



Course title: EOTIST Standard course
Course subject: Remote Sensing
Teacher: Lluís Pesquer (CREAF)
Co-authors: Xavier Pons, Alaitz Zabala (UAB)

LESSON SR1 - EXERCISE

PRINCIPLES AND CONCEPTS OF REMOTE SENSING



EOTIST project has received funding from the *European Union's Horizon 2020 research and innovation programme* under grant agreement No 952111

[H2020 WIDESPREAD-05-2020 (Twinning)]





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.....	7
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

MiraMon

DATA

Sentinel2-MSI image of the Barcelona region

MODIS image of Catalonia.

MERIS image of the Baltic region.

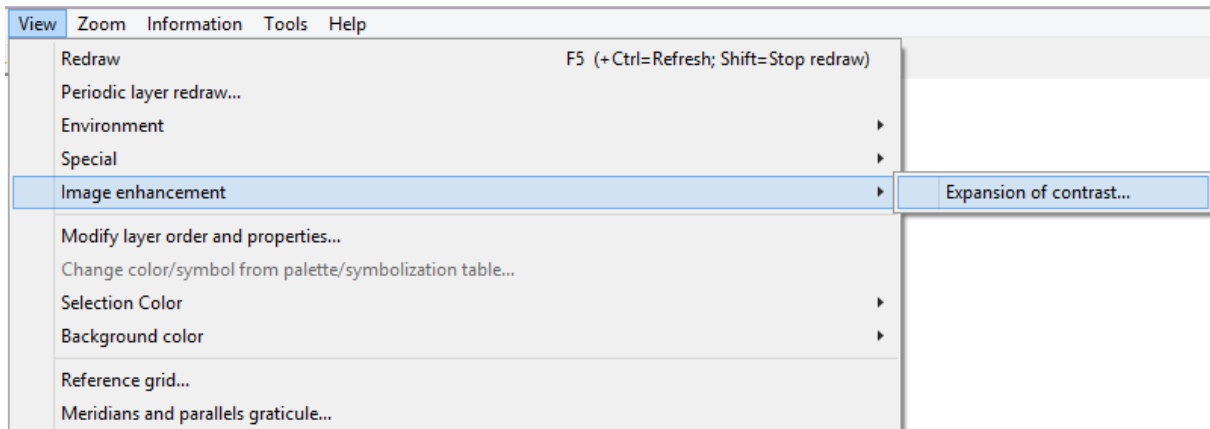
Landsat images from different platforms and sensors in different areas of Catalonia



