CNRD Center for Natural Resources and Development

Learning Unit

“IMAGE DOWNLOAD & VISUALIZATION"

“Image Download & Visualization"

In this learning unit you will have the first hands on experience using the SPRING software package.

You will learn how you can download a remote sensing images from the web catalogue and how visualize it in the SPRING project.

IMAGE DOWNLOAD

Image Catalogues of Remote Sensing – Types and Download

At the late 1990s, with the advance and consolidation of the Internet, image repositories became more accessible and allowed access to online data. These repositories or **image catalogues** are web applications that publish metadata and provide research and restoration of distributed repositories (Chae *et al*., 2004). In general, they have a good web interface with repositories information, browsing and search engines.

Like all technology beginnings, the catalogues were created by their institutions individually, without any interface, software and hardware pattern. Such different and unconnected environments waste users' time while learning the usage of interfaces and, subsequently, integrating data from different catalogues. Therefore, understanding the organization and functioning structures of each catalogue, as well as the images available, is important.

In general, there are three main interfaces in the Catalogues: search, metadata publishing and data access. These three access and search pillars are important in the usage of these tools.

The USGS Catalogue

The U.S. Geological Survey – USGS, the United States government agency that collects, monitors, analyze and provide scientific information on natural resources, releases satellite images from various sensors and derivative data, such as orthophotos and digital elevation models (USGS Technical Announcement). The catalogue has two interfaces: **USGS Earth Explorer** (*http://earthexplorer.usgs.gov/*), a query interface that provides both spatial and temporal search filters

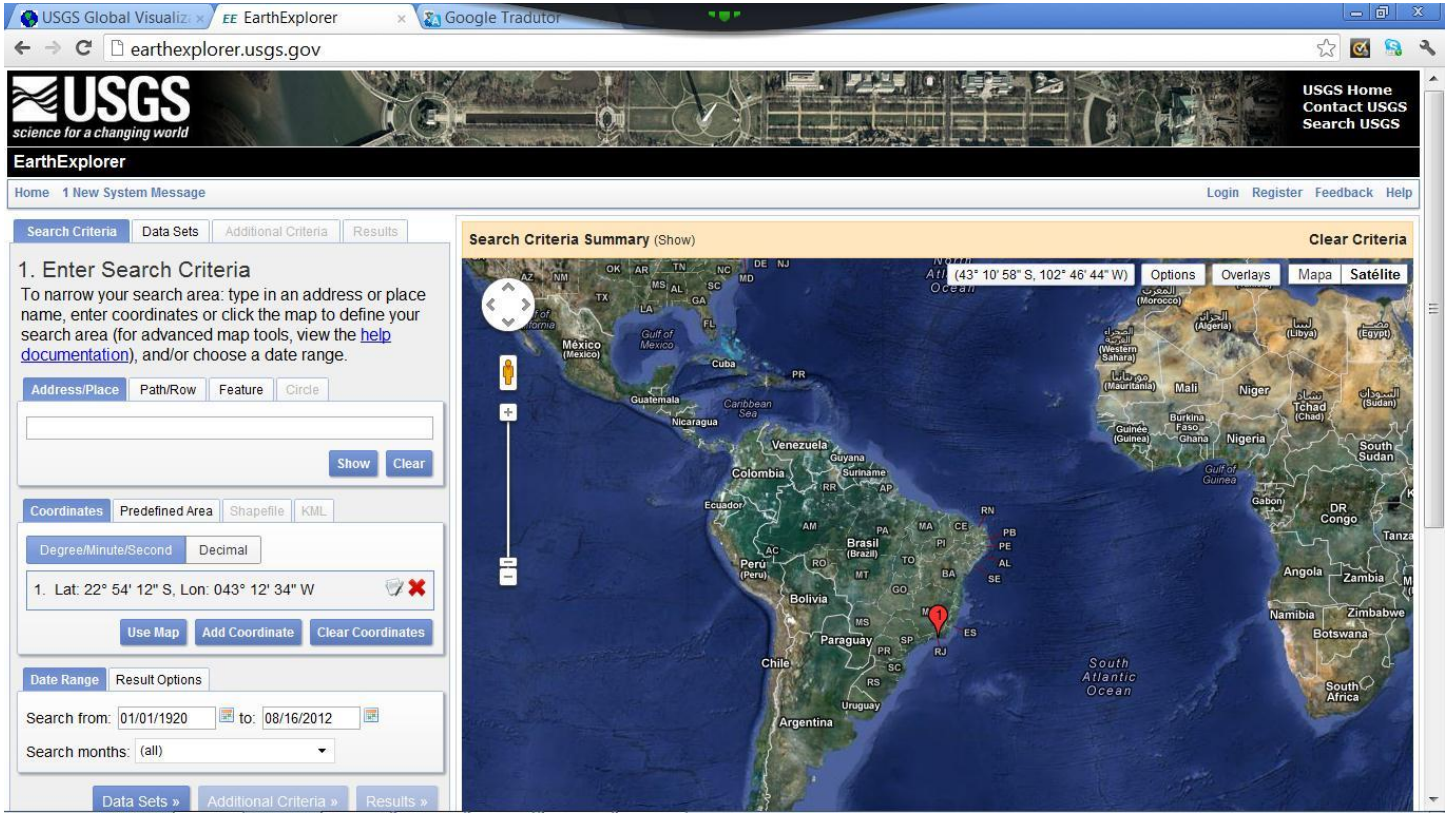
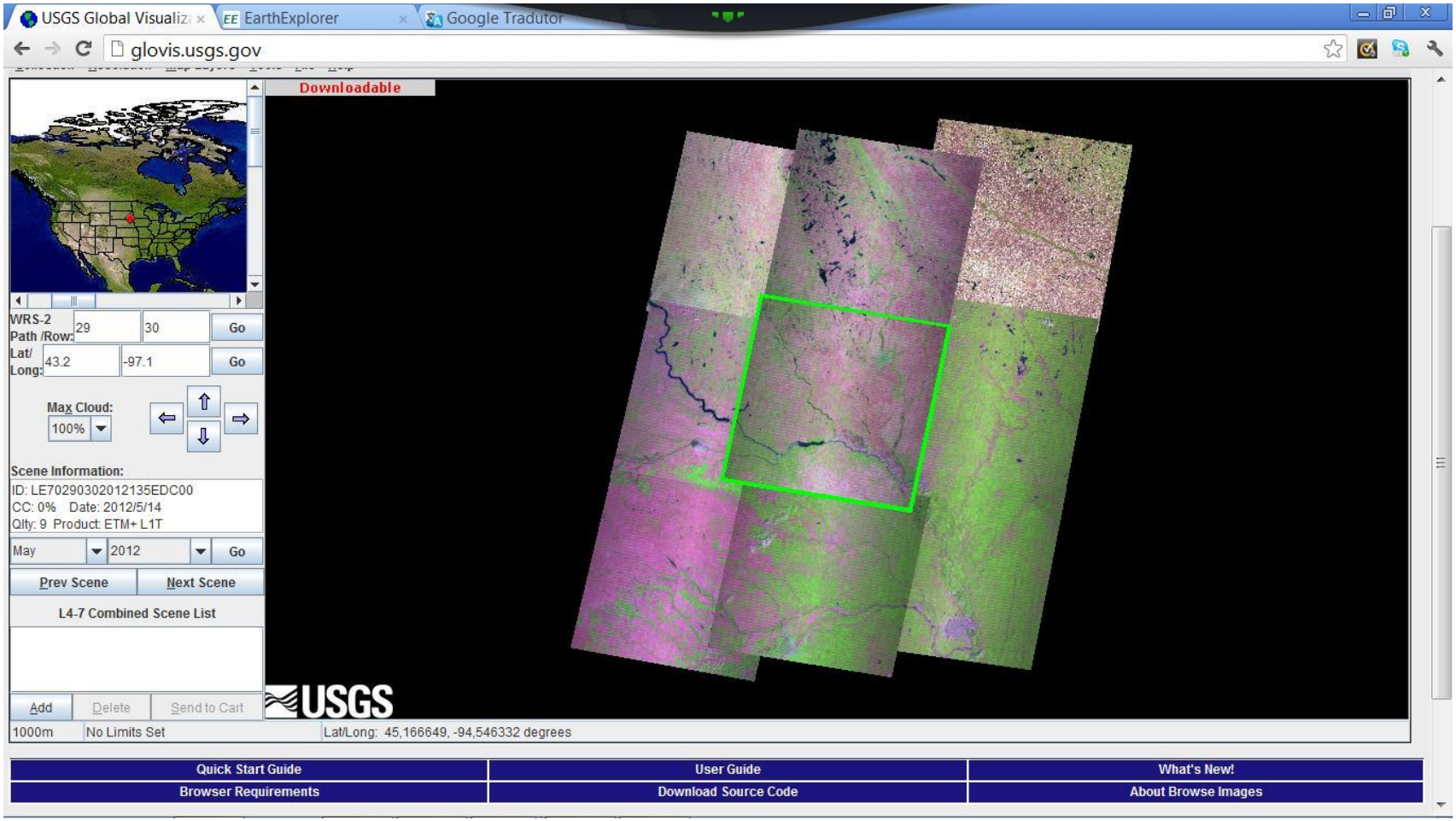


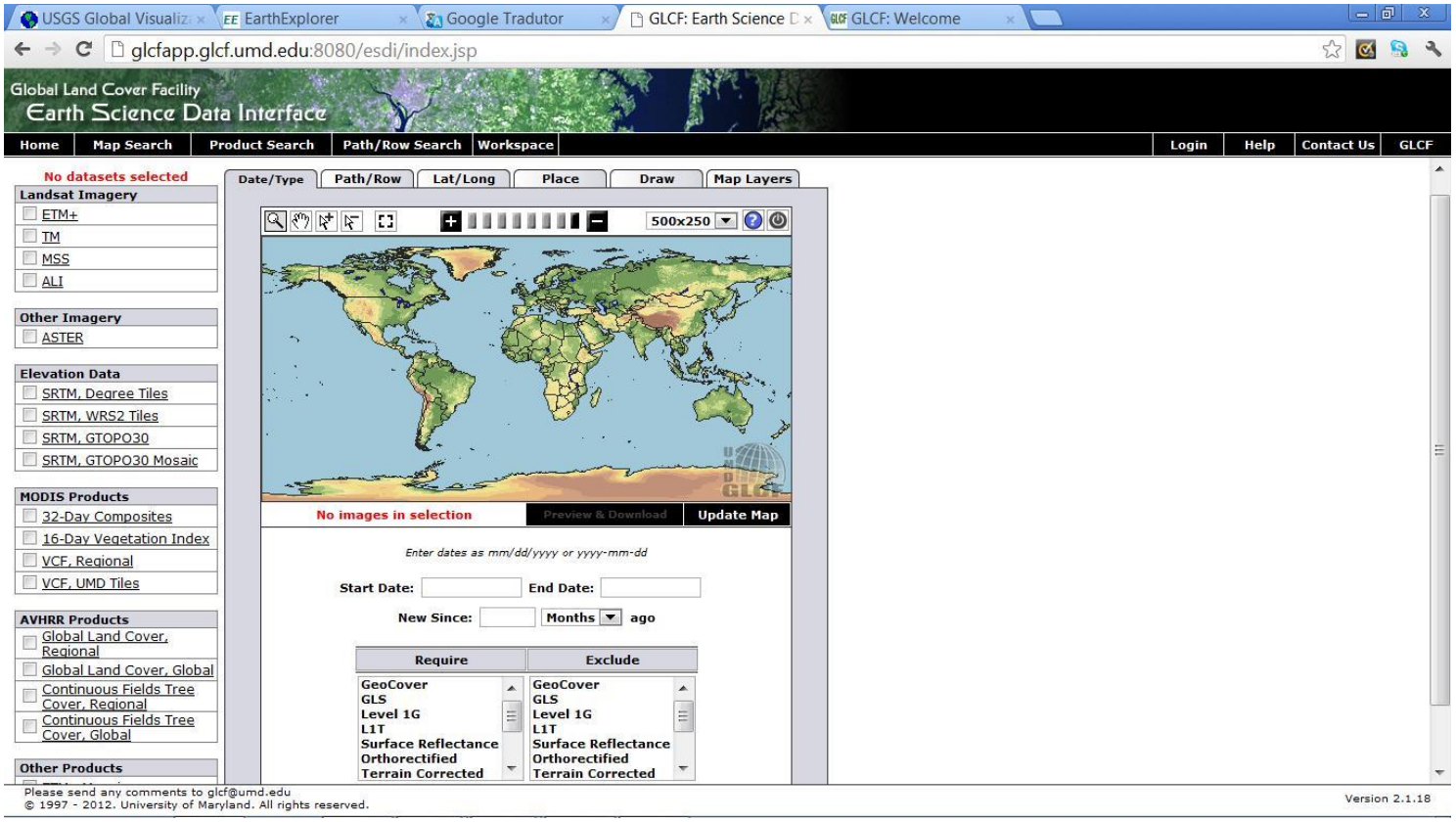
IMAGE DOWNLOAD

and the **USGS Global Visualization Viewer – GLOVIS** (*http://glovis.usgs.gov/*), that, besides query tools to catalog, is the interface to Download Data



