Universidade Federal do ABC

Sensoriamento remoto:
continuação

Carolina Moutinho Duque de Pinho

Flávia da Fonseca Feitos

Vitor Vieira Vasconcelos

Cartografia e Geoprocessamento para o Planejamento Territorial

Março de 2025

Universidade Federal do ABC

Conteúdo

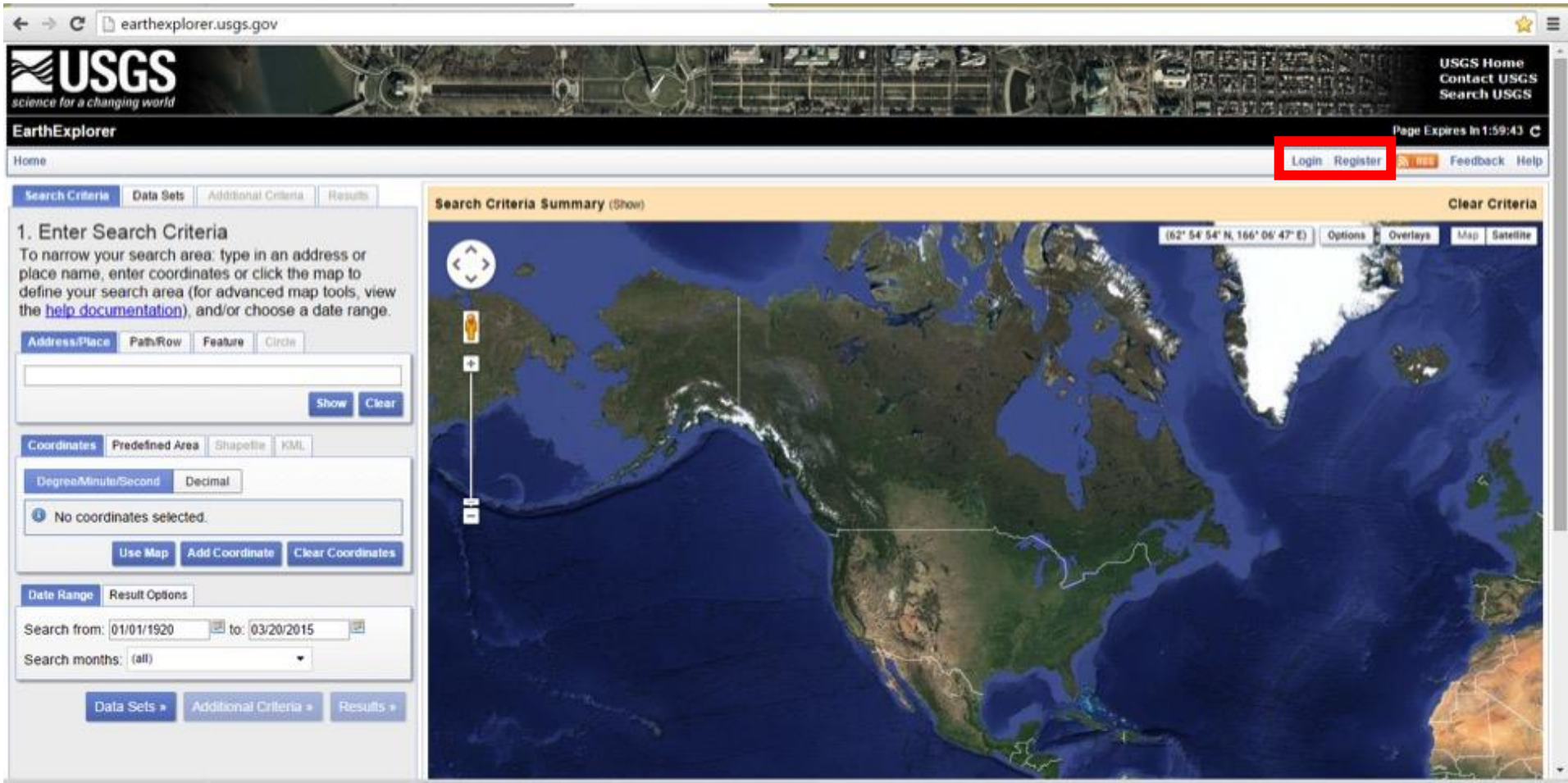
- **Fontes de imagens de satélite**
- Manipulação e visualização de imagens
- Índices espectrais e transformações
- Classificação espectral

Imagens Landsat Gratuitas:

Portal EarthExplorer

https://earthexplorer.usgs.gov/

Registro e Login



User Registration

User Credentials | Contact Demographic | Contact Information | Complete Registration

Registration and login credentials are required to access all system features and download data from USGS EROS web services. To ensure privacy and security, ERS uses Hypertext Transfer Protocol with Secure Sockets Layer (HTTPS) to encrypt user authentication.

To register, please create a username and password. The information gathered from the registration process is not distributed to other organizations and is only used to determine trends in data usage. Review USGS Privacy Policies.

The Cancel button can be used to exit the registration process at any time and information entered will be lost.

Username

New Password

Confirm New Password

Type the text

Privacy & Terms

Continue

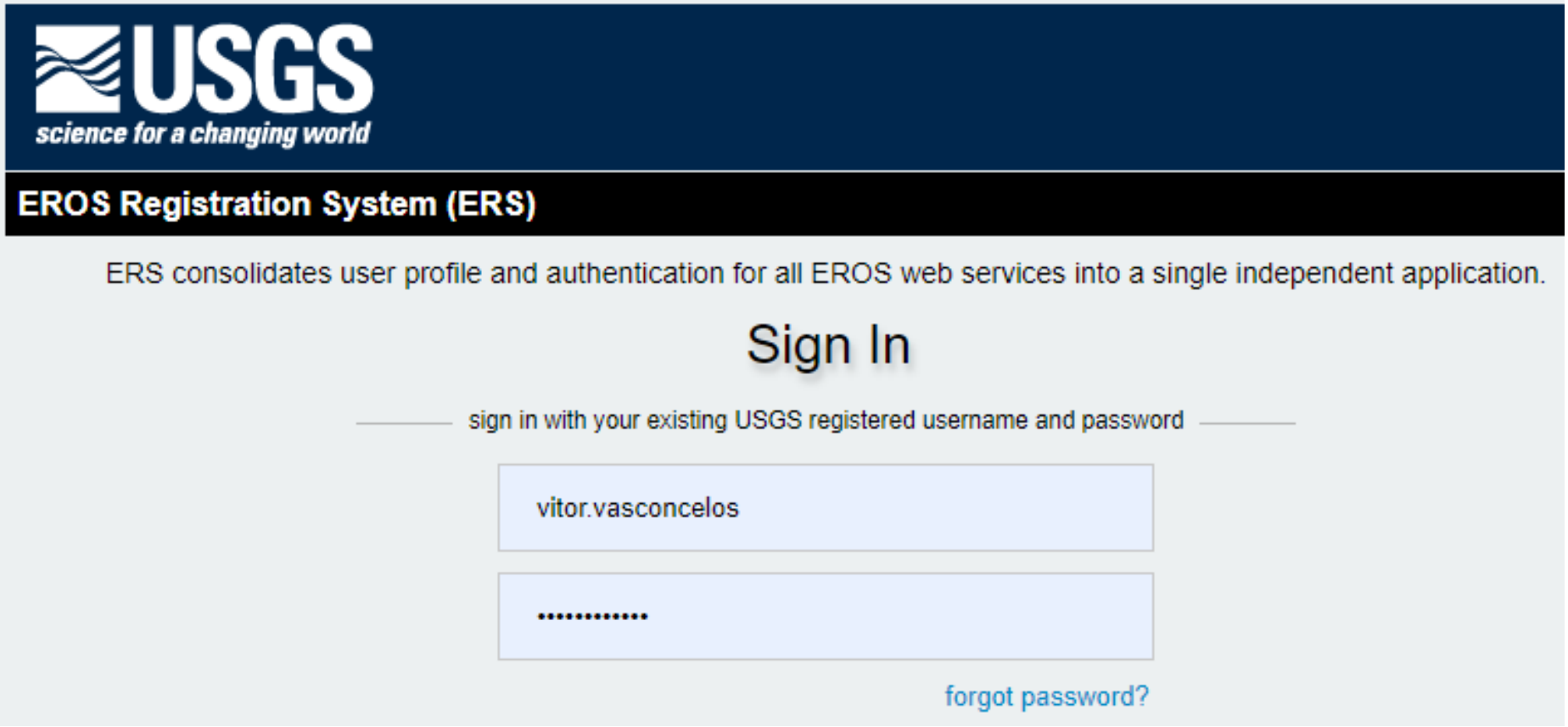
Username Requirements

Must be between 4 and 30 characters
May contain alphabetic and numeric characters
May only contain the following special characters
- period "."
- at sign "@"
- underscore "_"
- dash "-"

Password Requirements

Must be between 8 and 16 characters
Must contain at least one alphabetic character
Must contain at least one numeric character
May only contain the following special characters
- comma ","
- hyphen "-"
- period "."
- pipe "|"
- pound "#"
- underscore "_"