1. DATA VISUALIZATION AND QUERY

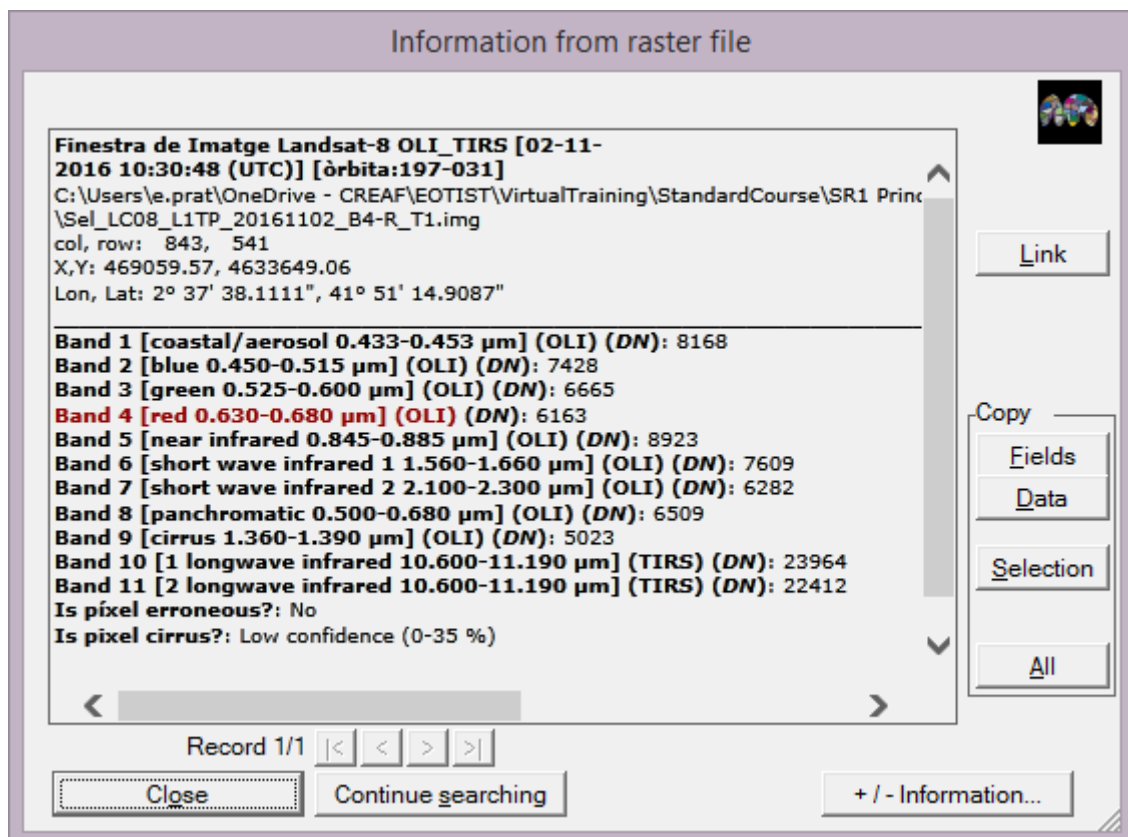
Open and display with the grayscale palette one of the bands (for example **Sel_LC08_L1TP_20161102_B4-R_T1.img**) of the Landsat image you will find in the folder **Selva_Landsat8_20161102.zip**.

Expand the contrast (default settings) from the *View / Image Enhancement* menu.



Expansion of contrast Menu

