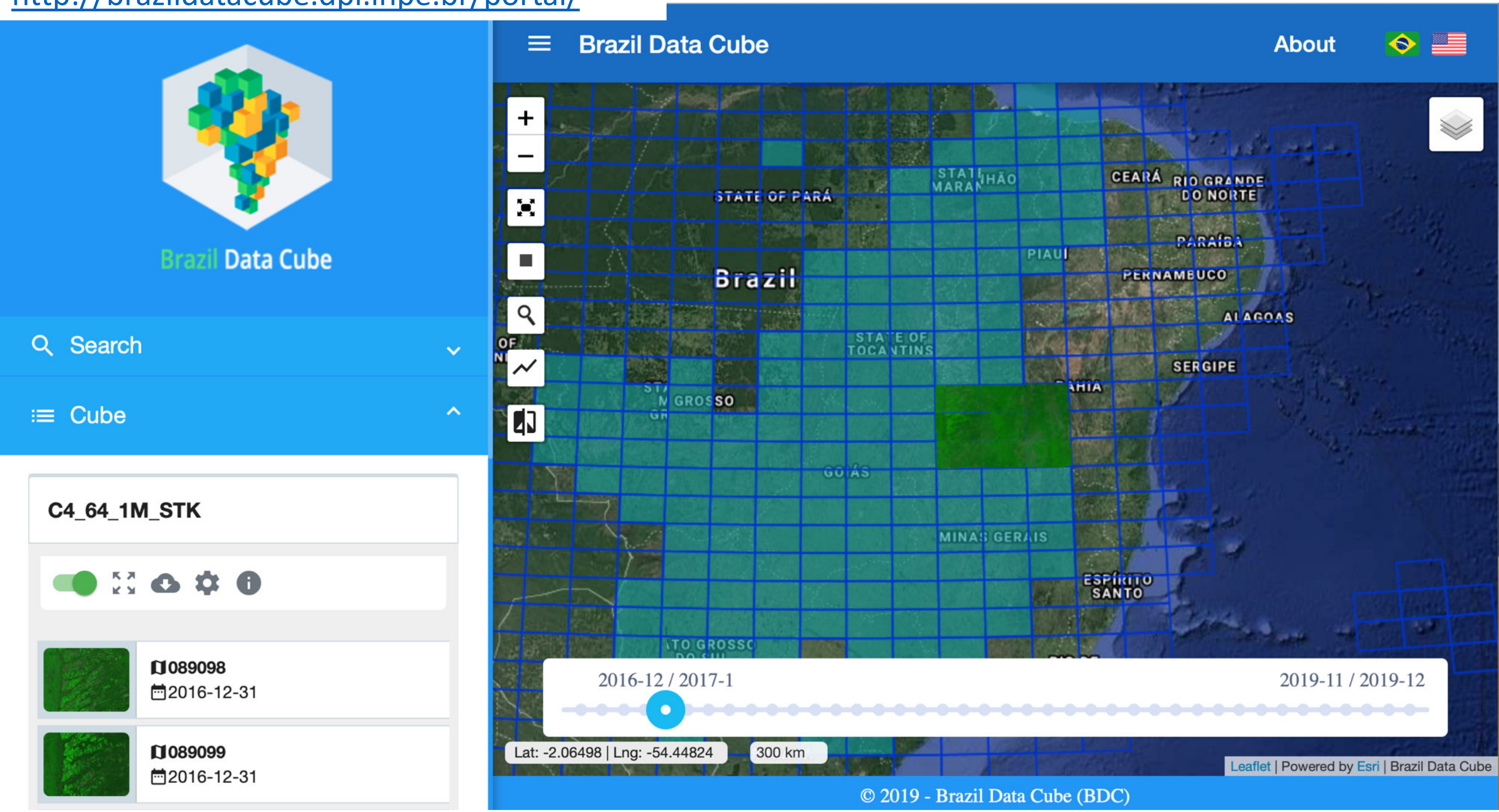


Creation



Data aquisition and preprocessing
Image collections - surface reflectance
External Provider
USGS
Landsat-8/OLI
LaSRC
External Provider
esa
Sentinel-2/MSI
Sen2cor
External Provider
NASA
MODIS/Terra & Aqua
MODAPS
External Provider
INPE
CBERS-4/AWFI
MS3
Metadata publishing
Metadata of image collections
Data cube generation
Search
Warp (merge, reproject, resample, griding)
Temporal Compositing
(Scenes)
(Tiles)
(Cube tiles)
Data cube collections
Metadata of data cube collections