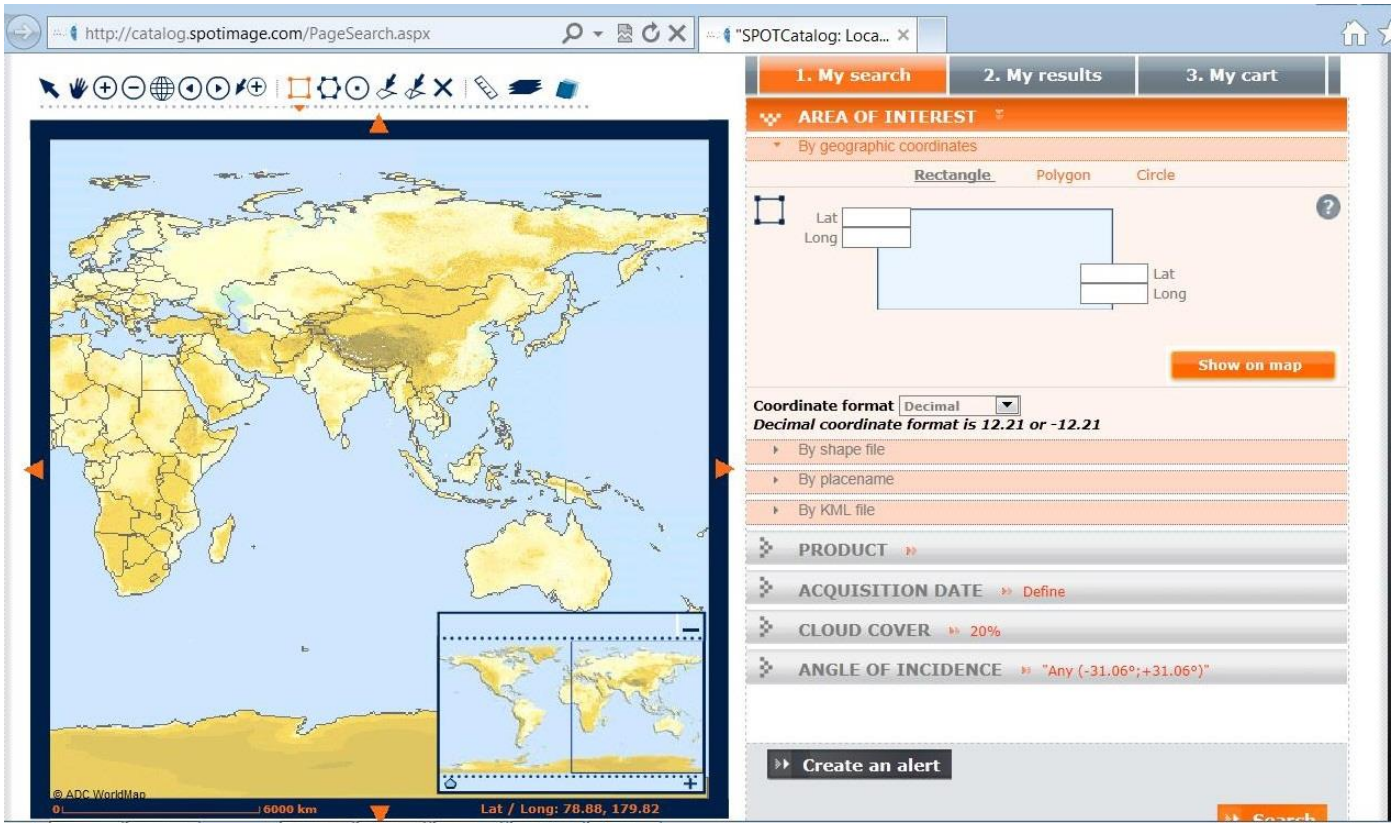
The Global Land Cover Facilities Catalogue

The Global Land Cover Facilities - GLCF is a Center that develops and distributes remotely sensed satellite data and products that explain land cover from the local to global scale. The **Earth Science Data Interface – ESDI** (*http://glcfapp.glcf.umd.edu:8080/esdi/index.jsp*) is the GLCF's web application for searching, browsing, and downloading data from our online holdings. The interface allows browsing for sensor images (Path/Row), bounding box (Lat/Long) or using the interactive map



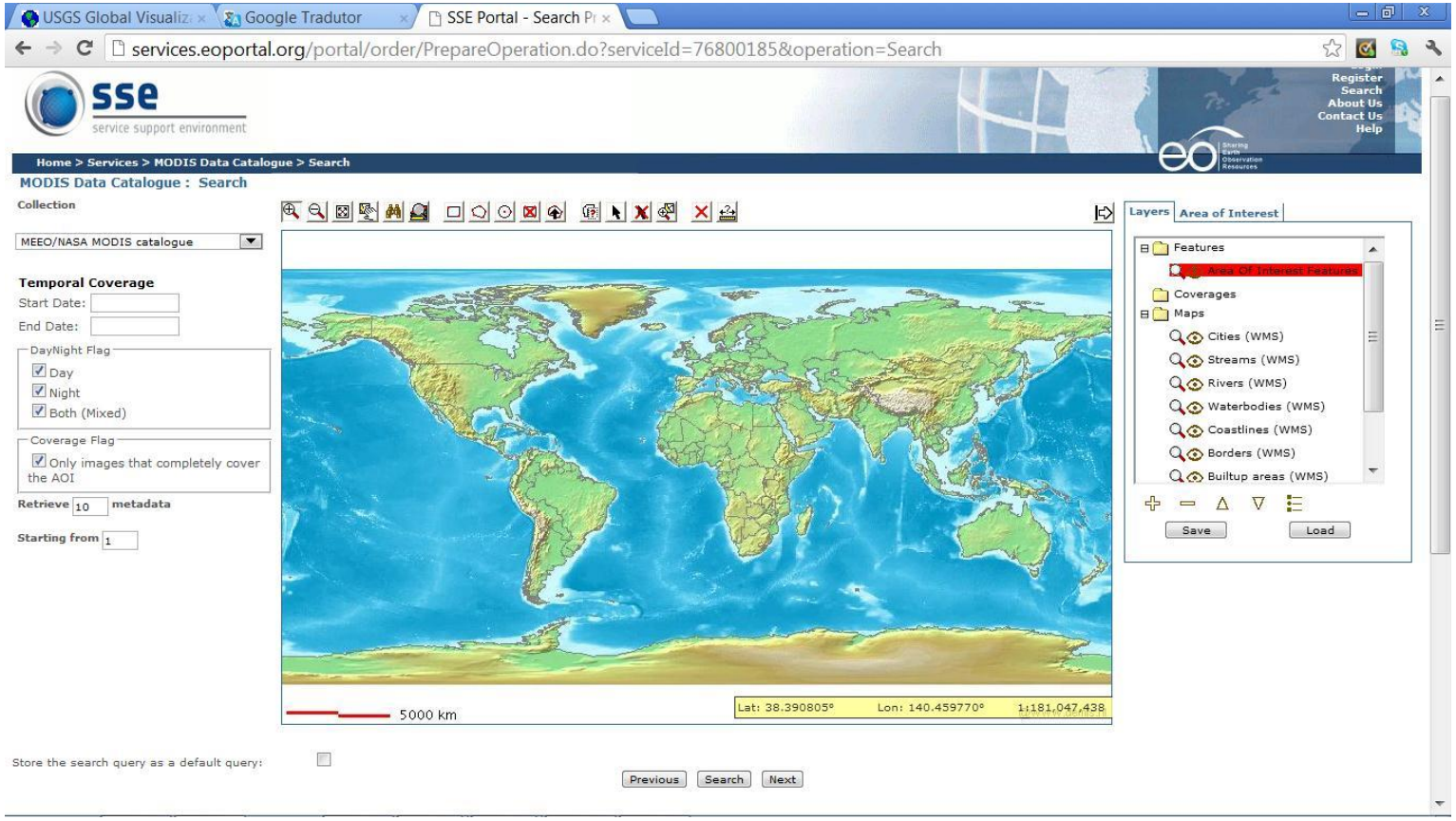
The SPOT Catalogue

ASTRIUM GeoInformation Services provides exclusive access to SPOT images through its catalogue, which has an available interface at *http://catalog.spotimage.com/PageSearch.aspx*. Besides providing polygon drawing tools, which is interesting in the interactive map, the interface allows coordinates bounding box browsing as well as shapefiles



