



Universidade Federal do ABC

Sensoriamento remoto: continuação

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Cartografia e Geoprocessamento para o Planejamento Territorial

Abril de 2024

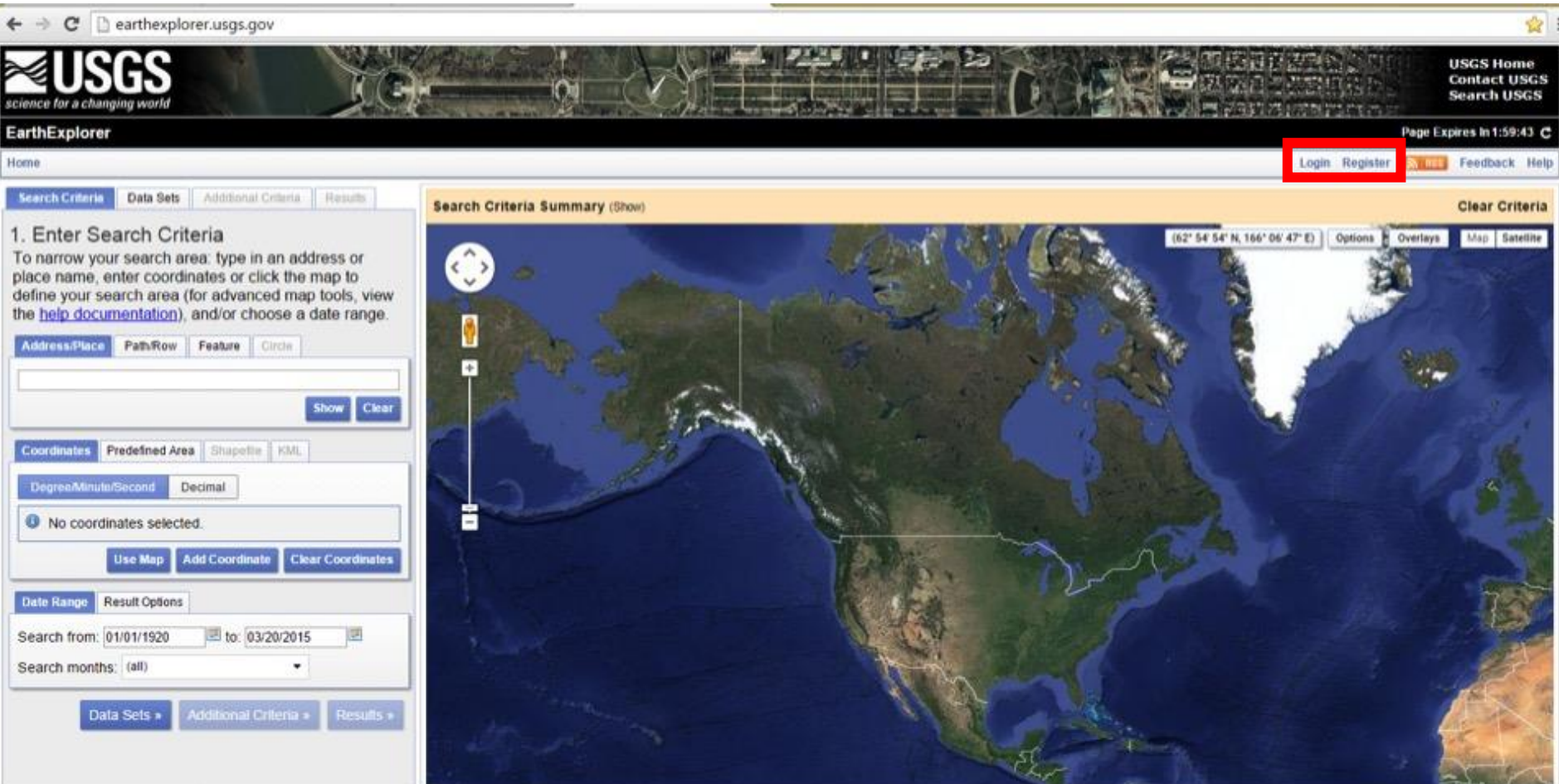
Universidade Federal do ABC

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 displays the EarthExplorer website interface. At the top, the USGS logo is visible with the tagline "science for a changing world". The page title is "EarthExplorer" and the URL is "earthexplorer.usgs.gov". The navigation bar includes "Home", "Login", "Register", "Feedback", and "Help". The "Login" and "Register" buttons are highlighted with a red box. Below the navigation bar, there are tabs for "Search Criteria", "Data Sets", "Additional Criteria", and "Results". The "Search Criteria" tab is active, showing a section titled "1. Enter Search Criteria". This section includes a text input field for "Address/Place", "Path/Row", "Feature", and "Circle". Below this is a "Coordinates" section with tabs for "Predefined Area", "Shapefile", and "KML". The "Coordinates" section has a "Degree/Minute/Second" tab selected and a message "No coordinates selected." Below this are buttons for "Use Map", "Add Coordinate", and "Clear Coordinates". The "Date Range" section has a "Date Range" tab selected and a search range from "01/01/1920" to "03/20/2015". Below this are buttons for "Data Sets", "Additional Criteria", and "Results". The main content area shows a "Search Criteria Summary (Show)" section with a map of North America. The map is centered on the coordinates (62° 54' 54" N, 166° 06' 47" E) and includes a compass rose, a location pin, and a scale bar. The map shows the Arctic region and parts of North America.

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

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

Santo André

Show Clear

Click on an Address/Place to show the location on the map and add coordinates to the Area of Interest Control.