http://brazildatacube.dpi.inpe.br/portal/



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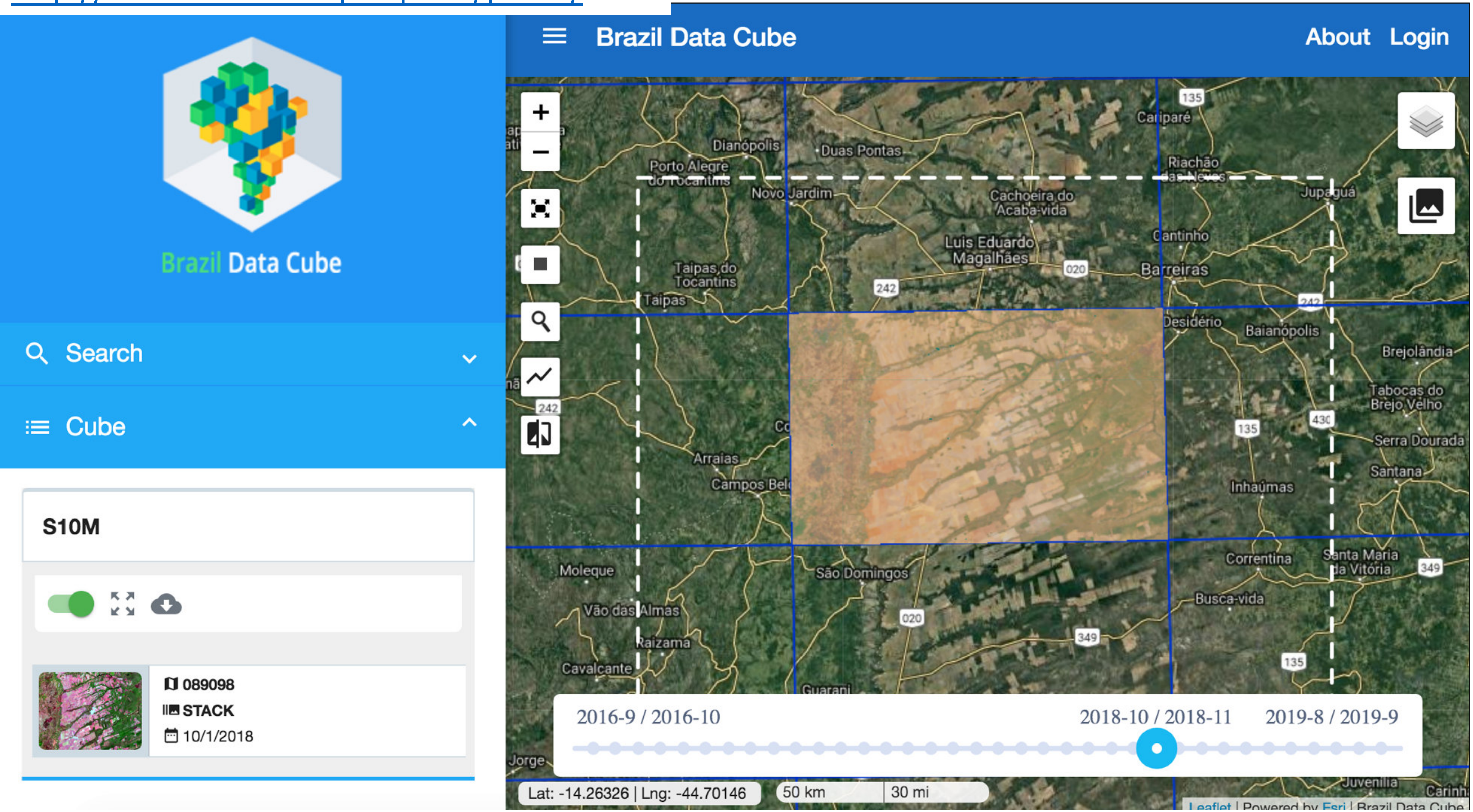

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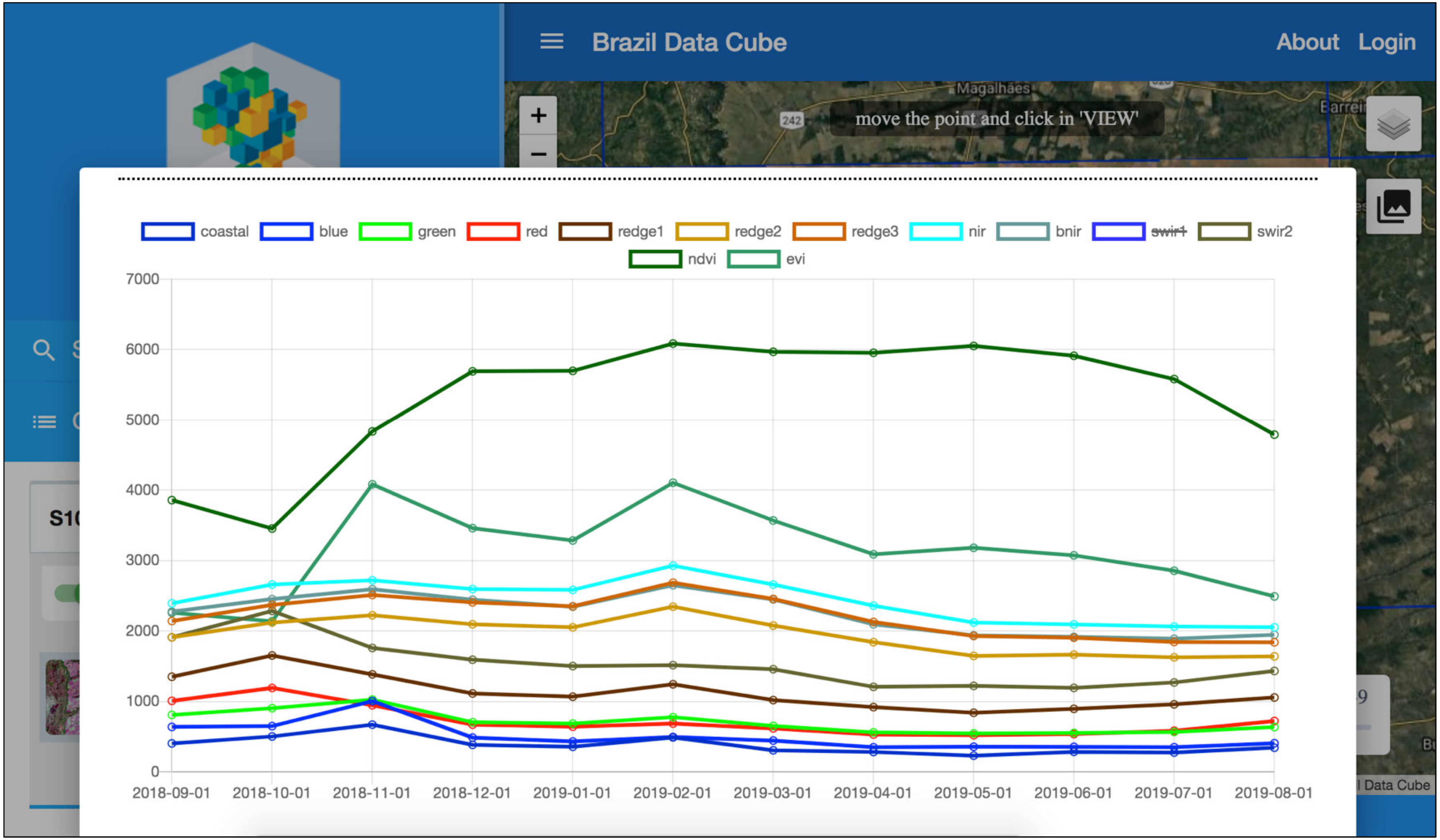

