



Universidade Federal do ABC

Sensoriamento remoto: continuação

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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

The screenshot shows the EarthExplorer.usgs.gov website. The browser address bar displays "earthexplorer.usgs.gov". The USGS logo is in the top left, with the tagline "science for a changing world". The "EarthExplorer" title is in the top left of the page content. The top right navigation bar includes "USGS Home", "Contact USGS", "Search USGS", and a "Page Expires In 1:59:43" timer. A red box highlights the "Login" and "Register" links. The main content area is divided into a left sidebar and a right map area. The sidebar contains the "1. Enter Search Criteria" section, which includes a search area definition, a search input field with "Show" and "Clear" buttons, a "Coordinates" section with "Degree/Minute/Second" and "Decimal" tabs, a "Date Range" section with "Search from" and "Search to" date pickers, and a "Search months" dropdown. The right map area shows a satellite image of North America with a search criteria summary overlay. The map includes a coordinate display (62° 54' 54" N, 166° 06' 47" E) and buttons for "Options", "Overlays", "Map", and "Satellite".

earthexplorer.usgs.gov

USGS
science for a changing world

EarthExplorer

USGS Home
Contact USGS
Search USGS

Page Expires In 1:59:43

Home

Login Register

Search Criteria Data Sets Additional Criteria Results

1. Enter Search Criteria

To narrow your search area: type in an address or place name, enter coordinates or click the map to define your search area (for advanced map tools, view the [help documentation](#)), and/or choose a date range.

Address/Place Path/Row Feature Circle

Show Clear

Coordinates Predefined Area Shapefile KML

Degree/Minute/Second Decimal

No coordinates selected.

Use Map Add Coordinate Clear Coordinates

Date Range Result Options

Search from: 01/01/1920 to: 03/20/2015

Search months: (all)

Data Sets Additional Criteria Results

Search Criteria Summary (Show)

Clear Criteria

62° 54' 54" N, 166° 06' 47" E

Options Overlays Map Satellite

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

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 "_"



Type the text

[Privacy & Terms](#)

Continue

Earth Explorer



EROS Registration System (ERS)

ERS consolidates user profile and authentication for all EROS web services into a single independent application.

Sign In

————— sign in with your existing USGS registered username and password —————

[forgot password?](#)

Earth Explorer

Coordinates

Predefined Area

Shapefile

KML

Degree/Minute/Second

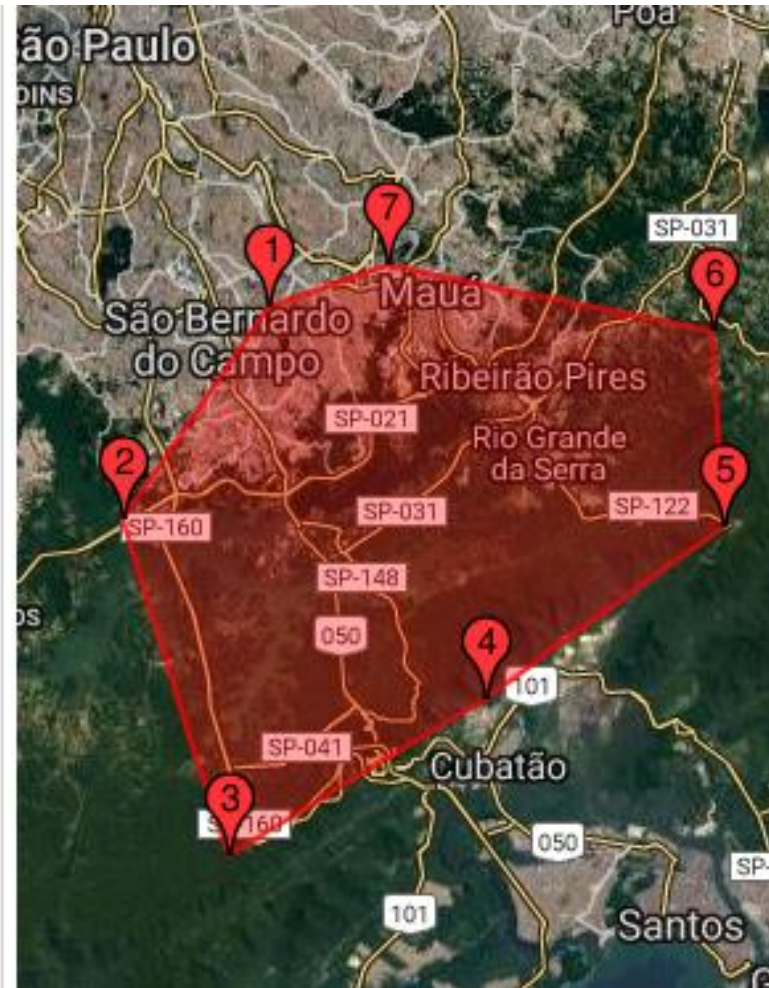
Decimal

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

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	 
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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

Date Range

Cloud Cover

Result Options

Search from:

04/06/2022



to:

04/01/2024



Search months:

(all)



Data Sets »

Additional Criteria »

Results »

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

Date Range

Cloud Cover

Result Options

Cloud Cover Range: 0% - 10%

Unknown Cloud Cover Values

Included

Data Sets »

Additional Criteria »

Results »

Earth Explorer

Landsat Archive

Collection 1 Level-2:

Imagens ortorretificadas com
correção atmosférica
(ordem por e-mail)

•Nãõ 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)

Search Criteria

Data Sets

Additional Criteria

Results

2. Select Your Data Set(s)

Check the boxes for the data set(s) you want to search. When done selecting data set(s), click the *Additional Criteria* or *Results* buttons below. Click the plus sign next to the category name to show a list of data sets.