Num	Address/Place	Latitude	Longitude
1	Santo André, SP, Brasil	-23.6742	-46.5436



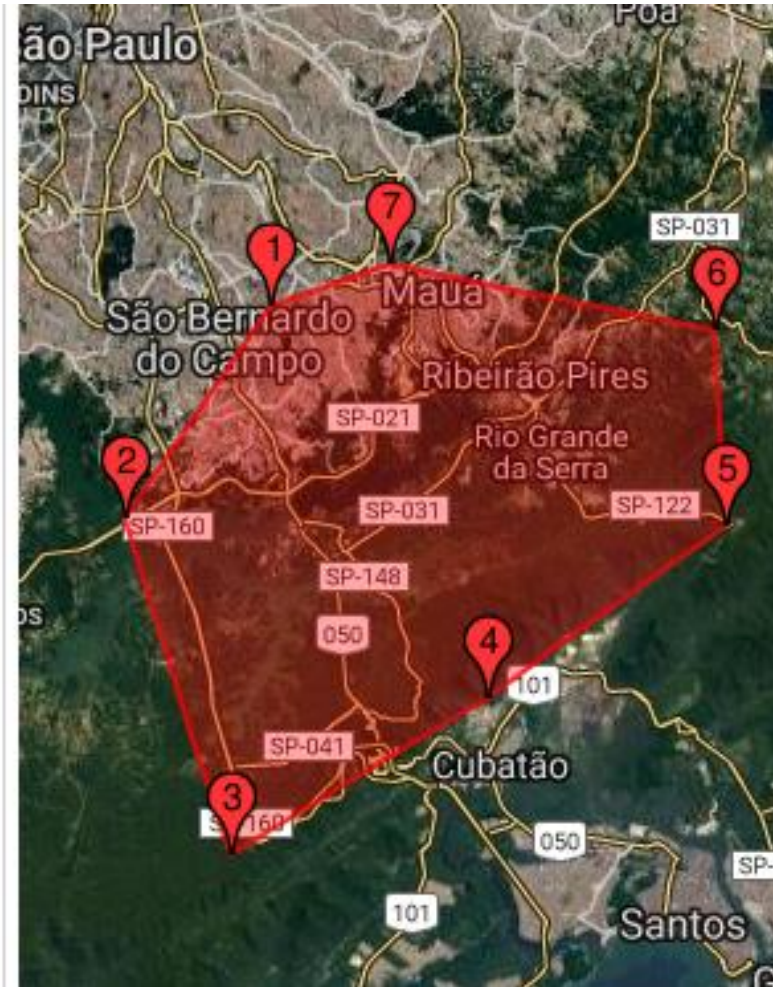
Earth Explorer

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	 
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

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)

• 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)























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

2. Select Your Data Set(s)

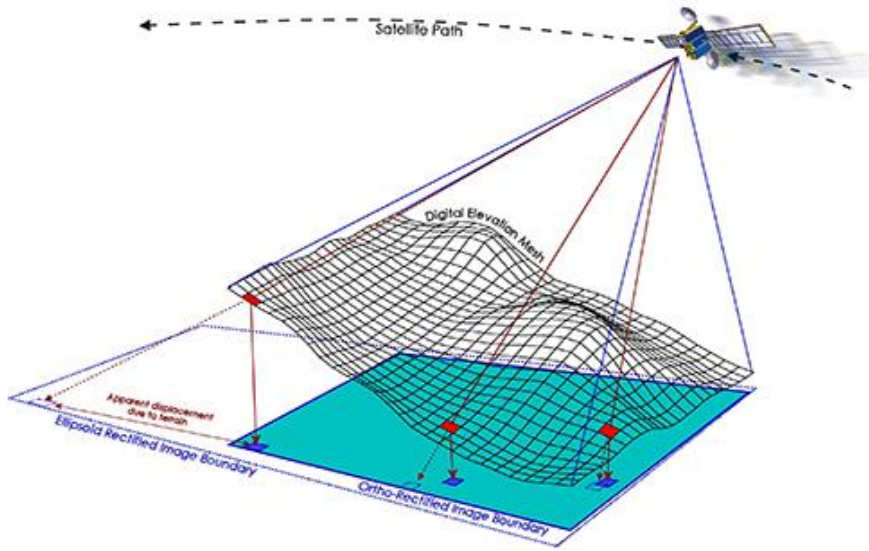
Check the boxes for the data set(s) you want to search. When done selecting data set(s), click the *Additional Criteria* or *Results* buttons below. Click the plus sign next to the category name to show a list of data sets.

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

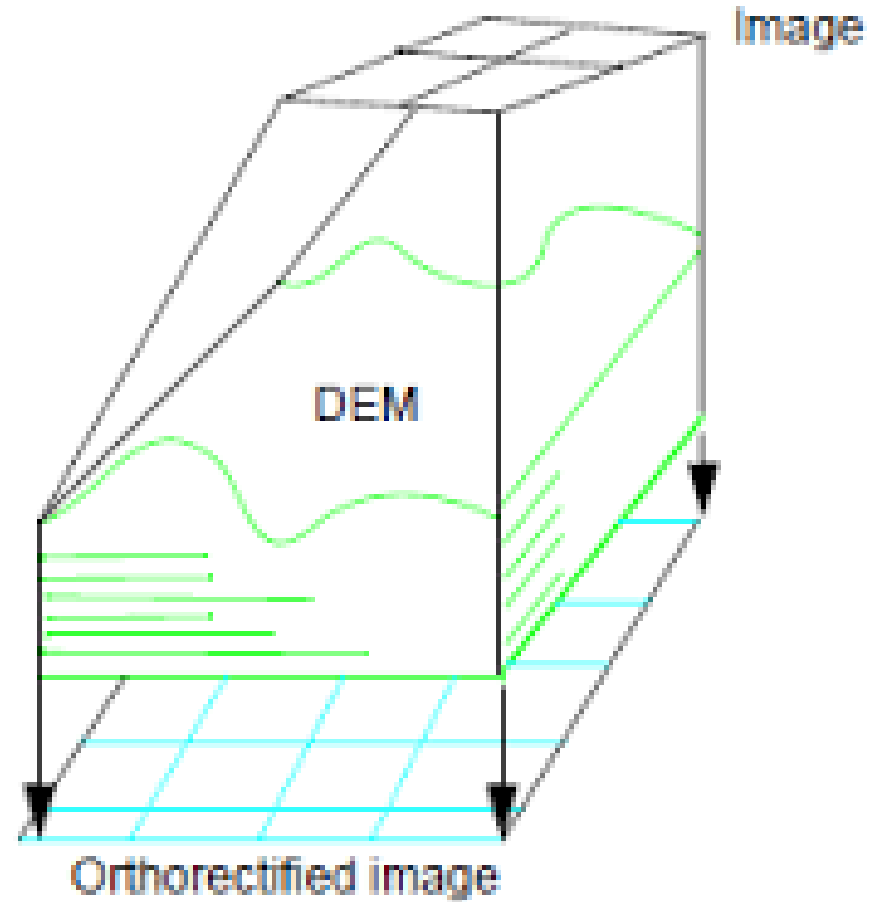
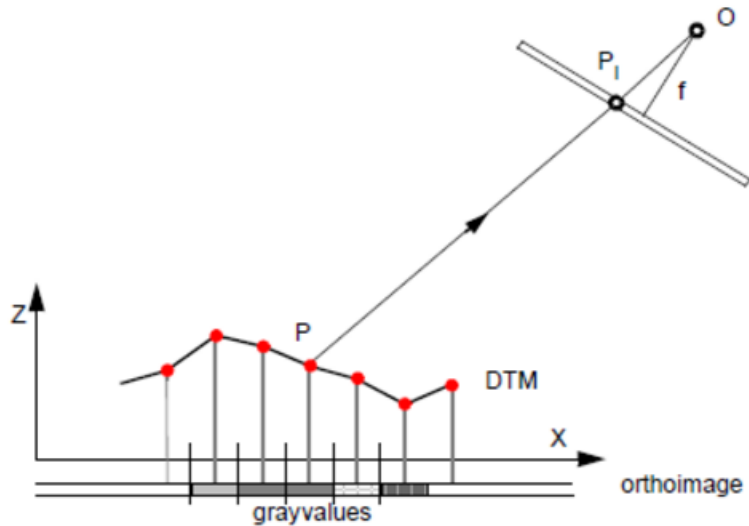
Data Set Search:

- + 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

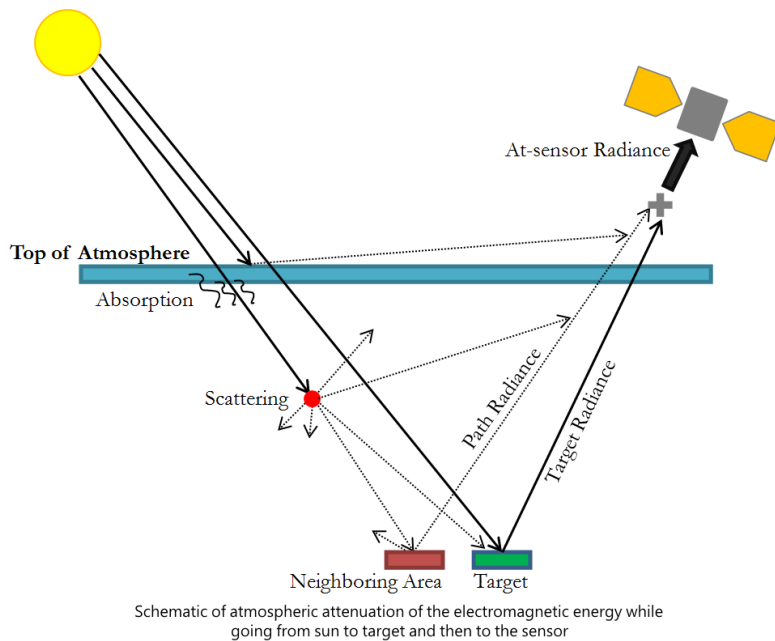


<http://www.geoimage.com.au/services/imageprocessing>



<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/>

Earth Explorer

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 Result Controls

Data Set Click here to export your results »

Landsat 8 OLI/TIRS C1 Level-2

2		ID:LC08_L1TP_219077_20190121_20190201_01_T1 Acquisition Date:21-JAN-19 Path:219 Row:77	     
3		ID:LC08_L1TP_219076_20180830_20180911_01_T1 Acquisition Date:30-AUG-18 Path:219 Row:76	     
4		ID:LC08_L1TP_219076_20180814_20180828_01_T1 Acquisition Date:14-AUG-18 Path:219 Row:76	     

Search Criteria Summary (Show)

Mapa **Satélite**



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 Result Controls

Data Set

[Click here to export your results](#)

Landsat 8 OLI/TIRS C1 Level-2

-  Acquisition Date:21-JAN-19
Path:219
Row:77

-  ID:LC08_L1TP_219076_20180830_20180911_01_T1
Acquisition Date:30-AUG-18
Path:219
Row:76

-  ID:LC08_L1TP_219076_20180828_20180828_01_T1
Acquisition Date:14-AUG-18
Path:219
Row:76

-  ID:LC08_L1TP_219077_20180713_20180730_01_T1
Acquisition Date:13-JUL-18
Path:219
Row:77

-  ID:LC08_L1TP_219076_20180510_20180517_01_T1
Acquisition Date:10-MAY-18
Path:219
Row:76


[View Item Basket](#)

[Submit Standing Request](#)

Search Criteria Summary (Show)



Earth Explorer

Order

Note: Data sets may contain items with multiple product options. Expand a data set to view your list of ordered scenes including metadata and product options.

▲ Landsat 8 OLI/TIRS C1 Level-2 (1)

🗑 Remove All Scenes ✎ Modify Options For All Scenes

LC08_L1TP_219076_20180830_20180911_01_T1

ID: LC08_L1TP_219076_20180830_20180911_01_T1

Acquisition Date: 30-AUG-18

Path: 219

Row: 76

Product: L8 OLI/TIRS COLLECTIONS LAND SURFACE REFLECTANCE ON-DEMAND ▼

Options: None

Output Media: DWNLD

Save Changes

Proceed To Checkout »

Order

Data Set

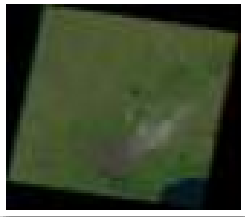
Landsat 8 OLI/TIRS C1 Level-2

Return To Item Basket

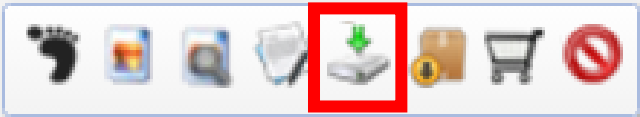
Submit Order

Earth Explorer

Download
direto dos
dados de
nível 1

21 

ID:LT05_L1TP_219076_20050623_20161125_01_T1
Acquisition Date:23-JUN-05
Path:219
Row:76



Download Options



Download

LandsatLook Natural Color Image (8.2 MB)

Download

LandsatLook Thermal Image (3.7 MB)

Download

LandsatLook Quality Image (539.9 KB)















Download

LandsatLook Images with Geographic Reference (12.5 MB)









Download

Level-1 GeoTIFF Data Product (159.8 MB)

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

Satélite MODIS com correção atmosférica

• Resolução temporal:

- Diário
- Composto de 8 dias

• Resolução espacial:

- 250m (2 bandas)
- 500m (7 bandas)
- 1km (3 bandas termais)