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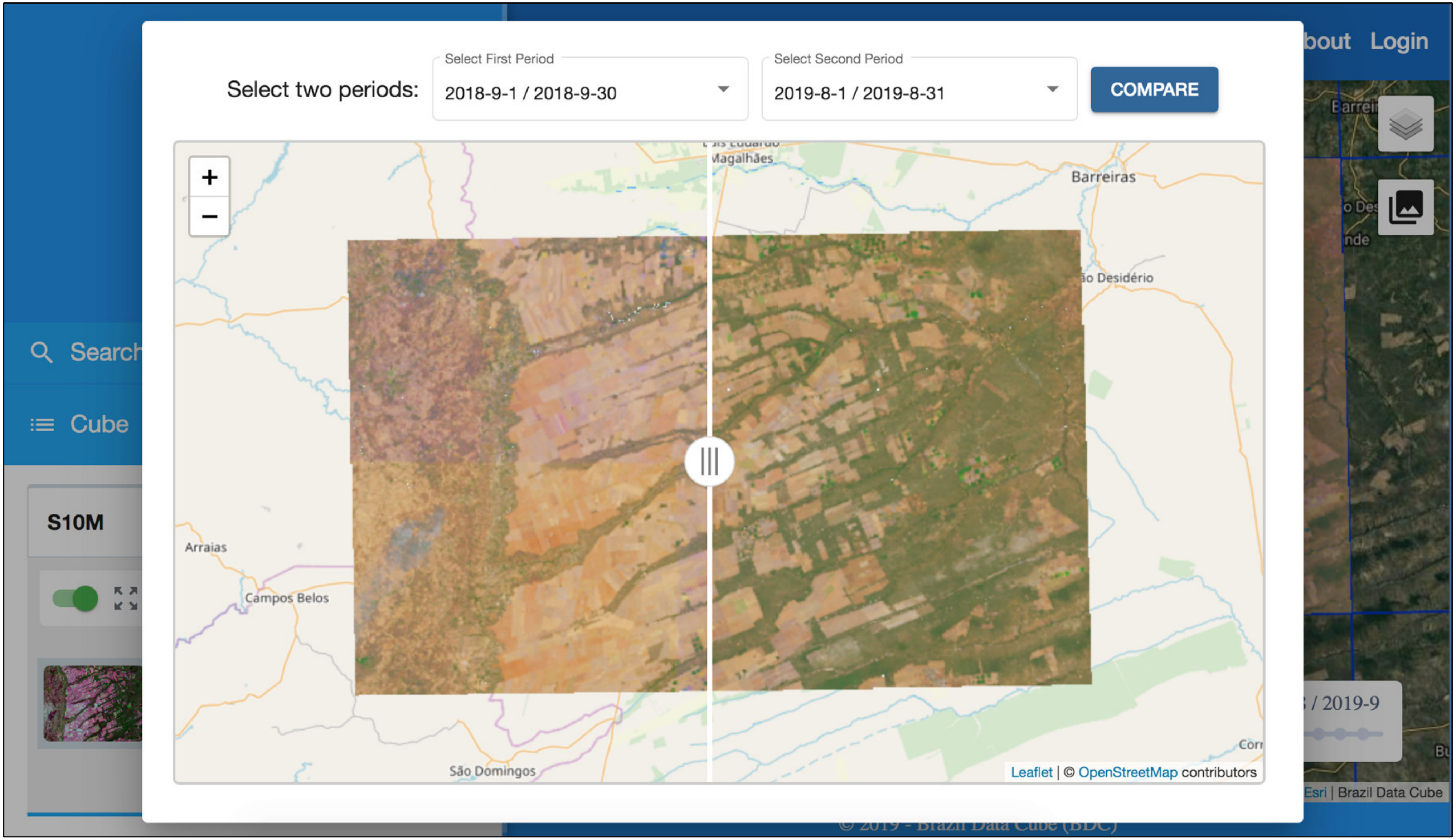