☐ Use Data Set Prefilter ([What's This?](#))

Data Set Search:

+ Land Cover

- Landsat 

+ Landsat Collection 2 Level-3 Science Products

+ Landsat C2 U.S. Analysis Ready Data (ARD)

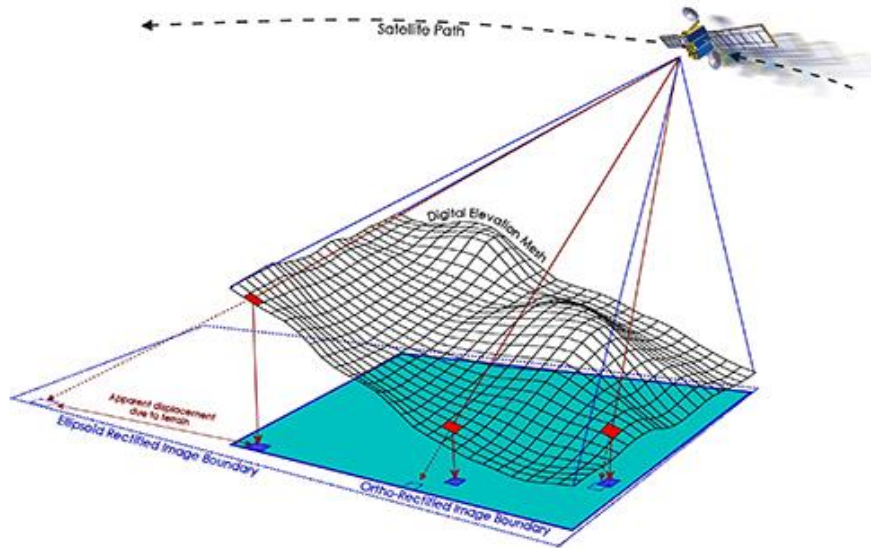
- Landsat Collection 2 Level-2

- ☐    Landsat 8-9 OLI/TIRS C2 L2
- ☐    Landsat 7 ETM+ C2 L2
- ☐    Landsat 4-5 TM C2 L2

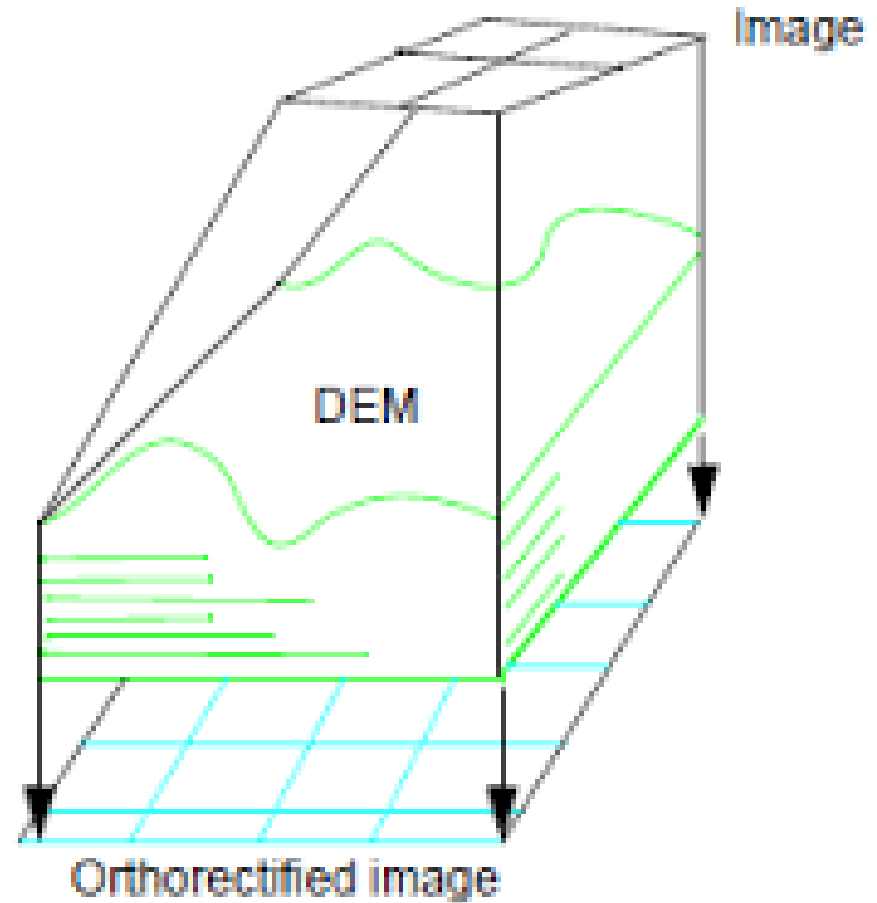
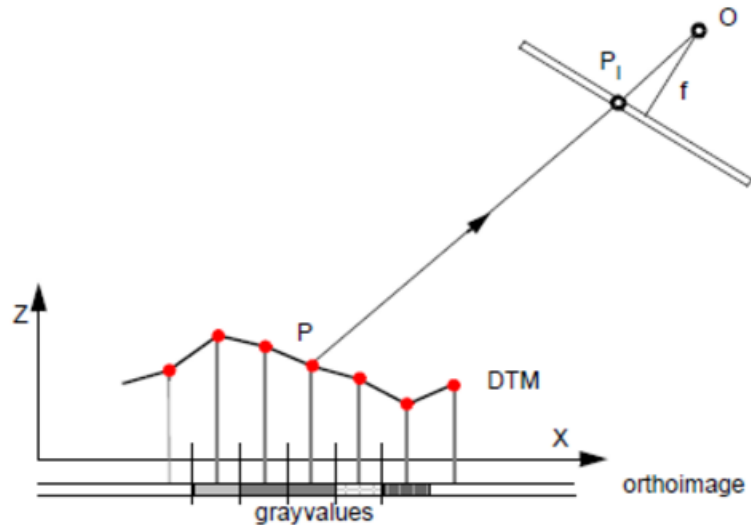
- Landsat Collection 2 Level-1

