



Course title: EOTIST Standard course

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LESSON SR1 - EXERCISE

PRINCIPLES AND CONCEPTS OF REMOTE SENSING



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TABLE OF CONTENTS

Objectives.....	1
Key elements.....	1
Software.....	1
Data.....	1
1. Data visualization and query.....	2
2. Metadata visualization and query.....	3
3. Visualization in natural color.....	5
4. Visualization in false color.....	6
5. Visualization with 8-bit palette for quality bands.....	7

OBJECTIVES

Basic remote sensing multispectral imaging visualization and query tools

Metadata query of remote sensing images

Compare different ways of representing remote sensing images

Know the guidelines for applying the most appropriate representation in each case

KEY ELEMENTS

Visualization, location query, metadata. Natural color. False color

SOFTWARE

SNAP

DATA

Sentinel2-MSI image of the Warsaw region

MODIS image of Catalonia.

Landsat images from different platforms and sensors in different areas of Catalonia and Warsaw.

MERIS Image of the Baltic region



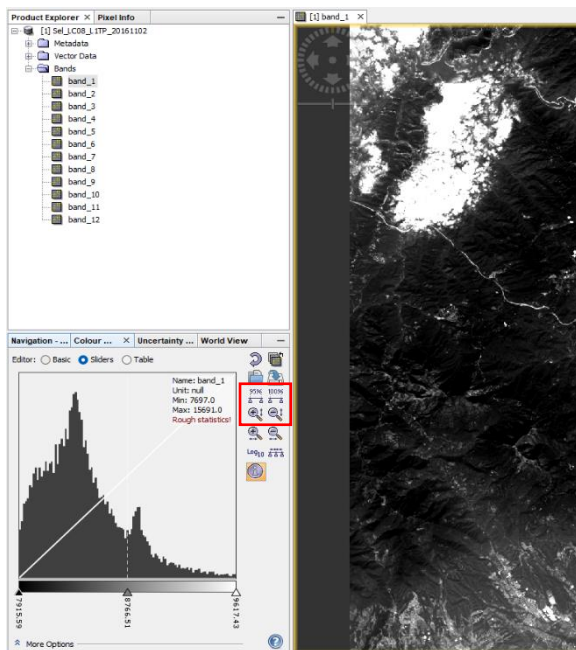
Remote Sensing

LESSON SR1 – EXERCISE Principles and concepts of Remote Sensing

1. DATA VISUALIZATION AND QUERY

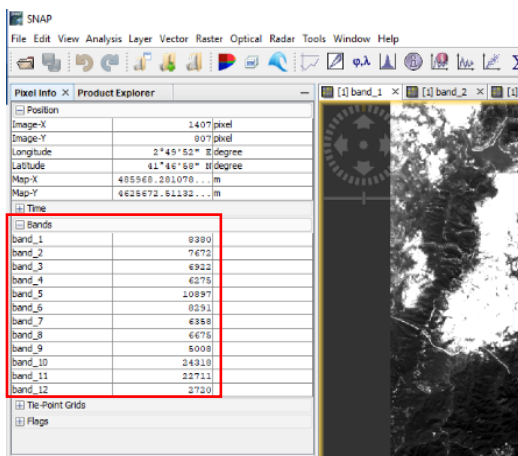
Open and display the multiband product **LC08_L1TP_20161102** of the Landsat image you will find in Data|SNAP folder: **LC08_L1TP_20161102_01_T1.tar** (*File -> Import -> Optical sensors -> Landsat -> Landsat(GeoTiff)*)

Expand the contrast (default settings): Colour Manipulation -> Sliders -> Auto-adjust contrast to 95% of all pixels. Note that you can modify contrast sliders by moving bars in Histogram window.



Symbology Menu

Practice with the Zooming and Panning tools and zoom in on different regions of the image. Make a query by location by right-clicking on a pixel and select “Copy pixel info to clipboard”. You can paste the spectral information in a text file. Opening all the remaining bands and going to *View -> Tool Windows -> Pixel Info*, will let you see the spectral and location info printed in the screen.



Result of the query by location

Question: What information do you get? Which are the units?