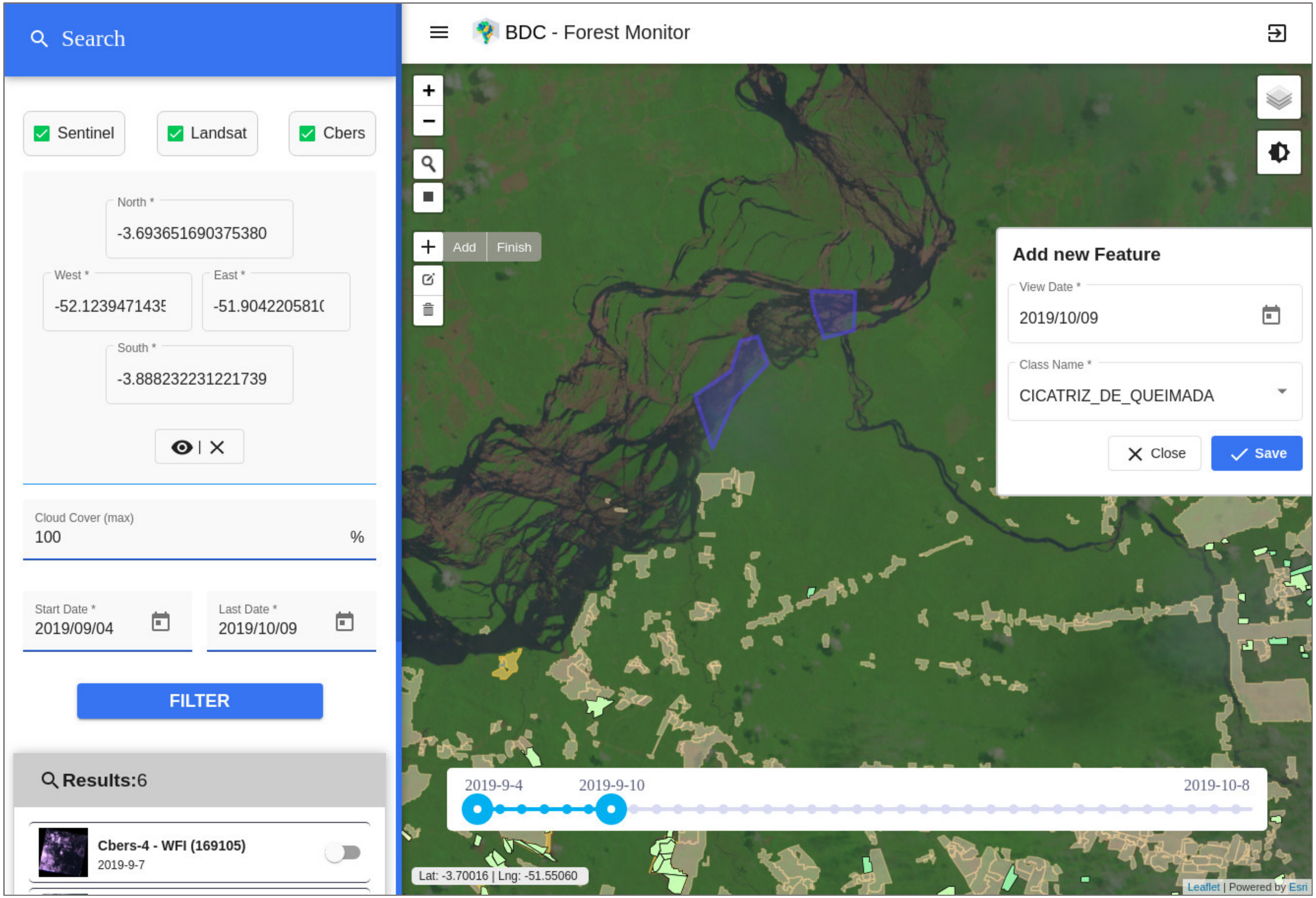
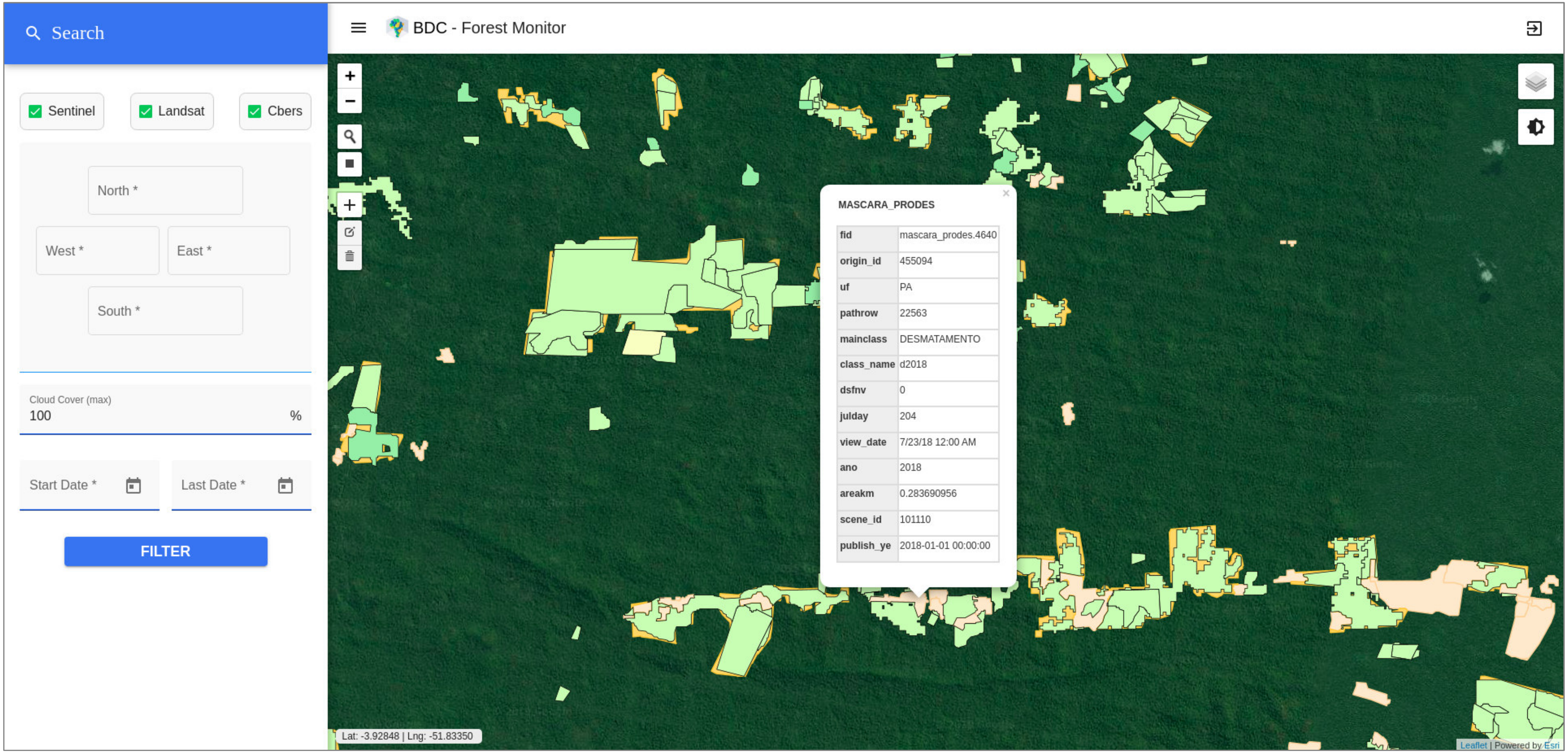