- ☐    Landsat 8-9 OLI/TIRS C2 L1
- ☐    Landsat 7 ETM+ C2 L1
- ☐    Landsat 4-5 TM C2 L1
- ☐    Landsat 1-5 MSS C2 L1

Ortorretificação

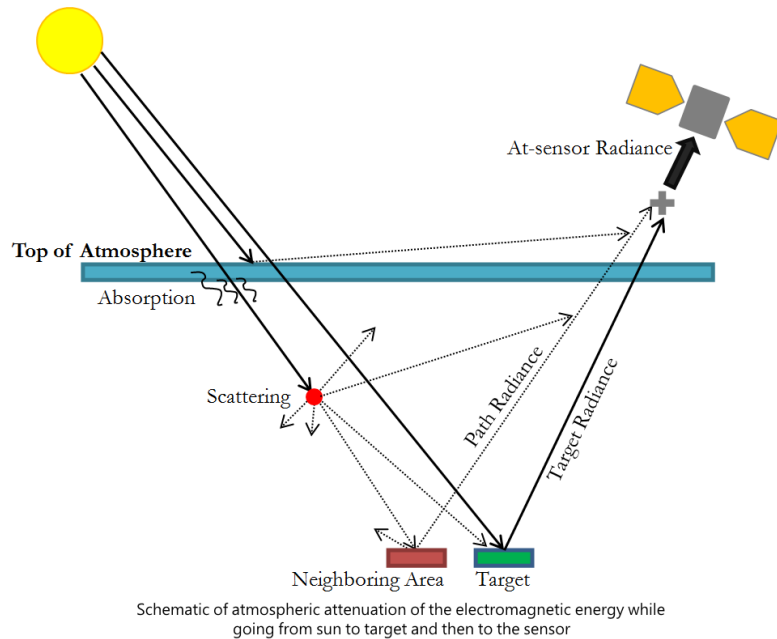


<http://www.geoimage.com.au/services/imageprocessing>



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

Correção Atmosférica



<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_20240923_20240924_02_T1

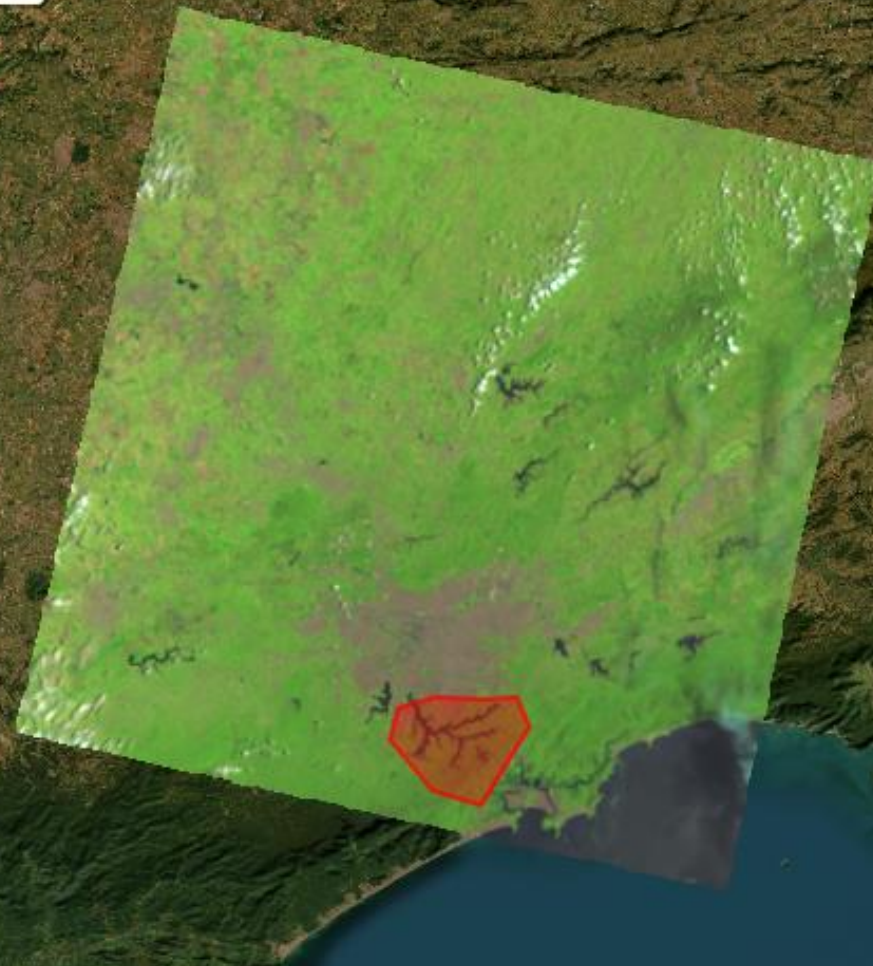
Date Acquired: 2024/09/23

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

Digital Elevation

- ☐   ASTER GLOBAL DEM
- ☐   CoNED TBDEM
- ☐   EDNA
- ☐   GMTED2010
- ☐   GTOPO30
- ☐   GTOPO30 HYDRO 1K
- ☐   IFSAR Alaska