Earth Explorer



Earth Explorer

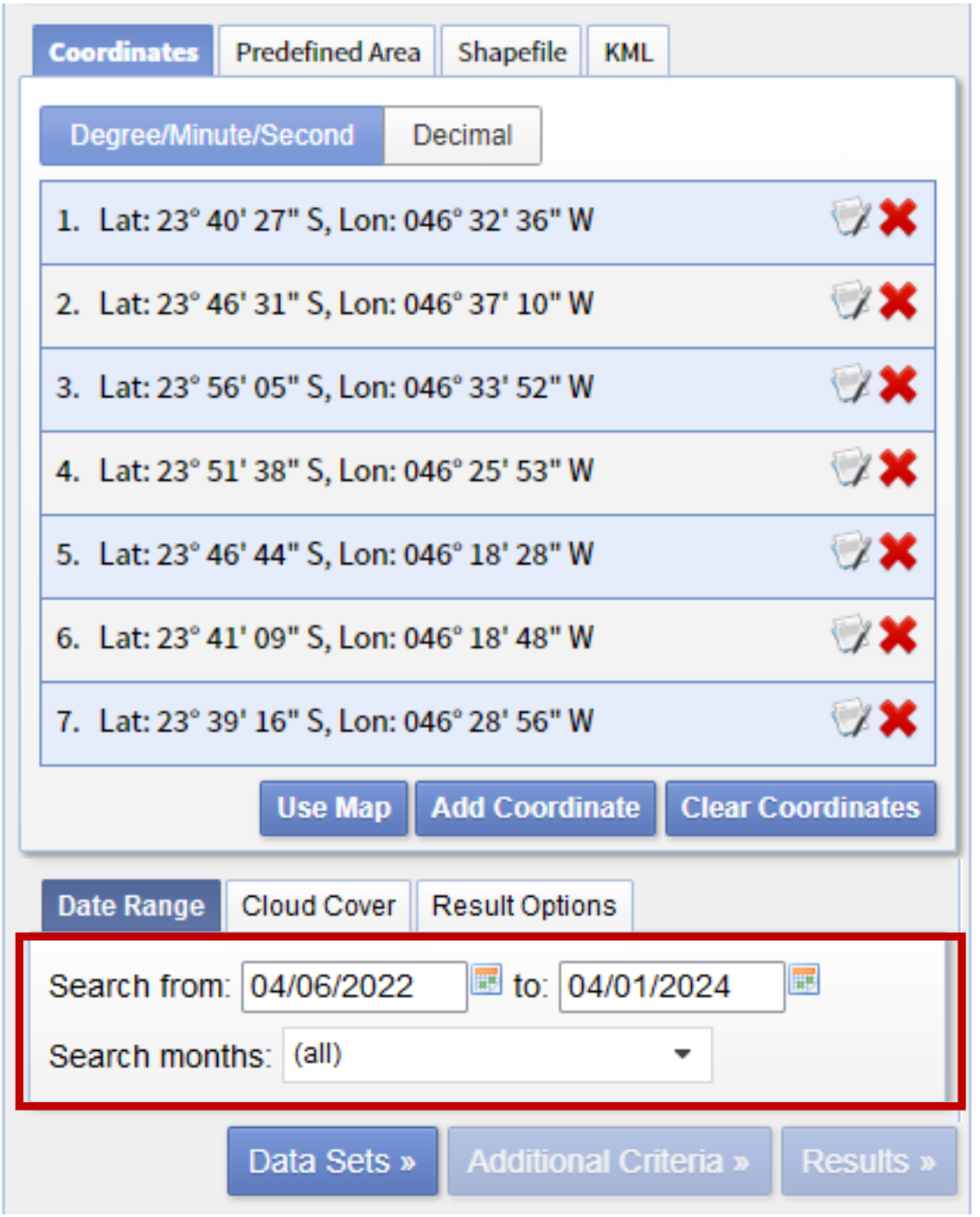
Coordinates | Predefined Area | Shapefile | KML

Degree/Minute/Second | Decimal

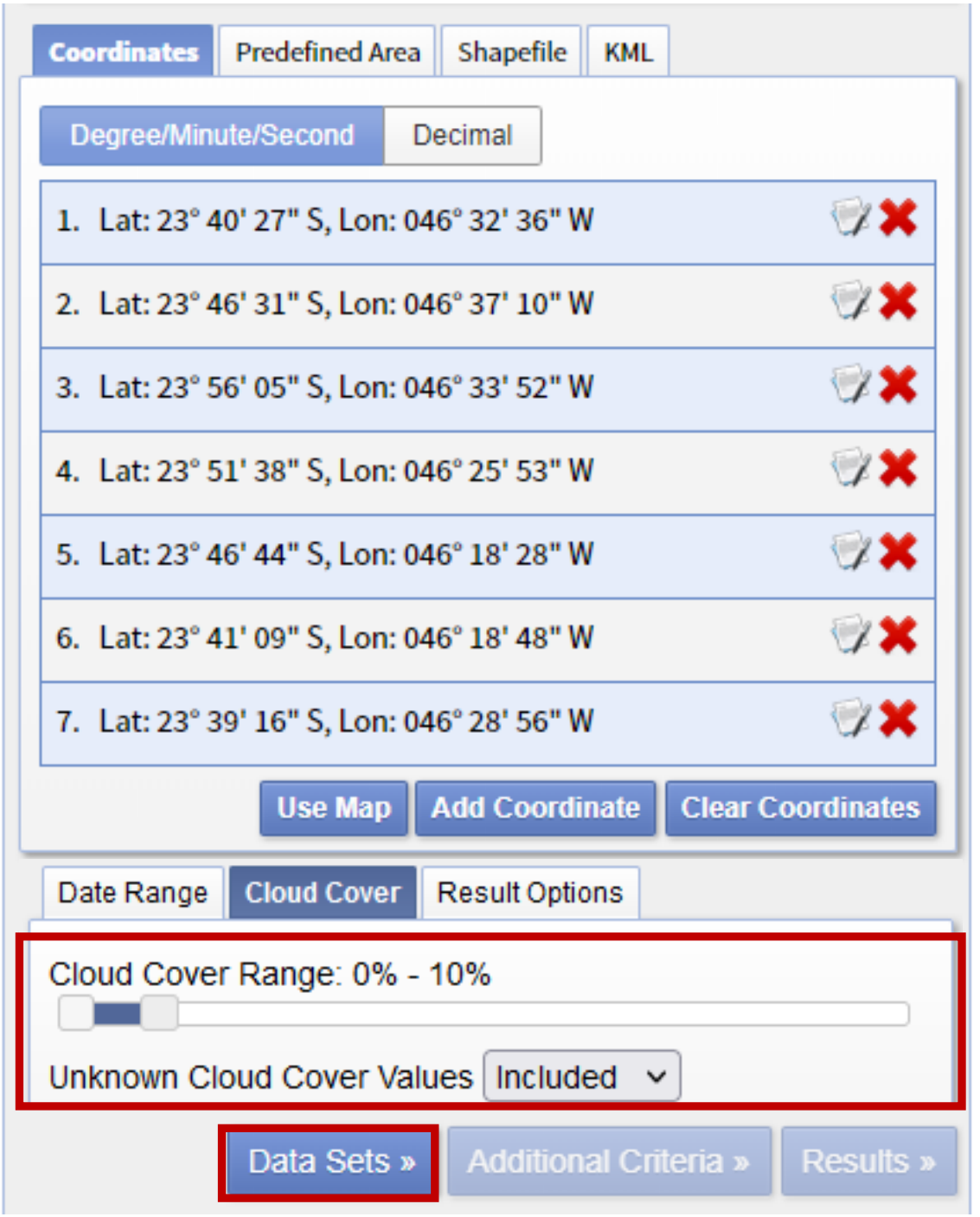
1. Lat: 23° 40' 27" S, Lon: 046° 32' 36" W
2. Lat: 23° 46' 31" S, Lon: 046° 37' 10" W
3. Lat: 23° 56' 05" S, Lon: 046° 33' 52" W
4. Lat: 23° 51' 38" S, Lon: 046° 25' 53" W
5. Lat: 23° 46' 44" S, Lon: 046° 18' 28" W
6. Lat: 23° 41' 09" S, Lon: 046° 18' 48" W
7. Lat: 23° 39' 16" S, Lon: 046° 28' 56" W

Use Map | Add Coordinate | Clear Coordinates

Earth Explorer



Earth Explorer



Earth Explorer

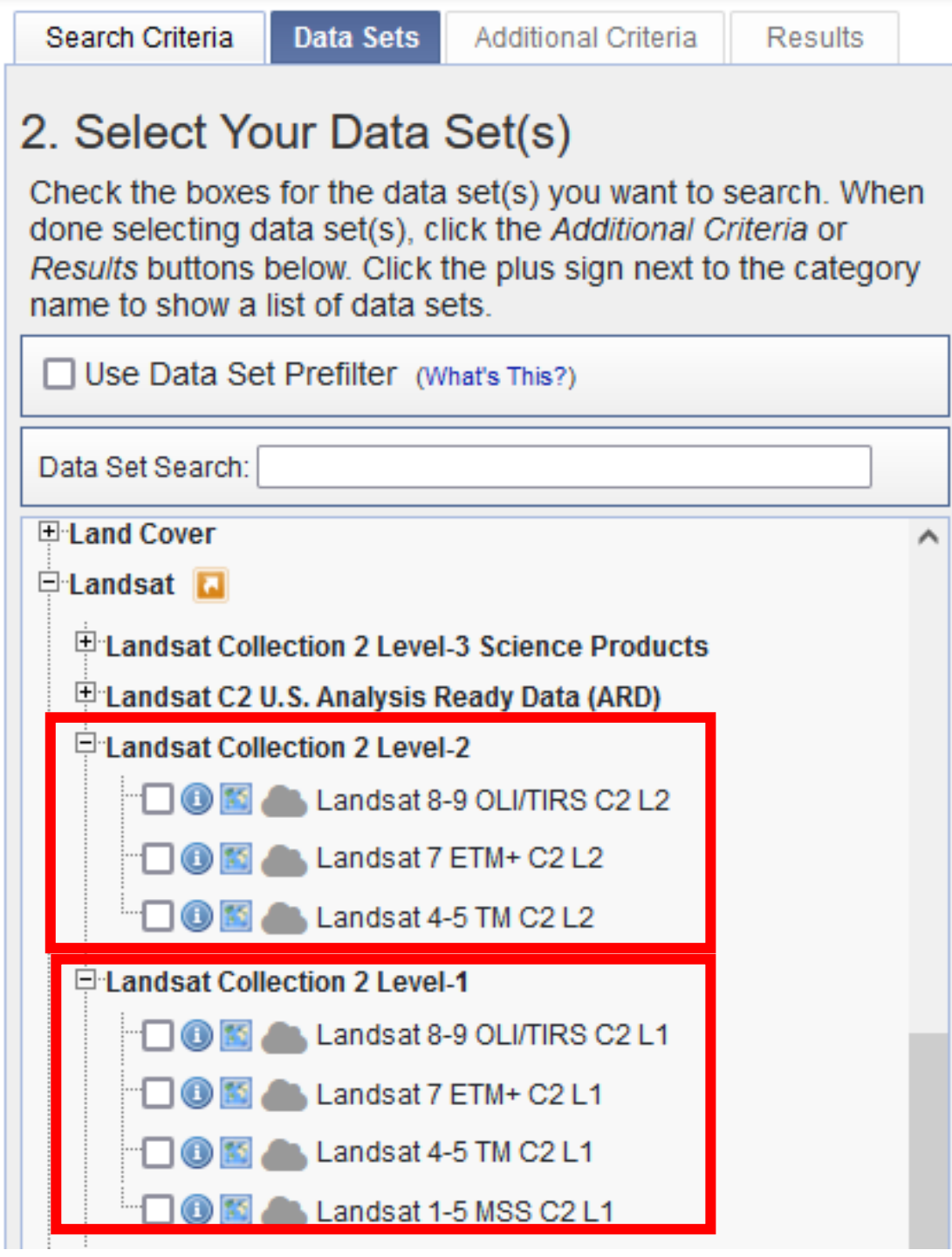
Landsat Archive

Collection 1 Level-2:
Imagens ortorretificadas com correção atmosférica (ordem por e-mail)