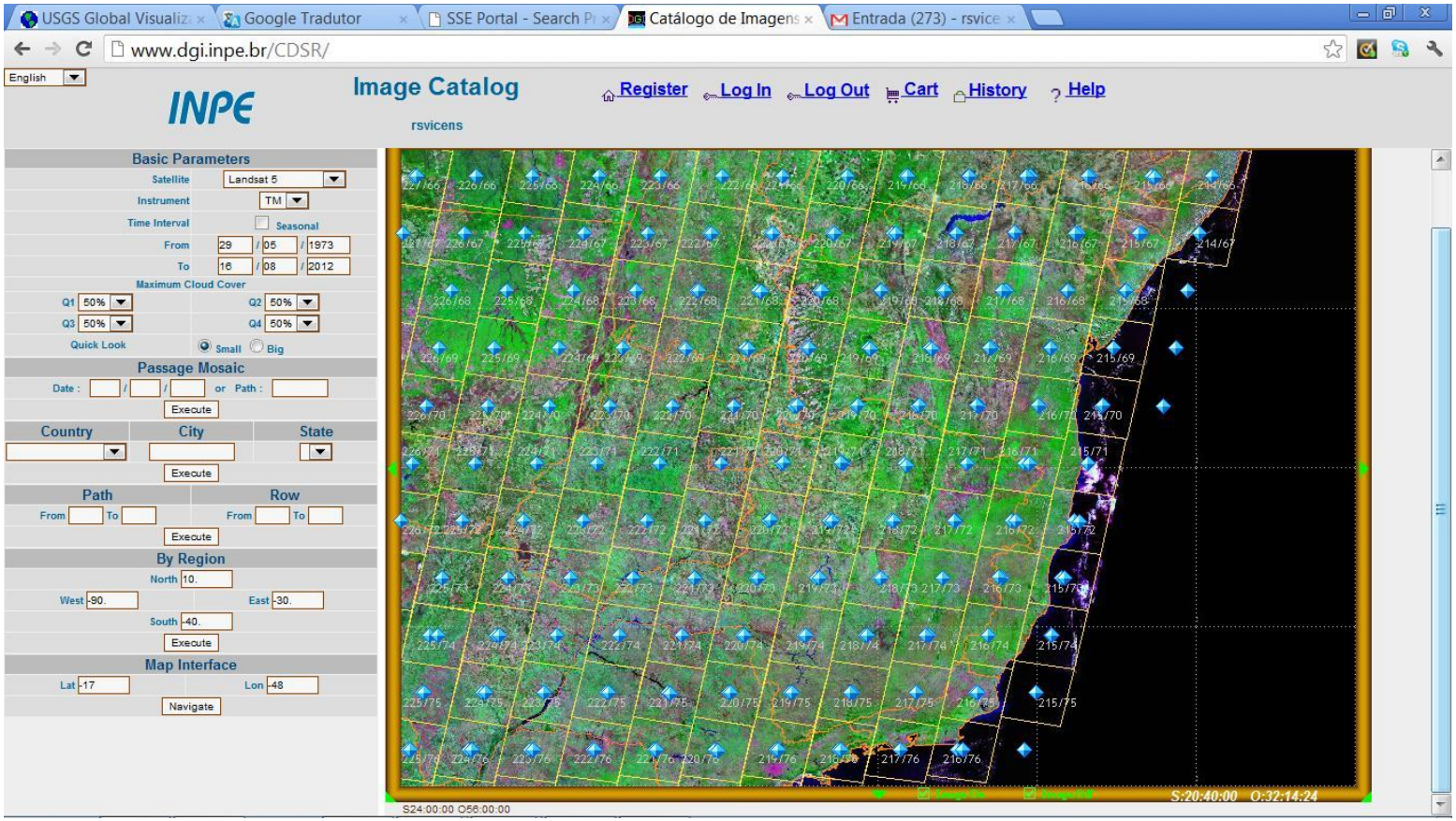
The Service Support Environment

The European Space Agency provides at **eoPortal** an online support with links to several image catalogues and thematic products. The **Service Support Environment** can be accessed at *http://services.eoportal.org/portal/service/ListService.do?serviceCategoryId=34801780*, and addresses to many catalogues through browsing interface, such as MODIS



The INPE Catalogue

The National Institute for Space Research – INPE, in Brazil, releases CBERS images and scenes from the entire Landsat family in South America (and others), acquired in the receiving antenna in Cuiabá. The access portal (*http://www.dgi.inpe.br/CDSR/*) releases, under previous register of its users, the image catalogue in a search interface with further download via FTP



Main search functions in satellite image catalogues

Search functions are tools performed in sequential steps that allow browsing using geographic criteria, as well as non-geographic attributes. The main searching tools are associated with a geographic position. Among the most important search engines it is possible to name: geographic coordinate insertion, area editing using maps that provide function such as polygon drawing, zoom and navigation or even the function of downloading a *shapefile* or *kml* file in the area of interest.

It is important to observe that not all images are available to download in these catalogues. Some image collections are available only for browsing and, in some cases, the user can ask for the scenes to download in a further step. In INPE, ESDI and SPOT catalogues it is possible to obtain all data under online registration. However, in Earth Explorer and GLOVIS some collections are available for browsing only. In the eoPortal all catalogues scenes are available for browsing only.

CNRD Center for Natural Resources and Development

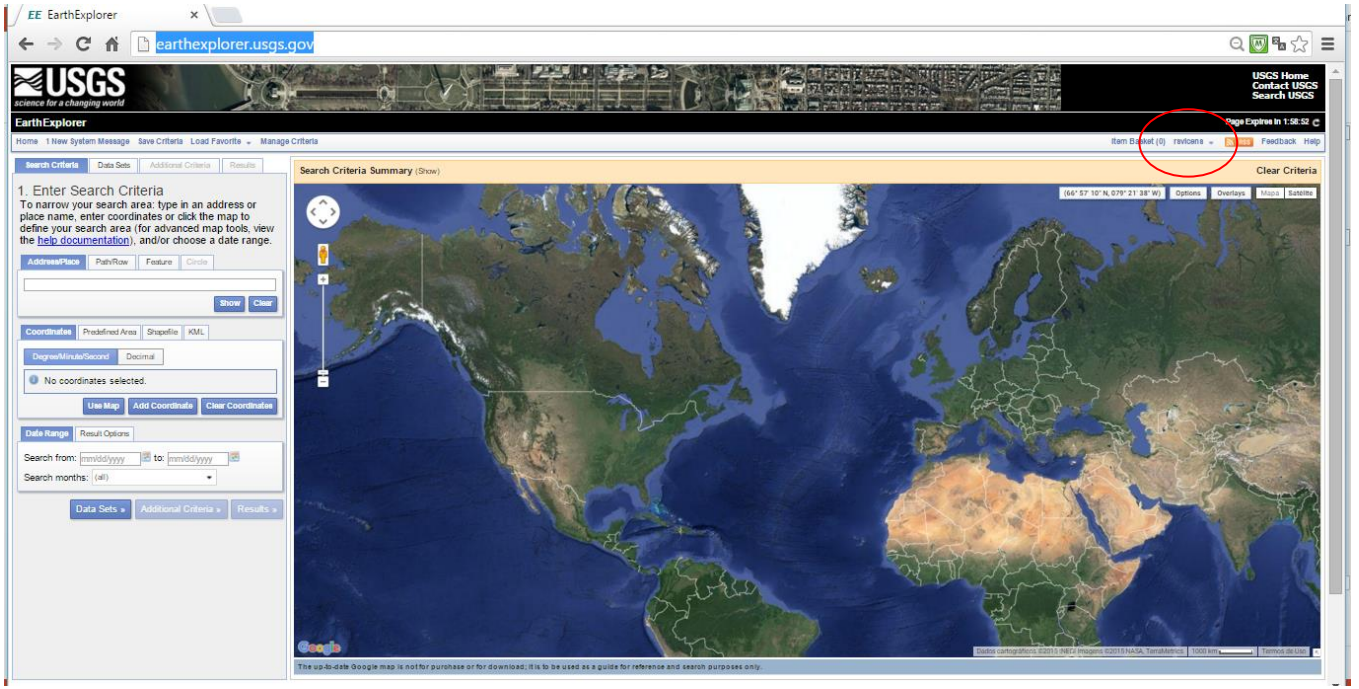
EJERCICIO PRÁCTICO *(Guiado)*

BUSCANDO Y BAJANDO IMÁGENES LANDSAT DEL CATÁLOGO USGS

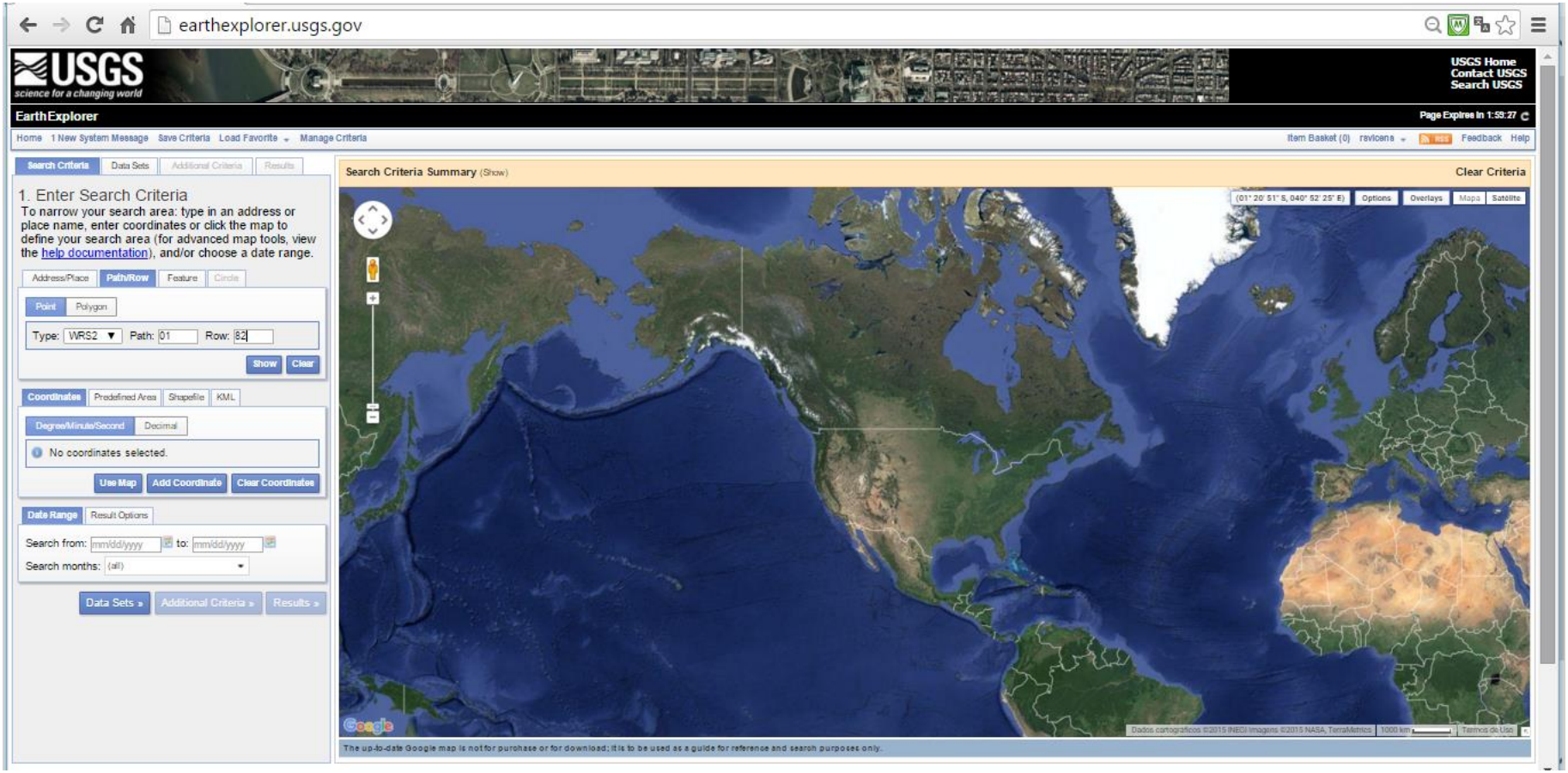
El objetivo de este ejercicio es seleccionar imágenes del sensor OLI/Landsat8 que cubran la Cuenca del rio Maipo, directamente del catálogo USGS (http://earthexplorer.usgs.gov/)