Practice with the Zoom tools and zoom in on different regions of the image. Make a query by location (left mouse button in a certain position).



Result of the query by location



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

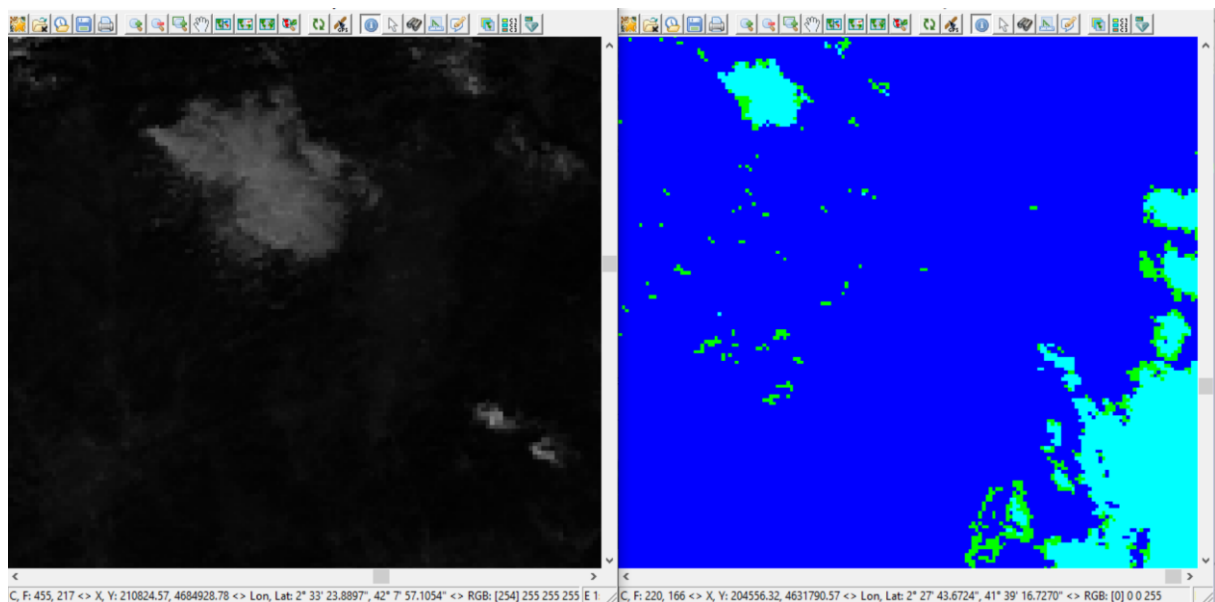
In a new session, open and display one of the bands (e.g. **MOD09GA_20090121_sur_refl_b01_1.img**) of the MODIS image **Catalunya_MODIS20090121.zip**.