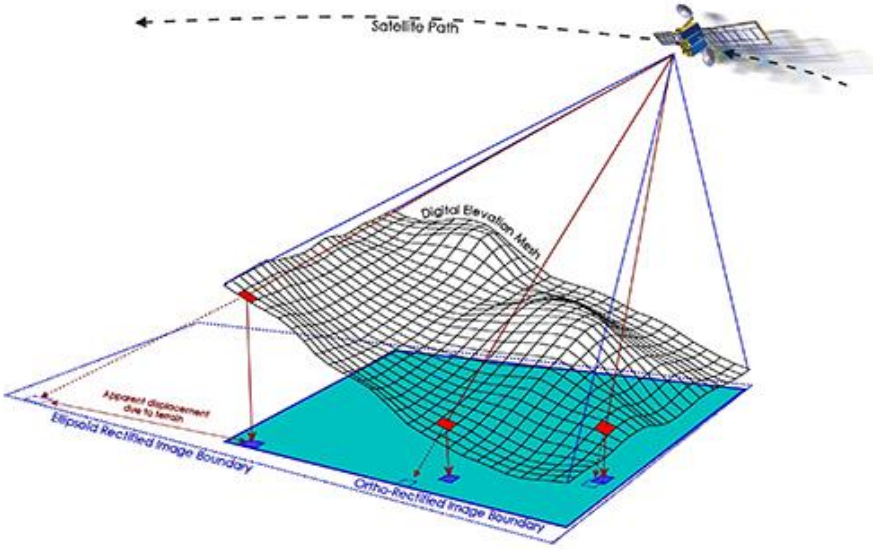
- Não inclui:
  - pancromática (15m)
  - termais (60m)

Collection 1 Level-1
Imagens ortorretificadas (download direto)

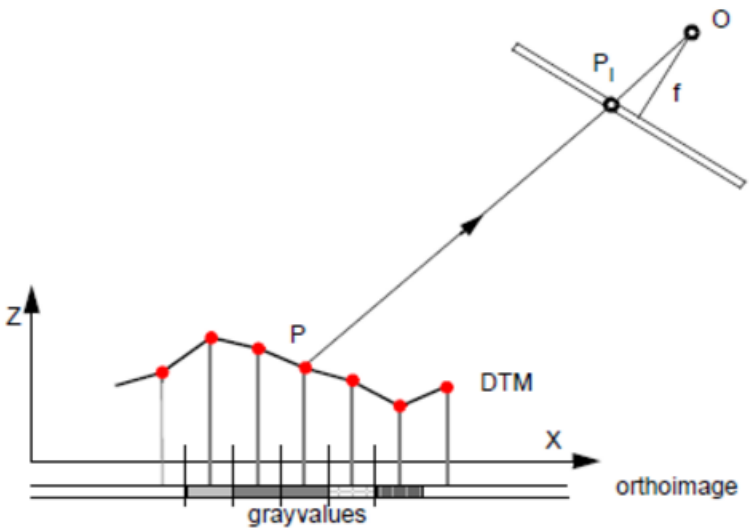
L8-9 = Landsat 8 (OLI)
L4-5 = Landsat 4 e 5 (TM)

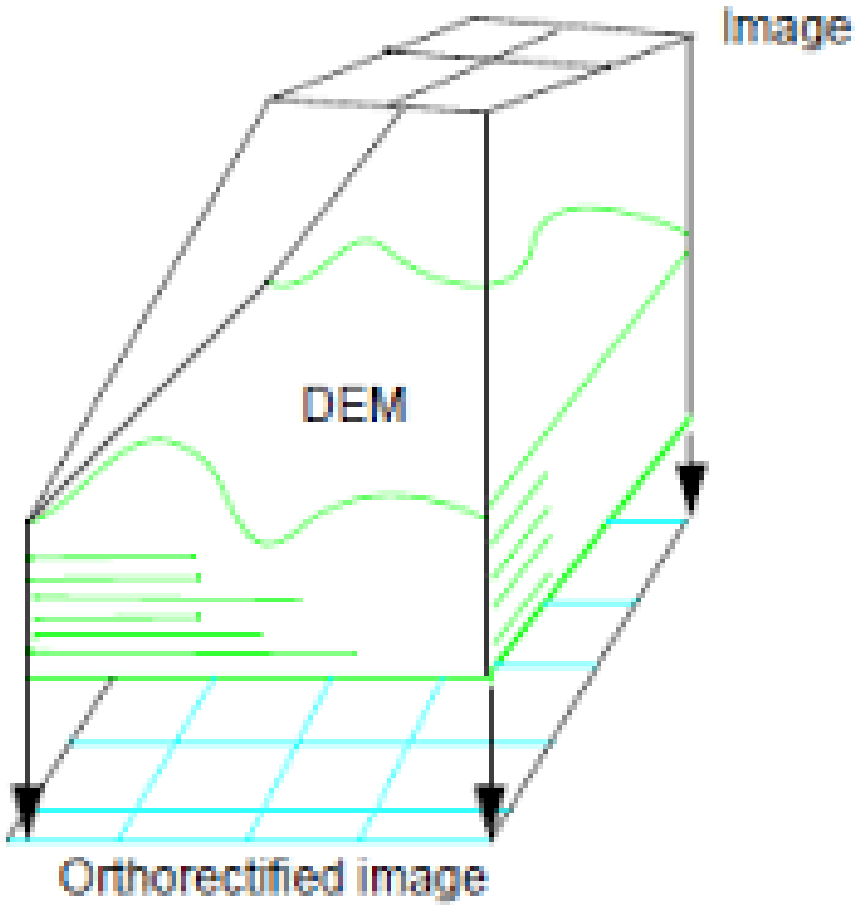


Ortorretificação



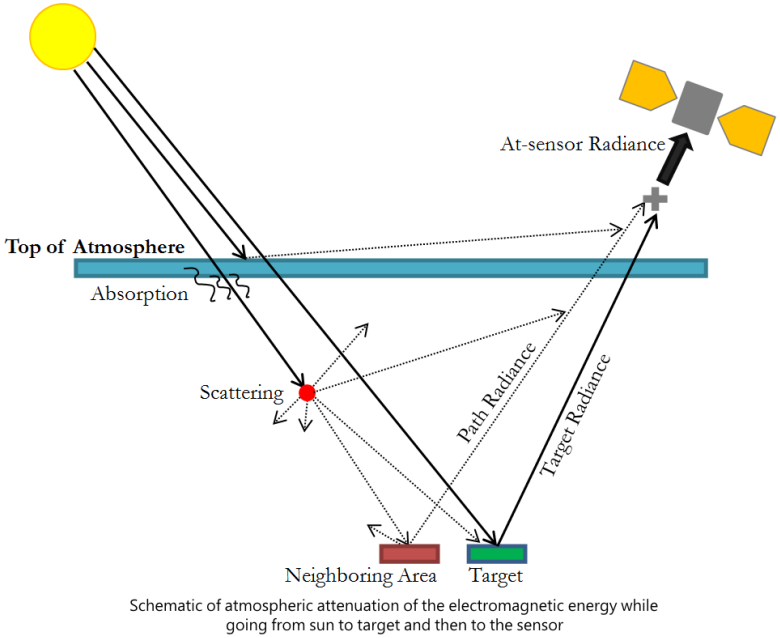
http://www.geoimage.com.au/services/imageprocessing





https://wiki.hexagongeospatial.com/index.php?title=Orthorectification

Correção Atmosférica



Schematic of atmospheric attenuation of the electromagnetic energy while going from sun to target and then to the sensor

http://www.hkcoastalwaterquality.tk/Methodology.html

Antes

Depois

https://www.mapbox.com/blog/atmospheric-correction-comparison/

Search Criteria | Data Sets | Additional Criteria | **Results**

4. Search Results

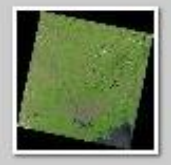
If you selected more than one data set to search, use the dropdown to see the search results for each specific data set.