• Produtos derivados

- Uso e cobertura da terra
- Índices de Vegetação

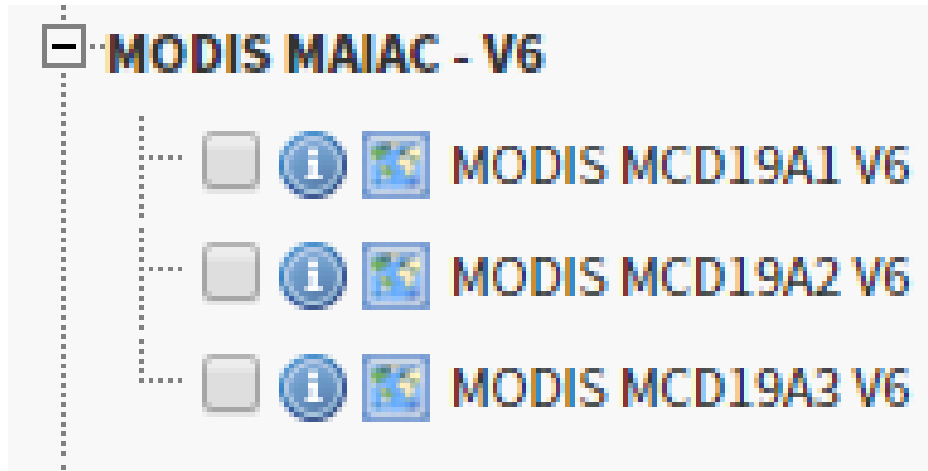
NASA LPDAAC Collections

- + ASTER Collections
- + ASTER Global Emissivity Datasets
- + MODIS BRDF and Albedo - V6
- + MODIS Gross Primary Productivity - V6
- + MODIS LAI/FPAR - V6
- + MODIS Land Cover
- + MODIS Land Cover - V6
- MODIS Land Surface Reflectance - V6
 - MODIS MOD09A1 V6
 - MODIS MOD09CMG V6
 - MODIS MOD09GA V6
 - MODIS MOD09GQ V6
 - MODIS MOD09Q1 V6
 - MODIS MODOCGA V6
 - MODIS MODTBGA V6
 - MODIS MYD09A1 V6
 - MODIS MYD09CMG V6
 - MODIS MYD09GA V6
 - MODIS MYD09GQ V6
 - MODIS MYD09Q1 V6
 - MODIS MYDOCGA V6
 - MODIS MYDTBGA V6

Terra

Aqua

Satélite MODIS com correção atmosférica



- .Combinação Terra + Aqua
- .Resolução temporal: diário
- .Resolução Espacial
 - 500m (7 bandas)
 - 1km (12 bandas)

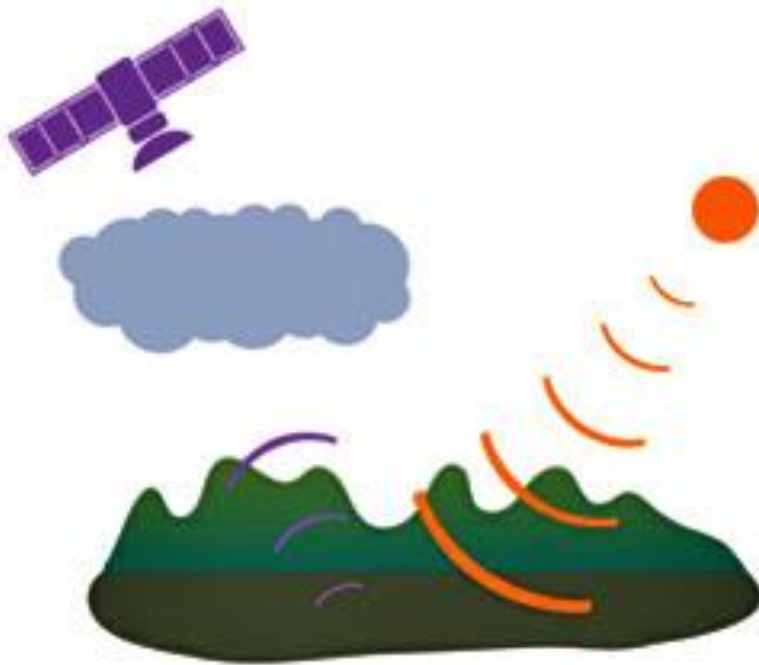
Satélites Sentinel

- 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

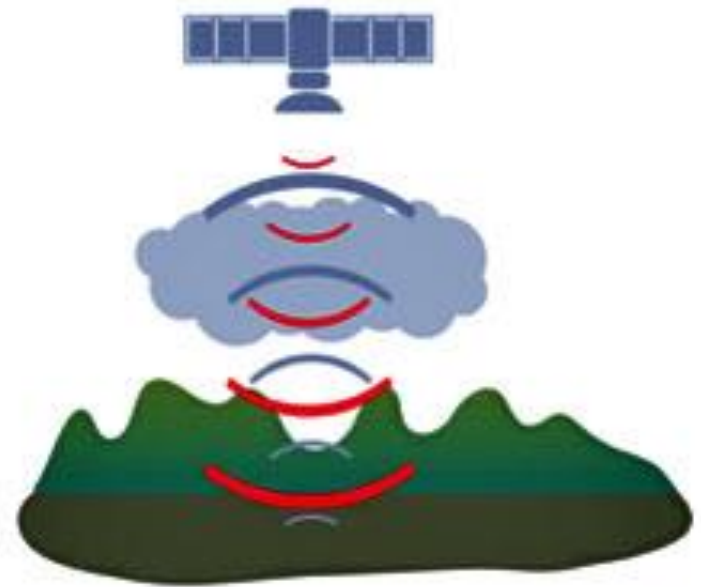
Usos do Radar

- Imagens em dias com nuvens

optical remote sensing



synthetic aperture radar
(SAR)