SRTM

- ☒   SRTM 1 Arc-Second Global
- ☐   SRTM Non-Void Filled
- ☐   SRTM Void Filled
- ☐   SRTM Water Body Data

SRTM – 30 metros

Máscara de água

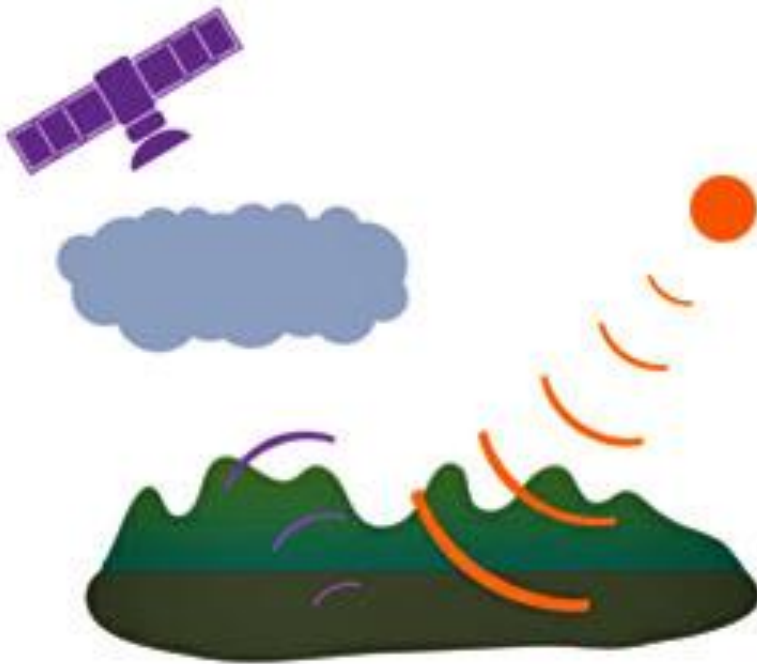
Satélites Sentinel

- 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

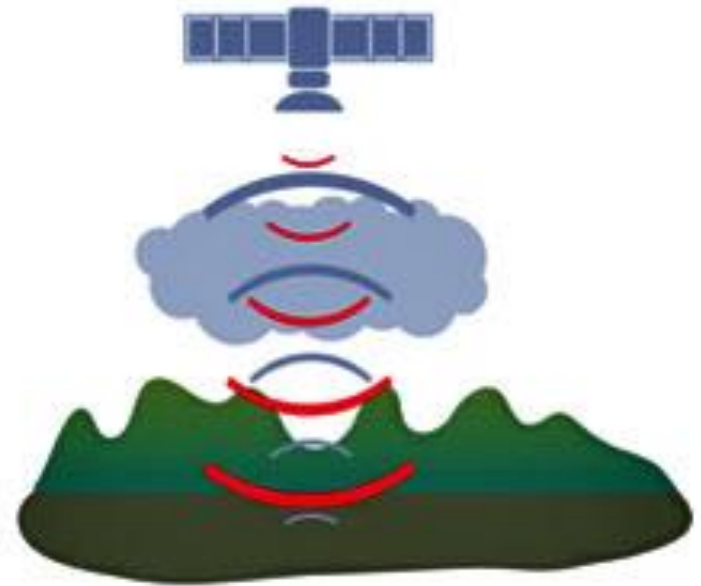
Usos do Radar

- Imagens em dias com nuvens

optical remote sensing



synthetic aperture radar
(SAR)