PASO 1. Crie una carpeta en su computador, donde serán guardadas las imágenes

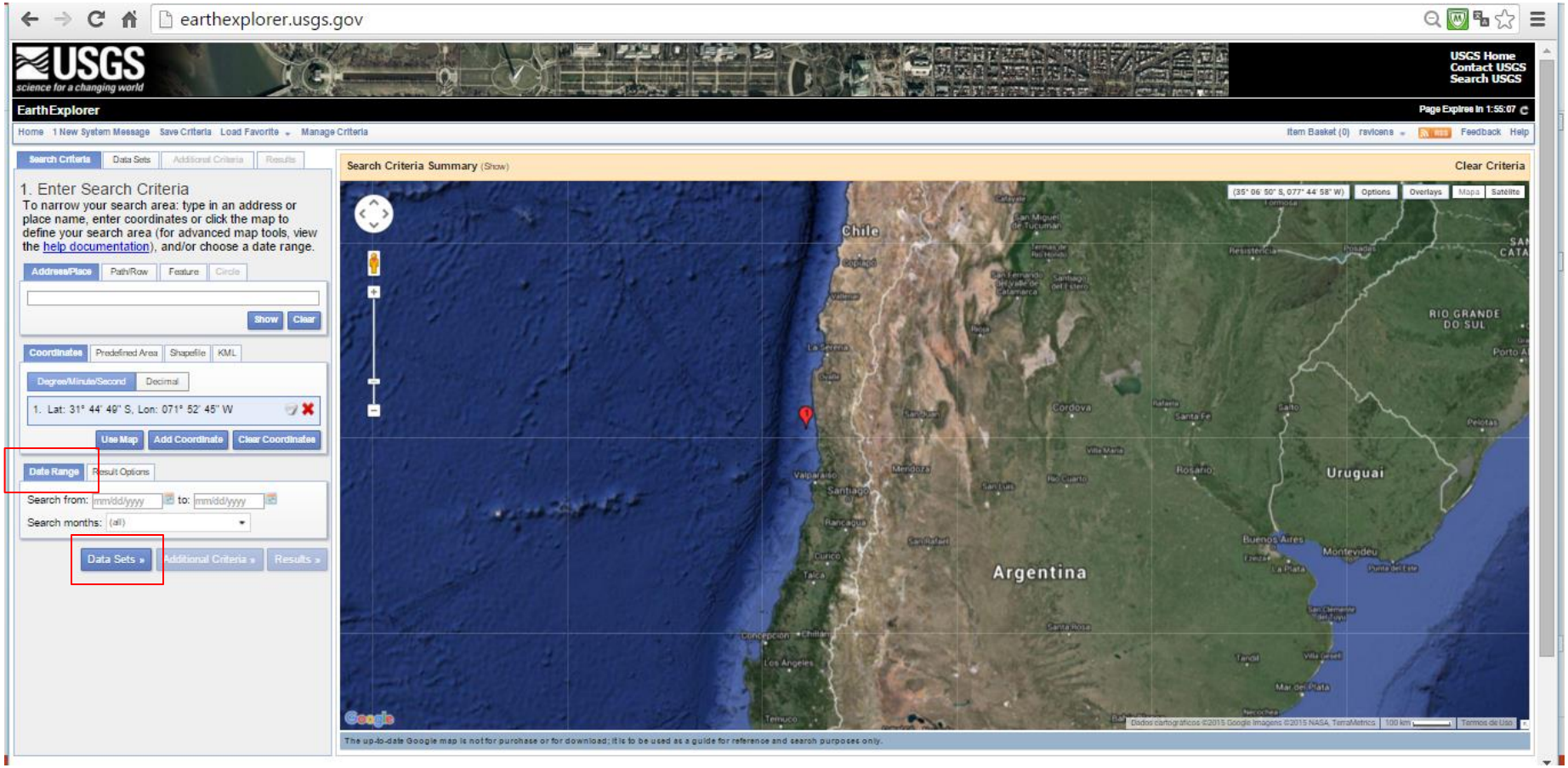
PASO 2. Es necesario hacer un registro de login



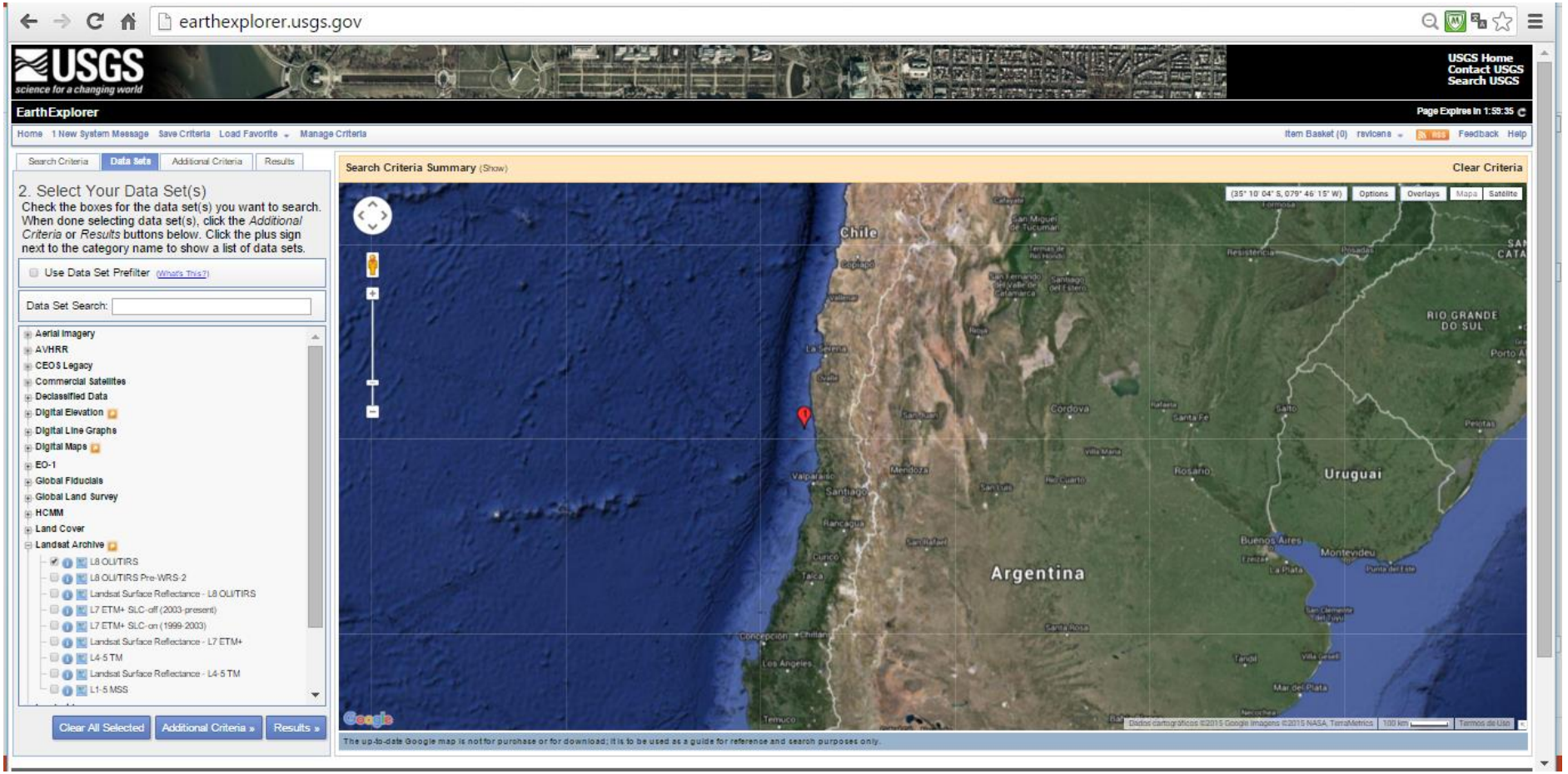
PASO 3. En los criterios de búsqueda, seleccione **Path/Row** 01/081. Pulse **Show** para mostrar la localización de la escena



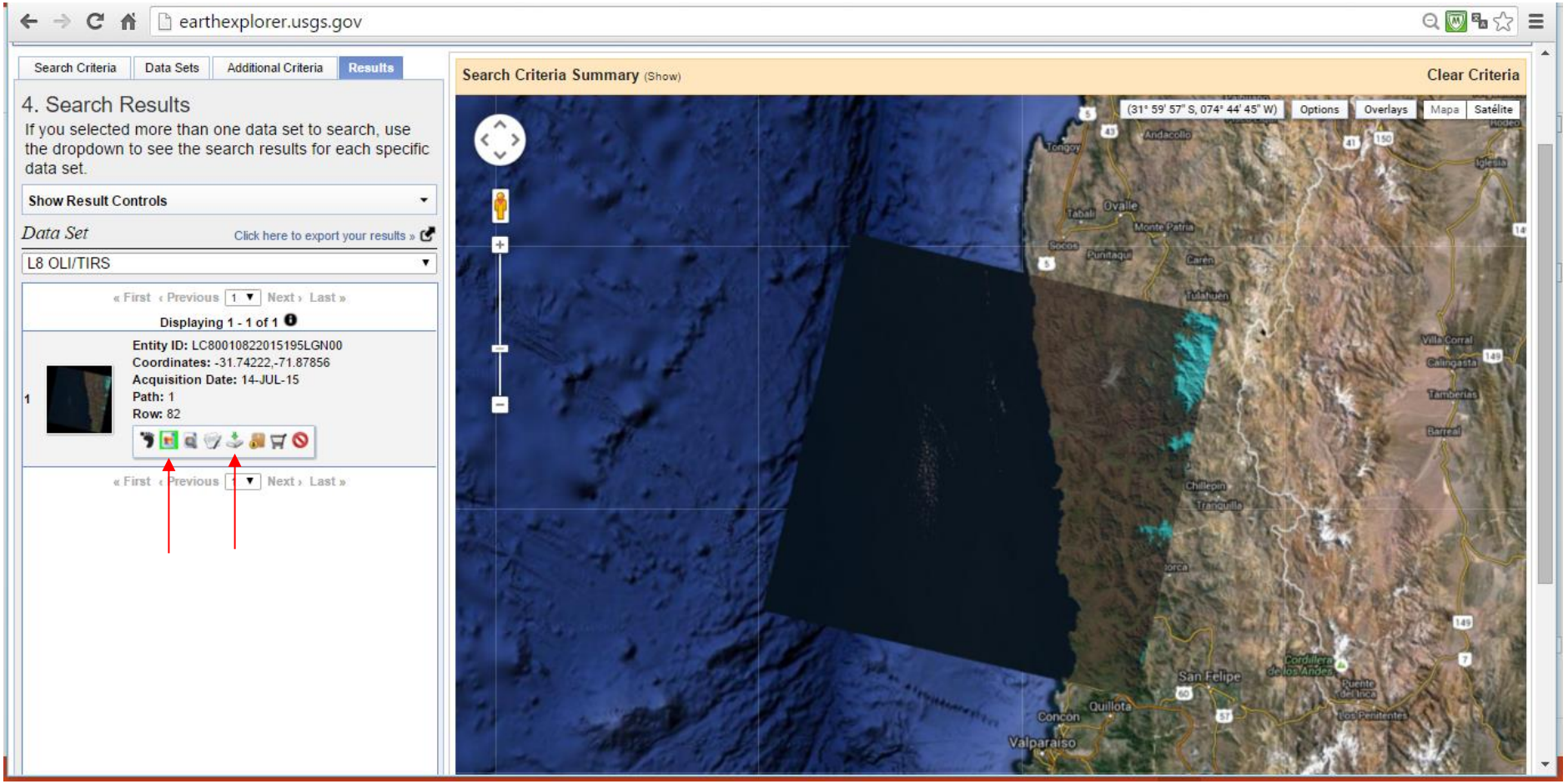
PASO 4. En el campo **Data Range**, seleccione el intervalo de fechas. Pulse **Data Sets** para seleccionar el sensor