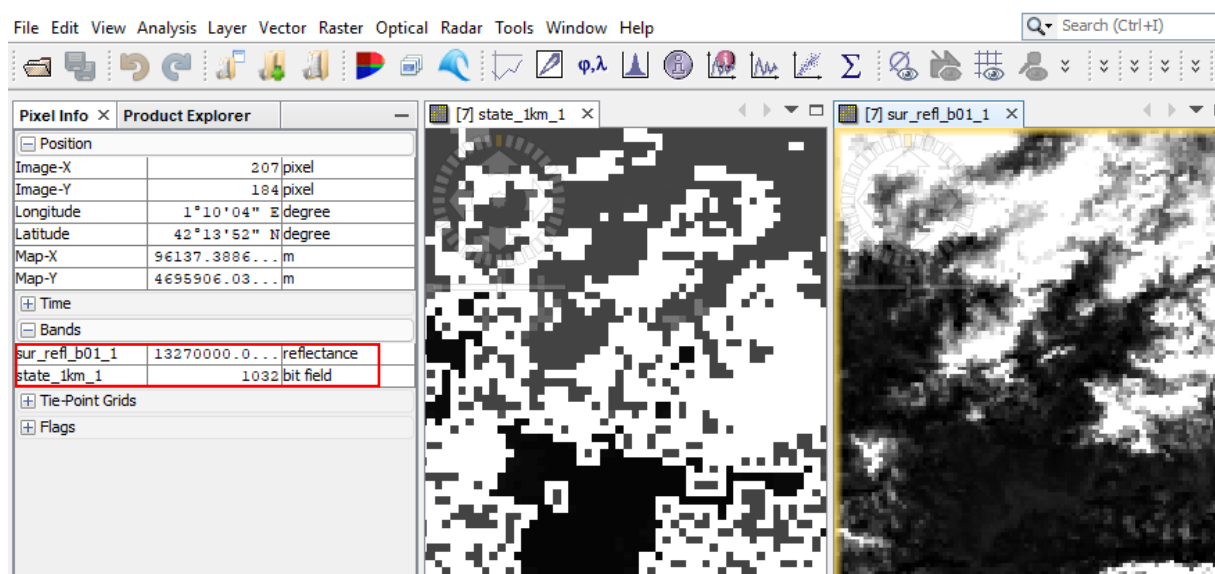
In a new session, import (*File -> Import -> Generic formats -> HDF*) the original MODIS MOD09GA product **MOD09GA.A2009021.h18v04.006.2015186063406.hdf**. Unfolding the product explorer tree, display one of the bands.

Also, expand the contrast to 95% of the histogram and then make the same type of queries. Compare values and units.

Double click to **state_1km_1** band and tile the displays vertically (Window arrangement toolbar). Synchronize both windows (*View -> Synchronise image views*). Zoom in in detail in some regions, particularly in some cloudy regions.

Question: What information do you get? Which are the units?

(tip: this band is coded in bits, each bit or combination of bits referring to a different flag. More info in https://landweb.modaps.eosdis.nasa.gov/FAQ/WWW/forPage/user_guide/MOD09_UserGuide_v1.4.pdf (table13))