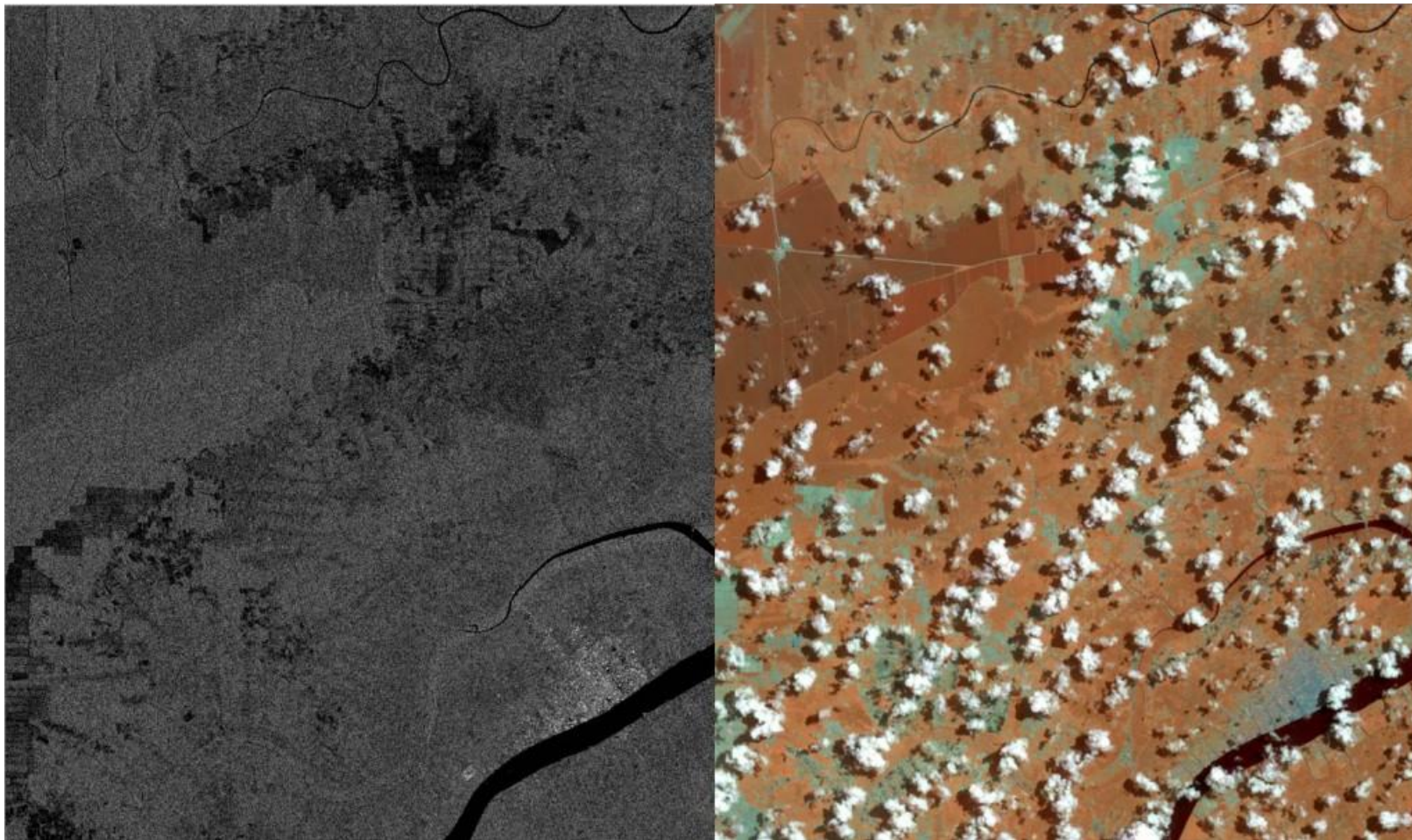


Usos do Radar

Imagens em dias com nuvens

Sentinel 1

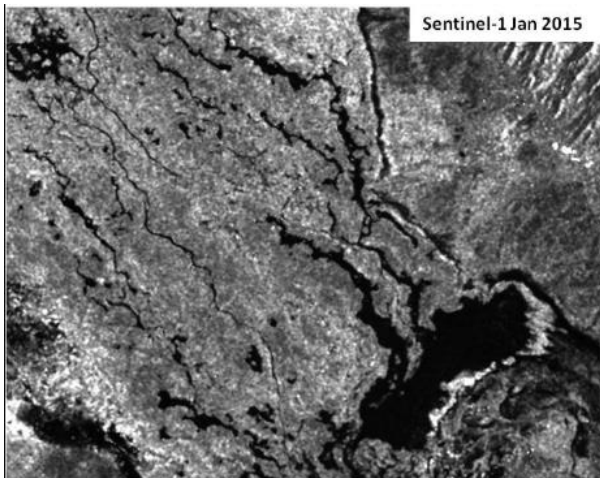
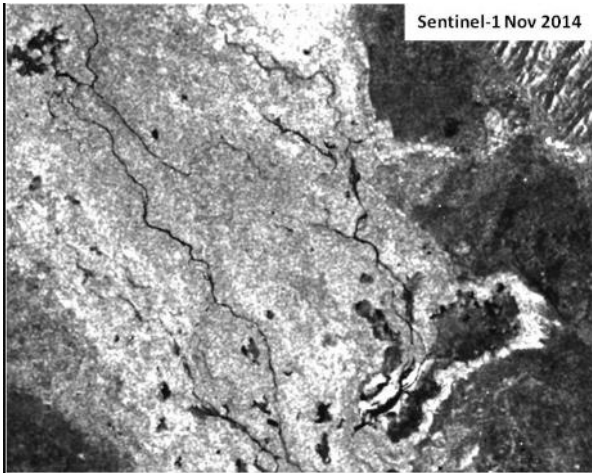
Landsat 8