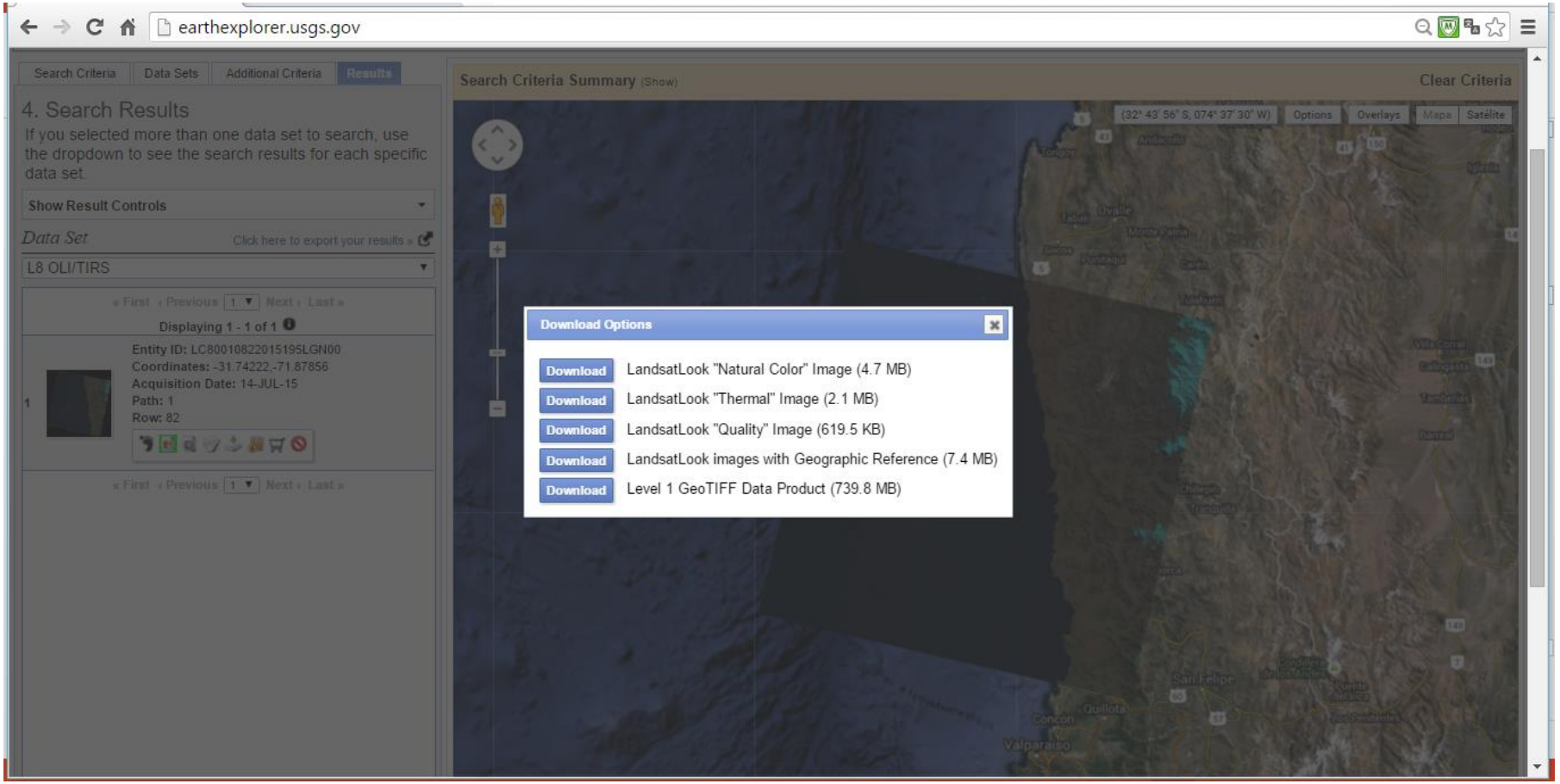
STEP 5. Seleccione **L8 OLI/TIRS** en **Landsat Archieve**. Es posible refinar la búsqueda con criterios adicionales (**Addditional Criteria**) como el porciento de cobertura de nubes en la escena. Al final, pulse **Results**



STEP 6. Una lista de escenas que atienden los criterios de búsqueda irá aparecer. Visualize as cenas utilizando el ícone **Show Browse Overlay**. Una vez escogida la imagen que se desa bajar, pulse el ícone **Download Option**



STEP 7. Utilize la ventana de **Download Options** para bajar las imágenes. Repita la operación para todas las cenas que cubren la cuenca del rio Maipo, Path/Rows: 01/082; 233/081 y 233/082



THE SPRING SOFTWARE

SPRING (System of Georreferenced Information Processing), which is considered a geographical data base of second generation, was built by the National Institute for Space Research/ Division of Image Processing with the participation of EMBRAPA/CNPTIA, IBM Brazil, TECGRAF-PUC Rio and PETROBRÁS/CENPES. Furthermore, it counted with the financial support of CNPq through RHAE and PROTEM/CC (GEOTEC project). The system that operates UNIX and Windows presents as its main functions spatial analysis, image processing, digital terrain model and querying of spatial database.

Download

The current platform of the Division of Image Processing of INPE allow free download of SPRING in Portuguese, English, Spanish and French versions. Moreover, SPRING fits in Linux and Windows 95/98/NT/ME/2000/XP/Vista/7 operating systems.

The software's license is available in INPE platform. If you are interested in consulting it, check SPRING license.

To access the entire SPRING website, it is necessary to register first. Later, upon login, users are identified by their e-mail and password. To download SPRING go to http://www.dpi.inpe.br/spring/

Install

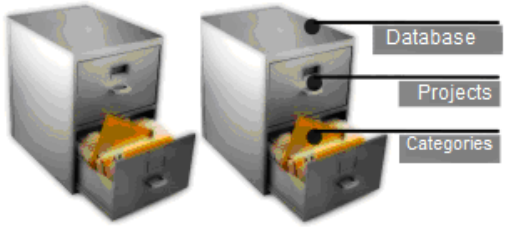
After downloading, open the executable file (_.*exe*) to install. It is important to observe that the main SPRING module setup comprises two more programs – SCARTA and IMPIMA, which are also available for free download.

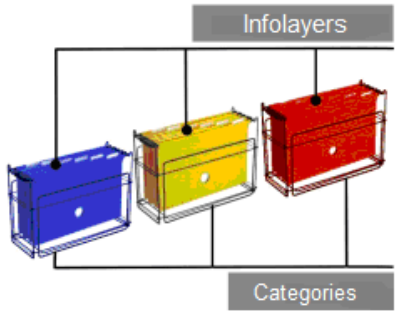
Before working with SPRING, it is important to understand the system conceptual model, which describes how the geographic reality will be represented. By installing SPRING you will have an online help system in your computer. In the **SPRING online help** initial page select **Concepts** and, afterwards, **Reference Information**, then read more about **SPRING Conceptual Model**.

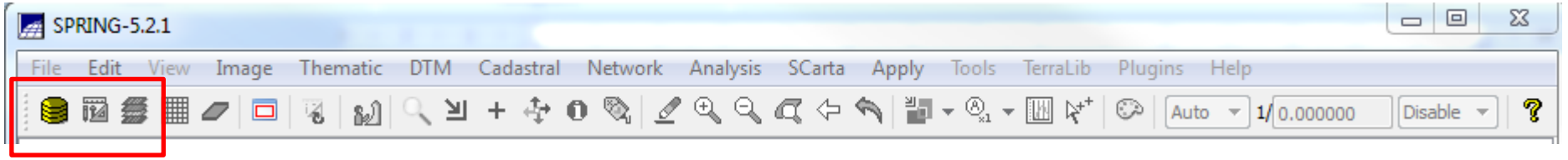
PRACTICAL EXERCISE *(Guided Exercise)*
STARTING SPRING

The aim of this guided exercise is simply to present the SPRING system. You will know how organize the information in a hierarchy of spatial Database. This organization is subdivided into four data models: **Database**, **Project**, **Category** and **Information Layer**

An SPRING Database corresponds physically to a directory where the Data Model, with its Classes and Categories definitions, as well as the Database projects will be stored, all of them are presented in the taskbar of software.







Create Database

In order to enter data in the SPRING System, it is first required to create a Database and define its Data Model. In order to perform any task, a Database has to be active and the data categories that will be handled in the Database have to be declared.

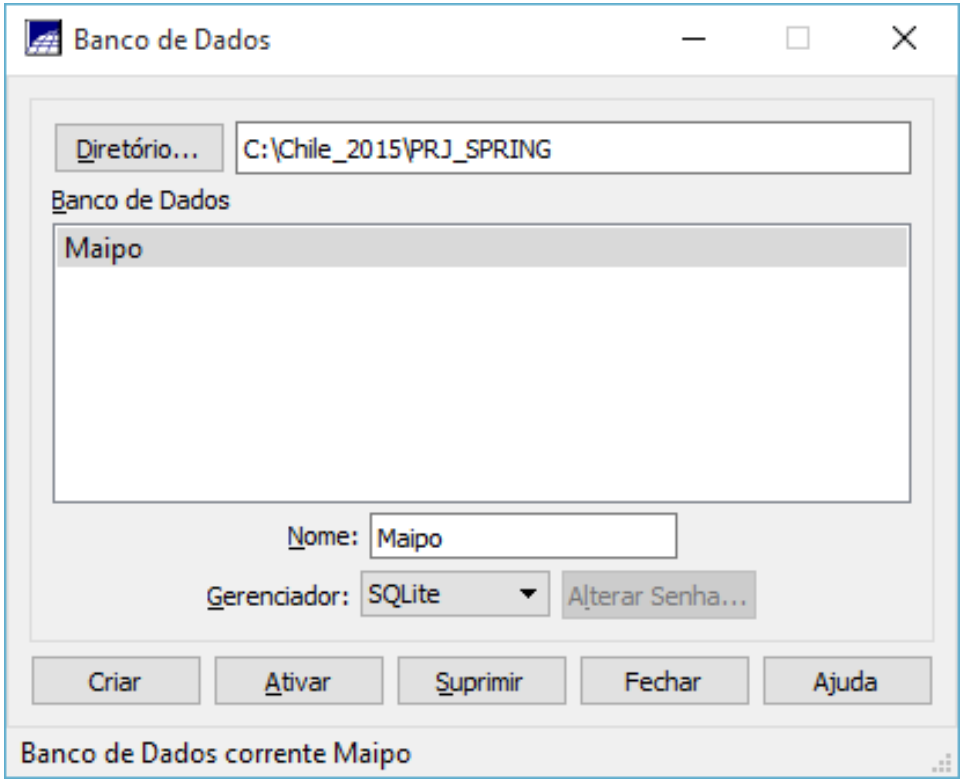
STEP 1. Create a Database: Click in **File**>**Database**, in the main menu or in the corresponding icon in the toolbar.

STEP 2. Select directory and Database name: **Click** in **Directory...**to select a directory where the Database will be created. **Type** the name for the Database that will be created (example: "**Maipo**"). You can use up to 32 characters without spaces.

STEP 3. Select a Database Manager among **Dbase, Access, Oracle, MySQL, PostgreSQL** or **SQLite**.

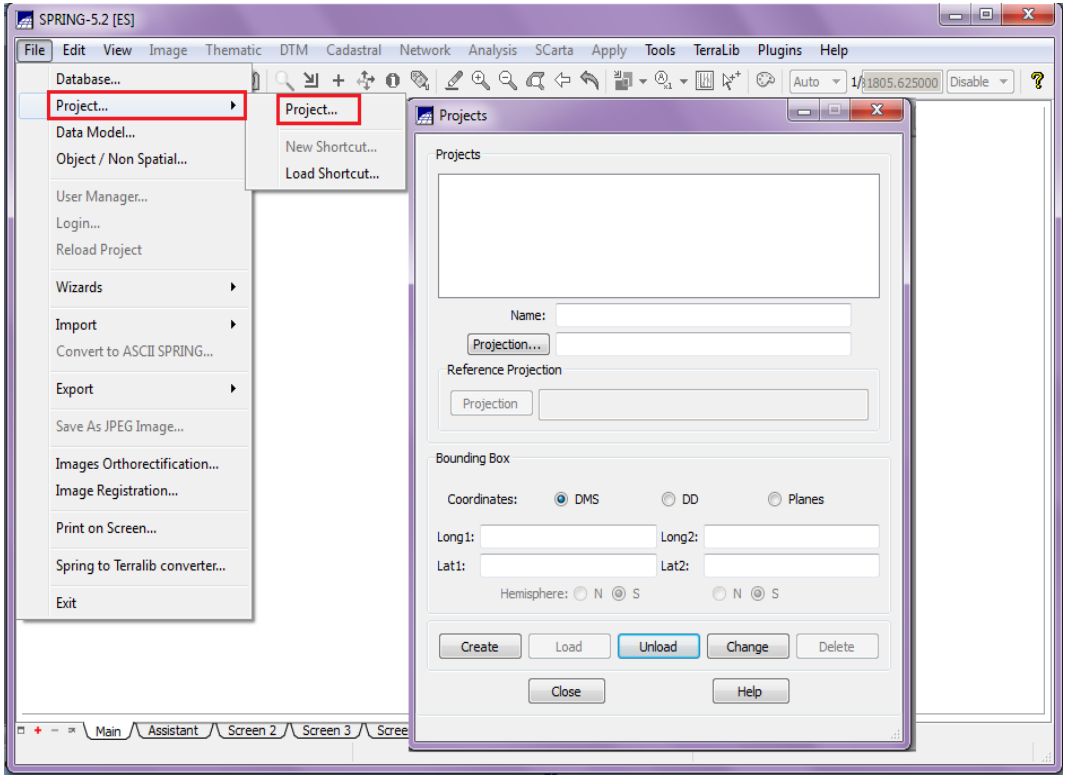
STEP 4. Confirm: **Click** in **Create** to create the Database. If a backup is needed, all information and data of this database will be stored in the selected directory.