Show Browse/Footprint Controls

Show Result Controls

Data Set Click here to export your results »

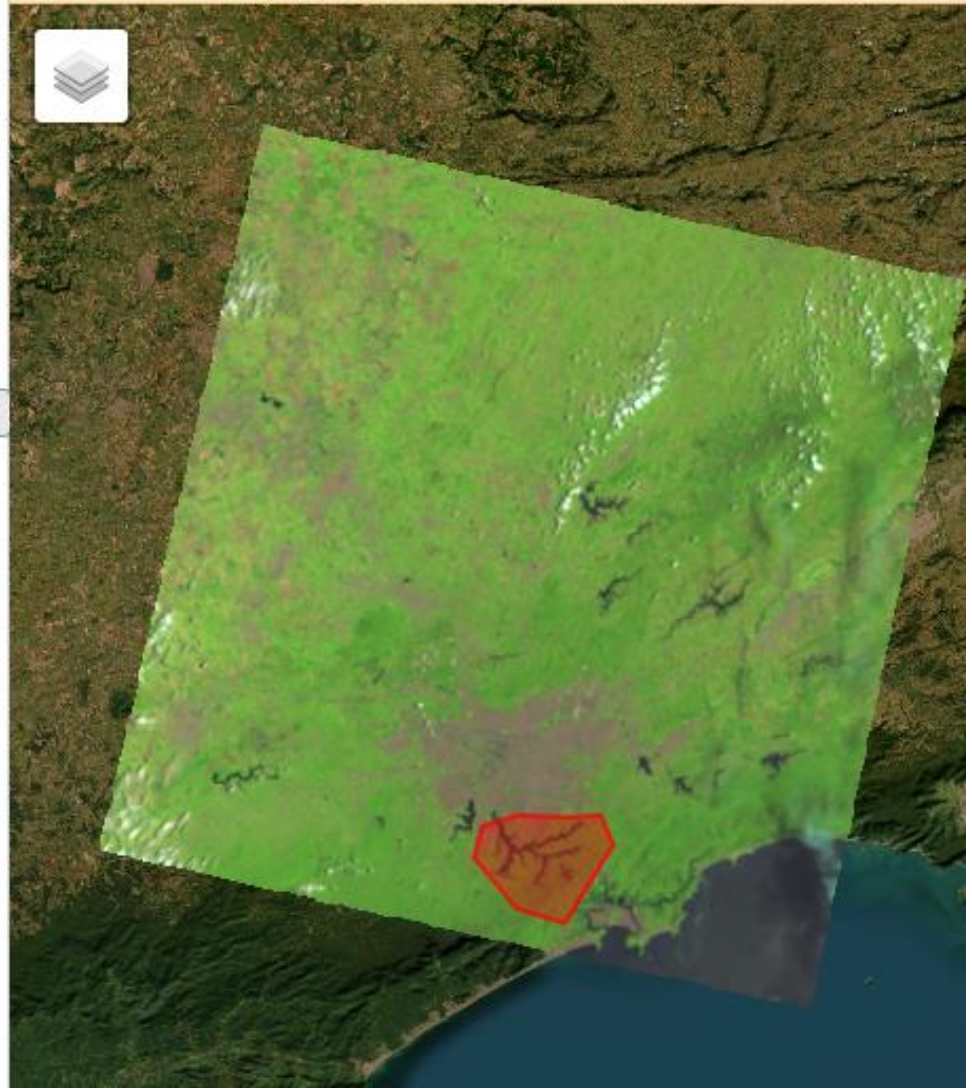
Landsat 8-9 OLI/TIRS C2 L2

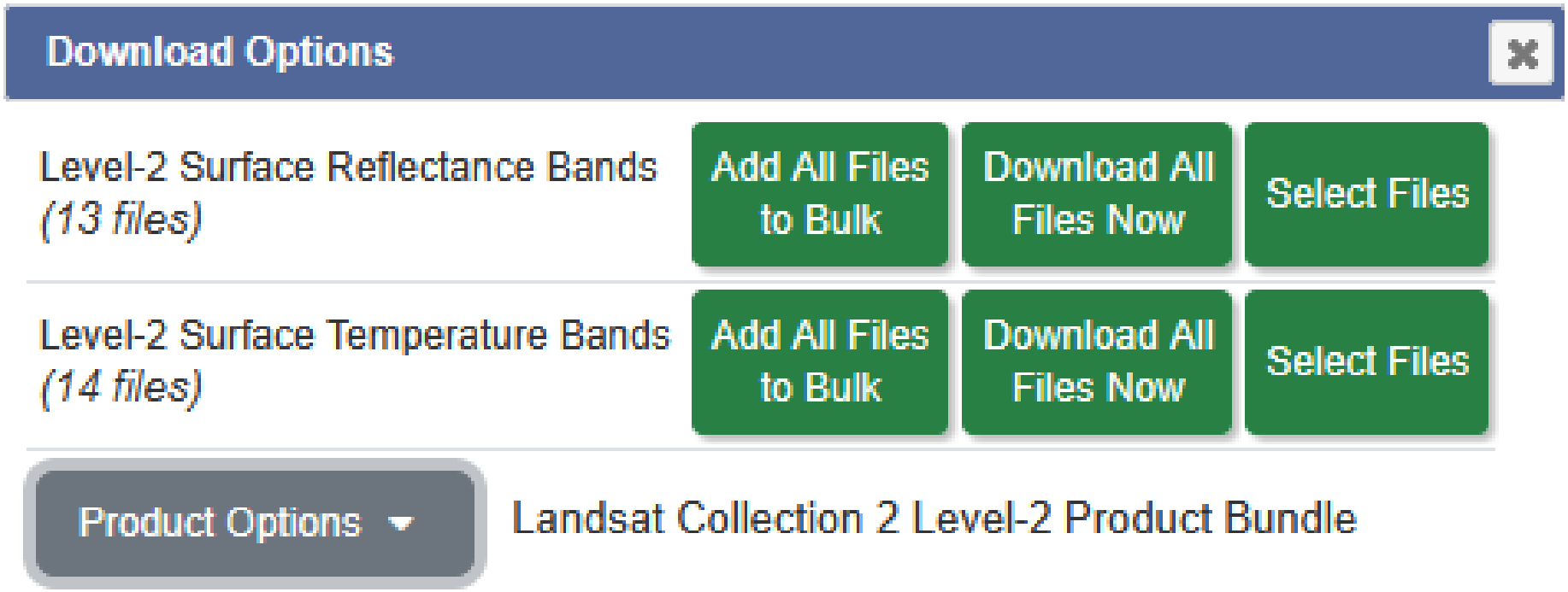


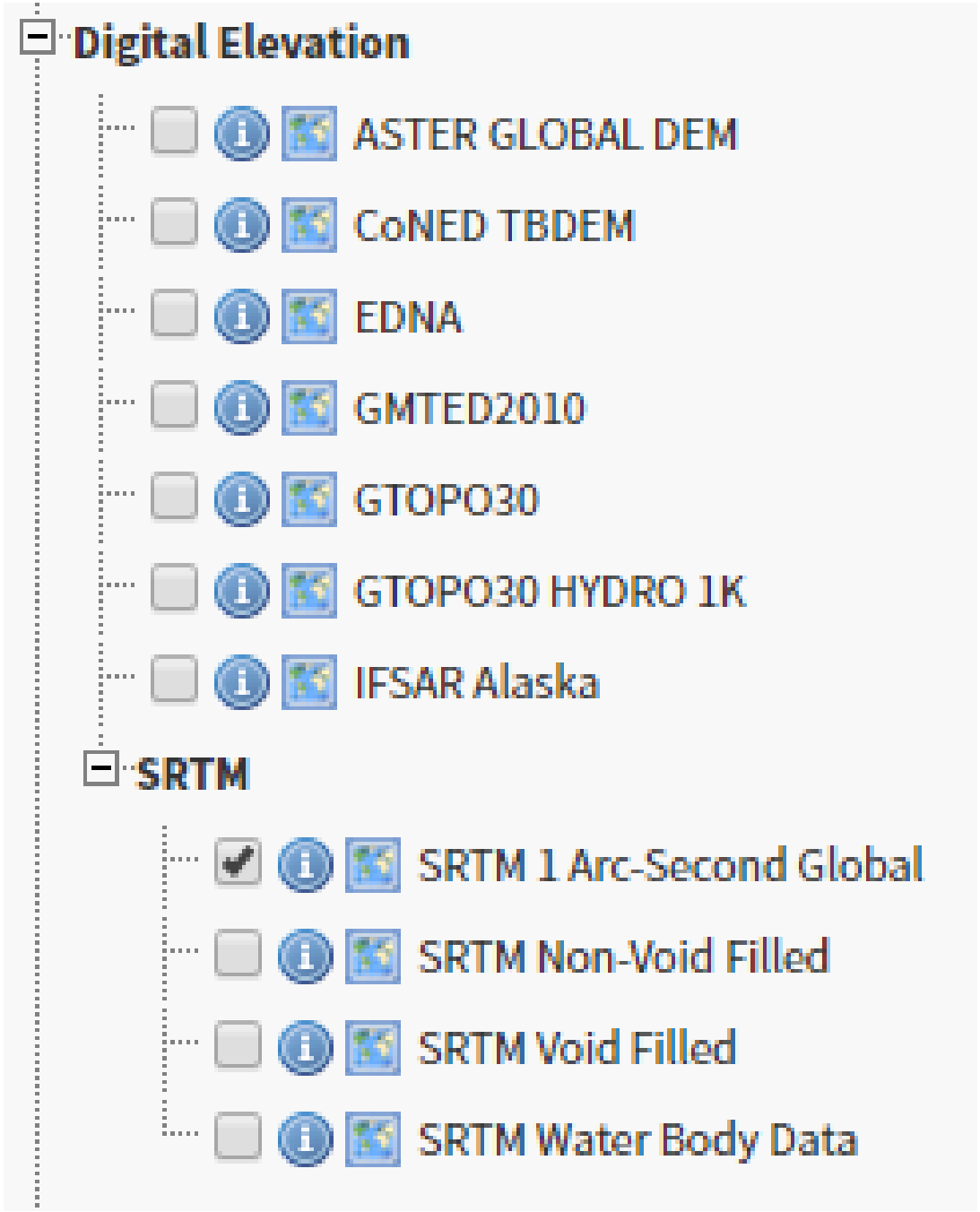
ID:
LC09_L2SP_219076_20241126_20241127_02_T1
Date Acquired: 2024/11/26
Path: 219
Row: 076

ID:
LC09_L2SP_219076_20[illegible]23_20240924_02_T1
Date Acquired: 2024/09/2[illegible]
Path: 219
Row: 076

Search Criteria Summary (Show)




Download Options
Level-2 Surface Reflectance Bands
(13 files)
Add All Files to Bulk
Download All Files Now
Select Files
Level-2 Surface Temperature Bands
(14 files)
Add All Files to Bulk
Download All Files Now
Select Files
Product Options
Landsat Collection 2 Level-2 Product Bundle