Search
Sentinel
Landsat
Cbers
North *
-3.693651690375380
West *
-52.1239471435
East *
-51.9042205810
South *
-3.888232231221739
Cloud Cover (max)
100
%
Start Date *
2019/09/04
Last Date *
2019/10/09
FILTER
Results:6
Cbers-4 - WFI (169105)
2019-9-7
BDC - Forest Monitor
Add
Finish
Add new Feature
View Date *
2019/10/09
Class Name *
CICATRIZ_DE_QUEIMADA
Close
Save
2019-9-4
2019-9-10
2019-10-8
Lat: -3.70016 | Lng: -51.55060
Leaflet | Powered by Esri

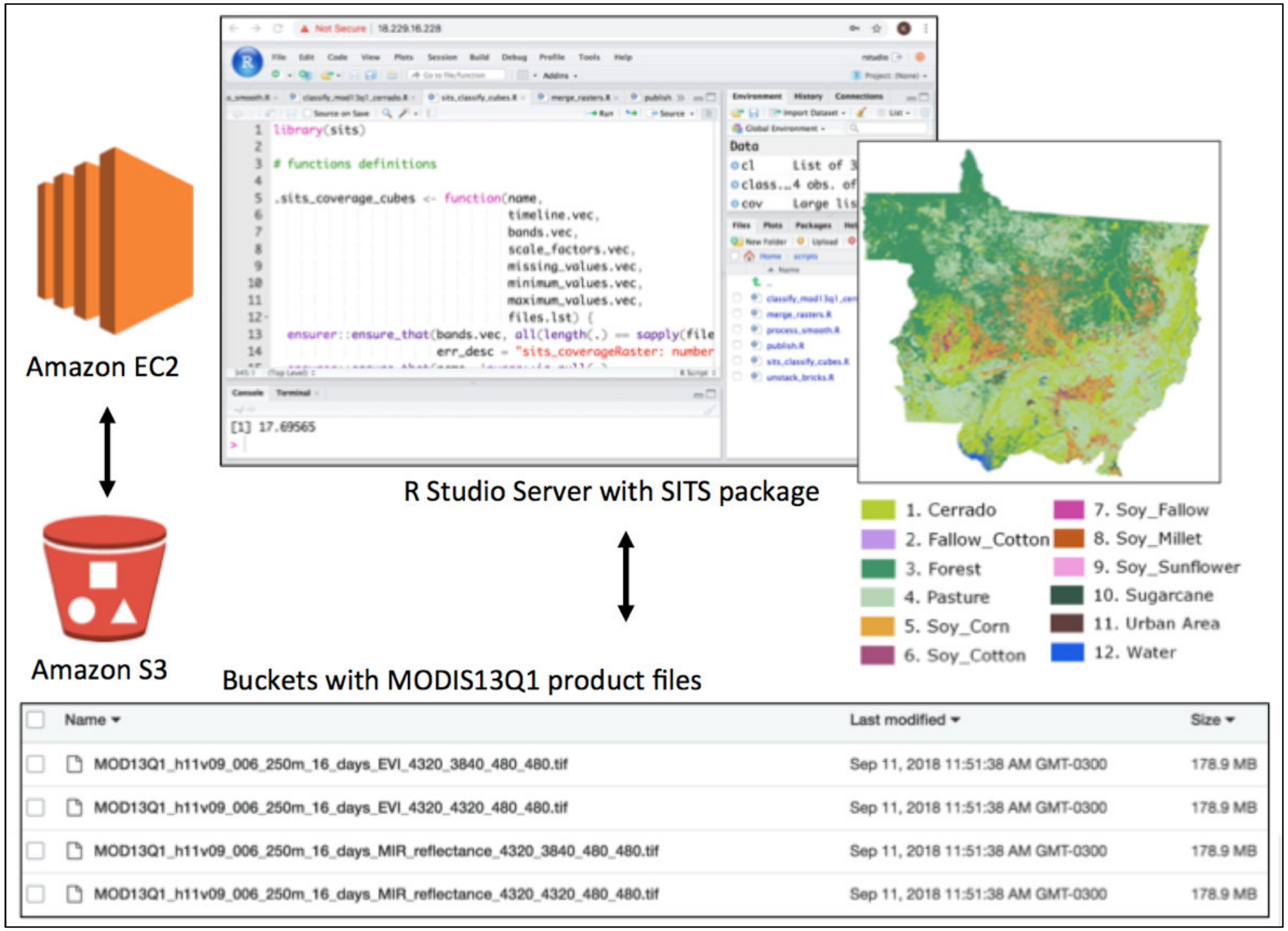

Search
Sentinel
Landsat
Cbers
North *
West *
East *
South *
Cloud Cover (max)
100
%
Start Date *
Last Date *
FILTER
BDC - Forest Monitor
MASCARA_PRODES
fid mascara_prodes.4640
origin_id 455094
uf PA
pathrow 22563
mainclass DESMATAMENTO
class_name d2018
dsfnv 0
julday 204
view_date 7/23/18 12:00 AM
ano 2018
areakm 0.283690956
scene_id 101110
publish_ye 2018-01-01 00:00:00
Lat: -3.92848 | Lng: -51.83350
Leaflet | Powered by Esri

Brazil Data Cube – Amazon Web Service (AWS)

June 2019 - Project approved in the program "Group on Earth Observation (GEO) and Amazon Web Services (AWS) Earth Observation Cloud Credits Program".