STEP 5. Activate Database: Click in **Apply** to activate the Database. Notice that the name of the active Database is presented in SPRING title bar between brackets.


Banco de Dados
Diretório...
C:\Chile_2015\PRJ_SPRING
Banco de Dados
Maipo
Nome:
Maipo
Gerenciador:
SQLite
Alterar Senha...
Criar
Ativar
Suprimir
Fechar
Ajuda
Banco de Dados corrente Maipo

Create Project

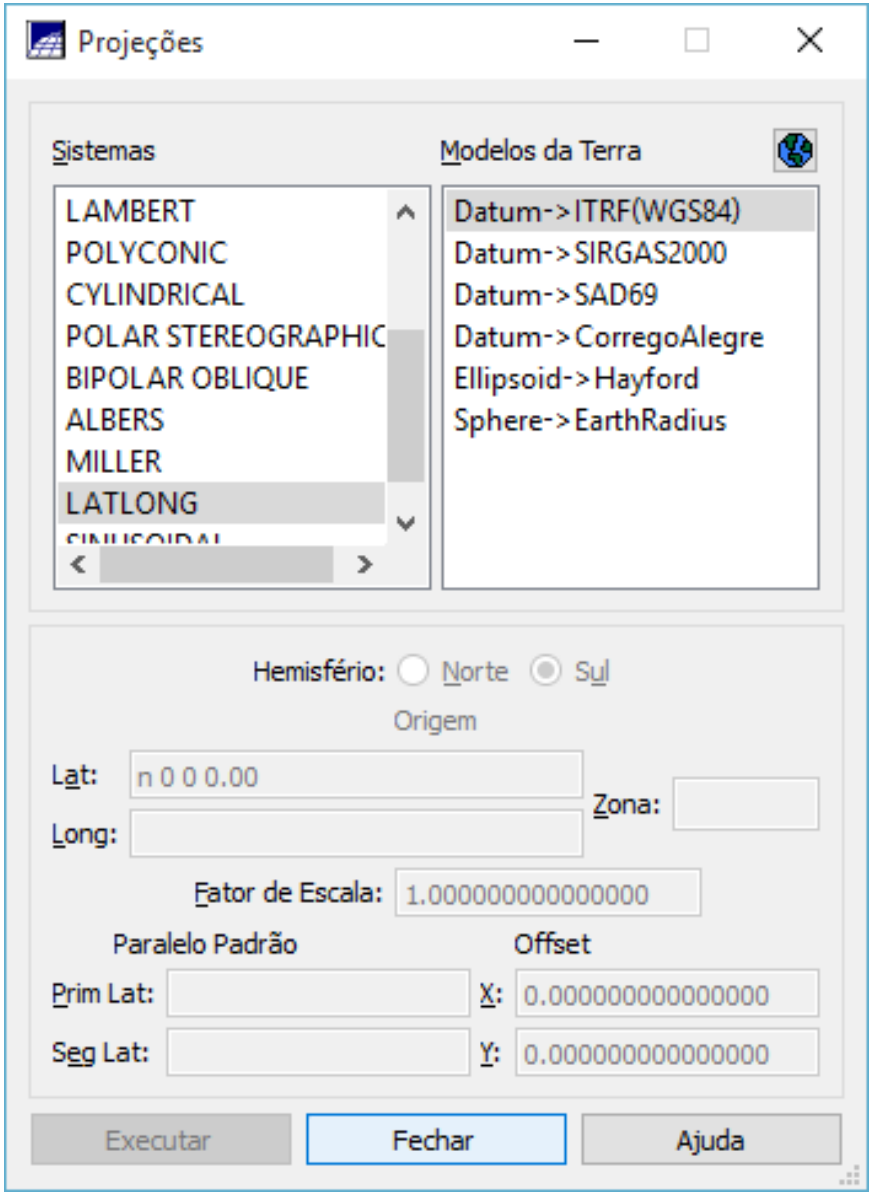
Once the Database is created, it will be necessary to define a Project with its geographical limit of the area under study **(Bounding Box)** and the **Cartographic Projection** that is more adequate to the geographic area that will be manipulated in the work area. Once these parameters are defined, then it is possible to enter or handle data in the SPRING System. The projects will be stored in sub directories together with its data files: points, lines, orbital and aerial images, thematic images, texts, grids and objects.



STEP 1.Create a project: Click on **File>Project...**in the main menu or in the corresponding icon in the toolbar.

STEP 2. Type a **name** for the project (example: "**Maipo**").

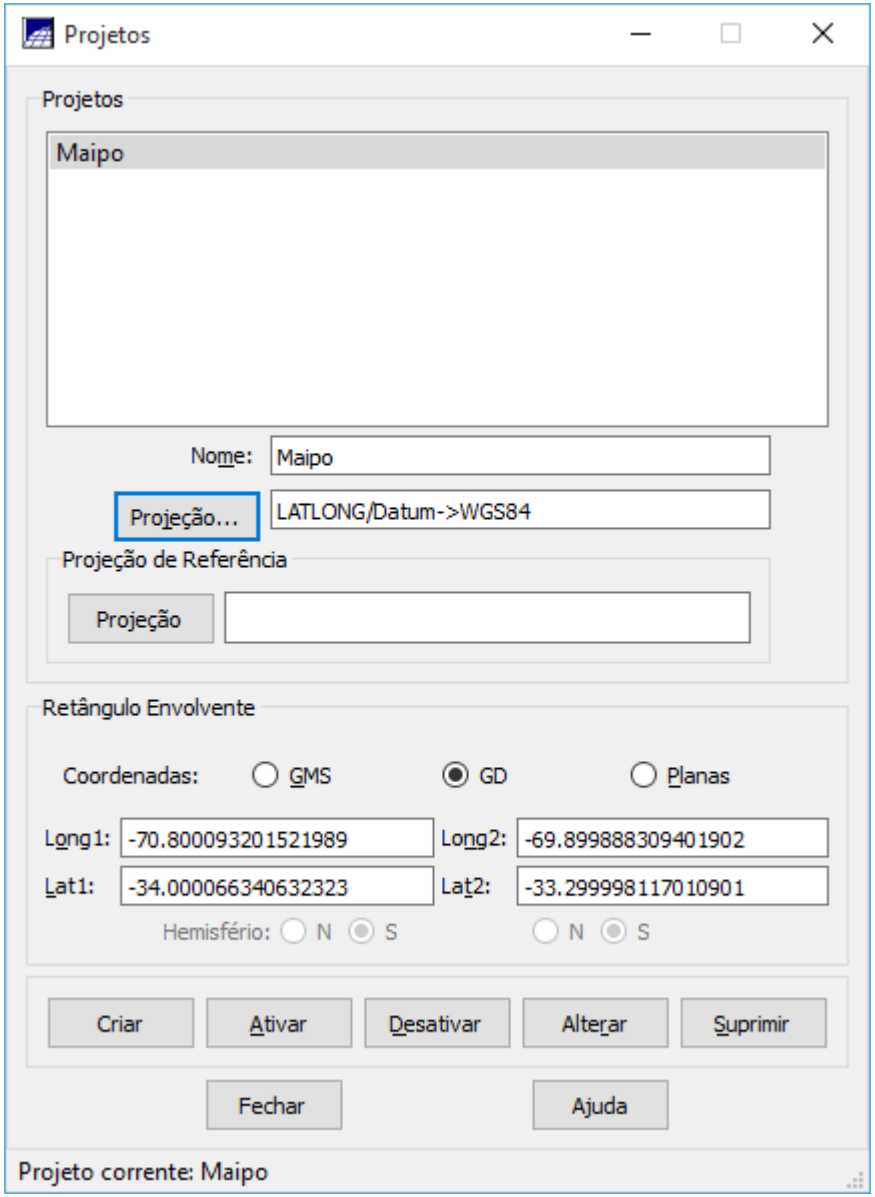
STEP 3. Define the cartographic parameters: Click on **Projection...** to inform the cartographic parameters to be used in the project. Select the **LATLONG** System (Geographical Coordinates System) and **WGS84** model (World Geodetic System defined in 1984). Click in **Apply** to define the projection. Note that the longitude of origin will be filled automatically.



STEP 4. Define the **Bounding Box** in Geographic or Planes coordinates (in meters). The two points should be diagonally opposite to each other, such that the first (1) is the lower left corner while the second (2) is the upper right corner. For the Maipo's basin use the Geographic coordinates:

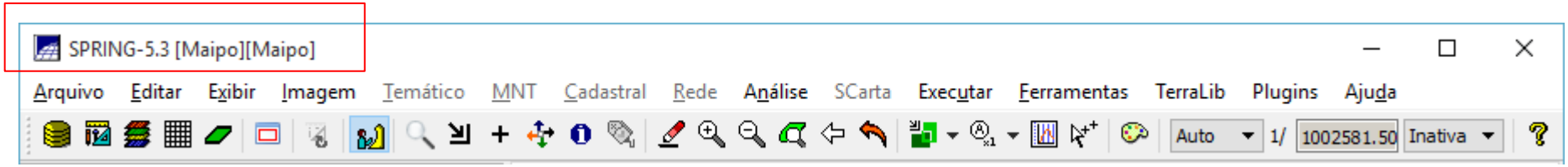
Long1: - 70.000	Long2: - 69.900
Lat1: -34.000	Lat2: -33.300

Click on **Create** to insert a project in the database. Note that the project name will appear on the **Projects** box



STEP 5. Load the project: Many projects can be stored in the SPRING Database. Therefore, select the "Macae" project to continue with the exercise. Click on **Load** to activate this project.

Note that in the SPRING title bar the name of the loaded Database and project is presented within brackets **[<Maipo>][Maipo]**.



Create Categories

To add data into SPRING it is required to define the different types of data that will be handled. Every map has to belong to a **Category**, that is, it has to belong to one of the following types: **Image**, **Digital Terrain Model (DTM)**, **Thematic**, **Cadastral** or **Network** (you can see the conceptual definition of each type in the SPRING online-help).