SRTM – 30 metros

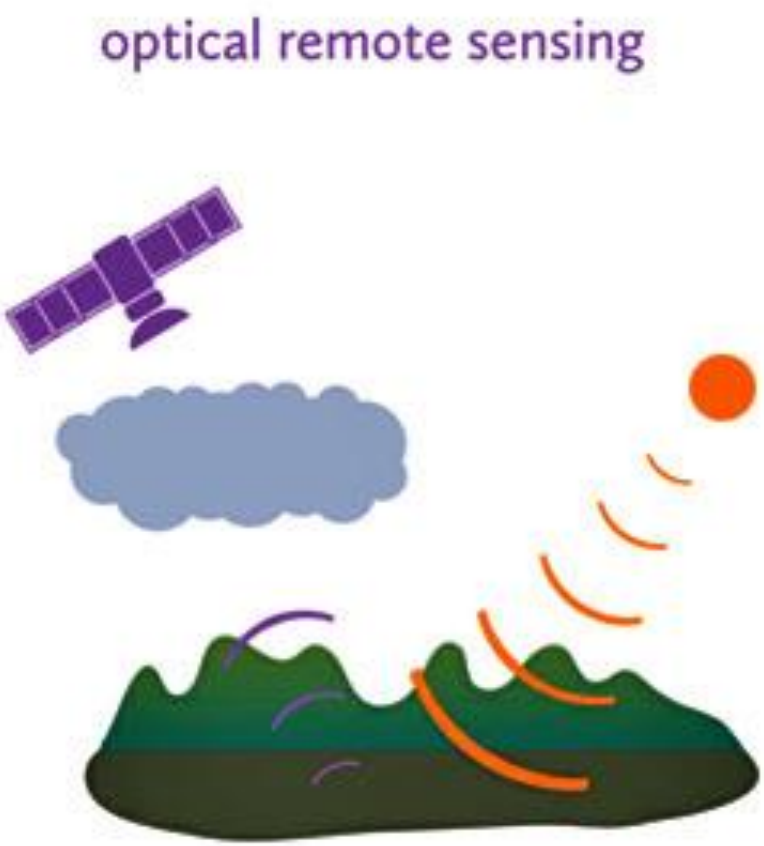
Máscara de água

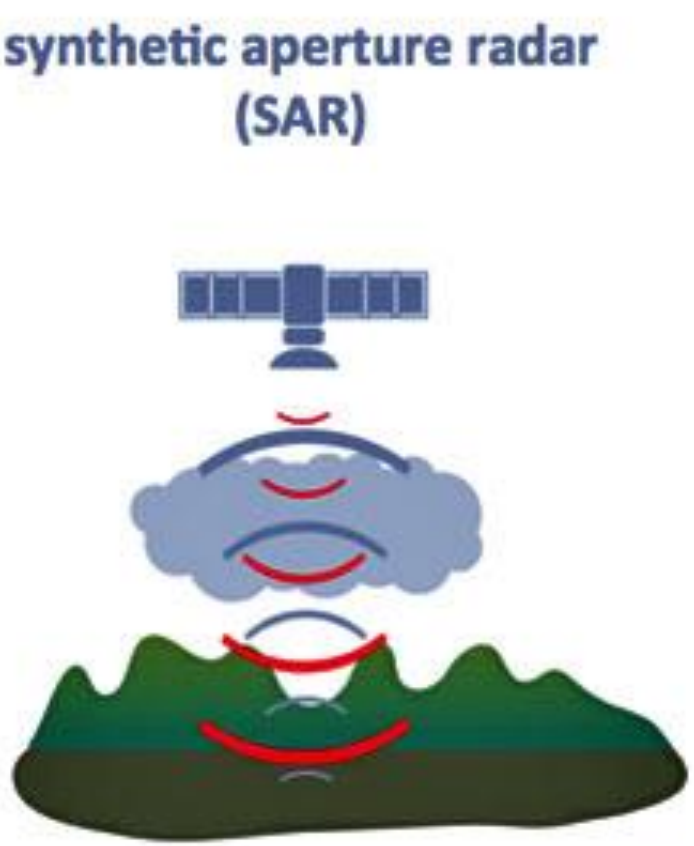
Satélites Sentinel

- Sentinel 1 – Radar
  - A partir de 2014
  - GRD – Ground Range Detected
  - Resoluções: 9m (SM), 20m (IW) e 50m (EW)
- Sentinel 2 – Passivo
  - A partir de 2015
  - S2MSI2A e S2MSI2Ap
  - Ortorretificação
  - Correção atmosférica

Usos do Radar

- Imagens em dias com nuvens





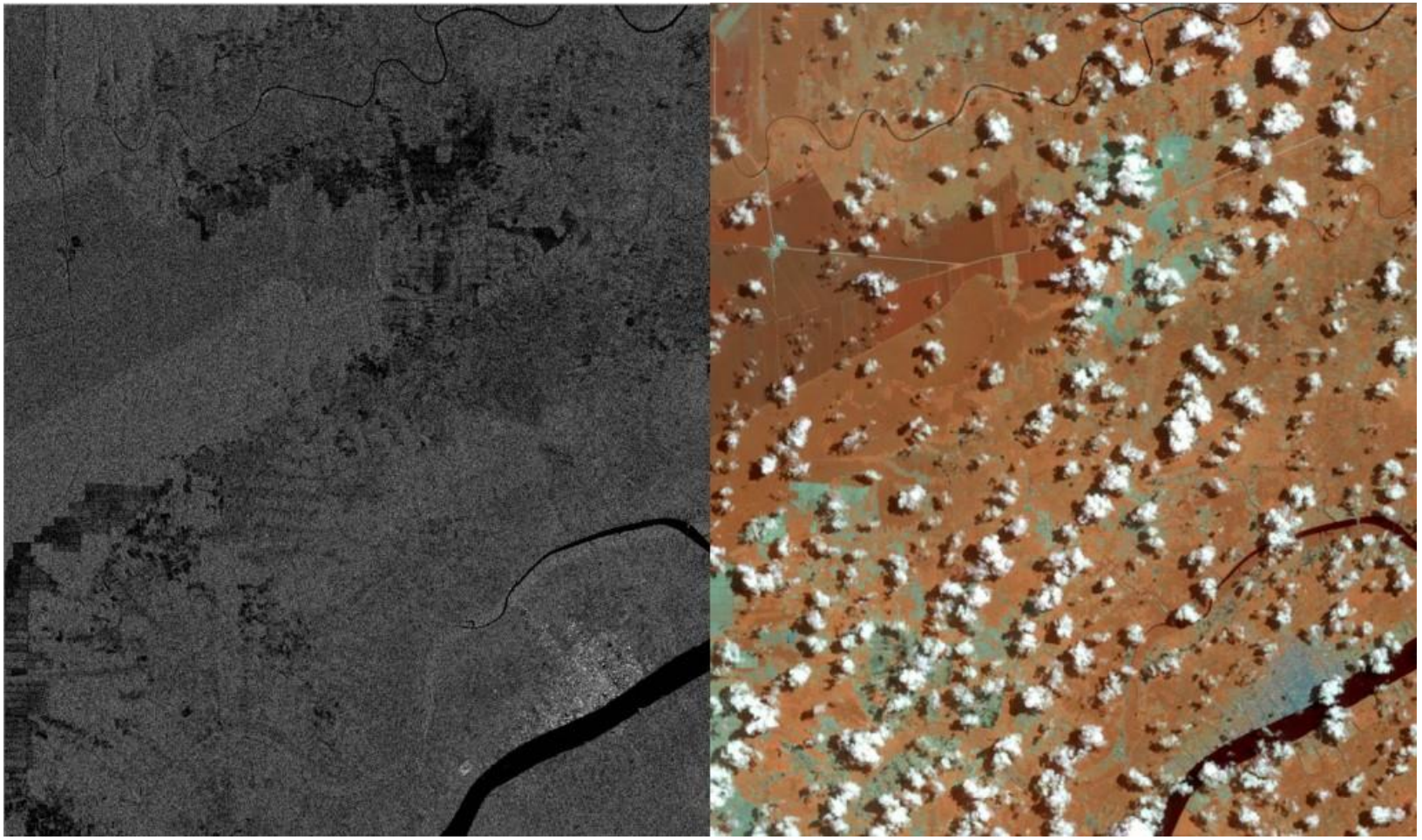
http://www.riice.org/how-riice-works/earth-observation-data-collection/

Usos do Radar

Imagens em dias com nuvens

Sentinel 1

Landsat 8

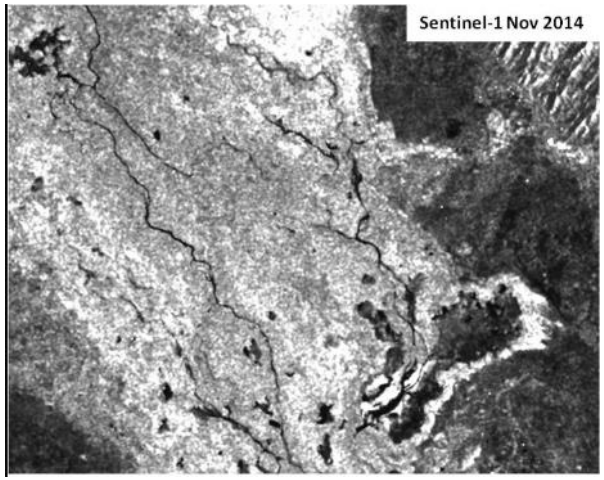


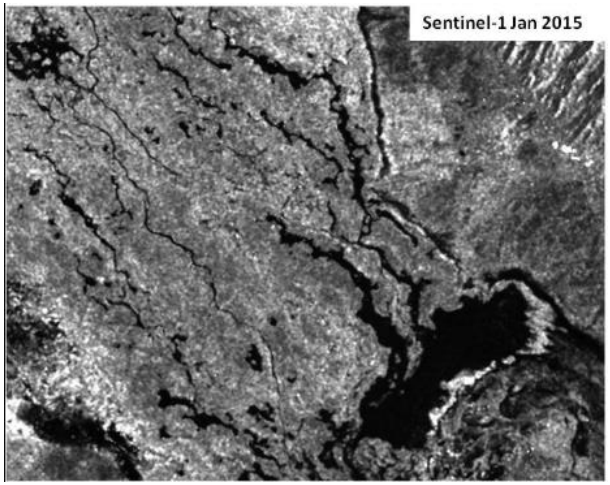
Sumatra (Indonésia), 2015

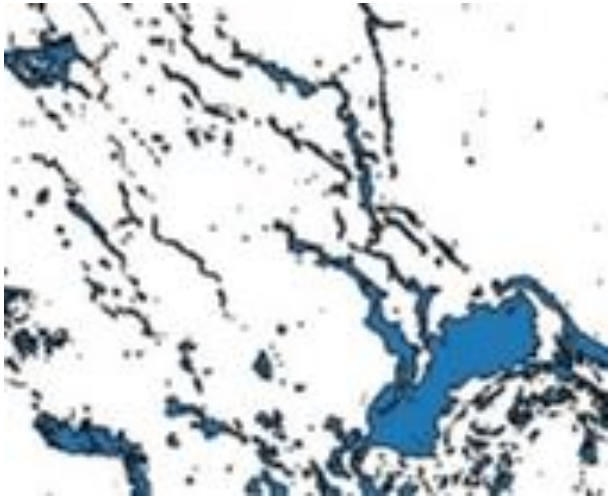
https://blog.conservation.org/2016/03/cloud-piercing-satellites-unleash-torrent-of-new-data-new-insights-into-planet-earth/