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

In a new session and without closing the previous one, open a second band of the MODIS image such as **MOD09GA_20090121_Cloud_state.img** (thematic palette).


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

Get a vertical mosaic of the two sessions with MODIS bands and synchronize them (*Zoom / Mosaic/synchronize MiraMon sessions*). Zoom in in detail in some regions, particularly in some cloudy regions.

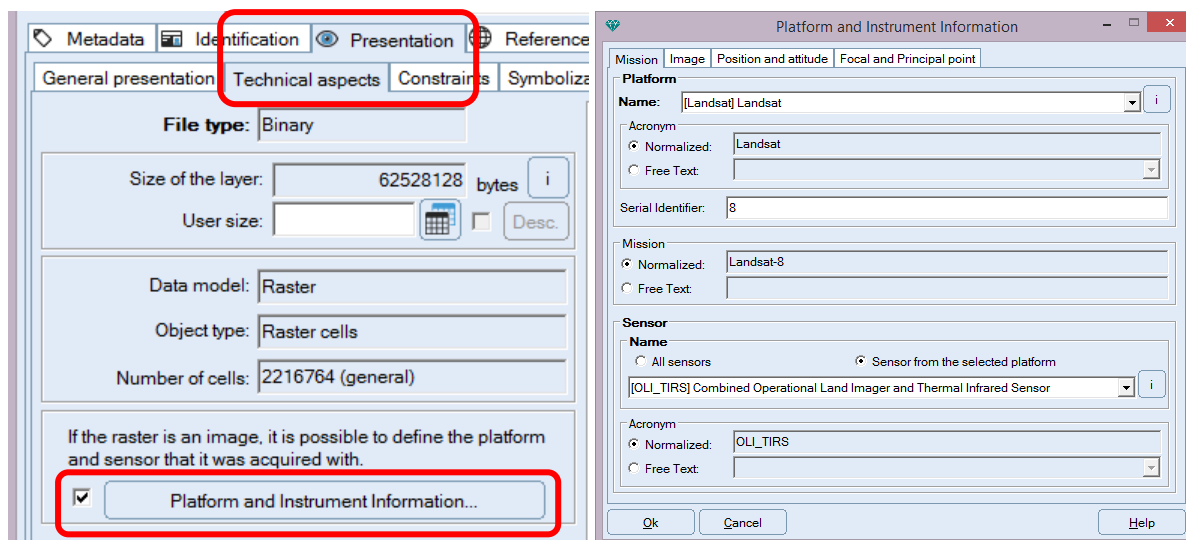


Two-band synchronized sessions

2. METADATA VISUALIZATION AND QUERY

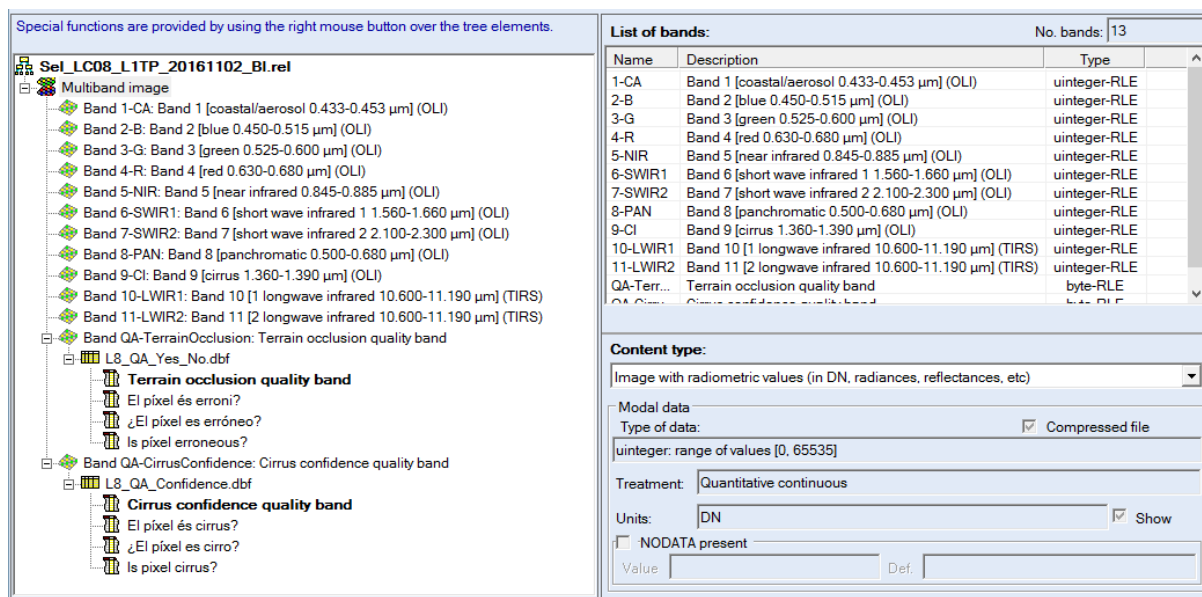
Open the metadata of the image **Sel_LC08_L1TP_20161102_B4-R_T1.img** and take a quick read of its summary (click the Metadata manager icon  in the icons bar).

Check the platform and sensor on the tab *Presentation / Technical aspects*:



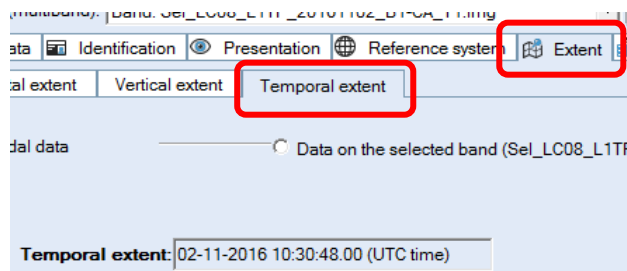
Information on the platform and sensor

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



Thematic information

Check the content date of the image (*Extent/Temporal extent*):



*Image capture date information*

Question: Which is the Reference System of this image?

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|MM 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.