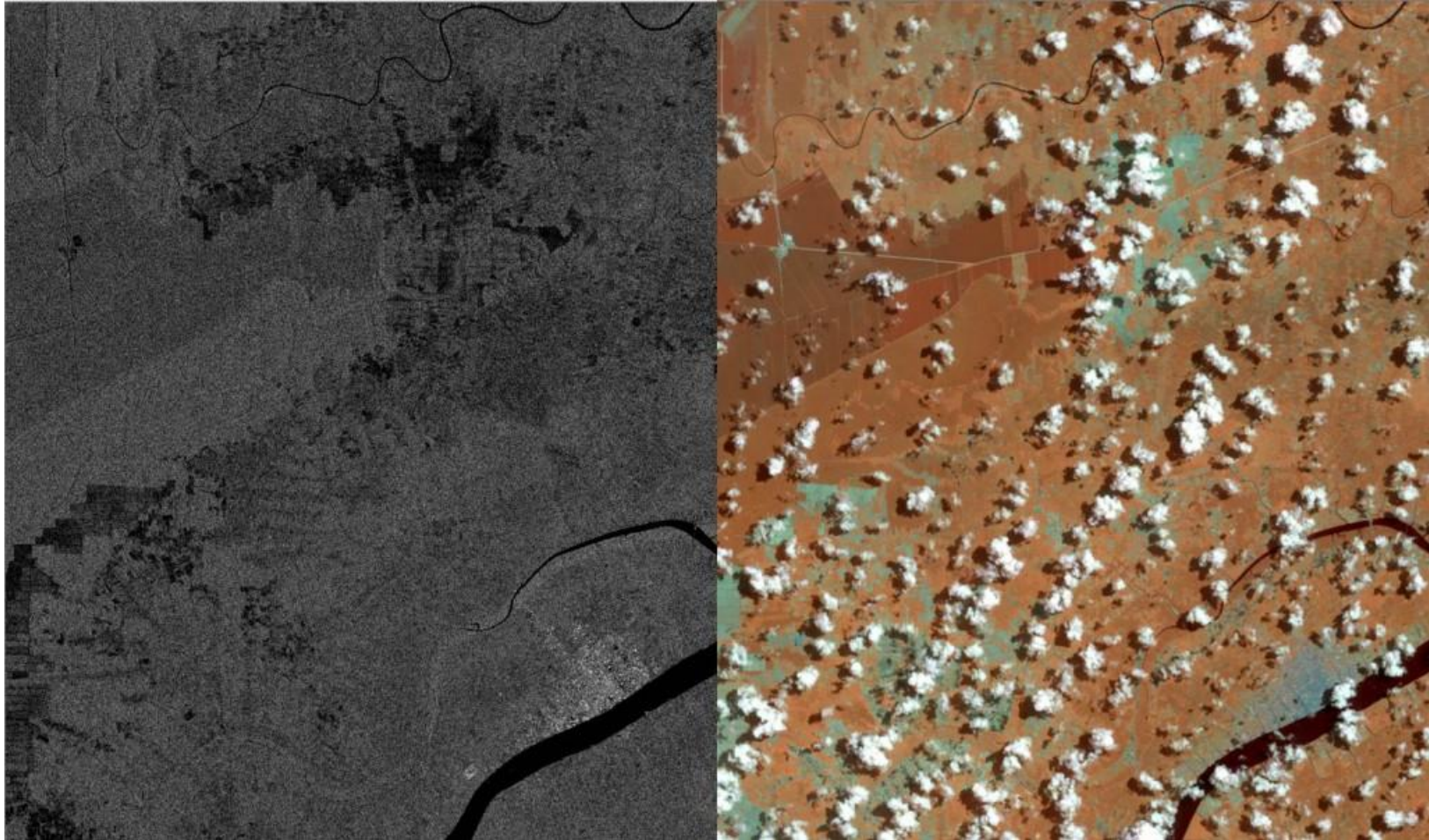


Usos do Radar

Imagens em dias com nuvens

Sentinel 1

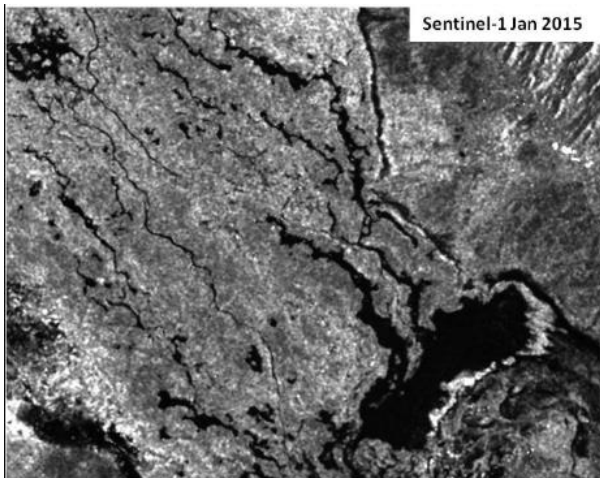
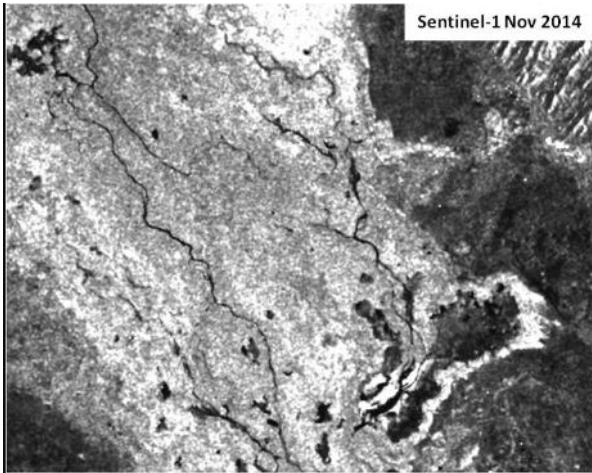
Landsat 8