Usos do Radar

- Detecção de áreas alagadas
  - Espelho d'água reflete sinal







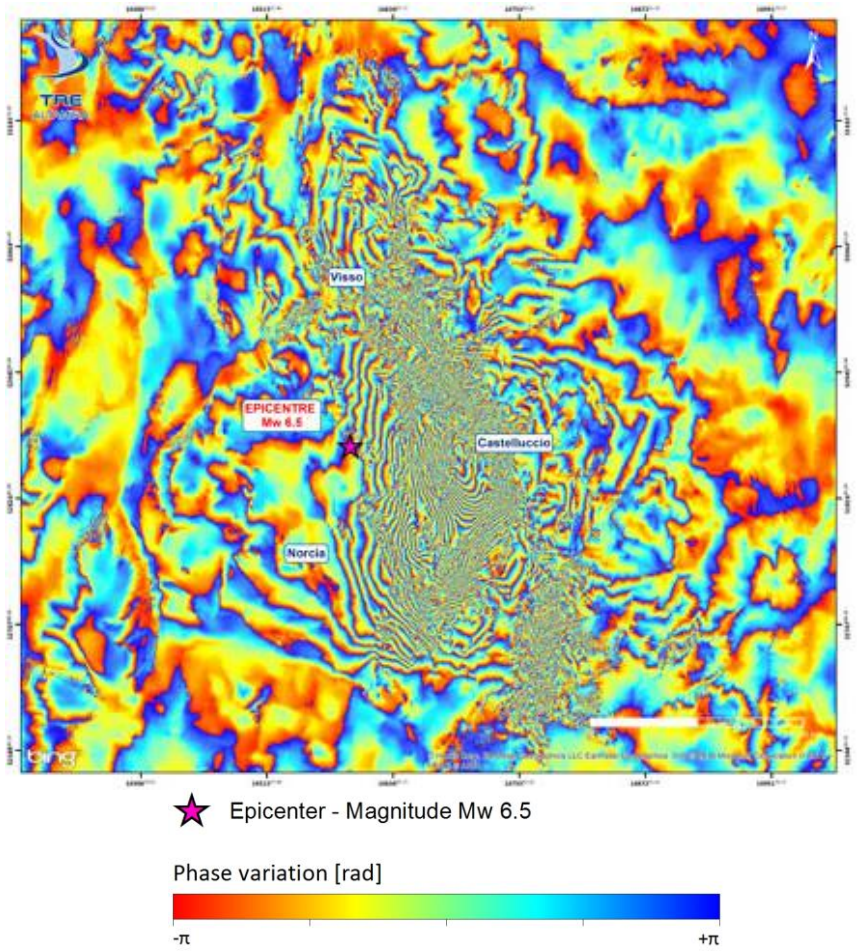
http://www.un-spider.org/book/export/html/7322

Usos do Radar

Detecção de movimentos na superfície

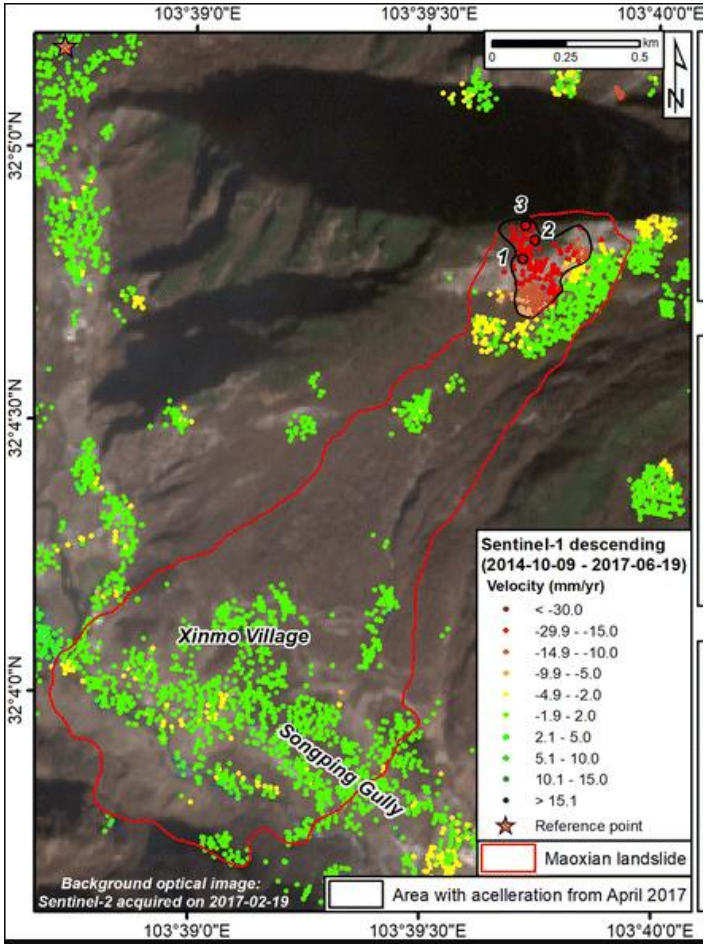
Terremotos

Perugia (Itália), 30 out. 2016



Movimentos de massa

Maoxian (China), 2014-2017



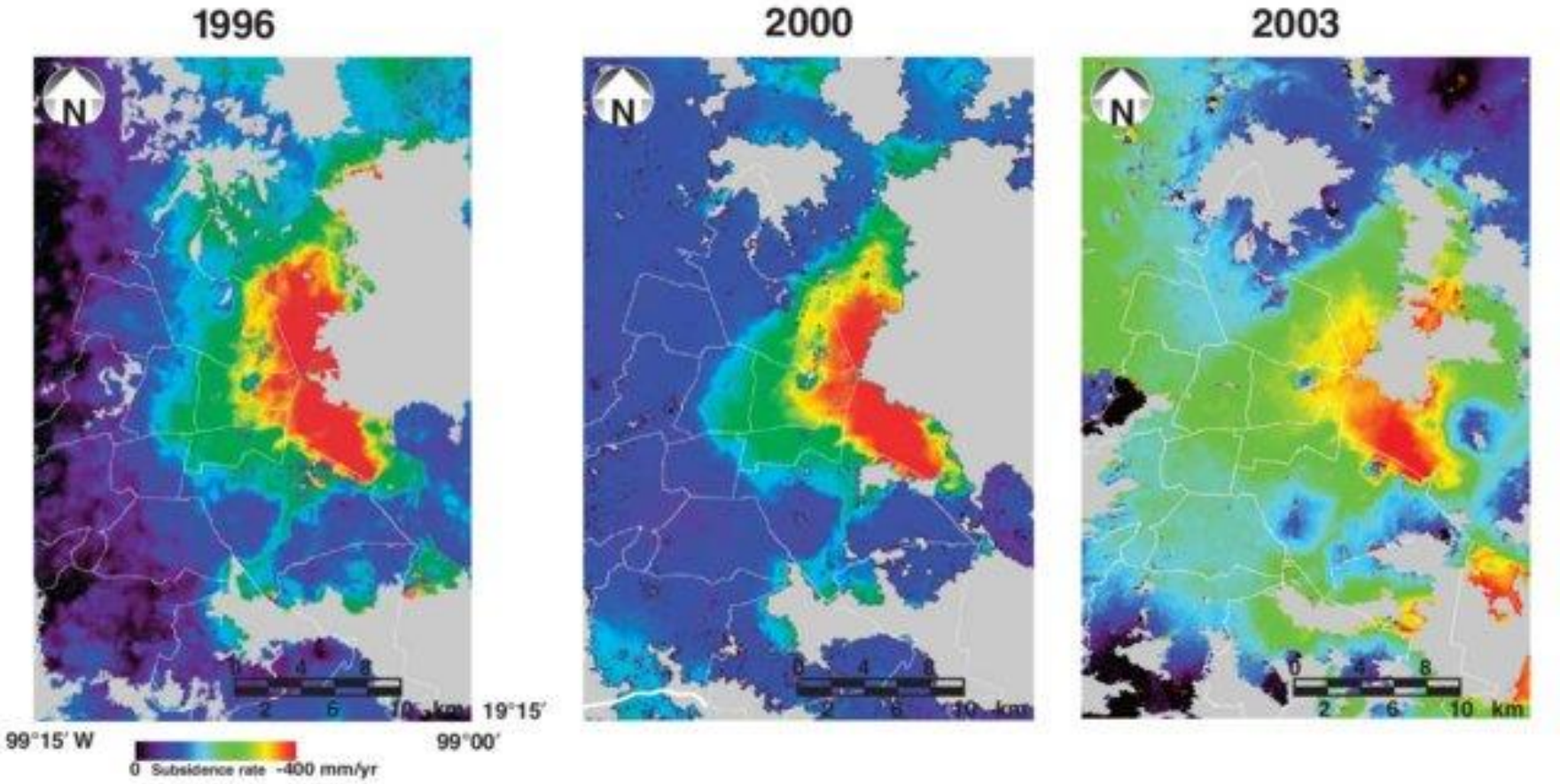
Intrieri, E.,et al.., 2018. The Maoxian landslide as seen from space: detecting precursors of failure with Sentinel-1 data. Landslides, 15(1), pp.123-133.

Polcari, M., et al. 2017. Using multi-band InSAR data for detecting local deformation phenomena induced by the 2016–2017 Central Italy seismic sequence. Remote Sensing of Environment, 201, pp.234-242.