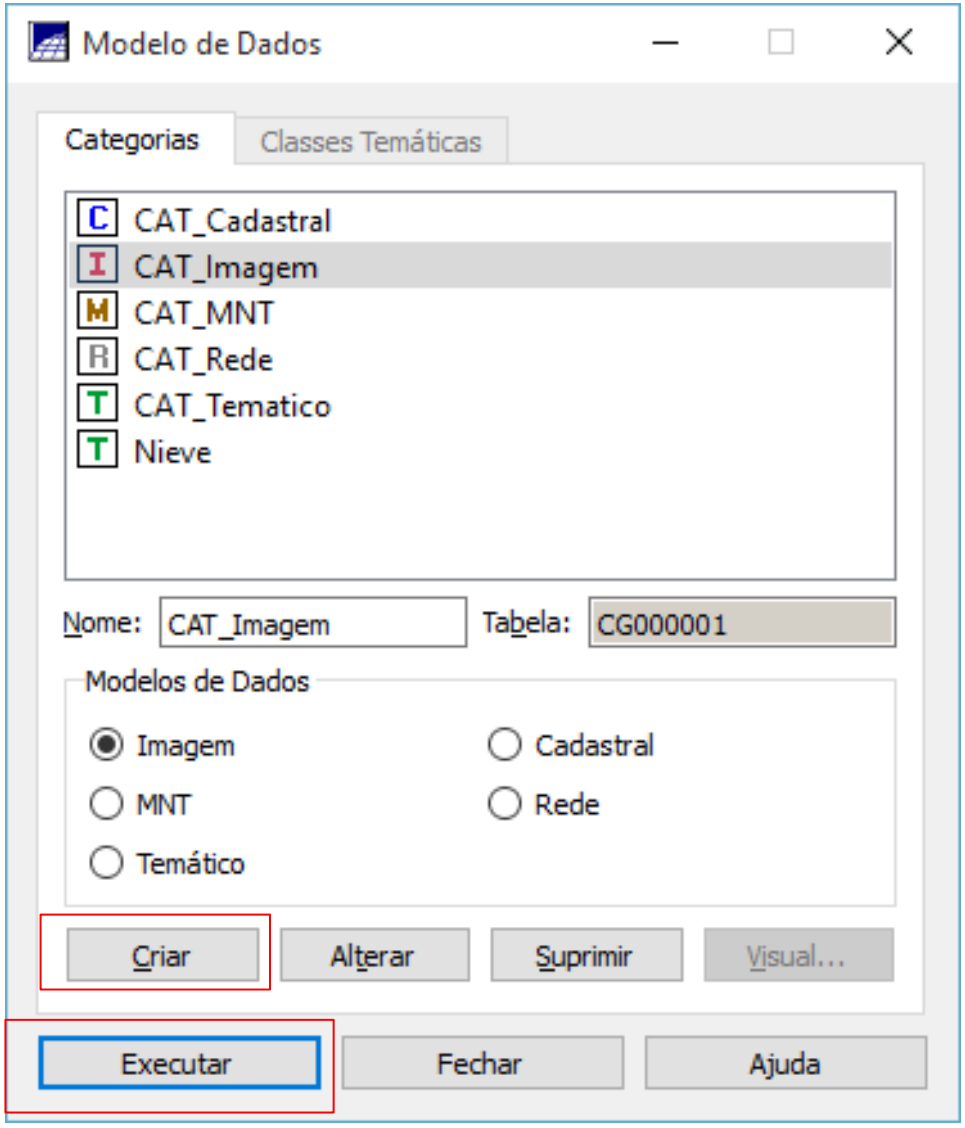
As we will use remote sensing image with matrix format, the “Image” category is more appropriate to this kind of data.

STEP 1. Create a category: Click on **File**>**Data Model...** in the main menu or in the corresponding icon in the toolbar. The “Data Model” dialog box will appear with the different categories used in the SPRING System.

STEP 2. Choose **Image** as type of **Data Model**. Assign a name for the category, for example: “Landsat”, to help identify the origin of the images you are inserting on the Database.

STEP 3. Click on **Create** and then on **Execute**.

This procedure can be repeated to create others categories

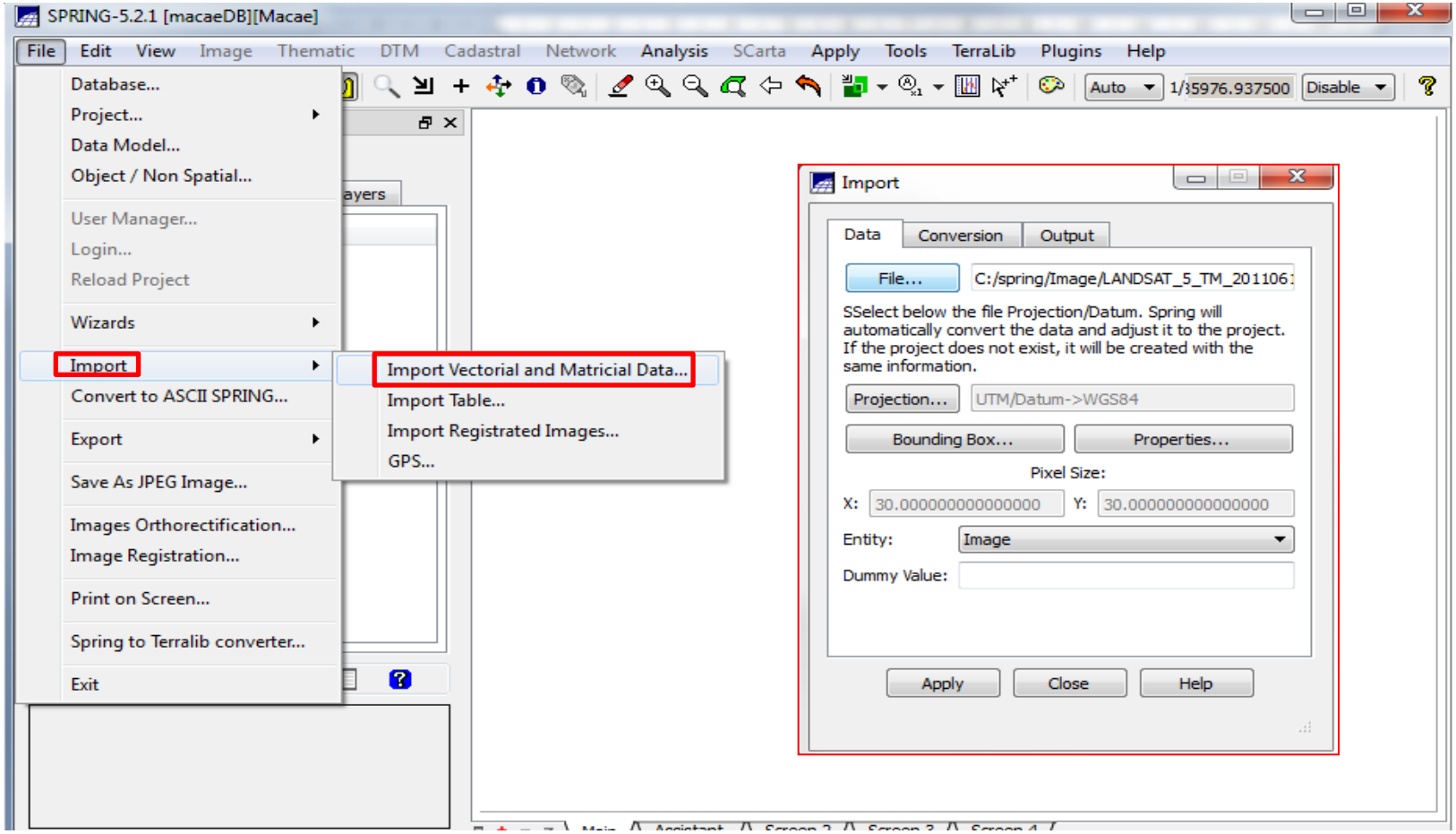

Modelo de Dados
Categorias
Classes Temáticas
CAT_Cadastral
CAT_Imagem
CAT_MNT
CAT_Rede
CAT_Tematico
Nieve
Nome:
CAT_Imagem
Tabela:
CG000001
Modelos de Dados
Imagem
Cadastral
MNT
Rede
Temático
Criar
Alterar
Suprimir
Visual...
Executar
Fechar
Ajuda

PRACTICAL EXERCISE *(Guided Exercise)*
LOAD AND VISUALIZE IMAGE

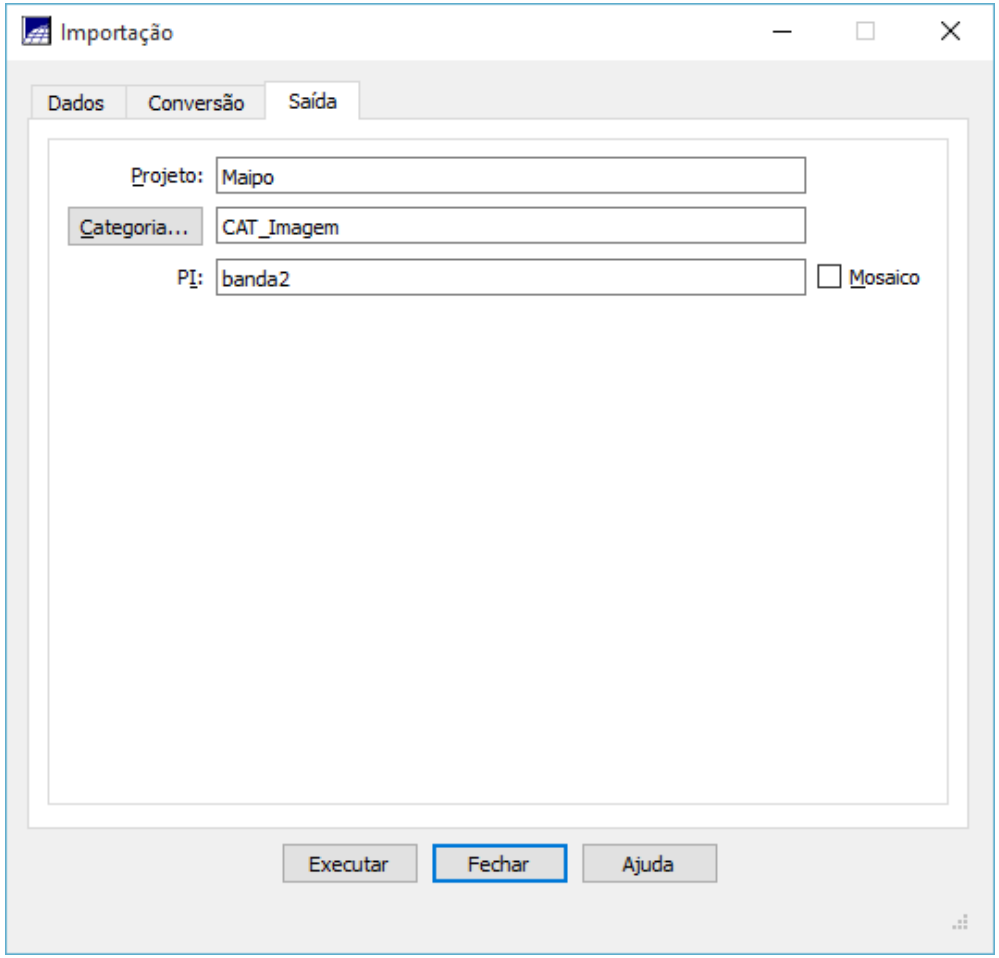
In the SPRING System, data can be imported in different formats (see SPRING on-line help for more details) provided that they are appropriate according to the previous definition of the Category. Most of the satellite images currently distributed by private companies or research organizations are geometrically corrected. Although the images in the GeoTIFF format could not be completely georeferenced, it should be imported to the SPRING project. In the current practical exercise, you will use the Landsat image previously downloaded from INPE Catalog and import it to “macaé” project.

Import image in GEOTIFF format

STEP 1. Click on **File>Import>Import Vectorial and Matricial Data...** in the main menu to open the Import dialog box.



STEP 2. Select file: Click on **File...** and select, in your directory, one of the files in GEOTIFF format corresponding to each band of the Landsat image previously downloaded. Click on **Apply.** The **Data** tab will show image attributes as **Projection** and **Pixel Size** (30 meters for Landsat image). Use the **Bounding Box** defined for "Maipo" project.