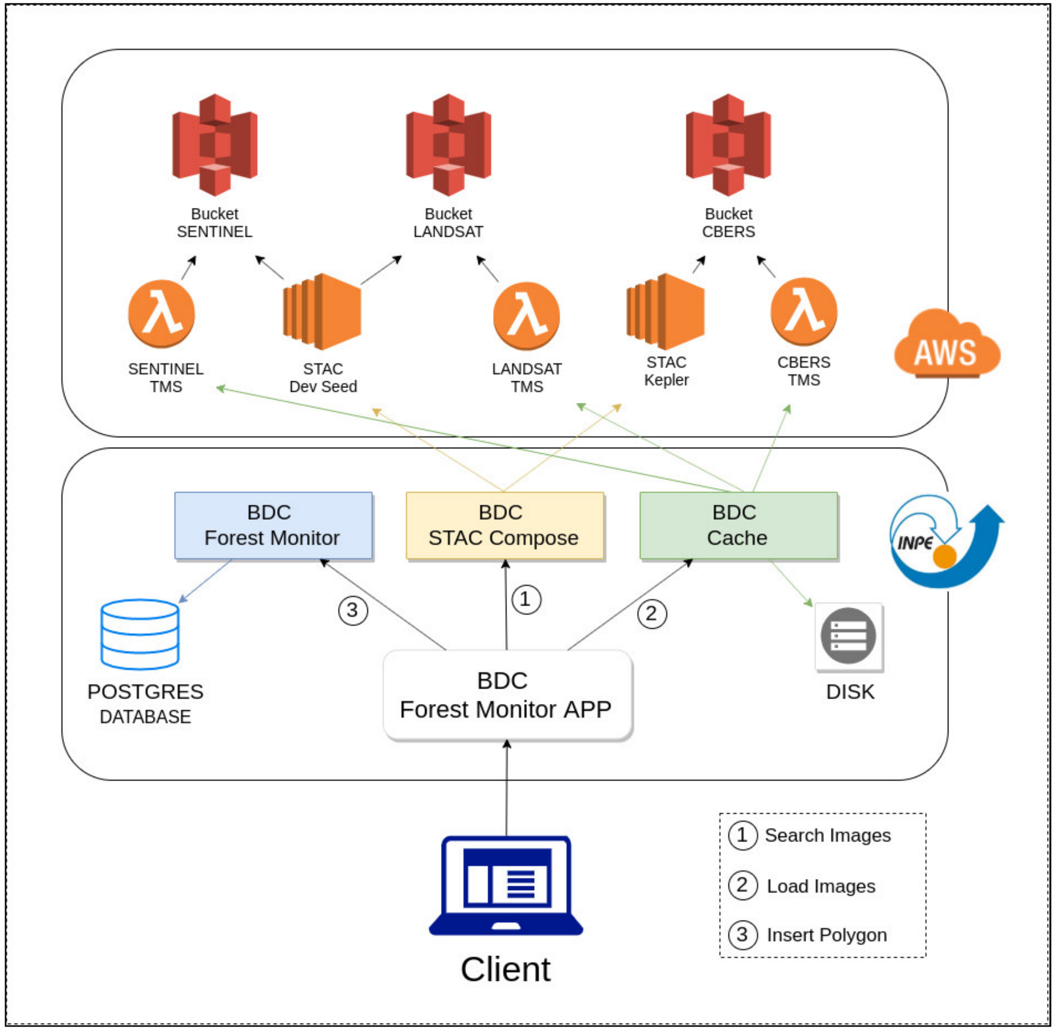
Brazil Data Cube project team wins a $ 60,000 credit to use in 3 years with AWS cloud computing services to store and process large volumes of Earth observation data for land use and land cover classification.