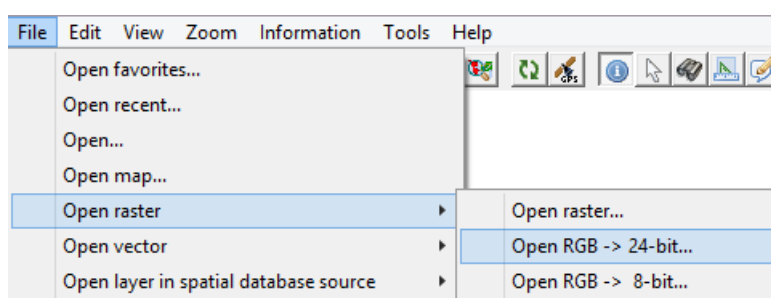
List of bands:		No. bands:	13
Name	Description	Type	
1-CA	Band 1 [coastal/aerosol 0.433-0.453 μm] (OLI)	uinteger-RLE	
2-B	Band 2 [blue 0.450-0.515 μm] (OLI)	uinteger-RLE	
3-G	Band 3 [green 0.525-0.600 μm] (OLI)	uinteger-RLE	
4-R	Band 4 [red 0.630-0.680 μm] (OLI)	uinteger-RLE	
5-NIR	Band 5 [near infrared 0.845-0.885 μm] (OLI)	uinteger-RLE	
6-SWIR1	Band 6 [short wave infrared 1 1.560-1.660 μm] (OLI)	uinteger-RLE	
7-SWIR2	Band 7 [short wave infrared 2 2.100-2.300 μm] (OLI)	uinteger-RLE	
8-PAN	Band 8 [panchromatic 0.500-0.680 μm] (OLI)	uinteger-RLE	
9-CI	Band 9 [cirrus 1.360-1.390 μm] (OLI)	uinteger-RLE	
10-LWIR1	Band 10 [1 longwave infrared 10.600-11.190 μm] (TIRS)	uinteger-RLE	
11-LWIR2	Band 11 [2 longwave infrared 10.600-11.190 μm] (TIRS)	uinteger-RLE	
QA-Terr	Terrain occlusion quality band	byte-RLE	

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 for the ESACCI-LC-L3-SR-MERIS-300m-P7D-h40v06-20030716 image) or on the websites from resellers.

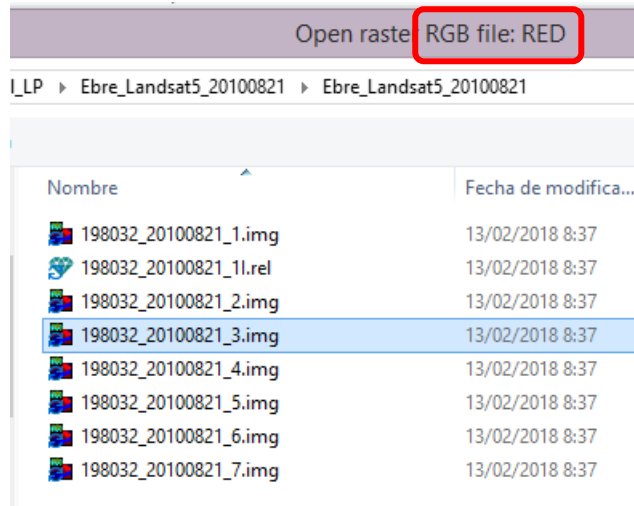
To display a 24 - bit natural color image you need (example with **Ebre_Landsat5_20100821**):