Usos do Radar

Detecção de movimentos na superfície

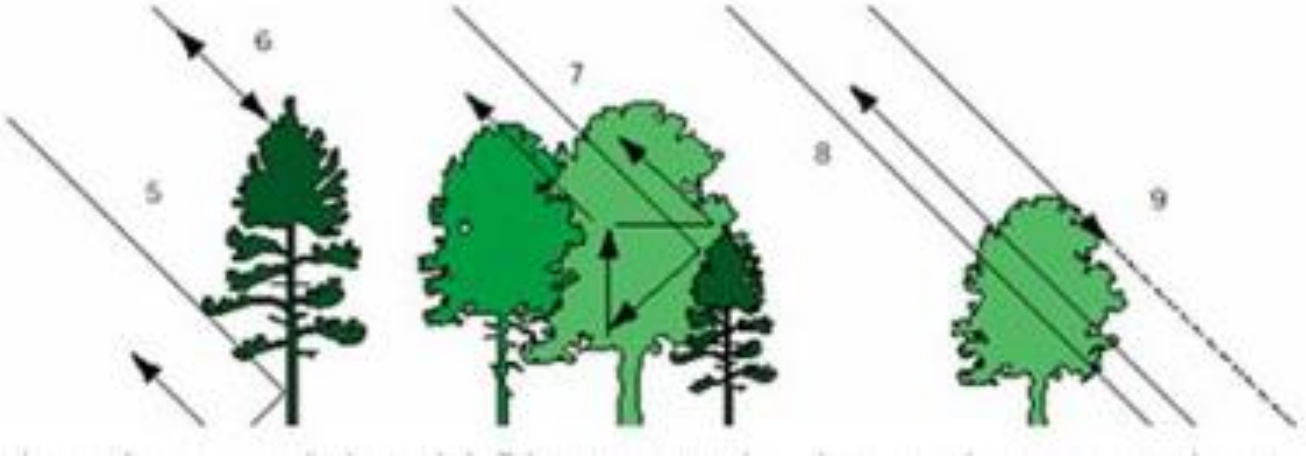
Taxa de subidência na Cidade do México



Cabral-Cano, E., Dixon, T.H., Miralles-Wilhelm, F., Díaz-Molina, O., Sánchez-Zamora, O. and Carande, R.E., 2008. Space geodetic imaging of rapid ground subsidence in Mexico City. Geological Society of America Bulletin, 120(11-12), pp.1556-1566.

Usos do Radar

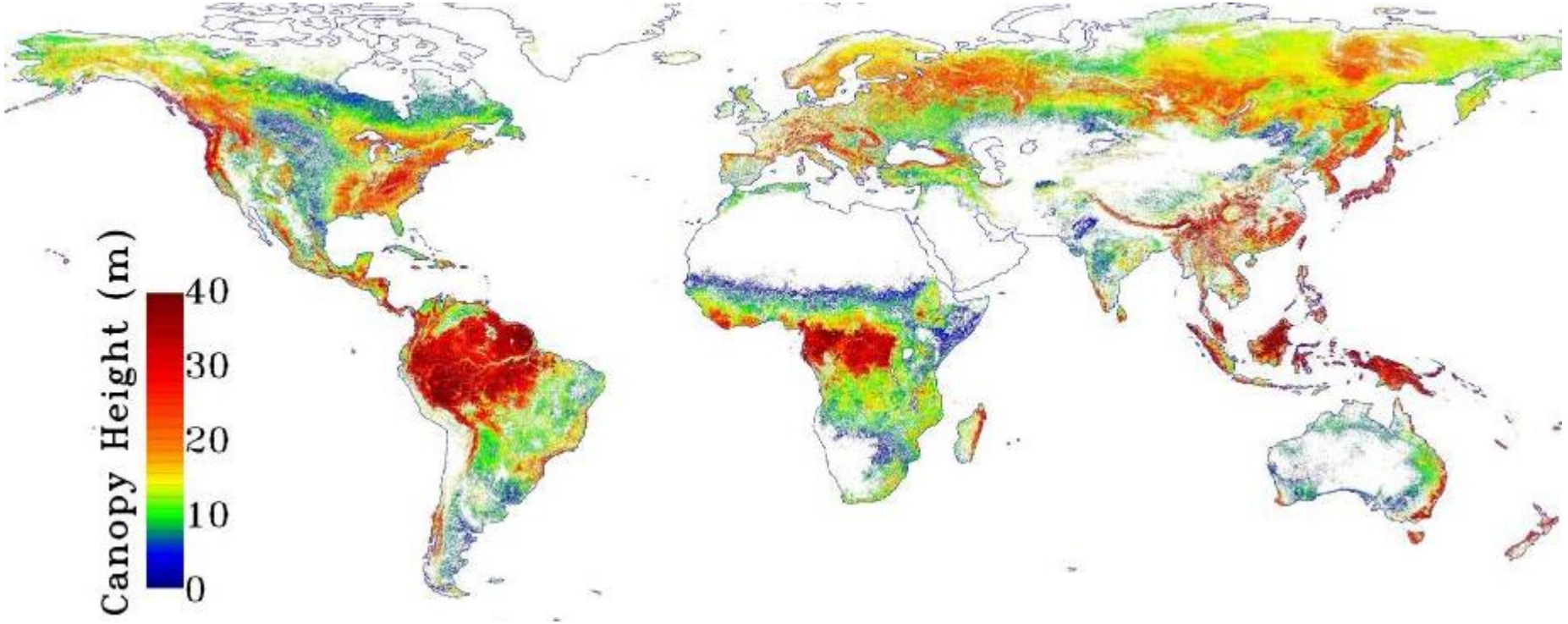
- Características geométricas e físicas dos objetos
  - Estruturas de folhas e galhos
  - Altura e biomassa de florestas



Fernandez-Ordonez, Y., Soria-Ruiz, J. and Leblon, B., 2009. Forest inventory using optical and radar remote sensing. In Advances in Geoscience and Remote Sensing. InTech.

Usos do Radar

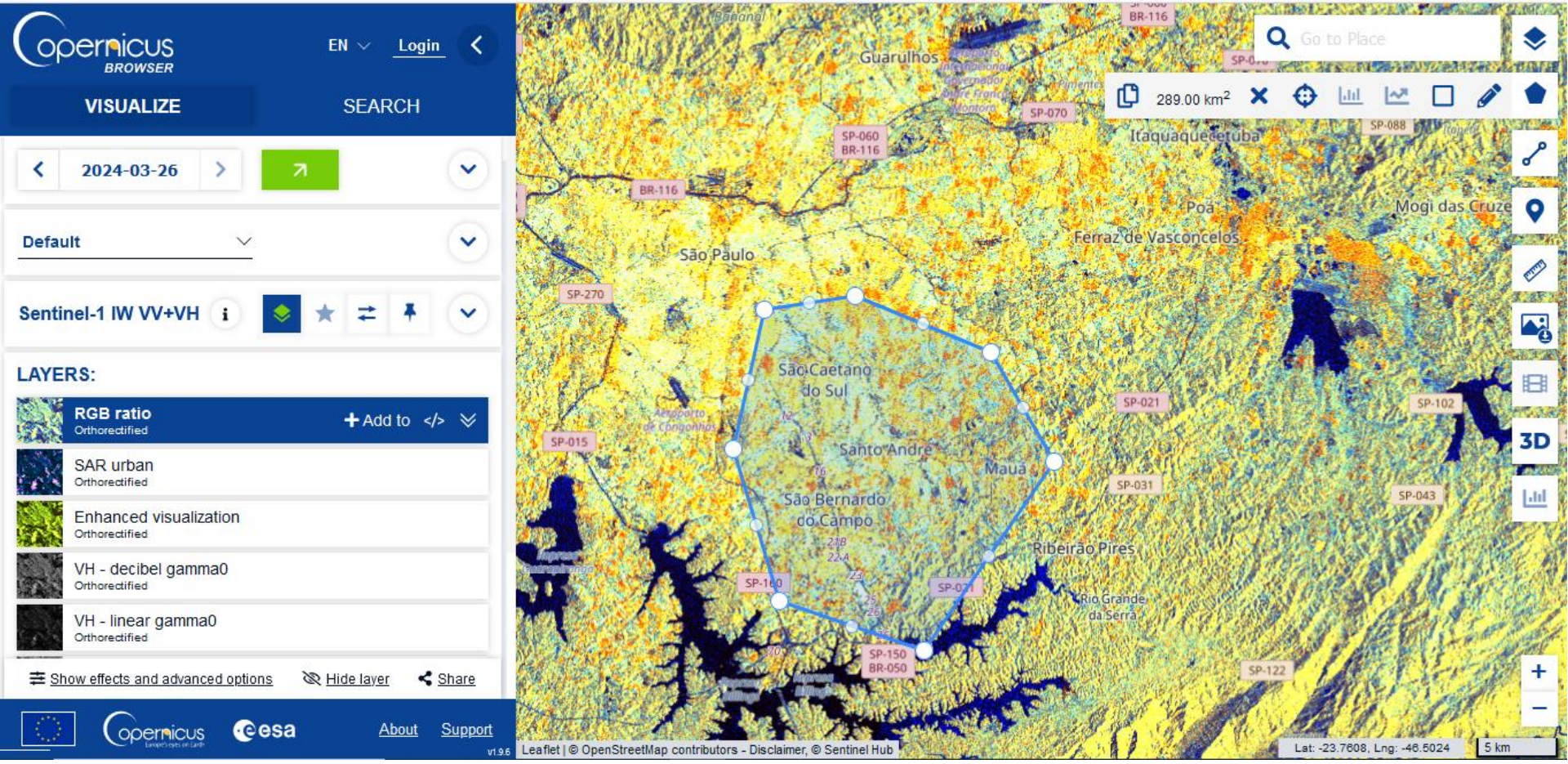
- Características geométricas e físicas dos objetos