http://earthobservations.org/article.php?id=362

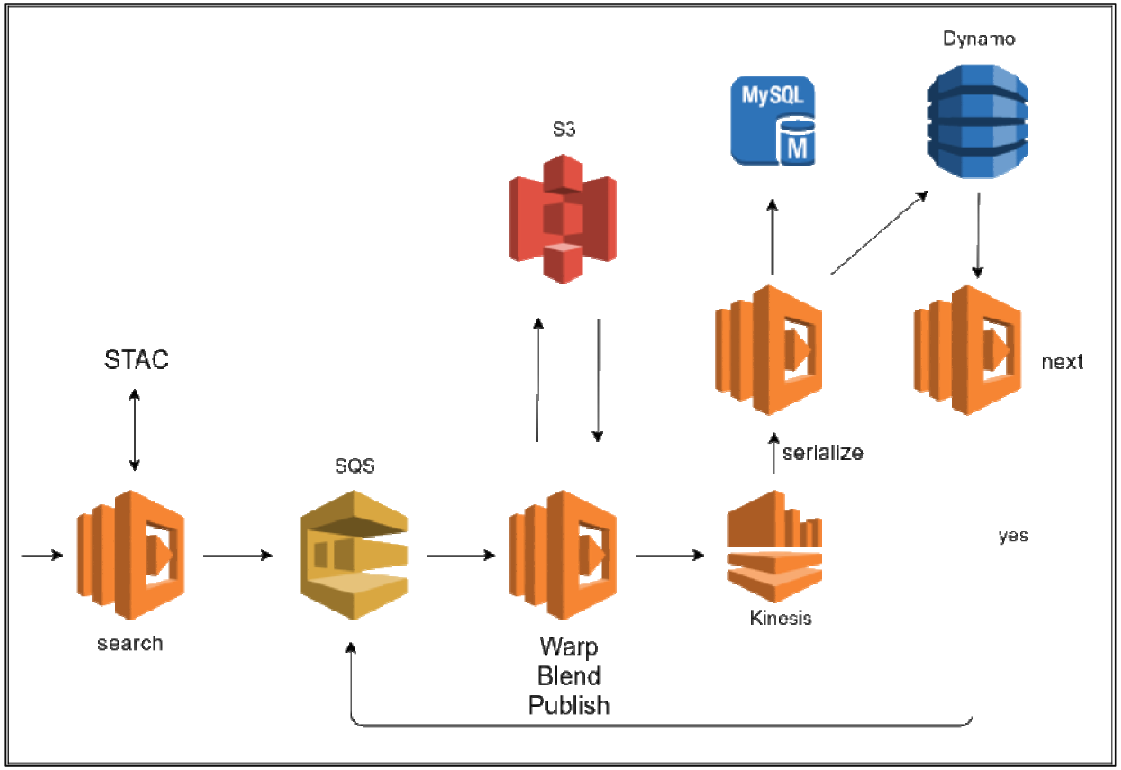


Brazil Data Cube – Amazon Web Service (AWS)

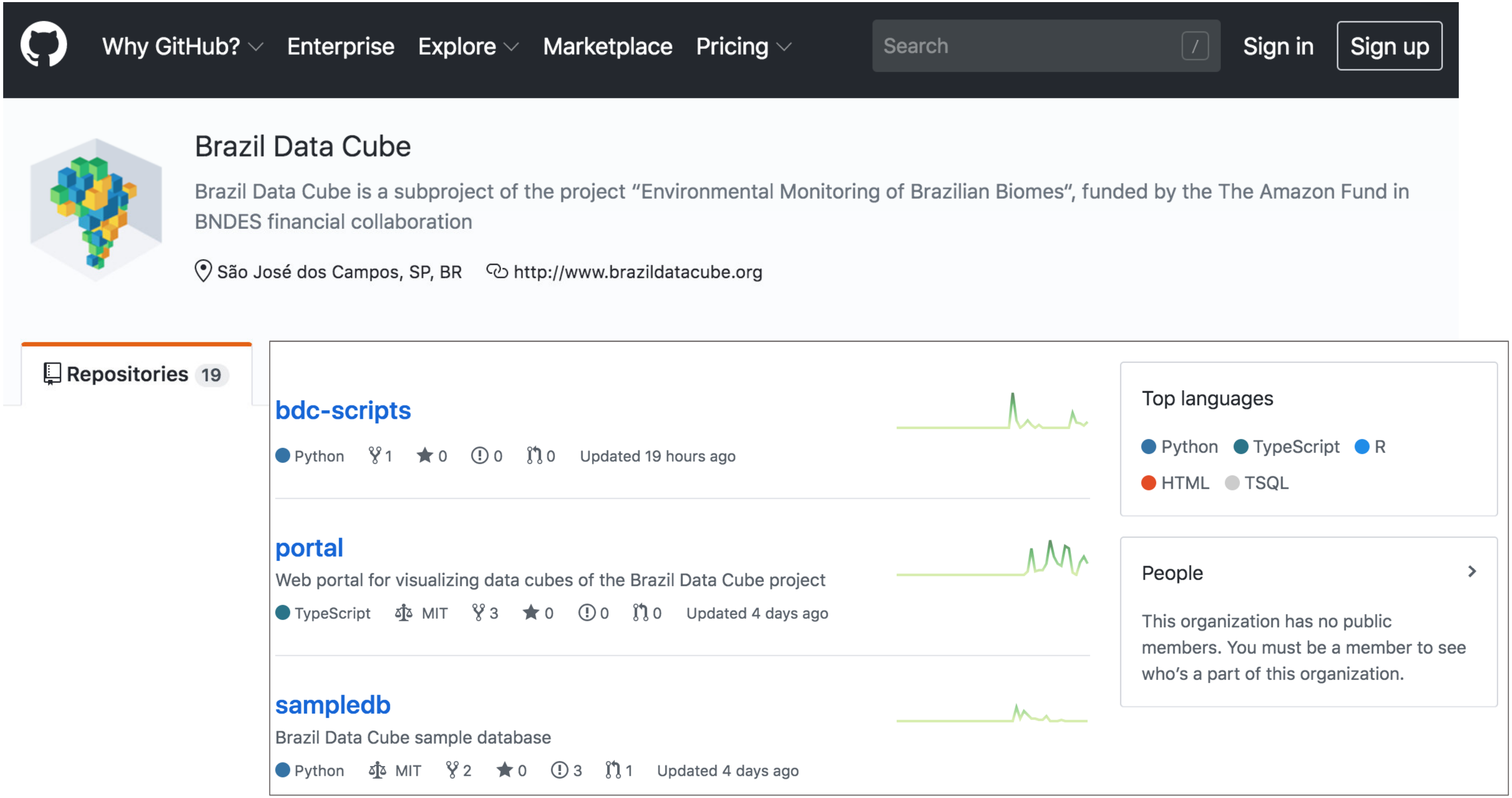
BDC Forest Monitor: TMS services using AWS Lambda to access satellite images of the Sentinel, Landsat and CBERS AWS Buckets.