Sumatra (Indonésia), 2015

Usos do Radar

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

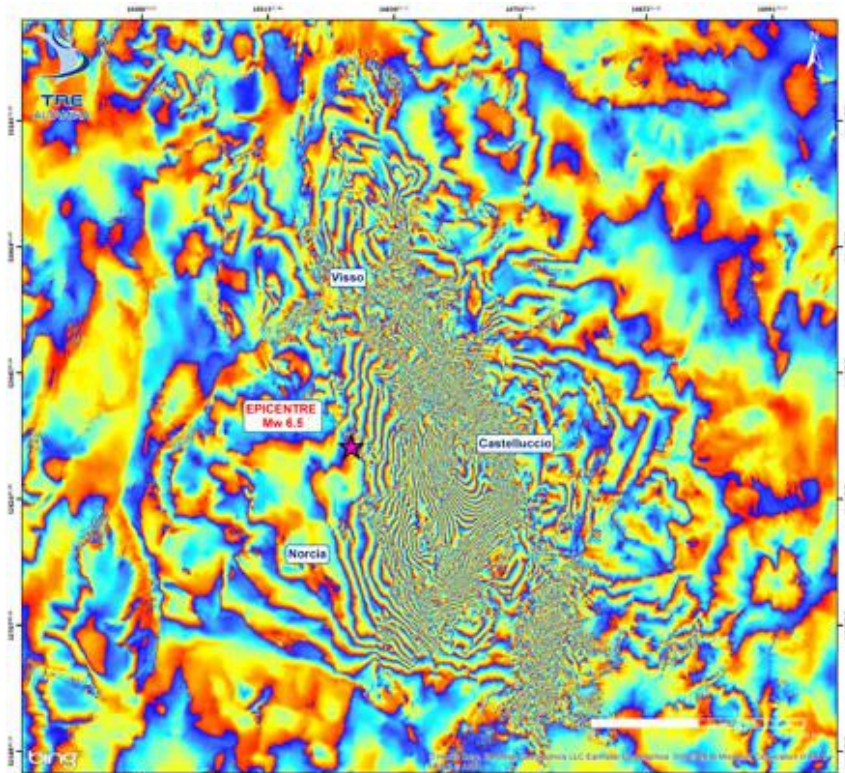


Usos do Radar

Detecção de movimentos na superfície

Terremotos

Perugia (Itália), 30 out. 2016



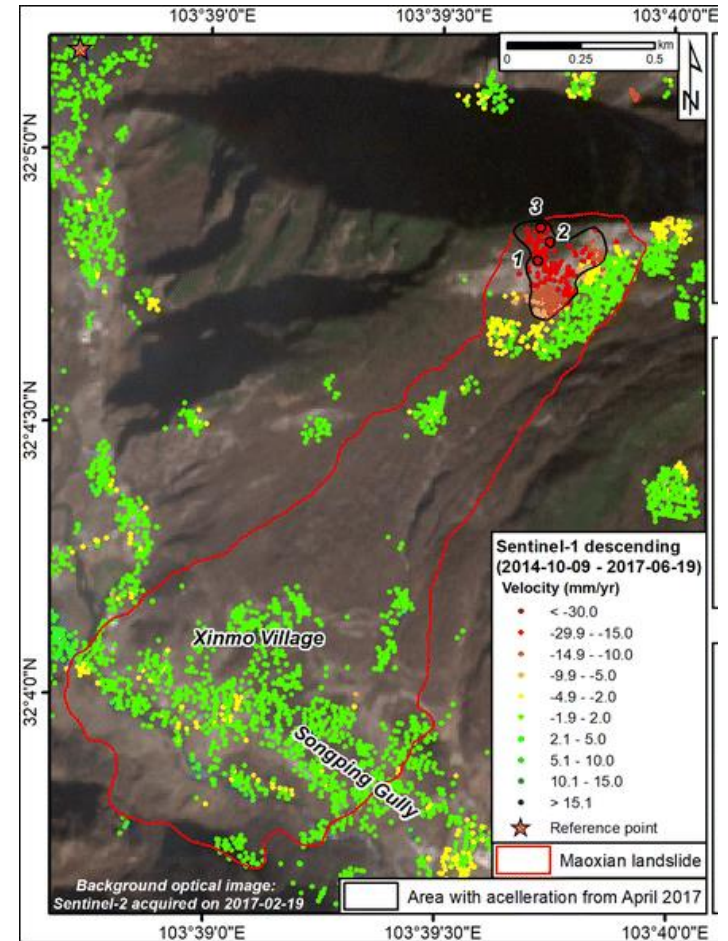
★ Epicenter - Magnitude Mw 6.5

Phase variation [rad]