Sumatra (Indonésia), 2015

Usos do Radar

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

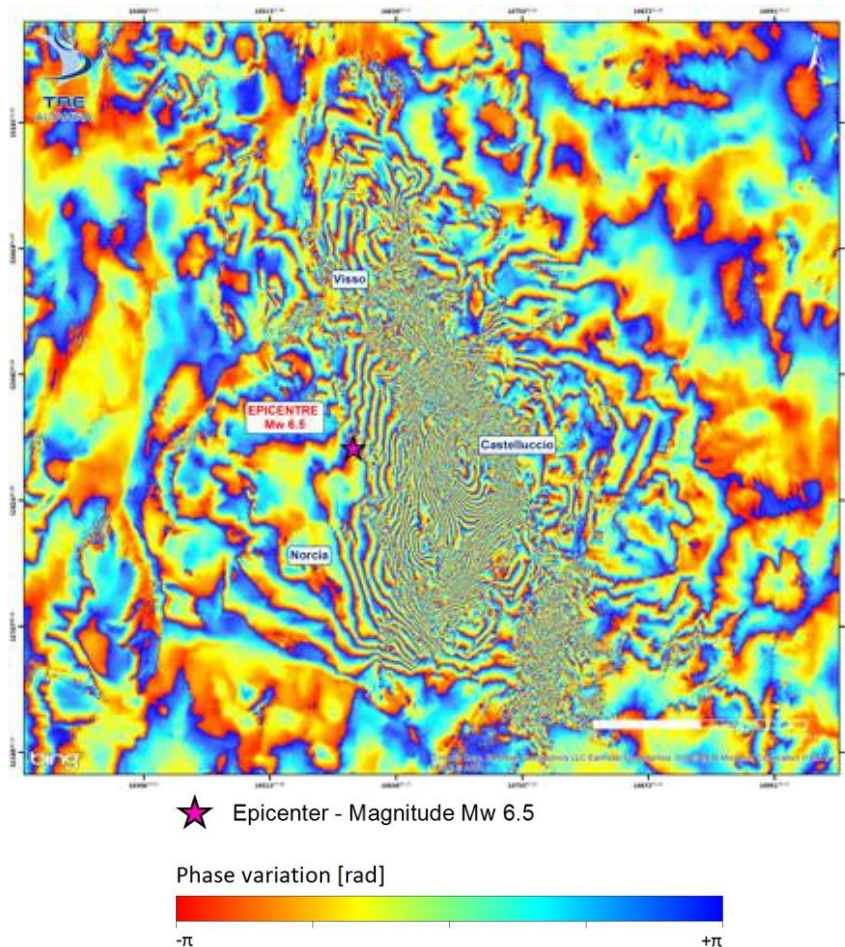


Usos do Radar

Detecção de movimentos na superfície

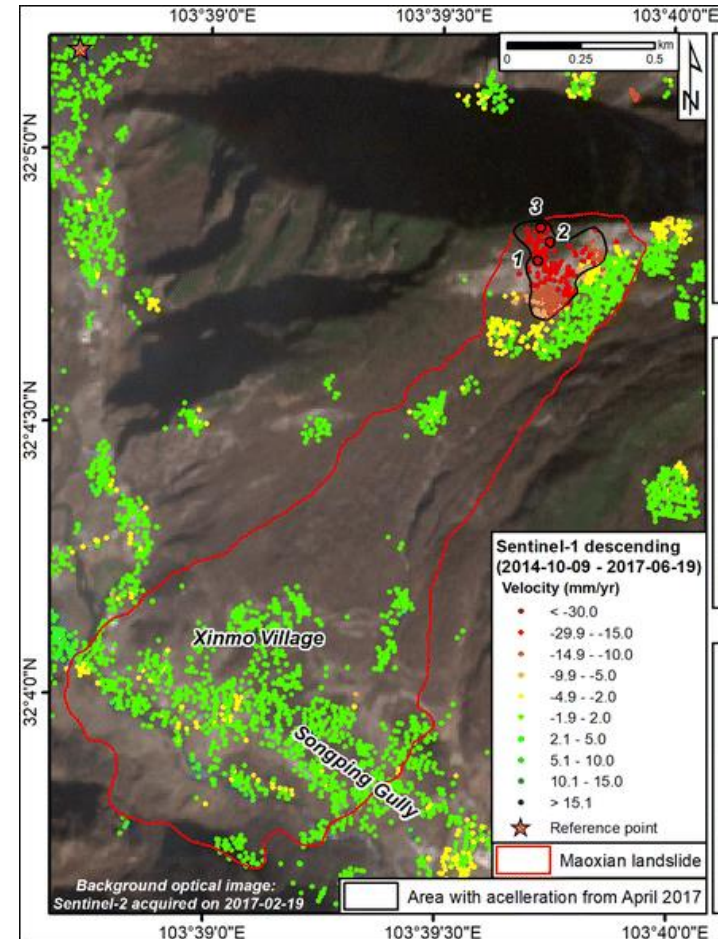
Terremotos

Perugia (Itália), 30 out. 2016