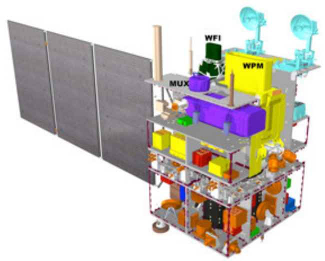
Creation of data cubes from Sentinel 2, CBERS 4 and Landsat 8 images using AWS Services.



https://github.com/brazil-data-cube



WFI camera – western Sao Paulo state

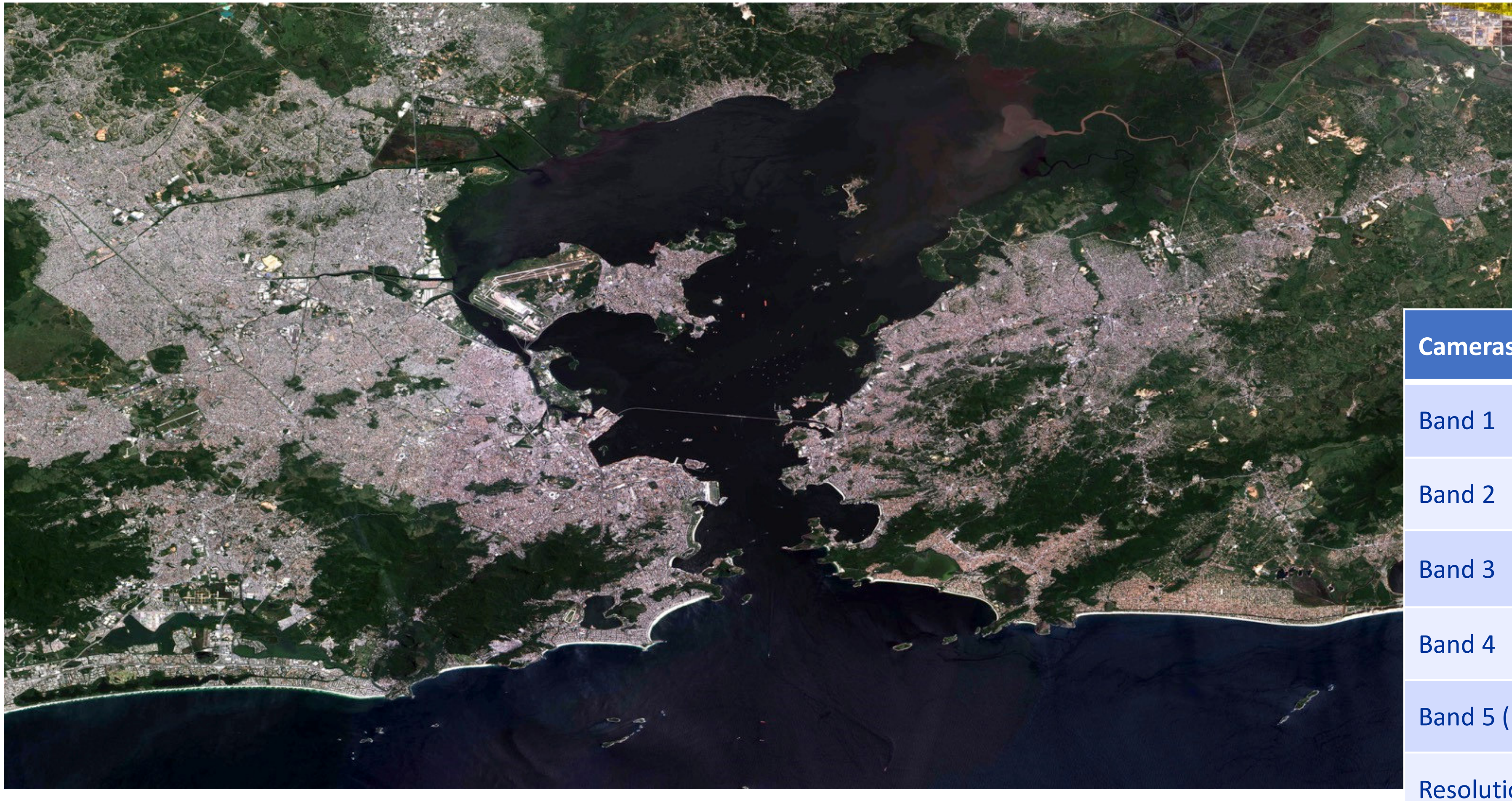


CBERS 04 A Commisioning Phase	
Camera	**WFI**
Band 1	0.45 - 0.52 µm
Band 2	0.52 - 0.59 µm
Band 3	0.63 - 0.69 µm
Band 4	0.77 - 0.89 µm
Band 5 (PAN)	
Resolution	55 m
Swath	684 km

MUX camera – Rio

Cameras	MUX
Band 1	0.45 - 0.52 µm
Band 2	0.52 - 0.59 µm
Band 3	0.63 - 0.69 µm
Band 4	0.77 - 0.89 µm
Band 5 (PAN)	
Resolution	16 m
Swath	95 km

WPM multispectral camera – Rio



Cameras	WPM
Band 1	0.45 - 0.52 µm
Band 2	0.52 - 0.59 µm
Band 3	0.63 - 0.69 µm
Band 4	0.77 - 0.89 µm
Band 5 (PAN)	0.45 - 0.90 µm
Resolution	2 m, 8 m
Swath	95 km

WPM panchromatic camera – Rio

Cameras	WPM
Band 1	0.45 - 0.52 µm
Band 2	0.52 - 0.59 µm
Band 3	0.63 - 0.69 µm
Band 4	0.77 - 0.89 µm
Band 5 (PAN)	0.45 - 0.90 µm
Resolution	2 m, 8 m
Swath	95 km

BRAZIL DATA CUBE

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brazildatacube@dpi.inpe.br

OBRIGADA

lubia.vinhas@inpe.br

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