Movimentos de massa

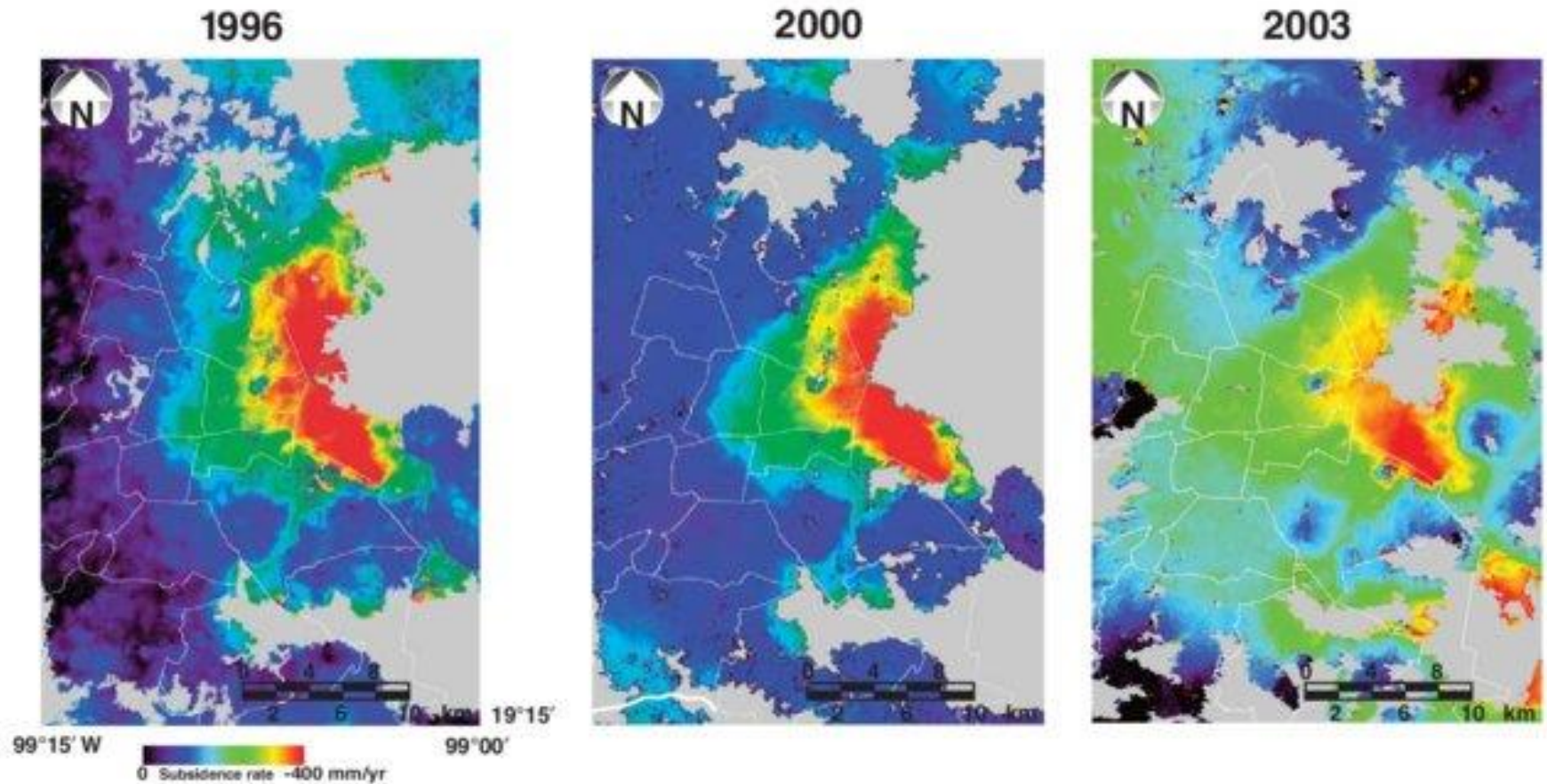
Maoxian (China), 2014-2017



Usos do Radar

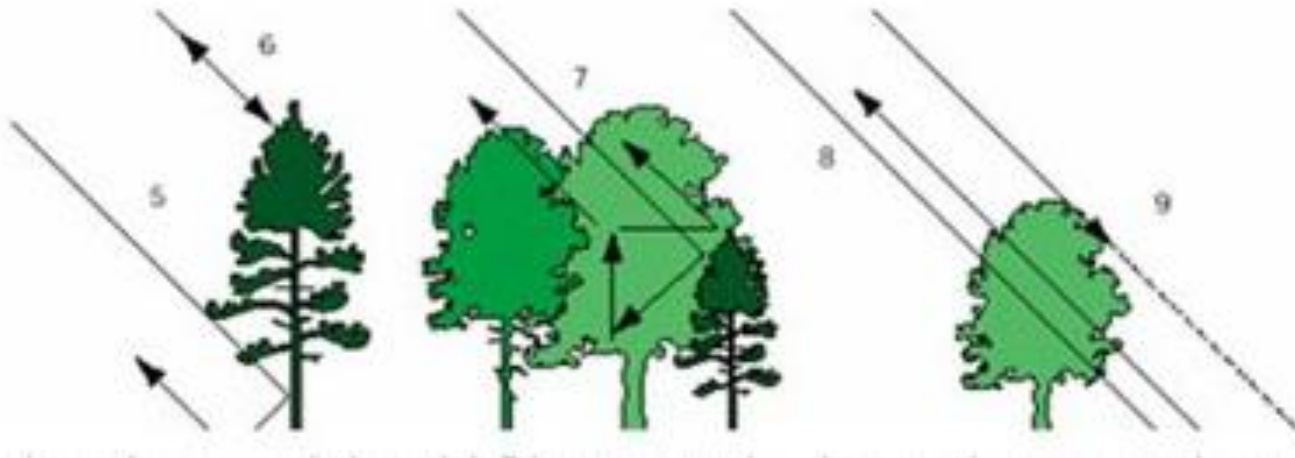
Detecção de movimentos na superfície

Taxa de subsidência na Cidade do México



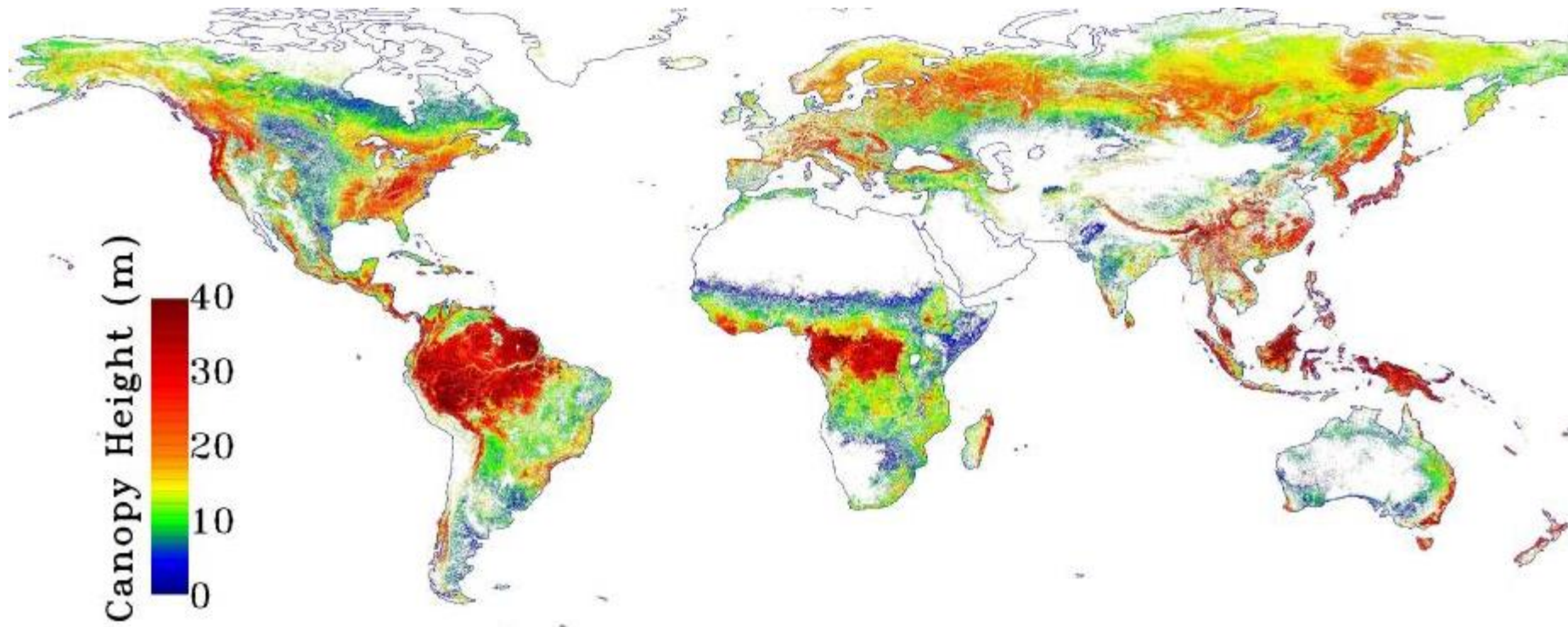
Usos do Radar

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



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 logo, language selection (EN), a login button, and a search bar. Below this, there are tabs for 'VISUALIZE' and 'SEARCH'. The main map area shows a satellite view of the São Paulo region, with a blue polygon highlighting a specific area. The map is overlaid with various data layers, including 'RGB ratio' and 'SAR urban'. The left sidebar contains a 'LAYERS:' section with a list of available layers and their status (Orthorectified). The bottom of the interface features logos for the European Union, Copernicus, and ESA, along with 'About' and 'Support' links. The status bar at the bottom right shows the current coordinates (Lat: -23.7608, Lng: -46.5024) and a 5 km scale bar.

EN Login

Go to Place

289.00 km²

Default

Sentinel-1 IW VV+VH

LAYERS:

- RGB ratio Orthorectified
- SAR urban Orthorectified
- Enhanced visualization Orthorectified
- VH - decibel gamma0 Orthorectified
- VH - linear gamma0 Orthorectified