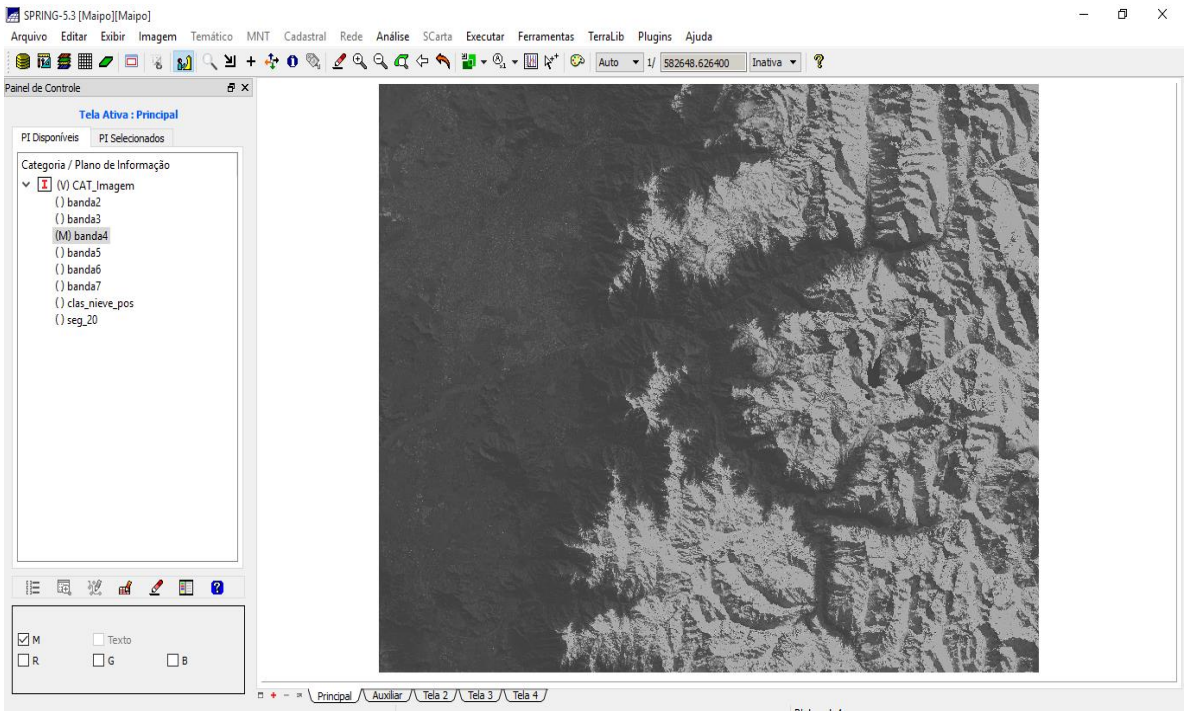


STEP 3. In the **Output** tab, choose the category previously created for image data ("Landsat") and type a name for the **Information Layer** (IL). It is advisable to specify the spectral band of the image in the filename, to facilitate identification (example: Band_1). Click on **Apply** to import the image. To import the other bands, the procedure is the same and should be done in sequence. The imported images will be displayed on the control panel.

Visualization of the images inserted in the Project

This step consists in viewing the images in grayscale separately and through normal composition and false color.

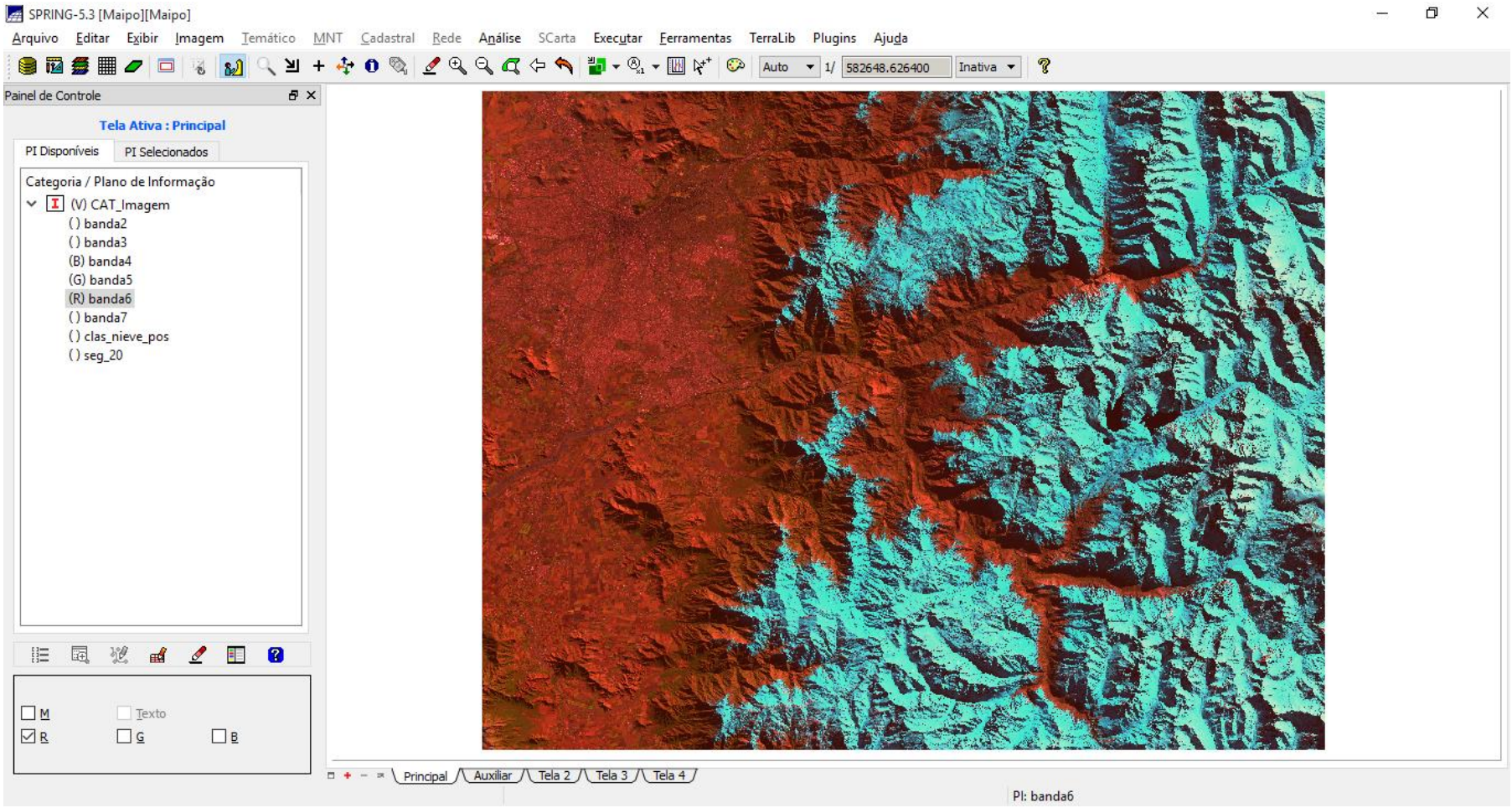
STEP 1. Add screens: Each added image will be visualized in a SPRING screen, therefore, add the number of screens corresponding to the quantity of images, aside from the "Main" and "Assistant" screens. This procedure is done with the tool (“Add Screen”), located on the bottom of the visualization area. In case you have added 5 bands, you will need 5 screens.



STEP 2. Click on **Screen 2**, on the bottom, and select the first image on the Control Panel. Below the Control Panel, activate the **M** option that represents the gray levels.

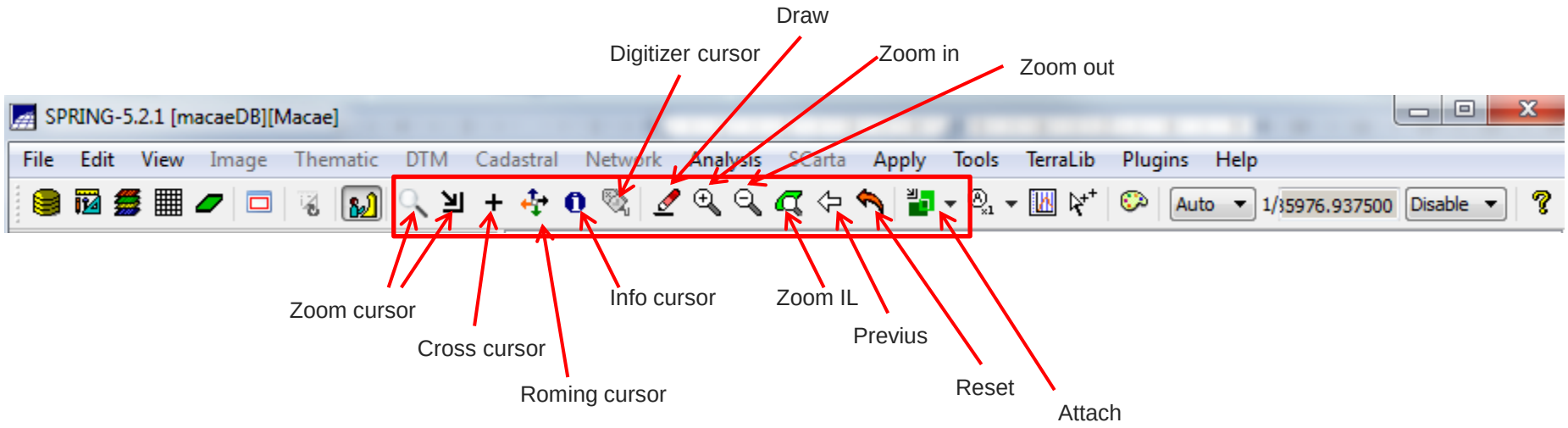
Repeat the process for the other added images, indicating to the next screen (Screen 3, 4, 5...) the next image on the list, activating the box with the **M** option.

STEP 3. False color composition: To elaborate this composition, use the bands 4 (red), 5 (near infrared) and 6 (swir). Click on the **Main** screen to activate it, then select, through the Control Panel, the corresponding image to the band 4 and activate the **B** (Blue) box; click on the band 5 image and activate the **G** (Green) box and, lastly, click on the band 6 image and activate the **R** (Red) box.



Visualization tools

In SPRING's main toolbar, several navigation and zoom tools are available, to aid in the image visualization.



Zoom Cursor: defines the area you want to enlarge.

Roaming Cursor: moves the image inside the visualization screen.

Info Cursor: obtains information about the image inside the visualization screen.

Zoom In and **Zoom Out**: the Zoom In tool enlarges 2 times the central area of the image and the Zoom Out tool reduces 2 times the center of the screen. To come back to the normal size of the image, click on the Zoom IL icon.

Zoom: allows you to enlarge the visualization of an area 2, 4 and 8 times in a window that floats on the main screen.

FURTHER LITERATURE

Textbooks

REMOTE SENSING OF THE ENVIRONMENT: AN EARTH RESOURCE PERSPECTIVE. 2nd Edition by JOHN JENSEN, published by Pearson Education, Inc., publishing as Prentice Hall, 2007, 316p.

Papers

Camara G, Souza RCM, Freitas UM, Garrido J, It FM (1996) **SPRING: Integrating remote sensing and GIS by object-oriented data modelling** Computers & Graphics, 20: (3) pp. 395-403.

Chae G.J., Yoon G.W., Park J.H. (2004) *Introduction of System for Satellite Imagery Information Management*. XXth ISPRS Congress Technical Commission II Volume XXXV Part 2. Istanbul, pp. 621-624.

Tait, M. G. (2004) Implementing geoportals: applications of distributed GIS. Computers, Environment and Urban Systems, v.29, n.1, pp.33-47.

FURTHER LITERATURE

Internet Resources

The WWW Virtual Library: Remote Sensing http://virtual.vtt.fi/space/rsvlib Extensive links to satellite data sources, journals and on-line publications, societies, and companies and other organizations engaged in remote sensing.

Remote Sensing Tutorial created by the Goddard Space Flight Center http://rst.gsfc.nasa.gov or http://www.fas.org/irp/imint/docs/rst/ An application-oriented on-line tutorial covering all aspects of remote sensing, including thermal images and radar, with many sample images.

Remote Sensing Tutorials created by the Canada Centre for Remote Sensing http://www.nrcan.gc.ca/earth-sciences/geography-boundary/remote sensing/fundamentals/1430 On-line tuturials in remote sensing fundamentals, radar and stereoscopy, and digital image analysis.