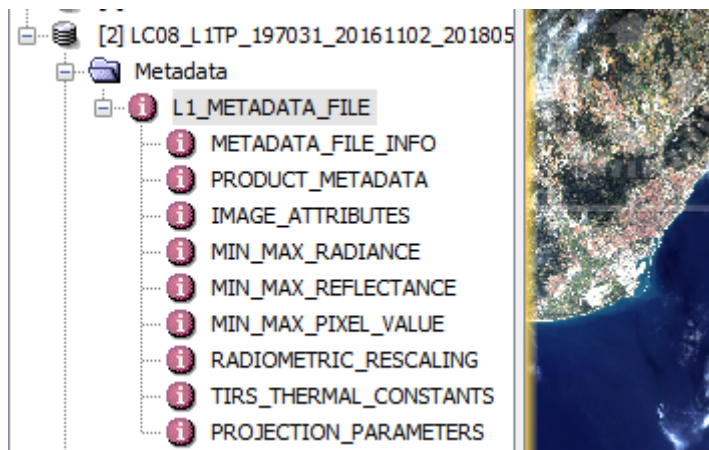


Two-band synchronized displays

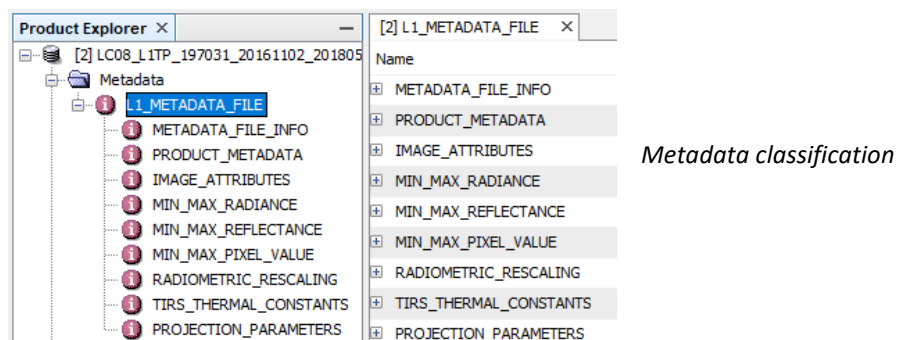
2. METADATA VISUALIZATION AND QUERY

Open the image **LC08_L1TP_20161102_01_T1.tar** and take a quick read of its summary (unfold the image tree and review metadata info)

Check the platform and sensor on the tab **L1_METADATA_FILE -> PRODUCT_METADATA**:



Go to the *L1_METADATA_FILE* tab and look at the bands present, their names, ranges, etc ...



Check the extent and temporal extent of the image:

WRS_PATH	197	int32
WRS_ROW	31	int32
NADIR_OFFNADIR	NADIR	ascii
TARGET_WRS_PATH	197	int32
TARGET_WRS_ROW	31	int32
DATE_ACQUIRED	2016-11-02	ascii
SCENE_CENTER_TIME	10:30:48.5120010Z	ascii
CORNER_UL_LAT_PRODUCT	42.80955	float64
CORNER_UL_LON_PRODUCT	1.4051	float64
CORNER_UR_LAT_PRODUCT	42.81377	float64
CORNER_UR_LON_PRODUCT	4.2562	float64
CORNER_LL_LAT_PRODUCT	40.67838	float64
CORNER_LL_LON_PRODUCT	1.457	float64
CORNER_LR_LAT_PRODUCT	40.6823	float64
CORNER_LR_LON_PRODUCT	4.21531	float64
CORNER_UL_PROJECTION_X_PRODUCT	369600.0	float64
CORNER_UL_PROJECTION_Y_PRODUCT	4740900.0	float64
CORNER_UR_PROJECTION_X_PRODUCT	602700.0	float64
CORNER_UR_PROJECTION_Y_PRODUCT	4740900.0	float64
CORNER_LL_PROJECTION_X_PRODUCT	369600.0	float64
CORNER_LL_PROJECTION_Y_PRODUCT	4504200.0	float64
CORNER_LR_PROJECTION_X_PRODUCT	602700.0	float64
CORNER_LR_PROJECTION_Y_PRODUCT	4504200.0	float64

Date and extent information

Question: Which is the Reference System of this image? (Search on the metadata info boxes)

Now make all previous metadata queries with the MODIS image. Compare the different metadata.

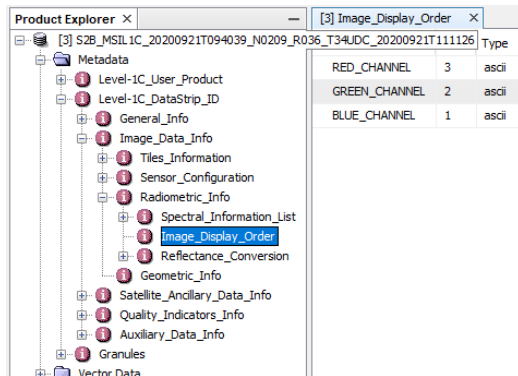
Question: Which is the Reference System of this image?



3. VISUALIZATION IN NATURAL COLOR

Identify for each image type in the Data | SNAP folder, what type of information we have (radiometric values or auxiliary quality data) and how it is grouped.

Second, it is necessary to identify in the metadata of the image (*Thematic information*) the bands of the visible that correspond to the range of red, green and blue respectively. In some cases metadata has very clear band names for correct identification.