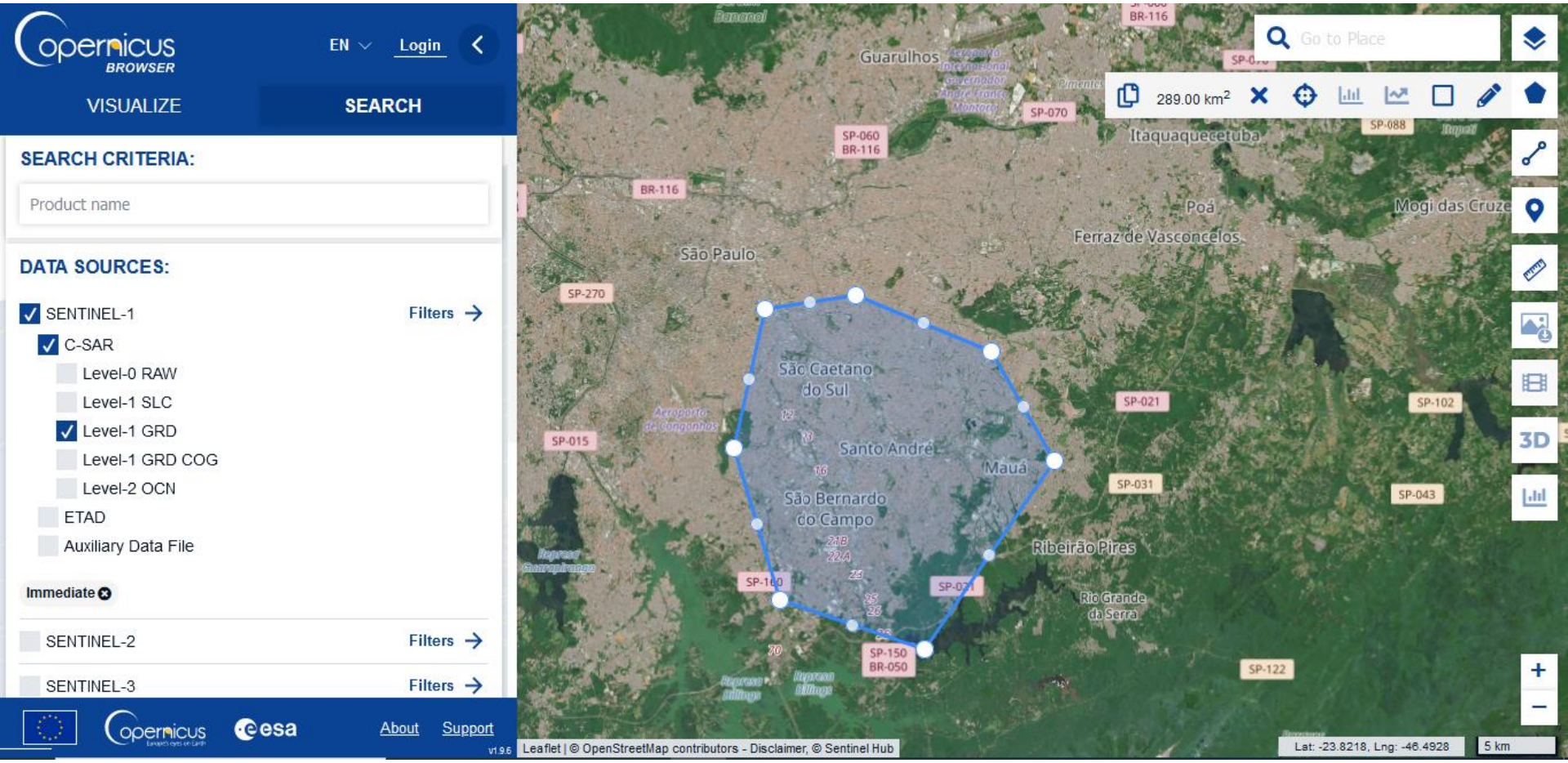


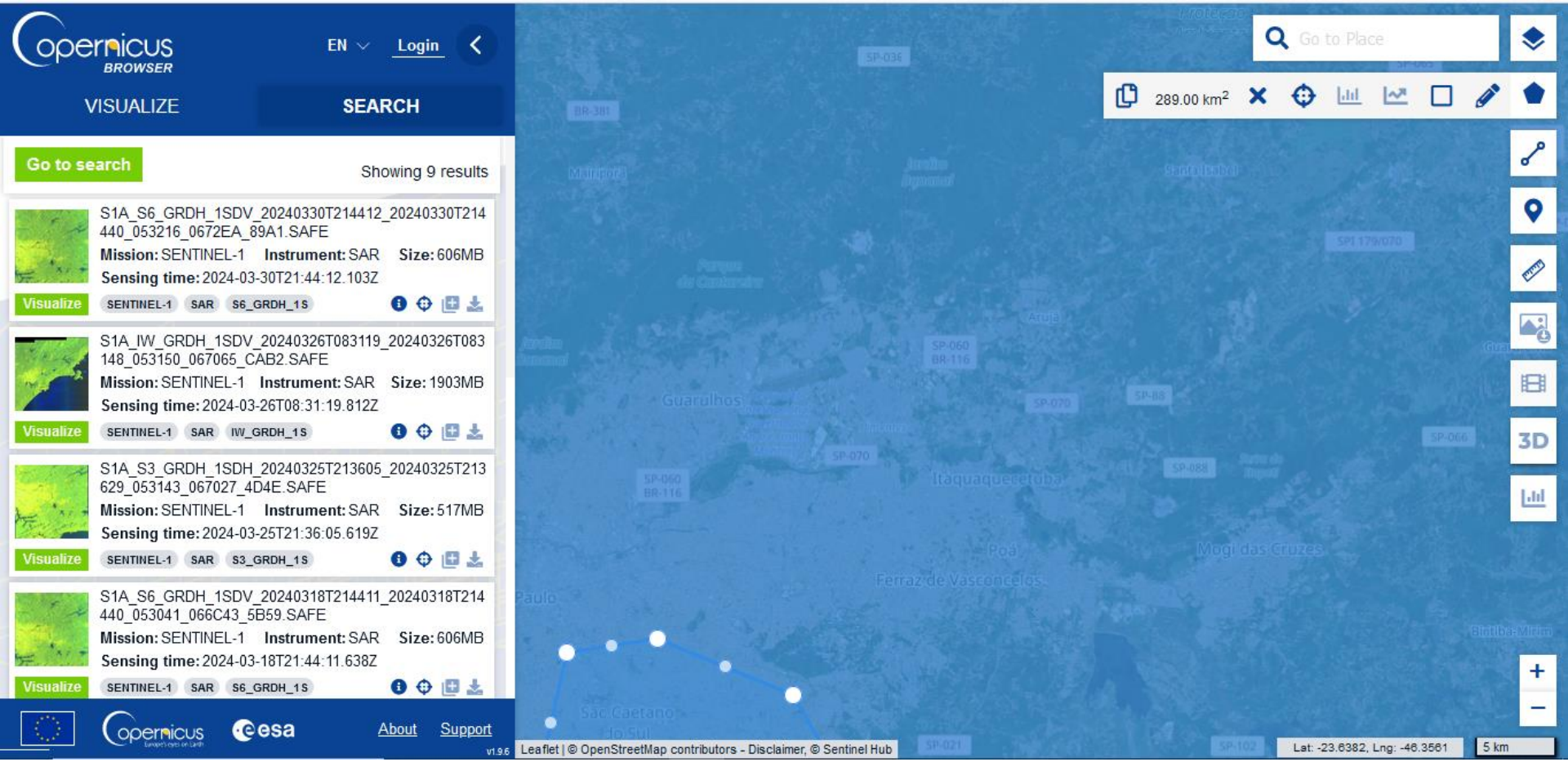
https://www.nasa.gov/topics/earth/features/forest20120217.html

Copernicus Browser

https://browser.dataspace.copernicus.eu




Copernicus BROWSER
EN
Login
VISUALIZE
SEARCH
SEARCH CRITERIA:
Product name
DATA SOURCES:
SENTINEL-1
Filters
C-SAR
Level-0 RAW
Level-1 SLC
Level-1 GRD
Level-1 GRD COG
Level-2 OCN
ETAD
Auxiliary Data File
Immediate
SENTINEL-2
Filters
SENTINEL-3
Filters
About
Support
v1.9.6
Go to Place
289.00 km²
3D
Guarulhos
Itaquaquecetuba
Poá
Ferraz de Vasconcelos
Mogi das Cruze
São Paulo
São Caetano do Sul
Santo André
Mauá
São Bernardo do Campo
Ribeirão Pires
Rio Grande da Serra
BR-116
SP-070
SP-060
SP-088
SP-270
SP-015
SP-021
SP-102
SP-031
SP-043
SP-150
BR-050
SP-122
Leaflet | © OpenStreetMap contributors - Disclaimer, © Sentinel Hub
Lat: -23.8218, Lng: -46.4928
5 km


Copernicus BROWSER
EN
Login
VISUALIZE
SEARCH
Go to search
Showing 9 results
S1A_S6_GRDH_1SDV_20240330T214412_20240330T214440_053216_0672EA_89A1.SAFE
Mission: SENTINEL-1 Instrument: SAR Size: 606MB
Sensing time: 2024-03-30T21:44:12.103Z
Visualize
SENTINEL-1 SAR S6_GRDH_1S
S1A_IW_GRDH_1SDV_20240326T083119_20240326T083148_053150_067065_CAB2.SAFE
Mission: SENTINEL-1 Instrument: SAR Size: 1903MB
Sensing time: 2024-03-26T08:31:19.812Z
Visualize
SENTINEL-1 SAR IW_GRDH_1S
S1A_S3_GRDH_1SDH_20240325T213605_20240325T213629_053143_067027_4D4E.SAFE
Mission: SENTINEL-1 Instrument: SAR Size: 517MB
Sensing time: 2024-03-25T21:36:05.619Z
Visualize
SENTINEL-1 SAR S3_GRDH_1S
S1A_S6_GRDH_1SDV_20240318T214411_20240318T214440_053041_066C43_5B59.SAFE
Mission: SENTINEL-1 Instrument: SAR Size: 606MB
Sensing time: 2024-03-18T21:44:11.638Z
Visualize
SENTINEL-1 SAR S6_GRDH_1S
About
Support
v1.9.6
Go to Place
289.00 km²
3D
Guarulhos
Itaquaquecetuba
Poá
Ferraz de Vasconcelos
Mogi das Cruzes
Leaflet | © OpenStreetMap contributors - Disclaimer, © Sentinel Hub
Lat: -23.6382, Lng: -46.3561
5 km

Obrigado!

Vitor Vieira Vasconcelos