Show effects and advanced options Hide layer Share

Leaflet | © OpenStreetMap contributors - Disclaimer, © Sentinel Hub

Lat: -23.7608, Lng: -46.5024 5 km

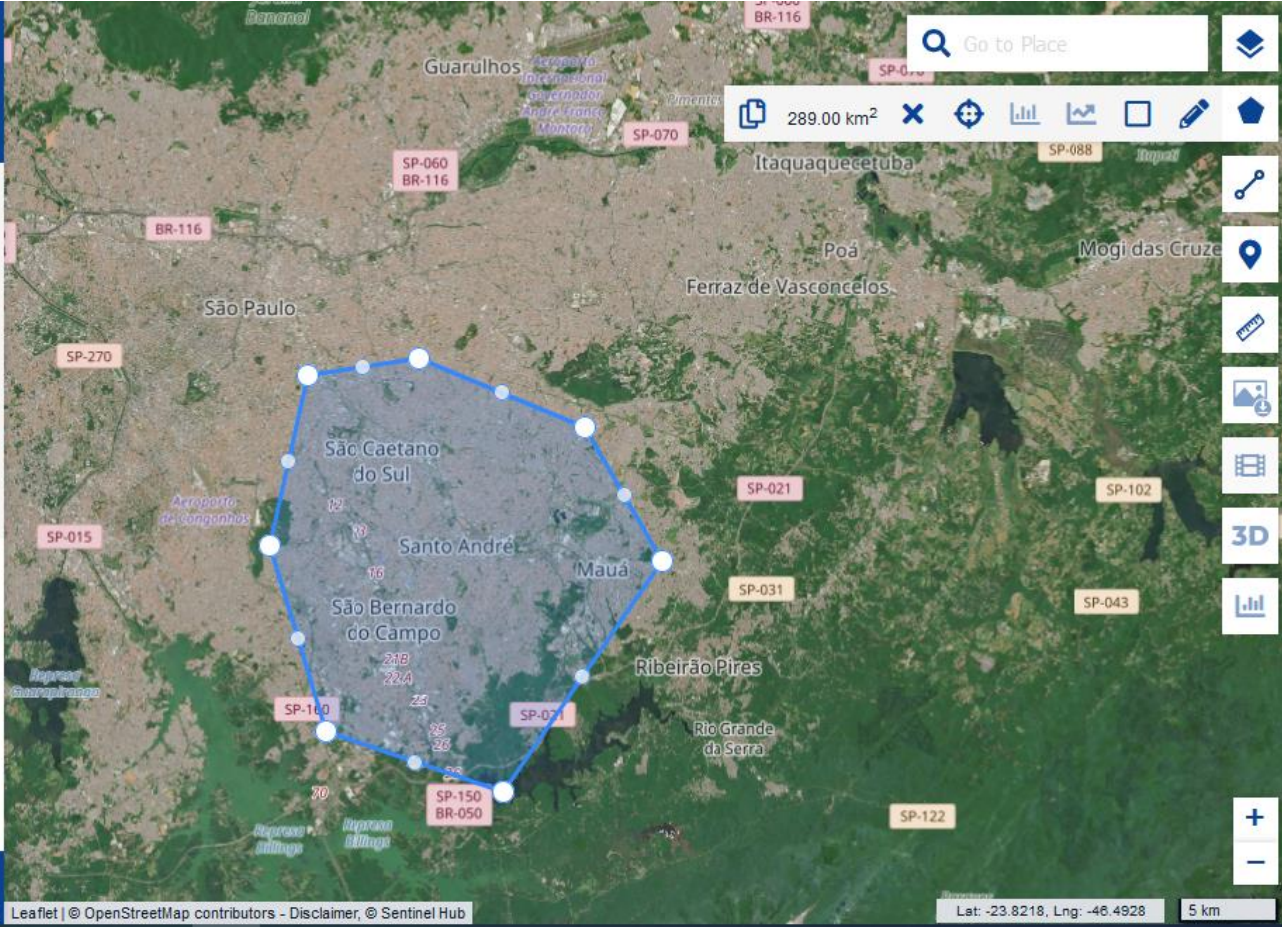
SEARCH CRITERIA:

Product name

DATA SOURCES:

- SENTINEL-1 Filters →
 - C-SAR
 - Level-0 RAW
 - Level-1 SLC
 - Level-1 GRD
 - Level-1 GRD COG
 - Level-2 ONC
 - ETAD
 - Auxiliary Data File


- Immediate
- SENTINEL-2 Filters →
 - SENTINEL-3 Filters →



Go to search Showing 9 results


S1A_S6_GRDH_1SDV_20240330T214412_20240330T21440_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
Info
Zoom
Share
Download


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

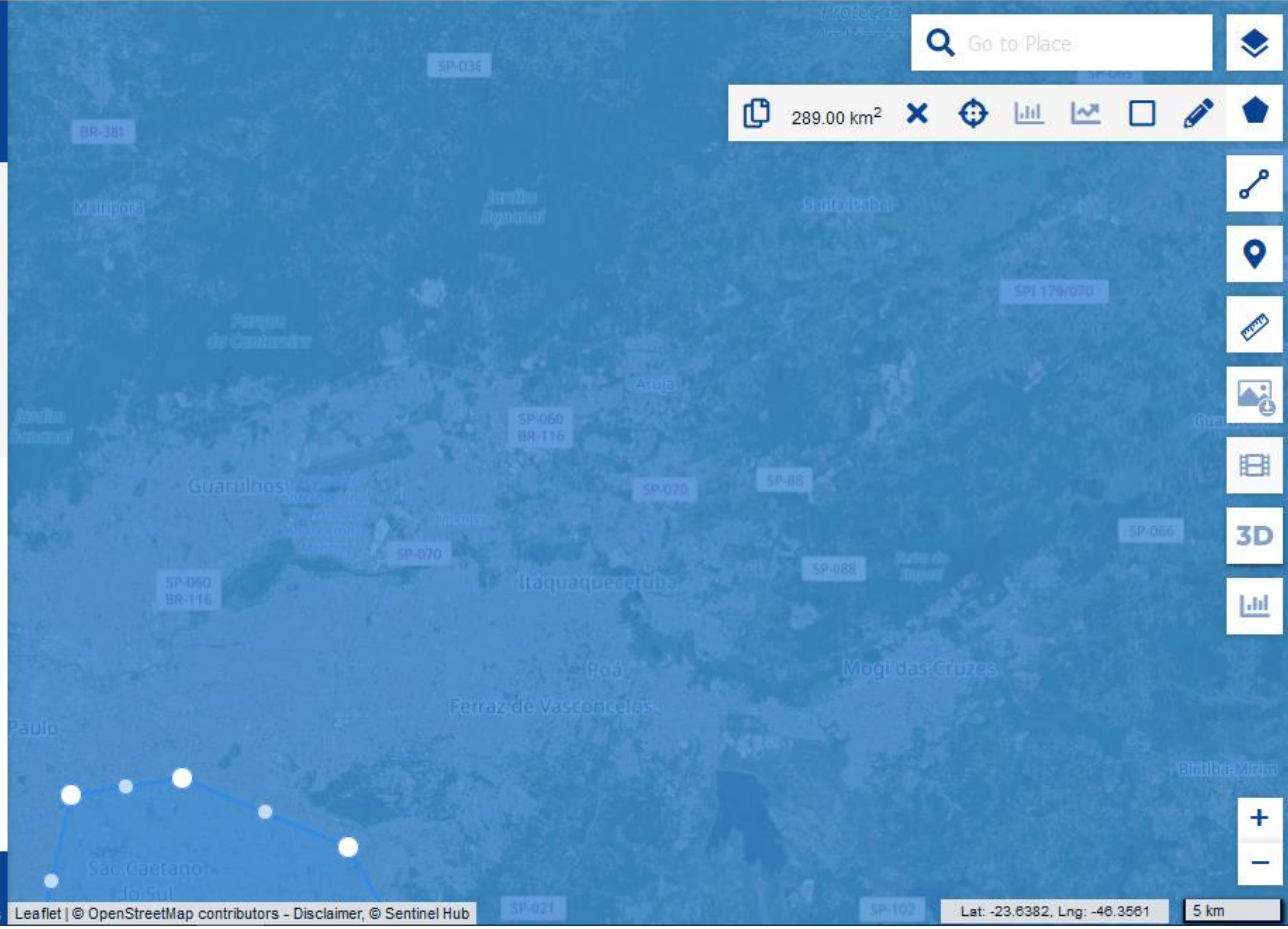
Visualize
SENTINEL-1
SAR
IW_GRDH_1S
Info
Zoom
Share
Download


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
Info
Zoom
Share
Download


S1A_S6_GRDH_1SDV_20240318T214411_20240318T21440_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
Info
Zoom
Share
Download



Obrigado!

Vitor Vieira Vasconcelos