1. Access the appropriate menu:



Open RGB 24 bits menu

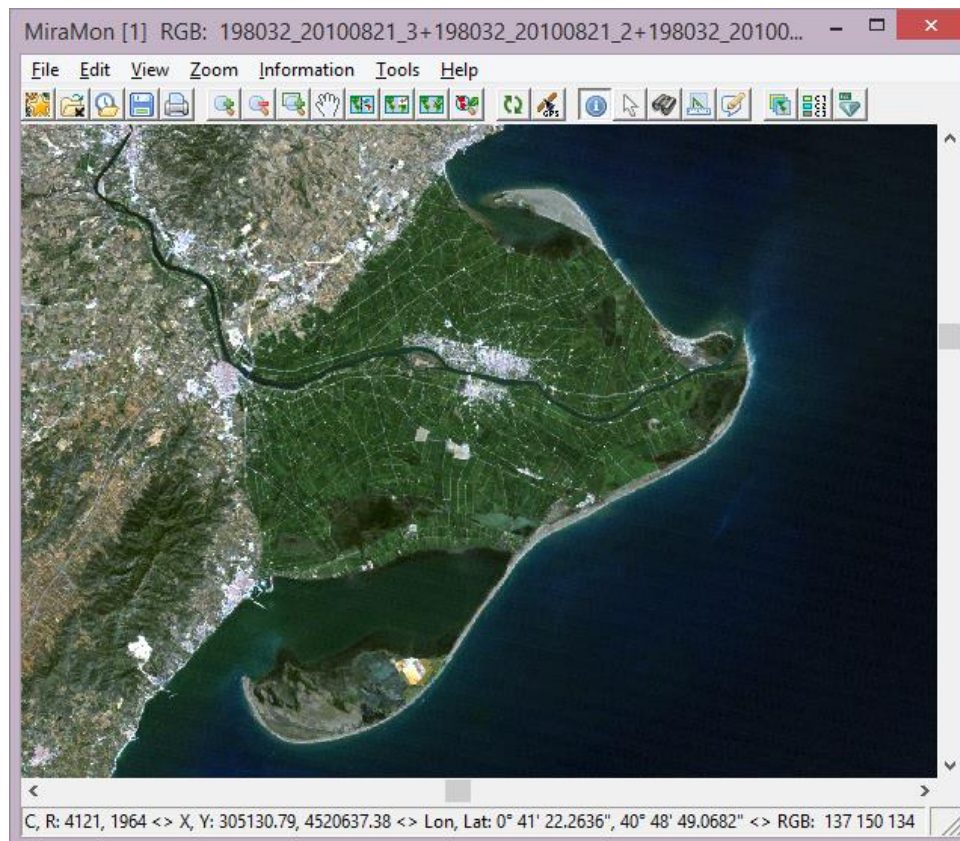
2. Select the IMG file that corresponds to the red band when asked for the R raster:



Raster R selection

3. Repeat the corresponding selection for rasters G (green band) and B (blue band).

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





Composition 3-2-1 Landsat TM

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

The band identification and the RGB display in natural color composition must be repeated for the rest of the images provided in the Data|MM 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 Tarragona you will get a view like:



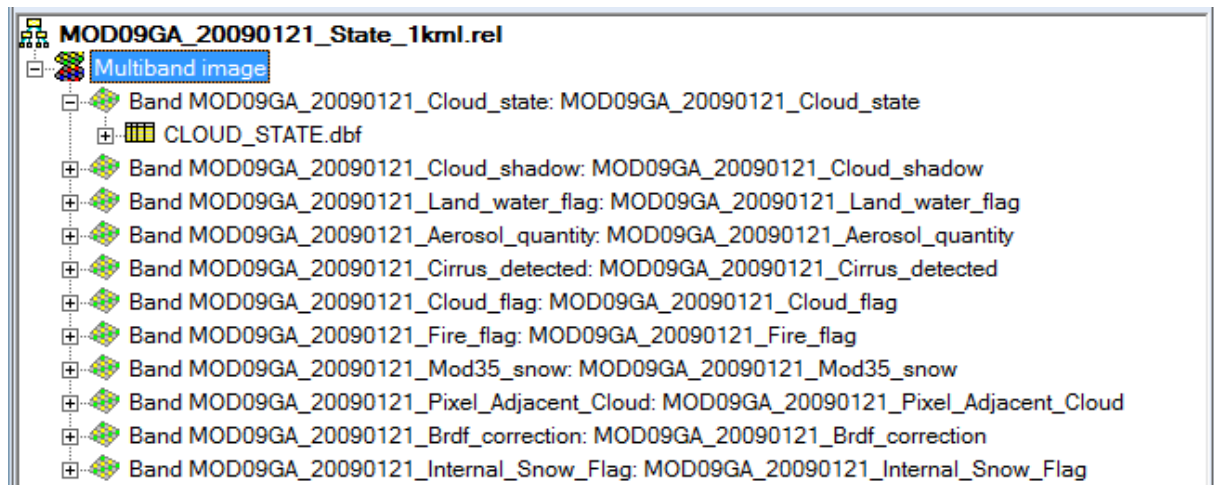
Composition 4-5-3 Landsat TM

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|MM 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:



MOD09GA_20090121 quality band set

Open the Cloud_flag band from the same GeM+ (Metadata manager) and display it with the Ctematic.dbf palette.

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