Movimentos de massa

Maoxian (China), 2014-2017



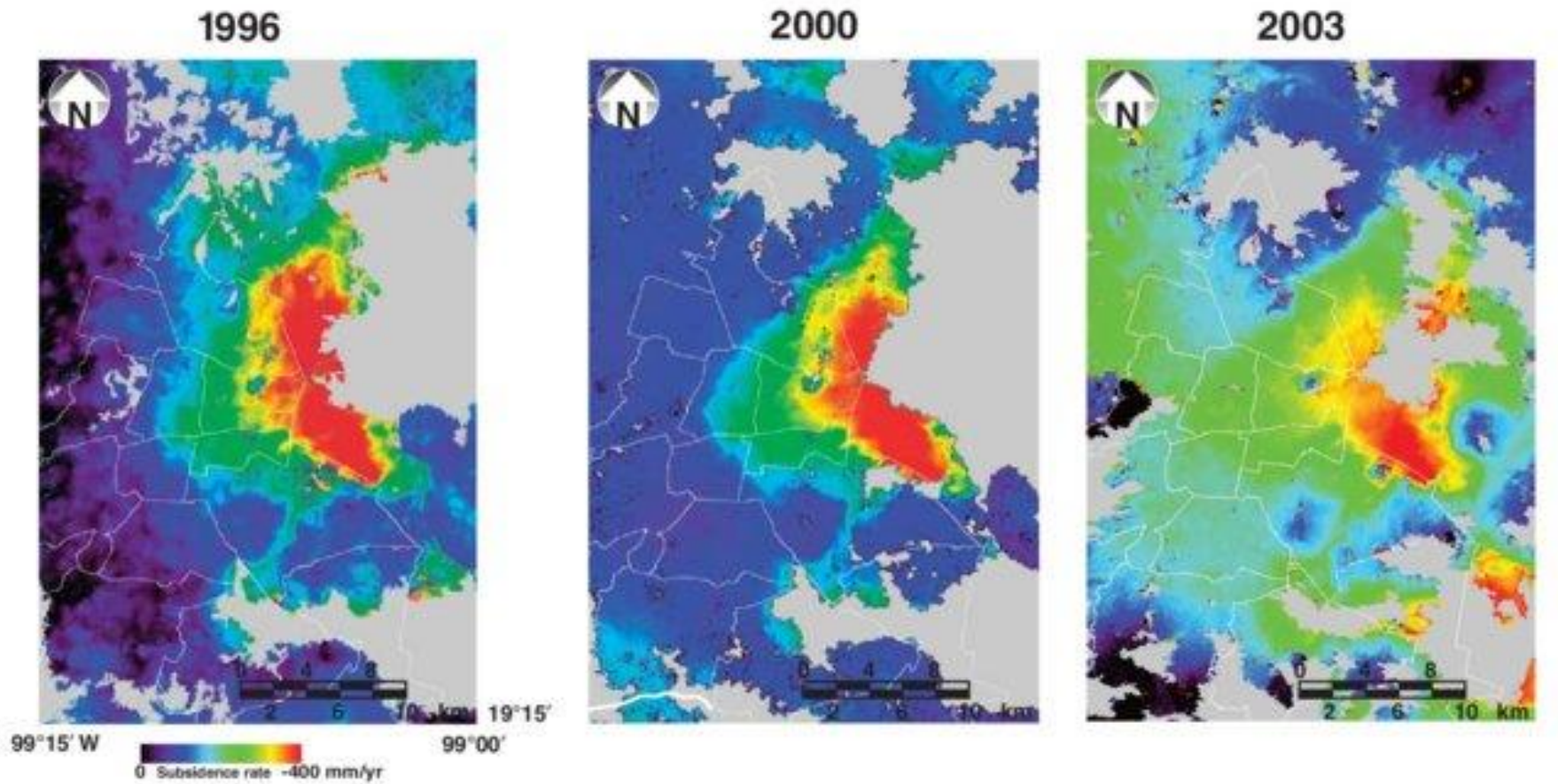
Intrieri, E., et al., 2018. The Maoxian landslide as seen from space: detecting precursors of failure with Sentinel-1 data. *Landslides*, 15(1), pp.123-133.