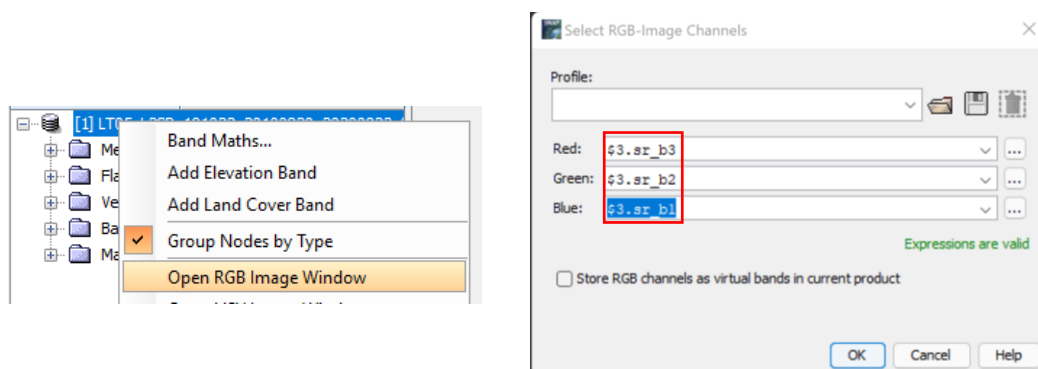


Example of metadata band identification for Sentinel-2

List of bands with description names

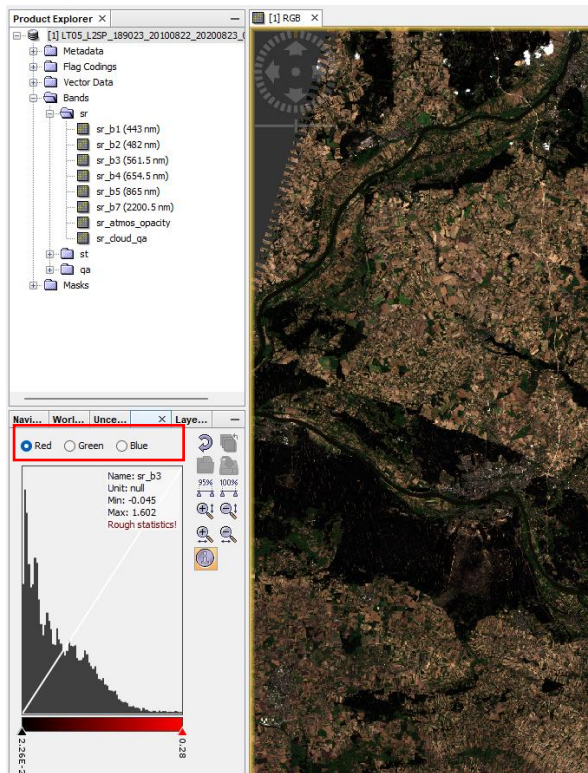
When this is not the case, it is necessary to look for documentation, either in manuals (for example, the file **MERIS_ESACCI-LC-Ph2-PUGv2_2.0.pdf** provided) or on the websites from resellers.

To display a 24 - bit natural color image you need (example with **LT05_L2SP_189023_20100822_20200823_02_T1.tar**) to right-click on the Image in product explorer and select the three composite bands to display (for natural colors, assign the correspondent wavelength for each color).



Raster selection

After an image enhancement (previous practice) and zooming in, you should come to a view like the following:



Composition 3-2-1 Landsat TM

Question: What does 3-2-1 composition mean?

You can modify color composition for each of the three bands in the color manipulation window.

The band identification and the RGB display in natural color composition must be repeated for the rest of the images provided in the Data|SNAP folder.

4. VISUALIZATION IN FALSE COLOR

We want to generate a false color composition by opening the near infrared band as R, the middle infrared band as G, and the red band as B. Note that according to the sensor there is no a single composition, for example for TM we have IRm1 and IRm2, you can view both options, although IRm1 is the most used.

Also apply an image enhancement with the default settings. If you zoom around the city of Torun you will get a view like:



Composition 4-5-3 Landsat TM



The band identification and the RGB display in false color composition IRp + IRm + R must be repeated for the rest of the images provided in the Data|SNAP folder.

There are more possible combinations suitable according to the objectives of our image exploration. You can consult <https://www.l3harrisgeospatial.com/Support/Self-Help-Tools/Help-Articles/Help-Articles-Detail/ArtMID/10220/ArticleID/15691/The-Many-Band-Comb%E2%80%A6> different possibilities for Landsat8 OIL-TIRS.

5. VISUALIZATION WITH 8-BIT PALETTE FOR QUALITY BANDS

For example, see the MODIS image metadata:

Open the *state_1km_1* band. And in the basic editor of the Colour Manipulation window, and select a classified palette. Open now the *num_observations_1km* band and select a different palette.

Question: Which palette do you think is appropriate for a quality band that gives information about the number of observations?