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

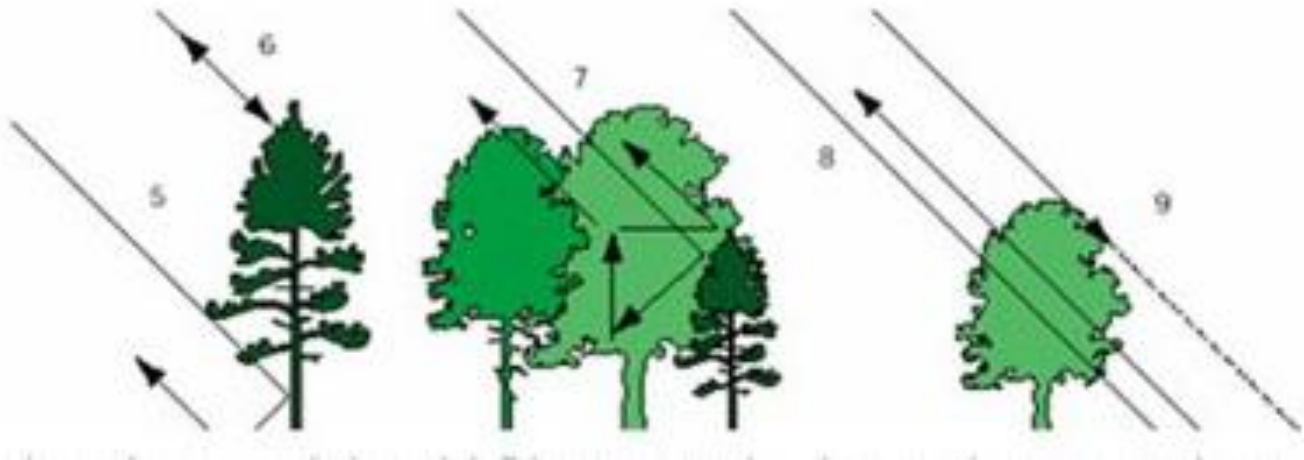
Detecção de movimentos na superfície

Taxa de subsidência na Cidade do México



Usos do Radar

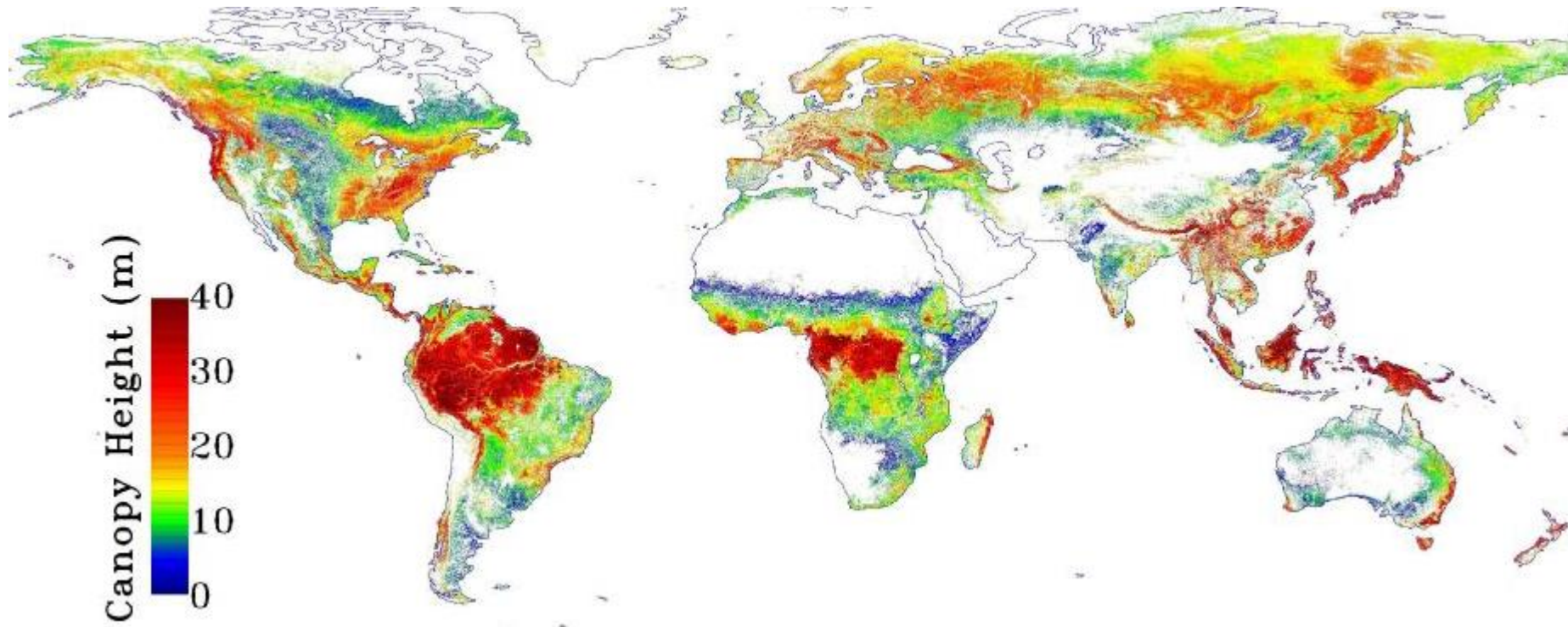
- Características geométricas e físicas dos objetos
 - Estruturas de folhas e galhos
 - Altura e biomassa de florestas



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



Copernicus Browser

<https://browser.dataspace.copernicus.eu>

The screenshot displays the Copernicus Browser interface. The top navigation bar includes the Copernicus Browser logo, language selection (EN), a login button, and a search bar. Below this, there are tabs for 'VISUALIZE' and 'SEARCH'. The left sidebar contains a date selector set to '2024-03-26', a layer selector set to 'Default', and a list of available layers: 'RGB ratio' (Orthorectified), 'SAR urban' (Orthorectified), 'Enhanced visualization' (Orthorectified), 'VH - decibel gamma0' (Orthorectified), and 'VH - linear gamma0' (Orthorectified). The main map area shows a satellite image of the São Paulo region, with a blue polygon highlighting a specific area. The map includes labels for various locations such as Guarulhos, São Paulo, São Caetano do Sul, Santo André, Mauá, São Bernardo do Campo, Ribeirão Pires, and Rio Grande da Serra. A search bar in the top right corner of the map area contains the text 'Go to Place'. The bottom of the interface features a footer with the European Union flag, the Copernicus logo, the ESA logo, and links for 'About' and 'Support'. The bottom right corner of the map area shows the coordinates 'Lat: -23.7608, Lng: -46.5024' and a scale bar for '5 km'.

Opennicus
BROWSER

EN ▼ [Login](#) ◀

VISUALIZE

SEARCH

SEARCH CRITERIA:

Product name

DATA SOURCES:

☒ SENTINEL-1

☒ C-SAR

☐ Level-0 RAW

☐ Level-1 SLC

☒ Level-1 GRD

☐ Level-1 GRD COG

☐ Level-2 OCN

☐ ETAD

☐ Auxiliary Data File

Filters →

Immediate ⊕

SENTINEL-2

Filters →

SENTINEL-3

Filters →

About

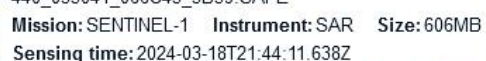
Support

vi 9.6

Leaflet | © OpenStreetMap contributors - Disclaimer, © Sentinel Hub

The figure is a satellite map of the São Paulo metropolitan area. A blue polygon highlights a specific region in the center, encompassing parts of São Caetano do Sul, Santo André, São Bernardo do Campo, and Mauá. The map displays various geographical features, including roads, rivers, and urban areas. A search bar at the top right contains the text "Go to Place". Below the search bar, there are several icons for map navigation and analysis, including a scale bar showing 289.00 km², a compass, a ruler, a magnifying glass, a square, a pencil, and a hexagon. The bottom right corner shows the coordinates "Lat: -23.8218, Lng: -46.4928" and a scale of "5 km".

Showing 9 results



Obrigado!

Vitor Vieira Vasconcelos